GEOTECHNICAL EXPLORATION AND PAVEMENT REPORT
NEVADA PROJECT PRA-LAME 1(8)
REHABILITATE NORTHSHORE ROAD
REHABILITATE ECHO BAY ROAD
REHABILITATE OVERTON BEACH ROAD
LAKE MEAD NATIONAL RECREATION AREA
CLARK COUNTY, NEVADA

Project No. 64055138
April 21, 2006

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Terracon

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CLARK COUNTY, NEVADA
Project No. 64035218
April 21, 2006

1.0 INTRODUCTION

This report presents the results of our geotechnical exploration for the proposed rehabilitation of Northshore Road from Mile Post 28.7 (Sta.45+680) to Mile Post 47.0 (Sta.75+125), Echo Bay Road from Mile Post 0.0 (Sta. 0+000) to Mile Post 4.7 (Sta. 7+593) and Overton Beach Road from Mile Post 0.0 (Sta. 13+700) to Mile Post 2.9 (Sta. 18+307), within the Lake Mead National Recreation Area, in Clark County, Nevada. The general location of the project alignment is shown on Plate 1, Vicinity Map, in Appendix A.

The purpose of our services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- General geology of the area
- Preliminary foundation design and construction
- Preliminary retaining wall design and construction
- Pavement distress and condition survey
- Pavement recommendations
- Earthwork

This report is for the purpose of providing geotechnical engineering and/or testing information and requirements. The scope of our services for this project did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic material in structures, soil, surface water, groundwater or air, below or around this site.

This report should be read in conjunction with our geotechnical engineering report for the proposed North Shore Drive bridge replacements at Echo Wash and Valley of Fire Wash dated March 1, 2006 (Terracon Project No. 64055119).

2.0 PROJECT INFORMATION

The project consisted of the rehabilitation of Northshore Road from Mile Post 28.7 to 47.0 (Sta. 45+680 to 75+125), Echo Bay Road from Mile Post 0.0 (Sta. 0+000) to Mile Post 4.7 (Sta.

7+593) and Overton Beach Road from Mile Post 0.0 (Sta. 13+700) to Mile Post 2.9 (Sta. 18+307). Northshore Road, Echo Bay Road and Overton Beach Road were two-lane, asphalt-paved roadways with native soil shoulders. The existing asphalt roadway on Northshore Road was approximately 6.70 meters [m] (22 feet) wide and the existing asphalt roadways on Echo Bay Road and Overton Beach were approximately 6.40 m (21 feet) wide. Shoulder widths varied along the length of the roadways. Approximately 24.45 kilometers [km] (15.2 miles) of Northshore Road would be rehabilitated and approximately 2.41 km (1.5 miles) would be realigned. Based on the plans provided to us, the existing roadway would be realigned from approximate Sta. 68+500 to Sta. 69+500. The existing intersection for the Overton Beach Road would also be realigned from approximate Sta. 71+800 to Sta. 72+800. Approximately 7.56 km (4.7 miles) of Echo Bay Road and approximately 4.51 km (2.8 miles) of Overton Beach Road would also be rehabilitated. The existing bridge at Echo Wash was approximately 7.90 m (26 feet) wide, and would be replaced with a new bridge structure with two spans approximately 135 to 150 feet in length. The existing culverts at the Valley of Fire Wash would be replaced with a new bridge structure with three spans approximately 70 to 120 feet in length.

3.0 SITE EXPLORATION

The scope of our services for this project included a preliminary subsurface exploration program for the Echo Wash Bridge and Valley of Fire Wash culverts, plus a geotechnical exploration for the roadway rehabilitations and re-alignments, and a pavement distress survey of the existing roadways. The subsurface exploration program consisted of the following:

- Advancement of thirty seven (37) soil borings along Northshore Road, ten (10) soil borings along Echo Bay Road and six (6) soil borings along Overton Beach Road performed on approximately 0.80 km (½ mile) centers along the existing roadway alignments and taken to depths of 1.5 m to 1.7 m (5 to 5½ feet) below the existing pavement surface.

- Performed thirty nine (39) pavement cores along Northshore Road, ten (10) pavement cores along Echo Bay Road and six (6) pavement cores along Overton Beach Road on approximately 0.80 km (½ mile) centers along the existing roadway alignments and within existing parking areas to determine the thickness of existing pavements and the presence and thickness of any base material. Roadway borings and corings were staged to provide asphalt pavement thickness on 0.40 km (¼ mile) spacing.

- Advancement of two (2) soil borings performed for the preliminary evaluation for the replacement of the Echo Wash Bridge with a new two span bridge structure.

- Advancement of one (1) soil boring performed for the preliminary evaluation for the replacement of the Valley of Fire Wash culvert with a new three span bridge structure.

- Advancement of two (2) soil borings performed for the realignment of Northshore Road from approximate Sta. 68+500 to Sta. 69+500.
- Advancement of three (3) soil borings performed for the realignment of the Northshore Road and Overton Beach Road intersection.

Borings and pavement cores were performed at locations selected by Terracon. The field explorations were conducted from January 6 through January 9, 2004, March 9 and 10, 2004 and October 24 through October 26, 2005. The borings and pavement cores were logged during drilling and samples were obtained to aid in material classification and for laboratory testing on selected samples. The approximate locations of the borings and corings are shown on Plates 2 through 70, Alignment Plans in Appendix A. The locations of the borings and corings were determined in the field by measuring from existing features or improvements. The location of the borings and corings should be considered accurate only to the degree implied by the method used. Boring logs and laboratory test results are included in Appendix B. Photographs of existing structures, boring locations, and drilling operations are presented in Appendix C.

A pavement distress survey and assessment was performed along the existing alignment of Northshore Road from Mile Post 28.7 to 47.0 (Sta. 45+680 to 75+125), along Echo Bay Road from Mile Post 0.0 (Sta. 0+000) to Mile Post 4.7 (Sta. 7+593) and along Overton Beach Road from Mile Post 0.0 (Sta. 13+700) to Mile Post 2.9 (Sta. 18+307). The definitions and severity levels of the pavement distress were noted as set forth in the, "Distress Identification Manual for the Long-Term Pavement Performance Project," SHRP-P-338, Strategic Highway Research Program, May 1993. The survey was conducted and recorded as set forth in Chapter 6 of the, "Federal Lands Highway Project Development and Design Manual", FHWA-DF-88-003, Federal Highway Administration (FHWA), June 1996 Metric Revision (PDDM). The results of the pavement distress survey and pavement cores are presented in Appendix D, along with photographs of the roadway taken during the distress survey.

4.0 ALIGNMENT CONDITIONS

Northshore Road was approximately 6.70 m (22 feet) wide and Echo Bay Road and Overton Beach Road were approximately 6.40 m (21 feet) wide for the majority of their lengths, except at turn off or parking areas. Shoulders along each side of the roadways generally consisted of native materials, compacted in-place, or gravel fill material. Shoulder widths varied along the length of the roadways from approximately 0.90 m (3 feet) to over 4.60 m (15 feet). The only curb and gutter and/or paved shoulders along Northshore Road were noted in the parking area near Sta. 59+650, the Echo Wash Bridge, Blue Point Springs parking area, and at the Valley of Fire Wash culverts. Though not strictly paved shoulders, the roadway shoulders in surface runoff overflow areas near Sta. 62+600 and Sta. 74+300 on Northshore Road were protected by a concrete layer for erosion control. Asphalt concrete curb and gutters were noted along Echo Bay Road at Sta. 6+185 and Sta. 6+410. Concrete curb and gutters were noted along Echo Bay Road in the marina area beginning near Sta. 7+255 and along Overton Beach Road in the marina area beginning near Sta. 18+255. The roadways generally followed the lay of the land, with only moderate cuts and fills, except approaching and leaving the Echo Wash and near Mile Post 37 (Sta. 59+035) on Northshore Road. At both of these locations, extensive cut/fill work had been performed to achieve the current roadway grades.

Two major structures were encountered along Northshore Road; the Echo Wash Bridge and the Valley of Fire Wash culverts. Several smaller culverts were located along the length of Northshore Road, Echo Bay Road and Overton Beach Road, as noted on the provided site plans. Most of these smaller culverts were observed to be partially filled with sediment. Paved intersections or turn-offs along Northshore Road were noted for Echo Bay, Stewarts Point, Overton Beach, Valley of Fire Road (NV-169), and St. Thomas Point Road and parking areas were noted at Sta. 59+600, Rogers Spring, and Blue Point Spring. Paved intersections were noted for Echo Bay Road at Sta. 6+110, Sta. 6+185, Sta. 6+410 and at the marina parking areas. Paved intersections for Overton Beach Road were noted at the marina parking areas. Several un-paved roads and trails connecting with the three roadways were noted along the existing alignments. Severe erosion problems were noted in several of the shoulder areas of Northshore Road near the cut to fill transition points. Please refer to the photographs in Appendix C for examples of these observed conditions.

Echo Wash Bridge was located at approximate Sta. 53+360 to Sta. 53+430. Two abutments and two center piers supported the bridge deck over Echo Wash. The structure and bridge deck consisted of cast-in-place, reinforced concrete. The type of foundation system supporting the abutments or piers (spread footing, drilled piers, etc...,) could not be ascertained from visual observation of the exposed concrete. As part of the proposed rehabilitation, the existing bridge would be replaced with a new bridge structure with two spans approximately 135 to 150 feet in length.

Six (6) 2.44 m (8 foot) diameter culverts transfer the runoff within the Valley of Fire Wash through the Northshore Road embankment at Sta. 67+850. According to the provided information, additional flow must to moved through this portion of the wash which would require the removal of the existing culverts and replacement with a new bridge structure with three spans approximately 70 to 120 feet in length.

Rehabilitation of Northshore Road would generally follow the existing alignment, except at two locations. To eliminate a sharp S-curve, the existing roadway would be re-located to a new alignment at approximate Sta. 68+500 to Sta. 69+500. At the Overton Beach Road intersection, four alternative alignments are under consideration for the existing intersection. Please refer to Alignment Plan numbers 42-43 and 47-48 for proposed re-alignments.

Rehabilitation of Echo Bay Road and Overton Beach Road would generally follow the existing alignments.

4.1 Surface Conditions

This area of the Lake Mead National Recreation Area consisted of steep ridges and mountains with narrow canyons leading to wide alluvial planes cut with numerous small and large washes. Vegetation was sparse to very sparse along the roadways, except near Rogers Spring and Blue Point Spring. Outside the roadway limits, the desert surface was generally covered with sand, gravel, and cobbles/boulders. Summer temperatures can easily exceed 38°C (100°F) daily, with winter lows seldom below 0°C (32°F). Annual precipitation is generally 127 mm (5 inches), but thunderstorms can produce flash flooding in the narrow canyons and washes during the late Summer and early Fall, August and September. Surface drainage was generally by sheetflow, with any excess runoff eventually entering Lake Mead to the east.

4.2 Subsurface Conditions

4.2.1 Northshore Road

As expected, sands and gravels were the prevailing soil types encountered within the roadway borings, Boring S-1 through S-37, whether in a natural state or as fill material. Fill material placed for the roadway embankments, roadbed and shoulder areas, was encountered in several soil explorations. The fill generally consisted of sandy gravel, poorly graded gravel, clayey gravel, gravelly sand, silty sand, clayey sand, silty-clayey sand, and sandy lean clay. There could be deeper and/or poorer quality fill in other areas of the roadway alignment beyond the explorations.

Native soils encountered along the roadway and shoulder areas generally consisted of medium dense to very dense sandy gravel, silty gravel, clayey gravel, gravelly sand, silty sand, clayey sand, and sand, stiff sandy silt; firm to stiff silt; firm to very stiff sandy clay, silty clay, and sandy silty clay; moderately hard to hard cemented sand and gravel; and loose to medium dense gypsum.

Clayey soils were noted in some of the roadway explorations. Laboratory test results on selected specimens indicated the clayey soils exhibited a low to moderate (0 to 8 percent) expansion potential. Six (6) samples were tested for expansion potential, with three (3) of the specimens exhibiting a low (0 to 4 percent) expansion and 3 specimens exhibiting a moderate (4 to 8 percent) expansion potential. The highest expansions were noted in samples from Borings S-16 and S-29, which exhibited expansion potentials of 7.4 percent and 6.9 percent, respectively. Expansion tests were performed on remolded oven-dried samples with a 2.9 kPa (60 pound per square foot) surcharge. The oven-dried condition is conservative.

Chemical test results indicated some of the soils encountered in the roadway soil borings contained sufficient quantities of sodium sulfate to be susceptible to chemical expansion. Results also indicated some of the soils contain sufficient quantities of sulfate to require additional concrete mix design considerations for any concrete elements exposed to those soils.

Gypsum bearing soils were noted along the length of the roadway, with layers of native gypsum encountered along the northern section of the roadway. Native gypsum was encountered in soil Borings S-26, S-34 and S-35. At each location, it appears that portions of the native gypsum had been overexcavated 15.2 to 30.5 centimeters [cm] (½ to 1-foot) and replaced with non-soluble fill material. Some settlement of the existing roadway was observed in the area of Boring S-34, where gypsum with a honeycombed structure was noted in the boring and observed within gypsum exposed in the ditch lines on each side of the roadway.

Cemented sand and gravel was noted in soil Borings between S-14 and S-19. The cemented sand and gravel exhibited a moderately hard to hard consistency. Depth to the top of the cemented sand and gravel layer varied from 45.7 to 137.2 cm (1½ to 4½-feet) below existing roadway grades. There could be shallower or more extensive cemented sand and gravel in other areas of the roadway beyond or between the explorations.

Groundwater was not encountered in any of the explorations to the depths explored 1.5 m (5 feet). However, groundwater levels can fluctuate due to seasonal variations. High seasonal surface runoff is general expected in late summer, August and September, when thunderstorms are expected. Groundwater flow can also be expected near Rogers Springs and Blue Point Springs, as is apparent by the vegetation growing on both sides of the roadway in these areas. Boring logs S-1 through S-37 and laboratory test results presented in Appendix B should be referred to for more detailed information on in-situ moisture content in the soils.

4.2.2 Echo Wash Bridge

Boring locations adjacent to the existing abutments could not be obtained due to the narrow embankment width and the location of the guardrails. The two borings for the bridge were performed within the wash, as close as possible to the proposed abutment and located as noted below. Besides information from the boring performed within the wash, a Terracon geologist also logged the exposed native materials from the bottom of the wash up to the exposed base of each adjacent abutment. Depths used on the logs for Borings B-1 and B-2 were measured from the base of the adjacent abutment. Please refer to Appendix C, Plate C-8 for photographs showing the base of the north and south abutments from which depth measurements were referenced. Information from the borings as well as the exposed native materials in the sides of the wash was combined to develop the logs present as Borings B-1, and B-2.

Boring B-1 was performed for the south abutment, located approximately 9.70 m (32 feet) from the southwest end of the bridge and 1.85 m (6 feet) west of the exterior edge of the bridge deck. B-1 was performed within the existing wash bottom, at a depth of 2.80 m (9.2 feet) below the base of the south abutment. GPS readings obtained for Boring B-1 were latitude 36° 18' 35.9" N and longitude 114° 29' 17.2" W. Depths noted on the logs for B-1 were measured from the base of the south abutment. Starting at the base of the existing south abutment, native soils were noted to the existing wash bottom, 2.80 m (9.2 feet) below the base of the south abutment at Boring B-1. These soils consisted of medium dense to moderately hard clayey sand and silty sand and very dense to moderately hard partially cemented sand and gravel and are logged on Boring B-1A. A 0.4 m (1.3 foot) layer of alluvial deposited loose sand and gravel was noted at the surface of Boring B-1. At a depth of 3.20 m (10.5 feet) below the base of the south abutment, rock was encountered and continued until refusal depth was encountered at 8.08 m (26.5 feet) below the base of the south abutment. Rock encountered in Boring B-1 consisted of severely weathered, very dense sandstone; weathered, very dense to moderately hard clayey sandstone and claystone. Please refer to Appendix B for copies of the logs of the exposed native materials from the base of the abutment to the wash bottom, Boring B-1A, and that portion drilled in the wash bottom, Boring B-1B. Please refer to Appendix C, Plate C-9 for a photograph of the boring location.

Boring B-2 was performed for the north abutment, located approximately 11.30 m (37 feet) south of the northeast end of the bridge and 1.80 m (6 feet) east of the exterior edge of the bridge deck. B-2 was performed within the existing wash bottom, at a depth of 3.70 m (12.1 feet) below the base of the north abutment. GPS readings obtained at Boring B-2 were latitude 36° 18' 33.9" N and longitude 114° 29' 20.3" W. Depths noted on the logs for Boring B-2 were measured from the base of the north abutment. Starting at the base of the north abutment, rock was exposed to the existing wash bottom, 3.70 m (12.1 feet) below the base of the north abutment at Boring B-2. From the base of the abutment to the bottom of the wash, rock exposed on the side of the wash adjacent to the north abutment consisted of weathered, very stiff to moderately hard siltstone; weathered, medium dense to very dense sandstone; and, weathered, moderately hard conglomerate and are noted on the log for Boring B-2A. A 1.52 m (5-foot) layer of alluvial deposited loose sand and gravel was noted at the surface of B-2, before rock was encountered. Rock encountered within Boring B-2 consisted of weathered to very weathered, stiff to moderately hard claystone; and, very weathered, dense to very dense sandstone and are noted on the log for Boring B-2B. Please refer to Appendix B for copies of the logs of the expose native materials from the base of the abutment to the wash bottom, Boring B-2A, and that portion drilled in the wash bottom, Boring B-2B. Please refer to Appendix C, Plate C-9 for a photograph of the boring location.

The actual bearing material at either the south or north abutment was not determined during this exploration. Determining the actual bearing conditions would depend upon the type of foundation system. If the abutments were constructed as shallow foundations, hand excavation would be required, as neither abutment is accessible to equipment. If the abutments are to utilize piles or piers, then coring would be required, through the bridge deck, to determining bearing conditions at the end of the proposed piers/piles. Site access at either end of the existing bridge is very limited beyond the existing roadway.

Within the wash bottom, a layer of alluvial deposited material, approximately 0.40 m (1.3 feet) to 1.52 m (5-feet) thick was noted at B-1 and B-2, respectively. The wash bottom material consisted of sandy gravel and gravelly sand with numerous cobbles and boulders. There could be deeper and/or poorer quality alluvial material in other areas of the wash beyond or between the explorations.

Chemical test results indicated some of the soil/rock encountered in the bridge borings contains sufficient quantities of sulfate to require additional concrete mix design considerations for any concrete exposed to those soils/rocks.

Groundwater was not encountered in either of the explorations. Boring logs B-1 and B-2 and laboratory test results presented in Appendix B should be referred to for more detailed information.

4.2.3 Valley of Fire Wash Culverts

Similar to the Echo Wash Bridge location, drilling within the existing fill over the Valley of Fire Wash culverts could not be performed due to the limited roadway access between the existing guardrails. One lane of the roadway would need to be closed to drill in the culvert area. The boring was performed as close as possible to the northern end of the existing culvert fill. At the north end of the culvert headwall, a Terracon geologist logged the existing embankment material along the downstream face from the edge of the roadway to the bottom of the wash.

The existing embankment material consisted of sandy gravel with silt and gravelly sand with silt. No visible signs of settlement were noted within the roadway surface, nor were unstable conditions visually observed along either the upstream or downstream embankment face. The only erosion problems appeared to be from surface runoff from the roadway eroding the soil fill at the north and south ends of the culvert headwalls.

Boring B-3 was performed near the north end of the culvert embankment. GPS readings obtained were latitude 36° 24' 19.7" N and longitude 114° 25' 02.3" W. Starting at the boring surface, materials encountered within the boring consisted of a 0.90 m (3 foot) thick layer of sandy gravel fill material; a 0.60 m (2 foot) thick layer of dense silty sand; followed by a very dense to very hard layer of gravelly sandstone and cobbly conglomerate that extended to boring termination depth at 6.10 m (20 feet). Please refer to Appendix C, Plate C-10 for a photograph of the boring location.

Test pits were excavated in the wash bottom, near the toe of the embankment fill, to a depth of 1.20 m (4 feet) without encountering native material. Only alluvial material, sandy gravel with silt and gravelly sand with silt, were noted in the test pits.

Groundwater was not encountered in any of the explorations. However, groundwater levels can fluctuate due to seasonal variations. The boring log B-3 and laboratory test results presented in Appendix B should be referred to for more detailed information.

4.2.4 Roadway Re-Alignment, Northshore Road Sta. 68+500 to Sta. 69+500

Borings B-4 and B-5 were performed within the proposed realignment right-of-way on Northshore Road. GPS readings obtained at B-4 were latitude 36° 24' 43.8" N and longitude 114° 24' 59.9" W and for Boring B-5 latitude 36° 24' 48.6" N and longitude 114° 25' 04.3" W. Native clayey soils were the prevailing soil types encountered within the roadway re-alignment at Sta. 68+500 through Sta. 69+500. The native soils consisted of soft to stiff silty clay; very stiff sandy clay; and, stiff to very stiff fat clay. Laboratory test results of selected specimens indicated the clayey soils exhibited a low to moderate (0 to 8 percent) expansion potential. Six samples were tested for expansion potential, with three of the specimens exhibiting a negligible (0 to 4 percent) expansion and three specimens exhibiting a moderate (4 to 8 percent) expansion potential. The highest expansions were noted in samples from S-16 and S-29, which exhibited expansion potentials of 7.4 percent and 6.9 percent, respectively.

Chemical test results indicated the clay soils encountered in the borings contained quantities of sodium sulfate in the range from 1.3 percent to 1.6 percent. Soluble sodium sulfate contents above 0.2 percent are considered to be capable of triggering chemical expansion. Results also indicated some of the soils contain sufficient quantities of sulfate to require additional mix considerations for any concrete exposed to those soils. Test results also indicated the soluble gypsum within the clayey soils ranged from 3.1 percent to 3.5 percent. Soils containing soluble gypsum levels over 2 percent are susceptible to excessive consolidation if moisture increases while under loading.

Groundwater was not encountered in any of the explorations. Boring logs B-4, B-5, S-29 and S-30 and laboratory test results presented in Appendix B should be referred to for more detailed information. Please refer to Appendix C, Plate C-11 for photographs of the boring locations.

4.2.5 Roadway Re-Alignment Overton Beach Intersection

Native clayey soils were the prevailing soil types encountered within the roadway re-alignment borings at the Overton Beach Intersection, Boring B-6 through B-8. GPS readings obtained at Boring B-6 were latitude 36° 26' 13.7" N and longitude 114° 24' 30.9" W, Boring B-7 were latitude 36° 26' 17.6" N and longitude 114° 24' 39.9" W, and at B-8 were latitude 36° 26' 06.0" N and longitude 114° 24' 30.8" W. The native soils consisted of loose to medium dense silty sand and clayey sand; stiff to very stiff clayey silt; loose to medium dense gypsum; firm to very stiff silty clay; and stiff to very stiff fat clay. Please refer to Appendix C, Plates F-12 and F-13 for photographs of the boring locations. A thin layer of clayey sand fill material was noted within the near surface of Boring B-8. There could be deeper and/or poorer quality fill in other areas of the Overton Beach Road intersection beyond the explorations.

Chemical test results indicated the clay soils encountered in the borings contained quantities of sodium sulfate up to 1.8 percent. Soluble sodium sulfate contents above 0.2 percent are considered to be capable of triggering chemical expansion. Results also indicated some of the soils contain sufficient quantities of sulfate to require additional mix considerations for any concrete exposed to those soils. Test results also indicated the soluble gypsum within the clayey soils ranged from 1.2 percent to 3.4 percent. Soils containing soluble gypsum levels over 2 percent are susceptible to excessive consolidation if moisture increases while under loading.

Groundwater was not encountered in any of the explorations. Boring logs B-6 through B-8 and laboratory test results presented in Appendix B should be referred to for more detailed information.

4.2.6 Echo Bay Road

As expected, sands and gravels were the prevailing soil types encountered within the Echo Bay Road borings, soil Borings EB-1 through EB-10, whether in a natural state or as fill material. Fill material placed for the roadbed and shoulder areas was encountered in each of the soil explorations and generally consisted of silty sand and gravel. There could be deeper and/or poorer quality fill in other areas of the roadway alignment beyond the explorations.

Native soils encountered along the roadway and shoulder areas generally consisted of medium dense to very dense sandy gravel; medium dense to dense silty sand and clayey sand; firm to stiff sandy silt; very stiff clayey silt and silty clay; very dense to moderately hard partially cemented silty sand; moderately hard cemented sand and gravel; moderately hard caliche; and medium dense gypsum.

Chemical test results indicated a sample of the soils encountered in the roadway soil borings contained sufficient quantities of sodium sulfate to be susceptible to chemical expansion. Results also indicated some of the soils contain sufficient quantities of sulfate to require additional concrete mix design considerations for any concrete elements exposed to those soils.

Gypsum was noted in soil Boring EB-9. The gypsum exhibited a medium dense consistency. Depth to the top of the gypsum layer was about 76.2 cm (2½ feet) below the existing roadway grade. Test results indicated the soluble gypsum was about 1.12 percent. Soils containing soluble gypsum levels less than 2 percent are generally not susceptible to excessive consolidation if moisture increases while under loading. However, there could be shallower or more extensive gypsum layers in other areas of the roadway beyond or between the explorations.

Partially cemented silty sand was noted in soil Boring EB-6. The partially cemented silty sand exhibited a very dense to moderately hard consistency. Depth to the top of the partially cemented layer was about 76.2 cm (2½ feet) below the existing roadway grade. There could be shallower or more extensive partially cemented layers in other areas of the roadway beyond or between the explorations.

Cemented sand and gravel was noted in soil Borings EB-1 and EB-3. The cemented sand and gravel exhibited a moderately hard consistency. Depth to the top of the cemented sand and gravel layers varied from 121.9 to 137.2 cm (4 to 4½ feet) below existing roadway grades. There could be shallower or more extensive cemented sand and gravel in other areas of the roadway beyond or between the explorations.

Groundwater was not encountered in any of the explorations to the depths explored 1.5 to 1.7 m (5 to 5½ feet). However, groundwater levels can fluctuate due to seasonal variations. High seasonal surface runoff is general expected in late summer, August and September, when thunderstorms are expected. Boring logs EB-1 through EB-10 and laboratory test results presented in Appendix B should be referred to for more detailed information on in-situ moisture content in the soils.

4.2.7 Overton Beach Road

Native clayey soils were the prevailing soil types encountered within the Overton Beach Road soil Borings OB-1 and OB-2. Sands and gravels were the prevailing soil types encountered within the Overton Beach Road soil Borings OB-3 through OB-6, whether in a natural state or as fill material. Fill material placed for the roadbed and shoulder areas was encountered in each of the soil explorations and generally consisted of silty sand and clayey gravel. There could be deeper and/or poorer quality fill in other areas of the roadway alignment beyond the explorations.

Native soils encountered along the roadway and shoulder areas generally consisted of dense gravel; medium dense to dense sandy gravel; dense silty-clayey sand; medium dense silty sand and clayey sand; very stiff clay, silty clay and sandy clay; and very dense to moderately hard partially cemented sand and gravel.

Clayey soils were noted in some of the roadway explorations. Laboratory test results on selected specimens indicated the clayey soils exhibited a moderate (4 to 8 percent) to high (8 to 12 percent) expansion potential. Two (2) samples were tested for expansion potential, with one (1) of the specimens from Boring OB-2 exhibiting a moderate expansion potential of 5.4 percent and one (1) of the specimens from Boring OB-1 exhibiting a high expansion potential of 8.1 percent. Expansion tests were performed on remolded oven-dried samples with a 2.9 kPa (60 pound per square foot) surcharge. The oven-dried condition is conservative.

Partially cemented sand and gravel was noted in soil Boring OB-3. The partially cemented sand and gravel layer exhibited a very dense to moderately hard consistency. Depth to the top of the layer was about 137.2 cm (4½ feet) below the existing roadway grade. There could be shallower or more extensive partially cemented layers in other areas of the roadway beyond or between the explorations.

Chemical test results indicated a sample of the soils encountered in the roadway soil borings did not contain sufficient quantities of sodium sulfate to be susceptible to chemical expansion. Results also indicated a sample of the soils did not contain sufficient quantities of sulfate to require additional concrete mix design considerations for any concrete elements exposed to those soils. However, there could be other areas in the roadway beyond or between the explorations, especially considering test results from other samples of the soils along Northshore Road and Echo Bay Road, that contain sufficient quantities of sodium sulfate to be susceptible to chemical expansion or that contain sufficient quantities of sulfate to require additional concrete mix design considerations for any concrete elements exposed to those soils.

Groundwater was not encountered in any of the explorations to the depths explored 1.5 to 1.7 m (5 to 5½ feet). However, groundwater levels can fluctuate due to seasonal variations. High seasonal surface runoff is general expected in late summer, August and September, when thunderstorms are expected. Boring logs OB-1 through OB-6 and laboratory test results presented in Appendix B should be referred to for more detailed information on in-situ moisture content in the soils.

5.0 GEOLOGIC INFORMATION

Northshore Road, Echo Bay Road and Overton Beach Road were located in the northeastern region of Clark County, within the Lake Mead National Recreation Area. At the start of the project, Mile Post 28.7, Northshore Road was located near the northwestern base of the Black Mountains. As the road proceeded northward, the roadway crossed Bitter Springs Valley and Echo Wash, then skirted along the eastern edge of the Muddy Mountains before crossing the Valley of Fire Wash, and ending at Mile Post 47.0, just east of the Valley of Fire State Park.

Echo Bay Road was located between the northwestern base of the Black Mountains and the eastern edge of the Muddy Mountains. At the start of Overton Beach Road, Mile Post 0.0, the roadway was located near the eastern edge of the Muddy Mountains.

At the start of the project, Northshore Road was underlain by the Gale Hills Formation, clastic deposits younger than the Aztec Sandstone and consisting of a basal conglomerate, 6.10 to 9.14 m (20 to 30 feet) thick, succeeded by layers of fine grained sand, silt, and clay with maximum thickness of about 61 m (200 feet). Some of the clay in this formation appears to consist of bentonite. As Northshore Road proceeded northward, it then crossed alluvial deposits of sand, silts, clays, gravels, cobbles, and boulders, which could be several hundreds of meters thick.

South of Echo Wash and extending just north of the Echo Wash bridge, Northshore Road was underlain by the Muddy Creek Formation. Echo Bay Road and Overton Beach Road were also underlain by the Muddy Creek Formation, which consisted of sedimentary deposits, widely exposed adjacent to Lake Mead and the larger tributary valleys. These deposits, coarse grained near the mountain borders, grade basinward into regular beds of fine-grained sandstone, siltstone, and clay. Gypsum was abundant in the Muddy Creek Formation; some beds are thick and extensive. Prior to creation of Lake Mead, large beds and plugs of rock salt, included in the Muddy Creek Formation, were exposed in several parts of the Virgin River Valley. [1]

Just north of Echo Wash, Northshore Road again crossed over a stretch of alluvial deposited materials, which ended just south of the eastern end of the Muddy Mountains, where the roadway crossed onto the Muddy Creek Formation again. Northshore Road continued across the Muddy Creek Formation until the project ended at Mile Post 47.0.

Faulting was somewhat extensive within the Muddy and Black Mountains. Northshore Road near the start of the project crossed a mapped fault, at the base of the Black Mountains. The roadway also paralleled a fault for several miles along the eastern edge of the Muddy Mountains, and crossed that fault just north of Bluepoint Springs. Overton Beach Road near the start of the roadway crossed a mapped fault that extended northeasterly from the Muddy Mountains. Echo Bay Road, however, did not cross a mapped fault. [2]

Numerous seismic events, most of which are a probable result of the filling of the Lake Mead reservoir and underground blasting at the Nevada Test Site (about 145 km (90 miles) north of Las Vegas), have been felt in and around the Southern Nevada area. There is a noticeable

[1] Longwell, C.R., E.H.Pampeyan, Ben Bowyer, and R.J.Roberts, 1965, "Geology and Mineral Deposits of Clark County, Nevada", Nevada Bureau of Mines and Geology, Bulletin 62.

[2] Bohannon, R.G., 1983, "Geologic Map, Tectonic Map and Structure Sections of the Muddy and Northern Black Mountains, Clark County, Nevada", U.S. Geological Survey, Miscellaneous Investigations Series Map I-1406.

lack of earthquakes with epicenters in the Southern Nevada area that have been directly attributable to deep-seated tectonic movement. A few events recorded in the Henderson area and in Lincoln County registered between 5.0 and 6.0 Richter magnitude (M_L). Most of the recorded events in the area range between M_L 4.0 and 4.9.[3]

6.0 RECOMMENDATIONS

6.1 General

Our recommendations are based on the assumption that the soil conditions between our borings are similar to those encountered within these explorations. If variations are noted during construction or if changes are made in the alignment plans, foundation type, or structural loading, we should be notified so we can supplement our recommendations, as applicable.

Expansive soils are expected to be present on the Northshore Road, Echo Bay Road and Overton Beach Road alignments. As previously indicated, the clay soils encountered along Northshore Road ranged from having a "low" to "moderate" expansion potential. The clay soils encountered along Overton Beach Road ranged from having a "moderate" to "high" expansion potential. Moderately to highly expansive clays have the potential to undergo relatively large movements due to increases in moisture content over time.

As previously indicated, some of the soils encountered along the Northshore Road contained sufficient gypsum that may be considered soluble and are prone to consolidation. Highly soluble gypsum soils can become considerably weaker and more compressible with increased moisture content. If encountered at roadway subgrades, native gypsum should be overexcavated a minimum of 0.6 m (2 feet) and replaced with properly compacted material with a total soluble gypsum of 2 percent or less.

Laboratory test results indicated that some of the soils within the roadways contained sufficient concentrations of sodium sulfate to be susceptible to chemical expansion. Heaving of transverse joints was observed to have occurred in areas of the roadways not underlain with clayey soils. However, most of these areas did appear to contain soils with high sodium sulfate concentrations. A sufficient thickness of aggregate base (15.3 cm (6 inches) or more) and proper drainage should reduce the effects of sodium sulfate induced expansion.

As previously indicated, alluvial deposited materials were observed within the limits of the Echo Wash bottom and the Valley of Fire Wash bottom. These alluvial deposited materials should be considered as unsuitable material within the limits of any structure support positioned within the bottom of either wash. The alluvial material should be overexcavated and replaced with

[3] Slemmons, Burt, 1990 "Earthquakes in Las Vegas", Address to first meeting of Southwestern Section of Association of Engineering Geologist. Las Vegas, Nevada, October 1990.

properly compacted, engineered fill. The alluvial material can be re-used for controlled fill provided all oversize material, unsuitable material (as determined by the geotechnical engineer), vegetation, and other deleterious debris is removed.

Deep foundations are recommended to protect the pier foundations at both the Echo Wash bottom and the Valley of Fire Wash bottom sites. Deep foundations are recommended at the abutments also to reduce the risk of differential settlement between different types of foundations. Both driven and drilled foundations could be considered at these sites. Small displacement steel piles should be considered if a driven pile foundation is selected. Shallow refusal could be anticipated if large displacement piles are selected.

Drilled shaft foundations are more commonly used for bridge structures in the southern Nevada area. Design charts for use in design of drilled shaft foundations at both the Echo Wash bottom and the Valley of Fire Wash bottom sites as well as additional recommendations relating to design and construction of the bridge structures are provided in our report, "Echo Wash and Valley of Fire Wash Bridge Sites" (Terracon Project No. 64055119), prepared under separate cover. Design recommendations for driven pile foundations can be provided at a later date, if requested.

6.2 Foundation Recommendations

The proposed bridge foundations may be supported by drilled shaft foundations. Drilled shaft diameters and lengths may be designed based on interpolation from plates provided in the aforementioned report. The design charts were developed from the exploration and testing data included in that report. The values obtained from the charts include an estimated factor of safety of 2.5 and would be applicable for design in the service load case. Drilled shaft capacities obtained from the plates provided in the aforementioned report would be appropriate for drilled shafts placed on at least 3 diameters center to center. Drilling and concrete placement should be logged during construction. A one-third increase may be used for wind and seismic loads.

Foundations for lightly loaded structures such as traffic control structures, retaining walls, mechanically stabilized embankments, wing walls, and storm drain head walls may be designed as shallow spread footings. Shallow foundations should be embedded a minimum of 2 feet below the local scour depth as determined by hydraulic analyses of the bridge sites. Shallow spread foundations should be designed to bear on undisturbed native soil or on properly placed and compacted structural fill. If encountered, gypsiferous soils should be over-excavated and removed from beneath foundations to a depth of 3 feet and replaced with approved granular compacted fill. An allowable net bearing pressure of 3000 psf may be used in design. A one-third increase may be used for wind and seismic loads.

Total settlement of the proposed drilled shaft and shallow foundations, supported as recommended, should be less than 1 inch. Differential settlement should be less than 2/3 the total settlement.

Hard drilling conditions should be anticipated where hard less weathered claystone or sandstone strata are encountered. Groundwater and non-cohesive potentially caving soils should be anticipated. Temporary casing may be required during drilling and concrete placement.

Drilled foundations should be drilled plumb and at the design location +/- 3". Reinforcement and concrete placement should proceed within one hour after final clean-out and inspection. Concrete should be placed by tremie from the bottom of the shaft. Drilled shaft concrete should be placed at a minimum slump of 6 inches. A minimum concrete head of 5 feet should be maintained during placement. A log of drilling and concrete placement should be maintained for each shaft. Field and laboratory testing of concrete should be performed to verify that project specifications for concrete placement and strength requirements have been met.

Cross-hole sonic logging or other non-destructive test methods are recommended for at least 20 percent of drilled foundations to verify integrity of completed shafts.

6.3 Seismic Considerations

Based on the results of our exploration and our knowledge of the area, the shallow subsurface soil profile for the Echo Wash and Valley of Fire bridge sites is best represented by AASHTO Soil Profile Type II (American Association of State Highway and Transportation Officials, Standard Specifications for Highway Bridges, 17th Edition – 2002). A search of the National Seismic Hazard Map database indicated the following peak ground acceleration (PGA) and spectral accelerations for 0.2 second (S_S) and 1.0 second (S_1) periods for a 10% probability of exceedance (PE) in 50 years in the area of the project sites:

PERIOD	ACCELERATION
PGA	0.09 g
0.2 sec S_S	0.22 g
1.0 sec S_1	0.07 g

The soil conditions encountered below anticipated foundation depths in the borings generally consisted of dense to very dense sand and gravel with some clay, stiff to very stiff clay and silt and residually weathered sedimentary rocks. Groundwater was encountered more than 20 feet below existing grade at the bridge sites. These soil types and groundwater conditions are generally not susceptible to liquefaction.

6.4 Lateral Earth Pressures

Lateral loads may be resisted by soil friction and by the passive resistance of the soil. A coefficient of friction of 0.35 may be used between foundations and the supporting soils. Lateral resistance of drilled shafts at 6.35 mm (¼ inch) ground line deflection may be taken as 10 percent of the axial capacity shown on the plates provided in the aforementioned report for drilled shaft lengths of 10 shaft diameters or more below the design scour depth. The resistance to lateral load may be determined using computer code LPILE (com 624) or other suitable beam on elastic foundation methods. Soil properties for input to LPILE may be selected from the Table No. 6.4-1 below.

TABLE NO. 6.4-1
Soil Properties for Input to (Pile Analyses)

Depth Interval (ft.)	Angle of Interval Friction (degrees)	Modulus of Subgrade (pci)	Elastics Strain @ E_{50}	Unit Weight (pci)
0-15	34	100	0.006	0.070
15-25	38	175	0.005	0.045
25-40	42	250	0.004	0.042
40-60	45	350	0.003	0.042

For soils above any free water surface, with level backfill and no surcharge loads, we recommend the following equivalent fluid pressures and coefficient of friction based on a retained soil with an in-place density of 115 pcf and an angle of internal friction of 30 degrees:

- Active..38 pcf
- Passive..300 pcf
- Coefficient of Friction 0.35

Notes:
1. Active pressure assumes unrestrained (cantilever) wall and assumes no loading from heavy compaction equipment.
2. The passive pressure and the frictional resistance of the soils may be combined without reduction in determining the total lateral resistance.

Fill against foundations and retaining walls should be properly placed and compacted. Backfill should be mechanically compacted in layers (150 to 205 mm (6 to 8 inches) maximum thickness); flooding should not be permitted. Backfill within 0.61 m (2 feet) of the back of retaining walls should be compacted to at least 90 percent of the maximum dry density obtainable by the ASTM D1557 method. Care should be taken when placing backfill so as not to damage the walls. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors. Overcompaction may cause excessive lateral earth pressures which could result in wall movements.

6.5 Earthwork

6.5.1 Alignment Clearing

- Strip and remove existing vegetation, debris, uncontrolled fill, or disturbed natural soils, and other deleterious materials from proposed structure areas and in areas to be paved. Excavations should extend at least 1.5 m (5 feet) beyond any structures in plan view. Uncontrolled fill is defined as any existing fill that was not properly placed, observed and tested.

- All exposed surfaces should be free of mounds and depressions, which could prevent uniform compaction.

- If unexpected fills or underground facilities are encountered during site clearing, such features should be removed and the excavation thoroughly cleaned and backfilled. All excavations should be observed by the geotechnical engineer prior to backfill placement.

6.5.2 Excavation

- It is anticipated that excavation of the on-site natural non-cemented deposits for the proposed project can be accomplished with conventional earthmoving equipment.

- Excavations penetrating moderately hard or relatively thin (less than one foot) hard layers of cemented sands and gravel should be able to be excavated using heavy-duty equipment.

- Excavations penetrating hard or very hard cemented deposits or rock will require special consideration where they are to be performed.

- Contractors, especially those digging utilities, should satisfy themselves as to the hardness of materials and equipment required.

- Trenching and shoring operations should be conducted in accordance with Section 10 Nos. 1926.650 through 1926.652 of the State of Nevada Occupational Safety and Health Standards for the Construction Industry (with amendments as of August, 1991) and in accordance with 29 CFR Part 1926, Occupational Safety and Health Standards - Excavations; Final Rule (October 31, 1989). Safety of construction personnel is the responsibility of the contractor.

6.5.3 Overexcavation

- As previously indicated, some of the soils encountered along the roadway contained sufficient gypsum to be considered moderately to highly soluble in water. Soils encountered along Northshore Road at borings B-4, B-5, B-6, and B-8 exhibited the highest amounts of soluble gypsum in laboratory tests, ranging from 3.06 percent to 3.47 percent. Highly soluble gypsum soils can become weaker and more compressible with increased moisture content. The highly soluble gypsum soils (soils containing more than 2-percent soluble gypsum) would not suitable for support of paving if soil moisture were allowed to increase over time. For this reason, it is very important that good drainage be provided to keep moisture from penetrating the soils below the new pavements supported on gypsum rich soils.

- Boring B-4 and B-5 are located in an area proposed for a realignment of the roadway. In the Pavement Recommendation section of this report it is recommended that a portion of the realignment be overexcavated due to low R-value material. This will reduce the risk associated with soluble gypsum in that area. The soils in the realignment area do not consist predominantly of gypsum, but are silty clay, sandy clay and clay that contain a fraction of gypsum. The Lake Mead area typically receives less than 127 mm (5-inches) of precipitation per year. Due to the native materials consisting of lower permeability clay soil, the low precipitation at Lake Mead, and assuming good drainage will be provided as part of the realignment design, we do not recommend that the subgrade soils be overexcavated due to the presence of soluble gypsum. However, if there are areas where drainage may be a concern, and the supporting soils are likely to become wetted, we recommend that the natural soils within 0.60 m (2 feet) of the pavement subgrade be overexcavated and replaced with properly compacted materials. Highly soluble gypsum soils should be blended with other materials until the blended soil has 1½-percent or less of soluble gypsum before being re-used as fill material.

- Native gypsum was encountered in soil Borings S-26, S-34 and S-35. At each location, it appeared that portions of the native gypsum had been overexcavated 15.2 to 30.5 centimeters [cm] (½ to 1-foot) and replaced with non-soluble fill material. Overexcavation of gypsum below roadway reconstruction/reconditioning is not recommended unless field observations during construction indicate it would be beneficial.

6.5.4 Fill Materials

- On-site soils with an expansion potential less than 8 percent, soluble gypsum less than 2 percent, minus all debris, or organic matter may be used in required soil fills. The R-value of the fill should conform to the R-value required for the pavement design as presented in section 6.6.4 of this report.

- Fill containing oversize material (greater than 150 mm (6-inches)) should not be used for trench backfill, behind retaining walls, within 0.6 m (2 feet) of roadway subgrade, or against foundations.

- Imported and on-site fill soils should conform to the following:

  - Gradation (ASTM C136): Percent Finer by Weight:

    6" 100
    3" 70-100
    No. 4 Sieve 35-80
    No. 200 Sieve 5-35

  - Plasticity Index .... less than 8

- Select granular backfill (FP-03 Section 704.10) should be used as backfill behind retaining walls, conforming to Section 704.10, plus the following:

  - Maximum Expansive Potential (%) (2.9 kPa (60-psf) surcharge) ..... Non-Expansive
  - Maximum Sulfate Content (%) 0.10
  - Maximum Soluble Gypsum (%) .... Non-Soluble

6.5.5 Fill Placement and Compaction

- After performing required excavations, the exposed soils should be carefully observed to verify removal of all unsuitable deposits. Exposed soils should then be scarified to a depth of 150 mm (6 inches) (not necessary if cemented soils (caliche) or bedrock exposed), moisture conditioned as necessary, and compacted as recommended.

- Fill materials should be placed on a horizontal plane unless otherwise accepted by the geotechnical engineer.

- Where the slope ratio of the original ground is steeper than 5H:1V (horizontal: vertical), the slope should be benched to create near-level areas for the placement of fill. The maximum allowable height of the bench is 0.9 m (3 feet). Bench excavation should be continued to the top of the existing slope in structural fill areas or the daylight (cut/fill) contact.

- All required fill should be placed in loose lifts approximately 203 mm (8 inches) thick.

- Materials should be compacted to the following:

MATERIAL	PERCENT COMPACTION (AASHTO T-99)	MOISTURE CONTENT
Fine – grained	90 minimum	+2 percent over optimum (minimum)
Granular	95 minimum	-2 percent of optimum (minimum)

Note: For the purpose of compaction, fine-grained soils are soils with at least 30 percent passing the No. 200 sieve and/or soils having an expansion greater than 4 percent.

All fill placed deeper than 1.50m (5 feet) below final grade should be compacted to a minimum of 95 percent.

- Field density tests should be performed as per Table 204-1 (FP-03) for the particular material being tested. The Engineer may take additional tests as considered necessary to check on the uniformity of compaction. Where sheepsfoot rollers are used, the tests shall be taken in the compacted material below the disturbed surface. No additional layers of fill shall be spread until the field density tests indicated that the specified density had been obtained.

- Clayey soils should not be allowed to dry out and crack during or after construction. Moisture contents should be maintained at least until foundations and pavements are constructed. Any dried or cracked soil could be wetted until they reach acceptable moisture contents or they could be excavated and replaced with acceptable properly compacted fill.

6.5.6 Material Volume Changes

- Clearing and grubbing operations will result in some loss of material in the new alignment segments of the project. Excavation and recompaction of the soils along the alignment will result in shrinkage losses.

- Based on our experience, a shrinkage factor of approximately 15 to 20 percent would be applicable for the upper native soils exhibiting a medium dense or stiff consistency when excavated and then recompacted. Native soils exhibiting a loose to medium dense or firm consistency prior to excavation may exhibit a shrinkage factor of 20 to 40 percent. As an example, a shrinkage factor of 10 percent would mean it would require 1.10 cubic meter of excavated material to equal 1.0 cubic meter of properly compacted fill.

6.5.7 Permanent Slopes

Earthwork activities to construct slopes at the site should be done in accordance with the following:

- Cut and/or fill slopes should be constructed no steeper than 2H:1V.
- If any slope exceeds 6.1 m (30 feet) in height, the slope design should include mid-height benches to intercept surface drainage and divert flow from the slope face.
- The surfaces of slopes should be compacted (not necessary where caliche/rock is exposed) to the minimum specifications recommended in the Earthwork section of this report and until the slopes are stable and there are no loose soils on the slopes. Alternately, fill slopes could be constructed by over-filling and cutting back to expose fully compacted soil.
- The ground surface adjacent to the top of slopes should be graded to drain away from the slopes. Any required erosion control measures should be provided for all slopes as soon as possible after grading.

6.6 Flexible Pavement Design and Recommendations

6.6.1 Pavement Distress Survey and Assessment

A pavement distress survey was conducted along the length of Northshore Road on December 3 and 4, 2003. A second pavement distress survey was conducted along the lengths Echo Bay Road and Overton Beach Road on February 8, 2006. The pavement surfaces were evaluated based on the information put forth in the "Distress Identification Manual for the Long-Term Pavement Performance Project", SHRP-P-338, Chapter 1-Distress for Pavements with Asphalt Concrete Surfaces. The distress surveys were recorded as set forth in Chapter 6 of the PDDM.

The only reference points available along the alignments at the time of the survey were mile post markers. These mile post markers were used to establish a relationship between the existing alignments and the stationing shown on the provided Northshore Road Plan Sheets and the Echo Bay Road and Overton Beach Road Plan Sheets. Stationing information provided in this report and used for the distress survey is only approximate.

Please refer to Appendix D for copies of the Asphaltic Concrete Pavement Condition Survey, and photographs taken during the distress survey, Plates D-1 through D-25.

Shoulder areas along the existing roadways appeared to be functioning, except in areas where gypsum soils and low R-value soils were observed. Shoulder widths were somewhat narrow in embankment and cut areas, but excessively wide where the roadway followed the existing topography. Widening of the roadways will require placement of additional fill in embankment areas and additional excavation in cut areas. If the recommendations put forth in the Earthwork section of this report are incorporated into the final design and specifications, shoulders constructed at the site should provide suitable services.

Northshore Road

The most predominate pavement distress observed over the length of the alignment was transverse cracking. Numerous transverse cracks were observed within every 0.4 km (¼-mile) portion of the roadway alignment, ranging in severity from low to high, except in new overlay areas. Judging from the crack widths, it appears most of the transverse cracking developed first, propagating into block and alligator cracking over time.

Heaving at transverse cracking was noted in most roadway cut areas, and most notability at the transition area from cut to fill, or fill to cut. Differential heaving of 6.5 mm (¼ inch) to 19 mm (¾ inches) was observed in several locations across transverse cracks in these transition areas. Transverse rutting of the existing asphalt pavement was noted near Sta. 45+587, most probably propagated by heaving of the transverse cracking in this roadway cut area. Heaving of the pavement cracks in roadway cut areas was most probably related to underlying clayey soils or sodium sulfate expansion.

Starting at the beginning of the project Sta. 45+680 to approximate Sta. 55+820, cracking in the existing asphalt pavement was open, exposing the underlying subgrade to moisture infiltration or loss however slight. From approximate Sta. 55+820 to Sta. 68+800, the previous pavement cracks had been sealed. However, some of the sealed transverse cracks in this area had begun to open again, exposing the subgrade to possible moisture changes. At several locations, excess sealing material had been squeezed out of the cracks due to past thermal expansion of the pavement.

Chip and seal coatings had been placed over a major portion of the roadway to help seal cracking and improve the wearing surface. Recovered pavement cores indicated most of the chip and seal coating had been worn off from the start of the project to near Boring S-8 (Sta. 51+790). From Boring S-8 to the end of the project, recovered pavement cores indicated the chip and seal coating was approximately 6.5 mm (¼ inch) to 9.5 mm (⅜ inches) thick. Starting just south of the Overton Beach Road intersection, Sta.72+200, the chip and seal coating had begun to ravel between the distributor truck spray paths, resulting in a washboard effect across the roadway surface. This surface condition continued to the end of the project, at Sta.75+125 or Mile Post 47.0.

Echo Bay Road

Block and transverse cracking were the predominate types of pavement distress observed over the length of the roadway alignment. Block cracking and transverse cracks were observed within every 0.4 km (¼-mile) portion of the roadway alignments, ranging in severity from low to high. Judging from the crack widths, it appears most of the transverse cracking developed first, propagating into block and alligator cracking over time.

Alligator cracking was observed from approximate Sta. 0+050 to 0+150 and from approximate Sta. 5+000 to Sta. 7+250, ranging in severity from low to moderate. However, areas of high severity alligator cracking were also observed at approximate Sta. 0+510, Sta. 0+535, Sta. 0+730 and Sta. 0+890. These areas of high severity alligator cracking were observed to correspond with areas having rut depths greater than 25.4 mm (1 inch).

Rutting was noted from approximate Sta. 0+000 to Sta. 1+610. Rut depths of 6.5 mm (¼ inch) to 51 mm (2 inches) were observed, with the larger rut depths observed predominately in the outer wheel paths of both travel lanes. Rutting was also observed near approximate Sta. 3+400 with a rut depth of 6.5 mm (¼ inch). Rutting of the pavement was most probably related to the asphalt concrete mix, though it may also have been related to inadequate subgrade soils not encountered during our site exploration. Rutting in the asphalt layer of the pavement section can be the result of an unstable asphalt mix, heavy vehicle traffic or high pavement temperatures and can be accompanied by asphalt displacement next to the wheel travel lanes.[4] An example of asphalt displacement can be observed in Photo 27, Plate D-15 of Appendix D.

Shoving was noted near the intersection of Echo Bay Road and Northshore Road. Low to moderate severity bleeding was observed in numerous locations along the roadway, but most noticeably from approximate Sta. 0+000 to Sta. 0+400 and from approximate Sta. 6+410 to Sta. 7+265.

Numerous patches were observed from approximate Sta. 0+480 to Sta. 1+180, predominately in the outer wheel paths at the pavement edge. These moderate to high severity patches ranged in size from approximately 0.1 m^2 (1 ft^2) to 9.3 m^2 (100 ft^2) and appear to have been placed in areas of moderate to high severity block and alligator cracking and rutting. A utility trench near Sta. 7+465 has settled, creating a moderate to high severity patch. In addition, a moderate severity pothole was noted near Sta. 7+360 at an existing pavement joint between Echo Bay Road and an asphalt concrete parking lot.

Heaving at block and transverse cracking was noted in several areas, including approximate Sta. 2+540, Sta. 3+400, Sta. 4+680, Sta. 5+250 and Sta. 5+460. Differential heaving of 6.5 mm

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[4] Santucci, Larry, 2001, "Rut Resistant Asphalt Pavements", Institute of Transportation Studies, Technology Transfer Program, pg 2.

(¼ inch) to 19 mm (¾ inches) was observed in several of these locations. Heaving of the pavement cracks was most probably related to sodium sulfate expansion.

Starting at the beginning of the roadway Sta. 0+000 to approximate Sta. 7+593, some cracking in the existing asphalt pavement was open, exposing the underlying subgrade to moisture infiltration or loss, however slight. It did not appear that any of the cracks had been sealed to help protect the subgrade from possible moisture changes.

Drainage issues were observed near Sta. 3+450 and Sta. 7+440. Near Sta. 3+450, surface water runoff had eroded a small channel in the shoulder adjacent to the edge of pavement. Near Sta. 7+440, ponding water was observed at the pavement edge and in the concrete curb and gutter. The ponding water was attributed to surface irrigation from the adjacent landscaped area and not to bleeding or pumping of water from beneath the pavement.

Chip and seal coatings had been placed over the roadway to help seal cracking and improve the wearing surface. Recovered pavement cores indicated the chip and seal coating was approximately 6.5 mm (¼ inch) to 9.5 mm (⅜ inches) thick.

Overton Beach Road

Block and transverse cracking were the predominate types of pavement distress observed over the length of the roadway alignment. Block cracking and transverse cracks were observed within every 0.4 km (¼-mile) portion of the roadway alignments, ranging in severity from low to high. Judging from the crack widths, it appears most of the transverse cracking developed first, propagating into block and alligator cracking over time. In addition, raveling was observed over the length of the roadway alignment in the chip and seal coating, ranging in severity from low to high.

Alligator cracking was observed near Sta. 14+230, Sta. 14+630 and Sta. 16+180, ranging in severity from low to high. Low to moderate severity bleeding was observed in numerous locations along the roadway, but most noticeably at approximate Sta. 14+230, Sta. 15+060, Sta. 16+180 and Sta. 18+160.

Patches were observed near Sta. 15+170, Sta. 16+180, Sta. 16+290, Sta. 17+125 and Sta. 18+160. These low to high severity patches ranged in size from approximately 2.0 m^2 (22 ft^2) to 12.3 m^2 (132 ft^2) and appear to have been placed in areas of low to moderate severity block and alligator cracking, at utility trenches and at culvert locations. In addition, near approximate Station 16+900 the edge of pavement had deteriorated into the roadway beyond the fog line creating a moderate severity pothole.

Heaving at transverse cracking was noted in a cut area near approximate Sta. 15+260. Differential heaving of 6.5 mm (¼ inch) to 12.7 mm (½ inch) was observed at this location. Heaving of the pavement cracks was most probably related to sodium sulfate expansion.

Starting at the beginning of the roadway Sta. 13+700 to approximate Sta. 18+307, some cracking in the existing asphalt pavement was open, exposing the underlying subgrade to moisture infiltration or loss, however slight. It did not appear that any of the cracks had been sealed to help protect the subgrade from possible moisture changes.

Chip and seal coatings had been placed over the roadway to help seal cracking and improve the wearing surface. Recovered pavement cores indicated most of the chip and seal coating had been worn off near Corings OC-1, OC-2 and OC-5, but that the chip and seal coating was approximately 6.5 mm (¼ inch) thick near Corings OC-3, OC-4 and OC-6. The chip and seal coating had begun to ravel across numerous areas of the roadway alignment.

6.6.2 Subgrade Investigation

Borings S-1 through S-37 were performed on 0.8 km (½ mile) centers along the length of Northshore Road, from Mile Post 29.0 to Mile Post 47.0 (Sta. 46+163 to Sta. 75+125). Borings EB-1 through EB-10 were performed on 0.80 km (½ mile) centers along the length of Echo Bay Road, from Mile Post 0.0 to Mile Post 4.7 (Sta. 0+000 to Sta. 7+593). Borings OB-1 through OB-6 were performed on 0.80 km (½ mile) centers along the length of Overton Beach Road, from Mile Post 0.0 to Mile Post 2.9 (Sta. 13+700 to Sta. 18+307). Each boring was performed within the outside wheel lane and taken to a depth of 1.5 to 1.7 m (5 to 5½ feet) below the existing pavement surface. A total of 53 borings were performed during this exploration. Each boring was performed within the outside wheel lane and taken to a depth of 1.5 m (5 feet) below the existing pavement surface. The borings were logged during drilling and disturbed (bag) samples of the underlying soils were obtained at each location to aid in material classification and for laboratory testing. Results of the borings are presented in the Appendix B, along with a tabulation of the laboratory analyses performed on selected specimens.

R-values were determined on selected specimens as per ASTM D 2844. Samples were selected from each 1.61 km (1 mile) section of Northshore Road. R-values varied from less than 5 to 80. A summary of the twenty-three (23) R-value tests for Northshore Road are presented in the following Table:

NORTHSHORE ROAD ALIGNMENT					
Boring No.	Approximate Mile Post Location	Depth (ft) below Existing Surface	R-Value	AASHTO Classification	USCS
B-50 *	28.9	0 – 3	5	A-6(11)	

NORTHSHORE ROAD ALIGNMENT					
Boring No.	Approximate Mile Post Location	Depth (ft) below Existing Surface	R-Value	AASHTO Classification	USCS
S-2	29.5	1 – 5	80	A-4	ML
B-52 *	30.4	0 – 3	46	A-2-4	
S-4	30.5	1 – 5	67	A-2-4	GC
S-5	31.0	1 – 5	77	A-1-b	GC-GM
S-7	32.0	1 – 5	70	A-1-b	SM
B-54 *	33.5	0 – 3	74	A-2-4	
S-10	33.5	1 – 5	80	A-2-4	SC-SM
S-11	34.0	1 – 5	80	A-1-b	SM
S-14	35.5	1 – 5	74	A-2-7	SM
S-16	36.5	1 – 5	8	A-6	CL
S-17	37.0	1 – 5	59	A-2-7	GC
S-20	38.5	1 – 5	78	A-2-4	SC-SM
S-22	39.5	1 – 5	74	A-4	SM
S-23	40.0	1 – 5	80	A-1-a	SM
S-26	41.5	1 – 5	60	A-4	ML
S-28	42.5	1 – 5	81	A-1-b	SM
B-4	43.25	5 – 10	<5	A-7-6	CL
B-5	43.38	0 – 5	20	A-6	CL
S-31	33.0	1 – 5	40	A-4	CL-ML
B-8	45.06	1 – 5	<5	A-7-6	CH
B-6	45.22	0 – 5	25	A-4	SC-SM
B-6	45.22	5 – 10	<5	A-7-6	CL
B-7	45.38	0 – 5	31	A-6	CL
S-36	46.5	1 – 5	76	A-2-4	SM
S-37	47.0	1 – 5	65	A-2-4	SP-SM

* - Provided by FHWA borings from 1992, MP 30.3 to MP 34.8.

Samples were selected from each 0.80 km to 1.61 km (½ to 1 mile) section of Echo Bay Road. R-values varied from 42 to 68. A summary of the eight (8) R-value tests for Echo Bay Road are presented in the following Table:

ECHO BAY ROAD ALIGNMENT					
Boring No.	Approximate Mile Post Location	Depth (ft) below Existing Surface	R-Value	AASHTO Classification	USCS
EB-2	0.75	2 – 5	58	A-5	SM
EB-4	1.75	2 – 5	48	A-7-5	SM
EB-5	2.25	2 – 5	52	A-2-4	SC-SM
EB-6	2.75	2 – 5	68	A-2-4	SM
EB-7	3.25	2 – 5	44	A-2-4	SC
EB-8	3.75	2 – 5	59	A-2-6	SM
EB-9	4.25	2 – 5	42	A-7-6	SM

ECHO BAY ROAD ALIGNMENT					
Boring No.	Approximate Mile Post Location	Depth (ft) below Existing Surface	R-Value	AASHTO Classification	USCS
EB-10	4.70	2 – 5	60	A-4	ML

Samples were selected from each 0.80 km to 1.61 km (½ to 1 mile) section of Overton Beach Road. R-values varied from less than 5 to 84. A summary of the six (6) R-value tests for Echo Bay Road are presented in the following Table:

OVERTON BEACH ROAD ALIGNMENT					
Boring No.	Approximate Mile Post Location	Depth (ft) below Existing Surface	R-Value	AASHTO Classification	USCS
OB-1	0.25	2 – 5	<5	A-7-6	CH
OB-2	0.75	2 – 5	<5	A-6	CL
OB-3	1.25	2 – 5	84	A-1-a	GP-GM
OB-4	1.75	2 – 5	59	A-1-b	GC-GM
OB-5	2.25	2 – 5	44	A-2-4	SC-SM
OB-6	2.8	2 – 5	72	A-1-b	SM

An oil soaked layer of soil was noted underlying the pavement and/or base aggregate along the northern portion of Northshore Road. Recovered pavement cores indicated this oil soil layer might extend from Coring C-24 northward through to the end of the project at Sta.75+125. This section of the roadway appears to have been in use somewhat longer than the roadway south of Coring C-24, as noted on older topography maps. From the recovered pavement core, an oil soaked layer was also evident beneath the pavement at the Blue Springs parking area.

6.6.3 Pavement and Base Investigation

Determination of the existing pavement and base thickness were obtained on 0.4 km (¼ mile) centers along the length of the existing roadway alignments, Sta. 45+680 to Sta. 75+125 on Northshore Road, Sta. 0+000 to Sta. 7+593 on Echo Bay Road and Sta. 13+700 to Sta. 18+307 on Overton Beach Road. Pavement cores, C-1 through C-39, EC-1 through EC-10 and OC-1 through OC-6, were obtained within the outside wheel lane on approximately 0.80 km (½ mile) centers, offset approximately 0.40 km (¼ mile) from the roadway soil borings, S-1 through S-37, EB-1 through EB-10 and OB-1 through OB-6. Cores were taken through the existing pavement and any underlying base course material, until fill or native soils were encountered. Pavement section information obtained within the roadway soil borings was combined with the pavement cores to provide pavement and base thickness on 0.40 km (¼-mile) spacing along the entire length of the roadway alignments. Please refer to Appendix D for In-Place Asphalt Pavement and Base Thickness tabulations.

Results of pavement cores and roadway soil borings indicated the lack of an aggregate base course layer under a majority of the asphalt pavement on Northshore Road. It appears the initial asphaltic concrete was placed over compacted native soils. Aggregate base course material was first noted in roadway Boring S-31 (approximate Sta. 70+300) and again at S-34 (approximate Sta. 72+900) through to the end of the project at S-37 (Sta. 75+125). Aggregate base course thickness at Boring S-31 was 64 mm (2½ inches), and varied from 75 mm (3 inches) to 102 mm (4 inches) at Borings S-34 to S-37. Aggregate base course thickness on Echo Bay Road typically varied from 102 mm (4 inches) to 203 mm (8 inches) at Borings EB-1 to EB-10, though aggregate base course thickness at Boring EB-5 was 75 mm (3 inches). Aggregate base course thickness on Overton Beach Road typically varied from 127 mm (5 inches) to 203 mm (8 inches) at Borings OB-2 to OB-6, though aggregate base course thickness at Boring EB-5 was 330 mm (13 inches).

Based on recovered pavement cores and measurements of the asphalt pavement exposed in the soil borings on Northshore Road, the existing asphalt pavement varied in thickness from 25 mm (1 inch) to 130 mm (5⅛ inches) over the length of the alignment. From the start of the project to Core C-14, the pavement thickness generally ranged from 38 mm (1½ inches) to 73 mm (2⅞ inches). From Boring S-14 to Core C-28 the pavement thickness ranged from 89 mm (3½ inches) to 127 mm (5 inches). At Boring S-28 and Core C-29, pavement thicknesses reduced to 44 mm (1¾ inches) to 57 mm (2¼ inches), respectively. From Boring S-29 through to the end of the project, the pavement thickness varied from 25 mm (1 inch) to 130 mm (5⅛ inches). An overlay was noted in the recovered pavement cores at Cores C-28 through C-33. At several locations it appears the existing overlay surface was placed over fractured or failed pavement, as the underlying recovered pavement cores consisted of only fragments, not intact cores. A geotextile layer was also noted between the overlay and original asphalt pavement, starting at Boring S-29 through to Core C-31. For Echo Bay Road, the existing asphalt pavement varied in thickness from 44 mm (1¾ inches) to 70 mm (2¾ inches) over the length of the alignment. For Overton Beach Road, the existing asphalt pavement varied in thickness from 32 mm (1¼ inches) to 73 mm (2⅞ inches) over the length of the alignment.

The existing, or initial asphalt pavement on Northshore Road generally consisted of a base course asphaltic concrete type material with the course aggregate consisting of rounded, not crushed aggregates. Aggregates up to 32 mm (1¼ inches) in length were exposed on the sides of the recovered pavement cores. The asphalt overlay noted above the geotextile layer, at Boring S-29 through to Core C-31, generally consisted of surface course asphaltic concrete type material, with the course aggregate consisting of crushed aggregates. Maximum fragment size noted on the side of the pavement cores generally was less than 13 mm (½ inch) for the overlay material. The existing asphalt pavement on Echo Bay Road and Overton Beach Road generally consisted of surface course asphaltic concrete type material, with the course aggregate consisting of crushed aggregates. Maximum fragment size noted on the side of the pavement cores generally was less than 13 mm (½ inch).

6.6.4 Traffic and Structural Analysis Inputs

Traffic information for the project was provided in the NPS Traffic Monitoring Program (TMP) report (DTFH71-02-R-00013, dated March 12, 2004). Typical ESAL per vehicle classification unit and pavement design input parameters was provided in the Supplement to the PDDM, Attachment A, Chapter 6. The information from the TMP report is presented in Appendix E.

Based on the information in the TMP report, AADT values for the year 2003 have been determined for three segments of the project alignment. For the Northshore Road segment from Callville Bay Road to Echo Bay Road the AADT was 538; for the segment from Echo Bay Road to Overton Beach Road the AADT was 397; and for the segment from Overton Beach Road to North Park Boundary the AADT was 699. For the Echo Bay Road segment from Northshore Road to Lake Mead the AADT was 388. For the Overton Beach Road segment from Northshore Road to Lake Mead the AADT was 542.

A traffic mix for Station 19051 was present in the TMP report. The mix included 1.61 percent motorcycles, 76.96 percent passenger cars, 19.78 percent vehicles pulling trailers, 0.14 percent busses, 1.27 percent RVs, 0.09 percent light duty trucks, and 0.15 percent heavy trucks.

The 20 year design 18-kip equivalent single-axle load (ESAL) for each segment of the project alignment was determined utilizing the ESAL factors for each vehicle type presented in Attachment A of the Federal Lands Highway Project Development Manual (FHWA, 1996). A factor of 0.0004 was used for passenger cars; 0.2 for vehicles pulling trailers, 0.88 for busses; 0.2 for RVs; 0.2 for light trucks; and 2.2 for heavy trucks. A directional split of 60 percent was used.

In accordance with CFLHD requirements, flexible pavement analysis was based on the AASHTO design procedure (AASHTO Guide For Design Of Pavement Structures, 1993). Design information from Attachment A of the Federal Lands Highway Project Development Manual (FHWA, 1996) was also utilized in the analysis. Parameters used in determining the required structural number (SN) of the flexible pavement sections included a reliability level of 75 percent, an overall standard deviation of 0.49, an initial serviceability index of 4.2, and a terminal serviceability index of 2.5.

For new construction, the Central Federal Lands Highway Division (CFLHD) recommended the following minimum thickness of pavement structure material: 75 mm (3 inches) Asphaltic Concrete Pavement over 150 mm (6 inches) Aggregate Base Course.

The annual precipitation within the Lake Mead area was obtained from the NPS Lake Mead National Recreation Area Website, which noted that the average annual precipitation was less than 13 cm (5-inches) per year. Therefore, a drainage coefficient of 1.0 was used for design. The elevation information used to determine the Regional Factor was obtained from the provided plans.

Individual layer coefficients for each layer in the pavement section were determined using values presented in Attachment A of the Federal Lands Highway Project Development Manual (FHWA, 1996). The following coefficients were used; HACP – 0.44, FDR – 0.15, pulverizing – 0.05 to 0.1, aggregate base (ABC) – 0.14. The R-value-subgrade resilient modulus correlation used in design is published in the PDDM, Table 6-14. A copy is provided in Appendix F.

Utilizing the above AADT information and ESAL factors for the given vehicle types, the design 18-kip equivalent single axle loads (ESAL's) for the project segments were computed. A 60 percent directional traffic distribution was used in the analysis. An annual growth rate of 2 percent was used for design. Results are presented in the following Tables.

NORTHSHORE ROAD ALIGNMENT			
Segment	**Sta. To Sta.**	**Design ESAL**	**Design Life**
Callville Bay Road to Echo Bay Road	45+680 to 56+540	143,200	20
Echo Bay Road to Overton Beach Road	56+540 to 72+270	105,700	20
Overton Beach Road to North Park Boundary	72+270 to 75+125	186,000	20

ECHO BAY ROAD ALIGNMENT			
Segment	**Sta. To Sta.**	**Design ESAL**	**Design Life**
Northshore Road to Lake Mead	0+000 to 7+593	103,300	20

OVERTON BEACH ROAD ALIGNMENT			
Segment	**Sta. To Sta.**	**Design ESAL**	**Design Life**

Northshore Road to Lake Mead	13+700 to 18+307	144,300	20

6.6.5 Pavement Recommendations

Two rehabilitation options were considered in our evaluation. Option 1 consisted of full depth recycling (FDR) of the existing surface course material, blending the recycled material with cement, and compacting to establish a new base. The newly established base would be overlain with HACP. Option 2 consisted of pulverizing the existing asphalt concrete pavement material, blending with underlying base and/or subgrade material, compacting the pulverized and blended materials to establish a new base, and placing new hot mixed surface course (HACP).

A significant issue for FDR along the Northshore Road alignment is that the majority of the alignment has little or no base course. Typically, a FDR process is performed on asphalt concrete pavement underlain by a continuous layer of reasonably good quality base course. With the lack of base course, the existing pavement along Northshore Road is established primarily on native soils and fill soils that are most likely native soils used as fill. The existing asphalt is established on a range of soil, ranging from gravel to clay, not on a uniform, homogeneous, continues soil. Although FDR with Portland cement is feasible in nearly all the soil conditions encountered along the alignment, the improvement depends on the cement concentration. Finer grained and higher plasticity soils require additional cement to achieve the same results. Typically a base course material would require 4 percent cement. A clay soil may require up to 15 percent. A higher cement concentration is recommended in the analysis to account for the condition that if FDR is performed, the resulting newly created base course would consist of a blend of a variety of soils.

As with most desert soils in southern Nevada, most of the soils tested along the alignment as part of this investigation have sulfate concentrations within the soil above what would be considered corrosive to Portland cement. Sulfate attack usually requires a certain amount of water to propagate the attack. The very dry climate and the condition that the cement treated base would be protected by a layer of asphalt pavement would provide some protection from moisture infiltration and subsequent attack. A higher concentration of cement, and utilizing Type V cement would also provide added protection. Future deterioration of the FDR would likely occur, although the severity and time of the deterioration is difficult to predict.

Results of our analysis are presented on the output files in Appendix F. As part of the analysis, cost estimates per kilometer of roadway were determined to evaluate the most cost effective alternative. Spread sheet computations of cost estimates are presented in Appendix F, and in the following discussion. The cost estimates are meant to be a tool to determine the relative cost differences between the two alternatives and are not engineering bid quantities or of bid quality. The costs primarily account for material cost and do not include contactor mobilization, traffic control or other related costs.

Northshore Road Segment Sta. 45+680 to Sta. 56+543 (Echo Bay Road)

Based on the investigation, the existing HACP ranges from 38 to 83 mm (1½ to 3¼ inches) thick and has no underlying base course. The average HACP thickness is 57 mm (2¼ inches). Thirteen soil samples were collected along the roadway segment. Supporting subgrade soils are predominantly granular with estimated and measured R-values ranging from 33 to 81, with an average of 65. All but one of the subgrade soils tested have minus 200 fractions ranging from 14 to 27 percent (one sample was 60 percent), with an average of 23 percent. The Plasticity Index (PI) ranged from non-plastic to 19. Of the eight samples that showed plasticity, the average was 7.

Due to the relatively thin asphalt concrete and the lack of base course, the rehabilitation options are limited. In the recommendations presented below, a structural coefficient of 0.09 was used for pulverization to account for a portion of the granular subgrade soil being used. In the FDR with cement recommendation, a cement content of 8 percent was used to account for the subgrade soils having fines concentrations above 15 percent. A structural coefficient of 0.15 was used.

As stated previously, a 20 year design ESAL of 143,200 was determined for this segment. A weighted average approach was used to determine a design R-value of 60, which corresponds to a subgrade resilient modulus (M_R) of 86 MPa (12,500 psi). The design R-value was determined using both laboratory test results and approximations utilizing the soils minus 200 fraction of the gradation, and the PI. The R-value compilation is presented in Appendix F. Utilizing the design ESAL, design M_R and other design factors previously presented, a design Structural Number (SN) of 1.87 was determined.

Option 1:
75 mm (3 inches) HACP
100 mm (4 inches) FDR with cement
SN = 1.90 > 1.87 ok
Estimated cost (not bid quality) per kilometer = $156,300

Option 2: Recommended
90 mm (3½ inches) HACP
100 mm (4 inches) Road Reconditioning/Pulverizing
SN = 1.92 > 1.87 ok
Estimated cost (not bid quality) per kilometer = $142,100

In order to consolidate the number of recommended pavement sections along the entire project roadway alignments and to better facilitate construction on this segment of the roadway, a pavement section of 90 mm (3½ inches) HACP over 127 mm (5 inches) of road reconditioning/pulverizing may be used.

Northshore Road Segment Sta. 56+543 (Echo Bay Road) to Sta. 68+200

Based on the investigation, the existing HACP ranges from 44 to 117 mm (1¾ to 4⅝ inches) thick and has no underlying base course. The average HACP thickness is 100 mm (4 inches). Fourteen soil samples were collected along the roadway segment. Supporting subgrade soils are predominantly granular with estimated and measured R-values ranging from 8 to 88, with an average of 65, excluding the 8 result. The subgrade soils tested have minus 200 fractions ranging from 9 to 71 percent (two samples were above 36 percent; 59 and 60 percent), with an average of 27 percent. The Plasticity Index (PI) ranged from non-plastic to 23. Of the eight samples that showed plasticity, the average value was 11.

Although most of the soils encountered along this segment were granular in nature and had R-values generally above 52, an R-value of 8 was determined at boring S-16 (Sta. 58+230). The recommendations presented below are suitable for this roadway segment except for the area that has a significantly lower R-value. This appears to be an isolated area. It is recommended that the subgrade near Sta. 58+230 be overexcavated to remove the low R-value soils. Based on boring S-16, sandy clay fill was placed to 0.61 meters (2 feet) below the asphalt concrete. We recommend that at least 305 mm (12 inches) of the clay soil be overexcavated and replaced with at least 305 mm (12 inches) of aggregate base. The recommended 90 mm (3½ inches) HACP, as presented below, should be placed over the base course for a total section thickness of 90 mm of HACP over 305 mm of aggregate base. The lateral extent of the low R-value clay was not known at the time of this report and was beyond the scope of work defined in this report. However, for preliminary design purposes we suggest that an area including 200 meters (660 feet) on ether side of S-16 (Sta. 58+230) be considered. The extent of the clay soil can be determined in the field during construction or additional explorations could be performed prior to construction.

Due to the relatively thin asphalt concrete in some areas of the segment, and the lack of base course, the rehabilitation options are limited. In the recommendations presented below, a structural coefficient of 0.09 was used for pulverization to account for a portion of the granular subgrade soil being used. In the FDR with cement recommendation, a cement content of 8 percent was used to account for the subgrade soils having fines concentrations above 15 percent. A structural coefficient of 0.15 was used.

As stated previously, a 20 year design ESAL of 105,700 was determined for this segment. A weighted average approach was used to determine a design R-value of 60, which corresponds to a subgrade resilient modulus (M_R) of 86 MPa (12,500 psi). The design R-value was determined using both laboratory test results and approximations utilizing the soils minus 200 fraction of the gradation, and the PI. The R-value compilation is presented in Appendix F. Utilizing the design ESAL, design M_R and other design factors previously presented, a design Structural Number (SN) of 1.78 was determined.

Option 1:

75 mm (3 inches) HACP
100 mm (4 inches) FDR with cement
SN = 1.90 > 1.78 ok
Estimated cost (not bid quality) per kilometer = $156,300

Option 2: Recommended

90 mm (3½ inches) HACP
100 mm (4 inches) Road Reconditioning/Pulverizing
SN = 1.92 > 1.78 ok
Estimated cost (not bid quality) per kilometer = $142,100

In order to consolidate the number of recommended pavement sections along the entire project roadway alignments and to better facilitate construction on this segment of the roadway, a pavement section of 90 mm (3½ inches) HACP over 127 mm (5 inches) of road reconditioning/pulverizing may be used.

Northshore Road Segment Sta. 68+200 to Sta. 69+500 - Realignment

This segment includes an area of roadway realignment. As a result, we anticipate that new pavement will be constructed and no rehabilitation of the existing pavement will be performed. The limits of the realignment were assumed and could be adjusted based on the final realignment design. It is our understanding that the minimum new pavement section recommended by Central Federal Lands Highway Division is 75 mm (3 inches HACP) and 150 mm (6 inches) of aggregate base.

Four soil samples were collected along the roadway segment. Subgrade soils have estimated and measured R-values ranging from 5 to 38. Although most of the upper soils encountered along this segment have R-values above 20, an R-value of 5 was determined at boring B-4 (near Sta. 69+100 on a proposed new alignment). The recommendations presented below are suitable for this roadway segment except for areas that have significantly lower R-values. This appears to be an isolated area since there are high R-values in the upper soils on either side of this location. It is recommended that the subgrade near Sta. 69+100 be overexcavated to remove the low R-value soils. We recommend that at least 460 mm (18 inches) of the clay soil be overexcavated and replaced with at least 460 mm (18 inches) of aggregate base. The recommended 75 mm (3 inches) HACP, as presented below, should be placed over the base course for a total section thickness of 75 mm of HACP over 460 mm of aggregate base. The lateral extent of the low R-value clay was not known at the time of this report and was beyond the scope of work defined in this report. In addition, the elevation of the new pavement may require cuts below grade revealing additional low R-value clay soils that would require additional overexcavation. For preliminary design purposes we suggest that the alignment from Sta. 68+800 to Sta. 69+200 be considered for overexcavation. The extent of the low R-value clay soil can be determined in the field during construction or additional explorations could be performed prior to construction to help identify the limits of the material.

As stated previously, a 20 year design ESAL of 105,700 was determined for this segment. A weighted average approach was used to determine a design R-value of 19, which corresponds to a subgrade resilient modulus (M_R) of 48 MPa (7,000 psi). The design R-value was determined using both laboratory test results and approximations utilizing the soils minus 200 fraction of the gradation, and the PI. The R-value compilation is presented in Appendix F. Utilizing the design ESAL, design M_R and other design factors previously presented, a design Structural Number (SN) of 2.24 was determined.

Option 1:
- 90 mm (3½ inches) HACP
- 150 mm (6 inches) Aggregate Base
- SN = 2.38 > 2.24 ok
- Estimated cost (not bid quality) per kilometer = $172,300

Option 2: Recommended
- 75 mm (3 inches) HACP
- 178 mm (7 inches) Aggregate Base
- SN = 2.30 > 2.24 ok
- Estimated cost (not bid quality) per kilometer = $164,900
- Cost does not include overexcavation

In order to consolidate the number of recommended pavement sections along the entire project roadway alignments and to better facilitate construction on this segment of the roadway, a pavement section of 90 mm (3½ inches) HACP over 203 mm (8 inches) of aggregate base may be used.

Northshore Road Segment Sta. 69+500 to Sta. 71+800

Based on the investigation, the existing HACP ranges from 25 to 100 mm (1 to 4 inches) thick and is underlain by aggregate base course at one location. The 25 mm thick asphalt concrete was underlain by a 25 mm thick layer of asphalt concrete fragments. The average HACP thickness is 73 mm (2⅞ inches). Three soil samples were collected along the roadway segment. Supporting subgrade soils have estimated and measured R-values ranging from 38 to 77, with an average of 54. The subgrade soils tested have minus 200 fractions ranging from

19 to 53 percent, with an average of 41 percent. Two of the three samples had a Plasticity Index (PI) of 6 and 7, respectively. The third sample was non-plastic.

Due to the relatively thin asphalt concrete and the lack of base course, the rehabilitation options are limited. In the recommendations presented below, a structural coefficient of 0.05 was used for pulverization to account for a portion of the higher fines subgrade soil being used. In the FDR with cement recommendation, a cement content of 10 percent was used to account for the subgrade soils having fines concentrations above 20 percent. A structural coefficient of 0.15 was used.

As stated previously, a 20 year design ESAL of 105,700 was determined for this segment. A weighted average approach to determine a design R-value would produce an R-value of 54. However, since two of the R-values were near 40 and one was above 70, we recommend that an R-value of 40 be used for design, which corresponds to a subgrade resilient modulus (M_R) of 69 MPa (10,000 psi). The design R-value was determined using both laboratory test results and approximations utilizing the soils minus 200 fraction of the gradation, and the PI. The R-value compilation is presented in Appendix F. Utilizing the design ESAL, design M_R and other design factors previously presented, a design Structural Number (SN) of 1.94 was determined.

Option 1:

90 mm (3½ inches) HACP
100 mm (4 inches) FDR with cement
SN = 2.14 > 1.94 ok
Estimated cost (not bid quality) per kilometer = $179,900

Option 2: Recommended

100 mm (4 inches) HACP
100 mm (4 inches) Road Reconditioning/Pulverizing
SN = 1.96 > 1.94 ok
Estimated cost (not bid quality) per kilometer = $154,200

In order to consolidate the number of recommended pavement sections along the entire project roadway alignments and to better facilitate construction on this segment of the roadway, a pavement section of 90 mm (3½ inches) HACP over 203 mm (8 inches) of road reconditioning/pulverizing may be used.

Northshore Road Segment Sta. 71+800 to Sta. 72+800 – Realignment at Overton Beach Road

This segment includes an area of roadway realignment at the Overton Beach Road turnoff. As a result, we anticipate that new pavement will be constructed and no rehabilitation of the existing pavement will be performed. The limits of the realignment were assumed and could be adjusted based on the final realignment design. It is our understanding that the minimum new pavement section recommended by Central Federal Lands Highway Division is 75 mm (3 inches HACP) and 150 mm (6 inches) of aggregate base.

Four soil samples were collected along the roadway segment. Subgrade soils have estimated and measured R-values ranging from 5 to 31. Although most of the upper soils encountered along this segment have R-values above 20, an R-value of 5 was determined at boring B-8 (near Sta. 72+000). The recommendations presented below are suitable for this roadway segment except for areas that have significantly lower R-values. This appears to be an isolated area since there are high R-values in the upper soils on either side of this location. It is recommended that the subgrade near Sta. 72+000 be overexcavated to remove the low R-value soils. We recommend that at least 483 mm (19 inches) of the clay soil be overexcavated and replaced with at least 483 mm (19 inches) of aggregate base. The recommended 90 mm (3½ inches) HACP, as presented below, should be placed over the base course for a total section thickness of 90 mm of HACP over 483 mm of aggregate base. The lateral extent of the low R-value clay was not known at the time of this report and was beyond the scope of work defined in this report. In addition, the elevation of the new pavement may require cuts below existing grade revealing additional low R-value clay soils that would require additional overexcavation. Test results indicate that at boring B-6, the upper soils (1 to 5 feet below ground surface) have an R-value of 25 and the lower soils (5 to 10 feet below ground surface) have an R-value of 5. Roadway cuts into the lower soils would require additional overexcavation and the thicker pavement section.

For preliminary design purposes, we suggest that the alignment from Sta. 71+950 to Sta. 72+200 be considered for overexcavation. The extent of the low R-value clay soil can be determined in the field during construction or additional explorations could be performed prior to construction to help identify the limits of the material.

As stated previously, a 20 year design ESAL of 186,000 was determined for this segment. A weighted average approach was used to determine a design R-value of 19, which corresponds to a subgrade resilient modulus (M_R) of 48 MPa (7,000 psi). The design R-value was determined using both laboratory test results and approximations utilizing the soils minus 200 fraction of the gradation, and the PI. The R-value compilation is presented in Appendix F. Utilizing the design ESAL, design M_R and other design factors previously presented, a design Structural Number (SN) of 2.46 was determined.

Option 1:

75 mm (3 inches) HACP
230 mm (9 inches) Aggregate Base
SN = 2.58 > 2.46 ok
Estimated cost (not bid quality) per kilometer = $183,800

Option 2: Recommended

90 mm (3½ inches) HACP
178 mm (7 inches) Aggregate Base
SN = 2.52 > 2.46 ok
Estimated cost (not bid quality) per kilometer = $181,800
Cost does not include overexcavation

In order to consolidate the number of recommended pavement sections along the entire project roadway alignments and to better facilitate construction on this segment of the roadway, a pavement section of 90 mm (3½ inches) HACP over 203 mm (8 inches) of road reconditioning/pulverizing may be used.

Northshore Road Segment Sta. 72+800 to Sta. 75+125 (North Park Boundary)

Based on the investigation, the existing HACP ranges from 51 to 63 mm (2 to 2½ inches) thick. The average HACP thickness is 57 mm (2¼ inches). The underlying aggregate base course is 75 to 100 mm (3 to 4 inches) thick.

Four soil samples were collected along the roadway segment. Supporting subgrade soils are predominantly granular with estimated and measured R-values ranging from 40 to 67. The subgrade soils tested have minus 200 fractions ranging from 5 to 67 percent. Three of the four samples were non-plastic. One sample had a Plasticity Index (PI) of 3.

In the recommendations presented below, a structural coefficient of 0.10 was used for pulverization to account for 5 inches of combined asphalt concrete and aggregate base. In the FDR with cement recommendation, a cement content of 6 percent was used assuming the existing base course has a fines concentration under 20 percent. A structural coefficient of 0.15 was used.

As stated previously, a 20 year design ESAL of 186,000 was determined for this segment. A weighted average approach was used to determine a design R-value of approximately 60, which corresponds to a subgrade resilient modulus (M_R) of 86 MPa (12,500 psi). The design R-value was determined using both laboratory test results and approximations utilizing the soils minus 200 fraction of the gradation, and the PI. The R-value compilation is presented in Appendix F. Utilizing the design ESAL, design M_R and other design factors previously presented, a design Structural Number (SN) of 1.96 was determined.

Option 1:
75 mm (3 inches) HACP
127 mm (5 inches) FDR with cement
SN = 2.07 > 1.96 ok
Estimated cost (not bid quality) per kilometer = $155,200

Option 2: Recommended

90 mm (3½ inches) HACP
127 mm (5 inches) Road Reconditioning/Pulverizing
SN = 2.04 > 1.96 ok
Estimated cost (not bid quality) per kilometer = $142,100

Echo Bay Road Segment Sta. 0+000 (Northshore Road) to Sta. 7+593

Based on the investigation, the existing HACP ranges from 41 to 70 mm (1⅝ to 2¾ inches) thick. The average HACP thickness is 55 mm (2⅛ inches). The underlying aggregate base course is 76 to 203 mm (3 to 8 inches) thick.

Eight soil samples were collected along the roadway segment. Supporting subgrade soils are predominantly granular with measured R-values ranging from 42 to 68. The subgrade soils tested have minus 200 fractions ranging from 20 to 58 percent. The Plasticity Index (PI) ranged from 6 to 18. Two of the eight samples were non-plastic.
Rutting was observed along the segment from approximate Sta. 0+000 to Sta. 1+610 and near approximate Sta. 3+400. Based on an R-value of 58 that was determined using laboratory test results at Boring EB-2 (near Sta. 1+207) and due to the subgrade soils in these areas being predominantly granular, rutting of the pavement was most probably related to the asphalt concrete mix. However, rutting may have been related to inadequate subgrade soils not encountered during our site exploration. If any areas of inadequate subgrade soils exist along the segment, they should be identified in the field during construction. Additional explorations could also be performed within the rutted areas prior to construction to collect additional R-value laboratory samples to determine if the segment would require a thicker pavement section.

In the recommendations presented below, a structural coefficient of 0.10 was used for pulverization to account for the combined asphalt concrete and aggregate base. In the FDR with cement recommendation, a cement content of 8 percent was used to account for the existing base course having fines concentrations predominantly above 15 percent. A structural coefficient of 0.15 was used.

As stated previously, a 20 year design ESAL of 103,300 was determined for this segment. A weighted average approach was used to determine a design R-value of 50, which corresponds to a subgrade resilient modulus (M_R) of 76 MPa (11,000 psi). The design R-value was determined using laboratory test results. The R-value compilation is presented in Appendix F. Utilizing the design ESAL, design M_R and other design factors previously presented, a design Structural Number (SN) of 1.86 was determined.

Option 1:

75 mm (3 inches) HACP
100 mm (4 inches) FDR with cement

SN = 1.92 > 1.86 ok
Estimated cost (not bid quality) per kilometer = $156,300

Option 2: Recommended
75 mm (3 inches) HACP
152 mm (6 inches) Road Reconditioning/Pulverizing
SN = 1.92 > 1.86 ok
Estimated cost (not bid quality) per kilometer = $124,100

In order to consolidate the number of recommended pavement sections along the entire project roadway alignments and to better facilitate construction on this segment of the roadway, a pavement section of 90 mm (3½ inches) HACP over 127 mm (5 inches) of road reconditioning/pulverizing may be used.

Overton Beach Road Segment Sta. 13+700 (Northshore Road) to Sta. 15+310

Based on the investigation, the existing HACP ranges from 57 to 73 mm (2¼ to 2⅞ inches) thick. The average HACP thickness is 64 mm (2½ inches). The underlying aggregate base course is 152 to 330 mm (6 to 13 inches) thick.

Two soil samples were collected along the roadway segment. Supporting subgrade soils are predominantly fine-grained with measured R-values of 5. The subgrade soils tested have minus 200 fractions ranging from 71 to 80 percent. The Plasticity Index (PI) ranged from 19 to 41.

For the pulverization rehabilitation option presented below, overexcavation of the low R-value subgrade soils for this roadway segment may be required to construct the recommended pavement section. The lateral extent of the low R-value clay was not known at the time of this report but can be determined in the field during construction. Additional explorations could also be performed prior to construction to help identify the limits of the material.

As an alternative to overexcavation of the low R-value subgrade soils, and to eliminate the need to remove and stockpile the pulverized pavement section during overexcavation, the pulverized pavement section and low R-value soils may be left in place. Properly placed and compacted aggregate base may then be added atop the pulverized pavement section to construct the recommended pavement section.

In the recommendations presented below, a structural coefficient of 0.14 was used for the aggregate base required for the new pavement section and a structural coefficient of 0.10 was used for pulverization to account for the combined asphalt concrete and aggregate base. In the FDR with cement recommendation, a cement content of 10 percent was used to account for the subgrade soils having fines concentrations above 20 percent. Although the existing base course has fines concentrations less than about 15 percent, the recommended depth of the

FDR will include the higher plasticity subgrade soils in the pavement section, requiring additional cement. A structural coefficient of 0.15 was used.

As stated previously, a 20 year design ESAL of 144,300 was determined for this segment. A weighted average approach was used to determine a design R-value of 5, which corresponds to a subgrade resilient modulus (M_R) of 12 MPa (1,800 psi). The design R-value was determined using laboratory test results. The R-value compilation is presented in Appendix F. Utilizing the design ESAL, design M_R and other design factors previously presented, a design Structural Number (SN) of 3.96 was determined.

Option 1:

75 mm (3 inches) HACP
460 mm (18 inches) FDR with cement
SN = 4.02 > 3.96 ok
Estimated cost (not bid quality) per kilometer = $261,800

Option 2: Recommended

90 mm (3½ inches) HACP
305 mm (12 inches) Aggregate Base
203 mm (8 inches) Road Reconditioning/Pulverizing
SN = 4.02 > 3.96 ok
Estimated cost (not bid quality) per kilometer = $252,900

<u>Overton Beach Road Segment Sta. 15+310 to Sta. 18+307</u>

Based on the investigation, the existing HACP ranges from 32 to 63 mm (1¼ to 2½ inches) thick. The average HACP thickness is 54 mm (2⅛ inches). The underlying aggregate base course is 127 to 152 mm (5 to 6 inches) thick.

Four soil samples were collected along the roadway segment. Supporting subgrade soils are predominantly granular with measured R-values ranging from 44 to 84. The subgrade soils tested have minus 200 fractions ranging from 10 to 25 percent. Two of the four samples had a Plasticity Index (PI) of 4 and 6, respectively. Two of the four samples were non-plastic.

In the recommendations presented below, a structural coefficient of 0.10 was used for pulverization to account for the combined asphalt concrete and aggregate base. In the FDR with cement recommendation, a cement content of 6 percent was used to account for the existing base course having fines concentrations predominantly less than 15 percent. A structural coefficient of 0.15 was used.

As stated previously, a 20 year design ESAL of 144,300 was determined for this segment. A weighted average approach was used to determine a design R-value of approximately 60, which corresponds to a subgrade resilient modulus (M_R) of 86 MPa (12,500 psi). The design R-value was determined using laboratory test results. The R-value compilation is presented in Appendix F. Utilizing the design ESAL, design M_R and other design factors previously presented, a design Structural Number (SN) of 1.88 was determined.

Option 1:

75 mm (3 inches) HACP
100 mm (4 inches) FDR with cement
SN = 1.92 > 1.88 ok
Estimated cost (not bid quality) per kilometer = $150,700

Option 2: Recommended

75 mm (3 inches) HACP
152 mm (6 inches) Road Reconditioning/Pulverizing
SN = 1.92 > 1.86 ok
Estimated cost (not bid quality) per kilometer = $124,100

In order to consolidate the number of recommended pavement sections along the entire project roadway alignments and to better facilitate construction on this segment of the roadway, a pavement section of 90 mm (3½ inches) HACP over 127 mm (5 inches) of road reconditioning/pulverizing may be used. Summary

6.6.6 Pavement Recommandations Summary

The recommended pavement sections for the Northshore Road, Echo Bay Road and Overton Beach Road segments are presented in the following Tables.

1

NORTHSHORE ROAD ALIGNMENT			
Sta. To Sta.	Recommended Pavement Sections		
	Hot Asphalt Concrete Pavement	Aggregate Base	Road Reconditioning/ Pulverizing
45+680 to 56+543	3½	---	5
56+543 to 68+200	3½	---	5
68+200 to 69+500	3½	8	---
69+500 to 71+800	3½	---	8
71+800 to 72+800	3½	---	8
72+800 to 75+125	3½	---	5

ECHO BAY ROAD ALIGNMENT			
Sta. To Sta.	Recommended Pavement Sections		
	Hot Asphalt Concrete Pavement	Aggregate Base	Road Reconditioning/ Pulverizing
0+000 to 7+593	3½	---	5

OVERTON BEACH ROAD ALIGNMENT			
Sta. To Sta.	Recommended Pavement Sections		
	Hot Asphalt Concrete Pavement	Aggregate Base	Road Reconditioning/ Pulverizing
13+700 to 15+310	3½	12	8
15+310 to 18+307	3½	---	5

6.6.7 Pavement Materials

- The HACP should be Item 401, Class B, Grading C or E with a Type II smoothness level. The unit weight can be estimated at 2325 kg/m^3 (145 lb/ft^3). For antistrip additive, use Hydrated Lime (Type III) as 1%. Quantity can be estimated at 1% by weight of mix. The asphalt cement should be a PG 70-22 (however, this may change pending results of 1(6) project). Quantity can be estimated at 6% by weight of mix.
- The HACP shall be placed in two lifts.
- FDR should be Item 304 (Need to develop SCR for Section 304). The unit weight can be estimated as 2265 kg/m^3 (141 lb/ft^3). Cement quantity can be estimated at 4% by weight of mix.
- Tack coat at 0.45 L/m^2 (0.10 gal/yd^2) is required between lifts and should either be a CSS-1, CSS-1h, SS-1, or SS-1h emulsion.
- A fog seal bid item 409 should be included in the contract. For determining quantities use an application rate of 0.45 L/m^2 (0.10 gal/yd^2). The emulsion type can be a CSS-1, CSS-1h, SS-1, or SS-1h.
- A prime coat should be applied on the pulverized base material prior to paving. The material should either be MC-70 or MC-35 cutback asphalt. For determining quantities use an application rate of 1.5 L/m^2 (0.33 gal/yd^2). An item for blotter material should be included at 8 kg/m^2 (1.64 lb/ft^2).

- For Open Graded Friction Course the asphalt cement should be AC-20P. The unit weight can be estimated at 2325 kg/m³ (145 lb/ft³). For antistrip additive, use Hydrated Lime (Type III) at 1%.

Very severe levels of water-soluble sodium sulfate were noted from soil samples obtained along Northshore Road at the proposed roadway relocation near Sta. 68+000 through Sta. 69+700, at the Overton Beach Road intersection, and along Echo Bay Road near Sta. 1+207. Laboratory test results indicated these soil contained sufficient concentrations of sodium sulfate to be susceptible to chemical expansion. To reduce the effects of possible sodium sulfate expansion, a sufficient thickness of base stone aggregate 150 mm (6 inches) or more, and proper drainage are recommended for the new pavement design in areas where the sodium sulfate levels meet or exceed 0.20 percent.

The R-values were determined from disturbed samples obtained at roadway Borings S-1 through S-37, Borings EB-1 through EB-10, Borings OB-1 through OB-6, borings performed within roadway realignment areas, and information provided by FHWA. After grading, soils exposed at subgrade may differ and additional R-value testing should be performed before proceeding with any pavement construction. If the R-values differ from those reported herein, then a revised pavement section should be designed based upon the most recent information.

According to Subsection 303.08 of FP-03, the existing pavement section and/or base should be pulverized to the depths indicated above with an approved rotary-milling machine to meet the following requirements:

Sieve Designation	Percent Passing
25 mm (1-inch)	100
19.5 mm (3/4 inch)	85-100

We recommend that the existing shoulder material be removed to a depth of 100 mm (4 inches) and that aggregate base material be placed across the width of the proposed roadway grades. The aggregate base material should then be pulverized with the existing pavement sections. This will eliminate the defined boundary between the existing pavement section and the newly placed aggregate base material and will reduce the risk for cracking to propagate up through the new HACP.

We recommend that the existing pavement be pulverized to a minimum depth of 100 mm (4 inches) or to a depth of 25 mm (1 inch) below the full depth of the existing pavement, whichever depth is greater.

Place and compact the pulverized material in accordance with Subsection 301.05, compacting each layer to 95 percent of the maximum density in accordance with AASHTO T 180 (Method

D). In-place density and moisture content should be determined in accordance with AASHTO T 310.

Unsuitable material should be removed and disposed of as directed by the Contracting Officer (CO), and replaced with minor crushed aggregate in accordance with Section 308 of FP-03.

The compacted surface should be cleaned of all loose material, dirt, or other deleterious substances by approved methods. Surface irregularities need to be corrected by scarifying the defective area and reworking the pulverized material. The pulverized ditch surface should be finished in accordance with Subsection 301.06 of FP-03.

6.7 Corrosivity

Based on test results, the on-site soils classify as having a "negligible" to "very severe" sulfate exposure, in accordance with Table 1904.3 of the 2000 International Building Code (IBC). We recommend that an appropriate cement type, along with an appropriate water-cement ratio, and minimum compressive strength be incorporated into the concrete mix design for this project in order to reduce sulfate attack as recommended in the building code. Consideration should be given to providing protection to buried metal pipes or use of nonmetallic pipe where permitted by local building codes. Test results are presented in the Appendix B.

7.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, along the alignment, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities. No warranties, either expressed or implied, are intended or made. We prepared this report as an aid in design of the proposed project. This report is not a bidding document. Any contractor reviewing this report must draw his own conclusions regarding alignment conditions and specific construction techniques to be used on this project.

Sincerely,
Terracon Consultants, Inc.

for

Bradley C. Conder
Geotechnical Project Engineer

Reviewed by:

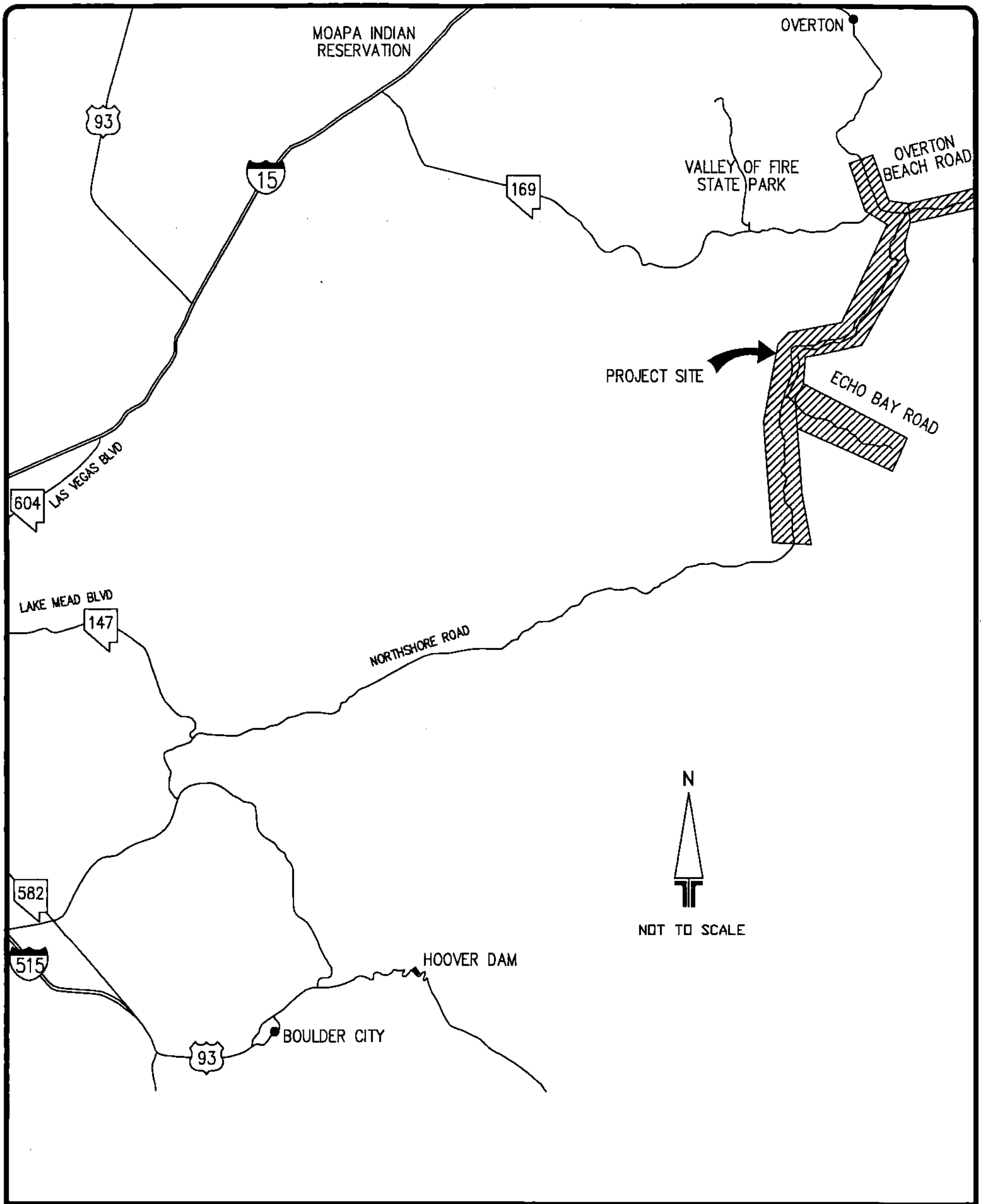
for Samuel D. Palmer, P.E., CEM
Sr. VP/Western Operating Group Manager

Keith Kosar, PhD, P.E.
Office Manager

PROFESSIONAL ENGINEER-STATE OF NEVADA
KEITH MICHAEL KOSAR
Exp. 6-30-09
CIVIL
No. 17663

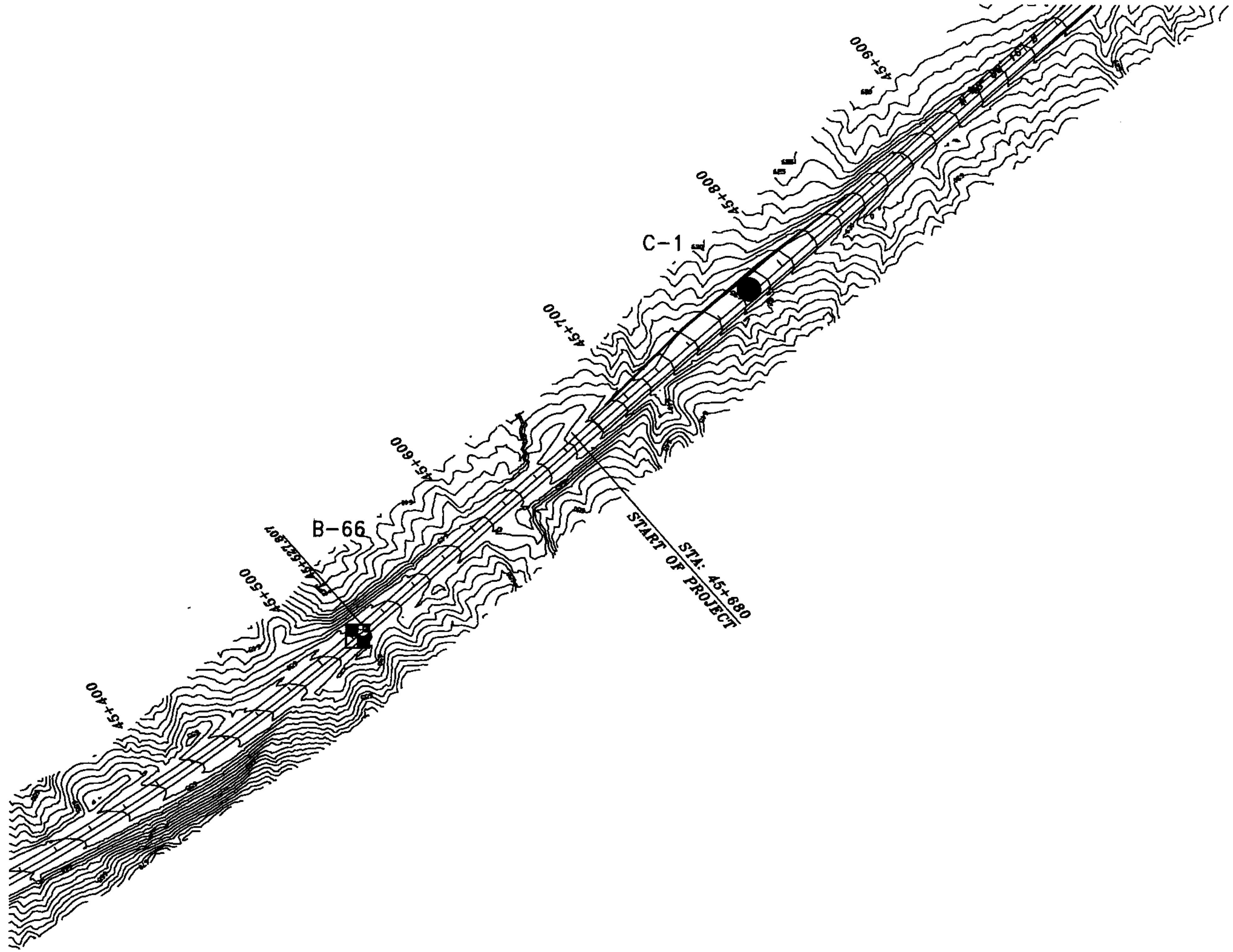
April 27/06

Appendix A



CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	Terracon	VICINITY MAP
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA		PROJECT NO.: 64055138 PLATE: 1

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



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0 30 60 METERS
SCALE

LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION
C-1 – APPROXIMATE PAVEMENT CORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 45+314 TO 45+994

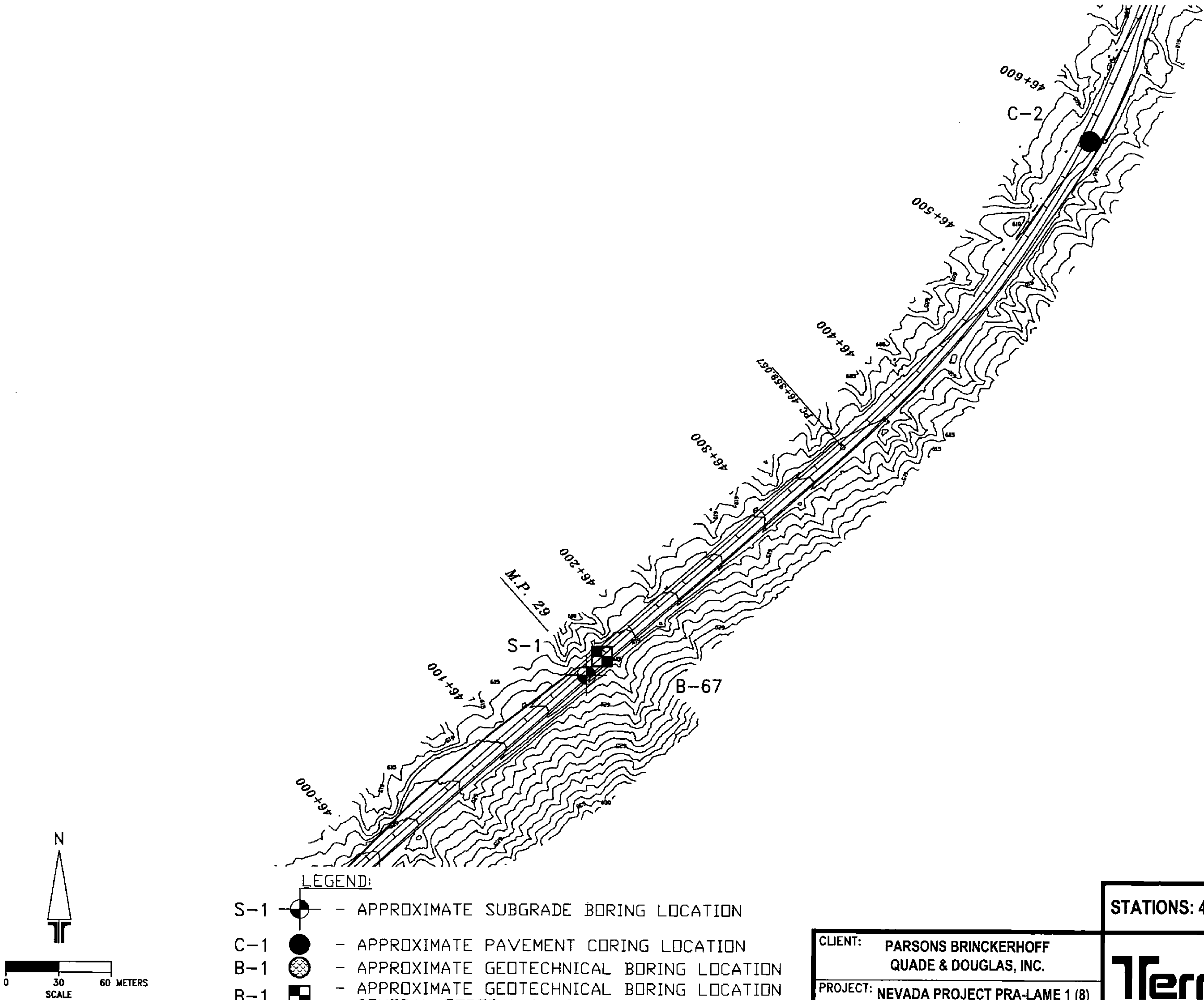
CLIENT:	PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
PROJECT:	NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

Terracon

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64035218	2

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION

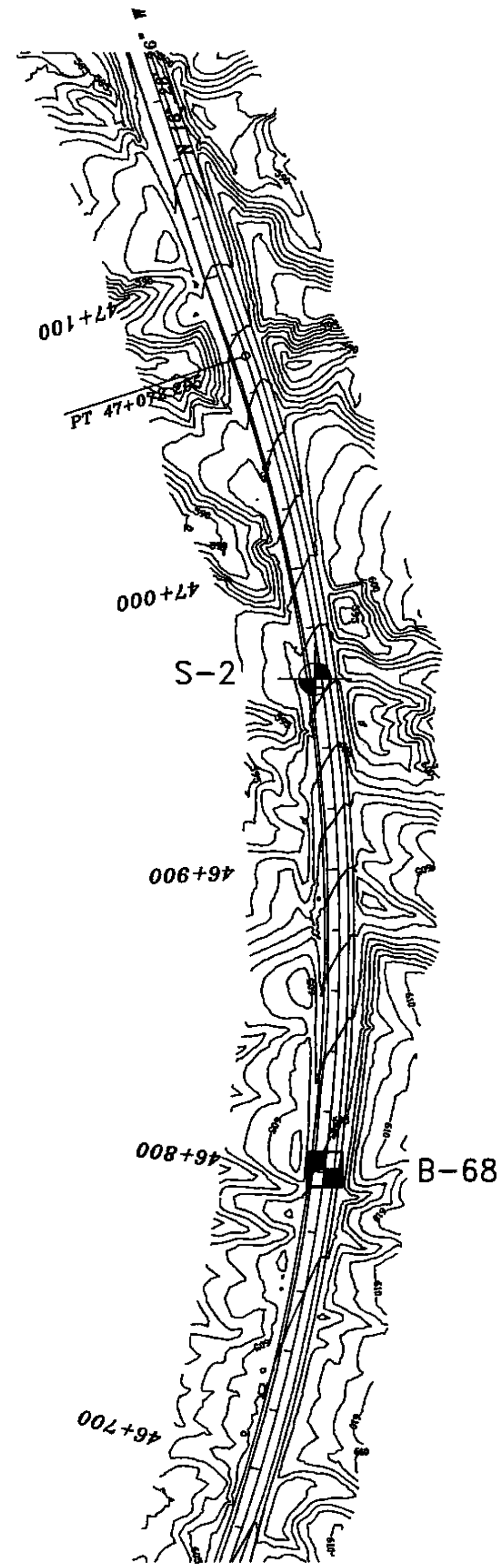
C-1 - APPROXIMATE PAVEMENT CORING LOCATION

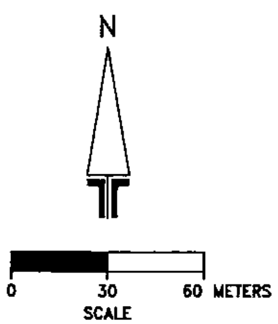
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION

B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	STATIONS: 45+994 TO 46+668	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	Terracon	PROJECT NO.: 64035218	PLATE: 3

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



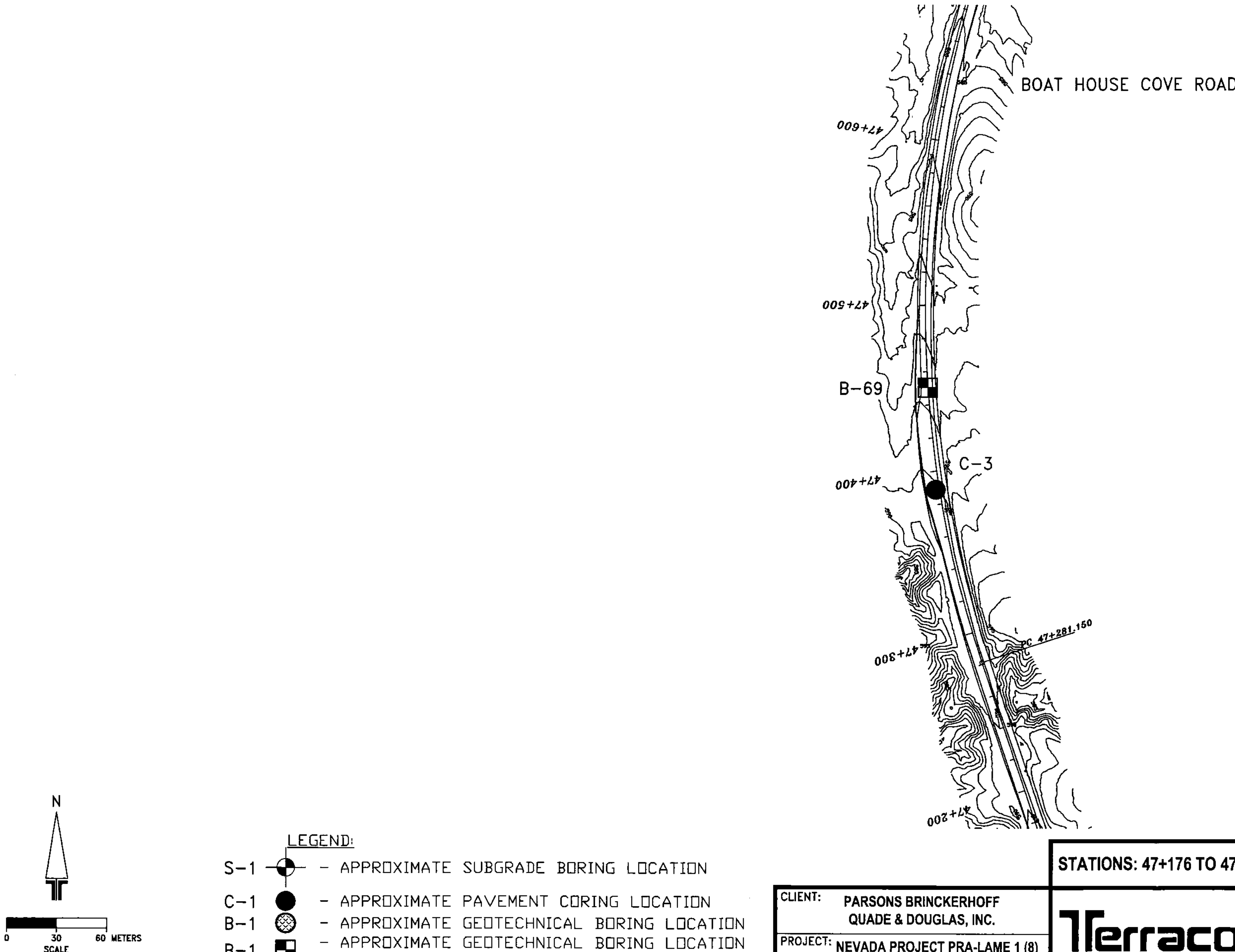


LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION
C-1 – APPROXIMATE PAVEMENT CORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

	STATIONS: 46+668 TO 47+176		
CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	Terracon	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD		PROJECT NO.: 64035218	PLATE: 4

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 47+176 TO 47+682

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

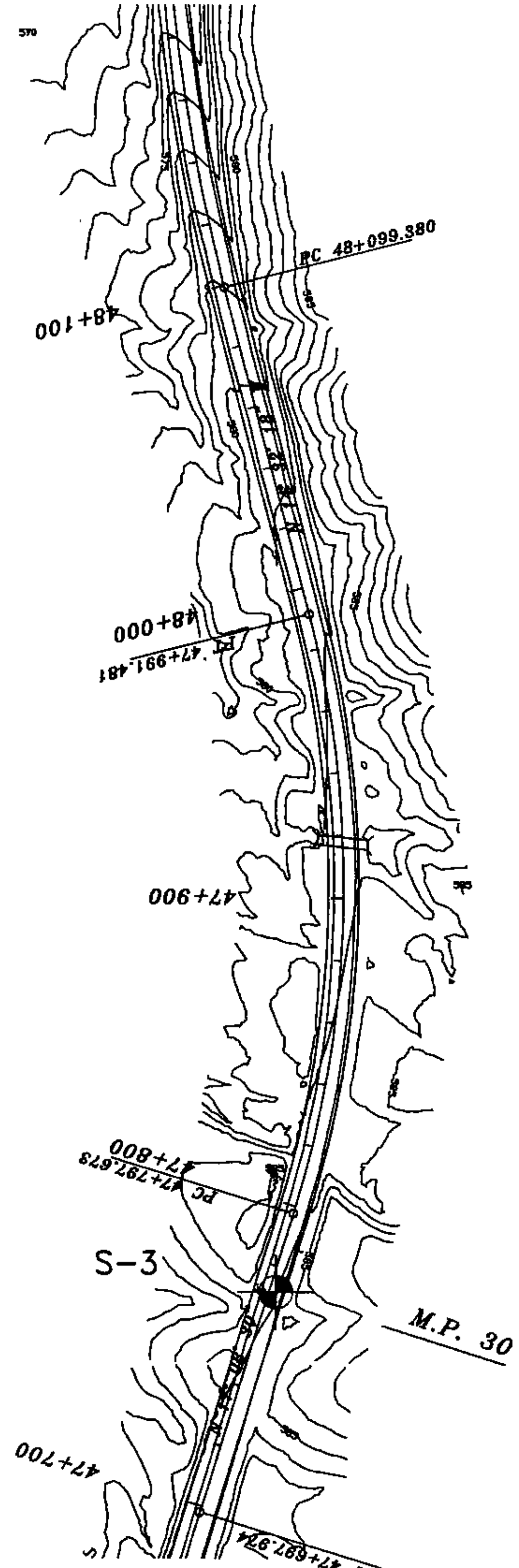
Terracon

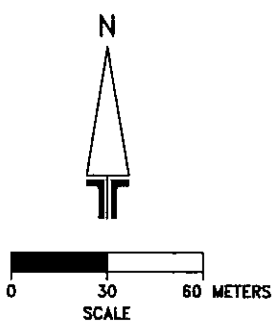
ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 5

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



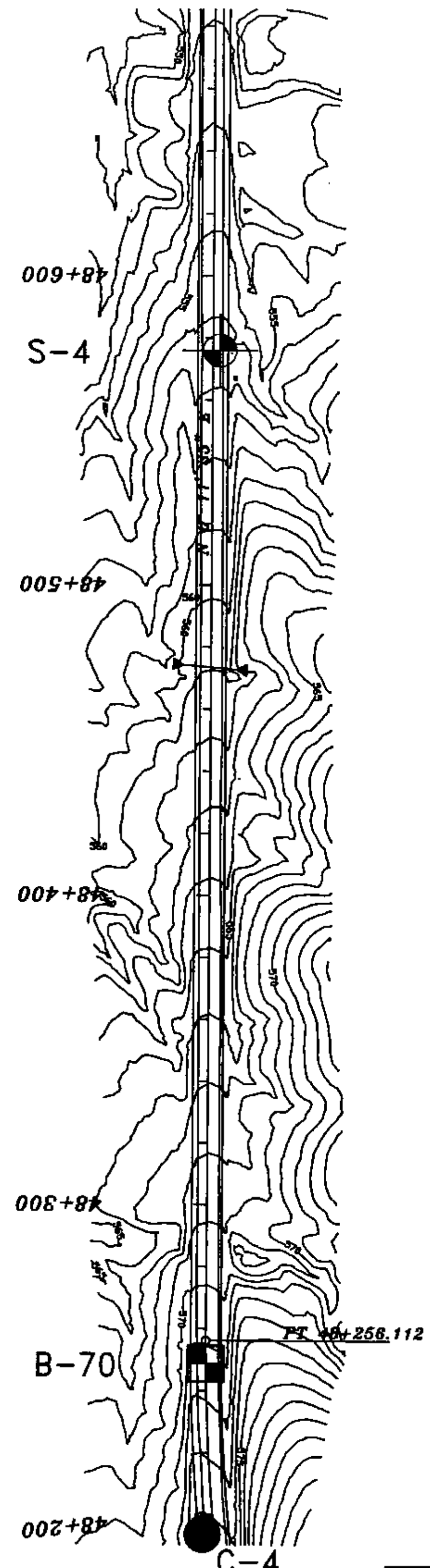


LEGEND:

- S-1 – APPROXIMATE SUBGRADE BORING LOCATION
- C-1 – APPROXIMATE PAVEMENT CORING LOCATION
- B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
- B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 47+682 TO 48+190	
CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	Terracon
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	
ALIGNMENT PLAN	
PROJECT NO.: 64035218	PLATE: 6

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



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0 30 60 METERS
SCALE

LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 48+190 TO 48+685

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

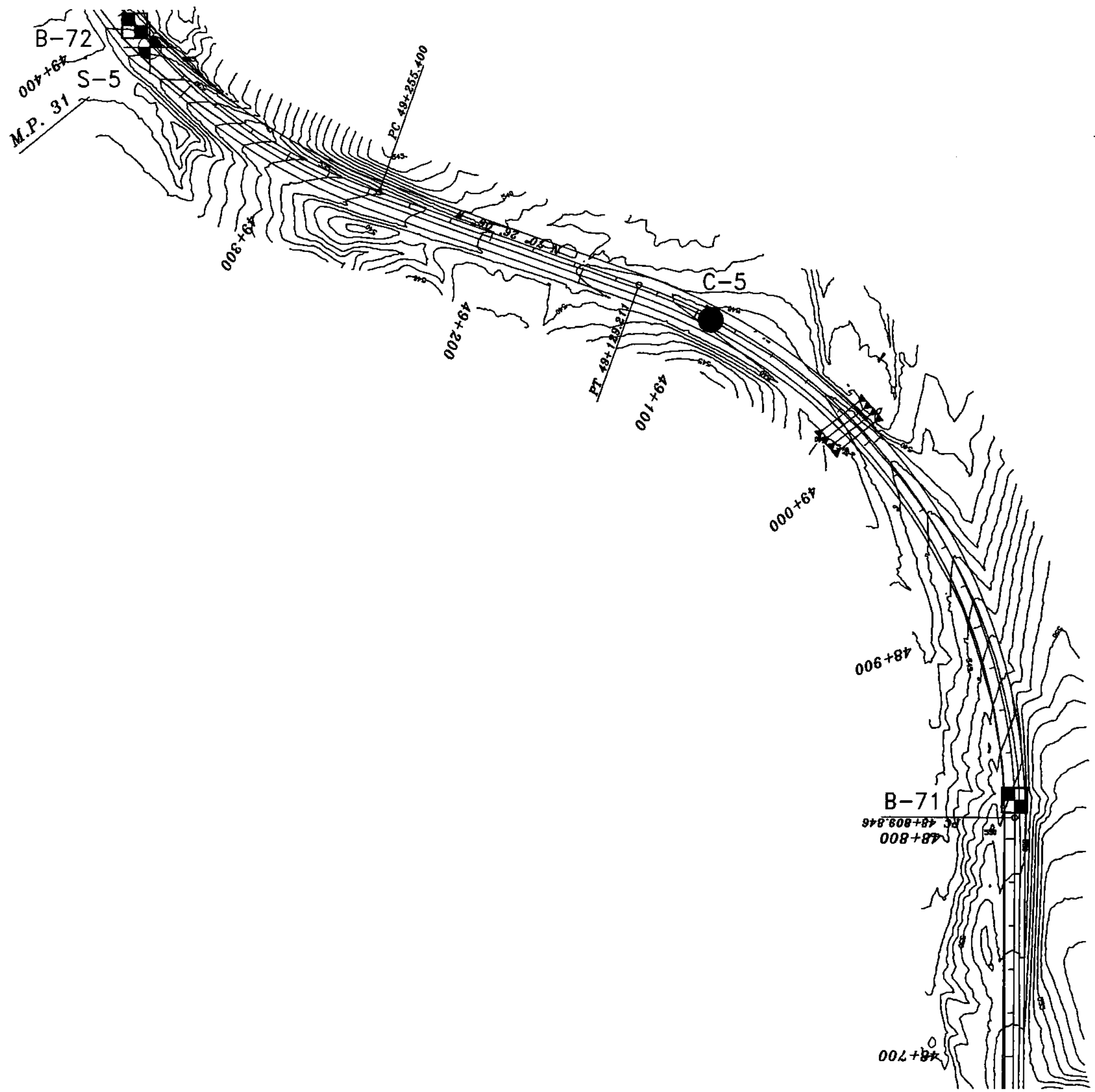
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 7

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

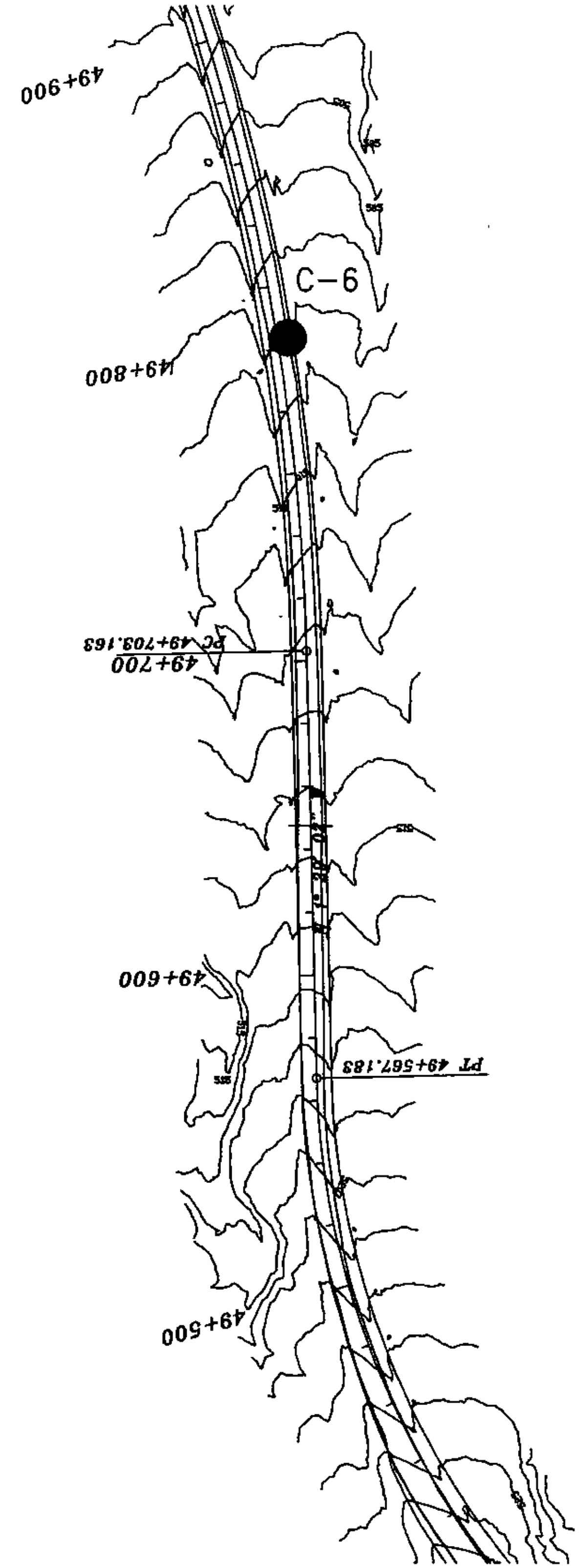
0 30 60 METERS
SCALE

LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	STATIONS: 48+685 TO 49+400	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	Terracon	PROJECT NO.: 64035218	PLATE: 8

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

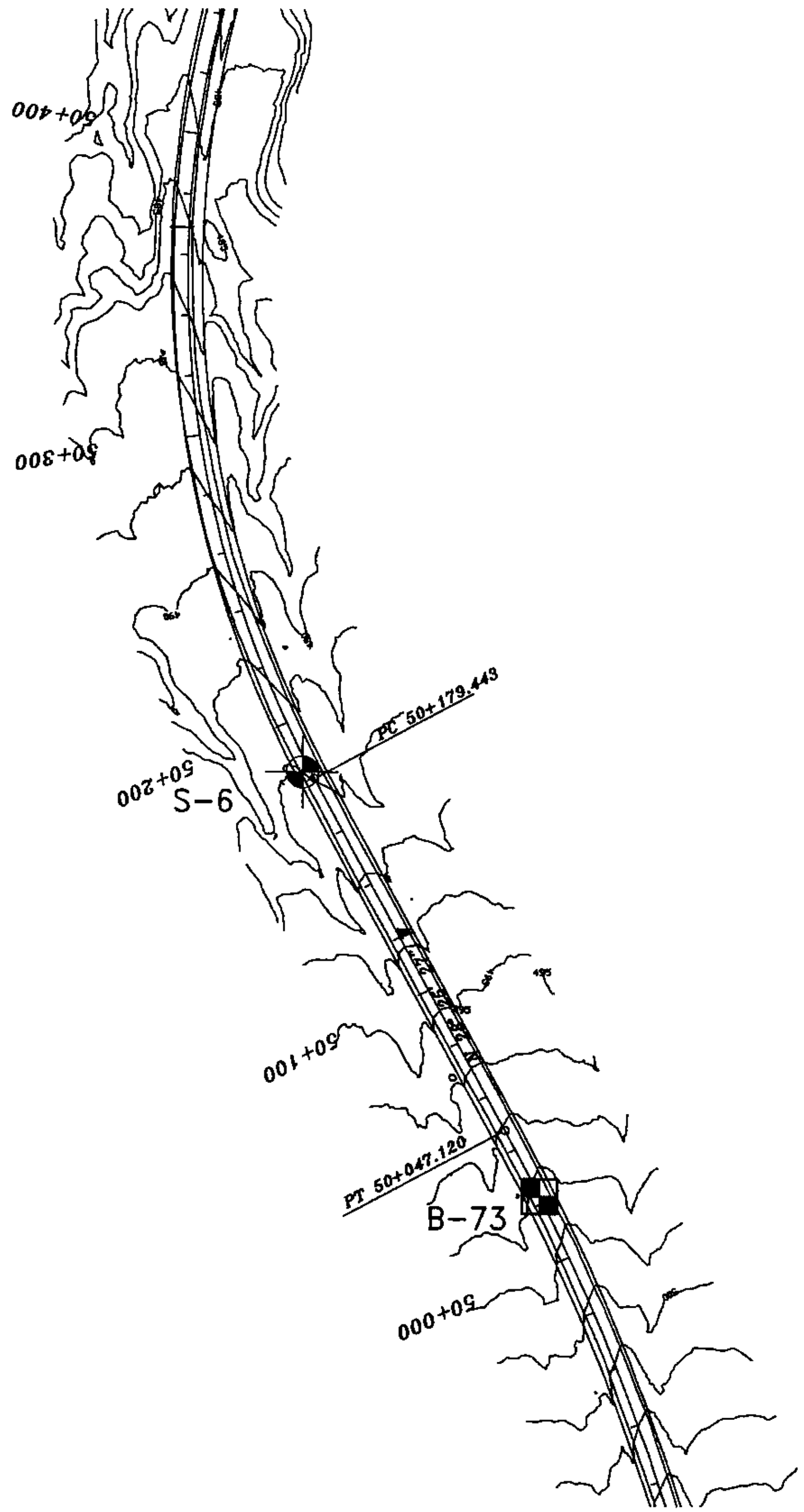
0 30 60 METERS
SCALE

LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

	STATIONS: 49+400 TO 49+911		
CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	Terracon	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD		PROJECT NO.: 64035218	PLATE: 9

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

0 30 60 METERS
SCALE

LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 49+911 TO 50+441

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

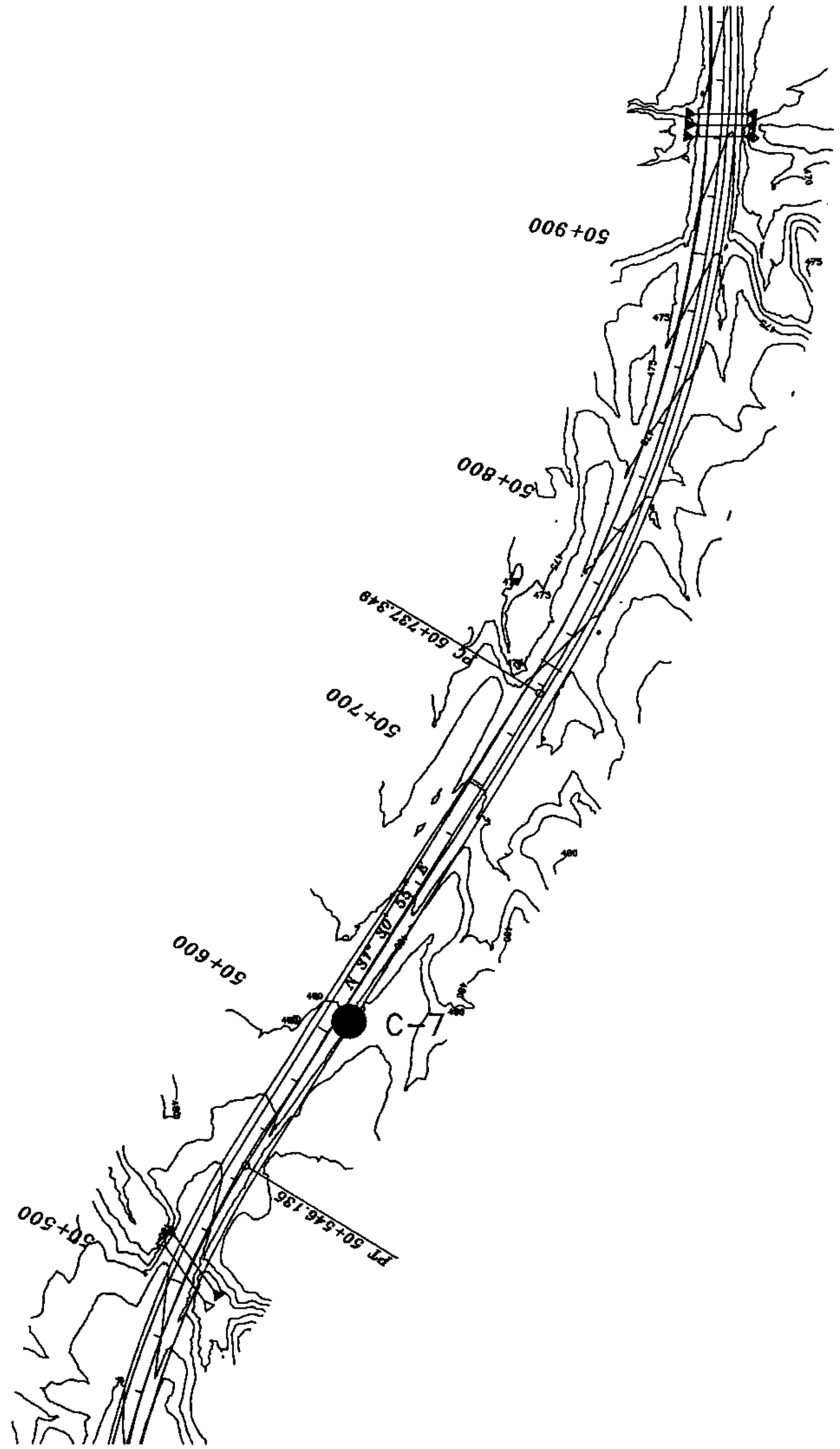
Terracon

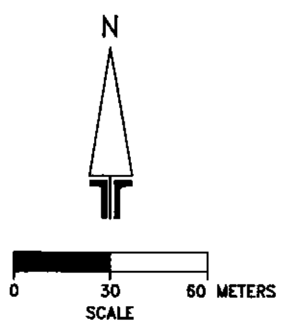
ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 10

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION
C-1 – APPROXIMATE PAVEMENT CORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 50+441 TO 50+985

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

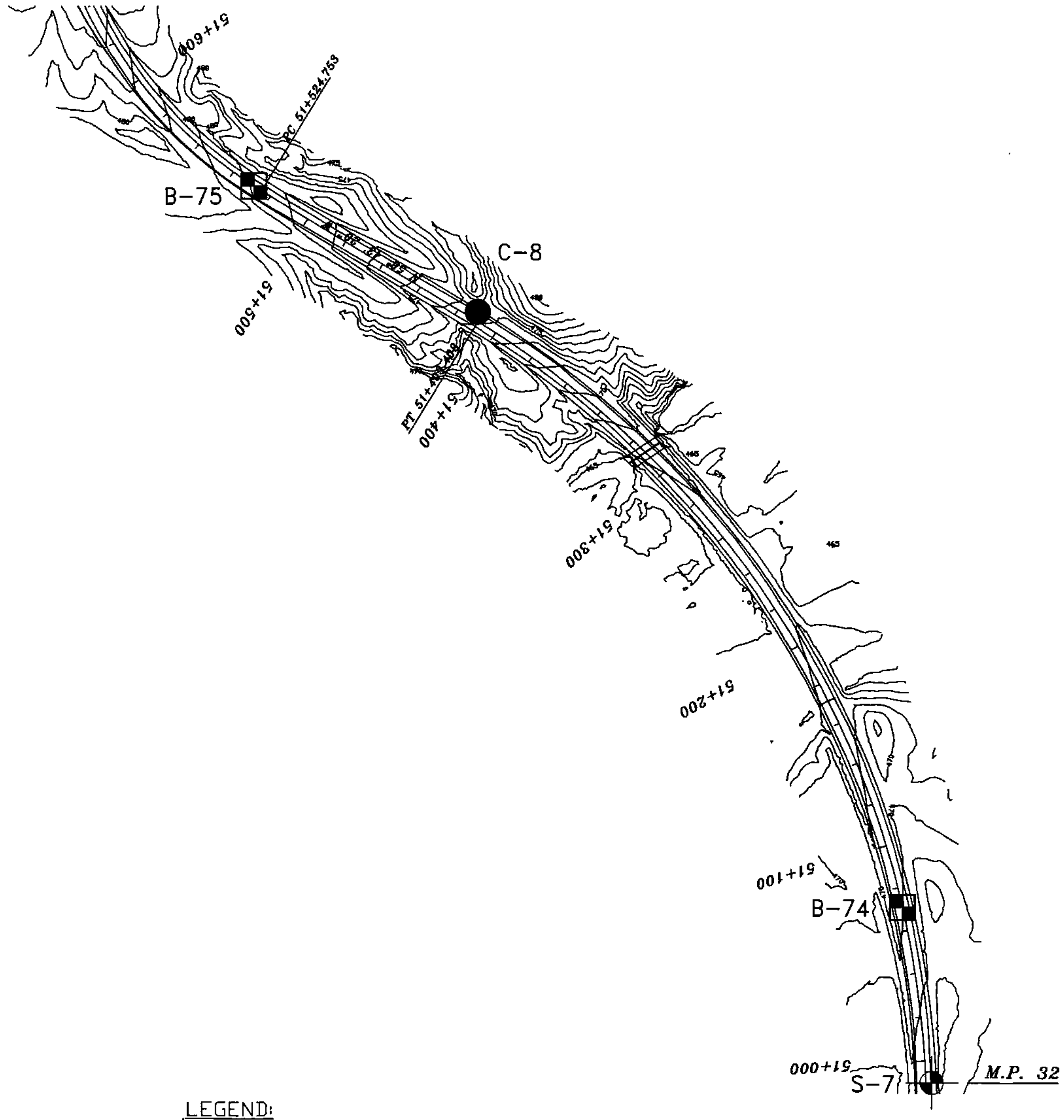
Terracon

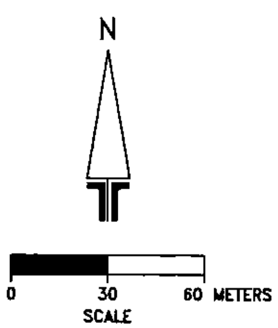
ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 11

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 50+985 TO 51+639

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

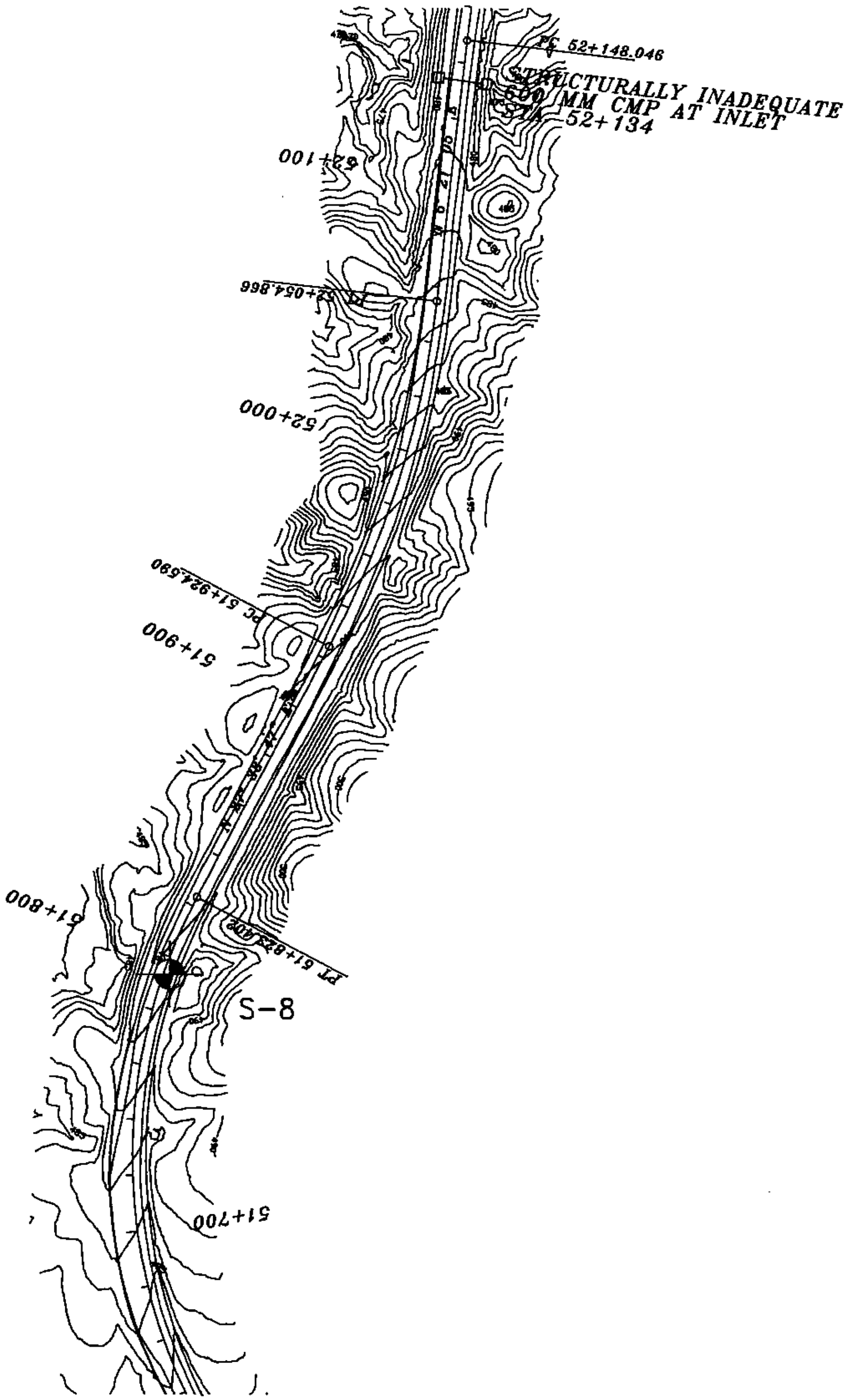
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 12

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

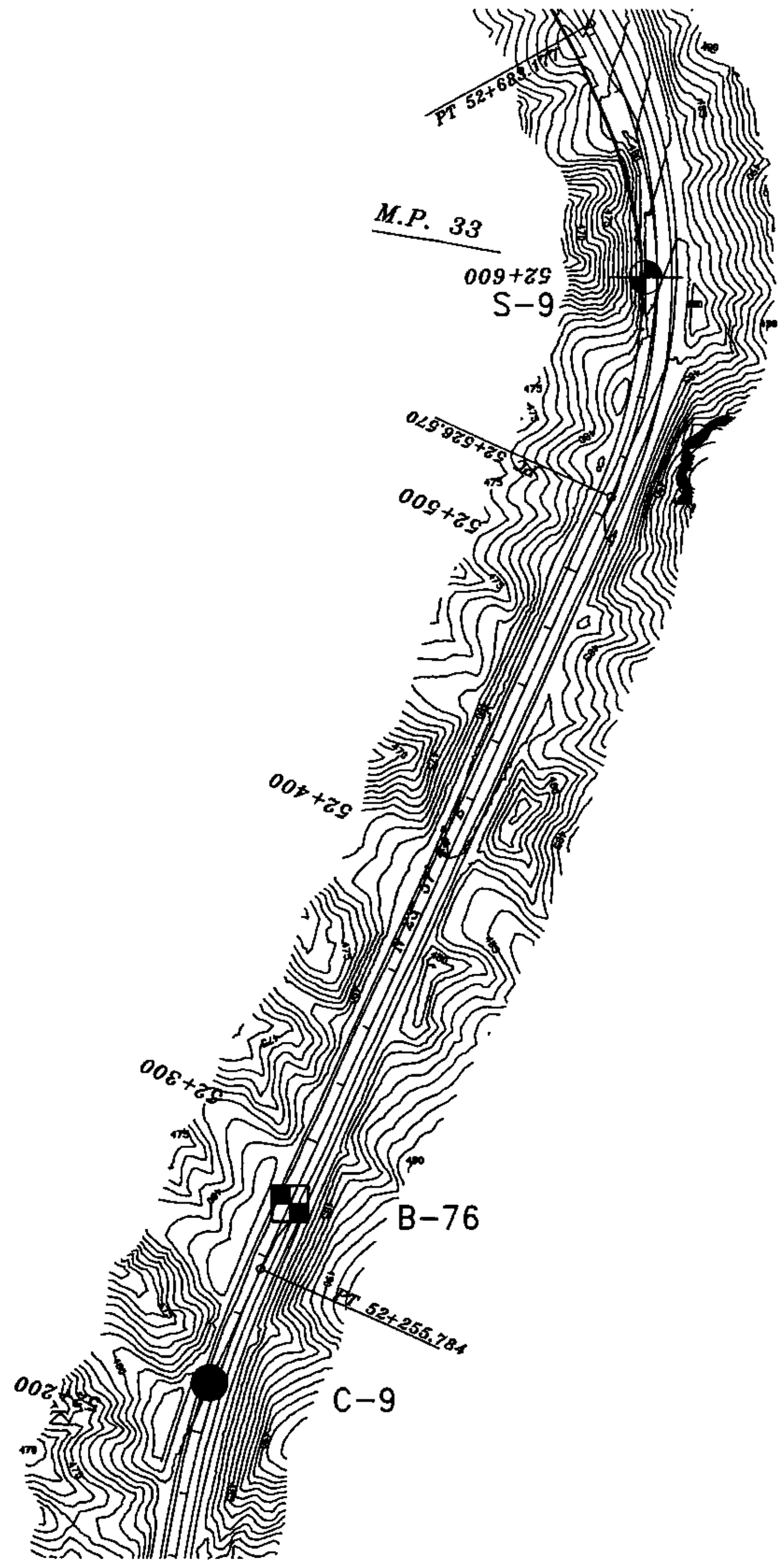
SCALE 0 30 60 METERS

LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 51+639 TO 52+139		
CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	Terracon	ALIGNMENT PLAN
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD		PROJECT NO.: 64035218 — PLATE: 13

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 52+139 TO 52+688

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

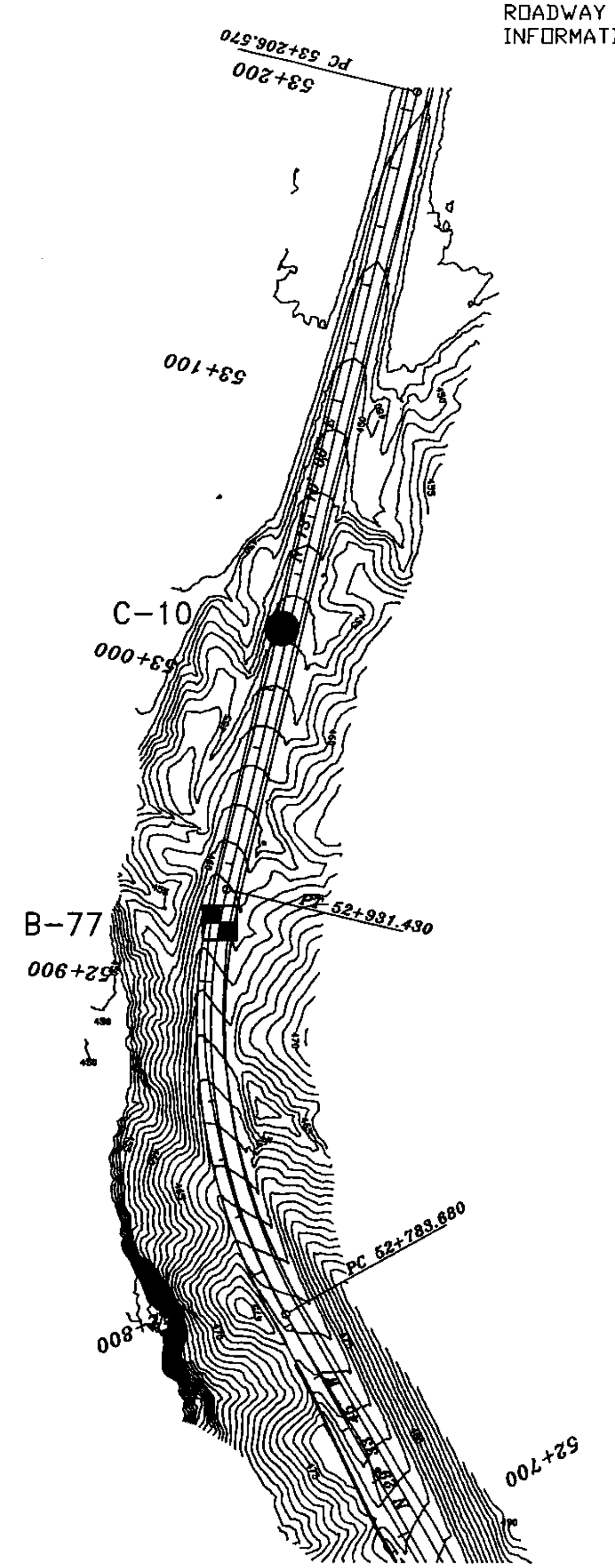
Terracon

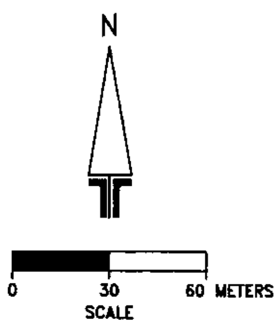
ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 14

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION
C-1 – APPROXIMATE PAVEMENT CORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 52+688 TO 53+207

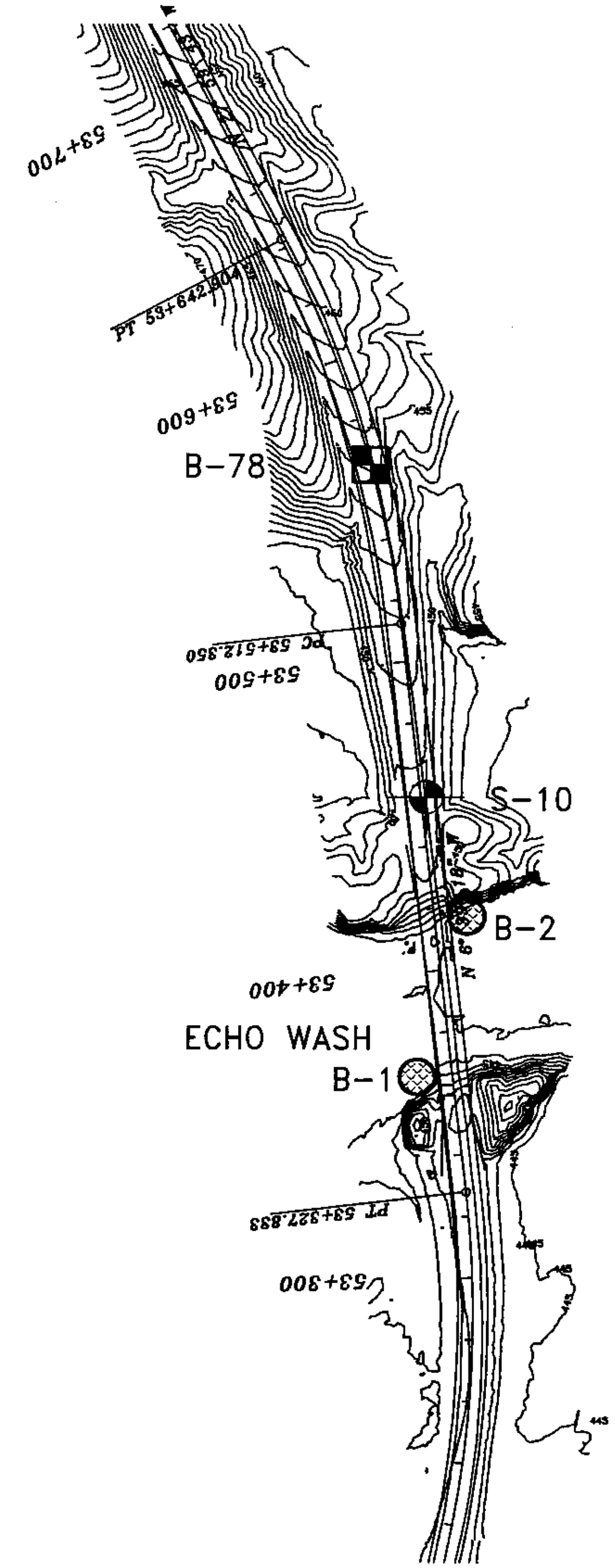
CLIENT:	PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
PROJECT:	NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

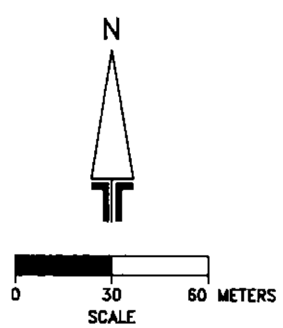
Terracon

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64035218	15

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 53+207 TO 53+720

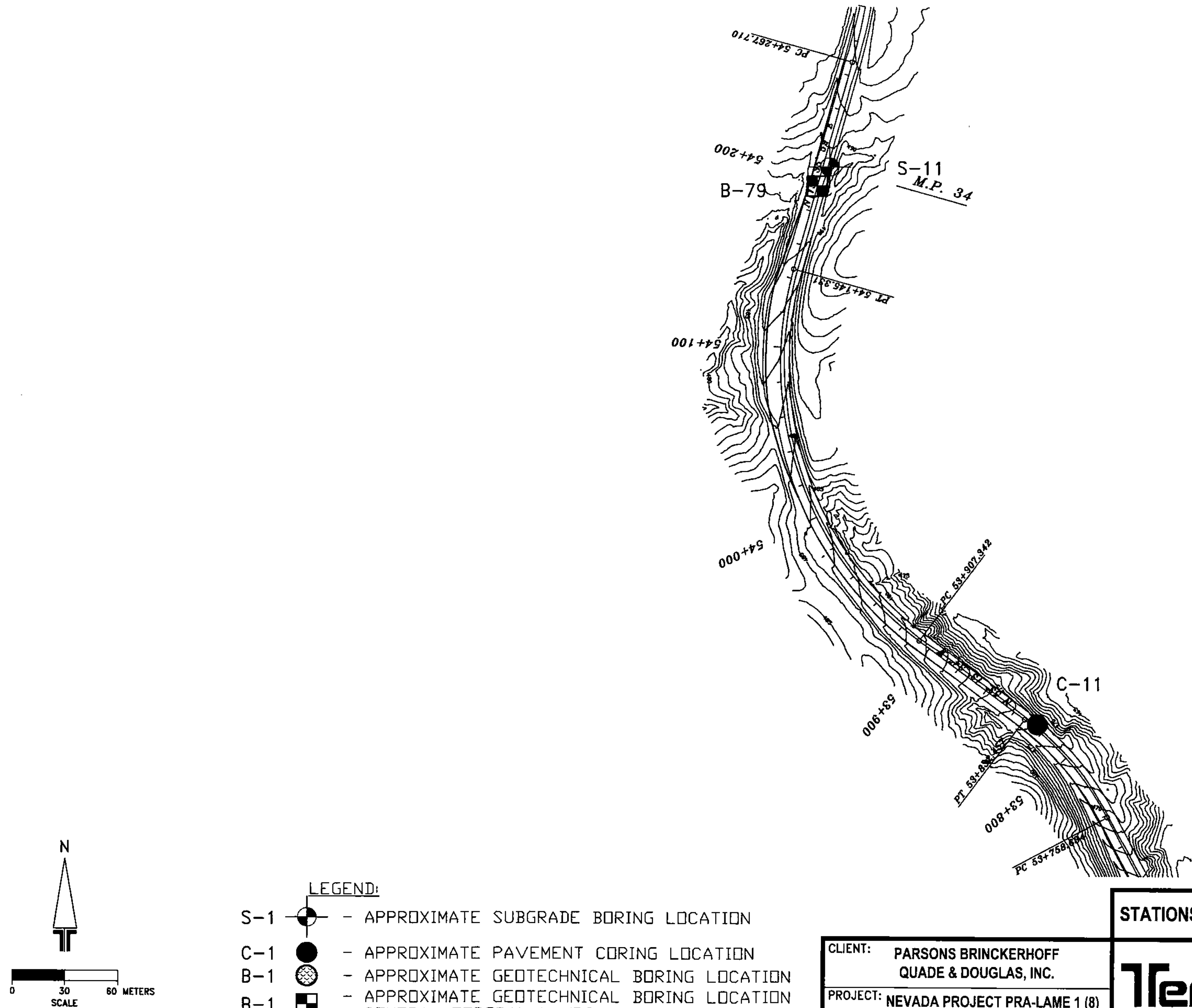
CLIENT:	PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
PROJECT:	NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

Terracon

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64035218	16

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.

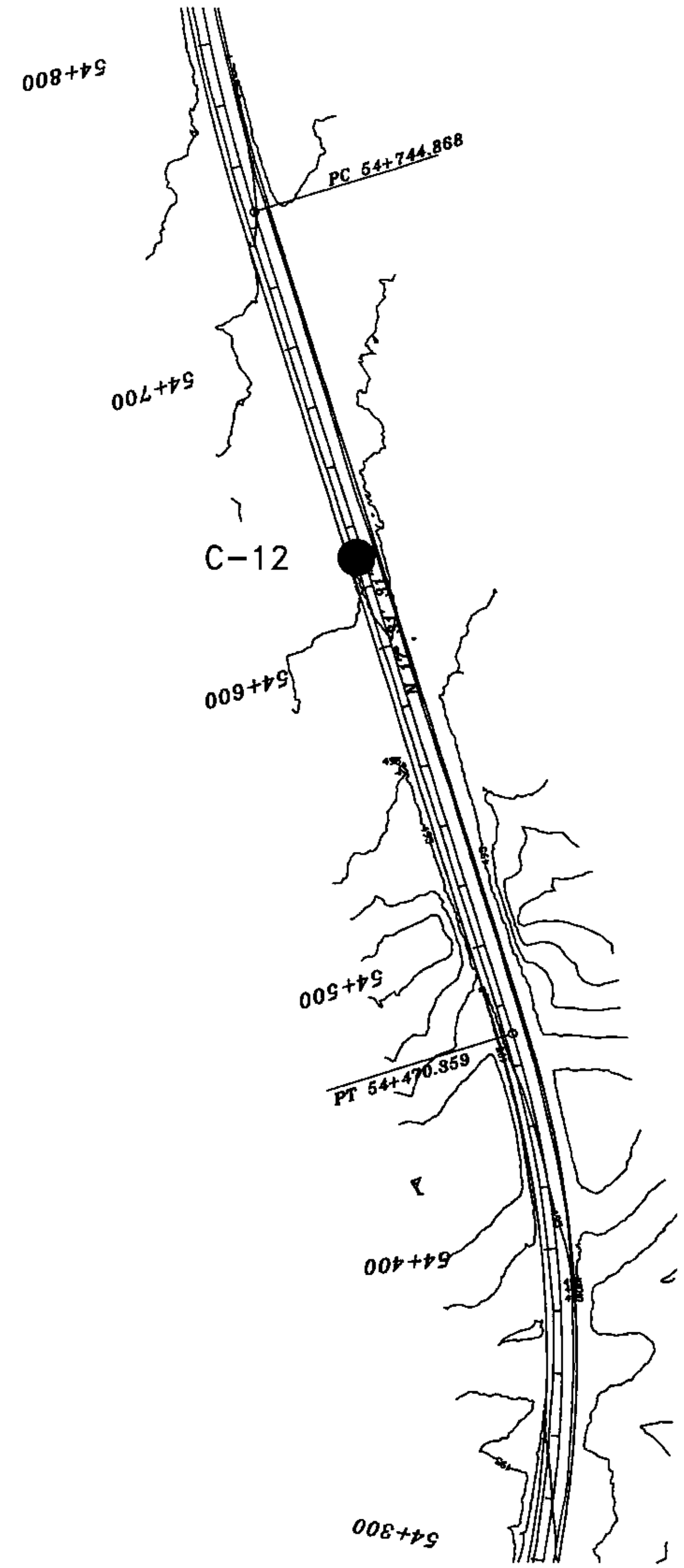


LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	STATIONS: 53+720 TO 54+300	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	Terracon	PROJECT NO.: 64035218	PLATE: 17

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

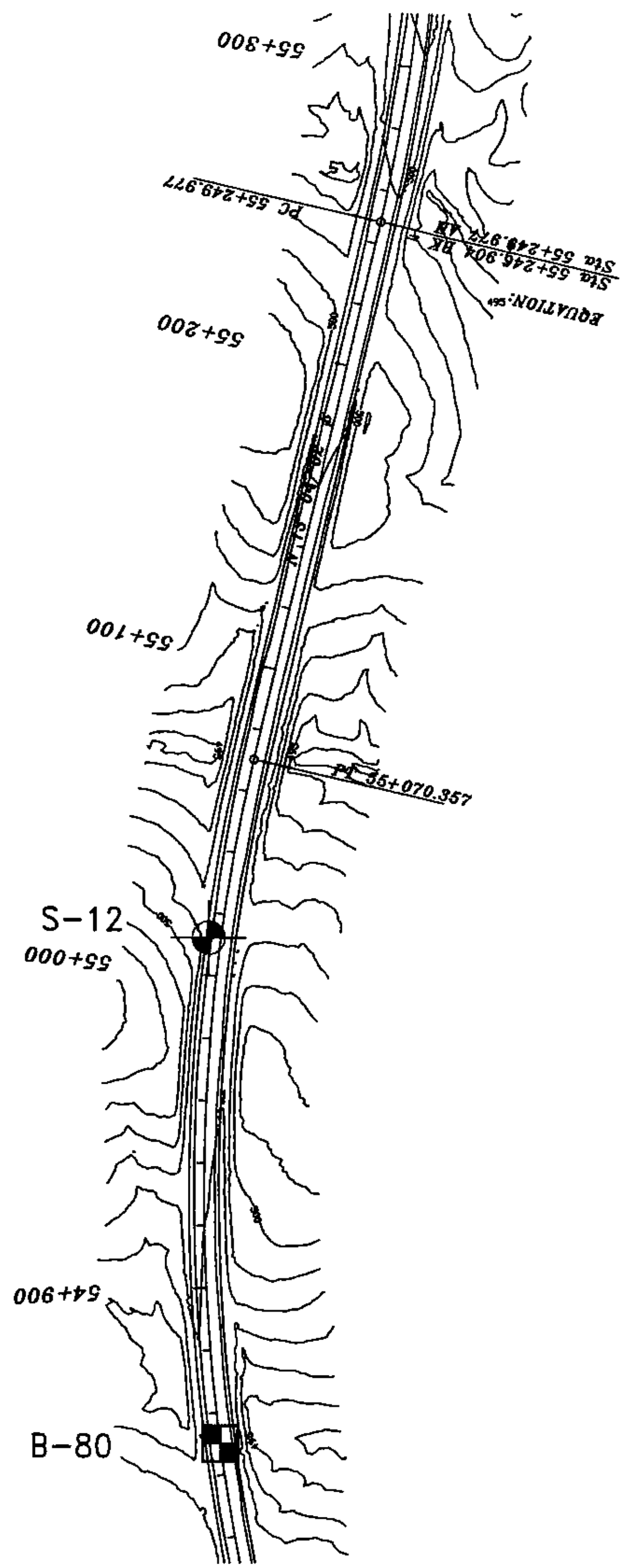
0 30 60 METERS
SCALE

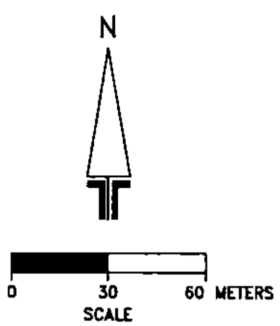
LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	STATIONS: 54+300 TO 54+811	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	Terracon	PROJECT NO.: 64035218	PLATE: 18

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



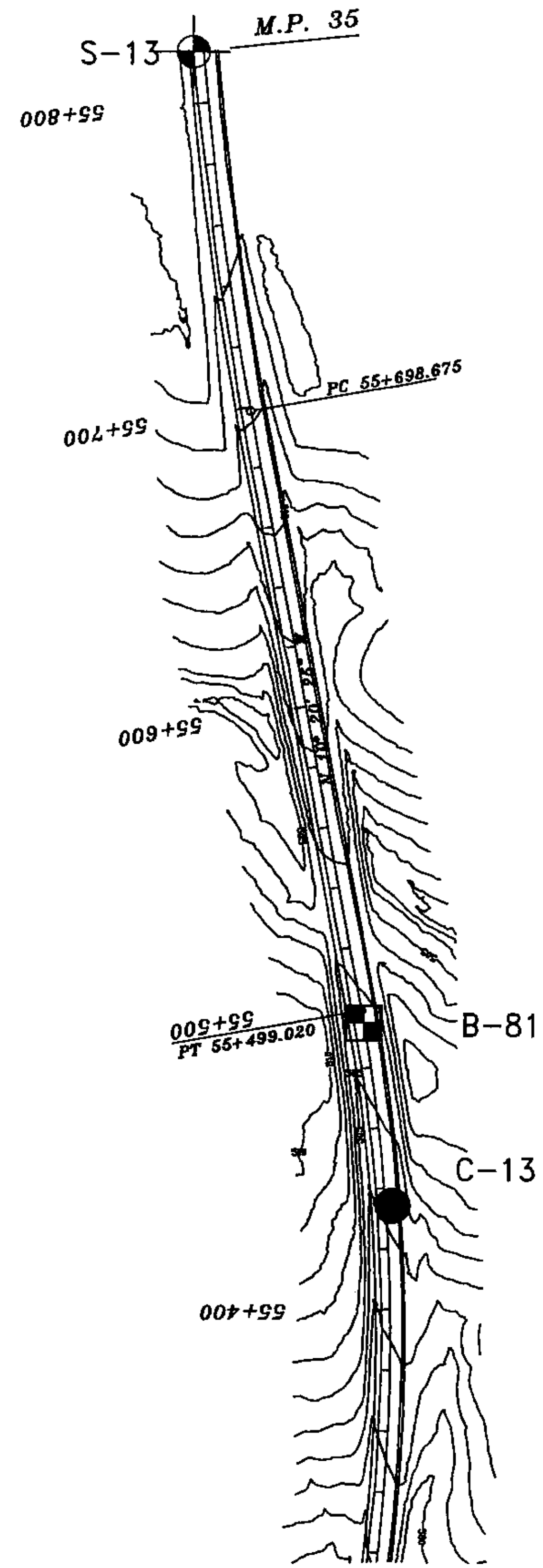


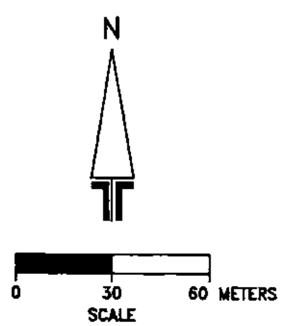
LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION
C-1 – APPROXIMATE PAVEMENT CORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	STATIONS: 54+811 TO 55+317	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	Terracon	PROJECT NO.: 64035218	PLATE: 19

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 55+317 TO 55+817

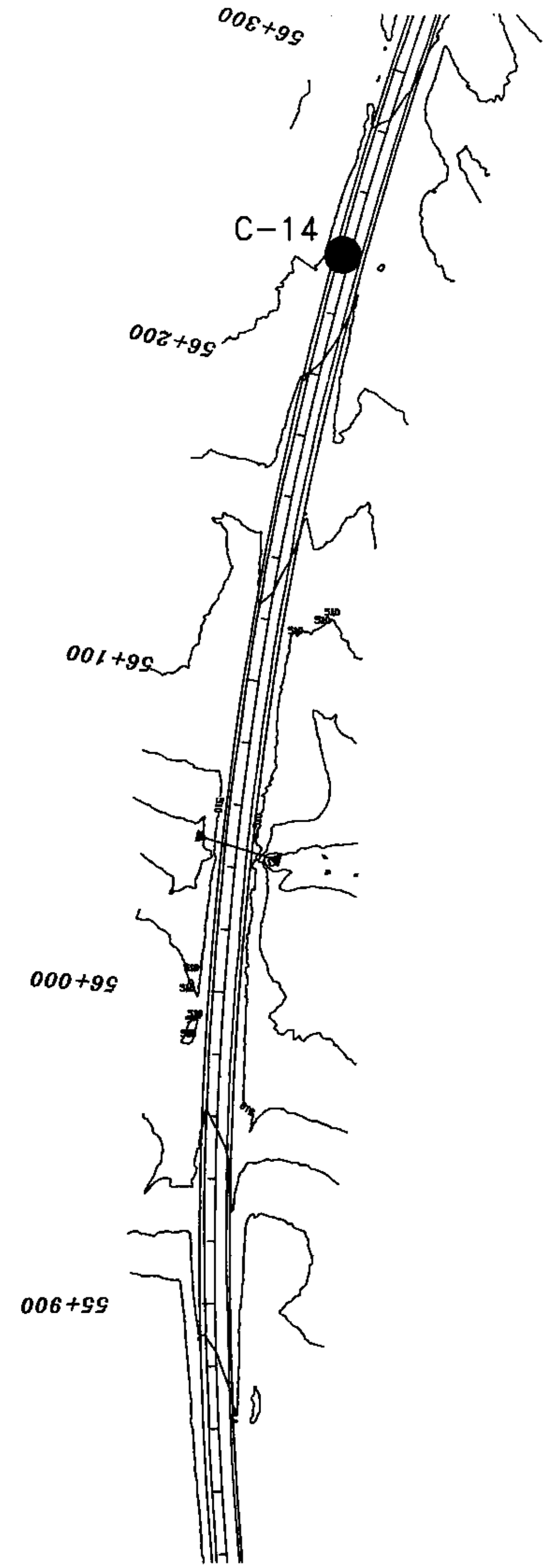
CLIENT:	PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
PROJECT:	NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

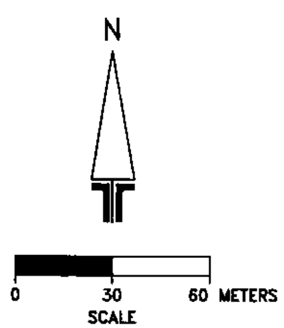
Terracon

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64035218	20

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



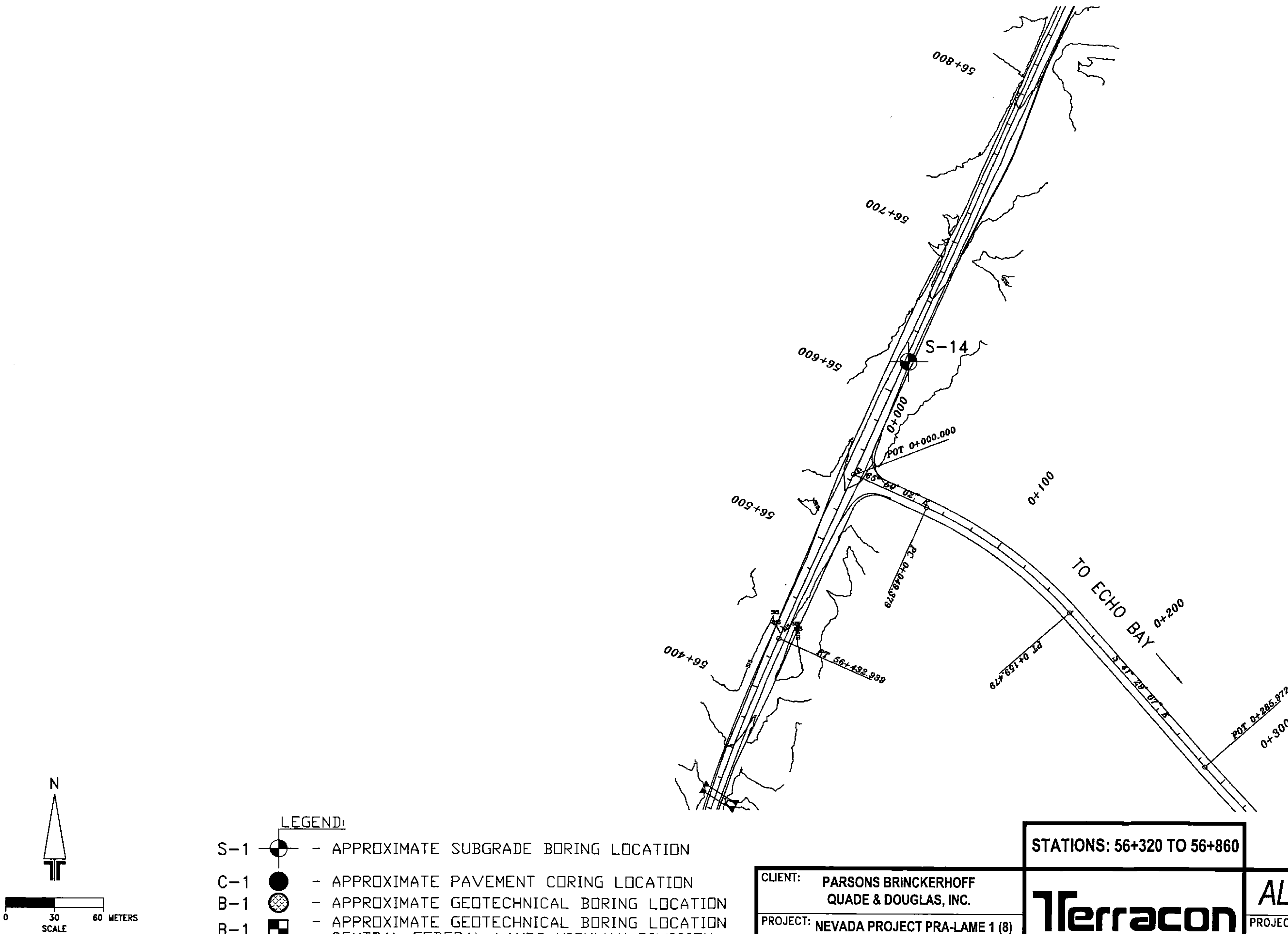


LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION
C-1 – APPROXIMATE PAVEMENT CORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	STATIONS: 55+817 TO 56+320	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	Terracon	PROJECT NO.: 64035218	PLATE: 21

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 56+320 TO 56+860

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

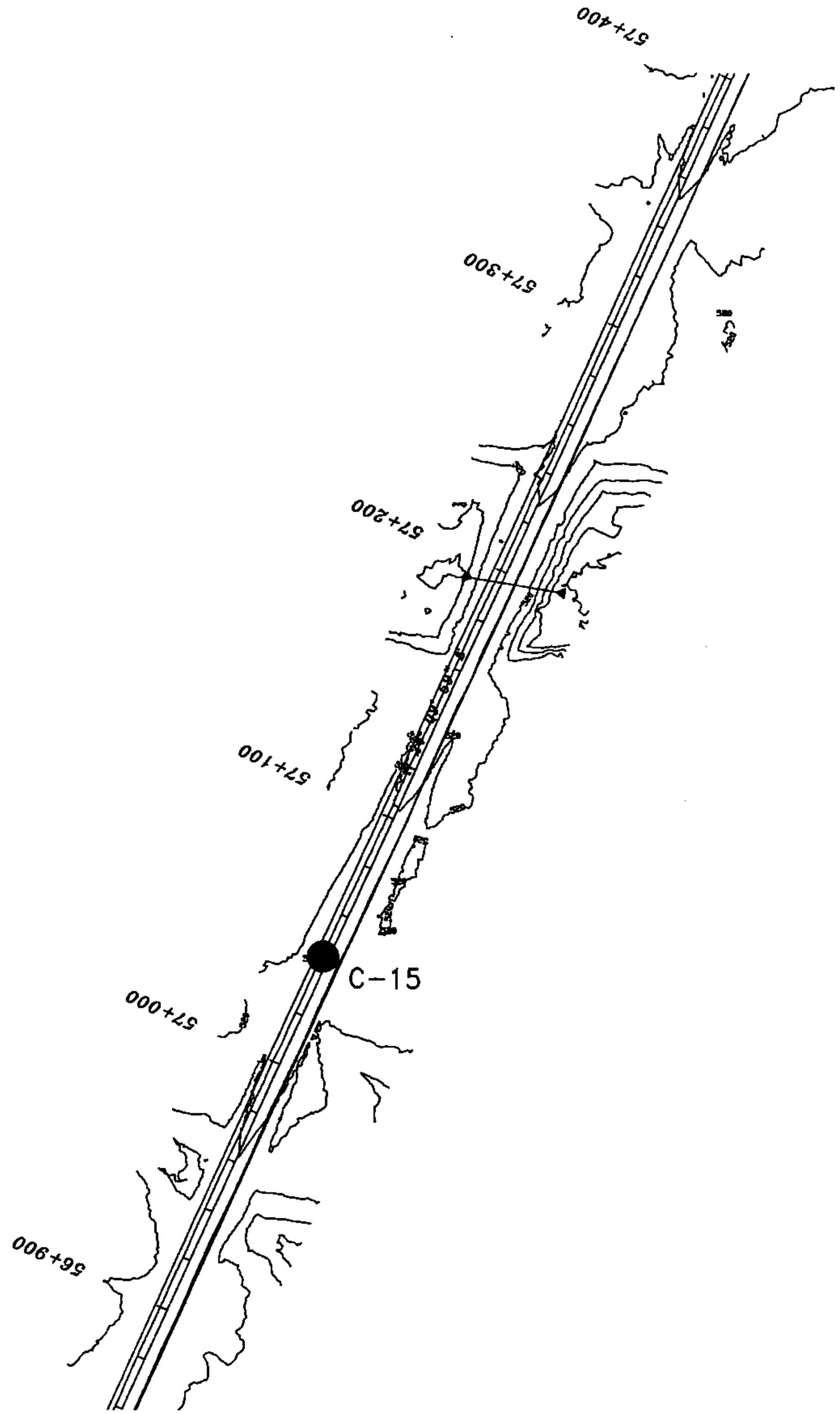
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 22

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

0 30 60 METERS
SCALE

LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION
C-1 – APPROXIMATE PAVEMENT CORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT:	PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
PROJECT:	NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

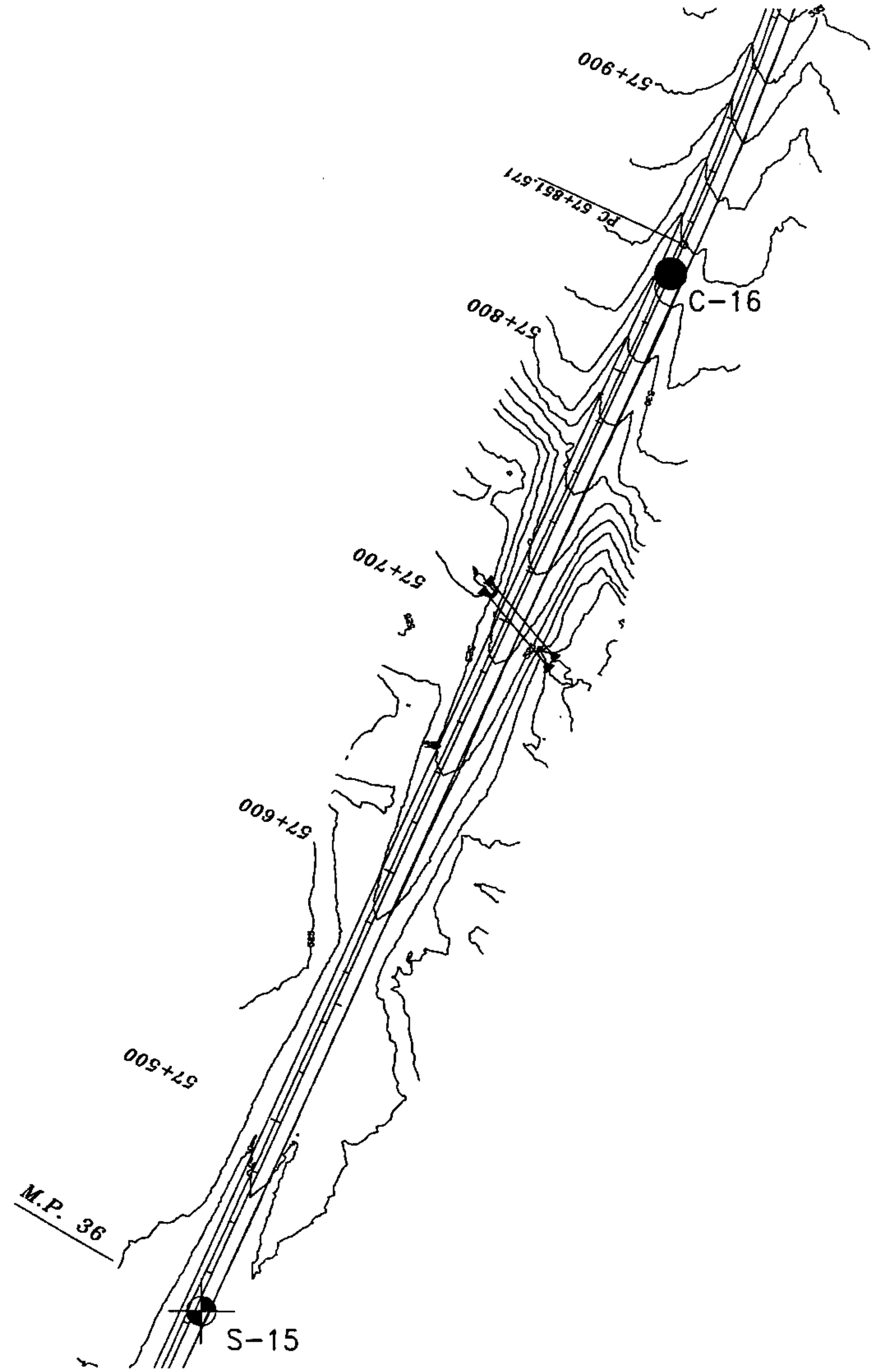
STATIONS: 56+860 TO 57+402

Terracon

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64035218	23

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

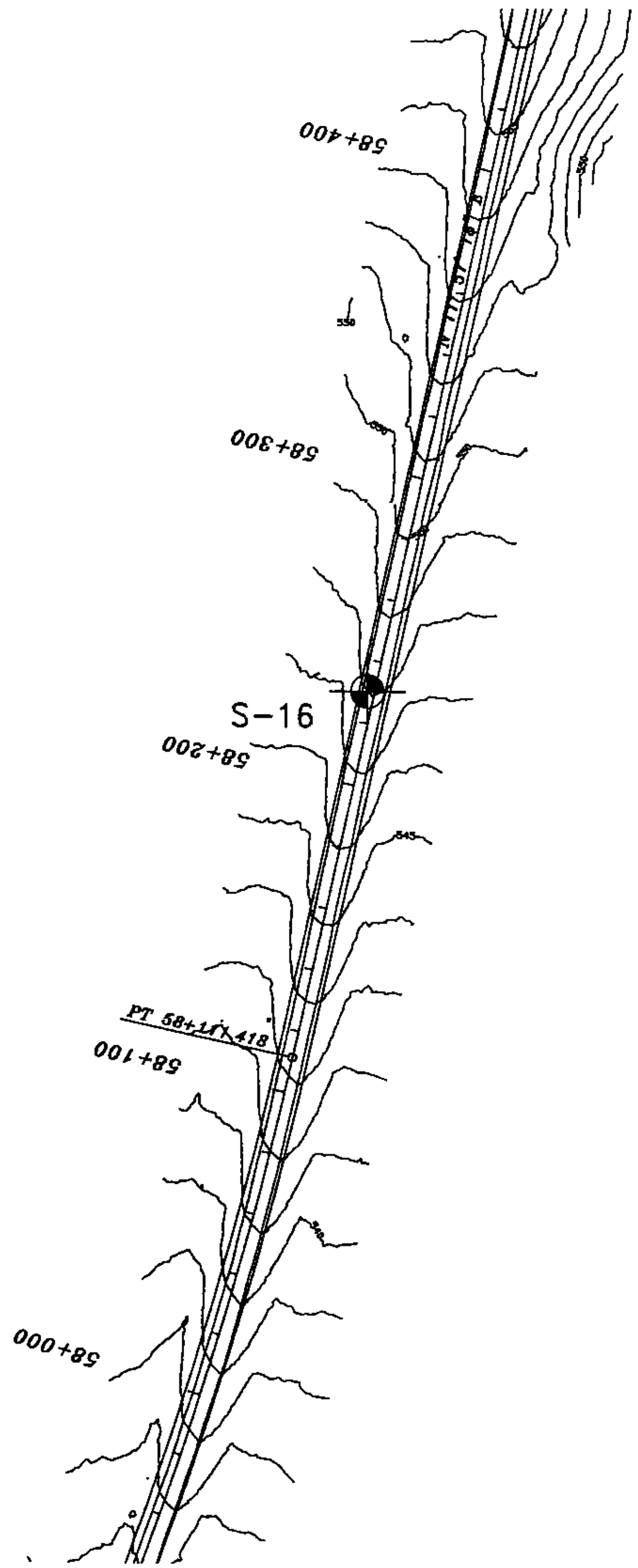
0 30 60 METERS
SCALE

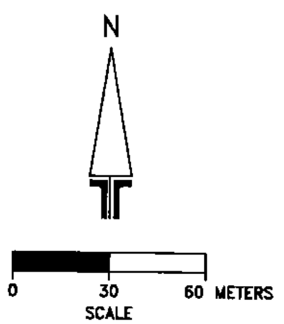
LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	STATIONS: 57+402 TO 57+943	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	Terracon	PROJECT NO.: 64035218	PLATE: 24

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION
C-1 – APPROXIMATE PAVEMENT CORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT:	PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
PROJECT:	NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

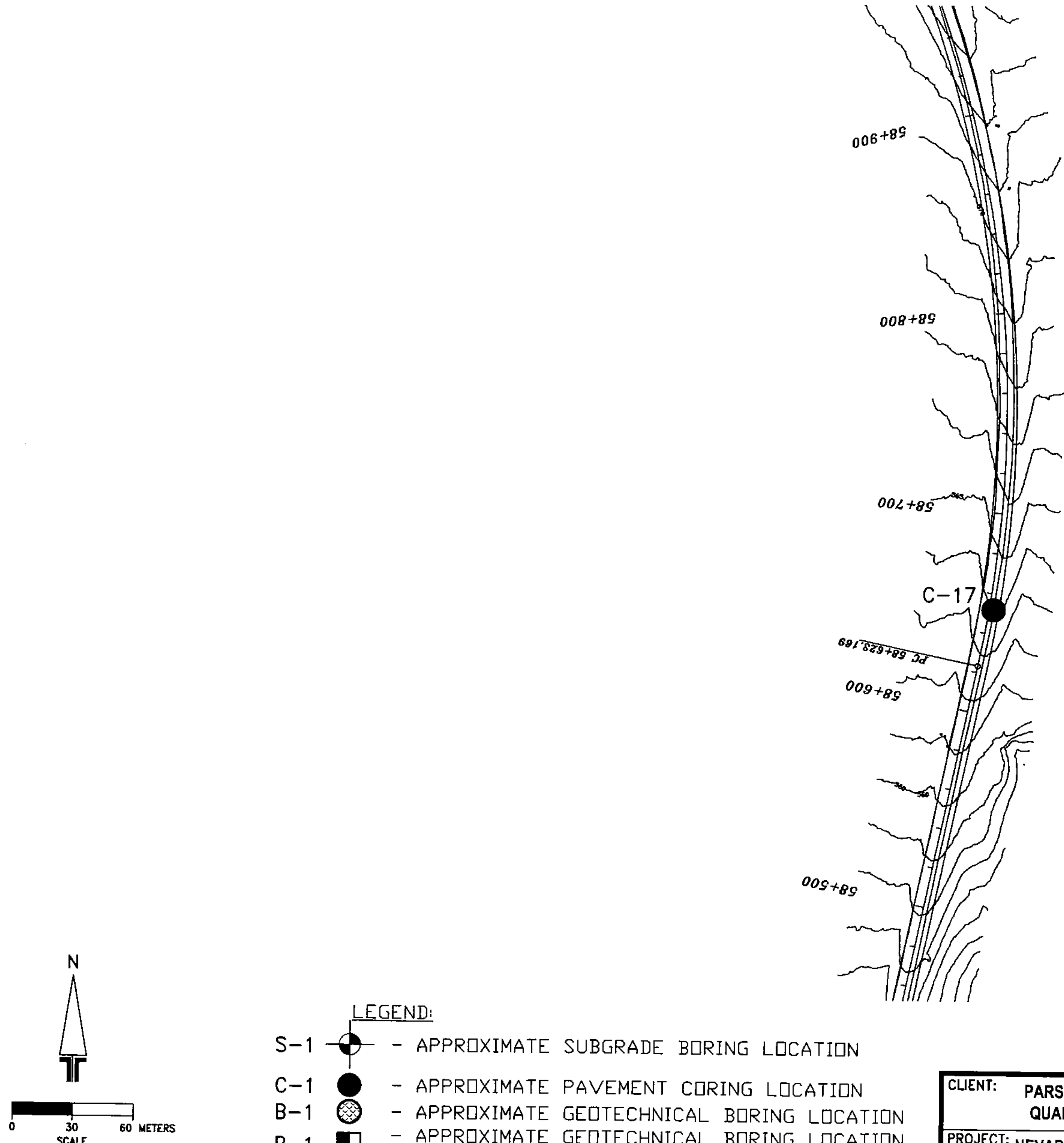
STATIONS: 57+943 TO 58+452

Terracon

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64035218	25

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION

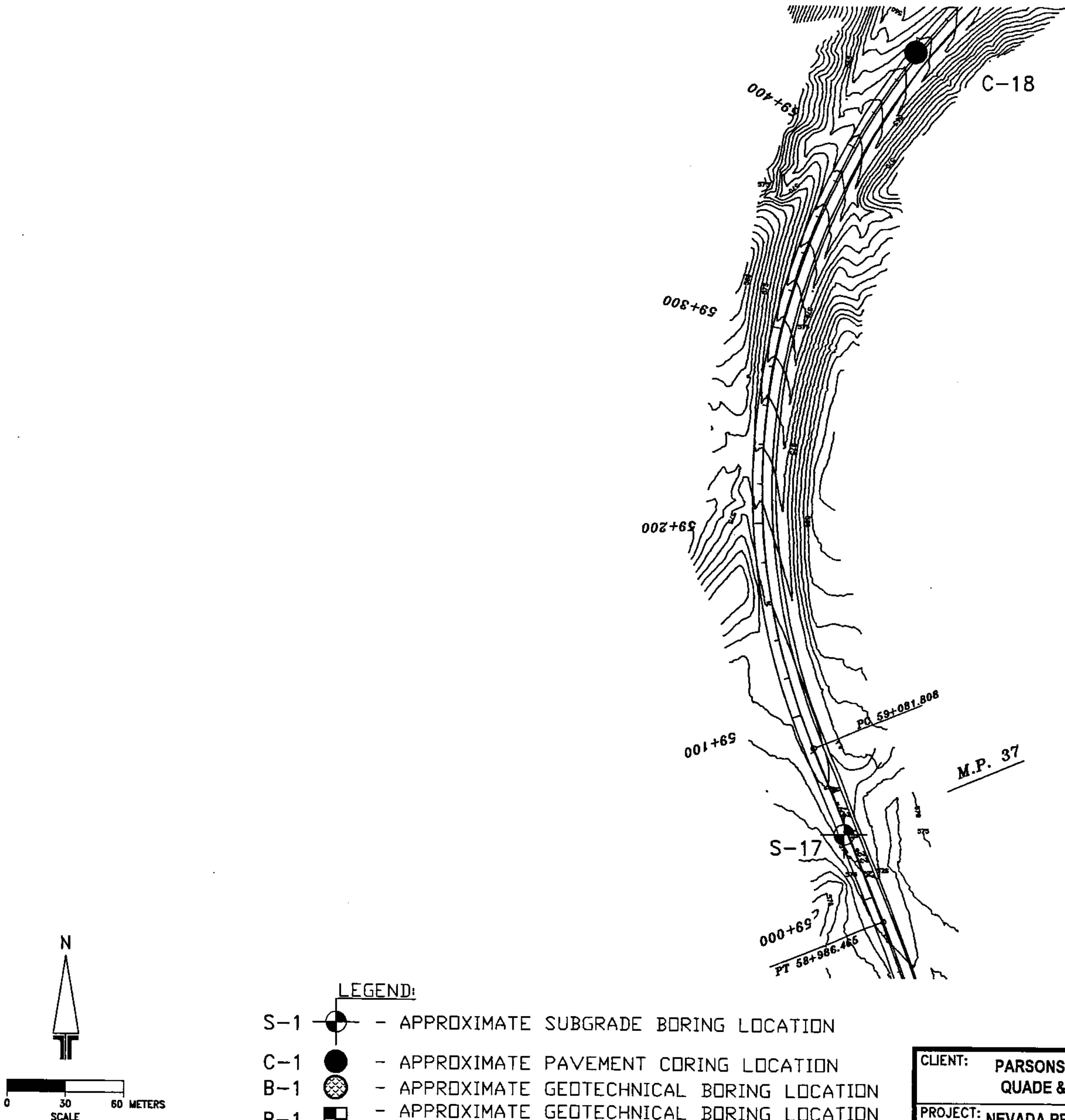
C-1 - APPROXIMATE PAVEMENT CORING LOCATION

B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION

B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	STATIONS: 58+452 TO 58+956	ALIGNMENT PLAN
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	Terracon	PROJECT NO.: 64035218
		PLATE: 26

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 58+956 TO 59+490

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

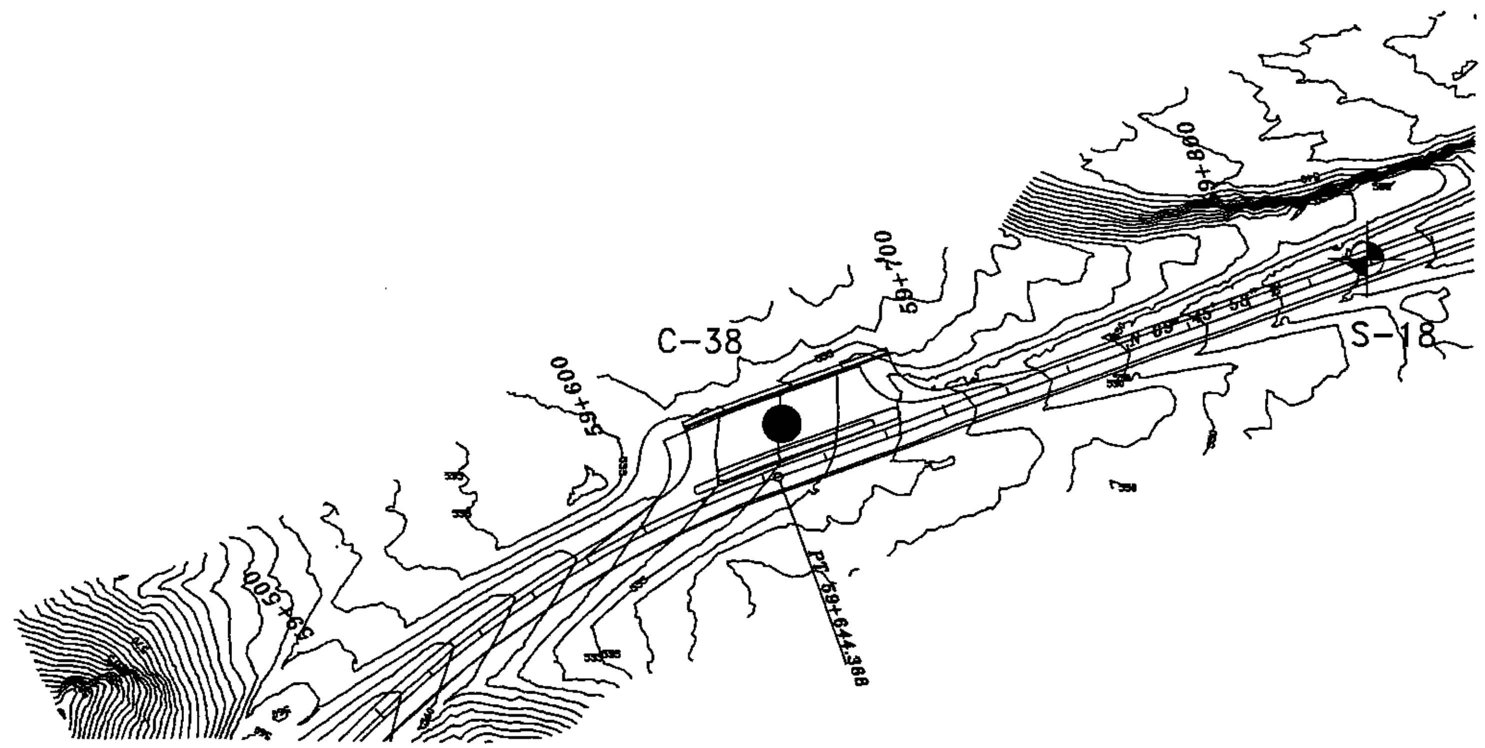
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 27

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

0 30 60 METERS
SCALE

LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 59+490 TO 59+873

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

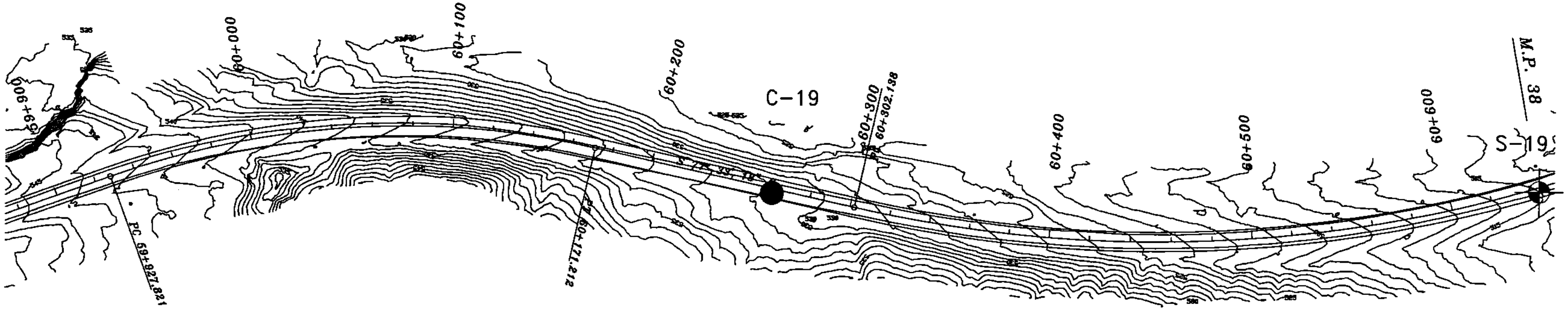
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 28

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

0 30 60 METERS
SCALE

LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION
C-1 – APPROXIMATE PAVEMENT CORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 59+873 TO 60+652

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

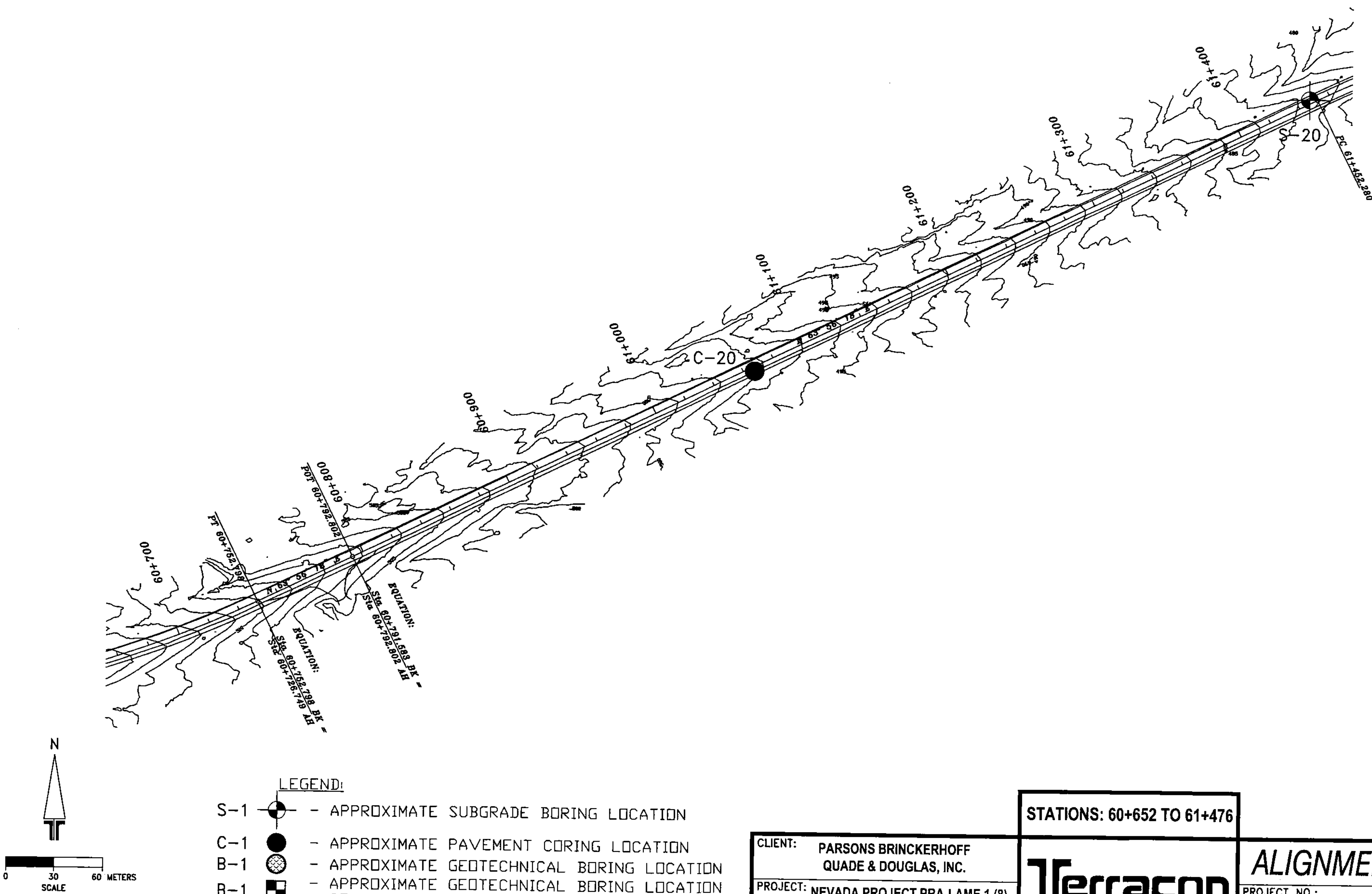
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 29

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION
C-1 – APPROXIMATE PAVEMENT CORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 60+652 TO 61+476

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

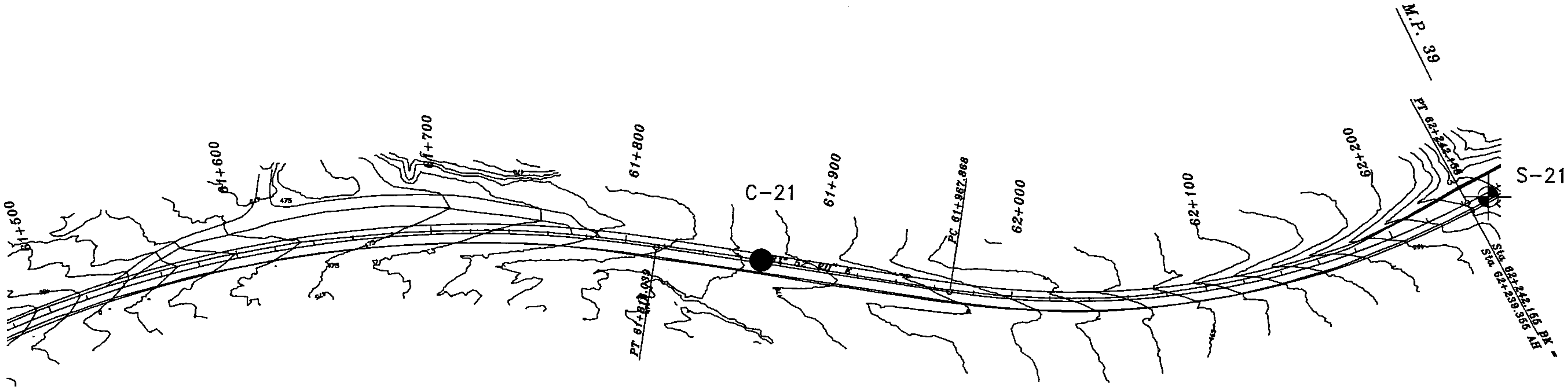
Terracon

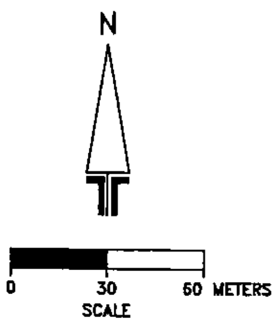
ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 30

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 61+476 TO 62+261

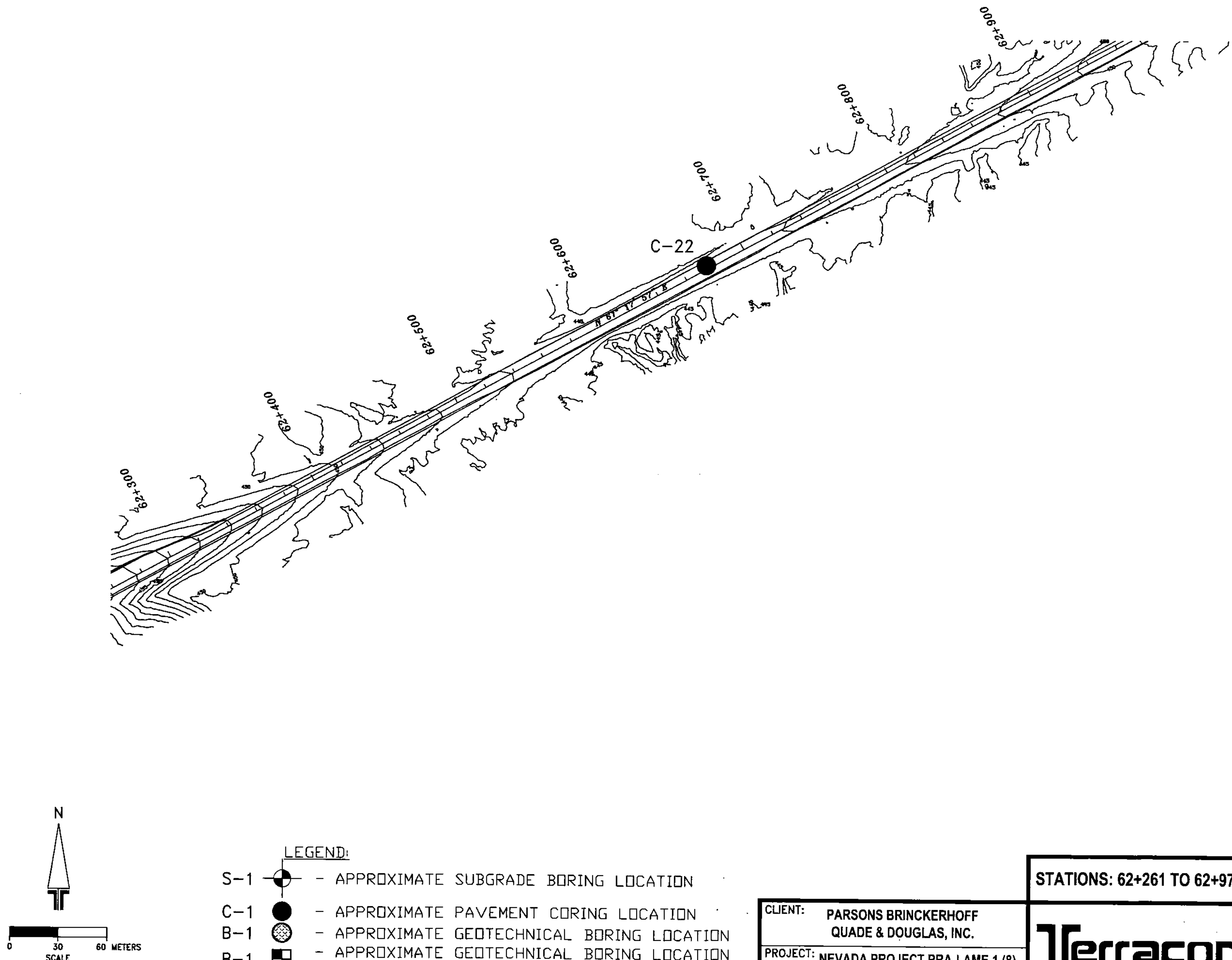
CLIENT:	PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
PROJECT:	NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

Terracon

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64035218	31

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION

C-1 - APPROXIMATE PAVEMENT CORING LOCATION

B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION

B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

STATIONS: 62+261 TO 62+970

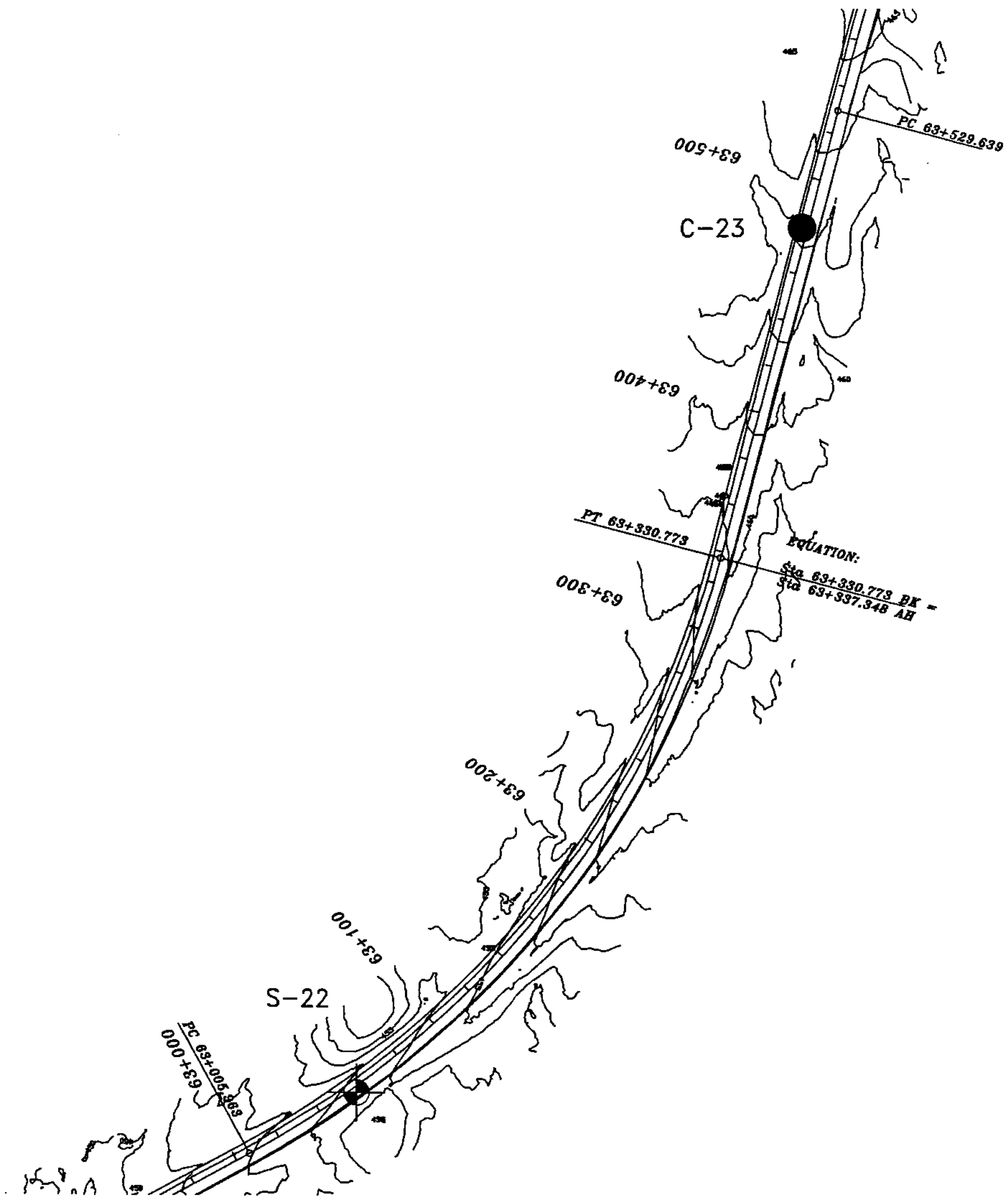
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 32

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

0 30 60 METERS
SCALE

LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 62+970 TO 63+573

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

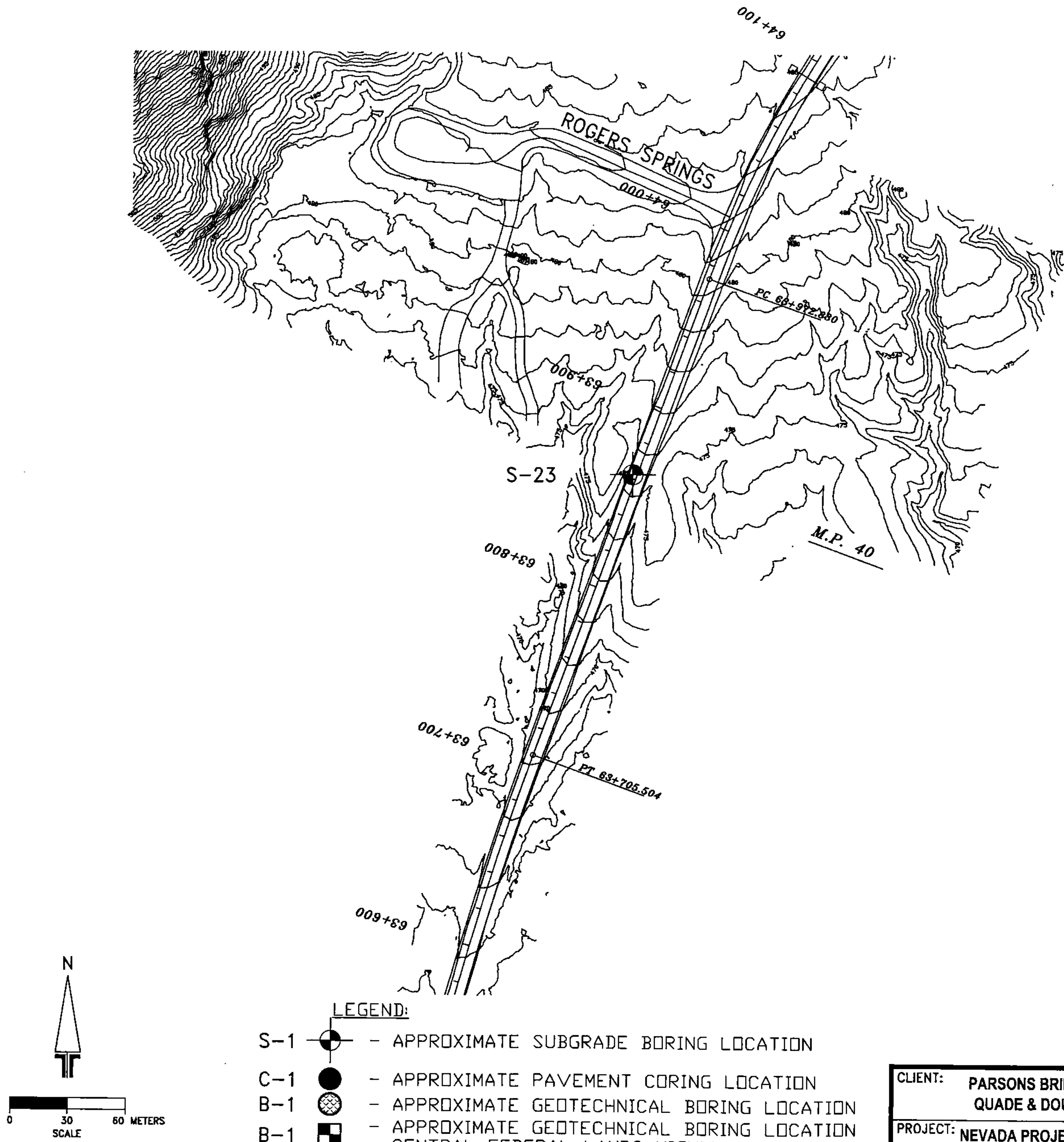
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 33

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 63+573 TO 64+104

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

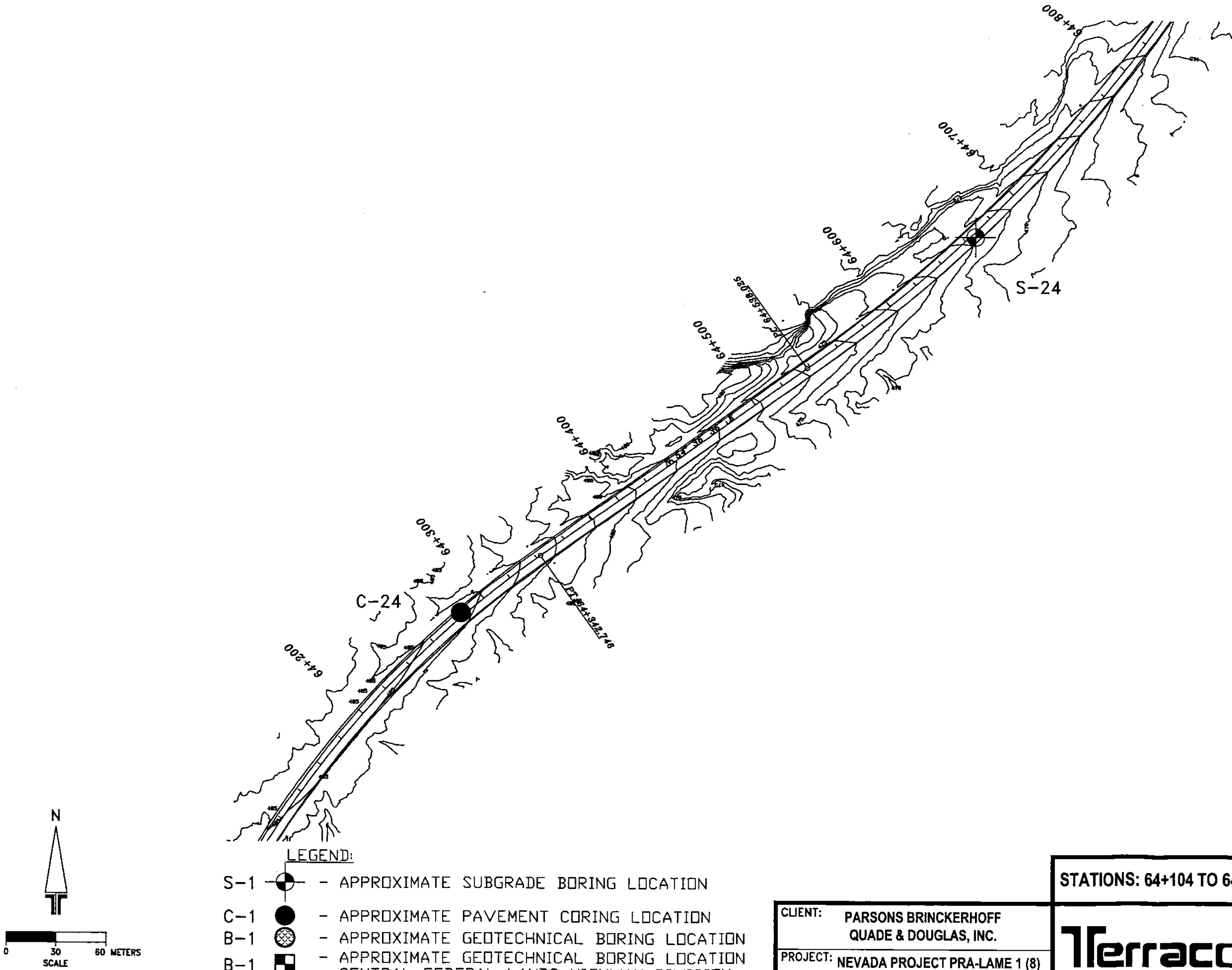
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 34

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION

C-1 - APPROXIMATE PAVEMENT CORING LOCATION

B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION

B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 64+104 TO 64+837

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

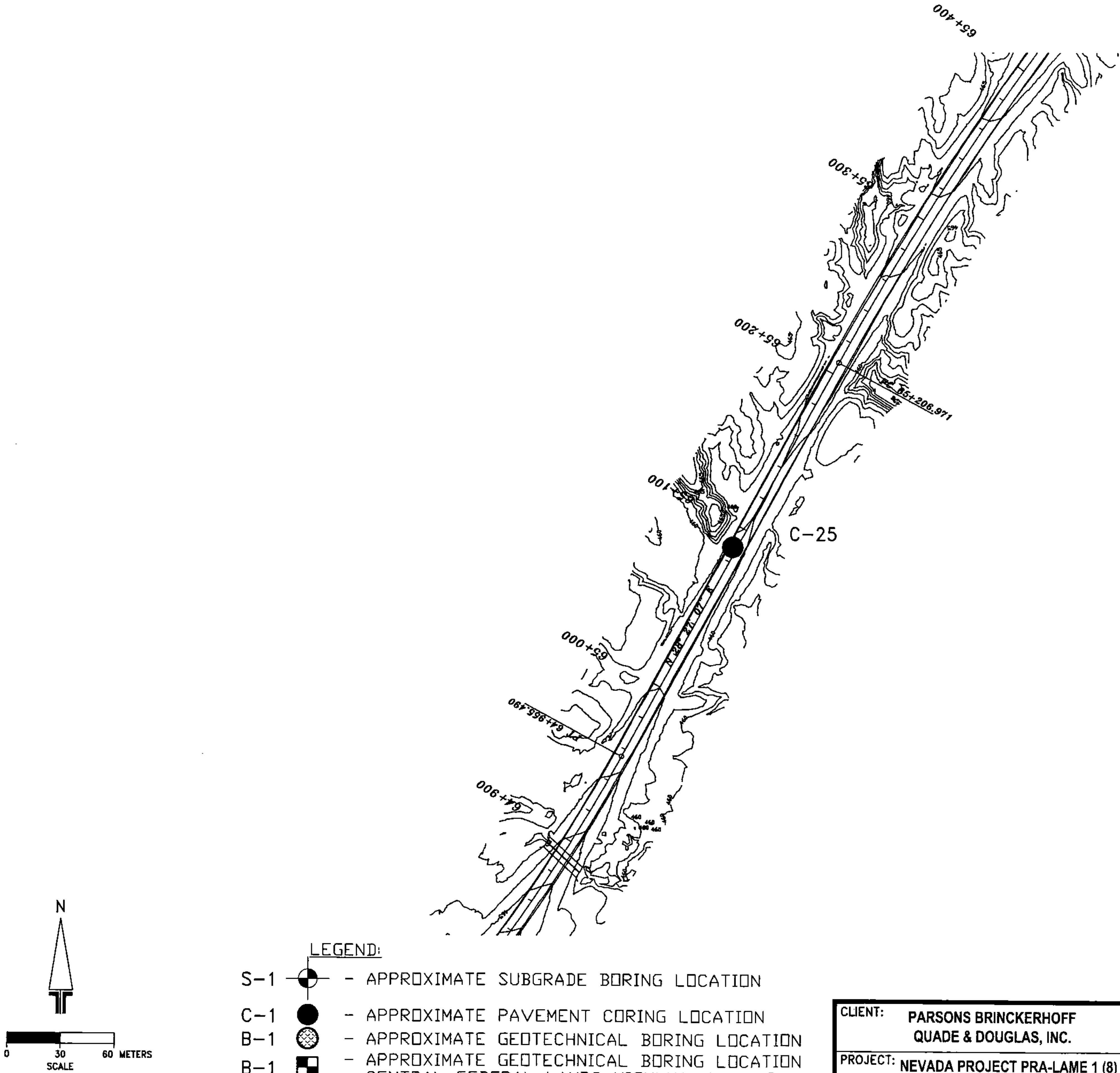
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 35

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 64+837 TO 65+412

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

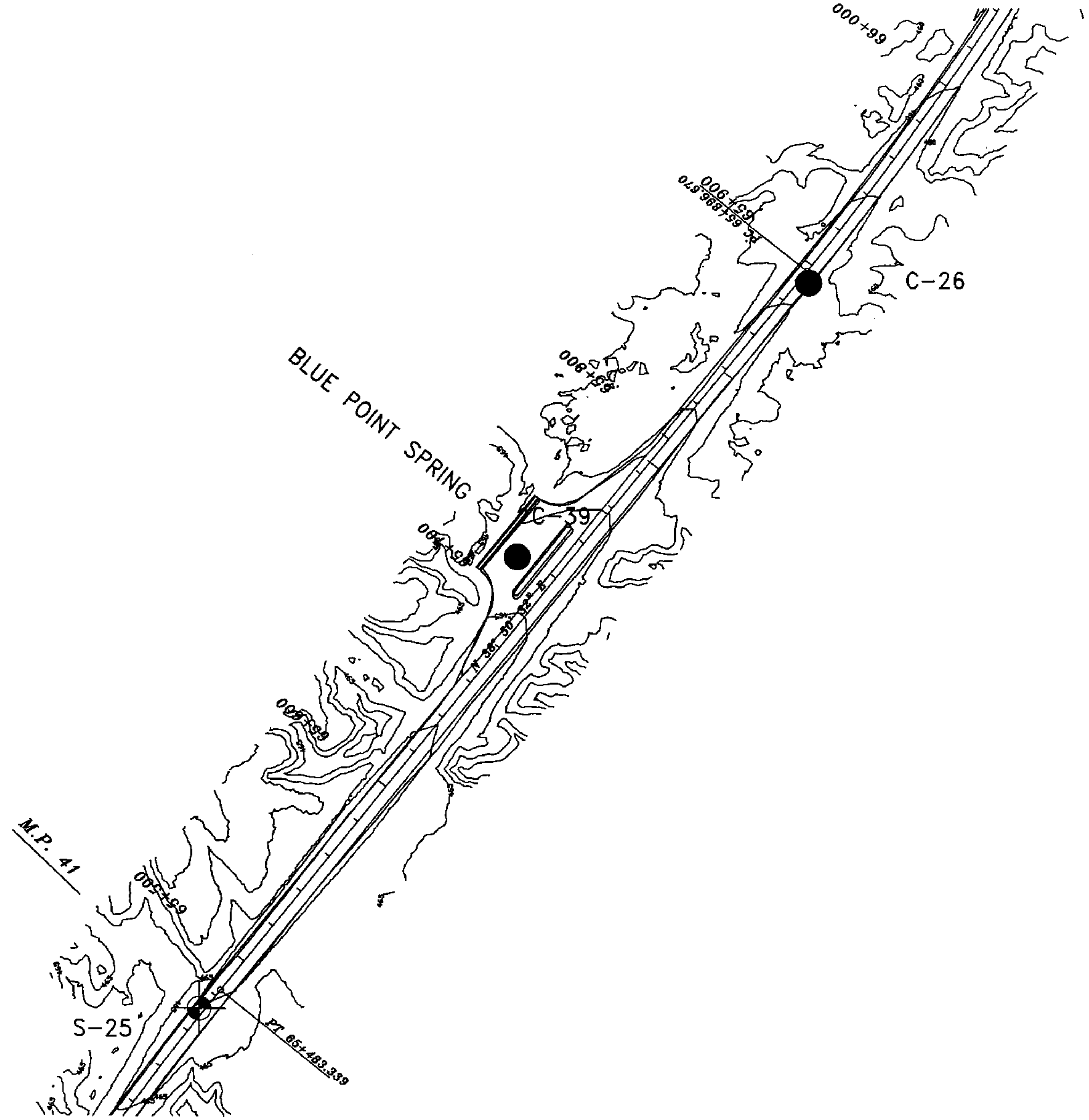
Terracon

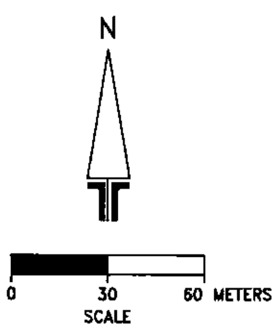
ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 36

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

- S-1 – APPROXIMATE SUBGRADE BORING LOCATION
- C-1 – APPROXIMATE PAVEMENT CORING LOCATION
- B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
- B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 65+412 TO 66+041

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

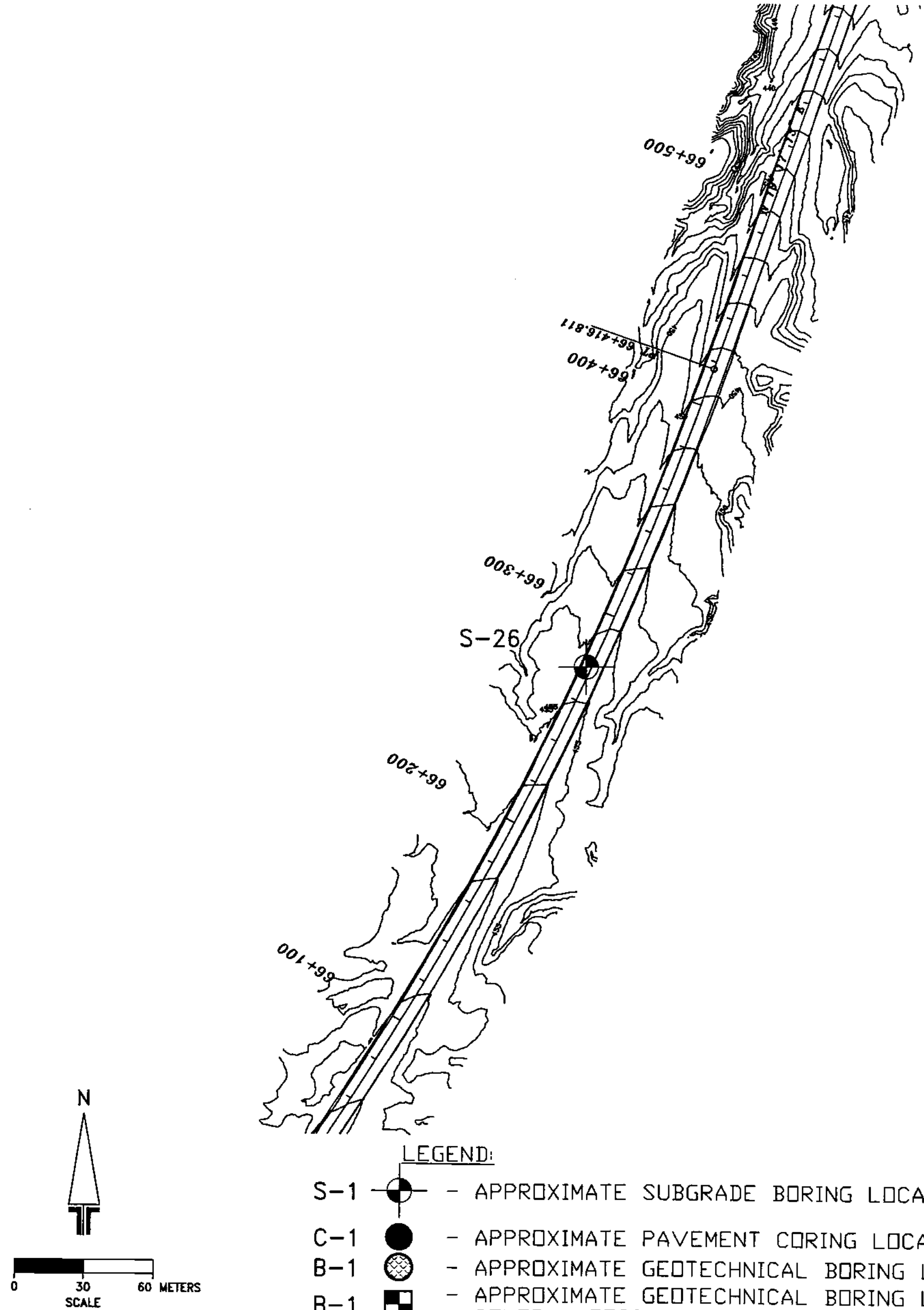
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 37

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION

C-1 – APPROXIMATE PAVEMENT CORING LOCATION

B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION

B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 66+041 TO 66+585

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

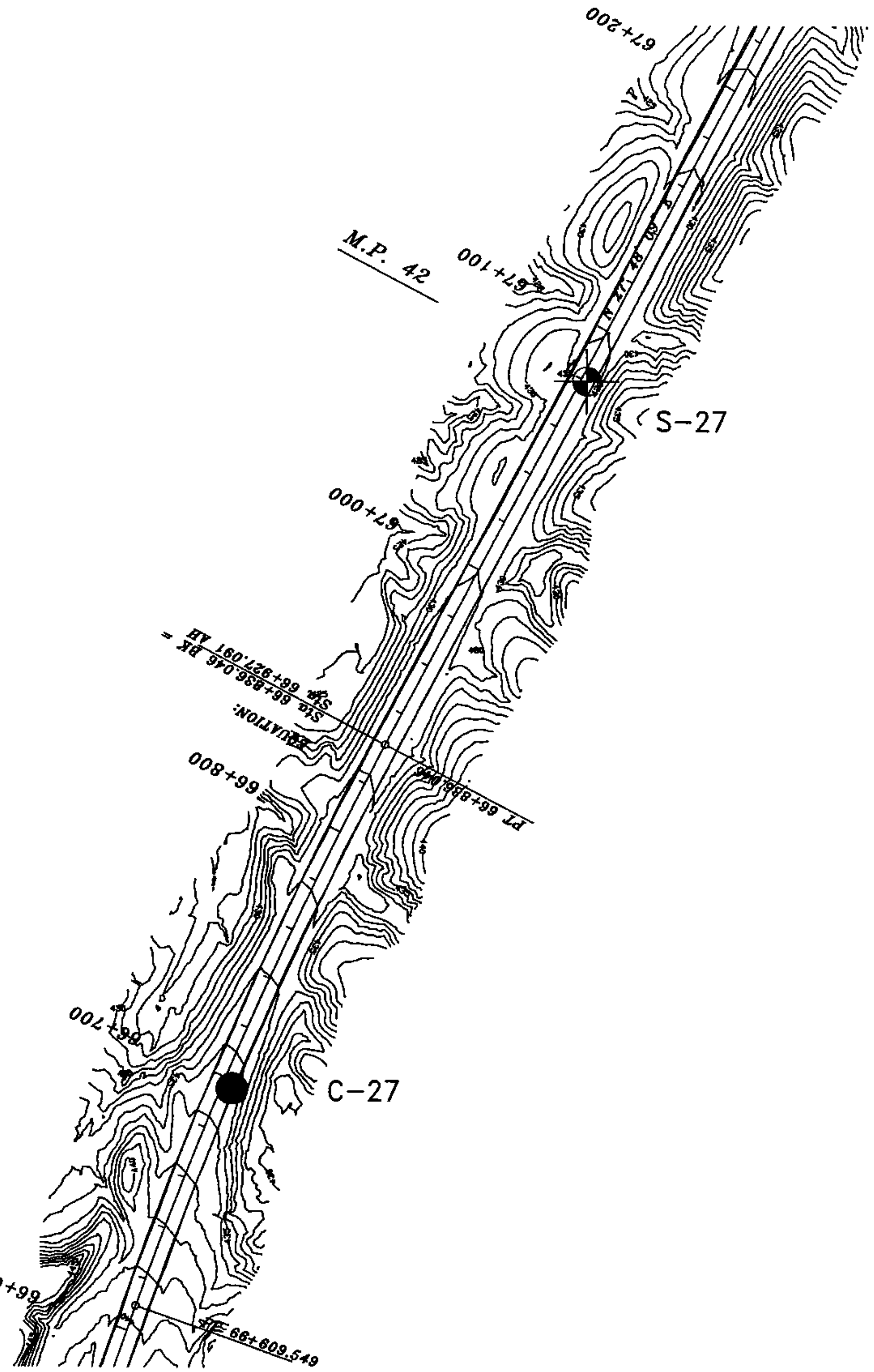
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 38

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

0 30 60 METERS
SCALE

LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION

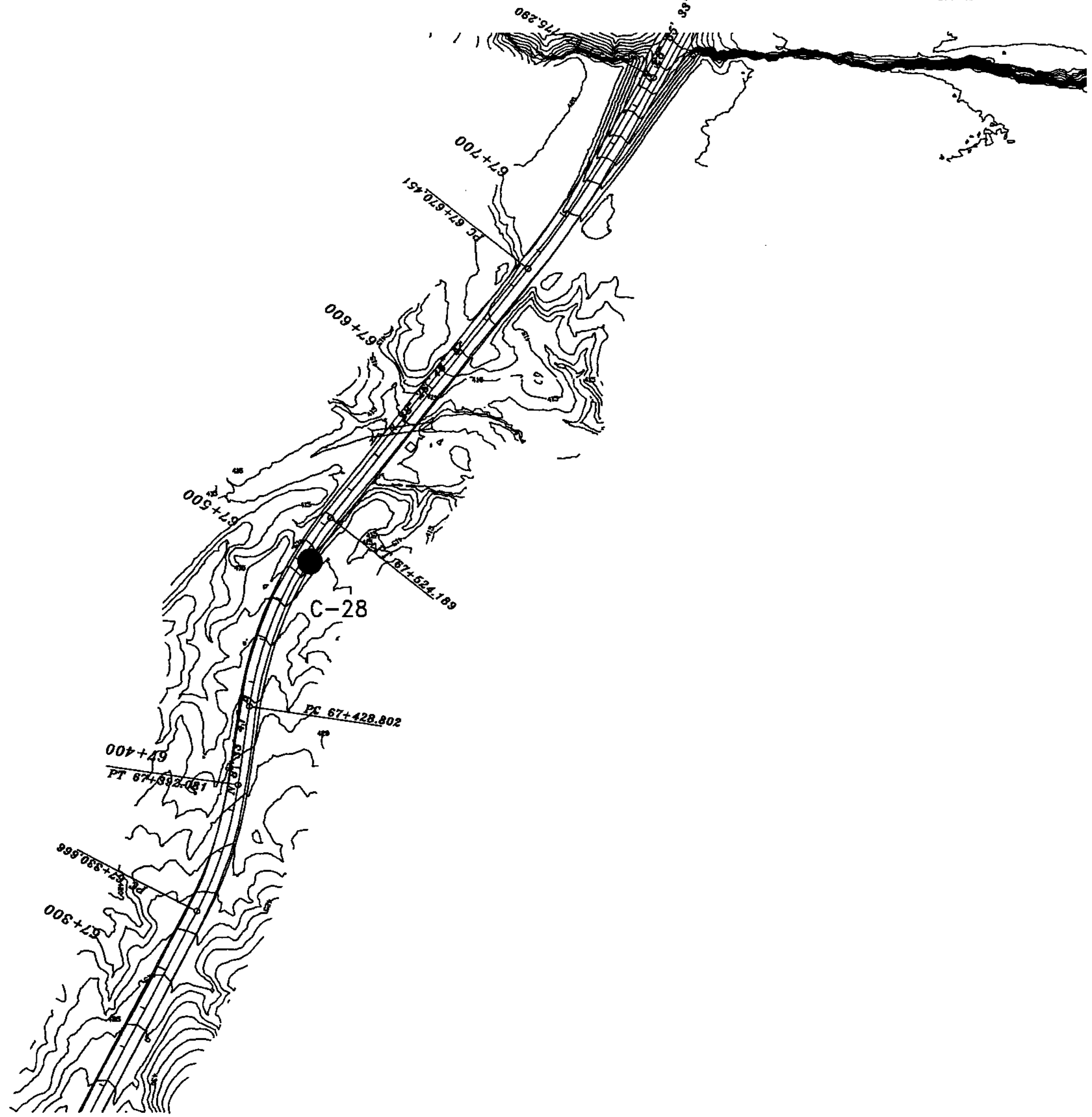
C-1 – APPROXIMATE PAVEMENT CORING LOCATION

B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION

B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	STATIONS: 66+585 TO 67+227	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	Terracon	PROJECT NO.: 64035218	PLATE: 39

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION

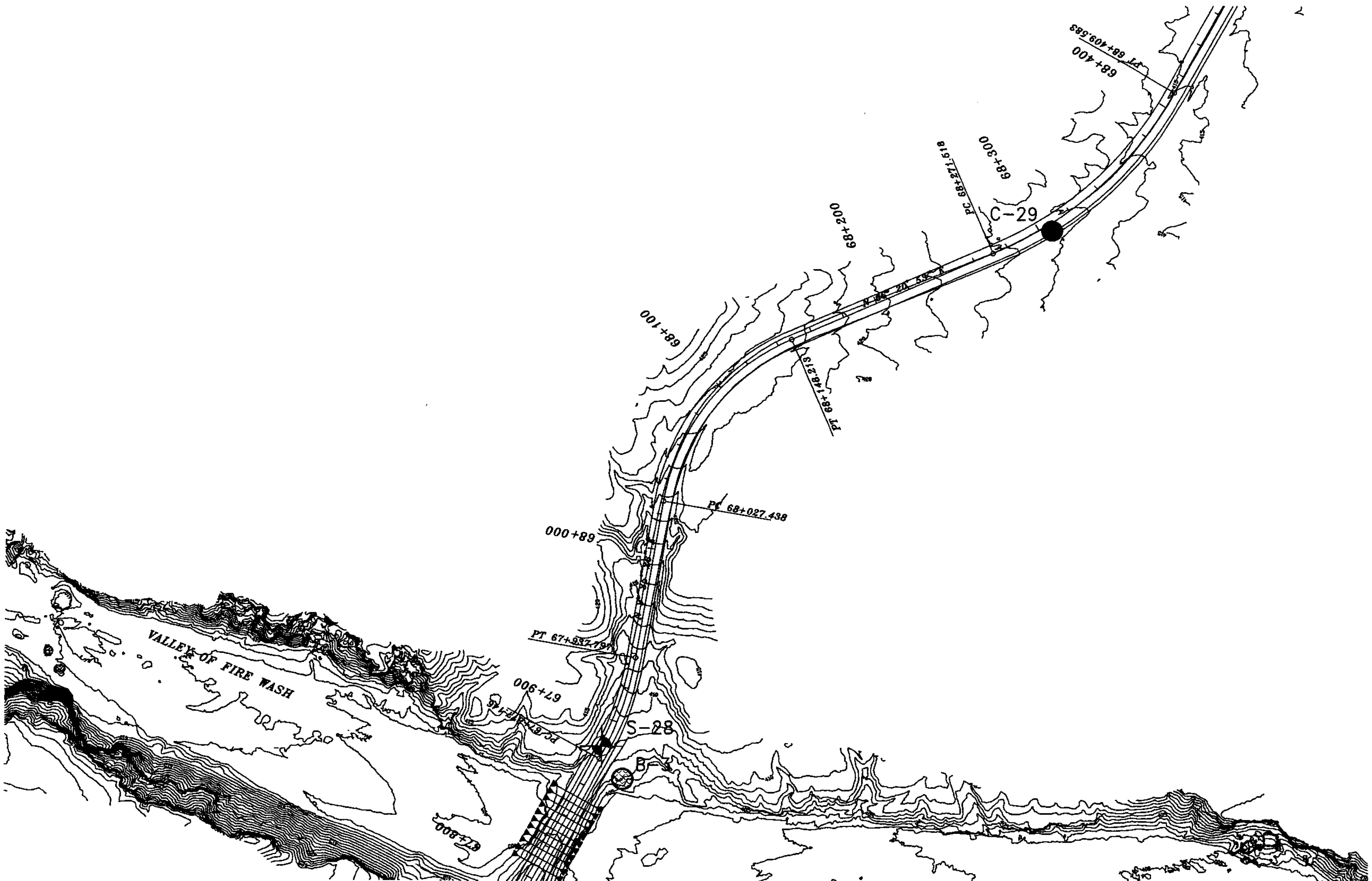
C-1 - APPROXIMATE PAVEMENT CORING LOCATION

B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION

B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	STATIONS: 67+227 TO 67+798	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	Terracon	PROJECT NO.: 64035218	PLATE: 40

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

0 30 60 METERS
SCALE

LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	STATIONS: 67+798 TO 68+465	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	Terracon	PROJECT NO.: 64035218	PLATE: 41

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.

N

0 30 60 METERS
SCALE

LEGEND:

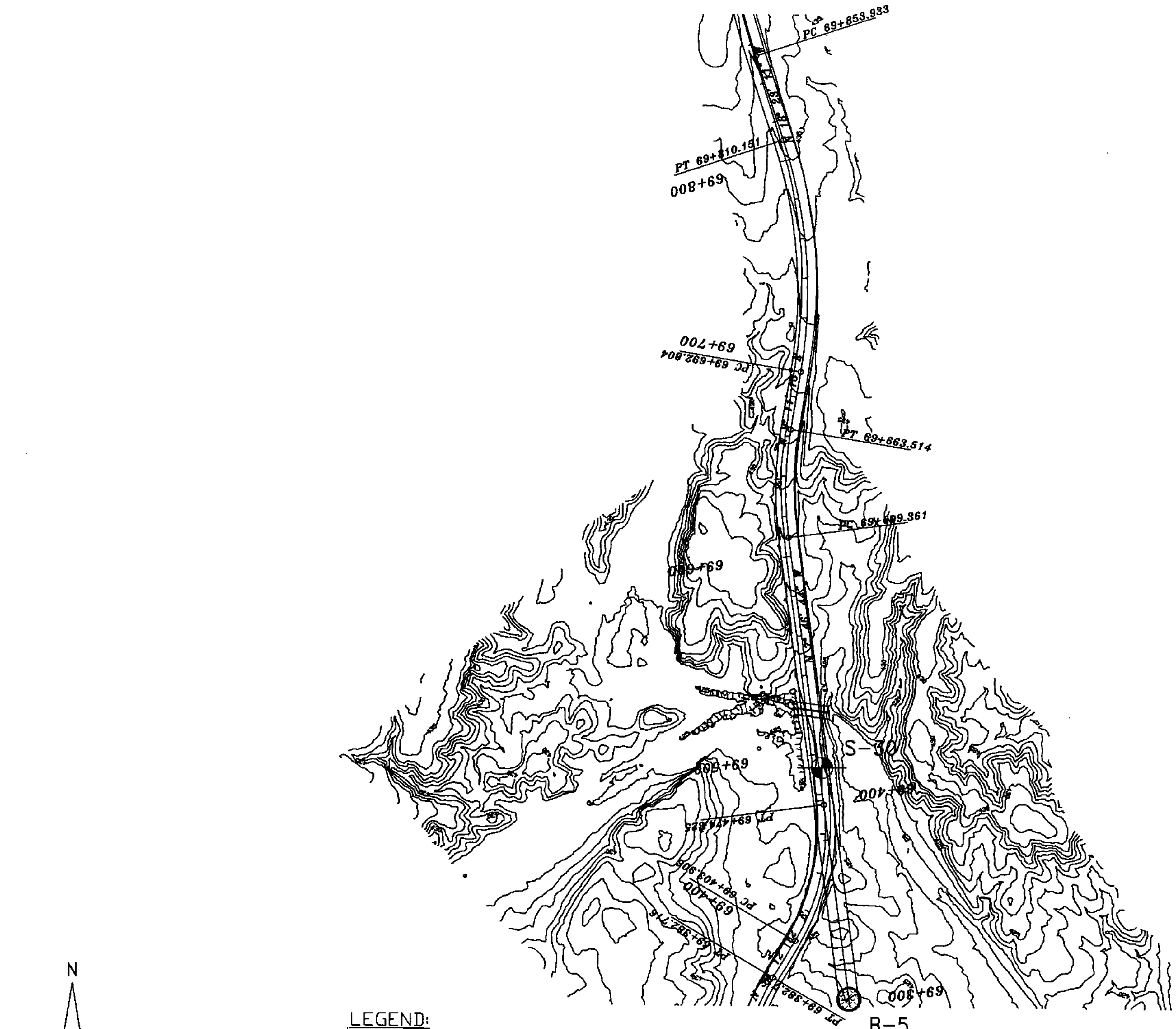
S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 68+465 TO 69+367	
CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	Terracon
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64035218	42

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION
C-1 – APPROXIMATE PAVEMENT CORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 69+367 TO 69+875

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

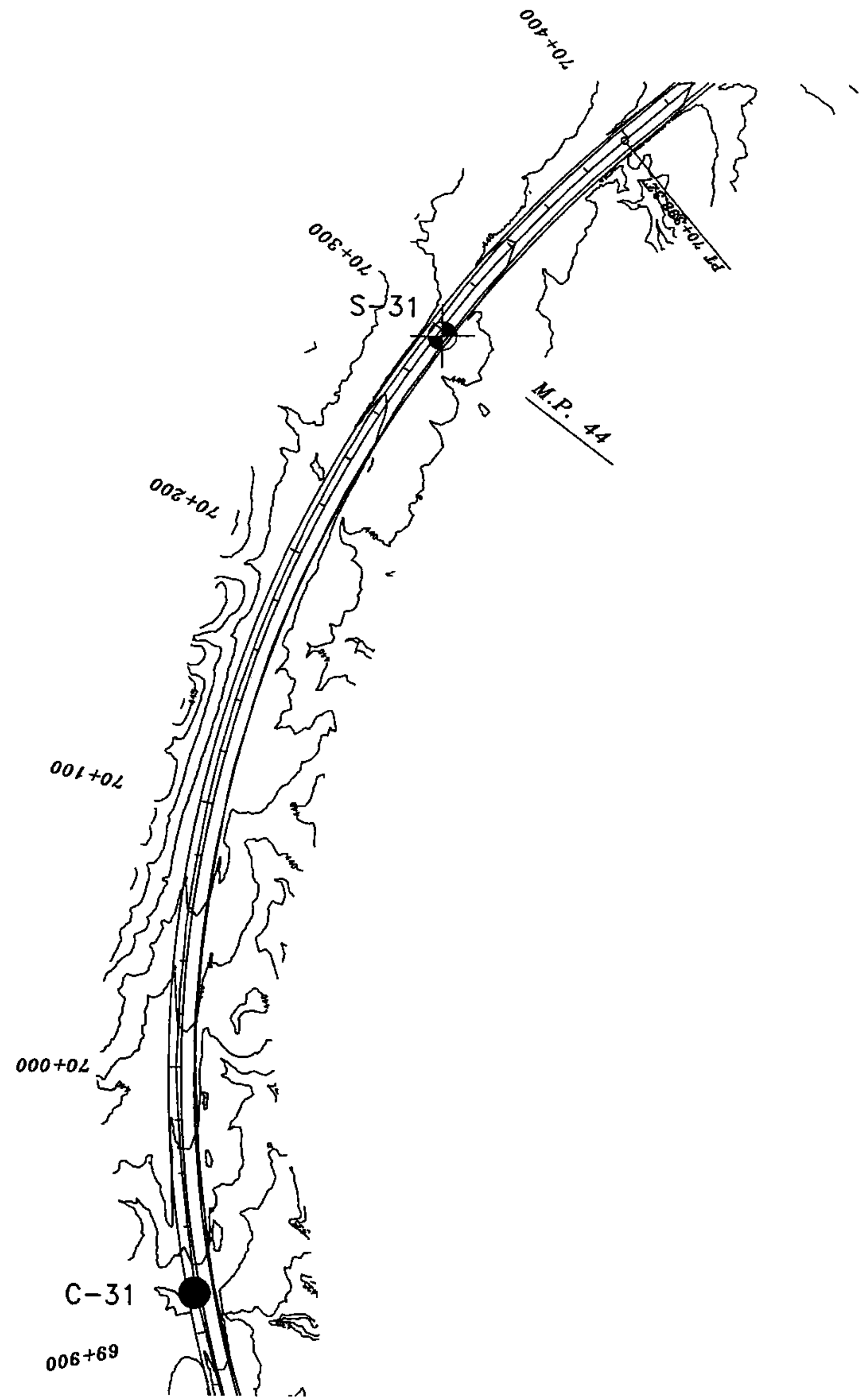
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 43

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

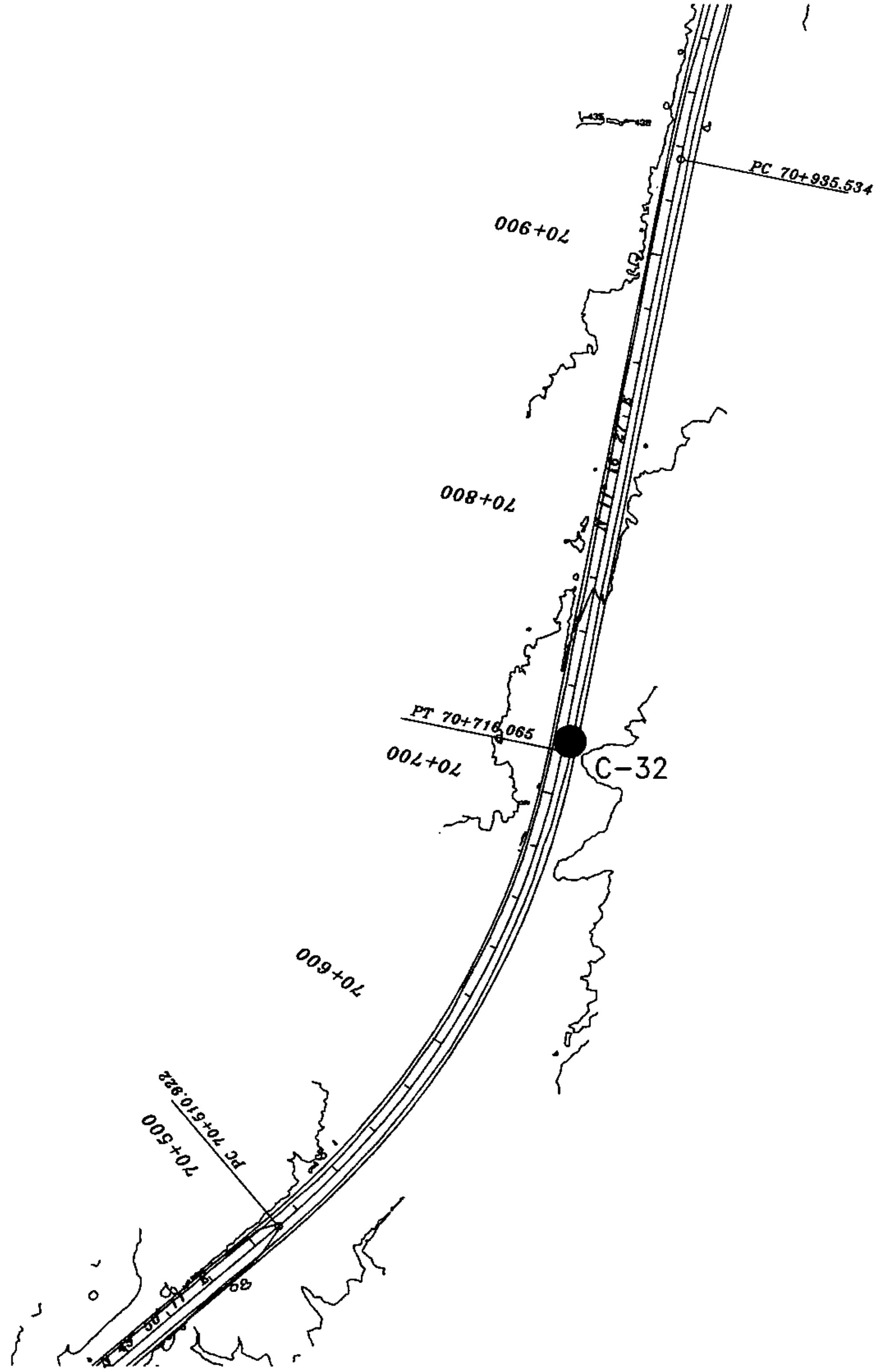
0 30 60 METERS
SCALE

LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION
C-1 – APPROXIMATE PAVEMENT CORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	STATIONS: 69+875 TO 70+432	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	Terracon	PROJECT NO.: 64035218	PLATE: 44

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 70+432 TO 70+993

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

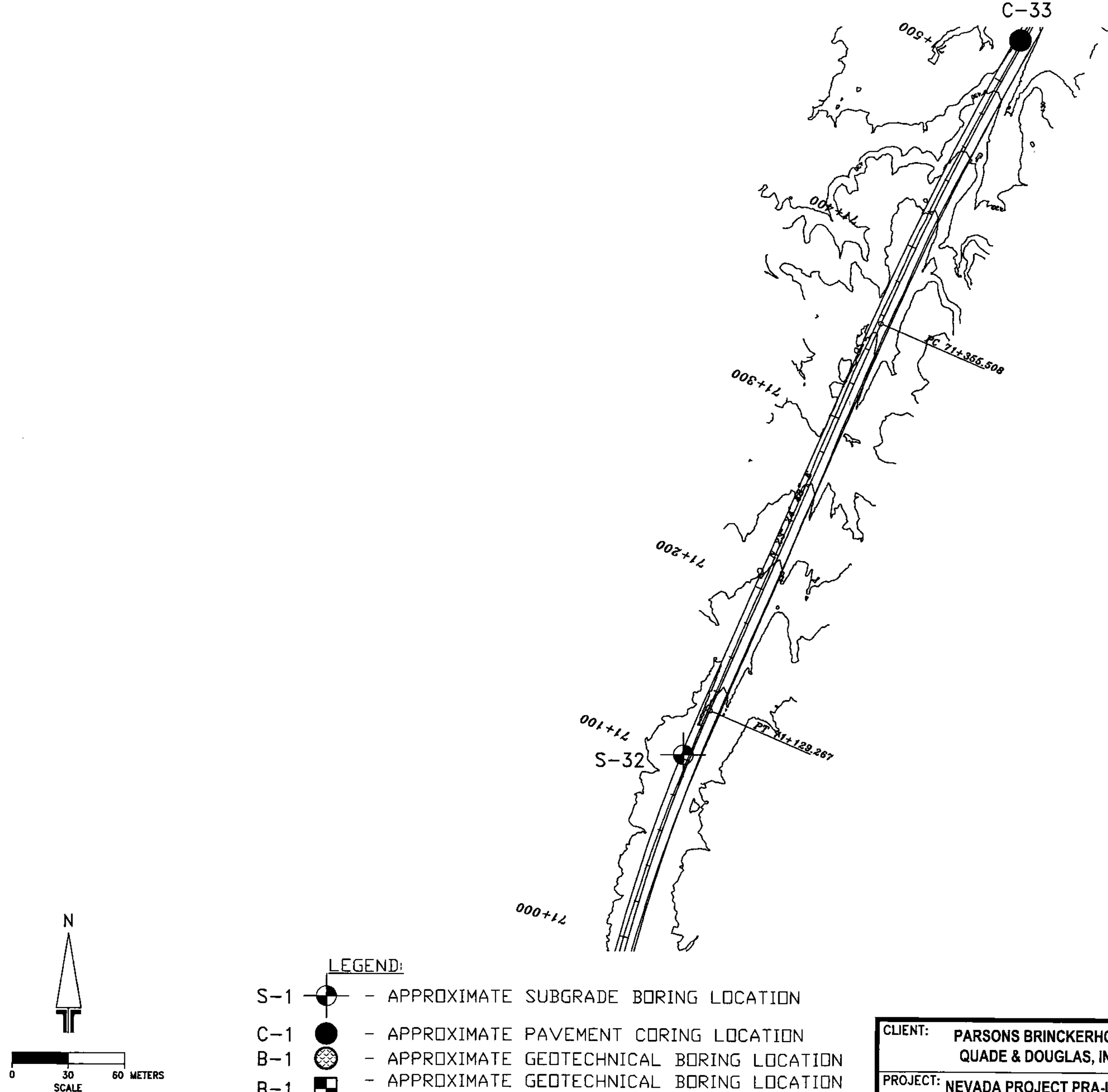
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 45

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 70+993 TO 71+533

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

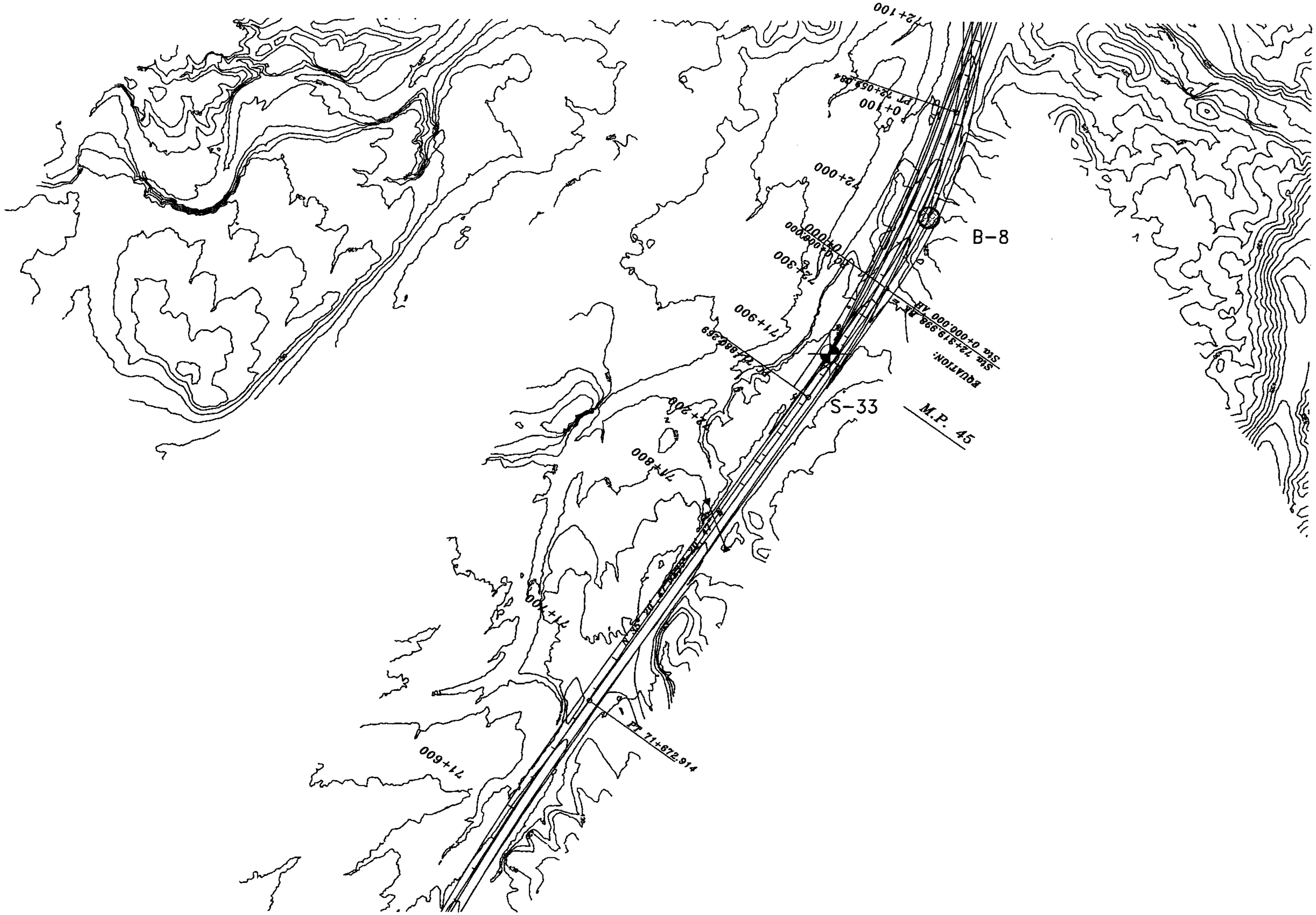
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 46

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

0 30 60 METERS
SCALE

LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION

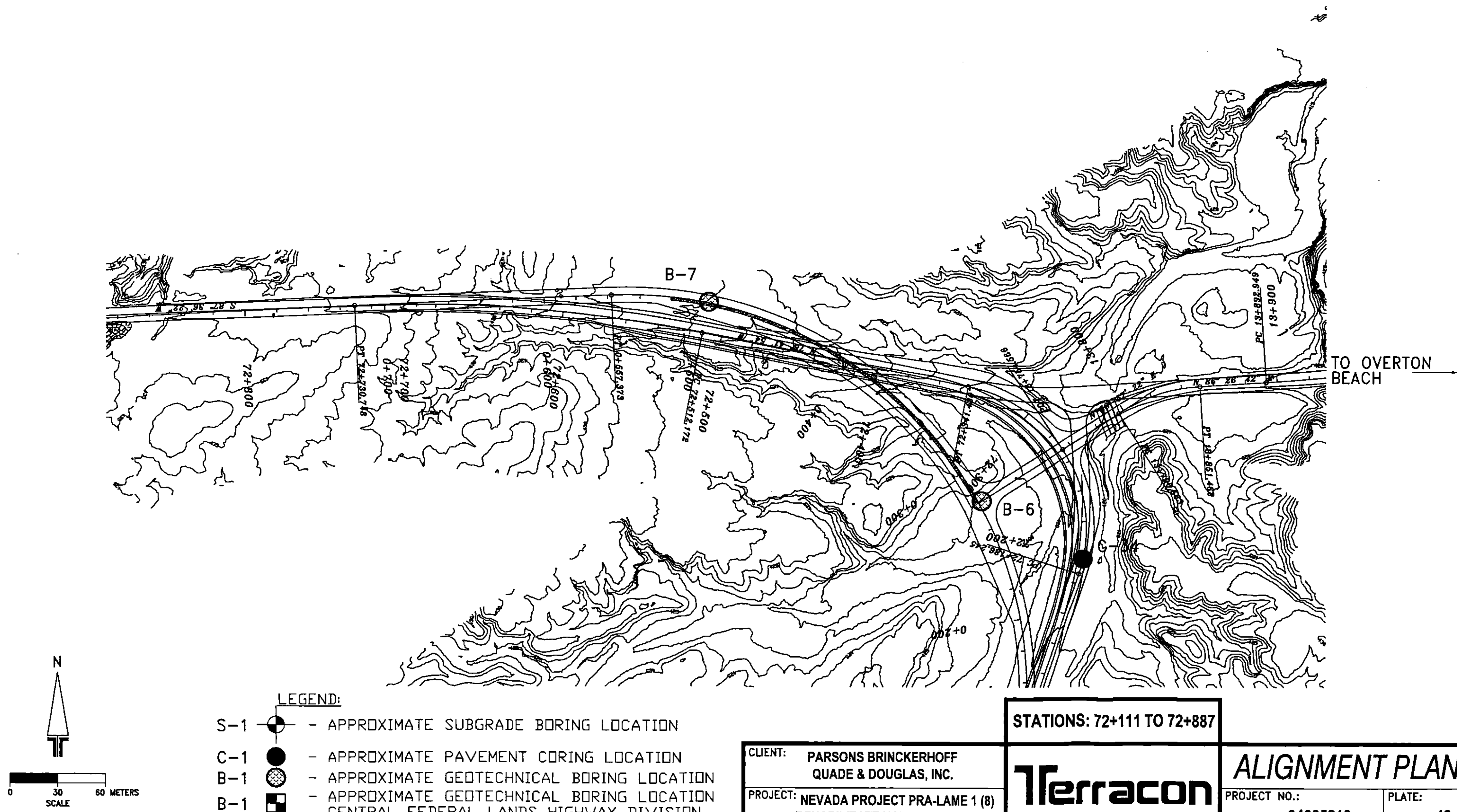
C-1 - APPROXIMATE PAVEMENT CORING LOCATION

B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION

B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 71+533 TO 72+111	
CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	ALIGNMENT PLAN
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD	PROJECT NO.: 64035218
Terracon	PLATE: 47

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION

C-1 - APPROXIMATE PAVEMENT CORING LOCATION

B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION

B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 72+111 TO 72+887

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

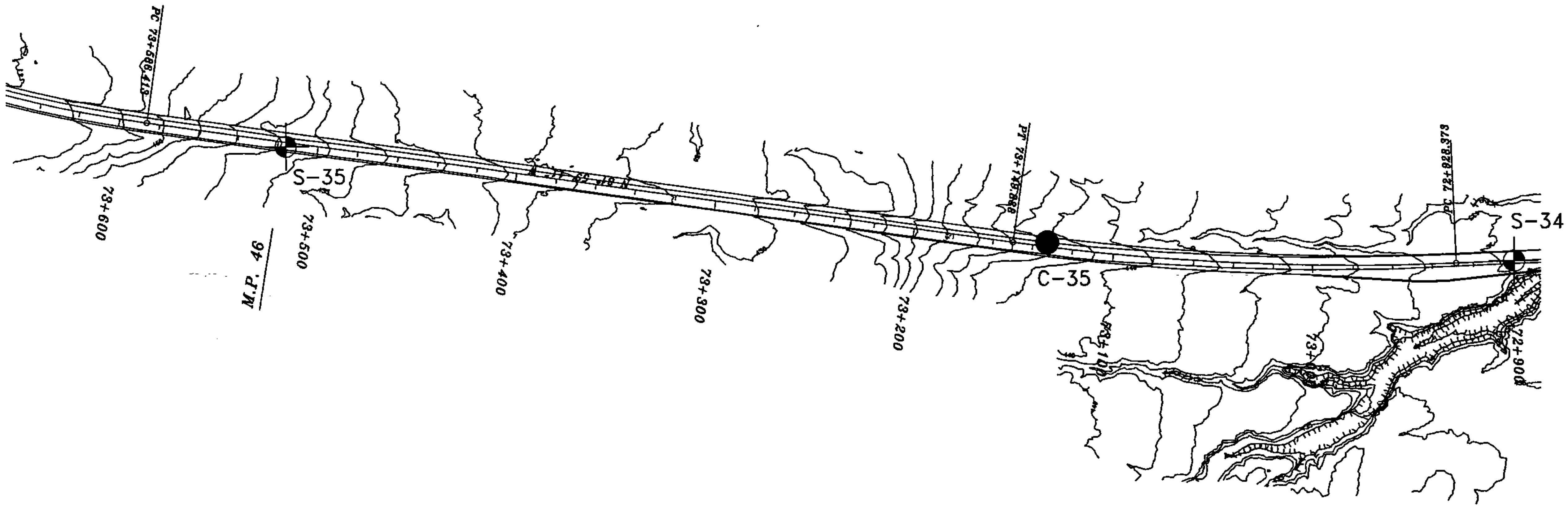
Terracon

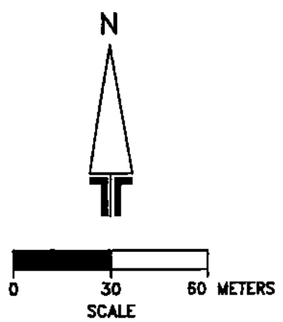
ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 48

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





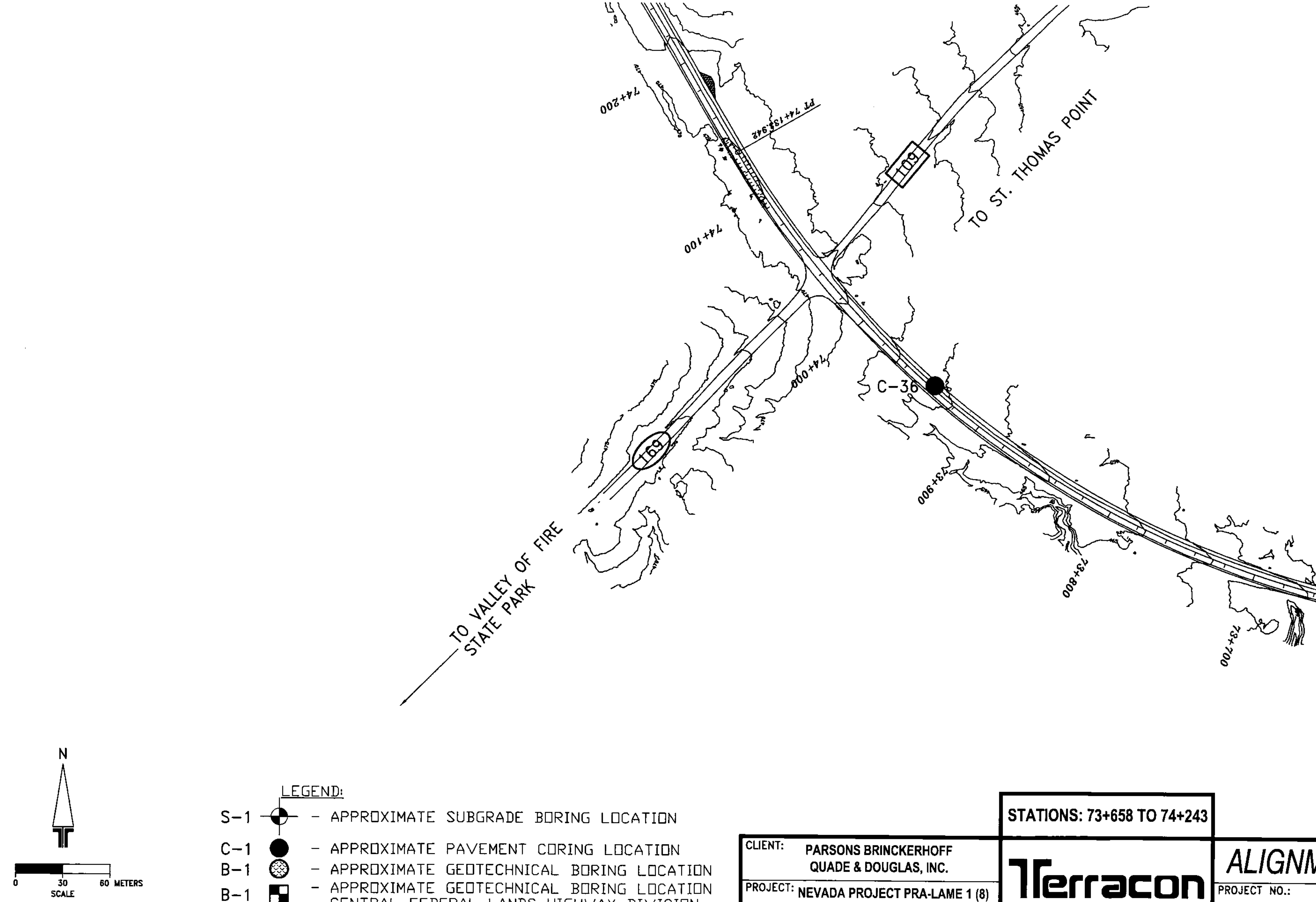
LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 72+887 TO 73+658

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	Terracon	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD		PROJECT NO.: 64035218	PLATE: 49

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 73+658 TO 74+243

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

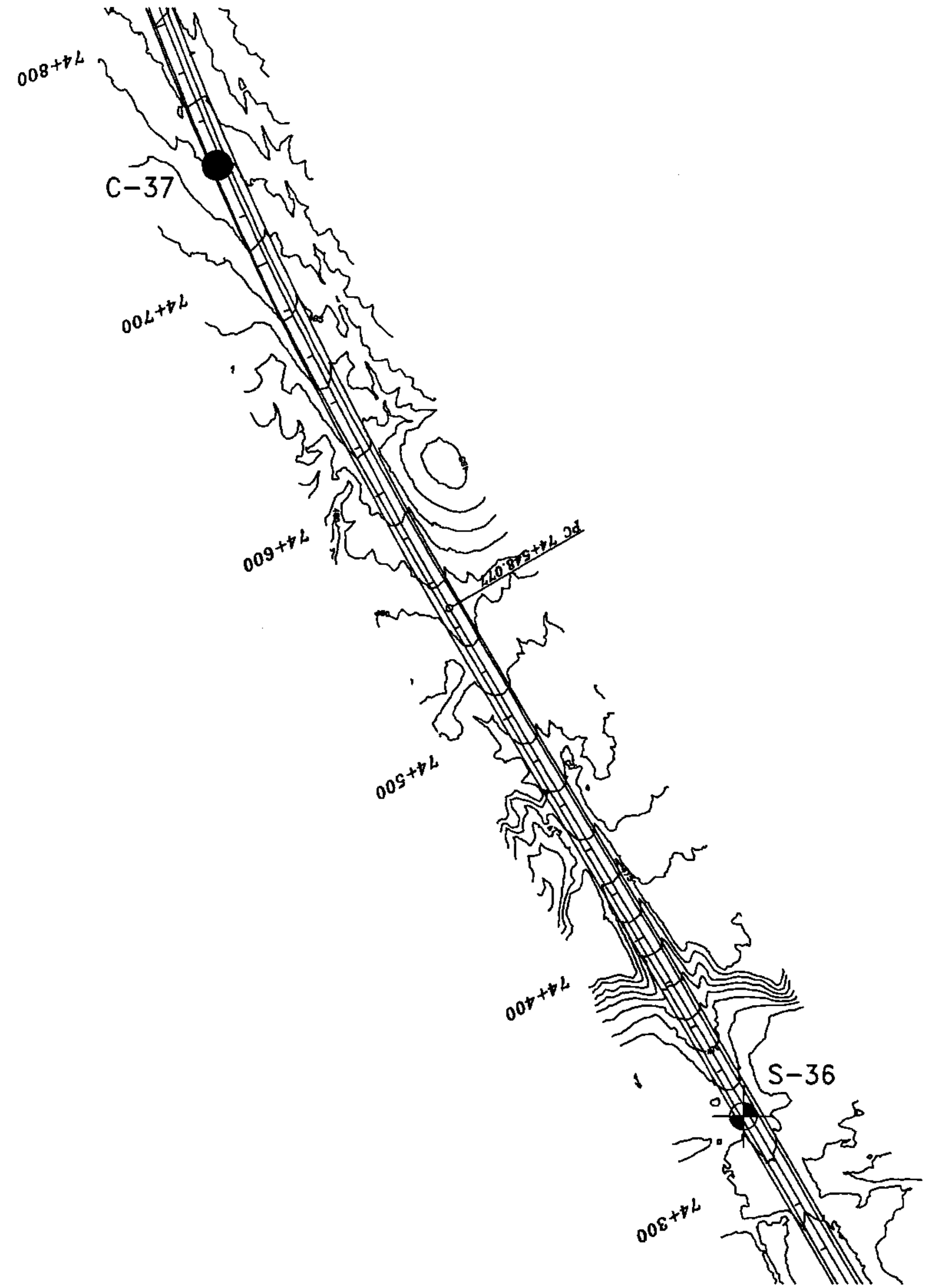
Terracon

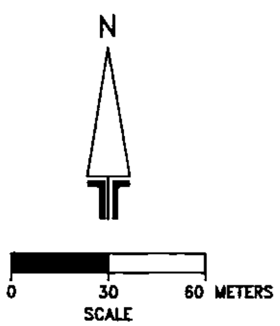
ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 50

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

S-1 - APPROXIMATE SUBGRADE BORING LOCATION
C-1 - APPROXIMATE PAVEMENT CORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 74+243 TO 74+806

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

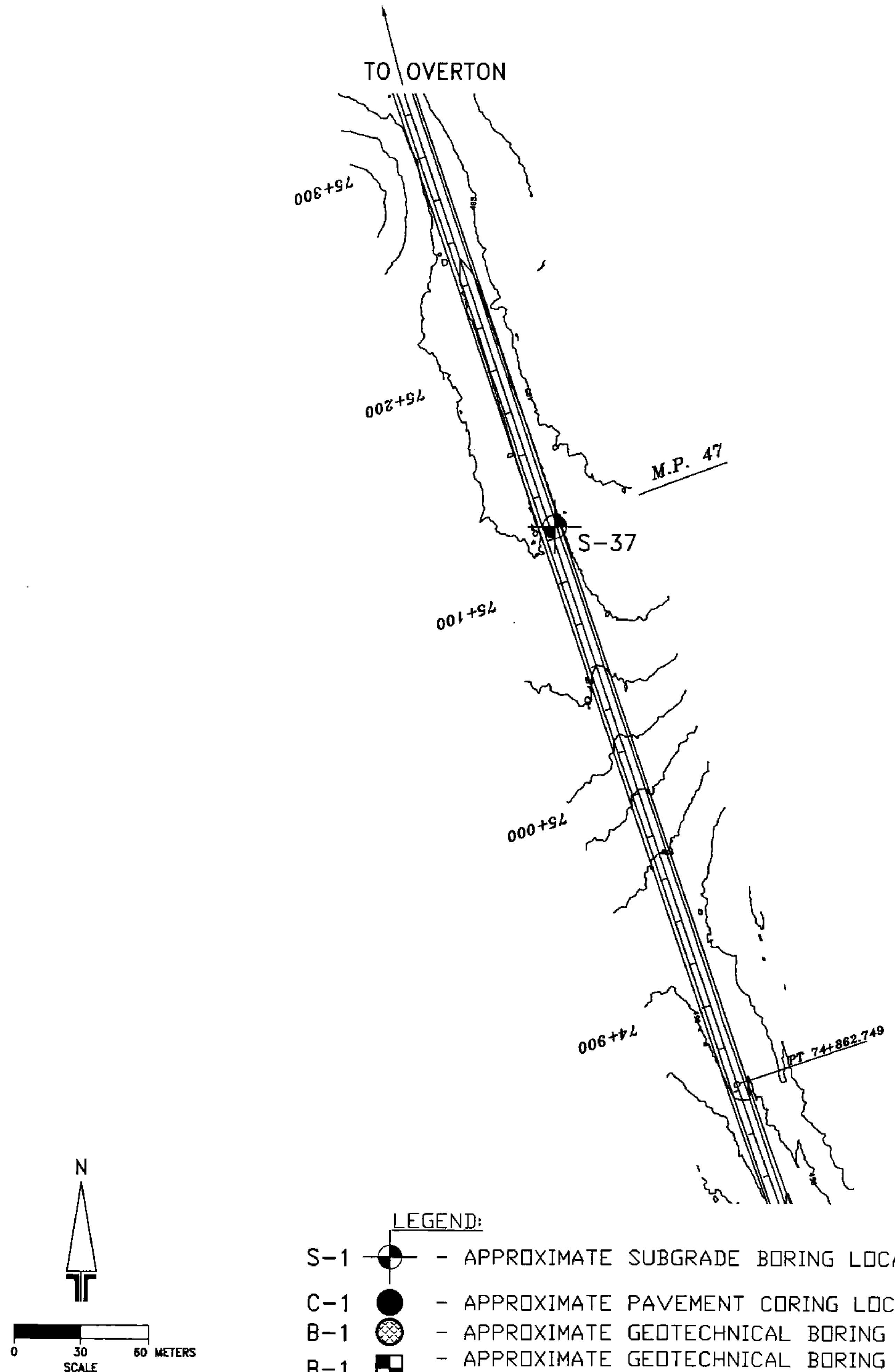
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 51

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

S-1 – APPROXIMATE SUBGRADE BORING LOCATION
C-1 – APPROXIMATE PAVEMENT CORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION
B-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION

STATIONS: 74+806 TO 75+330

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) REHABILITATE NORTHSHORE ROAD

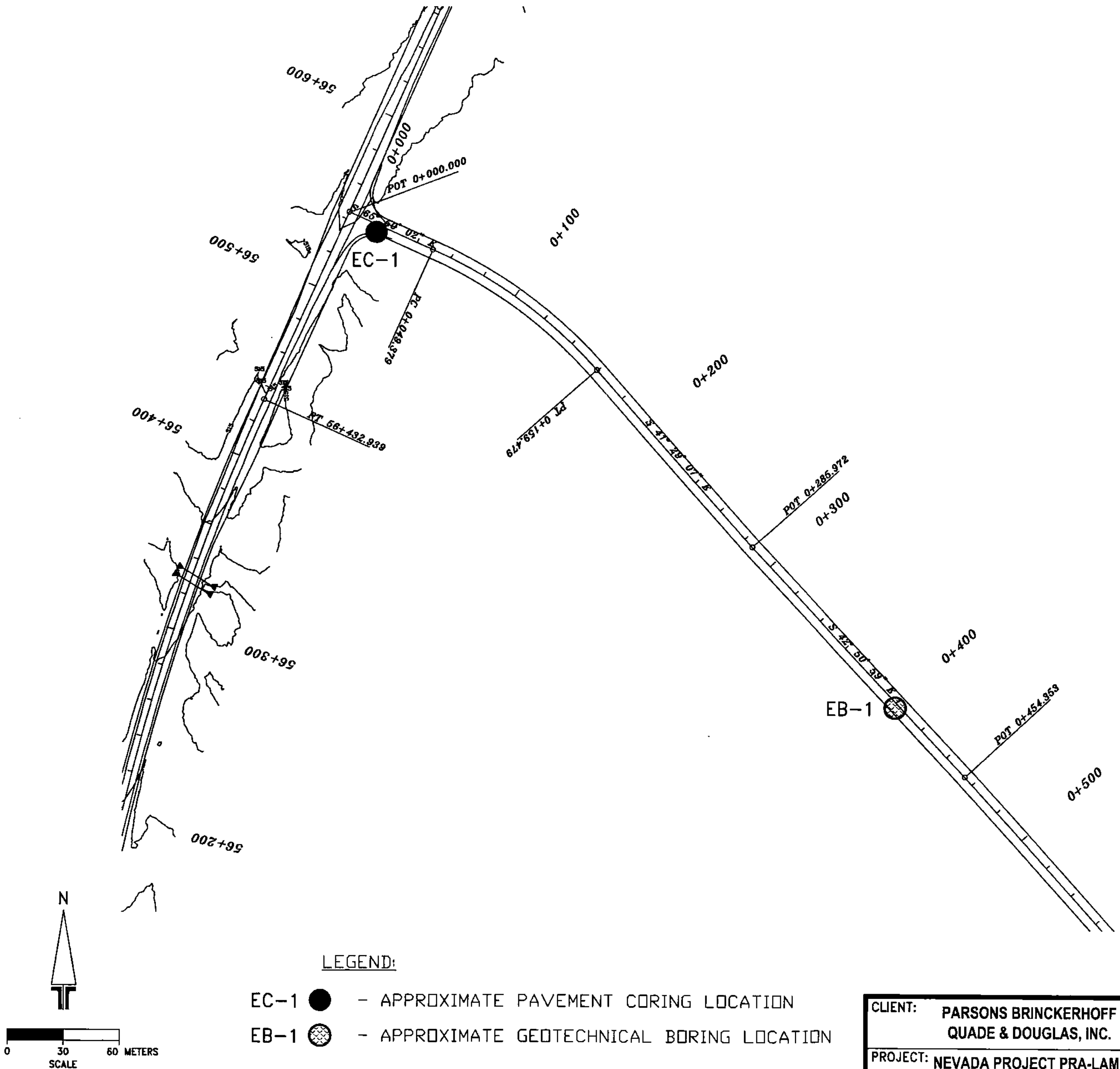
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64035218

PLATE: 52

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

EC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

EB-1 ◍ - APPROXIMATE GEOTECHNICAL BORING LOCATION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA

ECHO BAY ROAD
STATIONS: 0+000 TO 0+565

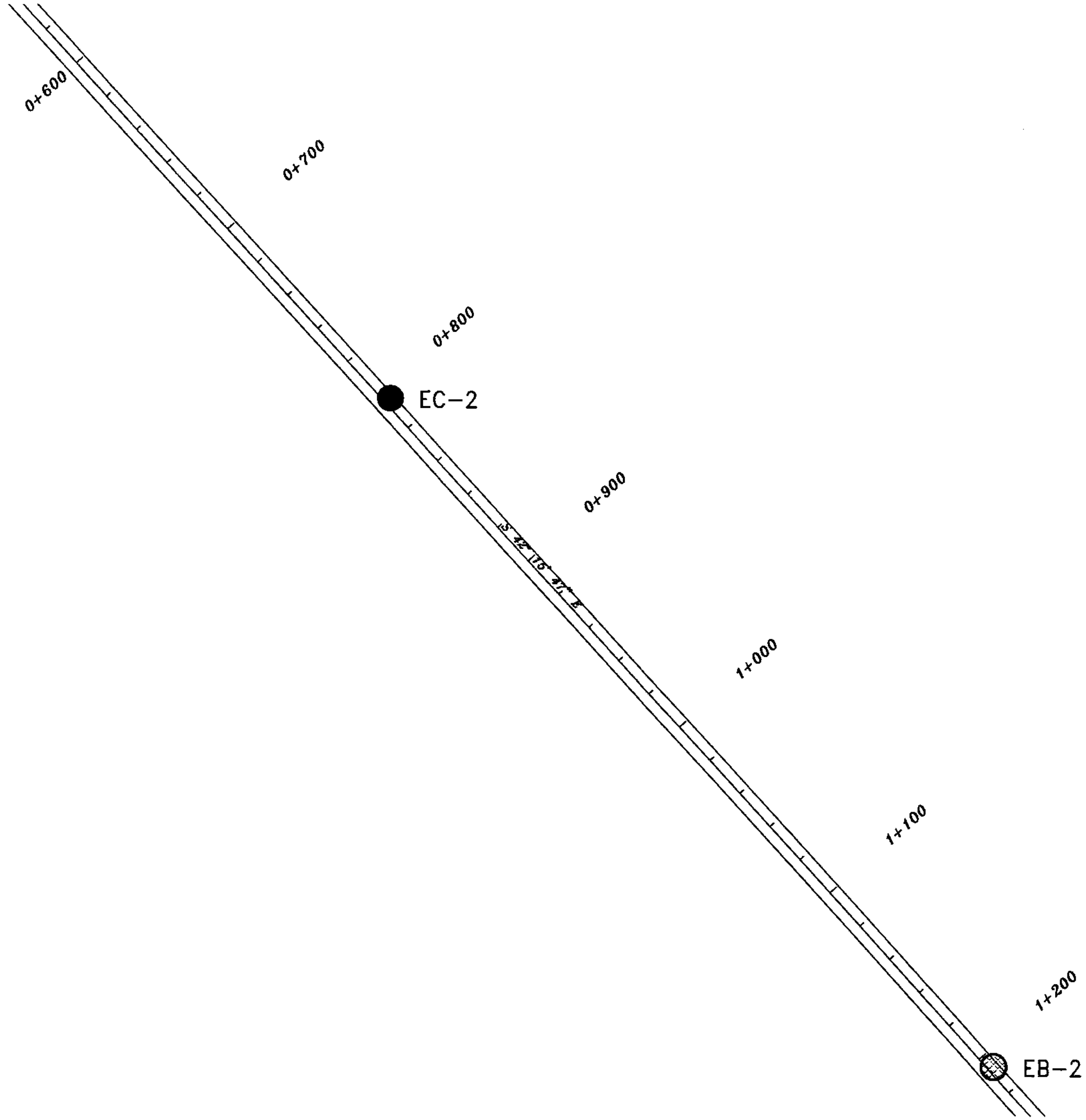
Terracon

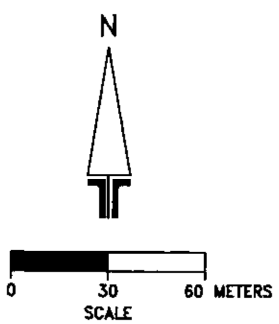
ALIGNMENT PLAN

PROJECT NO.: 64055138

PLATE: 53

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

EC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

EB-1 ◎ - APPROXIMATE GEOTECHNICAL BORING LOCATION

CLIENT:	PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
PROJECT:	NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA

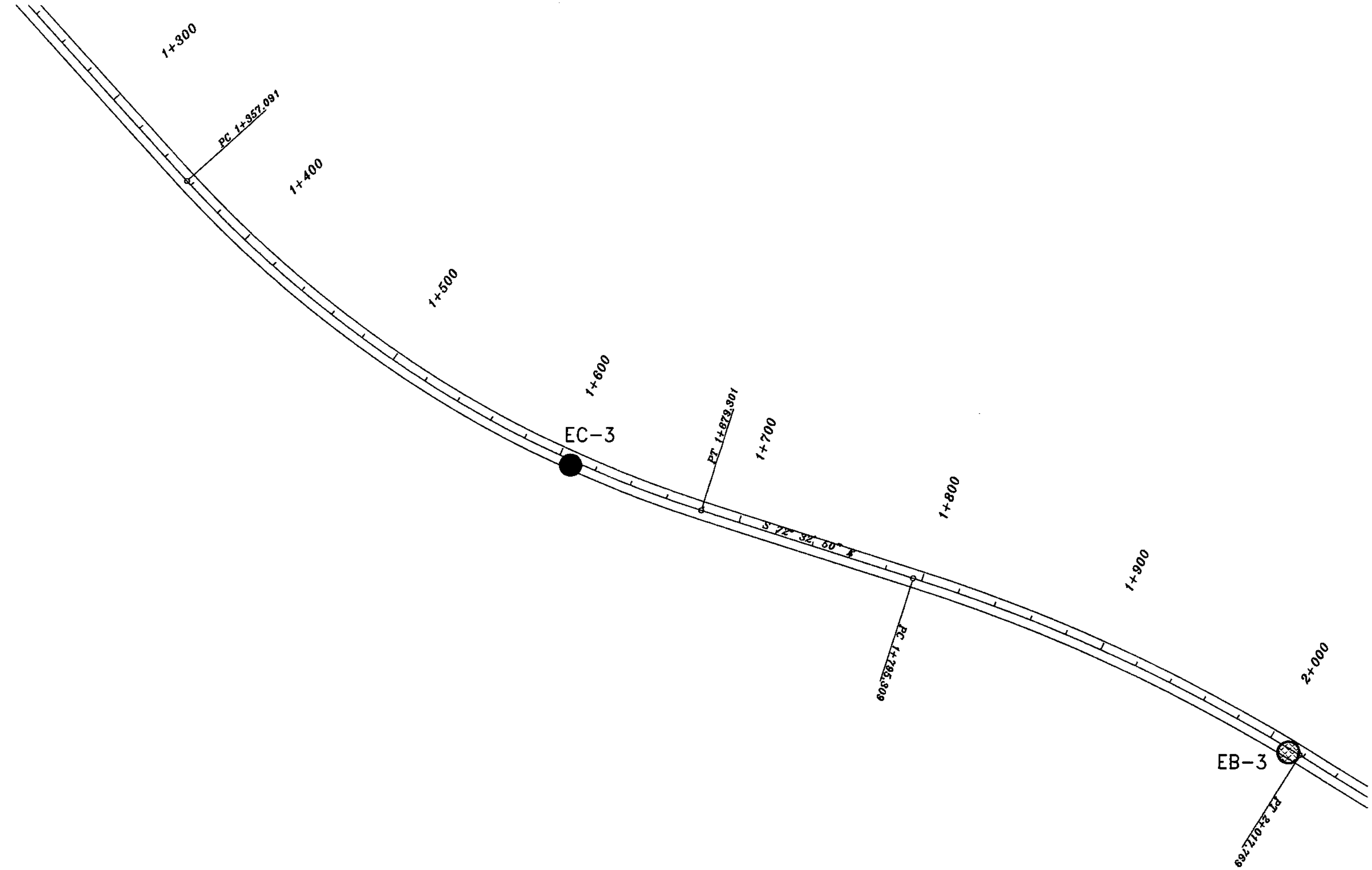
ECHO BAY ROAD
STATIONS: 0+565 TO 1+234

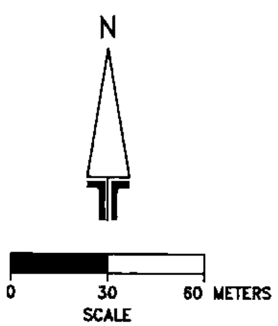
Terracon

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64055138	54

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

EC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

EB-1 ◍ - APPROXIMATE GEOTECHNICAL BORING LOCATION

CLIENT:	PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
PROJECT:	NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA

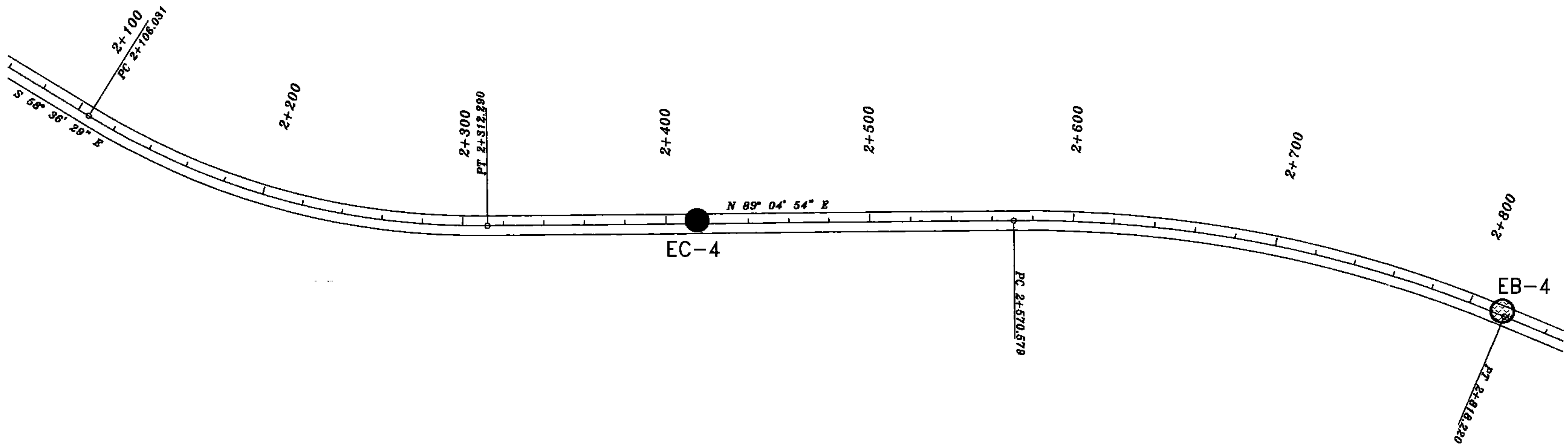
ECHO BAY ROAD
STATIONS: 1+234 TO 2+060

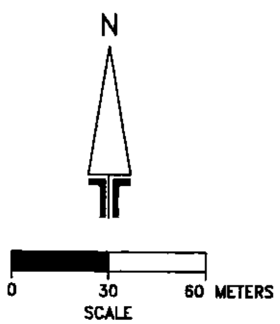
Terracon

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64055138	55

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

EC-1 ● – APPROXIMATE PAVEMENT CORING LOCATION

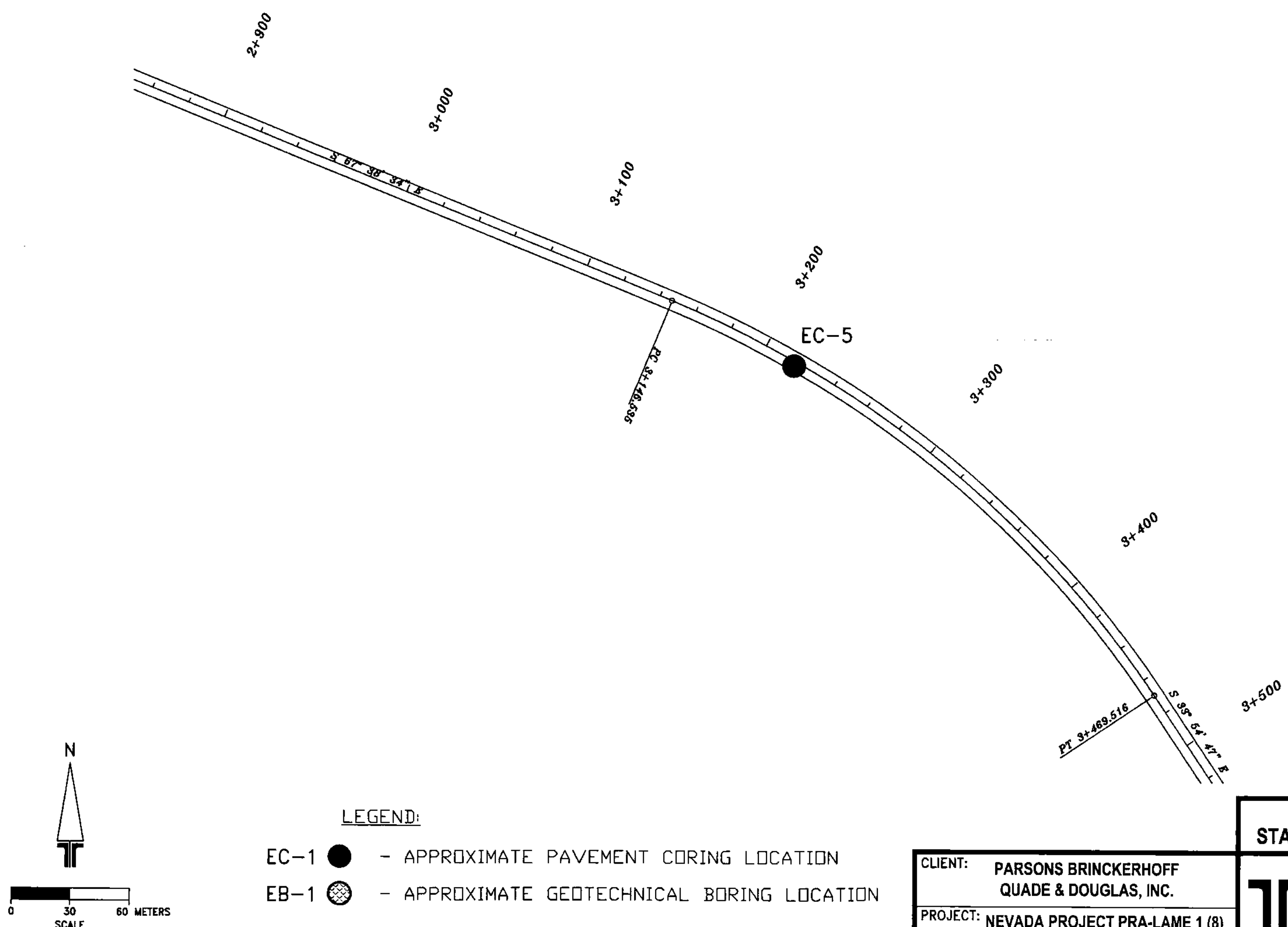
EB-1 ◍ – APPROXIMATE GEOTECHNICAL BORING LOCATION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	ECHO BAY ROAD STATIONS: 2+060 TO 2+850
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA	Terracon

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64055138	56

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



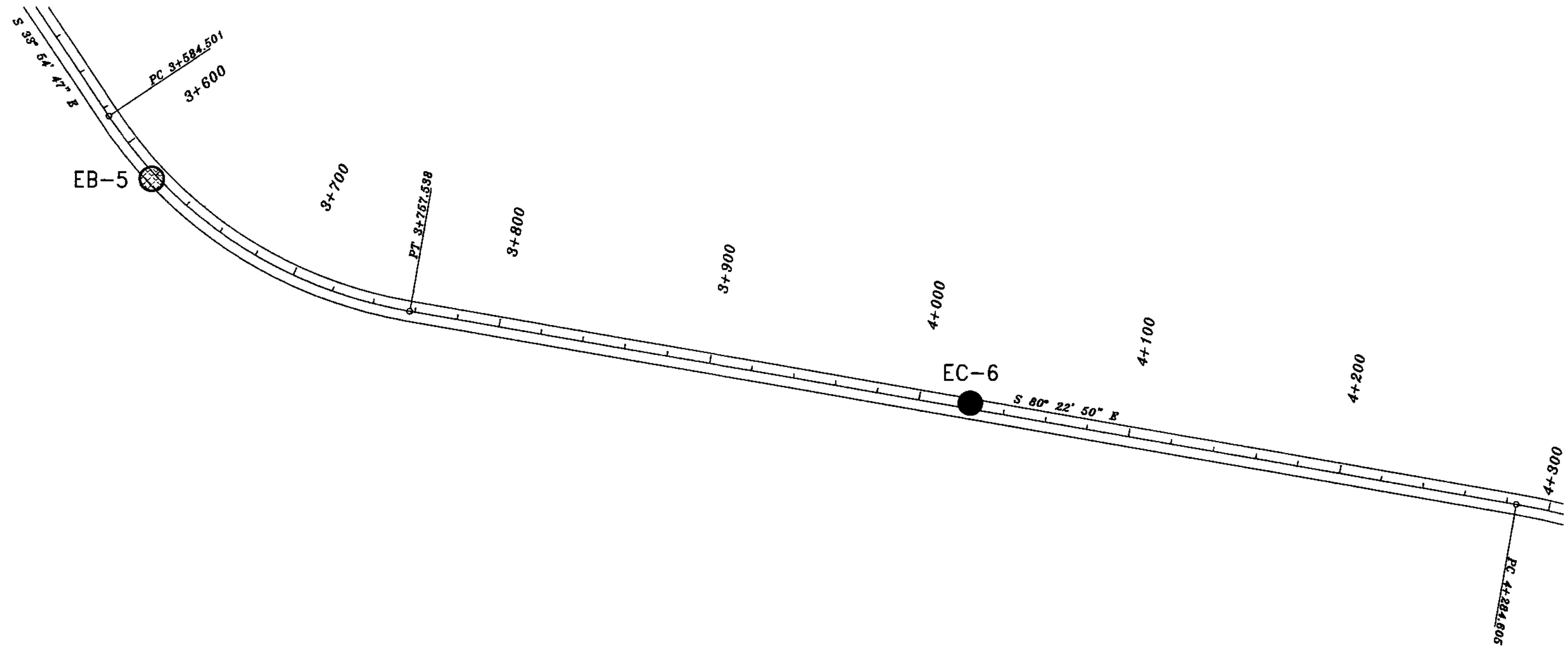
LEGEND:

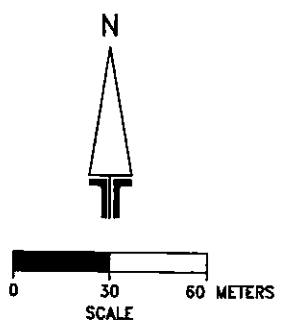
EC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

EB-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION

ECHO BAY ROAD STATIONS: 2+850 TO 3+523	
CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	Terracon
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA	
ALIGNMENT PLAN	
PROJECT NO.: 64055138	PLATE: 57

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





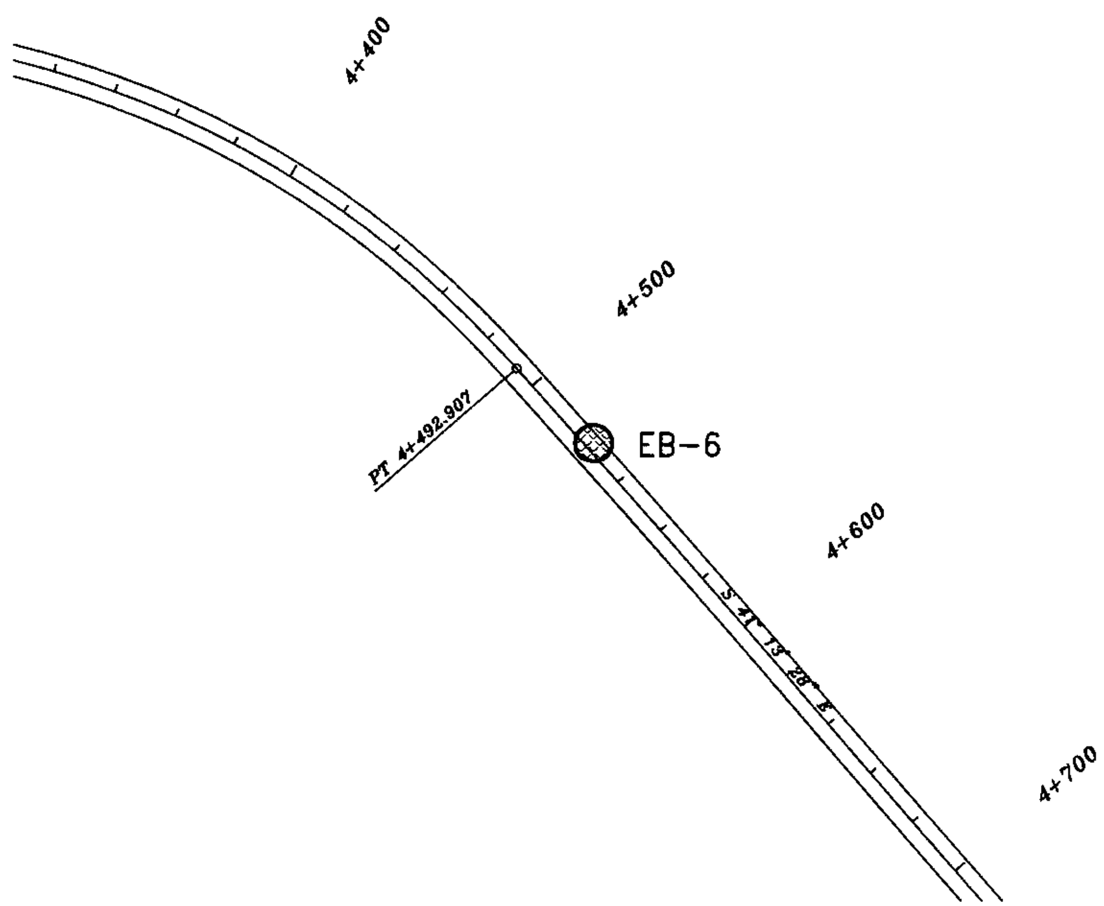
LEGEND:

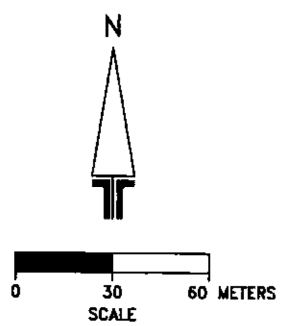
EC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

EB-1 ◎ - APPROXIMATE GEOTECHNICAL BORING LOCATION

ECHO BAY ROAD STATIONS: 3+523 TO 4+307		ALIGNMENT PLAN
CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	Terracon	PROJECT NO.: 64055138
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA		PLATE: 58

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





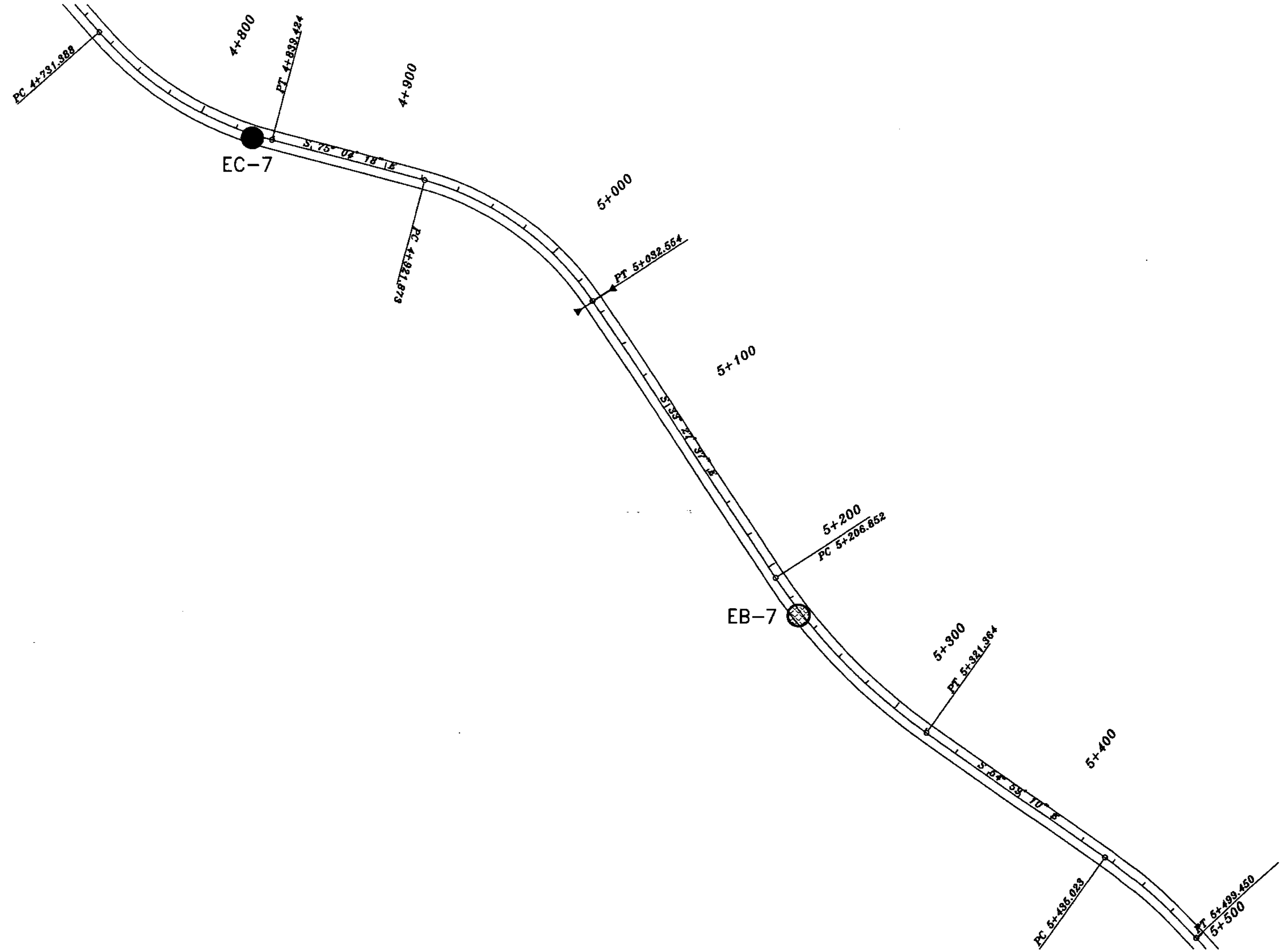
LEGEND:

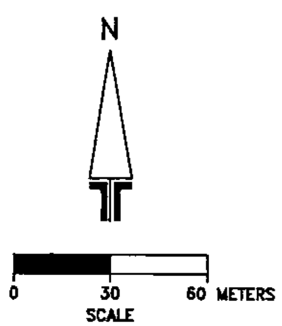
EC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

EB-1 ◍ - APPROXIMATE GEOTECHNICAL BORING LOCATION

	ECHO BAY ROAD STATIONS: 4+307 TO 4+712		
CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC. PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA	Terracon	ALIGNMENT PLAN PROJECT NO.: 64055138	PLATE: 59

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

EC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

EB-1 ◎ - APPROXIMATE GEOTECHNICAL BORING LOCATION

ECHO BAY ROAD
STATIONS: 4+712 TO 5+507

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA

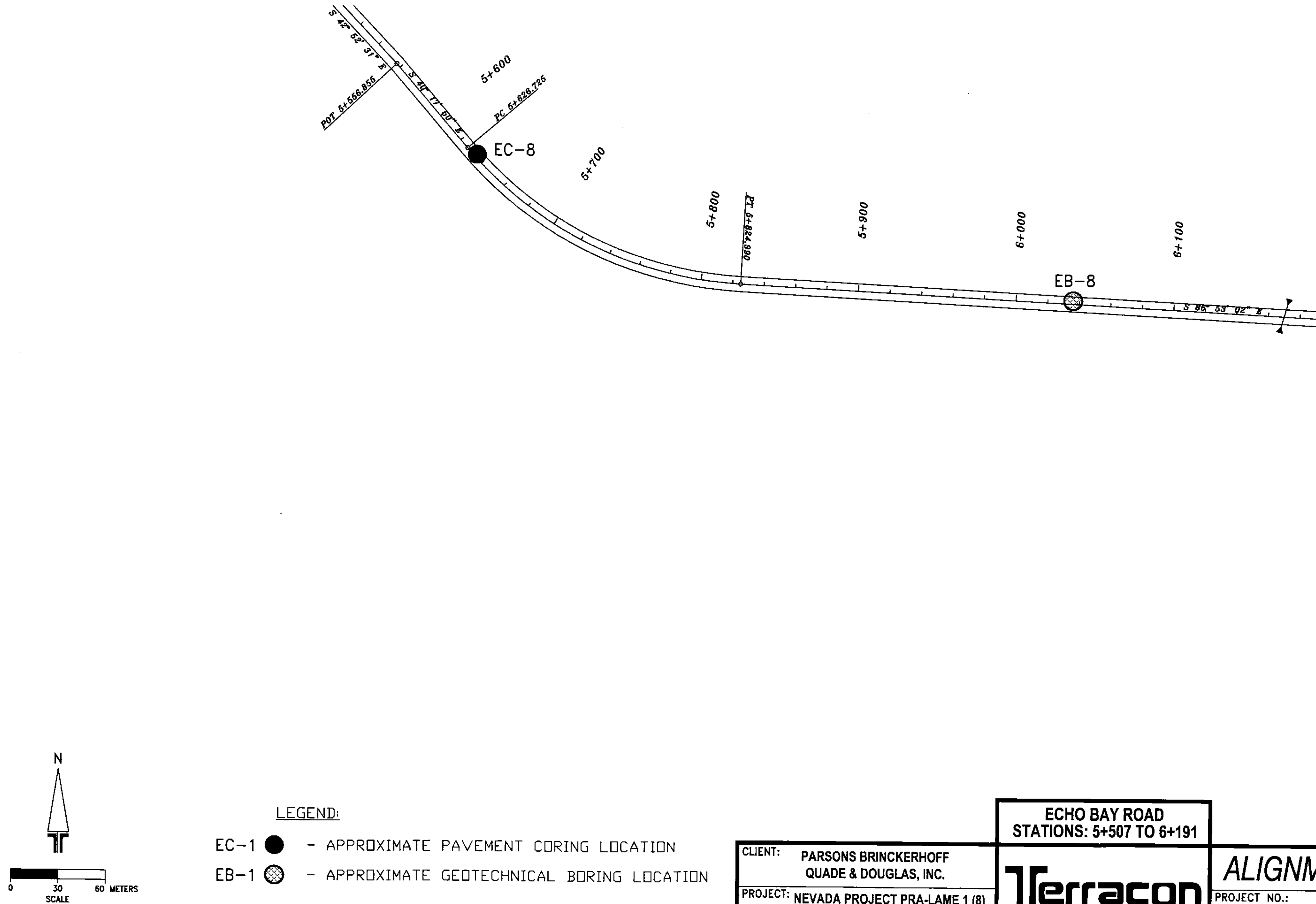
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64055138

PLATE: 60

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



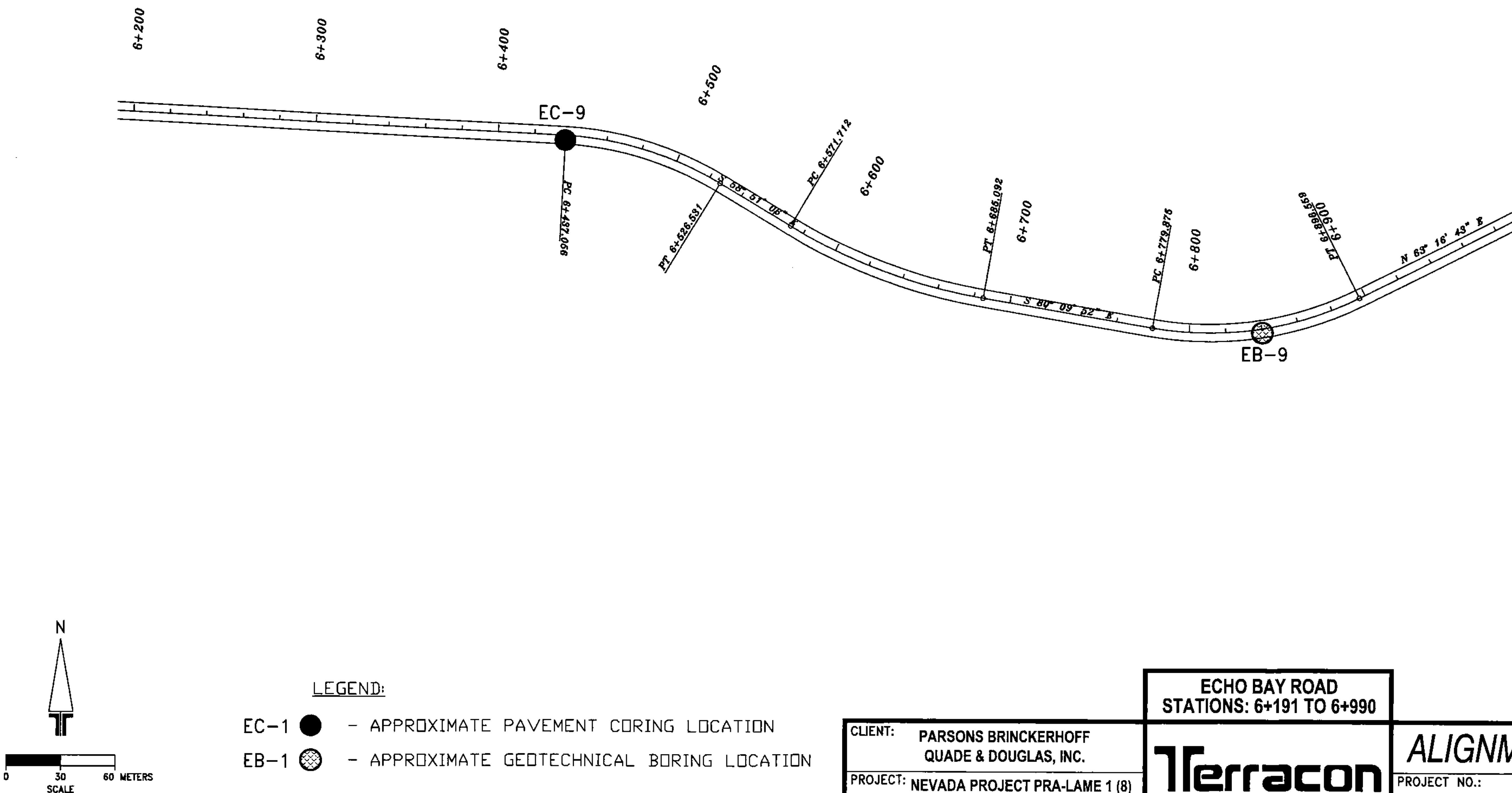
LEGEND:

EC-1 – APPROXIMATE PAVEMENT CORING LOCATION

EB-1 – APPROXIMATE GEOTECHNICAL BORING LOCATION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	ECHO BAY ROAD STATIONS: 5+507 TO 6+191	Terracon	ALIGNMENT PLAN
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA			PROJECT NO.: 64055138 / PLATE: 61

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



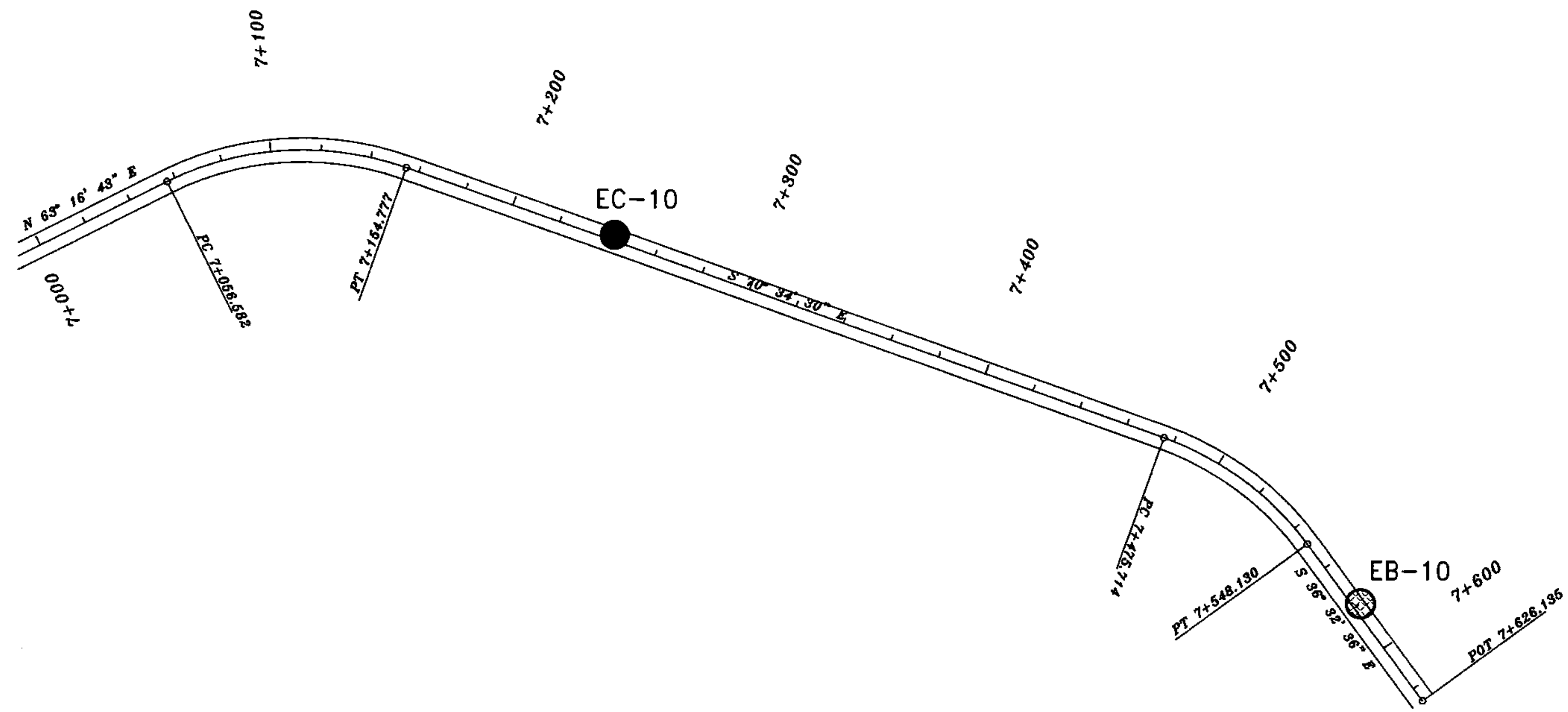
LEGEND:

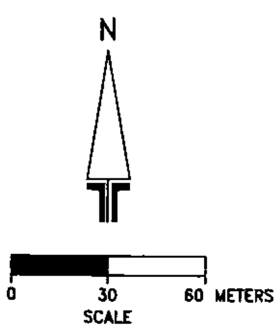
EC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

EB-1 ◎ - APPROXIMATE GEOTECHNICAL BORING LOCATION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	ECHO BAY ROAD STATIONS: 6+191 TO 6+990	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA	Terracon	PROJECT NO.: 64055138	PLATE: 62

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

EC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

EB-1 ◍ - APPROXIMATE GEOTECHNICAL BORING LOCATION

ECHO BAY ROAD
STATIONS: 6+990 TO 7+626

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA

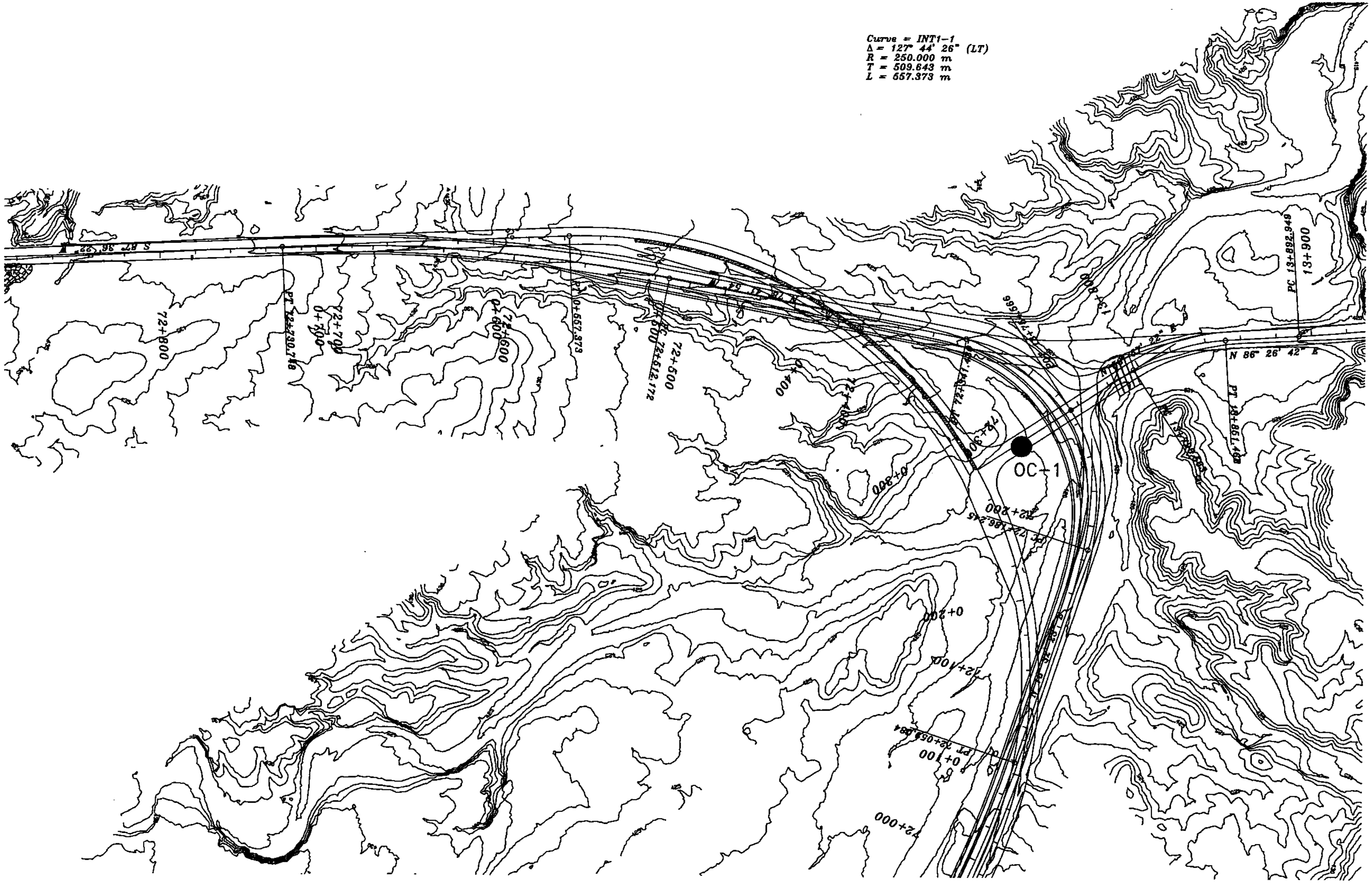
Terracon

ALIGNMENT PLAN

PROJECT NO.: 64055138

PLATE: 63

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



N

0 30 60 METERS
SCALE

LEGEND:

OC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

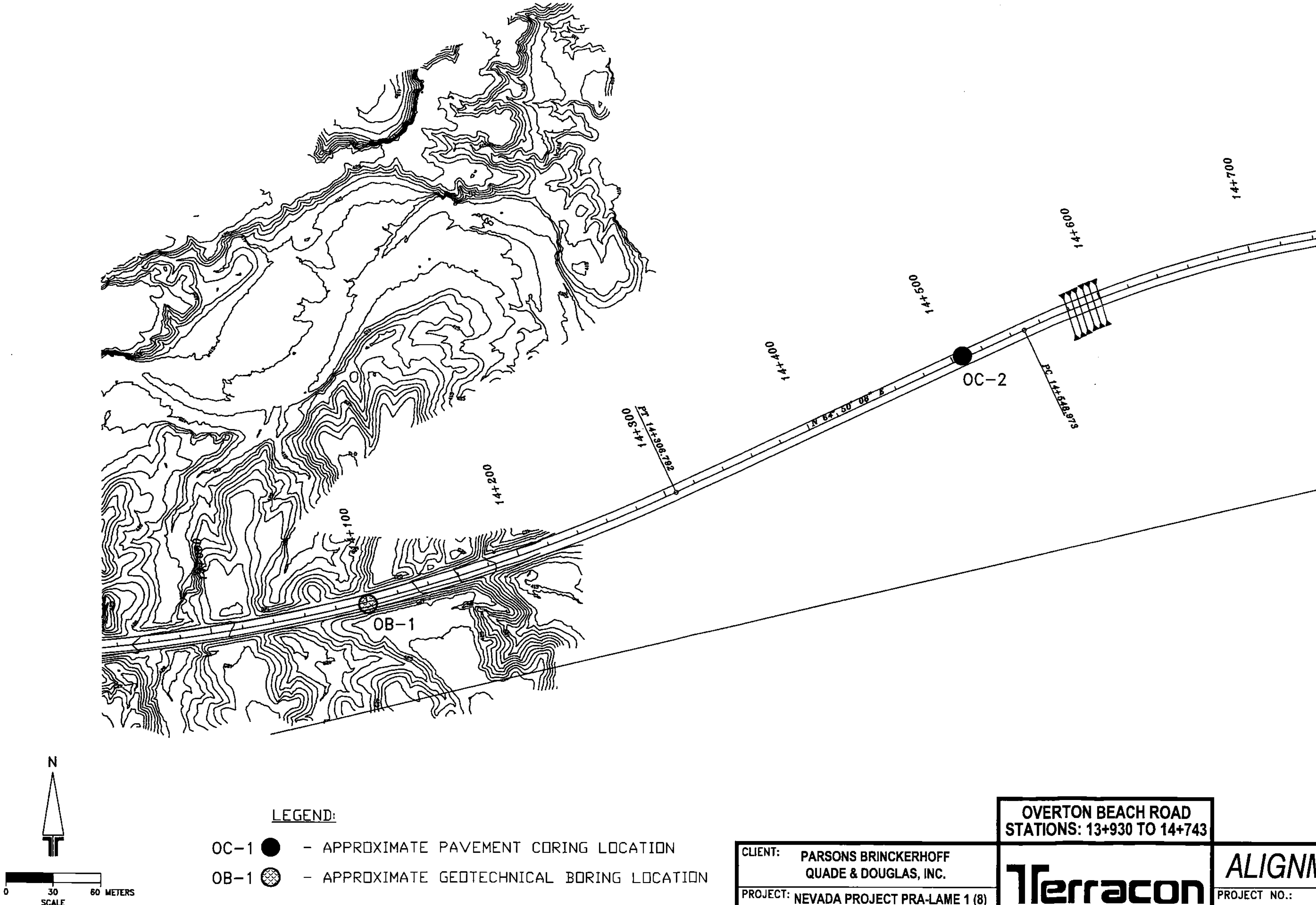
OB-1 ◍ - APPROXIMATE GEOTECHNICAL BORING LOCATION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	OVERTON BEACH ROAD STATIONS: 13+845 TO 13+930
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA	Terracon

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64055138	64

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

OC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

OB-1 ◎ - APPROXIMATE GEOTECHNICAL BORING LOCATION

CLIENT:	PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
PROJECT:	NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA

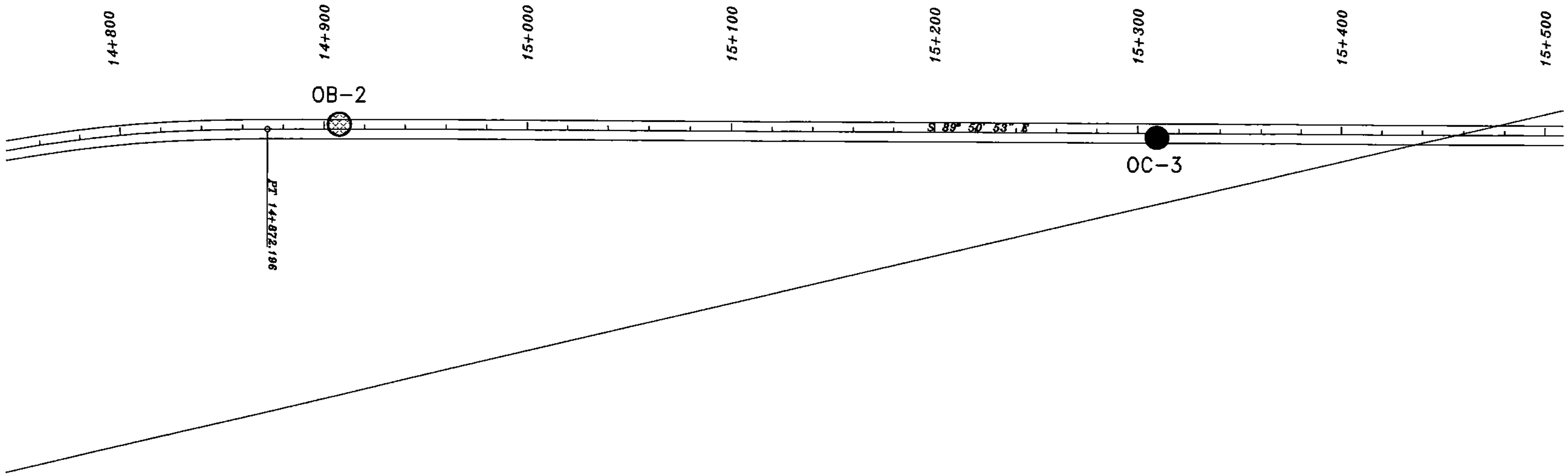
OVERTON BEACH ROAD
STATIONS: 13+930 TO 14+743

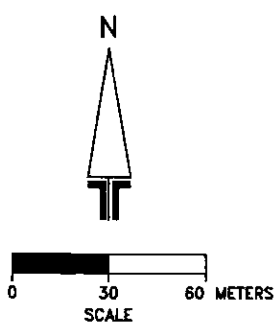
Terracon

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64055138	65

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





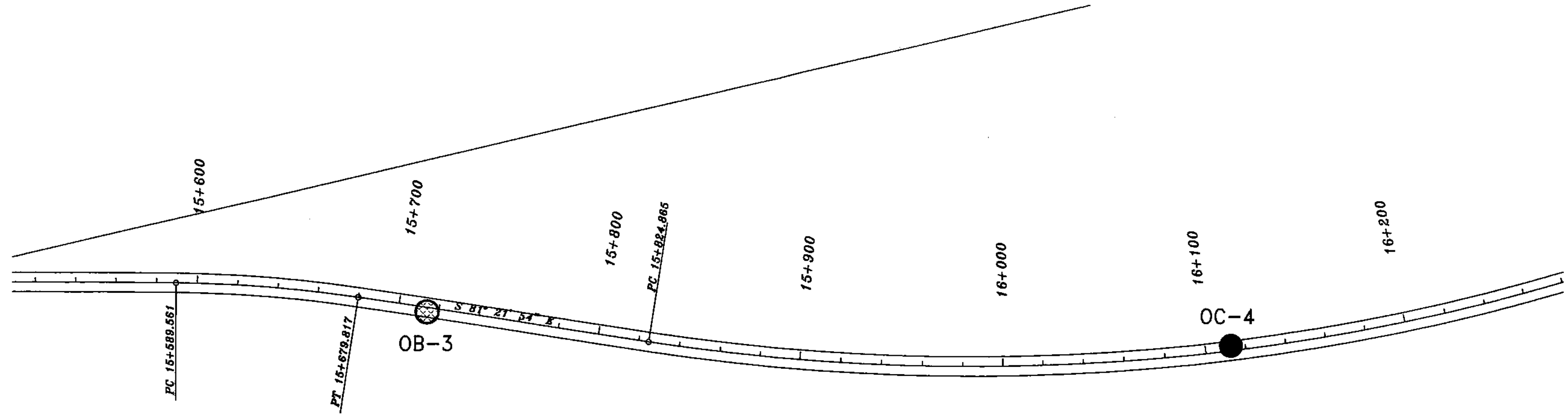
LEGEND:

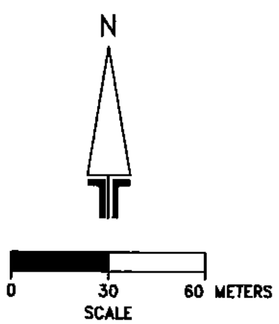
OC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

OB-1 ◎ - APPROXIMATE GEOTECHNICAL BORING LOCATION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	OVERTON BEACH ROAD STATIONS: 14+743 TO 15+509	ALIGNMENT PLAN	
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA	Terracon	PROJECT NO.: 64055138	PLATE: 66

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

OC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

OB-1 ◎ - APPROXIMATE GEOTECHNICAL BORING LOCATION

CLIENT:	PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
PROJECT:	NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA

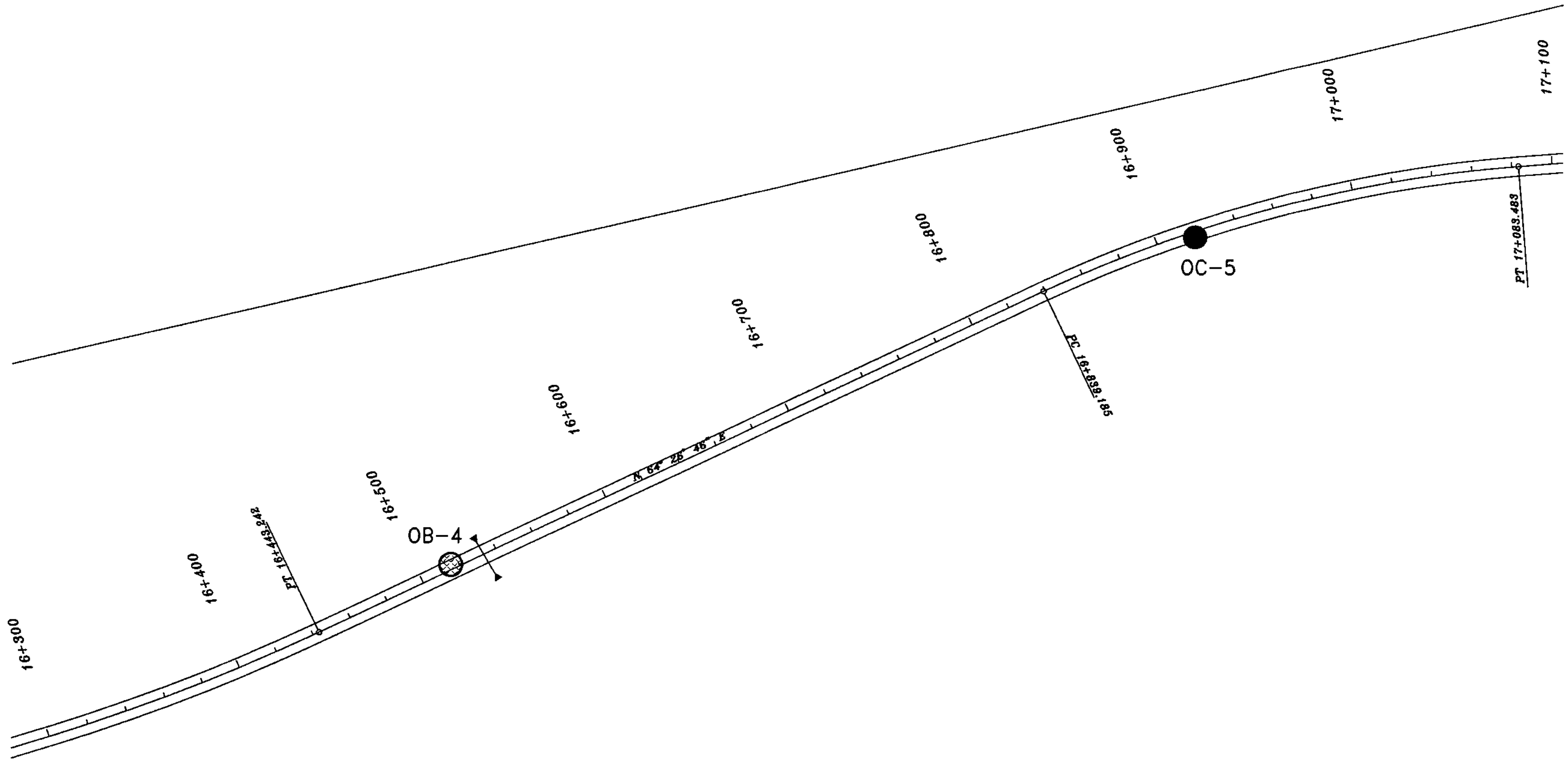
OVERTON BEACH ROAD
STATIONS: 15+509 TO 16+280

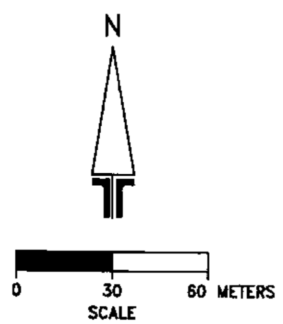
Terracon

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64055138	67

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





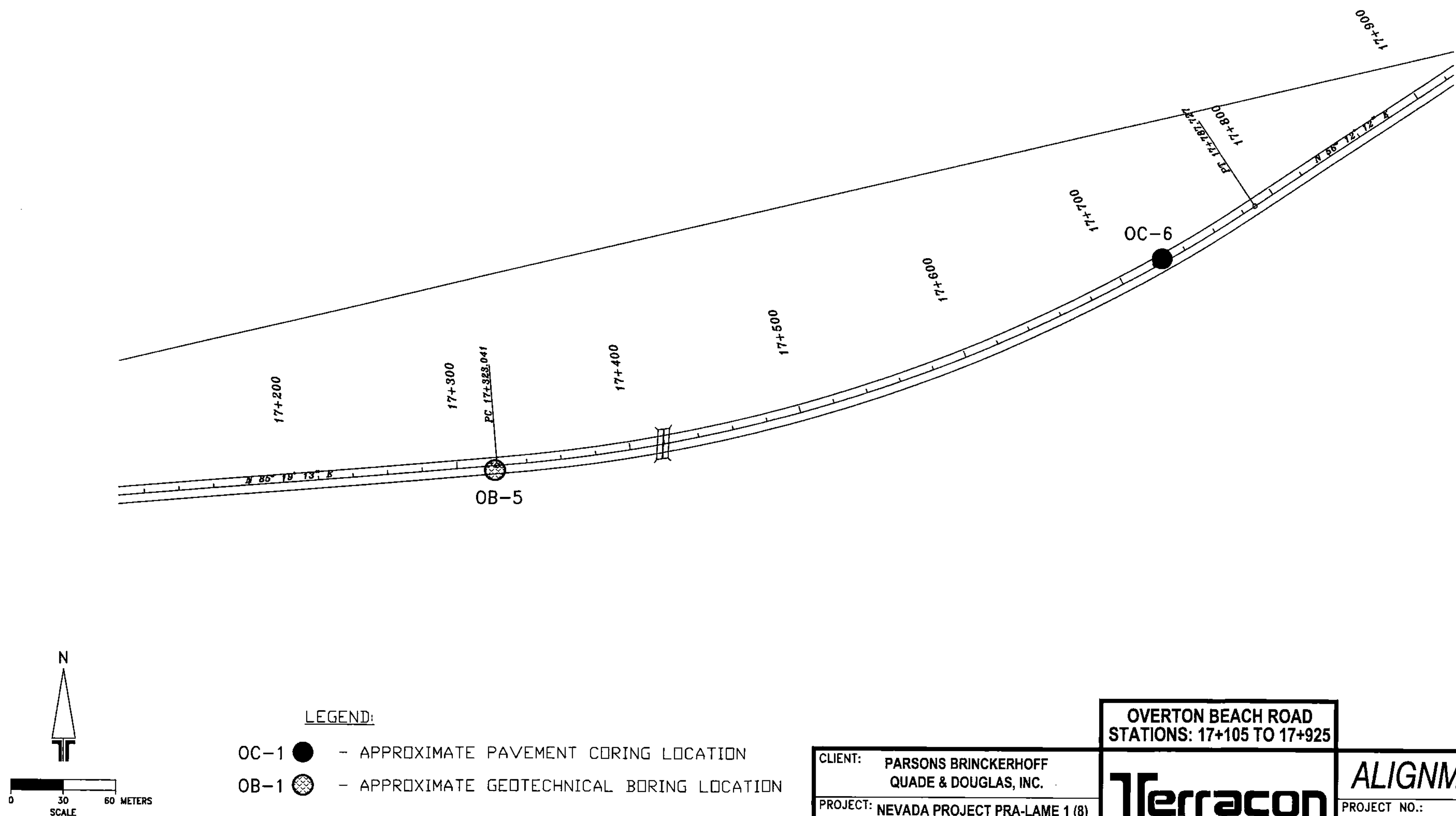
LEGEND:

OC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

OB-1 ◍ - APPROXIMATE GEOTECHNICAL BORING LOCATION

CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	OVERTON BEACH ROAD STATIONS: 16+280 TO 17+105	ALIGNMENT PLAN
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA	Terracon	PROJECT NO.: 64055138 / PLATE: 68

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.



LEGEND:

OC-1 ● - APPROXIMATE PAVEMENT CORING LOCATION

OB-1 - APPROXIMATE GEOTECHNICAL BORING LOCATION

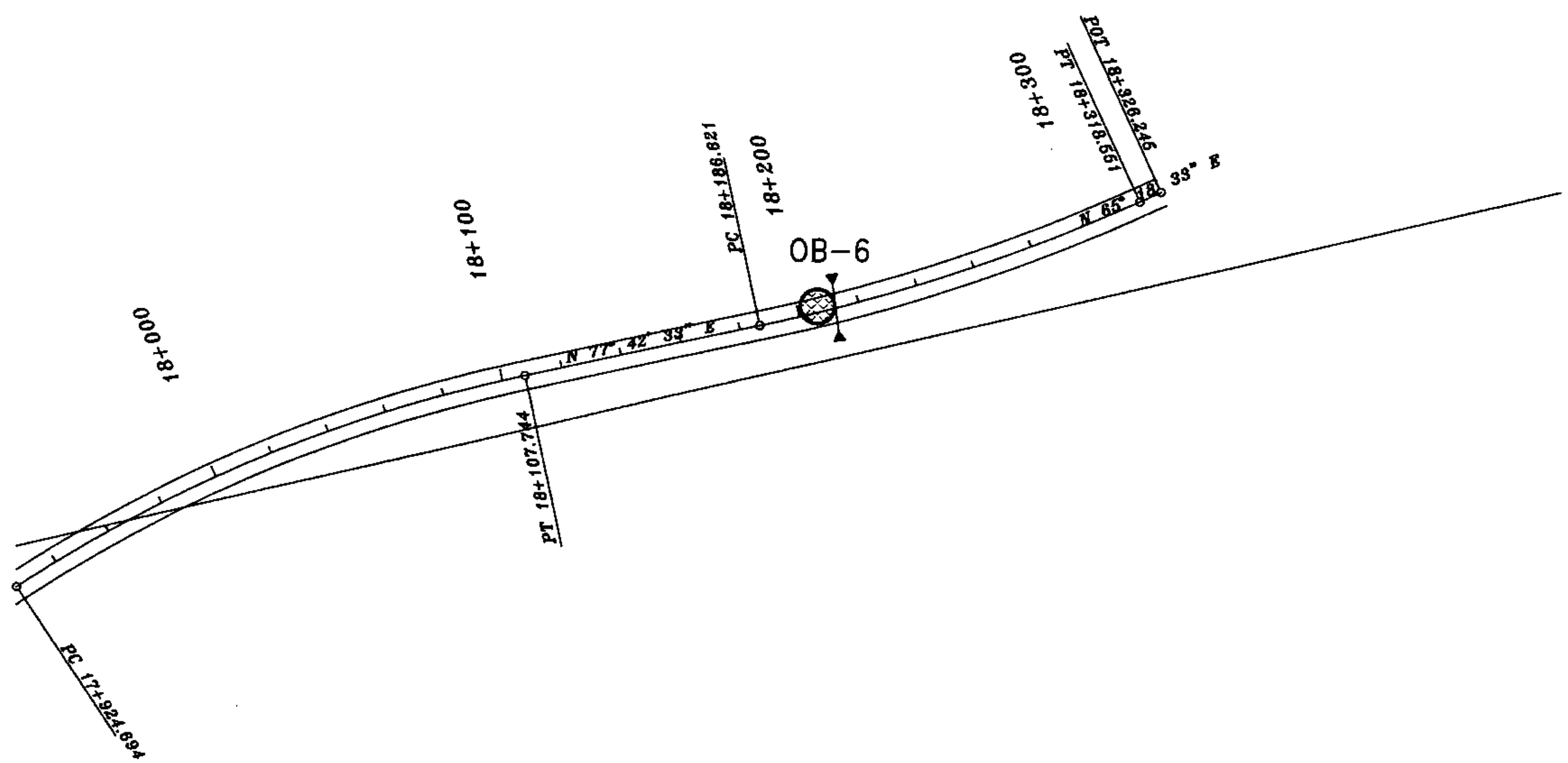
OVERTON BEACH ROAD STATIONS: 17+105 TO 17+925	
CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	Terracon
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA	

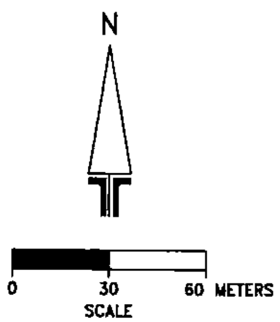
ALIGNMENT PLAN

PROJECT NO.: 64055138

PLATE: 69

NOTE:
ROADWAY ALIGNMENT AND TOPOGRAPHY INFORMATION PROVIDED BY CLIENT.





LEGEND:

OC−1 ● − APPROXIMATE PAVEMENT CORING LOCATION

OB−1 − APPROXIMATE GEOTECHNICAL BORING LOCATION

OVERTON BEACH ROAD STATIONS: 17+925 TO 18+326	
CLIENT: PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.	Terracon
PROJECT: NEVADA PROJECT PRA-LAME 1 (8) LAKE MEAD NATIONAL RECREATION AREA	

ALIGNMENT PLAN

PROJECT NO.:	PLATE:
64055138	70

APPENDIX B

Boring Logs
FHWA Boring Logs
Sieve Analysis Test Results
Explanation of Material Classifications
Chemical Test Results
Laboratory Summary
FHWA Laboratory Summary

APPENDIX B

Site Explorations

The subsurface conditions of the project alignments were explored by drilling forty-five (45) borings along Northshore Road, drilling ten (10) borings along Echo Bay Road and drilling six (6) borings along Overton Beach Road to depths ranging from approximately 1.5 m to 9.3 m (5 feet to 30½ feet) below existing alignment grades. Borings were drilled using an auger-type drill rig (Diedrich D-120) with a 6-inch continuous flight auger.

Soils were logged during drilling and samples were obtained to aid in material classification and for possible laboratory testing. Boring logs are presented on Plates B-1 through B-66. The number of blows required to drive a 1⅜-inch inside diameter (SPT) sampler 0.3 meters (12 inches) with a 63.5 kg (140-pound) hammer falling through 0.76 meters (30-inches) is shown on the logs. The soils are generally classified by the Unified Soil Classification System and AASHTO system. Plate B presents an explanation of material classifications used in this report.

Laboratory Testing

Laboratory testing was performed on selected samples of on-site soils. Tests were performed in general accordance with applicable ASTM or local standards.

Expansion tests were performed on selected remolded soil samples. The tests were performed from oven-dried moisture content to near saturated condition with a 60-psf-surcharge load. The test results are presented below. The oven-dried condition is worst case and is conservative.

SAMPLE	SOIL DESCRIPTION	MOISTURE CONTENT (%)		DRY DENSITY (pcf)	EXPANSION (%)
		INITIAL**	FINAL		
S-1 @ 1-5 ft.	Silty GRAVEL	12.1	16.8	104	0.2
S-7 @ 1–5 ft.	Silty SAND w/Gravel	7.1	11.6	118	0.4
S-16 @ 1-5 ft.	Sandy Lean CLAY	13.0	17.7	118	7.4
S-29 @ 1-5 ft.	Sandy Lean CLAY	16.6	19.2	110	6.9
S-31 @ 1-5 ft.	Sandy Silty CLAY	9.4	17.7	108	4.0
S-33 @ 1-5 ft.	Clayey SAND	4.7	15.9	108	0.4
OB-1 @ 2-5 ft.	Fat CLAY w/Sand	17.3	24.2	104	8.1
OB-2 @ 2–5 ft.	Lean CLAY w/Sand	15.0	18.1	112	5.4

* Test performed using a 2.9 kPa (60 psf) surcharge load.
** Moisture content at the time of remolding.
All samples are oven dried prior to testing.

R-value tests were performed on representative samples. The test results are presented below:

NORTHSHORE ROAD ALIGMENT				
SAMPLE	MATERIAL DESCRIPTION	PLASTICITY INDEX	% PASSING NO. 200	R-VALUE
S-2 @ 1-5 ft.	Sandy SILT	NP	60	80
S-4 @ 1-5 ft.	Clayey GRAVEL w/Sand	8	21	67
S-5 @ 1-5 ft.	Silty, Clayey GRAVEL w/Sand	5	24	77
S-7 @ 1-5 ft.	Silty SAND w/Gravel	NP	17	70
S-10 @ 1-5 ft.	Silty, Clayey SAND w/Gravel	4	27	80
S-11 @ 1-5 ft.	Silty SAND w/Gravel	NP	14	80
S-14 @ 1-5 ft.	Silty SAND w/Gravel	19	24	74
S-16 @ 1-5 ft.	Sandy Lean CLAY w/Gravel	23	52	8
S-17 @ 1-5 ft.	Clayey GRAVEL w/Sand	20	25	59
S-20 @ 1-5 ft.	Silty, Clayey SAND w/Gravel	6	25	78
S-22 @ 1-5 ft.	Silty SAND w/Gravel	NP	37	74
S-23 @ 1-5 ft.	Silty SAND w/Gravel	NP	13	80
S-26 @ 1-5 ft.	SILT w/Sand	NP	71	60
S-28 @ 1-5 ft.	Silty SAND w/Gravel	NP	13	81
S-31 @ 1-5 ft.	Sandy Silty CLAY	6	53	40
S-36 @ 1-5 ft.	Silty SAND	NP	23	76
S-37 @ 1-5 ft.	Poorly Graded SAND w/Silt and Gravel	3	5	65

NORTHSHORE ROAD NEW ALIGNMENT BORINGS				
SAMPLE	MATERIAL DESCRIPTION	PLASTICITY INDEX	% PASSING NO. 200	R-VALUE
B-4 @ 5-10 ft.	Lean CLAY	28	90	<5
B-5 @ 0-5 ft.	Sandy Lean CLAY	19	58	20
B-6 @ 0-5 ft.	Silty, Clayey SAND	5	46	25
B-6 @ 5-10 ft.	Lean CLAY w/Sand	28	76	<5
B-7 @ 0-5 ft.	Sandy Lean CLAY	13	59	31
B-8 @ 1-5 ft.	Fat CLAY w/Sand	40	79	<5

ECHO BAY ROAD ALIGMENT				
SAMPLE	MATERIAL DESCRIPTION	PLASTICITY INDEX	% PASSING NO. 200	R-VALUE
EB-2 @ 2-5 ft.	Silty SAND w/Gravel	6	40	58
EB-4 @ 2-5 ft.	Silty SAND w/Gravel	18	42	48
EB-5 @ 2-5 ft.	Silty, Clayey SAND w/Gravel	7	24	52
EB-6 @ 2-5 ft.	Silty SAND	NP	20	68
EB-7 @ 2-5 ft.	Clayey SAND w/Gravel	9	25	44

ECHO BAY ROAD ALIGMENT				
SAMPLE	MATERIAL DESCRIPTION	PLASTICITY INDEX	% PASSING NO. 200	R-VALUE
EB-8 @ 2-5 ft.	Silty SAND w/Gravel	12	23	59
EB-9 @ 2-5 ft.	Silty SAND w/Gravel	15	40	42
EB-10 @ 2-5 ft.	Sandy SILT	NP	58	60

OVERTON BEACH ROAD ALIGMENT				
SAMPLE	MATERIAL DESCRIPTION	PLASTICITY INDEX	% PASSING NO. 200	R-VALUE
OB-1 @ 2-5 ft.	Fat CLAY w/Sand	41	80	<5
OB-2 @ 2-5 ft.	Lean CLAY w/Sand	19	71	<5
OB-3 @ 2-5 ft.	Poorly Graded GRAVEL w/ Silt & Sand	NP	10	84
OB-4 @ 2-5 ft.	Silty, Clayey GRAVEL w/Sand	6	20	59
OB-5 @ 2-5 ft.	Silty, Clayey SAND w/Gravel	4	25	44
OB-6 @ 2-5 ft.	Silty SAND w/Gravel	NP	16	72

Sieve analyses were performed to determine the grain-size distribution of representative material samples. The test was performed in general accordance with ASTM C117 and C136 and the results are attached.

Chemical tests were performed on representative samples by Atlas Chemical Testing Laboratories, Inc. Tests were performed to determine the water-soluble sodium, sulfate, sodium sulfate, and soluble gypsum. Test results are attached.

Field moisture content determinations were performed on selected samples. Results of these tests are presented on the boring logs.

LOG OF BORING NO. B- 1A

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.		PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd.	ELEVATION: From Base of Abutment	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
CLAYEY SAND -w/tr. gravel, dry to sl. moist, red brown Base of south bridge abutment	med. dense to dense		SC	1, 2						
SILTY SAND -w/tr. gravel, partially cemented, dry to sl. mosit, lt. red brown	very dense to mod. hard		SM	3, 4						
PARTIALLY CEMENTED SAND AND GRAVEL -dry to sl. moist, lt. brown				5, 6						
SILTY SAND -w/gravel, tr. gypsum, sl. moist, lt. red brown	med. dense to dense		SM	7, 8, 9						
Bottom Depth at Approximately 9.2 feet				10, 11, 12, 13, 14, 15, 16						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered. Depth measured from base of south abutment. Exposed material from base of abutment to bottom of wash.

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED:	PAGE NUMBER:
3-9-04	**Page 1 of 1**
PROJECT NO.:	PLATE:
64035218	**B-1**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. B- 1B

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.		PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd.	ELEVATION: From Base of Abutment	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
				1						
				2						
				3						
				4						
				5						
				6						
				7						
				8						
				9			B			
SANDY GRAVEL -w/tr. silt, dry	loose		GC	10						
SANDSTONE -very weathered, moist, red brown	very dense to mod. hard			11		9 12 14	SPT			
				12						
				13						
				14		50/ 6"	SPT			
				15						
				16						

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered. Soils from 0 to 9.2 feet logged based on exposed materials in wash sidewalls -Boring advance in wash bottom.

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED: 3-9-04	PAGE NUMBER: Page 1 of 2
PROJECT NO.: 64035218	PLATE: B-2

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. B- 1B

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. / ELEVATION: From Base of Abutment	SITE: Lake Mead National Recreation Area

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
CLAYSTONE -weathered, sl. moist, red brown (Muddy Creek Formation)				17						
				18						
-w/gypsum lenses				19		50/ 4"	SPT B			
	very dense to mod. hard			20						
				21						
CLAYEY SANDSTONE -weathered, sl. moist, red brown				22						
				23						
				24		50/ 2"	SPT			
CLAYSTONE -sl. weathered, dry to sl. moist, red brown				25						
				26						
Bottom Depth at Approximately 26.5 feet				27						
				28						
				29						
				30						
				31						
				32						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered. Soils from 0 to 9.2 feet logged based on exposed materials in wash sidewalls -Boring advance in wash bottom.

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED:	PAGE NUMBER:
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PROJECT NO.:	PLATE:
64035218	**B-3**

LOG OF BORING NO. B- 2A

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. / ELEVATION: From Base of Abutment	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
SILTSTONE -weathered, dry to sl. moist, white Base of north abutment	very stiff to mod. hard			0 – 3						
SANDSTONE -w/gravel, weathered, dry to sl. moist, lt. red brown **-w/silt**	very dense			3 – 6.5						
WEATHERED GRAVELLY CONGLOMERATE -dry, lt. red brown	mod. hard			6.5 – 7.5						
SANDSTONE -w/gravel, very weathered, sl. moist, yellow brown **-w/gypsum**	med. dense to dense			7.5 – 12.1						
Bottom Depth at Approximately 12.1 feet										

Depth scale (ft.): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered. Depth measured from base of north abutment. Exposed material from base of abutment to bottom of wash.

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED: **3-9-04**	PAGE NUMBER: **Page 1 of 1**
PROJECT NO.: **64035218**	PLATE: **B-4**

LOG OF BORING NO. B- 2B

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. / ELEVATION: From Base of Abutment	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
				1						
				2						
				3						
				4						
				5						
				6						
				7						
				8						
				9						
				10						
				11						
SANDY GRAVEL -w/cobbles, tr. silt, dry			GC	12						
				13						
	loose			14	X	50/ 2"	SPT			
				15						
				16						
Continued Next Page										

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered. Depth measured from base of north abutment. Boring advanced in was bottom.

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED: 3-9-04	PAGE NUMBER: Page 1 of 2
PROJECT NO.: 64035218	PLATE: B-5

LOG OF BORING NO. B- 2B

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. / ELEVATION: From Base of Abutment	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
SANDY GRAVEL -w/cobbles, tr. silt, dry	loose		GC							
CLAYSTONE -very weathered, moist, red brown	stiff			17–18		7 14 16	SPT B			
SANDSTONE -very weathered, moist, red brown	dense			19–21						
	very dense			22–23		20 50/5"	SPT			
CLAYSTONE -weathered, sl. moist, red brown **-w/occ. sandstone lenses**	very stiff to mod. hard			24–30		50/ 3"	SPT B			
Bottom Depth at Approximately 30.5 feet				31–32						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered. Depth measured from base of north abutment. Boring advanced in was bottom.

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED:	PAGE NUMBER:
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PROJECT NO.:	PLATE:
64035218	B-6

LOG OF BORING NO. B- 3

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
FILL-SANDY GRAVEL -w/silt, cobbles, sl. moist, red brown			FILL	0			B			
-w/occ. boulders				2		50/ 2"	SPT			
SILTY SAND -w/tr. clay, dry to sl. moist, lt. brown to brown	dense		SM	3						
GRAVELLY SANDSTONE -weathered, sl. moist, red brown	very dense			4.5						
				5		20 38 48	SPT			
-w/yellow brown				6						
-conglomerate, weathered, dry, lt. red brown	mod. hard			7						
COBBLY CONGLOMERATE -dry, lt. red brown	hard			9						
	hard to very hard			10		50/ 0"	SPT B			
	very dense to mod. hard			12						
				15						
Continued Next Page										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED: **3-9-04**

PROJECT NO.: **64035218**

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PLATE: **B-7**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. B- 3

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLE	BLOWS/FT.	SMP. TYPE*	MOISTURE %	DRY DENSITY PCF	MICS. NOTES
COBBLY CONGLOMERATE -dry to sl. moist, lt. brown to lt. red brown	very dense to mod. hard					50/ 2"	SPT			
				16						
				17						
	very hard			18						
				19						
Bottom Depth at Approximately 20 feet				20		50/ 0"	SPT			
				21						
				22						
				23						
				24						
				25						
				26						
				27						
				28						
				29						
				30						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED:	PAGE NUMBER:
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PROJECT NO.:	PLATE:
64035218	**B-8**

LOG OF BORING NO. B- 4

CLIENT: **Parsons Brinckerhoff Quade & Douglas, Inc.**	PROJECT: **Nevada Project PRA-LAME 1 (8)**
BORING LOCATION: **Northshore Rd.** / ELEVATION: **Not Measured**	SITE: **Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
SILTY CLAY -w/gypsum, sl. moist, brown	firm		CL	1						
-moist	firm to stiff			2		8 8 8	SPT	9.4		
-w/partially cemented silt lenses	stiff			3						
CLAY -w/tr. sand, tr. gypsum, moist, red brown	stiff to very stiff			4						
-w/silt lenses				5		16 17 19	SPT B	16.2		
				6						
				7						
				8						
				9						
				10		12 11 14	SPT	13.9		
				11						
Bottom Depth at Approximately 11.5 feet				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED: **3-10-04**	PAGE NUMBER: **Page 1 of 1**
PROJECT NO.: **64035218**	PLATE: **B-9**

LOG OF BORING NO. B- 5

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
SILTY CLAY -heaved, sl. moist, brown	soft		CL	0			B			
-w/gypsum	firm to stiff			1						
-w/silt lenses	stiff			2		6 11 13	SPT	13.2		
CLAY -w/gypsum, moist, dark red brown			CH	3						
SANDY CLAY -w/silt, sl. moist, lt. green			CL	4						
				5		20 25 28	SPT	10.2		
CLAY -w/tr. gypsum, moist, dark red brown	very stiff		CH	6						
-w/thin gypsum lenses				8						
				10		69/ 9"	SPT	17.7		
-w/partially cemented silty clay lenses				11						
Bottom Depth at Approximately 11 feet										
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: **Groundwater not encountered.**	Terracon	DATE DRILLED: **3-10-04**	PAGE NUMBER: **Page 1 of 1**
HAMMER WEIGHT (lbs): **140**		PROJECT NO.: **64035218**	PLATE: **B-10**

LOG OF BORING NO. B- 6

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
SILTY SAND -sl. moist, red brown	loose		SM				B			
GYPSUM -w/silt, sand, sl. moist, white to lt. red brown	loose to m.dense			1						
SILTY, CLAYEY SAND -w/tr. gypsum, moist to very moist, red brown			SC/ SM	2		5 9 10	SPT	21.1		
-w/occ. gypsum lenses				3						
				4						
				5		4 7 8	SPT B	23.8		
	stiff			6						
CLAYEY SILT -moist, lt. brown			ML							
CLAY -w/sand, very moist, red brown			CL	7						
-w/occ. gypsum lenses				8						
				9						
				10		5 6 5	SPT	29.1		
				11						
Bottom Depth at Approximately 11.5 feet				12						
				13						
				14						
				15						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

NOTES:		DATE DRILLED:	PAGE NUMBER:
Groundwater not encountered.	Terracon	3-10-04	**Page 1 of 1**
HAMMER WEIGHT (lbs): **140**		PROJECT NO.: 64035218	PLATE: **B-11**

LOG OF BORING NO. B- 7

CLIENT:	PROJECT:
Parsons Brinckerhoff Quade & Douglas, Inc.	**Nevada Project PRA-LAME 1 (8)**

BORING LOCATION:	ELEVATION:	SITE:
Northshore Rd.	**Not Measured**	**Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
CLAYEY SAND -dry, lt. brown **-w/tr. gypsum**	loose to med. dense		SC	0–1.5			B			
CLAYEY SILT -w/sand, gypsum, sl. moist, lt. red brown	stiff to very stiff		ML	1.5–3.5		5 7 10	SPT	6.2		
SILTY CLAY -w/gypsum, sl. moist, red brown	very stiff		CL	3.5–6		10 15 18	SPT	11.0		
CLAY -w/sand, tr. gypsum, moist, dark brown to red brown **-w/occ. gypsum lenses**	stiff to very stiff			6–11.5			B			
						7 16 18	SPT	18.9		
Bottom Depth at Approximately 11.5 feet										

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED:	PAGE NUMBER:
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PROJECT NO.:	PLATE:
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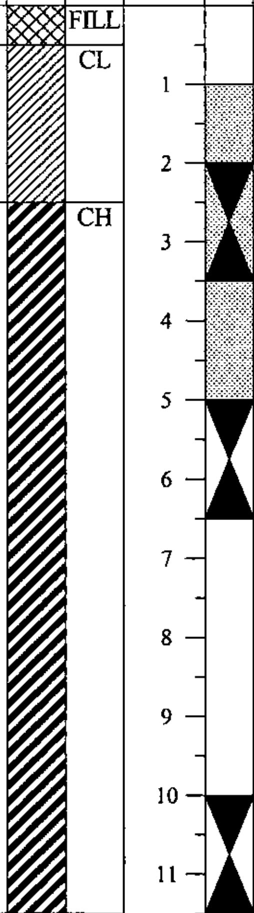
LOG OF BORING NO. B- 8

CLIENT:	PROJECT:
Parsons Brinckerhoff Quade & Douglas, Inc.	**Nevada Project PRA-LAME 1 (8)**

BORING LOCATION:	ELEVATION:	SITE:
Northshore Rd.	**Not Measured**	**Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
FILL-CLAYEY SAND -w/gravel, moist, brown			FILL							
SILTY CLAY -w/tr. gypsum, moist, brown to red brown	firm		CL	1			B			
				2		8 14 16	SPT	17.2		
CLAY -w/sand, tr. gypsum lenses, moist to very moist, dark red brown			CH	3						
-w/occ. gypsum lenses				4						
				5		8 14 17	SPT	18.5		
	stiff			6–7						
-w/occ. silty clay lenses				8–9						
				10		10 13 14	SPT	22.1		
				11						
Bottom Depth at Approximately 11.5 feet				12–15						



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED:	PAGE NUMBER:
3-10-04	**Page 1 of 1**
PROJECT NO.:	PLATE:
64035218	**B-13**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. S-01

CLIENT:	PROJECT:
Parsons Brinckerhoff Quade & Douglas, Inc.	Nevada Project PRA-LAME 1 (8)

BORING LOCATION:	ELEVATION:	SITE:
Northshore Rd. M.P. 29	Not Measured	Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2 1/4" ASPHALT			AC							
SANDY GRAVEL -w/silt, occ. cobbles, sl. moist, lt. red brown	very dense		GM	1–3	1–5		B	1.2		
SILTY SAND -w/gravel, sl. moist, lt. red brown	dense		SM	4–5						
Bottom Depth at Approximately 5 feet				5–15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED:	PAGE NUMBER:
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PROJECT NO.:	PLATE:
64035218	**B-14**

LOG OF BORING NO. S-02

CLIENT: **Parsons Brinckerhoff Quade & Douglas, Inc.**

PROJECT: **Nevada Project PRA-LAME 1 (8)**

BORING LOCATION: **Northshore Rd. M.P. 29.5**

ELEVATION: **Not Measured**

SITE: **Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2 1/2" ASPHALT			AC							
SANDY SILT -w/gypsum, sl. moist, green to lt. green			ML	1			B	5.8		
-w/silty clay lenses	stiff			2						
GRAVELLY SAND -w/silt, gypsum, sl. moist, green to lt. green	dense		SM	3–4						
Bottom Depth at Approximately 5 feet				5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: **1-6-04**

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PROJECT NO.: **64035218**

PLATE: **B-15**

LOG OF BORING NO. S-03

CLIENT:	PROJECT:
Parsons Brinckerhoff Quade & Douglas, Inc.	Nevada Project PRA-LAME 1 (8)

BORING LOCATION:	ELEVATION:	SITE:
Northshore Rd. M.P. 30	Not Measured	Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
1 7/8" ASPHALT			AC							
FILL-SANDY GRAVEL -w/silt, sl. moist, lt. brown			FILL							
SANDY GRAVEL -w/silt, occ. cobbles, sl. moist, lt. red brown	very dense		GM	1			B	1.9		
				2						
				3						
				4						
Bottom Depth at Approximately 5 feet				5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

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PROJECT NO.:	PLATE:
64035218	B-16

LOG OF BORING NO. S-04

CLIENT:	PROJECT:
Parsons Brinckerhoff Quade & Douglas, Inc.	**Nevada Project PRA-LAME 1 (8)**

BORING LOCATION:	ELEVATION:	SITE:
Northshore Rd. M.P. 30.5	**Not Measured**	**Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
1 1/2" ASPHALT			AC							
5" FILL-SANDY GRAVEL -w/clay, sl. moist, lt. red brown			FILL							
CLAYEY GRAVEL -w/sand, tr. gypsum, sl. moist, lt. red brown	very dense		GC	1–5			B	4.5		
Bottom Depth at Approximately 5 feet				5						

Depth scale (ft.): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:		DATE DRILLED:	PAGE NUMBER:
Groundwater not encountered.	Terracon	**1-6-04**	**Page 1 of 1**
HAMMER WEIGHT (lbs):		PROJECT NO.: **64035218**	PLATE: **B-17**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. S-05

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.		PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 31	ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2 1/2" ASPHALT			AC							
6" FILL-SANDY GRAVEL -w/silt, occ. cobbles, sl. moist, lt. brown			FILL							
SILTY, CLAYEY GRAVEL -w/sand, cobbles, tr. clay, sl. moist, lt. brown -w/occ. boulders	very dense		GC/ GM	1–5			B	2.6		
Bottom Depth at Approximately 5 feet				5						

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

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PROJECT NO.:	PLATE:
64035218	B-18

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. S-06

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 31.5 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2 1/4" ASPHALT			AC							
SANDY GRAVEL -w/silt, cobbles, dry to sl. moist, lt. brown	very dense		GM	1			B	2.1		
CLAYEY SAND -w/gypsum, sl. moist, lt. red brown	med. dense		SC	3						
SANDY CLAY -w/gypsum, sl. moist, lt. red brown	very stiff		CL	4						
Bottom Depth at Approximately 5 feet				5						

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: **1-6-04**	PAGE NUMBER: **Page 1 of 1**
PROJECT NO.: **64035218**	PLATE: **B-19**

LOG OF BORING NO. S-07

CLIENT: **Parsons Brinckerhoff Quade & Douglas, Inc.**	PROJECT: **Nevada Project PRA-LAME 1 (8)**
BORING LOCATION: **Northshore Rd. M.P. 32** / ELEVATION: **Not Measured**	SITE: **Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2" ASPHALT			AC							
SILTY SAND -w/gravel, tr. gypsum, sl. moist, lt. red brown **-w/cobbles** **-w/gypsum, no cobbles**	very dense		SM	1–3	1–5		B	2.3		
CLAYEY SAND -w/gypsum, t.r gravel, sl. moist, lt. red brown	med. dense to dense		SC	4–5						
Bottom Depth at Approximately 5 feet				6–15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: **1-6-04**	PAGE NUMBER: **Page 1 of 1**
PROJECT NO.: **64035218**	PLATE: **B-20**

LOG OF BORING NO. S-08

CLIENT: **Parsons Brinckerhoff Quade & Douglas, Inc.**

PROJECT: **Nevada Project PRA-LAME 1 (8)**

BORING LOCATION: **Northshore Rd. M.P. 32.5**

ELEVATION: **Not Measured**

SITE: **Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2 1/4" ASPHALT			AC							
FILL-SILTY, CLAYEY SAND -w/gravel, cobbles, tr. clay, sl. moist, lt. brown			FILL							
				1			B	4.7		
				2						
				3						
-w/clay				4						
				5						
Bottom Depth at Approximately 5 feet										
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: **1-6-04**

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PROJECT NO.: **64035218**

PLATE: **B-21**

LOG OF BORING NO. S-09

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 33 / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
1 1/2" ASPHALT			AC							
SILTY SAND -w/gravel, cobbles, sl. moist, lt. brown			SM							
				1			B	3.2		
-w/tr. clay										
	dense to very dense			2						
				3						
				4						
				5						
Bottom Depth at Approximately 5 feet										
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: 1-6-04	PAGE NUMBER: Page 1 of 1
PROJECT NO.: 64035218	PLATE: B-22

LOG OF BORING NO. S-10

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 33.5 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2 1/4" ASPHALT			AC							
FILL-SILTY, CLAYEY SAND -w/gravel, cobbles, sl. moist to moist, red brown			FILL	1			B	5.4		
				2						
				3						
				4						
				5						
Bottom Depth at Approximately 5 feet				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: Groundwater not encountered.	Terracon	DATE DRILLED: 1-7-04	PAGE NUMBER: Page 1 of 1
HAMMER WEIGHT (lbs):		PROJECT NO.: 64035218	PLATE: B-23

LOG OF BORING NO. S-11

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 34 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2 1/4" ASPHALT			AC							
SILTY SAND -w/gravel, cobbles, sl. moist, lt. brown			SM							
				1			B	2.9		
				2						
-w/cobbles, tr. clay	very dense			3						
				4						
				5						
Bottom Depth at Approximately 5 feet										
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

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PROJECT NO.: **64035218**	PLATE: **B-24**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. S-12

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 34.5 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2" ASPHALT			AC							
FILL-SILTY, CLAYEY SAND -w/gravel, cobbles, sl. moist, lt. brown			FILL							
				1			B	4.1		
				2						
-w/tr. clay, gypsum				3						
				4						
				5						
Bottom Depth at Approximately 5 feet										
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: 1-7-04	PAGE NUMBER: Page 1 of 1
PROJECT NO.: 64035218	PLATE: B-25

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. S-13

CLIENT: **Parsons Brinckerhoff Quade & Douglas, Inc.**	PROJECT: **Nevada Project PRA-LAME 1 (8)**
BORING LOCATION: **Northshore Rd. M.P. 35** — ELEVATION: **Not Measured**	SITE: **Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2 1/4" ASPHALT			AC							
5" FILL-SANDY GRAVEL -w/silt, sl. moist, brown			FILL							
SILTY SAND -w/gravel, tr. clay, sl. moist, lt. red brown	very dense		SM	1			B	6.1		
-w/partially cemented lenses	mod. hard			2–5						
Bottom Depth at Approximately 5 feet				5						

Depth scale: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: **1-7-04**

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PROJECT NO.: **64035218**

PLATE: **B-26**

LOG OF BORING NO. S-14

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.		PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 35.5	ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
3 1/2" ASPHALT			AC							
2" FILL-SANDY GRAVEL -w/silt, sl. moist, brown			FILL							
SANDY GRAVEL -w/silt, sl. moist, lt. brown	dense		GM	1			B	5.9		
CEMENTED SAND AND GRAVEL -w/cobbles, dry, lt. brown **-w/partially cemented lenses**	mod. hard			2 3						
SILTY SAND -w/gravel, occ. cobbles, sl. moist, lt. brown	very dense		SM	4						
Bottom Depth at Approximately 5 feet				5 6 7 8 9 10 11 12 13 14 15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: **1-7-04**

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PROJECT NO.: **64035218**

PLATE: **B-27**

LOG OF BORING NO. S-15

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 36 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
5" ASPHALT			AC							
FILL-SILTY SAND -w/gravel, sl. moist, red brown			FILL	1			B	3.9		
CEMENTED SAND AND GRAVEL -w/cobbles, dry, lt. brown	mod. hard to hard			2 3 4 5						
Bottom Depth at Approximately 5 feet				6 7 8 9 10 11 12 13 14 15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

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PROJECT NO.: **64035218**	PLATE: **B-28**

LOG OF BORING NO. S-16

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 36.5 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	BLOWS/FT.	SMP. TYPE*	TESTS: MOISTURE %	DRY DENSITY PCF	MICS. NOTES
3 1/2" ASPHALT			AC							
FILL-SANDY LEAN CLAY -w/gravel, moist, red brown			FILL	1			B	13.6		
FILL-SANDY GRAVEL -w/clay, moist, green brown to red brown				2, 3						
SANDY GRAVEL -w/silt, sl. moist, lt. brown -w/occ. cobbles	very dense		GM	4, 5						
Bottom Depth at Approximately 5 feet				6, 7, 8, 9, 10, 11, 12, 13, 14, 15						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: 1-7-04

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PROJECT NO.: 64035218

PLATE: B-29

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. S-17

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 37 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
4 1/8" ASPHALT			AC							
FILL-CLAYEY GRAVEL -w/sand, occ. cobbles, sl. moist, brown to lt. brown			FILL	1			B	5.4		
				2						
				3						
CEMENTED SAND AND GRAVEL -w/occ. cobbles, dry, lt. brown	hard			4						
Bottom Depth at Approximately 5 feet				5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

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PROJECT NO.:	PLATE:
64035218	**B-30**

LOG OF BORING NO. S-18

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 37.5 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
4 1/4" ASPHALT			AC							
FILL-POORLY GRADED GRAVEL -w/silt, sand, sl. moist, lt. brown -w/occ. cobbles			FILL	1			B	1.6		
				2						
CEMENTED SAND AND GRAVEL -dry, lt. brown	mod. hard to hard			3						
				4						
Bottom Depth at Approximately 5 feet				5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: **Groundwater not encountered.**

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: 1-7-04	PAGE NUMBER: Page 1 of 1
PROJECT NO.: 64035218	PLATE: B-31

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. S-19

CLIENT: **Parsons Brinckerhoff Quade & Douglas, Inc.**	PROJECT: **Nevada Project PRA-LAME 1 (8)**
BORING LOCATION: **Northshore Rd. M.P. 38** / ELEVATION: **Not Measured**	SITE: **Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
4 1/4" ASPHALT			AC							
FILL-SILTY, CLAYEY SAND -w/gravel, sl. moist, lt. brown			FILL	1			B	4.8		
				2						
				3						
SANDY GRAVEL -w/clay, sl. moist, red brown to lt. brown	dense		GC	4						
CEMENTED SAND AND GRAVEL -w/cobbles, dry, lt. brown	m.hard			5						
Bottom Depth at Approximately 5 feet				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: **1-8-04**	PAGE NUMBER: **Page 1 of 1**
PROJECT NO.: **64035218**	PLATE: **B-32**

LOG OF BORING NO. S-20

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 38.5 / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
3 7/8" ASPHALT			AC							
FILL-GRAVELLY SAND -w/clay, silt, cobbles, moist, yellow brown			FILL	1			B	3.4		
SILTY, CLAYEY SAND -w/gravel, cobbles, sl. moist, lt. yellow brown	very dense		SC/SM	2–5						
Bottom Depth at Approximately 5 feet				5–15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

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PROJECT NO.:	PLATE:
64035218	B-33

LOG OF BORING NO. S-21

CLIENT: **Parsons Brinckerhoff Quade & Douglas, Inc.**	PROJECT: **Nevada Project PRA-LAME 1 (8)**
BORING LOCATION: **Northshore Rd. M.P. 39** / ELEVATION: **Not Measured**	SITE: **Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	BLOWS/FT.	SMP. TYPE*	TESTS: MOISTURE %	DRY DENSITY PCF	MICS. NOTES
4 1/4" ASPHALT			AC							
FILL-GRAVELLY SAND -w/silt, tr. clay, moist, yellow brown			FILL	1			B	3.1		
-sl. moist, lt. yellow brown				2						
				3						
				4						
				5						
Bottom Depth at Approximately 5 feet				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: **Groundwater not encountered.**	Terracon	DATE DRILLED: **1-8-04**	PAGE NUMBER: **Page 1 of 1**
HAMMER WEIGHT (lbs):		PROJECT NO.: **64035218**	PLATE: **B-34**

LOG OF BORING NO. S-22

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.		PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 39.5	ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
3 7/8" ASPHALT			AC							
FILL-SILTY GRAVEL -w/tr. sand, clay, moist, yellow brown			FILL	1			B	6.1		
SILTY SAND -w/gypsum, tr. clay, sl. moist, lt. yellow brown	med. dense		SM	2–3						
SILTY GRAVEL -w/tr. sand, clay, moist, yellow brown	dense to very dense		GM	4–5						
Bottom Depth at Approximately 5 feet										

Depth scale (ft.): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

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PROJECT NO.: **64035218**	PLATE: **B-35**

LOG OF BORING NO. S-23

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 40 / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2 1/2" ASPHALT			AC							
FILL-SANDY GRAVEL -w/silt, tr. clay, cobbles, sl. moist to moist, lt. red brown			FILL	1			B	2.3		
SILTY SAND -w/gravel, tr. clay, sl. moist, lt. yellow brown -w/cobbles	very dense		SM	2–5						
Bottom Depth at Approximately 5 feet				5						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: **Groundwater not encountered.**

HAMMER WEIGHT (lbs):

Terracon

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PROJECT NO.: **64035218**	PLATE: **B-36**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. S-24

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 40.5 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
4 1/4" ASPHALT			AC							
FILL-GRAVELLY SAND -w/silt, occ. cobbles, sl. moist to moist, red brown -w/clay, green brown			FILL	1			B	4.9		
SILTY SAND -w/gravel, occ. cobbles, sl. moist, lt. yellow brown	very dense		SM	3						
Bottom Depth at Approximately 5 feet				5						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: 1-8-04

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PROJECT NO.: 64035218

PLATE: B-37

LOG OF BORING NO. S-25

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 41 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
3 3/4" ASPHALT			AC							
FILL-SILTY SAND -w/gravel, sl. moist to moist, red brown			FILL	1			B	2.7		
				2						
FILL-GRAVELLY SAND -w/silt, sl. moist to moist, red brown				3						
				4						
				5						
Bottom Depth at Approximately 5 feet				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

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PROJECT NO.: 64035218	PLATE: B-38

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. S-26

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 41.5 / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
4 1/2" ASPHALT			AC							
8" FILL-SANDY GRAVEL -w/silt, tr. clay, moist, red brown			FILL							
GYPSUM -sl. moist, white	loose to m.dense			1			B	11.5		
SILT -w/sand, tr. gypsum, sl. moist, lt. green	firm		ML	2–5						
Bottom Depth at Approximately 5 feet				6–15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATI

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: 1-8-04

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PROJECT NO.: 64035218

PLATE: B-39

LOG OF BORING NO. S-27

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 42 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
3 3/4" ASPHALT			AC							
10" FILL-SANDY GRAVEL -w/silt, sl. moist to moist, red brown			FILL	1			B	5.0		
SILTY, CLAYEY SAND -w/gravel, gypsum, tr. clay, sl. moist, white to lt. brown	m.dense to dense		SC/SM	2						
	dense			3–5						
Bottom Depth at Approximately 5 feet				6–15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test *SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

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PROJECT NO.: 64035218	PLATE: B-40

LOG OF BORING NO. S-28

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 42.5 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
1 3/4" ASPHALT			AC							
SILTY SAND -w/gravel, cobbles, sl. moist, lt. red brown			SM							
-w/occ. boulders				1	1–5		B	2.4		
	very dense			2						
				3						
				4						
				5						
Bottom Depth at Approximately 5 feet				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

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PROJECT NO.:	PLATE:
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LOG OF BORING NO. S-29

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 43 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2 1/2" ASPHALT over 1" AC BASE -one layer fabric			AC							
6" FILL-CLAYEY SAND -w/tr. gravel, gypsum, moist, red brown			FILL							
SILTY CLAY -w/tr. sand, gypsum, moist to very moist, red brown	firm to stiff		CL	1			B	16.4		
				2						
SANDY CLAY -w/gypsum, moist, lt. red brown	stiff			3						
CLAYEY SAND -w/gypsum, sl. moist, lt. red brown	dense to v.dense		SC	4						
Bottom Depth at Approximately 5 feet				5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: 1-9-04	PAGE NUMBER: Page 1 of 1
PROJECT NO.: 64035218	PLATE: B-42

LOG OF BORING NO. S-30

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 43.5 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
4" ASPHALT			AC							
2" FILL-CLAYEY SAND -w/tr. gypsum, gravel			FILL							
SANDY CLAY -w/silt, tr. gypsum, moist, red brown	firm to stiff		CL	1			B	11.4		
CLAYEY SAND -w/gypsum, sl. moist to moist, lt. red brown	m.dense to dense		SC	2						
SANDY CLAY -w/silt, gypsum, moist, red brown	stiff		CL	3, 4, 5						
Bottom Depth at Approximately 5 feet				6, 7, 8, 9, 10, 11, 12, 13, 14, 15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

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PROJECT NO.: **64035218**	PLATE: **B-43**

LOG OF BORING NO. S-31

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 44 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLE	BLOWS/FT.	SMP. TYPE*	MOISTURE %	DRY DENSITY PCF	MICS. NOTES
2 1/2" ASPHALT			AC							
SANDY, SILTY CLAY -w/tr. gravel, gypsum, sl. moist to moist, red brown	stiff		CL/ML	1–5			B	9.6		
Bottom Depth at Approximately 5 feet										

Depth scale: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test *SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: **1-9-04**

PAGE NUMBER: **Page 1 of 1**

PROJECT NO.: **64035218**

PLATE: **B-44**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. S-32

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 44.5 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
1" ASPHALT over 1" GROUND-UP ASPHALT			AC							
6" FILL-SILTY SAND -w/gravel, moist, red brown			FILL							
SANDY GRAVEL -w/silt, gypsum, tr. clay, moist, white to lt. red brown	dense		GM	1			B	3.4		
SILTY SAND -w/gypsum, tr. clay, sl. moist to moist, lt. red brown	med. dense		SM	3						
CLAYEY SAND -w/gypsum, sl. moist to moist, red brown			SC	4						
Bottom Depth at Approximately 5 feet				5						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: 1-9-04	PAGE NUMBER: Page 1 of 1
PROJECT NO.: 64035218	PLATE: B-45

LOG OF BORING NO. S-33

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 45 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2 1/4" ASPHALT			AC							
5" FILL-SANDY GRAVEL -w/clay, moist, red brown			FILL							
SILTY CLAY -w/tr. sand, tr. gravel, gypsum, moist, red brown	firm to stiff		CL	1			B	6.3		
CLAYEY SAND -w/tr. gypsum, moist, red brown to lt. red brown	m.dense to dense		SC	2						
SILTY SAND -w/tr. gypsum, sl. moist to moist, lt. red brown	med. dense		SM	3						
SILTY CLAY -w/tr. sand, gypsum, moist, red brown	stiff		CL	4						
Bottom Depth at Approximately 5 feet				5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: **1-9-04**

PAGE NUMBER: **Page 1 of 1**

PROJECT NO.: **64035218**

PLATE: **B-46**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. S-34

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 45.5 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2 1/4" ASPHALT over 4" AGGREGATE BASE TYPE I -sl. moist to moist, brown			AC							
FILL-SANDY GRAVEL -w/silt, sl. moist, red brown			FILL	1			B	4.2		
GYPSUM -w/silt, sand, sl. moist, white	med. dense			2, 3						
SILT -w/gypsum, sand, sl. moist, white	stiff		ML	4, 5						
Bottom Depth at Approximately 5 feet				6–15						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: **1-9-04**

PAGE NUMBER: **Page 1 of 1**

PROJECT NO.: **64035218**

PLATE: **B-47**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. S-35

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 46 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2" ASPHALT over 4" AGGREGATE BASE -moist, brown			AC							
FILL-SANDY GRAVEL -w/silt, moist, red brown			FILL	1			B	7.0		
GYPSUM -w/silt, sl. moist, white	med. dense			2						
				3						
				4						
				5						
Bottom Depth at Approximately 5 feet				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: 1-9-04	PAGE NUMBER: Page 1 of 1
PROJECT NO.: 64035218	PLATE: B-48

LOG OF BORING NO. S-36

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 46.5 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2" ASPHALT over 3" AGGREGATE BASE			AC							
SANDY GRAVEL -w/silt, sl. moist, red brown	m. dense to dense		GM	1			B	5.6		
SAND -w/silt, sl. moist, red brown	med. dense		SP	2						
SILTY SAND -sl. moist, red brown			SM	3, 4, 5						
Bottom Depth at Approximately 5 feet				6–15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs):

Terracon

DATE DRILLED: 1-9-04

PROJECT NO.: 64035218

PAGE NUMBER: Page 1 of 1

PLATE: B-49

LOG OF BORING NO. S-37

CLIENT: Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Northshore Rd. M.P. 47 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2 1/4" ASPHALT CONCRETE over 4" AGGREGATE BASE -lt. brown										
POORLY GRADED SAND -w/silt, gravel, sl. moist, red brown	med. dense		SP/SM	1			B			
				2						
SANDY GRAVEL -w/silt, sl. moist, red brown			GM	3						
CLAYEY SAND -sl. moist, lt. red brown	med. dense to dense		SC	4						
				5						
Bottom Depth at Approximately 5 feet				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater not encountered.

HAMMER WEIGHT (lbs): 140

Terracon

DATE DRILLED: 3-10-04	PAGE NUMBER: Page 1 of 1
PROJECT NO.: 64035218	PLATE: B-50

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. EB- 1

CLIENT: Parson Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Echo Bay Rd. M.P. 0.25 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2" ASPHALT CONCRETE			AC							
FILL - 6" AGGREGATE BASE COURSE - SILTY SAND -w/ gravel, sl. moist, lt. reddish brown			FILL				B			
FILL - SANDY GRAVEL -w/ clay, occ. cobbles, sl. moist, lt. reddish brown			FILL	1						
CALICHE -dry, lt. reddish brown	mod. hard			2		50/ 0"	B SPT			
SANDY GRAVEL -w/ clay, occ. cobbles, sl. moist, lt. reddish brown	very dense		GC	3						
				4		69/ 9"	SPT			
CEMENTED SAND & GRAVEL -dry, lt. reddish brown	mod. hard									
Bottom Depth at Approximately 5 feet				5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater Not Measured

HAMMER WEIGHT (lbs): 140

Terracon

DATE DRILLED:	PAGE NUMBER:
10-25-05	Page 1 of 1
PROJECT NO.:	PLATE:
64055138	B-51

LOG OF BORING NO. EB- 2

CLIENT: Parson Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Echo Bay Rd. M.P. 0.75 / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2-1/4" ASPHALT CONCRETE			AC							
FILL - 6" AGGREGATE BASE COURSE - SILTY SAND -w/ gravel, moist, brown			FILL	1			B			
CALICHE -dry, white	mod. hard									
SILTY CLAY -w/ caliche gravel, sl. moist, lt. reddish brown	very stiff		CL	2		31	B SPT			
CLAYEY SILT -w/ caliche gravel and gypsum, sl. moist, white			ML	3						
SILTY SAND -w/ gravel and gypsum, sl. moist, white	med. dense to dense		SM	4		35	R			
Bottom Depth at Approximately 5 feet				5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: **Groundwater Not Measured**	Terracon	DATE DRILLED: **10-25-05**	PAGE NUMBER: **Page 1 of 1**
HAMMER WEIGHT (lbs): **140**		PROJECT NO.: **64055138**	PLATE: **B-52**

LOG OF BORING NO. EB- 3

CLIENT: **Parson Brinckerhoff Quade & Douglas, Inc.**	PROJECT: **Nevada Project PRA-LAME 1 (8)**
BORING LOCATION: **Echo Bay Rd. M.P. 1.25** ELEVATION: **Not Measured**	SITE: **Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLE	BLOWS/FT.	SMP. TYPE*	MOISTURE %	DRY DENSITY PCF	MICS. NOTES
2-1/4" ASPHALT CONCRETE			AC							
FILL - 8" AGGREGATE BASE COURSE - GRAVEL -w/silt and sand, moist, brown			FILL	1			B			
SANDY GRAVEL -w/ clay, sl. moist, lt. reddish brown	dense		GC							
CLAYEY SAND -sl. moist, lt. reddish brown			SC	2		71	B SPT			
SANDY GRAVEL -w/ clay, sl. moist, lt. reddish brown	dense to very dense		GC	3						
CEMENTED SAND & GRAVEL -dry, lt. brown	mod. hard			4		50/ 0"	SPT			
Bottom Depth at Approximately 5 feet				5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: **Groundwater Not Measured**	Terracon	DATE DRILLED: **10-25-05**	PAGE NUMBER: **Page 1 of 1**
HAMMER WEIGHT (lbs): **140**		PROJECT NO.: **64055138**	PLATE: **B-53**

LOG OF BORING NO. EB- 4

CLIENT: **Parson Brinckerhoff Quade & Douglas, Inc.**	PROJECT: **Nevada Project PRA-LAME 1 (8)**
BORING LOCATION: **Echo Bay Rd. M.P. 1.75** / ELEVATION: **Not Measured**	SITE: **Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2-1/4" ASPHALT CONCRETE			AC							
FILL - 8" AGGREGATE BASE COURSE - SILTY, CLAYEY SAND -w/ gravel, moist, brown			FILL				B			
SILTY SAND -w/ gravel, sl. moist, lt. reddish brown	med. dense to dense		SM	1						
				2		33	B SPT			
	dense			3						
				4		22	SPT			
				5						
Bottom Depth at Approximately 5.5 feet				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test *SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: **Groundwater Not Measured**	Terracon	DATE DRILLED: **10-25-05**	PAGE NUMBER: **Page 1 of 1**
HAMMER WEIGHT (lbs): **140**		PROJECT NO.: **64055138**	PLATE: **B-54**

LOG OF BORING NO. EB- 5

CLIENT: Parson Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Echo Bay Rd. M.P. 2.25 / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2" ASPHALT CONCRETE			AC							
FILL - 3" AGGREGATE BASE COURSE - SILTY SAND -w/ gravel, sl. moist, brown			FILL				B			
SILTY, CLAYEY SAND -w/ gravel, sl. moist, lt. reddish brown			FILL	1						
				2		32	B SPT			
				3						
				4		48	SPT			
				5						
Bottom Depth at Approximately 5.5 feet				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater Not Measured

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED: **10-26-05**	PAGE NUMBER: **Page 1 of 1**
PROJECT NO.: **64055138**	PLATE: **B-55**

LOG OF BORING NO. EB- 6

CLIENT: Parson Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Echo Bay Rd. M.P. 2.75 — ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
1-7/8" ASPHALT CONCRETE			AC							
FILL - 4" AGGREGATE BASE COURSE - GRAVEL -w/ silt and sand, moist, brown			FILL	1			B			
SILTY SAND -moist, reddish brown	dense		SM	2		88/ 11"	B SPT			
-partially cemented, dry to sl. moist, reddish brown to lt. reddish brown	very dense to mod. hard			3, 4		50/ 5"	SPT			
Bottom Depth at Approximately 5 feet				5						
				6, 7, 8, 9, 10, 11, 12, 13, 14, 15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater Not Measured

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED:	PAGE NUMBER:
10-26-05	Page 1 of 1
PROJECT NO.:	PLATE:
64055138	B-56

LOG OF BORING NO. EB- 7

CLIENT: **Parson Brinckerhoff Quade & Douglas, Inc.**	PROJECT: **Nevada Project PRA-LAME 1 (8)**
BORING LOCATION: **Echo Bay Rd. M.P. 3.25** ELEVATION: **Not Measured**	SITE: **Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	USCS SYMBOL	DEPTH (FT.)	BLOWS/FT.	SMP. TYPE*	MOISTURE %	DRY DENSITY PCF	MICS. NOTES
2-3/4" ASPHALT CONCRETE		AC						
FILL - 6" AGGREGATE BASE COURSE - SILTY, CLAYEY SAND -w/ gravel, sl. moist, reddish brown		FILL	1		B			
SANDY GRAVEL -w/ clay, sl. moist, lt. reddish brown	med. dense to dense	GC	2	14	B SPT			
CLAYEY SAND -w/ tr. gypsum and gravel, sl. moist, lt. reddish brown to reddish brown	med. dense	SC	3–4	25	SPT			
	med. dense to dense		5					
Bottom Depth at Approximately 5.5 feet			6–15					

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: **Groundwater Not Measured**	Terracon	DATE DRILLED: **10-26-05**	PAGE NUMBER: **Page 1 of 1**
HAMMER WEIGHT (lbs): **140**		PROJECT NO.: **64055138**	PLATE: **B-57**

LOG OF BORING NO. EB- 8

CLIENT: **Parson Brinckerhoff Quade & Douglas, Inc.**	PROJECT: **Nevada Project PRA-LAME 1 (8)**
BORING LOCATION: **Echo Bay Rd. M.P. 3.75** / ELEVATION: **Not Measured**	SITE: **Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2" ASPHALT CONCRETE			AC							
FILL - 6" AGGREGATE BASE COURSE - SILTY, CLAYEY SAND -w/ gravel, moist, brown			FILL	1			B			
SILTY SAND -w/ gravel, sl. moist, white to lt. brown	dense		SM	2–3		32	B SPT			
CLAYEY SAND -w/ tr. gypsum, moist, reddish brown	med. dense		SC	4–5		13	SPT			
Bottom Depth at Approximately 5.5 feet				6–15						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater Not Measured

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED: **10-26-05**

PAGE NUMBER: **Page 1 of 1**

PROJECT NO.: **64055138**

PLATE: **B-58**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. EB- 9

CLIENT: **Parson Brinckerhoff Quade & Douglas, Inc.**

PROJECT: **Nevada Project PRA-LAME 1 (8)**

BORING LOCATION: **Echo Bay Rd. M.P. 4.25**

ELEVATION: **Not Measured**

SITE: **Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2" ASPHALT CONCRETE			AC							
FILL - 6" AGGREGATE BASE COURSE - SILTY SAND -w/ gravel, moist, brown			FILL	1			B			
SILTY SAND -w/ gravel, tr. gypsum, sl. moist, lt. reddish brown			SM	2		15	B SPT			
GYPSUM -w/ clay and sand, moist, white to lt. reddish brown	med. dense		GYP	3						
CLAYEY SAND -w/ gypsum, tr. gravel, moist, white to lt. reddish brown	dense		SC	4 5		30	SPT			
Bottom Depth at Approximately 5.5 feet				6 7 8 9 10 11 12 13 14 15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater Not Measured

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED: **10-26-05**

PAGE NUMBER: **Page 1 of 1**

PROJECT NO.: **64055138**

PLATE: **B-59**

LOG OF BORING NO. EB-10

CLIENT: Parson Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Echo Bay Rd. M.P. 4.71 / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2" ASPHALT CONCRETE			AC							
FILL - 6" AGGREGATE BASE COURSE - SILTY SAND -w/ gravel, moist, brown			FILL				B			
SILTY SAND -moist, reddish brown	med. dense		SM	1						
SANDY SILT -moist, reddish brown	firm to stiff		ML	2		8	B SPT			
SILTY SAND -moist, reddish brown	med. dense		SM	3 4 5		9	SPT			
Bottom Depth at Approximately 5.5 feet				6 7 8 9 10 11 12 13 14 15						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater Not Measured

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED: **10-26-05**	PAGE NUMBER: **Page 1 of 1**
PROJECT NO.: **64055138**	PLATE: **B-60**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. OB- 1

CLIENT: **Parson Brinckerhoff Quade & Douglas, Inc.**	PROJECT: **Nevada Project PRA-LAME 1 (8)**
BORING LOCATION: **Overton Beach Rd. M.P. 0.25** / ELEVATION: **Not Measured**	SITE: **Lake Mead National Recreation Area**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2-7/8" ASPHALT CONCRETE			AC							
FILL - 13" AGGREGATE BASE COURSE - CLAYEY GRAVEL -w/ sand, moist, brown			FILL	1			B			
CLAY -w/ sand, very moist, reddish brown			CH	2			B			
-moist	very stiff			3		38	R			
SILTY CLAY -w/ tr. gypsum, moist, lt. brown			CL	4		63	R			
CLAY -moist, reddish brown			CH	5						
Bottom Depth at Approximately 5 feet										

Depth scale: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: **Groundwater Not Measured**	Terracon	DATE DRILLED: **10-24-05**	PAGE NUMBER: **Page 1 of 1**
HAMMER WEIGHT (lbs): **140**		PROJECT NO.: **64055138**	PLATE: **B-61**

LOG OF BORING NO. OB- 2

CLIENT: Parson Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Overton Beach Rd. M.P. 0.75 / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	USCS SYMBOL	DEPTH (FT.)	BLOWS/FT.	SMP. TYPE*	MOISTURE %	DRY DENSITY PCF	MICS. NOTES
2-1/2" ASPHALT CONCRETE		AC						
FILL - AGGREGATE BASE COURSE - SILTY SAND -w/ gravel, moist, brown		FILL	1		B			
SILTY SAND -sl. moist, lt. reddish brown	med. dense	SM	2	46	B R			
CLAY -w/ sand, moist, reddish brown	very stiff	CL	3, 4	86	R			
SANDY CLAY -moist, lt. reddish brown		CL	5					
Bottom Depth at Approximately 5 feet								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test *SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: Groundwater Not Measured

HAMMER WEIGHT (lbs): 140

Terracon

DATE DRILLED: 10-24-05

PAGE NUMBER: Page 1 of 1

PROJECT NO.: 64055138

PLATE: B-62

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. OB- 3

CLIENT: Parson Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Overton Beach Rd. M.P. 1.25 / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2-1/8" ASPHALT CONCRETE			AC							
FILL - 6" AGGREGATE BASE COURSE - GRAVEL -w/ silt and sand, sl. moist, lt. brown			FILL	1			B			
GRAVEL -w/ silt and sand, occ. cobbles, sl. moist, lt. brown	dense		GP-GM	2		38	B SPT			
				3						
CLAYEY SAND -w/ tr. gravel, sl. moist, lt. brown	med. dense to dense		SC	4		64/ 10"	SPT			
PARTIALLY CEMENTED SAND & GRAVEL -dry to sl. moist, white to lt. brown	very dense to mod. hard			5						
Bottom Depth at Approximately 5 feet										
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater Not Measured

HAMMER WEIGHT (lbs): 140

Terracon

DATE DRILLED: 10-24-05

PAGE NUMBER: Page 1 of 1

PROJECT NO.: 64055138

PLATE: B-63

LOG OF BORING NO. OB- 4

CLIENT: Parson Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Overton Beach Rd. M.P. 1.75 / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2-1/2" ASPHALT CONCRETE			AC							
FILL - 5" AGGREGATE BASE COURSE - SAND -w/ silt and gravel, sl. moist, brown			FILL	1			B			
FILL - SILTY, CLAYEY GRAVEL -w/ sand, occ. cobbles, sl. moist, lt. reddish brown			FILL	2, 3		20	B SPT			
SANDY GRAVEL -w/ clay, tr. gypsum, sl. moist, lt. reddish brown	med. dense to dense		GC	4, 5		28	SPT			
Bottom Depth at Approximately 5.5 feet				6–15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: **Groundwater Not Measured** HAMMER WEIGHT (lbs): **140**	Terracon	DATE DRILLED: **10-24-05**	PAGE NUMBER: **Page 1 of 1**
		PROJECT NO.: **64055138**	PLATE: **B-64**

LOG OF BORING NO. OB- 5

CLIENT: Parson Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Overton Beach Rd. M.P. 2.25 / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: MICS. NOTES
2-1/2" ASPHALT CONCRETE			AC							
FILL - 5" AGGREGATE BASE COURSE - SILTY SAND -w/ gravel, moist, brown			FILL	1			B			
CLAYEY SAND -w/ gravel, very moist, reddish brown	med. dense		SC							
SANDY GRAVEL -w/ clay, occ. clayey lenses, moist, lt. reddish brown			GC	2		36	B SPT			
SILTY, CLAYEY SAND -w/ gravel, moist, lt. reddish brown	dense		SC-SM	3, 4, 5		32	SPT			
Bottom Depth at Approximately 5.5 feet				6, 7, 8, 9, 10, 11, 12, 13, 14, 15						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: Groundwater Not Measured

HAMMER WEIGHT (lbs): 140

Terracon

DATE DRILLED: 10-24-05	PAGE NUMBER: Page 1 of 1
PROJECT NO.: 64055138	PLATE: B-65

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. OB- 6

CLIENT: Parson Brinckerhoff Quade & Douglas, Inc.	PROJECT: Nevada Project PRA-LAME 1 (8)
BORING LOCATION: Overton Beach Rd. M.P. 2.80 / ELEVATION: Not Measured	SITE: Lake Mead National Recreation Area

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLE	BLOWS/FT.	SMP. TYPE*	MOISTURE %	DRY DENSITY PCF	MICS. NOTES
2-1/4" ASPHALT CONCRETE			AC							
FILL - 6" AGGREGATE BASE COURSE - SILTY,CLAYEY GRAVEL -w/ sand, moist, brown			FILL				B			
FILL - SILTY SAND -w/ gravel, moist, brown			FILL	1						
				2		40	B SPT			
				3						
				4		46	SPT			
				5						
Bottom Depth at Approximately 5.5 feet				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: Groundwater Not Measured	Terracon	DATE DRILLED: 10-24-05	PAGE NUMBER: Page 1 of 1
HAMMER WEIGHT (lbs): 140		PROJECT NO.: 64055138	PLATE: B-66

B-61 MM 26.62
0 TO 2¼" Pavement
2¼" TO 2' Red Sand & gravel

B-62 MM 27.0
0 TO 2¼" Pavement
2¼" TO 2' Red Sand & gravel

B-63 MM 27.4
0 TO 2¼" Pavement
2¼" TO 2' Light brown Sand & gravel

B-64 MM 27.8
0 TO 2¼" Pavement
2¼" TO 2' Light brown Sand and gravel

B-65 MM 28.2
0 TO 2½" Pavement
2½" TO 2' Red Sand & gravel

B-66 MM 28.6
0 TO 2¼" Pavement
2¼" TO 2' Sand & gravel

B-67 MM 29.0
0 TO 2¼" Pavement
2¼" TO 2' Light brown Sand and gravel

B-68 MM 29.4
0 TO 2" Pavement
2" TO 2' Light brown Sand and gravel

B-69 MM 29.8
0 TO 1¾" Pavement
1¾" TO 2' Light brown Sand and gravel

B-70 MM 30.3
0 TO 2" Pavement
2" TO 5' Light brown Sand and gravel

B-71 MM 30.65
0 TO 1¾" Pavement
1¾" TO

B-72 MM 31.0
0 TO 2½" Pavement
2½" TO 2' Light brown Sand and gravel

B-72 MM 31.0
0 to 2½" Pavement
2½" to 2' Light brown
Sand and gravel

B-73 MM 31.4
0 to 2½" Pavement
2½" to 2' Light brown
Sand and gravel

B-74 MM 32.05
0 to 2¼" Pavement
2¼" to 2' Light brown
Sand and gravel

B-75 MM 32.4
0 to 2¼" Pavement
2¼" to 2' Light brown
Sand and gravel

B-76 MM 32.8
0 to 3" Pavement
3" to 2' Light brown
Sand and gravel

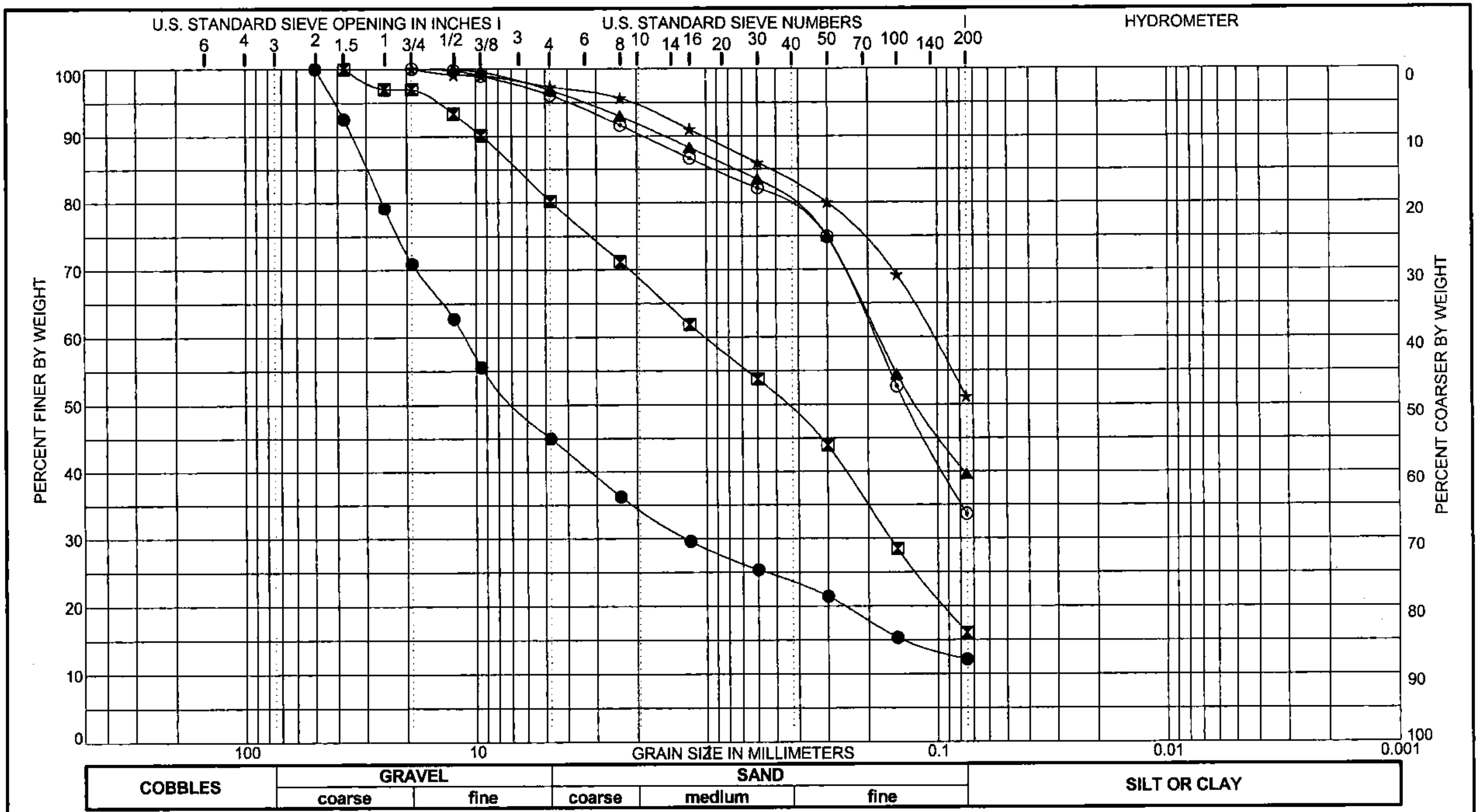
B-77 MM 33.2
0 to 2½" Pavement
2½" to 2' Light brown
Sand and gravel

B-78 MM 33.6
0 to 2¼" Pavement
2¼" to 2' Light brown
Sand and gravel

B-79 MM 34.0
0 to 3" Pavement
3" to 2' Light brown
Sand and gravel

B-80 MM 34.4
0 to 2" pavement
2" to 2' Light brown
Sand and gravel

B-81 MM 34.8
0 to 2" Pavement
2" to 2' Light brown
Sand and gravel



	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	*B- 1*	@	*0.0 ft.*	*SILTY GRAVEL with SAND GM*		*NP*	*NP*	*NP*	*2.90*	*240.7*
⊠	*B- 1*	@	*9.0 ft.*	*SILTY SAND with GRAVEL SM*		*NP*	*NP*	*NP*		
▲	*B- 1*	@	*19.0 ft.*	*CLAYEY SAND SC*		*19*	*11*	*8*		
★	*B- 2*	@	*0.0 ft.*	*SANDY SILT ML*		*NP*	*NP*	*NP*		
⊙	*B- 2*	@	*17.0 ft.*	*SILTY SAND SM*		*NP*	*NP*	*NP*		

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	*B- 1*	@	*0.0 ft.*	*50.00*	*29.84*	*6.598*	*0.1390*	*55.0*	*32.8*	*12.2*	
⊠	*B- 1*	@	*9.0 ft.*	*37.50*	*6.64*	*0.461*		*19.8*	*64.1*	*16.1*	
▲	*B- 1*	@	*19.0 ft.*	*12.50*	*0.75*	*0.122*		*3.1*	*57.3*	*39.6*	
★	*B- 2*	@	*0.0 ft.*	*19.00*	*0.54*			*2.6*	*46.2*	*51.1*	
⊙	*B- 2*	@	*17.0 ft.*	*19.00*	*0.92*	*0.136*		*3.9*	*62.5*	*33.6*	

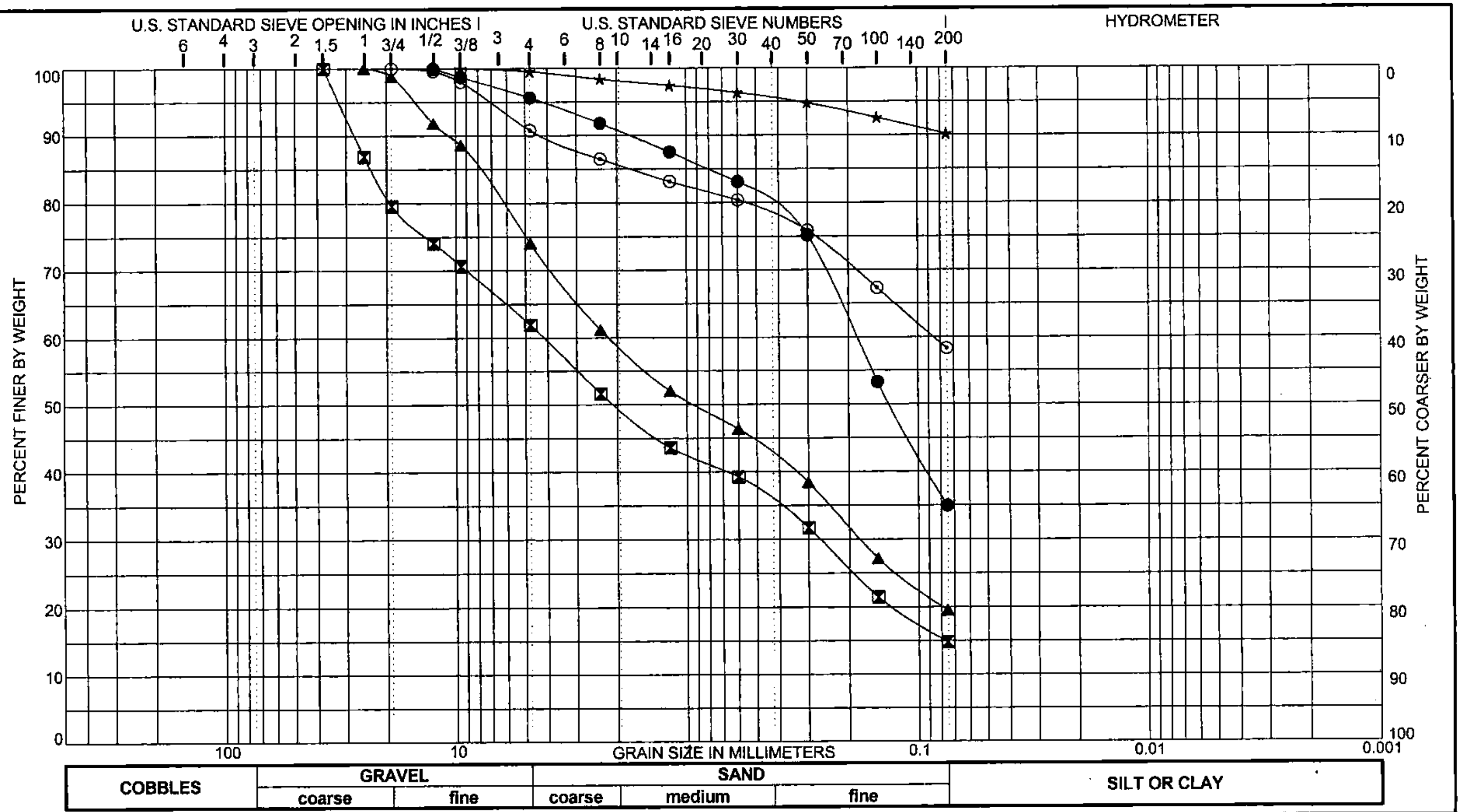
Terracon

Client: *Parsons Brinckerhoff Quade & Douglas, Inc.*
Project: *Nevada Project PRA-LAME 1 (8)*
Project Site *Lake Mead National Recreation Area*
Project No. *64035218*

SIEVE ANALYSES

Date *February 2006*

1



Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
● B-2	@	28.0 ft.	SILTY SAND SM		NP	NP	NP		
⊠ B-3	@	0.0 ft.	SILTY SAND with GRAVEL SM		NP	NP	NP		
▲ B-3	@	10.0 ft.	SILTY SAND with GRAVEL SM		NP	NP	NP		
★ B-4	@	5.0 ft.	LEAN CLAY CL		46	17	28		
⊙ B-5	@	0.0 ft.	SANDY LEAN CLAY CL		34	14	19		

Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
● B-2	@	28.0 ft.	12.50	0.80	0.132		4.4	60.7	34.9	
⊠ B-3	@	0.0 ft.	37.50	23.30	2.051	0.0762	38.1	47.1	14.9	
▲ B-3	@	10.0 ft.	25.00	8.03	0.929		26.0	54.5	19.5	
★ B-4	@	5.0 ft.	9.50				0.5	9.4	90.1	
⊙ B-5	@	0.0 ft.	19.00	1.73			9.3	32.4	58.3	

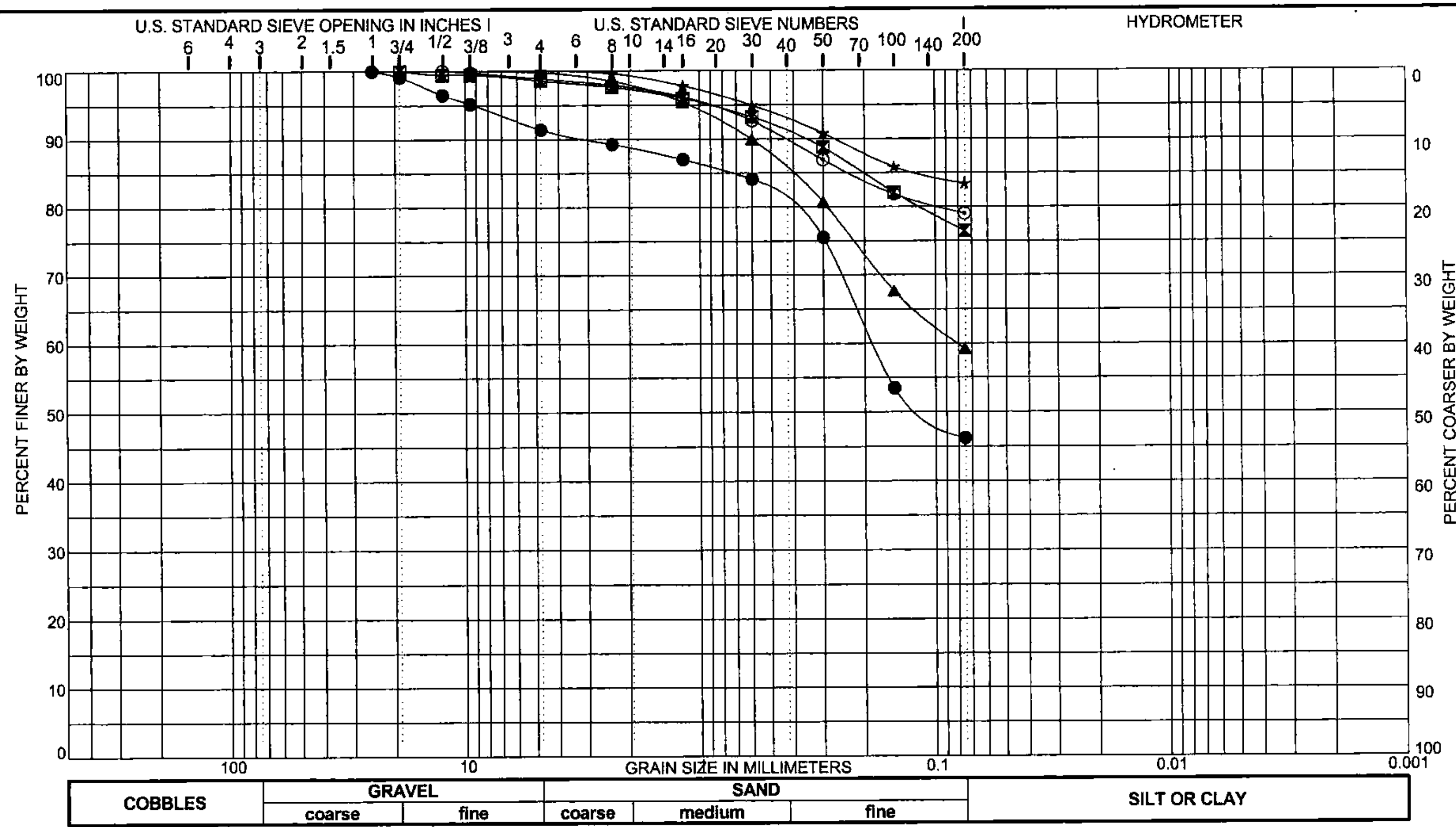
Terracon

Client: Parsons Brinckerhoff Quade & Douglas, Inc.
Project: Nevada Project PRA-LAME 1 (8)
Project Site Lake Mead National Recreation Area
Project No. 64035218

SIEVE ANALYSES

Date February 2006

2



	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	B- 6	@	0.0 ft.	SILTY, CLAYEY SAND SC-SM		19	14	5		
⊠	B- 6	@	5.0 ft.	LEAN CLAY with SAND CL		46	18	28		
▲	B- 7	@	0.0 ft.	SANDY LEAN CLAY CL		27	14	13		
★	B- 7	@	6.0 ft.	LEAN CLAY with SAND CL		49	16	33		
⊙	B- 8	@	1.0 ft.	FAT CLAY with SAND CH		56	17	40		

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	B- 6	@	0.0 ft.	25.00	0.74	0.108		8.6	45.2	46.2	
⊠	B- 6	@	5.0 ft.	19.00	0.20			1.4	22.1	76.4	
▲	B- 7	@	0.0 ft.	9.50	0.42			0.3	40.5	59.2	
★	B- 7	@	6.0 ft.	4.75	0.12			0.0	16.7	83.3	
⊙	B- 8	@	1.0 ft.	12.50	0.23			1.1	19.9	79.0	

Terracon

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Project: *Nevada Project PRA-LAME 1 (8)*
Project Site *Lake Mead National Recreation Area*
Project No. *64035218*

SIEVE ANALYSES

Date *February 2006*

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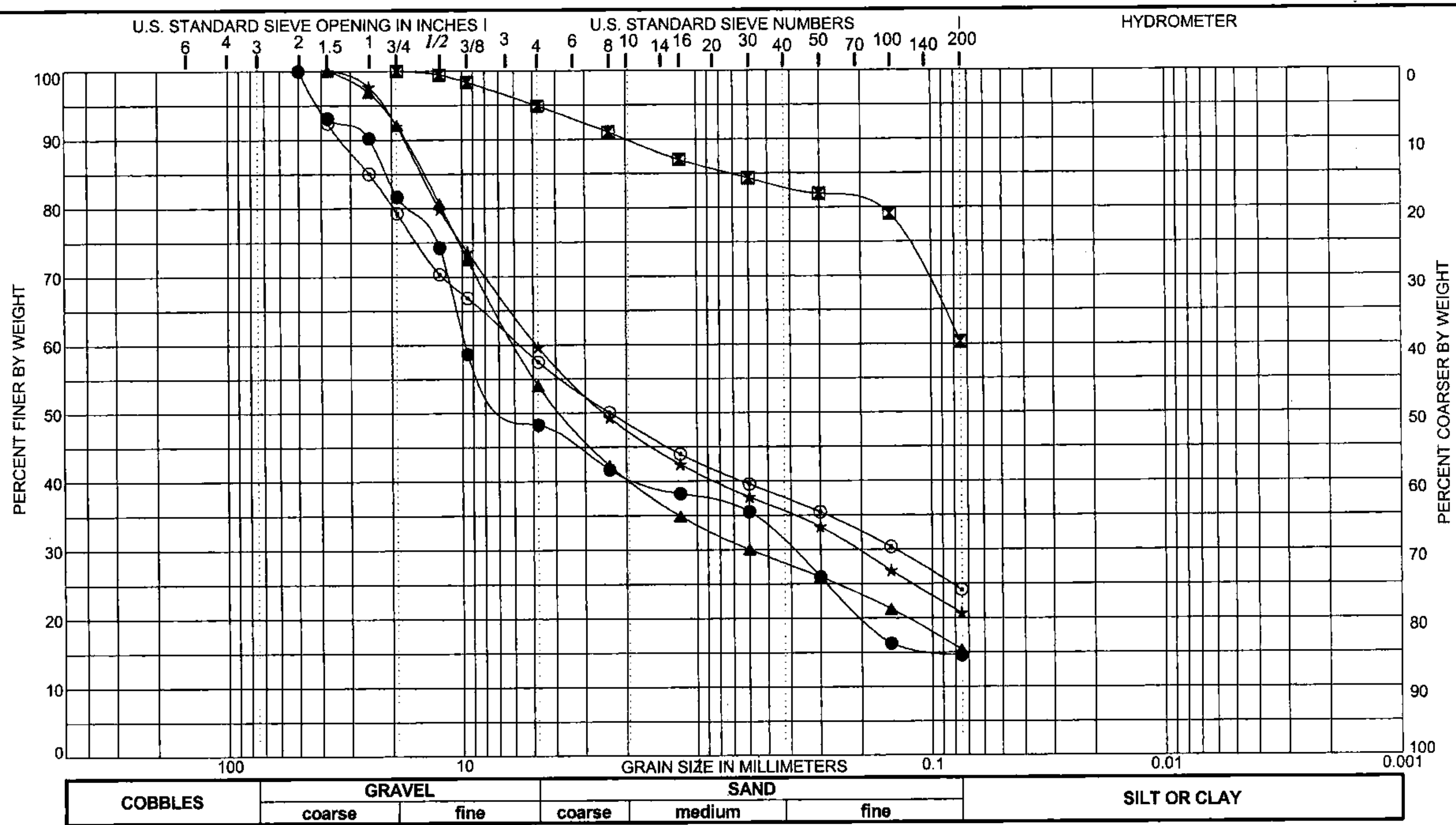

	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	S-01	@	1.0 ft.	SILTY GRAVEL with SAND GM		NP	NP	NP		
⊠	S-02	@	1.0 ft.	SANDY SILT ML		NP	NP	NP		
▲	S-03	@	1.0 ft.	SILTY GRAVEL with SAND GM		NP	NP	NP		
★	S-04	@	1.0 ft.	CLAYEY GRAVEL with SAND GC		27	19	8		
⊙	S-05	@	1.0 ft.	SILTY, CLAYEY GRAVEL with SAND GC-GM		26	21	5		

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	S-01	@	1.0 ft.	50.00	21.15	5.339	0.0880	51.8	33.6	14.6	
⊠	S-02	@	1.0 ft.	19.00	0.71			5.1	34.5	60.3	
▲	S-03	@	1.0 ft.	37.50	14.66	3.741		46.0	38.6	15.4	
★	S-04	@	1.0 ft.	37.50	14.93	2.481		40.3	39.0	20.7	
⊙	S-05	@	1.0 ft.	50.00	24.97	2.348		42.5	33.4	24.1	

Terracon

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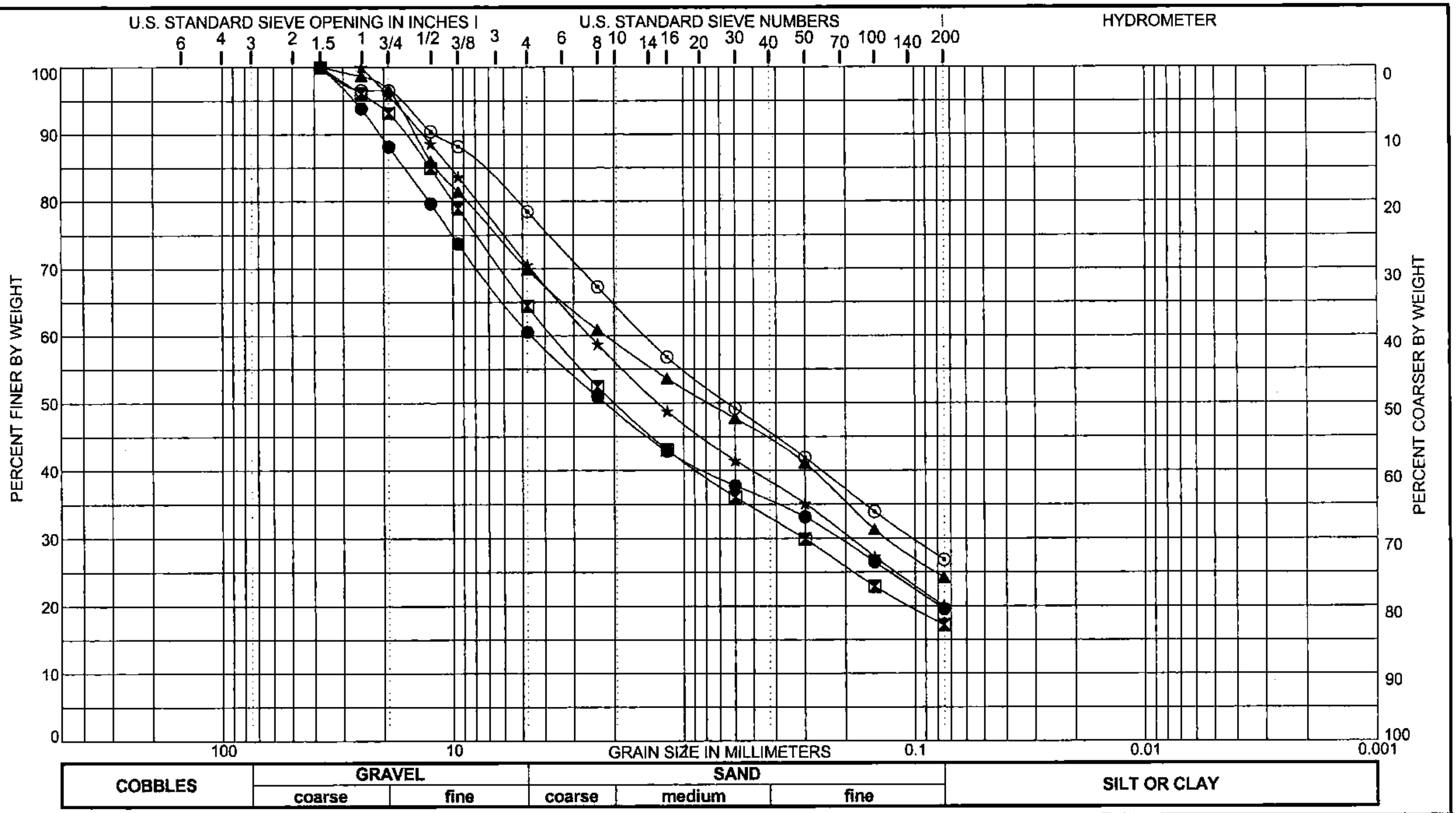
Project: *Nevada Project PRA-LAME 1 (8)*
Project Site *Lake Mead National Recreation Area*
Project No. *64035218*

SIEVE ANALYSES

Date *February 2006* 4



	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	*S-06*	@	*1.0 ft.*	*SILTY, CLAYEY SAND with GRAVEL SC-SM*		*24*	*18*	*6*		
⊠	*S-07*	@	*1.0 ft.*	*SILTY SAND with GRAVEL SM*		*NP*	*NP*	*NP*		
▲	*S-08*	@	*1.0 ft.*	*SILTY, CLAYEY SAND with GRAVEL SC-SM*		*21*	*15*	*6*		
★	*S-09*	@	*1.0 ft.*	*SILTY SAND with GRAVEL SM*		*16*	*15*	*1*		
⊙	*S-10*	@	*1.0 ft.*	*SILTY, CLAYEY SAND with GRAVEL SC-SM*		*19*	*15*	*4*		

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	*S-06*	@	*1.0 ft.*	*37.50*	*16.26*	*2.180*		*39.5*	*41.0*	*19.6*	
⊠	*S-07*	@	*1.0 ft.*	*37.50*	*12.55*	*1.973*		*35.6*	*47.2*	*17.2*	
▲	*S-08*	@	*1.0 ft.*	*37.50*	*11.79*	*0.780*		*30.1*	*45.7*	*24.2*	
★	*S-09*	@	*1.0 ft.*	*25.00*	*10.25*	*1.285*		*29.4*	*50.6*	*20.0*	
⊙	*S-10*	@	*1.0 ft.*	*37.50*	*7.57*	*0.645*		*21.5*	*51.6*	*26.8*	

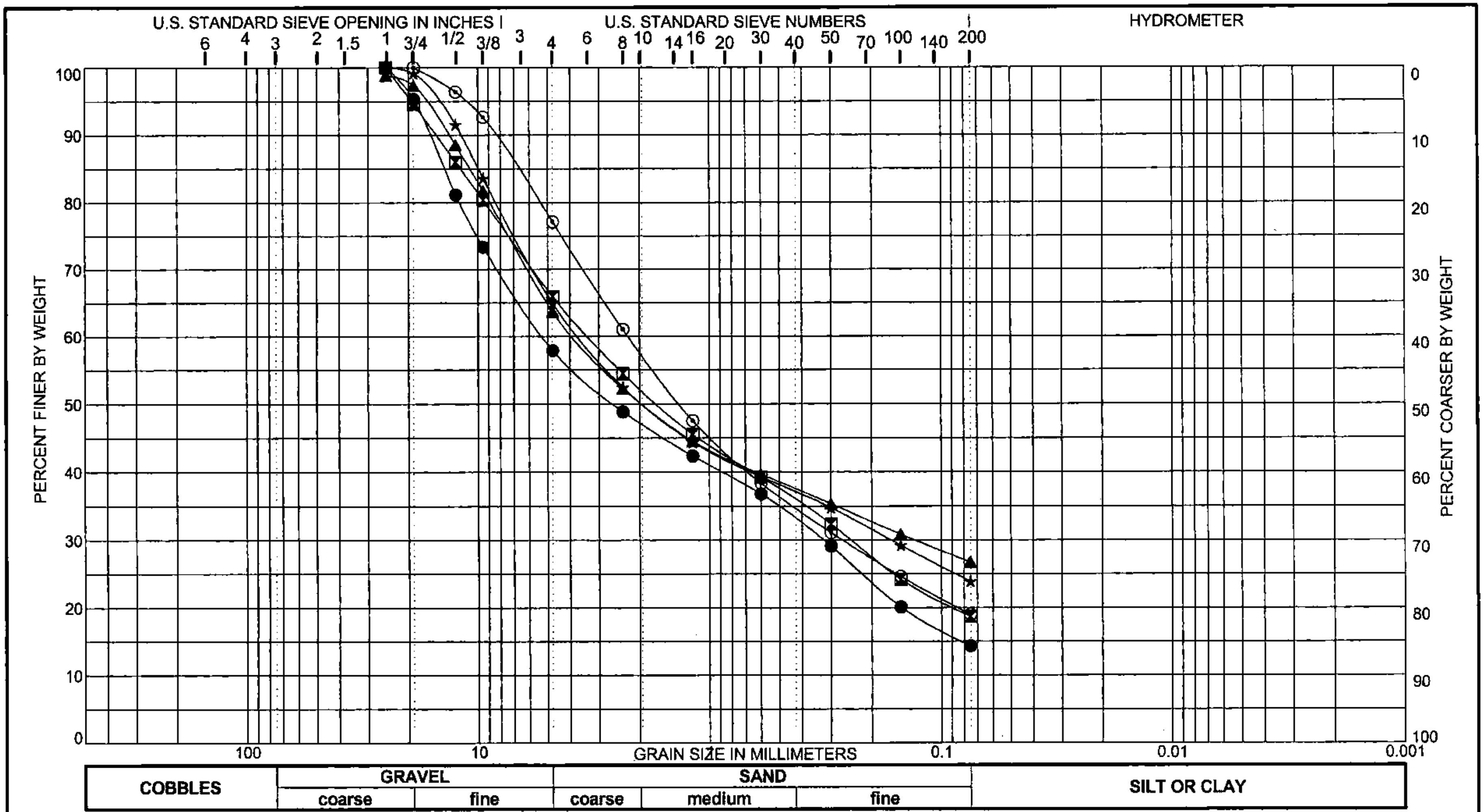
Terracon

Client: *Parsons Brinckerhoff Quade & Douglas, Inc.*
Project: *Nevada Project PRA-LAME 1 (8)*
Project Site *Lake Mead National Recreation Area*
Project No. *64035218*

SIEVE ANALYSES

Date *February 2006*

5



	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	S-11	@	1.0 ft.	SILTY SAND with GRAVEL SM		NP	NP	NP		
⊠	S-12	@	1.0 ft.	SILTY, CLAYEY SAND with GRAVEL SC-SM		26	20	6		
▲	S-13	@	1.0 ft.	SILTY SAND with GRAVEL SM		58	39	19		
★	S-14	@	1.0 ft.	SILTY SAND with GRAVEL SM		53	34	19		
⊙	S-15	@	1.0 ft.	SILTY SAND with GRAVEL SM		29	23	6		

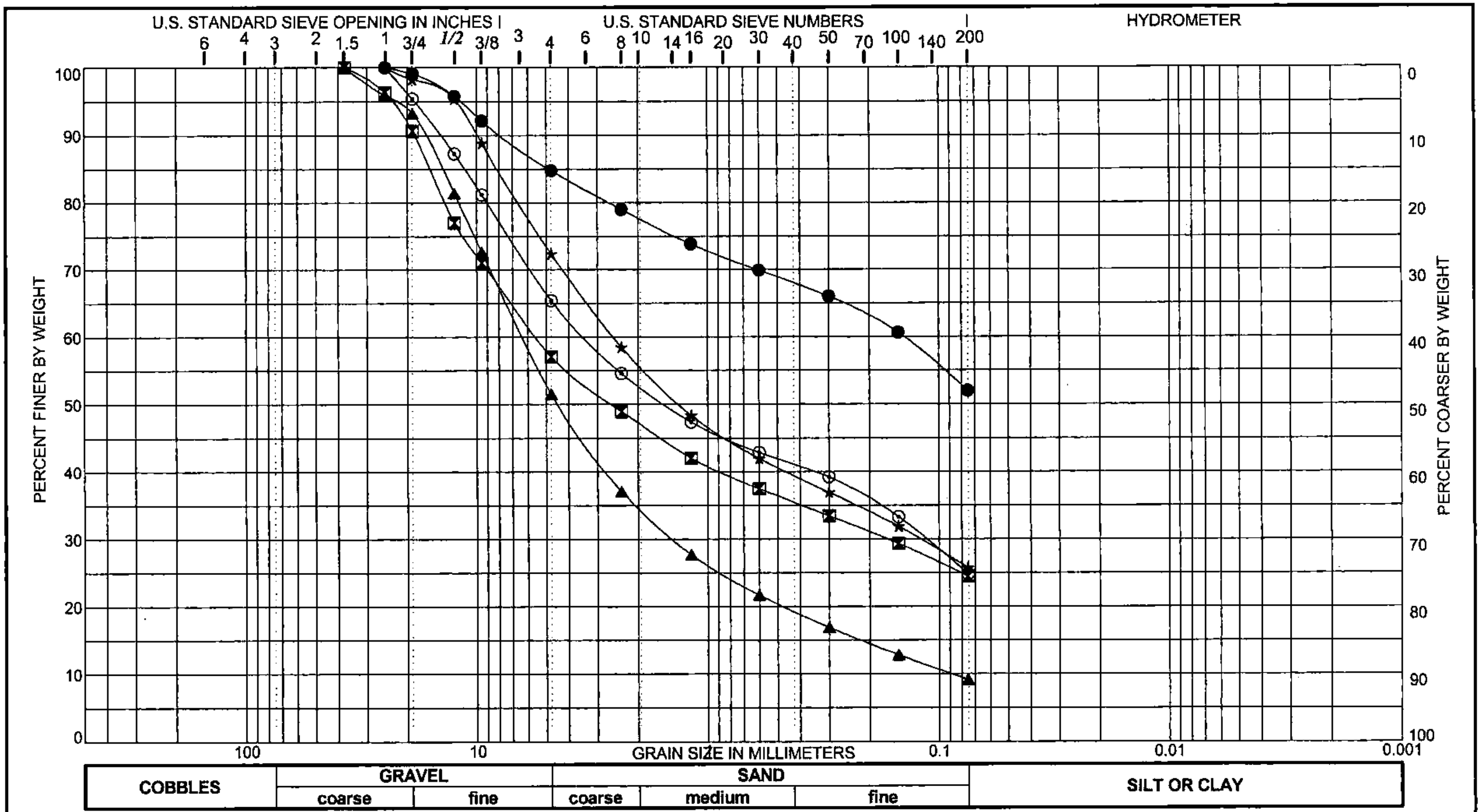
	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	S-11	@	1.0 ft.	25.00	14.01	2.579	0.0815	42.1	43.6	14.3	
⊠	S-12	@	1.0 ft.	25.00	11.90	1.670		34.1	47.2	18.7	
▲	S-13	@	1.0 ft.	25.00	10.84	1.930		35.1	37.0	26.7	
★	S-14	@	1.0 ft.	25.00	9.96	1.918		35.1	41.1	23.8	
⊙	S-15	@	1.0 ft.	19.00	6.75	1.341		22.9	58.1	19.0	

Terracon

Client: *Parsons Brinckerhoff Quade & Douglas, Inc.*
Project: *Nevada Project PRA-LAME 1 (8)*
Project Site *Lake Mead National Recreation Area*
Project No. *64035218*

SIEVE ANALYSES

Date *February 2006* 6



	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	*S-16*	@	*1.0 ft.*	*SANDY LEAN CLAY with GRAVEL CL*		*39*	*16*	*23*		
⊠	*S-17*	@	*1.0 ft.*	*CLAYEY GRAVEL with SAND GC*		*42*	*23*	*20*		
▲	*S-18*	@	*1.0 ft.*	*POORLY GRADED GRAVEL with SILT and SAND GP-GM*		*NP*	*NP*	*NP*	*3.55*	*71.2*
★	*S-19*	@	*1.0 ft.*	*SILTY, CLAYEY SAND with GRAVEL SC-SM*		*21*	*15*	*6*		
⊙	*S-20*	@	*1.0 ft.*	*SILTY, CLAYEY SAND with GRAVEL SC-SM*		*25*	*18*	*6*		

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	*S-16*	@	*1.0 ft.*	*25.00*	*4.85*			*15.2*	*32.8*	*52.0*	
⊠	*S-17*	@	*1.0 ft.*	*37.50*	*15.97*	*2.589*		*43.0*	*32.6*	*24.5*	
▲	*S-18*	@	*1.0 ft.*	*37.50*	*14.20*	*4.424*	*0.2174*	*48.5*	*42.3*	*9.1*	
★	*S-19*	@	*1.0 ft.*	*25.00*	*8.07*	*1.322*		*27.6*	*46.7*	*25.7*	
⊙	*S-20*	@	*1.0 ft.*	*25.00*	*11.28*	*1.520*		*34.6*	*40.6*	*24.8*	

Terracon

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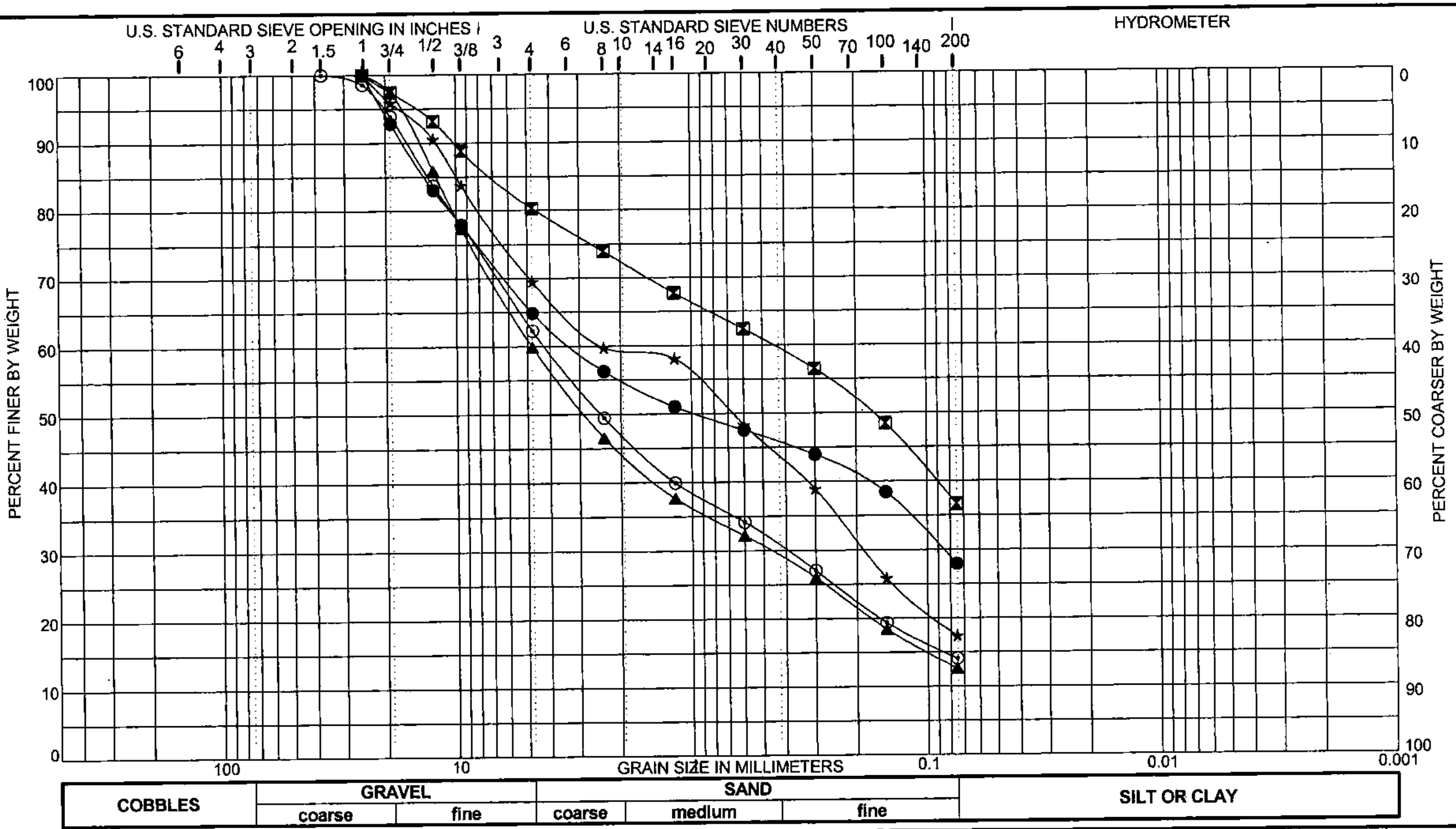
Project: *Nevada Project PRA-LAME 1 (8)*
Project Site *Lake Mead National Recreation Area*
Project No. *64035218*

SIEVE ANALYSES

Date *February 2006* **7**



	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	S-21	@	1.0 ft.	SILTY SAND with GRAVEL SM		20	18	3		
⊠	S-22	@	1.0 ft.	SILTY SAND with GRAVEL SM		NP	NP	NP		
▲	S-23	@	1.0 ft.	SILTY SAND with GRAVEL SM		NP	NP	NP		
★	S-24	@	1.0 ft.	SILTY SAND with GRAVEL SM		NP	NP	NP		
⊙	S-25	@	1.0 ft.	SILTY SAND with GRAVEL SM		NP	NP	NP		

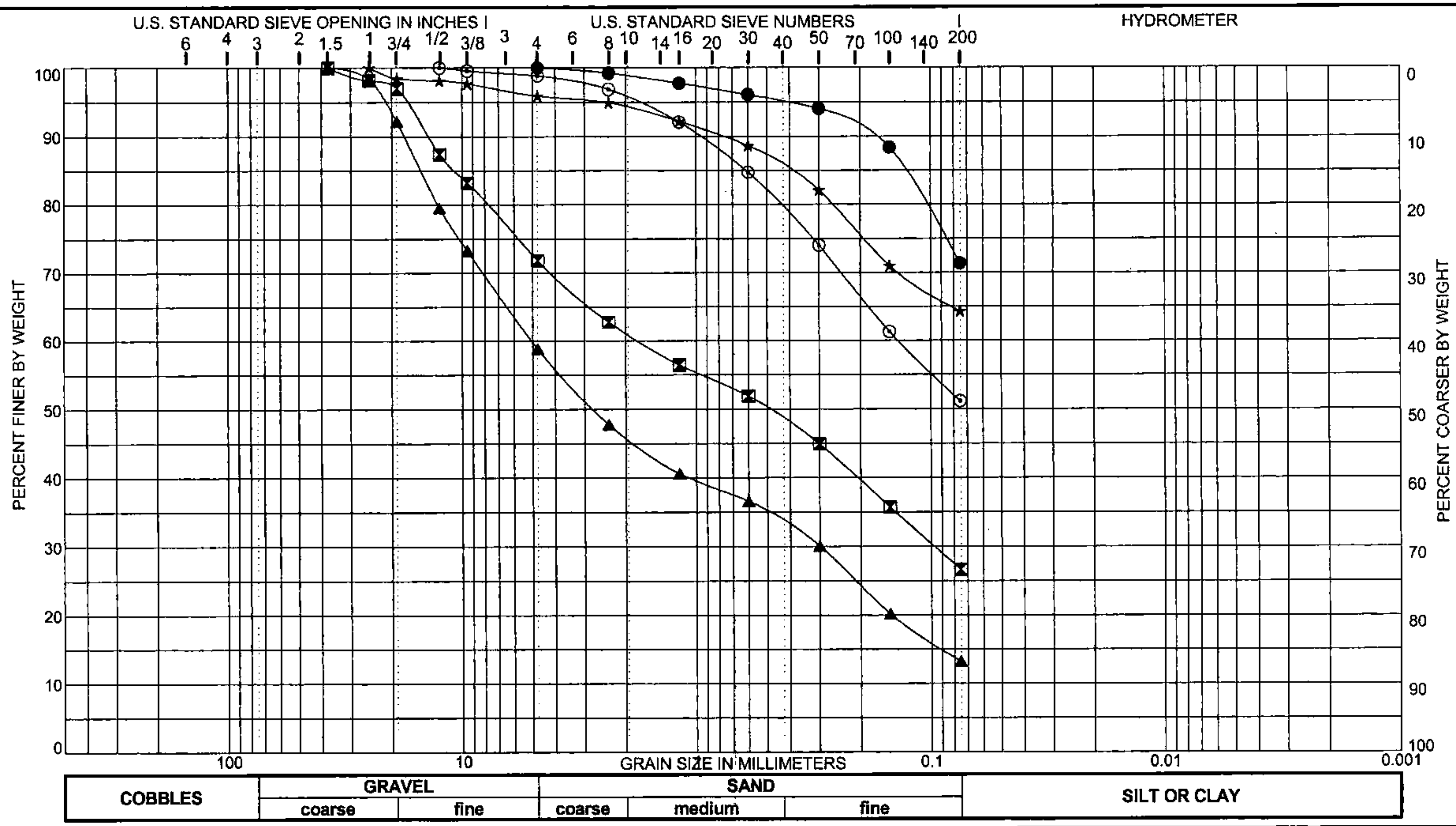
	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	S-21	@	1.0 ft.	25.00	13.61	0.965		35.1	37.0	27.9	
⊠	S-22	@	1.0 ft.	25.00	6.97	0.172		19.7	43.6	36.6	
▲	S-23	@	1.0 ft.	25.00	12.17	2.832	0.0998	40.1	47.2	12.6	
★	S-24	@	1.0 ft.	25.00	10.00	0.675		30.5	52.1	17.4	
⊙	S-25	@	1.0 ft.	37.50	13.19	2.432	0.0848	37.7	48.2	14.1	

Terracon

Client: *Parsons Brinckerhoff Quade & Douglas, Inc.*
Project: *Nevada Project PRA-LAME 1(8)*
Project Site *Lake Mead National Recreation Area*
Project No. *64035218*

SIEVE ANALYSES

Date *February 2006* **8**



	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	S-26	@	1.0 ft.	SILT with SAND ML		NP	NP	NP		
⊠	S-27	@	1.0 ft.	SILTY, CLAYEY SAND with GRAVEL SC-SM		25	21	4		
▲	S-28	@	1.0 ft.	SILTY SAND with GRAVEL SM		NP	NP	NP		
★	S-29	@	1.0 ft.	SANDY LEAN CLAY CL		31	14	17		
⊙	S-30	@	1.0 ft.	SANDY SILTY CLAY CL-ML		24	17	7		

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	S-26	@	1.0 ft.	4.75	0.13			0.0	28.6	71.4	
⊠	S-27	@	1.0 ft.	37.50	10.71	0.496		28.2	45.2	26.6	
▲	S-28	@	1.0 ft.	37.50	15.00	2.721	0.0896	41.2	45.6	13.2	
★	S-29	@	1.0 ft.	25.00	0.41			4.1	31.6	64.3	
⊙	S-30	@	1.0 ft.	12.50	0.62			1.2	47.7	51.2	

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Client: *Parsons Brinckerhoff Quade & Douglas, Inc.*
Project: *Nevada Project PRA-LAME 1 (8)*
Project Site: *Lake Mead National Recreation Area*
Project No. *64035218*

SIEVE ANALYSES

Date *February 2006*

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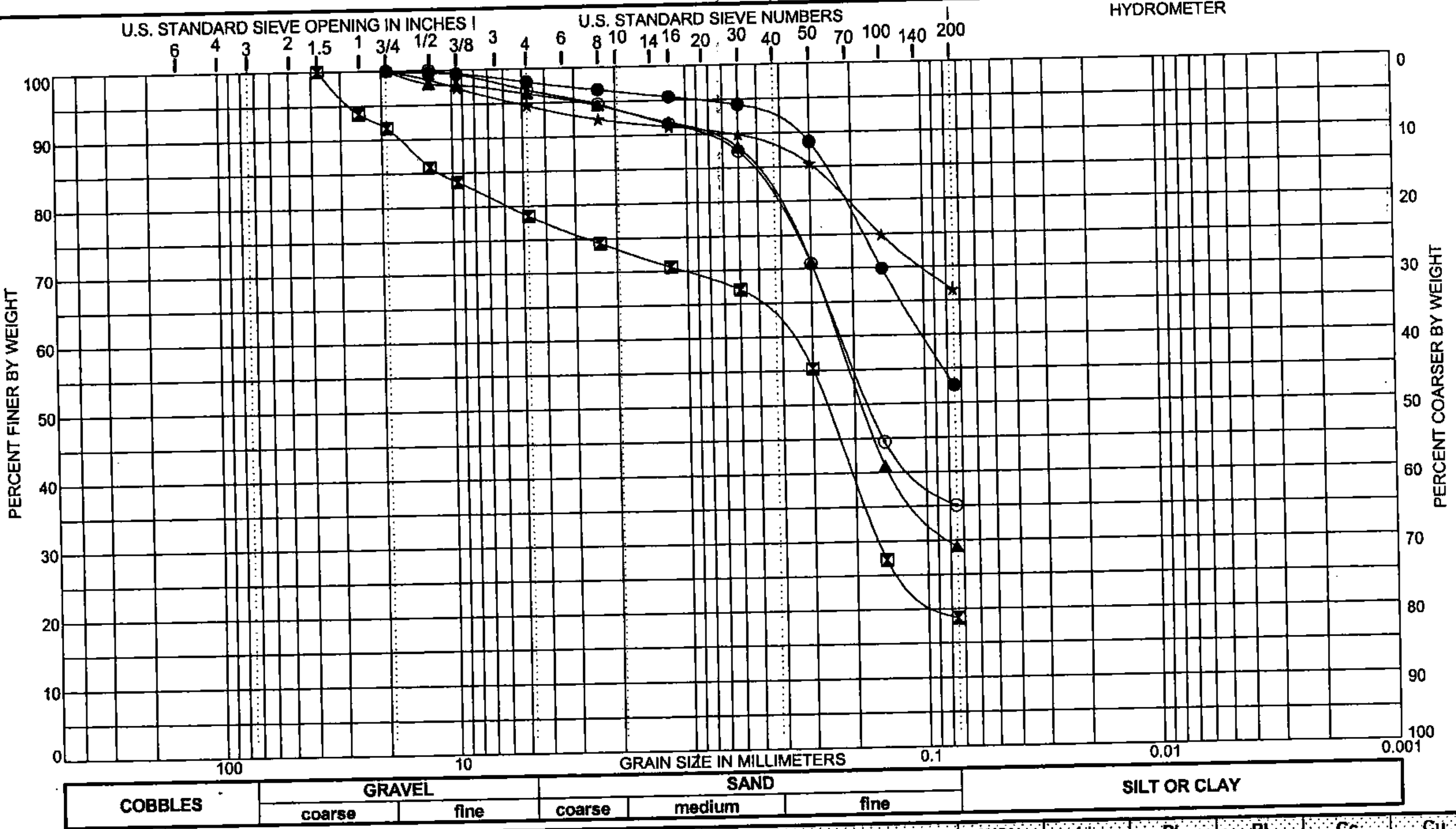

	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	S-31	@	1.0 ft.	SANDY SILTY CLAY CL-ML		22	16	6		
⊠	S-32	@	1.0 ft.	SILTY SAND with GRAVEL SM		NP	NP	NP		
▲	S-33	@	1.0 ft.	CLAYEY SAND SC		44	17	27		
★	S-34	@	1.0 ft.	SANDY SILT ML		NP	NP	NP		
⊙	S-35	@	1.0 ft.	SILTY SAND SM		NP	NP	NP		

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt / %Clay
●	S-31	@	1.0 ft.	19.00	0.26			1.9	45.5	52.5
⊠	S-32	@	1.0 ft.	37.50	11.27	0.263		21.5	59.8	18.6
▲	S-33	@	1.0 ft.	19.00	0.53	0.185		3.6	67.4	29.0
★	S-34	@	1.0 ft.	19.00	0.29			5.4	28.1	66.5
⊙	S-35	@	1.0 ft.	12.50	0.54	0.174		3.0	61.9	35.0

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Client:	Parsons Brinckerhoff Quade & Douglas, Inc.
Project:	Nevada Project PRA-LAME 1 (8)
Project Site	Lake Mead National Recreation Area
Project No.	64035218

SIEVE ANALYSES

Date February 2006

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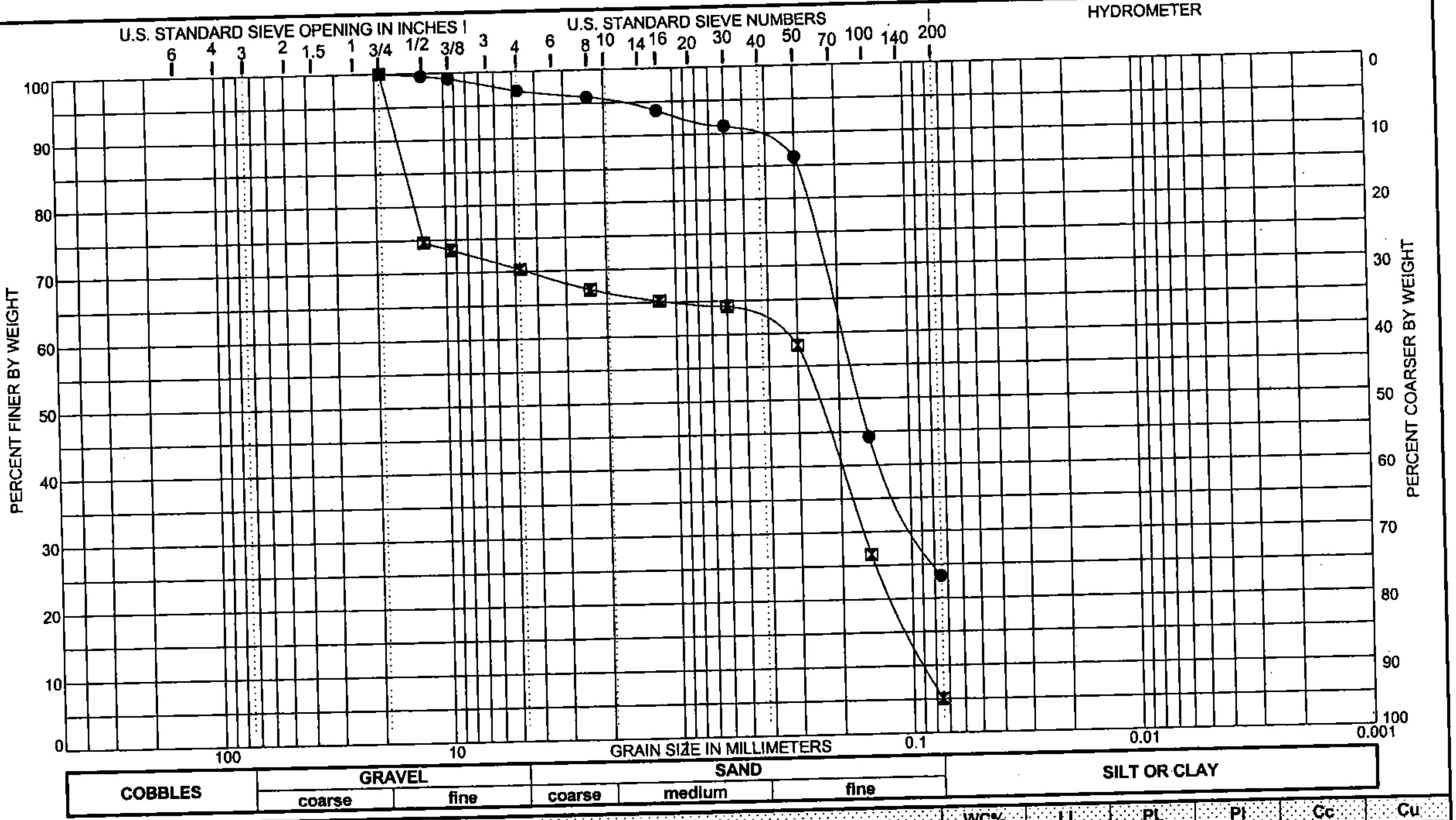

	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	S-36	@	1.0 ft.	SILTY SAND SM		NP	NP	NP		
⊠	S-37	@	1.0 ft.	POORLY GRADED SAND with SILT and GRAVEL SP-SM		18	15	3	0.80	4.2

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	S-36	@	1.0 ft.	19.00	0.29	0.165		2.9	73.8	23.3	
⊠	S-37	@	1.0 ft.	19.00	14.83	0.251	0.1032	29.7	65.2	5.1	

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Project Site Lake Mead National Recreation Area
Project No. 64035218

SIEVE ANALYSES

Date February 2006

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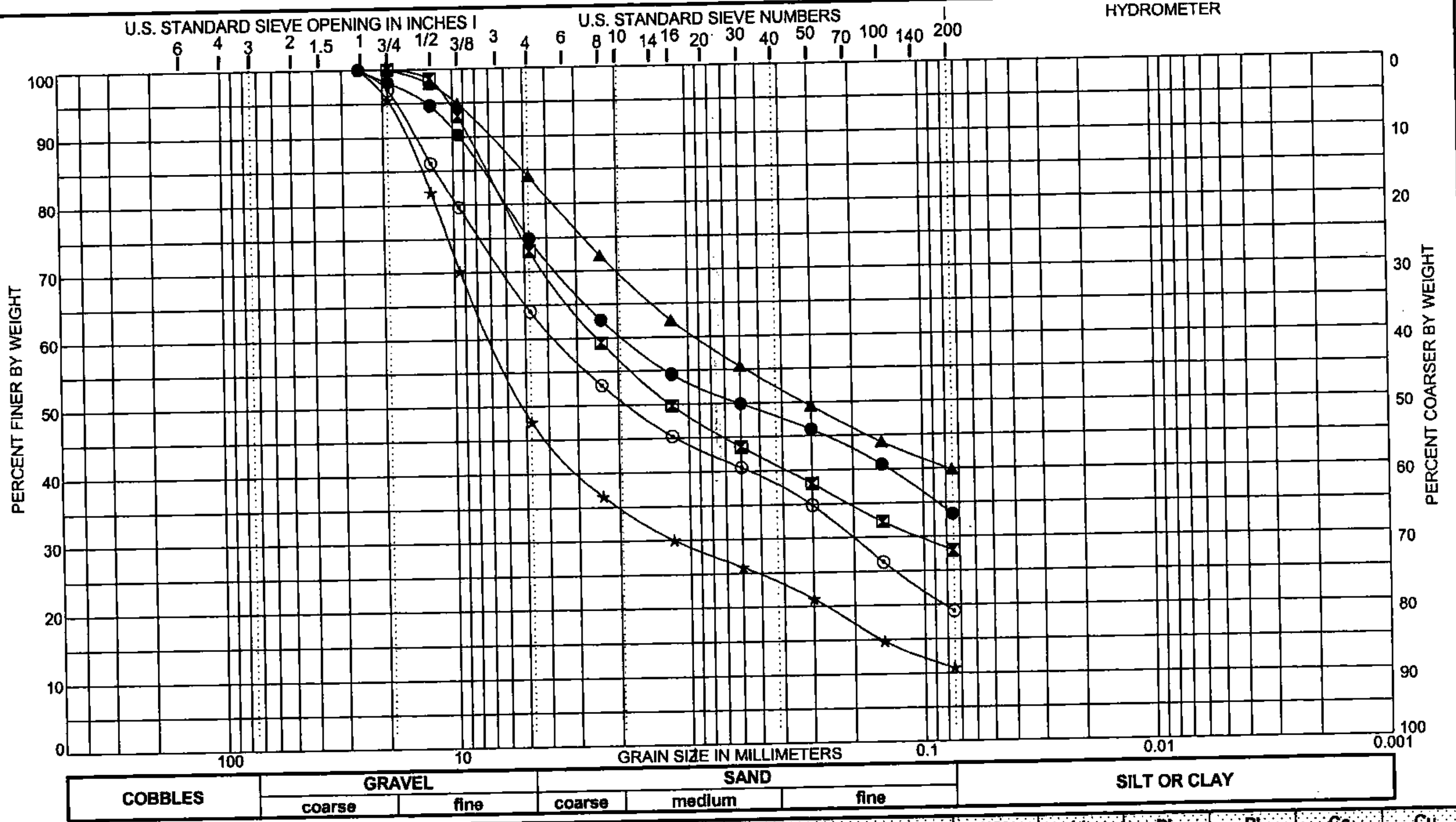

	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	EB- 1	@	0.2 ft.	SILTY SAND with GRAVEL SM		55	33	21		
⊠	EB- 2	@	0.2 ft.	SILTY SAND with GRAVEL SM		63	43	20		
▲	EB- 2	@	2.0 ft.	SILTY SAND with GRAVEL SM		44	38	6		
★	EB- 3	@	0.2 ft.	POORLY GRADED GRAVEL with SILT and SAND GP-GM		NP	NP	NP	3.07	105.9
⊙	EB- 4	@	0.2 ft.	SILTY, CLAYEY SAND with GRAVEL SC-SM		26	20	7		

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	EB- 1	@	0.2 ft.	25.40	7.49	0.605		25.1	41.6	33.3	
⊠	EB- 2	@	0.2 ft.	19.00	7.20	1.199		27.0	45.1	27.9	
▲	EB- 2	@	2.0 ft.	19.00	5.07	0.320		16.0	44.2	39.8	
★	EB- 3	@	0.2 ft.	25.40	13.78	5.106	0.1539	52.4	36.9	10.8	
⊙	EB- 4	@	0.2 ft.	25.40	11.92	1.809		35.9	45.1	19.0	

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Client: Parson Brinckerhoff Quade & Douglas, Inc.
Project: Nevada Project PRA-LAME 1 (8)
Project Site Lake Mead National Recreation Area
Project No. 64055138

SIEVE ANALYSES

Date February 2006

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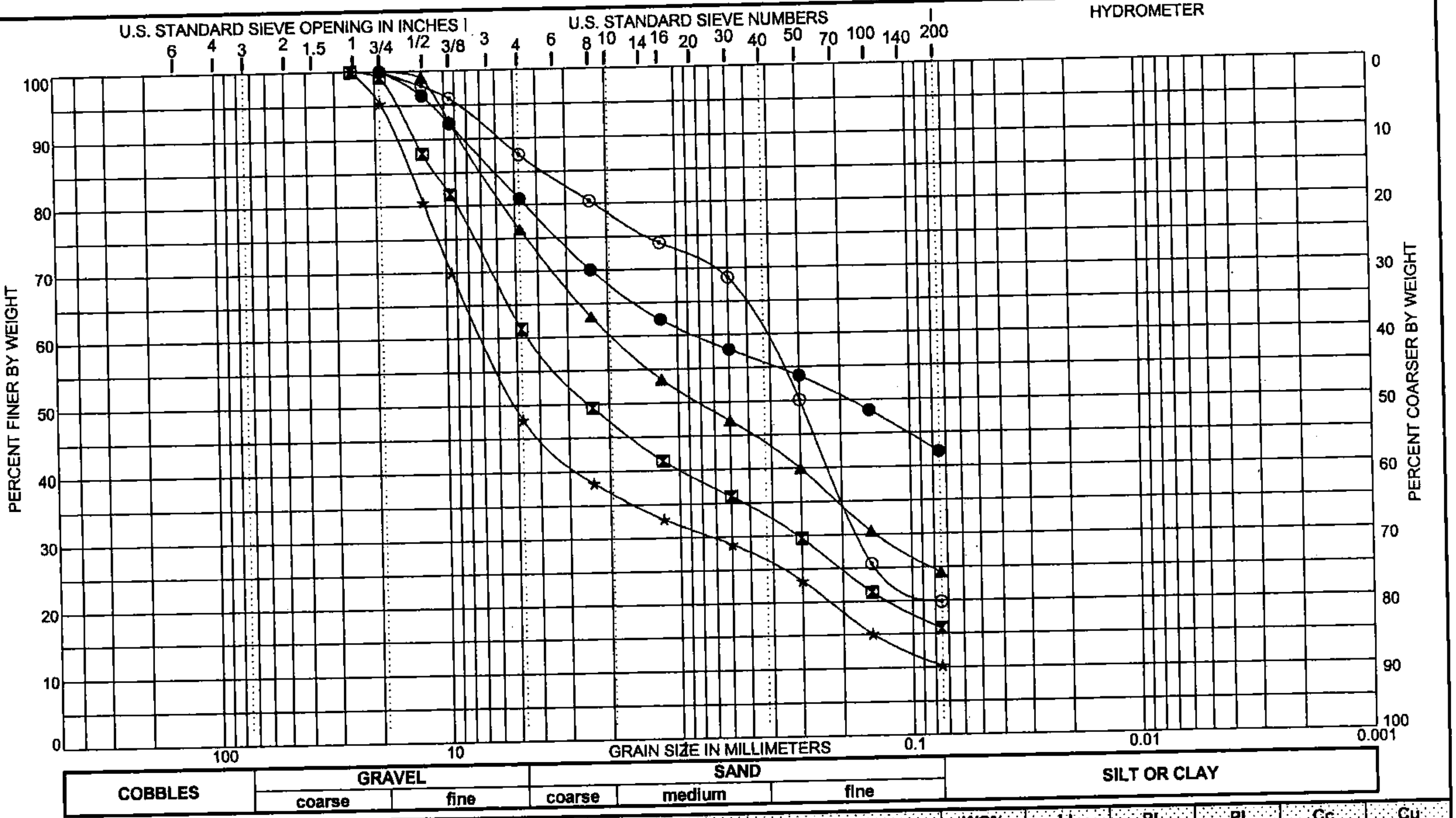

	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	*EB- 4*	@	*2.0 ft.*	*SILTY SAND with GRAVEL SM*		*54*	*36*	*18*		
⊠	*EB- 5*	@	*0.2 ft.*	*SILTY SAND with GRAVEL SM*		*NP*	*NP*	*NP*		
▲	*EB- 5*	@	*2.0 ft.*	*SILTY, CLAYEY SAND with GRAVEL SC-SM*		*23*	*16*	*7*		
★	*EB- 6*	@	*0.2 ft.*	*WELL-GRADED GRAVEL with SILT and SAND GW-GM*		*NP*	*NP*	*NP*	*1.07*	*96.3*
⊙	*EB- 6*	@	*2.0 ft.*	*SILTY SAND SM*		*NP*	*NP*	*NP*		

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	*EB- 4*	@	*2.0 ft.*	*19.00*	*6.11*	*0.185*		*19.1*	*38.7*	*42.1*	
⊠	*EB- 5*	@	*0.2 ft.*	*25.40*	*11.02*	*2.440*		*38.7*	*45.6*	*15.8*	
▲	*EB- 5*	@	*2.0 ft.*	*19.00*	*6.89*	*0.812*		*23.7*	*52.1*	*24.2*	
★	*EB- 6*	@	*0.2 ft.*	*25.40*	*14.19*	*5.090*	*0.1489*	*52.2*	*37.5*	*10.3*	
⊙	*EB- 6*	@	*2.0 ft.*	*19.00*	*3.71*	*0.299*		*12.5*	*67.8*	*19.7*	

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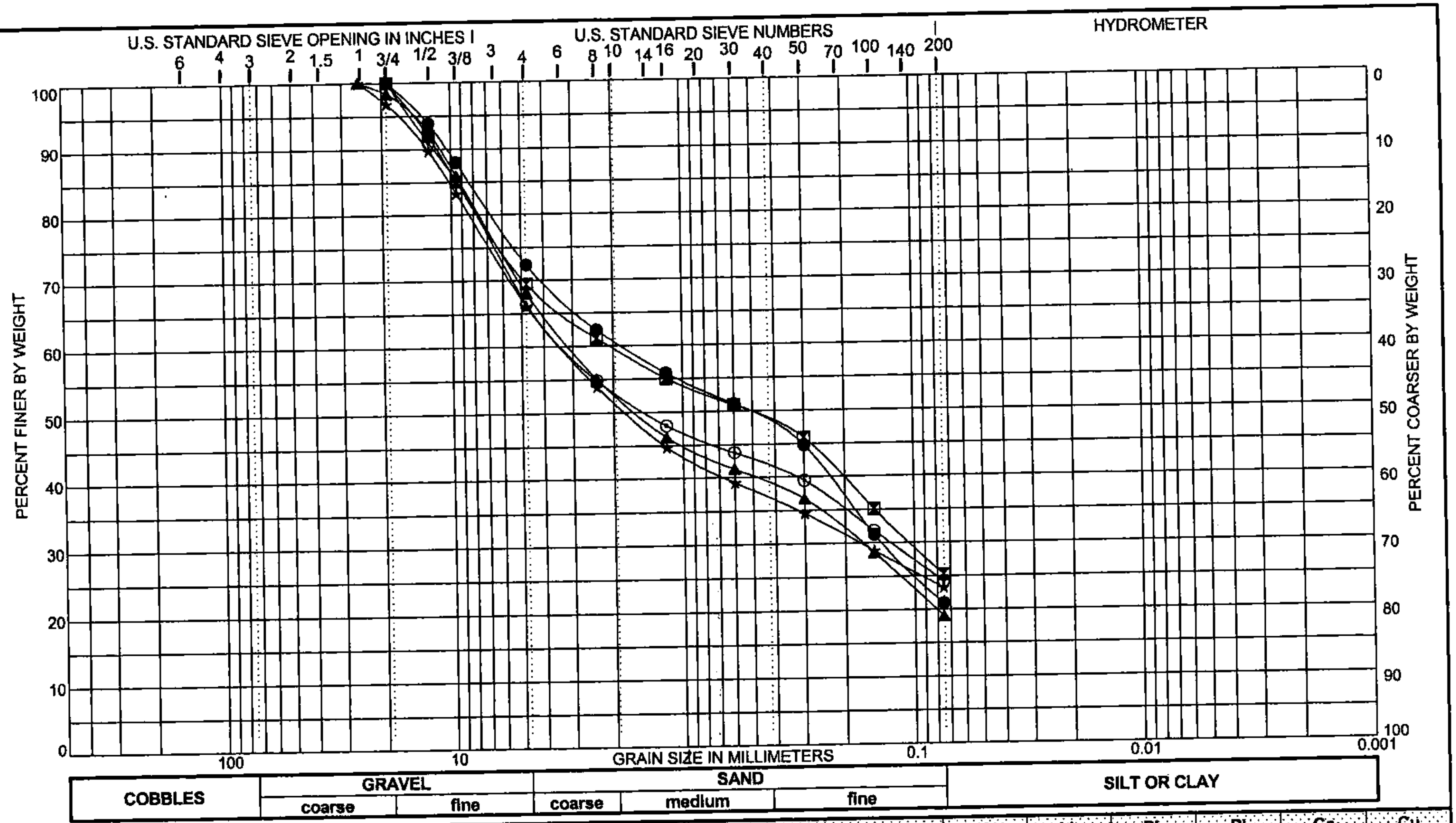
Project Site *Lake Mead National Recreation Area*
Project No. *64055138*

SIEVE ANALYSES

Date *February 2006* 13



	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	EB- 7	@	0.2 ft.	SILTY, CLAYEY SAND with GRAVEL SC-SM		24	19	5		
⊠	EB- 7	@	2.0 ft.	CLAYEY SAND with GRAVEL SC		27	19	9		
▲	EB- 8	@	0.2 ft.	SILTY, CLAYEY SAND with GRAVEL SC-SM		26	20	7		
★	EB- 8	@	2.0 ft.	SILTY SAND with GRAVEL SM		38	26	12		
⊙	EB- 9	@	0.2 ft.	SILTY SAND with GRAVEL SM		34	24	10		

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	EB- 7	@	0.2 ft.	19.00	8.34	0.530		27.6	51.5	20.9	
⊠	EB- 7	@	2.0 ft.	19.00	9.49	0.527		30.6	44.2	25.2	
▲	EB- 8	@	0.2 ft.	25.40	9.18	1.585		31.9	49.0	19.0	
★	EB- 8	@	2.0 ft.	25.40	10.25	1.759		33.9	42.8	23.3	
⊙	EB- 9	@	0.2 ft.	19.00	9.44	1.449		33.6	42.2	24.2	

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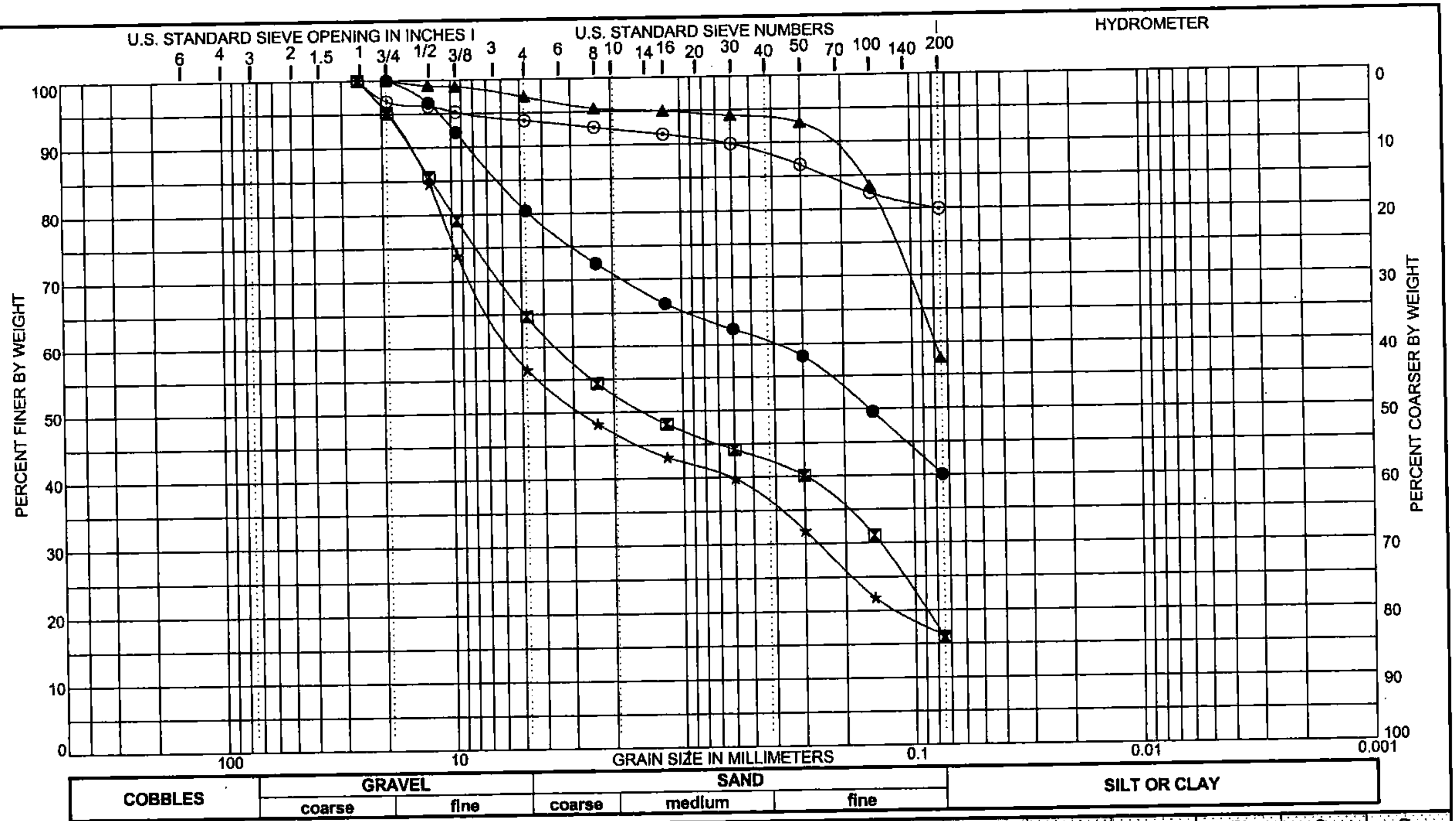
Project Site *Lake Mead National Recreation Area*
Project No. *64055138*

SIEVE ANALYSES

Date *February 2006* 14



	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	EB- 9	@	2.0 ft.	SILTY SAND with GRAVEL SM		43	28	15		
⊠	EB-10	@	0.2 ft.	SILTY SAND with GRAVEL SM		NP	NP	NP		
▲	EB-10	@	2.0 ft.	SANDY SILT ML		NP	NP	NP		
★	OB- 1	@	0.2 ft.	CLAYEY GRAVEL with SAND GC		24	16	8		
⊙	OB- 1	@	2.0 ft.	FAT CLAY with SAND CH		63	23	41		

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	EB- 9	@	2.0 ft.	19.00	6.22	0.156		19.6	40.4	40.0	
⊠	EB-10	@	0.2 ft.	25.40	12.19	1.458		35.4	48.6	16.0	
▲	EB-10	@	2.0 ft.	19.00	0.17			2.7	39.8	57.5	
★	OB- 1	@	0.2 ft.	25.40	12.71	2.740		43.5	40.3	16.2	
⊙	OB- 1	@	2.0 ft.	25.40	0.23			6.2	13.9	79.9	

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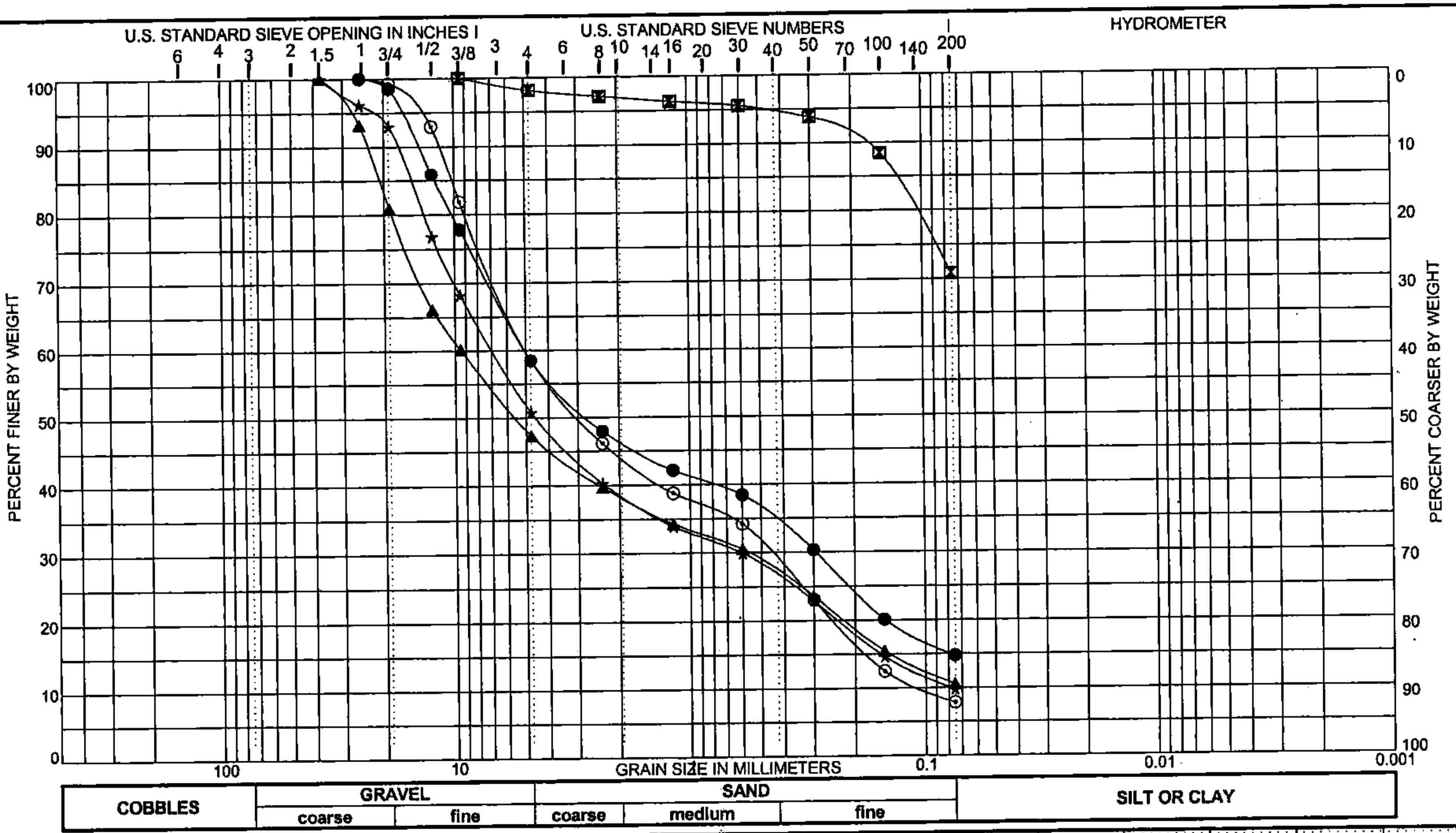
Project Site Lake Mead National Recreation Area
Project No. 64055138

SIEVE ANALYSES

Date February 2006 — 15



	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	*OB-2*	@	*0.2 ft.*	*SILTY SAND with GRAVEL SM*		*NP*	*NP*	*NP*		
⊠	*OB-2*	@	*2.0 ft.*	*LEAN CLAY with SAND CL*		*38*	*18*	*19*		
▲	*OB-3*	@	*0.2 ft.*	*POORLY GRADED GRAVEL with SILT and SAND GP-GM*		*NP*	*NP*	*NP*	*0.50*	*137.2*
★	*OB-3*	@	*2.0 ft.*	*POORLY GRADED GRAVEL with SILT and SAND GP-GM*		*NP*	*NP*	*NP*	*0.71*	*88.8*
⊙	*OB-4*	@	*0.2 ft.*	*POORLY GRADED SAND with SILT and GRAVEL SP-SM*		*NP*	*NP*	*NP*	*0.42*	*48.1*

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt / %Clay
●	*OB-2*	@	*0.2 ft.*	*25.40*	*12.13*	*2.705*	*0.0772*	*41.5*	*43.7*	*14.8*
⊠	*OB-2*	@	*2.0 ft.*	*9.50*	*0.13*			*1.9*	*27.3*	*70.8*
▲	*OB-3*	@	*0.2 ft.*	*37.50*	*20.96*	*5.501*	*0.1405*	*52.7*	*36.7*	*10.6*
★	*OB-3*	@	*2.0 ft.*	*37.50*	*15.47*	*4.520*	*0.1547*	*49.3*	*41.0*	*9.8*
⊙	*OB-4*	@	*0.2 ft.*	*25.40*	*10.28*	*2.939*	*0.1766*	*41.5*	*50.6*	*7.8*

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Project Site *Lake Mead National Recreation Area*
Project No. *64055138*

SIEVE ANALYSES

Date *February 2006*

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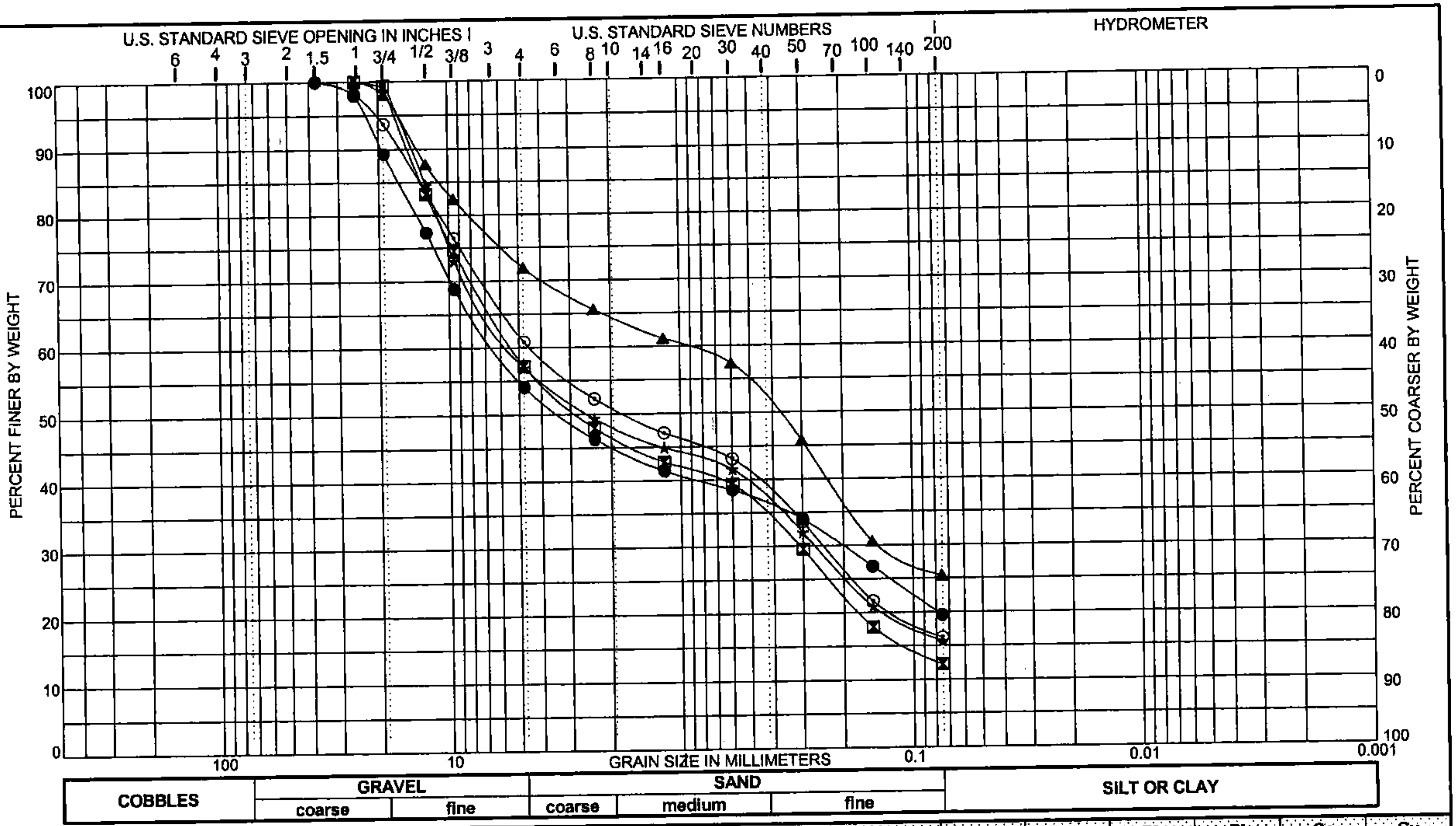

	Specimen Identification			Classification	WC%	LL	PL	PI	Cc	Cu
●	OB- 4	@	2.0 ft.	SILTY, CLAYEY GRAVEL with SAND GC-GM		24	18	6		
⊠	OB- 5	@	0.2 ft.	SILTY SAND with GRAVEL SM		NP	NP	NP	0.32	93.9
▲	OB- 5	@	2.0 ft.	SILTY, CLAYEY SAND with GRAVEL SC-SM		19	14	4		
★	OB- 6	@	0.2 ft.	SILTY, CLAYEY GRAVEL with SAND GC-GM		22	16	6		
⊙	OB- 6	@	2.0 ft.	SILTY SAND with GRAVEL SM		NP	NP	NP		

	Specimen Identification			D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	OB- 4	@	2.0 ft.	37.50	16.37	3.298		46.0	34.5	19.6	
⊠	OB- 5	@	0.2 ft.	25.40	13.13	2.761	0.1055	42.9	44.9	12.3	
▲	OB- 5	@	2.0 ft.	25.40	10.89	0.387		28.1	46.5	25.4	
★	OB- 6	@	0.2 ft.	19.00	12.68	2.512		43.1	41.2	15.7	
⊙	OB- 6	@	2.0 ft.	37.50	13.33	1.740		39.2	44.7	16.2	

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Project: Nevada Project PRA-LAME 1 (8)
Project Site Lake Mead National Recreation Area
Project No. 64055138

SIEVE ANALYSES

Date February 2006

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UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Group Symbol	Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]	SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines Classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay[K,L,M,N]
					Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI lots below "A" line	MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay[K,L,M,P]
					Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A]Based on the material passing the 3-in. (75-mm) sieve

[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C]Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D]Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E]$Cu = D_{60}/D_{10} \quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥ 15% sand, add "with sand" to group name.

[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H]If fines are organic, add "with organic fines" to group name.

[I]If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J]If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K]If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L]If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

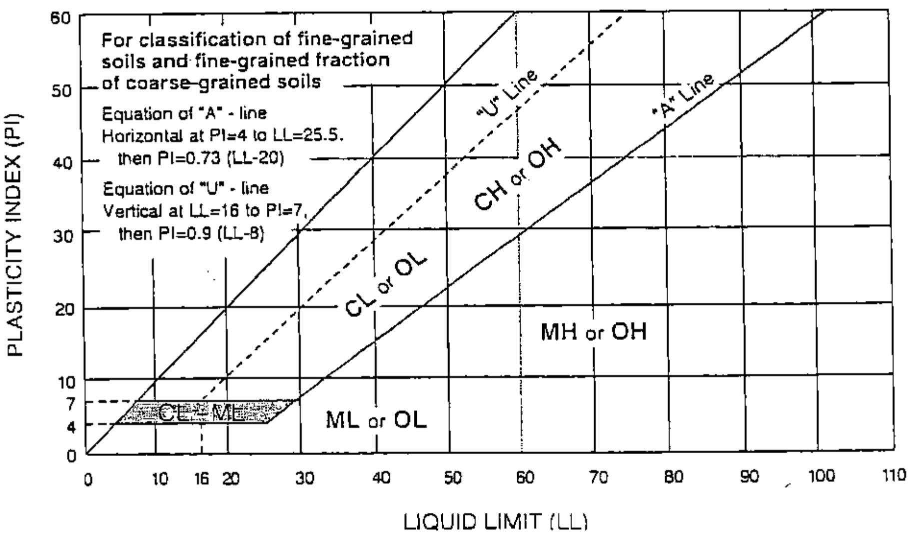
[M]If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N]PI ≥ 4 and plots on or above "A" line.

[O]PI < 4 or plots below "A" line.

[P]PI plots on or above "A" line.

[Q]PI plots below "A" line.



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Atlas Consultants, Inc.

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(702) 383-1199 • Fax (702) 383-4983

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TESTING MATERIALS

ACT LAB NO: 12183(j)

DATE: March 18, 2004

PROJECT NO: 64035218

P.O.:

ANALYZED BY: Robert L. Summers

LAB ID:

WATER SOLUBLE SALT ANALYSIS IN SOIL
1:5 (soil:water) Aqueous Extraction
AWWA 3500-Na D, AWWA 4500 E

SOIL SIEVE SIZE = -10 MESH

Sample No.	Location	Depth (feet)	Sodium (Percent)	Water Soluble Sulfate (SO_4) (Percent)	Total Available Water Soluble Sodium Sulfate (Na_2SO_4) (Percent)
	B-1	0-5	<0.01	0.85	<0.01
	B-1	+0-5	0.01	0.85	0.03
	B-1	10-15	<0.01	0.05	0.01
	B-2	5-10	0.01	0.36	0.03
	B-2	+5-10	<0.01	0.85	0.01
	B-2	15-17.5	0.01	0.24	0.04
	B-3	0-5	<0.01	0.46	<0.01
	B-3	10-15	<0.01	0.12	<0.01
S-37		1-5	<0.01	0.01	<0.01

Robert L. Summers

LABORATORY MANAGER

Notes: The results for each constituent denote the percentage of that analyte, at a 1:5 (soil:water) extraction ratio, which is present in the soil. Sodium was determined by flame photometry, sulfate turbidimetrically, and sodium sulfate by calculation.

Atlas Consultants, Inc.

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ACT LAB NO: 12183(k) **DATE:** March 18, 2004

PROJECT NO: 64035218 **P.O.:**

ANALYZED BY: Robert L. Summers **LAB ID:**

WATER SOLUBLE SALT ANALYSIS IN SOIL
1:5 (soil:water) Aqueous Extraction
AWWA 3500-Na D, AWWA 4500 E
AWWA 2540 C

SOIL SIEVE SIZE = -10 MESH

Sample No.	Location	Depth (feet)	Sodium (Percent)	Water Soluble Sulfate (SO_4) (Percent)	Total Available Water Soluble Sodium Sulfate (Na_2SO_4) (Percent)
	B-4	5-10	0.42	1.76	1.30
Solubility = 3.11%					
	B-5	0-5	0.51	1.82	1.58
Solubility = 3.47%					
	B-9	1-5	0.57	2.20	1.77
Solubility = 3.43%					

Robert L. Summers

LABORATORY MANAGER

Notes: The results for each constituent denote the percentage of that analyte, at a 1:5 (soil:water) extraction ratio, which is present in the soil. Sodium was determined by flame photometry, sulfate turbidimetrically, and sodium sulfate by calculation.

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ACT LAB NO: 12197(j) **DATE:** March 25, 2004

PROJECT NO: 64035218 **P.O.:**

ANALYZED BY: Robert L. Summers **LAB ID:**

WATER SOLUBLE SALT ANALYSIS IN SOIL

1:5 (soil:water) Aqueous Extraction
AWWA 3500-Na D, AWWA 4500 E
AWWA 2540 C

SOIL SIEVE SIZE = -10 MESH

Sample No.	Location	Depth (feet)	Sodium (Percent)	Water Soluble Sulfate (SO_4) (Percent)	Total Available Water Soluble Sodium Sulfate (Na_2SO_4) (Percent)
	B-6	0-5	0.11	1.19	0.33
Solubility = 1.72%					
	B-7	0-5	<0.01	0.92	0.01
Solubility = 1.22%					
	B-7	6-8	0.05	1.35	0.15
Solubility = 1.79%					

Robert L. Summers

LABORATORY MANAGER

Notes: The results for each constituent denote the percentage of that analyte, at a 1:5 (soil:water) extraction ratio, which is present in the soil. Sodium was determined by flame photometry, sulfate turbidimetrically, and sodium sulfate by calculation.

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ACT LAB NO: 12197(p) **DATE:** March 29, 2004

PROJECT NO: 64035218 **P.O.:**

ANALYZED BY: Robert L. Summers **LAB ID:**

WATER SOLUBLE SALT ANALYSIS IN SOIL
1:5 (soil:water) Aqueous Extraction
AWWA 3500-Na D, AWWA 4500 E
AWWA 2540 C

SOIL SIEVE SIZE = -10 MESH

Sample No.	Location	Depth (feet)	Sodium (Percent)	Water Soluble Sulfate (SO_4) (Percent)	Total Available Water Soluble Sodium Sulfate (Na_2SO_4) (Percent)
	B-6	5-10	0.43	2.36	1.34

Solubility = 3.06%

LABORATORY MANAGER

Notes: The results for each constituent denote the percentage of that analyte, at a 1:5 (soil:water) extraction ratio, which is present in the soil. Sodium was determined by flame photometry, sulfate turbidimetrically, and sodium sulfate by calculation.

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AMERICAN BOARD OF FORENSIC EXAMINERS
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ACT LAB NO: 12035(f) **DATE:** January 12, 2004

PROJECT NO: 64035218 **P.O.:**

ANALYZED BY: Robert L. Summers **LAB ID:**

WATER SOLUBLE SALT ANALYSIS IN SOIL
1:5 (soil:water) Aqueous Extraction
AWWA 3500-Na D, AWWA 4500 E
AWWA 2540 C

SOIL SIEVE SIZE = -10 MESH

Sample No.	Location	Depth (feet)	Sodium (Percent)	Water Soluble Sulfate (SO_4) (Percent)	Total Available Water Soluble Sodium Sulfate (Na_2SO_4) (Percent)
	B-9	1-5	0.01	0.03	0.02
Solubility = 0.13%					
	B-15	1-5	<0.01	0.01	<0.01
Solubility = 0.08%					
S-2		1-5	<0.01	0.82	0.01
Solubility = 1.13%					

Robert L. Summers

LABORATORY MANAGER

Notes: The results for each constituent denote the percentage of that analyte, at a 1:5 (soil:water) extraction ratio, which is present in the soil. Sodium was determined by flame photometry, sulfate turbidimetrically, and sodium sulfate by calculation.

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ACT LAB NO: 12035(k)

PROJECT NO: 64035218

ANALYZED BY: Robert L. Summers

DATE: January 15, 2004

P.O.:

LAB ID:

WATER SOLUBLE SALT ANALYSIS IN SOIL

1:5 (soil:water) Aqueous Extraction
AWWA 3500-Na D, AWWA 4500 E

SOIL SIEVE SIZE = -10 MESH

Sample No.	Location	Depth (feet)	Sodium (Percent)	Water Soluble Sulfate (SO_4) (Percent)	Total Available Water Soluble Sodium Sulfate (Na_2SO_4) (Percent)
	S-20	1-5	<0.01	0.77	0.01
	S-25	1-5	<0.01	0.90	0.01
	S-29	1-5	0.16	1.44	0.50

Robert L. Summers

LABORATORY MANAGER

Notes: The results for each constituent denote the percentage of that analyte, at a 1:5 (soil:water) extraction ratio, which is present in the soil. Sodium was determined by flame photometry, sulfate turbidimetrically, and sodium sulfate by calculation.

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ACT LAB NO: 12035(I)

DATE: January 15, 2004

PROJECT NO: 64035218

P.O.:

ANALYZED BY: Robert L. Summers

LAB ID:

WATER SOLUBLE SALT ANALYSIS IN SOIL

1:5 (soil:water) Aqueous Extraction
AWWA 3500-Na D, AWWA 4500 E
AWWA 2540 C

SOIL SIEVE SIZE = -10 MESH

Sample No.	Location	Depth (feet)	Sodium (Percent)	Water Soluble Sulfate (SO_4) (Percent)	Total Available Water Soluble Sodium Sulfate (Na_2SO_4) (Percent)
	S-26	1-5	<0.01	0.82	<0.01
Solubility = 1.11%					
	S-33	1-5	0.03	0.94	0.09
Solubility = 1.30%					
	S-34	1-5	<0.01	0.87	0.01
Solubility = 1.17%					
	S-35	1-5	<0.01	0.86	<0.01
Solubility = 1.12%					

LABORATORY MANAGER

Notes: The results for each constituent denote the percentage of that analyte, at a 1:5 (soil:water) extraction ratio, which is present in the soil. Sodium was determined by flame photometry, sulfate turbidimetrically, and sodium sulfate by calculation.

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ACT LAB NO: 13507(b)

DATE: December 21, 2005

PROJECT NO: 64055150

P.O. :

LAB ID:

ANALYZED BY: Kurt D. Ergun

WATER SOLUBLE SALT ANALYSIS IN SOIL
1:5 (soil:water) Aqueous Extraction
AWWA 3500-Na D, AWWA 4500 E
ASTM C 471, AWWA 2540 C

Sample Date	Sample Designation	Gypsum (Percent)	Sodium (Percent)	Water Soluble Sulfate (SO_4) (Percent)	Total Available Water Soluble Sodium Sulfate(Na_2SO_4) (Percent)
	EB-9 @ 2.0'	7.62	<0.01	0.42	0.01

Solubility = 1.12%

LABORATORY MANAGER

Notes: The results for each constituent denote the percentage of that analyte, at a 1:5 (soil:water) extraction ratio, which is present in the soil. Sodium was determined by flame photometry, sulfate turbidimetrically, and sodium sulfate by calculation.

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ACT LAB NO:	13592(a)	**DATE:**	February 13, 2006
PROJECT NO:	64055138	**P.O.:**	
ANALYZED BY:	Kurt D. Ergun	**LAB ID:**	

WATER SOLUBLE SALT ANALYSIS IN SOIL

1:5 (soil:water) Aqueous Extraction
AWWA 3500-Na D, AWWA 4500 E

SOIL SIEVE SIZE = -10 MESH

Sample No.	Location	Depth (feet)	Sodium (Percent)	Water Soluble Sulfate (SO_4) (Percent)	Total Available Water Soluble Sodium Sulfate (Na_2SO_4) (Percent)
	EB-2	2.0	0.11	0.49	0.33
	EB-6	2.0	<0.01	0.01	0.01
	OB-5	4.0	0.01	0.02	0.02

LABORATORY MANAGER

Notes: The results for each constituent denote the percentage of that analyte, at a 1:5 (soil:water) extraction ratio, which present in the soil. Sodium was determined by flame photometry, sulfate turbidimetrically, and sodium sulfate by calculation.

	SAMPLE LOCATION AND DEPTH										
Mile Post	33.48	33.48	33.48	33.51	33.51	33.51	42.49	42.49	43.25	43.38	45.22
Boring No.	B-1	B-1	B-1	B-2	B-2	B-2	B-3	B-3	B-4	B-5	B-6
Depth (ft.)	0 - 5	9 - 14	19 – 24	0-5	17 - 22	28 – 30	0 - 5	10 - 15	5 – 10	0 – 5	0 - 5
Sieve											
6"											
3"											
2"	100										
1 1/2"	93	100					100				
1"	79	97					87	100			100
3/4"	71	97		100		100	80	99		100	99
1/2"	63	94	100	99	100	99	74	91		99	96
3/8"	55	90	99	98	99	98	71	89	100	98	95
4	45	80	96	97	96	96	62	74	99	91	91
8	36	71	93	96	92	92	52	61	98	86	89
16	30	62	88	91	86	87	44	52	97	83	87
30	25	54	84	86	83	84	39	46	96	80	84
50	21	44	75	80	75	75	32	39	95	76	75
100	15	28	54	69	53	53	21	26	93	67	54
200	13	16	39	51	34	35	15	20	90	58	46
Liquid Limit	NP	NP	19	NP	NP	NP	NP	NP	46	34	19
Plasticity Index	NP	NP	8	NP	NP	NP	NP	NP	28	19	5
R-Value									< 5	20	25
Expansion Potential (%)											
Solubility (%)									3.11	3.47	1.72
Sulfate (%)	0.85	0.85	0.05	0.85	0.36	0.24	0.46	0.12	1.76	1.82	1.19
Sodium Sulfate (%)	0.03	<0.01	0.01	0.01	0.03	0.04	<0.01	<0.01	1.30	1.58	0.33
USCS Classification	GM	SM	SC	ML	SM	SM	SM	SM	CL	CL	SC-SM
ASSHTO Classification	A-1-a	A-1-b	A-4	A-4	A-2-4	A-2-4	A-1-b	A-1-b	A-7-6	A-6	A-4

NP = Non Plastic

	SAMPLE LOCATION AND DEPTH										
Mile Post	45.22	45.38	45.38	45.06	29.0	29.5	30.0	30.5	31.0	31.5	32.0
Boring No.	B-6	B-7	B-7	B – 8	S-1	S-2	S-3	S-4	S-5	S-6	S-7
Depth (ft.)	5 – 10	0 - 5	6 - 8	1 – 5	1-5	1-5	1-5	1-5	1-5	1-5	1-5
Sieve											
6"											
3"											
2"					100				100		
1 1/2"					94		100	100	93	100	100
1"					90		97	98	85	94	96
3/4"	100				82	100	93	93	79	88	93
1/2"	99	100		100	74	99	80	80	70	80	85
3/8"	99	99	100	99	59	98	73	74	67	74	79
4	98	98	99	98	48	95	54	60	58	60	64
8	97	97	98	97	42	91	42	49	50	51	53
16	96	95	97	96	38	87	35	43	44	43	44
30	94	90	95	93	35	84	30	37	40	38	36
50	88	80	91	87	26	82	26	34	36	33	30
100	82	68	86	82	16	79	21	27	31	26	23
200	76	59	84	79	14	60	15	21	24	20	17
Liquid Limit	46	27	49	56	NP	NP	NP	27	26	24	NP
Plasticity Index	28	13	33	40	NP	NP	NP	8	5	6	NP
R-Value	<5	31		<5		44		67	77		70
Expansion Potential (%)					0.2						0.4
Solubility (%)	3.06	1.22	1.79	3.43		1.13					
Sulfate (%)	2.36	0.92	1.35	2.20		0.82					
Sodium Sulfate (%)	1.34	0.01	0.15	1.77		0.01					
USCS Classification	CL	CL	CL	CH	GM	ML	GM	GC	GC-GM	SC-SM	SM
ASSHTO Classification	A–7-6	A-6	A-7-6	A-7-6	A-1-b	A-4	A-1-a	A-2-4	A-1-b	A-1-b	A-1-b

NP = Non Plastic

	SAMPLE LOCATION AND DEPTH										
Mile Post	32.5	33.0	33.5	34.0	34.5	35.0	35.5	36.0	36.5	37.0	37.5
Boring No.	S-8	S-9	S-10	S-11	S-12	S-13	S-14	S-15	S-16	S-17	S-18
Depth (ft.)	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5
Sieve											
6”											
3”											
2”											
1 1/2”	100		100							100	100
1”	98	100	97	100	100	100	100		100	96	96
3/4”	96	96	96	95	95	97	99	100	99	91	93
1/2”	86	89	90	81	86	88	92	97	96	77	81
3/8”	81	84	88	74	80	81	84	93	92	71	72
4	70	71	79	57	66	64	65	77	85	56	51
8	61	58	67	49	55	52	53	61	79	49	37
16	54	49	56	42	45	45	45	47	74	42	28
30	47	42	49	36	39	44	39	39	70	38	22
50	41	35	42	29	32	35	35	31	66	34	16
100	31	27	34	20	24	30	29	25	61	29	13
200	24	20	27	14	19	26	24	19	52	24	9
Liquid Limit	21	16	19	NP	26	58	53	29	39	42	NP
Plasticity Index	6	1	4	NP	6	19	19	6	23	20	NP
R-Value			80	80			74		8	59	
Expansion Potential (%)									7.4		
Solubility (%)		0.13							0.08		
Sulfate (%)		0.03							0.01		
Sodium Sulfate (%)		0.02							0.01		
USCS Classification	SC-SM	SM	SC-SM	SM	SC-SM	SM	SM	SM	CL	GC	GP-GM
ASSHTO Classification	A-1-b	A-1-b	A-2-4	A-1-b	A-1-b	A-2-7	A-2-7	A-1-b	A-6	A-2-7	A-1-a

NP = Non Plastic

	SAMPLE LOCATION AND DEPTH										
Mile Post	38.0	38.5	39.0	39.5	40.0	40.5	41.0	41.5	42.0	42.5	43.0
Boring No.	S-19	S-20	S-21	S-22	S-23	S-24	S-25	S-26	S-27	S-28	S-29
Depth (ft.)	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5
Sieve											
6”											
3”											
2”											
1 1/2”							100		100	100	
1”	100	100	100	100	100	100	98		98	98	100
3/4”	98	95	93	97	97	96	94		97	93	99
1/2”	96	87	83	93	86	90	84		87	84	98
3/8”	88	81	77	88	76	84	77		84	73	97
4	72	65	65	80	60	70	62	100	72	59	96
8	58	55	56	74	46	60	50	99	63	48	95
16	49	47	51	68	37	58	40	97	56	45	92
30	42	43	48	63	32	48	34	96	52	36	88
50	37	39	44	56	26	39	26	94	45	30	83
100	32	34	38	48	18	26	20	88	36	20	71
200	25	25	28	36	13	18	14	71	27	13	64
Liquid Limit	21	25	20	NP	NP	NP	NP	NP	25	NP	31
Plasticity Index	6	6	3	NP	NP	NP	NP	NP	4	NP	17
R-Value		78		74	80			60		81	
Expansion Potential (%)											6.9
Solubility (%)								1.11			
Sulfate (%)		0.77					0.90	0.82			1.44
Sodium Sulfate (%)		0.01					0.01	<0.01			0.50
USCS Classification	SC-SM	SC-SM	SM	SM	SM	SM	SM	ML	SC-SM	SM	CL
ASSHTO Classification	A-2-4	A-2-4	A-2-4	A-4	A-1-a	A-1-b	A-1-b	A-4	A-2-4	A-1-b	A-6

NP = Non Plastic

	SAMPLE LOCATION AND DEPTH										
Mile Post	43.5	44.0	44.5	45.0	45.5	46.0	46.5	47.0	0.25	0.75	0.75
Boring No.	S-30	S-31	S-32	S-33	S-34	S-35	S-36	S-37	EB-1	EB-2	EB-2
Depth (ft.)	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	0.2-1	0.2-1	2-5
Sieve											
6”											
3”											
2”											
1 1/2”			100								
1”			94						100		
3/4”		100	92	100	100		100	100	98	100	100
1/2”	100	99	86	98	98	100	99	74	95	99	98
3/8”	99	98	84	97	97	99	98	73	90	93	95
4	98	97	78	96	95	97	97	70	75	73	84
8	97	96	74	94	93	95	96	68	63	59	72
16	92	95	71	91	91	92	94	65	54	50	63
30	85	94	66	88	90	87	91	64	50	44	55
50	74	88	55	71	85	71	86	58	46	38	49
100	61	70	27	41	75	44	44	26	41	32	44
200	51	53	19	29	67	35	23	5	33	28	40
Liquid Limit	24	22	NP	44	NP	NP	NP	18	55	63	44
Plasticity Index	7	6	NP	27	NP	NP	NP	3	21	43	6
R-Value		40					76	65			58
Expansion Potential (%)		4.0		0.4							
Solubility (%)				1.30	1.17	1.12					
Sulfate (%)				0.94	0.87	0.86		0.01			0.49
Sodium Sulfate (%)				0.09	0.01	<0.01		<0.01			0.33
USCS Classification	CL-ML	CL-ML	SM	SC	ML	SM	SM	SP-SM	SM	SM	SM
ASSHTO Classification	A-4	A-4	A-2-4	A-2-7	A-4	A-2-4	A-2-4	A-2-4	A-2-7	A-2-7	A-5

NP = Non Plastic

	SAMPLE LOCATION AND DEPTH										
Mile Post	1.25	1.75	1.75	2.25	2.25	2.75	2.75	3.25	3.25	3.75	3.75
Boring No.	EB-3	EB-4	EB-4	EB-5	EB-5	EB-6	EB-6	EB-7	EB-7	EB-8	EB-8
Depth (ft.)	0.2-1	0.2-1	2-5	0.2-1	2-5	0.2-1	2-5	0.2-1	2-5	0.2-1	2-5
Sieve											
6”											
3”											
2”											
1 1/2”											
1”	100	100		100		100				100	100
3/4”	95	97	100	99	100	95	100	100	100	98	97
1/2”	82	86	96	88	99	81	98	94	92	93	90
3/8”	70	80	92	82	93	70	96	88	85	86	83
4	48	64	81	61	76	48	88	72	69	68	66
8	37	53	70	49	63	38	80	62	61	55	54
16	30	45	62	41	53	33	74	56	55	46	45
30	26	41	58	36	47	29	69	51	51	41	39
50	21	35	54	30	40	23	50	45	46	37	35
100	15	26	48	21	30	15	26	31	35	29	29
200	11	19	42	16	24	10	20	21	25	19	23
Liquid Limit	NP	26	54	NP	23	NP	NP	24	27	26	38
Plasticity Index	NP	7	18	NP	7	NP	NP	5	9	7	12
R-Value			48		52		68		44		59
Expansion Potential (%)											
Solubility (%)											
Sulfate (%)							0.01				
Sodium Sulfate (%)							0.01				
USCS Classification	GP-GM	SC-SM	SM	SM	SC-SM	GW-GM	SM	SC-SM	SC	SC-SM	SM
ASSHTO Classification	A-1-a	A-2-4	A-7-5	A-1-b	A-2-4	A-1-a	A-2-4	A-1-b	A-2-4	A-2-4	A-2-6

NP = Non Plastic

	SAMPLE LOCATION AND DEPTH										
Mile Post	4.25	4.25	4.70	4.70	0.25	0.25	0.75	0.75	1.25	1.25	1.75
Boring No.	EB-9	EB-9	EB-10	EB-10	OB-1	OB-1	OB-2	OB-2	OB-3	OB-3	OB-4
Depth (ft.)	0.2-1	2-5	0.2-1	2-5	0.2-1.5	2-5	0.2-1.5	2-5	0.2-1	2-5	0.2-1
Sieve											
6”											
3”											
2”											
1 1/2”									100	100	
1”			100		100	100	100		93	96	100
3/4”	100	100	95	100	95	97	98		81	93	99
1/2”	91	97	86	99	85	96	86		66	77	93
3/8”	85	92	79	99	74	95	78	100	60	68	82
4	66	80	65	97	57	94	58	98	47	51	58
8	55	72	54	95	48	93	48	97	40	40	46
16	48	66	48	95	43	91	42	96	34	34	39
30	44	62	44	94	40	90	38	96	31	30	34
50	39	58	40	93	32	87	30	94	24	23	23
100	32	50	31	83	22	82	20	88	15	15	13
200	24	40	16	58	16	80	15	71	11	10	8
Liquid Limit	34	43	NP	NP	24	63	NP	38	NP	NP	NP
Plasticity Index	10	15	NP	NP	8	41	NP	19	NP	NP	NP
R-Value		42		60		<5		<5		84	
Expansion Potential (%)						8.1	5.4				
Solubility (%)		1.12									
Sulfate (%)		0.42									
Sodium Sulfate (%)		0.01									
USCS Classification	SM	SM	SM	ML	GC	CH	SM	CL	GP-GM	GP-GM	SP-SM
ASSHTO Classification	A-2-4	A-7-6	A-1-b	A-4	A-2-4	A-7-6	A-1-b	A-6	A-1-a	A-1-a	A-1-a

NP = Non Plastic

	SAMPLE LOCATION AND DEPTH										
Mile Post	1.75	2.25	2.25	2.8	2.8						
Boring No.	OB-4	OB-5	OB-5	OB-6	OB-6						
Depth (ft.)	2-5	0.2-1	2-5	0.2-1	2-5						
Sieve											
6”											
3”											
2”											
1 1/2”	100				100						
1”	98	100	100		98						
3/4”	89	99	98	100	94						
1/2”	77	83	88	84	83						
3/8”	69	74	82	73	76						
4	54	57	72	57	61						
8	46	48	66	49	52						
16	41	43	61	45	47						
30	38	39	57	42	43						
50	34	29	46	32	34						
100	27	18	31	21	22						
200	20	12	25	16	16						
Liquid Limit	24	NP	19	22	NP						
Plasticity Index	6	NP	4	6	NP						
R-Value	59		44		72						
Expansion Potential (%)											
Solubility (%)											
Sulfate (%)			0.02								
Sodium Sulfate (%)			0.02								
USCS Classification	GC-GM	SM	SC-SM	GC-GM	SM						
ASSHTO Classification	A-1-b	A-1-b	A-2-4	A-1-b	A-1-b						

NP = Non Plastic

rm-B-226-A
Rev 4-76

US DEPARTMENT OF TRANSPORTATION - REGION 8
SUMMARY OF SOIL OR AGGREGATE TESTS

DATE 5-31-83
SHEET 3 OF 3

PROJECT Nevada NP - Lake Mead NRA, North Shore Road
SUBMITTED BY: Bob Blenk TESTED BY: DH, KW, KR REPORTED BY: A. Held
DISTRIBUTION: Project Engineer -1, Region -1, Materials Lab -2

SAMPLE NUMBER	Field No.							
	Hole No.	B-46	B-48	B-49*	B-50	B-52	B-54	
	Lab No.	83-393-S	83-395-S	83-396-S	83-397-S	83-399-S	83-401-S	
SAMPLE LOCATION	Station or Location	MP 25.7	MP 27.2	MP 27.95	MP 28.9	MP 30.4	MP 33.5	
	Offset							
	Depth	0-3'	0-3'	0-3'	0-3'	0-3'	0-3'	
AASHTO T-11, 27 & 88	3½"							
	3"	100	100	100		100	100	
	1-1/2"	98	97	98		90	98	
	3/4"	87	84	81		81	92	
	1/2"	79	74	69		75	87	
	3/8"	74	66	63	100	71	83	
	#4	64	52	53	98	63	74	
	#8							
	#10	57	42	46	96	56	64	
	#16	53	36	43	96	53	59	
	#30							
	#40	49	28	40	94	47	47	
	#50							
	#100	40	23	35	93	41	33	
	#200	29.5	19.2	22.2	91.9	34.4	26.9	
	0.05 mm							
	0.02mm							
	0.002mm							
	0.001mm							
% Moist.								
AASHTO T-89, 90 & 92	SL							
	LL	20	25	NV	32	28	26	
	PI	2	5	NP	13	6	3	
AASHTO M-145	Class	A-2-4	A-1-b	A-1-b	A-6	A-2-4	A-2-4	
	GI				(11)			
AASHTO T-190	R	56	69	66	5	46	74	
	W(%)	9.4	9.3	8.6	17.3	12.2	9.5	
	γ_d (pcf)	127.5	129.5	129.9	113.3	119.8	125.0	
AASHTO T-99,180	W(%)							
	γ_d (pcf)							

REMARKS
*B-49 was a weak ~~shale~~ sandstone sample which was sieved as received with no malling per Bob Blenk's instruction.

APPENDIX C

Site Photographs

PHOTO 1

SOUTH ABUTMENT, LEFT SIDE, ECHO WASH BRIDGE.

PHOTO 2

NORTH ABUTMENT, LEFT SIDE, ECHO WASH BRIDGE.

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218**	PLATE: **C-1**

PHOTO 3

NORTH ABUTMENT, ECHO WASH BRIDGE.

PHOTO 4

SOUTH ABUTMENT, RIGHT SIDE, ECHO WASH BRIDGE.

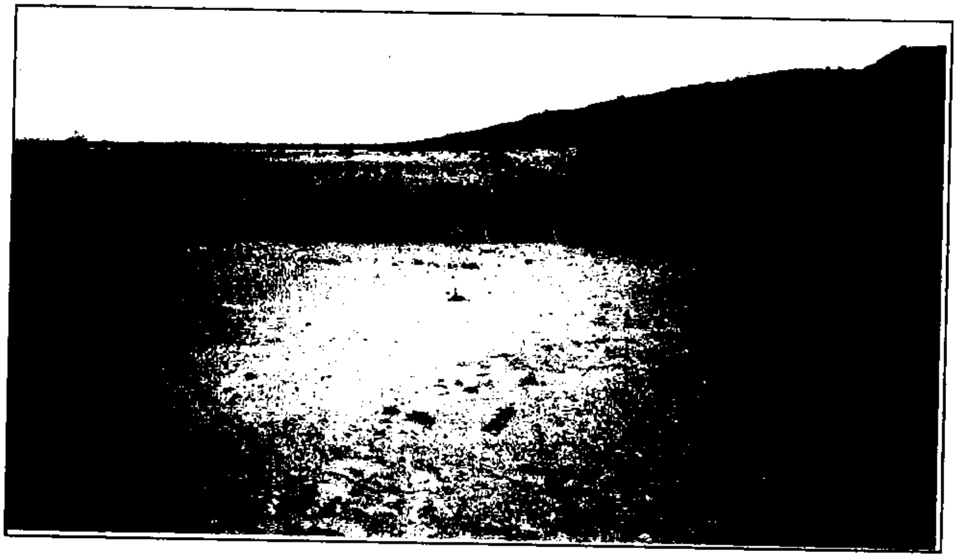
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218** / PLATE: **C-2**

PHOTO 5

NORTH ABUTMENT, RIGHT SIDE, ECHO WASH BRIDGE.

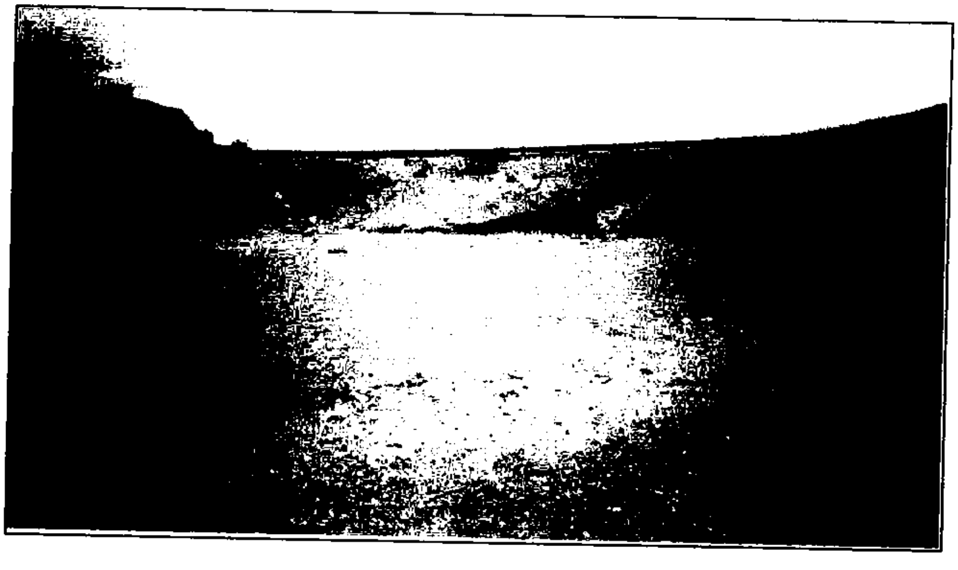
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218** PLATE: **C-3**

PHOTO 6



UPSTREAM END, VALLEY OF FIRE WASH CULVERTS.

PHOTO 7



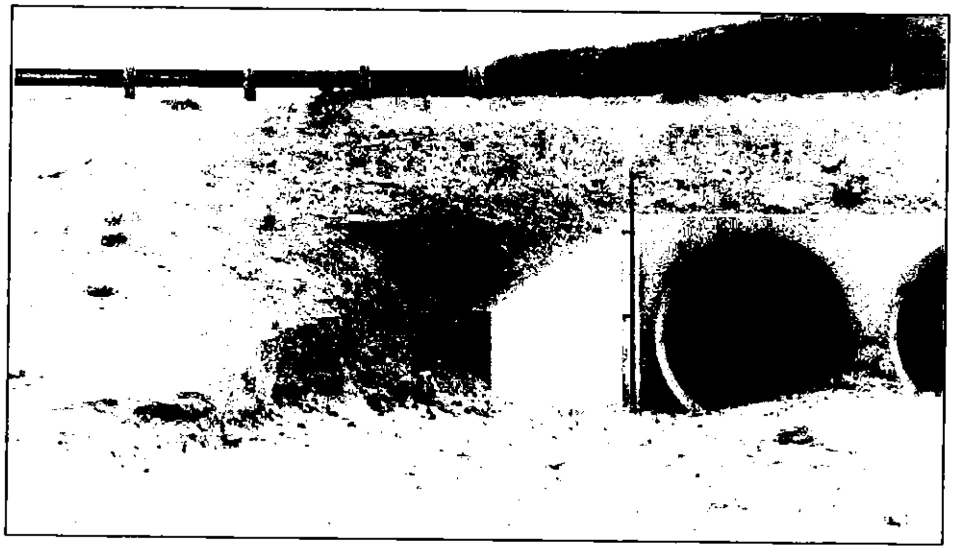
LEFT SIDE, UPSTREAM END VALLEY OF FIRE WASH CULVERTS.

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218** PLATE: **C-4**

PHOTO 8

RIGHT SIDE, UPSTEAM END VALLEY OF FIRE WASH CULVERTS.

PHOTO 9



WASHOUT AT LEFT SIDE OF UPSTREAM END VALLEY OF FIRE WAS CULVERTS.

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	**SITE PHOTOGRAPHS**	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218**	PLATE: **C-5**

PHOTO 10

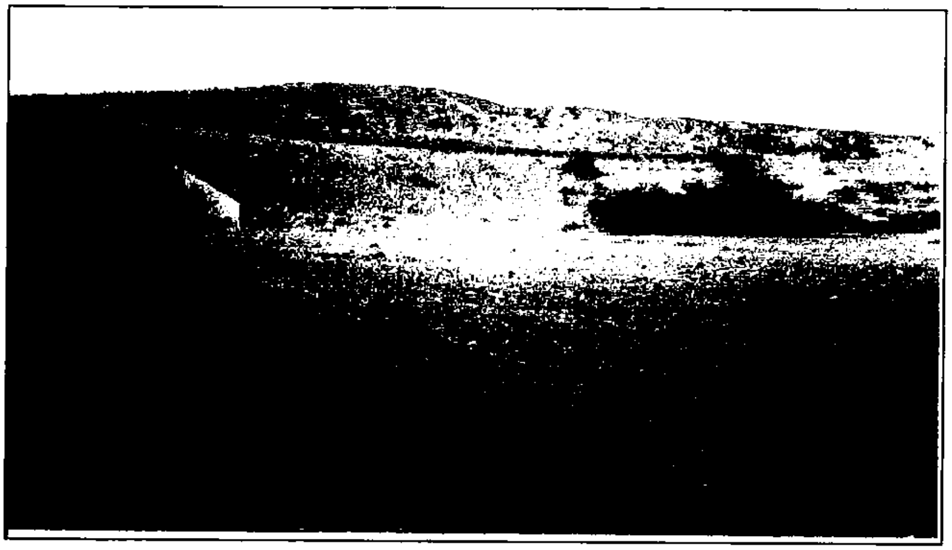
DOWNSTREAM END VALLEY OF FIRE WASH CULVERTS.

PHOTO 11

DOWNSTREAM END VALLEY OF FIRE WASH CULVERTS.

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218**	PLATE: **C-6**

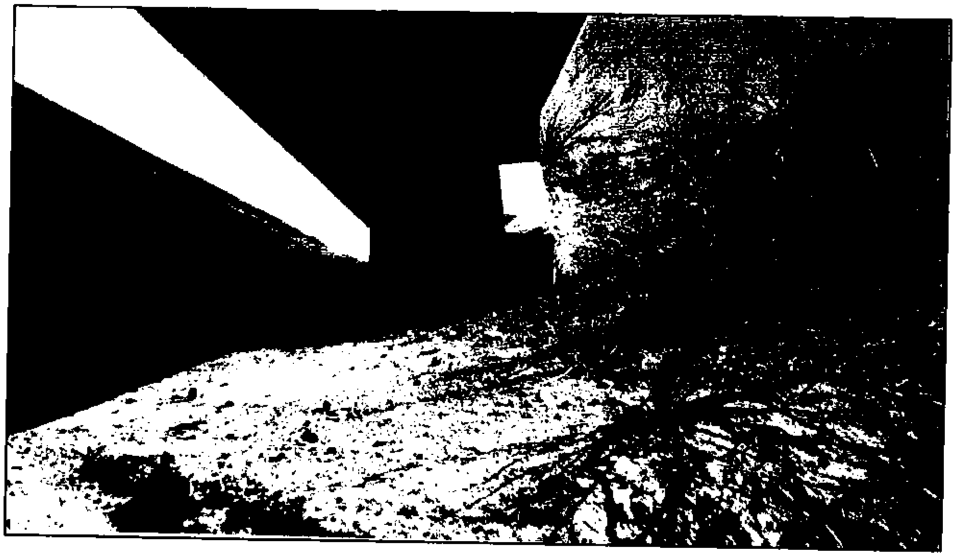
PHOTO 12



RIGHT SIDE, DOWNSTREAM END VALLEY OF FIRE WASH CULVERTS.

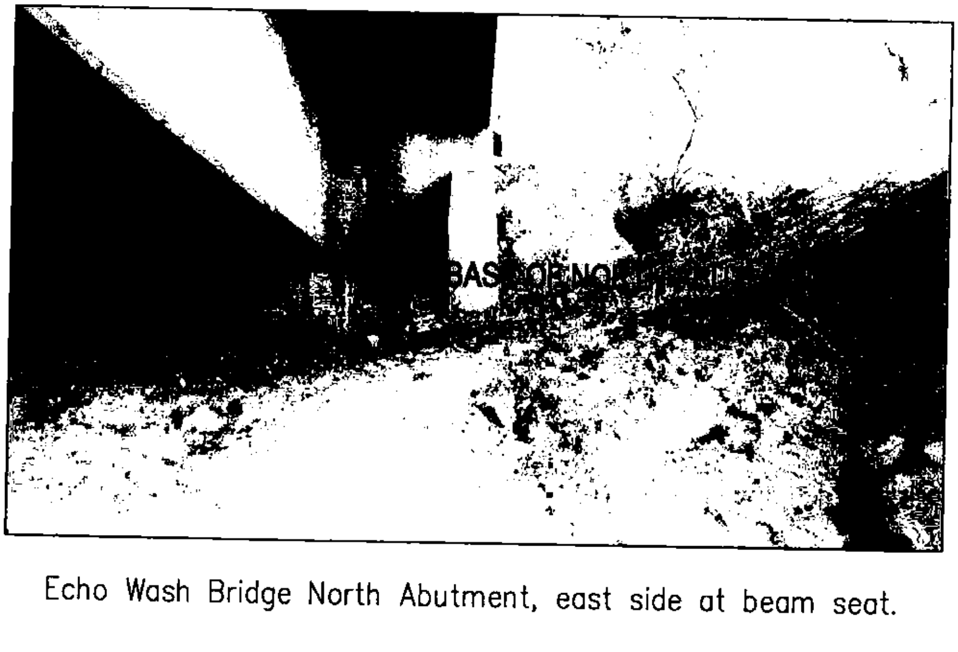
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218** PLATE: **C-7**

PHOTO 13



Echo Wash Bridge South Abutment, west side at beam seat.

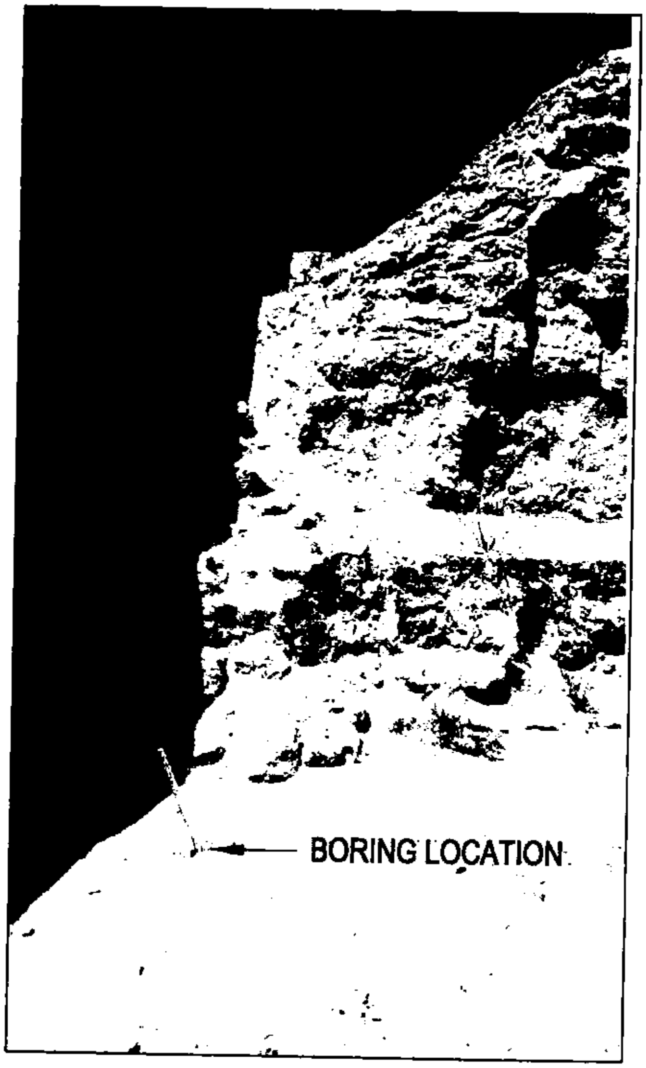
PHOTO 14



Echo Wash Bridge North Abutment, east side at beam seat.

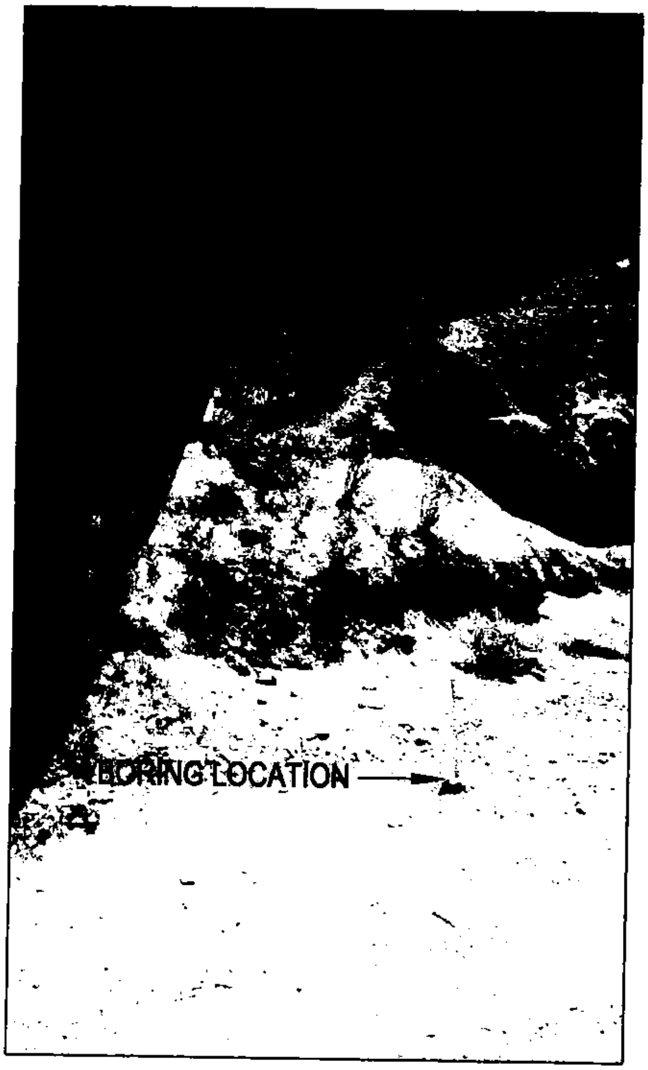
CLIENT: PARSONS BRINKERHOFF QUADE & DOUGLAS	Terracon	*SITE PHOTOGRAPHS*	
PROJECT: PRA-LAME 1 (8)		PROJECT NO.: 64035218	PLATE: C-8

PHOTO 15



Boring No. 2 – Abutment North

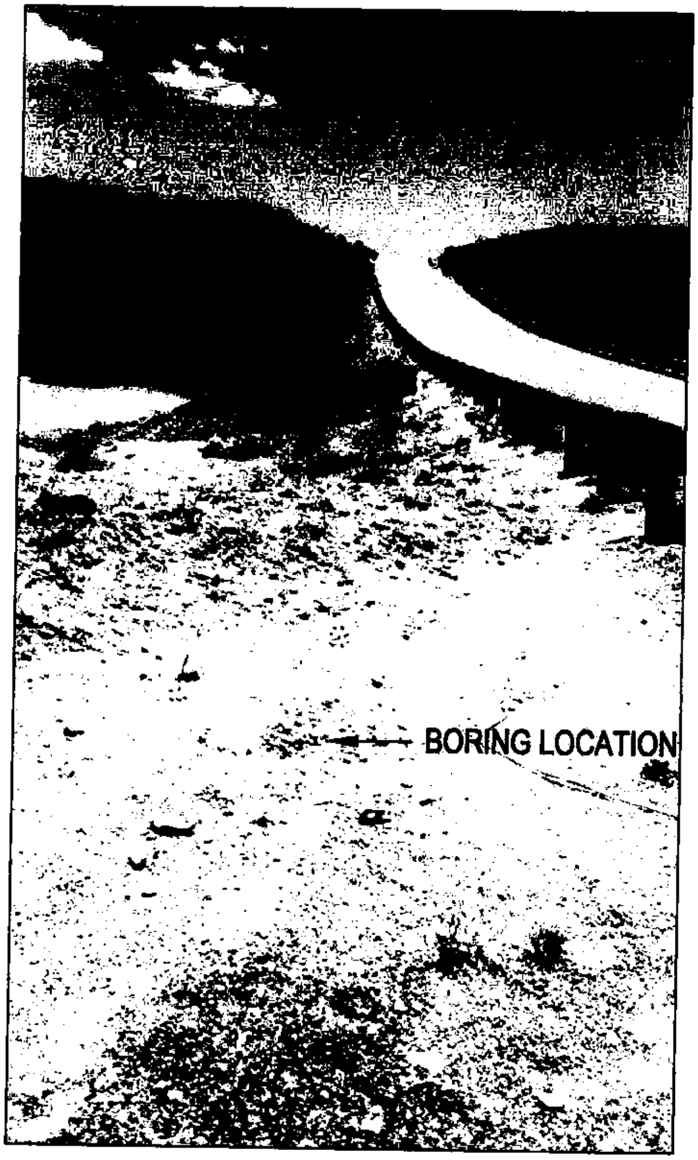
PHOTO 16



Boring No. 1 – Abutment South

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	***SITE PHOTOGRAPHS***	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218**	PLATE: **C-9**

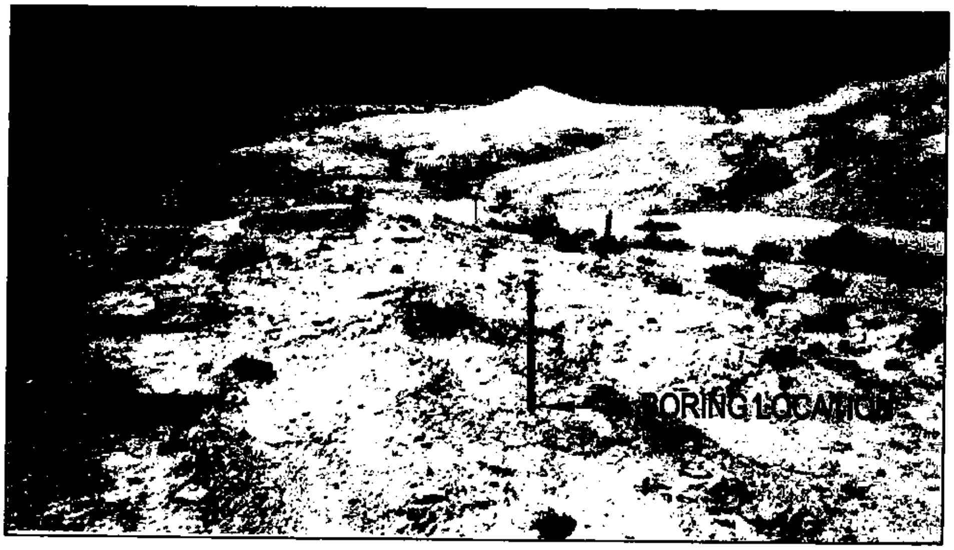
PHOTO 17



Boring No. 3 – Valley of Fire Wash
Northshore Road, Near Station 67+877

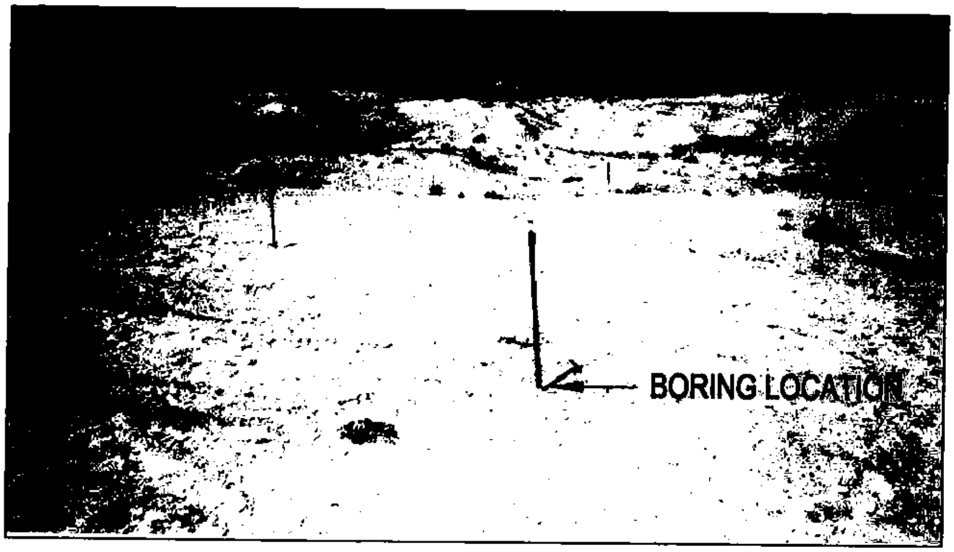
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218**	PLATE: **C-10**

PHOTO 18



Boring No. 4 – Northshore Road, Near Station 69+100 Centerline

PHOTO 19



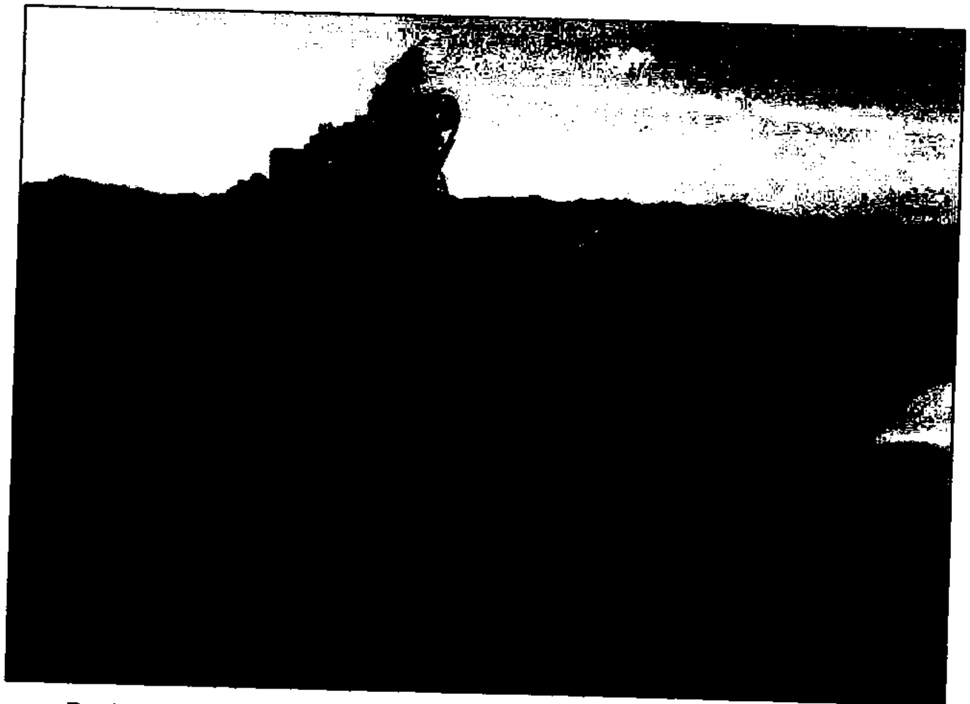
Boring No. 5 – Northshore Road, Near Station 69+300 Centerline

CLIENT: PARSONS BRINKERHOFF QUADE & DOUGLAS	Terracon	SITE PHOTOGRAPHS
PROJECT: PRA-LAME 1 (8)		PROJECT NO.: 64035218 / PLATE: C-11

PHOTO 25

Coring No. EC–2 – Echo Bay Road, Near Station 0+805

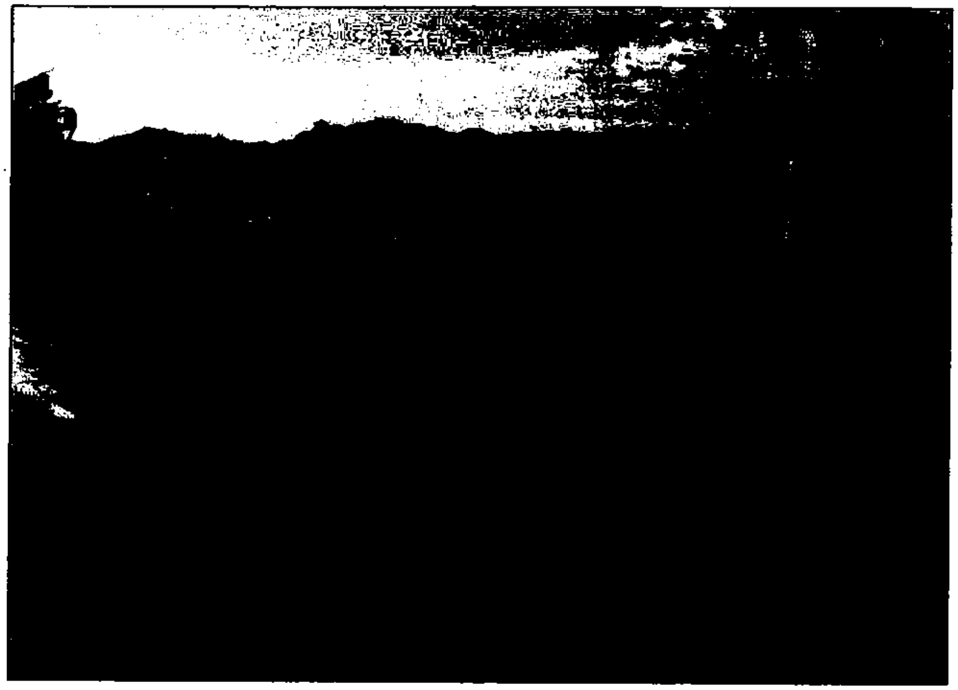
PHOTO 26



Boring No. EB–2 – Echo Bay Road, Near Station 1+207

CLIENT: PARSONS BRINKERHOFF QUADE & DOUGLAS	Terracon	SITE PHOTOGRAPHS	
PROJECT: PRA-LAME 1 (8)		PROJECT NO.: 64055138	PLATE: C-15

PHOTO 23



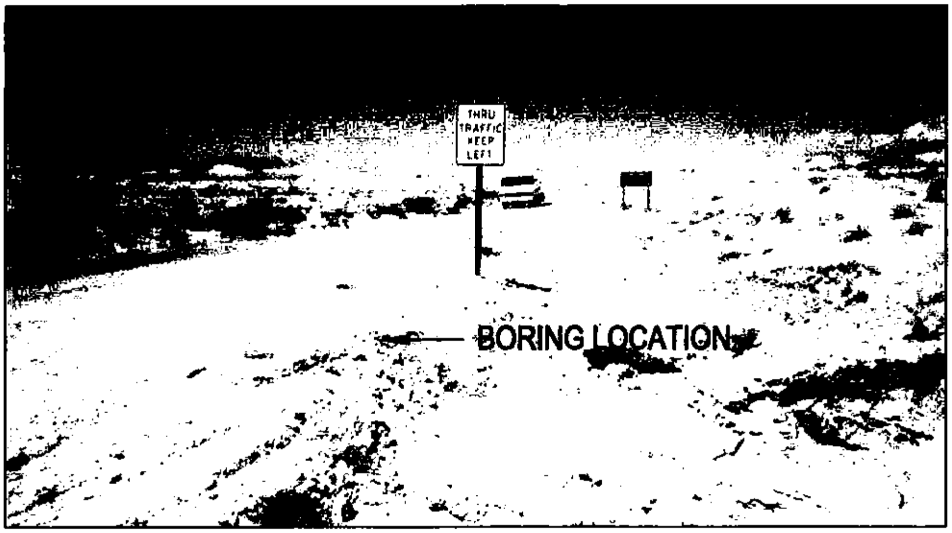
Coring No. EC–1 – Echo Bay Road, Near Station 0+016

PHOTO 24

Boring No. EB–1 – Echo Bay Road, Near Station 0+402

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138**	PLATE: **C-14**

PHOTO 22



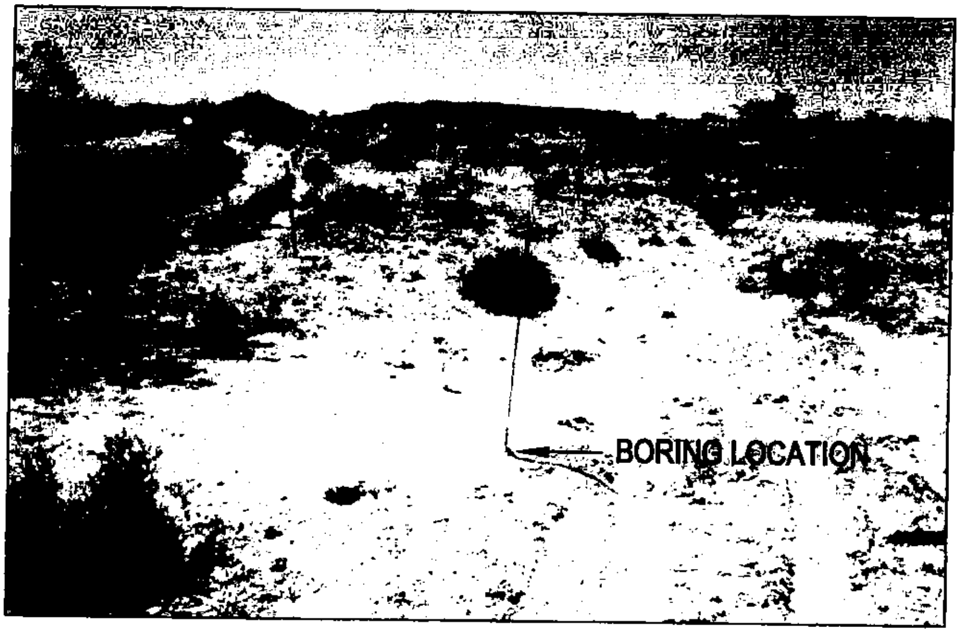
Boring No. 8 – Northshore Road, Near Station 72+000 Centerline

CLIENT: PARSONS BRINKERHOFF QUADE & DOUGLAS	Terracon	SITE PHOTOGRAPHS	
PROJECT: PRA-LAME 1 (8)		PROJECT NO.: 64035218	PLATE: C-13

PHOTO 20

Boring No. 6 – Northshore Road, Near Station 72+300 Centerline

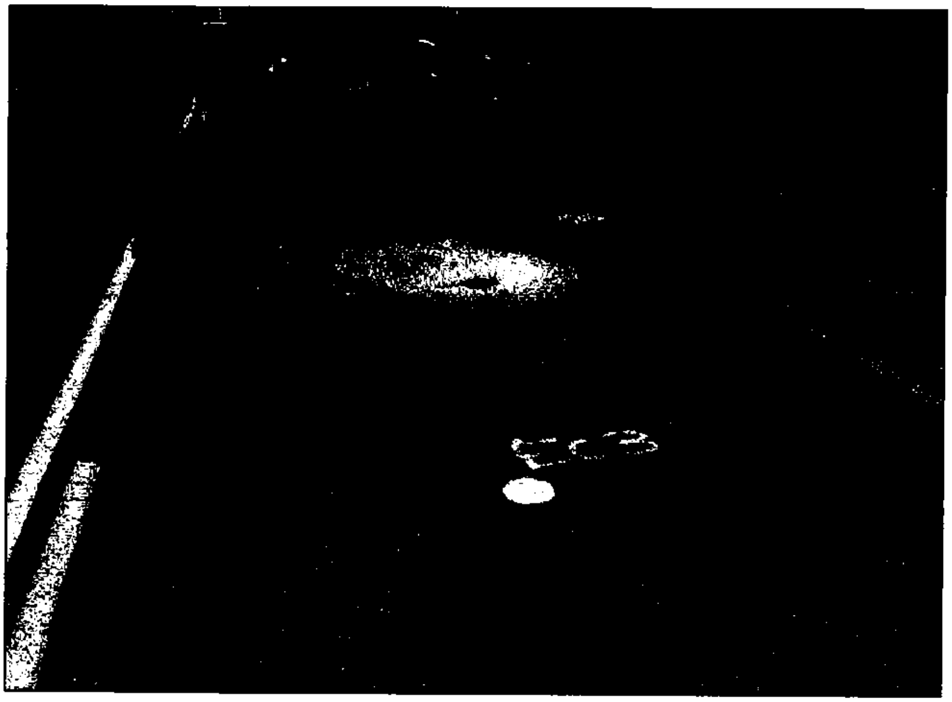
PHOTO 21



Boring No. 7 – Northshore Road, Near Station 72+500 Centerline

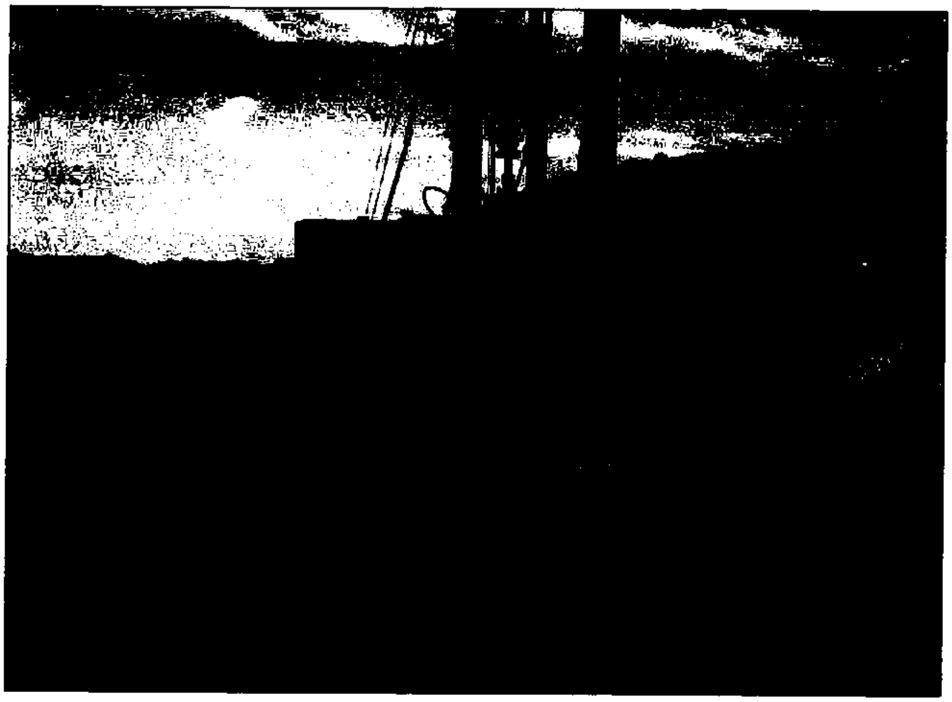
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218** PLATE: **C-12**

PHOTO 27



Coring No. EC–3 – Echo Bay Road, Near Station 1+609

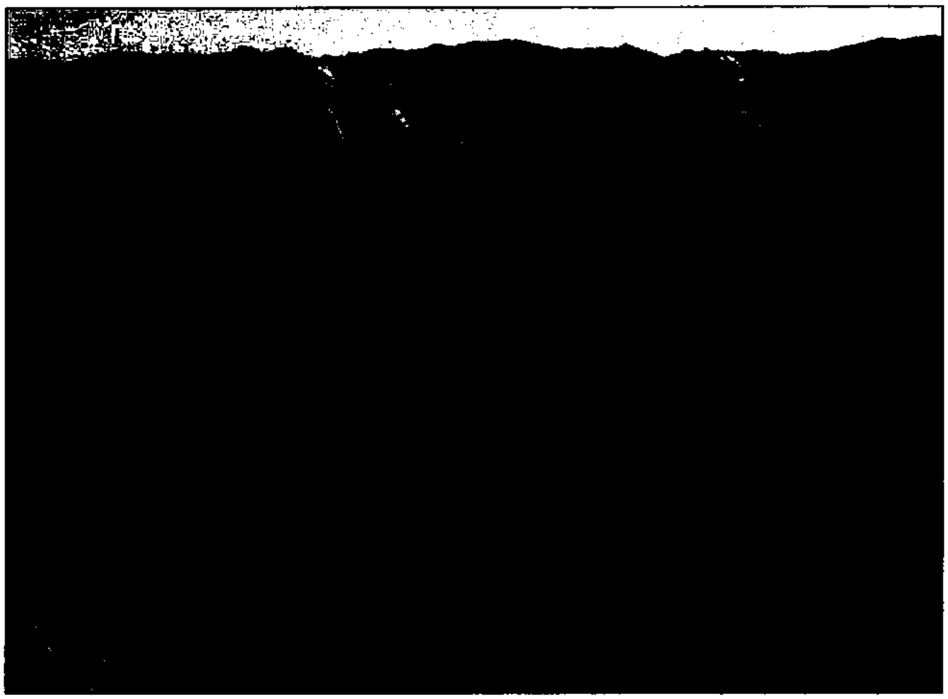
PHOTO 28



Boring No. EB–3 – Echo Bay Road, Near Station 2+012

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	***SITE PHOTOGRAPHS***	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138**	PLATE: **C-16**

PHOTO 29



Coring No. EC–4 – Echo Bay Road, Near Station 2+414

PHOTO 30

Boring No. EB–4 – Echo Bay Road, Near Station 2+816

CLIENT: PARSONS BRINKERHOFF QUADE & DOUGLAS	Terracon	SITE PHOTOGRAPHS
PROJECT: PRA-LAME 1 (8)		PROJECT NO.: 64055138 — PLATE: C-17

PHOTO 31

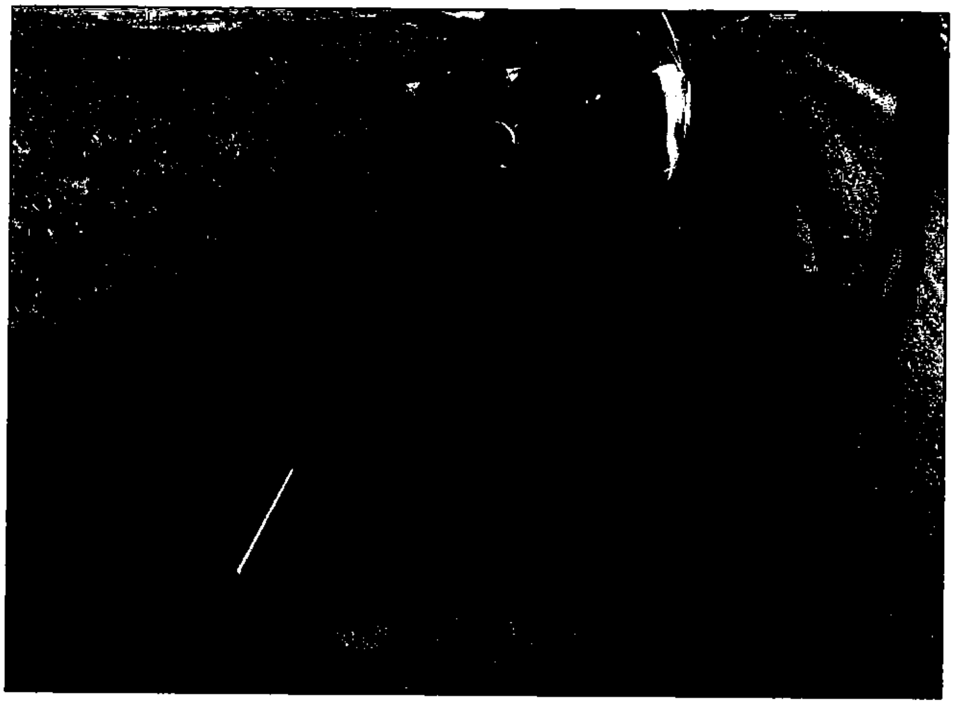
Coring No. EC–5 – Echo Bay Road, Near Station 3+219

PHOTO 32

Boring No. EB–5 – Echo Bay Road, Near Station 3+621

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138** / PLATE: **C-18**

PHOTO 33



Coring No. EC–6 – Echo Bay Road, Near Station 4+023

PHOTO 34

Boring No. EB–6 – Echo Bay Road, Near Station 4+426

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138** / PLATE: **C-19**

PHOTO 35

Coring No. EC–7 – Echo Bay Road, Near Station 4+828

PHOTO 36

Boring No. EB–7 – Echo Bay Road, Near Station 5+230

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138** PLATE: **C-20**

PHOTO 37

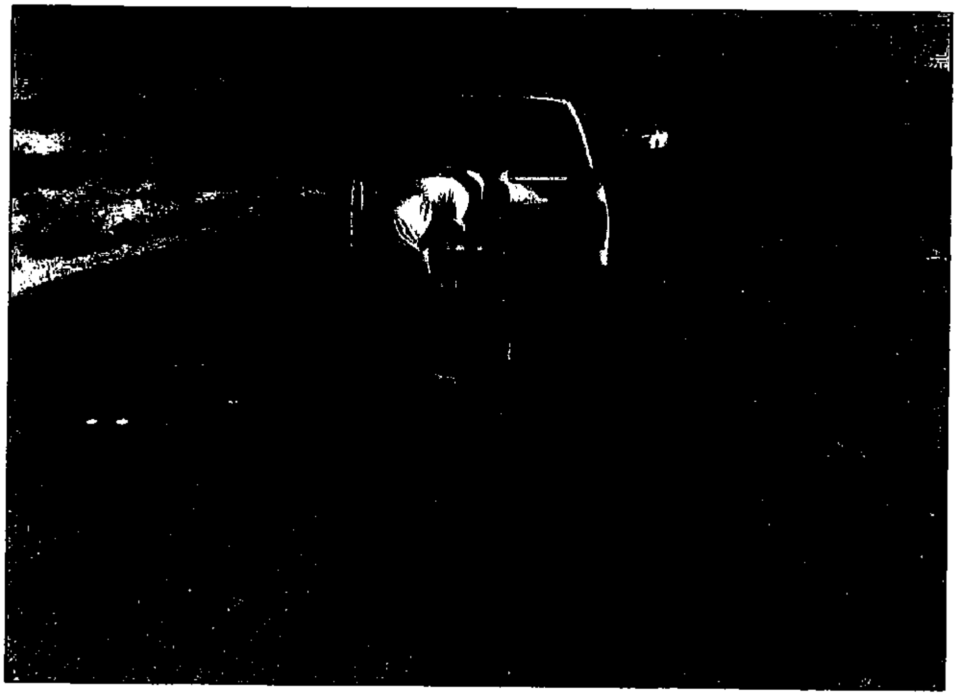
Coring No. EC–8– Echo Bay Road, Near Station 5+633

PHOTO 38

Boring No. EB–8 – Echo Bay Road, Near Station 6+035

CLIENT: PARSONS BRINKERHOFF QUADE & DOUGLAS	Terracon	SITE PHOTOGRAPHS	
PROJECT: PRA-LAME 1 (8)		PROJECT NO.: 64055138	PLATE: C-21

PHOTO 43



Coring No. OC–1 – Overton Beach Road, Near Station 13+720

PHOTO 44

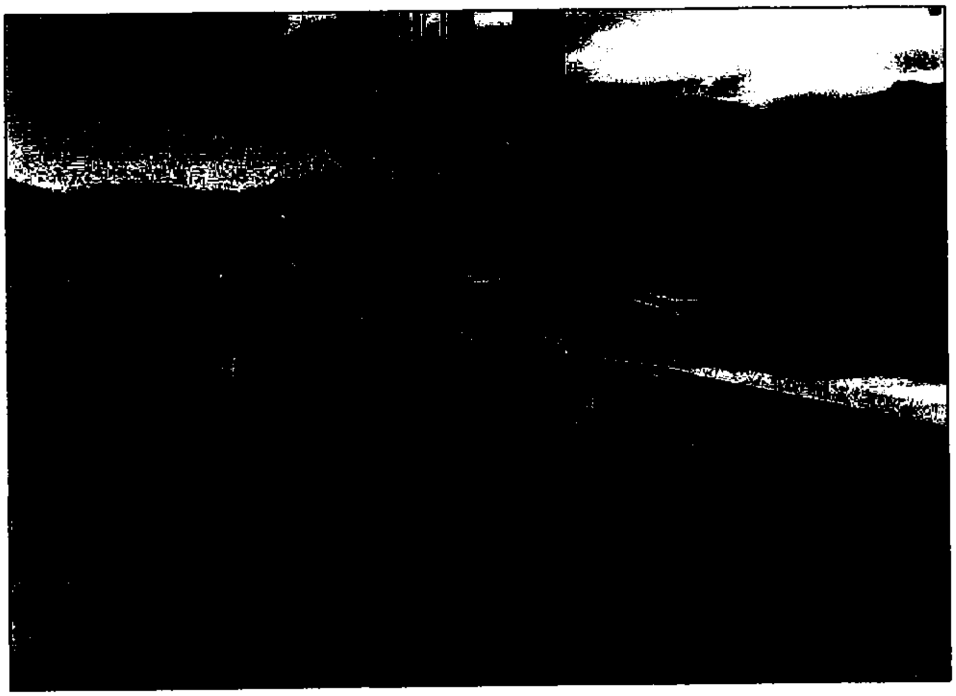
Boring No. OB–1 – Overton Beach Road, Near Station 14+102

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138** PLATE: **C-24**

PHOTO 41

Coring No. EC-10 – Echo Bay Road, Near Station 7+242

PHOTO 42



Boring No. EB-10 – Echo Bay Road, Near Station 7+580

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	***SITE PHOTOGRAPHS***	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138**	PLATE: **C-23**

PHOTO 39

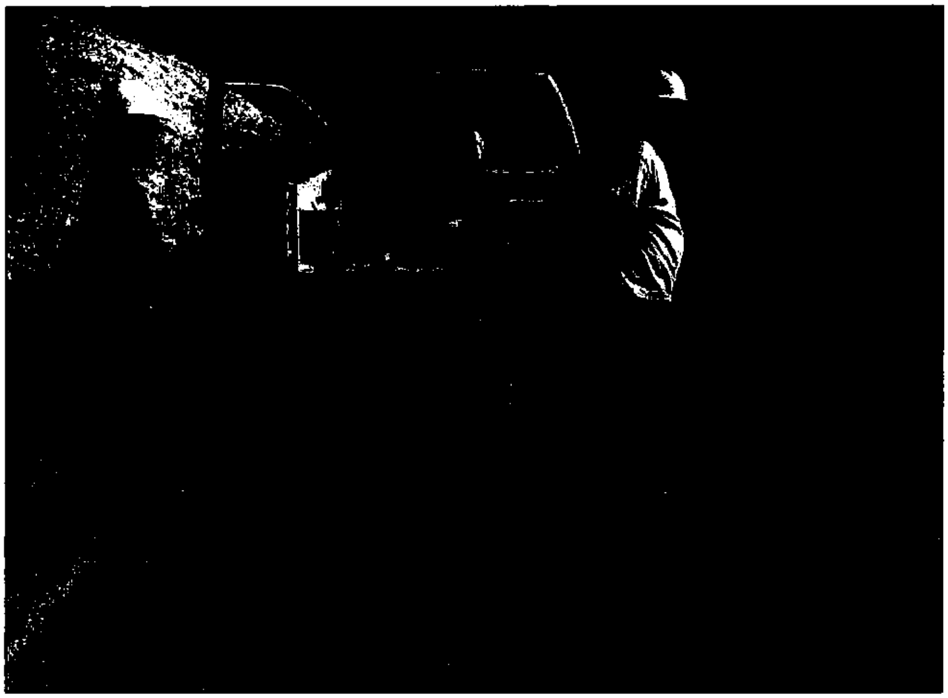
Coring No. EC–9 – Echo Bay Road, Near Station 6+437

PHOTO 40

Boring No. EB–9 – Echo Bay Road, Near Station 6+840

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	**SITE PHOTOGRAPHS**	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138**	PLATE: **C-22**

PHOTO 45



Coring No. OC–2 – Overton Beach Road, Near Station 14+505

PHOTO 46

Boring No. OB–2 – Overton Beach Road, Near Station 14+907

CLIENT: PARSONS BRINKERHOFF QUADE & DOUGLAS	Terracon	SITE PHOTOGRAPHS	
PROJECT: PRA-LAME 1 (8)		PROJECT NO.: 64055138	PLATE: C-25

PHOTO 47

Boring No. OB–3 – Overton Beach Road, Near Station 15+712

CLIENT: PARSONS BRINKERHOFF QUADE & DOUGLAS	Terracon	SITE PHOTOGRAPHS
PROJECT: PRA-LAME 1 (8)		PROJECT NO.: 64055138 / PLATE: C-26

PHOTO 48

Coring No. OC–4 – Overton Beach Road, Near Station 16+114

PHOTO 49

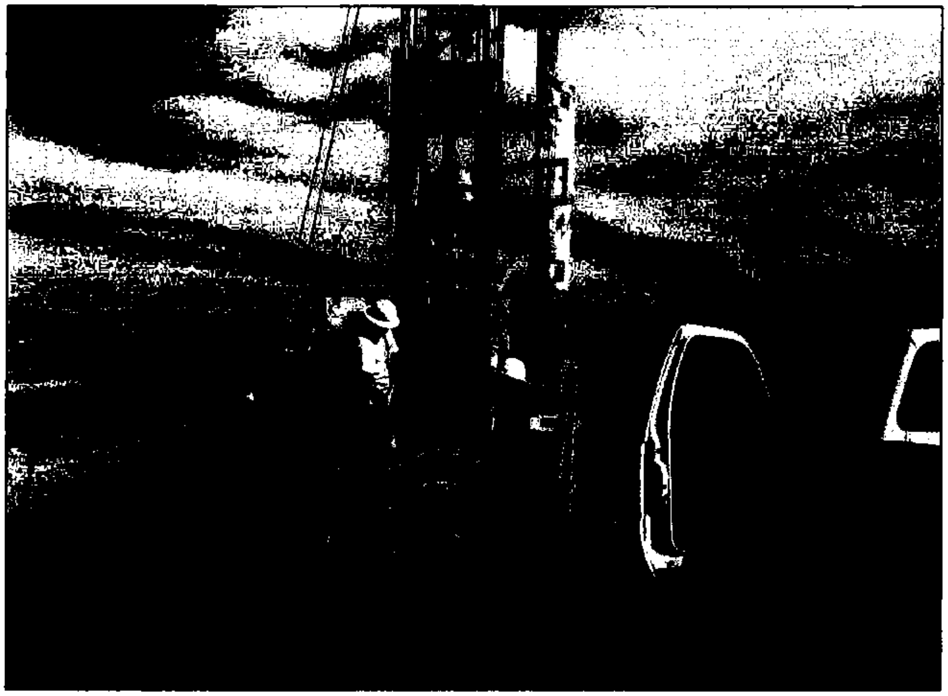
Boring No. OB–4 – Overton Beach Road, Near Station 16+516

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138** PLATE: **C-27**

PHOTO 50

Coring No. OC–5 – Overton Beach Road, Near Station 16+919

PHOTO 51



Boring No. OB–5 – Overton Beach Road, Near Station 17+321

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*SITE PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138** PLATE: **C-28**

PHOTO 52

Coring No. OC-6 – Overton Beach Road, Near Station 17+723

PHOTO 53

Boring No. OB-6 – Overton Beach Road, Near Station 18+206

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	***SITE PHOTOGRAPHS***	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138**	PLATE: **C-29**

APPENDIX D

In-Place Pavement and Base Thickness
Pavement Distress Survey
Pavement Distress Photographs

TABLE - 1 NORTHSHORE ROAD
In-Place Asphalt Pavement and Base Thickness

Location	Station	Left or Right Lane	Asphalt Thickness (inches)	Aggregate Base Course Thickness (inches)	NOTES
C-1	45+780	L	2	None	Chip & Seal coat mostly gone. Asphalt pavement consists of base course mix with rounded aggregate.
S-1	46+160	R	2¼	None	
C-2	46+580	R	2⅜	None	Chip & Seal coat mostly gone. Asphalt pavement consists of base course mix with rounded aggregate.
S-2	46+970	L	2½	None	
C-3	47+390	L	2⅛	None	Chip & Seal coat mostly gone. Asphalt pavement consists of base course mix with rounded aggregate.
S-3	47+770	R	1⅞	None	
C-4	48+200	L	1½	None	Chip & Seal coat mostly gone. Asphalt pavement consists of base course mix with rounded aggregate.
S-4	48+580	R	1½	None	
C-5	49+000	R	3¼	None	Chip & Seal coat mostly gone. Asphalt pavement consists of base course mix with rounded aggregate.
S-5	49+380	L	2½	None	
C-6	49+800	R	2¼	None	Chip & Seal coat mostly gone. Asphalt pavement consists of base course mix with rounded aggregate.
S-6	50+180	L	2¼	None	
C-7	50+610	R	2¼	None	Chip & Seal coat mostly gone. Asphalt pavement consists of base course mix with rounded aggregate.
S-7	50+990	R	2	None	
C-8	51+410	R	2	None	Chip & Seal coat mostly gone. Asphalt pavement consists of base course mix with rounded aggregate.
S-8	51+790	R	2¼	None	
C-9	52+220	L	2¼	None	¼" Chip & Seal coating. Asphalt pavement consists of base course mix with rounded aggregate.
S-9	52+600	L	1½	None	
C-10	53+020	L	3	None	¼" Chip & Seal coating. Asphalt pavement consists of base course mix with rounded aggregate.
S-10	53+460	R	2¼	None	
C-11	53+820	R	2¼	None	⅜" to ¼" Chip & Seal coating. Asphalt pavement consists of base course mix

Location	Station	Left or Right Lane	Asphalt Thickness (inches)	Aggregate Base Course Thickness (inches)	NOTES
					with rounded aggregate.
S-11	54+210	R	2¼	None	
C-12	54+630	L	2¼	None	¼" Chip & Seal coating. Asphalt pavement consists of base course mix with rounded aggregate.
S-12	55+010	L	2	None	
C-13	55+430	R	2½	None	⅜" Chip & Seal coating. Asphalt pavement consists of base course mix with rounded aggregate.
S-13	55+820	L	2½	None	
C-14	56+240	L	2⅞	None	¼" Chip & Seal coating. Asphalt pavement consists of base course mix with rounded aggregate.
S-14	56+620	R	3½	None	
C-15	57+040	L	4⅝	None	Chip & Seal coat mostly gone. Asphalt pavement consists of base course mix with rounded aggregate.
S-15	57+430	R	5	None	
C-16	57+550	R	4½	None	¼" Chip & Seal coating. Asphalt pavement consists of base course mix with rounded aggregate.
S-16	58+230	L	3½	None	
C-17	58+650	R	4½	None	¼" Chip & Seal coating. Asphalt pavement consists of base course mix with rounded aggregate.
S-17	59+040	L	4⅛	None	
C-18	59+460	L	4⅛	None	Pavement section consisted of ¼" Chip & Seal coating, 1¼" overlay and 2⅞" original pavement. Asphalt pavement consists of base course mix with rounded aggregate.
S-18	59+840	L	4¼	None	
C-19	60+260	R	4⅛	None	¼" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
S-19	60+640	R	4¼	None	
C-20	61+070	R	4¼	None	¼" Chip & Seal coating. Asphalt pavement consists of base course mix with rounded aggregate.
S-20	61+450	L	3⅞	None	
C-21	61+870	R	4½	None	¼" Chip & Seal coating. Asphalt pavement consists of base course mix with rounded aggregate.
S-21	62+250	R	4¼	None	
C-22	62+670	L	4¼	None	⅜" Chip & Seal coating. Oiled soil layer

Location	Station	Left or Right Lane	Asphalt Thickness (inches)	Aggregate Base Course Thickness (inches)	NOTES
					under pavement section. Asphalt pavement consists of base course mix with rounded aggregate.
S-22	63+060	R	3⅞	None	
C-23	63+480	L	4⅝	None	⅜" Chip & Seal coating. Asphalt pavement consisted of base course mix with crushed aggregate.
S-23	63+860	L	2½	None	2" layer of asphalt pavement fragments under pavement layer.
C-24	64+280	L	4⅜	None	⅜" Chip & Seal coating. Oiled soil layer under pavement section. Asphalt pavement consists of base course mix with rounded aggregate.
S-24	64+670	R	4¼	None	
C-25	65+090	L	3¾	None	¼" Chip & Seal coating. Oiled soil layer under pavement section. Asphalt pavement consists of base course mix with rounded aggregate.
S-25	65+470	L	3¾	None	
C-26	65+890	R	4⅜	None	⅜" Chip & Seal coating. Oiled soil layer under pavement section. Asphalt pavement consists of base course mix with rounded aggregate.
S-26	66+270	L	4½	None	
C-27	66+700	R	3⅞	None	¼" Chip & Seal coating. Oiled soil layer under pavement section. Asphalt pavement consists of base course mix with rounded aggregate.
S-27	67+080	R	3¾	None	
C-28	67+500	R	3½	None	Pavement section consisted of ¼" Chip & Seal coating, 2" layer of surface course with crushed aggregate, and a 1¼" layer of base course with rounded aggregate. Oiled soil layer under pavement section.
S-28	67+880	L	1¾	None	
C-29	68+310	R	2¼	None	⅜" Chip & Seal coating. Oiled soil layer under pavement section. Asphalt pavement consists of base course mix with rounded aggregate.
S-29	68+690	L	2½	None	Pavement section consisted of ⅜" Chip & Seal coating, 2⅛" layer of surface course with crushed aggregate, a layer of geotextile, and a 1" layer of asphalt fragments.

Location	Station	Left or Right Lane	Asphalt Thickness (inches)	Aggregate Base Course Thickness (inches)	NOTES
C-30	69+110	L	4½	None	Pavement section consisted of ⅜" Chip & Seal coating, 2¼" layer of surface course with crushed aggregate, a layer of geotextile, and a 1⅞" layer of base course with rounded aggregate. Oiled soil layer under pavement section.
S-30	69+490	R	4	None	Pavement section consisted of chip and seal coat, 2" layer of surface course with crushed aggregate, followed by a layer of geotextile, followed by a 2" layer of base course with rounded aggregate section.
C-31	69+910	L	3⅞	None	Pavement section consisted of ⅜" Chip & Seal coating, 1¾" layer of surface course with crushed aggregate, a layer of geotextile, and a 1¾" layer of base course with rounded aggregate. Oiled soil layer under pavement section.
S-31	70+300	R	2½	2½	
C-32	70+720	R	3⅛	None	Pavement section consisted of ¼" Chip & Seal coating, 1½" layer of surface course with crushed aggregate, and a 1⅜" layer of base course with rounded aggregate. Oiled soil layer under pavement section.
S-32	71+100	L	1	None	Pavement section consisted of 1" of surface course with crushed aggregate, followed by a 1" layer of asphalt pavement fragments.
C-33	71+520	L	5⅛	None	Pavement section consisted of ⅜" Chip & Seal coating, 2½" layer of surface course with crushed aggregate, and a 2¼" layer of base course with rounded aggregate. Oiled soil layer under pavement section.
S-33	71+910	L	2¼	None	
C-34	72+330	R	2⅜	None	⅜" Chip & Seal coating. Oiled soil layer under pavement section. Asphalt pavement consists of base course mix with rounded aggregate.
S-34	72+900	L	2¼	4	Type I aggregate base
C-35	73+130	R	2⅛	4	¼" Chip & Seal coating. Oiled soil layer under pavement section. Asphalt pavement consists of base course mix with rounded aggregate.

Location	Station	Left or Right Lane	Asphalt Thickness (inches)	Aggregate Base Course Thickness (inches)	NOTES
S-35	73+520	L	2	4	Type I aggregate base
C-36	73+940	R	3	4	¼" Chip & Seal coating. Oiled soil layer under pavement section. Asphalt pavement consists of base course mix with rounded aggregate.
S-36	74+320	R	2	3	Type I aggregate base
C-37	74+740	L	2½	3	¼" Chip & Seal coating. Oiled soil layer under pavement section. Asphalt pavement consists of base course mix with rounded aggregate.
S-37	75+120	R	2¼	4	Type I aggregate base
C-38	59+650	PARKING AREA	4½	4	¼" Chip & Seal coating. Asphalt pavement consisted of base course with crushed aggregate.
C-39	65+720	PARKING AREA	4½	None	¼" Chip & Seal coating. Asphalt pavement consisted of base course with crushed aggregate. Oiled soil layer under pavement section.

Note: "NONE" marked in the Aggregate Base Course Thickness column indicates no aggregate base layer was observed under the asphalt pavement layer.

TABLE - 2 ECHO BAY ROAD
In-Place Asphalt Pavement and Base Thickness

Location	Station	Left or Right Lane	Asphalt Thickness (inches)	Aggregate Base Course Thickness (inches)	NOTES
EC-1	0+016	R	2	6	⅜" to ¼" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
EB-1	0+402	R	2	6	
EC-2	0+805	L	2	N/M	⅜" to ¼" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
EB-2	1+207	L	2¼	6	
EC-3	1+609	R	2½	N/M	¼" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
EB-3	2+012	R	2¼	8	
EC-4	2+414	L	2⅜	N/M	¼" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
EB-4	2+816	L	2¼	8	
EC-5	3+219	R	2¼	N/M	⅜" to ¼" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
EB-5	3+621	R	2	3	
EC-6	4+023	L	2⅜	4	¼" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
EB-6	4+426	L	1⅞	4	
EC-7	4+828	R	1¾	N/M	¼" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
EB-7	5+230	R	2¾	6	
EC-8	5+633	L	1¾	4	⅜" to ¼" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
EB-8	6+035	L	2	6	
EC-9	6+437	R	2	4	⅜" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
EB-9	6+840	R	2	6	
EC-10	7+242	L	1⅝	N/M	¼" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
EB-10	7+580	L	2	6	

Note: "N/M" marked in the Aggregate Base Course Thickness column indicates the thickness of the aggregate base layer observed under the asphalt pavement layer was not measured.

TABLE - 3 OVERTON BEACH ROAD
In-Place Asphalt Pavement and Base Thickness

Location	Station	Left or Right Lane	Asphalt Thickness (inches)	Aggregate Base Course Thickness (inches)	NOTES
OC-1	13+720	R	2¾	N/M	Chip & Seal coat mostly gone. Asphalt pavement consists of base course material with crushed aggregate.
OB-1	14+102	R	2⅞	13	
OC-2	14+505	L	2½	6	Chip & Seal coat mostly gone. Asphalt pavement consists of base course material with crushed aggregate.
OB-2	14+907	L	2½	8	
OC-3	15+309	R	2¼	N/M	¼" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
OB-3	15+712	R	2⅛	6	
OC-4	16+114	L	2¼	N/M	¼" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
OB-4	16+516	L	2½	5	
OC-5	16+919	R	1¼	N/M	Chip & Seal coat mostly gone. Asphalt pavement consists of base course material with crushed aggregate.
OB-5	17+321	R	2½	5	
OC-6	17+723	L	2	N/M	¼" Chip & Seal coating. Asphalt pavement consists of base course material with crushed aggregate.
OB-6	18+206	L	2¼	6	

Note: "N/M" marked in the Aggregate Base Course Thickness column indicates the thickness of the aggregate base layer observed under the asphalt pavement layer was not measured.

ASPHALTIC CONCRETE PAVEMENT CONDITION SURVEY *

PROJECT : Nevada Project PRA-LAME 1 (8) **PAGE** 1 **OF** 4
BEGINNING REFERENCE LOCATION: Northshore Road Mile Post 28.0
DIRECTION: Northward **LOGGED BY:** Larry W. Snedegar, P.E. **DATE:** 12/04/03

Station	Left Lane	Right Lane		Station	Left Lane	Right Lane
45+680				50+215		
	2L, 8L	8L			2L, 10M	2L, 10M
45+730				50+425		
	2L, 8L	10M			2L, 9M, 10M	2L, 9M, 10M
45+760				50+590		
	10L	10L			10L	10L
46+165				50+830		
	2L, 10M	2L, 10M			1M, 10H	10H
46+400				50+990		
	1M, 2L, 10M	2L, 10M			2L, 10L	2L, 10L
46+810				51+230		
	2L, 10L	2L, 10L			2M, 9M, 10M	2M, 9M, 10M
46+945				51+960		
	6	6			2L, 10L	2L, 10L
46+990				52+040		
	2L, 10L	2L, 10L			10M to H	10M to H
47+450				53+360		
	2L, 10H	2L, 10H			ECHO WASH	BRIDGE
47+460				53+425		
	2M, 10M	2M, 10M			NEW	OVERLAY
47+770				53+805		
	2L, 10L	2L, 10L			9L, 10H	9L, 10H
48+415				54+500		
	2L, 9L, 10H	2L, 9L, 10H			2M, 5M,10M	2M, 10M
48+450				54+850		
	2M, 10M	2M, 10M			2L, 10M	2L, 9M, 10M
48+980				54+900		
	2M, 10H	2M, 10H			10L	10L
49+040				55+125		
	2L, 10M	2L, 10M			9L to M, 10M	9 L to M, 10M
50+185				55+175		
	2L, 9M, 10M	2L, 9M, 10M			10L	10L
50+215				55+490		

* - See Highway Pavement Distress Identification Manuel

Key:

Severity	**Code**	**Distress Types**	**Code**	**Distress Types**	**Code**
High	H	Alligator Cracking	1	Raveling	8
Medium	M	Block Cracking	2	Rutting	9
Low	L	Lane/Shoulder Drop-off or Heave	3	Transverse Cracks	10
		Lane/Shoulder Joint Separation	4	Bleeding	11
		Longitudinal Cracks	5	Shoving	12
		Patching	6	Cracks Sealed	s
		Pothole	7		

ASPHALTIC CONCRETE PAVEMENT CONDITION SURVEY *

PROJECT : Nevada Project PRA-LAME 1 (8) **PAGE** 2 **OF** 4
BEGINNING REFERENCE LOCATION: Northshore Road Mile Post 28.0
DIRECTION: Northward **LOGGED BY:** Larry W. Snedegar, P.E. **DATE:** 12/04/03

Station	Left Lane	Right Lane		Station	Left Lane	Right Lane
55+490				67+875		
	6, 10L	10L			5^SM, 10M	10M
55+655				68+500		
	10M	10M			2^SM,10M	2^SM,3H, 10M
55+820				68+800		
	2^SL, 10^SL	2^SL, 10^SL			1M, 2M, 10M	1M,2M, 10M
56+540				69+330		
	2^SL, 10^SL	2^SL, 3M,			6, 10H	6, 10H
		10^SL		70+300		
57+020					1M, 10M	1M, 10M
	10M	10M		70+700		
57+745					1M, 2M, 10M	1M, 2M, 10M
	5^SH, 10M	5^SH, 10M		71+340		
59+035					NEW	OVERLAY
	10^SM	10^SM		71+700		
61+850					10M	10M
	5^S M	5^SM		71+900		
	10^SM	10^SM			1H	1H
63+300				71+910		
	2^SM,	2^SM			8M	1M, 8M
	10^SM	10^SM		72+450		
63+860					2M, 10M	2M, 10M
	10^SM	5^SM,		74+160		
		10^SM			2M, 10H	2M, 10H
64+260				74+250		
	10^SM	10^SM			2M, 10M	2M, 10M
67+080				76+465		
	10^SM	2^SM, 10^SM			END	PROJECT
67+240						
	2^SM, 10M	2^SM, 10M				
67+800						
	Valley of Fire	Wash				
67+875						

* - See Highway Pavement Distress Identification Manuel

Key:

Severity	**Code**	**Distress Types**	**Code**	**Distress Types**	**Code**
High	H	Alligator Cracking	1	Raveling	8
Medium	M	Block Cracking	2	Rutting	9
Low	L	Lane/Shoulder Drop-off or Heave	3	Transverse Cracks	10
		Lane/Shoulder Joint Separation	4	Bleeding	11
		Longitudinal Cracks	5	Shoving	12
		Patching	6	Cracks Sealed	s
		Pothole	7		

ASPHALTIC CONCRETE PAVEMENT CONDITION SURVEY *

PROJECT : Nevada Project PRA-LAME 1 (8) **PAGE** 3 **OF** 4
BEGINNING REFERENCE LOCATION: Echo Bay Road Mile Post 0.0
DIRECTION: Eastward **LOGGED BY:** Bradley C. Conder, P.E. **DATE:** 2/08/06

Station	Left Lane	Right Lane		Station	Left Lane	Right Lane
0+000				1+250		
	12, 11L	11L			2H, 9, 10H	2H, 9, 10H
0+030				2+540		
	9, 11L	9, 11L			2M, 10M	2M, 10M, 11M
0+050				3+400		
	1M, 2M, 9	2M, 9			2M, 9, 10H	1L, 2M, 9,
	10M, 11L	10M,11L				10M
0+480				4+680		
	2M, 10M	2M, 6H, 9,			2M, 10H	2M , 10H
		10M, 11L		5+000		
0+510					1M, 2M, 11L	1M, 2M, 11L
	2M, 9,	1H, 2M, 6H,		5+250		
	10M, 11L	9, 10H, 11L			1L, 2M, 10H,	1L, 2M, 10H,
0+535					11L	11L
	2M, 10M	1H, 2M, 6H		5+460		
		9, 10M			1L, 2M, 10M	1H, 2M, 10M,
0+730					11L	11L
		1H, 6H, 9		6+410		
0+850					11M	11M
		1M, 6H, 9		7+360		
0+880						4H, 7M
		1M, 6H, 9		7+465		
0+890						1H, 6H
	1H, 6M, 9			7+593		
0+895					END	PROJECT
		1M, 6M, 9				
0+920						
		1H, 6H, 9				
1+180						
		1H, 6H, 9,				
		10H, 11L				
1+250						

* - See Highway Pavement Distress Identification Manuel

Key:

Severity	Code	Distress Types	Code	Distress Types	Code
High	H	Alligator Cracking	1	Raveling	8
Medium	M	Block Cracking	2	Rutting	9
Low	L	Lane/Shoulder Drop-off or Heave	3	Transverse Cracks	10
		Lane/Shoulder Joint Separation	4	Bleeding	11
		Longitudinal Cracks	5	Shoving	12
		Patching	6	Cracks Sealed	s
		Pothole	7		

ASPHALTIC CONCRETE PAVEMENT CONDITION SURVEY *

PROJECT : Nevada Project PRA-LAME 1 (8) **PAGE** 4 **OF** 4
BEGINNING REFERENCE LOCATION: Overton Beach Road Mile Post 0.0
DIRECTION: Eastward **LOGGED BY:** Bradley C. Conder, P.E. **DATE:** 2/08/06

Station	Left Lane	Right Lane		Station	Left Lane	Right Lane
13+800				18+160		
	2M, 8H	2M, 8H			6M, 8L, 11M	6M, 8L, 11M
13+880				18+307		
	2M, 8H	2M, 8H			END	PROJECT
14+020						
	2M, 8H	2M, 8H				
14+230						
	1M, 2M, 8H	1M, 2M, 8H				
		11H				
14+630						
	1H, 2H, 8M	1H, 2H, 8M				
15+060						
	2L, 8H, 10M	2L, 8H, 10M				
	11M	11M				
15+170						
	6L, 8H	8H				
15+620						
	8L, 10H	8L, 10H				
16+180						
	2M, 8L, 11M	1M, 2M, 6L				
		8L				
16+290						
	2M, 8L, 10M	2M, 6L, 8L,				
		10M				
16+900						
	2M, 8L, 10M	2M, 7M, 8L,				
		10M				
17+125						
	2M, 6H, 8H,	2M, 6H, 8H,				
	10M	10M				
17+900						
	2H, 8H, 10H	2H, 8H, 10H				
18+160						

* - See Highway Pavement Distress Identification Manuel

Key:

Severity	**Code**	**Distress Types**	**Code**	**Distress Types**	**Code**
High	H	Alligator Cracking	1	Raveling	8
Medium	M	Block Cracking	2	Rutting	9
Low	L	Lane/Shoulder Drop-off or Heave	3	Transverse Cracks	10
		Lane/Shoulder Joint Separation	4	Bleeding	11
		Longitudinal Cracks	5	Shoving	12
		Patching	6	Cracks Sealed	s
		Pothole	7		

ASPHALTIC CONCRETE PAVEMENT CONDITION SURVEY REMARKS

PROJECT : Nevada Project PRA-LAME 1 (8) **PAGE** 1 **OF** 6
BEGINNING REFERENCE LOCATION: Northshore Road Mile Post 28.0
DIRECTION: Northward **LOGGED BY:** Larry W. Snedegar, P.E. **DATE:** 12/04/03

STATION	REMARKS
45+680	Start Project. 6.7 m (22 feet) wide asphaltic concrete pavement with natural gravel shoulders.
46+805	Photo-1: Block cracking width.
	Photo-2: Typical of washout at transition of cut to fill section, left lane.
	Photo-3: Surface texture of existing asphaltic concrete pavement.
	Photo-4: Chip and seal coat over older pavement, right edge.
46+965	Heaving at transverse cracks. Heaving noted in cut sections, at transition of fill to cut, or cut to fill.
47+772	Photo-5: End chip and seal coat. Block and transverse cracking pattern.
	Photo-6: Right edge, Overlay over previous pavement. Note change in aggregate type between the pavement layers.
48+415	Shoving noted on downgrade transverse cracks.
	Photo-7: Width of transverse crack.
	Photo-8: Pothole starting at wide transverse cracking.
48+978	Photo-9: Heave at transverse cracking in cut area.
48+450	Washout at right shoulder, in cut to fill transition area. Washouts are typical in most cut to fill transition areas.
49+140	Washout at right shoulder, in cut to fill transition area.
49+540	Photo-9A: Block cracking pattern.
50+185	Heave along longitudinal crack (paving joint) along centerline of roadway.
50+587	Photo-10: Rutting and heaving in cut section.
	Photo-11: Rutting and heaving in cut section. Heave is worst along transverse cracking.
51+230	Heave along block and transverse cracking in cut section.
52+035	Heave along block and transverse cracking in cut section.
53+805	Heave along transverse cracking in cut section.
To	
55+500	
55+655	Photo-12: Longitudinal cracking along centerline paving joints.

ASPHALTIC CONCRETE PAVEMENT CONDITION SURVEY REMARKS

PROJECT : Nevada Project PRA-LAME 1 (8) **PAGE** 2 **OF** 6
BEGINNING REFERENCE LOCATION: Northshore Road Mile Post 28.0
DIRECTION: Northward **LOGGED BY:** Larry W. Snedegar, P.E. **DATE:** 12/04/03

STATION	REMARKS
55+820	Begin sealing of pavement cracks, but transverse cracking is resuming.
57+747	Photo-13: Seal material being squeezed out of transverse crack.
59+039	Photo-14: Change in surface aggregate, from crushed aggregate to rounded gravel.
63+300	Drainage from Rogers Spring
63+860	Photo-15: Surface texture of existing pavement.
67+240	Heave along pavement cracks in cut section.
To	
67+780	
68+045	Vehicle fire damage of existing pavement, left lane.
68+688	Photo-16: Transverse cracking with alligator cracking
69+330	Photo-17: Depressions along transverse cracking.
70+700	Photo-18: Alligator cracking.
72+150	Photo-19: Surface texture of existing pavement.
72+200	Photo-20: Raveling of chip and seal coat at Overton Beach intersection.
72+600	Photo-21and 22: Block and transverse cracking.
	Raveling of chip and seal coat outside of spray path.
72+870	Pavement settlement over existing culvert.
	Washout at shoulders on left and right sides.
	Gypsum exposed in washout areas.
76+465	Photo-23: Block and transverse cracking at the end of the project, Mile Post 47.0.
	Raveling of chip and seal coat outside of spray paths.

ASPHALTIC CONCRETE PAVEMENT CONDITION SURVEY REMARKS

PROJECT : Nevada Project PRA-LAME 1 (8) **PAGE** 3 **OF** 6
BEGINNING REFERENCE LOCATION: Echo Bay Road Mile Post 0.0
DIRECTION: Eastward **LOGGED BY:** Bradley C. Conder, P.E. **DATE:** 2/08/06

STATION	REMARKS
0+000	Start Project. 6.4 m (21 feet) wide asphaltic concrete pavement with natural gravel shoulders.
0+000	Shoving near intersection of Echo Bay Road and Northshore Road, left lane.
To	
0+030	
0+000	Rutting, most severe in outer wheel paths, rut depths to 51 mm (2 inches).
To	Alligator cracking, block cracking, transverse cracking and bleeding.
1+610	
0+110	Photo-24: Bleeding, left lane.
0+130	Photo-25: Alligator cracking, left lane.
0+480	Photo-26: Rutting of existing pavement and patch, rut depth to 25 mm (1 inch), right lane.
	Alligator cracking and transverse cracking.
0+510	Photo-27: Rutting of existing pavement and patch, rut depth to 51 mm (2 inches), right lane.
	Photo-28: Alligator cracking.
	Transverse cracking and bleeding.
0+535	Photo-29: Rutting of existing pavement and patch, rut depth to 51 mm (2 inches), right lane.
	Alligator cracking, block cracking, transverse cracking, pothole and bleeding.
0+730	Rutting of existing pavement and patch, rut depth to 38 mm (1½ inches), right lane.
	Alligator cracking.
0+850	Rutting of existing pavement and patch, rut depth to 19 mm (¾ inch), right lane.
	Alligator cracking.
0+880	Rutting of existing pavement and patch, rut depth to 25 mm (1 inch), right lane.
	Alligator cracking.
0+890	Rutting of existing pavement and patch, rut depth to 25 mm (1 inch), left lane.
	Alligator cracking.
0+895	Rutting of existing pavement and patch, rut depth to 10 mm (⅜ inch), right lane.
	Alligator cracking.

ASPHALTIC CONCRETE PAVEMENT CONDITION SURVEY REMARKS

PROJECT : Nevada Project PRA-LAME 1 (8) **PAGE** 4 **OF** 6
BEGINNING REFERENCE LOCATION: Echo Bay Road Mile Post 0.0
DIRECTION: Eastward **LOGGED BY:** Bradley C. Conder, P.E. **DATE:** 2/08/06

STATION	REMARKS
0+920	Rutting of existing pavement and patch, rut depth to 19 mm (¾ inch), right lane.
	Alligator cracking.
1+180	Photo-30: Rutting of existing pavement and patch, rut depth to 32 mm (1¼ inches), right lane.
	Alligator cracking, transverse cracking and bleeding.
1+250	Photo-31: Block cracking, left lane.
	Rutting of existing pavement, rut depth to 6 mm (¼ inch).
2+540	Photo-32: Transverse cracking and bleeding. Heave along transverse cracking.
3+400	Rutting of existing pavement, rut depth to 6 mm (¼ inch).
	Alligator cracking, transverse cracking. Heave along transverse cracking.
3+450	Photo-33: Washout at shoulder on right side.
4+680	Photo-34: Block cracking and transverse cracking. Heave along transverse cracking.
5+000	Alligator cracking, block cracking and bleeding.
To	
7+250	
5+250	Heave along transverse cracking.
5+290	Edge cracking, right lane.
5+460	Photo-35: Heave along alligator cracking, right lane.
7+360	Photo-36: Pothole at pavement joint, right lane.
7+440	Standing water attributed to irrigation of adjacent planter area.
7+465	Photo-37: Settlement of patch over utility trench.
	Alligator cracking.
7+593	End of the project.

ASPHALTIC CONCRETE PAVEMENT CONDITION SURVEY REMARKS

PROJECT : Nevada Project PRA-LAME 1 (8)
BEGINNING REFERENCE LOCATION: Overton Beach Road Mile Post 0.0
DIRECTION: Eastward **LOGGED BY:** Bradley C. Conder, P.E. **DATE:** 2/08/06

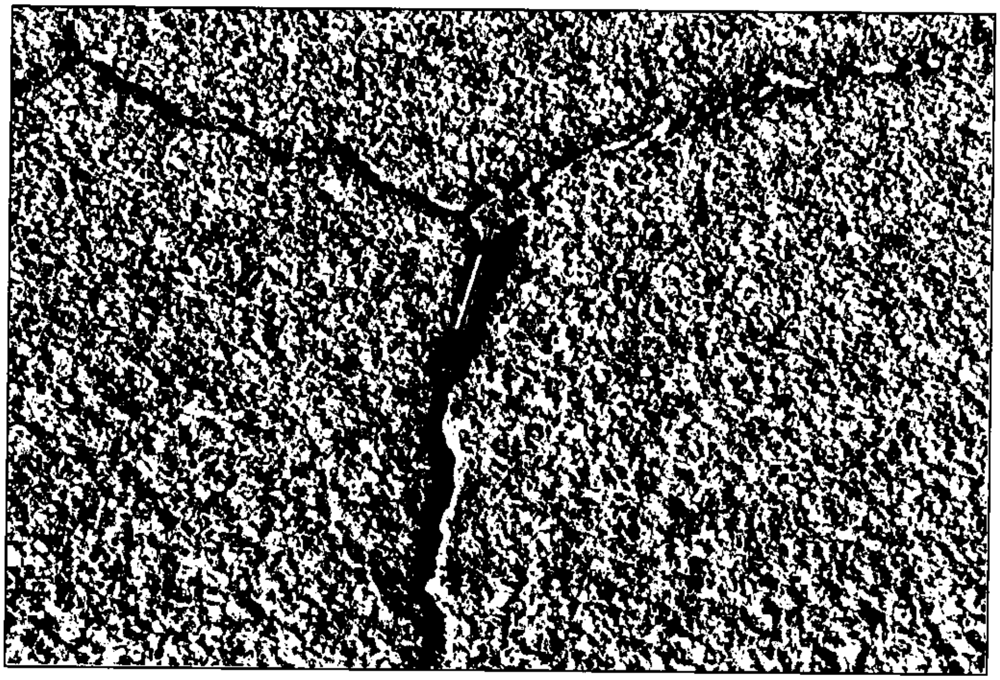
STATION	REMARKS
13+700	Start Project. 6.4 m (21 feet) wide asphaltic concrete pavement with natural gravel shoulders.
13+800	Photo-38: Raveling of chip and seal coat, left lane. Note size of aggregate under chip and seal coat.
13+880	Photo-39: Raveling of chip and seal coat, right lane.
14+020	Photo-40: Block cracking pattern, left lane.
14+230	Alligator and block cracking.
	Raveling of chip and seal coat.
	Bleeding, right lane.
14+630	Photo-41: Alligator cracking.
	Raveling of chip and seal coat.
	Block cracking.
15+060	Photo-42: Bleeding and transverse cracking.
15+170	Photo-43: Patch at location of existing box culvert.
15+620	Photo-44: Heave along transverse cracking.
	Raveling of chip and seal coat.
16+180	Photo-45: Patch along outside shoulder, right lane.
	Alligator and block cracking.
	Raveling of chip and seal coat.
	Bleeding, left lane.
16+290	Block cracking and transverse cracking.
	Raveling of chip and seal coat.
	Patch, right lane.
16+900	Photo-46: Pothole along outside shoulder, right lane.
	Block and transverse cracking.
17+125	Patches over two utility trenches.
	Block cracking and transverse cracking.
	Raveling of chip and seal coat.

ASPHALTIC CONCRETE PAVEMENT CONDITION SURVEY REMARKS

PROJECT : Nevada Project PRA-LAME 1 (8) **PAGE** 6 **OF** 6
BEGINNING REFERENCE LOCATION: Overton Beach Road Mile Post 0.0
DIRECTION: Eastward **LOGGED BY:** Bradley C. Conder, P.E. **DATE:** 2/08/06

STATION	REMARKS
17+900	Block cracking and transverse cracking.
	Raveling of chip and seal coat.
18+160	Photo-47: Patch at location of existing box culvert, with bleeding.
	Raveling of chip and seal coat.
18+307	End of the project.

PHOTO 1



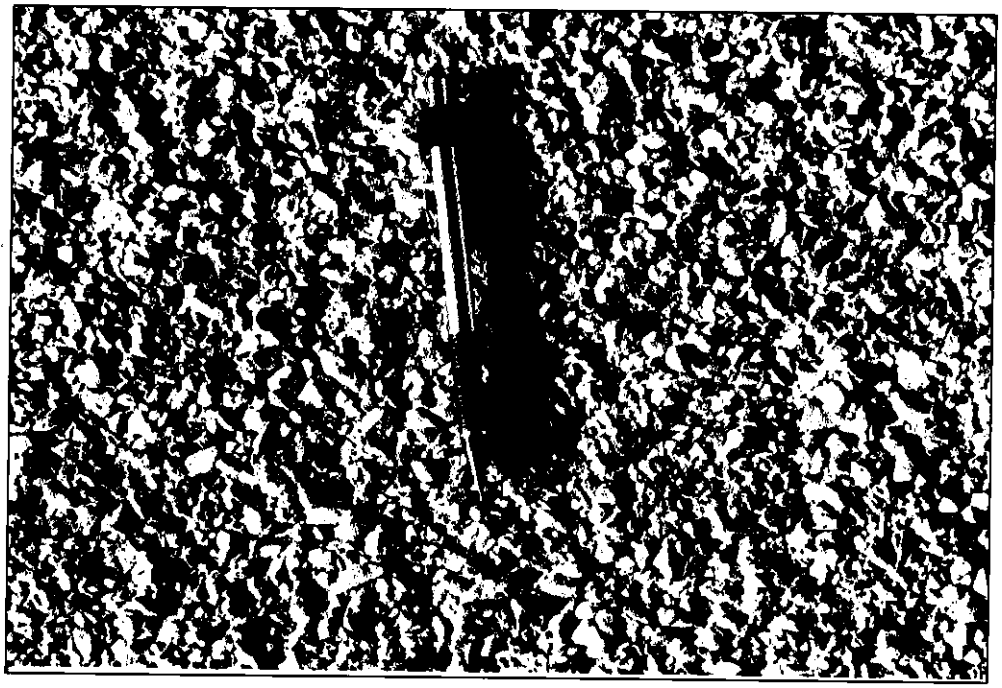
BLOCK CRACK, NORTHSHORE ROAD, NEAR STA: 46+805 RIGHT LANE.

PHOTO 2

TYPICAL OF WASHOUT AT SHOULDER IN CUT TO FILL TRANSITION AREA.
NORTHSHORE ROAD, NEAR STA: 46+805 LEFT LANE.

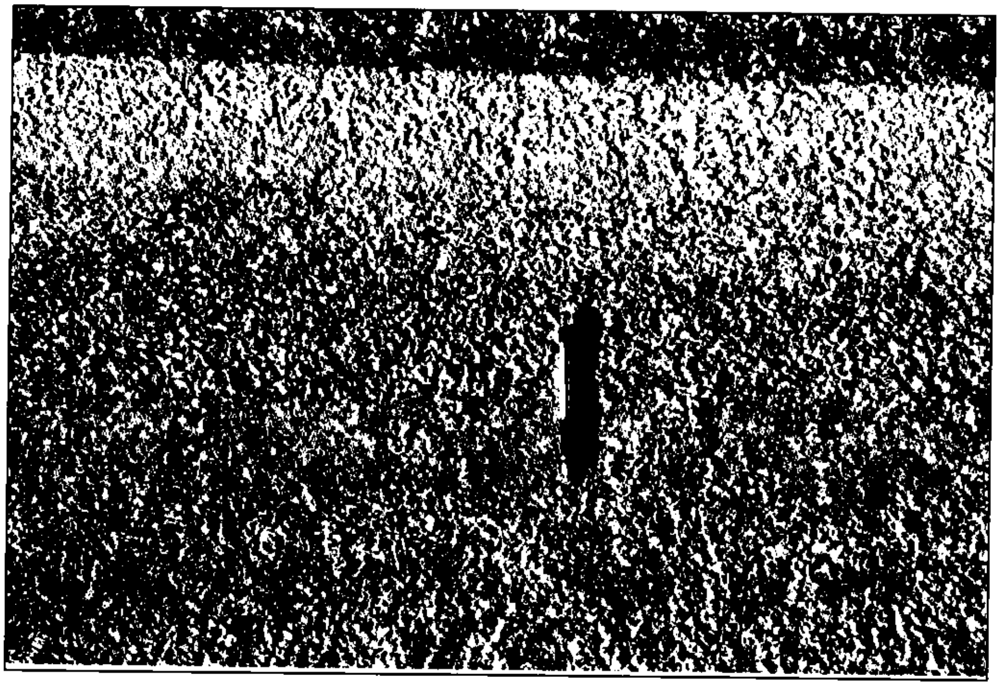
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218** PLATE: **D-1**

PHOTO 3



TYPICAL SURFACE TEXTURE OF EXISTING PAVEMENT, NORTHSHORE ROAD, NEAR STA: 46+805.

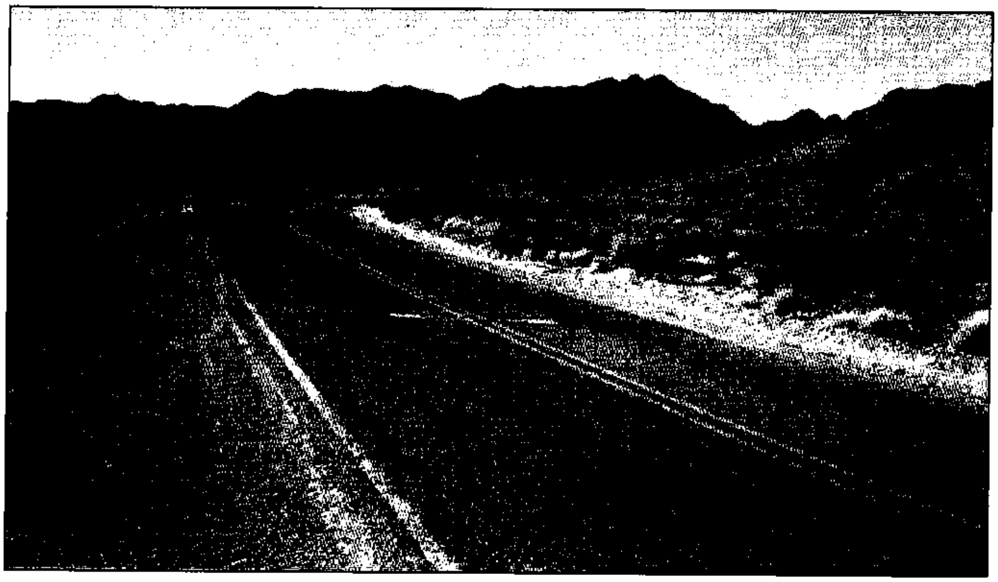
PHOTO 4



CHIP AND SEAL COAT OVER OLDER PAVEMENT.
NORTHSHORE ROAD, NEAR STA: 46+805 RIGHT LANE.

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218**	PLATE: **D-2**

PHOTO 5



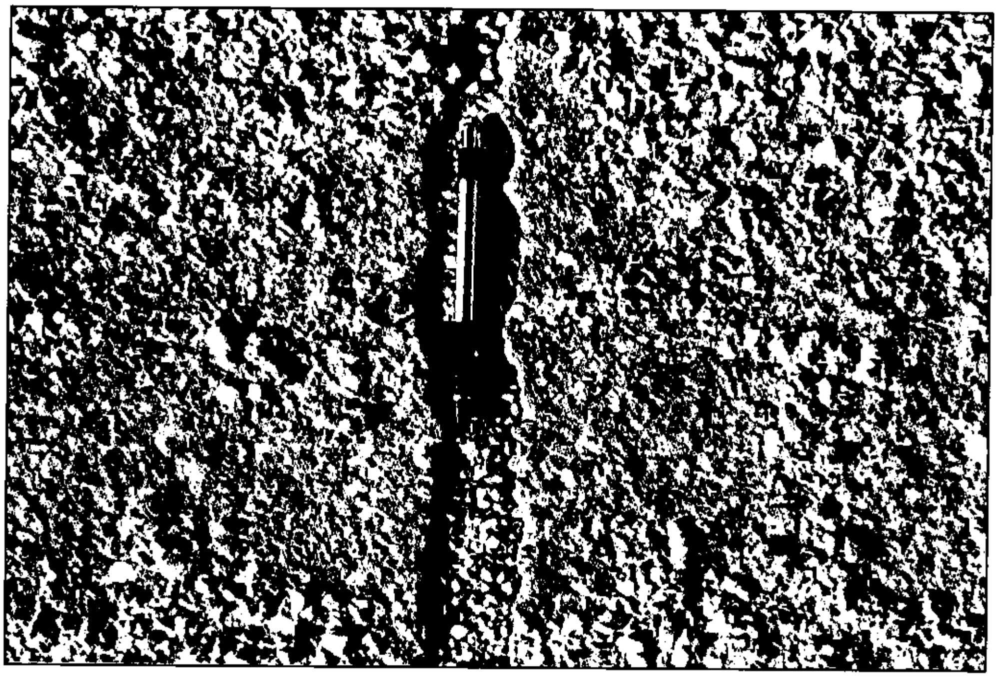
CHIP AND SEAL COAT ENDING, NORTHSHORE ROAD, AT M.P. 30.
NOTE BLOCK AND TRANSVERSE CRACKS IN PAVEMENT.

PHOTO 6

EDGE RIGHT LANE, NORTHSHORE ROAD, NEAR STA: 47+772.
OVERLAY OVER PREVIOUS PAVEMENT (GRAVEL AGGREGATE).

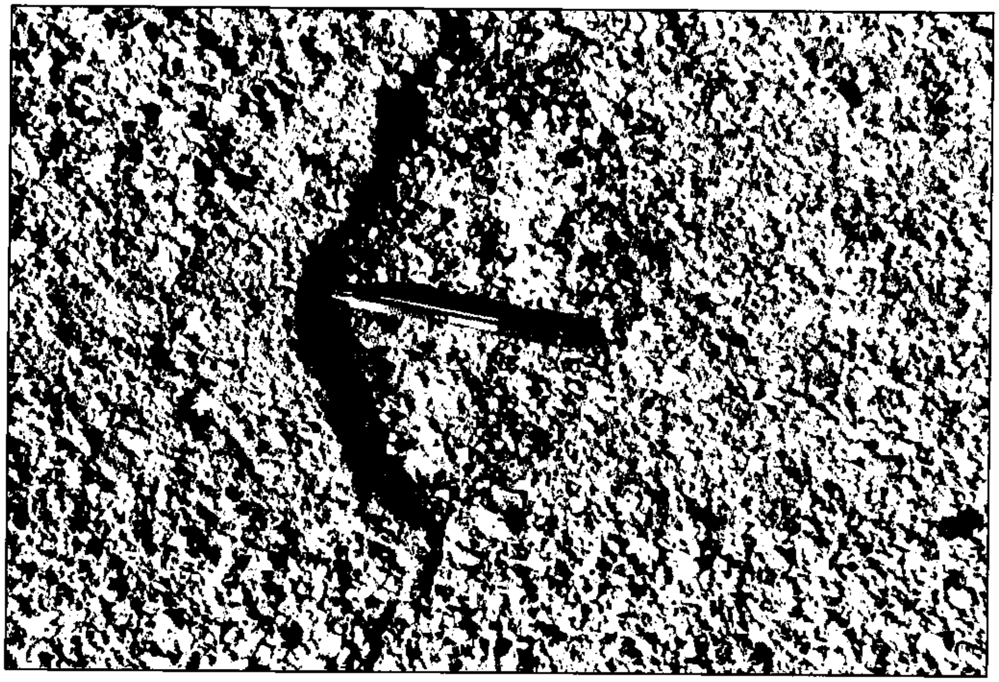
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218**	PLATE: **D-3**

PHOTO 7



TRANSVERSE CRACK NORTHSHORE ROAD, NEAR STA: 48+415, RIGHT LANE

PHOTO 8



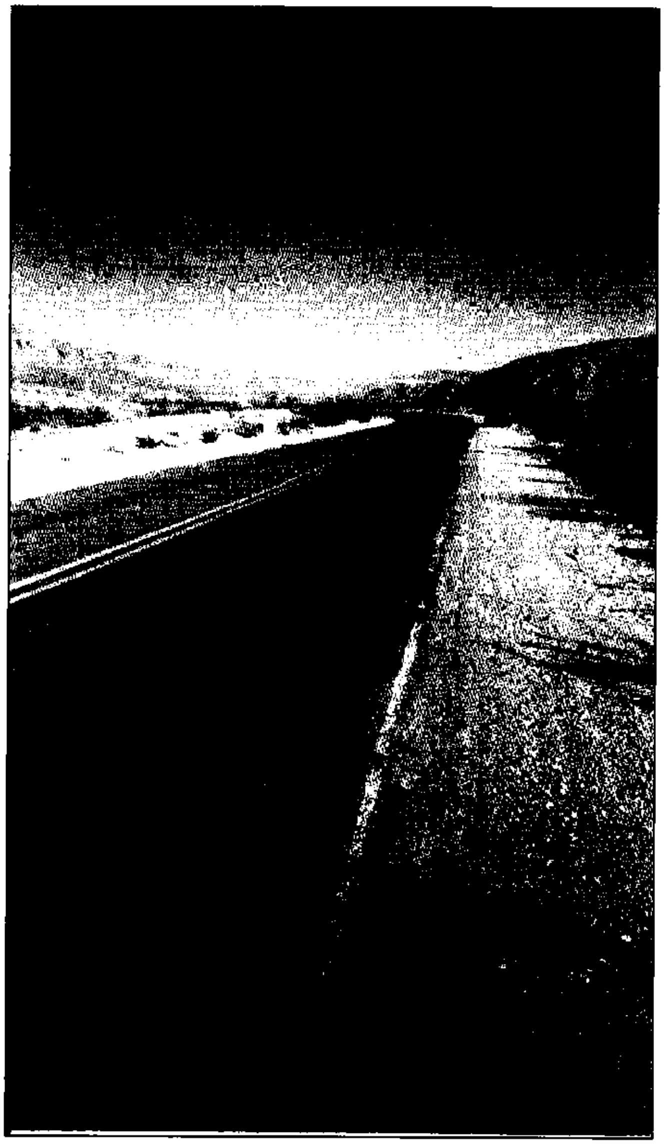
POT HOLE, NORTHSHORE ROAD, NEAR STA: 48+415 LEFT LANE.

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218** PLATE: **D-4**

PHOTO 9

TRANSVERSE CRACK WITH HEAVE IN CUT SECTION, NORTHSHORE ROAD, NEAR STA: 48+978.

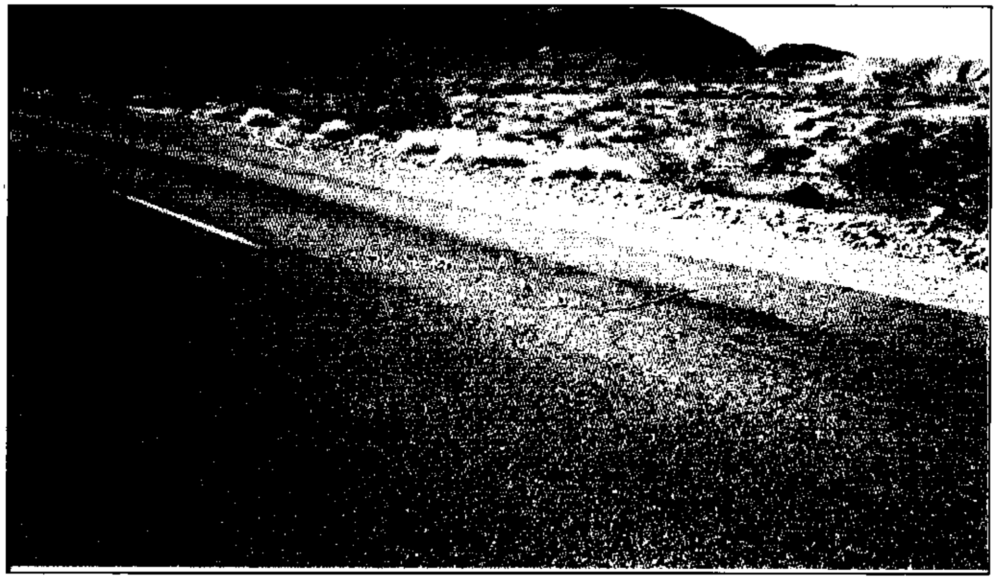
PHOTO 10



RUTTING OF PAVEMENT IN CUT SECTION, NORTHSHORE ROAD, NEAR STA: 50+587.

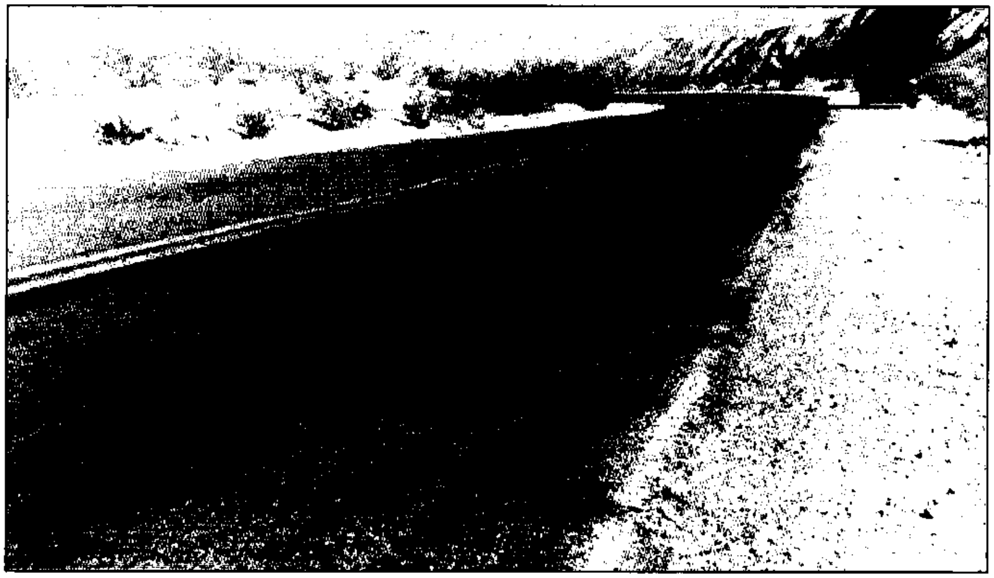
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218** / PLATE: **D-5**

PHOTO 9A



BLOCK CRACKING PATTERN, NORTHSHORE ROAD, NEAR STA: 49+540.

PHOTO 11



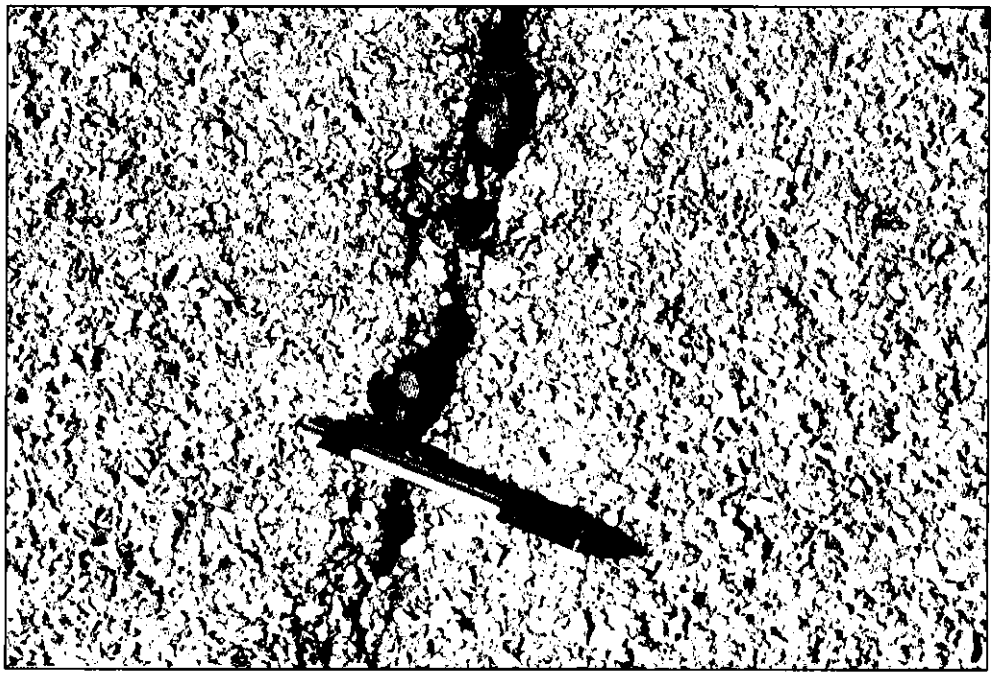
RUTTING OF PAVEMENT IN CUT SECTION, NORTHSHORE ROAD, NEAR STA: 50+587.

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218**	PLATE: **D-6**

PHOTO 12

PAVEMENT, NORTHSHORE ROAD, NEAR STA: 55+655.

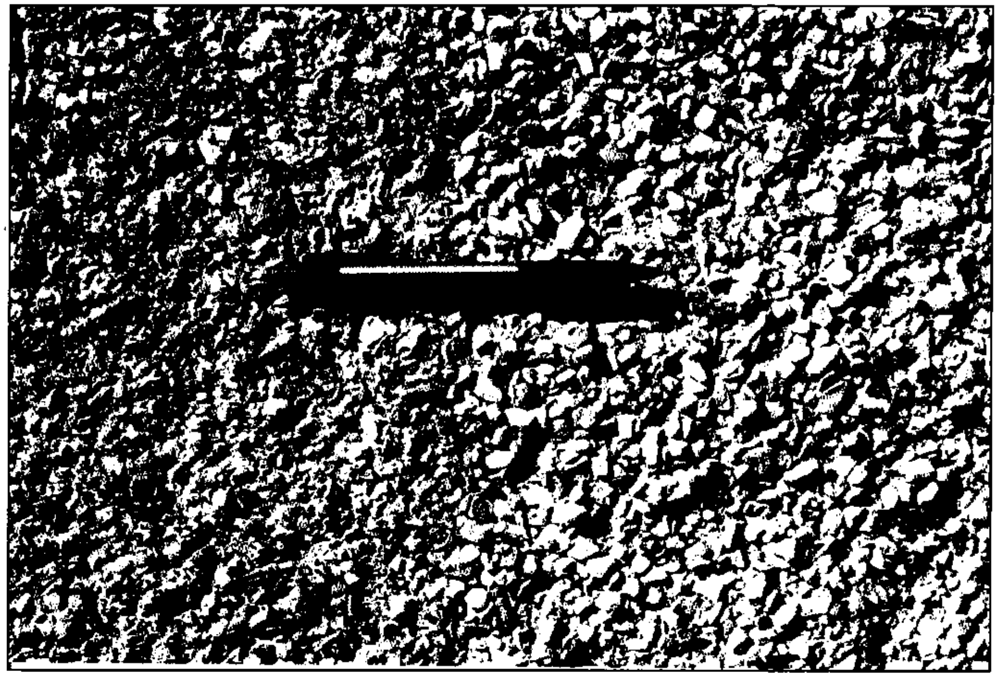
PHOTO 13



SEAL MATERIAL SQUEEZED OUT OF TRANSVERSE CRACK,
NORTHSHORE ROAD, NEAR STA: 57+747.

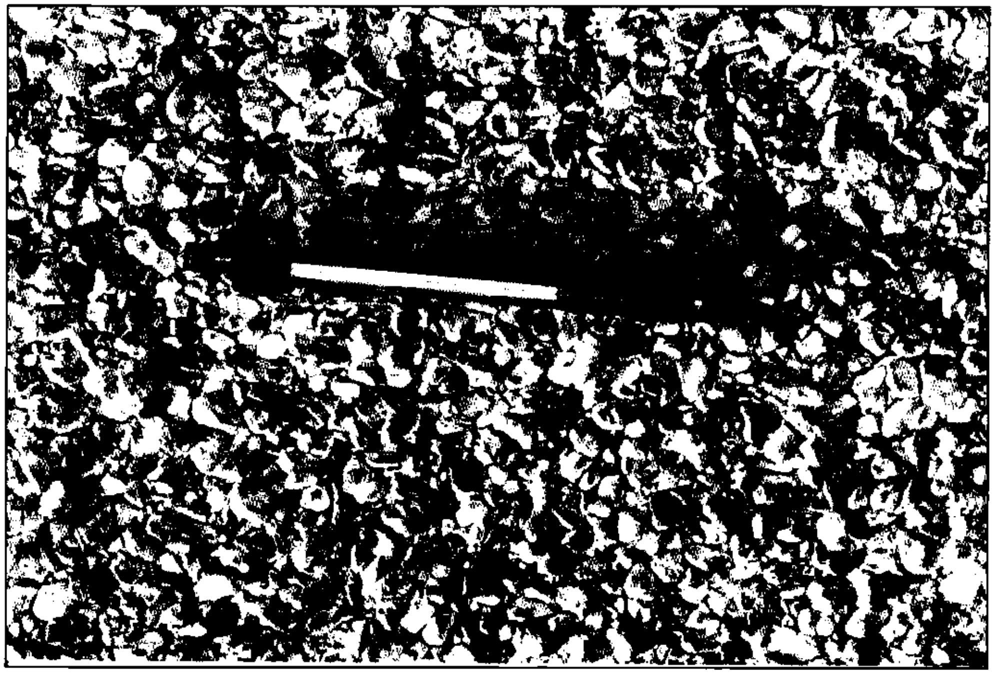
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218** / PLATE: **D-7**

PHOTO 14



CHANGE IN SURFACE AGGREGATE, CRUSHED AGGREGATE TO ROUND GRAVEL, NORTHSHORE ROAD AT M.P. 37.

PHOTO 15



SURFACE TEXTURE OF EXISTING PAVEMENT, NORTHSHORE ROAD, NEAR M.P. 40.

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218**	PLATE: **D-8**

PHOTO 16

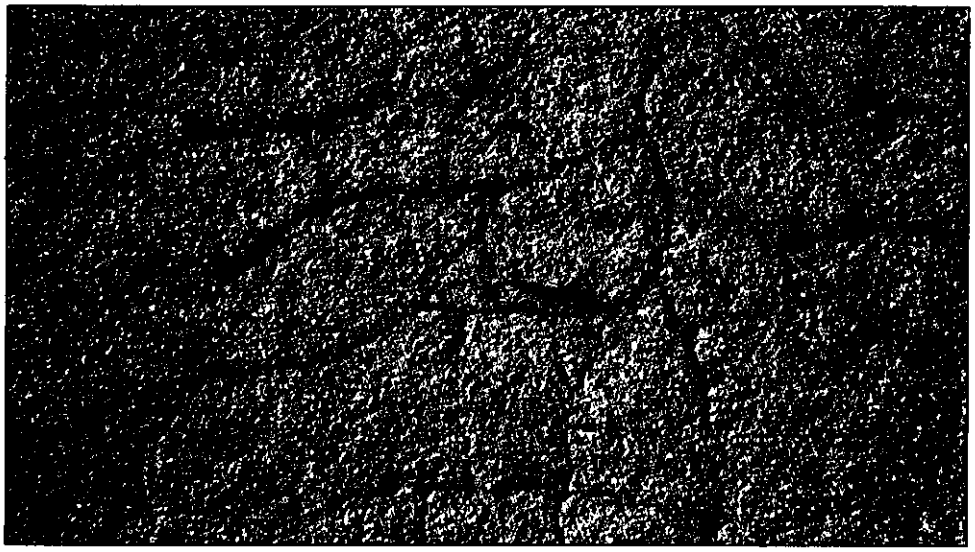
TRANSVERSE WITH ALLIGATOR CRACKING,
NORTHSHORE ROAD, NEAR STA: 68+688.

PHOTO 17

TRANSVERSE CRACK WITH HEAVE,
NORTHSHORE ROAD, NEAR STA: 69+330.

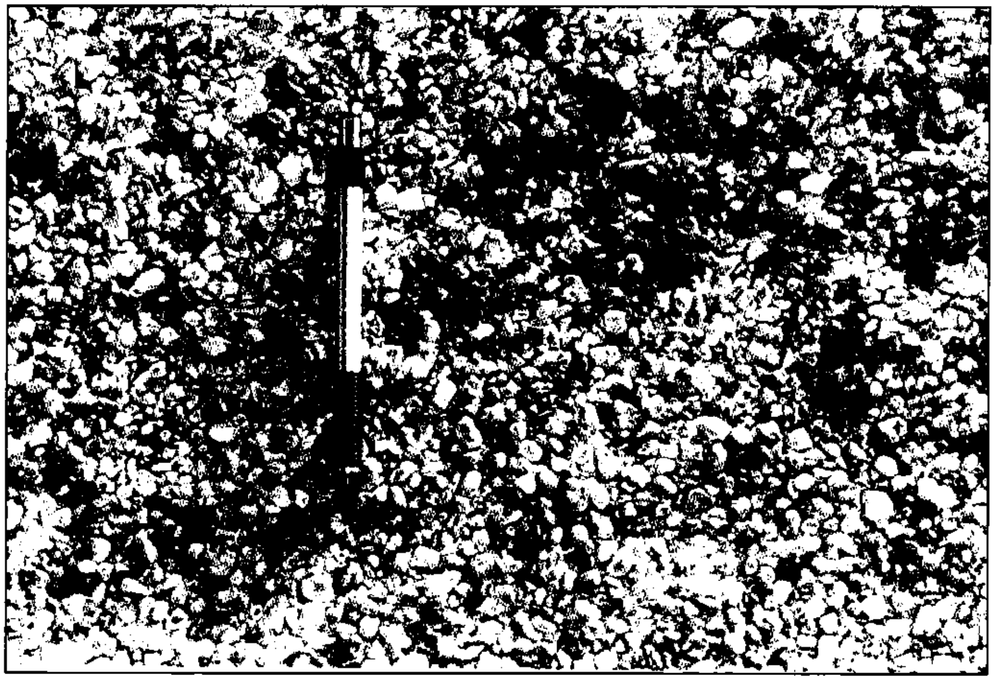
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218** — PLATE: **D-9**

PHOTO 18



ALLIGATOR CRACKING, NORTHSHORE ROAD, NEAR STA: 70+700.

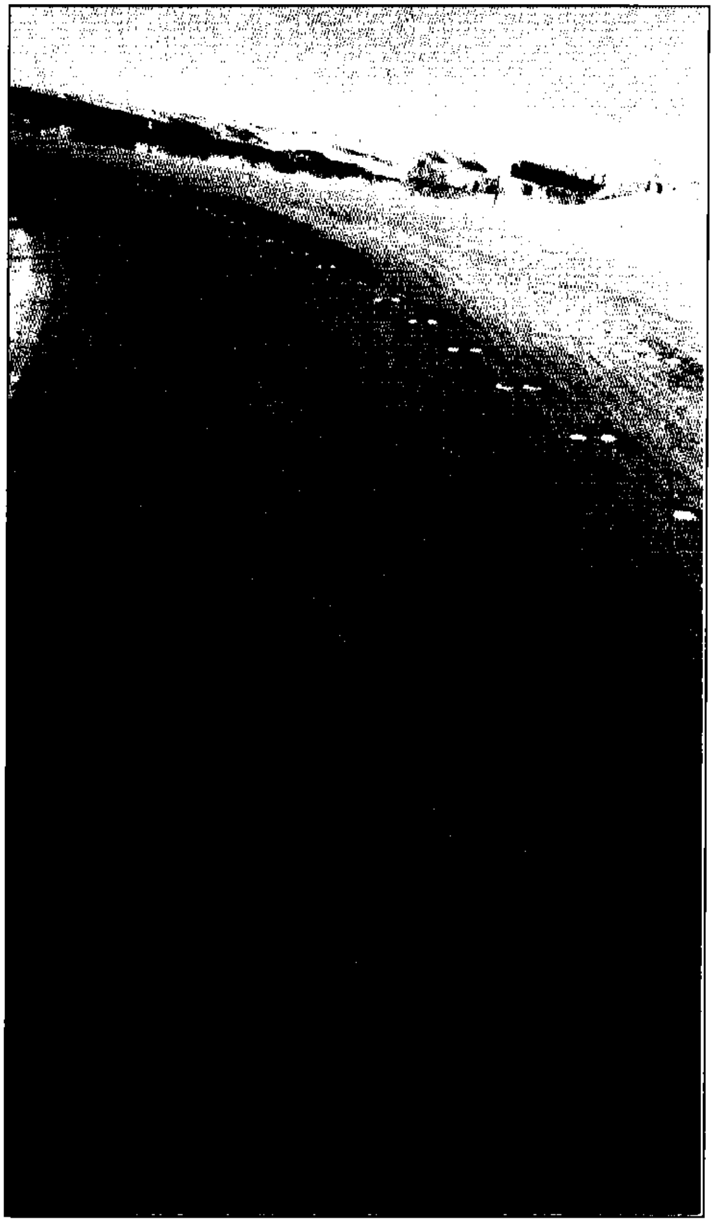
PHOTO 19



SURFACE TEXTURE OF EXISTING PAVEMENT,
NORTHSHORE ROAD, NEAR STA: 72+150.

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218** PLATE: **D-10**

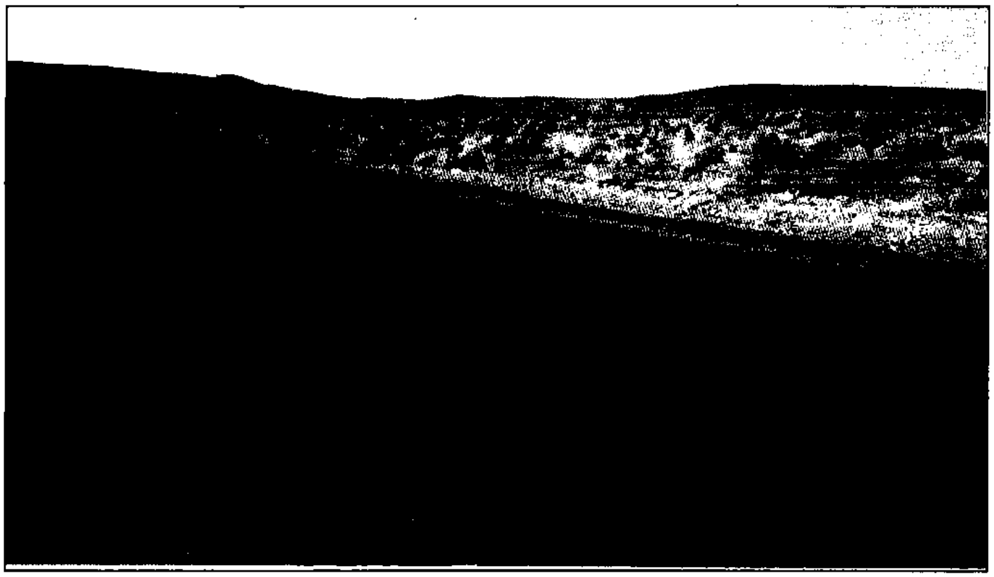
PHOTO 20



RAVELING OF EXISTING SURFACE,
NORTHSHORE ROAD, NEAR STA: 72+200 LEFT LANE.

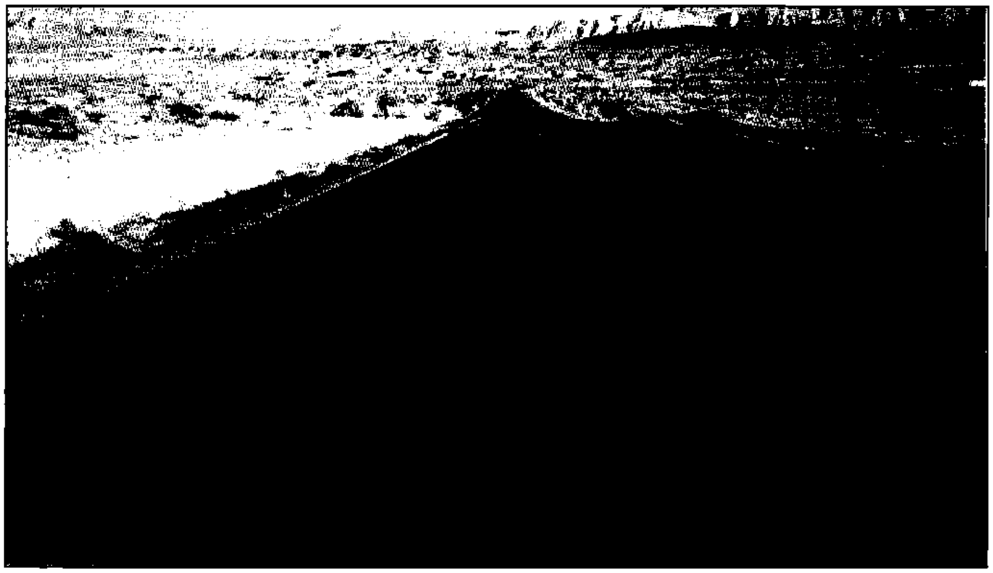
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218** / PLATE: **D-11**

PHOTO 21



BLOCK AND TRANSVERSE CRACKS, NORTHSHORE ROAD, NEAR STA: 72+600.

PHOTO 22



CONDITION OF PAVEMENT, NORTHSHORE ROAD, NEAR STA: 72+600 LOOKING EAST TOWARD OVERTON BEACH TURN OFF.

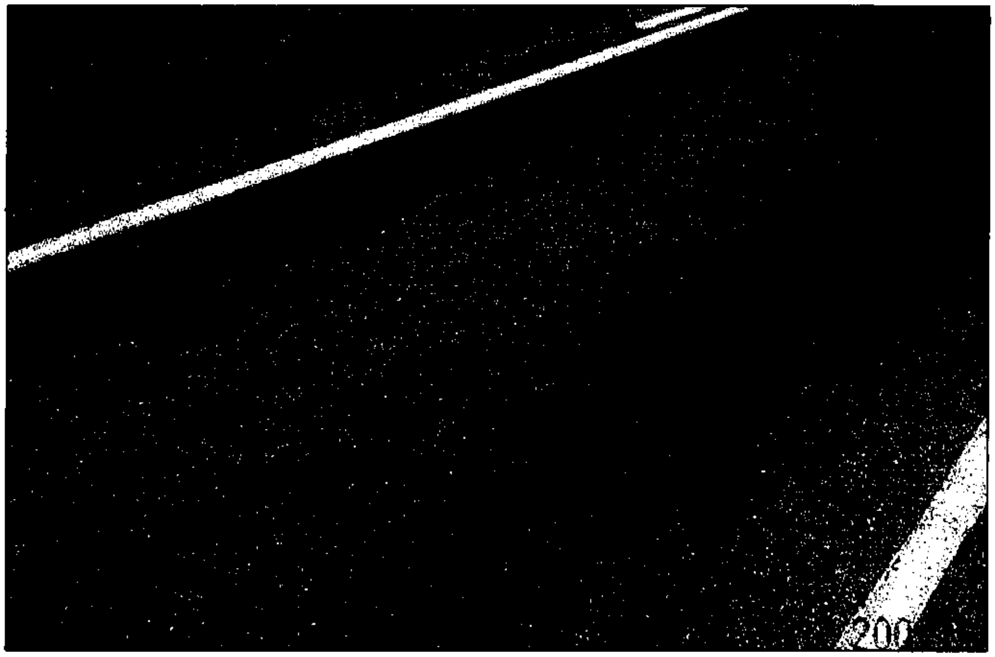
CLIENT: PARSONS BRINKERHOFF QUADE & DOUGLAS	Terracon	PAVEMENT DISTRESS PHOTOGRAPHS	
PROJECT: PRA-LAME 1 (8)		PROJECT NO.: 64035218	PLATE: D-12

PHOTO 23

BLOCK AND TRANSVERSE CRACKING, NORTHSHORE ROAD AT M.P. 47, LOOKING SOUTH.

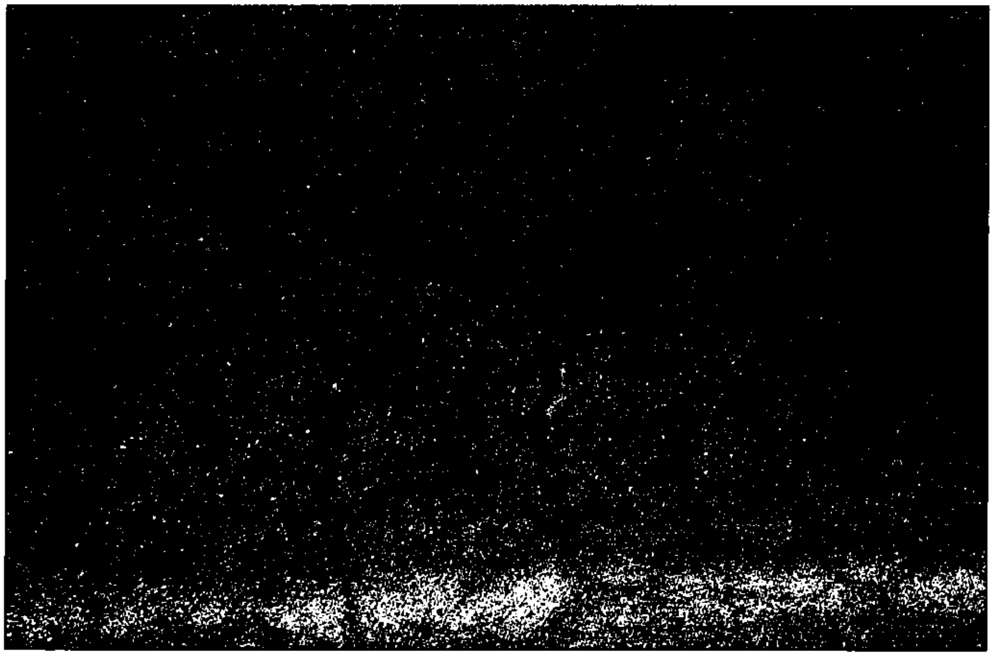
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64035218** — PLATE: **D-13**

PHOTO 24



BLEEDING, ECHO BAY ROAD, NEAR STA 0+110, LEFT LANE

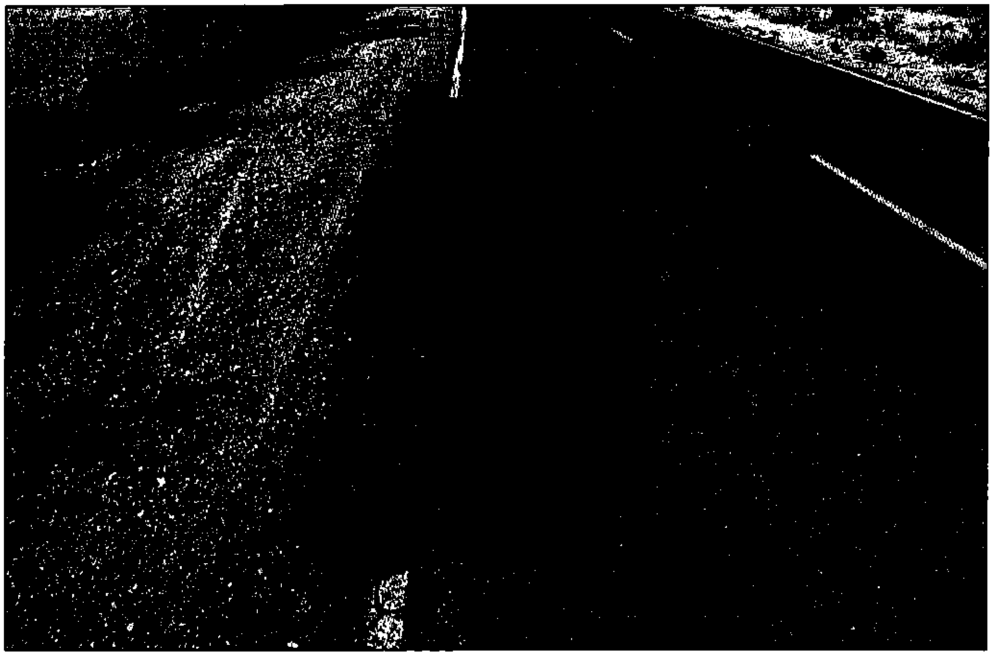
PHOTO 25



ALLIGATOR CRACKING, ECHO BAY ROAD, NEAR STA 0+130, LEFT LANE

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138**	PLATE: **D-14**

PHOTO 26



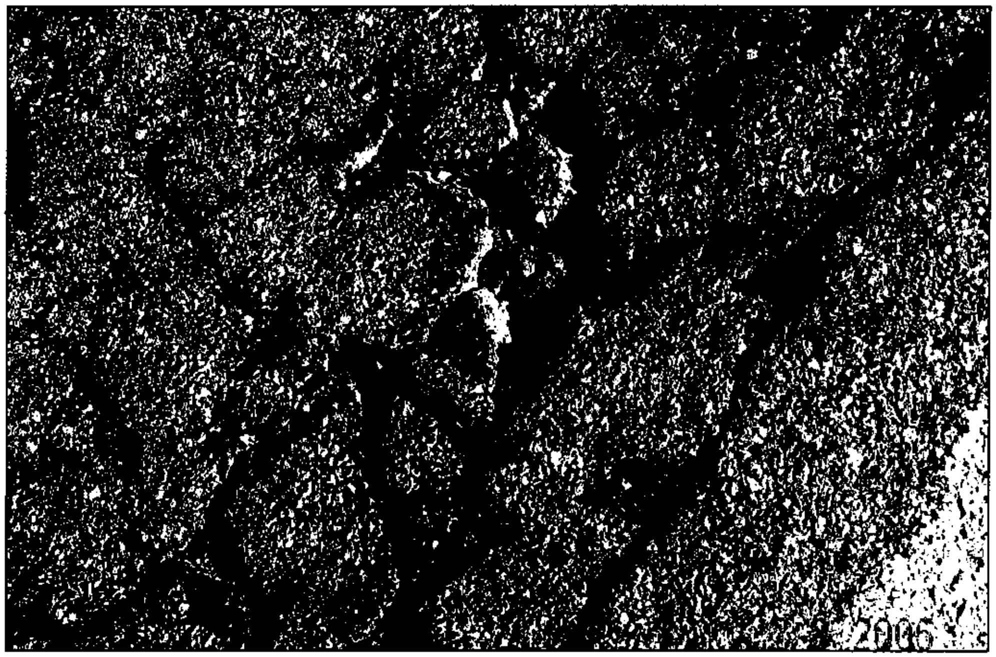
RUTTING OF PAVEMENT AND PATCH, ECHO BAY ROAD, NEAR STA 0+480, RIGHT LANE

PHOTO 27

RUTTING OF PAVEMENT AND PATCH, ECHO BAY ROAD, NEAR STA 0+510, RIGHT LANE

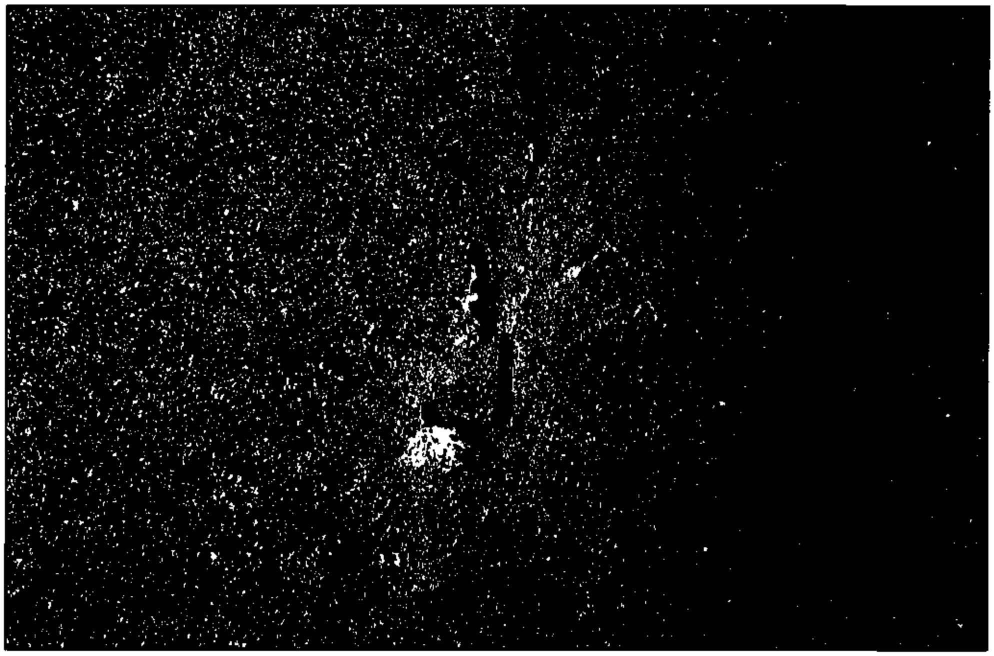
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138**	PLATE: **D-15**

PHOTO 28



ALLIGATOR CRACKING, ECHO BAY ROAD, NEAR STA 0+510, RIGHT LANE

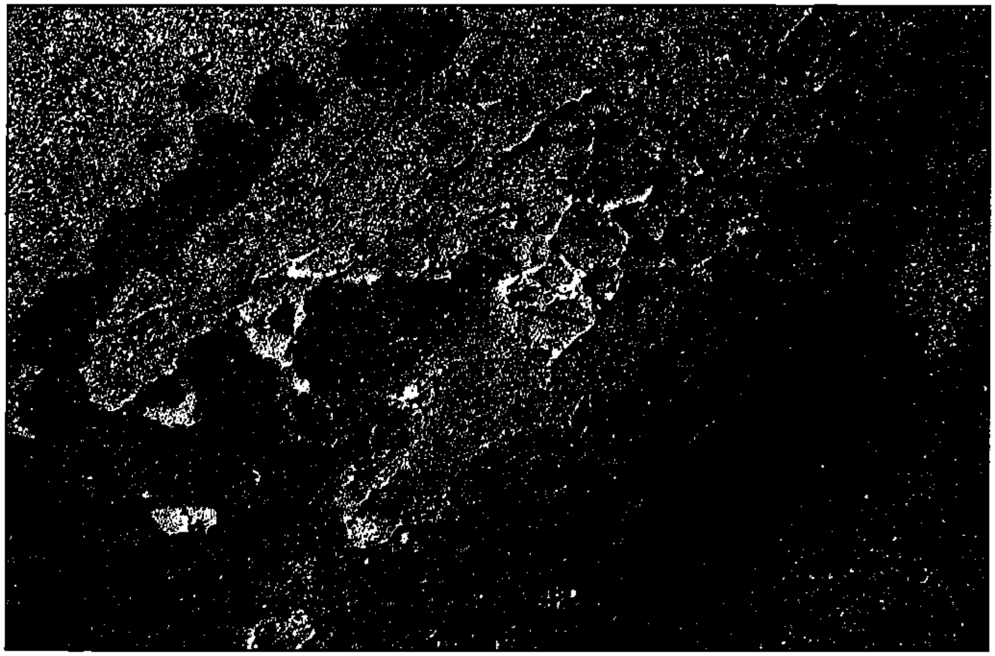
PHOTO 29



RUTTING OF PAVEMENT AND PATCH W/ ALLIGATOR CRACKING AND POTHOLE, ECHO BAY ROAD, NEAR STA 0+535, RIGHT LANE

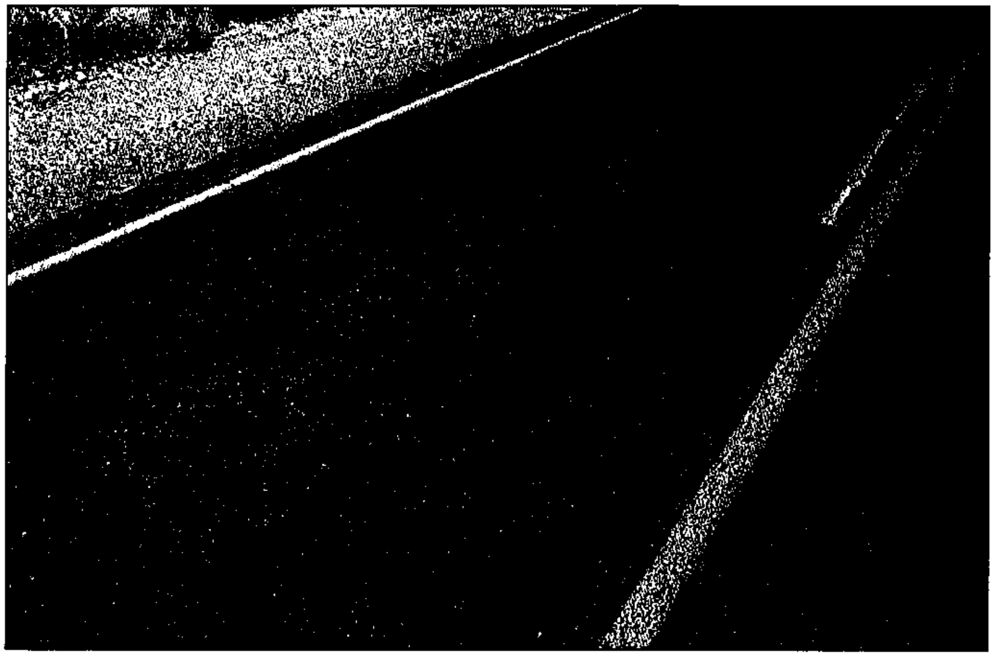
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138** PLATE: **D-16**

PHOTO 30



RUTTING OF PAVEMENT AND PATCH W/ ALLIGATOR CRACKING, ECHO BAY ROAD, NEAR STA 1+180, RIGHT LANE

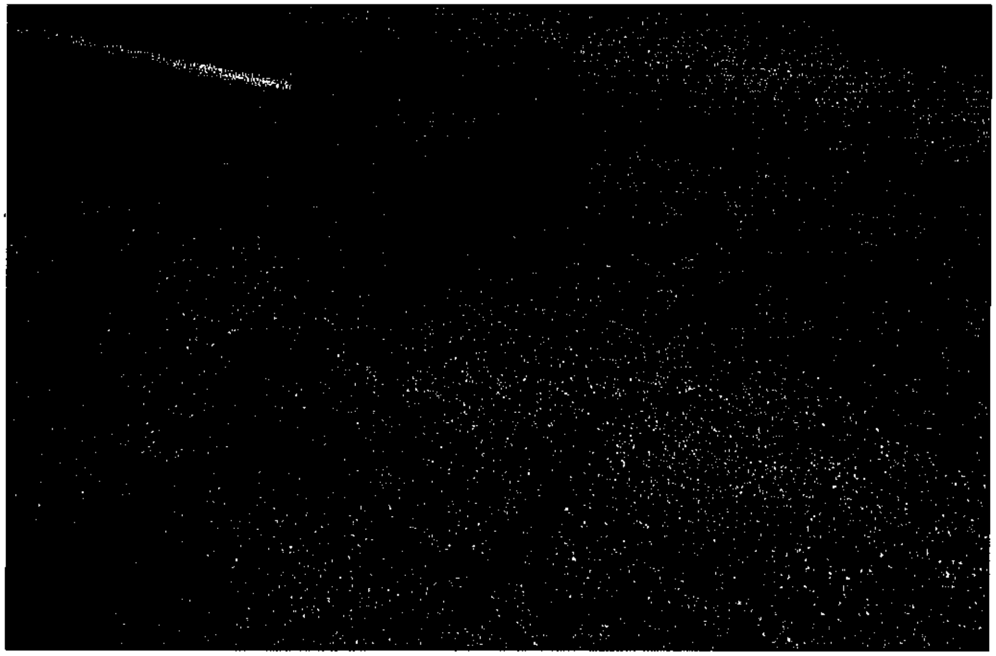
PHOTO 31



BLOCK CRACKING, ECHO BAY ROAD, NEAR STA 1+250, LEFT LANE

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138** / PLATE: **D-17**

PHOTO 32



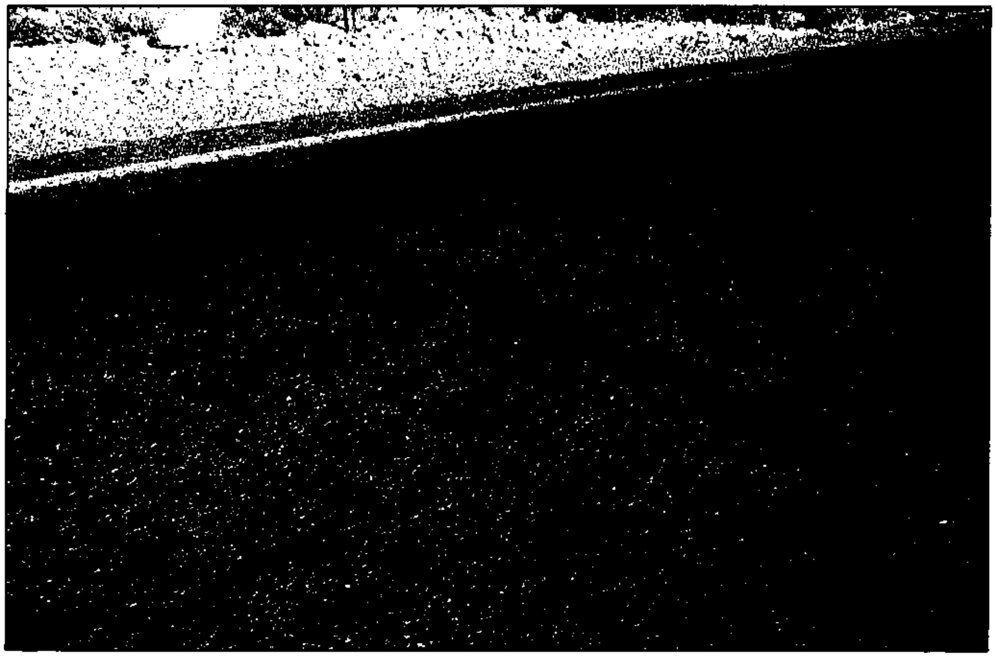
TRANSVERSE CRACKING AND BLEEDING, ECHO BAY ROAD, NEAR STA: 2+540, RIGHT LANE

PHOTO 33

WASHOUT AT SHOULDER, ECHO BAY ROAD, NEAR STA 3+450, RIGHT LANE

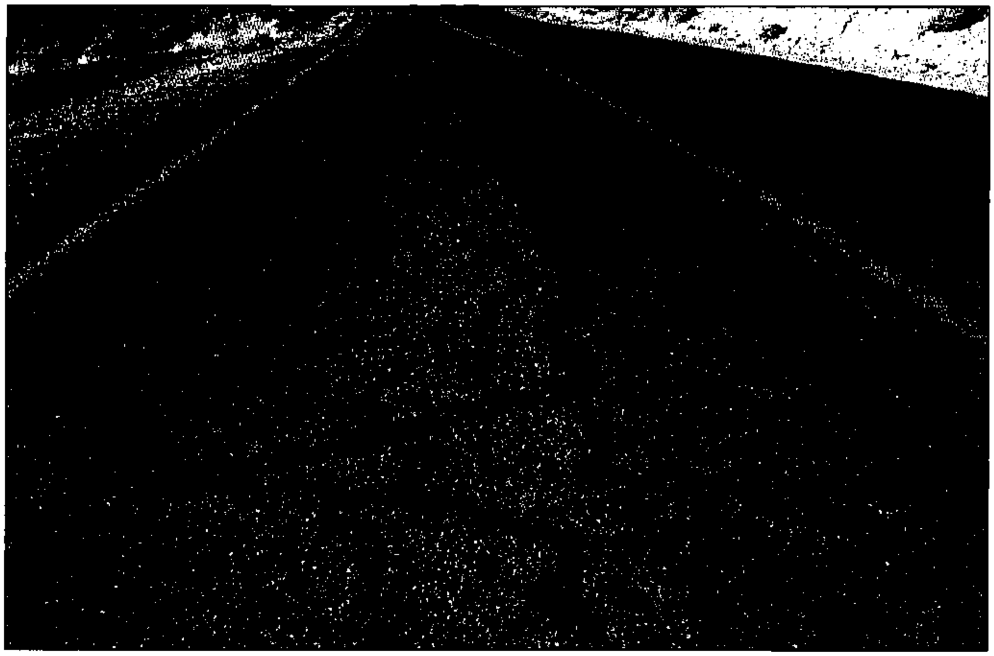
CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138**	PLATE: **D-18**

PHOTO 34



TRANSVERSE CRACKING W/ HEAVE, ECHO BAY ROAD, NEAR STA 4+680, LEFT LANE

PHOTO 35



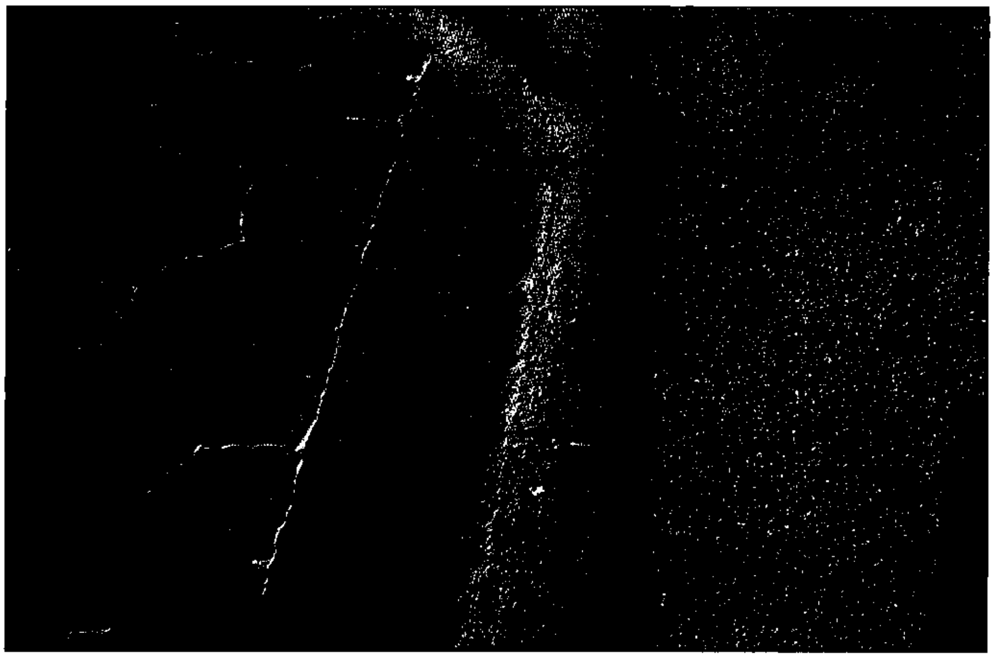
ALLIGATOR CRACKING W/ HEAVE, ECHO BAY ROAD, NEAR STA 5+460, RIGHT LANE

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138**	PLATE: **D-19**

PHOTO 36

POTHOLE AT PAVEMENT JOINT, ECHO BAY ROAD, NEAR STA 7+360, RIGHT LANE

PHOTO 37



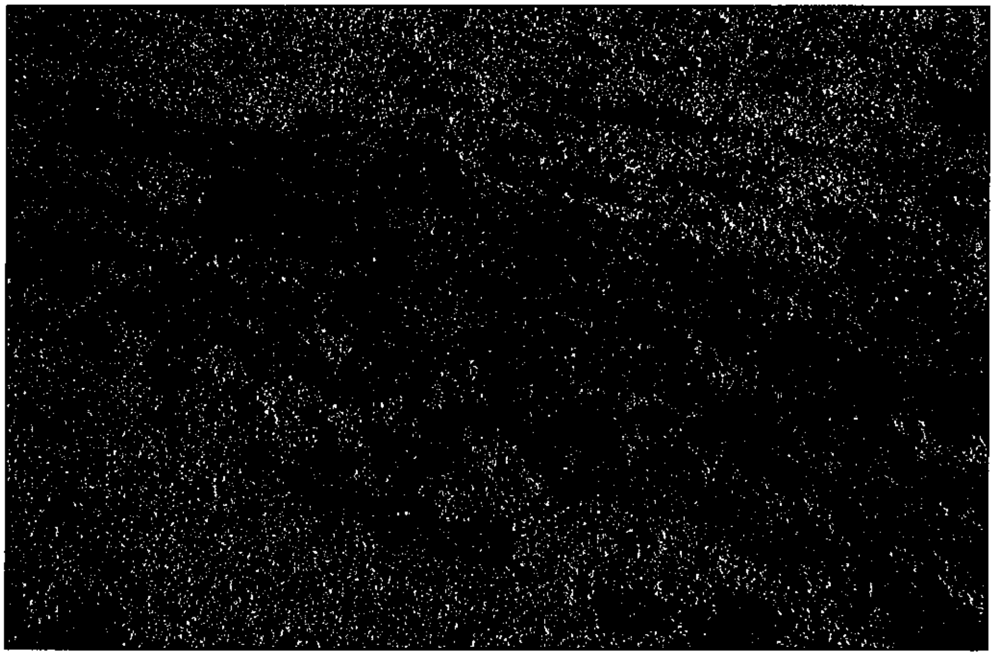
SETTLEMENT OF UTILITY TRENCH AND PATCH, W/ ALLIGATOR CRACKING,
ECHO BAY ROAD, NEAR STA 7+465, RIGHT LANE

CLIENT: PARSONS BRINKERHOFF QUADE & DOUGLAS	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*	
PROJECT: PRA-LAME 1 (8)		PROJECT NO.: 64055138	PLATE: D-20

PHOTO 38

PAVELING OF EXISTING SURFACE, OVERTON BEACH ROAD, NEAR STA 13+800, LEFT LANE

PHOTO 39



PAVELING OF EXISTING SURFACE, OVERTON BEACH ROAD, NEAR STA 13+880, RIGHT LANE

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138**	PLATE: **D-21**

PHOTO 40

BLOCK CRACKING PATTERN, OVERTON BEACH ROAD, NEAR STA 14+020, LEFT LANE

PHOTO 41

ALLIGATOR CRACKING, OVERTON BEACH ROAD, NEAR STA 14+630, RIGHT LANE

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138**	PLATE: **D-22**

PHOTO 42

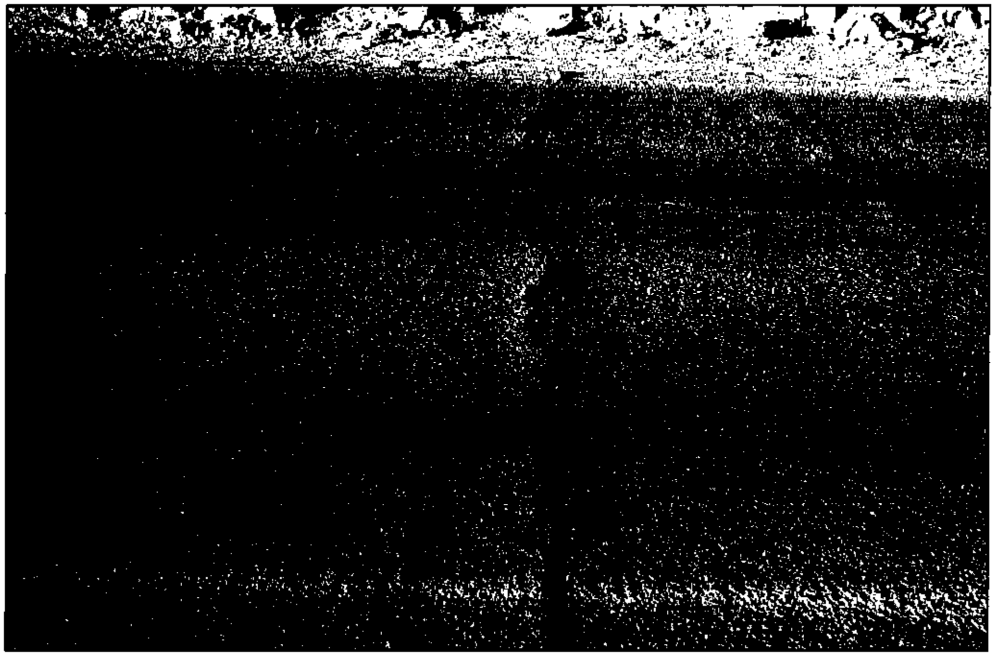
BLEEDING AND TRANSVERSE CRACKING, OVERTON BEACH ROAD, NEAR STA 15+060, LEFT LANE

PHOTO 43

PATCH AT EXISTING BOV CULVERT, OVERTON BEACH ROAD, NEAR STA 15+170, LEFT LANE

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138**	PLATE: **D-23**

PHOTO 44



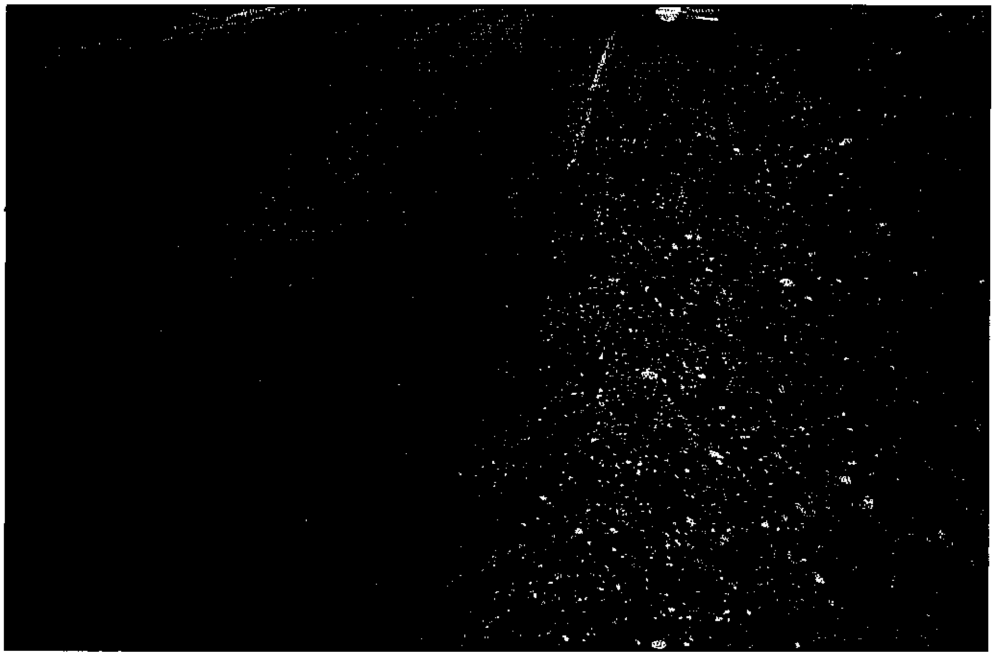
TRANSVERSE CRACK W/ HEAVE, OVERTON BEACH ROAD, NEAR STA 15+620

PHOTO 45

PATCH W/ ALLIGATOR AND BLOCK CRACKING,
OVERTON BEACH ROAD, NEAR STA 16+180, RIGHT LANE

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*	
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138**	PLATE: **D-24**

PHOTO 46



POTHOLE AT RIGHT SHOULDER, OVERTON BEACH ROAD, NEAR STA 16+900, RIGHT LANE

PHOTO 47

PATCH AT EXISTING BOX CULVERT, W/ BLEEDING, OVERTON BEACH ROAD, NEAR STA 18+160

CLIENT: **PARSONS BRINKERHOFF QUADE & DOUGLAS**	Terracon	*PAVEMENT DISTRESS PHOTOGRAPHS*
PROJECT: **PRA-LAME 1 (8)**		PROJECT NO.: **64055138** PLATE: **D-25**

APPENDIX E

Traffic Information

LAKE MEAD NATIONAL RECREATION AREA

NPS Traffic Monitoring Program, Coverage Count and Data Reporting Project

DTFH71-02-R-00013

March 12, 2004

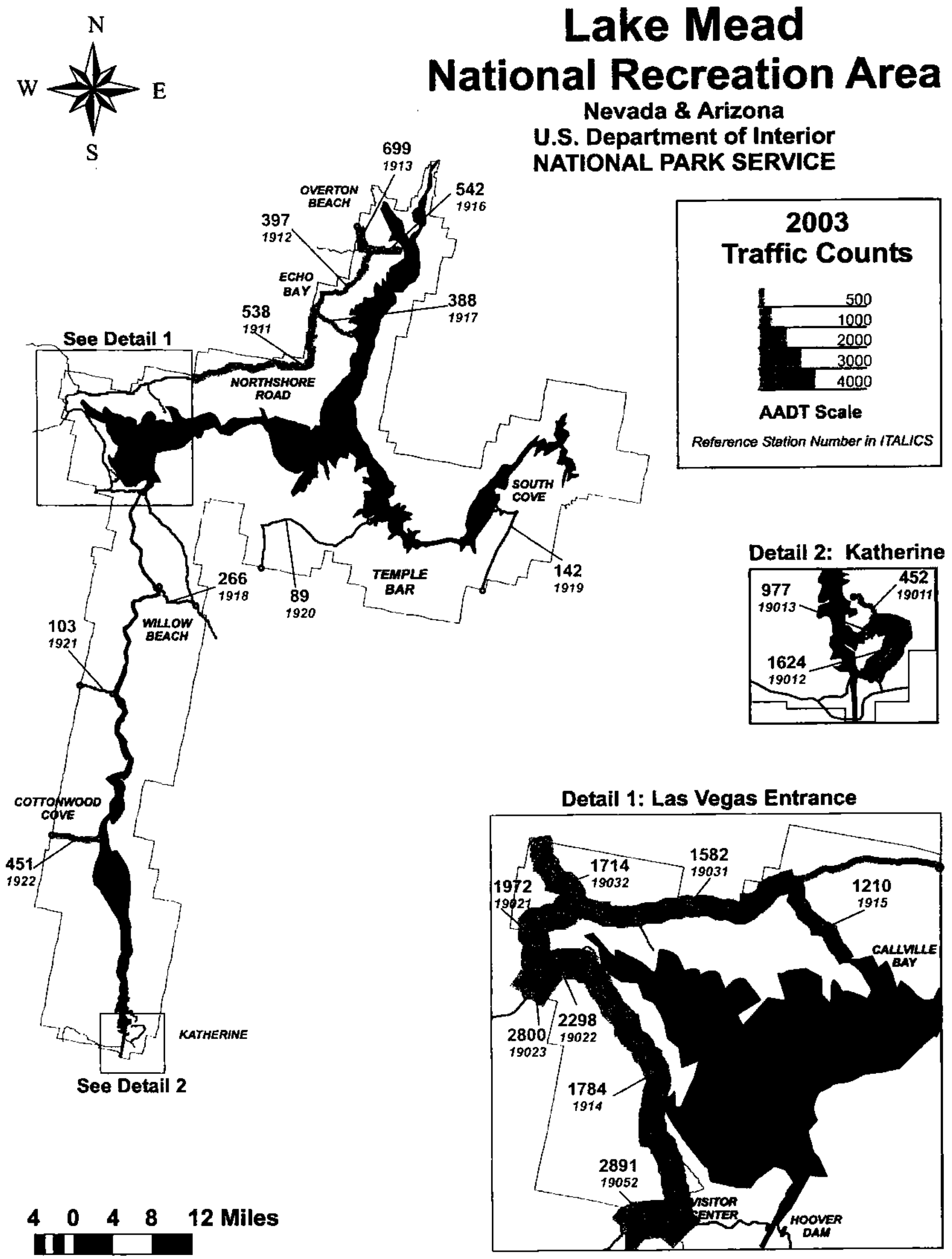
Prepared for

Department of Transportation
Federal Highway Administration
Eastern Federal Lands Highway Division

U.S. Department of Transportation
Federal Highway Administration

Submitted by

ERES Consultants
A Division of Applied Research Associates, Inc.


Lake Mead
National Recreation Area
Nevada & Arizona
U.S. Department of Interior
NATIONAL PARK SERVICE
N
W
E
S
2003
Traffic Counts
500
1000
2000
3000
4000
AADT Scale
Reference Station Number in ITALICS
699
1913
OVERTON BEACH
542
1916
397
1912
ECHO BAY
538
1911
388
1917
See Detail 1
NORTHSHORE ROAD
SOUTH COVE
TEMPLE BAR
142
1919
266
1918
89
1920
WILLOW BEACH
103
1921
COTTONWOOD COVE
451
1922
KATHERINE
See Detail 2
Detail 2: Katherine
977
19013
452
19011
1624
19012
Detail 1: Las Vegas Entrance
1714
19032
1582
19031
1972
19021
1210
1915
CALLVILLE BAY
2298
19022
2800
19023
1784
1914
2891
19052
VISITOR CENTER
HOOVER DAM
4 0 4 8 12 Miles

National Park Service Traffic Count Program

LAKE MEAD NATIONAL RECREATION AREA — TRAFFIC TRENDS SUMMARY

Rt. No.	Roadway Segment	Sta. ID.	Length	AADT 1988	AADT 1991	AADT 1994	AADT 2003	VMT(1000's) 1988	VMT(1000's) 1991	VMT(1000's) 1994	VMT(1000's) 2003
1	Northshore Rd. - Lakeshore Rd. to Lake Mead Blvd.	19021	3.2	1607	1740	1836	1972	1877	2032	2144	2303
1	Northshore Rd. - Lake Mead Blvd. To Callville Bay Rd.	19031	7.9	1662	1721	1817	1582	4792	4963	5239	4562
1	Northshore Rd. - Callville Bay Rd. to Echo Bay Rd.	1911	24.2	1474	340	723	538	13020	3003	6386	4752
1	Northshore Rd. - Echo Bay Rd. to Overton Beach Road	1912	9.76	1474	282	402	397	5251	1005	1432	1414
1	Northshore Rd. - Overton Beach Road to North Park Bdry.	1913	2.59	1470	349	661	699	1390	330	625	661
2	Lake Mead Blvd. - Northshore Rd. to West Park Bdry.	19032	2.58	2044	1763	1861	1714	1925	1660	1753	1614
3	Lakeshore Rd. - U.S. Hwy. 93 to Boulder Beach Rd.	19051*	1.88	3123	3176	3353	1784	2143	2179	2301	1224
3	Lakeshore Rd. - Boulder Beach Rd. to Las Vegas Wash.	1914	7.34	2800	2676	2453	1784	7501	7169	6572	4780
3	Lakeshore Rd. - Las Vegas Wash to Northshore Rd.	19022	1.85	2682	3445	3637	2298	1811	2326	2456	1552
3	Lakeshore Rd. - Northshore Rd. to West Park Bdry.	19023	0.62	2638	3083	3255	2800	597	698	737	634
10	Callville Bay Rd. - Northshore Rd. to Callville Bay	1915	3.88	100	496	1501	1210	142	702	2126	1714
11	Overton Beach Rd. - Northshore Rd. to Lake Mead	1916	2.92	100	283	490	542	107	302	522	578
112	Echo Bay Rd. - Northshore Rd. to Lake Mead	1917	4.72	100	289	607	388	172	498	1048	668
113	Willow Beach Rd. - U. S. Hwy. 93 to Willow Beach	1918	4.64	100	222	218	266	169	376	369	450
114	Katherine Access Rd. - Ariz. Hwy. 68 to Cabinsite Rd.	19012	3.34	1982	2232	1744	1624	2416	2721	2126	1980
114	Katherine Access Rd. - Cabinsite Rd. to Launch Ramp	19013	0.7	1882	1867	1536	977	481	477	392	250
115	Pearce Ferry Rd. - South Park Boundary to Lake Mead	1919	13.54	10	262	412	142	49	1295	2036	702
116	Temple Bar Rd. - South Park Boundary to Lake Mead	1920	17.09	10	104	145	89	62	649	904	555
235	Eldorado Canyon Rd. - West Park Boundary to Lake Mohave	1921	4.14	20	26	84	103	30	39	127	156
237	Cottonwood Cove Rd. - West Park Boundary to Lake Mohave	1922	5.26	20	200	417	451	38	384	801	866
260	Cabinsite Rd. - Katherine Access Rd. to Cabinsite	19011	1.38	444	506	546	452	224	255	275	228
VMT SUMMARY								44198	33063	40369	31641

Note: AADT – Annual Average Daily Traffic
VMT– Vehicle Miles of Travel

* ATR Station 19051 experienced equipment problems during the study. The 2003 value is based on the nearby coverage count station 1914.

National Park Service Traffic Count Program

LAKE MEAD NATIONAL RECREATION AREA **2003 TRAFFIC VOLUME SUMMARY**

Sta. ID.	STATION LOCATION	BEGIN DATE	24 HR. VOL.	SEAS. FACT.	ANN. FACT.	SADT	AADT	REF. STA.
19011	Cabinsite Rd. - Katherine Access Rd. to Cabinsite					748	452	Self
19012	Katherine Access Rd. - Ariz. Hwy. 68 to Cabinsite Rd.					2062	1624	Self
19013	Katherine Access Rd. - Cabinsite Rd. to Launch Ramp					1195	977	Self
19052	US Highway 93					3075	2891	Self
19021	Northshore Rd. - Lakeshore Rd. to Lake Mead Blvd.	6/14/03	3110	0.67464	0.63423	2098	1972	19052
19022	Lakeshore Rd. - Las Vegas Wash to Northshore Rd.	6/14/03	3624	0.67464	0.63423	2445	2298	19052
19023	Lakeshore Rd. - Northshore Rd. to West Park Bdry.	6/14/03	4414	0.67464	0.63423	2978	2800	19052
19031	Northshore Rd. - Lake Mead Blvd. To Callville Bay Rd.	6/14/03	2495	0.67464	0.63423	1683	1582	19052
19032	Lake Mead Blvd. - Northshore Rd. to West Park Bdry.	6/14/03	2703	0.67464	0.63423	1824	1714	19052
1911	Northshore Rd. - Callville Bay Rd. to Echo Bay Rd.	6/14/03	849	0.67464	0.63423	573	538	19052
1912	Northshore Rd. - Echo Bay Rd. to Overton Beach Road	6/14/03	626	0.67464	0.63423	422	397	19052
1913	Northshore Rd. - Overton Beach Road to North Park Bdry.	6/14/03	1102	0.67464	0.63423	743	699	19052
1914	Lakeshore Rd. - Boulder Beach Rd. to Las Vegas Wash.	6/14/03	2813	0.67464	0.63423	1898	1784	19052
1915	Callville Bay Rd. - Northshore Rd. to Callville Bay	6/14/03	1908	0.67464	0.63423	1287	1210	19052
1916	Overton Beach Rd. - Northshore Rd. to Lake Mead	6/14/03	854	0.67464	0.63423	576	542	19052
1917	Echo Bay Rd. - Northshore Rd. to Lake Mead	6/14/03	612	0.67464	0.63423	413	388	19052
1918	Willow Beach Rd. - U. S. Hwy. 93 to Willow Beach	6/14/03	604	0.53853	0.4401	325	266	19013
1919	Pearce Ferry Rd. - South Park Boundary to Lake Mead	6/14/03	323	0.53853	0.4401	174	142	19013
1920	Temple Bar Rd. - South Park Boundary to Lake Mead	6/14/03	202	0.53853	0.4401	109	89	19013
1921	Eldorado Canyon Rd. - West Park Boundary to Lake Mohave	6/14/03	234	0.53853	0.4401	126	103	19013
1922	Cottonwood Cove Rd. - West Park Boundary to Lake Mohave	6/14/03	1025	0.53853	0.4401	552	451	19013

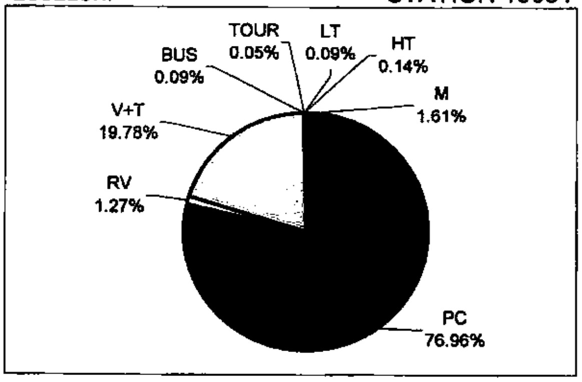
Note: AADT -- Annual Average Daily Traffic
SADT -- Seasonal Average Daily Traffic computed using data for the months containing 80% of annual volume.
REF. STA. -- a permanent Automated Traffic Recorder (ATR) reference station used to obtain seasonal and annual adjustment factors for coverage counts.

National Park Service Traffic Count Program

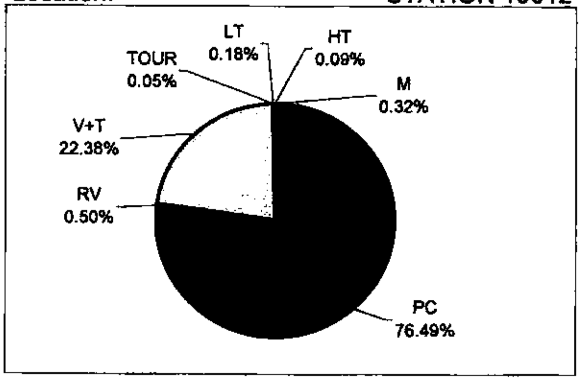
LAKE MEAD NATIONAL RECREATION AREA **2003 TRAFFIC COMPOSITION SUMMARY**

Vehicle Classification

Location: STATION 19051

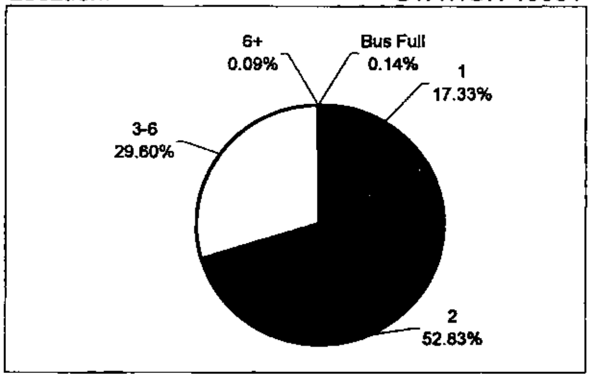


Location: STATION 19012

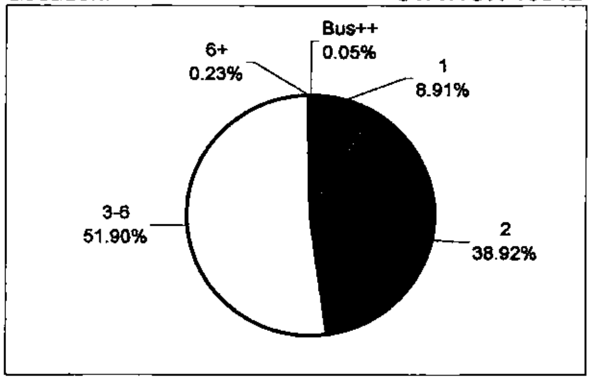


Vehicle Occupancy

Location: STATION 19051



Location: STATION 19012



CLASSIFICATION LEGEND:

No.	Vehicle Type	FHWA Class
M	Motorcycles	Class 1
PC	Passenger Cars	Class 2
RV	Recreational Vehicles	N/A
V+T	Vehicles/RV pulling Trailer	N/A
BUS	Transit/Shuttle Buses	Class 4
TOUR	Tour Buses	Class 4
LT	Light-duty Trucks	Classes 3, 5
HT	Heavy-duty Trucks	Classes 6 - 13

OCCUPANCY LEGEND:

No.	Vehicle Occupancy
1	1 Occupant
2	2 Occupants
3-6	3-6 Occupants (car load)
6+	More than 6 Occupants, (non-Bus)
Bus 0	Bus, No Passengers
Bus +	Bus, Few Passengers
Bus++	Bus, Semi-Loaded
Bus Full	Bus, Fully Loaded

Note: Vehicle Classifications and Vehicle Occupancy values represented by 0% (No Occurrence) are not shown on the charts.

APPENDIX F

Traffic Calculations
ESAL Calculations
Pavement Design Calculations
Cost Analysis Results
Design R-Values Determinations

	North Shore Road				64035218	
	Callville Bay Road to Echo Bay Road					
	2	GROWTH PER YEAR %				
	0.02	GROWTH RATE				
		YEAR	CALCULATED ADT	GIVEN ADT	TRAFFIC FOR YEAR	CUMULATIVE TRAFFIC FOR YEARS
		2003	538	538	196370	
Construction		2004	548.76		200297.4	
Year		2005	559.7352		204303.348	204303.348
	1	2006	570.929904		208389.415	208389.415
	2	2007	582.3485021		212557.2033	420946.6182
	3	2008	593.9954721		216808.3473	637754.9655
	4	2009	605.8753816		221144.5143	858899.4798
	5	2010	617.9928892		225567.4046	1084466.884
	6	2011	630.352747		230078.7526	1314545.637
	7	2012	642.9598019		234680.3277	1549225.965
	8	2013	655.818998		239373.9343	1788599.899
	9	2014	668.9353779		244161.4129	2032761.312
	10	2015	682.3140855		249044.6412	2281805.953
	11	2016	695.9603672		254025.534	2535831.487
	12	2017	709.8795745		259106.0447	2794937.532
	13	2018	724.077166		264288.1656	3059225.697
	14	2019	738.5587093		269573.9289	3328799.626
	15	2020	753.3298835		274965.4075	3603765.034
	16	2021	768.3964812		280464.7156	3884229.749
	17	2022	783.7644108		286074.0099	4170303.759
	18	2023	799.439699		291795.4901	4462099.25
	19	2024	815.428493		297631.4	4759730.65
	20	2025	831.7370629		303584.028	5063314.677
		20 YEAR TRAFFIC			5,063,315	

North Shore Road 64035218

Echo Bay Road to Overton Beach Road

2	GROWTH PER YEAR %
0.02	GROWTH RATE

		YEAR	CALCULATED ADT	GIVEN ADT	TRAFFIC FOR YEAR	CUMULATIVE TRAFFIC FOR YEARS
		2003	397	397	144905	
Construction		2004	404.94		147803.1	
Year		2005	413.0388		150759.162	150759.162
	1	2006	421.299576		153774.3452	153774.3452
	2	2007	429.7255675		156849.8321	310624.1774
	3	2008	438.3200789		159986.8288	470611.0062
	4	2009	447.0864804		163186.5654	633797.5715
	5	2010	456.0282101		166450.2967	800247.8682
	6	2011	465.1487743		169779.3026	970027.1708
	7	2012	474.4517497		173174.8887	1143202.059
	8	2013	483.9407847		176638.3864	1319840.446
	9	2014	493.6196004		180171.1542	1500011.6
	10	2015	503.4919924		183774.5772	1683786.177
	11	2016	513.5618323		187450.0688	1871236.246
	12	2017	523.8330689		191199.0702	2062435.316
	13	2018	534.3097303		195023.0516	2257458.368
	14	2019	544.9959249		198923.5126	2456381.88
	15	2020	555.8958434		202901.9828	2659283.863
	16	2021	567.0137603		206960.0225	2866243.886
	17	2022	578.3540355		211099.223	3077343.109
	18	2023	589.9211162		215321.2074	3292664.316
	19	2024	601.7195385		219627.6316	3512291.948
	20	2025	613.7539293		224020.1842	3736312.132

20 YEAR TRAFFIC 3,736,312

North Shore Road 64035218

Overton Beach Road to North Park Boundry

2	GROWTH PER YEAR %
0.02	GROWTH RATE

	YEAR	CALCULATED ADT	GIVEN ADT	TRAFFIC FOR YEAR	CUMULATIVE TRAFFIC FOR YEARS
	2003	699	699	255135	
Construction	2004	712.98		260237.7	
Year	2005	727.2396		265442.454	265442.454
1	2006	741.784392		270751.3031	270751.3031
2	2007	756.6200798		276166.3291	546917.6322
3	2008	771.7524814		281689.6557	828607.2879
4	2009	787.1875311		287323.4488	1115930.737
5	2010	802.9312817		293069.9178	1409000.655
6	2011	818.9899073		298931.3162	1707931.971
7	2012	835.3697055		304909.9425	2012841.913
8	2013	852.0770996		311008.1413	2323850.055
9	2014	869.1186416		317228.3042	2641078.359
10	2015	886.5010144		323572.8703	2964651.229
11	2016	904.2310347		330044.3277	3294695.557
12	2017	922.3156554		336645.2142	3631340.771
13	2018	940.7619685		343378.1185	3974718.889
14	2019	959.5772079		350245.6809	4324964.57
15	2020	978.768752		357250.5945	4682215.165
16	2021	998.3441271		364395.6064	5046610.771
17	2022	1018.31101		371683.5185	5418294.29
18	2023	1038.67723		379117.1889	5797411.479
19	2024	1059.450774		386699.5327	6184111.011
20	2025	1080.63979		394433.5233	6578544.534

20 YEAR TRAFFIC 6,578,545

Echo Bay Road | 64055138
Northshore Road to Lake Mead

2	GROWTH PER YEAR %
0.02	GROWTH RATE

		YEAR	CALCULATED ADT	GIVEN ADT	TRAFFIC FOR YEAR	CUMULATIVE TRAFFIC FOR YEARS
		2003	388	388	141620	
Construction		2004	395.76		144452.4	
Year		2005	403.6752		147341.448	147341.448
	1	2006	411.748704		150288.277	150288.277
	2	2007	419.9836781		153294.0425	303582.3195
	3	2008	428.3833516		156359.9233	459942.2428
	4	2009	436.9510187		159487.1218	619429.3646
	5	2010	445.690039		162676.8643	782106.2289
	6	2011	454.6038398		165930.4015	948036.6304
	7	2012	463.6959166		169249.0096	1117285.64
	8	2013	472.969835		172633.9898	1289919.63
	9	2014	482.4292317		176086.6696	1466006.299
	10	2015	492.0778163		179608.4029	1645614.702
	11	2016	501.9193726		183200.571	1828815.273
	12	2017	511.9577601		186864.5824	2015679.856
	13	2018	522.1969153		190601.8741	2206281.73
	14	2019	532.6408536		194413.9116	2400695.641
	15	2020	543.2936706		198302.1898	2598997.831
	16	2021	554.1595441		202268.2336	2801266.065
	17	2022	565.2427349		206313.5983	3007579.663
	18	2023	576.5475896		210439.8702	3218019.533
	19	2024	588.0785414		214648.6676	3432668.201
	20	2025	599.8401123		218941.641	3651609.842

20 YEAR TRAFFIC | 3,651,610

Overton Beach Road | 64055138
Northshore Road to Lake Mead

2	GROWTH PER YEAR %
0.02	GROWTH RATE

		YEAR	CALCULATED ADT	GIVEN ADT	TRAFFIC FOR YEAR	CUMULATIVE TRAFFIC FOR YEARS
		2003	542	542	197830	
Construction		2004	552.84		201786.6	
Year		2005	563.8968		205822.332	205822.332
	1	2006	575.174736		209938.7786	209938.7786
	2	2007	586.6782307		214137.5542	424076.3329
	3	2008	598.4117953		218420.3053	642496.6381
	4	2009	610.3800312		222788.7114	865285.3496
	5	2010	622.5876319		227244.4856	1092529.835
	6	2011	635.0393845		231789.3753	1324319.211
	7	2012	647.7401722		236425.1629	1560744.373
	8	2013	660.6949756		241153.6661	1801898.039
	9	2014	673.9088751		245976.7394	2047874.779
	10	2015	687.3870527		250896.2742	2298771.053
	11	2016	701.1347937		255914.1997	2554685.253
	12	2017	715.1574896		261032.4837	2815717.737
	13	2018	729.4606394		266253.1334	3081970.87
	14	2019	744.0498522		271578.196	3353549.066
	15	2020	758.9308492		277009.76	3630558.826
	16	2021	774.1094662		282549.9552	3913108.781
	17	2022	789.5916555		288200.9543	4201309.735
	18	2023	805.3834886		293964.9733	4495274.709
	19	2024	821.4911584		299844.2728	4795118.981
	20	2025	837.9209816		305841.1583	5100960.14

20 YEAR TRAFFIC | 5,100,960

PROJECT: North Shore Road

PROJ NO: 64035218

RDWY SEGMENT: Callville Bay Road to Echo Bay Road

TOTAL 20 YEAR TRAFFIC =	5063315
NO. ONE-WAY LANES =	1
% TRAFFIC IN DESIGN LANE =	60
DESIGN TRAFFIC =	3037989

	ENTER % TRUCK MIX	% TOTAL MIX	VEHICLE TYPE	CFL VEHICLE CLASS	20 YR TRAFFIC	ESAL FACTOR	20 YR ESAL
		1.61	Motercycles	1	48911.62	0	0
		76.96	Cars	2	2338036	0.0004	935.2145
		19.78	Vehicles pulling Trailers	5	600914.2	0.2	120182.8
		0.14	Busses	4	4253.185	0.88	3742.802
		1.27	RVs	5	38582.46	0.2	7716.492
		0.09	Light Trucks	5	2734.19	0.2	546.838
		0.15	Heavy Trucks	6	4556.984	2.2	10025.36
					0		0
					0		0
					0		0
					3037989		0
TOTALS		100		DIRECTIONAL		ESAL =	143149.6
						TI =	7.14137

PROJECT: North Shore Road

RDWY SEGMENT: Echo Bay Road to Overton Beach Road

PROJ NO: 64035218

TOTAL 20 YEAR TRAFFIC = 3736312

NO. ONE-WAY LANES = 1

% TRAFFIC IN DESIGN LANE = 60

DESIGN TRAFFIC = 2241787.2

ENTER % TRUCK MIX	% TOTAL MIX	VEHICLE TYPE	CFL VEHICLE CLASS	20 YR TRAFFIC	ESAL FACTOR	20 YR ESAL
	1.61	Motercycles	1	36092.77	0	0
	76.96	Cars	2	1725279	0.0004	690.1118
	19.78	Vehicles pulling Trailers	5	443425.5	0.2	88685.1
	0.14	Busses	4	3138.502	0.88	2761.882
	1.27	RVs	5	28470.7	0.2	5694.139
	0.09	Light Trucks	5	2017.608	0.2	403.5217
	0.15	Heavy Trucks	6	3362.681	2.2	7397.898
				0		0
				0		0
				0		0
				2241787		
TOTALS	100		DIRECTIONAL		ESAL =	105632.7
					TI =	6.887704

PROJECT: North Shore Road

RDWY SEGMENT: Overton Beach Road to North Park Boundry

PROJ NO: 64035218

TOTAL 20 YEAR TRAFFIC =	6578545
NO. ONE-WAY LANES =	1
% TRAFFIC IN DESIGN LANE =	60
DESIGN TRAFFIC =	3947127

ENTER % TRUCK MIX	% TOTAL MIX	VEHICLE TYPE	CFL VEHICLE CLASS	20 YR TRAFFIC	ESAL FACTOR	20 YR ESAL
	1.61	Motercycles	1	63548.74	0	0
	76.96	Cars	2	3037709	0.0004	1215.084
	19.78	Vehicles pulling Trailers	5	780741.7	0.2	156148.3
	0.14	Busses	4	5525.978	0.88	4862.86
	1.27	RVs	5	50128.51	0.2	10025.7
	0.09	Light Trucks	5	3552.414	0.2	710.4829
	0.15	Heavy Trucks	6	5920.691	2.2	13025.52
				0		0
				0		0
				0		0
				3947127		
TOTALS	100		DIRECTIONAL		ESAL =	185988
					TI =	7.367348

PROJECT: Echo Bay Road

RDWY SEGMENT: Northshore Road to Lake Mead

PROJ NO: 64055138

TOTAL 20 YEAR TRAFFIC =	3651610
NO. ONE-WAY LANES =	1
% TRAFFIC IN DESIGN LANE =	60
DESIGN TRAFFIC =	2190966

ENTER % TRUCK MIX	% TOTAL MIX	VEHICLE TYPE	CFL VEHICLE CLASS	20 YR TRAFFIC	ESAL FACTOR	20 YR ESAL
	1.61	Motercycles	1	35274.55	0	0
	76.96	Cars	2	1686167	0.0004	674.467
	19.78	Vehicles pulling Trailers	5	433373.1	0.2	86674.61
	0.14	Busses	4	3067.352	0.88	2699.27
	1.27	RVs	5	27825.27	0.2	5565.054
	0.09	Light Trucks	5	1971.869	0.2	394.3739
	0.15	Heavy Trucks	6	3286.449	2.2	7230.188
				0		0
				0		0
				0		0
				2190966		0
TOTALS	100		DIRECTIONAL		ESAL =	103238
					TI =	6.868935

PROJECT: Overton Beach Road

RDWY SEGMENT: Northshore Road to Lake Mead

PROJ NO: 64055138

TOTAL 20 YEAR TRAFFIC =	5100960
NO. ONE-WAY LANES =	1
% TRAFFIC IN DESIGN LANE =	60
DESIGN TRAFFIC =	3060576

ENTER % TRUCK MIX	% TOTAL MIX	VEHICLE TYPE	CFL VEHICLE CLASS	20 YR TRAFFIC	ESAL FACTOR	20 YR ESAL
	1.61	Motercycles	1	49275.27	0	0
	76.96	Cars	2	2355419	0.0004	942.1677
	19.78	Vehicles pulling Trailers	5	605381.9	0.2	121076.4
	0.14	Busses	4	4284.806	0.88	3770.63
	1.27	RVs	5	38869.32	0.2	7773.863
	0.09	Light Trucks	5	2754.518	0.2	550.9037
	0.15	Heavy Trucks	6	4590.864	2.2	10099.9
				0		0
				0		0
				0		0
				3060576		0
TOTALS	100		DIRECTIONAL		ESAL =	144213.9
					TI =	7.147667

State: Northshore Road - 1 Job Number: 64035218

Agency:

Company: Location: Sta 45+680 to Sta 56+543

Contractor:

Engineer:

========================== Flexible Analysis ==========================

Structural Number	=	1.87	
Design E 18's	=	143,200	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	12,500.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number ======	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t =========
1	0.44	1.00	3.00	1.32
2	0.15	1.00	4.00	0.60
3				
4				
5				
6				
				=========
			Total SN =	1.92

State: Northshore Road - 1 Job Number: 64035218

Agency:

Company: Location: Sta 45+680 to Sta 56+543

Contractor:

Engineer:

========================== Flexible Analysis ==========================

Structural Number	=	1.87	
Design E 18's	=	143,200	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	12,500.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t
1	0.44	1.00	3.50	1.54
2	0.09	1.00	4.00	0.36
3				
4				
5				
6				

Total SN = 1.90

State: Northshore Road - 2
Agency:
Company:
Contractor:
Engineer:

Job Number: 64035218

Location: Sta 56+543 to Sta 68+200

========================== Flexible Analysis ==========================

Structural Number	=	1.78	
Design E 18's	=	105,700	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	12,500.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t
1	0.44	1.00	3.00	1.32
2	0.15	1.00	4.00	0.60
3				
4				
5				
6				

=========
Total SN = 1.92

State: Northshore Road - 2 Job Number: 64035218
Agency:
Company: Location: Sta 56+543 to Sta 68+200
Contractor:
Engineer:

========================== Flexible Analysis ==========================

Structural Number	=	1.78	
Design E 18's	=	105,700	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	12,500.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number ======	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t =========
1	0.44	1.00	3.50	1.54
2	0.09	1.00	4.00	0.36
3				
4				
5				
6				
				=========
			Total SN =	1.90

State: Northshore Road - 3
Agency:
Company:
Contractor:
Engineer:

Job Number: 64035218

Location: Sta 68+200 to Sta 69+500

========================== Flexible Analysis ==========================

Structural Number	=	2.24	
Design E 18's	=	105,700	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	7,000.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number ======	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t =========
1	0.44	1.00	3.50	1.54
2	0.14	1.00	6.00	0.84
3				
4				
5				
6				
				=========
			Total SN =	2.38

State: Northshore Road - 3   Job Number: 64035218
Agency:
Company: Location: Sta 68+200 to Sta 69+500
Contractor:
Engineer:

========================== Flexible Analysis ==========================

Structural Number	=	2.24	
Design E 18's	=	105,700	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	7,000.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number ======	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t =========
1	0.44	1.00	3.00	1.32
2	0.14	1.00	7.00	0.98
3				
4				
5				
6				
				=========
			Total SN =	2.30

State: Northshore Road - 4 Job Number: 64035218
Agency:
Company: Location: Sta 69+500 to Sta 71+800
Contractor:
Engineer:

Flexible Analysis

Structural Number	=	1.94	
Design E 18's	=	105,700	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	10,000.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number	Layer Coefficient a (i)	Drainage Coefficient Cd	Layer Thickness t	a(i)*Cd*t
1	0.44	1.00	3.50	1.54
2	0.15	1.00	4.00	0.60
3				
4				
5				
6				
			Total SN =	2.14

State: Northshore Road - 4
Agency:
Company:
Contractor:
Engineer:

Job Number: 64035218

Location: Sta 69+500 to Sta 71+800

========================== Flexible Analysis ==========================

Structural Number	=	1.94	
Design E 18's	=	105,700	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	10,000.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number ======	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t =========
1	0.44	1.00	4.00	1.76
2	0.05	1.00	4.00	0.20
3				
4				
5				
6				
				=========
			Total SN =	1.96

State: Northshore Road - 5
Agency:
Company:
Contractor:
Engineer:

Job Number: 64035218

Location: Sta 71+800 to Sta 72+800

========================== Flexible Analysis ==========================

Structural Number	=	2.46	
Design E 18's	=	186,000	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	7,000.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number ======	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t =========
1	0.44	1.00	3.00	1.32
2	0.14	1.00	9.00	1.26
3				
4				
5				
6				
				=========
			Total SN =	2.58

State: Northshore Road - 5 Job Number: 64035218
Agency:
Company: Location: Sta 71+800 to Sta 72+800
Contractor:
Engineer:

=========================== Flexible Analysis ==========================

Structural Number	=	2.46	
Design E 18's	=	186,000	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	7,000.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t
1	0.44	1.00	3.50	1.54
2	0.14	1.00	7.00	0.98
3				
4				
5				
6				

Total SN = 2.52

State: Northshore Road - 6
Agency:
Company:
Contractor:
Engineer:

Job Number: 64035218

Location: Sta 72+800 to Sta 75+125

========================== Flexible Analysis ==========================

Structural Number	=	1.96	
Design E 18's	=	186,000	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	12,500.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t
1	0.44	1.00	3.00	1.32
2	0.15	1.00	5.00	0.75
3				
4				
5				
6				
			Total SN =	2.07

State: Northshore Road - 6
Agency:
Company:
Contractor:
Engineer:

Job Number: 64035218

Location: Sta 72+800 to Sta 75+125

========================== Flexible Analysis ==========================

Structural Number	=	1.96	
Design E 18's	=	186,000	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	12,500.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number ======	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t =========
1	0.44	1.00	3.50	1.54
2	0.10	1.00	5.00	0.50
3				
4				
5				
6				
				=========
			Total SN =	2.04

State: Echo Bay Road - 7   Job Number: 64055138
Agency:
Company: Location: Sta 0+000 to Sta 7+593
Contractor:
Engineer:

========================== Flexible Analysis ==========================

Structural Number	=	1.86	
Design E 18's	=	103,300	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	11,000.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number ======	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t =========
1	0.44	1.00	3.00	1.32
2	0.15	1.00	4.00	0.60
3				
4				
5				
6				
				=========
			Total SN =	1.92

State: Echo Bay Road - 7
Agency:
Company:
Contractor:
Engineer:

Job Number: 64055138

Location: Sta 0+000 to 7+593

========================== Flexible Analysis ========================

Structural Number	=	1.86	
Design E 18's	=	103,300	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	11,000.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number ======	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t =========
1	0.44	1.00	3.00	1.32
2	0.10	1.00	6.00	0.60
3				
4				
5				
6				
				=========
			Total SN =	1.92

State: Overton Beach Road - 8   Job Number: 64055138
Agency:
Company: Location: Sta 13+700 to 15+310
Contractor:
Engineer:

========================== Flexible Analysis ==========================

Structural Number	=	3.96	
Design E 18's	=	144,300	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	1,800.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t
1	0.44	1.00	3.00	1.32
2	0.15	1.00	18.00	2.70
3				
4				
5				
6				
			Total SN =	4.02

State: Overton Beach Road - 8 Job Number: 64055138
Agency:
Company: Location: Sta 13+700 to 15+310
Contractor:
Engineer:

========================= Flexible Analysis =========================

Structural Number = 3.96
Design E 18's = 144,300
Reliability = 75.00 percent
Overall Deviation = 0.49
Resilient Modulus = 1,800.0 psi
Initial Serviceability = 4.20
Terminal Serviceablity = 2.50

Layer Number	Layer Coefficient	Drainage Coefficient	Layer Thickness	a(i)*Cd*t
======	== a (i) ==	==== Cd ===	=== t ===	=========
1	0.44	1.00	3.50	1.54
2	0.14	1.00	12.00	1.68
3	0.10	1.00	8.00	0.80
4				
5				
6				
				=========
			Total SN =	4.02

State: Overton Beach Road - 9 Job Number: 64055138
Agency:
Company: Location: Sta 15+310 to 18+307
Contractor:
Engineer:

========================== Flexible Analysis ========================

Structural Number	=	1.88	
Design E 18's	=	144,300	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	12,500.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number ======	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t =========
1	0.44	1.00	3.00	1.32
2	0.15	1.00	4.00	0.60
3				
4				
5				
6				
			Total SN =	1.92

State: Overton Beach Road - 9   Job Number: 64055138
Agency:
Company: Location: Sta 15+310 to 18+307
Contractor:
Engineer:

========================== Flexible Analysis ==========================

Structural Number	=	1.88	
Design E 18's	=	144,300	
Reliability	=	75.00	percent
Overall Deviation	=	0.49	
Resilient Modulus	=	12,500.0	psi
Initial Serviceability	=	4.20	
Terminal Serviceablity	=	2.50	

Layer Number	Layer Coefficient == a (i) ==	Drainage Coefficient ==== Cd ===	Layer Thickness === t ===	a(i)*Cd*t
1	0.44	1.00	3.00	1.32
2	0.10	1.00	6.00	0.60
3				
4				
5				
6				
			Total SN =	1.92

Cost Estimate

Project	Northshore Road	1	Length (m)	10863	Project No.	64035218
Location	STA 45+680 to 56+543					

Materials

Asphalt	2325	kg/m^3		
Prime Coat	1.5	L/m^2	0.0015 t/m^2	
Tack Coat	0.45	L/m^2	0.00045 t/m^2	
Lime	0.01	%		
AC	0.06	%		
Blotter	8	kg/m^2		
ABC	2225	kg/m^3	**=VAB**	
Cement	2225	kg/m^3	**=VC**	

ROADWAY SEGMENT

	meters		Area (m^2)/km	Length (m)	Total Area (m^2)
Road Width	9.6	**= W**	9600	10863	104284.8

	mm	m		
Option 1	75	0.075	HACP	**= TA (m)**
	0	0	ABC	**= AB (m)**
	100	0.1	FDR /w cement	
Option 2	90	0.09	HACP	
		0	ABC	
	100	0.1	Pulverize	
	0	0	FDR /w cement	

Option 1

			Material/ km	Unit	Estm. Unit Cost	Total Cost	Cost/km
Asphalt		2325 kg/m^3***W***1000m***TA**	1674.0	metric ton	40	66960	
AC	6%	0.06*asphalt (ton)	100.4	metric ton	210	21092	
Lime	1%	0.01*asphalt (ton)	16.7	metric ton	136	2277	
Roadway Reconditioning FDR		**W***1000m	1.0	m^2	35000	35000	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	0.0	metric ton	17	0	
Cement	8%	**VC**kg/m^3***W***1000*FDRm*cement%/1000m	170.9	metric ton	130	22214	
						156267	$/km

Option 2

Asphalt		2325 kg/m^3***W***1000m***TA**	2008.8	metric ton	40	80352	
AC	6%	0.06*asphalt (ton)	120.5	metric ton	210	25311	
Lime	1%	0.01*asphalt (ton)	20.1	metric ton	136	2732	
Roadway Reconditioning		**W***1000m	1	m^2	25000	25000	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	0.0	metric ton	17	0	
Cement	8%	**VC**kg/m^3***W***1000*FDRm*cement%/1000m	0.0	metric ton	130	0	
						142119	$/km

Note: Costs are not of engineering bid quality

Cost Estimate

Project	Northshore Road	2	Length (m)	11657	Project No.	64035218
Location	STA 56+543 to 68+200					

Materials

Asphalt	2325	kg/m^3		
Prime Coat	1.5	L/m^2	0.0015 t/m^2	
Tack Coat	0.45	L/m^2	0.00045 t/m^2	
Lime	0.01	%		
AC	0.06	%		
Blotter	8	kg/m^2		
ABC	2225	kg/m^3	**=VAB**	
Cement	2225	kg/m^3	**=VC**	

ROADWAY SEGMENT

	meters		Area (m^2)/km	Length (m)	Total Area (m^2)
Road Width	9.6	**= W**	9600		0

	mm	m		
Option 1	75	0.075 HACP	**= TA (m)**
	0	0 ABC	**= AB (m)**
	100	0.1 FDR /w cement	
Option 2	90	0.09 HACP	
		0 ABC	
	100	0.1 Pulverize	
	0	0 FDR /w cement	

Option 1

			Material/ km	Unit	Estm. Unit Cost	Total Cost	Cost/km
Asphalt		2325 kg/m^3***W***1000m***TA**	1674.0	metric ton	40	66960	
AC	6%	0.06*asphalt (ton)	100.4	metric ton	210	21092	
Lime	1%	0.01*asphalt (ton)	16.7	metric ton	136	2277	
Roadway Reconditioning FDR		**W***1000m	1.0	m^2	35000	35000	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	0.0	metric ton	17	0	
Cement	8%	**VC**kg/m^3***W***1000*FDRm*cement%/1000m	170.9	metric ton	130	22214	
						156267	$/km

Option 2

			Material/ km	Unit	Estm. Unit Cost	Total Cost	Cost/km
Asphalt		2325 kg/m^3***W***1000m***TA**	2008.8	metric ton	40	80352	
AC	6%	0.06*asphalt (ton)	120.5	metric ton	210	25311	
Lime	1%	0.01*asphalt (ton)	20.1	metric ton	136	2732	
Roadway Reconditioning		**W***1000m	1	m^2	25000	25000	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	0.0	metric ton	17	0	
Cement	9%	**VC**kg/m^3***W***1000*FDRm*cement%/1000m	0.0	metric ton	130	0	
						142119	$/km

Note: Costs are not of engineering bid quality

Cost Estimate

Project	Northshore Road	3	Length (m)	1300	Project No.	64035218
Location	STA 68+200 to 69+500					

Materials

Asphalt	2325	kg/m^3		
Prime Coat	1.5	L/m^2	0.0015 t/m^2	
Tack Coat	0.45	L/m^2	0.00045 t/m^2	
Lime	0.01	%		
AC	0.06	%		
Blotter	8	kg/m^2		
ABC	2225	kg/m^3	**=VAB**	
Cement	2225	kg/m^3	**=VC**	

ROADWAY SEGMENT

	meters		Area (m^2)/km	Length (m)	Total Area (m^2)
Road Width	9.6	**= W**	9600		0

	mm	m		
Option 1	90	0.09	HACP	**= TA (m)**
	152	0.152	ABC	**= AB (m)**
		0	FDR /w cement	
Option 2	76	0.076	HACP	
	178	0.178	ABC	
		0	Pulverize	
	0	0	FDR /w cement	

Option 1

			Material/ km	Unit	Estm. Unit Cost	Total Cost	Cost/km
Asphalt		2325 kg/m^3***W***1000m***TA**	2008.8	metric ton	40	80352	
AC	6%	0.06*asphalt (ton)	120.5	metric ton	210	25311	
Lime	1%	0.01*asphalt (ton)	20.1	metric ton	136	2732	
Roadway Reconditioning FDR		**W***1000m	1.0	m^2		0	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	3246.7	metric ton	17	55194	
Cement		**VC**kg/m^3***W***1000*FDRm*cement%/1000m	0.0	metric ton	130	0	
						172313	$/km

Option 2

Asphalt		2325 kg/m^3***W***1000m***TA**	1696.32	metric ton	40	67853	
AC	6%	0.06*asphalt (ton)	101.8	metric ton	210	21374	
Lime	1%	0.01*asphalt (ton)	17.0	metric ton	136	2307	
Roadway Reconditioning		**W***1000m	1	m^2		0	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	3802.1	metric ton	17	64635	
Cement		**VC**kg/m^3***W***1000*FDRm*cement%/1000m	0.0	metric ton	130	0	
						164893	$/km

Note: Costs are not of engineering bid quality

Cost Estimate

Project	Northshore Road	4	Length (m)	2300	Project No.	64035218
Location	STA 69+500 to 71+800					

Materials

Asphalt	2325	kg/m^3	
Prime Coat	1.5	L/m^2	0.0015 t/m^2
Tack Coat	0.45	L/m^2	0.00045 t/m^2
Lime	0.01	%	
AC	0.06	%	
Blotter	8	kg/m^2	
ABC	2225	kg/m^3	**=VAB**
Cement	2225	kg/m^3	**=VC**

ROADWAY SEGMENT

	meters		Area (m^2)/km	Length (m)	Total Area (m^2)
Road Width	9.6	**= W**	9600		0

	mm	m		
Option 1	90	0.09	HACP	**= TA (m)**
	0	0	ABC	**= AB (m)**
	100	0.1	FDR /w cement	
Option 2	100	0.1	HACP	
		0	ABC	
	100	0.1	Pulverize	
	0	0	FDR /w cement	

Option 1

			Material/ km	Unit	Estm. Unit Cost	Total Cost	Cost/km
Asphalt		2325 kg/m^3***W***1000m***TA**	2008.8	metric ton	40	80352	
AC	6%	0.06*asphalt (ton)	120.5	metric ton	210	25311	
Lime	1%	0.01*asphalt (ton)	20.1	metric ton	136	2732	
Roadway Reconditioning FDR		**W***1000m	1.0	m^2	35000	35000	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	0.0	metric ton	17	0	
Cement	10%	**VC**kg/m^3***W***1000*FDRm*cement%/1000m	213.6	metric ton	130	27768	
						179887	$/km

Option 2

Asphalt		2325 kg/m^3***W***1000m***TA**	2232	metric ton	40	89280	
AC	6%	0.06*asphalt (ton)	133.9	metric ton	210	28123	
Lime	1%	0.01*asphalt (ton)	22.3	metric ton	136	3036	
Roadway Reconditioning		**W***1000m	1	m^2	25000	25000	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	0.0	metric ton	17	0	
Cement	9%	**VC**kg/m^3***W***1000*FDRm*cement%/1000m	0.0	metric ton	130	0	
						154163	$/km

Note: Costs are not of engineering bid quality

Cost Estimate

Project	Northshore Road	5	Length (m)	1000	Project No.	64035218
Location	STA 71+800 to 72+800					

Materials

Asphalt	2325	kg/m^3		
Prime Coat	1.5	L/m^2	0.0015 t/m^2	
Tack Coat	0.45	L/m^2	0.00045 t/m^2	
Lime	0.01	%		
AC	0.06	%		
Blotter	8	kg/m^2		
ABC	2225	kg/m^3	**=VAB**	
Cement	2225	kg/m^3	**=VC**	

ROADWAY SEGMENT

	meters		Area (m^2)/km	Length (m)	Total Area (m^2)
Road Width	9.6	= W	9600		0

	mm	m		
Option 1	76	0.076	HACP	**= TA (m)**
	230	0.23	ABC	**= AB (m)**
		0	FDR /w cement	
Option 2	90	0.09	HACP	
	178	0.178	ABC	
		0	Pulverize	
	0	0	FDR /w cement	

Option 1

			Material/ km	Unit	Estm. Unit Cost	Total Cost	Cost/km
Asphalt		2325 kg/m^3*W*1000m*TA	1696.3	metric ton	40	67853	
AC	6%	0.06*asphalt (ton)	101.8	metric ton	210	21374	
Lime	1%	0.01*asphalt (ton)	17.0	metric ton	136	2307	
Roadway Reconditioning FDR		**W***1000m	1.0	m^2		0	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	4912.8	metric ton	17	83518	
Cement		**VC**kg/m^3***W***1000*FDRm*cement%/1000m	0.0	metric ton	130	0	
						183775	$/km

Option 2

Asphalt		2325 kg/m^3***W***1000m***TA**	2008.8	metric ton	40	80352	
AC	6%	0.06*asphalt (ton)	120.5	metric ton	210	25311	
Lime	1%	0.01*asphalt (ton)	20.1	metric ton	136	2732	
Roadway Reconditioning		**W***1000m	1	m^2		0	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	3802.1	metric ton	17	64635	
Cement		**VC**kg/m^3***W***1000*FDRm*cement%/1000m	0.0	metric ton	130	0	
						181754	$/km

Note: Costs are not of engineering bid quality

Cost Estimate

Project	Northshore Road	6	Length (m)	2520	Project No.	64035218
Location	STA 72+800 to 75+125					

Materials

Asphalt	2325	kg/m^3		
Prime Coat	1.5	L/m^2	0.0015 t/m^2	
Tack Coat	0.45	L/m^2	0.00045 t/m^2	
Lime	0.01	%		
AC	0.06	%		
Blotter	8	kg/m^2		
ABC	2225	kg/m^3	=**VAB**	
Cement	2225	kg/m^3	=**VC**	

ROADWAY SEGMENT

	meters		Area (m^2)/km	Length (m)	Total Area (m^2)
Road Width	9.6	**= W**	9600		0

	mm	m		
Option 1	75	0.075	HACP	= **TA** (m)
	0	0	ABC	= **AB** (m)
	127	0.127	FDR /w cement	
Option 2	90	0.09	HACP	
		0	ABC	
	127	0.127	Pulverize	
	0	0	FDR /w cement	

Option 1

			Material/ km	Unit	Estm. Unit Cost	Total Cost	Cost/km
Asphalt		2325 kg/m^3***W***1000m***TA**	1674.0	metric ton	40	66960	
AC	6%	0.06*asphalt (ton)	100.4	metric ton	210	21092	
Lime	1%	0.01*asphalt (ton)	16.7	metric ton	136	2277	
Roadway Reconditioning FDR		**W***1000m	1.0	m^2	35000	35000	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	0.0	metric ton	17	0	
Cement	6%	**VC**kg/m^3***W***1000*FDRm*cement%/1000m	162.8	metric ton	130	21159	
						$\boxed{155212}$	$/km

Option 2

Asphalt		2325 kg/m^3***W***1000m***TA**	2008.8	metric ton	40	80352	
AC	6%	0.06*asphalt (ton)	120.5	metric ton	210	25311	
Lime	1%	0.01*asphalt (ton)	20.1	metric ton	136	2732	
Roadway Reconditioning		**W***1000m	1	m^2	25000	25000	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	0.0	metric ton	17	0	
Cement	9%	**VC**kg/m^3***W***1000*FDRm*cement%/1000m	0.0	metric ton	130	0	
						$\boxed{142119}$	$/km

Note: Costs are not of engineering bid quality

Cost Estimate

Project	Echo Bay Road	7	Length (m)	7593	Project No.	64055138
Location	STA 0+000 to 7+593					

Materials

Asphalt	2325	kg/m^3		
Prime Coat	1.5	L/m^2	0.0015 t/m^2	
Tack Coat	0.45	L/m^2	0.00045 t/m^2	
Lime	0.01	%		
AC	0.06	%		
Blotter	8	kg/m^2		
ABC	2225	kg/m^3		**=VAB**
Cement	2225	kg/m^3		**=VC**

ROADWAY SEGMENT

	meters		Area (m^2)/km	Length (m)	Total Area (m^2)
Road Width	9.6	**= W**	9600	7593	72892.8

	mm	m		
Option 1	75	0.075	HACP	= **TA (m)**
	0	0	ABC	= **AB (m)**
	100	0.1	FDR /w cement	
Option 2	75	0.075	HACP	
		0	ABC	
	152	0.152	Pulverize	
	0	0	FDR /w cement	

Option 1

			Material/ km	Unit	Estm. Unit Cost	Total Cost	Cost/km
Asphalt		2325 kg/m^3***W***1000m***TA**	1674.0	metric ton	40	66960	
AC	6%	0.06*asphalt (ton)	100.4	metric ton	210	21092	
Lime	1%	0.01*asphalt (ton)	16.7	metric ton	136	2277	
Roadway Reconditioning FDR		**W***1000m	1.0	m^2	35000	35000	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	0.0	metric ton	17	0	
Cement	8%	**VC**kg/m^3***W***1000*FDRm*cement%/1000m	170.9	metric ton	130	22214	
						156267	$/km

Option 2

Asphalt		2325 kg/m^3***W***1000m***TA**	1674	metric ton	40	66960	
AC	6%	0.06*asphalt (ton)	100.4	metric ton	210	21092	
Lime	1%	0.01*asphalt (ton)	16.7	metric ton	136	2277	
Roadway Reconditioning		**W***1000m	1	m^2	25000	25000	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	0.0	metric ton	17	0	
Cement	9%	**VC**kg/m^3***W***1000*FDRm*cement%/1000m	0.0	metric ton	130	0	
						124053	$/km

Note: Costs are not of engineering bid quality

Cost Estimate

Project	Overton Beach Road	8	Length (m)	1610	Project No.	64055138
Location	STA 13+700 to 15+310					

Materials

Asphalt	2325	kg/m^3		
Prime Coat	1.5	L/m^2	0.0015 t/m^2	
Tack Coat	0.45	L/m^2	0.00045 t/m^2	
Lime	0.01	%		
AC	0.06	%		
Blotter	8	kg/m^2		
ABC	2225	kg/m^3	**=VAB**	
Cement	2225	kg/m^3	**=VC**	

ROADWAY SEGMENT

	meters		Area (m^2)/km	Length (m)	Total Area (m^2)
Road Width	9.6	**= W**	9600	1610	15456

	mm	m		
Option 1	75	0.075	HACP	**= TA (m)**
	0	0	ABC	**= AB (m)**
	460	0.46	FDR /w cement	
Option 2	90	0.09	HACP	
	305	0.305	ABC	
	203	0.203	Pulverize	
	0	0	FDR /w cement	

Option 1

			Material/ km	Unit	Estm. Unit Cost	Total Cost	Cost/km
Asphalt		2325 kg/m^3*W*1000m***TA**	1674.0	metric ton	40	66960	
AC	6%	0.06*asphalt (ton)	100.4	metric ton	210	21092	
Lime	1%	0.01*asphalt (ton)	16.7	metric ton	136	2277	
Roadway Reconditioning FDR		**W***1000m	1.0	m^2	35000	35000	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	0.0	metric ton	17	0	
Cement	10%	**VC**kg/m^3***W***1000*FDRm*cement%/1000m	982.6	metric ton	130	127733	
						261786	$/km

Option 2

			Material/ km	Unit	Estm. Unit Cost	Total Cost	Cost/km
Asphalt		2325 kg/m^3***W***1000m***TA**	2008.8	metric ton	40	80352	
AC	6%	0.06*asphalt (ton)	120.5	metric ton	210	25311	
Lime	1%	0.01*asphalt (ton)	20.1	metric ton	136	2732	
Roadway Reconditioning		**W***1000m	1	m^2	25000	25000	
Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
ABC		**VAB**kg/m^3***W***1000m***AB**	6514.8	metric ton	17	110752	
Cement		**VC**kg/m^3***W***1000*FDRm*cement%/1000m	0.0	metric ton	130	0	
						252870	$/km

Note: Costs are not of engineering bid quality

Cost Estimate

Project	Overton Beach Road	9	Length (m)	2997	Project No.	64055138
Location	STA 15+310 to 18+307					

Materials

Asphalt	2325	kg/m^3		
Prime Coat	1.5	L/m^2	0.0015 t/m^2	
Tack Coat	0.45	L/m^2	0.00045 t/m^2	
Lime	0.01	%		
AC	0.06	%		
Blotter	8	kg/m^2		
ABC	2225	kg/m^3		**=VAB**
Cement	2225	kg/m^3		**=VC**

ROADWAY SEGMENT

	meters		Area (m^2)/km	Length (m)	Total Area (m^2)
Road Width	9.6	**= W**	9600	2997	28771.2

	mm	m		
Option 1	75	0.075	HACP	**= TA (m)**
	0	0	ABC	**= AB (m)**
	100	0.1	FDR /w cement	
Option 2	75	0.075	HACP	
		0	ABC	
	150	0.15	Pulverize	
	0	0	FDR /w cement	

				Material/ km	Unit	Estm. Unit Cost	Total Cost	Cost/km
Option 1	Asphalt		2325 kg/m^3***W***1000m***TA**	1674.0	metric ton	40	66960	
	AC	6%	0.06*asphalt (ton)	100.4	metric ton	210	21092	
	Lime	1%	0.01*asphalt (ton)	16.7	metric ton	136	2277	
	Roadway Reconditioning FDR		**W***1000m	1.0	m^2	35000	35000	
	Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
	Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
	Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
	ABC		**VAB**kg/m^3***W***1000m***AB**	0.0	metric ton	17	0	
	Cement	6%	**VC**kg/m^3***W***1000*FDRm*cement%/1000m	128.2	metric ton	130	16661	
							$\boxed{150714}$	$/km
Option 2	Asphalt		2325 kg/m^3***W***1000m***TA**	1674	metric ton	40	66960	
	AC	6%	0.06*asphalt (ton)	100.4	metric ton	210	21092	
	Lime	1%	0.01*asphalt (ton)	16.7	metric ton	136	2277	
	Roadway Reconditioning		**W***1000m	1	m^2	25000	25000	
	Prime Coat		0.0015t/m^2***W***1000m	14.4	metric ton	360	5184	
	Tack Coat		0.00045t/m^2***W***1000m	4.3	metric ton	375	1620	
	Blotter		8kg/m^2***W***1000m/1000kg	76.8	metric ton	25	1920	
	ABC		**VAB**kg/m^3***W***1000m***AB**	0.0	metric ton	17	0	
	Cement		**VC**kg/m^3***W***1000*FDRm*cement%/1000m	0.0	metric ton	130	0	
							$\boxed{124053}$	$/km

Note: Costs are not of engineering bid quality

Project	Northshore Road	1	Project no.	64035218
Segament	Start to Echo Bay Road STA 45+680 to 56+543			

STA to STA		Mile to Mile		
45680	56543	28.7	35.45	
Length (m)	10863	Length (mile)	6.75	

Boring No.	Mile Post	MP Range	Length		Est. and Lab Test R-value	Multiplier	Weighted Average
		28.7					
1	29			e	81	0.08148	6.60000
		29.25	0.55				
2	29.5				44	0.07407	3.25926
		29.75	0.5				
3	30			e	81	0.07407	6.00000
		30.25	0.5				
4	30.5				67	0.07407	4.96296
		30.75	0.5				
5	31				77	0.07407	5.70370
		31.25	0.5				
6	31.5			e	59	0.07407	4.37037
		31.75	0.5				
7	32				70	0.07407	5.18519
		32.25	0.5				
8	32.5			e	57	0.07407	4.22222
		32.75	0.5				
9	33			e	72	0.07407	5.33333
		33.25	0.5				
10	33.5				80	0.07407	5.92593
		33.75	0.5				
11	34				80	0.07407	5.92593
		34.25	0.5				
12	34.5			e	62	0.07407	4.59259
		34.75	0.5				
13	35			e	33	0.10370	3.42222
		35.45	0.7				
		Total	6.75			R-value	65.50370

e = estimate from -200 and PI

Project	Northshore Road	2		Project no.	64035218	
Segament	STA 56+543 to 68+200					
	STA to STA		Mile to Mile			
	56543	68200	35.45	42.69		
	Length (m)	11657	Length (mile)	7.24		

Boring No.	Mile Post	MP Range	Length		Est. and Lab Test R-value	Multiplier	Weighted Average	
		35.45						
15	36			e	52	0.11050	5.74586	
		36.25	0.8					
16	36.5				60	0.06906	4.14365	replace R=8 w/60
		36.75	0.5					
17	37				59	0.06906	4.07459	
		37.25	0.5					
18	37.5			e	88	0.06906	6.07735	
		37.75	0.5					
19	38			e	57	0.06906	3.93646	
		38.25	0.5					
20	38.5				78	0.06906	5.38674	
		38.75	0.5					
21	39			e	61	0.06906	4.21271	
		39.25	0.5					
22	39.5				74	0.06906	5.11050	
		39.75	0.5					
23	40				80	0.06906	5.52486	
		40.25	0.5					
24	40.5			e	78	0.06906	5.38674	
		40.75	0.5					
25	41			e	82	0.06906	5.66298	
		41.25	0.5					
26	41.5				60	0.06906	4.14365	
		41.75	0.5					
27	42				59	0.06906	4.07459	
		42.25	0.5					
28	42.5			e	81			
		42.69	0.44					
		Total	7.24			R-value	63.48066	

e = estimate from -200 and PI

Project	Northshore Road	3		Project no.	64035218
Segament	STA 68+200 to 69+500				
	STA to STA		Mile to Mile		
	68200	69500	42.69	43.5	
	Length (m)	1300	Length (mile)	0.81	

Boring No.	Mile Post	MP Range	Length		Est. and Lab Test R-value	Multiplier	Weighted Average
		42.69					
S-29	43			e	22	0.53704	11.81481
		43.125	0.435				
B-4	43.25				5	0.23457	1.17284
		43.315	0.19				
B-5	43.38				20	0.15432	3.08642
		43.44	0.125				
S-30	43.5			e	38	0.07407	2.81481
		43.5	0.06				
		Total	0.81			R-value	18.88889

e = estimate from -200 and PI

Project	Northshore Road	4		Project no.	64035218
Segament	STA 69+500 to 71+800				
	STA to STA		Mile to Mile		
	69500	71800	43.5	44.93	
	Length (m)	2300	Length (mile)	1.43	

Boring No.	Mile Post	MP Range	Length		Est. and Lab Test R-value	Multiplier	Weighted Average
		43.25					
S-30	43.5			e	38	0.29762	11.30952
		43.75	0.5				
S-31	44				40	0.29762	11.90476
		44.25	0.5				
S-32	44.5			e	77	0.40476	31.16667
		44.93	0.68				
		Total	1.68			R-value	54.38095

e = estimate from -200 and PI

Project	Northshore Road	5		Project no.	64035218
Segament	STA 71+800 to 72+800				
	STA to STA		Mile to Mile		
	71800	72800	44.93	45.56	
	Length (m)	1000	Length (mile)	0.63	

Boring No.	Mile Post	MP Range	Length		Est. and Lab Test R-value	Multiplier	Weighted Average
		44.93					
S-33	45			e	23	0.15873	3.65079
		45.03	0.1				
B-8	45.06				5	0.30159	1.50794
		45.22	0.19				
B-7	45.38				31	0.12698	3.93651
		45.3	0.08				
S-6	45.22				25	0.41270	10.31746
		45.56	0.26				
		Total	0.63			R-value	19.41270

e = estimate from -200 and PI

Project	Northshore Road	6		Project no.	64035218
Segament	STA 72+800 to 75+125				
	STA to STA		Mile to Mile		
	72800	75320	45.56	47.12	
	Length (m)	2520	Length (mile)	1.56	

Boring No.	Mile Post	MP Range	Length		Est. and Lab Test R-value	Multiplier	Weighted Average
		45.56					
S-34	45.5			e	40	0.12179	4.87179
		45.75	0.19				
S-35	46			e	61	0.32051	19.55128
		46.25	0.5				
S-36	46.5				76	0.32051	24.35897
		46.75	0.5				
S-37	47				65	0.23718	15.41667
		47.12	0.37				
		Total	1.56			R-value	64.19872

e = estimate from -200 and PI

Project	Echo Bay Road	7	Project no.	64055138
Segament	Start (Northshore Road) to Lake Mead STA 0+000 to 7+593			

STA to STA		Mile to Mile	
0	7593	0	4.7
Length (m)	7593	Length (mile)	4.7

Boring No.	Mile Post	MP Range	Length	Est. and Lab Test R-value	Multiplier	Weighted Average
		0				
EB-2	0.75			58	0.26596	15.42553
		1.25	1.25			
EB-4	1.75			48	0.15957	7.65957
		2	0.75			
EB-5	2.25			52	0.10638	5.53191
		2.5	0.5			
EB-6	2.75			68	0.10638	7.23404
		3	0.5			
EB-7	3.25			44	0.10638	4.68085
		3.5	0.5			
EB-8	3.75			59	0.10638	6.27660
		4	0.5			
EB-9	4.25			42	0.10106	4.24468
		4.475	0.475			
EB-10	4.7			60	0.04787	2.87234
		4.7	0.225			
		Total	4.7		R-value	53.92553

e = estimate from -200 and PI

Project	Overton Beach Road	**8**		Project no.	64055138	
Segament	Start (Northshore Road) STA 13+700 to 15+310					
	STA to STA		Mile to Mile			
	13700	15310	0	1		
	Length (m)	1610	Length (mile)	1		

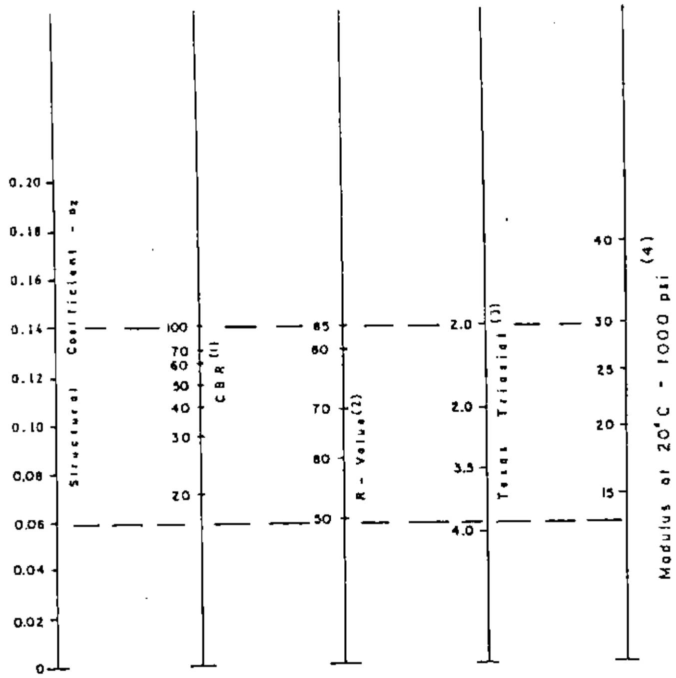
Boring No.	Mile Post	MP Range	Length	Est. and Lab Test R-value	Multiplier	Weighted Average
		0				
OB-1	0.25			5	0.50000	2.50000
		0.5	0.5			
OB-2	0.75			5	0.50000	2.50000
		1	0.5			
		Total	1		R-value	5.00000

e = estimate from -200 and PI

Project	Overton Beach Road	**9**		Project no.	64055138	
Segament	STA 15+310 to 18+307					
	STA to STA		Mile to Mile			
	15310	18307	1	2.9		
	Length (m)	2997	Length (mile)	1.9		

Boring No.	Mile Post	MP Range	Length	Est. and Lab Test R-value	Multiplier	Weighted Average
		1				
OB-3	1.25			84	0.26316	22.10526
		1.5	0.5			
OB-4	1.75			59	0.26316	15.52632
		2	0.5			
OB-5	2.25			44	0.27632	12.15789
		2.525	0.525			
OB-6	2.8			72	0.19737	14.21053
		2.9	0.375			
		Total	1.9		R-value	64.00000

e = estimate from -200 and PI



(1) Scale derived by averaging correlations obtained from Illinois.
(2) Scale derived by averaging correlations obtained from California, New Mexico, and Wyoming.
(3) Scale derived by averaging correlations obtained from Texas.
(4) Scale derived on NCHRP Project 1-11 (1).

Figure GG.8. Variation in granular coefficient (a_2) with base strength parameters (1).

TABLE 202.02-3

BODY OF TABLE IS R-VALUE AT 300 psi EXUDATION PRESSURE

PERCENT PASSING #200 SIEVE

PI	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75	78	81	84	87	90	93	96
0	100	96	92	88	85	81	78	75	72	69	66	63	61	58	56	54	52	49	47	45	44	42	40	39	37	35	34	33	31	30	29	28	27
1	96	92	89	85	81	78	75	72	69	66	64	61	58	56	54	52	50	48	46	44	42	40	39	37	36	34	33	31	30	29	28	27	26
2	92	89	85	82	78	75	72	69	66	64	61	59	56	54	52	50	48	46	44	42	40	39	37	36	34	33	31	30	29	28	27	26	25
3	89	85	82	79	75	72	69	67	64	61	59	56	54	52	50	48	46	44	42	40	39	37	36	34	33	32	30	29	28	27	26	25	24
4	86	82	79	76	72	70	67	64	61	59	56	54	52	50	48	46	44	42	41	39	37	36	34	33	32	30	29	28	27	26	25	24	23
5	82	79	76	73	70	67	64	62	59	57	54	52	50	48	46	44	42	41	39	37	36	34	33	32	30	29	29	27	26	25	24	23	22
6	79	76	73	70	67	64	62	59	57	54	52	50	48	46	44	42	41	39	37	36	35	33	32	30	29	28	27	26	25	24	23	22	21
7	76	73	70	67	64	62	59	57	55	52	50	48	46	44	43	41	39	38	36	35	33	32	31	29	28	27	26	25	24	23	22	21	20
8	73	70	67	65	62	59	57	55	52	50	48	46	44	43	41	39	38	36	35	33	32	31	29	28	27	26	25	24	23	22	21	20	19
9	70	67	65	62	60	57	55	53	50	48	46	45	43	41	39	38	36	35	33	32	31	29	28	27	26	25	24	23	22	21	20	19	19
10	68	65	62	60	57	55	53	51	49	47	45	43	41	39	38	36	35	33	32	31	30	28	27	26	25	24	23	22	21	20	19	19	18
11	65	62	60	57	55	53	51	49	47	45	43	41	40	38	36	35	33	32	31	30	28	27	26	25	24	23	22	21	20	20	19	18	17
12	63	60	58	55	53	51	49	47	45	43	41	40	38	36	35	34	32	31	30	28	27	26	25	24	23	22	21	20	20	19	18	17	17
13	60	58	55	53	51	49	47	45	43	41	40	38	37	35	34	32	31	30	29	27	26	25	24	23	22	21	20	20	19	18	17	17	16
14	58	55	53	51	49	47	45	43	41	40	38	37	35	34	32	31	30	29	27	26	25	24	23	22	21	21	20	19	18	17	17	16	15
15	56	53	51	49	47	45	43	42	40	38	37	35	34	32	31	30	29	27	26	25	24	23	22	21	21	20	19	18	17	17	16	15	15
16	53	51	49	47	45	43	42	40	38	37	35	34	33	31	30	29	28	26	25	24	23	22	21	21	20	19	18	17	17	16	15	15	14
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21	44	42	40	39	37	36	34	33	32	30	29	28	27	26	25	24	23	22	21	20	19	18	18	17	16	16	15	14	14	13	13	12	12
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25	38	36	35	33	32	31	29	28	27	26	25	24	23	22	21	20	19	19	18	17	16	16	15	14	14	13	13	12	12	11	11	10	10
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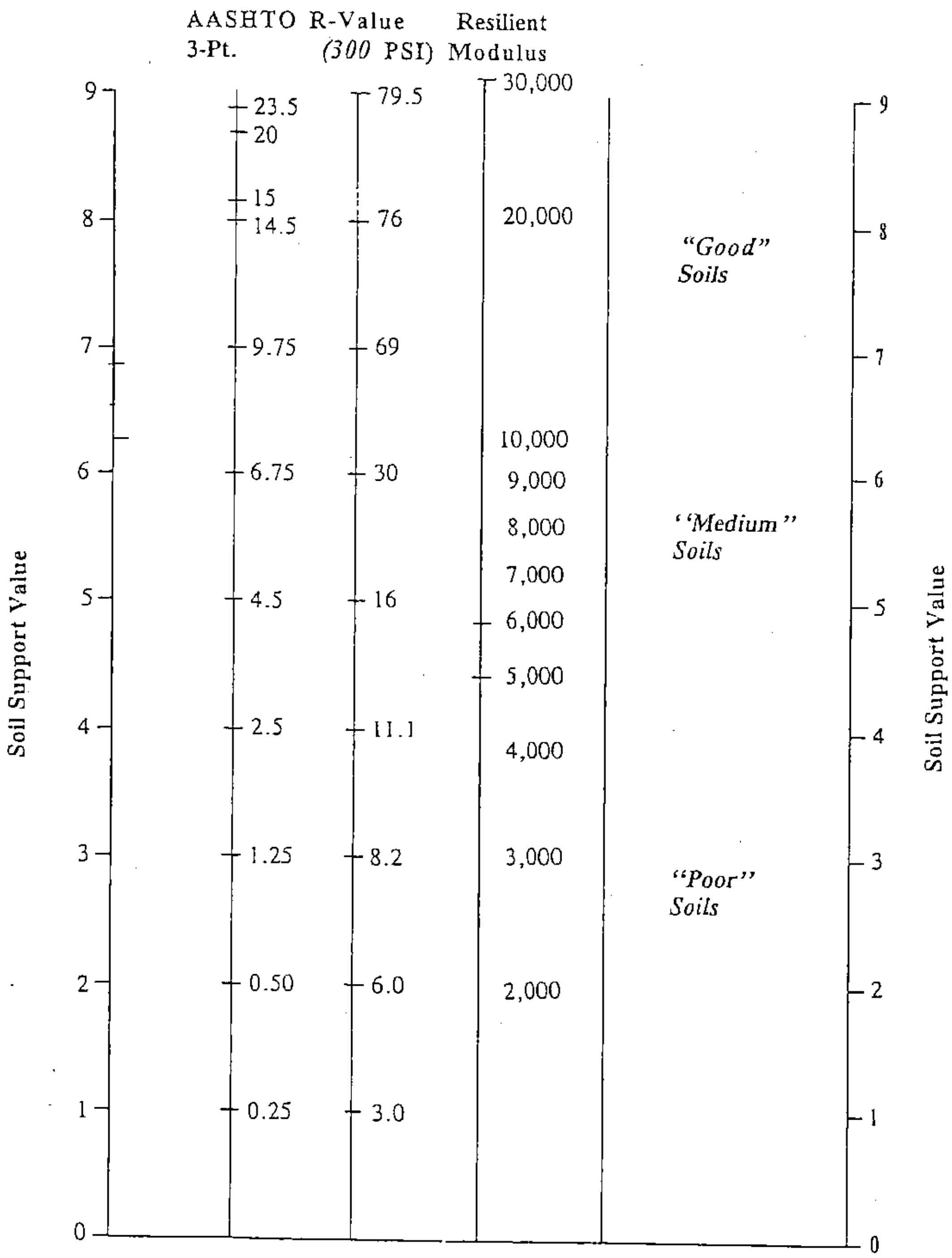

Table 6-14
Soil Support Correlations