3725-00002

MT ROSE FAN EXPLORATORY DRILLING

JULY - AUGUST 1992

WASHOE COUNTY

DEPARTMENT OF PUBLIC WORKS

UTILITY DIVISION

P.O. BOX 11130 RENO, NEVADA 89520

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EXECUTIVE SUMMARY

Washoe County contracted Nevada Drilling, Inc., to drill five exploratory test holes on the upper portion of the Mt. Rose Fan. The purpose was to determine the extent of the Truckee Formation, to help define the hydrogeology and to estimate the potential for ground water production.

Test holes were drilled from 340 feet to 1100 feet deep. Cuttings were examined in detail and all boreholes were geophysically logged. The boreholes were completed as 2" steel cased wells and are to remain as long term monitor wells.

The Hunter Creek Member of the Truckee Formation was found to be laterally extensive. In test hole 4, the Hunter Creek was found at a depth of 750 feet to at least 1100 feet. There appears to be poor to fair water production from this formation.

Based on estimated aquifer transmissivities, the southern portion of section 23 appears to be the most likely area for future ground water production. A test hole should be drilled in the center of section 23 before determining this site as a production well location. Water quality does not present any potential problems.

INTRODUCTION

The Washoe County Utility Division has conducted water resource investigations of the South Truckee Meadows (STM) since 1981. Currently, a program is being conducted to more accurately determine the quantity and characteristics of ground water in the South Truckee Meadows and adjacent basins. The accuracy in quantifying ground water resources is limited to the adequacy of sub-surface data. Two areas where little information exists are on the southern Galena Fan and the northwest Mt. Rose Fan.

An exploratory drilling program in the northwest area of the Mt. Rose Fan was initiated in July of 1992. The purpose was to:

1. to determine the subsurface lithology of the alluvium in areas where little, if any, information exists,
2. to the determine the potential of the alluvial aquifer in this area,
3. To determine potential future production well sites, and
4. to construct long term monitoring wells.

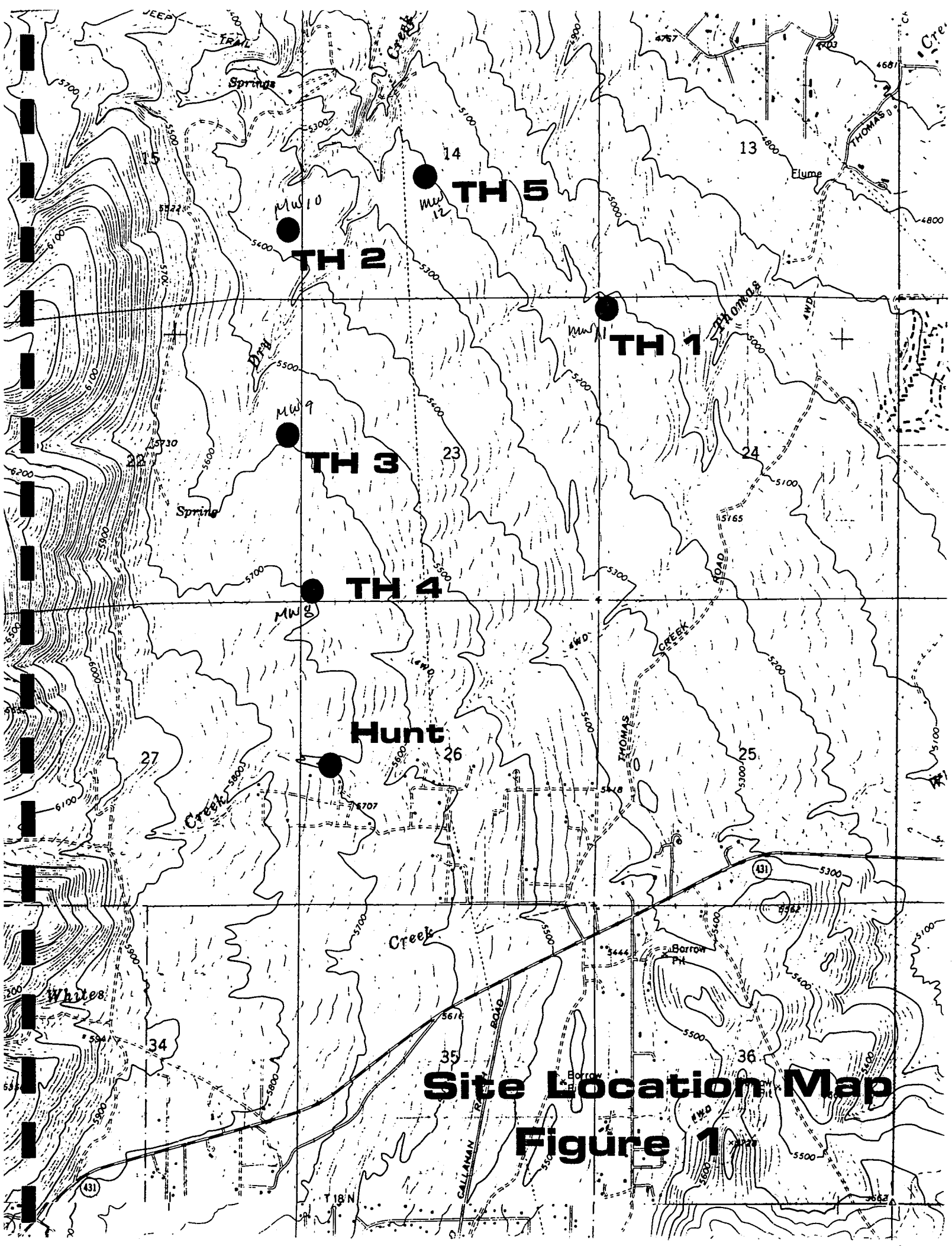
The area of drilling was confined to the Redfield property located on Figure 1. Five sites were contracted with Nevada Drilling, Inc. to drill in alluvium to the bedrock contact and construct monitor wells. Additionally, a domestic water well was also drilled in the vicinity wherein the Utility Division was permitted by the owner to log the borehole both lithologically and geophysically.

The data gained from this program allows for a more accurate delineation of the alluvial aquifer, ground water flow paths and the resource itself. This report contains the results of the drilling program. The section "Discussion of Results" attempts to delineate the subsurface geology with respect to the alluvial aquifer. Potential ground water production is also estimated. Finally, recommendations are made towards future exploratory work.

DRILLING OPERATIONS

Through a low bid process, Nevada Drilling was awarded the drilling contract for five test holes (Figure 1). A Midway Model 15 Direct Rotary drilling rig with tri-cone bits were used to drill 8-3/4 inch diameter boreholes. Depths of these boreholes ranged from 340 feet to 1100 feet.

The drilling fluid consisted of high yield bentonite clay with minor amounts of synthetic polymer additives. At lost circulation zones, Lost Circulation Material (LCM) was used to "plug off" these zones. The LCM consisted of wood shavings and cellophane.



Site Location Map

Figure 1

Utility Division personnel supervised the drilling operations and performed the lithology sampling. Samples were collected throughout the borehole and bagged at ten foot intervals. BPB Instruments performed borehole geophysics which included electric (long and short normal, spontaneous potential and point resistivity), caliper, sonic and gamma logs.

The boreholes were then constructed as 2 inch diameter, galvanized steel cased monitor wells. Local 3/8 inch pea gravel was used for the gravel envelope and was tremmied. A fifty foot seal was installed. The wells were air lift developed until clean. The wells were also sampled for water quality.

DESCRIPTION OF LITHOLOGY

While commonly referred to as the Mt. Rose Fan, this area is more accurately described as an alluvial veneered pediment. The alluvium encountered ranged from large boulders (15 feet) to clays. Generally, the boulders and cobbles were encountered in the top 100 to 150 feet in unconsolidated sediments that continued in depth as gravels, sands, silts and clay size particles.

Most boreholes encountered the Hunter Creek Member of the Truckee Formation. Two sequences of this member were delineated. The first is a diatomaceous siltstone of various and distinct colors particularly a blue-green color and a deep, brown "oily" color. At first inspection out of the borehole, the cuttings were logged as mostly clays. On closer inspection the cuttings can be described as diatomaceous siltstones. With depth the second sequence of sediments increased in coarseness to a "dirty" sandstone and often contained thin lenses of clay altered and fractured andesitic rock. The consolidated sediments generally lay atop the Kate Peak Formation (andesite).

A general description for each borehole follows with the complete lithology described in Appendix 1. Appendix 2 contains the geophysical logs for each borehole.

Test Hole 1 (STMMW 11)

Mixed unconsolidated alluvial material was encountered to a depth of 260 feet. The grain size generally decreased with depth. From 260 - 360 feet a clay, possibly of the Hunter Creek Member, was found. These clays were colored creme, yellow, grey-green or brown with silts and sands. Consolidated silts, sands, gravels and clays continued to 512 feet. Clay altered volcanics were drilled to 580 feet before more competent reddish-purple, andesitic bedrock thought to be the Kate Peak Formation. The drilling was stopped at 590 feet.

Geophysical logs run were electric, temperature and sonic. The resistivites ranged from 20 to 100 ohm-m below the water table (210 ft). The siltstones averaged 40 ohm-m and the lower sedimentary sequence ranged from 20 to 100 ohm-m. A possible production zone would be from 330 ft to 490 feet where gravel lenses are located. Below 500 feet the resistance was consistently 20 ohm-m and appears to verify the clay altered volcanics where the transit time increased on the sonic log. 160' Screen

Test Hole 2 (STMMW 10)

Mixed volcanic alluvial material was encountered to 100 feet before the Hunter Creek Member. This section (100 - 308) consisted of the multi-colored clays or siltstone and particularly the grey-green and brown to black "oily" colored clays. At 220 feet a lost circulation zone was encountered with poor sample return until 257 feet. A distinct sandstone was drilled to 308 feet and then silt and clay size particles to 320 feet. A dark grey, andesite (?) was drilled then to 340 feet.

Geophysical logs run were electric, temperature, caliper and gamma. The resistance from 100 - 310 feet was consistently 20 ohm-m. This resistance reflects the consolidation of silt and sand size particles (Gates, 1992). The gamma log shows two distinct zones from 100 - 200 and 200 - 300 feet indicating a change in grain size of the sediments (silt and clay and then sand).

A water level elevation is at 97 feet. There does not appear to be much ground water production potential from this site. It would be helpful to know what the hydraulic conductivity of these consolidated sediments are.

Test Hole 3 (STMMW 9)

The cobbley, bouldery alluvium was encountered to a depth of 100 feet, then gravelly sands, silts and clays to 282 feet. The Hunter Creek Member followed to 560 feet. The clays or siltstone of this section were from 282 - 440 feet. Then a "dirty" sandstone to 560 feet. A clay altered andesite was found from 560 to 585 feet, then a sandy, silty, gravel with well rounded pebbles to 638 feet. Clay altered volcanics with decreasing alteration to 680 feet was encountered.

Geophysical logs run were electric, temperature, and sonic. The resistance was as in Test Hole 2, consistently 20 ohm-m throughout the Hunter Creek Member.

The sonic log appears to verify the changes in grain size of the Hunter Creek Member with the siltstone having transit times less than the sandstone.

The satic water level was 140 feet. Depending on the hydraulic conductivity of the Hunter Creek Member sandstone, a possible water production zone is from 450 -650 feet.

Test Hole 4 (STMMW 8)

Bouldery alluvium was encountered to a depth of 160 feet. Silty, sandy gravels were found to a depth of 310 feet, then sandy silts, clays and mixed gravels to 740 feet. These appear to be unconsolidated. The upper sequence of siltstone of the Hunter Creek Member was then found and continued to at least 1100 feet when all the drill pipe had been used.

An electric log was run to a depth of 700 feet before getting stuck. Resistance ranged much higher (40 - 120 ohm-m), indicating unconsolidated and coarser sediments. A good to moderate zone for water production may occur from 400-700 feet. The water level was measured at 228 feet.

Test Hole 5 (STMMW 12)

Cobbley gravels were encountered to a depth of 155 feet before a clay lense, with granitic sand was drilled from 155 - 200 feet. The upper sequence of the Hunter Creek Member was drilled to a depth of 363 feet. From this depth to 612 feet an alteration clay with volcanic fragments were encountered. Throughout this zone the drilling alternated from hard and slow drilling to soft and fast. This zone could be interpreted as highly altered volcanic flows with lenses of depositional sands and silts. It was felt that the Kate Peak Formation was encountered at 575 feet. The total depth of the hole was 630 feet.

The geophysical logs run were electric and sonic. The electric log generally shows resistances in the 20 - 40 ohm-m range with subtle changes occuring that are more pronounced in the sonic log. These occur from 150 - 260 feet (upper sequence of the Hunter Creek Member), 260 - 360 feet (finer grained upper sequence), 360 - 460 feet (highly altered and fractured andesite ?), 460 - 575 feet (clay altered andesite ?) and finally the more competent andesite to 630 feet.

The water level was measured at 148 feet. Based on the lithology and geophysical logs, there appears to be fair to poor potential for water production.

Hunt Domestic Well

Sand, gravel, cobbles and boulders were drilled to 130 feet, then sands, gravels and clays to 210 feet. Hard andesite was then encountered to 380 feet. Fractures occured throughout the hard rock section with minor clay.

Geophysical logs run were electric and gamma. They did not appear to differentiate the alluvium from the hard rock. The static water level was 240 feet. At this site the alluvium is apparently unsaturated. The volcanics contain adequate ground water for domestic use.

MONITOR WELL CONSTRUCTION

Appendix 3 shows the well construction for each well. Table 1 lists total depth and slot intervals for each well.

TABLE 1
MONITOR WELL CONSTRUCTION

Test Hole	Total Depth (ft)	Casing Depth (ft)	Slot Interval (ft)	Seal Depth (ft)	Devel. Time (hrs)
1 11	590	500	200-500	50	3
2 10	340	313	82-313	50	4
3 9	680	630	189-630	50	6
4 8	1100	704	200-704	50	7
5 12	630	605	357-605	50	8

Test Hole 4 was cased to 704 feet as the borewall apparrently had collapsed below this depth.

WATER QUALITY

Appendix 5 contains water quality reports from the Nevada State Health Lab for the five test wells. Table 2 is a summary listing of the major anions and cations.

TABLE 2
WATER QUALITY SUMMARY
(ppm)

Well	TDS	Ca	Mg	Na	K	SO4	Cl	HCO3	As
TH 1 11	183	19	14	10	4	1	0	159	.003
TH 2 10	238	24	9	36	6	10	1	195	.008
TH 3 9	205	22	10	25	6	3	0	171	.004
TH 4 8	226	8	3	45	5	8	2	142	.033
TH 5 12	268	25	11	37	8	24	3	200	.018

From the analysis (Appendix) it can be seen that water quality meets all Federal and State primary and secondary requirements for potable water.

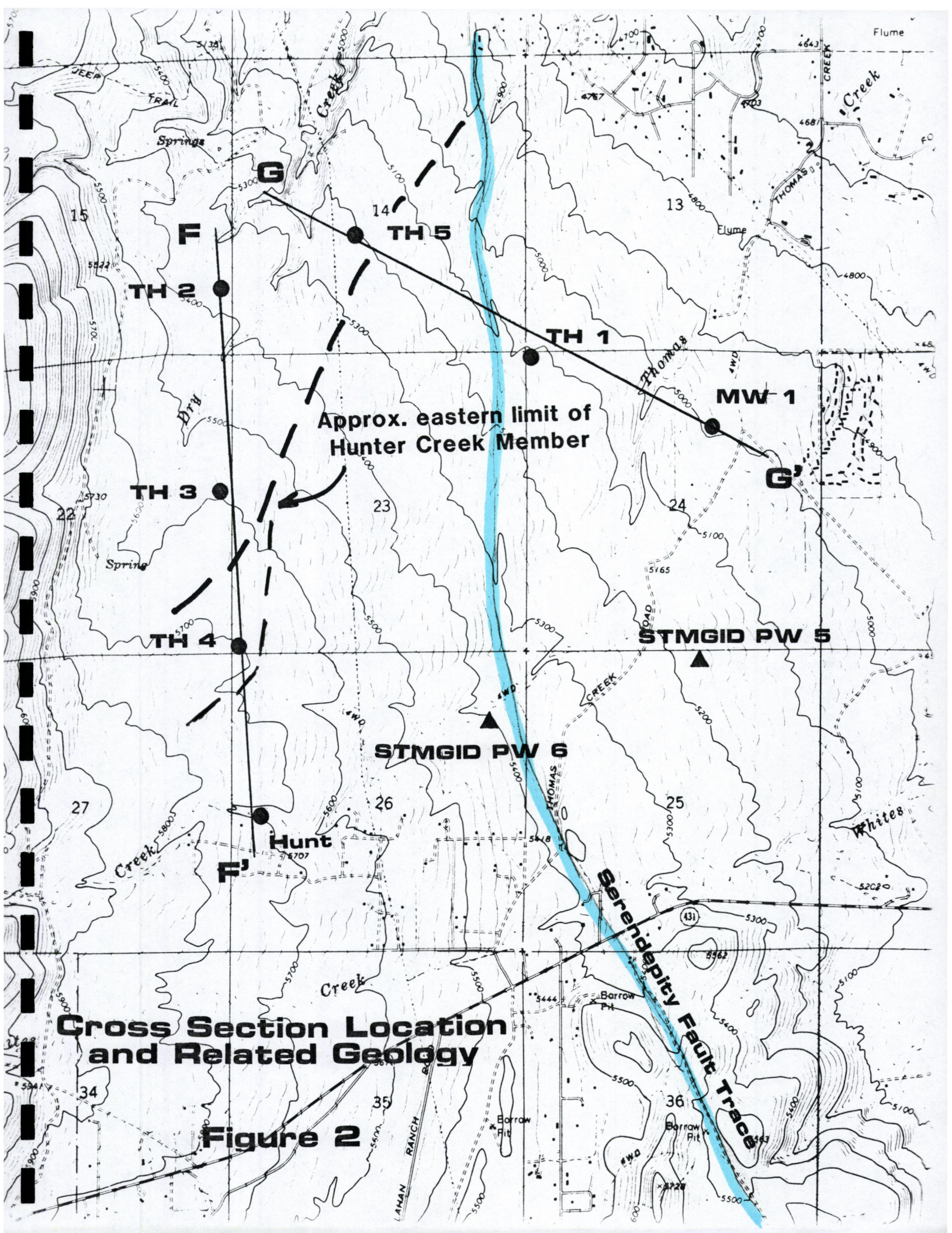
DISCUSSION OF RESULTS

Geology

The Mt. Rose Fan is more accurately described as an alluvial veneered, volcanic pediment. The pediment being made up primarily of andesites of the Kate Peak Formation (Thompson and White, 1964). It is bounded on the west by the Carson Range (mountain front faulting) and on the east by the valley floor of the South Truckee Meadows. The valley floor is thought to be a graben produced by an inferred regional fault trending north-south near US 395 and the Virginia Range further east. The uplifted Steamboat Hills bound the pediment on the south. The pediment is mapped with numerous faults (Bonham and Rogers, 1983), but any vertical and horizontal movement of these faults is poorly understood. There is also evidence of east-west faulting that pre-dates the north-south faulting (van De Kamp, 1990) particularly along the Whites Creek drainage.

The thickness of the alluvial veneer is thought to be approximately 600 to 700 feet thick until the valley floor is reached where accumulated sediments are more likely 2,000 feet thick. The veneer is also thought to be primarily poorly sorted, unconsolidated sediments. The Hunter Creek Member of the Truckee Formation (or Coal Valley Formation) are mostly fine grained, well sorted to moderately sorted, siltstones and sandstones (Bonham, 1969). Delineating the southern areal extent of the Hunter Creek Member was a primary objective of this drilling project.

Figure 2 shows where two geologic cross sections are illustrated in Plate 1. Section F-F′ is a north to south cross section of test holes 2, 3, 4 and the Hunt domestic well. From test hole 2 and 3 the sequence of sediments are essentially the same with thicker deposits in test hole 3. Both upper and lower sequences of the Hunter Creek member are present. A section of altered volcanics present in test hole 3 may represent the same volcanics in test hole 2, but in an unaltered state. At test hole 4 the HCM appears to have been downfaulted (?) 300 feet relative to test hole 3. This faulting is inferred from geologic mapping (Bonham and Rogers, 1983). The upper sequence is substantially thicker in test hole 4. Down faulting is also inferred at test hole 4 relative to the Hunt domestic where the HCM is missing and the volcanics are found at the 5500 foot elevation. A surface expression of this faulting could be inferred from the deep drainage immediately south of test hole 4.


G
F
TH 5
TH 2
TH 1
MW 1
G'
Approx. eastern limit of
Hunter Creek Member
TH 3
TH 4
STMGID PW 5
STMGID PW 6
Hunt
F'
Serendepity Fault Trace
Cross Section Location
and Related Geology
Figure 2

Cross section G-G' illustrates the geology trending northwest to southeast. The HCM as mapped in the Dry Creek drainage is not readily identified in TH 5 until a depth of approximately 150 feet. Again, faulting is inferred to have offset these sediments. The Upper HCM is thicker in test hole 5 that in test holes 2 and 3 and the Lower sequence is missing in test hole 5. A thick sequence of altered volcanics follows. Between test holes 5 and 1, a swarm of faults are mapped (Bonham and Rogers, 1983) and the Serendepity Fault (Widmer, 1991) is inferred to cross the pediment. The Hunter Creek Member is not evident in test hole 1. The Hunter Creek is also missing from MW 1 (CH2MHill, 1983).

It is inferred from the cross section F-F' that faulting has vertically displaced the Hunter Creek sediments and the Kate Peak Formation in the area of TH 4 relative to TH 3. There may also be displacement relative to the Hunt site, but it is also possible that these volcanics are simply very localized and overlie older sediments. This would indicate that these particular volcanics are much younger (Pliocene basaltic andesite of Carson Range ?) than the Kate Peak (Miocene) and the Hunter Creek Member of the Truckee Formation. Evidence for this is that the drill cuttings did not appear to be altered, but rather "fresh" and more mafic than the altered volcanics such as in TH 5.

The Hunter Creek is not found east of the Serendepity Fault (Figure 2). The Hunter Creek sediments were not found at STMGID Production wells 5 and 6, which are immediately south of the Thomas Creek drainage (Widmer, 1991). However, these boreholes were drilled only to 700 feet, which may not have been deep enough to find the HCM as demonstrated in TH 4. Either this sequence of sediments have been eroded from this area, east of the Serendepity Fault, or were not initially deposited. From section G-G", the north central portion of the pediment, the thickness of total sediment remains constant down slope from test hole 5 to MW 1 and further eastward as seen in MW 2 and STMGID Production Well 1 (CH2MHill, 1983). It is still unknown how thick the sediments are in the south central portion of the pediment.

Hydrogeology

Figure 3 depicts the piezometric surface on the Mt. Rose Pediment. In the area of interest there is a fairly uniform gradient from the mountain front northeastward to section 13. This gradient would infer that there are no geological changes in the alluvial aquifer. However, southward the gradient flattens and is interpreted as a thickening of sediments with respect to the volcanics to the west. A future test hole in the center of section 23 (T19R18) would be beneficial to our understanding of the hydrogeology. Depth to water is approximately 100 to 200 feet throughout the area of study.

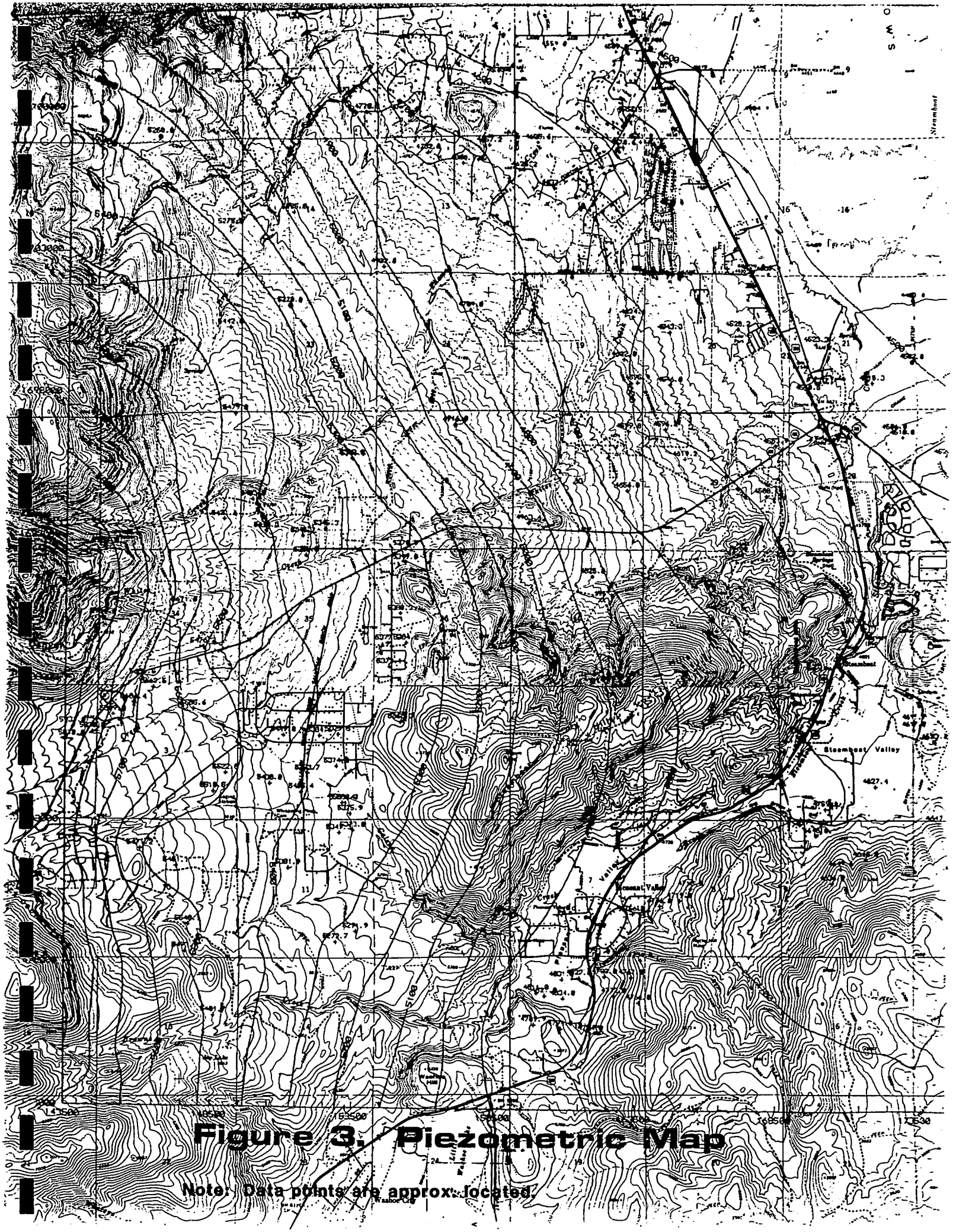


Figure 3. Piezometric Map

Note: Data points are approx. located.

From the drilling program it was observed that the Hunter Creek Member is fairly extensive within the area of section 14 and the northwest portion of 23. The drill cuttings of this formation can be compared to other nearby sites, such as STMPW 5 and STMPW 6 (Washoe County, 1989), in order to estimate aquifer parameters. The hydraulic conductivity of this formation is consequently estimated to be relatively poor and within the range of 0.1 to 2 ft/day. The coarse grained, unconsolidated sediments, such as those drilled extensively in TH 4, are estimated to be fair to good or 5 to 17 ft/day.

Figure 4 is a map of the bedrock elevation within the study area. Subtracting these elevations from the piezometric map gives the resultant Figure 5 which is an estimate of the saturated thickness of the alluvial aquifer. From this figure the area of greatest saturated thickness appears to be in the southern portion of section 23. Transmissivities in this area are estimated at 18,000 to 60,000 gpd/ft of drawdown. If these estimates are reasonably correct, a production well in the southern portion of section 23 could easily provide 600 gpm to 1000 gpm. Conversely, a production well at TH 5 may have a production rate of only 200 gpm.

CONCLUSIONS

The Hunter Creek Member of the Truckee Formation was found to be extensive within the area of study. The Upper sequence is mostly a siltstone while the Lower member is a silty sandstone. Underlying this is altered andesites, most likely of the Kate Peak Formation. Water production from the Hunter Creek Member is estimated to be poor to fair.

The southern portion of section 23 has the best potential for ground water development. Transmissivites of 18,000 to 60,000 gpd/ft are estimated. This correlates well with transmissivites in the areas of STMPW 5 and STMPW 6.

A test hole should be drilled in the center of section 23. This is to verify:

1. the lateral extent of the Hunter Creek Formation to the north and west,

2. to determine the lateral extent of the volcanics located to the southwest, and

3. to determine this site's potential for ground water production.

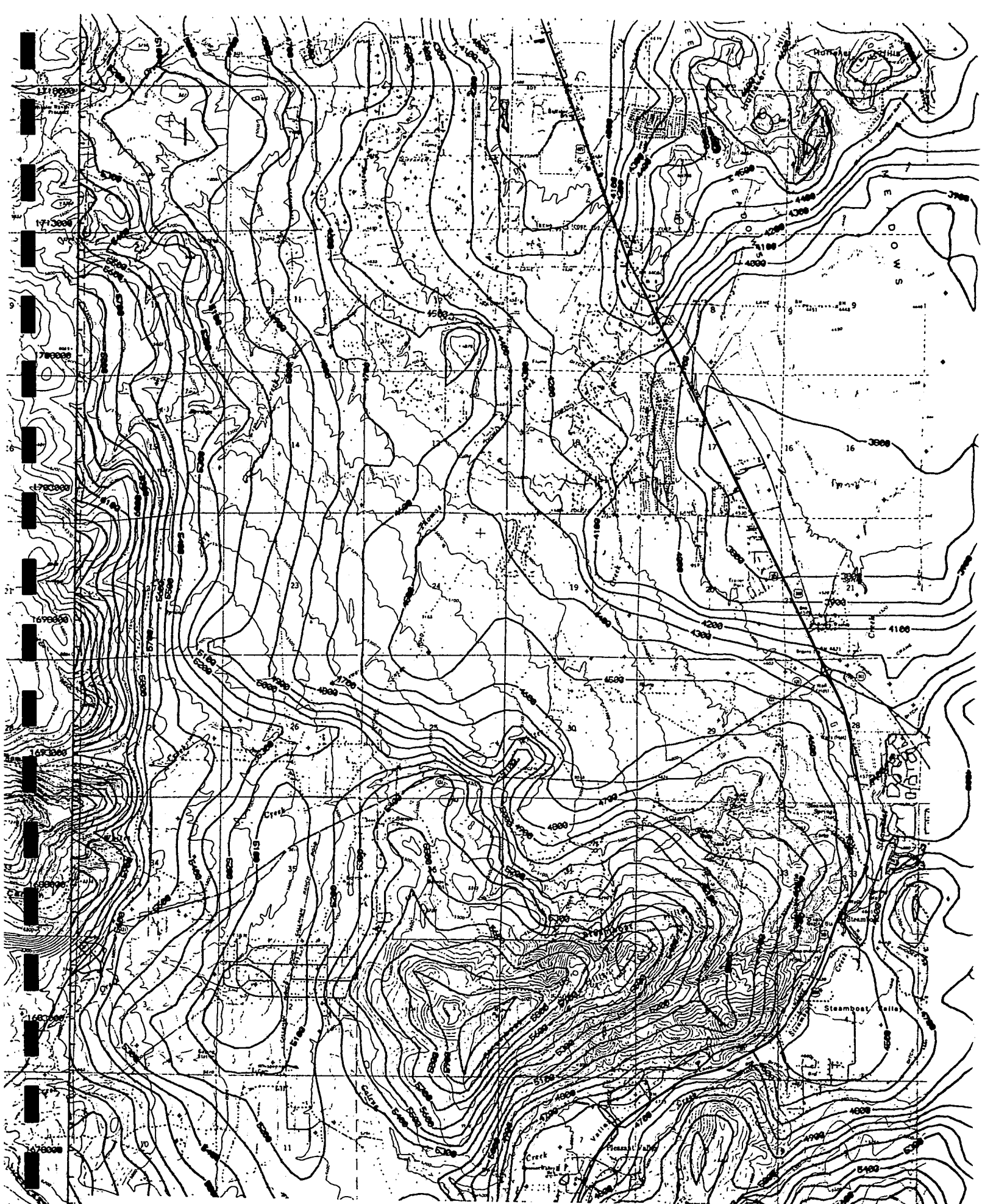


Figure 4. Top of Bedrock Contour Map

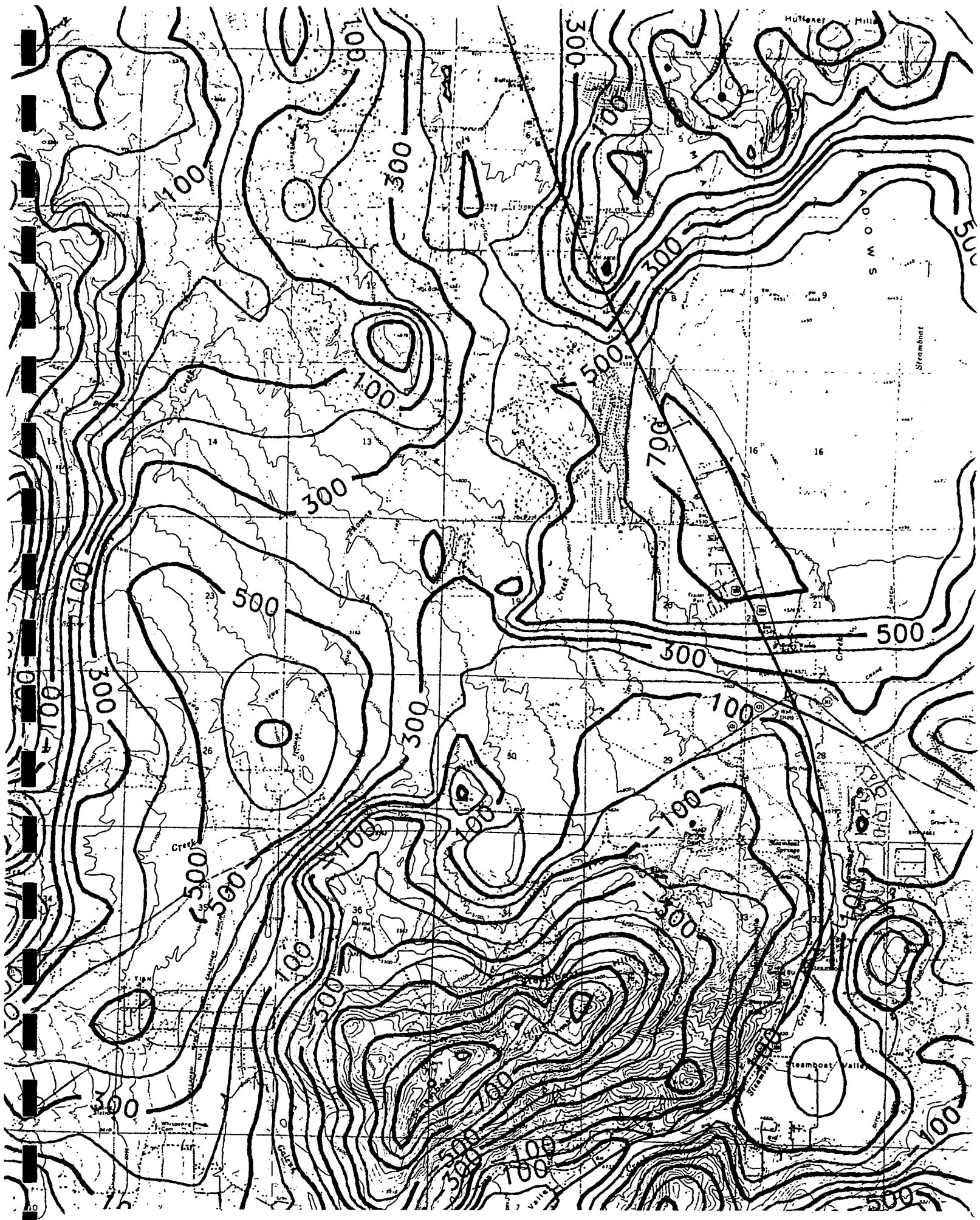


Figure 5. Saturated thickness of Alluvium

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APPENDIX

1. Lithology Logs
2. Geophysical Logs
3. Well Drillers Reports
4. Water Quality Reports
5. Bid Proposal

TH #1
"KAREN"

Ft	Lithology
000-180	Silt, sand, gravel and boulders
177-180	Lost circulation zone
180-223	mostly silty, sandy gravels with decreasing cobbles and gravel
223-240	silty sand with silt stringers, rapid drilling
240-260	sandy, silty clay or clayey silt, occassional gravels
260-~~280~~ 360	Truckee Formation (?)
	260-270 creme or yellow, plastic clay
	270-360 pebbley, sandy, silty clay or clayey silt; gritty; brown or grey green, increasing sandy gravels w/depth
360-380	silty, sandy, clayey gravel; fine grained gravel, granitic, clayey silt balls, creme colored
380-420	grades to pebbley, sandy, silty, brown clay
420-460	lost circulation zone, poor cuttings return
460-500	sandy, silty gravel; occassional cobble or boulder mixed volcanic and granitic cuttings
500-512	sandy, clayey gravel; drilling slows; increasing greenish-yellow, plastic(?) clayballs
512-580	altered volcanics; volcanic chips and purplish, clay altered andesite (?); no granitics
580-590	reddish-purple, andesitic bedrock

TH #2
"KAYE"

Ft	Lithology
000-069	coarse volcanic sands, gravels and cobbles
069-078	sandy, silty gravel
078-100	silty,sandy gravel;coarse, sub-rounded to angular; appears entirely volcanic, minor cinder
100-308	Truckee Formation
	100-135 reddish-brown, sandy, silty clay grades to creme, dessicated, plastic clay; really a siltsonte or diatomaceous siltstone
	135-151 brown to black brown
	151-160 grey to grey-green
	160-180 brown-black "oily"
	180-200 goes to grey-green, gritty and/or sandy w/ green "altered" clasts (alteration insitu)
	200-220 goes to tan
	220-240 lost circulation zone
	240-257 poor returns, silty sand?
	257-260 coarse sand, hard drilling w/pulldown
	260-308 silty to coarse sandstone, minor volcanic chips; semi-angular to rounded sand, used pulldown
308-320	yellow, silty clay or clayey silt w/mixed volcanic sand. Slow to fast drilling
320-340	Volcanic bedrock; dark grey, andesitic (?) chips; some chips almost like peels; very slow, hard drilling; apparent fracture zones @ 322 and 329 feet

TH #3
"LAURA"

~ 140'

Ft	Lithology
000-095	silty, sandy gravels with boulders
095-147	silty gravel w/ brown silty clay
147-185	silty, tan-brown clay w/gravel lenses
185-282	pebbly, sandy, clayey silt; tan to creme
282-560	Truckee Formation
	282-288 distinct green, sandy siltstone
	288-290 dark brown "oily", siltstone
	290-400 mostly green to grey-green siltstone w/ alternating lenses of "oily", creme or tan colored siltstone
	400-440 alternating colors of siltstone, less consolidated (?)
	440-460 goes to pebbley sandstone; pebbles are dark brown to black w/ small white phenocrysts in fine grained groundmass
	460-500 cobbley, pebbley, sandy silt; pebbles are black-brown to yellow-green, angular to rounded, minor cinder
	500-545 grades to brown clay then sandy gravel; sub-angular to rounded
	545-560 grades to sandy, clayey silt with stringers of sandy gravel; gravels are volcanics (?), chert and sandstone
560-585	volcanic cuttings and alteration silts and minor clays; alterations mostly gritty, reddish silts or fine sands; hard drilling with much drill slammin'
585-638	clayey, silty gravel; well rounded pebbles
638-650	grey-blue to grey-black altered volcanics; hard and slow drilling; alterations reddish then multicolored-reddish, yellow-tan, grey-blue and grey-green.
650-666	blue-green, clay altered volcanic cuttings
666-680	blue-green and tan, clay altered volcanic cuttings with decreasing alterations

TH #4
"ROBIN"

≈ 240'

Ft	Lithology
000-060	Boulders and cobbles
060-160	silty, sandy, gravelly, bouldery cobbles
160-172	mixed volcanic and granitic gravel
172-200	silty, sandy gravel; pyrite in andesitic gravels; propylitic calcite sands.
200-310	sandy, gravelly silt. Propylite decreasing at 220 ft.; clay balls begin to increase at 240 ft. (felsic); granitics decrease; gravel more rounded at 260 ft.
310-400	mostly sandy silt, brown with some creme colored clay.
400-445	mixed sands, gravels and silts. Balling, granitic and volcanic gravels, angular to well rounded.
445-460	silty clay
460-520	pebbley, sandy, clayey silt. Gravel well rounded, granitic and volcanic (arkosic? chert?); stringers of silt, clay and sand, grey creme to lite brown.
520-550	fine to coarse sand w/ clay and silt balls.
550-555	brown silty clay
555-590	coarse sand in clayey silt. Distinct lite tan or red-tan clay/silt balls.
590-600	tan clayey silt
600-620	silty sand; mixed volcanic and granitic, chert?
620-640	clayey silt
640-705	silty sand. Some purple alteration silt balls as TH1.
705-742	sandy, clayey silt. Creme ~~of~~ to greyish, then brown.
742-1100	Truckee Formation
	742-770 grey green silty clay w/ sand "Leisick"
	770-785 brown "oily" and olive grey siltstone
	785-810 aternating purplish grey, brown, grey black and greenish siltstone
	810-835 grey green siltstone
	835-850 "oily" siltstone
	850-1030 grey green siltstone with occassional "oily" siltstone or olive brown clay (silky)
	1030-1040 stringers of grey blue clay, olive brown clay Leisick, and med. grained white sand (5ft).
	1040-1100 Leisick siltstone

TH 5
"KATHY"

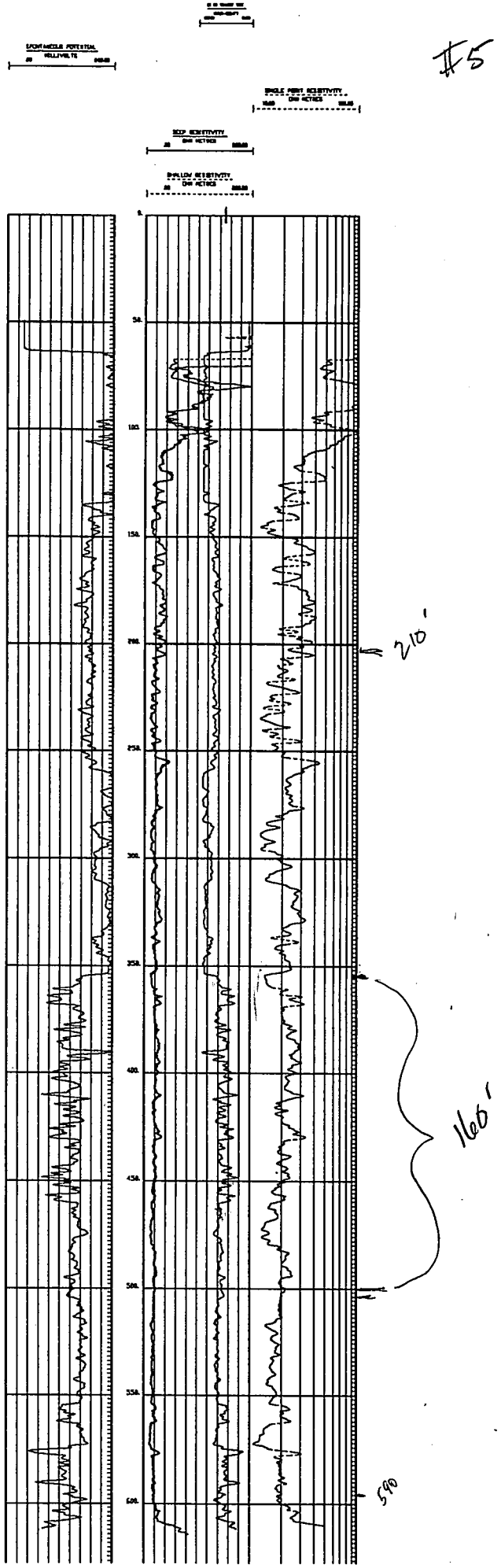
FT	LITHOLOGY
000-040	Boulders, cobbles and gravel
040-063	volcanic gravel
063-085	cobbles and gravels
085-135	volcanic gravel
135-155	gravel and clay balls
155-167	tan clay
167-200	tan clay with granitic sand
200-	Truckee Formation
	200-217 tan/brown clay
	217-235 blue gray clay
	235-262 tan/brown clay
	262-270 brown "oily" clay
	270-363 gray/blue clay w/alt lenses of tan, brown, "oily" clays
	363-398 gray/blue clay with andesite fragments
398-407	andesite fragments, hard drilling
407-440	grey alteration clay with volcanics
440-560	purple/grey clay with volcanics
560-595	same, but hard drilling
595-612	tan/red clay w/mixed volcanics
612-630	black/grey andesite cuttings

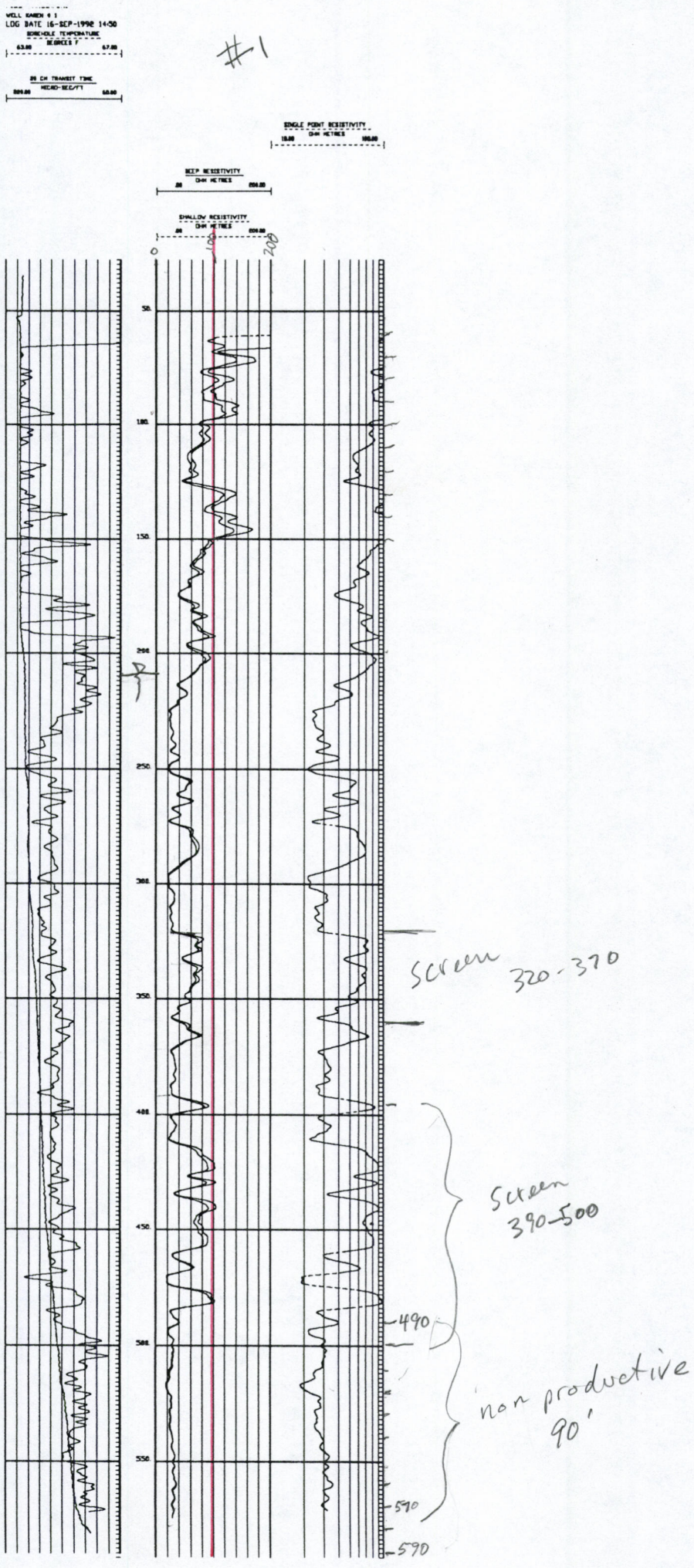
TH 6
"LYNN"

FT	LITHOLOGY
000-080	sand, cobbles and boulders
080-090	same with clay stringers, brown
090-130	sand, gravel and cobbles
130-210	sand, gravel and clay (or silt)
210-305	dark colored andesite
305-315	more purplish andesite (see TH1)
315-380	dark colored andesite

STMMW 1

FT	LITHOLOGY
000-175	sand, gravel, cobbles and boulders
175-236	silty sand and gravel
236-255	boulder
255-357	silty, sandy clay w/ occassional gravel
357-496	mixtures of silts, sands, gravels and clays
496-529	cemented sand and gravel
529-536	silty, sandy clay
536-598	hard rock or cemented sands and gravels
598-621	red volcanic rock fragments (fractured volcanics)


#5
210'
160'
590


WELL RANCH # 1
LOG DATE 16-SEP-1992 14:50
BOREHOLE TEMPERATURE
DEGREES F
63.00
67.00
20 CM TRANSIT TIME
MICRO-SEC/FT
200.00
50.00
SINGLE POINT RESISTIVITY
OHM METRES
10.00
100.00
DEEP RESISTIVITY
OHM METRES
.20
2000.00
SHALLOW RESISTIVITY
OHM METRES
.20
2000.00
0
100
200
50.
100.
150.
200.
250.
300.
350.
400.
450.
500.
550.
490
590
590
#1
Screen 320-370
Screen 390-500
non productive 90'

WELL LAURA # 3
LOG DATE 16-SEP-1992 15:43

#3

SPONTANEOUS POTENTIAL
MILLIVOLT
-350.00 700.00

BS CH TRANSIT TIME
MICRO-SEC/FT

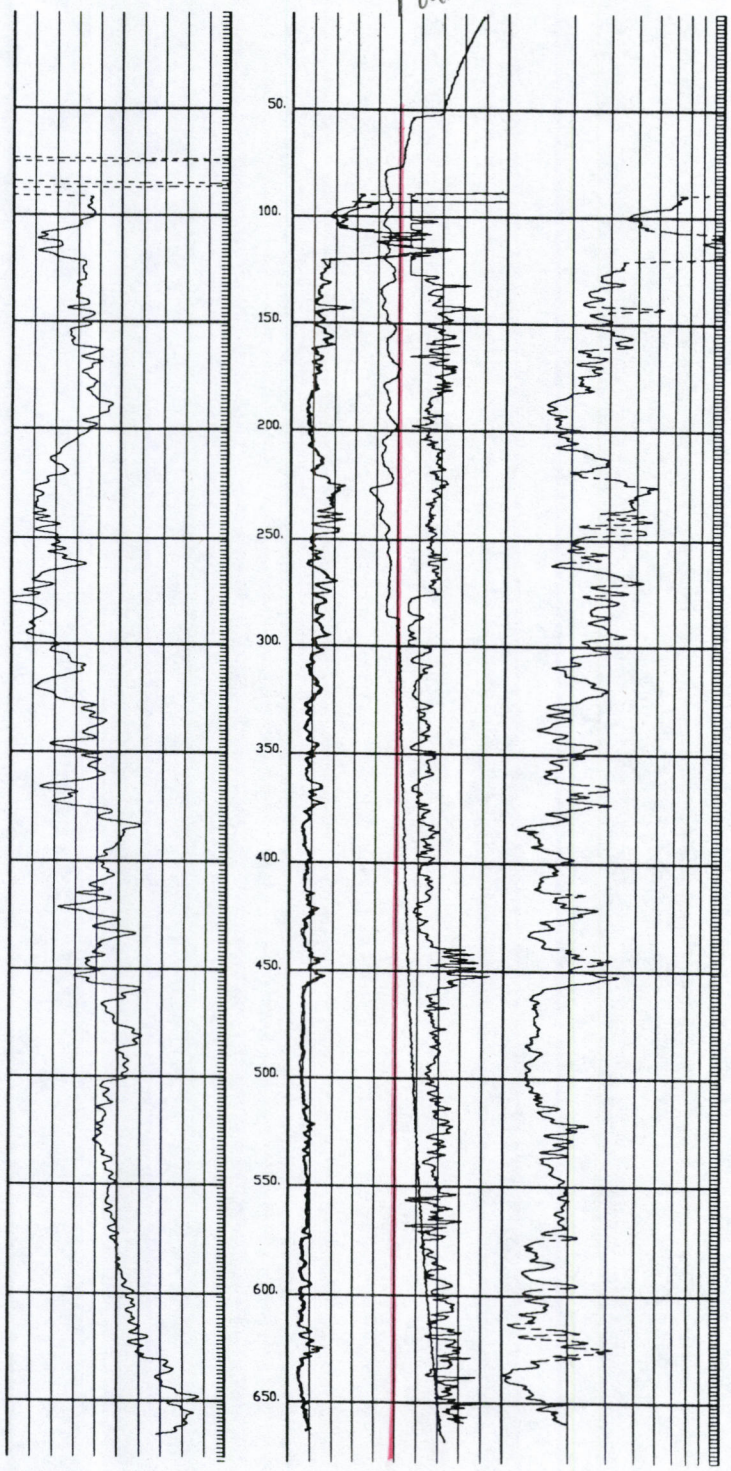
BOREHOLE TEMPERATURE
DEGREES F
65.00 70.00

SINGLE POINT RESISTIVITY
OHM METRES
10.00 100.00

FE RESISTIVITY 2
OHM METRES
.00 200.00

FE RESISTIVITY 1
OHM METRES
.00 200.00

100 ohm-m



WELL KAYE # 2
LOG DATE 23-JUN-1992 18:07

#2

BOREHOLE TEMPERATURE
DEGREES F
65.00 80.00

SPONTANEOUS POTENTIAL
MILLIVOLTS
140.00 180.00

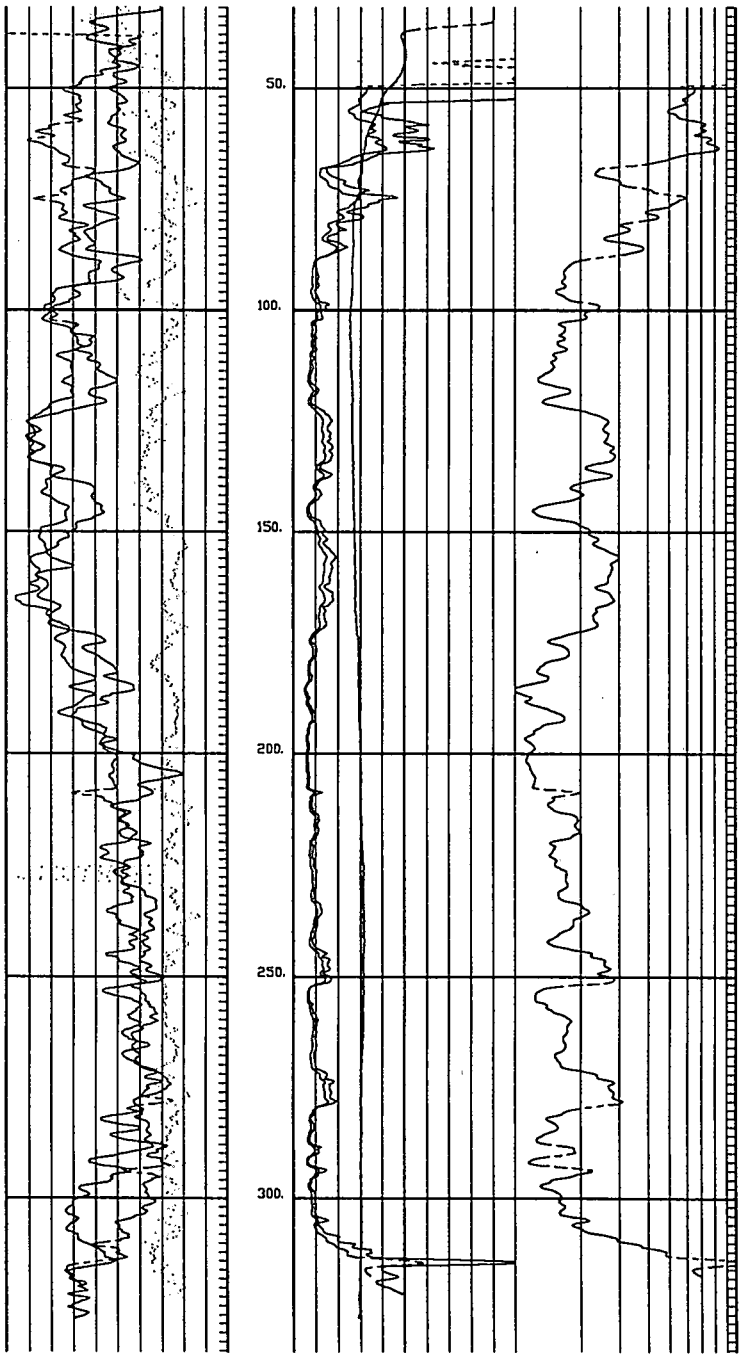
CALIPER FROM DENSITY
INCHES
12.00 7.00

GAMMA FROM DENSITY TOOL
API
.00 100.00

SINGLE POINT RESISTIVITY
OHM METRES
10.00 100.00

DEEP RESISTIVITY
OHM METRES
.00 200.00

SHALLOW RESISTIVITY
OHM METRES
.00 200.00



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

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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. 20755

1. OWNER Washoe County Utility — ADDRESS AT WELL LOCATION TH-1
MAILING ADDRESS Division — None
Box 11130 Reno, NV 89520

2. LOCATION NW ¼ NW ¼ Sec. 24 T. 18 N/S R. 19 E. Washoe County
PERMIT NO. (Issued by Water Resources) — NA (Parcel No.) — NA (Subdivision Name)

3. WORK PERFORMED	4. PROPOSED USE	5. WELL TYPE
☒ New Well ☐ Deepen ☐ Replace ☐ Abandon ☐ Recondition ☐ Other	☐ Domestic ☐ Municipal/Industrial ☐ Irrigation ☒ Monitor ☐ Test ☐ Stock	☐ Cable ☒ Rotary ☐ RVC ☐ Air ☐ Other

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
Silt, Sand, Grvl Cobbles		0	240	240
Sandy, Silty Clay		240	300	60
Clay		300	320	20
Grvly, Sndy Clays		320	460	140
Clayey, Sndy Grvl		460	510	50
Clay, Altered Andesite		510	580	70
Hard Andesite		580	590	110

Date started 6/3, 1992
Date completed 6/17, 1992

7. WELL TEST DATA

TEST METHOD: ☐ Bailer ☐ Pump ☒ Air Lift

G.P.M.	Draw Down (Feet Below Static)	Time (Hours)
+10		6

8. WELL CONSTRUCTION

Depth Drilled 590 Feet — Depth Cased 504 Feet

HOLE DIAMETER (BIT SIZE)

	From	To
8¾ Inches	0 Feet	590 Feet
Inches	Feet	Feet
Inches	Feet	Feet

CASING SCHEDULE

Size O.D. (Inches)	Weight/Ft. (Pounds)	Wall Thickness (Inches)	From (Feet)	To (Feet)
2½		¼	+4	504

Perforations:
Type perforation: Sawcut
Size perforation: 3 x 3/32
From 189 feet to 504 feet
From ____ feet to ____ feet
From ____ feet to ____ feet
From ____ feet to ____ feet
From ____ feet to ____ feet

Surface Seal: ☒ Yes ☐ No — Seal Type: ☒ Neat Cement ☐ Cement Grout ☐ Concrete Grout
Depth of Seal 50 FT
Placement Method: ☐ Pumped ☒ Poured
Gravel Packed: ☒ Yes ☐ No
From 50 feet to 504 feet

9. WATER LEVEL

Static water level 211.1 ? feet below land surface
Artesian flow No G.P.M. P.S.I.
Water temperature Cold °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 Nevada Drilling, Inc (Contractor)
Address Box 2154B (Contractor)
Carson City NV 89721

Nevada contractor's license number issued by the State Contractor's Board 13697A
Nevada driller's license number issued by the Division of Water Resources, the on-site driller 1790

Signed [signature] (By driller performing actual drilling on site or contractor)
Date 11/20/92

(Rev. 3-91)

USE ADDITIONAL SHEETS IF NECESSARY

(O)-627

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

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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 20756

1. OWNER Washoe County Utility | ADDRESS AT WELL LOCATION TH-2
MAILING ADDRESS Division
Box 11130 Reno, NV 89520

2. LOCATION NE ¼ SE ¼ Sec. 15 T 18 N R 19 E Washoe County
PERMIT NO. (Issued by Water Resources) | Parcel No. NA | Subdivision Name NA

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
Coarse Sands, Gruls, Cobbles		0	69	69
Sandy, Silty, Clay		69	80	11
Coarse sand/gravel		80	100	20
Soft siltstone of Truckee Fm		100	220	120
Silty sandstone of Truckee Fm		220	308	88
Clay, altered Andesite		308	320	12
Hard Andesite		320	340	20

Date started 6/19, 1992
Date completed 6/24, 1992

7. WELL TEST DATA
TEST METHOD: ☐ Bailer ☐ Pump ☒ Air Lift

G.P.M.	Draw Down (Feet Below Static)	Time (Hours)
+20		6-8

8. WELL CONSTRUCTION
Depth Drilled 340 Feet Depth Gased 313 Feet

HOLE DIAMETER (BIT SIZE)

	From	To
8¾ Inches	0 Feet	313 Feet
Inches	Feet	Feet
Inches	Feet	Feet

CASING SCHEDULE

Size O.D. (Inches)	Weight/Ft. (Pounds)	Wall Thickness (Inches)	From (Feet)	To (Feet)
2½		¼	+4	313

Perforations:
Type perforation Sawcut
Size perforation ⅛ 3/32
From 82 feet to 313 feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

Surface Seal: ☒ Yes ☐ No
Depth of Seal 50
Placement Method: ☐ Pumped ☒ Poured
Seal Type: ☒ Neat Cement ☐ Cement Grout ☐ Concrete Grout
Gravel Packed: ☒ Yes ☐ No
From 50 feet to 340 feet

9. WATER LEVEL
Static water level 96.7 ? feet below land surface
Artesian flow No G.P.M. P.S.I.
Water temperature Cold °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 Nevada Drilling, Inc. (Contractor)
Address Box 21548 (Contractor)
Carson City, NV 89721
Nevada contractor's license number issued by the State Contractor's Board 13697A
Nevada driller's license number issued by the Division of Water Resources, the on-site driller 1790
Signed Joe Reisch (By driller performing actual drilling on site or contractor)
Date 11/20/92

(Rev. 3-91)

USE ADDITIONAL SHEETS IF NECESSARY

(O)-627

WHITE—DIVISION OF WATER RESOURCES
CANARY—CLIENT'S COPY
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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. 20757

1. OWNER Washoe County Utility | ADDRESS AT WELL LOCATION TH-3
MAILING ADDRESS Division Box 11130 Reno, NV 89520

2. LOCATION SE ¼ NE ¼ Sec. 22 T 18 N/S R 19 E Washoe County
PERMIT NO. | Issued by Water Resources | Parcel No. NA | Subdivision Name NA

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
SILT, SAND, GRVL		0	100	100
BLDRS				
CLAY, SILT, SAND		100	280	180
SILTSTONE OF TRUCKEE FM		280	400	120
SANDY, PEBBLY, SILT		400	560	160
ALTERED VOLCANICS		560	585	25
CLAYEY, PEBBLY, SILT		585	635	50
ALTERE VOLCANICS & BED ROCK		635	680	45

Date started 6/26 92, 1992
Date completed 7/2, 1992

7. WELL TEST DATA
TEST METHOD: ☐ Bailer ☐ Pump ☒ Air Lift

G.P.M.	Draw Down (Feet Below Static)	Time (Hours)
120		6-8

8. WELL CONSTRUCTION
Depth Drilled 680 Feet Depth Cased 627 Feet

HOLE DIAMETER (BIT SIZE)
8 3/4 Inches From 0 Feet To 680 Feet
Inches From Feet To Feet
Inches From Feet To Feet

CASING SCHEDULE

Size O.D. (Inches)	Weight/Ft. (Pounds)	Wall Thickness (Inches)	From (Feet)	To (Feet)
2½		¼	+1	627

Perforations: Sawcut
Type perforation 3 x 3/32
Size perforation 86
From 627 feet to feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

Surface Seal: ☒ Yes 50 ☐ No
Depth of Seal
Placement Method: ☒ Pumped ☒ Poured
Seal Type: ☒ Neat Cement ☐ Cement Grout ☐ Concrete Grout
Gravel Packed: 50 ☒ Yes ☐ No
From 627 feet to feet

9. WATER LEVEL ?
Static water level No feet below land surface
Artesian flow Cold G.P.M. ? P.S.I.
Water temperature °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 Nevada Drilling, Inc (Contractor)
Address Box 21548 CARSON CITY, NV 89721 (Contractor)

Nevada contractor's license number issued by the State Contractor's Board 13697
Nevada driller's license number issued by the Division of Water Resources, the on-site driller 1790

Signed Joe Reisch (By driller performing actual drilling on site or contractor)
Date 11/20/92

(Rev. 3-91)

USE ADDITIONAL SHEETS IF NECESSARY

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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. 20758

1. OWNER Washoe County Utility
MAILING ADDRESS Division Box 11130 Reno, NV 89520
ADDRESS AT WELL LOCATION TH-4 #4 None

2. LOCATION SW ¼ SW ¼ Sec. 23 T. 18 N/S R. 19 E. Washoe County
PERMIT NO. Issued by Water Resources | Parcel No. None | Subdivision Name None

3. WORK PERFORMED: [X] New Well [ ] Deepen [ ] Replace [ ] Recondition [ ] Abandon [ ] Other

4. PROPOSED USE: [ ] Domestic [ ] Irrigation [ ] Test [ ] Municipal/Industrial [X] Monitor [ ] Stock

5. WELL TYPE: [ ] Cable [X] Rotary [ ] RVC [ ] Air [ ] Other

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
Clay Loam		0	2	2
Cemented Grvl, Cobbles, Bldrs		2	160	158
Silt, Sand, Grvl	X	160	740	580
Truckee Fm, Siltstone		740	1100	360

Date started 7/7, 1992
Date completed 7/21, 1992

7. WELL TEST DATA
TEST METHOD: [ ] Bailer [ ] Pump [X] Air Lift

G.P.M.	Draw Down (Feet Below Static)	Time (Hours)
30±		8

8. WELL CONSTRUCTION
Depth Drilled 1100 Feet Depth Cased 714 Feet

HOLE DIAMETER (BIT SIZE)

	From	To
8 3/4 Inches	0 Feet	1100 Feet
Inches	Feet	Feet
Inches	Feet	Feet

CASING SCHEDULE

Size O.D. (Inches)	Weight/Ft. (Pounds)	Wall Thickness (Inches)	From (Feet)	To (Feet)
2 1/2			+4	714

Perforations:
Type perforation SAWCUT
Size perforation 3 X 3/32
From 210 feet to 714 feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

Surface Seal: [X] Yes [ ] No
Depth of Seal 50
Placement Method: [ ] Pumped [X] Poured
Seal Type: [X] Neat Cement [ ] Cement Grout [ ] Concrete Grout

Gravel Packed: [X] Yes [ ] No
From 50 feet to 1100 feet

9. WATER LEVEL
Static water level 228 feet below land surface
Artesian flow G.P.M. P.S.I.
Water temperature Cold °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 Nevada Drilling, Inc (Contractor)
Address Box 21548 (Contractor)
Carson City NV 89721
Nevada contractor's license number issued by the State Contractor's Board 13697A
Nevada driller's license number issued by the Division of Water Resources, the on-site driller 1790
Signed Joe Reineh (By driller performing actual drilling on site or contractor)
Date 11/17/92

(Rev. 3-91)

USE ADDITIONAL SHEETS IF NECESSARY

(O)-627

WHITE—DIVISION OF WATER RESOURCES
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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. 20759

1. OWNER WASHOE COUNTY UTILITY
MAILING ADDRESS DIVISION BOX 11130 RENO, NV 89520
ADDRESS AT WELL LOCATION TH-5

2. LOCATION NE ¼ SW ¼ Sec. 14 T. 18 ☒N ☐S R. 19 E. WASHOE County
PERMIT NO. (Issued by Water Resources) NA (Parcel No.) NA (Subdivision Name)

3. WORK PERFORMED: ☒ New Well ☐ Deepen ☐ Replace ☐ Abandon ☐ Recondition ☐ Other
4. PROPOSED USE: ☐ Domestic ☐ Municipal/Industrial ☐ Irrigation ☒ Monitor ☐ Test ☐ Stock
5. WELL TYPE: ☐ Cable ☒ Rotary ☐ RVC ☐ Air ☐ Other

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
SANDS, GRVLS, COBBLES, BLDRS		0	85	85
SANDS, GRVLS, SILTS		85	155	70
SILTY CLAY		155	200	45
TRUCKEE FM SILTSTONE		200	400	200
CLAY, ALTERED VOLCANICS		400	575	175
ANDESITE		575	630	55

Date started 8/5, 1992
Date completed 8/19, 1992

7. WELL TEST DATA
TEST METHOD: ☐ Bailer ☐ Pump ☒ Air Lift

G.P.M.	Draw Down (Feet Below Static)	Time (Hours)
20±		8

8. WELL CONSTRUCTION
Depth Drilled 630 Feet Depth Cased 605 Feet

HOLE DIAMETER (BIT SIZE)

	Inches	From	Feet	To	Feet
	8¾		0		630
		Inches	Feet		Feet
		Inches	Feet		Feet

CASING SCHEDULE

Size O.D. (Inches)	Weight/Ft. (Pounds)	Wall Thickness (Inches)	From (Feet)	To (Feet)
2½		¼	+4	605

Perforations:
Type perforation SAWCUT
Size perforation 3 X 3/32
From 357 feet to 605 feet
From ____ feet to ____ feet
From ____ feet to ____ feet
From ____ feet to ____ feet
From ____ feet to ____ feet

Surface Seal: ☒ Yes ☐ No
Depth of Seal 50
Placement Method: ☐ Pumped ☒ Poured
Seal Type: ☒ Neat Cement ☐ Cement Grout ☐ Concrete Grout
Gravel Packed: ☒ Yes ☐ No
From 50 feet to 630 feet

9. WATER LEVEL
Static water level 148 feet below land surface
Artesian flow NO G.P.M. ? P.S.I.
Water temperature COLD °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 NEVADA DRILLING, INC (Contractor)
Address BOX 21548 (Contractor)
CARSON CITY, NV 89721
Nevada contractor's license number issued by the State Contractor's Board 13697A
Nevada driller's license number issued by the Division of Water Resources, the on-site driller 1790
Signed Joe Reinke (By driller performing actual drilling on site or contractor)
Date 11/20

(Rev. 3-91)

USE ADDITIONAL SHEETS IF NECESSARY

(O)-627

WHITE—DIVISION OF WATER RESOURCES
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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

1. OWNER Doug Chris Hunt
MAILING ADDRESS 15619 Fawn Lane Reno NV
ADDRESS AT WELL LOCATION 5700 Melarky Way Reno, NV
NOTICE OF INTENT NO.

2. LOCATION NE ¼ SW ¼ Sec. 26 T. 18 N/S R. 19 E. Washoe County
PERMIT NO. 49040-15 (Issued by Water Resources; Parcel No.)
Subdivision Name: None

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
Conglomerate		0	245	245
Vol Rubble	X	245	280	35
Hit Peak Vol.	X	280	380	100

Date started 7/25/92
Date completed 8/4/92

WELL TEST DATA
TEST METHOD: ☐ Bailer ☐ Pump ☒ Air Lift

G.P.M.	Draw Down (Feet Below Static)	Time (Hours)
20±		4½

8. WELL CONSTRUCTION
Depth Drilled 380 Feet Depth Cased 380 Feet

HOLE DIAMETER (BIT SIZE)

	From	To
12¼ Inches	0 Feet	380 Feet
Inches	Feet	Feet
Inches	Feet	Feet

CASING SCHEDULE

Size O.D. (Inches)	Weight/Ft. (Pounds)	Wall Thickness (Inches)	From (Feet)	To (Feet)
6 5/8		.188	+4	380

Perforations:
Type perforation: Saw cut
Size perforation: 3" x 3/32
From 220 feet to 380 feet
From ____ feet to ____ feet
From ____ feet to ____ feet
From ____ feet to ____ feet
From ____ feet to ____ feet

Surface Seal: ☒ Yes ☐ No
Depth of Seal 103 FT
Placement Method: ☒ Pumped ☐ Poured
Seal Type: ☒ Neat Cement ☐ Cement Grout ☐ Concrete Grout

Gravel Packed: ☒ Yes ☐ No
From 103 feet to 380 feet

9. WATER LEVEL
Static water level 190 feet below land surface
Artesian flow No G.P.M. P.S.I.
Water temperature Cold °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 Nevada Drilling, Inc (Contractor)
Address Box 21548 (Contractor)
Carson City NV 89721
Nevada contractor's license number issued by the State Contractor's Board 13697A
Nevada driller's license number issued by the Division of Water Resources, the on-site driller 1539
Signed Joseph H. Leisch (By driller performing actual drilling on site or contractor)
Date 8/24/92

(rev. 3-91)

USE ADDITIONAL SHEETS IF NECESSARY

(O)-627

(PLEASE PRINT OR TYPE)

NEVADA DIVISION OF HEALTH
[illegible] Virginia Street
Reno, Nevada 89503
(702) 789-0[illegible]

SEP 1992
RECEIVED
WASHOE COUNTY
UTILITY
DIVISION

MT. ROSE TH1

C98550

WATER CHEMISTRY ANALYSIS:

Attn: Fees may apply to some types of samples.

All of the information below must be filled in or the analysis will not be performed.

State NEVADA County WASHOE
Township 18N Range 19E Section 24
General Location MT. ROSE FAN; REDFIELD ESTATE
Source Address APPROX 1 1/2 MILES NORTH OF SR 431

TYPE OF ANALYSIS:

☒ Check here for ROUTINE DOMESTIC ANALYSIS.
Circle the constituents needed for PARTIAL ANALYSIS.

SAMPLING INSTRUCTIONS:

The sample submitted must be representative of the source. Spring and surface water samples should be as free of dirt and debris as possible. Wells should be pumped thoroughly before sampling, changing the water in the casing at least three times. Product water from filters should be sampled after running for about ten (10) minutes.

Sampled by RANDY VAN HOOZEN Date 8/21/92
Owner WASHOE COUNTY Phone 785-4743
Address 1195-B CORPORATE BLVD
City RENO State NV

REPORT TO:

Name MIKE WIDMER; W.C.U.D.
Address P.O. BOX 11130
City RENO
State NV Zip 89520

REASON FOR ANALYSIS:

☐ Loan
☐ Personal health reasons
☐ Purchase of the property
☐ Rental or sale of property
☐ Subdivision approval
☒ Other EXPLORATORY DRILLING

USE OF WATER:

☐ Domestic drinking water
☐ Geothermal
☐ Industrial or mining
☐ Irrigation
☒ Other MONITORING WELL
Initials

SOURCE OF WATER:

Filter ☐ Yes ☒ No
Public ☐ Yes ☒ No
Spring
Well Depth 590 ft.
Hot Cold X
IN USE ☐ Yes ☒ No

Type
Name
Surface
Casing diameter 2 in.
Casing depth 504 ft.

The results below are representative only of the sample submitted to this laboratory.

FOR LABORATORY USE ONLY

Constituent	ppm	Constituent	ppm	Constituent	ppm	Constituent	S.U.	PRINT OTHER DESIRED CONSTITUENTS BELOW: Constituent	ppm
T.D.S. @ 103° C.	183	Chloride	0	Iron	0.00	Color	3		
Hardness	105	Nitrate -N	0.6	Manganese	0.00	Turbidity	0.2		
Calcium	19	Alkalinity	130	Copper	0.00	pH	7.80		
Magnesium	14	Bicarbonate	159	Zinc	0.64	EC	249		
Sodium	10	Carbonate	0	Barium	0.08				
Potassium	4	Fluoride	0.07	Boron	0.0				
Sulfate	1	Arsenic	<.003	Silica	63				

-0.0278 207 0.73 29.3 6.5 -1501 98550

RECEIVED
SEP 01 1992
HEALTH PROTECTION SERVICES

Fee
Collected by
WSI.D.
DWA—Pri. Sec.
1st 2nd 3rd
Date Rec'd Init.

ppm = parts per million, milligrams per liter
S.U. = Standard Units

Remarks

KR

called 8/25/92

8/27/92

O-1561 (Rev. 11-85)

IN TRIPLICATE
(PLEASE PRINT OR TYPE)

NEVADA STATE HEALTH LABORATORY
NEVADA DIVISION OF HEALTH
1660 N. Virginia Street
Reno, Nevada 89503
(702) 789-0335

SAMPLE ID.
MT ROSE TH2

SEP 1992
RECEIVED
WASHOE COUNTY
UTILITY
DIVISION

098551

WATER CHEMISTRY ANALYSIS:

Attn: Fees may apply to some types of samples.

All of the information below must be filled in or the analysis will not be performed.

TYPE OF ANALYSIS:

☒ Check here for ROUTINE DOMESTIC ANALYSIS.
Circle the constituents needed for PARTIAL ANALYSIS.

State NEVADA County WASHOE
Township 18N Range 19E Section 15
General Location MT ROSE FAN: REDFIELD ESTATE
Source Address APPROXIMATELY 3.5 MILES NORTH OF SR 431

SAMPLING INSTRUCTIONS:

The sample submitted must be representative of the source. Spring and surface water samples should be as free of dirt and debris as possible. Wells should be pumped thoroughly before sampling, changing the water in the casing at least three times. Product water from filters should be sampled after running for about ten (10) minutes.

Sampled by RANDY VAN HOOZER Date 8/21/92
Owner WASHOE COUNTY Phone 785-4743
Address 1195-B CORPORATE BLVD
City RENO State NV

REASON FOR ANALYSIS:

- ☐ Loan
- ☐ Personal health reasons
- ☐ Purchase of the property
- ☐ Rental or sale of property
- ☐ Subdivision approval
- ☒ Other EXPLORATION DRILLING

USE OF WATER:

- ☐ Domestic drinking water
- ☐ Geothermal
- ☐ Industrial or mining
- ☐ Irrigation
- ☒ Other MONITORING WELL
  Initials

REPORT TO:

Name MIKE WIDMER
Address P.O. BOX 11130
City RENO
State NV Zip 89520

SOURCE OF WATER:

Filter ☐ Yes ☒ No
Public ☐ Yes ☒ No
Spring
Well X Depth 340 ft.
Hot Cold X
IN USE ☐ Yes ☒ No

Type
Name
Surface
Casing diameter 2 in.
Casing depth 315 ft.

The results below are representative only of the sample submitted to this laboratory.

FOR LABORATORY USE ONLY: 0.0242 282 0.72 29.7 8.4 0.2 1721 98551

Constituent	ppm	Constituent	ppm	Constituent	ppm	Constituent	S.U.	PRINT OTHER DESIRED CONSTITUENTS BELOW: Constituent	ppm
T.D.S. @ 103° C.	238	Chloride	1	Iron	0.02	Color	5		
Hardness	97	Nitrate -N	0.4	Manganese	0.07	Turbidity	1.1		
Calcium	24	Alkalinity	168	Copper	0.00	pH	8.20		
Magnesium	9	Bicarbonate	195	Zinc	0.54	EC	331		
Sodium	36	Carbonate	5	Barium	0.04				
Potassium	6	Fluoride	0.20	Boron	0.1				
Sulfate	10	Arsenic	0.008	Silica	64				

RECEIVED
SEP 01 1992
HEALTH PROTECTION SERVICES

Fee
Collected by
WS I.D.
SDWA—Pri. Sec.
t 2nd 3rd
Date Rec'd Init.

ppm = parts per million, milligrams per liter
S.U. = Standard Units

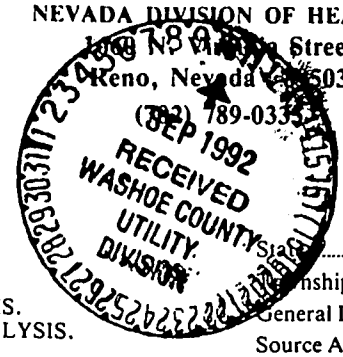
Remarks
Silica 8/24/92
K.R
8/20/92

O-1561 (Rev. 11-85)

IN TRIPLICATE
(PLEASE PRINT OR TYPE)

NEVADA STATE HEALTH LABORATORY
NEVADA DIVISION OF HEALTH
1000 N. Virginia Street
Reno, Nevada 89503
(702) 789-0333

SAMPLE ID:
MT ROSE TH3



098552

WATER CHEMISTRY ANALYSIS:

Attn: Fees may apply to some types of samples.

All of the information below must be filled in or the analysis will not be performed.

State NEVADA County WASHOE
Township 18N Range 19E Section 22
General Location MT ROSE FAN : REDFIELD ESTATE
Source Address APPROXIMATELY 2.5 MILES NORTH OF SR 431

TYPE OF ANALYSIS:

☒ Check here for ROUTINE DOMESTIC ANALYSIS.
Circle the constituents needed for PARTIAL ANALYSIS.

SAMPLING INSTRUCTIONS:

The sample submitted must be representative of the source. Spring and surface water samples should be as free of dirt and debris as possible. Wells should be pumped thoroughly before sampling, changing the water in the casing at least three times. Product water from filters should be sampled after running for about ten (10) minutes.

Sampled by RANDY VAN HOOZER Date 8/21/92
Owner WASHOE COUNTY Phone 785-4743
Address 1195-13 CORPORATE BLVD
City RENO State NV

REPORT TO:

Name MIKE WIDMER
Address P.O. BOX 11130
City RENO
State NV Zip 89520

REASON FOR ANALYSIS:

☐ Loan
☐ Personal health reasons
☐ Purchase of the property
☐ Rental or sale of property
☐ Subdivision approval
☒ Other EXPLORATION DRILLING

USE OF WATER:

☐ Domestic drinking water
☐ Geothermal
☐ Industrial or mining
☐ Irrigation
☒ Other MONITORING WELL
Initials

SOURCE OF WATER:

Filter ☐ Yes ☒ No
Public ☐ Yes ☒ No
Spring
Well X Depth 680 ft.
Hot Cold X
IN USE ☐ Yes ☒ No

Type
Name
Surface
Casing diameter 2 in.
Casing depth 630 ft.

The results below are representative only of the sample submitted to this laboratory.

FOR LABORATORY USE ONLY

0.1086 237 0.72 27.9 7.4 0.2 383.8 98552

PRINT OTHER DESIRED CONSTITUENTS BELOW

Constituent	ppm	Constituent	ppm	Constituent	ppm	Constituent	S.U.	Constituent	ppm
T.D.S. @ 103° C.	205	Chloride	0	Iron	0.02	Color	3		
Hardness	96	Nitrate -N	0.4	Manganese	0.02	Turbidity	0.4		
Calcium	22	Alkalinity	148	Copper	0.00	pH	8.38		
Magnesium	10	Bicarbonate	171	Zinc	0.30	EC	283		
Sodium	25	Carbonate	5	Barium	0.05				
Potassium	6	Fluoride	0.08	Boron	0.0				
Sulfate	3	Arsenic	0.004	Silica	60				

RECEIVED
SEP 01 1992
HEALTH PROTECTION SERVICES

Fee
Collected by
WS I.D.
SDWA—Pri. Sec.
1st 2nd 3rd
Date Rec'd Init.

ppm = parts per million, milligrams per liter
S.U. = Standard Units

Remarks
Billed 8/24/92
KR
8/22/92

O-1561 (Rev. 11-85)

(PLEASE PRINT OR TYPE)

NEVADA STATE HEALTH LABORATORY SAMPLE ID:

651

NEVADA DIVISION OF HEALTH
1660 W. Virginia Street
Reno, Nevada 89503
(702) 789-0335

MT. ROSE TH4

098651

WATER CHEMISTRY ANALYSIS:

Attn: Fees may apply to some types of samples.

All of the information below must be filled in or the analysis will not be performed.

State NEVADA County WASHOE
Township 18N Range 19E Section 23
General Location MT. ROSE FAN: REDFIELD ESTATE
Source Address APPROX 1½ MILES NORTH OF SR 431

TYPE OF ANALYSIS:

☒ Check here for ROUTINE DOMESTIC ANALYSIS.
Circle the constituents needed for PARTIAL ANALYSIS.

SAMPLING INSTRUCTIONS:

The sample submitted must be representative of the source. Spring and surface water samples should be as free of dirt and debris as possible. Wells should be pumped thoroughly before sampling, changing the water in the casing at least three times. Product water from filters should be sampled after running for about ten (10) minutes.

Sampled by RANDY VAN HOUZER Date
Owner WASHOE COUNTY Phone 785-4743
Address 1195-B CORPORATE BLVD
City RENO State NV

REPORT TO:

Name MIKE WIDMER: W.C.U.D.
Address P.O. BOX 11130
City RENO
State NV Zip 89520

REASON FOR ANALYSIS:

☐ Loan
☐ Personal health reasons
☐ Purchase of the property
☐ Rental or sale of property
☐ Subdivision approval
☒ Other EXPLORATORY DRILLING

USE OF WATER:

☐ Domestic drinking water
☐ Geothermal
☐ Industrial or mining
☐ Irrigation
☒ Other MONITORING WELL
Initials

SOURCE OF WATER:

Filter ☐ Yes ☒ No Type
Public ☐ Yes ☒ No Name
Spring Surface
Well X Depth 700 ft. Casing diameter 2 in.
Hot Cold X Casing depth 700 ft.
IN USE ☐ Yes ☒ No

The results below are representative only of the sample submitted to this laboratory.

FOR LABORATORY USE ONLY

-0.0878 218 0.88 17.3 6.4 0.3 -475 98651

Constituent	ppm	Constituent	ppm	Constituent	ppm	Constituent	S.U.	PRINT OTHER DESIRED CONSTITUENTS BELOW: Constituent	ppm
T.D.S. @ 103° C.	226 ✓	Chloride	2	Iron	0.25 ✓	Color	>70 D		
Hardness	32	Nitrate -N	0.2 ✓	Manganese	0.05 D	Turbidity	65		
Calcium	8	Alkalinity	128	Copper	0.00	pH	8.38 ✓		
Magnesium	3	Bicarbonate	142	Zinc	1.12 ✓	EC	256		
Sodium	45	Carbonate	7	Barium	0.03 ✓				
Potassium	5	Fluoride	0.42 ✓	Boron	0.1				
Sulfate	8	Arsenic	0.033 ✓	Silica	37				

Fee
Collected by
PWS I.D.
SDWA—Pri. Sec.
1st 2nd 3rd
Date Rec'd Init.
ppm = parts per million, milligrams per liter
S.U. = Standard Units

Remarks

KR

Billed 8/31/92

9/8/92

O-1561 (Rev. 11-85)

IN TRIPLICATE
(PLEASE PRINT OR TYPE)

NEVADA STATE HEALTH LABORATORY
NEVADA DIVISION OF HEALTH
1660 N. Virginia Street
Reno, Nevada 89503
789-0335

RECEIVED SEP 1992 WASHOE COUNTY UTILITY DIVISION

SAMPLE ID:
MT. ROSE TH5

098553

WATER CHEMISTRY ANALYSIS:

Attn: Fees may apply to some types of samples.

All of the information below must be filled in or the analysis will not be performed.

State: NEVADA County: WASHOE
Township: 18N Range: 19E Section: 14
General Location: MT ROSE FAN : REDFIELD ESTATE
Source Address: APPROX 2.5 MILES NORTH OF SR 431

TYPE OF ANALYSIS:

☒ Check here for ROUTINE DOMESTIC ANALYSIS.
Circle the constituents needed for PARTIAL ANALYSIS.

SAMPLING INSTRUCTIONS:

The sample submitted must be representative of the source. Spring and surface water samples should be as free of dirt and debris as possible. Wells should be pumped thoroughly before sampling, changing the water in the casing at least three times. Product water from filters should be sampled after running for about ten (10) minutes.

Sampled by: RANDY VAN HOOZER Date: 8/21/92
Owner: WASHOE COUNTY Phone: 785-4743
Address: 1195-B CORPORATE BLVD
City: RENO State: NEVADA

REASON FOR ANALYSIS:

☐ Loan
☐ Personal health reasons
☐ Purchase of the property
☐ Rental or sale of property
☐ Subdivision approval
☒ Other EXPLORATION DRILLING

USE OF WATER:

☐ Domestic drinking water
☐ Geothermal
☐ Industrial or mining
☐ Irrigation
☒ Other MONITORING WELL
Initials

REPORT TO:

Name: MIKE WIDMER : W.C.U.D.
Address: P.O. BOX 11130
City: RENO
State: NV Zip: 89520

SOURCE OF WATER:

Filter ☐ Yes ☒ No — Type
Public ☐ Yes ☒ No — Name
Spring — Surface
Well X Depth 620 ft. — Casing diameter 2 in.
Hot Cold X — Casing depth 605 ft.
IN USE ☐ Yes ☒ No

The results below are representative only of the sample submitted to this laboratory.

FOR LABORATORY USE ONLY

0.0497 309 0.74 29.4 8.2 838.3 98553

Constituent	ppm	Constituent	ppm	Constituent	ppm	Constituent	S.U.
T.D.S. @ 103° C.	268	Chloride	3	Iron	0.42	Color	35
Hardness	108	Nitrate -N	0.6	Manganese	0.29	Turbidity	12
Calcium	25	Alkalinity	164	Copper	0.00	pH	8.05
Magnesium	11	Bicarbonate	200	Zinc	2.10	EC	361
Sodium	37	Carbonate	0	Barium	0.07		
Potassium	8	Fluoride	0.23	Boron	0.0		
Sulfate	24	Arsenic	0.018	Silica	63		

PRINT OTHER DESIRED CONSTITUENTS BELOW

Constituent	ppm

RECEIVED
SEP 01 1992
HEALTH PROTECTION SERVICES

Fee
Collected by
PWS I.D.
SDWA—Pri Sec
1st 2nd 3rd
Date Rec'd Init.

ppm = parts per million, milligrams per liter
S.U. = Standard Units

Remarks
Killed 8/31/92

KR
8/20/92

O-1561 (Rev. 11-85)

BID PROPOSAL

ITEM	APPROX QUANTITY	DESCRIPTION OF ITEM WITH UNIT PRICE WRITTEN IN WORDS	UNIT PRICES	TOTAL
1.	5 EA.	Mobilization and Demobilization including all materials, labor, equipment for completion of 5 observation wells as described in Specifications for the lump sum price of Five hundred dollars per well.	$500/move	$2500.00 ✓
2.	3000 LF	Drill minimum 6-inch diameter exploratory boreholes, approx. 3000 feet at Seventeen dollars & thirty three cents per linear foot.	$17.33/ft	$52,000.00
3.	2000 FT	Furnish and install 2-inch diameter slotted steel pipe, estimate at 400 feet per well at	$4.76/ft	$9510.00
4.	1000 FT	Furnish and install 2-inch diameter blank steel pipe estimated at 200 feet per well at Three dollars and fifty cents per foot	$3.50/ft	$3500.00 ✓
5.	25 yds^3	Furnish and install gravel pack, estimated at 5 yds per well at One hundred twelve dollars per yard.	$112/yd	$2800.00

ITEM	APPROX QUANTITY	DESCRIPTION OF ITEM WITH UNIT PRICE WRITTEN IN WORDS	UNIT PRICES	TOTAL
6.	250 FT	Furnish and install grout sanitary seal estimated at 50 feet per well at Sixteen dollars per foot.	$16/ft	$4000.00
7.	20 HRS	Furnish and install necessary equipment for air-development of 2-inch diameter monitoring wells estimated at 4 hours per well at Three hundred ninty five dollars per hour.	$395/hr	$7900.00
8.	5 EA.	Furnish and install vandal resistant, 6-inch well head protector and locking cap at each well at One hundred twenty dollars per well.	$120/well	$600.00
10.	5 EA.	Provide geophysical log at each well at Two thousand dollars per well.	$2000/well	$10,000.00
11.	5 HR.	Standby Time estimated at five hours at Eighty dollars per hour.	$80/hr	$400.00

TOTAL BID	WRITTEN IN WORDS	TOTAL
	Ninty three thousand two hundred and ten dollars	$ 93,210.00

-- LOGPLOT V2.0 --

Desert Research Institute

Well Name:TEM-4
Location :North of Thomas Creek
Log Date :3 AUG 92
Operator :BF Lyles, TM Mihevc
Tool # :TT2
Cal Date :29 JUL 92
Casing Diameter:2
Casing Stick-up: 3'
TD Drilled :1200'
Hole Bottom:720'
Land Elevation (ft):?
Depth to Water (ft):224.8'
Logging Speed (ft/min):20

Well has a lot of tight spots, perhaps at each screen. There appears to be some high EC mud in bull-nose (718-721')

Input file name: tem4.dat

Logging time start: 1249 end: 1321

	min	max
Depth (ft)	225	715
Temp (C)	13.73	18.49
EC(umhos)	204.8	234
Log Start	225	
Log End	715	

Downward logging direction assumed

Scale Factors

Depth (ft/in):	50
EC (umhos/in):	5
Temp ((C)/in):	1

ELECTRIC LOGS

COMPANY	WASHOE CO. UTILITIES
WELL	ROBIN # 4
FIELD	MT. ROSE FAN
PROVINCE/COUNTY	WASHOE
COUNTRY/STATE	NEVADA

LOCATION SOUTHWEST
PRVNC/CO. WASHOE
FIELD MT. ROSE FAN
WELL: ROBIN # 4
COMPANY: WASHOE CO. UTILITIES

LOCATION			
SOUTHWEST			
LSD	SEC	TWP	RGE
	23	18N	19E

OTHER SERVICES

PERMANENT DATUM GROUND LEVEL , ELEVATION 5700'
LOG MEASURED FROM GROUND LEVEL ABOVE PERMANENT DATUM
DRILLING MEASURED FROM GROUND LEVEL

ELEVATIONS: KB DF GL 5700'

DATE	17-JUL-92			
RUN NUMBER	ONE			
DEPTH-DRILLER	1100'			
DEPTH-LOGGER	702'			
FIRST READING	702'			
LAST READING	80'			
CASING-DRILLER	NONE			
CASING-LOGGER	NONE			
BIT SIZE	8 3/4"			
HOLE FLUID TYPE	BENTONITE			
DENS./VISC.				
PH/FLUID LOSS				
SAMPLE SOURCE	MUDPIT			
RM @ MEAS TEMP	16.00 @ 23C			
RMF @ MEAS TEMP	14.00 @ 23C			
RMC @ MEAS TEMP				
SOURCE: RMF/RMC	MUDPIT			
RM @ BIT				
TIME SINCE CIRC	1 HOUR			
MAX REC TEMP				
EQUIPMENT/BASE	V833 NEVADA			
RECORDED BY	M.WARD			
WITNESSED BY	J.LEISEC			

RUN	BOREHOLE RECORD			CASING RECORD			
NUMBER	BIT	FROM	TO	SIZE	WEIGHT	FROM	TO
ONE	8 3/4"	SURFACE	T.D.				

EQUIPMENT	RUN 1	RUN 2	RUN 3	RUN 4
RR1	127			

REMARKS

ELECTRIC LOGS

UNABLE TO GET TO T.D DUE TO BRIDGE @ 702'

SYSTEM CONFIGURATION DATES: LOGGED PROCESSED PLOTTED

MAIN LOG

DEPTH BASED DATA - MAXIMUM SAMPLING INCREMENT 10CM. RECORDED ON 17-JUL-1992 AT 08:06
FILENAME: MRGEROB4.CIB RUN ID: MAIN LOG PLOTTED ON 27-JUL-1992 AT 08:42

DEPTH BASED DATA - MAXIMUM SAMPLING INCREMENT 10CM. RECORDED ON 17-JUL-1992 AT 08:06
FILENAME: MRGEROB4.CIB RUN ID: MAIN LOG PLOTTED ON 27-JUL-1992 AT 08:42

MAIN LOG

LOGGING/CALIBRATION CONSTANTS

CONSTANTS LAST EDITED: 17-JUL-1992 AT 08:06

SPFE LOGGING CONSTANTS AND BIT SIZE MEASUREMENTS

RESISTIVITY SONDE TYPE	DUAL RR1	MUD RESISTIVITY (OHM METRES)	14.500
BIT SIZE UNITS (INS/MM)	INCHES	BIT DEPTH UNITS (M/FT)	FEET
BIT SIZE 1	8.75	BIT DEPTH 1	1100.00
BIT SIZE 2	0.00	BIT DEPTH 2	0.00
BIT SIZE 3	0.00	BIT DEPTH 3	0.00
BIT SIZE 4	0.00	BIT DEPTH 4	0.00
BIT SIZE 5	0.00	BIT DEPTH 5	0.00

SPFE CALIBRATION CONSTANTS

FE1	CALIBRATOR VALUE 1	3.[illegible]	FE1	COUNT RATE 1	4196.0000
FE1	CALIBRATOR VALUE 2	[illegible]	FE1	COUNT RATE 2	2997.0000
FE2	CALIBRATOR VALUE 1	2.[illegible]	FE2	COUNT RATE 1	4605.0000
FE2	CALIBRATOR VALUE 2	2741.[illegible]	FE2	COUNT RATE 2	2992.0000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SP	CALIBRATOR VALUE 1	1.0000	SP	COUNT RATE 1	1.0000
SP	CALIBRATOR VALUE 2	0.0000	SP	COUNT RATE 2	0.0000

COMPANY	WASHOE CO. UTILITIES
WELL	ROBIN # 4
FIELD	MT. ROSE FAN
PROVINCE/COUNTY	WASHOE
COUNTRY/STATE	NEVADA

F

5700
5600
5500
5400
5300
5200
5100
5000
4900
4800

TH 2
5370'

DRY CREEK FAULT?

HUNTER CREEK MEMBER

LEISICK
OILY
LEISICK

UPPER HCM

LOWER HCM

TD 340'
5030'

TH 3
5570'

LEISICK
OILY
LEISICK

UPPER HCM

LOWER HCM

TD 680'
4890'

TH 4
5700'

LEISICK
OILY
LEISICK
OILY
LEISICK
OILY
LEISICK

HUNTER CREEK MEMBER

TD 1100'
4600'

THOMAS CREEK

TH 6
5700'

TD 380'
5320'

5600
5700
5600
5500
5400
5300
5200
5100
5000
4900
4800
4700
4600

LEGEND

HCM — HUNTER CREEK MEMBER

SAND, SILT AND GRAVEL

HCM
UPPER
LEISICK
OILY
TAN

LOWER
SANDSTONE

ALTERED VOLCANICS

VOLCANICS

SCALE 1" : 100' Vertical
1" : 500' Horizontal

G

5400
5300
5200
5100
5000
4900
4800
4700
4600
4500
4400
4300

HCM
HCM
DRY CREEK

TH 5
5230'

Serendipity Fault

FAULT SWARM

SERENDIPITY FAULT

TH 1
5110'

FAULT SWARM

THOMAS CREEK

STMMW 1
4990'

HUNTER CREEK MEMBER

LEISICK
OILY
LEISICK

UPPER HCM

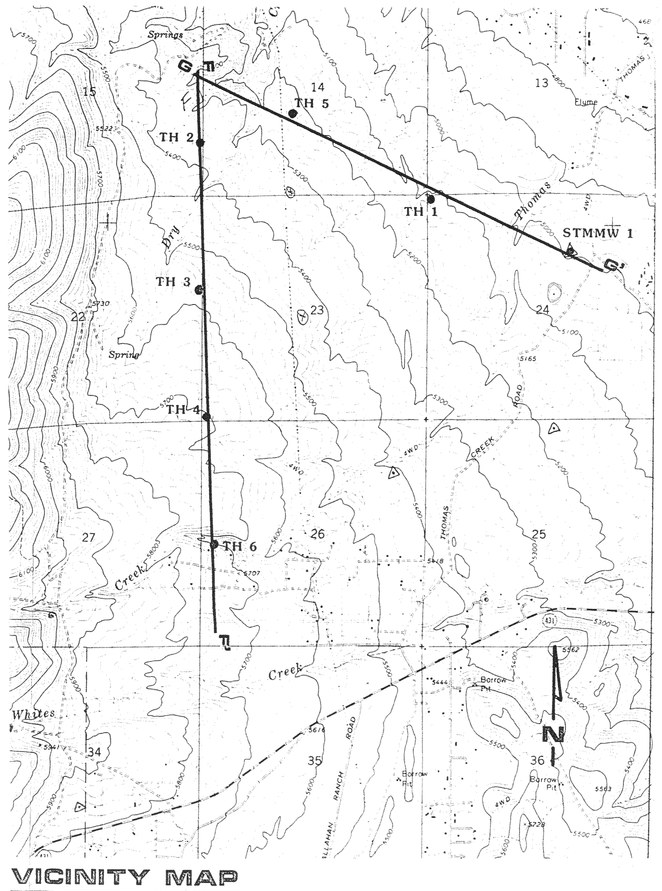
TD 630'
4600'

TD 590'
4520'

TD 620'
4370'

G'

5200
5100
5000
4900
4800
4700
4600
4500
4400
4300



VICINITY MAP
SCALE 1" : 2000'