INSTALLATION REPORT

HARVEY WELL REPLACEMENT

RW-1

Prepared for:

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1 INTRODUCTION

The Harry Allen Station (Station) is an existing power generating facility located approximately 25 miles northeast of Las Vegas, Nevada in Garnet Valley (Dry Lake Valley), Hydrographic Basin 216 (Site). Historically one source of water for the Station was the Harvey Well, located about three and one-half miles from the Station. The Harvey Well has aged since its installation in 1958, and its production decreased, due in part to a collapse of the well casing from corrosion. SRK Consulting (SRK) was retained to provide consulting services for the installation of a replacement for the damaged well.

Included in this well installation and testing report is general hydrogeologic information for Hidden (north) Valley, Hydrographic Basin 217 and Garnet Valley. The objective for including this information is to provide some context for comparing the performance of the replacement well with other wells in general site area. The site area is shown on Figure 1.

1.1 Background

Well logs were examined for wells in Garnet Valley (Dry Lake Valley) and Hidden Valley (North), Hydrographic Basins 216 and 217, respectively. The Nevada Division of Water Resources well log database was reviewed for T16S, T17S, and T18S in R63E and R64E to locate wells in the vicinity of the Site; Figure 1 shows the locations of selected wells. Well logs were selected for review on the basis of available information including proximity to the Site, well depth, water yield information, and depth to groundwater. Table 1 presents a summary of information from the well logs utilized in the evaluation.

As shown on Figure 1 the wells are located predominantly along the flanks of the valley where the Paleozoic carbonate rock can presumably be intercepted at shallower depths and fault zones provide enhanced hydraulic conductivity. The Harry Allen Exploratory Borehole was the only borehole located in the Dry Lake Valley basin.

The yields noted on the logs of wells shown on Table 1 range from less than 100 gpm (Georgia Pacific) to 550 gpm (Crystal Well No.1). Specific capacity for the wells ranges from 0.2 gpm/ft to 23.3 gpm/ft (Crystal Well No.1). Specific capacity decreases with

duration of pumping and increased discharge. The specific capacity decrease with pumping duration is related to drawdown and with increased discharge is related to turbulent losses. The Crystal Well No. 1 was completed in either a highly fractured or cavernous zone and screened in that interval. Well yield does not appear to correlate to well depth. The deepest well included in the inventory had one of the lowest specific capacities, but yielded 300 gpm due to the drawdown available.

1.2 Summary of Site Conditions

The Dry Lake Valley is bounded on the east by the Dry Lake Range and on the west by the Arrow Canyon Range. Muddy Creek Formation deposits underlie the Site to a depth of about 500 feet (1,568.6 ft. elevation). Near the mountain borders these sediments are coarse grained and grade toward the basin into regular beds of fine-grained sandstone, siltstone, and clay (Longwell, et al, 1965). The Dry Lake Range is composed predominantly of Paleozoic Callville Limestone (Longwell, et al, 1965). In the northern portion of the range the Muddy Creek Formation overlies the older formations (Longwell, et al, 1965). The Arrow Canyon Range is primarily Paleozoic carbonate rock.

Regional groundwater flow in the eastern Great Basin is controlled by thick Paleozoic carbonate aquifers. The distribution of the carbonate rocks is largely the result of structural extension and thinning of the sedimentary rock sections (Dettinger and Schaefer, 1996). The extension is related to low-angle normal faults and associated high-angle faults during the middle Tertiary period (Dettinger and Schaefer, 1996). The response to the extensional thinning varied from area to area with some areas developing a broken terrain and other areas a stable intact rock mass (Dettinger, 1992). Both Garnet and Hidden (north) Valleys are located in an area of stable terrain.

2 FIELD PROGRAM

The field program comprised drilling and setting surface casing, installation of conductor casing to seal off the Muddy Creek formation, drilling sufficient thickness of the limestone unit to ensure adequate well production, installation, development, and testing

of the replacement well. Details of these activities and the results of the well testing are presented in the sections that follow.

2.1 Drilling

Drilling commenced June 6, 2001 with installation of 40 feet of 30-inch diameter surface casing into a 48-inch diameter auger-drilled hole completed by Anderson Drilling, a local firm subcontracted by Layne-Christensen Drilling Company (Layne). Layne mobilized a Schramm TM200 drill rig, two water trucks, grout batch plant, a 20,000 gallon water tank, and field office trailer. Layne set up over the hole and began rotary drilling June 11, 2001 using flooded reverse circulation through dual wall drill pipe. Drill water was obtained from the adjacent Harvey Well using an electric submersible pump supplied and installed by Layne for that purpose. Drill cuttings were discharged through a cyclone and were collected and bagged by Layne personnel at five-foot intervals from a depth of 40 feet to the final drilled depth of 870 feet (1,198.6 ft. elevation).

The Muddy Creek formation was sealed off using 20-inch diameter welded Roscoe Moss high-strength, low alloy steel conductor casing installed to 500 feet (near the top of the limestone unit) in a 28-inch diameter borehole. The casing was cemented into place with a neat cement grout displacement-pumped into the annulus using a 1.5-inch diameter tremmie pipe.

A 17.5-inch hole was then advanced into the limestone unit to final depth. Though the final depth was targeted at 900 feet (1,998.6 ft. elevation), drilling was terminated at 870 feet when a sudden and complete loss of drilling fluid indicated contact with an interval of highly transmissive limestone. Final depth of drilling was reached June 17, 2001. Downhole caliper and electrical resistance geophysical logs were run by Southwest Geophysical Services. A notable feature on the logs is the caliper trace showing a borehole diameter to 25 inches between 830 feet (1,138.6 ft. elevation) and 870 feet (1,198.6 ft. elevation). The smooth sidewall of the hole in this zone of highest water production may suggest the presence of a limestone dissolution cavity. The drill string did not drop when this zone was intercepted, suggesting that if the feature is a cavity, it is at least partially filled with sediments.

A "geolograph" drill-rate log was maintained by Layne and provided to SRK. Drilling rates averaged approximately 20.5 ft/hr through the Muddy Creek formation while drilling the 28-inch diameter hole, and approximately 13.6 ft/hr through the limestone unit while drilling the 17.5-inch hole.

Borehole alignment was checked five times during drilling using downhole photographic deviation surveys. The results showed the borehole deviated very little with only one of the readings, at 0.5^{o}, off vertical. The average over the 870-foot depth is 0.13^{o}, which equates to a horizontal deviation of less than two feet at the bottom of the hole. The values are included on the borehole and well construction log in Appendix A.

Sediments or rock chips representative of the sample interval were collected from the bagged samples and were washed and placed in chip trays. The lithologic characteristics of the sediments and rock chips were recorded in the field by the SRK hydrogeologist. Those data along with drilling rate, the geophysical logs, zones of fracturing and drill fluid loss recorded by the Layne driller, and well construction details were compiled to create the borehole and well construction log presented in Appendix A.

2.2 Well Installation

The production casing was installed into the hole to a bottom depth of 833 feet (1,235.6 ft. elevation). A blockage, described by Layne site supervisors as a hard and solid blockage, rather than a gradational impingement from a squeezed hole, prevented the well casing from reaching the 870-foot drilled depth. It was decided to set the well at that depth rather than risk damage to the screen by pushing from the surface, or risk further disrupting the borehole wall by removing the well string and clearing the hole by re-drilling. Layne and SRK considered that the sufficient water production had been intercepted above that depth to supply the design rate of 300 to 500 gpm.

The blank well casing and screen manufactured by Roscoe Moss Company, have an inside diameter of 12 inches and a wall thickness of 0.3125-inches ($5/16^{ths}$ of an inch). The production casing is a high-strength, low-alloy steel conforming to the requirements of ASTM A 606 Type 4. The blank casing was provided in 40-foot lengths, and the

screen, in 20-foot lengths. The ends of both were factory-beveled to accommodate welding during well construction. The screen is of the louvered type with an aperture size of 0.094 inch (3/32nd of an inch) having 120 openings per lineal foot, and an open area of 28.5 square inches per linear foot. A steel bottom plug was welded to the base of the screen.

A 1.5-inch diameter steel sounding tube was installed into the borehole to a depth of 740 feet (1,328.6 ft. elevation) to allow monitoring of water levels during test and future production pumping. The bottom 100 feet (640 – 740 feet in depth) of the tube is slotted. Water level measurements are less impacted by turbulent well losses than measurements from the well bore, and can provide the opportunity during testing to separate well performance from aquifer responses. The sounding tube also provides an effective means for assessing changes in performance as the well ages.

A washed 0.125"– 0.25" sub-angular to sub-rounded gravel pack predominantly comprise of silica was placed into the annulus from 870 feet to 60 feet below ground surface. The gravel pack was poured with water into the annular space between the 20-inch conductor and 12-inch production casing while simultaneously pumping water out of the well bore, thereby creating a smooth downward flow of the material. Sodium hypochlorite (a powdered chlorine compound) was added to the pour to breakdown the polymer drilling fluid additive, and to sanitize the well. The sodium hypochlorite was added at a rate of approximately one gallon of powder per cubic yard of gravel, with a total addition of approximately 30 pounds. A summary of drilling and well materials is presented on Table 2.

2.3 Well Development

Development of the well was done in two phases. The first involved surging by lifting and lowering the drill pipe fitted with a rubber disk-type surge block to create a piston action in the well. The action rapidly moves water in and out of the screen section being surged. The block was repeatedly raised and lowered the maximum 40-foot travel of the drive head in the rig mast. The sediment-laden water generated during block surging was continuously airlifted out of the well. The dual wall drill rods was used as an eductor to

pump air down the annulus between the two pipes, and lift water out the center pipe. The surging and airlifting progressed upward from the bottom to the top of the 270 feet of well screen, and continued with a given interval until the sediment load in the discharge water decreased appreciably. Water was discharged through the cuttings cyclone and into the mud pit. The first phase of development was completed in 30 hrs; after which the drill rig was moved off the well. Table 3 presents the durations and estimated volumes of water discharged during well development, as well as during the subsequent aquifer pumping test.

The second phase of development utilized the aquifer test pump. A 14-stage turbine line-shaft test pump, manufactured by Simflo (model SW10C) was provided and installed by Layne. The pump was driven at the surface by a 510 hp diesel engine linked to the pump shaft via a gearbox installed at the well head (see photo on Plate E-5, Appendix E). An 8-inch diameter pipe conveyed the pumped water approximately 400 feet to a surface water drainage. Figure 2 illustrates the conditions of water discharge and drainage during development and aquifer testing.

A gate valve on the discharge line controlled discharge rate. An orfice plate having a six-inch diameter opening fitted to the eight-inch diameter discharge pipe was the primary means to measure flow rate (photo on Plate E-6, Appendix E). That configuration can measure flow between approximately 300 and 1,300 gpm with an accuracy of $\pm$2% (Driscoll, 1986). A sight-tube manometer was used to manually record the 10 to 70 inches of back-pressure produced by the orfice plate. Published orfice tables were used to convert the pressures to flow rate. In addition to the manual sight-tube measurements, back-pressure data were digitally recorded at five-minute intervals with a 10-psi transducer was plumbed into the sight tube. Two inline totalizing flow meters were used to confirm the orfice plate data (photo on Plate E-5, Appendix E).

Development pumping progressed incrementally from an initial rate of 150 gpm to a final rate of 1,600 gpm, the maximum output of the pump (Table 3). If an increase in turbidity was noticed when the rate was increased, the pump was cycled on and off (15 – 30 seconds off, several minutes on) to create a surging action with which to remove residual

fine-grained sediments adhered to the screen and gravel pack. The pump cycling continued until no increase in turbidity was noted. No cycling was necessary at 1,325 gpm and above. Duration at a given rate depended on the turbidity of the discharge water, and ranged between 18 and 109 minutes. Development pumping was terminated after 7.5 hours.

2.4 Aquifer Testing

Pumping started the morning of June 30, 2001 with a three-rate step test with which to evaluate performance of the well. The third rate was held constant for an extended period to evaluate aquifer hydraulic characteristics. The pump was stopped the morning of July 3, 2001. Recovery was monitored through mid-day July 6th.

Data collection included water level and pump rate monitoring in RW-1, and monitoring water levels in the Harvey Well and Nevada Power's Crystal Well South. The Harvey Well is located 254 feet from RW-1, and Crystal Well No. 1 is about two miles distant. Both wells are installed into the limestone aquifer, and served as observation points to evaluate the extent of influence from pumping. Water levels were monitored using data acquisition systems (DASs) that recorded changes in water level sensed by pressure transducers installed to below the pre-test static water levels in the wells. Readings were recorded at one or two minute intervals throughout the pumping and recovery periods. Confirmatory manual depth to water measurements were taken periodically and recorded on field data forms. Summary plots of the test data from the DASs are presented on Figures 3 and 4.

2.5 Step Discharge

The step test was conducted at the progressively higher flow rates of 575 gpm, 862 gpm, and 1,321.6 gpm. Each step was maintained until water levels stabilized in the well bore and gravel pack. The durations for the first two steps were 190 minutes and 170 minutes. The duration for the third step was 3,970 minutes (66.2 hours). Though much longer than needed for a step test analysis, the third step was extended to serve as the longer-term constant rate portion of the testing program. In total, pumping lasted 4,330 minutes (72.2 hours).

2.6 Constant Discharge

The discharge rate for the longer-term third step varied between 1,299.4 gpm and 1,330.4 gpm, corresponding to 2.3% variation. Only minor adjustments of the discharge valve were required. The test was monitored around the clock by Layne personnel, with daily supervision by the SRK senior hydrogeologist. The DAS instruments were downloaded each day to secure the data already collected. Manual data were collected to SRK requirements and recorded on field data forms by Layne personnel .

Maximum drawdown in the RW-1 was 24.1 feet in the well bore, and 11.9 feet in the gravel pack. The maximum drawdown in the Harvey Well was 1.1 feet. Evident in the data from that well is a 0.2 to 0.3-foot diurnal variation thought to result from external influences such as lunar-induced earth tides, a phenomenon that can produce water level fluctuations in highly confined aquifers (Figure 4).

The Crystal Well No. 1, at a distance of about two miles from RW-1, showed no discernible influence from the pumping. A similar but smaller (0.1-foot) diurnal variation to that in the Harvey Well is seen in the data from Crystal Well No. 1.

As can be seen on Figure 3, DAS data for the RW-1 well bore and the orfice plate manometer transducers exhibit high frequency fluctuations. Because manual measurements from the well bore and orfice plate sight tube were stable and repeatable, the variations are considered random noise from electrical interference on transducer cable or data logger circuitry and/or pump shaft vibrations. The affected DAS data were smoothed using running averages.

Water levels recovered rapidly following shutdown of the pump. The level in the RW-1 well bore recovered to its pre-test static level in about three minutes. In the gravel pack the water level recovered to within one foot of its pre-test static level within five minutes, and was fully recovered in five hours. The Harvey Well recovered in about two hours. The rapidity of the recovery is indicative of the high transmissivity of the limestone aquifer. Also contributing to the rapidity of recovery was the drainage of the pump riser pipe and the siphoning of at least a portion of the surface conveyance pipe, owing to the lack of a downhole check valve. The rate at which a pumped well recovers is also

affected by well efficiency. This factor is illustrated by comparing the duration of recovery of the Harvey Well with one foot of drawdown, to that of RW-1, with 32 feet of drawdown.

3 ANALYSIS AND INTERPRETATION

3.1 Aquifer Characteristics

The shape of the plotted drawdown data from RW-1 can provide insight into certain hydraulic characteristics of the carbonate aquifer. For example, the slight and consistent increase in drawdown in the pumped well during the 66 hours of pumping at a constant rate indicates that there is no measurable vertical leakage from the overlying Muddy Creek formation. The consistent trend of the drawdown also suggests that there is no evidence of boundaries that limit the extent of the aquifer in the immediate area of the well.

The test data downloaded from the DAS instruments were compiled into Excel spreadsheets, and conditioned for analysis by calculating elapsed time and drawdown from clock time and pressure head on the transducers. The smoothing of the noise in the data from the orfice plate manometer and the RW-1 well bore was also part of the conditioning.

Analyses were performed using the Aqtesolv software program. Several analytical methods were applied to explore the factors that control the flow system within the carbonate aquifer. The influence of vertical leakage from the overlying Muddy Creek formation was evaluated with the Hantush solution for leaky confined conditions. The analysis showed no influence on drawdown from leakage. In addition, analytical techniques developed by Moench and Gringarten & Witherspoon (Kruseman and de Ridder, 1991) for analysis of test data from sparsely fractured aquifers were evaluated. No acceptable fit to the data was evident using those solutions, suggesting that the flow system in the carbonate aquifer is a significantly interconnected network of fractures, voids and fault zones. The Theis solution modified for changes in well efficiency during

step tests applied to the drawdown data, and the Theis residual drawdown recovery solution was used to analyze recovery data.

Plots of the analyses are presented on Figures 5, 6, and 7, and the results summarized on Table 4. Values calculated for transmissivity range between 64,000 ft^2/day and 530,000 ft^2/day. The broad range in values is likely a result of aquifer discharge to the well being concentrated in discrete zones which creates excessive entrance velocities and large turbulent losses through the well screen adjacent to those zones. In terms of aquifer storage, values calculated for the coefficient of storage range between 0.00015 and 0.0068, supporting the evidence that the aquifer is a confined flow system.

In summary, the carbonate aquifer yields water from fractures and dissolution features. As such, production capacity of the aquifer is controlled by discrete transmissive features and is highly dependent on the location and depth of a supply well; a characteristic illustrated by the large variation in well production throughout Dry Valley. The values calculated for transmissivity and storage are within the range of values reported in literature for the carbonate aquifers of southern Nevada (Dettinger, 1995). Based on a static water level above the top of aquifer, the lack of evidence for vertical leakage, and on the values for the coefficient of storage it can be concluded that the carbonate aquifer at RW-1 is hydraulically confined. This is consistent with the presence of the clay confining unit overlying the aquifer.

3.2 Well Efficiency and Well Performance

The relationship of specific capacity to pumping rate was determined using the Hantush-Biershenk step test analytical method (Kruseman and de Ridder, 1992). The method is based on using the specific capacities calculated from each of the stepped rates to generate a linear regression equation for specific capacity. The method applies the general equation of the form $y = mx + b$ to estimate parameters of linear head losses in the aquifer and the non-linear losses from the turbulence of water entering the well. The Hantush-Biershenk solution equates the y-intercept b to the linear aquifer response to pumping parameter B, and the slope m to the non-linear well loss parameter C. The coefficients y and x equate to the measured values of specific capacity for a given

pumped rate. As shown of the regression plot in Figure 8, the regression analysis yielded correlation coefficients (R^2) of 0.981 and 0.978 for the well bore and gravel pack, respectively. Given the good regression fits, the method can be considered appropriate for use in predicting the performance of RW-1.

The difference in specific capacity between the well bore and gravel pack are to be interpreted with care. As mentioned in Section 2.1, the great majority of water is produced from two discrete zones. One occurs at a depth of 750 to 760 feet (1,308.6 to 1,318.6 ft. elevation), and the other at approximately 830 to 870 feet (1,198.6 ft. to 1,238.6 ft. elevation). Of the two, the deeper zone was significantly more productive based on the sudden loss of fluid circulation at 870 feet. With the base of the well at 833 feet (1,235.6 ft. elevation), the screen is adjacent to the upper of the two production zones and just intercepted the lower zone. Consequently water produced by the lower zone must travel upward through the gravel pack to enter the well. Furthermore, that water likely enters the well in the lower-most part of the screen, creating turbulent losses from flow convergence and high screen entrance velocities. This condition could lower well efficiency. Figure 9 presents a plot of the predicted drawdown in RW-1 as a function of pumping rate. As can be seen, the well is capable of yielding 1,500 gpm with a drawdown of about 32 feet in the well. At pumping rates greater than 1,500 gpm the predicted drawdown in the well increases rapidly. Though this represents a dramatic loss of efficiency at the highest possible production rates for a 12-inch well, it is not viewed as a limitation on the well given that the well can produce 1,000 gpm to 1,500 gpm with minimal drawdown. These rates are two to three times higher than the original goal for well.

3.3 Water Quality

During well development and test pumping the specific conductance of the discharge water was monitored for a general indication of the overall groundwater quality (Table 5). The specific conductance values for water from the Harvey Well in 1997, 1998, and during the current drilling program are shown for comparison. The data for RW-1 show that as the well was developed and test pumped water quality improved with the specific conductance stabilizing in the 1410 to 1450 µS/cm range.

Groundwater samples were collected from RW-1 on July 2, 2001, during the second day of the constant rate discharge test and submitted to NEL Laboratories for analysis. The analyses consisted of major cations and anions; drinking water standards for metals and inorganic non-metals; and coliform bacteria. The laboratory analytical report is provided in Appendix C. The analyses are summarized in Table 6. The TDS of the groundwater was 836 mg/L, sulfate was 350 mg/L, and chloride was 170 mg/L; secondary drinking water standards in Nevada for these constituents are 1000, 500, and 400 mg/L, respectively. Arsenic was 0.029 mg/L compared to a standard of 0.05 mg/l; iron was 0.23 compared to a standard of 0.6; and fluoride was 2 mg/L compared to a standard of 4 mg/L. In terms of physical parameters color was 0 and odor was ND. Total coliform was 5.1 MPN and E. Coli was "Absent" (<1.1 MPN). The presence of a low level total coliform would appear to indicate that some portion of the system (well, pump, or discharge line) was not completely disinfected.

Groundwater chemistry type was determined by plotting the inorganic data in the Piper Trilinear diagram shown in Figure 10. The data are plotted as percentage reacting values of the major cation species (Na^+, K^+, Ca^{2+}, and Mg^{2+}) and anion species (Cl^-, HCO_3^-, CO_3^{2-}, and SO_4^{2-}). As can be seen on the diagram, groundwater at RW-1 has a similar water chemistry to other wells in Dry Lake Valley installed into the regional carbonate aquifer. Although, no single cation-anion pair predominates, the groundwater in the carbonate aquifer is of a calcium sulfate type.

4 RECOMMENDATIONS

- SRK recommends that long-term pumping rate of RW-1 be maintained at or below 1,500 gpm. RW-1 is a highly productive well that can produce 1,500 gpm with an estimated 32 feet of drawdown in the wellbore. Well losses increase significantly at pumping rates higher than that.

- Water levels while the well is in operation should be monitored on a long-term basis to track well and aquifer performance.

5 REFERENCES

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Tables

Table 2.

Summary of Drilling and Well Construction

	Depth to Top (ft)	Depth to Bottom (ft)	Comments
Borehole			
48 inches	0	40	Drilled by auger method
28 inches	40	507	Drilled by flooded reverse circulation
17.5 inches	507	870	Drilled by flooded reverse circulation
Casing			
30 inches	0	40	Mild steel, welded joints
20 inches	0	499	High strength, low alloy, welded joints
12 inches	0	553	High strength, low alloy, welded joints
Well Screen			
12 inches	553	833	0.094" louvered slots, 120 louvers/ft, 29.5 sq-in/ft open area, "FulFlo" design.
Access Tube			
1.5 inches - blank tubing	0	640	Installed into gravel pack outside of well casing.
1.5 inches - slotted	640	700	machine-cut slots of approx. 0.020". Welded bottom cap.
Gravel Pack			
1/8" - 1/4"	60	870	Washed subrounded predominantely silica pea gravel from Marysville CA
Cement Seal			
Between 20" and 30" casing	0	507	Portland Type II mixed at 6 gallons / 94 pounds, tremmie pumped.

Table 3.

Well Production During Well Development and Aquifer Testing

Activity and Date	Duration of Discharge (minutes)	(hours)	(days)	Average Discharge Rate (gpm)	Discharge Volume (gallons)	(ac-ft)
Surge/Airlift Development						
6/19/01	1,020	17.00	0.71	70.0	71,400	0.22
6/20/01	780	13.00	0.54	93.0	72,540	0.22
Subtotals:	1,800	30.00	1.25	80.0	143,940	0.44
Pumping Development						
6/29/01	89	1.52	0.06	155	13,756	0.04
	28	0.48	0.02	263	7,430	0.02
	96	1.62	0.07	513	48,992	0.15
	36	0.62	0.03	820	29,110	0.09
	109	1.83	0.08	1138	123,473	0.38
	46	0.78	0.03	1325	61,281	0.19
	18	0.30	0.01	1500	27,000	0.08
	25	0.42	0.02	1600	40,000	0.12
Subtotals:	446	7.43	0.31	787	351,042	1.08
Stepped Aquifer Test						
6/30/01	836	13.93	0.58	1,115.2	932,307	2.86
7/1/01	1,440	24.00	1.00	1,322.4	1,904,256	5.84
7/2/01	1,440	24.00	1.00	1,318.2	1,898,208	5.83
7/3/01	614	10.23	0.43	1,330.2	816,743	2.51
Subtotals:	4,330	72.17	3.01	1,282.1	5,551,514	17.04
Grand Totals:	**6,576**	**109.60**	**4.57**	**919.5**	**6,046,496**	**18.56**

Note:

Duration of discharge during Pumping Development adjusted downward by 8 minutes to account for non-pumping time. Total elapsed clock time was 454 minutes.

Table 1.
Summary of Permitted Wells in the Dry Lake Valley

Well Owner	Total Depth (feet)	Elevation (feet, msl)	Depth to Water (feet)	Water Level Elevation (feet, msl)	Specific Capacity / Reported Pumping Rate
Dry Lake Water Co.	2,480	2,704	882	1,822	0.3 gpm/ft @ 336 hrs.; Yield – 300 gpm
Dry Lake Water Co.	1,400	2,522	888	1,634	
Harry Allen Exploratory Borehole	1,275	2,093	279	1,814	
U. S. Lime	712	2,280			Well bailed dry at 3 hours; well abandoned
Western Gypsum	725	2,187	377	1,810	
U. S. Lime	500	2,150	338	1,812	2.5 gpm/ft @ 8 hrs.; Yield – 96 gpm
Kerr McGee	1,145	2,415	578	1,837	9.5 gpm/ft @ 48 hrs.; Yield – 200 gpm
Chemical Lime	860	2,300	471	1,829	
Georgia Pacific	1,205	2,480	660	1,820	Yield – 72 gpm @ 24 hrs.
Georgia Pacific	960		608		Yield – 130 gpm @ 72 hrs.
Georgia Pacific	1,598		606		14 gpm/ft @ 4 hrs.; Yield – 140 gpm
Crystal Well No. 1	565	2,045	230	1,815	23.3 gpm/ft @ 43 hrs.; Max. pumping rate about 550 gpm
Crystal Well No. 2	497	2,080	256	1,824	1.5 gpm/ft @24 hrs.; Max. pumping rate about 300 gpm
Harvey Well	575	2,080	260	1,820	
Great Star Cement	736	2,200	485	1,715	
U. S. Lime	600	2,060	230	1,830	0.2 gpm/ft; Yield – 110 gpm
Silver State Disposal	720	2,167	405	1,762	

Note: Elevation interpolated from topographic map

Table 4.
Summary of Aquifer Test Analyses

Well	Type of Analysis	Depth of Well (ft)	Screen Interval (ft)	Distance from RW-1 (ft)	Pre-Test Depth to Water (ft)	Maximum Drawdown (ft)	Trans-missivity (ft2/day)	Storage Coefficient
RW-1 Gravelpack	Theis Step Test	870	553 - 833	---	256	11.9	5.30E+05	2.2E-04
RW-1 Gravelpack	Theis Recovery	871	553 - 833	---	256	---	4.10E+05	---
RW-1 Wellbore	Theis Step Test	853	553 - 833	---	256.4	24.1	6.40E+04	6.8E-04
Harvey Well	Theis Step Test	575	510 - 575	254	254	1.1	3.3.E+05	1.50E-05
Harvey Well	Theis Recovery	575	510 - 575	254	254	---	4.1E+05	---
Crystal Well South	---	497	442 - 492	+/- 2 miles	255	<0.1	---	---

Notes:

Pumping rates were stepped at 575 gpm, 862 gpm, and 1,325 gpm. Total pumping duration was 4,330 minutes.

Harvey Well corroded and partially collapsed at 440 ft bgs

No pumping influence detected at Crystal Well South

Table 5.

Specific Conductance and pH Values from Harvey Well and RW-1

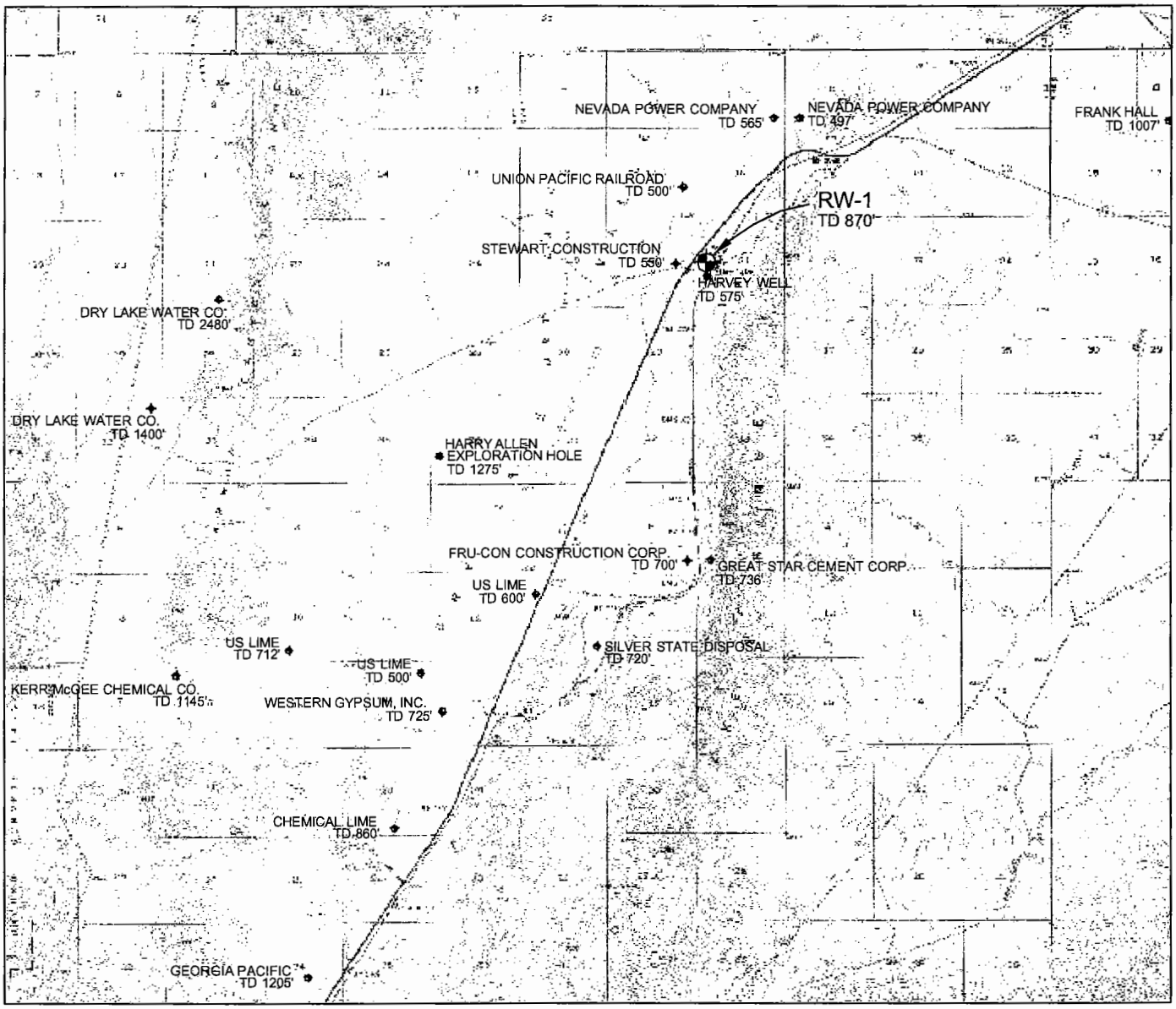
Well / Activity	Date	Time	Specific Conducance (µS/cm)	pH
Harvey Well				
Historical Values				
	1/24/97		1560	7.55
	6/24/98		1415	7.32
Drill Water				
	6/16/01		1433	
	6/17/01		1460	
RW-1				
Airlift Development/Surging				
	6/19/01	9:00	1697	
		10:00	1720	
		11:00	1673	
		12:15	1681	
		13:30	1669	
		17:00	1645	
		18:30	1651	
		19:20	1655	
		20:20	1656	
		22:30	1661	
	6/20/01	9:00	1592	
		10:30	1602	
		15:15	1565	
		15:45	1570	
Development Pumping (pump on @ 08:07hrs)				
	6/29/01	8:30	1532	6.73
		9:55	1521	7.16
		11:10	1504	7.16
		12:45	1488	7.37
		15:35	1450	7.32
Pumping Test (pump on @ 10:40)				
	6/30/01	21:50	1441	7.63
	7/1/01	10:30	1434	7.38
		19:50	1453	7.17
	7/2/01	7:20	1427	7.19
		19:05	1411	7.14
	7/3/01	8:43	1424	7.28

Table 6.

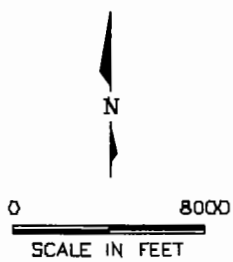
Water Quality for RW-1 and Selected Wells in Dry Lake Valley

Analyte	**RW-1**	Harvey Well	Georgia Pacific	Kerr McGee	Chemical Lime Company
Date Sampled	**7/2/01**	1/24/97	2/15/89	2/1/94	7/20/95
		(values in mg/L unless noted)			
Calcium	**100**	126	124	106	122
Magnesium	**49**	42	47	53	46
Sodium	**120**	110	136	141	130
Potassium	**14**		15	13	15
Iron as Fe	**0.23**		0.47	0.65	0.03
Bicarbonate	**146**	200	220	220	229
Carbonate		0	0	0	0
Chloride	**170**	172	187	205	176
Fluoride	**2.3**		1.48	1.47	1.5
Nitrate	**ND**	0.0	0.2	3.30	0.4
Sulfate	**350**	443	374	336	348
Silica		21	22	18	24
pH (S.U.)	**7.75**	7.55	7.94	8.09	7.75
TDS	**836**	1,100	1080	1062	1037
Specific Conductivity (µS/cm)	**1427**	1,560	1,595	1,588	1496
Total Hardness	**452**	168	503	483	494
Alkalinity	**170**	164	180		

Figures



BASE MAP: DRY LAKE, NEVADA 15' QUAD (1952)



LEGEND

US LIME
TD 338' ◆ WELL LOCATION SHOWING OWNER AND TOTAL DEPTH

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Figure 1

Site Location and
Permitted Well in the Vicinity

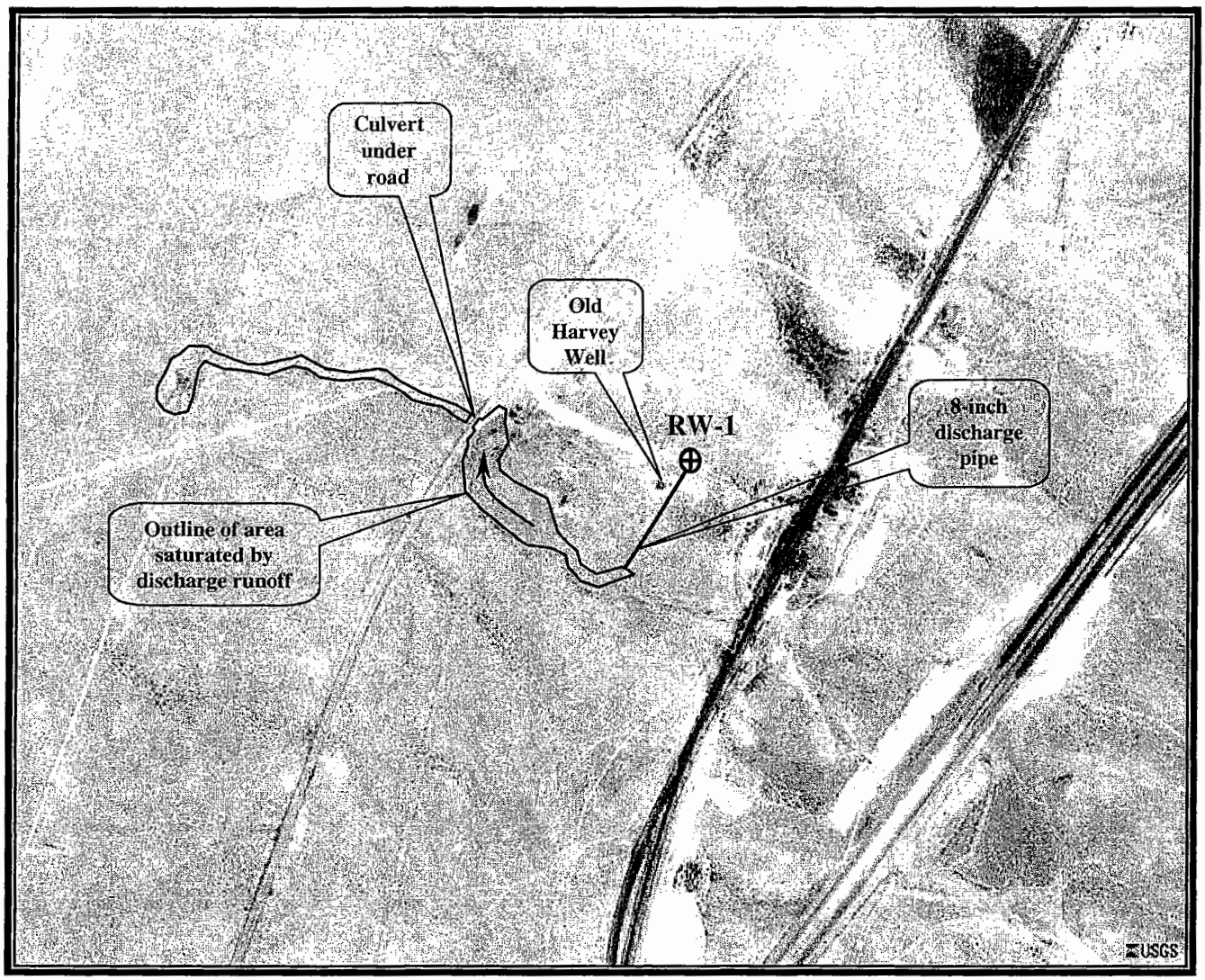

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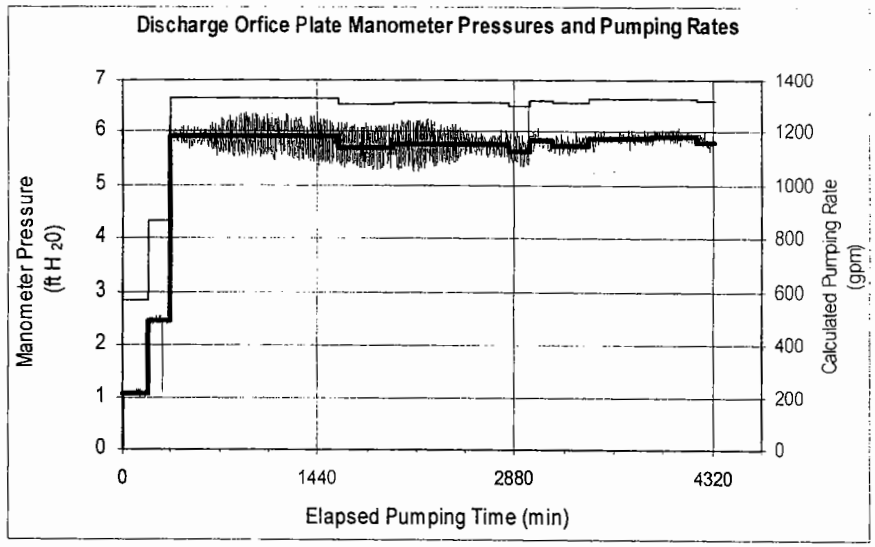
Figure 2.

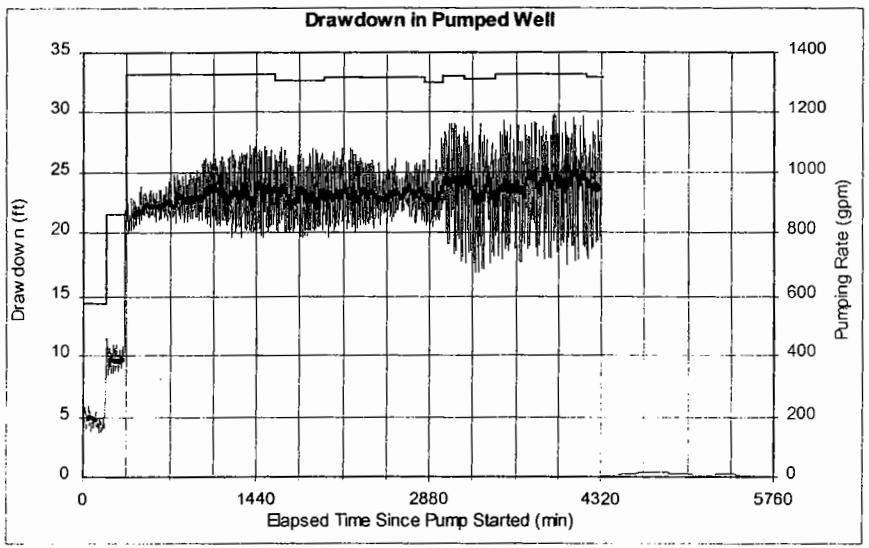
Air Photo Showing Site Conditions During Aquifer Pumping Test

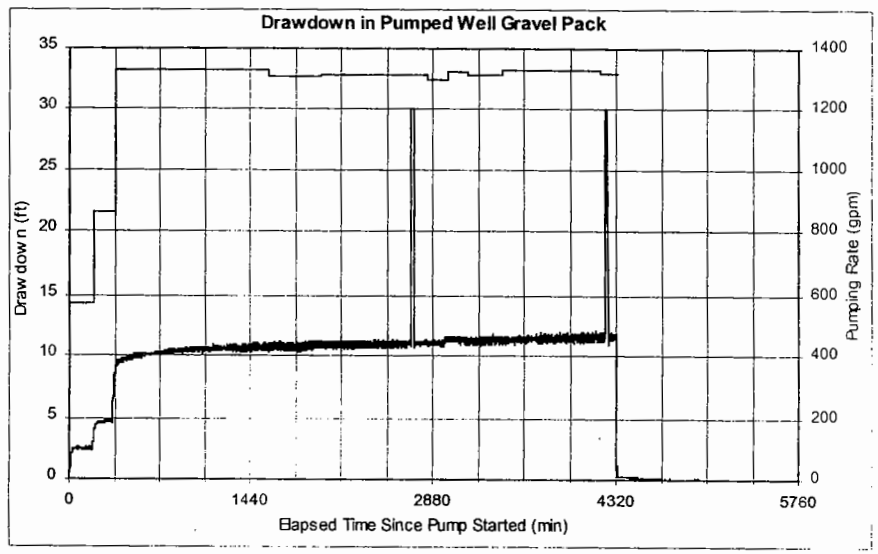
Pumping Rates Used in Test Analyses

Manometer from Transducer		Elapsed Pumping Time (min)		GPM
feet	inches	Start	End	
1.06	12.72	0	190	575.0
2.47	29.64	190	360	862.0
5.89	70.68	360	1592	1330.4
5.70	68.40	1592	2000	1309.0
5.75	69.00	2000	2840	1315.0
5.62	67.44	2840	2996	1299.4
5.82	69.84	2996	3164	1322.4
5.74	68.88	3164	3425	1313.8
5.86	70.32	3425	3876	1327.2
5.89	70.68	3876	4200	1330.4
5.80	69.60	4200	4330	1320.0

Notes:
Maximum pumping rate variation during the extended higher rate portion of the test was 2.3%.







Note:

Data for drawdown in pumped well and orfice plate manometer are smoothed (heavy line) to decrease electronic noise interference in readings.

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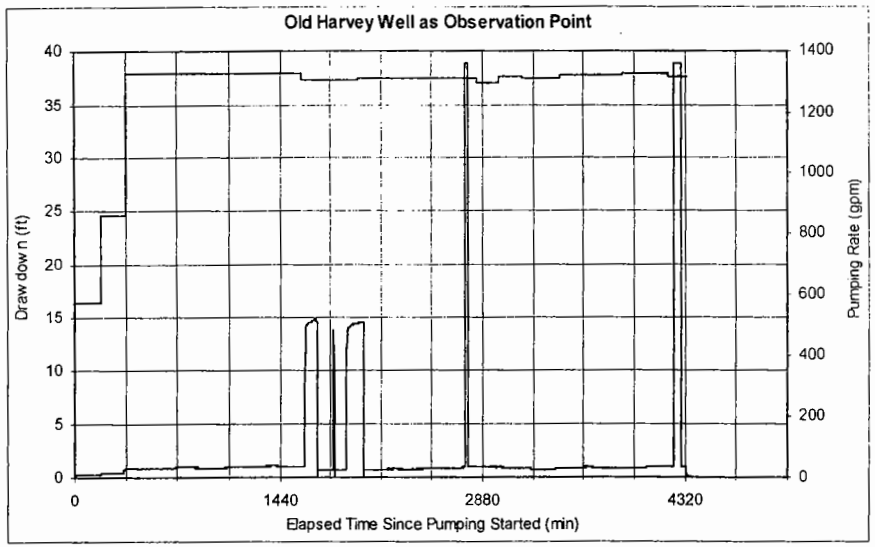
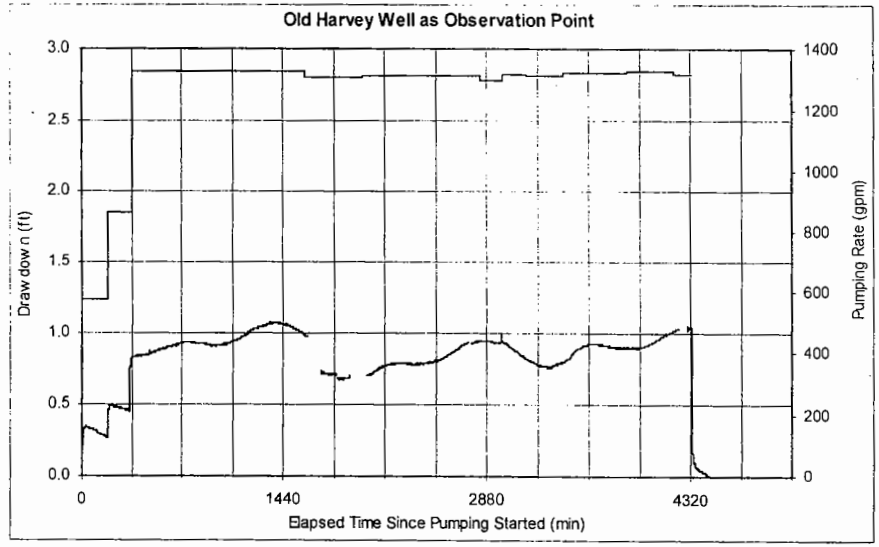
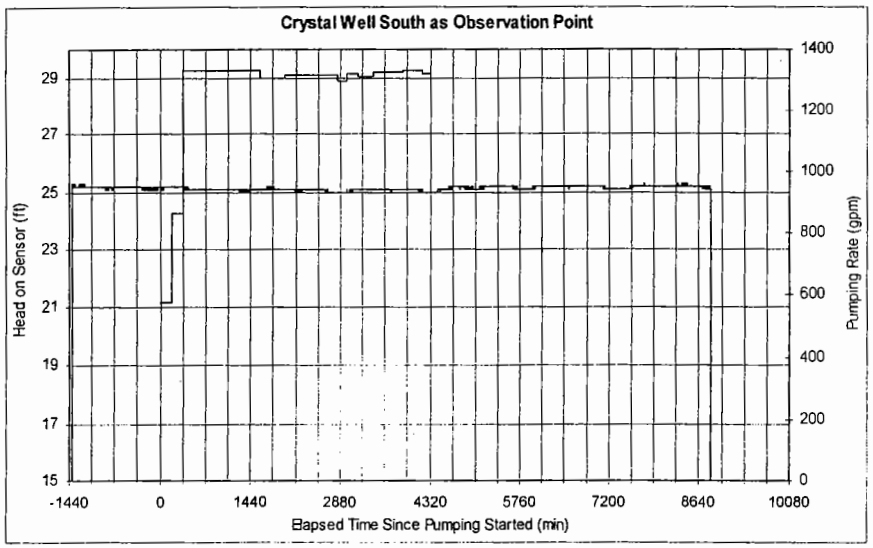
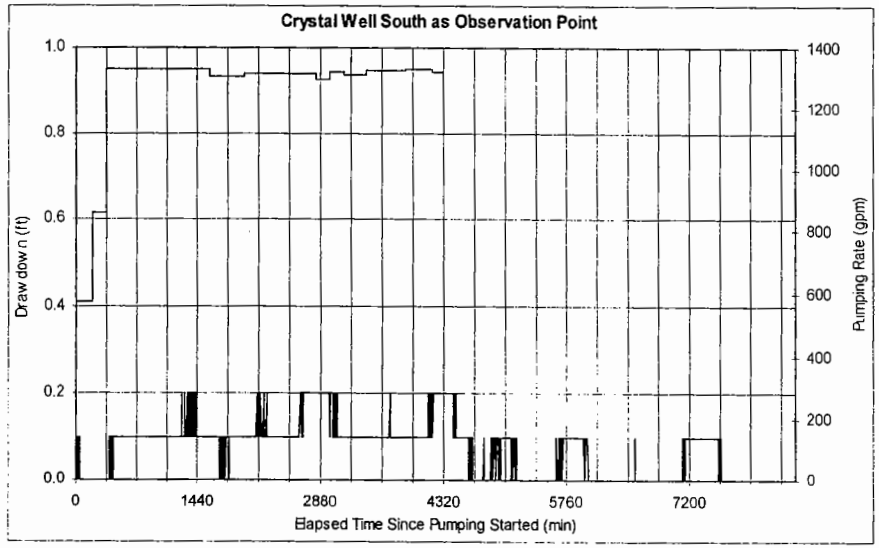
FIGURE 3

Test Summary Plots for RW-1









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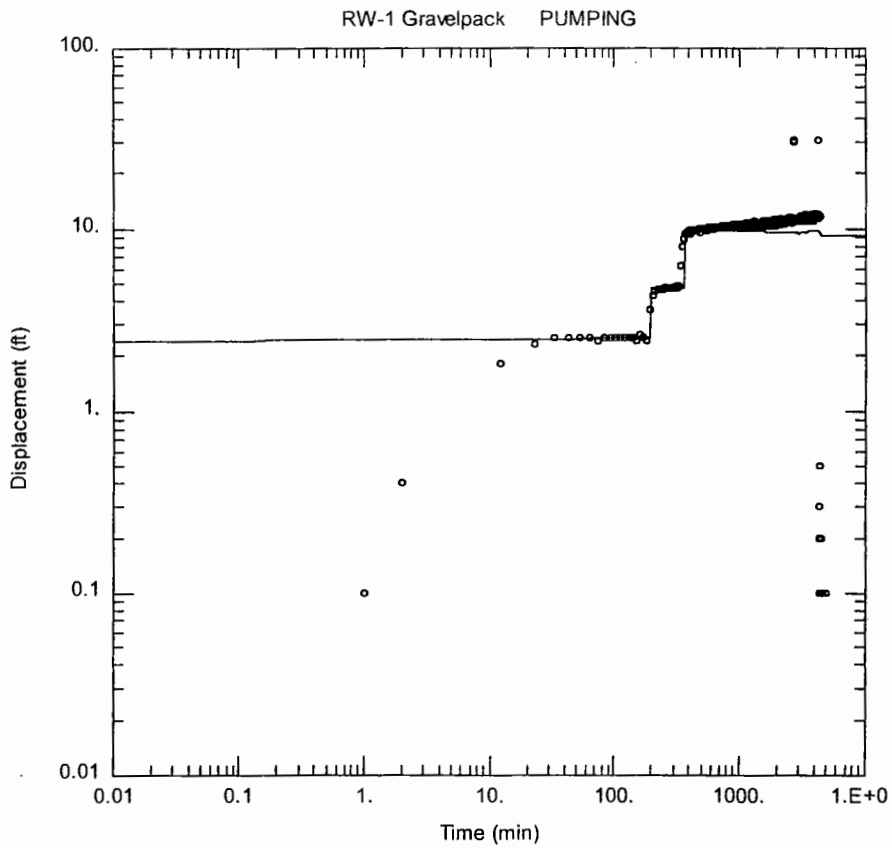
PROJECT NO.	DATE	REVISION
137901	Sept. 2001	2.0

FIGURE 4

Test Summary Plots for Harvey Well and Crystal Well No. 1



Obs. Wells

° RW1 ObsGvl

Aquifer Model

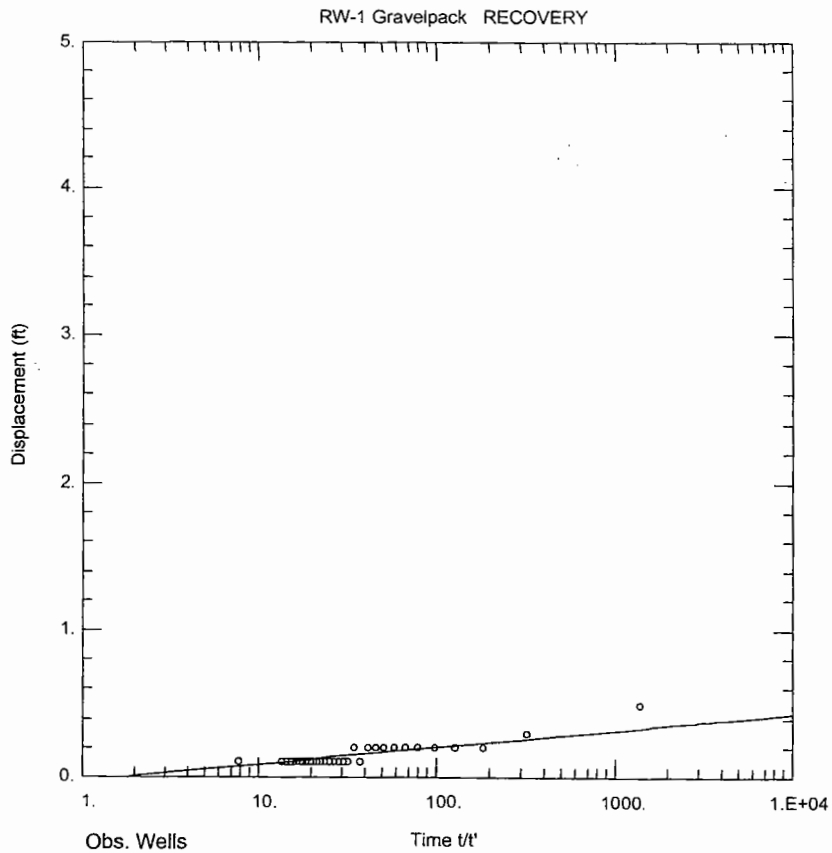
Confined

Solution

Theis (Step Test)

Parameters

T = 1.334E+06ft^2/day
S = 0.0002297
Sw = -5.
C = 0.0017min^2/ft^5
P = 1.664



Obs. Wells

° RW1 ObsGvl

Aquifer Model

Confined

Solution

Theis (Recovery)

Parameters

T = 4.048E+05 ft^2/day
S' = 1.836

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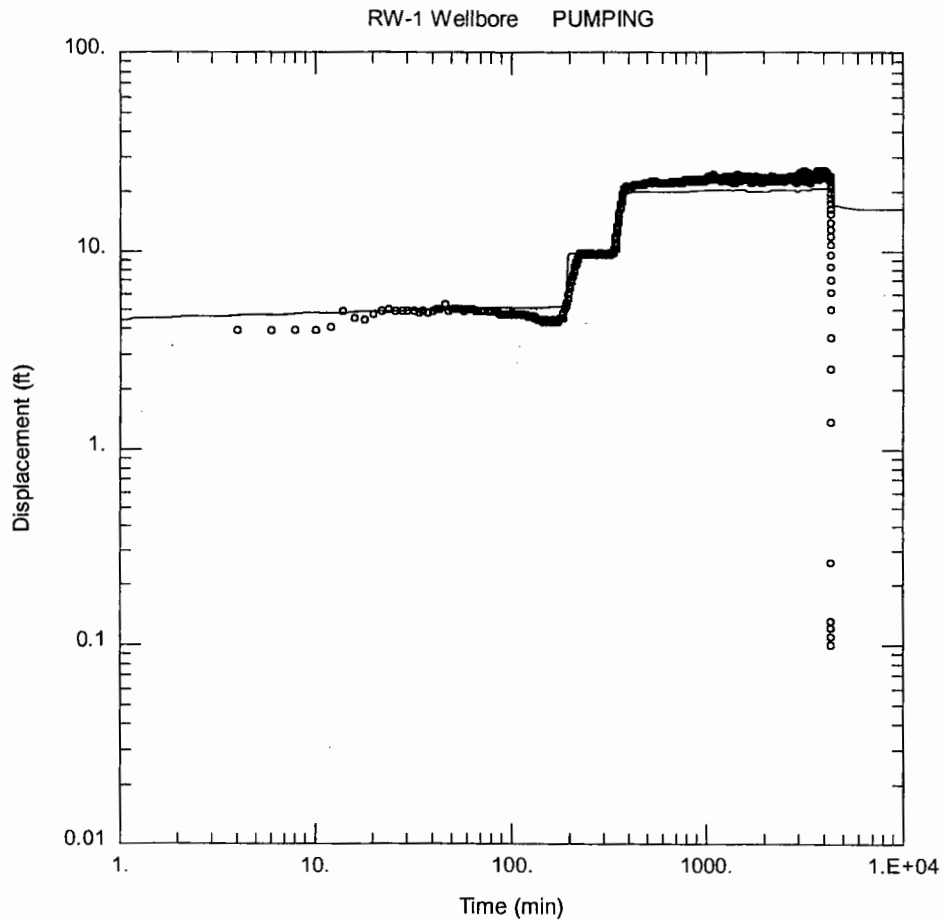
FIGURE 5

Theis Analysis of RW-1 Gravelpack Test Data



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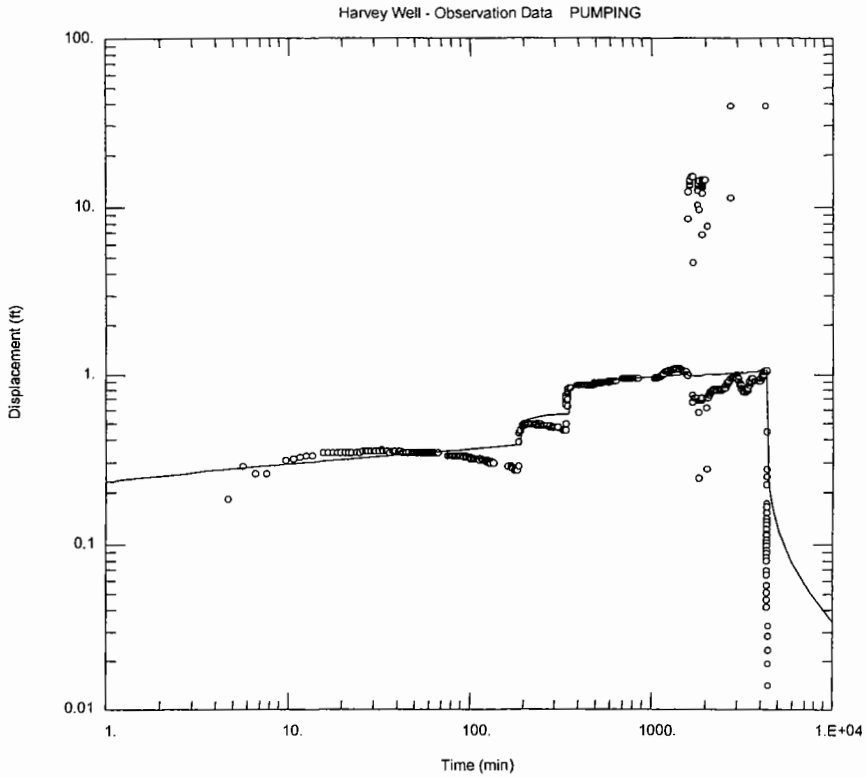
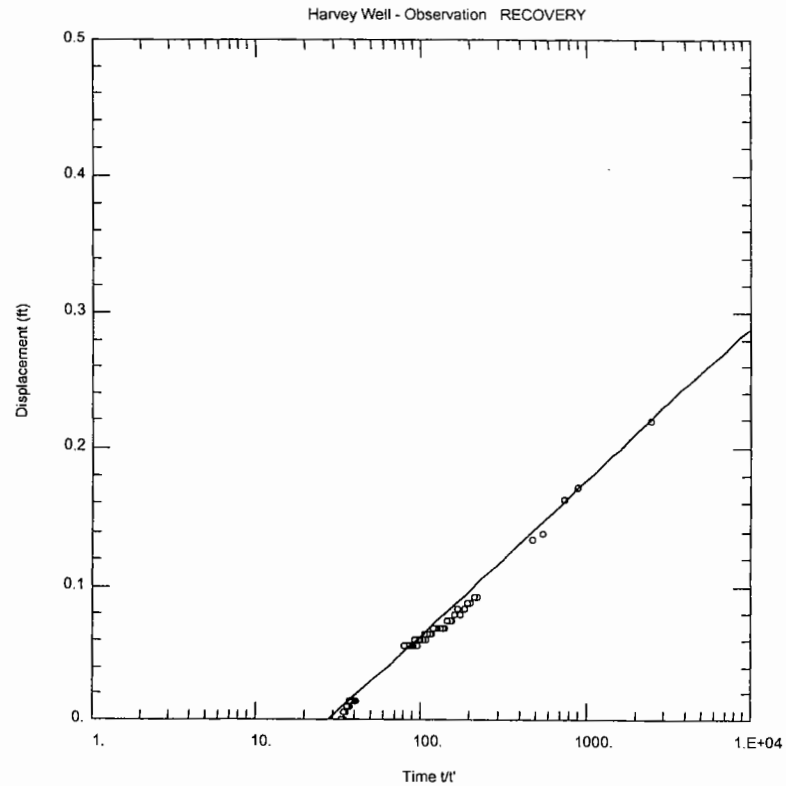
PROJECT NO. 137901.00	DATE Sept. 2001	REVISION 2

FIGURE 6

Theis Analysis of RW-1 Wellbore Test Data



Obs. Wells
° Harvey Well
Aquifer Model
Confined
Solution
Theis (Step Test)
Parameters
T = 3.269E+05ft^2/day
S = 1.523E-05
Sw = -2.404
C = 0. min^2/ft^5
P = 1.



Obs. Wells
° Harvey Well
Aquifer Model
Confined
Solution
Theis (Recovery)
Parameters
T =4.114E+05ft^2/day
S' =27.93

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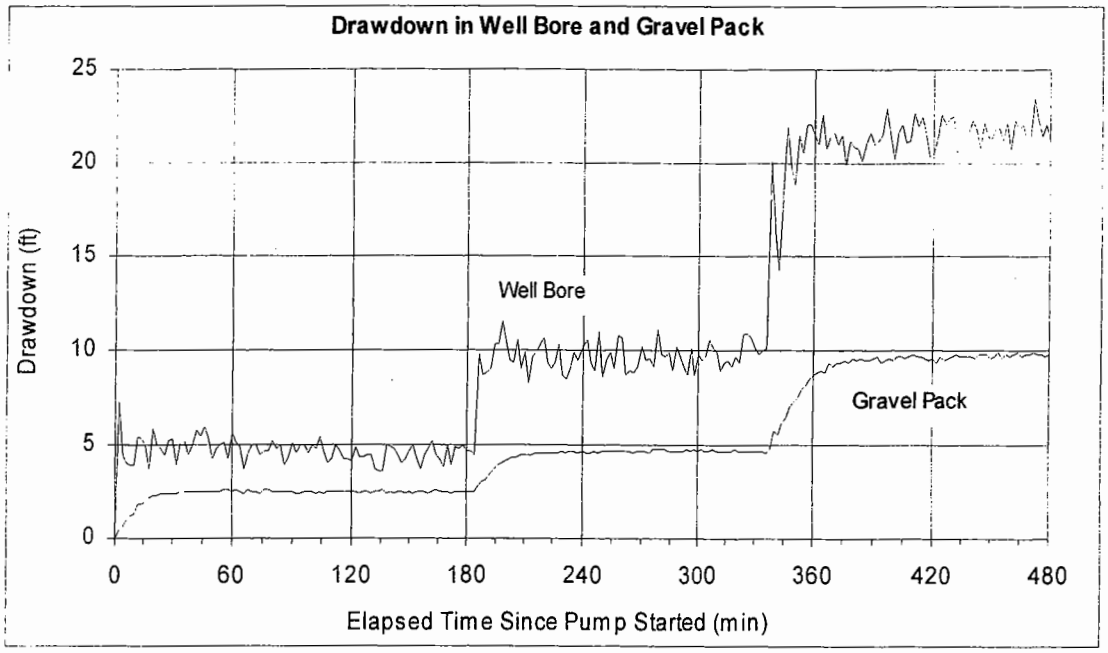
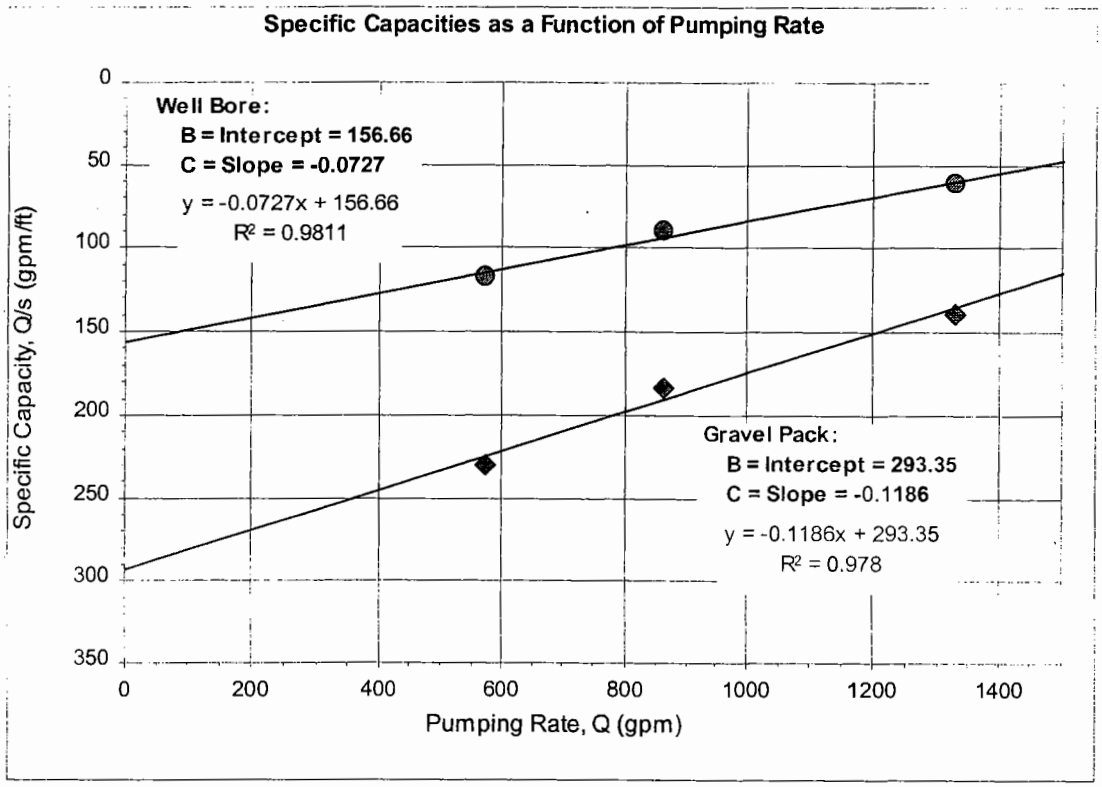
FIGURE 7

Theis Analysis of Harvey Well Test Data





Step	t min	Q gpm	Drawdown Well ft.	Q/s gpm/ft	Drawdown Gravelpack ft.	Q/s gpm/ft
1	60	575	4.89	117.6	2.5	230.0
2	250	862	9.62	89.6	4.7	183.4
3	420	1330.4	21.59	61.6	9.6	138.6

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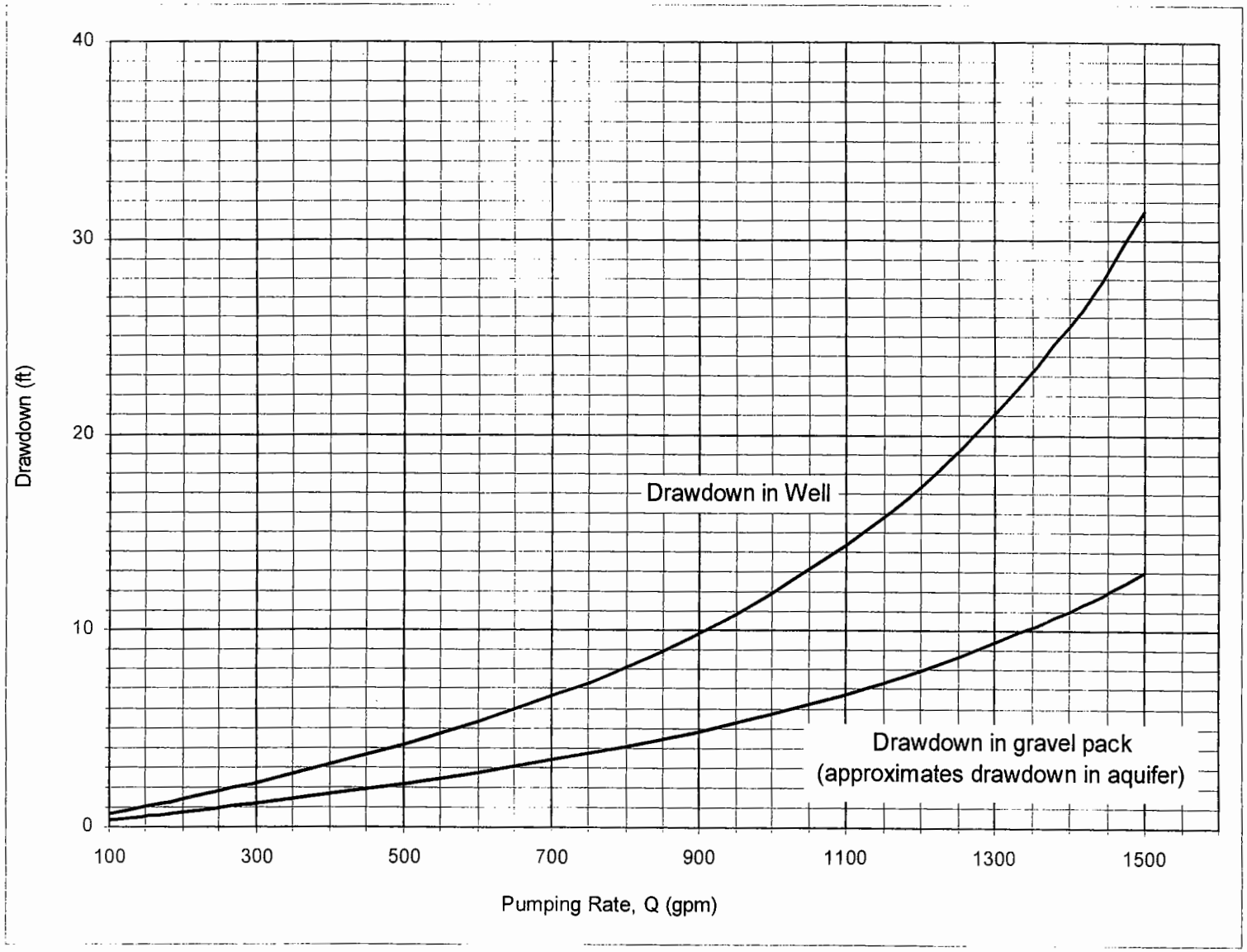
FIGURE 8
Analysis of Specific Capacity, Plot for B and C Parameters Used in Well Performance Analysis



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137901.00	Sept. 2001	2

FIGURE 9

Predicted Drawdown as a Function of Pumping Rate

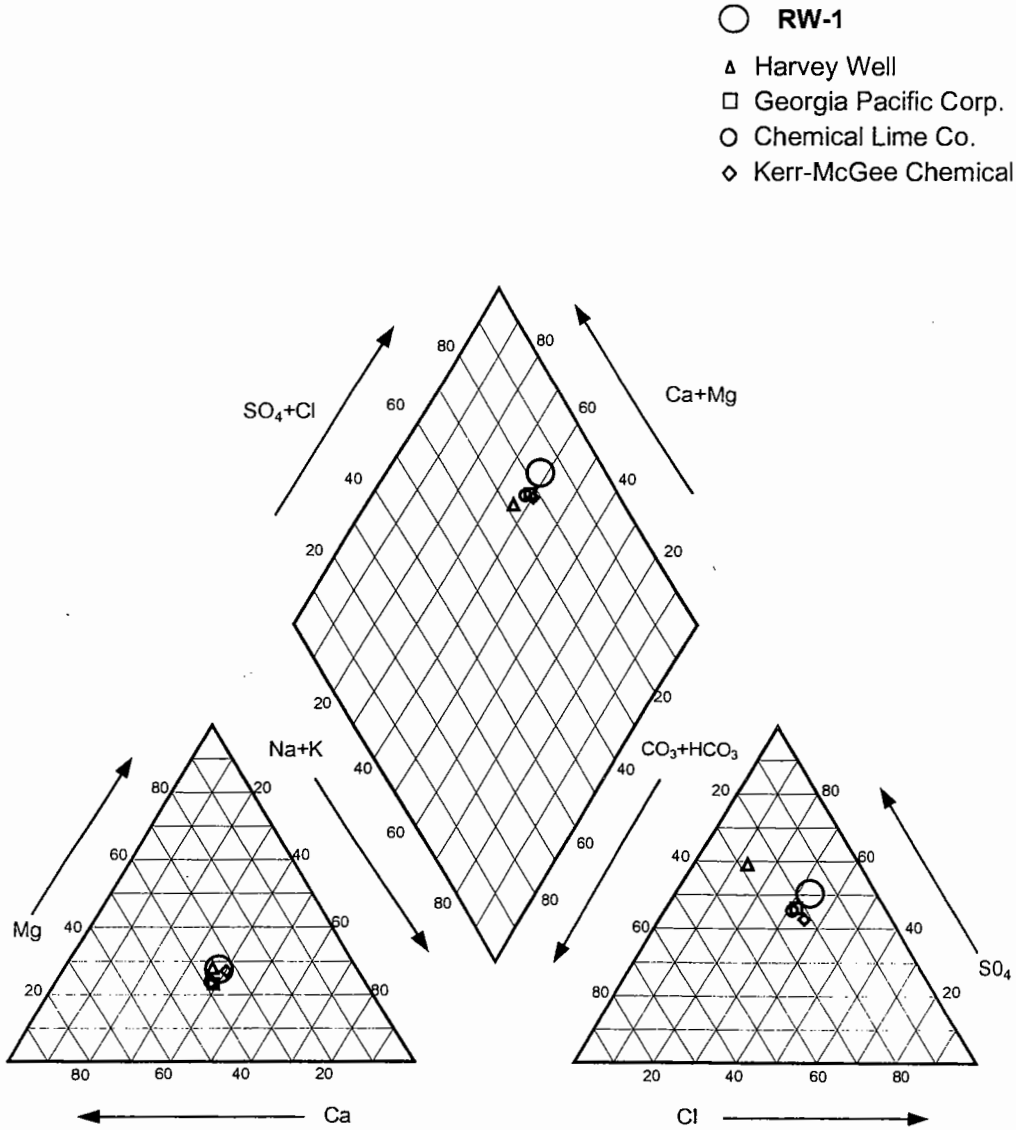

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FIGURE 10
Piper Trilinear Diagram of Groundwater Analytical Results

Nevada Power Company
Harvey Well Replacement, RW-1

DRAWN PSH	DATE Sept. 2001	JOB NO. 137901
CHECKED PSH	SCALE NA	DWG. NO. / REV. NO.
REVIEWED	FILE NO.	

Appendix A

Borehole and Well Construction Log

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Borehole and Well Installation Log: RW-1

Project Name: Harvey Well Replacement
Client: Nevada Power Company
Location: Garnet Valley, NV

Drill Method: Rotary Dual Tube Flooded Reverse
Drill Date: 9 June - 16 June, 2001
Well Install Date: 17 June, 2001

Northing: UTM 26,872,170.83
Easting: UTM 872,569.64
G.S. Elevation: 2,068.55 ft.

Depth (ft) | Graphic | Description | Drill Rate (ft/hr) 5 15 25 | Caliper inches 20 24 28 32 | Resistivity mmohs/m 4 5 6 | Deviation | Well Construction Details

Residual Soils: 0' - 15'

Light brown. subangular well graded clayey gravel (GC) to 2.5" with some v.f. to f. angular to subangular coarse sand, moderate to high plasticity and low strength clay. Cobbles to 6" present. Lithics of micritic limestone with strong HCl reaction.

Muddy Creek fm: 15' - 495'

Reddish brown to grey-brown clays and silty clays (CL),variably but typically only slightly lithified. Occaisionally contains trace to some very fine to fine sand, slightly to highly plastic, stiff to hard.

@15' - 140', material is predominantly reddish bown clay.

@ 60' - 70', clay contains some gravel.

@ 140' - 200', grades silty.

48" DIAMETER HOLE to 40'
28" DIAMETER HOLE 40' to 507'
Silica Gravel Pack, 60' - 870'.
30" Mild Steel Surface Casing 0' - 40'.
20" High-Strength, Low-Alloy Steel Conductor Casing, Cemented in place to 499'.
12" High-Strength, Low-Alloy Steel Well Casing, 0' - 553'.

Drilled By: Layne-Christensen Drilling Co. | Logged By: B. Giroux | Checked By: P. Hackenberry/L. Cope | Date: 8/17/01

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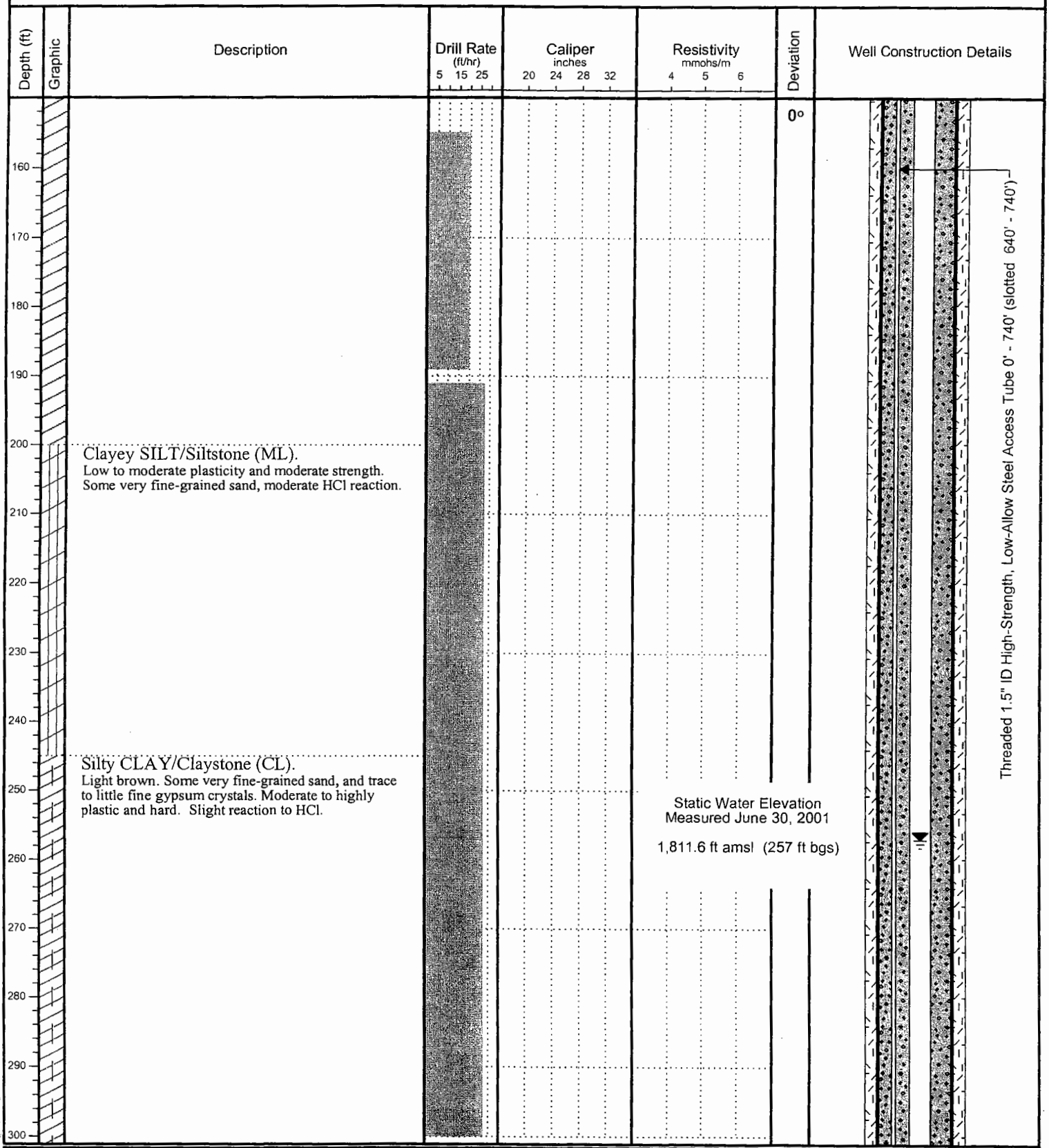
Engineers and Scientists

Borehole and Well Installation Log: RW-1

Project Name: Harvey Well Replacement
Client: Nevada Power Company
Location: Garnet Valley, NV

Drill Method: Rotary Dual Tube Flooded Reverse
Drill Date: 9 June - 16 June, 2001
Well Install Date: 17 June, 2001

Northing: UTM 26,872,170.83
Easting: UTM 872,569.64
G.S. Elevation: 2,068.55 ft.



Drilled By: Layne-Christensen Drilling Co. | Logged By: B. Giroux | Checked By: P. Hackenberry/L. Cope | Date: 8/17/01

SRK Consulting
Engineers and Scientists

Borehole and Well Installation Log: RW-1

Project Name: Harvey Well Replacement
Client: Nevada Power Company
Location: Garnet Valley, NV

Drill Method: Rotary Dual Tube Flooded Reverse
Drill Date: 9 June - 16 June, 2001
Well Install Date: 17 June, 2001

Northing: UTM 26,872,170.83
Easting: UTM 872,569.64
G.S. Elevation: 2,068.55 ft.

Depth (ft)	Graphic	Description	Drill Rate (ft/hr) 5 15 25	Caliper inches 20 24 28 32	Resistivity mmohs/m 4 5 6	Deviation	Well Construction Details
310							
320							
330							
340							
350						0°	
360							
370							
380		Clay/Claystone (CH) Light brown and plastic.					
390							
400							
410		Silty Clay/Claystone (CL/CH) @ 410' - 495', Light greyish-brown gypsiferous silty clay with little to some fine to coarse sand. Occaisonal white stringers and pods of gypsum throughout. Moderately plastic.					
420							
430							
440							
450							

Drilled By: Layne-Christensen Drilling Co. | Logged By: B. Giroux | Checked By: P. Hackenberry/L. Cope | Date: 8/17/01

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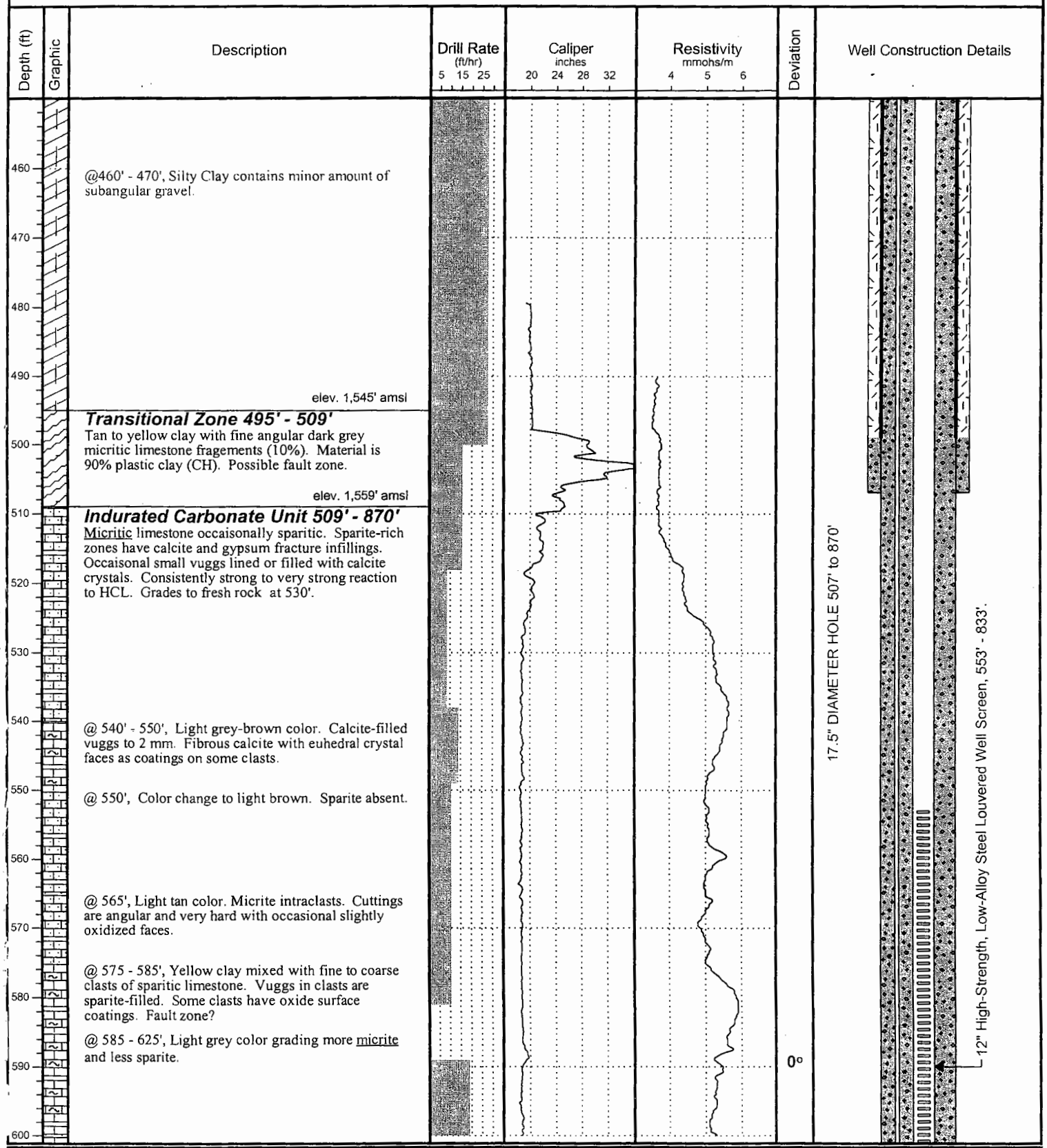
Borehole and Well Installation Log: RW-1

Project Name: Harvey Well Replacement
Client: Nevada Power Company
Location: Garnet Valley, NV

Drill Method: Rotary Dual Tube Flooded Reverse
Drill Date: 9 June - 16 June, 2001
Well Install Date: 17 June, 2001

Northing: UTM 26,872,170.83
Easting: UTM 872,569.64
G.S. Elevation: 2,068.55 ft.



Drilled By: Layne-Christensen Drilling Co. | Logged By: B. Giroux | Checked By: P. Hackenberry/L. Cope | Date: 8/17/01

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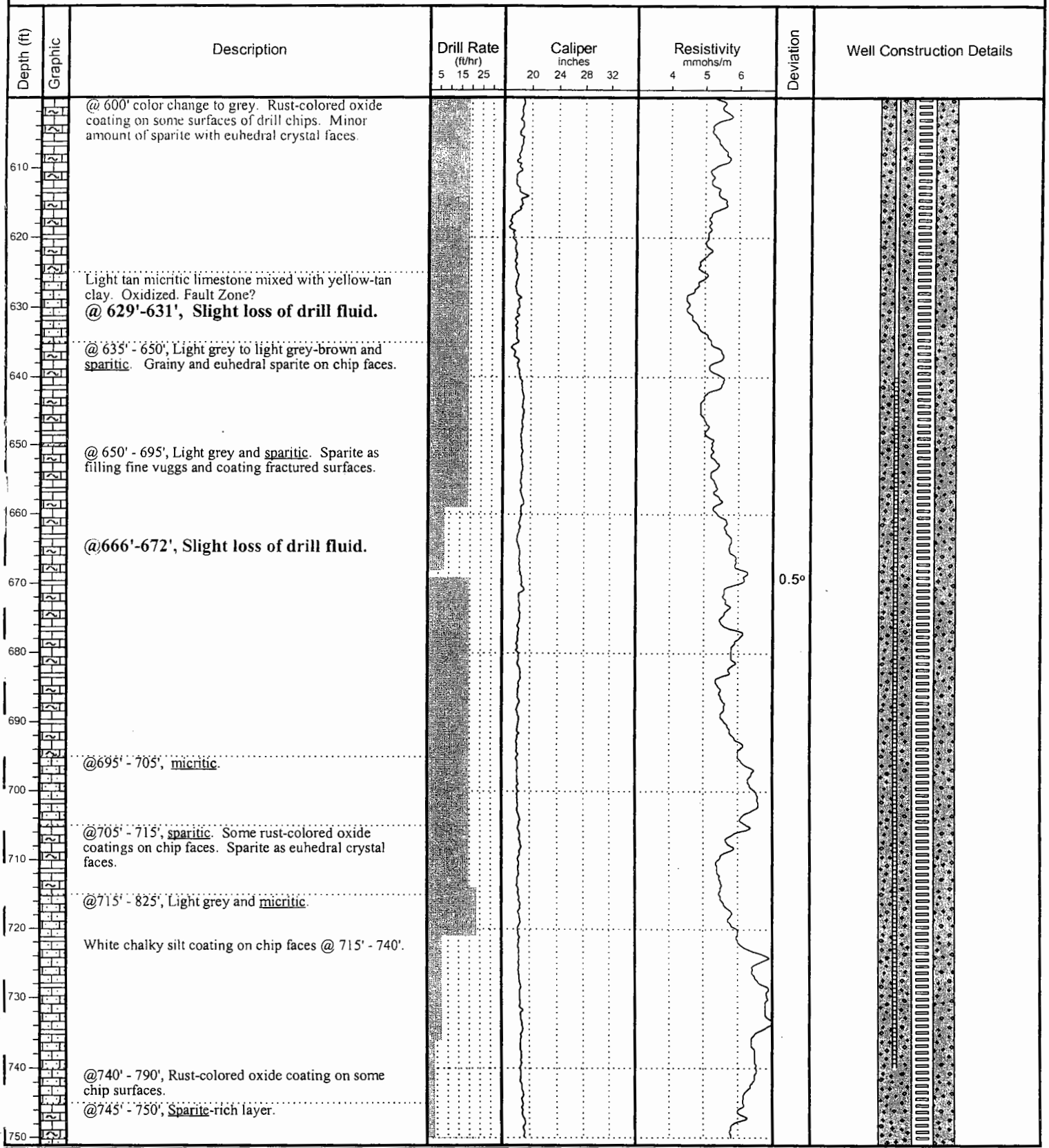
Borehole and Well Installation Log: RW-1

Project Name: Harvey Well Replacement
Client: Nevada Power Company
Location: Garnet Valley, NV

Drill Method: Rotary Dual Tube Flooded Reverse
Drill Date: 9 June - 16 June, 2001
Well Install Date: 17 June, 2001

Northing: UTM 26,872,170.83
Easting: UTM 872,569.64
G.S. Elevation: 2,068.55 ft.



Drilled By: Layne-Christensen Drilling Co. | Logged By: B. Giroux | Checked By: P. Hackenberry/L. Cope | Date: 8/17/01

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Borehole and Well Installation Log: RW-1

Project Name: Harvey Well Replacement
Client: Nevada Power Company
Location: Garnet Valley, NV

Drill Method: Rotary Dual Tube Flooded Reverse
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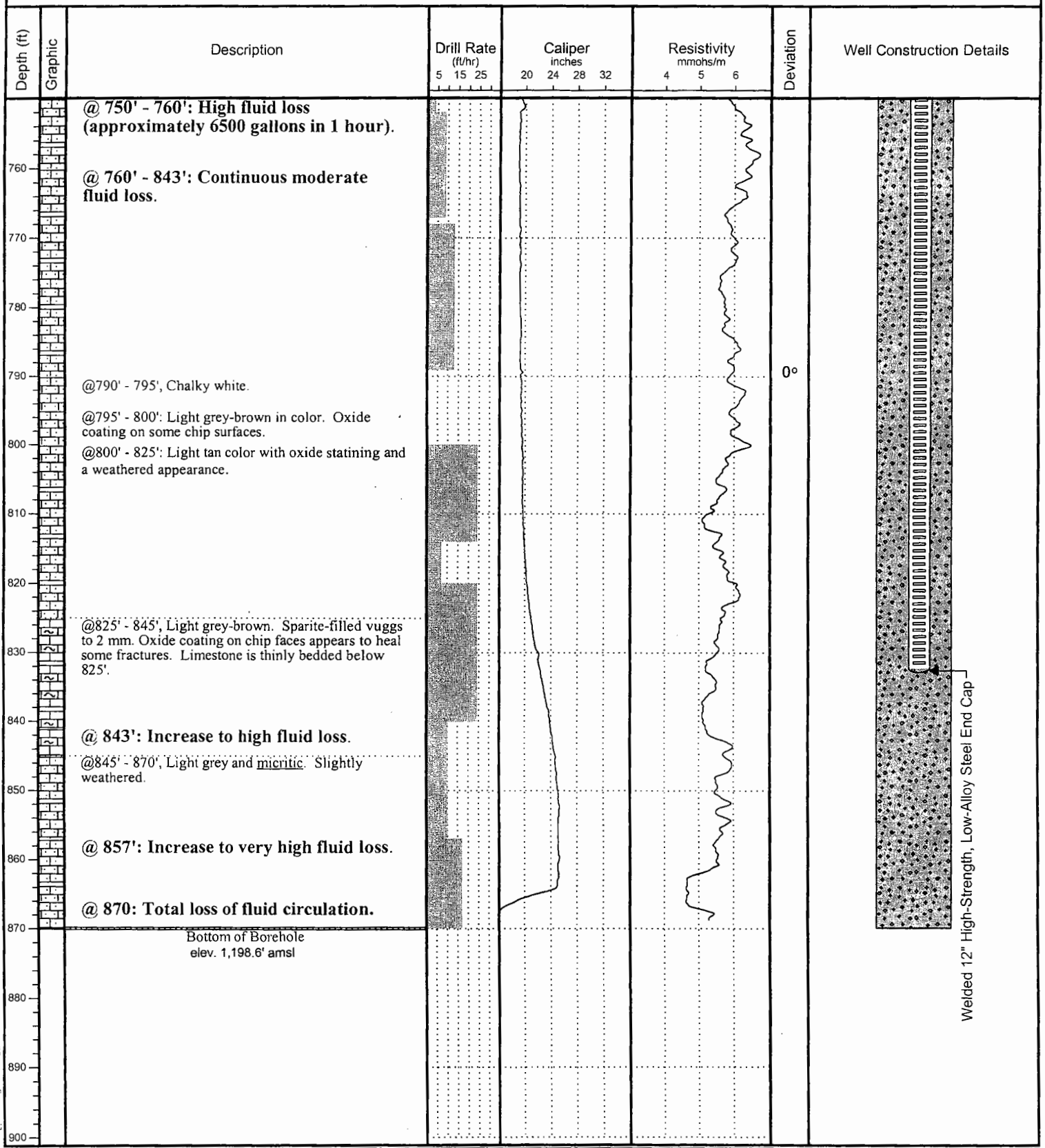
Well Install Date: 17 June, 2001

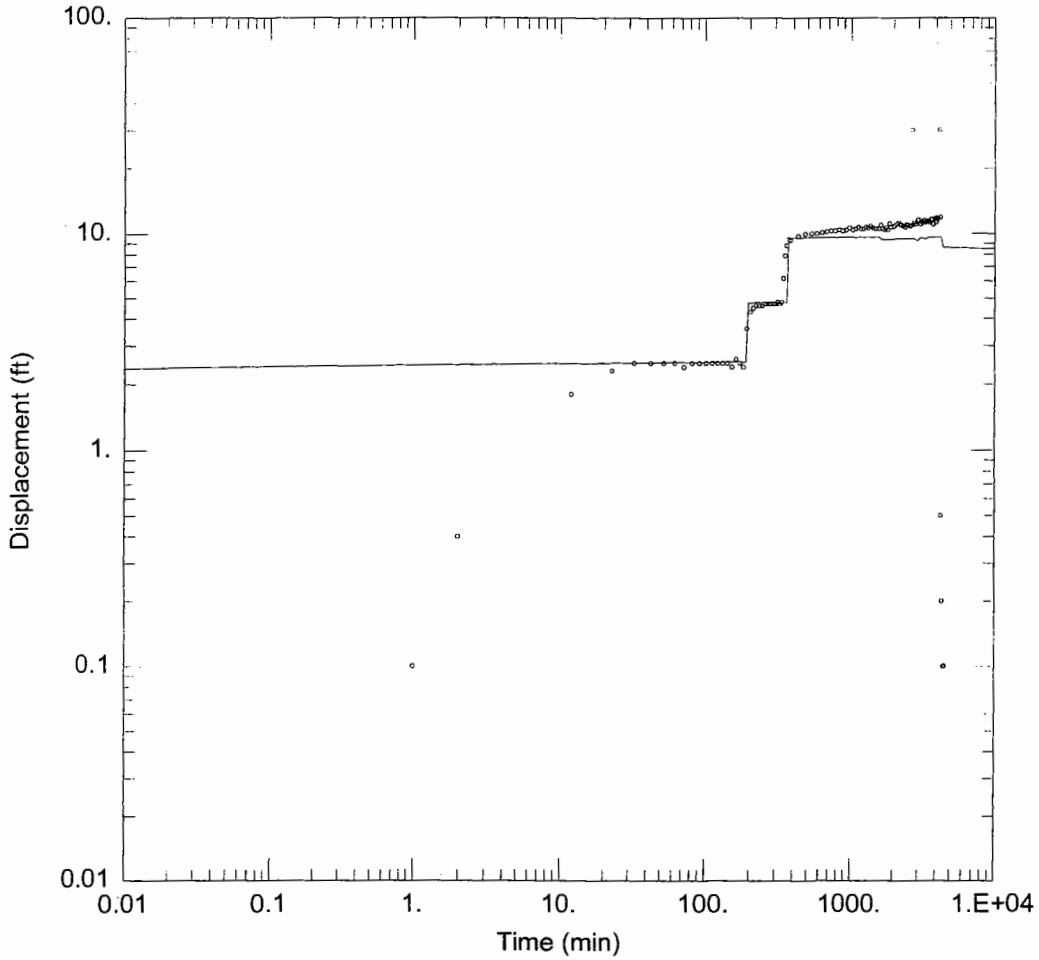
Northing: UTM 26,872,170.83
Easting: UTM 872,569.64
G.S. Elevation: 2,068.55 ft.



Drilled By: Layne-Christensen Drilling Co. | Logged By: B. Giroux | Checked By: P. Hackenberry/L. Cope | Date: 8/17/01

Appendix B

Aquifer Test Data



RW-1 GRAVELPACK PUMPING

Data Set: I:\Projects\137901 Nevada Power-Harvey Well\Aquifer Testing\RW-1 Gravelpack2.aqt
Date: 09/27/01 Time: 09:58:38

AQUIFER DATA

Saturated Thickness: 600. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW-1	0	0

Observation Wells

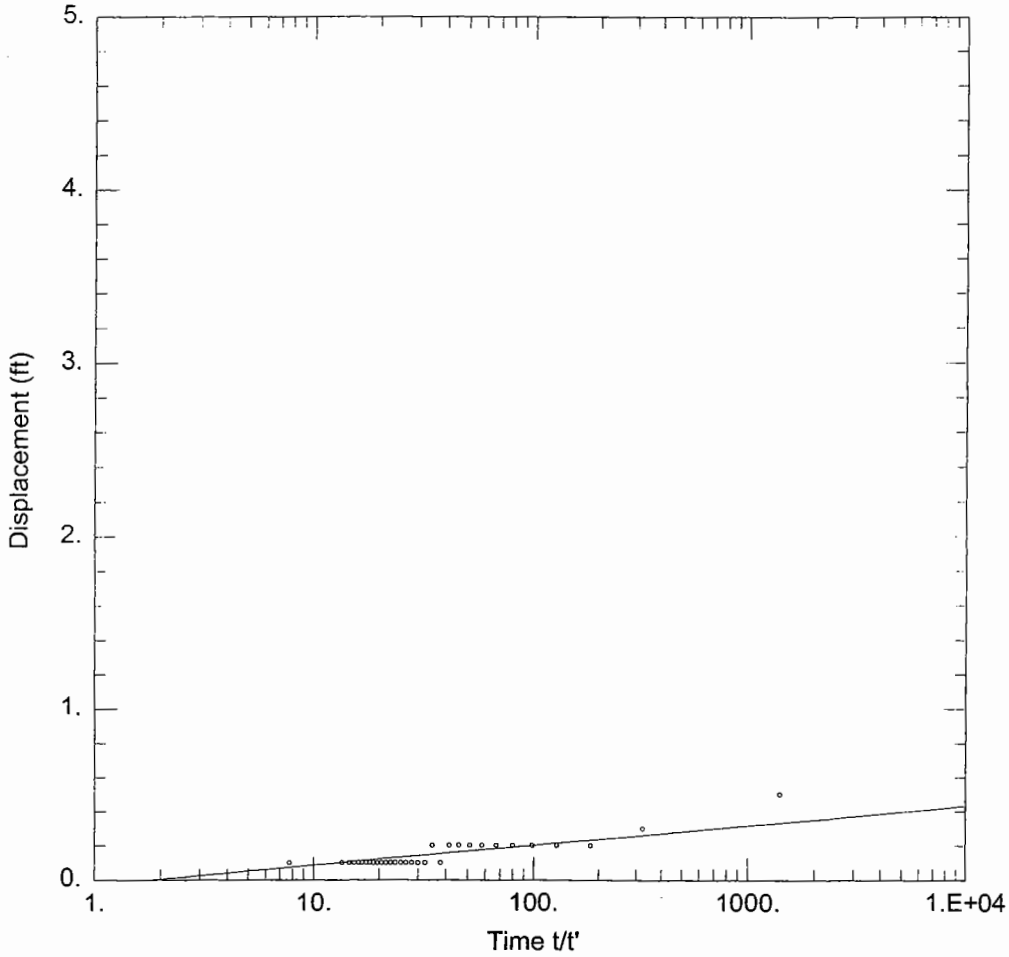
Well Name	X (ft)	Y (ft)
RW1 ObsGvl	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Step Test)

T = 5.319E+05 ft^2/day S = 0.0002185
Sw = -5. C = 0.00155 min^2/ft^5
P = 1.664

Step Test Model: Jacob-Rorabaugh $s(t) = 0.004967Q + 0.00155Q^{1.664}$
Time (t) = 60. min Rate (Q) in cu. ft/min W.E. = 21.77%



RW-1 GRAVELPACK RECOVERY

Data Set: I:\...\RW-1 Gravelpack Recovery2.aqt
Date: 09/27/01 Time: 09:50:02

AQUIFER DATA

Saturated Thickness: 600. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW-1	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
RW1 ObsGvl	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 4.048E+05 ft^2/day S' = 1.836

Data Set: I:\Projects\137901 Nevada Power-Harvey Well\Aquifer Testing\RW-1 Gravelpack2.aqt
Title: RW-1 Gravelpack PUMPING
Date: 09/27/01
Time: 09:58:08

PROJECT INFORMATION

Company: SRK Consulting, Inc
Client: Nevada Power
Project: 137901.00
Location: Dry Lake Valley, Nevada
Test Date: 6-30-01
Test Well: RW-1

AQUIFER DATA

Saturated Thickness: 600. ft
Anisotropy Ratio (Kz/Kr): 1.

PUMPING WELL DATA

Number of pumping wells: 1

Pumping Well No. 1: RW-1

X Location: 0. ft
Y Location: 0. ft

Partially Penetrating Well
Depth To Top Of Screen: 18. ft
Depth To Bottom Of Screen: 298. ft

No. of pumping periods: 12

Pumping Period Data

Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.001	575.	2996.	1322.4
190.	862.	3164.	1313.8
360.	1330.4	3425.	1327.2
1592.	1309.	3876.	1330.4
2000.	1315.	4200.	1320.
2840.	1299.4	4330.	0.

OBSERVATION WELL DATA

Number of observation wells: 1

Observation Well No. 1: RW1 ObsGvl

X Location: 0. ft
Y Location: 0. ft

Partially Penetrating Well
Depth To Top Of Screen: 18. ft
Depth To Bottom Of Screen: 298. ft

No. of observations: 125

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.	0.1	1583.	10.5
2.	0.4	1633.	10.9
12.	1.8	1683.	10.5
23.	2.3	1733.	10.4
33.	2.5	1783.	10.6
43.	2.5	1833.	10.4
53.	2.5	1883.	11.1
63.	2.5	1933.	10.7
73.	2.4	1983.	10.7
83.	2.5	2033.	10.8
93.	2.5	2083.	11.
103.	2.5	2133.	11.1
113.	2.5	2183.	11.2
123.	2.5	2233.	11.
133.	2.5	2283.	10.9
143.	2.5	2333.	10.8
153.	2.4	2383.	11.
163.	2.6	2433.	10.7
173.	2.5	2483.	11.
183.	2.4	2533.	10.9
193.	3.6	2583.	10.9
203.	4.3	2633.	10.8
213.	4.5	2683.	10.9
223.	4.6	2733.	30.1
233.	4.6	2783.	11.
243.	4.6	2833.	11.2
253.	4.7	2883.	11.
263.	4.7	2933.	11.1
273.	4.7	2983.	11.5
283.	4.7	3033.	11.6
293.	4.7	3083.	11.1
303.	4.7	3133.	11.
313.	4.8	3183.	11.3
323.	4.7	3233.	11.2
333.	4.8	3283.	11.5
343.	6.2	3333.	11.2
353.	7.9	3383.	11.5
363.	8.8	3433.	11.3
373.	9.4	3483.	11.4
383.	9.3	3533.	11.4
433.	9.7	3583.	11.4
483.	9.9	3633.	11.2
533.	10.	3683.	11.6
583.	10.	3733.	11.6
633.	10.1	3783.	11.1
683.	10.2	3833.	11.
733.	10.3	3883.	11.6
783.	10.3	3933.	11.8
833.	10.4	3983.	11.3
883.	10.3	4033.	11.7
933.	10.4	4083.	11.7
983.	10.6	4133.	11.9
1033.	10.4	4183.	11.6
1083.	10.5	4233.	30.1
1133.	10.7	4283.	11.9
1183.	10.5	4333.	0.5
1233.	10.5	4383.	0.2
1283.	10.7	4433.	0.2

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1333.	10.6	4483.	0.1
1383.	10.8	4533.	0.1
1433.	10.6	4583.	0.1
1483.	10.5	4664.	0.1
1533.	10.5		

SOLUTION

Aquifer Model: Confined
Solution Method: Theis (Step Test)

VISUAL ESTIMATION RESULTS

Estimated Parameters

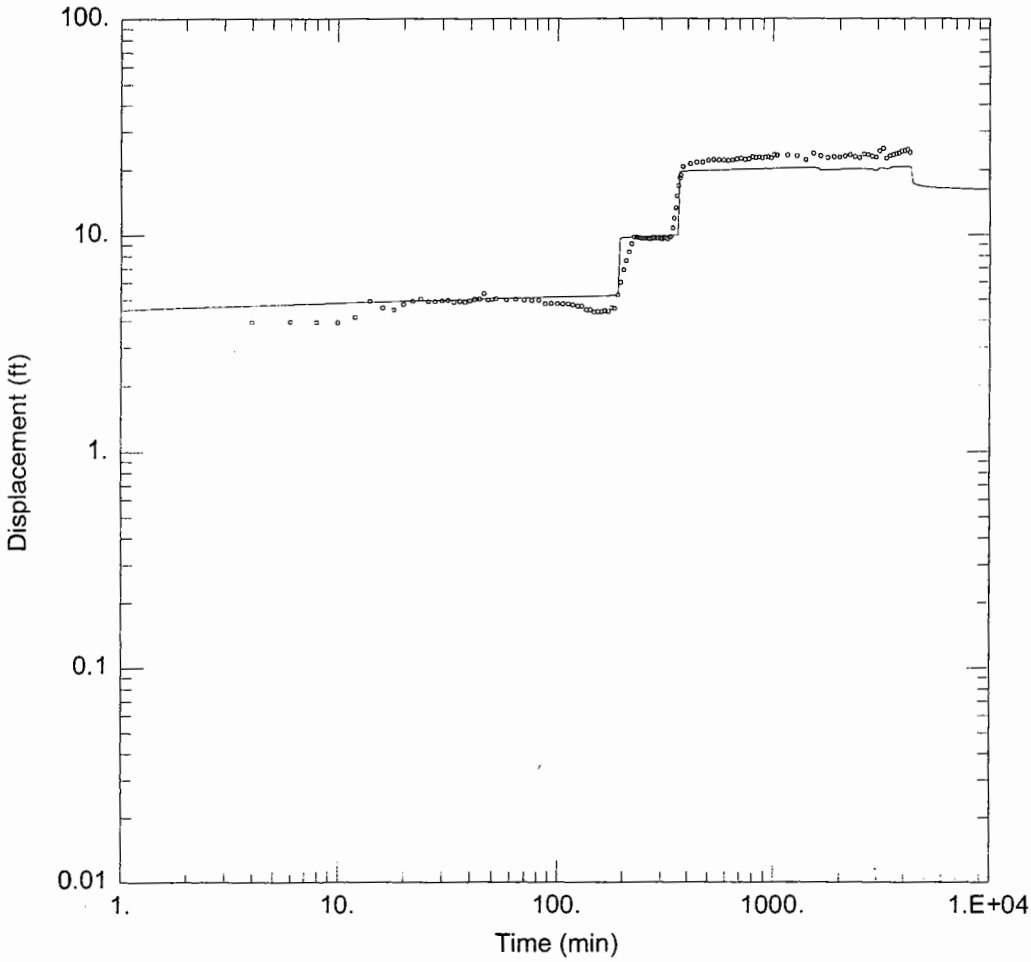
Parameter	Estimate	
T	5.319E+05	ft^2/day
S	0.0002185	
Sw	-5.	
C	0.00155	min^2/ft^5
P	1.664	

STEP TEST ANALYSIS RESULTS

Jacob-Rorabaugh Step Test Model: $s(t) = BQ + CQ^P$
t = 60.ft
Q in cu.ft/min
B = 0.004967
C = 0.00155
P = 1.664

Eden-Hazel Step Test Model: $s(t) = (a + b \log_{10}(t))Q + CQ^P$
Q in cu.ft/min
a = 0.003564
b = 0.0004962
C = 0.00155
P = 1.664

Well Efficiency = 21.77%



RW-1 WELLBORE PUMPING

Data Set: I:\Projects\137901 Nevada Power-Harvey Well\Aquifer Testing\RW-1 Wellbore2.aqt
Date: 09/27/01 Time: 10:05:06

AQUIFER DATA

Saturated Thickness: 600. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW-1	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
RW1 ObsWll	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Step Test)

T = 6.409E+04 ft^2/day S = 0.000679
Sw = -10. C = 0.0017 min^2/ft^5
P = 1.77

Step Test Model: Jacob-Rorabaugh $s(t) = 0.01753Q + 0.0017Q^{1.77}$
Time (t) = 60. min Rate (Q) in cu. ft/min W.E. = 81.23%

Data Set: I:\Projects\137901 Nevada Power-Harvey Well\Aquifer Testing\RW-1 Wellbore2.aqt
Title: RW-1 Wellbore PUMPING
Date: 09/27/01
Time: 10:05:23

PROJECT INFORMATION

Company: SRK Consulting, Inc
Client: Nevada Power
Project: 137901.00
Location: Dry Lake Valley, Nevada
Test Date: 6-30-01
Test Well: RW-1

AQUIFER DATA

Saturated Thickness: 600. ft
Anisotropy Ratio (Kz/Kr): 1.

PUMPING WELL DATA

Number of pumping wells: 1

Pumping Well No. 1: RW-1

X Location: 0. ft
Y Location: 0. ft

Partially Penetrating Well
Depth To Top Of Screen: 18. ft
Depth To Bottom Of Screen: 298. ft

No. of pumping periods: 12

Pumping Period Data

Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.001	575.	2996.	1322.4
190.	862.	3164.	1313.8
360.	1330.4	3425.	1327.2
1592.	1309.	3876.	1330.4
2000.	1315.	4200.	1320.
2840.	1299.4	4330.	0.

OBSERVATION WELL DATA

Number of observation wells: 1

Observation Well No. 1: RW1 ObsWll

X Location: 0. ft
Y Location: 0. ft

Partially Penetrating Well
Depth To Top Of Screen: 18. ft
Depth To Bottom Of Screen: 298. ft

No. of observations: 129

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
4.	3.92	298.	9.57
6.	3.93	304.	9.52
8.	3.92	310.	9.69
10.	3.91	316.	9.61
12.	4.13	322.	9.53
14.	4.89	328.	9.72
16.	4.57	334.	9.76
18.	4.47	340.	10.67
20.	4.73	346.	11.9
22.	4.89	352.	13.31
24.	5.01	358.	15.07
26.	4.88	364.	16.82
28.	4.87	370.	18.32
30.	4.91	372.	18.84
32.	4.95	382.	20.65
34.	4.84	412.	21.28
36.	4.87	442.	21.65
38.	4.83	472.	21.63
40.	4.91	502.	22.13
42.	4.98	532.	22.27
44.	4.99	562.	22.2
46.	5.29	592.	22.2
48.	4.96	622.	22.1
50.	4.98	652.	22.21
52.	5.02	682.	22.44
58.	4.96	712.	22.58
64.	5.	742.	22.22
70.	4.94	772.	22.44
76.	4.93	802.	22.91
82.	4.93	832.	22.72
88.	4.75	862.	22.84
94.	4.76	892.	22.73
100.	4.77	922.	22.82
106.	4.74	952.	22.85
112.	4.74	982.	22.67
118.	4.69	1012.	23.44
124.	4.63	1042.	23.23
130.	4.63	1162.	23.29
136.	4.46	1282.	23.14
142.	4.46	1402.	22.21
148.	4.36	1522.	23.73
154.	4.38	1642.	23.12
160.	4.37	1762.	22.69
166.	4.4	1882.	22.9
172.	4.37	2002.	22.82
178.	4.55	2122.	23.01
184.	4.52	2242.	23.31
190.	5.21	2362.	22.96
196.	5.96	2482.	22.69
202.	6.84	2602.	23.58
208.	7.55	2722.	23.46
214.	8.27	2842.	23.

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
220.	9.04	2962.	22.89
226.	9.7	3082.	24.38
232.	9.71	3202.	25.11
238.	9.65	3322.	22.59
244.	9.59	3442.	23.17
250.	9.57	3562.	23.46
256.	9.59	3682.	23.7
262.	9.55	3802.	23.86
268.	9.51	3922.	24.31
274.	9.59	4042.	24.42
280.	9.67	4162.	24.72
286.	9.59	4282.	23.96
292.	9.62		

SOLUTION

Aquifer Model: Confined
Solution Method: Theis (Step Test)

VISUAL ESTIMATION RESULTS

Estimated Parameters

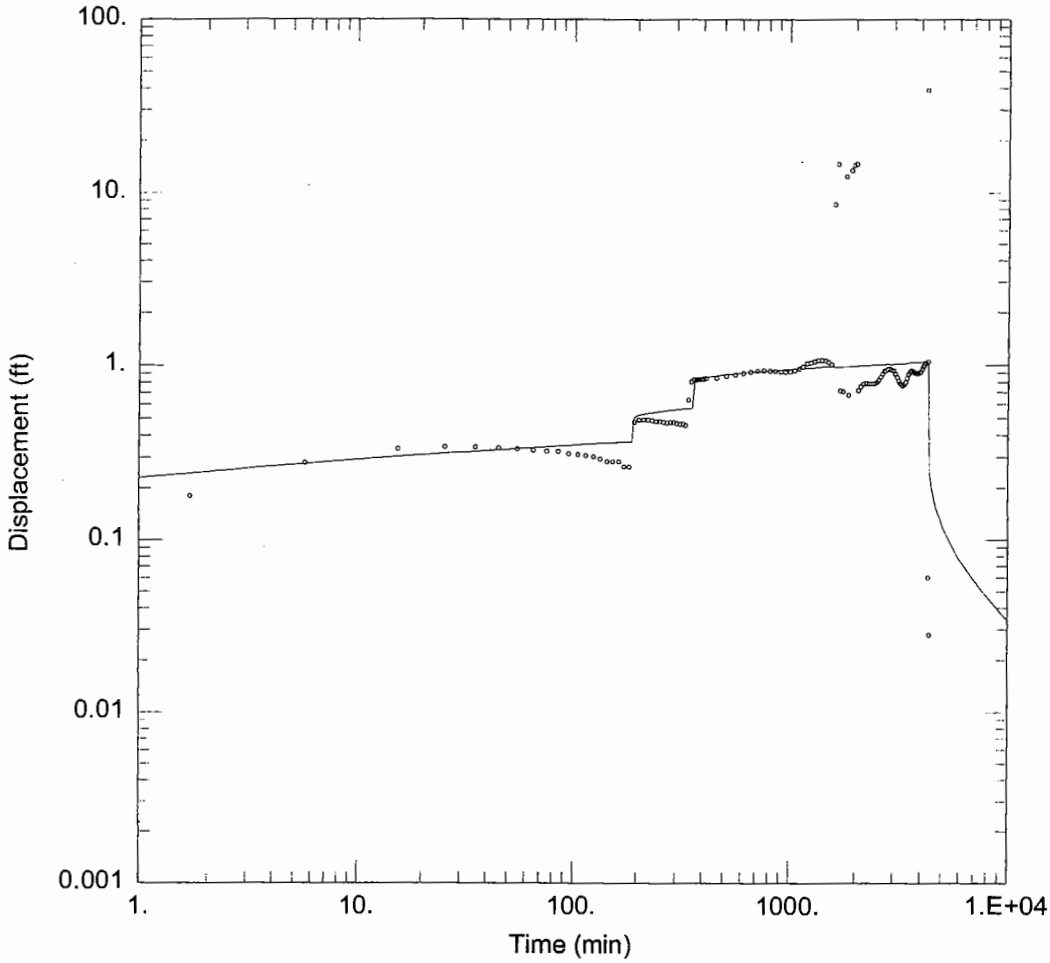
Parameter	Estimate	
T	6.409E+04	ft^2/day
S	0.000679	
Sw	-10.	
C	0.0017	min^2/ft^5
P	1.77	

STEP TEST ANALYSIS RESULTS

Jacob-Rorabaugh Step Test Model: $s(t) = BQ + CQ^P$
t = 60.ft
Q in cu.ft/min
B = 0.01753
C = 0.0017
P = 1.77

Eden-Hazel Step Test Model: $s(t) = (a + b \log_{10}(t))Q + CQ^P$
Q in cu.ft/min
a = 0.02376
b = 0.004118
C = 0.0017
P = 1.77

Well Efficiency = 81.23%



HARVEY WELL - OBSERVATION DATA PUMPING

Data Set: I:\Projects\137901 Nevada Power-Harvey Well\Aquifer Testing\Harvey Well Obs.aqt
Date: 09/27/01 Time: 09:43:37

AQUIFER DATA

Saturated Thickness: 1000. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW-1	0	0

Observation Wells

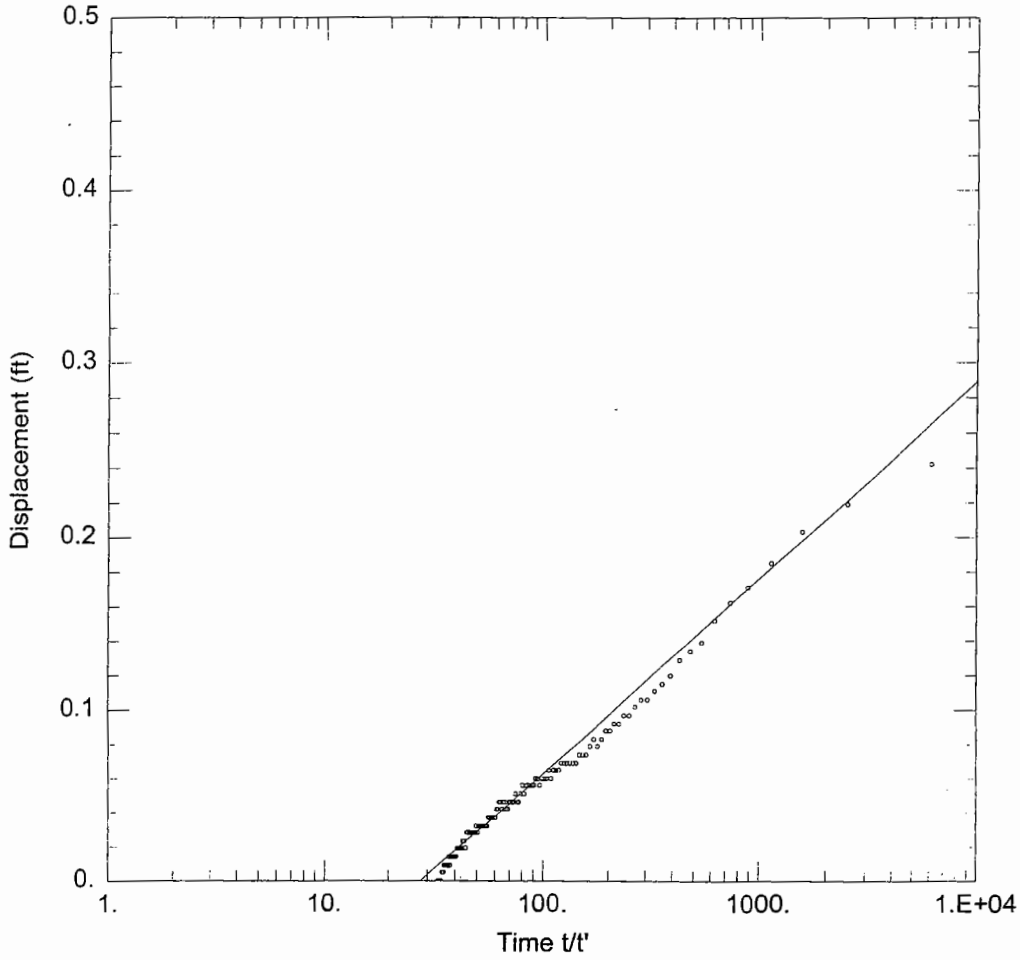
Well Name	X (ft)	Y (ft)
Harvey Well	254	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Step Test)

T = 3.269E+05 ft^2/day S = 1.523E-05
Sw = -2.404 C = 0. min^2/ft^5
P = 1.

Step Test Model: Jacob-Rorabaugh $s(t) = 0.004412Q + 0.Q^{1.}$
Time (t) = 60. min Rate (Q) in cu. ft/min W.E. = 138.2%



HARVEY WELL - OBSERVATION RECOVERY

Data Set: I:\...\Harvey Well Obs Recovery.aqt
Date: 09/27/01 Time: 09:45:44

AQUIFER DATA

Saturated Thickness: 1000. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW-1	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
◦ Harvey Well	254	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 4.114E+05 ft^2/day S' = 27.93

Data Set: I:\Projects\137901 Nevada Power-Harvey Well\Aquifer Testing\Harvey Well Obs.aqt
Title: Harvey Well - Observation Data PUMPING
Date: 09/27/01
Time: 09:44:06

PROJECT INFORMATION

Company: SRK Consulting, Inc
Client: Nevada Power
Project: 137901.00
Location: Dry Lake Valley, Nevada
Test Date: 6-30-01
Test Well: RW-1

AQUIFER DATA

Saturated Thickness: 1000. ft
Anisotropy Ratio (Kz/Kr): 1.

PUMPING WELL DATA

Number of pumping wells: 1

Pumping Well No. 1: RW-1

X Location: 0. ft
Y Location: 0. ft

Partially Penetrating Well
Depth To Top Of Screen: 18. ft
Depth To Bottom Of Screen: 298. ft

No. of pumping periods: 12

Pumping Period Data

Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.001	575.	2996.	1322.4
190.	862.	3164.	1313.8
360.	1330.4	3425.	1327.2
1592.	1309.	3876.	1330.4
2000.	1315.	4200.	1320.
2840.	1299.4	4330.	0.

OBSERVATION WELL DATA

Number of observation wells: 1

Observation Well No. 1: Harvey Well

X Location: 254. ft
Y Location: 0. ft

Partially Penetrating Well
Depth To Top Of Screen: 5. ft
Depth To Bottom Of Screen: 75. ft

No. of observations: 123

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.68	0.18	1415.7	1.07
5.68	0.279	1465.7	1.057
15.68	0.335	1515.7	1.038
25.68	0.344	1565.7	1.006
35.68	0.344	1615.7	8.514
45.68	0.339	1665.7	14.59
55.68	0.335	1717.7	0.715
65.68	0.33	1767.7	0.706
75.68	0.325	1817.7	12.36
85.68	0.325	1869.7	0.674
95.68	0.316	1919.7	13.37
105.7	0.312	1969.7	14.37
115.7	0.307	2019.7	14.56
125.7	0.302	2071.7	0.715
135.7	0.293	2121.7	0.752
145.7	0.284	2171.7	0.775
155.7	0.284	2221.7	0.787
165.7	0.284	2271.7	0.787
175.7	0.265	2321.7	0.782
185.7	0.265	2371.7	0.778
195.7	0.478	2421.7	0.782
205.7	0.491	2471.7	0.787
215.7	0.491	2521.7	0.801
225.7	0.491	2571.7	0.819
235.7	0.487	2621.7	0.851
245.7	0.482	2671.7	0.884
255.7	0.482	2721.7	0.921
265.7	0.478	2771.7	0.93
275.7	0.473	2821.7	0.939
285.7	0.473	2871.7	0.951
295.7	0.473	2921.7	0.941
305.7	0.468	2971.7	0.927
315.7	0.464	3021.7	0.923
325.7	0.464	3071.7	0.884
335.7	0.455	3121.7	0.851
345.7	0.634	3171.7	0.814
355.7	0.807	3221.7	0.787
365.7	0.826	3271.7	0.768
375.7	0.826	3321.7	0.759
385.7	0.831	3371.7	0.773
395.7	0.835	3421.7	0.796
405.7	0.835	3471.7	0.84
415.7	0.84	3521.7	0.891
465.7	0.844	3571.7	0.914
515.7	0.867	3621.7	0.927
565.7	0.881	3671.7	0.923
615.7	0.9	3721.7	0.914
665.7	0.914	3771.7	0.9
715.7	0.927	3821.7	0.895
765.7	0.932	3871.7	0.9
815.7	0.927	3921.7	0.895
865.7	0.923	3971.7	0.904

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
915.7	0.918	4021.7	0.918
965.7	0.914	4071.7	0.946
1015.7	0.918	4121.7	0.978
1065.7	0.932	4171.7	1.001
1115.7	0.951	4221.7	1.029
1165.7	0.983	4271.7	38.89
1215.7	1.024	4321.7	1.043
1265.7	1.038	4371.7	0.06
1315.7	1.052	4421.7	0.028
1365.7	1.066		

SOLUTION

Aquifer Model: Confined
Solution Method: Theis (Step Test)

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	3.269E+05	ft^2/day
S	1.523E-05	
Sw	-2.404	
C	0.	min^2/ft^5
P	1.	

STEP TEST ANALYSIS RESULTS

Jacob-Rorabaugh Step Test Model: $s(t) = BQ + CQ^P$
t = 60.ft
Q in cu.ft/min
B = 0.004412
C = 0.
P = 1.

Eden-Hazel Step Test Model: $s(t) = (a + b \log_{10}(t))Q + CQ^P$
Q in cu.ft/min
a = 0.006561
b = 0.0008072
C = 0.
P = 1.

Well Efficiency = 138.2%

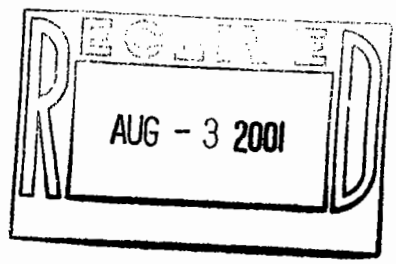
Appendix C

Water Quality Laboratory Analytical Results

Sent Via Fax
775-[illegible]6820

Nevada Power SM

July 31, 2001



SRK Consulting Inc.
Attn. Paul Hackenberry
5252 Neil Road, Suite 300
Reno NV 89502

Re: Harry Allen RW-1

Dear Paul:

Nel Laboratories sent the results to me of the samples delivered to them July 2, 2001. As I am sure you want to include the results in the pumping test report I am sending a copy to you.

Please let me know when I might expect to see your report.

Sincerely

Richard A. Willer, E.I.
Engineer IV, Civil

H:\WILLER\RW-1 WQ.doc
Created on 07/31/01 10:33 AM

NEL LABORATORIES
Reno • Las Vegas
Phoenix • Burbank

Las Vegas Division
4208 Arcata Way, Suite A • Las Vegas, NV 89030
(702) 657-1010 • Fax: (702) 657-1577
1-888-368-3282

CLIENT: Nevada Power Company
P.O. Box 230 MS30
Las Vegas, NV 89151
ATTN: Richard Willer

PROJECT NAME: Harvey Replacement Well
PROJECT NUMBER: NA

NEL ORDER ID: L0107003

Attached are the analytical results for samples in support of the above referenced project.

Samples submitted for this project were not sampled by NEL Laboratories. Samples were received by NEL in good condition, under chain of custody on 7/2/01.

Should you have any questions or comments, please feel free to contact our Client Services department at (702) 657-1010.

Some results have been flagged as follows:

Jl - The batch MS and/or MSD were outside acceptance limits. The batch LCS was acceptable.

Some QA results have been flagged as follows:

C - Sample concentration is a least 5 times greater than spike contribution. Spike recovery criteria do not apply.

Jl - The batch MS and/or MSD were outside acceptance limits. The batch LCS was acceptable.

Stan Van Wagenen
Laboratory Manager

7/24/01
Date

CERTIFICATIONS:

	Reno	Las Vegas	S. California
Arizona	AZ0520	AZ0518	AZ0605
California	1707	2002	2264
US Army Corps of Engineers	Certified	Certified	

	Reno	Las Vegas	S. California
Idaho	Certified	Certified	
Montana	Certified	Certified	
Nevada	NV033	NV052	CA084
L.A.C.S.D.			10228

NEL LABORATORIES

CLIENT:	Nevada Power Company	CLIENT ID:	**Harvey Well Replacement (HR-2**
PROJECT ID:	Harvey Replacement Well	DATE SAMPLED:	7/2/01
PROJECT #:	NA	NEL SAMPLE ID:	L0107003-01
TEST:	**Metals**		
MATRIX:	Drinking Water	ANALYST:	JTY - Reno Division

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.001 mg/L	1	EPA 200.8	7/3/01	7/5/01
Arsenic	0.029	0.001 mg/L	1	EPA 200.8	7/3/01	7/5/01
Barium	0.024	0.0025 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Beryllium	ND	0.0025 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Cadmium	ND	0.002 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Calcium	100	0.25 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Chromium	ND	0.005 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Copper	0.015	0.002 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Iron	0.23	0.05 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Lead	ND	0.001 mg/L	1	EPA 200.8	7/3/01	7/5/01
Magnesium	49	0.25 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Manganese	0.014	0.0025 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Mercury	ND	0.0002 mg/L	1	EPA 245.1	7/9/01	7/9/01
Nickel	ND	0.02 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Potassium	14	1. mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Selenium	ND	0.001 mg/L	1	EPA 200.8	7/3/01	7/5/01
Silver	ND	0.005 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Sodium	120	0.25 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Thallium	ND	0.001 mg/L	1	EPA 200.8	7/3/01	7/5/01
Zinc	ND	0.05 mg/L	0.5	EPA 200.7	7/3/01	7/6/01

D.F. - Dilution Factor

ND - Not Detected

NEL LABORATORIES

CLIENT:	Nevada Power Company	CLIENT ID:	**Method Blank**
PROJECT ID:	Harvey Replacement Well	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	0703-3.2-BLK

TEST: **Metals**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.001 mg/L	1	EPA 200.8	7/3/01	7/5/01
Arsenic	ND	0.001 mg/L	1	EPA 200.8	7/3/01	7/5/01
Lead	ND	0.001 mg/L	1	EPA 200.8	7/3/01	7/5/01
Selenium	ND	0.001 mg/L	1	EPA 200.8	7/3/01	7/5/01
Thallium	ND	0.001 mg/L	1	EPA 200.8	7/3/01	7/5/01

D.F. - Dilution Factor

ND - Not Detected

NEL LABORATORIES

CLIENT: Nevada Power Company
PROJECT ID: Harvey Replacement Well
PROJECT #: NA

CLIENT ID: **Method Blank**
DATE SAMPLED: NA
NEL SAMPLE ID: 0703-4.2-BLK

TEST: **Metals**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Barium	ND	0.0025 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Beryllium	ND	0.0025 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Cadmium	ND	0.002 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Calcium	ND	0.25 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Chromium	ND	0.005 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Copper	ND	0.002 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Iron	ND	0.05 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Magnesium	ND	0.25 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Manganese	ND	0.0025 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Nickel	ND	0.02 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Potassium	ND	1. mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Silver	ND	0.005 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Sodium	ND	0.25 mg/L	0.5	EPA 200.7	7/3/01	7/6/01
Zinc	ND	0.05 mg/L	0.5	EPA 200.7	7/3/01	7/6/01

D.F. - Dilution Factor

ND - Not Detected

NEL LABORATORIES

CLIENT:	Nevada Power Company	CLIENT ID:	**Method Blank**
PROJECT ID:	Harvey Replacement Well	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	L7003-HG-BLK

TEST: **Metals**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Mercury	ND	0.0002 mg/L	1	EPA 245.1	7/9/01	7/9/01

D.F. - Dilution Factor

ND - Not Detected

NEL LABORATORIES

CLIENT: Nevada Power Company
PROJECT ID: Harvey Replacement Well
PROJECT #: NA

CLIENT ID: **Harvey Well Replacement (HR-2)**
DATE SAMPLED: 7/2/01
NEL SAMPLE ID: L0107003-01

TEST: **Inorganic Non-Metals**
MATRIX: Drinking Water

PARAMETER	RESULT		R. L.	D. F.	METHOD	UNITS	ANALYZED
Alkalinity - Bicarbonate as CaCO3	170			1	SM 2320 B	mg/L	8/7/01
Alkalinity - Carbonate as CaCO3	ND			1	SM 2320 B	mg/L	8/7/01
Alkalinity - Hydroxide as CaCO3	ND			1	SM 2320 B	mg/L	8/7/01
Alkalinity, Total as CaCO3	170		25.	1	SM 2320 B	mg/L	8/7/01
Chloride	170		50.	500	EPA 300.0	mg/L	7/5/01
Color	0		0.	1	SM 2120B	Color	7/2/01
Cyanide, TOTAL	ND		0.02	1	SM 4500-CN E	mg/L	7/6/01
Fluoride	2.3		0.4	1	SM 4500-F C	mg/L	7/3/01
Hardness, Total (as CaCO3)	452		5.	1	SM 2340 C	mg/L	9/28/01
MBAS	ND	J1	0.02	1	SM 5540 C	mg/L	7/3/01
Nitrate, as N	ND		1.	10	EPA 300.0	mg/L-N	7/3/01
Nitrite, as N	ND		1.	10	EPA 300.0	mg/L-N	7/3/01
Odor	ND		1.	1	SM 2150 B	TON	7/2/01
pH	7.75		2.	1	EPA 150.1	pH Units	7/2/01
pH Temperature	30.9		1.	1	EPA 150.1	°C	7/2/01
Sulfate	350		20.	200	EPA 300.0	mg/L	7/18/01
Total Dissolved Solids	836		15.	1	SM 2540 C	mg/L	7/3/01

R.L. - Reporting Limi
D.F. - Dilution Factor
ND - Not Detected

NEL LABORATORIES

CLIENT:	Nevada Power Company	CLIENT ID:	**Method Blank**
PROJECT ID:	Harvey Replacement Well	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	010702COLOR-BLK
TEST:	**Non-Metals**		

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Color	ND	0	1	SM 2120B	Color Un	7/2/01

D.F. - Dilution Factor

ND - Not Detected

NEL LABORATORIES

CLIENT:	Nevada Power Company	CLIENT ID:	**Method Blank**
PROJECT ID:	Harvey Replacement Well	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	010702ODOR-BLK
TEST:	**Non-Metals**		

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Odor	ND	1	1	SM 2150 B	Odor Uni	7/2/01

D.F. - Dilution Factor

ND - Not Detected

NEL LABORATORIES

CLIENT:	Nevada Power Company	CLIENT ID:	**Method Blank**
PROJECT ID:	Harvey Replacement Well	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	010703F-BLK
TEST:	**Non-Metals**		

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Fluoride	ND	0.4	1	SM 4500-F C	mg/L	7/3/01

D.F. - Dilution Factor

ND - Not Detected

NEL LABORATORIES

CLIENT:	Nevada Power Company	CLIENT ID:	**Method Blank**
PROJECT ID:	Harvey Replacement Well	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	010703MBAS-BLK

TEST: **Non-Metals**

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
MBAS	ND	0.02	1	SM 5540 C	mg/L	7/3/01

D.F. - Dilution Factor

ND - Not Detected

NEL LABORATORIES

CLIENT:	Nevada Power Company	CLIENT ID:	**Method Blank**
PROJECT ID:	Harvey Replacement Well	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	010703NO2-BLK
TEST:	**Non-Metals**		

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Nitrite, as N	ND	0.1	1	EPA 300.0	mg/L-N	7/3/01

D.F. - Dilution Factor

ND - Not Detected

NEL LABORATORIES

CLIENT:	Nevada Power Company	CLIENT ID:	**Method Blank**
PROJECT ID:	Harvey Replacement Well	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	010703NO3-BLK
TEST:	**Non-Metals**		

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Nitrate, as N	ND	0.1	1	EPA 300.0	mg/L-N	7/3/01

D.F. - Dilution Factor

ND - Not Detected

NEL LABORATORIES

CLIENT:	Nevada Power Company	CLIENT ID:	**Method Blank**
PROJECT ID:	Harvey Replacement Well	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	010703TDS-BLK

TEST: **Non-Metals**

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Total Dissolved Solids	ND	15	1	SM 2540 C	mg/L	7/3/01

D.F. - Dilution Factor

ND - Not Detected

NEL LABORATORIES

CLIENT:	Nevada Power Company	CLIENT ID:	**Method Blank**
PROJECT ID:	Harvey Replacement Well	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	010705CL-BLK

TEST: **Non-Metals**

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Chloride	ND	0.1	1	EPA 300.0	mg/L	7/5/01

D.F. - Dilution Factor

ND - Not Detected

NEL LABORATORIES

CLIENT:	Nevada Power Company	CLIENT ID:	**Method Blank**
PROJECT ID:	Harvey Replacement Well	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	010706CN-BLK

TEST: **Non-Metals**

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Cyanide, TOTAL	ND	0.02	1	SM 4500-CN E	mg/L	7/6/01

D.F. - Dilution Factor

ND - Not Detected

NEL LABORATORIES

CLIENT:	Nevada Power Company	CLIENT ID:	**Method Blank**
PROJECT ID:	Harvey Replacement Well	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	010718SO4-BLK

TEST: **Non-Metals**

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Sulfate	ND	0.1	1	EPA 300.0	mg/L	7/18/01

D.F. - Dilution Factor

ND - Not Detected

West Lakes
Laboratory & Consulting Services, LLC

Laboratory Analysis Report

TO:

09-Jul-01

NEVADA ENVIRONMENTAL LABORATORY
Attn: Mike Empey
4208 Arcata Way, Suite A
Las Vegas, NV 89030

Nevada State Certification: NV047

Date Sampled	Date Analyzed	Sample Identification	C-of-C #	Analysis	Results (mg/L)	Detection Limit	Method of Analysis
02-Jul-01	02-Jul-01	Harvey Well Replacement	L0107003-1	Total Coli. DW	**PRESENT** (5.1 MPN)	1.1 MPN	SM 9221-B
02-Jul-01	02-Jul-01	Harvey Well Replacement	L0107003-1	E. Coli. DW	ABSENT (<1.1 MPN)	1.1 MPN	EPA 1104

Thank You

LeAnna Risso
Laboratory Manager

2545 Chandler Avenue, Suite #8
Las Vegas, NV 89120
Tel: (702) 739-8786 Fax: (702) 739-8875

NEL LABORATORIES

Reno • Las Vegas • Boise
Phoenix • Sacramento

Las Vegas Division • 4208 Arcata Way, Suite A • Las Vegas, Nevada 89030
702-657-1010 • Fax: 702-657-1577 • 888-368-3282

CHAIN OF CUSTODY

NEL Work Order: [illegible]

Project Name: HARVEY REPLACEMENT WELL

Project Number:

Purchase Order Number:

Sampled By: L. Cope

Company: NEVADA POWER

Attention: RICHARD WILLER

Address:

Phone Number:

Fax Number:

Billing Address:

Expected Due Date: 7/10

Requested Turnaround: X 5-day ___ 2-day ___ 1-day ___ Other

Time/Date Sampled	Customer Sample Identification	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Analysis: PRIMARY + SECONDARY METALS + K, Na, Ca + PO4	PRIMARY & SECONDARY INORGANICS	MBAS	ODOR	CYANIDE	TOTAL COLIFORM	[illegible]	Remarks
0750 7/2/01	HARVEY WELL REPLACEMENT (HR-2)	01	1	DW	—	X							PROVIDE HARD COPY REPORT AND EDD
"	"	"	1	DW	—		X						
"	"	"	1	DW	—			X					
"	"	"	1	DW	—				X				
"	"	"	1	DW	D					X			
"	"	"	1	DW	F						X		EDD emailed to lcope@srk.com

Custody Seal intact? Y N (None) Temp. 27°C

Condition when received (good)

Box #1: DW - Drinking Water; WW - Waste Water; OL - Oil/Organic Liquid; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other $Na_2S_2O_3$; G. Not Preserved

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 LAWRENCE COPE		7/2/01 1040	A. FLOOD		7-2-01/1040
2					
3					

ORIGINAL

Appendix D

Nevada DWR Well Driller's Report

WHITE—DIVISION OF WATER RESOURCES
CANARY—CLIENT'S COPY
PINK—WELL DRILLER'S COPY

PRINT OR TYPE ONLY
DO NOT WRITE ON BACK

STATE OF NEVADA
DIVISION OF WATER RESOURCES

WELL DRILLER'S REPORT

Please complete this form in its entirety in accordance with NRS 534.170 and NAC 534.340

OFFICE USE ONLY
Log No.
Permit No.
Basin

NOTICE OF INTENT NO. 22197

1. OWNER Nev Power Co
MAILING ADDRESS 6201 West Sahara Av. Las Vegas NV
ADDRESS AT WELL LOCATION I-15 and Nev Highway 93

2. LOCATION NW ¼ SW ¼ Sec. 21 T 7 N/S R 64 E Clark County
PERMIT NO. 60022 (Issued by Water Resources) 083-20-000-202 (Parcel No.) Subdivision Name

3. WORK PERFORMED
☐ New Well ☒ Replace ☐ Recondition ☐ Deepen ☐ Abandon ☐ Other

4. PROPOSED USE
☐ Domestic ☐ Irrigation ☐ Test ☒ Municipal/Industrial ☐ Monitor ☐ Stock

5. WELL TYPE
☐ Cable ☐ Rotary ☒ RVC ☐ Air ☐ Other

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
Hard clay and gravel		0	10	10
clay		10	60	50
Clay with gravel		60	70	10
clay		70	120	50
clay		120	170	50
clay		170	220	50
clay		220	270	50
clay		270	320	50
clay		320	370	50
clay		370	420	50
clay		420	460	40
clay with gravel		460	470	10
clay		470	495	25
clay mixed with limestone		495	510	15
limestone		510	550	40
limestone		550	600	50
limestone		600	650	50
limestone		650	700	50
limestone		700	750	50
limestone		750	800	50
limestone and clay		800	815	15
broken limestone		815	870	55

Date started 6-7-2001
Date completed 7- 20, 2001

7. WELL TEST DATA

TEST METHOD: ☐ Bailer ☒ Pump ☒ Air Lift

	G.P.M.	Draw Down (Feet Below Static)	Time (Hours)
Airlift	90	2	45
pump	1500	32	72

8. WELL CONSTRUCTION
Depth Drilled 870 Feet Depth Cased 833 Feet

HOLE DIAMETER (BIT SIZE)

Inches	From (Feet)	To (Feet)
48	0	40
28	40	510
17½	510	870

CASING SCHEDULE

Size O.D. (Inches)	Weight/Ft. (Pounds)	Wall Thickness (Inches)	From (Feet)	To (Feet)
30"		.375	0	40
20"	78	.375	0	500
12	49.6	.375 (0.312)	0	833

Perforations:
Type perforation Louvered (Roscoe Moss)
Size perforation .050
From 833 feet to 553 feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

Surface Seal: ☒ Yes ☐ No
Depth of Seal 500
Placement Method: ☒ Pumped ☐ Poured
Seal Type: ☐ Neat Cement ☒ Cement Grout ☐ Concrete Grout

Gravel Packed: ☒ Yes ☐ No
From 870 feet to 500 feet

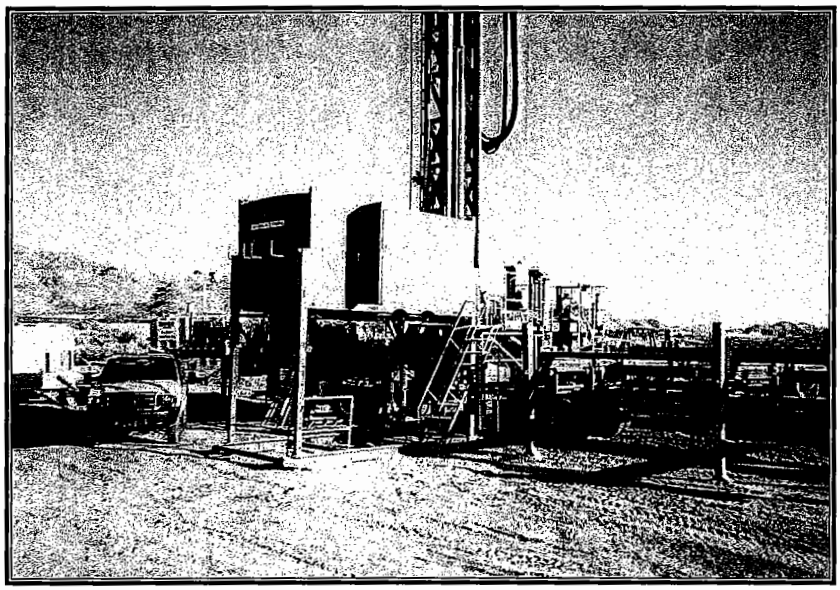
9. WATER LEVEL
Static water level 260 feet below land surface
Artesian flow G.P.M. P.S.I.
Water temperature 83 °F Quality

10. DRILLER'S CERTIFICATION
This well was drilled under my supervision and the report is true to the best of my knowledge.
Name Layne Christensen Co. (Contractor)
Address 12030 East Riggs Road Chandler Az. 85249 (Contractor)
Nevada contractor's license number issued by the State Contractor's Board 19101
Nevada driller's license number issued by the Division of Water Resources, the on-site driller 1339
Signed [signature] By driller performing actual drilling on site or contractor
Date 7-8-01

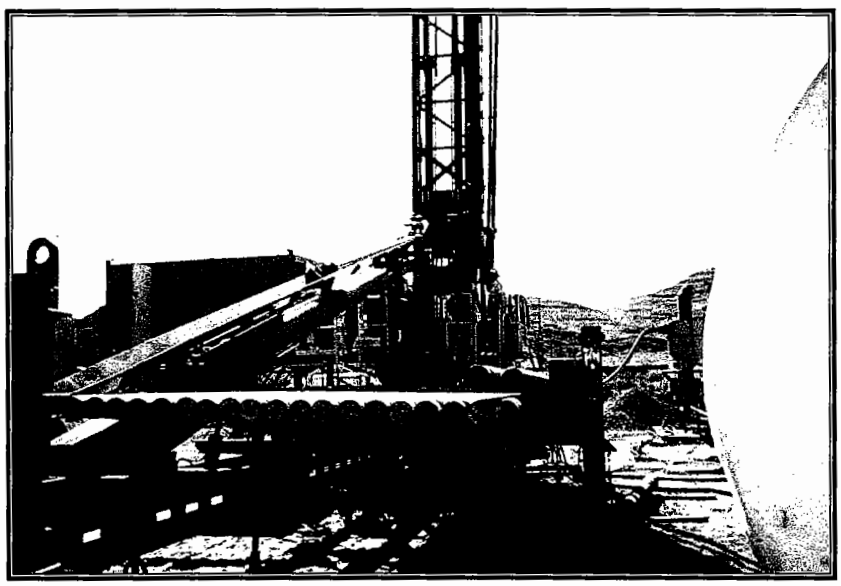
(Rev. 3-91) USE ADDITIONAL SHEETS IF NECESSARY (D)-627

Appendix E

Photographs

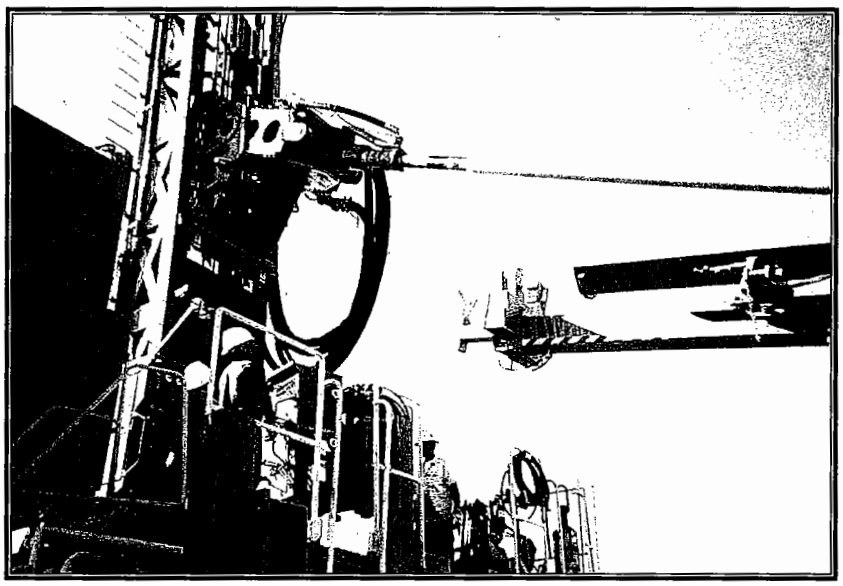


Drill rig looking southeast.



Hydraulic operated pipe rack while tripping out of hole.

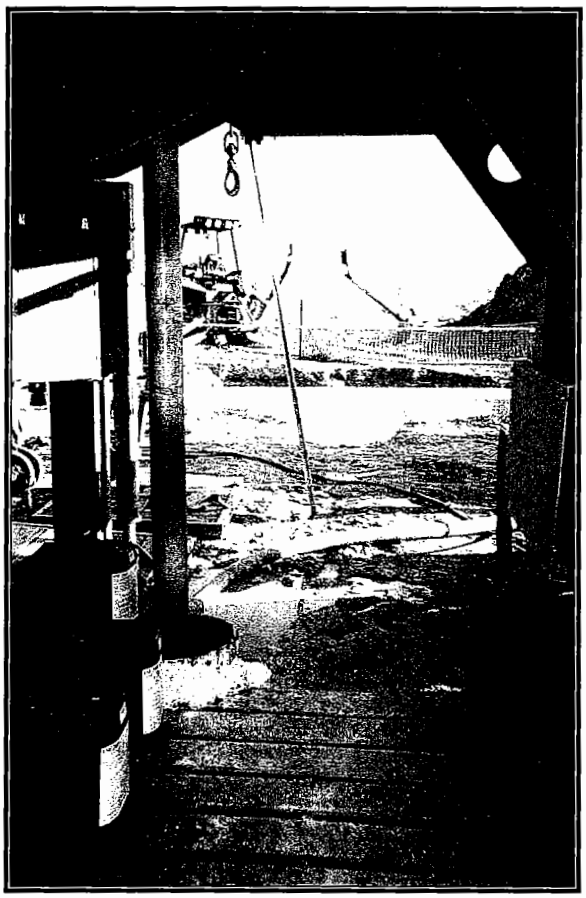
SRK Consulting Engineers and Scientists			**Nevada Power Company** **Harvey Well Replacement, RW-1**
PROJECT NO. 137901.00	DATE Sept. 2001	Plate E-1	



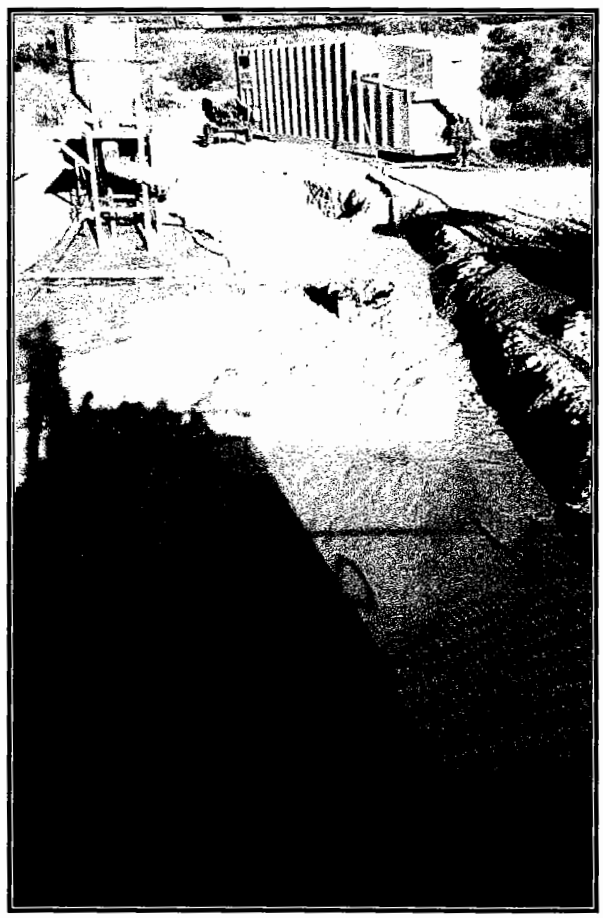
Drive head while tripping out of hole.

Rig floor. Drilling with dual-wall pipe.

SRK Consulting Engineers and Scientists			Nevada Power Company Harvey Well Replacement, RW-1
PROJECT NO. 137901.00	DATE Sept. 2001	Plate E-2	

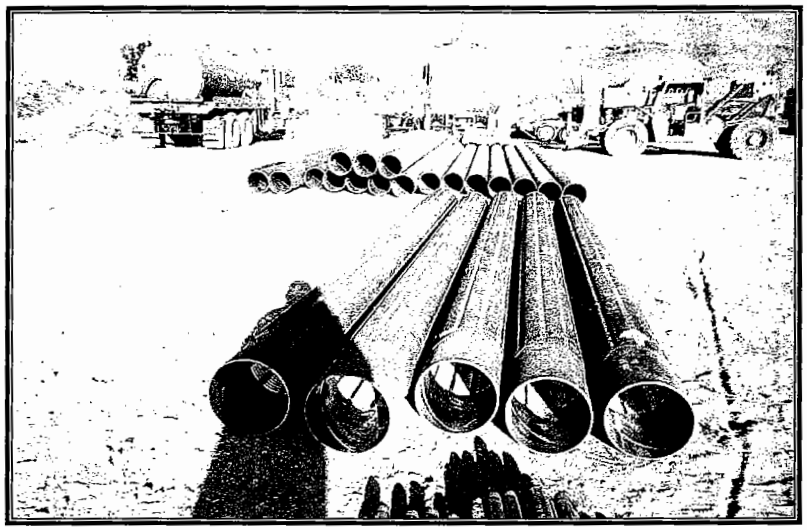


Below rig floor with mud pit in the background. Black containers are polymer drilling fluid additive.

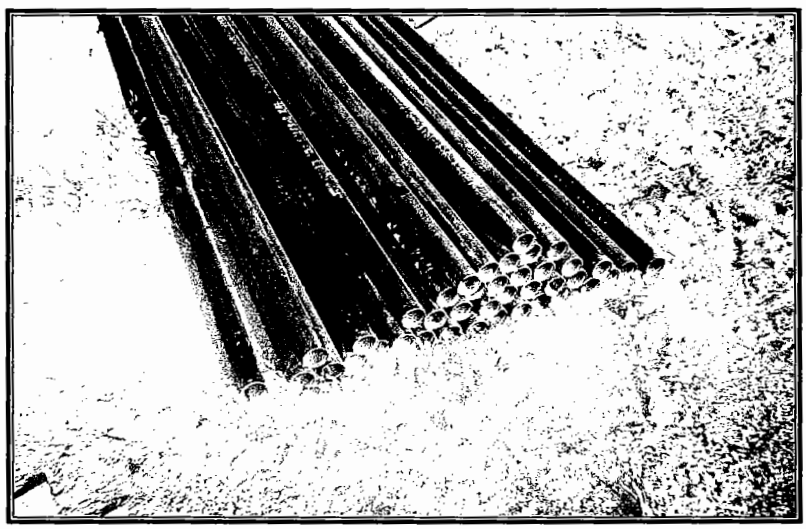


Two-stage mud pit. Cyclone sample splitter and drill-water holding tank in the background.

SRK Consulting Engineers and Scientists			**Nevada Power Company** **Harvey Well Replacement, RW-1**
PROJECT NO. 137901.00	DATE Sept. 2001	Plate E-3	

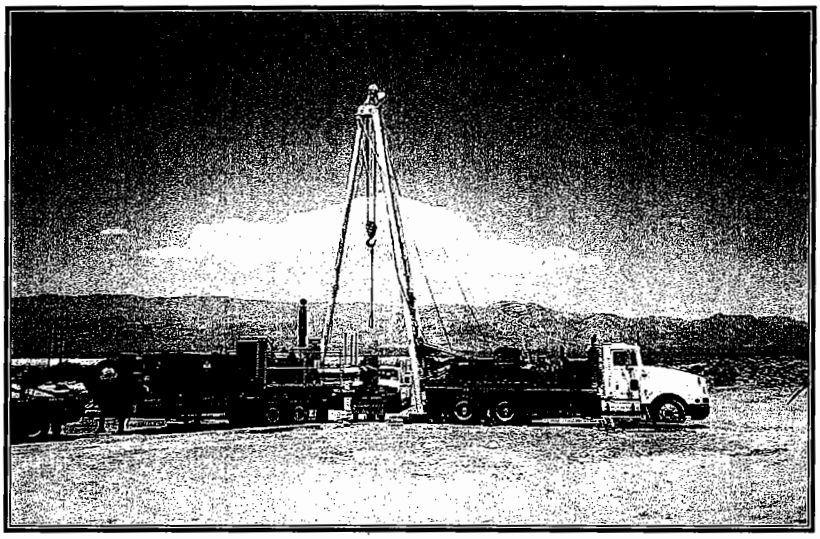


12-inch diameter well casing and screen.

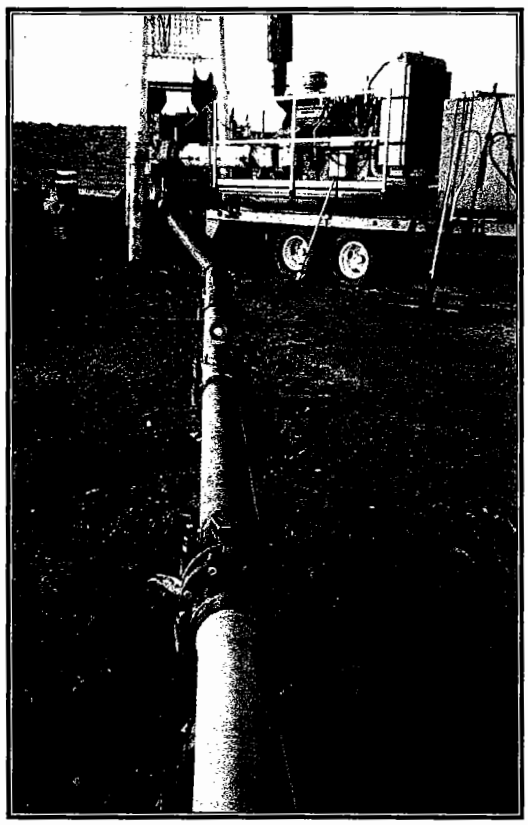


1.5-inch tremmie/sounding tube.

SRK Consulting Engineers and Scientists			Nevada Power Company Harvey Well Replacement, RW-1
PROJECT NO. 137901.00	DATE Sept. 2001	Plate E-4	

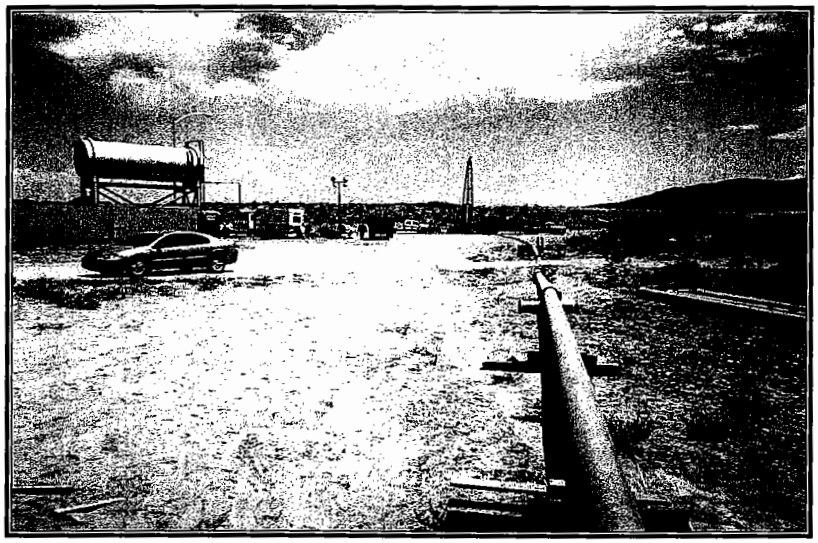


Equipment setup during pumping test. Showing service rig, diesel engine and line-shaft turbine pump gearbox. Looking west.

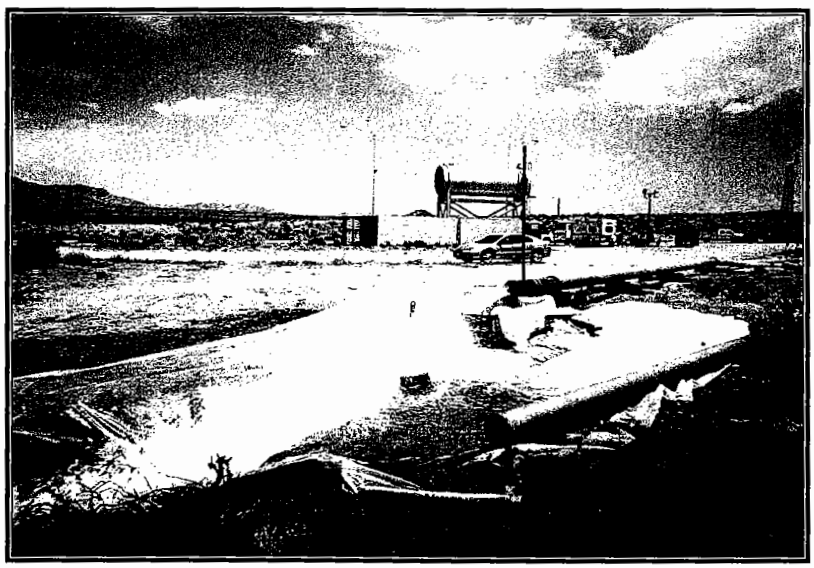


Discharge line showing gate valve (foreground) and two in-line flow meters.

SRK Consulting Engineers and Scientists			Nevada Power Company Harvey Well Replacement, RW-1
PROJECT NO. 137901.00	DATE Sept. 2001	Plate E-5	



Looking from discharge outlet back to well-head. The Harvey Well and its storage tank in the left mid-ground.



Discharge outlet showing energy dissipater (steel cage) and plastic liner to minimize soil erosion.

SRK Consulting Engineers and Scientists			Nevada Power Company Harvey Well Replacement, RW-1
PROJECT NO. 137901.00	DATE Sept. 2001	Plate E-6	

Haybales and stones used to dissipate runoff energy. Looking south-southeast.

Dissipated overland flow of run-off downstream of haybales. Looking west-northwest with Dry Lake and the Arrow Range in the background.

SRK Consulting Engineers and Scientists			Nevada Power Company Harvey Well Replacement, RW-1
PROJECT NO. 137901.00	DATE Sept. 2001	Plate E-7	