GEOTECHNICAL
INVESTIGATION REPORT
PROPOSED NORTH TRUCKEE DRAIN
REALIGNMENT
SPARKS, NEVADA

November 11, 2009

KLEINFELDER
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November 11, 2009
File: 102314.104

HDR Engineering, Inc.
9805 Double R Boulevard, Suite 101
Reno, NV 89521

Attention: Mr. Noel Laughlin, P.E.

SUBJECT: Geotechnical Investigation Report
Proposed North Truckee Drain Realignment
Sparks, Nevada

Dear Mr. Laughlin:

The attached report presents the results of our geotechnical investigation to support design of the proposed North Truckee Drain (NTD) Realignment in Sparks, Nevada. Our work consisted of review of available information, obtaining applicable permits, performing subsurface exploration, laboratory testing, engineering analyses, and preparation of this report.

We understand the proposed project includes approximately 2.5 miles of box culverts extending from the Interstate 80 at Sparks Boulevard to the Truckee River. The proposed alignment crosses several significant structures including Interstate 80, Union Pacific Railroad (UPRR) tracks, the existing NTD open channel, the East Greg Street embankment, and outfalls into the Truckee River.

Based on the results of our study, we observed no severe soil or groundwater constraints that would preclude project development. The encountered subsurface soils generally consisted of clayey to silty sand fill with varying amounts of gravel, underlain by native lean to fat clay overlying very dense granular glacial outwash deposits. Groundwater levels generally corresponded to approximately the top of the outwash deposits. We anticipate that major design items will include shoring and temporary slopes associated with excavations, subgrade stabilization to establish a working construction platform in the native clays, and construction dewatering below the groundwater table. These and other conclusions and recommendations, along with restrictions and limitations regarding them, are discussed in the attached report.

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We appreciate this opportunity to be of service to you, and look forward to future endeavors. If you have any questions regarding this report or need additional information or services, please feel free to call one of the undersigned in our Reno office.

Sincerely,

KLEINFELDER WEST, INC.

Don Adams, P.E.
Staff Professional

Jonathan Pease, P.E., Ph.D.
Senior Geotechnical Engineer

Scott Smith, P.E., Ph.D.
Senior Principal Engineer

Enclosures: Report (5 Bound)

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SPARKS, NEVADA

1. INTRODUCTION AND SCOPE

1.1 Introduction

This report presents the results of Kleinfelder's geotechnical investigation for the proposed realignment of the North Truckee Drain (NTD), a storm water drainage facility in the southeastern portion of the City of Sparks, Nevada. This project is being designed by HDR Inc. for the City of Sparks. Information regarding the proposed construction presented in this report was obtained from preliminary plans by HDR (2009) and in various conversations and meetings with HDR and the City of Sparks.

1.2 Project Description

The project location is shown on the Site Plan, Plate 1. The proposed project consists of realignment and replacement of the existing NTD to carry the design flood flow of a 117-year storm with an increased level of flood protection for the adjacent and upstream areas of eastern Sparks. The proposed NTD modifications are from Interstate 80 east of Sparks Boulevard to the Truckee River, near the Vista Narrows. The existing NTD is an open channel which flows east and then south to join the Truckee River. The existing NTD channel joins the Truckee River about 700 feet southwest of the intersection of Kleppe Lane and East Greg Street, approximately 3,700 feet upstream of the Vista Narrows.

The project concept has advanced since the start of our geotechnical investigations. Initially, replacement of the existing NTD culvert under Interstate 80 and the UPRR tracks with new larger culverts was considered necessary to provide the required additional capacity. Construction of the culvert using open excavations or jacking was under consideration. The current plan instead splits the flow beneath Interstate 80 and UPRR tracks between the NTD and the People's Drain, a former agricultural drain ditch, which crosses under the Interstate 80 and the UPRR tracks about 850 feet west of the existing NTD culvert. Dividing the flow through both drains provides adequate capacity under the Interstate 80 and the UPRR tracks without the need to replace the main culverts.

South of Interstate 80 and the UPRR tracks, the proposed NTD (and additional outflow from the People's Drain) will be routed through new reinforced concrete box culverts (RCBs) which will run east, parallel to the UPRR tracks, to East Greg Street. Two alignments, a base and an alternate alignment, were initially considered downstream from East Greg Street.

The base alignment turns south for approximately 400 feet before crossing under the East Greg Street embankment. The base alignment would be constructed under the northern leg of Larkin Circle, and outfall into the Truckee River would be about 200 feet from the edge of the street immediately downstream of the Vista Narrows. This outfall is approximately 3,700 feet downriver from the existing NTD confluence with the Truckee River.

An alternate alignment was considered that bent slightly southward to avoid a fiber-optic line junction east of the East Greg Street embankment, but otherwise proceeded east within the UPRR right-of-way about 200 feet south of the UPRR mainline. This alternate alignment was proposed to intercept the Truckee River about 1,300 feet downriver of the Vista Narrows, or about 5,000 feet downstream of the existing confluence. Although several soil borings were drilled along this alternate alignment, the proposed alternate has been eliminated and geotechnical recommendations for this alternate route are not discussed in this report.

Based on the draft plans, upstream of where the People's Drain and the NTD rejoin, the proposed box culverts are to be double 8-foot by 8-foot RCBs (16 feet nominal width). Downstream from this junction, the NTD will be built as double 14-foot-wide by 10-foot-high RCBs (28-feet nominal width). Both sizes can be built with cast-in-place concrete or two side-by-side pre-cast segments. For most of the alignment, backfill over the RCBs will be between 2 and 8 feet thick. The entire alignment will be designed for HS-20 truck loadings. At East Greg Street, the RCB will be built below an embankment approximately 20 feet high. A specific discussion on this and other special conditions are addressed in Section 5.12.

1.3 Purpose and Scope of Work

The purpose of this investigation was to evaluate the feasibility of the proposed infrastructure improvements with respect to the observed subsurface conditions, and to provide our geotechnical recommendations and opinions to support the project design and construction. Our scope of services consisted of background review, site reconnaissance, field exploration, laboratory testing, engineering analyses, and preparation of this report. As outlined in our proposal dated April 23, 2008 and amended in a Modification to Scope letter dated June 24, 2009, the items listed below were to be addressed in the final report:

- Provide a brief description of geologic setting, general seismicity, and local geologic hazards based on a review of available literature;
- Discuss general soil and groundwater conditions including the subsurface profile encountered at the project site, with emphasis on how the conditions are expected to affect the proposed construction;
- Recommendations for temporary excavations, including preliminary slopes and possible retaining systems;
- Lateral earth pressures and drainage recommendations for RCBs and retaining structures;
- Construction recommendations for the proposed drainage facilities, including identification of anticipated construction difficulties; and,
- Potential for site soils to corrode steel, or to adversely react with concrete.

This study did not include site-specific evaluations of seismicity, fault trenching, other potential geologic or environmental hazards, or pavement design recommendations.

1.4 Authorization

Authorization to proceed with our work on this project was provided by HDR on February 23, 2008 in the form of a signed Geotechnical Subconsultant Agreement.

1.5 References

Partial improvements plans for the North Truckee Drain Realignment by HDR dated June 10, 2009 were provided to Kleinfelder in the course of this study and serve as the basis of our understanding of the project type and scope.

2. METHODS OF STUDY

2.1 Literature Review

A literature review was previously performed and summarized in a *Phase 1 Data Report* (Kleinfelder, 2007) which consisted of compiling and reviewing available geotechnical-related information that was provided to Kleinfelder. The results of the literature review were compiled on a plate which showed historic boring locations previously performed by others, boring surface elevations, depth of measured groundwater, estimated depth to Tahoe Outwash deposits, and soil layers identified above the Tahoe Outwash deposit.

2.2 Field Exploration

As part of the *Phase 1 Data Report* (Kleinfelder 2007) two preliminary soil borings were drilled for the project in January 2007. One of these borings was located on Larkin Circle in the vicinity of the proposed alignment; therefore we have shown this boring on the Site Plan (Plate 1) and have included the boring log in Appendix A.

Subsurface exploration as part of the current investigation consisted of drilling 15 soil borings along the proposed base and alternate alignments. Borings B-01 to B-06 were located to provide information for potential pipe-jacking or other culvert installation methods under I-80 and the UPRR. Borings B-09 and B-10 were selected to obtain subsurface information within and under the East Greg Street embankment. The remaining boring locations were planned at roughly uniform spacings along the alignment. All locations were modified as necessary based on considerations of site access.

The soil borings were drilled using a Mobile B-57 truck-mounted drill rig and a CME-55 track-mounted drill rig. All borings were advanced using 8-inch outer-diameter (O.D.), 4.25-inch-inside-diameter (I.D.) hollow stem augers. Due to the amount of time necessary to obtain right-of-entry notices for locations on private property and the UPRR right-of-way, the soil borings were drilled in two mobilizations. Soil borings B-01 through B-03, B-05, B-10, and B-11 were drilled on April 8 and 9, 2009. Soil borings B-04, B-06 through B-09, and B-12 through B-15 were drilled between June 30 and July 2, 2009. Soil borings ranged from 16½ to 46½ feet depth below the existing ground surface.

The locations of the field explorations are shown on the Site Plan, Plate 1. All boring locations were surveyed after completion by Bigby and Associates to obtain horizontal and vertical coordinates within 0.1 foot. Table 1 provides a summary of boring coordinates and elevations. All coordinates and elevations in this report are provided in NAD83 and NAVD88.

TABLE 1 – BORING COORDINATES[1]

Boring	Elevation (feet)	Easting (feet)	Northing (feet)
B-01	4,393.6	2,306,747.7	14,867,863.8
B-02	4,397.0	2,306,952.5	14,867,654.3
B-03 (MW)	4,395.3	2,307,659.6	14,867,700.0
B-04	4,387.6	2,306,665.3	14,867,524.2
B-05	4,396.9	2,307,610.3	14,867,555.0
B-06	4,389.5	2,307,569.7	14,867,336.5
B-07 (MW)	4,398.2	2,308,199.2	14,867,223.3
B-08	4,393.2	2,308,820.3	14,867,134.5
B-09	4,423.3	2,309,874.5	14,866,679.1
B-10	4,410.4	2,309,766.9	14,866,327.7
B-11 (MW)	4,389.9	2,310,738.8	14,865,844.3
B-12	4,397.9	2,310,525.7	14,866,540.5
B-13	4,397.4	2,311,252.1	14,866,240.1
B-14	4,391.5	2,312,002.0	14,865,867.8
B-15	4,837.8	2,312,313.4	14,865,700.4

Note: 1) Boring locations surveyed by Bigby and Associates relative to NAD83 and NAVD 88.

Samples were taken at 5-foot intervals above and below the approximate depth of invert of the proposed RCB, and at 2½-foot intervals within the approximate top and bottom depths of the RCB. Soil samples were obtained by driving a 2½-inch I.D., 3-inch O.D. California Sampler containing thin brass or steel liners or a 1-3/8-inch I.D., 2-inch O.D. Standard Penetration Sampler. The Mobile B-57 drill rig was equipped with an automatic hammer and the CME 55 was equipped with a cathead hammer. Both hammers weighed 140-pounds and were operated with a normal drop of 30 inches.

The number of blows required to drive the last 12 inches of an 18-inch drive is recorded as the penetration resistance (Blows per foot) on the boring logs. When the sampler was withdrawn from the boring, the liners containing the samples were removed, examined for logging, labeled, and sealed to preserve the natural moisture content for laboratory testing.

A Kleinfelder field engineer logged the soil conditions exposed in the soil borings and collected the bulk and driven samples for laboratory testing. Our engineer also performed on site testing at selected locations in order to evaluate soil strength and consistency. On site testing performed included Standard Penetration Tests (SPT) and undrained shear strength measurements using a pocket penetrometer. The results of the on site testing are presented on the soil boring logs.

Soil conditions encountered are presented on the logs of boring which are included as Plates 2 through 16. A description of the Unified Soil Classification System and a legend of boring log symbols are presented on Plates 17 and 18.

After the soil borings were completed, borings in Nevada Department of Transportation (NDOT) right-of-way (B-1, B-2, and B-5) and in the East Greg Street embankment (B-9 and B-10) were grouted. Borings B-3, B-7, and B-11 were converted to monitoring wells after completion; all other borings (B-4, B-6, B-8, B-10, and B-12 through B-15) were backfilled with excavated soil. Backfill was loosely placed and not compacted to the requirements typically specified for engineered fill.

2.3 Monitoring Wells

Monitoring wells were constructed in three of the soil borings, B-3 (MW), B-7 (MW) and B-11 (MW) for the purpose of evaluating groundwater levels. Wells varied from 25 to 33.5 feet deep with the screened interval extending from the bottom of the well to 5 to 10 feet below ground surface. Blank well casing was used in the top 5 to 10 feet. Details of well construction are shown on the respective boring logs. The monitoring wells must eventually be abandoned in accordance with state regulations during or prior to construction of the NTD by the Owner.

2.4 Laboratory Testing

Laboratory testing is useful for evaluating both index and engineering properties of soils. Typical index tests evaluate soil moisture content, unit weight, soil particle gradation, and plasticity characteristics. Tests for engineering properties can assess soil strength, compressibility, and swell potential. We performed laboratory testing on selected soil samples to assess the following:

- Soil Classification (ASTM D422 and D4318)
- Unit Weight and Moisture Content (ASTM D2937 and D2216)
- Consolidation (ASTM D2435)
- Direct Shear Strength (ASTM D3080)

Gradation and plasticity tests were performed to evaluate the potential re-use of excavated soils as structural fill or backfill, identify the OSHA material classification for excavations, and to provide information for dewatering purposes. Three consolidation tests were used for settlement calculations for the RCBs. Six direct shear tests were performed to assess lateral loads, slope stability, and provide information for temporary, excavation slopes and shoring.

In addition, the following analytical tests were performed by Western Environmental Testing (WET) Laboratory:

- Soluble Sulfate Content
- Resistivity and pH

Individual laboratory test results can be found summarized on the field exploration logs with detailed results on Plates 19 through 30, and in Appendix B at the end of this report.

3. DISCUSSION

3.1 Regional Geology and Faulting

The site is located in the transition area between the Sierra Nevada geologic province to the west and the Basin and Range geologic province to the east. The site lies within the eastern edge of the Truckee Meadows, a fault-bounded sedimentary basin underlying Reno and Sparks, which is bounded by the Carson Range to the west and the Pah-Rah and Virginia Ranges to the east. Basin and range faulting uplifted these ranges and depressed the valleys starting during Tertiary time, with these movements continuing to the present.

The Truckee Meadows and Truckee River have been greatly influenced by flooding particularly during past glacial periods, with the most recent glacial period, the Tahoe glaciation, most directly influencing near-surface deposits. Torrential glacial floods have resulted in house-size boulders present in outwash deposits under downtown Reno upstream to the west, and resulted in the (confirmed largest grain size in our investigation) gravel- to cobble-sized Tahoe Outwash soils under the North Truckee Drain site on the eastern (downstream) edge of the basin. Boulders are also likely present. With the advent of a warmer, drier climate, the volume and size distribution of sediment transported was greatly reduced, and the sedimentation process became largely limited to the reworking of earlier deposits. Prior to filling, much of this area would develop into a large lake during floods at least once every 1 or 2 decades (USACE, 1970), resulting in deposition of primarily fine-grained (clay and silt) sediments.

According to the *Geologic Map of the Vista Quadrangle* (Bell and Bonham, 1987), no faults have been mapped crossing the project site. Based on review of the *Quaternary Fault and Fold Database for the United States* by the U.S. Geological Survey and the Nevada Bureau of Mines and Geology (2006), the nearest mapped active fault (younger than 15,000 years) is a splay of the unnamed fault zone east of Reno located approximately 3.3 miles to the north of the project site. Therefore it is our opinion that the potential for ground rupture on known mapped Holocene or Quaternary faults at the site is low.

The nearest mapped fault is a splay of the unnamed north-south-trending fault zone approximately 0.2 mile to the north of Larkin Circle (Bell and Bonham, 1987, USGS, 2006). This fault crosses a lower alluvial fan slope along the abrupt western front of the Pah Rah range and the eastern edge of the Truckee Meadows. While Holocene movement of this fault has apparently not occurred or has not been noted, steady uplift of the Pahrah Range/subsidence of the Truckee Meadows must occur on this fault zone over geologic time to allow greater than 600 to 1,000 feet thickness of Quaternary infill of the Truckee Meadows bedrock basin relative to the bedrock sills of the Truckee River Canyon (Gates & Watters, 1992; Lowe, 2001).

The Truckee River near the east end of the project encounters bedrock at the Vista Narrows. The Vista Narrows is a bedrock ridge that is largely buried in the deep alluvium of the Truckee Meadows but that intercepts the ground surface and restricts down cutting of the Truckee River. This and several other bedrock ridges south of the NTD alignment were reduced in elevation and extent by blasting and excavation in the 1950's in order to improve flood flows out of the Truckee Meadows. As seen on Plate 1, a remaining portion of one of the bedrock areas still creates a constriction to the flow of the Truckee River near the planned NTD outfall. The presence of the bedrock ridges, including a former hill (noted below) near Sparks Boulevard and Brierley Way, suggests that the Pahrah range-front fault could be buried under Truckee Meadows alluvium well west of the present day topographic edge of the range.

The project site lies within the zone of influence of numerous fault systems in western Nevada and eastern California. Should a seismic event occur along any of the nearby faults or fault systems, the site could be significantly affected by ground shaking.

3.1.1 Seismic Design Parameters

The site is located in Sparks, Nevada, which has adopted the *2006 International Building Code (IBC)* as the building design standard. If seismic loadings are evaluated using the 2006 *International Building Code* (IBC) method, we recommend using the following:

- Site Class: D (Applicable to a stiff soil profile with an average shear wave velocity of 600 to 1,200 feet per second and blow counts between 15 and 50) (Table 1613.5.2))

- Mapped Spectral Response Acceleration at Short Periods (S_S): 1.41g (Figure 1613.5(3))

- Mapped Spectral Response Acceleration at 1-Second Period (S_1): 0.53g (Figure 1613.5(4))

The spectral response accelerations were obtained from the soil borings performed on site and the USGS *Seismic Design Values for Buildings,* Java Ground Motion Parameter Calculator-Version 5.08 for the location of 39.5248° Latitude and -119.7017° Longitude.

3.2 Site Geology

Information presented on the *Geologic Map of the Vista Quadrangle* (Bell and Bonham, 1987) indicates the site area is underlain by Floodplain deposits of the Truckee River (Qfl) of the Holocene era. The map describes this deposit as "light gray to dark gray brown sit, sandy silt, and clayey silt with local lenses of well rounded pebble to cobble gravel derived from mainstream and overbank deposition by the Truckee River." Locally much of this area prior to development was subject to periodic flooding from the Truckee River. Most of the surface natural deposits in the proposed alignment are expected to be fine-grained silt or clay deposits.

The floodplain deposits are underlain by very dense, Pleistocene-age Tahoe Outwash (Qto) deposits described as "gray, sandy, cobble to boulder gravel with lenses of light brown to light gray medium sand and light gray clayey silt." For the purposes of this investigation Tahoe Outwash deposits are characterized as dense to very dense poorly graded sands and gravels with the likely presence of cobbles and boulders. The Tahoe Outwash deposits can generally be characterized as high permeability soils.

3.3 Site Conditions

Access to the project site is provided by various paved and gravel roadways and through private property. The northern portion of the property (north of Interstate 80) consists of roadways along Brierley Way and the I-80 westbound off ramp to Sparks Boulevard. Areas adjacent to the freeway ramp and Brierley Way are landscaped with low to moderate-height shrubs.

Prior to 1968, a 45-foot high hill stood above the surrounding floodplain north of Brierley Way on the east side of the NTD, at the northwest extent of the project alignment (see Plate 1). This hill was likely excavated as a borrow source for development of the adjacent areas (USACE, 1970).

The freeway and railroad are on raised embankments above the surrounding terrain. There is typically a depression between I-80 and the railroad mainline. There is also typically a depressed corridor between the UPRR mainline embankment and the industrial properties to the south which are on fill. Both depressed areas have low to moderate-height brushy vegetation, including sage brush, willows, and weeds. Regional utilities (gas pipelines and fiber optic cables) are suspected along either side of the railroad but have not been investigated by Kleinfelder in detail.

South of Interstate 80 and the UPRR tracks the proposed alignment runs west through vegetated undeveloped right-of-way and industrial properties. A portion of the alignment traverses adjacent to and partially in the existing NTD channel. The proposed alignment crosses through the East Greg Street embankment then traverses under Larkin Circle to a short levee before discharging into the Truckee River. Specific discussions on the proposed construction adjacent to the existing NTD channel, through the East Greg Street embankment, and through the existing levee are addressed in Section 5.12.

3.4 Subsurface Conditions

The following paragraphs provide brief general summaries of the results of our field explorations for the proposed project. The boring logs, presented in Appendix A, should be reviewed for a more detailed description of the subsurface conditions at the locations explored. The stratification lines shown on the borings logs are inferred boundaries between soil types, and the actual transition may be gradual. Due to the nature and depositional characteristics of the native soils, care should be taken in interpolating and extrapolating subsurface conditions between and beyond the boring locations.

3.4.1 Fill

Most of the developed portions of the alignment including all roadways and industrial areas are likely on fill. The encountered fill was generally granular material, consisting of clayey or silty sands or gravels. It is likely cobbles and boulders are also present in the fill. It should be expected that fill material under Interstate 80, the UPRR tracks, East Greg Street embankment, Larkin Circle, within the levee, and in industrial yards will be of greatly varying material due to the different years of construction, potential fill sources, and level of care associated with their construction.

Research was not performed to assess whether the encountered fills were properly compacted or documented as structural fill; therefore, apparent densities of the encountered fill material have not been provided on the soil boring logs. Deeper and/or poorer quality fill in other areas of the alignment beyond our explorations could be present and should be anticipated.

The bottom of fill was generally interpreted based on encountering the top of the underlying soft to stiff fine-grained alluvial, floodplain soils. The interpreted thickness and approximate elevation of bottom of fill encountered during this investigation are presented in Table 2, below.

TABLE 2
SUMMARY OF ENCOUNTERED FILL THICKNESS AND ELEVATIONS

Boring Number	General Location	Elevation of Boring (feet)[1]	Approximate Depth of Fill (feet)[2]	Approximate Elevation of Bottom of Fill (feet)[2]
B-01	Interstate 80 off ramp	4,393.6	8 ½	4385
B-02	Interstate 80	4,397.0	12 ½	4384.5
B-03 (MW)	Briery Way	4,395.3	10	4385
B-04	People's Drain	4,387.6	0	4388
B-05	Interstate 80	4,396.9	10 ½	4386.5
B-06	Existing NTD channel	4,389.5	5	4385
B-07 (MW)	Washoe County School District	4,398.2	14	4384
B-08	UPRR ROW	4,393.2	6	4387
B-09	East Greg Street Embankment	4,423.3	30 ½	4393
B-10	East Greg Street Embankment	4,410.4	26	4384.5
B-11 (MW)	Larkin Circle	4,389.9	4	4386
B-12	UPRR ROW	4,397.9	4	4394
B-13	UPRR ROW	4,397.4	4	4393.5
B-14	UPRR ROW	4,391.5	0	4391.5
B-15	UPRR ROW	4,387.8	0	4388

Notes: 1) Boring elevations provided by Bigby and Associates in NAVD 88.
2) Depths of fill and elevations to bottom of fill are rounded to nearest ½ foot due to measurement methods.

3.4.2 Native Material

The native soils along the alignment generally consisted of flood-plain clays and silts underlain by Tahoe Outwash sands and gravels, except at the northwest end of the alignment near Brierley Way, and at the eastern portion along Larkin Circle.

The floodplain clays and silts were generally soft to very stiff, moderate- to high-plasticity, and contained some fine and medium sized sand. Occasionally gravel or possible cobbles were encountered which resulted in unrepresentatively high blow counts for this material. East of the East Greg Street embankment under Larkin Circle, the flood-plain deposits appear to be more consistently silty sand, poorly-graded sand with silt, or sandy silt (borings B-11 through B-15), possibly because the river gradients and velocities increased towards the outlet of the flood-plain into the mouth of the Truckee Canyon. Aerial photographs prior to development (USACE, 1970) indicate a number of flood-level river channels or drainages converging on the mouth of the Truckee Canyon underlying the vicinity of Larkin Circle.

The fill and floodplain deposits are generally underlain by the Tahoe Outwash, the approximate depths and elevations of the outwash deposits encountered in the borings are summarized in Table 3, below. Sands and gravels of the Tahoe Outwash were generally very dense with low to moderate content of non-plastic fines. Interbedded sand and clay layers were noted at 3 to 6 inch intervals in the outwash deposits in some borings, specifically B-07 and B-08. Boulders, cobbles, and/or coarse gravel are likely present in some locations based on locally-difficult drilling. The base of the floodplain deposits was not encountered at boring B-06 which extended through clays and sandy clays to 4,363 feet, the maximum depth explored. Dense outwash deposits were also not encountered in the borings B-13 through B-15.

TABLE 3
SUMMARY OF TAHOE OUTWASH DEPTHS AND ELEVATIONS

Boring Number	General Location	Elevation of Boring (feet)[1]	Approximate Depth to Outwash Deposits (feet)[2]	Approximate Elevation of Outwash Deposits (feet)[2]
B-01	Interstate 80 off ramp	4,393.6	19 ½	4374
B-02	Interstate 80	4,397.0	24	4373
B-03 (MW)	Brierley Way	4,395.3	18 ½	4377
B-04	People's Drain	4,387.6	16	4371.5
B-05	Interstate 80	4,396.9	29	4368
B-06	Existing NTD channel	4,389.5	>26 ½ [3]	<4363[3]
B-07 (MW)	Washoe County School District	4,398.2	23	4375
B-08	UPRR ROW	4,393.2	18 ½	4374.5
B-09	East Greg Street Embankment	4,423.3	46	4377.5
B-10	East Greg Street Embankment	4,410.4	33	4377.5
B-11 (MW)	Larkin Circle	4,389.9	23	4367
B-12	UPRR ROW	4,397.9	15	4383
B-13	UPRR ROW	4,397.4	>30 ½ [3]	<4367[3]
B-14	UPRR ROW	4,391.5	>26 ½ [3]	<4365[3]
B-15	UPRR ROW	4,387.8	>16 ½ [3]	<4371.5[3]

Notes: 1) Boring elevations provided by Bigby and Associates in NAVD 88.
2) Depths and elevations are rounded to nearest ½ foot due to measurement methods.
3) Outwash deposits were not encountered to the maximum depth explored.

In Borings B-03 and B-05, brown to purple-brown clayey gravel to clayey sand was present below the fill which is likely soil and weathered bedrock materials present from the former hill on the north side of Brierley Way. The extent of this material was not determined further.

Significant thickness of the outwash deposits throughout the project site, and sandy floodplain deposits (under Larkin Circle) will likely have very high permeability. Heaving sands were encountered at a depth of 24 feet in soil boring B-1 and lower blow counts were observed near the top of the sands and gravels. These conditions can be the result of concentrated seepage towards the boring excavations as discussed in the following section.

3.4.3 Groundwater

Groundwater was encountered in all soil borings, except B-13, and ranged in elevations of approximately 4,371 to 4,381 feet, with higher groundwater elevations typically in the western (upriver) portions of the project. Table 4, below, summarizes the approximate groundwater depths and elevations at the locations where groundwater was first encountered and stabilized groundwater elevation was recorded if the boring was maintained open long enough for the levels to stabilize. It is possible that variations in groundwater elevation and moisture content may occur due to seasonal changes, run-off, precipitation, construction activities, and/or other factors.

In general, free standing groundwater was initially encountered within the borings near the top of the Tahoe Outwash. Once the lower permeability clays and fills were penetrated, the free standing groundwater rose within the bore holes. This is suggestive of an artesian condition.

Groundwater elevations from various dates taken from the three monitoring wells are also summarized in the table. Kleinfelder will continue to monitor the groundwater wells on at least a quarterly basis and will provide a summary letter upon completion of one year of groundwater measurements. These monitoring wells must be abandoned in accordance with Nevada regulations prior to or during construction; it is the Owner's responsibility to ensure these wells are abandoned.

TABLE 4
SUMMARY OF GROUNDWATER DEPTHS AND ELEVATIONS

Boring Number	General Location	Elevation of Boring (feet)[1]	Approximate Depth to Initial Ground-water (feet)[2]	Approximate Elevation of Initial Ground-water (feet)[2]	Approximate Depth to Stabilized Ground-water (feet)	Approximate Elevation of Stabilized Ground-water (feet)[2]
B-01	Interstate 80 off ramp	4,393.6	19	4374.5	17	4376.5
B-02	Interstate 80	4,397.0	25	4372	15.5	4381.5
B-03 (MW)	Brierley Way	4,395.3	19	4376.5	19.0 (4/8/2009)	4,376.0
					13.9 (6/18/2009)	4,381.4
					14.1 (7/20/2009)	4,381.2
					13.8 (11/10/2009)	4,381.5
B-04	People's Drain	4,387.6	7 ½	4380	NA	-
B-05	Interstate 80	4,396.9	20	4377	16 ½	4380.5
B-06	Existing NTD channel	4,389.5	11	4378.5	NA	-
B-07 (MW)	Washoe County School District	4,398.2	23	4375	17.3 (7/2/2009)	4380.9
					17.8 (7/20/2009)	4380.4
					17.45 (11/10/2009)	4380.7
B-08	UPRR ROW	4,393.2	15	4378	NA	-
B-09	East Greg Street Embankment	4,423.3	45	4378	NA	-
B-10	East Greg Street Embankment	4,410.4	34 ½	4376	34 ½	4376
B-11 (MW)	Larkin Circle	4,389.9	14 ½	4375.5	14.5 (4/8/2009)	4,375.4
					12.3 (6/18/2009)	4.377.6
					13.2 (7/20/2009)	4.376.7
					13.6 (11/10/2009)	4376.3
B-12	UPRR ROW	4,397.9	17	4381	17	4381
B-13	UPRR ROW	4,397.4	>30 ½ [3]	< 4367[3]	NA	-
B-14	UPRR ROW	4,391.5	16	4375.5	NA	-
B-15	UPRR ROW	4,387.8	16 ½	4371 ½	NA	-

Notes: 1) Boring elevations provided by Bigby and Associates in NAVD 88.
2) Depths and elevations are rounded to nearest ½ foot due to measurement methods unless otherwise noted.
3) Groundwater was not encountered to the maximum depth explored.

Long-term groundwater level records were obtained from the Washoe County School District property, located North of Kleppe Lane and approximately south of boring B-7. The south-central portion of this property was instrumented with 12 monitoring wells, as summarized in Broadbent & Associates, (2008); a site plan and data tables from this report are included in Appendix C. Groundwater data from 1999 to 2008 for the four wells closest to the proposed NTD alignment are summarized on Plate 31. Readings from monitoring well B-07(MW) installed on this project have been appended to the previous results and show readings which are consistent with median trends for the previous monitoring wells.

The Broadbent & Associates report (2008) does not indicate the method used to determine the elevation and exact location of the monitoring wells. It should be noted that the groundwater elevation has varied up to 5 feet over a six-year time period (excluding a reading in January 2008 which is assumed to be incorrect and has been removed), primarily during wet winter seasons. Based on conversations with Mr. John Nolan of the Washoe County School District, the monitoring wells were abandoned after January 2008.

3.5 Liquefaction

A quantitative liquefaction analyses was outside the scope of this project and has therefore not been performed. Qualitative discussion is provided below based on Kleinfelder's experience in the area and encountered subsurface material to limited depths.

Liquefaction is a nearly completed loss of soil shear strength that can occur during a seismic event in saturated, loose to medium dense, poorly-graded sands, silty sands, cohesionless silts, and some gravels. Liquefaction results from cyclic shear stresses and strains causing partial collapse of the soil matrix and development of excessive pore water pressure between the soil grains. Liquefaction will result in settlements shortly after the earthquake. Water and sand may be expelled to the surface, referred to as sand boils; these may cause minimal damage, except if building footings are located directly over a major sand boil. For sites with gentle or minimal slopes or with an adjacent slope, significant damage may potentially result from ground oscillation or lateral spreading. Uplift can occur to buried structures which are less dense than the surrounding soil.

Based on the depth of groundwater and the presence of plastic clays over dense Tahoe Outwash deposits, liquefaction potential for most of the project alignment is expected to be negligible.

East of East Greg Street, medium dense sands are present, with negligible fines contents, which are at least 8 feet thick below the groundwater table. The low blow counts near the top of these soil layers suggest these soils may potentially liquefy during a design-level earthquake; however, it is our professional opinion the low blow counts are due to the drilling method and the likely artesian condition in the borings at the contact between the floodplain and outwash deposits. The hollow stem drilling method that was used has been known to result in lower blow counts than the standard field methods for liquefaction analysis (i.e. rotary wash). Based on the preliminary information, it is our opinion the likelihood of liquefaction during a design-level earthquake is low.

4. CONCLUSIONS

The following conclusions are based on the data collected during this assessment and are subject to the limitations stated in this report. These conclusions may change if additional information becomes available. Based on the results of our study, no severe soil or groundwater constraints were observed which would preclude development. The following is a summary of our conclusions.

Most of the proposed RCB alignment is located several feet below the groundwater table as measured in this investigation, and about one third to half of the alignment is located over soft to stiff clays. These saturated soils will be difficult to prepare for RCB subgrade, and therefore extensive use of stabilizing fill under the box culverts will generally be required. Excavated fill materials will generally be re-usable as structural fill (likely with some processing); however the 5 to 10 feet of clay in the excavations will have limited potential for re-use.

Extensive dewatering will be required to maintain a relatively dry excavation to allow for construction of the RCB. Dewatering and subgrade preparation requirements may be less stringent where pre-cast concrete segments can be put in place rather than using cast-in-place concrete. Use of drain rock stabilizing fill may assist in removing groundwater in addition to other methods such as wells or sumps. The dewatering system shall be designed by the contractor. The contractor may need to shore excavations to compensate for limited construction easement width.

Specific recommendations and specifications for project design and construction including mitigation of potential problems described above are presented in Section 5.0. A summary table including the boring location, elevation of boring, proposed bottom of RCB, depth of fill, elevation of outwash deposits, and elevation of initial groundwater measurements are included in Table 5, below.

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TABLE 5
SUMMARY OF ENCOUNTERED SUBSURFACE CONDITIONS AND ELEVATION OF RCB

Boring Number	General Location	Elevation of Boring (feet)[1]	Approximate Elevation of Bottom of RCB (feet)[2]	Approximate Depth/ Elevation of Fill (feet)[3]	Approximate Elevation of Initial Groundwater (feet)[3]	Approximate Elevation of Outwash Deposits (feet)[3, 5]
B-01	Interstate 80 off ramp	4,393.6	4,385.5	8 ½ / 4,385	4,374.5	4,374
B-02	Interstate 80	4,397.0	4,382	12 ½ / 4,384.5	4,372	4,373
B-03 (MW)	Brierley Way	4,395.3	-	10 / 4,385	4,376.5	NE[4]
B-04	People's Drain	4,387.6	4,379	0 / 4,387.5	4,380	4,371.5
B-05	Interstate 80	4,396.9	-	10 ½ / 4,386.5	4,377	4,368
B-06	Existing NTD channel	4,389.5	4,378	5 / 4,384.5	4,378.5	NE[4]
B-07 (MW)	Washoe County School District	4,398.2	4,377	14 / 4,384	4,375	4,375
B-08	UPRR ROW	4,393.2	4,377	6 / 4,397	4,378	4,374.5
B-09	East Greg Street	4,423.3	-	30 ½ / 4,393	4,378	4,377.5
B-10	East Greg Street	4,410.4	4,376.5	26 / 4,384.5	4,376	4,377.5
B-11 (MW)	Larkin Circle	4,389.9	4,376	4 / 4,386	4,375.5	4,367
B-12	UPRR ROW	4,397.9	-	4 / 4,394	4,381	NE[4]
B-13	UPRR ROW	4,397.4	-	4 / 4,393.5	< 4,367[4]	NE[4]
B-14	UPRR ROW	4,391.5	-	0 / 4,391.5	4,375.5	NE[4]
B-15	UPRR ROW	4,387.8	-	0 / 4,388	4,371 ½	NE[4]

Notes: 1) Boring elevations provided by Bigby and Associates in NAVD 88.
2) Elevations from HDR preliminary plans (2009) and are estimated to nearest ½ foot.
3) Depths and elevations are rounded to nearest ½ foot due to measurement methods. Groundwater elevations will vary seasonally.
4) Not encountered to the maximum depth explored.
5) Elevation of Outwash deposits are typically the bottom elevation of the floodplain deposits. Refer to boring logs for more detail.

5. RECOMMENDATIONS

5.1 General Recommendations

The following sections of this report present our analysis and recommendations regarding site preparation, excavation, earthwork, and box culvert construction, and recommended observation and testing during construction. Prior to performing excavations, the groundwater level should be sufficiently lowered to minimize the likelihood of unstable subgrade conditions. Given the granular nature of the outwash deposits and groundwater levels in the vicinity of the site, significant construction dewatering should be anticipated.

5.2 Site Clearing and Preparation

Prior to construction, all existing improvements (sidewalks, curb and gutter, underground utilities, etc.) will need to be demolished and removed from the site. Bituminous pavements, concrete curb, sidewalks, gutters, and driveways should be removed to neatly sawed edges. Existing asphalt pavements should be disposed of off site or stockpiled and processed for reuse beneath new pavements.

Landscaping areas should be stripped/grubbed of organic soils, tree roots, etc. It appears approximately 4 to 6 inches can be used as a reasonable estimate for average depth of stripping. Deeper stripping/grubbing of organic soils, roots, etc., and potentially removal of debris fill in industrial lot areas may be required locally. Tree root balls should be removed and the resulting voids backfilled with adequately compacted backfill soil.

Existing monitoring wells (installed as part of this investigation) must be abandoned in accordance with Nevada Department of Environmental Protection standards and shall be the responsibility of the Owner. Kleinfelder can perform the abandonment of the monitoring wells if necessary at the Owner's direction.

We understand that the existing footings for the UPRR bridge crossing over the North Truckee Drain will be cut in order to provide greater lateral clearance for the proposed box culvert. This bridge presently may be supported by spread footings or pile foundations. A structural investigation should be performed to confirm removal of the toe of the footings will not cause distress or failure.

The Geotechnical Engineer should be present during demolition and site preparation to observe stripping and grubbing depths. Dust control should be the responsibility of the Contractor.

5.3 Earthwork

Where import fill is necessary, materials should meet the gradation and plasticity requirements listed for "structural fill" based on the Standard Specification for Public Works (2007, Section 200.01.09) except for reconstruction of the levee at the east end of the project. These specifications include requirements including but not limited to a maximum particle size of one inch, between 5 and 20 percent of materials passing the No. 200 sieve, and a liquid limit of 35 maximum and a plastic limit of 12 maximum. It appears that some of the existing site fills or Tahoe Outwash soils may be capable of meeting recommended requirements for structural fill, with some processing.

Structural fills used to backfill over the culvert in the East Greg Street embankment should also have an R-value of 45 or greater to meet NDOT requirements. We have assumed that the existing material in the East Greg Street embankment may be re-used to reconstruct the embankment.

The floodplain deposits are unsuitable for structural fill and should be exported off site or used only in non-structural fills. However, one exception is that the floodplain deposits may be reused as structural fill above the RCB assuming that no permanent improvements except industrial yards or pavements are planned above the box culvert. These soils should be compacted to 90 percent relative density and above optimum moisture content as determined by ASTM D1557 and at least three feet of structural fill is placed above the floodplain soils.

Fill within structural areas and backfill over and around box culverts should be placed in maximum 8-inch-thick (loose) lifts, each densified to, at least, 90 percent relative compaction (ASTM D1557). In all cases, the finished surface should be smooth, firm, and show no signs of deflection. Grading should not be performed with or on frozen soils.

5.4 Subgrade Preparation and Subgrade Stabilization

Subgrade preparation requirements (remedial earthwork) differ for three separate conditions: subgrade for pre-cast RCB placement, subgrade for cast-in-place RCB, and subgrade for near-surface improvements that will be founded less than 5 feet below final grade. In many cases, the requirement for subgrade preparation will be superceded by the requirement to provide a stable subgrade for construction (i.e., subgrade stabilization). The methods described below are contingent upon adequate groundwater control, as discussed in Section 5.6

Clay soils were found to exist from the ground surface down to or below the planned RCB invert at most boring locations. Where clay is not present, saturated granular soils are present with groundwater present at or above the planned RCB invert. Either of these soil conditions may require stabilization. Prior to excavation, the groundwater should be sufficiently lowered to prevent unstable conditions. Light, track-mounted construction equipment should be used in excavations to help prevent destabilizing the subgrade soils and causing "pumping". In the event unstable soils are encountered in the excavation bottoms, additional construction dewatering, overexcavation and/or subgrade stabilization would be necessary.

5.4.1 Subgrade Stabilization

For preparation of the box culvert subgrade and for any construction that may be performed during wet weather, the subgrade soils will most likely be well above optimum moisture content and difficult to impossible to compact. In some situations, moisture conditioning of the top 12 inches of subgrade may allow the soil to dry sufficiently to allow compaction. Where construction schedules preclude delays or drying is ineffective, mechanical subgrade stabilization will be necessary. Subgrade stabilization is usually a trial and error process, typically determined with a test section. Two potential mitigation options are discussed here. The final selection of a method of stabilization and final subgrade stabilization is the contractor's responsibility.

For cast-in-place RCB construction, mechanical stabilization may be achieved by over-excavation and/or placement of an initial 12- to 18-inch-thick lift of 12-inch-minus, 3-inch-plus, well graded, angular rock fill. The more angular and well graded the rock is, the more effective it will be. This fill should be densified with large equipment, such as a self-propelled sheeps-foot or a large loader, until no further deflection is noted. Additional lifts of rock may be necessary to achieve adequate stability. A leveling course of on average 6 inches of drain rock or aggregate base could be placed over the rock fill to allow for fine grading of the RCB footprint.

For preparation of subgrade particularly for pre-cast culvert sections, a greater thickness of drain rock underlain by a reinforcing geotextile could be considered. A moderate strength geotextile, such as Mirafi 180N, Mirafi S800, or equal, would be placed in the range of 24 inches below planned subgrade, and would be covered with drain rock (Class C or D backfill, Standard Specifications Section 200.03, 2007). The drain rock bedding would ease minor grade adjustments during RCB placement, and could potentially provide a supplemental drain material for groundwater removal.

If the stabilizing fill is intended to support extensive vehicular traffic, additional geotextile strength and/or fill thickness may be required. The contract documents should provide flexibility for additional subgrade stabilization and overexcavation of as needed during grading operations.

5.4.2 Pre-Cast RCB Construction

Pre-cast RCBs founded at least 5 feet below final grade may be constructed on the native clay soils or other native subgrade, provided a working surface can be established. Clays should not be allowed to dry out prior to backfilling. In order to facilitate leveling of subgrade under the RCB, it is common to place a granular leveling course such as 6 to 12 inches of drain rock under the precast segments that can be easily leveled. This leveling course will also assist in maintaining moisture conditions of underlying clays where present. Aggregate base or pit-run sand should not be used for leveling because it will tend to become unstable and pump once it is saturated. This approach assumes that the subgrade for the RCB will not be subject to heavy or repeated loads. If excess movement (pumping) of subgrade occurs during placement of the drain rock (Class C or D backfill, Standard Specifications Section 200.03, 2007), mechanical stabilization should first be used.

5.4.3 Cast-in-Place RCB Construction

Cast-in-place RCB segments founded at least 5 feet below native grade (except for connector segments less than 10 feet long joining adjacent pre-cast segments, which can use the criteria for pre-cast segments) may be founded on existing clay or native subgrade, provided that a working surface can be established, and the top 6 inches of subgrade can be densified to at least 90 percent relative compaction relative to ASTM D 1557. Granular soils should be within 2 percent of optimum moisture content, and clays should be at or above optimum moisture content. Where these conditions cannot be achieved, mechanical subgrade stabilization should first be used.

5.4.4 Improvements Founded Near Final Grade

Clay soils were classified as moist to wet, soft to very stiff, and as exhibiting low to high plasticity, and therefore have potential for shrink-swell movement when subject to seasonal moisture changes. For structures or other improvements that are founded within 5 feet of final grade, the structure should be separated from clays or silts by a minimum of 2 feet of structural fill (as defined in Section 5.3). These structures may potentially include wing walls footings, outlet and inlet structures and slabs, any portion of the RCB with less than 5 feet of cover to foundation level, maintenance buildings, and new pavements.

Prior to structural fill placement, the exposed subgrade surfaces at the base of the 2 feet of separation should be scarified to a minimum depth of six inches, moisture conditioned as necessary, and compacted to a minimum of 90% relative compaction in accordance with the ASTM D1557 compaction test method. A minimum of 90% relative compaction in accordance with the ASTM D1557 compaction test method is also recommended for the structural fill required for separation. Where less than 70 percent passes the 3/4-inch sieve, subgrade soils are too coarse for standard density testing techniques. In this case, as will likely occur on Tahoe Outwash soils, proof rolling is recommended. For bidding purposes, we assume that proof-rolling often can be achieved a minimum of five single passes with a minimum 10-ton roller in mass grading, or five complete passes with hand compactors in footing trenches, however the exact procedure will have to be determined by the contractor and inspector in the field. Proof-rolling has proved to provide adequate project performance for coarse-grained soils, as long as all other geotechnical recommendations are closely followed. In all cases, the final surface should be smooth, firm, and exhibit no signs of deflection.

Clay subgrade to be left in place and covered with fill should be moisture-conditioned to at or over optimum for a minimum depth of 12 inches. This moisture level will significantly decrease the magnitude of shrink-swell movements in the upper foot of clay. The high moisture content must be maintained by periodic surface wetting, or other methods, until the surface is covered by at least one lift of fill. If allowed to dry out, subsequent expansion of clay soils could results in differential heave or settlement of improvements.

5.5 Trenching and Excavation

We expect that all materials can be excavated with conventional earthmoving equipment, e.g. bulldozers and excavators. The contractor should be aware cobbles and boulders are likely present in the subsurface soils and the contractor should be prepared to handle this size material.

Most of the project is underlain by firm to stiff clays which extend from approximately the top to midheight of the planned culvert to at or below the box culvert invert (See Table 5). Therefore while trucks, scrapers, or other wheeled equipment could be supported along haul roads near original ground surface, excavation below the surface fill would be expected to require track-mounted excavators. Excavation operations should be performed in a manner so as to minimize disturbance of clays which can decrease bearing capacity and increase settlements. Subgrade stabilization may be required for construction on the fine grained material and is discussed further in Section 5.4.

5.6 Construction Dewatering

Groundwater is expected to be encountered in excavations (see Table 4). Fluctuations in the level of the groundwater and soil moisture conditions as noted in this report may occur due to variations in precipitation, land use, irrigation, snow melt, river levels, and other factors. It should be noted the Broadbent & Associates report showed groundwater levels as high as approximately 4,384.5 feet in June of 2006.

Groundwater should ideally be lowered several feet below the bottom of the excavations to provide a firm, unyielding subgrade for construction and prevent unstable excavation wall conditions. The dewatering system should be a Contractor-designed system. Control of groundwater should be accomplished in such a manner that will preserve the strength of the foundation of soils, not cause instability of any excavated slopes or the nearby existing slopes, and not result in damage to existing structures. The water should be lowered in advance of any excavations by deep wells, well points, or other methods. Open sumps should not be permitted if it results in boils, loss of fines, or unacceptable settlement of existing structures. Water should not be allowed to pool and remain in the excavated area over an extended period of time.

Although 28 gradation tests have been performed, extreme caution should be used in evaluating permeability and dewatering rates based on grain size only, especially in the outwash deposits since larger soil particles cannot be obtained in the soil samples used in this investigation. Excavations into or immediately above the Tahoe Outwash will increase rate of groundwater seepage and likely require more stringent groundwater control methods. It has been Kleinfelder's experience that outwash deposits are highly permeable and significant dewatering should be anticipated.

General lowering of the groundwater can result in surface settlement of nearby structures. This should be taken into account in the Contractor's design of the dewatering system. If well points are used, nearby structures should be monitored for settlement and instability during dewatering operations.

Discharge should be arranged to meet the necessary local governmental requirements and permits and to facilitate sampling by the engineer of record. Potential points of discharge include land disposal, the sanitary sewer system, and the Truckee River. Discharge to the Truckee River will require an NPDES permit from the State of Nevada Division of Environmental Protection may likely require pre-treatment and will require considerable monitoring of the Truckee River and discharge waters.

5.7 Temporary Excavation Slopes

We understand the proposed project will include the installation of RCBs up to 35 feet deep at East Greg Street; however the majority of the project will involve excavations on the order of 15 to 20 feet deep. This section addresses the majority of the excavations necessary for the proposed project; a specific discussion on the cuts for East Greg Street is addressed in Section 5.12.2. Construction dewatering for excavations below groundwater should be anticipated to lower the groundwater below proposed excavations.

The Contractor is responsible for site safety and all excavations should be evaluated to verify their stability, prior to occupation by construction personnel. We do not expect the walls of excavations in the site fill soils to stand near vertical without sloughing. The Contractor should be prepared to shore or slope excavations in these materials. For the clayey site soils, trench excavations should comply with current OSHA safety requirements (Federal Register 29 CFR, Part 1926) for Type B soil. In the granular soils, including structural fill, excavations will need to be modified to comply with OSHA requirements for Type C soil. Any area in question should be considered Type C, unless specifically examined by the contractor's engineer during construction. Conditions more restrictive than Class C could result if the contractor does not provide adequate groundwater control. All trenching shall be performed and stabilized in accordance with OSHA standards.

Excavations will require shoring or laying back of sidewalls to maintain adequate stability. Regulations amended in Part 1926, Volume 54, Number 209 of the Federal Register (Table B-1, October 31, 1989) requires that temporary sidewall slopes be no greater than those presented in Table 6.

TABLE 6 – MAXIMUM ALLOWABLE TEMPORARY EXCAVATION SLOPES

Soil or Rock Type	Maximum Allowable Slopes[1] for Deep Excavations less than 20 Feet Deep[2]
Stable Rock	Vertical (90 degrees)
Type A[3]	3H:4V (53 degrees)
Type B	1H:1V (45 degrees)
Type C	3H:2V (34 degrees)
Notes:	
1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.	
2. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.	
3. A short-term (open 24 hours or less) maximum allowable slope of 1H:2V (63 degrees) is allowed in excavation in Type A soils that are 12 feet or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet in depth shall be 3H:4V (53 degrees).	

The State of Nevada, Department of Industrial Relations, Division of Occupational Safety and Health, has adopted and strictly enforces these regulations, including the classification system and the maximum slopes. In general, Type A soils are cohesive, non-fissured soils, with an unconfined compressive strength of 1.5 tons per square foot (tsf) or greater. Type B are cohesive soils with an unconfined compressive strength between 0.5 and 1.5 tsf. Type C soils have an unconfined compressive strength below 0.5 tsf. Numerous additional factors and exclusions are included in the formal definitions. The client, owner, design engineer, and contractor shall refer to Appendix A and B of Subpart P of the previously referenced Federal Register for complete definitions and requirements on sloping and benching of trench sidewalls. Appendices C through F of Subpart P apply to requirements and methodologies for shoring.

For any temporary slopes, the cut faces should be inspected by the Contractor during the work day for any signs of movement and tension cracks. Workers should not be allowed to work near the excavations unless such inspections deem the area safe. During periods of heavy precipitation, a potential for slough of the cut slope will exist and precautions should be taken. Workers should not work at the toe of the slopes during such storm events. In the event the soils become wet from a storm event, or any other source; work along the toe of the slopes should be halted until the stability of the slopes is reassessed.

During wet weather, runoff water should be prevented from entering excavations. Water should be collected and disposed of outside the construction limits. Heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed within a distance of one-third the slope height from the top of any excavation.

5.8 Shoring

Shoring will be required where space or other restrictions do not allow a sloped construction slope, and where loose fill material is encountered near the surface, or excavations may be shored at the option of the contractor. Layers of cohesionless sands in the outwash deposits should be anticipated that would slough or ravel and would not retain a vertical cut. Soil nailing and walls with ground anchors (tiebacks) have been used successfully for construction excavations within the Reno Valley in similar deposits. Any shoring design (e.g. soil nail, tieback anchor/solider pile, etc.) should consider, among other things: bottom heave/shear failure at/below shoring walls; groundwater inflow in and below shoring; effect of temporary stand-up time in cohesionless soil; flowing sands; presence of cobbles and boulders.

Any shoring system would have to meet OSHA pre-approved configurations or be designed by the Contractor to meet OSHA standards. The contractor should submit details and calculations of any non-standard shoring or excavation support systems to the Owner prior to construction. The shoring system should prevent unacceptable movement or settlement of adjacent structures.

It is understood UPRR has stringent design criteria for any temporary shoring within their ROW. Any proposed shoring within the UPRR ROW must be approved by UPRR. The contractor should refer to "Guidelines for Temporary Shoring", dated October 25, 2004, published by UPRR for additional information.

5.9 Recommended Permanent Slope Angles

We recommend that permanent fill and cut slopes be no steeper than 2H:1V. The East Greg Street embankment may be rebuilt to match the existing slopes which is slightly steeper than 2H:1V provided the embankment uses fill with an R-value of 45 or greater. Satisfactory slope performance is primarily affected by drainage and runoff. Care must be taken that drainage is not directed to flow over slope faces. Slope faces should be protected against erosion resulting from direct rain impact.

5.10 Foundations

The proposed box culvert will be supported by a concrete mat foundation (i.e. the bottom of the RCB) and may be designed for an allowable soil bearing pressure of 1,500 psf. If the RCBs will be entirely founded on dense outwash deposits or structural fill extending to outwash deposits the allowable bearing capacity may be increased to 3,000 psf.

Other foundations which may be part of this project may include wingwalls, retaining walls, outfall structures, maintenance buildings or temporary loads which will also likely be founded at depths near the top of the clay layers or lower. Foundations designed and constructed in accordance with the recommendations of this geotechnical report may be designed for an allowable soil bearing pressure of 1,500 pounds per square foot for dead loads plus long-term live loads. This assumes a minimum separation of foundations from clays with at least 24 inches of structural fill compacted to 90% relative compaction (ASTM D1557). The allowable soil bearing pressure was calculated using a minimum foundation width of 12 inches and an embedment depth of 12 inches.

The allowable bearing pressure value may be increased by one-third for short-term loading conditions, including temporary wind and seismic forces. The allowable bearing pressure is a net value; therefore, the weight of the foundation and the weight of backfill below the lowest grade adjacent to the structure may be neglected when computing dead loads.

Resistance to lateral loads may be calculated using an allowable passive equivalent fluid unit weight as described in Lateral Earth Pressures, Section 5.11. Both passive and frictional resistances may be assumed to act concurrently.

We estimate that total-post construction settlement of footings and RCBs designed and constructed in accordance with our recommendations will be on the order of 1 inch or less, with approximate differential settlement of on the order of ½ inch or less between adjacent similarly loaded isolated footings.

5.10.1 Hydrostatic Uplift Pressures

All buried structures proposed to extend below the groundwater table are subjected to uplift pressures or buoyant forces. All structures extending below the groundwater table should be designed to resist these uplift pressures, especially the RCB if groundwater levels outside the culvert can exceed water depth in the culvert. Buoyant pressures can be found by multiplying the unit weight of water (62.4 pcf) by the depth below the groundwater table. For example if the bottom of the RCB was 10 feet below the design groundwater surface, a pressure of 624 psf would be applied across the bottom of the RCB.

5.11 Retaining Structures and Lateral Earth Pressures

Lateral earth pressures will be imposed on all subterranean structures, including culverts and foundations. Table 7 and Table 8 present a list of lateral earth pressures with and without hydrostatic pressures, respectively, which we recommend for design and planning of structures. These values assume a level backfill. The values assume a minimum internal angle of friction of 32 degrees for imported or on-site granular, backfill material meeting the structural fill specification (section 5.3), and a unit weight of 120 pcf.

The lateral "at-rest" earth pressures should be used for design of the RCB. Lateral earth pressures acting against buried/retaining structures may be computed from the equivalent fluid densities presented below for the static case. The "active" condition may be used for walls that are able to deflect away from the backfill (i.e., unbraced walls). For walls that are not allowed to deflect, the "at-rest" condition should be used. The "passive" condition applies to walls or structures that move into the backfill. The uppermost 2 feet of the backfill should not be used for calculation of passive soil resistance unless it is protected by a permanent surface covering (pavement, slab, etc.). Maximum fluctuations in groundwater levels, should be considered in the design.

TABLE 7
PRELIMINARY LATERAL EARTH PRESSURES
WITH HYDROSTATIC PRESSURES

Earth Pressure	Equivalent Fluid Density
Active	80
At-rest	90
Passive	250
Friction Coefficient	0.40

TABLE 8
PRELIMINARY LATERAL EARTH PRESSURES
WITHOUT HYDROSTATIC PRESSURES

Earth Pressure	Equivalent Fluid Density
Active	35
At-rest	55
Passive	390
Friction Coefficient	0.40

The at-rest case is applicable for braced walls where rotational movement is confined to less than 0.001H. If greater movement is possible, the active case applies.

The lateral loads computed using the values in Tables 7 and 8 assume a level backfill and structural fill will extend laterally at least one-half of the wall height. If this condition does not apply, the design values may require revision. This backfill should be compacted to 90% of maximum dry density and within 2% of the optimum moisture content as determined by ASTM D1557. Over-compaction should be avoided, as the increased compactive effort will result in lateral pressures higher than those recommended above. Heavy compaction equipment or other loads should not be allowed in close proximity to the wall unless planned for in the structural design.

Recommended minimum factors of safety against sliding, overturning, and bearing failure are listed in Table 9, below.

TABLE 9
RECOMMENDED MINIMUM FACTORS OF SAFETY

Factor of safety against sliding	1.5
Factor of safety against overturning	To be determined by Structural Engineer
Factor of safety against bearing failure	3*

* Factor of safety included in provided allowable bearing pressure.

If both passive and frictional resistances are assumed to act concurrently, we recommend a minimum safety factor of 2 be used for design against sliding.

5.12 Special Areas

The following sections include specific discussions and recommendations for specific areas of the proposed alignment; adjacent to the existing NTD channel, the East Greg Street embankment, and the proposed Truckee River Levee crossing.

5.12.1 Adjacent to the Existing NTD Channel

For approximately 1,000 feet from the confluence of the People's Drain to the Washoe County School District Property, the proposed NTD RCB crosses, is partially in, or is adjacent to the existing NTD channel. Special earthwork recommendations and settlement analyses are provided for this area.

Although no explorations were performed within the existing channel it is likely the channel bottom will consist of soft or loose clays, silts, and/or fine grained sands. These materials must be completely removed to expose at least firm or medium dense native material. For bidding purposes we recommend that two feet of the in-place material is removed and replaced with structural fill. However, the contract documents should provide flexibility in overexcavation of this area.

The proposed RCBs generally will be installed below existing grade and will generally weigh less than the excavated soil it replaces, therefore settlement will be minimal. An exception is in the vicinity of the existing NTD channel, where the existing ground surface (in the ditch itself) is lower than the top of box culvert, and higher final stresses and settlement can potentially result. The greatest additional loading and potential for settlement will occur, not to construction of the RCB, but where the adjacent NTD ditch is backfilled adjacent to the new box culvert.

Settlement analysis was evaluated for the subsurface profile in the vicinity of boring B-6. The existing clay soils in this area under the existing NTD ditch are deepest in this area and have lower initial consolidation stresses due to less soil cover under the existing ditch. Settlement analysis was performed assuming overconsolidated clays based on laboratory testing in boring B-6. Incremental stresses were assumed to occur due to 11 feet of backfill from the bottom of the existing ditch to an expected 2 feet of fill over the top of the adjacent box culvert. These stresses were assumed to occur over a limited strip loading approximately 30 feet wide along the existing ditch footprint.

Total calculated settlement is in the range of 1½ to 2½ inches. A portion of the settlement will occur during backfill of the channel. We estimate that post-backfill settlements will be on the order of 1½ inches under the centerline of the channel, and any settlements will drop off rapidly under the new RCB, with little potential for significant differential settlement of the RCB.

It is estimated the majority of the settlement will occur within 1 year of backfill placement. We therefore recommend that construction of settlement-sensitive improvements over the drain ditch backfill within 1 year after the current construction should include settlement surveys for a 30-day waiting period prior to construction, with level surveys performed at the beginning and end of the waiting period, to verify that no remaining movement is occurring.

The settlement estimates are contingent on the assumption that the contractor's operations will not disturb the existing firm to soft clays at the bottom of the existing NTD channel.

5.12.2 East Greg Street Embankment

Slope stability analyses were performed using SLIDE (Rocscience, 2008) to confirm global stability where the proposed culvert excavation will be parallel and adjacent to the existing East Greg Street embankment. The east side of the East Greg Street embankment is built at 1.6H:1V and is 27 to 28 feet above existing grade at the north end of the parallel box culvert alignment. The invert of the box culvert in this area is 18 feet below existing grade, and the edge of the box culvert will be approximately 40 feet from the toe of the existing slope. Results of the slope stability analysis showed a factor of safety greater than 1.3 which is recommended for temporary construction conditions.

Kleinfelder understands that at the present time, the project team has selected to perform an open cut in the East Greg Street embankment to install the proposed RCB. Box culvert installation would be performed during a short duration (e.g. weekend) closure of East Greg Street, during which period the embankment would be excavated, box culvert would be constructed with precast concrete segments, and the embankment backfilled. For safety purposes, the excavation would have to be evaluated by the contractor. However, for preliminary design purposes, we expect that a temporary slope in the range of 1.5H:1V to 1.75H:1V would have an acceptable temporary slope factor of safety.

Other approaches could potentially include use of a vertical excavation with soil-nails or tied-back soldier piles, or jacking the new culverts into place under the existing embankment. These alternatives would only be necessary if it were not feasible to perform the necessary construction with a short-term closure. Soil-nail or soldier-pile shoring with tiebacks could potentially allow for detoured lanes of East Greg Street to remain open on one side of the embankment while the other side is excavated.

The soils are generally suitable for soil nails or tieback anchors, although some of these nails or anchors would potentially hit refusal in embankment or native granular soils. Longer nails or anchors would likely be required for the bottom of the excavation in the firm to stiff clays. Soldier piles would likely have to be installed in pre-augered holes backfilled with lean concrete, due to uncertainty of driving into fill and native soils with likely cobbles and boulders. The augered holes would have to be cased in the Tahoe Outwash. After completion of the first half of the culvert, a geotextile-wrapped-face mechanically-stabilized wall would generally be the most appropriate method to rebuild the embankment above the first half of the completed culvert. A jacked culvert installation may potentially be feasible given the subsurface conditions but is generally more costly. A specialty contractor and design would be required for the soil nail, tieback anchor, soldier pile, or jacked culvert installation option.

5.12.3 Truckee River Levee and NTD Outfall

The proposed RCB will penetrate through native soils and fill below the existing Truckee River Levee just short of the outfall. We understand that the existing levee is owned by the City of Sparks and is neither United States Army Corps of Engineers (USACE) nor FEMA certified. Therefore special criteria for levee construction are not presented and we have not performed additional evaluation of levee stability or seepage. We propose the following backfill methods around the RCB so that the levee backfill will meet or be more stringent than the existing conditions.

We recommend that the levee prism, any excavation below the levee footprint, and backfill around the culvert in this excavation consist of low permeability backfill meeting USACE levee material requirements. Levee fill should have greater than 20 percent fines, 100 percent passing the 2-inch sieve, a plasticity index between 8 and 40, and a liquid limit of less than 45 percent (USACE 2004). These soils could include clays to clayey sands excavated from the existing levee or obtained from floodplain deposits along the RCB alignment. Levee soil shall be placed in 8 inch maximum loose lifts and compacted to a minimum density (ASTM D698) at a moisture content within 2 percent of optimum moisture content. Levee armoring should match existing materials, unless additional hydraulic design is required due to a protruding outfall.

The previous recommendations for mechanical subgrade stabilization under the box culvert should not be used for closer than 25 feet to the proposed levee centerline to avoid creating more permeable seepage paths under the levee. If subgrade stabilization is required in this area, a 2-foot-thick mat of sand-cement slurry, meeting the criteria for excavatable slurry backfill (Standard Specifications, 2007, Section 337.08) should be used in lieu of drain rock or rock fill.

It is Kleinfelder's understanding a future levee or floodwall alignment is proposed near the existing, uncertified levee. It is strongly recommended the design team notifies and discusses the proposed RCB with USACE.

The proposed outfall is shown as discharging slightly above the normal Truckee River water level (water elevation 4,375 feet) on a bench which is most likely composed of fine, poorly-graded sand or silty sand. Both due to the need to provide construction support and to reduce erosion potential, we recommend that a 2-foot thick mechanical stabilizing fill be placed under headwall and erosion control improvements to replace the saturated sands. Adequate armoring and energy dissipation including rip-rap, cellular concrete mats, or cast-in-place concrete slabs should be used. A heavy non-woven filter/separation fabric such as Mirafi 180N or equal, is generally recommended for subsurface protection, separation, and filtration of underlying sandy soils, drainage layers, and armoring layers. Different geotextile products may be more appropriate for different applications.

5.13 Site Drainage

Final surface grades should be designed so as to direct runoff water away from the proposed improvements and should not allow ponding. Reconstructed pavement areas should be sloped and drainage gradients maintained to match the existing conditions and carry all surface water off the site.

5.14 Steel and Concrete Reactivity

Analytical testing of selected soil samples were performed to assess the potential for adverse reactivity with concrete and corrosivity with steel. Limited soil testing was performed on three samples, which may not be representative of all surface and subsurface soils on site. Kleinfelder is not a corrosion engineering consultant and all testing and results are for the Clients reference only. Sulfate, pH and resistivity results from WET Labs are included in Appendix B.

Resistivity testing indicates the subgrade soils have extremely varying resistivity ranging from 1,400 to 430,000 ohm-cm. The two lowest resistivity values (1,400 and 2,300 ohm-cm) were samples of fill soil. The source of the fill soils is not known. A corrosion engineer should review resistivity and pH testing results to determine if corrosion protection for metal elements should be incorporated into the design.

Soluble sulfate testing was performed to evaluate potential sulfate attack against Portland Cement Concrete. The soluble sulfate content of the samples tested ranged from 25 to 200 ppm. Therefore, based on these samples the potential for sulfate attack appears to be very low and conventional Type II cement may be used, according to data furnished by WET Laboratory and the requirements of Section 19, Table 19-A-4 of the 2003 *International Building Code*.

6. ADDITIONAL SERVICES

6.1 Project Bid Documents

It has been our experience during the bidding process, that contractors often contact us to discuss the geotechnical aspects of the project. Informal contacts between Kleinfelder and an individual contractor could result in incorrect or incomplete information being provided to the contractor. Therefore, we recommend a pre-bid meeting be held to answer any questions about the report prior to submittal of bids. If this is not possible, questions or clarifications regarding this report should be directed to the project Owner or his designated representative. After consultation with Kleinfelder, the project Owner (or his representative) should provide clarifications or additional information to all contractors bidding the job.

6.2 Construction Observation/Testing and Plan Review

The recommendations made in this report are based on the assumption that an adequate program of tests and observations will be made during construction to verify compliance with these recommendations. These tests and observations should include, but not necessarily be limited to, the following:

- Part time observations and testing during site preparation and excavations.
- Review and comment on contractor submittals including shoring and dewatering.
- Observation and testing of construction materials.
- Full-time observations and testing during backfill.
- Consultation as may be required during construction.

We also recommend that project plans and specifications be reviewed by us to verify compatibility with our conclusions and recommendations. Additional information concerning the scope and cost of these services can be obtained from our office.

The review of plans and specifications and the field observation and testing by Kleinfelder are an integral part of the conclusions and recommendations made in this report. If we are not retained for these services, the Client agrees to assume Kleinfelder's responsibility for any potential claims that may arise during construction.

7. LIMITATIONS

Preliminary recommendations contained in this report are based on our field explorations, laboratory tests, and our understanding of the proposed construction. The study was performed using a mutually agreed upon scope of work. It is our opinion that this study was a cost-effective method for evaluation of the subject site and evaluation of the potential geotechnical concerns.

The soils data used in the preparation of this report were obtained from borings made for this investigation. It is possible that variations in soils exist between the points explored. The nature and extent of soil variations may not be evident until construction occurs.

This report has been prepared for preliminary planning purposes for specific application to the North Truckee Drain project in accordance with the generally accepted standards of practice at the time the report was written. No warranty, express or implied, is made.

This report may be used only by the client and only for the purposes stated, within a reasonable time from its issuance, but in no event later than 3 years from the date of the report. Land or facility use, on and off-site conditions, regulations, or other factors may change over time, and additional work may be required with the passage of time. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party and client agrees to defend, indemnify, and hold harmless Kleinfelder from any claim or liability associated with such unauthorized use or non-compliance.

8. REFERENCES

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PLATES

APPENDIX A

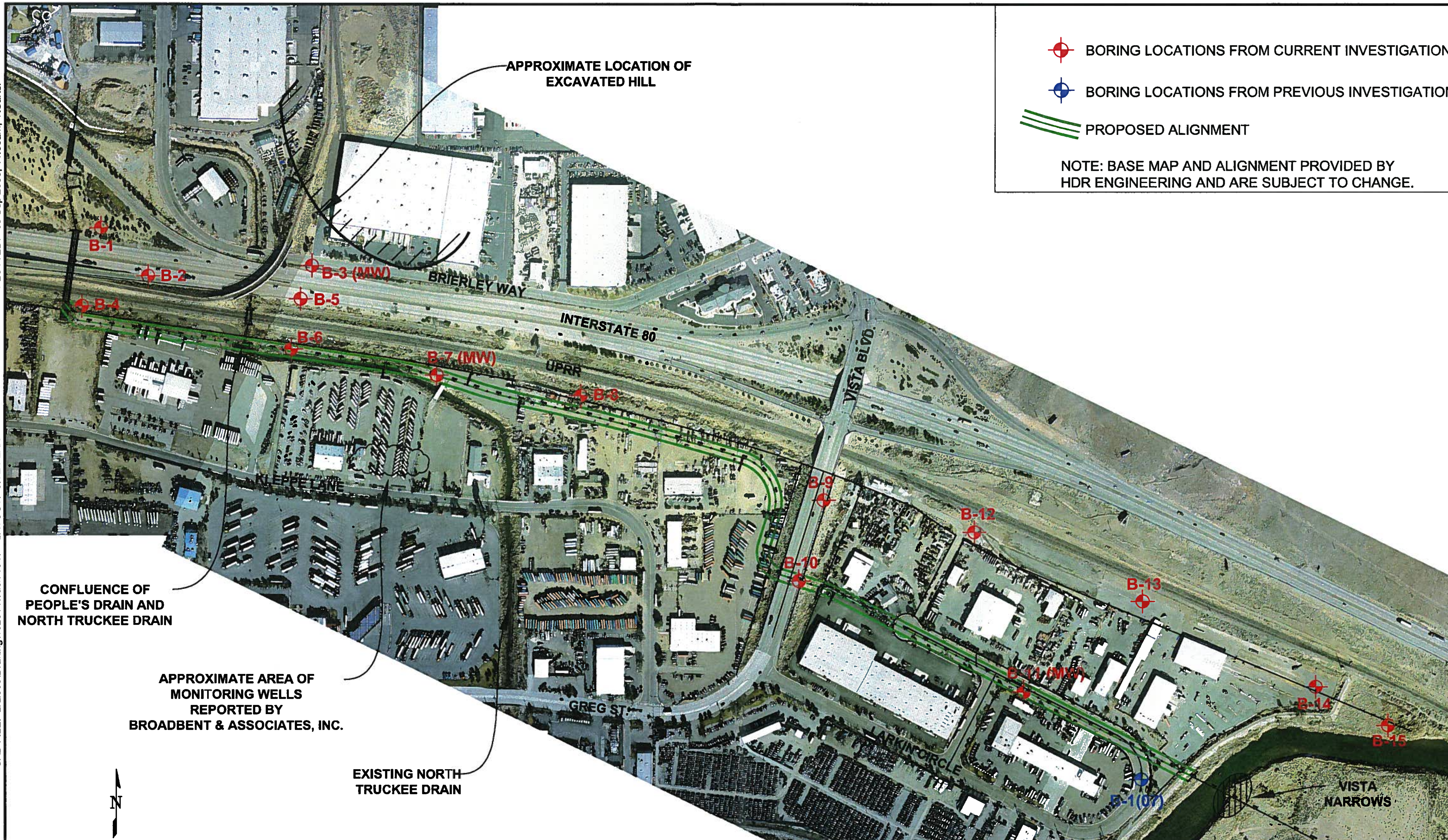
Previous Boring Logs

APPENDIX B

WET Lab Results

APPENDIX C

Sections of Groundwater Report 2008, Broadbent & Associates, Inc.



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PLOTTED: 03 Sep 2009, 11:38am, KCarter
LAYOUT: SITE PLAN
CAD FILE: L:\2009\Drafting\102314\Task 104\
ATTACHED IMAGES: Images: TRD_1.jpg Images: TRD_2.jpg
ATTACHED XREFS: XRef: TRD_Topo: XRef: Bigby_NTD-boreholes
RENO, NV

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PROJECT NO.	102314.104
DRAWN:	SEPT. 3, 2009
DRAWN BY:	K. CARTER
CHECKED BY:	D. ADAMS
FILE NAME:	SITE PLAN_SURVEYED LOCATIONS.dwg

SITE PLAN

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE
1

Depth (ft)	Dry Density lb/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	Soil Description
0–1.5	111	8	64		FILL: **BROWN SILTY SAND (SM)** slightly moist, non-plastic fines, fine to coarse sand, fine to coarse gravel.
1.5–8.5					FILL: **PURPLE BROWN CLAYEY SAND (SC)** slightly moist to moist, medium plastic fines, fine to coarse sand, fine to coarse gravel.
5			37		Color change to olive brown
8			18		
8.5–19.5					**DARK BROWN TO GRAY BROWN LEAN CLAY (CL)** moist, stiff, high plastic fines, fine to medium sand.
10			11		pp = 3.25 tsf (pocket penetrometer)
13			8		Color change to light brown, very moist, soft pp = 0.5 tsf (pocket penetrometer)
15			10	97 PI = 21 LL = 48	pp = 2.25 tsf (pocket penetrometer)
19.5–26					**BLUE GRAY TO GRAY BROWN POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)** wet, very dense, non-plastic fines, fine to coarse sand, fine to coarse gravel.
20			68	9	
25			50/5"		Approximately 1 foot of heave

Groundwater symbols shown at approximately 17 feet (▼) and 19 feet (▽).

DEPTH IN FEET

DATE: 4-9-09

TOTAL DEPTH: 26.0 feet

LOGGED BY: D. ADAMS

EQUIPMENT: MOBILE B-57 WITH AUTOHAMMER

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DRAFTED BY: K. Carter PROJECT NO. 102314.104

LOG OF B-01

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE **2**

Depth (ft)	Dry Density lb/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	SOIL DESCRIPTION
0					**3 INCHES ASPHALT CONCRETE**
					6 INCHES AGGREGATE BASE
2			33		**FILL: BROWN CLAYEY GRAVEL WITH SAND (GC)** moist, medium plastic fines, fine to coarse sand, fine to coarse gravel.
8		9	30	16 PI = 13 LL = 31	
10			12		Color change to light brown to brown, increase in fines, some gravel
12			25		**BLACK TO DARK BROWN LEAN CLAY (CL)** moist, stiff, medium plastic fines, some fine sand.
15			23		pp = 1.75 tsf (pocket penetrometer)
18			23		Color change to gray pp = 0.5 tsf (pocket penetrometer)
20			71/9"		Sampler driving on gravel or possible cobbles greater than 2½ inches in diameter
24					**GRAY POORLY GRADED SAND WITH SILT (SP-SM)** wet, loose, non-plastic fines, fine to medium sand.
25			10		
30			28		Medium dense, with fine to coarse gravel

DEPTH IN FEET

DATE: 4-9-09
TOTAL DEPTH: 31.5 feet
LOGGED BY: D. ADAMS
EQUIPMENT: MOBILE B-57 WITH AUTOHAMMER

KLEINFELDER *Bright People. Right Solutions.*

LOG OF B-02

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE 3

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DEPTH IN FEET	Well Graphics	Well Design Info.	Dry Density lbs/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	Sample	USCS	SOIL DESCRIPTION
0		CEMENT			14				**12 INCHES AGGREGATE BASE**
2		BENTONITE	101	24		18 PI = 15 LL = 31			**FILL: <u>PINK BROWN CLAYEY GRAVEL WITH SAND (GC)</u>** moist, medium plastic fines, fine to coarse sand, fine to coarse gravel.
4		SAND							
6		SCREEN			45				Color change to dark brown to black
8					66/9"				Moist Color change to gray brown
10					50/5"	17 PI = 18 LL = 32			Drill rig grinding from 9½ to 10 feet **<u>PURPLE BROWN CLAYEY GRAVEL (GC)</u>** dry, very dense, medium plastic fines, fine to coarse sand, fine to coarse gravel.
12					50/3"				
14									
16					20/0"				
18				▼					Hard drilling
20					53				**<u>BROWN TO YELLOWISH BROWN POORLY GRADED GRAVEL WITH SAND (GP)</u>** wet, very dense, non-plastic fines, fine to coarse sand, fine to coarse gravel.
22									
24									
26					59				
28									
30									
32									
34									

DATE: 4-8-09
TOTAL DEPTH: 26.5 feet

LOGGED BY: D. ADAMS
EQUIPMENT: MOBILE B-57 WITH AUTOHAMMER

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LOG OF B-03 (MW)

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE

4

Depth (ft)	Dry Density lb/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	SOIL DESCRIPTION
0	77	15	36	54 LL = 60 PI = 33	**GRAYISH BROWN GRAVELLY FAT CLAY WITH SAND (CH)** dry to slightly moist, very stiff, high plastic fines, fine to coarse sand, fine to coarse angular gravel.
5			31		**LIGHT GRAY BROWN FAT CLAY (CH)** moist, hard, medium plastic fines, fine to coarse sand.
7		∇			
8			39		Wet
10.5			13		
11.5		42		87 LL = 59 PI = 28	Stiff pp = 1.25 tsf (pocket penetrometer)
13			46		Hard
15.5			20		**DARK BROWN TO BLACK POORLY GRADED SAND (SP)** wet, medium dense, fine to medium sand.
16	95	30		4	
19					With gravel
20.5			33		Dense
25			50/4"		Very dense

DEPTH IN FEET

DATE: 7-1-09

TOTAL DEPTH: 25.5 feet

LOGGED BY: S. RAHE

EQUIPMENT: CME 55, CATHEAD, TRACK MOUNTED

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DRAFTED BY: K. Carter PROJECT NO. 102314.104

LOG OF B-04

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE **5**

Depth (ft)	Dry Density lb/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	Soil Description
0					3 INCHES PCC PAVEMENT
0.25					3 INCHES AGGREGATE BASE
0.5–5			32		FILL: **OLIVE BROWN SILTY SAND (SM)** moist, non-plastic fines, fine to coarse sand, trace fine gravel.
5–10.5			9		FILL: **BROWN TO RED BROWN CLAYEY SAND (SC)** moist, medium plastic fines, fine to coarse sand, fine to coarse gravel.
10.5–13.5			20, 42		**DARK BROWN TO BLACK FAT CLAY (CH)** moist, stiff, high plastic fines, fine to medium sand, some fine gravel.
13.5–29.5	102	13	50/5"		**PURPLE CLAYEY SAND (SC)** dry to slightly moist, very dense, medium to high plastic fines, fine to coarse sand, fine to coarse gravel.
16.5					Moist
20.5			35		Wet, dense
23–25			43	50 LL = 47 PI = 26	
29.5–31.5			86/11"		**PURPLE POORLY GRADED GRAVEL WITH SAND (GP)** wet, very dense, non-plastic fines, fine to coarse sand, fine to coarse gravel.

DEPTH IN FEET

DATE: 4-9-09
TOTAL DEPTH: 31.5 feet
LOGGED BY: D. ADAMS
EQUIPMENT: MOBILE B-57 WITH AUTOHAMMER

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DRAFTED BY: K. Carter PROJECT NO. 102314.104

LOG OF B-05

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE 6

Depth (feet)	Dry Density lb/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	SOIL DESCRIPTION
0			16		FILL: **GRAY BROWN CLAYEY SAND (SC)** dry, low plastic fines, fine to coarse sand, organics.
5			25		**RED TO BLACK FAT CLAY (CH)** slightly moist, very stiff, high plastic fines.
6		28		95 LL = 69 PI = 41	
8					Color change to dark brown to black, very moist to wet, very stiff, high plastic fines, fine to coarse sand. pp > 4.5 tsf (pocket penetrometer)
10		∇	30		
12			8		**DARK BROWN SANDY LEAN CLAY (CL)** wet, medium stiff, low plastic fines, fine sand. pp = 0.5-1.0 tsf (pocket penetrometer)
15			22		Color change to dark green, stiff pp = 1.0-2.5 tsf (pocket penetrometer)
17.5			12		
19					Drill rig grinding on possible cobbles or boulders
20			50/5"		
21.5					pp = 0.5-2.5 tsf (pocket penetrometer) Increasing fine sand
24		42		69 LL = 42 PI = 20	
25			84/10"		pp = 0.5-1.75 tsf (pocket penetrometer)

DEPTH IN FEET: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34

Sample | GRAPHIC LOG

DATE: 7-1-09

TOTAL DEPTH: 26.5 feet

LOGGED BY: S. RAHE

EQUIPMENT: CME 55, CATHEAD, TRACK MOUNTED

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DRAFTED BY: K. Carter PROJECT NO. 102314.104

LOG OF B-06

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE
7

Depth (ft)	Well Graphics	Well Design Info.	Dry Density lbs/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	Sample	USCS	SOIL DESCRIPTION
0		CEMENT			23				FILL: **BROWN WELL-GRADED SAND WITH CLAY, GRAVEL AND COBBLES (GW-GC)** dry, low plastic fines, fine to coarse sand, angular gravel up to ¾ inches in diameter.
3		BENTONITE							
4									Coarse gravel and cobbles
5		SAND			50/5"				
8									FILL: **BROWN WELL-GRADED SAND WITH SILT (SW-SM)** moist, non-plastic fines, fine to coarse sand, fine gravel.
10					60				
10.5		FILTER							Sampler encountered gravel/cobbles > 2.5 inches in diameter
12					36				
14									Sampler encountered gravel/cobbles > 1.5 inches in diameter
15					29				**DARK BROWN FAT CLAY (CH)** moist, very stiff, medium plastic fines, fine sand. pp = 2.0 tsf (pocket penetrometer)
17				▼ 38	14	97 LL = 78 PI = 48			Stiff pp = 1.75-2.25 tsf (pocket penetrometer)
20					11				Medium stiff, low to medium plastic fines pp = 1.0-1.5 tsf (pocket penetrometer)
23				▽					**GRAY TO BROWN POORLY GRADED SAND WITH SILT (SP-SM)** wet, very dense, non-plastic fines, fine to coarse sand, rounded gravel up to 1½ inches in diameter.
25					91/11"	94 9			
26									Interbedded with approximately 6 inch layers of lean clay
28									**BROWN CLAYEY SAND (SC)** wet, medium dense, low plastic fines, fine to coarse sand, fine to coarse gravel.
30					25	43			

DEPTH IN FEET

DATE: 7-2-09

TOTAL DEPTH: 31.0 feet

LOGGED BY: J. PEASE

EQUIPMENT: MOBILE B-57, AUTOHAMMER

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DRAFTED BY: K. Carter

PROJECT NO. 102314.104

LOG OF B-07 (MW)

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT GEOTECHNICAL INVESTIGATION SPARKS, NEVADA

PLATE **8**

Depth in Feet	Dry Density lb/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	Soil Description
0			34		FILL: **REDDISH BROWN SILTY SAND (SM)** dry, non to low plastic fines, fine to coarse sand, fine to coarse gravel, organics (roots), debris.
5			15		
6					**DARK BROWN LEAN CLAY WITH SAND (CL)** slightly moist, stiff, low to medium plastic fines, fine to coarse sand.
10			60		Hard pp > 4.5 tsf (pocket penetrometer)
12.5			2		**BROWN SILTY SAND WITH GRAVEL (SM)** slightly moist, very loose, non to low plastic fines, fine to coarse sand, fine to coarse gravel.
15	96	▽ 29	13	63 LL = 35 PI = 16	**REDDISH GRAY BROWN LEAN CLAY (CL)** moist to wet, medium stiff, non-plastic fines, fine to coarse sand. Increase in sand, fine to coarse gravel
17.5			50/2"		
19					**YELLOWISH BROWN SILTY SAND WITH GRAVEL (SM)** wet, very dense, non-plastic fines, fine to coarse sand, fine gravel Lenses of approximately 3-6 inches of reddish brown silt
20			73	19	
25			25		Medium dense
30			50/2"		Very dense

DATE: 7-1-09
TOTAL DEPTH: 31.0 feet
LOGGED BY: S. RAHE
EQUIPMENT: CME 55, CATHEAD, TRACK MOUNTED

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LOG OF B-08

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE 9

Depth (ft)	Dry Density lb/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	Soil Description
0			80/11"		**10 INCHES ASPHALT CONCRETE**
1					**FILL: <u>RED BROWN SILTY SAND WITH GRAVEL (SM)</u>** slightly moist, non to low plastic fines, fine to coarse sand, fine to coarse subrounded gravel.
5			82		
7					Increase in gravel
10			50/2"		
12.5			75		**FILL: <u>BROWN CLAYEY SAND WITH GRAVEL (SC)</u>** moist, low to medium plastic fines, fine to coarse sand, fine to coarse subrounded to subangular gravel.
15			50/5"		
17					Gravel up to 3 inches in diameter
17.5			50/5"		
20			50/1"		Increase in fines, coarse sand
22					Color change to light gray
24		11		42 LL = 37 PI = 19	
25			20/0"		Difficult drilling, drill rig grinding on possible cobbles or boulders
30			50/2"		
30.5					**<u>DARK BROWN FAT CLAY (CH)</u>** moist to very moist, stiff, medium to high plastic fines, medium sand. Note: Logged from drill cuttings
32.5					**<u>DARK YELLOWISH BROWN POORLY GRADED SAND (SP)</u>** moist to wet, very dense, non-plastic fines, fine to coarse sand, some gravel up to 3 inches in diameter.

DEPTH IN FEET

DATE: 7-1-09
TOTAL DEPTH: 51.5 feet

LOGGED BY: S. RAHE
EQUIPMENT: CME 55, CATHEAD, TRACK MOUNTED

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LOG OF B-09

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT GEOTECHNICAL INVESTIGATION SPARKS, NEVADA

PLATE **10**

Dry Density lb/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	Sample	GRAPHIC LOG	SOIL DESCRIPTION
		50/4"				
		50/4"				**BLACK FAT CLAY (CH)** moist, stiff, fine sand, organics. pp = 1.5 tsf (pocket penetrometer)
		30				Very stiff pp = 4.5 tsf (pocket penetrometer)
		43				Hard pp =2.5 tsf (pocket penetrometer)
	▽	41				**YELLOWISH BROWN SANDY SILT (ML)** very moist to wet, hard, low plastic fines, fine sand. pp = 2.5 tsf (pocket penetrometer)
						YELLOW BROWN SILTY SAND (SM) moist, medium dense, low plastic fines, fine sand, fine to coarse gravel. Gravel up to 2 inches in diameter
		50/6"				Very dense
						Practical refusal at 51.5 feet.

DEPTH IN FEET: 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70

DATE: 7-1-09
TOTAL DEPTH: 51.5 feet
LOGGED BY: S. RAHE
EQUIPMENT: CME 55, CATHEAD, TRACK MOUNTED

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LOG OF B-09

**PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA**

PLATE

10

Depth (ft)	Dry Density lb/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	Soil Description
0					**4 INCHES OF ASPHALT CONCRETE**
			50/3"		**6 INCHES OF AGGREGATE BASE**
2					**FILL: BROWN CLAYEY GRAVEL WITH SAND (GC)** slightly moist, low to medium plastic fines, fine to coarse sand, fine to coarse gravel.
5			60		
7					Drill rig grinding at 7 feet
10		7	50/5"	20 PI = 13 LL = 32	
15			50/4"		
16					Refusal on gravel larger than 2.5 inches in diameter
20			32		
25			36		
26					**BLACK LEAN CLAY (CL)** moist, stiff, medium to high plastic fines, some fine sand.
28			20	74 PI = 24 LL = 44	
30			23		Moist
33			7		**GRAY BROWN TO GRAY SILTY SAND (SM)** very moist, loose, non-plastic fines, fine sand, oxidation.
34		▼			

DEPTH IN FEET

DATE: 4-8-09
TOTAL DEPTH: 46.0 feet

LOGGED BY: D. ADAMS
EQUIPMENT: MOBILE B-57 WITH AUTOHAMMER

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LOG OF B-10

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT GEOTECHNICAL INVESTIGATION SPARKS, NEVADA

PLATE **11**

Depth (feet)	Dry Density lb/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	Sample	GRAPHIC LOG	SOIL DESCRIPTION
35–36			44				**GRAY BROWN POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)** wet, dense, non-plastic fines, fine to coarse sand, fine to coarse gravel. Drill rig grinding from 35 to 36 feet
40			100/10"				Color change to brown, very dense. Drill rig grinding at 40 feet
45			50/5"				

DEPTH IN FEET: 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70

DATE: 4-8-09

TOTAL DEPTH: 46.0 feet

LOGGED BY: D. ADAMS

EQUIPMENT: MOBILE B-57 WITH AUTOHAMMER

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PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE 11

Depth (feet)	Well Design Info.	Dry Density lbs/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	Soil Description
0	CEMENT					**3 INCHES ASPHALT CONCRETE**
						3 INCHES AGGREGATE BASE
1		128	6	44		**FILL: <u>LIGHT BROWN SANDY CLAY WITH GRAVEL (SC)</u>** moist, low plastic fines, fine to coarse sand, fine to coarse gravel.
2	BENTONITE					
3	SAND			12		
5	SCREEN			25		**<u>GRAY BROWN LEAN CLAY (CL)</u>** slightly moist, stiff, high plastic fines, trace fine sand. pp > 4.5 tsf (pocket penetrometer) pp = 0.75 tsf (pocket penetrometer)
8				16		**<u>GRAY BROWN CLAYEY SAND (SC)</u>** moist, medium dense, low to medium plastic fines, fine sand.
10		80	16	6	10 N.P.	**<u>GRAY BROWN POORLY GRADED SAND WITH SILT (SP-SM)</u>** moist, loose, non to low plastic fines, fine sand, some organics, oxidation.
14			▼			
15				21		Color change to dark gray, wet, medium dense
17						Some gravel from 17 to 17.5 feet
20				19		**<u>GRAY BROWN SILTY SAND (SM)</u>** wet, medium dense, low plastic fines, fine sand.
23						Drill rig grinding at 23 feet
24						**<u>GRAY POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)</u>** wet, very dense, non-plastic fines, fine to coarse sand, fine to coarse gravel, possible cobbles.
25				70		

DEPTH IN FEET

DATE: 4-8-09
TOTAL DEPTH: 26.5 feet

LOGGED BY: D. ADAMS
EQUIPMENT: MOBILE B-57 WITH AUTOHAMMER

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LOG OF B-11 (MW)

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE **12**

DEPTH IN FEET	Dry Density lb/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	SOIL DESCRIPTION
0			68		FILL: **YELLOWISH BROWN POORLY GRADED SAND WITH SILT (SP-SM)** slightly moist, non-plastic fines, fine to coarse sand, fine to coarse gravel.
3					Cobbles up to 5 inches in diameter
4					**RED GRAY CLAYEY SAND WITH GRAVEL (SC)** slightly moist, very dense, low to medium plastic fines, fine to medium sand, fine gravel.
5			50/5"		
8		7		36 LL = 28 PI = 14	
10			50/5"		
11					Sampler driving on gravel or possible cobble greater than 2½ inches in diameter
12			50/4"		
15			50/4"		**LIGHT BROWN POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)** slightly moist, very dense, non-plastic fines, fine to coarse sand, fine to coarse gravel.
17		∇	100/9"	6	Wet
20			50/3"		
21					Drill rig grinding, slow drilling (2 inches in 10 minutes)
23			20/0"		Practical refusal at 23 feet. Hole caved to 14 feet.

Depth scale: 0 – 34 feet

DATE: 6-30-09

TOTAL DEPTH: 23.0 feet

LOGGED BY: D. ADAMS

EQUIPMENT: CME 55, CATHEAD, TRACK MOUNTED

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PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE **13**

DRAFTED BY: K. Carter PROJECT NO. 102314.104

Depth in Feet	Dry Density lb/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	Soil Description
0	122	13	32		**3 INCHES ASPHALT CONCRETE** **3 INCHES AGGREGATE BASE** **FILL: LIGHT BROWN CLAYEY SAND (SC)** slightly moist, medium to high plastic fines, fine to coarse sand, fine gravel up to ¾ inch in diameter.
4			50/3"		**RED GRAY CLAYEY GRAVEL WITH SAND (GC)** slightly moist, very dense, medium plastic fines, fine to coarse sand, fine to coarse angular to subangular gravel. Hard and slow drilling
10		6	50/2"	24 LL = 31 PI = 14	Increasing gravel
12			50/3"		
15			50/2"		
17			50/4"		
18.5			50/3"		**LIGHT BROWN SILT WITH SAND (ML)** dry, hard, low plastic fines, fine sand.
25		17	83	78 LL = 32 PI = 10	**PURPLISH GRAY LEAN CLAY WITH SAND (CL)** moist, very hard, medium plastic fines, fine to coarse sand, trace fine gravel. pp > 4.5 tsf (pocket penetrometer)
30			50/4"		
31					No free water encountered.

DATE: 6-30-09
TOTAL DEPTH: 31.0 feet
LOGGED BY: D. ADAMS
EQUIPMENT: CME 55, CATHEAD, TRACK MOUNTED

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PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE **14**

DRAFTED BY: K. Carter PROJECT NO. 102314.104

Depth (ft)	Dry Density lb/ft3	Moisture Content %	Blows/ Ft.	Percent Passing #200	Soil Description
0					**3 INCHES ASPHALT CONCRETE**
					3 INCHES AGGREGATE BASE
1			10		**GRAY BROWN FAT CLAY (CH)** moist, medium stiff, medium to high plastic fines, trace fine sand, trace fine well-rounded gravel. pp = 1.25 tsf (pocket penetrometer)
5.5			62		
8		31	10	88 LL = 64 PI = 41	Color change to red gray, trace organics pp = 1.0 tsf (pocket penetrometer)
10.5			26		Color change to gray brown, increase in sand, trace oxidation pp = 0.5-2.5 tsf (pocket penetrometer)
13		62	5	83 LL = 49 PI = 26	Very moist, soft pp = 0.25-0.75 tsf (pocket penetrometer)
15.5			17		Trace organics
16 (∇)	91	32		40	**GRAY SILTY SAND (SM)** wet, medium dense, non to low plastic fines, fine to medium sand.
20.5			20		**GRAY POORLY GRADED SAND (SP)** wet, medium dense, non-plastic fines, fine to medium sand.
25.5			28		

DATE: 6-30-09
TOTAL DEPTH: 26.5 feet
LOGGED BY: D. ADAMS
EQUIPMENT: CME 55, CATHEAD, TRACK MOUNTED

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LOG OF B-14

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT GEOTECHNICAL INVESTIGATION SPARKS, NEVADA

PLATE **15**

DRAFTED BY: K. Carter PROJECT NO. 102314.104

Depth (feet)	Dry Density lb/ft3	Moisture Content %	Blows/Ft.	Percent Passing #200	Soil Description
0–10.5			37 (0–1.5)		**DARK BROWN SANDY SILT (ML)** dry to slightly moist, stiff, medium plastic fines, fine sand, organics up to 1 foot. pp > 4.5 tsf (pocket penetrometer)
~4.5					Laminated layers of black lean clay
5–6.5			16		With sand
10.5–16.5			25 (10–11.5)		**RED-GRAY POORLY GRADED SAND (SP)** moist, medium dense, non-plastic fines, fine sand.
~14.5					Very moist
15–16.5		▽ (water level, ~16 ft)	10		Color change to gray, wet, loose

DEPTH IN FEET: 0–34

DATE: 6-30-09

TOTAL DEPTH: 16.5 feet

LOGGED BY: D. ADAMS

EQUIPMENT: CME 55, CATHEAD, TRACK MOUNTED

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LOG OF B-15

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE **16**

DRAFTED BY: K. Carter PROJECT NO. 102314.104

THE UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOIL More than 50% of the material is LARGER than the No. 200 sieve.	GRAVELS More than 50% of coarse part is LARGER than the No. 4 Sieve.	CLEAN GRAVELS Less than 5% finer than No. 200 Sieve.	GW	Well graded gravels, gravel - sand mixtures, little or no fines, Cu>4 & 1<Cc>3
			GP	Poorly graded gravels or gravel - sand mixtures, little or no fines Cu<4 or 1>Cc<3
		GRAVEL More than 12% finer than No. 200 Sieve.	GM	Silty gravels, gravel - sand - silt mixtures
			GC	Clayey gravels, gravel - sand - clay mixtures
	SANDS More than 50% of coarse part is SMALLER than the No. 4 Sieve.	CLEAN SANDS Less than 5% finer than No. 200 Sieve.	SW	Well graded sands, gravelly sands, little or no or no fines, Cu>6 & 1<Cc>3
			SP	Poorly graded sands or gravelly sands, little or no fines Cu<6 or 1>Cc<3
		SAND More than 12% finer than No. 200 Sieve.	SM	Silty sands, sand - silt mixtures
			SC	Clayey sands, sand - clay mixtures
FINE GRAINED SOIL More than 50% of the material is SMALLER than the No. 200 sieve.	SILTS AND CLAYS Liquid limit LESS than 50	PI-Below A-Line	ML	Inorganic silts, rock flour, or clayey silts of low plasticity
		PI-Above A-Line	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts & organic clays of low plasticity
	SILTS AND CLAYS Liquid limit GREATER than 50	PI-Below A-Line	MH	Inorganic silts, clayey silts, or silts of high plasticity
		PI-Above A-Line	CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			PT	Peat & other highly organic soils

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

BOULDERS	COBBLES	GRAVEL		SAND			SILT	CLAY
		Coarse	Fine	Coarse	Medium	Fine		

12" 3" 3/4" #4 #10 #40 #200 0.002 mm

DESCRIPTIVE TERMS USED WITH SOILS

CONSISTENCY & APPARENT DENSITY		
	SILTS & CLAYS	SANDS & GRAVELS
Strongest	Hard	Very Dense
	Very Stiff	Dense
	Stiff	Medium Dense
	Medium Stiff	Loose
Weakest	Soft	Very Loose
	Very Soft	

MOISTURE CONTENT	
Wettest	Wet
	Very Moist
	Moist
	Slightly Moist
Driest	Dry

∇ - Water Level Observed During Exploration

▼ - Water Level Observed After Exploration

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PROJECT NO.	102314.104
DRAWN:	AUGUST 27, 2009
DRAWN BY:	K. WUJCIK
CHECKED BY:	D. ADAMS
FILE NAME:	USCS.dwg

KEY TO SOIL CLASSIFICATION AND TERMS

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE
17

SYMBOLS

Disturbed Bag or Bulk Sample

Standard Penetration Sample
(1.4 inch I.D., 2.0 inch O.D.)

Modified California (Porter) Sample
(2.0 inch I.D., 2.56 inch O.D.)

California Sample (2.5 inch I.D., 3 inch O.D.)

No Sample Recovery

Water Level Observed During Drilling

Water Level Observed After Drilling

COMMENTS

NOTE: Blow count represents the number of blows required to drive a sampler through the last 12 inches of an 18 inch penetration. A standard 140 pound hammer with a 30.4 inch free fall is used to drive the sampler.

NOTE: The lines separating strata on the logs represent approximate boundaries only. The actual transition may be gradual. No warranty is provided as to the continuity of soil strata between borings.

PLOTTED: 27 Aug 2009, 9:15am, KCarter

CAD FILE: L:\2009\Drafting\102314\Task 104\ LAYOUT: KEY

ATTACHED IMAGES:
ATTACHED XREFS:
RENO, NV

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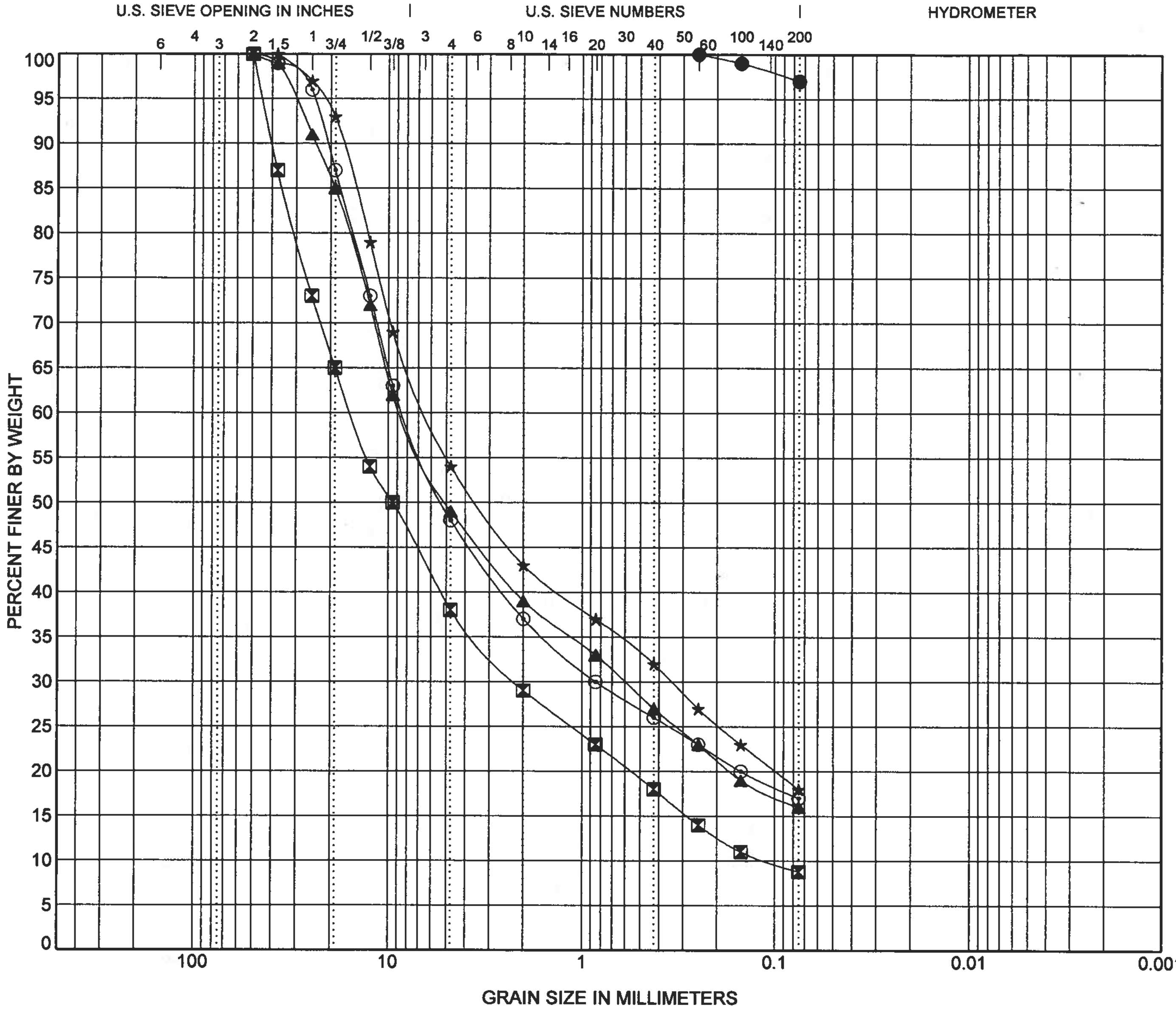
PROJECT NO. 102314.104	KEY TO BORING LOGS		PLATE
DRAWN: AUGUST 27, 2009			
DRAWN BY: K. WUJCIK			18
CHECKED BY: D. ADAMS	PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT GEOTECHNICAL INVESTIGATION SPARKS, NEVADA		
FILE NAME: USCS.dwg			



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring	Depth (ft.)	Description - ASTM Classification	LL	PL	PI	Cc	Cu
●	B-01	15.0	LEAN CLAY (CL)	48	27	21		
⊠	B-01	20.5	POORLY GRADED GRAVEL with SILT AND SAND (GP-GM)				2.82	143.50
▲	B-02	7.5	CLAYEY GRAVEL with SAND (GC)	31	18	13		
★	B-03 (MW)	1.0	CLAYEY GRAVEL with SAND (GC)	31	16	15		
⊙	B-03 (MW)	10.0	CLAYEY GRAVEL with SAND (GC)	32	14	18		

	Boring	Depth (ft.)	D100	D60	D30	D10	% Gravel	% Sand	% Silt	% Clay
●	B-01	15.0	0.25				0.0	3.0	97.0	
⊠	B-01	20.5	50	15.707	2.202	0.109	62.0	29.2	8.8	
▲	B-02	7.5	50	8.539	0.601		51.0	33.0	16.0	
★	B-03 (MW)	1.0	37.5	6.268	0.344		46.0	36.0	18.0	
⊙	B-03 (MW)	10.0	50	8.27	0.85		52.0	31.0	17.0	

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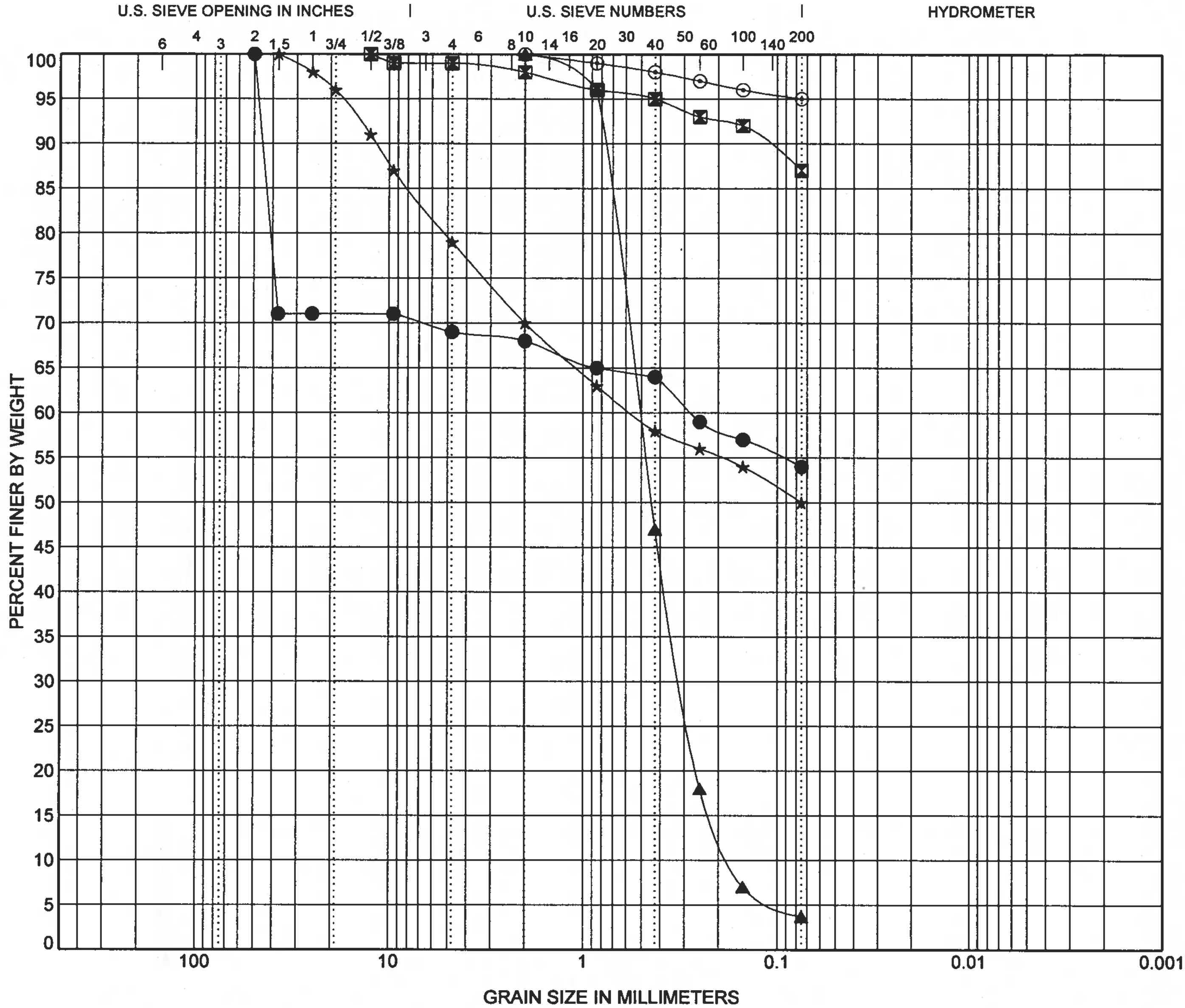
PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE
19

DRAFTED BY: K. CARTER   PROJECT NUMBER: 102314.104

GRAIN SIZE ANALYSES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring	Depth (ft.)	Description - ASTM Classification	LL	PL	PI	Cc	Cu
●	B-04	0.5	GRAVELLY FAT CLAY with SAND (CH)	60	27	33		
⊠	B-04	10.0	ELASTIC SILT (MH)	59	31	28		
▲	B-04	15.5	POORLY GRADED SAND (SP)				1.10	2.96
★	B-05	20.0	SANDY LEAN CLAY with GRAVEL (CL)	47	21	26		
⊙	B-06	5.0	FAT CLAY (CH)	69	28	41		

	Boring	Depth (ft.)	D100	D60	D30	D10	% Gravel	% Sand	% Silt	% Clay
●	B-04	0.5	50	0.278			31.0	15.0	54.0	
⊠	B-04	10.0	12.5				1.0	12.0	87.0	
▲	B-04	15.5	2	0.511	0.311	0.172	0.0	96.3	3.7	
★	B-05	20.0	37.5	0.561			21.0	29.0	50.0	
⊙	B-06	5.0	2				0.0	5.0	95.0	

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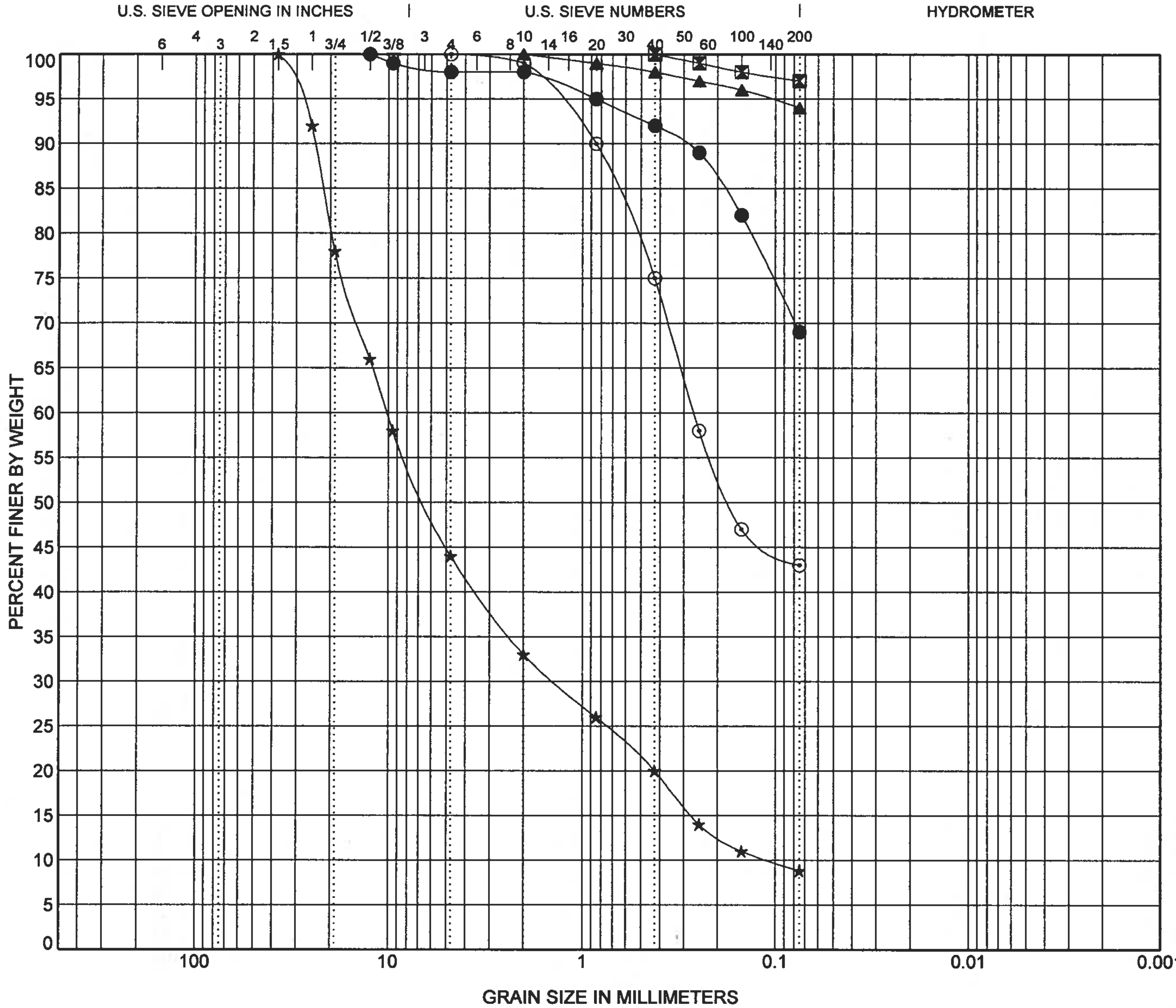
PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE
20

DRAFTED BY: K. CARTER **PROJECT NUMBER:** 102314.104

GRAIN SIZE ANALYSES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring	Depth (ft.)	Description - ASTM Classification	LL	PL	PI	Cc	Cu
●	B-06	22.0	SANDY LEAN CLAY (CL)	42	22	20		
⊠	B-07 (MW)	16.5	FAT CLAY (CH)	78	30	48		
▲	B-07 (MW)	24.5	LEAN CLAY (CL)					
★	B-07 (MW)	25.0	POORLY GRADED GRAVEL WTH SILT AND SAND (GP-GM)				1.72	92.95
⊙	B-07 (MW)	29.5	CLAYEY SAND (SC)					

	Boring	Depth (ft.)	D100	D60	D30	D10	% Gravel	% Sand	% Silt	% Clay
●	B-06	22.0	12.5				2.0	29.0	69.0	
⊠	B-07 (MW)	16.5	0.425				0.0	3.0	97.0	
▲	B-07 (MW)	24.5	2				0.0	6.0	94.0	
★	B-07 (MW)	25.0	37.5	10.175	1.386	0.109	56.0	35.2	8.8	
⊙	B-07 (MW)	29.5	4.75	0.266			0.0	57.0	43.0	

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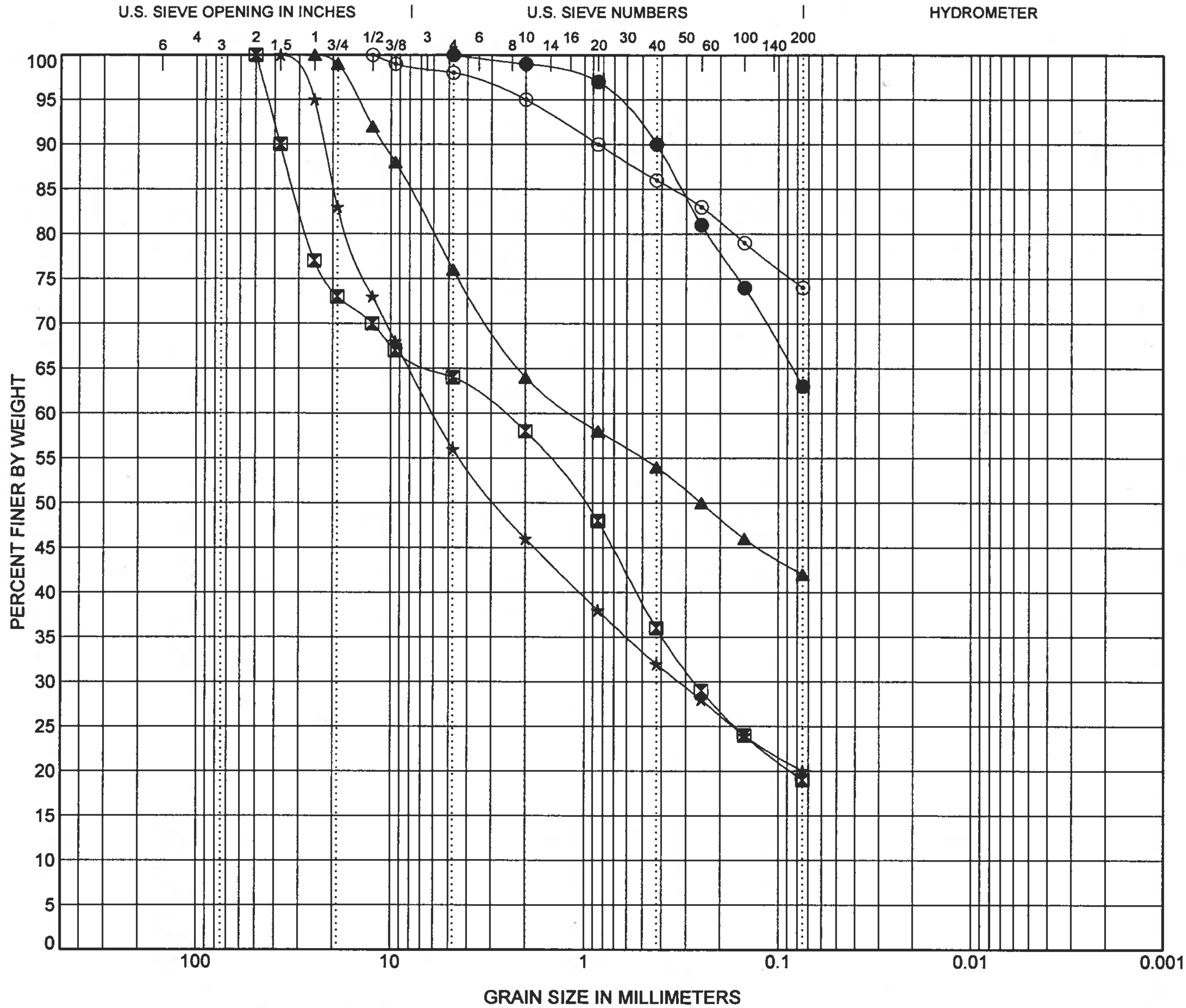
PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE
21

DRAFTED BY: K. CARTER **PROJECT NUMBER:** 102314.104

GRAIN SIZE ANALYSES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring	Depth (ft.)	Description - ASTM Classification	LL	PL	PI	Cc	Cu
●	B-08	15.5	SANDY LEAN CLAY (CL)	35	19	16		
⊠	B-08	20.5	SILTY SAND with GRAVEL (SM)					
▲	B-09	21.0	CLAYEY SAND with GRAVEL (SC)	37	18	19		
★	B-10	10.0	CLAYEY GRAVEL with SAND (GC)	32	19	13		
⊙	B-10	27.5	LEAN CLAY with SAND (CL)	44	20	24		

	Boring	Depth (ft.)	D100	D60	D30	D10	% Gravel	% Sand	% Silt	% Clay
●	B-08	15.5	4.75				0.0	37.0	63.0	
⊠	B-08	20.5	50	2.668	0.27		36.0	45.0	19.0	
▲	B-09	21.0	25	1.131			24.0	34.0	42.0	
★	B-10	10.0	37.5	5.985	0.326		44.0	36.0	20.0	
⊙	B-10	27.5	12.5				2.0	24.0	74.0	

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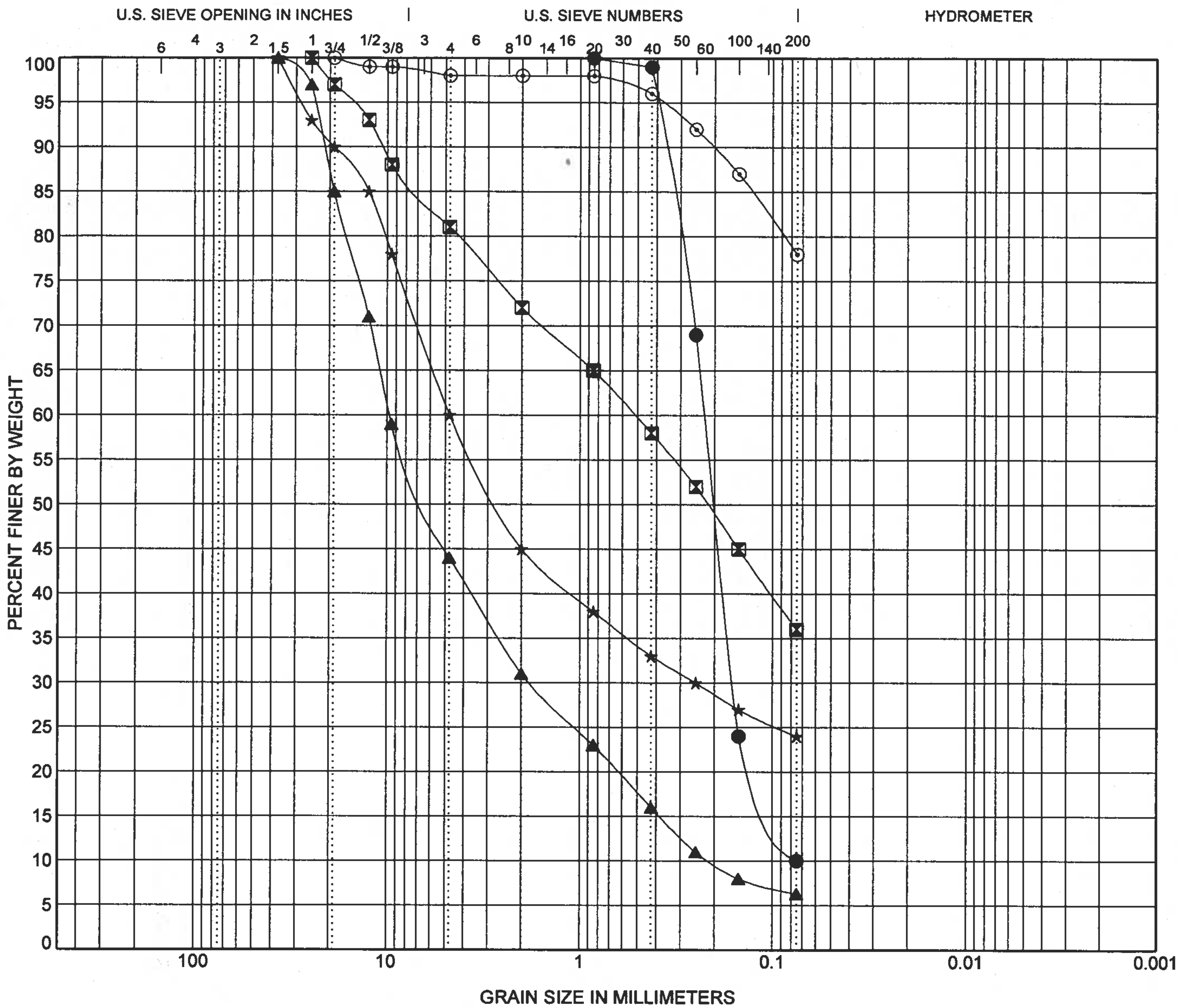
PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE
22

DRAFTED BY: K. CARTER PROJECT NUMBER: 102314.104

GRAIN SIZE ANALYSES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring	Depth (ft.)	Description - ASTM Classification	LL	PL	PI	Cc	Cu
●	**B-11 (MW)**	**10.5**	**POORLY GRADED SAND with SILT (SP-SM)**	**NP**	**NP**	**NP**	**1.52**	**3.01**
⊠	**B-12**	**5.0**	**CLAYEY SAND with GRAVEL (SC)**	**28**	**14**	**14**		
▲	**B-12**	**17.5**	**POORLY GRADED GRAVEL with SILT AND SAND (GP-GM)**				**1.58**	**46.10**
★	**B-13**	**10.0**	**CLAYEY GRAVEL with SAND (GC)**	**31**	**17**	**14**		
⊙	**B-13**	**25.0**	**LEAN CLAY with SAND (CL)**	**32**	**22**	**10**		

	Boring	Depth (ft.)	D100	D60	D30	D10	% Gravel	% Sand	% Silt	% Clay
●	**B-11 (MW)**	**10.5**	**0.85**	**0.226**	**0.161**	**0.075**	**0.0**	**90.0**	**10.0**	
⊠	**B-12**	**5.0**	**25**	**0.518**			**19.0**	**45.0**	**36.0**	
▲	**B-12**	**17.5**	**37.5**	**9.72**	**1.797**	**0.211**	**56.0**	**37.7**	**6.3**	
★	**B-13**	**10.0**	**37.5**	**4.75**	**0.25**		**40.0**	**36.0**	**24.0**	
⊙	**B-13**	**25.0**	**19**				**2.0**	**20.0**	**78.0**	

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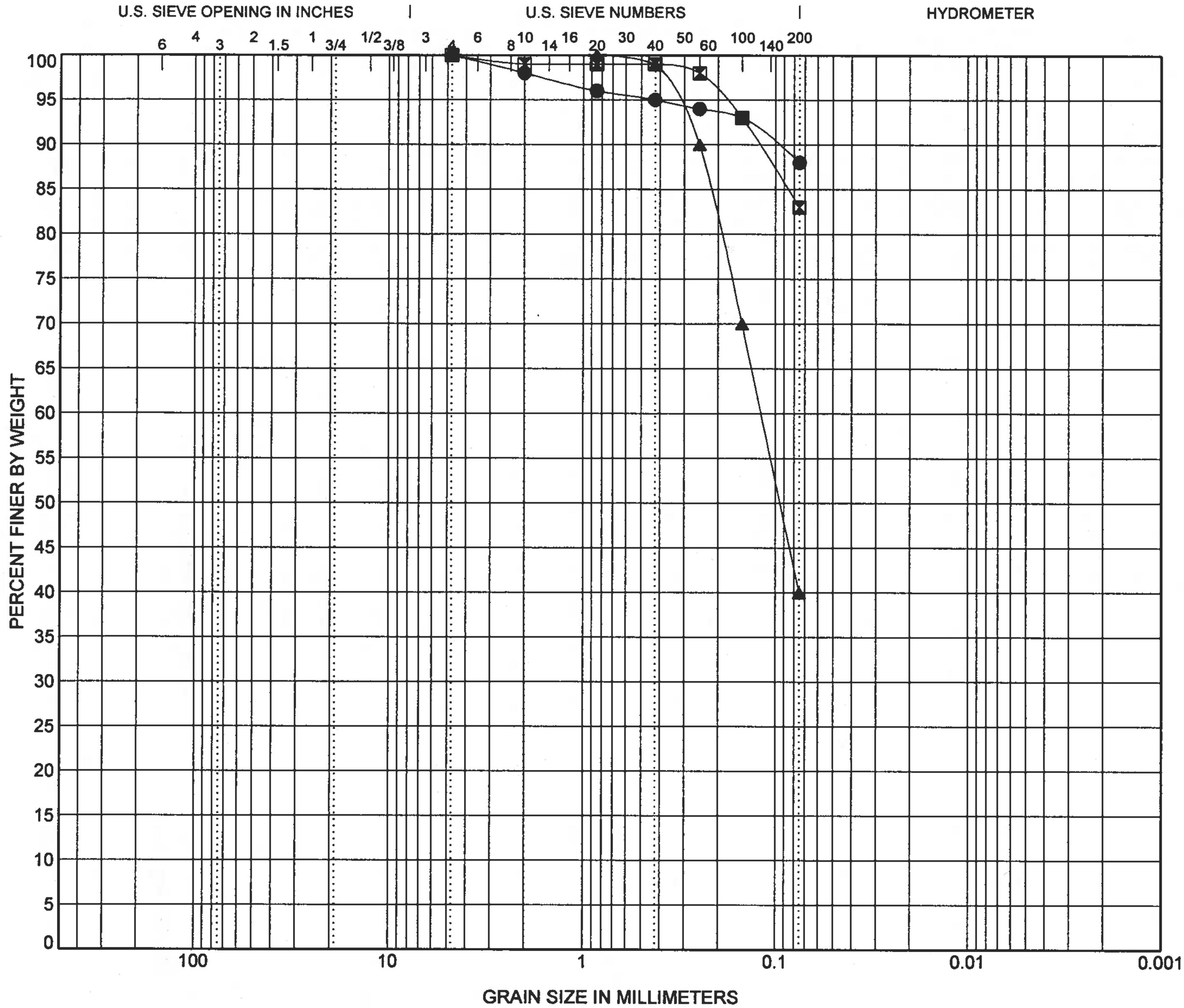
PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE

23

DRAFTED BY: K. CARTER **PROJECT NUMBER: 102314.104**

GRAIN SIZE ANALYSES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring	Depth (ft.)	Description - ASTM Classification	LL	PL	PI	Cc	Cu
●	B-14	7.5	FAT CLAY (CH)	64	23	41		
⊠	B-14	12.5	LEAN CLAY with SAND (CL)	49	23	26		
▲	B-14	16.0	SILTY SAND (SM)					

	Boring	Depth (ft.)	D100	D60	D30	D10	% Gravel	% Sand	% Silt	% Clay
●	B-14	7.5	4.75				0.0	12.0	88.0	
⊠	B-14	12.5	4.75				0.0	17.0	83.0	
▲	B-14	16.0	0.85	0.119			0.0	60.0	40.0	

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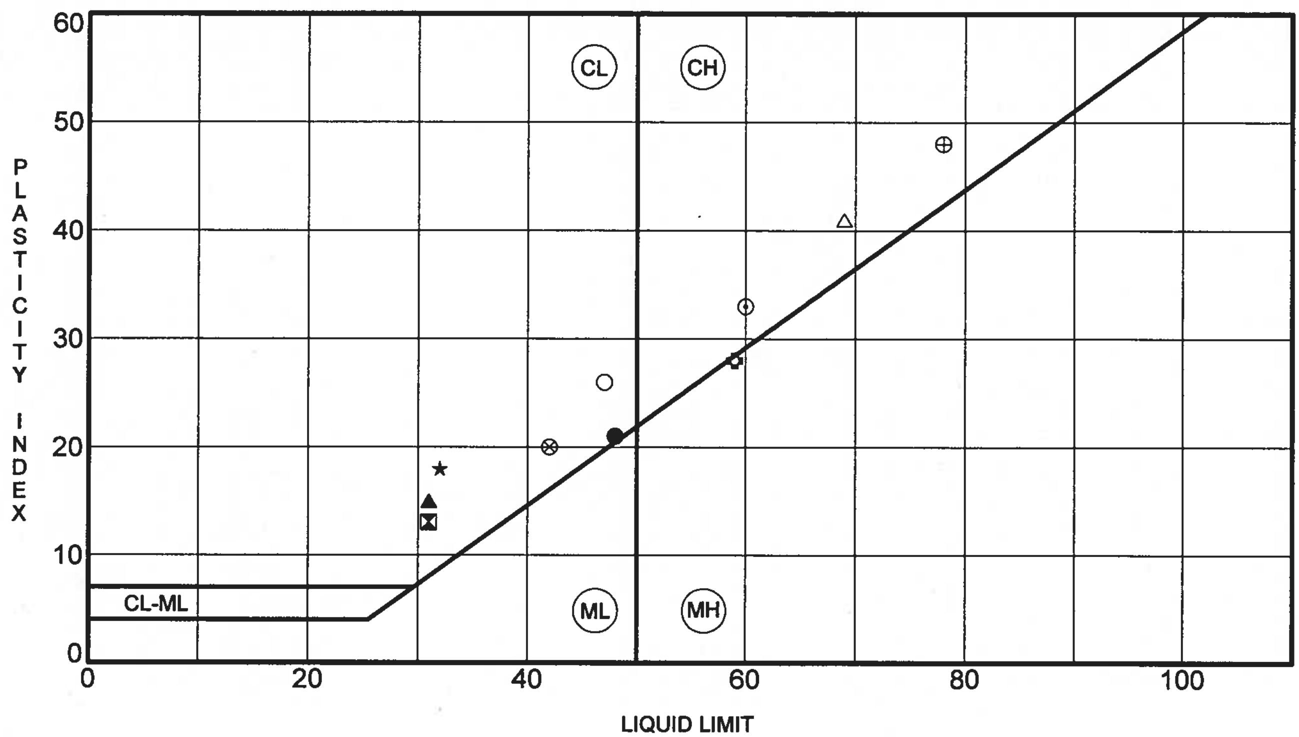
PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE
24

DRAFTED BY: K. CARTER **PROJECT NUMBER: 102314.104**

GRAIN SIZE ANALYSES



	Specimen Identification		LL	PL	PI	Fines	Classification
●	B-01	15.0	48	27	21	97	LEAN CLAY (CL)
⊠	B-02	7.5	31	18	13	16	CLAYEY GRAVEL with SAND (GC)
▲	B-03 (MW)	1.0	31	16	15	18	CLAYEY GRAVEL with SAND (GC)
★	B-03 (MW)	10.0	32	14	18	17	CLAYEY GRAVEL with SAND (GC)
⊙	B-04	0.5	60	27	33	54	GRAVELLY FAT CLAY with SAND (CH)
✿	B-04	10.0	59	31	28	87	ELASTIC SILT (MH)
○	B-05	20.0	47	21	26	50	SANDY LEAN CLAY with GRAVEL (CL)
△	B-06	5.0	69	28	41	95	FAT CLAY (CH)
⊗	B-06	22.0	42	22	20	69	SANDY LEAN CLAY (CL)
⊕	B-07 (MW)	16.5	78	30	48	97	FAT CLAY (CH)

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PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE
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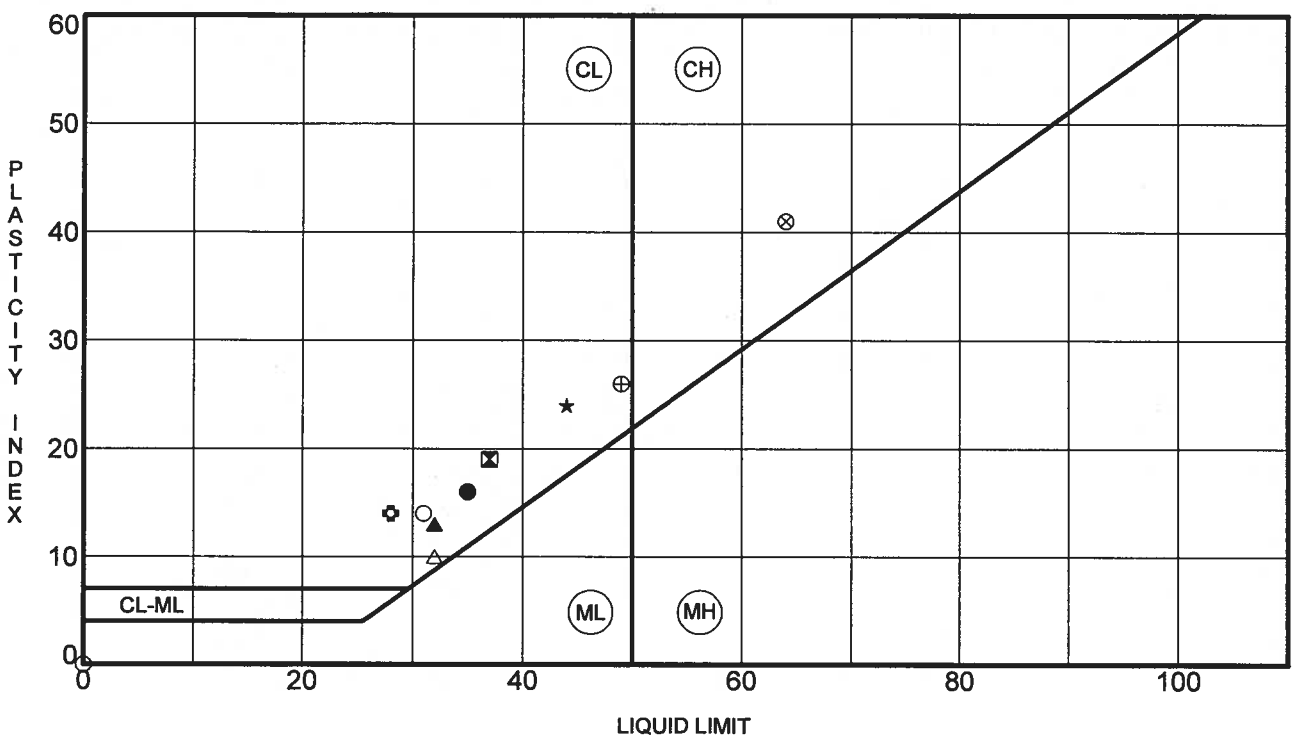
DRAFTED BY: K. CARTER   PROJECT NUMBER: 102314.104

PLASTICITY INDEX



	Specimen Identification		LL	PL	PI	Fines	Classification
●	B-08	15.5	35	19	16	63	SANDY LEAN CLAY (CL)
⊠	B-09	21.0	37	18	19	42	CLAYEY SAND with GRAVEL (SC)
▲	B-10	10.0	32	19	13	20	CLAYEY GRAVEL with SAND (GC)
★	B-10	27.5	44	20	24	74	LEAN CLAY with SAND (CL)
⊙	B-11 (MW)	10.5	NP	NP	NP	10	POORLY GRADED SAND with SILT (SP-SM)
✿	B-12	5.0	28	14	14	36	CLAYEY SAND with GRAVEL (SC)
○	B-13	10.0	31	17	14	24	CLAYEY GRAVEL with SAND (GC)
△	B-13	25.0	32	22	10	78	LEAN CLAY with SAND (CL)
⊗	B-14	7.5	64	23	41	88	FAT CLAY (CH)
⊕	B-14	12.5	49	23	26	83	LEAN CLAY with SAND (CL)

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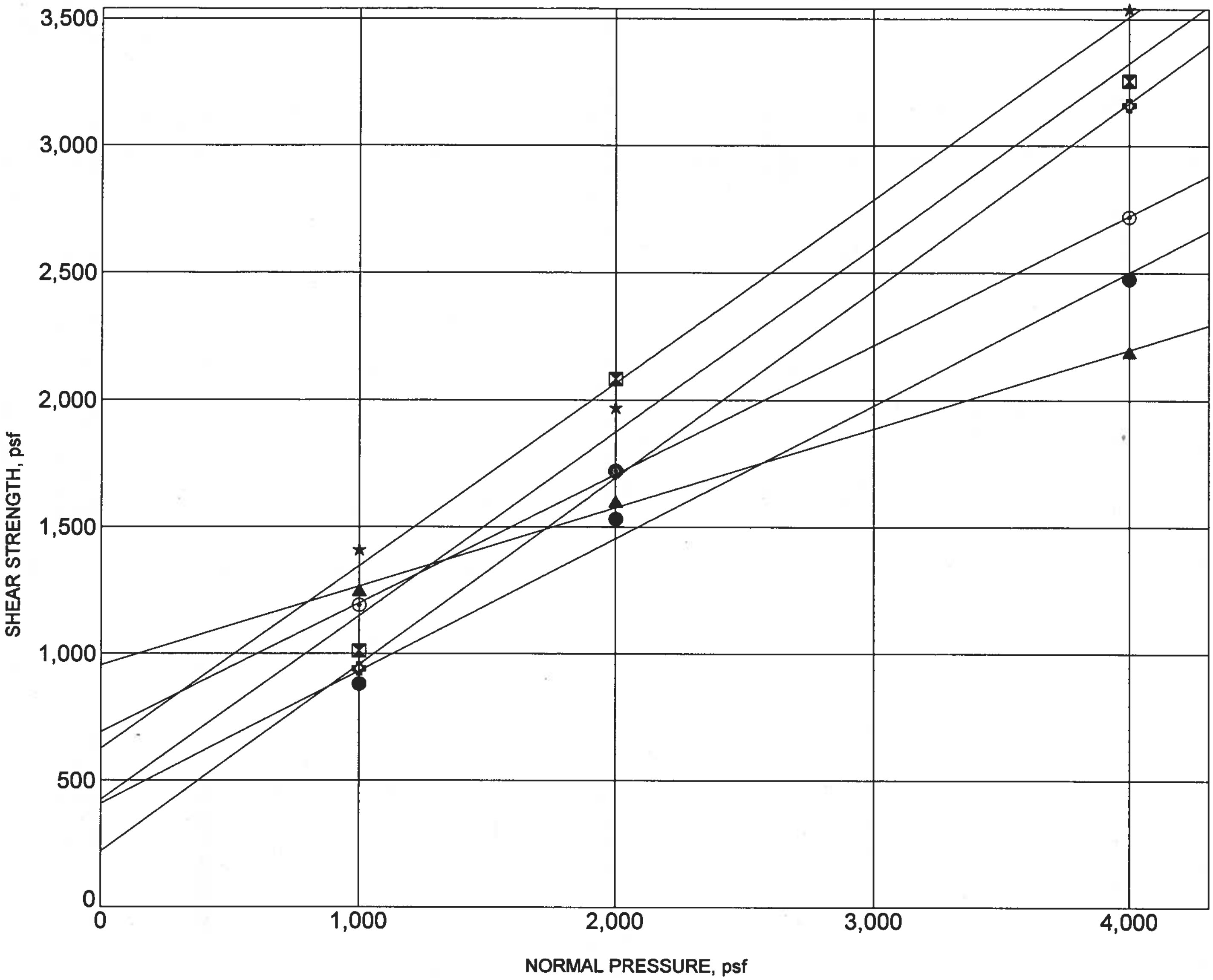
PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE
26

DRAFTED BY: K. CARTER **PROJECT NUMBER: 102314.104**

PLASTICITY INDEX



Specimen Identification			Classification	γ_d	MC%	c	ϕ
●	B-01	13.5	LEAN CLAY (CL)	82	37	408	28
⊠	B-03 (MW)	8.5	FILL: CLAYEY GRAVEL WITH SAND (GC)	113	9	424	36
▲	B-06	15.0	SANDY LEAN CLAY (CL)	80	37	955	17
★	B-11 (MW)	10.0	POORLY GRADED SAND with SILT (SP-SM)	91	25	625	36
⊙	B-14	11.0	FAT CLAY (CH)	86	32	691	27
✿	B-15	11.0	POORLY GRADED SAND (SP)	80	27	220	36

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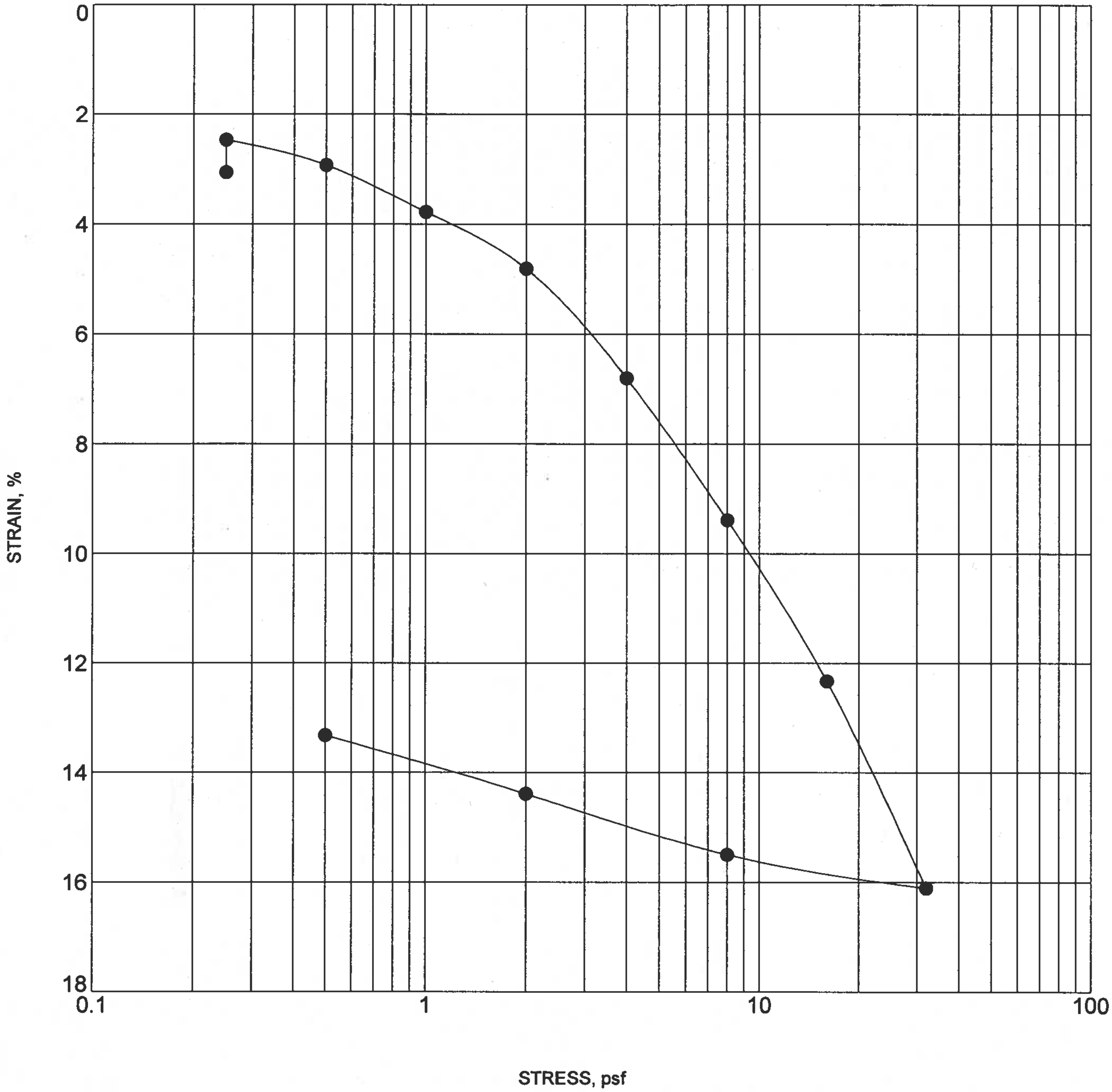
PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE

27

DRAFTED BY: K. CARTER PROJECT NUMBER: 102314.104

DIRECT SHEAR TEST



	Specimen Identification		Classification	γ_d	MC%
●	B-06	20.5	SANDY LEAN CLAY (CL)	96	28

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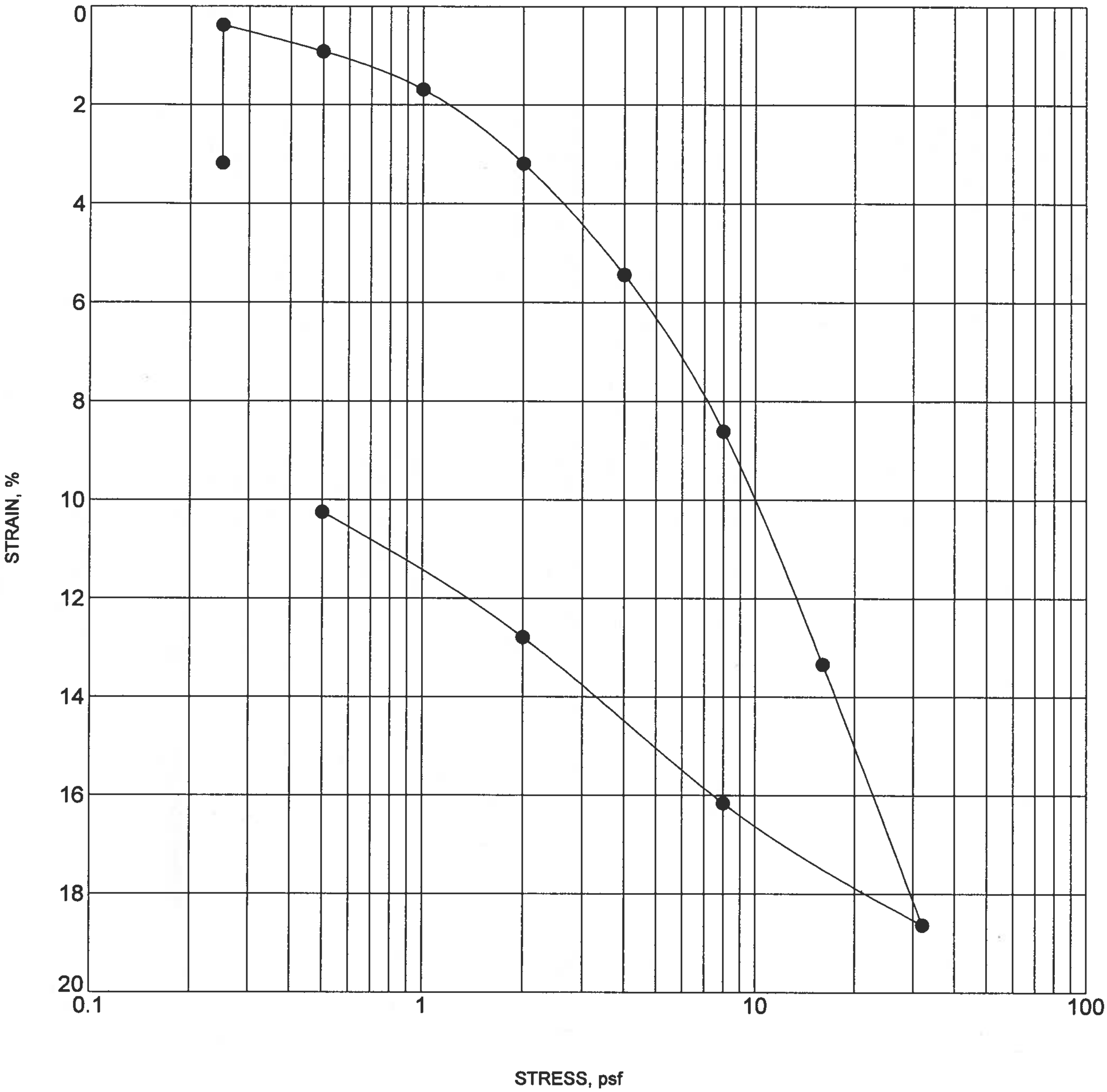
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE

28

DRAFTED BY: K. CARTER **PROJECT NUMBER: 102314.104**

CONSOLIDATION



	Specimen Identification		Classification	γ_d	MC%
●	B-07 (MW)	20.0	FAT CLAY (CH)	78	40

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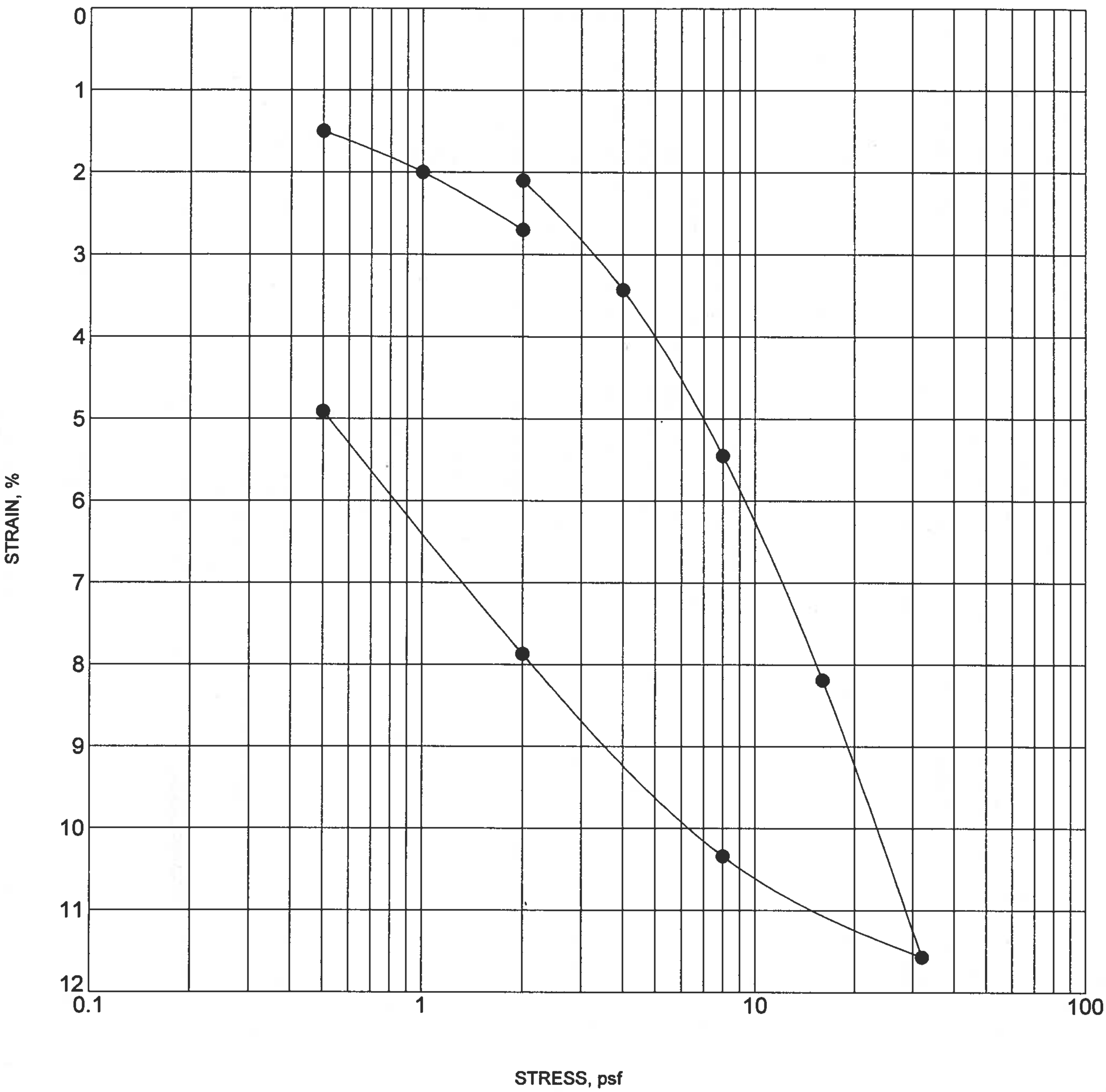
PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE

29

DRAFTED BY: K. CARTER **PROJECT NUMBER: 102314.104**

CONSOLIDATION



	Specimen Identification		Classification	γ_d	MC%
●	B-13	30.5	LEAN CLAY WITH SAND (CL)	112	15

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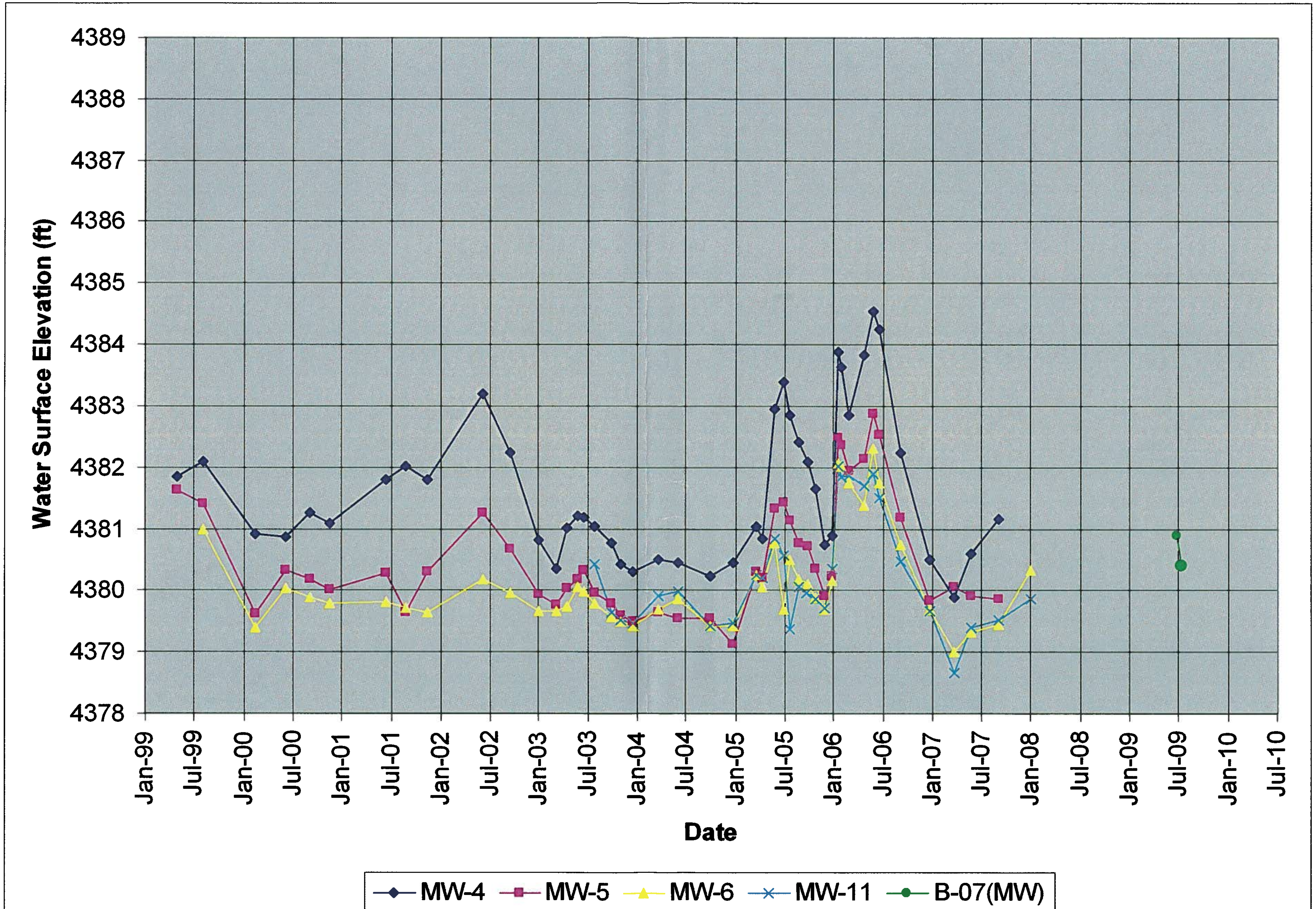
PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE

30

DRAFTED BY: K. CARTER **PROJECT NUMBER: 102314.104**

CONSOLIDATION



REFERENCE: GROUNDWATER DATA OBSERVED FROM BROADBENT & ASSOCIATES, INC. GROUNDWATER LEVELS REPORT (2008)

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www.kleinfelder.com

PROJECT NO.	102314.104
DRAWN:	SEPT. 3, 2009
DRAWN BY:	K. CARTER
CHECKED BY:	J. PEASE
FILE NAME:	GROUNDWATER GRAPH.dwg

LONG TERM GROUNDWATER ELEVATIONS IN PROJECT VICINITY

PROPOSED NORTH TRUCKEE DRAIN REALIGNMENT
GEOTECHNICAL INVESTIGATION
SPARKS, NEVADA

PLATE
31

PLOTTED: 03 Sep 2009, 11:18am, KCarter
CAD FILE: L:\2009\Drafting\102314\Task 104\ LAYOUT: PLATE 31
ATTACHED IMAGES:
ATTACHED XREFS:
RENO, NV

DRAFT

APPENDIX A

Previous Boring Logs

Depth in Feet	Dry Density lb/ft3	Moisture Content %	Plasticity Index	Percent Passing #200	Soil Description
0					**4 INCHES ASPHALT CONCRETE**
					3 INCHES AGGREGATE BASE
			50/3"		**RED GRAY SANDY CLAY (CH)** moist, firm, medium to high plastic fines, fine sand.
2					
			58		
4					
			15		**RED GRAY CLAYEY SAND (SC)** moist, medium dense, low plastic fines, fine sand.
6					
8					
10			9		**LIGHT BROWN POORLY GRADED SAND (SP)** moist, loose, fine to medium sand.
12					
		∇			Wet
14					
			20		Medium dense
16					
18					
20			50/3"		**GRAY GRAVELY SAND (SW)** wet, very dense, fine to coarse sand.
22					
					Larger gravel
24					

DATE: **1-16-07**
TOTAL DEPTH: **31.0 feet**

LOGGED BY: **D. ADAMS**
EQUIPMENT: **MAYHEW 1000**

KLEINFELDER
4835 Longley Lane
Reno, NV 89502
PH. (775) 689-7800 Fax (775) 689-7810
www.kleinfelder.com

PROJECT NO. **57319.02**

NORTH TRUCKEE DRAIN

WASHOE COUNTY, NEVADA

LOG OF B-1 (07)

PLATE

2

DEPTH IN FEET	Dry Density lb/ft3	Moisture Content %	Plasticity Index	Percent Passing #200	Sample	GRAPHIC LOG	SOIL DESCRIPTION
26			50/4"				
28							
30			50/5"				Flowing sand
32							
34							
36							
38							
40							
42							
44							
46							
48							
50							

DATE: **1-16-07**
TOTAL DEPTH: **31.0 feet**
LOGGED BY: **D. ADAMS**
EQUIPMENT: **MAYHEW 1000**

KLEINFELDER
4835 Longley Lane
Reno, NV 89502
PH. (775) 689-7800 Fax (775) 689-7810
www.kleinfelder.com

PROJECT NO. **57319.02**

NORTH TRUCKEE DRAIN

WASHOE COUNTY, NEVADA

LOG OF B-1 (07)

PLATE

2

DRAFT

APPENDIX B

WET Lab Results

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder, Inc.
4835 Longley Lane
Reno, NV 89502
Attn: Don Adams
Phone: (775) 689-7800 **Fax:** (775) 689-7810
PO\Project: *North Truckee Drain Reanlignment/102314.103*

Date Printed: 8/18/2009
OrderID: *0908113*

Customer Sample ID: B-10 Bulk 10'-15' **Collect Date/Time:** 8/12/2009
WETLAB Sample ID: 0908113-001 **Receive Date:** 8/12/2009 12:25

Parameter	Method	Results	Units	Reporting Limit	Date Analyzed
Sulfate	EPA 300.0	200	mg/kg	15	8/14/2009
Paste pH	SW846 9045B	8.05	pH Units		8/17/2009
Resistivity	SM 2510B	2300	ohms.cm	1.0	8/17/2009

Customer Sample ID: B-8 Baggie 12.5-14 **Collect Date/Time:** 8/12/2009
WETLAB Sample ID: 0908113-002 **Receive Date:** 8/12/2009 12:25

Parameter	Method	Results	Units	Reporting Limit	Date Analyzed
Sulfate	EPA 300.0	45	mg/kg	15	8/14/2009
Paste pH	SW846 9045B	7.63	pH Units		8/17/2009
Resistivity	SM 2510B	6200	ohms.cm	1.0	8/17/2009

Customer Sample ID: B-7 Baggie 0-1.5 **Collect Date/Time:** 8/12/2009
WETLAB Sample ID: 0908113-003 **Receive Date:** 8/12/2009 12:25

Parameter	Method	Results	Units	Reporting Limit	Date Analyzed
Sulfate	EPA 300.0	91	mg/kg	15	8/14/2009
Paste pH	SW846 9045B	7.56	pH Units		8/17/2009
Resistivity	SM 2510B	1400	ohms.cm	1.0	8/17/2009

Western Environmental Testing Laboratory
Analytical Report

Kleinfelder, Inc.
4835 Longley Lane
Reno, NV 89502
Attn: Don Adams
Phone: (775) 689-7800 **Fax:** (775) 689-7810
PO\Project: *North Truckee Drain / 9474*

Date Printed: 4/20/2009
OrderID: *0904115*

Customer Sample ID: B-1 bulk 12-18
WETLAB Sample ID: 0904115-001
Collect Date/Time: 4/10/2009
Receive Date: 4/13/2009 17:10

Parameter	Method	Results	Units	Reporting Limit	Date Analyzed
Sulfate	EPA 300.0	160	mg/kg	15	4/15/2009
Paste pH	SW846 9045B	7.30	pH Units		4/15/2009
Resistivity	SM 2510B	5400	ohms.cm	1.0	4/15/2009

Customer Sample ID: B-3 bulk 10-12
WETLAB Sample ID: 0904115-002
Collect Date/Time: 4/10/2009
Receive Date: 4/13/2009 17:10

Parameter	Method	Results	Units	Reporting Limit	Date Analyzed
Sulfate	EPA 300.0	68	mg/kg	15	4/15/2009
Paste pH	SW846 9045B	7.73	pH Units		4/15/2009
Resistivity	SM 2510B	69000	ohms.cm	1.0	4/15/2009

Customer Sample ID: B-11 bulk 5-7.5
WETLAB Sample ID: 0904115-003
Collect Date/Time: 4/10/2009
Receive Date: 4/13/2009 17:10

Parameter	Method	Results	Units	Reporting Limit	Date Analyzed
Sulfate	EPA 300.0	25	mg/kg	15	4/15/2009
Paste pH	SW846 9045B	7.59	pH Units		4/15/2009
Resistivity	SM 2510B	430000	ohms.cm	1.0	4/15/2009

DRAFT

APPENDIX C

Sections of Groundwater Report 2008, Broadbent & Associates, Inc.

FOURTH QUARTER, 2007
GROUND-WATER MONITORING REPORT
WASHOE COUNTY SCHOOL DISTRICT
GETTO TRANSPORTATION FACILITY
1850 KLEPPE LANE

Per John Nolan:
All Monitoring Wells are grouted/removed.

Prepared for

Mr. John Nolan
Washoe County School District
7495 South Virginia Street
Reno, Nevada 89520

Prepared by

BROADBENT & ASSOCIATES, INC.
2000 Kirman Avenue
Reno, NV 89502
(775) 322-7969
www.broadbentinc.com

February, 2008

Project No. 98-02-573

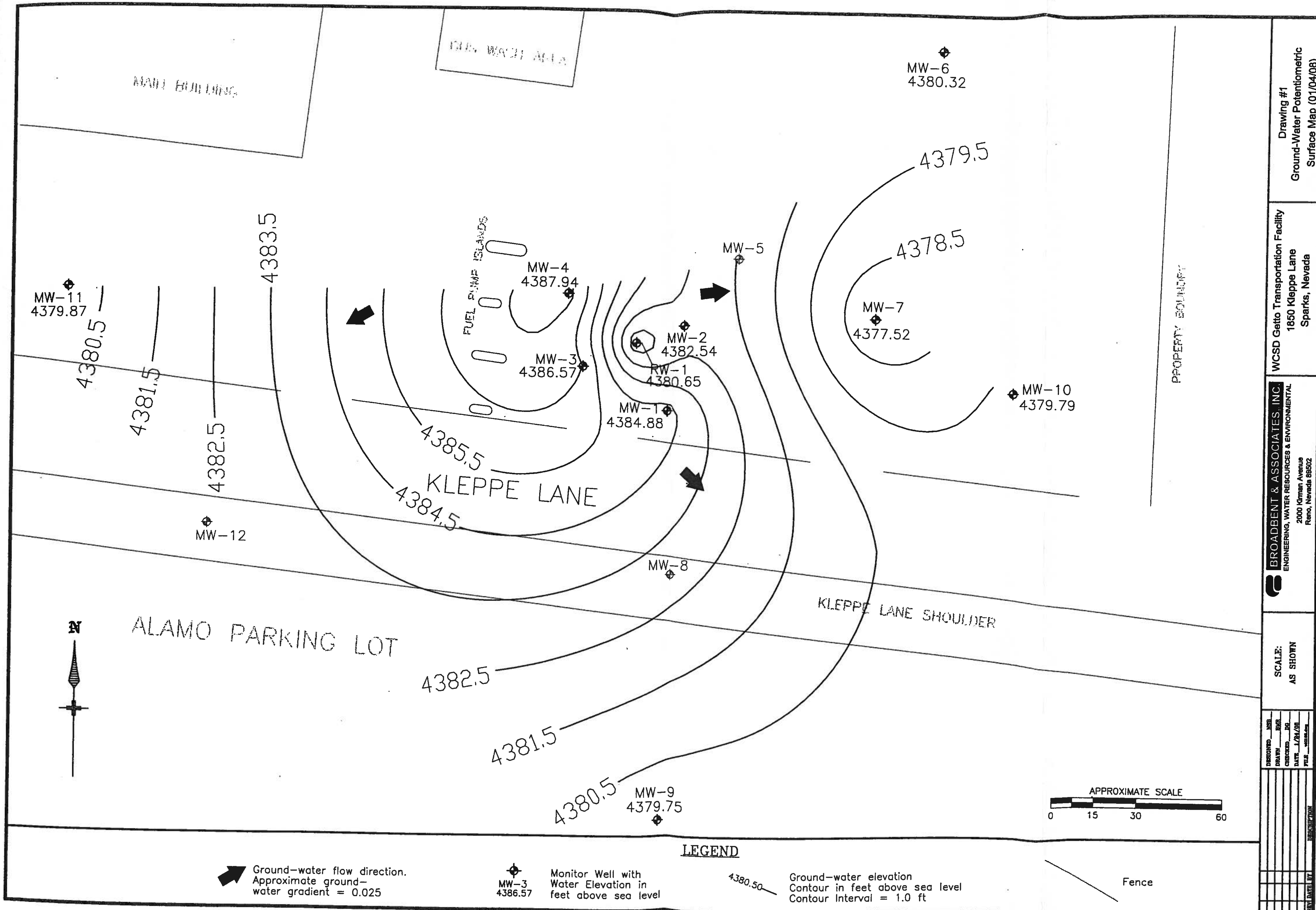
MAIN BUILDING
CAR WASH AREA
MW-6
4380.32
4379.5
4378.5
4383.5
FUEL PUMP ISLANDS
MW-5
MW-4
4387.94
MW-11
4379.87
MW-7
4377.52
MW-2
4382.54
MW-3
4386.57
RW-1
4380.65
4380.5
4381.5
MW-10
4379.79
PROPERTY BOUNDARY
MW-1
4384.88
4382.5
4385.5
KLEPPE LANE
4384.5
MW-12
MW-8
KLEPPE LANE SHOULDER
N
ALAMO PARKING LOT
4382.5
4381.5
4380.5
MW-9
4379.75
APPROXIMATE SCALE
0
15
30
60
LEGEND
Ground-water flow direction. Approximate ground-water gradient = 0.025
MW-3
4386.57
Monitor Well with Water Elevation in feet above sea level
4380.50
Ground-water elevation Contour in feet above sea level Contour Interval = 1.0 ft
Fence
Drawing #1
Ground-Water Potentiometric Surface Map (01/04/08)
WCSD Getto Transportation Facility
1850 Kleppe Lane
Sparks, Nevada
BROADBENT & ASSOCIATES, INC.
ENGINEERING, WATER RESOURCES & ENVIRONMENTAL
2000 Kirman Avenue
Reno, Nevada 89502
SCALE:
AS SHOWN

TABLE 1
Summary of Ground-Water Monitoring Data
WCSD-Getto Transportation Facility,
Sparks, Nevada

Well Number	Date	MPE (ft)	DTW (ft)	Water Level (ft)	TPHg (mg/l)	TPH-E (mg/l)	Benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	E-Benzene (ug/l)	MTBE (ug/l)
MW-1	1/21/1999	99.57	9.39	90.18	ND	---	ND	ND	ND	ND	102
	4/29/1999		8.3	91.27	ND	---	ND	ND	ND	ND	68.2
	8/3/1999		8.28	91.29	ND	---	ND	ND	ND	ND	26.8
	2/15/2000		10.15	89.42	---	ND	ND	ND	ND	ND	12.1
	6/5/2000		9.62	89.95	ND	---	ND	ND	ND	ND	7.5
	9/5/2000		9.81	89.76	ND	---	ND	ND	ND	ND	ND
	11/14/2000		9.95	89.62	ND	---	2.2	3.7	3.9	ND	44.8
	2/20/2001		^20.23	79.34	<0.5	---	<2.0	<2.0	<2.0	<2.0	8.6
	6/13/2001		9.74	89.83	<0.5	---	<2.0	<2.0	<2.0	<2.0	94.6
	8/28/2001		9.62	89.95	0.67	---	<2.0	<2.0	<2.0	<2.0	663.5
	11/16/2001		9.66	89.91	1.13	---	<2.0	<2.0	<2.0	<2.0	1129.8
	3/6/2002		NA	NA	<0.05	---	<2.0	<2.0	<2.0	<2.0	<2.0
	6/6/2002	4389.92	8.64	4381.28	0.58	---	<2.0	<2.0	<2.0	<2.0	572
	9/16/2002		9.39	4380.53	0.29	---	<2.0	<2.0	<2.0	<2.0	293
	12/30/2002		9.85	4380.07	<0.05	---	<1.0	<1.0	<1.0	<1.0	2.1
	3/13/2003		10.16	4379.76	<0.05	---	<2.0	<2.0	<2.0	<2.0	<2.0
	4/22/2003		9.98	4379.94	NM	---	NM	NM	NM	NM	NM
	5/28/2003		9.90	4380.02	NM	---	NM	NM	NM	NM	NM
	6/20/2003		9.89	4380.03	<0.5	---	<1.0	<1.0	<1.0	<1.0	12
	7/31/2003		10.11	4379.81	NM	---	NM	NM	NM	NM	NM
	9/30/2003		10.29	4379.63	<0.05	---	<0.5	<0.5	0.9	<0.5	0.7
	11/5/2003		10.37	4379.55	NM	---	NM	NM	NM	NM	NM
	12/18/2003		10.54	4379.38	<0.02	---	<1.0	<1.0	<2.0	<1.0	2.3
	3/22/2004		10.28	4379.64	<0.02	---	<1.0	<1.0	<2.0	<1.0	<1.0
	6/3/2004		10.25	4379.67	<0.02	---	<1.0	<1.0	<2.0	<1.0	1.7
	9/30/2004		10.61	4379.31	<0.01	---	<1.0	<1.0	<1.0	<1.0	1.5
	12/29/2004		10.62	4379.30	<0.01	---	<1.0	<1.0	<2.0	<1.0	<1.0
	3/23/2005		9.41	4380.51	<0.02	---	<1.0	<1.0	<2.0	<1.0	<1.0
	4/14/2005		9.58	4380.34	---	---	---	---	---	---	---
	5/27/2005		8.70	4381.22	---	---	---	---	---	---	---
	6/29/2005		8.56	4381.36	<0.50	---	<1.0	<1.0	<1.0	<1.0	1.1
	7/25/2005		8.82	4381.10	---	---	---	---	---	---	---
	8/30/2005		9.16	4380.76	---	---	---	---	---	---	---

TABLE 1
Summary of Ground-Water Monitoring Data
WCSD-Getto Transportation Facility,
Sparks, Nevada

Well Number	Date	MPE (ft)	DTW (ft)	Water Level (ft)	TPHg (mg/l)	TPH-E (mg/l)	Benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	E-Benzene (ug/l)	MTBE (ug/l)
MW-1	9/29/2005		9.76	4380.16	<0.50	---	<1.0	<1.0	<1.0	<1.0	1.3
Cont.	10/31/2005		9.59	4380.33	---	---	---	---	---	---	---
	11/30/2005		10.03	4379.89	---	---	---	---	---	---	---
	12/29/2005		9.88	4380.04	<0.50	---	<1.0	<1.0	<1.0	<1.0	6.0
	1/24/2006		7.16	4382.76	---	---	---	---	---	---	---
	2/1/2006		7.28	4382.64	---	---	---	---	---	---	---
	3/1/2006		7.86	4382.06	<0.50	---	<1.0	<1.0	<1.0	<1.0	1.8
	4/27/2006		7.81	4382.11	---	---	---	---	---	---	---
	5/31/2006		7.12	4382.80	---	---	---	---	---	---	---
	6/23/2006		7.39	4382.53	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	9/8/2006		8.74	4381.18	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	12/28/2006		10.04	4379.88	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	3/26/2007		10.90	4379.02	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	6/1/2007		10.50	4379.42	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	9/7/2007		10.31	4379.61	<0.50	---	<1.0	<1.0	<1.0	<1.0	84
	1/4/2008		**5.04**	**4384.88**	**<0.50**	---	**<1.0**	**<1.0**	**<1.0**	**<1.0**	**61**
MW-2	1/21/1999	99.32	9.99	89.33	6	---	ND	ND	ND	ND	5,600
	4/29/1999		8.66	90.66	6	---	ND	ND	ND	ND	5,946
	8/3/1999		9.07	90.25	7.1	---	ND	24	32	24	6,944
	2/15/2000		10.20	89.12	---	ND	ND	ND	ND	ND	7,604
	6/5/2000		9.95	89.37	1.7	---	ND	ND	ND	ND	1,668
	9/5/2000		9.97	89.35	2.84	---	ND	ND	ND	ND	2,838
	11/14/2000		10.15	89.17	4.5	---	ND	ND	ND	ND	4420.0
	2/20/2001		^20.73	78.59	0.8	---	<2.0	<2.0	<2.0	<2.0	791.0
	6/13/2001		9.79	89.53	1.4	---	<2.0	<2.0	<2.0	<2.0	1,400
	8/28/2001		9.50	89.82	1.29	---	<2.0	<2.0	<2.0	<2.0	1283.4
	11/16/2001		9.76	89.56	0.61	---	<2.0	<2.0	<2.0	<2.0	605.0
	3/6/2002		NA	NA	<0.05	---	<2.0	<2.0	<2.0	<2.0	286
	6/6/2002	4390.21	8.64	4381.57	0.43	---	<2.0	<2.0	<2.0	<2.0	424
	9/16/2002		9.40	4380.81	0.75	---	<2.0	12.9	18.2	3.0	721
	12/30/2002		10.24	4379.97	0.44	---	<1.0	<1.0	<1.0	<1.0	438
	3/13/2003		10.46	4379.75	0.45	---	<2.0	<2.0	<2.0	<2.0	450
	4/22/2003		10.12	4380.09	NM	---	NM	NM	NM	NM	NM
	5/28/2003		9.91	4380.30	NM	---	NM	NM	NM	NM	NM
	6/30/2003		9.92	4380.29	<0.5	---	<1.0	<1.0	<1.0	<1.0	400

TABLE 1
Summary of Ground-Water Monitoring Data
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Sparks, Nevada

Well Number	Date	MPE (ft)	DTW (ft)	Water Level (ft)	TPHg (mg/l)	TPH-E (mg/l)	Benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	E-Benzene (ug/l)	MTBE (ug/l)
MW-2	7/31/2003		10.42	4379.79	NM	---	NM	NM	NM	NM	NM
Cont.	9/30/2003		10.41	4379.80	0.42	---	<0.5	<0.5	<0.5	<0.5	422
	11/5/2003		10.63	4379.58	NM	---	NM	NM	NM	NM	NM
	12/18/2003		10.68	4379.53	0.06	---	<1.0	<1.0	<2.0	<1.0	56.5
	3/22/2004		10.33	4379.88	0.037	---	<1.0	<1.0	<2.0	<1.0	37.2
	6/3/2004		10.56	4379.65	0.20	---	<1.0	<1.0	<2.0	<1.0	196
	9/30/2004		10.98	4379.23	0.192	---	<1.0	<1.0	<1.0	<1.0	192
	12/29/2004		10.99	4379.22	0.190	---	<1.0	<1.0	<2.0	<1.0	188
	3/23/2005		9.86	4380.35	0.071	---	<1.0	<1.0	<2.0	<1.0	70.8
	4/14/2005		9.94	4380.27	---	---	---	---	---	---	---
	5/27/2005		8.76	4381.45	---	---	---	---	---	---	---
	6/29/2005		8.67	4381.54	<0.50	---	<1.0	<1.0	<1.0	<1.0	140
	7/25/2005		9.23	4380.98	---	---	---	---	---	---	---
	8/30/2005		9.31	4380.90	---	---	---	---	---	---	---
	9/29/2005		9.42	4380.79	<0.50	---	<1.0	<1.0	<1.0	<1.0	100
	10/31/2005		9.75	4380.46	---	---	---	---	---	---	---
	11/30/2005		10.27	4379.94	---	---	---	---	---	---	---
	12/29/2005		9.91	4380.30	<0.50	---	<1.0	<1.0	<1.0	<1.0	42
	1/24/2006		7.53	4382.68	---	---	---	---	---	---	---
	2/1/2006		7.68	4382.53	---	---	---	---	---	---	---
	3/1/2006		8.18	4382.03	<0.50	---	<1.0	<1.0	<1.0	<1.0	140
	4/27/2006		7.94	4382.27	---	---	---	---	---	---	---
	5/31/2006		7.24	4382.97	---	---	---	---	---	---	---
	6/23/2006		7.53	4382.68	---	---	<1.0	<1.0	<1.0	<1.0	130
	9/8/2006		8.94	4381.27	---	---	<1.0	<1.0	<1.0	<1.0	88
	12/28/2006		10.37	4379.84	---	---	<1.0	<1.0	<1.0	<1.0	87
	3/26/2007		11.19	4379.02	<0.50	---	<1.0	<1.0	<1.0	<1.0	150
	6/1/2007		10.59	4379.62	---	---	<1.0	<1.0	<1.0	<1.0	45
	9/7/2007		10.35	4379.86	<0.50	---	<1.0	<1.0	<1.0	<1.0	45
	1/4/2008		7.67	4382.54	<0.50	---	<1.0	<1.0	<1.0	<1.0	5.9
MW-3	1/21/1999	99.77	9.75	90.02	25	---	870	340	1,978	1,360	23,100
	4/29/1999		8.49	91.28	14.7	---	268	340	144	728	13,564
	8/3/1999		8.95	90.82	15.2	---	120	100	280	ND	14,600
	2/15/2000		10.60	89.17	---	ND	9.0	ND	2.5	22.5	8,280
	6/5/2000		9.91	89.86	7.1	---	104.0	ND	132.0	ND	6,080

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Well Number	Date	MPE (ft)	DTW (ft)	Water Level (ft)	TPHg (mg/l)	TPH-E (mg/l)	Benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	E-Benzene (ug/l)	MTBE (ug/l)
MW-3	9/5/2000		10.05	89.72	2.76	---	ND	ND	ND	ND	2,760
Cont.	11/14/2000		10.08	89.69	1.8	---	ND	ND	ND	ND	1,728
	2/20/2001		^20.41	79.36	1.20	---	26.0	<2.0	34.0	65.0	1,062
	6/13/2001		9.66	90.11	0.52	---	<2.0	<2.0	<2.0	<2.0	516.0
	8/28/2001		9.96	89.81	0.94	---	<2.0	<2.0	<2.0	<2.0	938.0
	11/16/2001		9.39	90.38	<0.5	---	<2.0	<2.0	<2.0	<2.0	97.3
	3/6/2002		NA	NA	0.19	---	4.0	<2.0	<2.0	5	538
	6/6/2002	4390.11	8.15	4381.96	0.40	---	2.0	<2.0	3.2	3.2	239
	9/16/2002		9.24	4380.87	0.14	---	<2.0	<2.0	<2.0	<2.0	138
	12/30/2002		10.20	4379.91	0.30	---	<1.0	<1.0	<1.0	<1.0	280
	3/13/2003		10.36	4379.75	0.60	---	2.70	<2.0	<2.0	3.9	555
	4/22/2003		10.19	4379.92	NM	---	NM	NM	NM	NM	NM
	5/28/2003		9.85	4380.26	NM	---	NM	NM	NM	NM	NM
	6/20/2003		10.06	4380.05	0.86	---	24	<1.0	4.4	23	680
	7/31/2003		10.45	4379.66	NM	---	NM	NM	NM	NM	NM
	9/30/2003		10.52	4379.59	0.49	---	2.5	<0.5	<0.5	5.2	400
	11/5/2003		10.68	4379.43	NM	---	NM	NM	NM	NM	NM
	12/18/2003		10.64	4379.47	0.81	---	8.6	<1.0	1.3	27.6	649
	3/22/2004		10.61	4379.50	0.88	---	13.6	<1.0	<2.0	61.5	812
	6/3/2004		10.47	4379.64	0.83	---	3.5	<1.0	11.5	11.9	581
	9/30/2004		10.74	4379.37	0.718	---	5.0	<1.0	<1.0	<1.0	718
	12/29/2004		10.55	4379.56	0.530	---	1.4	<1.0	<2.0	<1.0	533
	3/23/2005		9.75	4380.36	0.034	---	<1.0	<1.0	<2.0	<1.0	33.5
	4/14/2005		9.90	4380.21	---	---	---	---	---	---	---
	5/27/2005		8.47	4381.64	---	---	---	---	---	---	---
	6/29/2005		8.34	4381.77	<0.50	---	<1.0	<1.0	<1.0	<1.0	160
	7/25/2005		8.64	4381.47	---	---	---	---	---	---	---
	8/30/2005		8.98	4381.13	---	---	---	---	---	---	---
	9/29/2005		9.15	4380.96	<0.50	---	<1.0	<1.0	<1.0	<1.0	8.9
	10/31/2005		9.56	4380.55	---	---	---	---	---	---	---
	11/30/2005		10.19	4379.92	---	---	---	---	---	---	---
	12/29/2005		9.67	4380.44	<0.50	---	<1.0	<1.0	<1.0	<1.0	45
	1/24/2006		7.25	4382.86	---	---	---	---	---	---	---
	2/1/2006		7.37	4382.74	---	---	---	---	---	---	---

TABLE 1
Summary of Ground-Water Monitoring Data
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Well Number	Date	MPE (ft)	DTW (ft)	Water Level (ft)	TPHg (mg/l)	TPH-E (mg/l)	Benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	E-Benzene (ug/l)	MTBE (ug/l)
MW-3 Cont.	3/1/2006		7.83	4382.28	<0.50	---	<1.0	<1.0	<1.0	<1.0	48
	4/27/2006		7.36	4382.75	---	---	---	---	---	---	---
	5/31/2006		6.63	4383.48	---	---	---	---	---	---	---
	6/23/2006		6.78	4383.33	---	---	<1.0	<1.0	<1.0	<1.0	7.1
	9/8/2006		8.52	4381.59	---	---	<1.0	<1.0	<1.0	<1.0	12
	12/28/2006		10.31	4379.80	---	---	<1.0	<1.0	<1.0	<1.0	20
	3/26/2007		11.17	4378.94	<0.50	---	<1.0	<1.0	<1.0	<1.0	36
	6/1/2007		10.50	4379.61	---	---	<1.0	<1.0	<1.0	1.1	35
	9/7/2007		10.22	4379.89	<0.50	---	1.2	<1.0	<1.0	2.0	53
	1/4/2008		**3.54**	**4386.57**	**<0.50**	---	**<1.0**	**<1.0**	**<1.0**	**1.2**	**1.3**
MW-4	4/29/1999	99.95	8.34	91.61	25	---	80	24	964	252	752
	8/3/1999		8.09	91.86	2.4	---	78	20	700	160	1,260
	2/15/2000		9.27	90.68	---	ND	5.3	ND	ND	ND	87.4
	6/5/2000		9.32	90.63	ND	---	13.1	ND	ND	11.9	227.9
	9/5/2000		8.92	91.03	ND	---	ND	ND	ND	ND	81.4
	11/14/2000		9.10	90.85	0.8	---	ND	ND	8.9	ND	750.0
	2/20/2001		^19.94	80.81	<0.5	---	<2.0	<2.0	<2.0	<2.0	341.0
	6/13/2001		8.40	91.55	<0.5	---	<2.0	<2.0	<2.0	<2.0	60.0
	8/28/2001		8.16	91.79	<0.5	---	<2.0	<2.0	<2.0	<2.0	254.7
	11/16/2001		8.40	91.55	<0.5	---	<2.0	<2.0	<2.0	<2.0	51.0
	3/6/2002		NA	NA	0.15	---	16	<2.0	<2.0	46	170
	6/6/2002	4390.19	6.99	4383.20	<0.05	---	<2.0	<2.0	<2.0	<2.0	2.7
	9/16/2002		7.95	4382.24	<0.05	---	<2.0	<2.0	<2.0	<2.0	1.7
	12/30/2002		9.37	4380.82	<0.05	---	<1.0	<1.0	<1.0	<1.0	34.4
	3/13/2003		9.85	4380.34	0.47	---	15.2	<2.0	<2.0	5.9	89
	4/22/2003		9.18	4381.01	NM	---	NM	NM	NM	NM	NM
	5/28/2003		8.98	4381.21	NM	---	NM	NM	NM	NM	NM
	6/20/2003		9.00	4381.19	<0.5	---	<1.0	<1.0	<1.0	<1.0	20
	7/31/2003		9.14	4381.05	NM	---	NM	NM	NM	NM	NM
	9/30/2003		9.42	4380.77	<0.05	---	<0.5	<0.5	<0.5	<0.5	1.1
	11/5/2003		9.77	4380.42	NM	---	NM	NM	NM	NM	NM
	12/18/2003		9.89	4380.30	0.49	---	10.6	<1.0	2.1	8.1	89.8
	3/22/2004		9.68	4380.51	0.31	---	6.2	<1.0	<2.0	<1.0	43.5
	6/3/2004		9.75	4380.44	0.038	---	1.0	<1.0	<2.0	<1.0	35.8
	9/30/2004		9.96	4380.23	0.366	---	5.5	3.6	15.6	<1.0	127

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MW-4 Cont.	12/29/2004		9.73	4380.46	0.43	---	3.6	<1.0	<2.0	<1.0	38.1
	3/23/2005		9.16	4381.03	<0.020	---	<1.0	<1.0	<2.0	<1.0	6.6
	4/14/2005		9.35	4380.84	---	---	---	---	---	---	---
	5/27/2005		7.25	4382.94	---	---	---	---	---	---	---
	6/29/2005		6.81	4383.38	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	7/25/2005		7.34	4382.85	---	---	---	---	---	---	---
	8/30/2005		7.78	4382.41	---	---	---	---	---	---	---
	9/29/2005		8.11	4382.08	<0.50	---	<1.0	<1.0	<1.0	<1.0	3.1
	10/31/2005		8.55	4381.64	---	---	---	---	---	---	---
	11/30/2005		9.44	4380.75	---	---	---	---	---	---	---
	12/29/2005		9.30	4380.89	<0.50	---	<1.0	<1.0	<1.0	<1.0	4.2
	1/24/2006		6.31	4383.88	---	---	---	---	---	---	---
	2/1/2006		6.55	4383.64	---	---	---	---	---	---	---
	3/1/2006		7.34	4382.85	<0.50	---	<1.0	<1.0	<1.0	<1.0	1.2
	4/27/2006		6.37	4383.82	---	---	---	---	---	---	---
	5/31/2006		5.66	4384.53	---	---	---	---	---	---	---
	6/23/2006		5.95	4384.24	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	9/8/2006		7.94	4382.25	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	12/28/2006		9.68	4380.51	---	---	<1.0	<1.0	<1.0	<1.0	5.7
	3/26/2007		10.31	4379.88	<0.50	---	<1.0	<1.0	<1.0	<1.0	17
	6/1/2007		9.59	4380.60	---	---	<1.0	<1.0	<1.0	<1.0	1.7
	9/7/2007		9.02	4381.17	<0.50	---	<1.0	<1.0	<1.0	<1.0	1.9
	1/4/2008		**2.25**	**4387.94**	**<0.50**	---	**<1.0**	**<1.0**	**<1.0**	**<1.0**	**<1.0**
MW-5	4/29/1999	100.02	8.73	91.29	3.1	---	ND	ND	ND	ND	3,028
	8/3/1999		8.95	91.07	4.4	---	ND	21	25	17	4,230
	2/15/2000		10.75	89.27	---	ND	ND	ND	ND	ND	7,280
	6/5/2000		10.04	89.98	4.0	---	ND	ND	ND	ND	3,972
	9/5/2000		10.17	89.85	2.5	---	ND	ND	ND	ND	2,535
	11/14/2000		10.35	89.67	3.5	---	ND	ND	ND	ND	3,444.0
	2/20/2001		^20.72	79.30	0.95	---	<2.0	<2.0	<2.0	<2.0	946
	6/13/2001		10.08	89.94	1.5	---	<2.0	<2.0	<2.0	<2.0	1,454
	8/28/2001		10.72	89.30	2.29	---	<2.0	<2.0	<2.0	<2.0	2,290.0
	11/16/2001		10.06	89.96	3.85	---	<2.0	<2.0	<2.0	<2.0	3,848.0
	3/6/2002		NA	NA	<0.05	---	<2.0	<2.0	<2.0	<2.0	2,050
	6/6/2002	4390.36	9.09	4381.27	1.8	---	<2.0	<2.0	<2.0	9	1,771

TABLE 1
Summary of Ground-Water Monitoring Data
WCSD-Getto Transportation Facility,
Sparks, Nevada

Well Number	Date	MPE (ft)	DTW (ft)	Water Level (ft)	TPHg (mg/l)	TPH-E (mg/l)	Benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	E-Benzene (ug/l)	MTBE (ug/l)
MW-5	9/16/2002		9.70	4380.66	*NS	---	*NS	*NS	*NS	*NS	*NS
Cont.	12/30/2002		10.42	4379.94	1.38	---	<1.0	<1.0	<1.0	<1.0	1,378
	3/13/2003		10.59	4379.77	1.52	---	<2.0	<2.0	<2.0	<2.0	1,522
	4/22/2003		10.32	4380.04	NM	---	NM	NM	NM	NM	NM
	5/28/2003		10.19	4380.17	NM	---	NM	NM	NM	NM	NM
	6/20/2003		10.04	4380.32	0.67	---	<1.5	<1.5	<1.5	<1.5	1,100
	7/31/2003		10.39	4379.97	NM	---	NM	NM	NM	NM	NM
	9/30/2003		10.57	4379.79	0.64	---	<0.5	<0.5	<0.5	<0.5	644
	11/5/2003		10.77	4379.59	NM	---	NM	NM	NM	NM	NM
	12/18/2003		10.87	4379.49	0.77	---	<1.0	<1.0	<2.0	<1.0	768
	3/22/2004		10.71	4379.65	0.78	---	<1.0	<1.0	<2.0	<1.0	782
	6/3/2004		10.81	4379.55	0.63	---	<1.0	<1.0	<2.0	<1.0	628
	9/30/2004		10.82	4379.54	0.792	---	<1.0	<1.0	<2.0	<1.0	792
	12/29/2004		11.23	4379.13	0.530	---	<1.0	<1.0	<2.0	<1.0	530
	3/23/2005		10.06	4380.30	0.431	---	<1.0	<1.0	<2.0	<1.0	431
	4/14/2005		10.15	4380.21	---	---	---	---	---	---	---
	5/27/2005		9.03	4381.33	---	---	---	---	---	---	---
	6/29/2005		8.94	4381.42	<0.50	---	<1.0	<1.0	<1.0	<1.0	280
	7/25/2005		9.23	4381.13	---	---	---	---	---	---	---
	8/30/2005		9.59	4380.77	---	---	---	---	---	---	---
	9/29/2005		9.65	4380.71	<0.50	---	<1.0	<1.0	<1.0	<1.0	220
	10/31/2005		10.02	4380.34	---	---	---	---	---	---	---
	11/30/2005		10.46	4379.90	---	---	---	---	---	---	---
	12/29/2005		10.13	4380.23	<0.50	---	<1.0	<1.0	<1.0	<1.0	120
	1/24/2006		7.87	4382.49	---	---	---	---	---	---	---
	2/1/2006		7.99	4382.37	---	---	---	---	---	---	---
	3/1/2006		8.42	4381.94	<0.50	---	<1.0	<1.0	<1.0	<1.0	200
	4/27/2006		8.22	4382.14	---	---	---	---	---	---	---
	5/31/2006		7.49	4382.87	---	---	---	---	---	---	---
	6/23/2006		7.82	4382.54	---	---	<1.0	<1.0	<1.0	<1.0	130
	9/8/2006		9.18	4381.18	---	---	<1.0	<1.0	<1.0	<1.0	76
	12/28/2006		10.52	4379.84	---	---	<1.0	<1.0	<1.0	<1.0	78
	3/26/2007		10.31	4380.05	<0.50	---	<1.0	<1.0	<1.0	<1.0	150

TABLE 1
Summary of Ground-Water Monitoring Data
WCSD-Getto Transportation Facility,
Sparks, Nevada

Well Number	Date	MPE (ft)	DTW (ft)	Water Level (ft)	TPHg (mg/l)	TPH-E (mg/l)	Benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	E-Benzene (ug/l)	MTBE (ug/l)
MW-5	6/1/2007		10.46	4379.90	---	---	<1.0	<1.0	<1.0	<1.0	61
Cont.	9/7/2007		10.51	4379.85	<0.50	---	<1.0	<1.0	<1.0	<1.0	37
	1/4/2008		**covered by car**								
MW-6	8/3/1999	99.27	8.5	90.77	ND	---	ND	ND	ND	ND	ND
	2/15/2000		10.09	89.18	---	ND	ND	ND	ND	ND	ND
	6/5/2000		9.45	89.82	ND	---	ND	ND	ND	ND	ND
	9/5/2000		9.59	89.68	ND	ND	ND	ND	ND	ND	ND
	11/14/2000		9.69	89.58	ND	---	ND	ND	ND	ND	ND
	2/20/2001		^19.94	79.33	<0.5	---	<2.0	<2.0	<2.0	<2.0	<2.0
	6/13/2001		9.66	89.61	<0.5	---	<2.0	<2.0	<2.0	<2.0	<2.0
	8/28/2001		9.77	89.50	<0.5	---	<2.0	<2.0	<2.0	<2.0	<2.0
	11/16/2001		9.83	89.44	<0.5	---	<2.0	<2.0	<2.0	<2.0	<2.0
	3/6/2002		NA	NA	<0.05	---	<2.0	<2.0	<2.0	<2.0	<2.0
	6/6/2002	*4389.48	9.30	4380.18	<0.05	---	<2.0	<2.0	<2.0	<2.0	4
	9/16/2002		9.51	4379.97	<0.05	---	<2.0	<2.0	<2.0	<2.0	<2.0
	12/30/2002		9.81	4379.67	<0.05	---	<2.0	<2.0	<2.0	<2.0	<2.0
	3/13/2003		9.82	4379.66	<0.05	---	<1.0	<1.0	<1.0	<1.0	1.7
	4/22/2003		9.74	4379.74	<0.05	---	<2.0	<2.0	<2.0	<2.0	<2.0
	5/28/2003		9.43	4380.05	NM	---	NM	NM	NM	NM	NM
	6/20/2003		9.50	4379.98	NM	---	NM	NM	NM	NM	NM
	7/31/2003		9.70	4379.78	<0.5	---	<1.0	<1.0	<1.0	<1.0	<1.0
	9/30/2003		9.91	4379.57	NM	---	NM	NM	NM	NM	NM
	11/5/2003		9.99	4379.49	<0.05	---	<0.5	<0.5	<0.5	<0.5	<0.5
	12/18/2003		10.07	4379.41	NM	---	NM	NM	NM	NM	NM
	3/22/2004		9.78	4379.70	<0.02	---	<1.0	<1.0	<2.0	<1.0	<1.0
	6/3/2004		9.61	4379.87	<0.02	---	<1.0	<1.0	<2.0	<1.0	<1.0
	9/30/2004		10.07	4379.41	<0.02	---	<1.0	<1.0	<2.0	<1.0	<1.0
	12/29/2004		10.06	4379.42	<0.01	---	<1.0	<1.0	<1.0	<1.0	<1.0
	3/23/2005		9.23	4380.25	<0.01	---	<1.0	<1.0	<2.0	<1.0	<1.0
	4/14/2005		9.41	4380.07	<0.02	---	<1.0	<1.0	<2.0	<1.0	<1.0
	5/27/2005		8.72	4380.76	---	---	---	---	---	---	---
	6/29/2005		9.78	4379.70	---	---	---	---	---	---	---
	7/25/2005		8.98	4380.50	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	8/30/2005		9.31	4380.17	---	---	---	---	---	---	---
	9/29/2005		9.37	4380.17	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0

TABLE 1
Summary of Ground-Water Monitoring Data
WCSD-Getto Transportation Facility,
Sparks, Nevada

Well Number	Date	MPE (ft)	DTW (ft)	Water Level (ft)	TPHg (mg/l)	TPH-E (mg/l)	Benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	E-Benzene (ug/l)	MTBE (ug/l)
MW-6	10/31/2005		9.60	4379.88	---	---	---	---	---	---	---
Cont.	11/30/2005		9.78	4379.70	---	---	---	---	---	---	---
	12/29/2005		9.32	4380.16	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	1/24/2006		7.42	4382.06	---	---	---	---	---	---	---
	2/1/2006		7.47	4382.01	---	---	---	---	---	---	---
	3/1/2006		7.72	4381.76	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	4/27/2006		8.10	4381.38	---	---	---	---	---	---	---
	5/31/2006		7.16	4382.32	---	---	---	---	---	---	---
	6/23/2006		7.74	4381.74	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	9/8/2006		8.73	4380.75	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	12/28/2006		9.78	4379.70	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	3/26/2007		10.48	4379.00	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	6/1/2007		10.15	4379.33	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	9/7/2007		10.04	4379.44	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	1/4/2008		**9.16**	**4380.32**	**<0.50**	**---**	**<1.0**	**<1.0**	**<1.0**	**<1.0**	**<1.0**
MW-7	8/3/1999	99.40	8.65	90.75	ND	---	ND	50	48	35	ND
	2/15/2000		10.14	89.26	---	ND	ND	ND	ND	ND	ND
	6/5/2000		9.64	89.76	ND	---	ND	ND	ND	ND	ND
	9/5/2000		9.8	89.60	ND	ND	ND	ND	ND	ND	ND
	11/14/2000		9.93	89.47	ND	---	ND	ND	ND	ND	ND
	2/20/2001		^20.16	79.24	<0.5	---	<2.0	<2.0	<2.0	<2.0	<2.0
	6/13/2001		9.86	89.54	<0.5	---	<2.0	<2.0	<2.0	<2.0	4.4
	8/28/2001		9.96	89.44	<0.5	---	<2.0	<2.0	<2.0	<2.0	36.9
	11/16/2001		10.01	89.39	0.17	---	<2.0	<2.0	<2.0	<2.0	168.3
	3/6/2002		NA	NA	<0.05	---	<2.0	<2.0	<2.0	<2.0	204
	6/6/2002	4389.63	9.10	4380.53	0.28	---	<2.0	<2.0	<2.0	<2.0	284
	9/16/2002		9.75	4379.88	0.46	---	<2.0	<2.0	<2.0	<2.0	457
	12/30/2002		9.98	4379.65	0.36	---	<1.0	<1.0	<1.0	<1.0	363
	3/13/2013		10.04	4379.59	0.48	---	<2.0	<2.0	<2.0	<2.0	476
	4/22/2003		9.93	4379.70	NM	---	NM	NM	NM	NM	NM
	5/28/2003		9.66	4379.97	NM	---	NM	NM	NM	NM	NM
	6/20/2003		9.67	4379.96	<0.5	---	<1.0	<1.0	<1.0	<1.0	390
	7/31/2003		9.92	4379.71	NM	---	NM	NM	NM	NM	NM
	9/30/2003		10.10	4379.53	0.18	---	<0.5	<0.5	<0.5	0.8	176
	11/5/2003		10.23	4379.40	NM	---	NM	NM	NM	NM	NM

TABLE 1
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WCSD-Getto Transportation Facility,
Sparks, Nevada

Well Number	Date	MPE (ft)	DTW (ft)	Water Level (ft)	TPHg (mg/l)	TPH-E (mg/l)	Benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	E-Benzene (ug/l)	MTBE (ug/l)
MW-7	12/18/2003		10.28	4379.35	0.033	---	<1.0	<1.0	<2.0	<1.0	33.5
Cont.	3/22/2004		9.96	4379.67	0.13	---	<1.0	<1.0	<2.0	<1.0	131
	6/3/2004		10.14	4379.49	0.196	---	<1.0	<1.0	<2.0	<1.0	196
	9/30/2004		10.40	4379.23	0.147	---	<1.0	<1.0	<2.0	<1.0	147
	12/29/2004		10.54	4379.09	0.150	---	<1.0	<1.0	<1.0	<1.0	149
	3/23/2005		9.49	4380.14	0.157	---	<1.0	<1.0	<2.0	<1.0	157
	4/14/2005		9.63	4380.00	---	---	<1.0	<1.0	<2.0	<1.0	---
	5/27/2005		8.86	4380.77	---	---	---	---	---	---	---
	6/29/2005		9.06	4380.57	<0.50	---	---	---	---	---	---
	7/25/2005		9.27	4380.36	---	---	<1.0	<1.0	<1.0	<1.0	58
	8/30/2005		9.61	4380.02	---	---	---	---	---	---	---
	9/26/2005		10.68	4378.95	<0.50	---	---	---	---	---	---
	10/31/2005		10.11	4379.52	---	---	<1.0	<1.0	<1.0	<1.0	66
	11/30/2005		10.06	4379.57	---	---	---	---	---	---	---
	12/29/2005		9.52	4380.11	<0.50	---	---	---	---	---	---
	1/24/2006		7.61	4382.02	---	---	<1.0	<1.0	<1.0	<1.0	140
	2/1/2006		7.69	4381.94	---	---	---	---	---	---	---
	3/1/2006		7.94	4381.69	<0.50	---	---	---	---	---	---
	4/27/2006		8.02	4381.61	---	---	<1.0	<1.0	<1.0	<1.0	380
	5/31/2006		7.58	4382.05	---	---	---	---	---	---	---
	6/23/2006		8.04	4381.59	---	---	---	---	---	---	---
	9/8/2006		9.10	4380.53	---	---	<1.0	<1.0	<1.0	<1.0	190
	12/28/2006		10.02	4379.61	---	---	<1.0	<1.0	<1.0	<1.0	150
	3/26/2007		10.78	4378.85	<0.50	---	<1.0	<1.0	<1.0	<1.0	210
	6/1/2007		10.40	4379.23	---	---	<1.0	<1.0	<1.0	<1.0	190
	9/7/2007		10.32	4379.31	<0.50	---	<1.0	<1.0	<1.0	<1.0	70
	1/4/2008		12.11	4377.52	<0.50	---	<1.0	<1.0	<1.0	<1.0	140
	1/4/2008		**12.11**	**4377.52**	**<0.50**	---	**<1.0**	**<1.0**	**<1.0**	**<1.0**	**<1.0**
MW-8	4/26/2002		9.87	NA	<0.05	---	<2.0	<2.0	<2.0	2.5	<2.0
	6/6/2002	4389.09	8.71	4380.38	<0.05	---	<2.0	<2.0	<2.0	<2.0	<2.0
	9/16/2002		9.43	4379.66	<0.05	---	<2.0	<2.0	<2.0	<2.0	6.8
	12/30/2002		9.35	4379.74	<0.05	---	<1.0	<1.0	<1.0	<1.0	1.4
	3/13/2003		9.53	4379.56	<0.05	---	<2.0	<2.0	<2.0	<2.0	<2.0
	4/22/2003		9.38	4379.71	NM	---	NM	NM	NM	NM	NM
	5/28/2003		9.14	4379.95	NM	---	NM	NM	NM	NM	NM
	6/20/2003		9.24	4379.85	<0.5	---	<1.0	1.1	1.4	<1.0	6.1

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MW-8	7/31/2003		9.51	4379.58	NM	---	NM	NM	NM	NM	NM
Cont.	9/30/2003		9.52	4379.57	<0.05	---	<0.5	<0.5	<0.5	<0.5	14.3
	11/5/2003		9.68	4379.41	NM	---	NM	NM	NM	NM	NM
	12/18/2003		9.72	4379.37	0.013	---	<1.0	<1.0	<2.0	<1.0	12.8
	3/22/2004		9.29	4379.80	<0.020	---	<1.0	<1.0	<2.0	<1.0	<1.0
	6/3/2004		9.20	4379.89	<0.020	---	<1.0	<1.0	<2.0	<1.0	11.7
	9/30/2004		9.81	4379.28	0.017	---	<1.0	<1.0	<1.0	<1.0	17.3
	12/29/2004		9.72	4379.37	<0.01	---	<1.0	<1.0	<2.0	<1.0	2.4
	3/23/2005		8.94	4380.15	<0.02	---	<1.0	<1.0	<2.0	<1.0	1.3
	4/14/2005		9.05	4380.04	---	---	---	---	---	---	---
	5/27/2005		8.36	4380.73	---	---	---	---	---	---	---
	**6/29/2005		Covered by Curb		---	---	---	---	---	---	---
	7/25/2005		7.97	---	---	---	---	---	---	---	---
	8/30/2005		8.28	---	---	---	---	---	---	---	---
	9/26/2005		8.34	---	<0.50	---	<1.0	<1.0	<1.0	<1.0	7.3
	10/31/2005		8.47	---	---	---	---	---	---	---	---
	11/30/2005		8.54	---	---	---	---	---	---	---	---
	12/29/2005		8.17	---	<0.50	---	<1.0	<1.0	<1.0	<1.0	2.3
	1/24/2006		6.06	---	---	---	---	---	---	---	---
	2/1/2006		6.14	---	---	---	---	---	---	---	---
	3/1/2006		6.46	---	<0.50	---	<1.0	<1.0	<1.0	<1.0	1.6
	4/27/2006		6.54	---	---	---	---	---	---	---	---
	5/31/2006		Covered by Car		---	---	---	---	---	---	---
	6/23/2006		6.72	---	---	---	<1.0	<1.0	<1.0	<1.0	1.5
	9/8/2006		7.81	---	---	---	<1.0	<1.0	<1.0	<1.0	5.8
	12/28/2006		8.61	---	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	3/26/2007		9.45	---	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	6/1/2007		8.93	---	---	---	<1.0	<1.0	<1.0	<1.0	44
	9/7/2007		8.95	---	<0.50	---	<1.0	<1.0	<1.0	<1.0	33
	1/4/2008		**Unable to locate**								
MW-9	4/26/2002		12.25	NA	<0.05	---	<2.0	3.1	8.1	2.0	103.3
	6/6/2002	4392.22	9.11	4383.11	0.25	---	<2.0	<2.0	<2.0	<2.0	196
	9/16/2002		12.68	4379.54	0.79	---	4.3	<2.0	56	30	780
	12/30/2003		12.70	4379.52	0.63	---	<1.0	<1.0	<1.0	<1.0	647
	3/13/2003		12.78	4379.44	0.79	---	<2.0	<2.0	<2.0	<2.0	793

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Well Number	Date	MPE (ft)	DTW (ft)	Water Level (ft)	TPHg (mg/l)	TPH-E (mg/l)	Benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	E-Benzene (ug/l)	MTBE (ug/l)
MW-9	4/22/2003		12.63	4379.59	NM	---	NM	NM	NM	NM	NM
Cont.	5/28/2003		12.31	4379.91	NM	---	NM	NM	NM	NM	NM
	6/20/2003		12.54	4379.68	0.51	---	<1.5	<1.5	<1.5	<1.5	840
	7/31/2003		12.75	4379.47	NM	---	NM	NM	NM	NM	NM
	9/30/2003		12.72	4379.50	0.93	---	<0.5	<0.5	<0.5	<0.5	927
	11/5/2003		12.89	4379.33	NM	---	NM	NM	NM	NM	NM
	12/18/2003		12.96	4379.26	1.15	---	<1.0	<1.0	<2.0	<1.0	1,148
	3/22/2004		12.57	4379.65	1.13	---	<1.0	<1.0	<2.0	<1.0	1,129
	6/3/2004		12.45	4379.77	0.82	---	<1.0	<1.0	<2.0	<1.0	820
	9/30/2004		13.03	4379.19	1.42	---	<1.0	<1.0	<1.0	<1.0	1,420
	12/29/2004		13.02	4379.20	0.91	---	<1.0	<1.0	<2.0	<1.0	912
	3/23/2005		12.26	4379.96	0.581	---	<1.0	<1.0	<2.0	<1.0	581
	4/14/2005		12.29	4379.93	---	---	---	---	---	---	---
	5/27/2005		12.02	4380.20	---	---	---	---	---	---	---
	6/29/2005		11.88	4380.34	<0.50	---	<1.0	<1.0	<1.0	<1.0	590
	7/25/2005		12.15	4380.07	---	---	---	---	---	---	---
	8/30/2005		12.50	4379.72	---	---	---	---	---	---	---
	9/26/2005		12.55	4379.67	<0.50	---	<1.0	<1.0	<1.0	<1.0	710
	10/31/2005		12.67	4379.55	---	---	---	---	---	---	---
	11/30/2005		12.80	4379.42	---	---	---	---	---	---	---
	12/29/2005		12.08	4380.14	<0.50	---	<1.0	<1.0	<1.0	<1.0	380
	1/24/2006		10.43	4381.79	---	---	---	---	---	---	---
	2/1/2006		10.49	4381.73	---	---	---	---	---	---	---
	3/1/2006		10.68	4381.54	1.2	---	<1.0	<1.0	<1.0	<1.0	1,200
	4/27/2006		10.83	4381.39	---	---	---	---	---	---	---
	5/31/2006		10.49	4381.73	---	---	---	---	---	---	---
	6/23/2006		11.00	4381.22	---	---	<1.0	<1.0	<1.0	<1.0	920
	9/8/2006		12.05	4380.17	---	---	<1.0	<1.0	<1.0	<1.0	740
	12/28/2006		12.79	4379.43	---	---	<1.0	<1.0	<1.0	<1.0	800
	3/26/2007		13.58	4378.64	<0.50	---	<1.0	<1.0	<1.0	<1.0	630
	6/1/2007		13.11	4379.11	---	---	<1.0	<1.0	<1.0	<1.0	510
	9/7/2007		13.09	4379.13	<0.50	---	<1.0	<1.0	<1.0	<1.0	390
	1/4/2008		**12.47**	**4379.75**	**<0.50**	---	**<1.0**	**<1.0**	**<1.0**	**<1.0**	**320**
MW-10	4/26/2002		9.81	NA	<0.05	---	<2.0	<2.0	<2.0	<2.0	<2.0
	6/6/2002	4389.50	11.98	4377.52	<0.05	---	<2.0	<2.0	<2.0	<2.0	<2.0

TABLE 1
Summary of Ground-Water Monitoring Data
WCSD-Getto Transportation Facility,
Sparks, Nevada

Well Number	Date	MPE (ft)	DTW (ft)	Water Level (ft)	TPHg (mg/l)	TPH-E (mg/l)	Benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	E-Benzene (ug/l)	MTBE (ug/l)
MW-10	9/16/2002		9.62	4379.88	<0.05	---	<2.0	<2.0	<2.0	<2.0	5.6
Cont.	12/30/2002		9.90	4379.60	<0.05	---	<1.0	<1.0	<1.0	<1.0	5.7
	3/13/2003		10.00	4379.50	<0.05	---	<2.0	<2.0	<2.0	<2.0	17.8
	4/22/2003		9.86	4379.64	NM	---	NM	NM	NM	NM	NM
	5/28/2003		9.61	4379.89	NM	---	NM	NM	NM	NM	NM
	6/20/2003		9.69	4379.81	<0.5	---	<1.0	<1.0	<1.0	<1.0	1.8
	7/31/2003		9.88	4379.62	NM	---	NM	NM	NM	NM	NM
	9/30/2003		10.08	4379.42	<0.05	---	<0.5	<0.5	<0.5	<0.5	4.2
	11/5/2003		10.10	4379.40	NM	---	NM	NM	NM	NM	NM
	12/18/2003		10.19	4379.31	0.04	---	<1.0	<1.0	<2.0	<1.0	37
	3/22/2004		9.84	4379.66	0.044	---	<1.0	<1.0	<2.0	<1.0	44.1
	6/3/2004		9.79	4379.71	0.067	---	<1.0	<1.0	<2.0	<1.0	66.7
	9/30/2004		10.26	4379.24	0.071	---	<1.0	<1.0	<1.0	<1.0	71.1
	12/29/2004		10.41	4379.09	0.11	---	<1.0	<1.0	<2.0	<1.0	113
	3/23/2005		9.54	4379.96	0.118	---	<1.0	<1.0	<2.0	<1.0	118
	4/14/2005		9.57	4379.93	---	---	---	---	---	---	---
	5/27/2005		8.87	4380.63	---	---	---	---	---	---	---
	6/29/2005		9.10	4380.40	<0.50	---	<1.0	<1.0	<1.0	<1.0	100
	7/25/2005		9.34	4380.16	---	---	---	---	---	---	---
	8/30/2005		9.64	4379.86	---	---	---	---	---	---	---
	9/26/2005		9.71	4379.79	<0.50	---	<1.0	<1.0	<1.0	<1.0	170
	10/31/2005		9.90	4379.60	---	---	---	---	---	---	---
	11/30/2005		10.01	4379.49	---	---	---	---	---	---	---
	12/29/2005		9.42	4380.08	<0.50	---	<1.0	<1.0	<1.0	<1.0	190
	1/24/2006		7.69	4381.81	---	---	---	---	---	---	---
	2/1/2006		7.75	4381.75	---	---	---	---	---	---	---
	3/1/2006		7.96	4381.54	<0.50	---	<1.0	<1.0	<1.0	<1.0	280
	4/27/2006		8.04	4381.46	---	---	---	---	---	---	---
	5/31/2006		7.68	4381.82	---	---	---	---	---	---	---
	6/23/2006		8.14	4381.36	---	---	<1.0	<1.0	<1.0	<1.0	260
	9/8/2006		9.24	4380.26	---	---	<1.0	<1.0	<1.0	<1.0	230
	12/28/2006		10.02	4379.48	---	---	<1.0	<1.0	<1.0	<1.0	210
	3/26/2007		10.70	4378.80	<0.50	---	<1.0	<1.0	<1.0	<1.0	210
	6/1/2007		10.36	4379.14	---	---	<1.0	<1.0	<1.0	<1.0	360
	9/7/2007		10.21	4379.29	<0.50	---	<1.0	<1.0	<1.0	<1.0	200
	1/4/2008		9.71	4379.79	<0.50	---	<1.0	<1.0	<1.0	<1.0	120

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WCSD-Getto Transportation Facility,
Sparks, Nevada

Well Number	Date	MPE (ft)	DTW (ft)	Water Level (ft)	TPHg (mg/l)	TPH-E (mg/l)	Benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	E-Benzene (ug/l)	MTBE (ug/l)
MW-11	8/1/2003	4389.91	9.49	4380.42	<1.0	---	<1.0	<1.0	<1.0	<1.0	<1.0
	9/30/2003		10.28	4379.63	<0.05	---	<0.5	<0.5	<0.5	<0.5	<0.5
	11/5/2003		10.38	4379.53	NM	---	NM	NM	NM	NM	NM
	12/18/2003		10.44	4379.47	<0.02	---	<1.0	<1.0	<2.0	<1.0	<1.0
	3/22/2004		10.01	4379.90	<0.02	---	<1.0	<1.0	<2.0	<1.0	<1.0
	6/3/2004		9.92	4379.99	<0.02	---	<1.0	<1.0	<2.0	<1.0	<1.0
	9/30/2004		10.50	4379.41	<0.01	---	<1.0	<1.0	<1.0	<1.0	<1.0
	12/29/2004		10.43	4379.48	<0.01	---	<1.0	<1.0	<2.0	<1.0	<1.0
	3/23/2005		9.66	4380.25	<0.02	---	<1.0	<1.0	<2.0	<1.0	<1.0
	4/14/2005		9.71	4380.20	---	---	---	---	---	---	---
	5/27/2005		9.06	4380.85	---	---	---	---	---	---	---
	6/29/2005		9.33	4380.58	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	7/25/2005		10.54	4379.37	---	---	---	---	---	---	---
	8/30/2005		9.86	4380.05	---	---	---	---	---	---	---
	9/26/2005		9.94	4379.97	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	10/31/2005		10.05	4379.86	---	---	---	---	---	---	---
	11/30/2005		10.20	4379.71	---	---	---	---	---	---	---
	12/29/2005		9.55	4380.36	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	1/24/2006		7.88	4382.03	---	---	---	---	---	---	---
	2/1/2006		8.06	4381.85	---	---	---	---	---	---	---
	3/1/2006		8.05	4381.86	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	4/27/2006		8.21	4381.70	---	---	---	---	---	---	---
	5/31/2006		8.02	4381.89	---	---	---	---	---	---	---
	6/23/2006		8.41	4381.50	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	9/8/2006		9.43	4380.48	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	12/28/2006		10.25	4379.66	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	3/26/2007		11.25	4378.66	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	6/1/2007		10.52	4379.39	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	9/7/2007		10.39	4379.52	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	1/4/2008		**10.04**	**4379.87**	**<0.50**	---	**<1.0**	**<1.0**	**<1.0**	**<1.0**	**<1.0**
MW-12	8/1/2003	4389.05	10.30	4378.75	<1.0	---	<1.0	<1.0	<1.0	<1.0	1.3
	9/30/2003		9.49	4379.56	<0.05	---	<0.5	<0.5	<0.5	<0.5	<0.5
	11/5/2003		*NS	*NS	*NS	*NS	*NS	*NS	*NS	*NS	*NS
	12/18/2003		9.67	4379.38	<0.02	---	<1.0	<1.0	<2.0	<1.0	<1.0

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Well Number	Date	MPE (ft)	DTW (ft)	Water Level (ft)	TPHg (mg/l)	TPH-E (mg/l)	Benzene (ug/l)	Toluene (ug/l)	Xylenes (ug/l)	E-Benzene (ug/l)	MTBE (ug/l)
MW-12 Cont.	3/22/2004		9.20	4379.85	<0.02	---	<1.0	<1.0	<2.0	<1.0	1.2
	6/3/2004		9.15	4379.90	<0.02	---	<1.0	<1.0	<2.0	<1.0	<1.0
	9/30/2004		9.73	4379.32	<0.01	---	<1.0	<1.0	<1.0	<1.0	1.6
	12/29/2004		9.67	4379.38	<0.01	---	<1.0	<1.0	<2.0	<1.0	<1.0
	3/23/2005		8.91	4380.14	<0.02	---	<1.0	<1.0	<2.0	<1.0	<1.0
	4/14/2005		8.97	4380.08	---	---	---	---	---	---	---
	5/27/2005		8.32	4380.73	---	---	---	---	---	---	---
	6/29/2005		8.57	4380.48	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	7/25/2005		Well Not Located, Buried in Base Material						---	---	---
	8/30/2005		9.15	---	---	---	---	---	---	---	---
	9/26/2005		9.20	4379.85	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	10/31/2005		9.33	4379.72	---	---	---	---	---	---	---
	11/30/2005		9.43	4379.62	---	---	---	---	---	---	---
	12/29/2005		8.74	4380.31	<0.50	---	<1.0	<1.0	<1.0	<1.0	<1.0
	1/24/2006		6.77	4382.28	---	---	---	---	---	---	---
	2/1/2006		6.83	4382.22	---	---	---	---	---	---	---
	3/1/2006		7.30	4381.75	<0.50	---	<1.0	<1.0	<1.0	<1.0	1.2
	4/27/2006		Covered by Car		---	---	---	---	---	---	---
	5/31/2006		7.21	4381.84	---	---	---	---	---	---	---
	6/23/2006		7.69	4381.36	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	9/8/2006		8.73	4380.32	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	12/28/2006		9.51	4379.54	---	---	<1.0	<1.0	<1.0	<1.0	<1.0
	3/26/2007		10.46	4378.59	<0.50	---	<1.0	<1.0	<1.0	<1.0	2.6
	6/1/2007		9.75	4379.30	---	---	<1.0	<1.0	<1.0	<1.0	1.5
	9/7/2007		NM	---	NS	---	NS	NS	NS	NS	NS
	1/4/2008		NM	---	NS	---	NS	NS	NS	NS	NS
RW-1	8/13/1999	99.94	8.73	91.21	1.9	---	ND	ND	ND	ND	1,907
	2/15/2000		10.75	89.19	---	ND	ND	ND	ND	ND	6,360
	6/5/2000		10.09	89.85	4.3	---	ND	ND	ND	ND	4,328
	9/5/2000		10.15	89.79	4.55	---	ND	ND	ND	ND	4,544
	11/14/2000		10.36	89.58	1.1	---	ND	ND	ND	ND	1041.0
	2/20/2001		^20.62	79.32	0.69	---	<2.0	<2.0	<2.0	<2.0	682
	6/13/2001		10.10	89.84	1.42	---	<2.0	<2.0	<2.0	<2.0	1,415
	8/28/2001		9.41	90.53	2.07	---	3.4	<2.0	<2.0	<2.0	2067.0
	11/16/2001		10.10	89.84	0.69	---	<2.0	<2.0	<2.0	<2.0	684.0

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RW-1	3/6/2002		NA	NA	<0.05	---	<2.0	<2.0	<2.0	<2.0	403
Cont.	6/6/2002	4390.18	8.60	4381.58	1.20	---	<2.0	<2.0	<2.0	<2.0	1,200
	9/16/2002		10.00	4380.18	0.42	---	<2.0	<2.0	<2.0	<2.0	415
	12/30/2002		10.38	4379.80	0.26	---	<1.0	<1.0	<1.0	<1.0	259
	3/13/2003		10.54	4379.64	0.30	---	<2.0	<2.0	<2.0	<2.0	304
	4/22/2003		10.40	4379.78	NM	---	NM	NM	NM	NM	NM
	5/28/2003		10.91	4379.27	NM	---	NM	NM	NM	NM	NM
	6/20/2003		10.62	4379.56	<0.5	---	<1.0	<1.0	<1.0	<1.0	140
	7/31/2003		10.51	4379.67	NM	---	NM	NM	NM	NM	NM
	9/30/2003		10.54	4379.64	<0.05	---	<0.5	<0.5	<0.5	<0.5	93.5
	11/5/2003		10.85	4379.33	NM	---	NM	NM	NM	NM	NM
	12/18/2003		10.80	4379.38	0.32	---	<1.0	<1.0	<2.0	<1.0	318
	3/22/2004		10.43	4379.75	0.24	---	<1.0	<1.0	<2.0	<1.0	240
	6/3/2004		10.27	4379.91	<0.02	---	<1.0	<1.0	<2.0	<1.0	44.3
	9/30/2004		10.84	4379.34	0.102	---	<1.0	<1.0	<1.0	<1.0	102
	12/29/2004		10.78	4379.40	0.150	---	<1.0	<1.0	<2.0	<1.0	155
	3/23/2005		9.99	4380.19	0.132	---	<1.0	<1.0	<2.0	<1.0	132
	4/14/2005		10.06	4380.12	---	---	---	---	---	---	---
	5/27/2005		9.25	4380.93	---	---	---	---	---	---	---
	6/29/2005		9.56	4380.62	<0.50	---	1.8	<1.0	<1.0	<1.0	91
	7/25/2005		9.77	4380.41	---	---	---	---	---	---	---
	8/30/2005		10.15	4380.03	---	---	---	---	---	---	---
	9/26/2005		10.23	4379.95	<0.50	---	<1.0	<1.0	<1.0	<1.0	54
	10/31/2005		10.34	4379.84	---	---	---	---	---	---	---
	11/30/2005		10.51	4379.67	---	---	---	---	---	---	---
	12/29/2005		9.85	4380.33	<0.50	---	<1.0	<1.0	<1.0	<1.0	11
	1/24/2006		7.98	4382.20	---	---	---	---	---	---	---
	2/1/2006		8.29	4381.89	---	---	---	---	---	---	---
	3/1/2006		8.31	4381.87	<0.50	---	<1.0	<1.0	<1.0	<1.0	37
	4/27/2006		8.37	4381.81	---	---	---	---	---	---	---
	5/31/2006		8.05	4382.13	---	---	---	---	---	---	---
	6/23/2006		8.43	4381.75	---	---	<1.0	<1.0	<1.0	<1.0	53
	9/8/2006		9.50	4380.68	---	---	<1.0	<1.0	<1.0	<1.0	5.2
	12/28/2006		10.48	4379.70	---	---	<1.0	<1.0	<1.0	<1.0	11
	3/26/2007		11.42	4378.76	<0.50	---	<1.0	<1.0	<1.0	<1.0	49

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RW-1	6/1/2007		10.82	4379.36	---	---	<1.0	<1.0	<1.0	<1.0	46
Cont.	9/7/2007		10.77	4379.41	<0.50	---	<1.0	<1.0	<1.0	<1.0	23
	1/4/2008		**9.53**	**4380.65**	**<0.50**	---	**<1.0**	**<1.0**	**<1.0**	**<1.0**	**4**

MPE = Measuring Point Elevation
TPHg = Total Petroleum Hydrocarbons - gasoline
TPH-E = Total Petroleum Hydrocarbons - Extractable
--- = Not Analyzed
ND = Below Laboratory Detection Limits
**NS/*NM=Not Sampled, Not Monitored, vehicle parked over the well*
**4389.48=Estimation based on Surveyor's measurement from top of well cap*
**MW-8 well head modified after being buried by curb
^ Depth to water considered anomalous on this date; value appears to be 10 feet greater than actual depth.