GROUND WATER
RESOURCE EVALUATION
PINE MEADOW
RIVERSIDE COUNTY, CALIFORNIA

Prepared for:

Lake Hemet Municipal Water District
2480 E. Florida Avenue,
P.O. Box 5039
Hemet, CA 92544

GSi/water
520 Mission Street
South Pasadena, California 91030
(626) 441-0039

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PROJECT TEAM

Reinis Berzins — Data Collection, Analysis, Report and Graphics

Under the Supervision of:

____

R. A. Sorensen – RG 6702; HG 643
General Manager
GSi/water

____

J. H. Birman – RG 994; HG 125
President
GSi/water

TABLE OF CONTENTS

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INTRODUCTION

Figure 1: Project Location

This report provides an evaluation of the geohydrologic setting and ground water resources of Pine Meadow in Garner Valley, Riverside County, California. Specifically in this report, we evaluate whether Lake Hemet Municipal Water District (LHMWD) can expect to be able to support the water demand of residents of the area through extended periods of drought. At present, there are 217 residences in the Pine Meadows area but this is expected to grow to 307 residences in the near future.

Pine Meadow is located in the southern half of Garner Valley on the south-western slope of the San Jacinto Mountains (Figure 1). Garner Valley is bounded on both sides by ridges of approximately 5000 ft elevation to the west and 6500 ft elevation to the east. The valley trends northwest-southeast from the drainage divide at the Santa Rosa summit (5000 ft elevation) to Lake Hemet (4320 ft elevation). Pine Meadow is located to the north and east of Thomas Mountain.

LHMWD currently owns five wells in the Pine Meadows area. Wells G.V. #1 and #2 were drilled in 1969. It is not known when Well G.V. #3 was drilled, but it has been inactive since 1984 due to water quality issues. Well G.V. #4 was drilled in 1985 and is the highest producer. G.V. #5 was drilled in 2002.

The water supply system is currently in the process of being upgraded. Two new 500,000 gallon water tanks are planned to be installed by the end of 2004 - one replacing the current 350,000 gallon tank. In addition, pipeline and pressure system improvements are also planned.

This study included a review of published literature and information from LHMWD files, analysis of aerial photographs, geologic and topographic maps, and a field reconnaissance. Fieldwork was conducted from 29th September, 2003 to 2nd October, 2003.

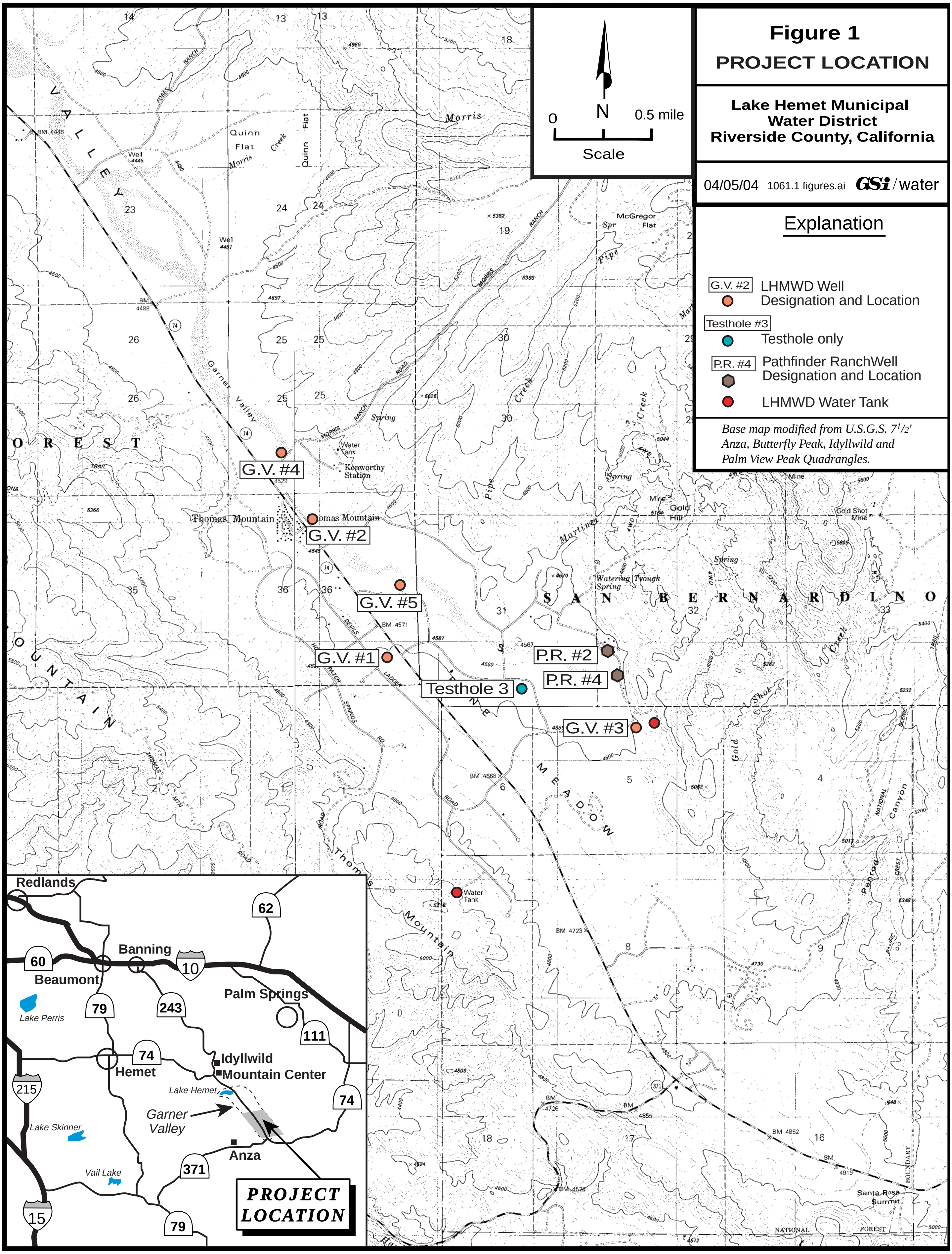


Figure 1
PROJECT LOCATION
Lake Hemet Municipal
Water District
Riverside County, California
04/05/04 1061.1 figures.ai GSi/water
N
0
0.5 mile
Scale
Explanation
G.V. #2 LHMWD Well Designation and Location
Testhole #3 Testhole only
P.R. #4 Pathfinder RanchWell Designation and Location
LHMWD Water Tank
Base map modified from U.S.G.S. 7 1/2' Anza, Butterfly Peak, Idyllwild and Palm View Peak Quadrangles.
G.V. #4
G.V. #2
G.V. #5
G.V. #1
Testhole 3
P.R. #2
P.R. #4
G.V. #3
Thomas Mountain
Water Tank
Kenworthy Station
McGregor Flat
Quinn Flat
Garner Valley
S A N B E R N A R D I N O
M E A D O W
Redlands
Banning
Beaumont
Palm Springs
Lake Perris
Hemet
Idyllwild
Mountain Center
Lake Hemet
Garner Valley
Lake Skinner
Anza
Vail Lake
60
10
79
243
62
111
74
215
371
15
PROJECT LOCATION

GEOHYDROLOGIC SETTING

Figure 2: Geohydrologic Setting

A review of field data and available literature was used to provide geohydrologic context with which to interpret the existing well data (Figure 2).

There are primarily two classifications of lithologic units that will be used in this report: the bedrock units and the younger sedimentary units. The hills flanking the valley are primarily bedrock consisting of metasediments (mica schist and gneiss) and granite (quartz diorite, quartz monzonite and granodiorite).

Although field reconnaissance indicates that few zones of pervasive fracturing exist in the bedrock, large-scale lineaments can be seen in the field and on aerial photographs. These lineaments represent a series of dikes and fractures. These lineaments have two visible trends. A northwest-southeast trending set appears to be predominantly the result of lithologic variations, such as dikes. By themselves, dikes would limit the aquifer potential of the bedrock by filling one-time open fractures. However, the other lineament set - which is northeast-southwest trending - appears to represent fractures, such as faulting. Many of the dikes are offset by the suspected faulting and the rock may be shattered in these areas. A number of springs occur along or near where these features intersect.

The main mapped structural feature is the Thomas Mountain Fault which is exposed on the western side of Garner Valley. Zones of fracturing are sometimes associated with faulting of granitic rocks but where the Thomas Mountain Fault is exposed in the field, it consists mainly of fine-grained clayey gouge with no extensive fracture zone. However, the Thomas Mountain Fault may not be the only major fault in the valley. The eastern side of the Valley is coincident with a possible extension of the Hot Springs Fault. The Hot Springs Fault shown by Dibblee (1982) terminates along the eastern edge of Lake Hemet. We have found no extension of this fault as having been mapped, but if it extends into Pine Meadow, the intersection of the Hot Springs Fault with the smaller northeast-southwest trending faults, may represent untapped aquifer conditions for the area.

The younger sedimentary units exposed near Pine Meadow include recent alluvial fill and older terrestrial deposits. The latter were termed the "Bautista beds" by Fraser, 1931 and this convention will be used in this report. The alluvial fill is comprised of silty and clayey sand. The Bautista beds consist of well stratified clay layers and fine sand to coarse gravels in a clay matrix.

Production from wells in the Pine Meadows basin is interpreted to be from the recent alluvium, the Bautista beds and possibly the weathered uppermost part of the granite. Insufficient information is available from the drilling of the wells to accurately determine how much production is derived from each of these units. However, estimates can be made based on drilling in similar settings and the Districts current well production records.

The recent alluvium likely produces 25 - 60gpm and would have the highest hydraulic conductivity of these units because of its unconsolidated and porous nature. Production from the Bautista beds is probably slightly lower (15 - 50gpm) due to its more compacted nature, and flow is likely confined to layers of porous coarse-grained sands. Production from the bedrock may vary considerably but likely produces 10 - 25gpm. Drilling deeper into bedrock is unlikely to produce more than 10gpm unless a significant fracture zone is encountered.

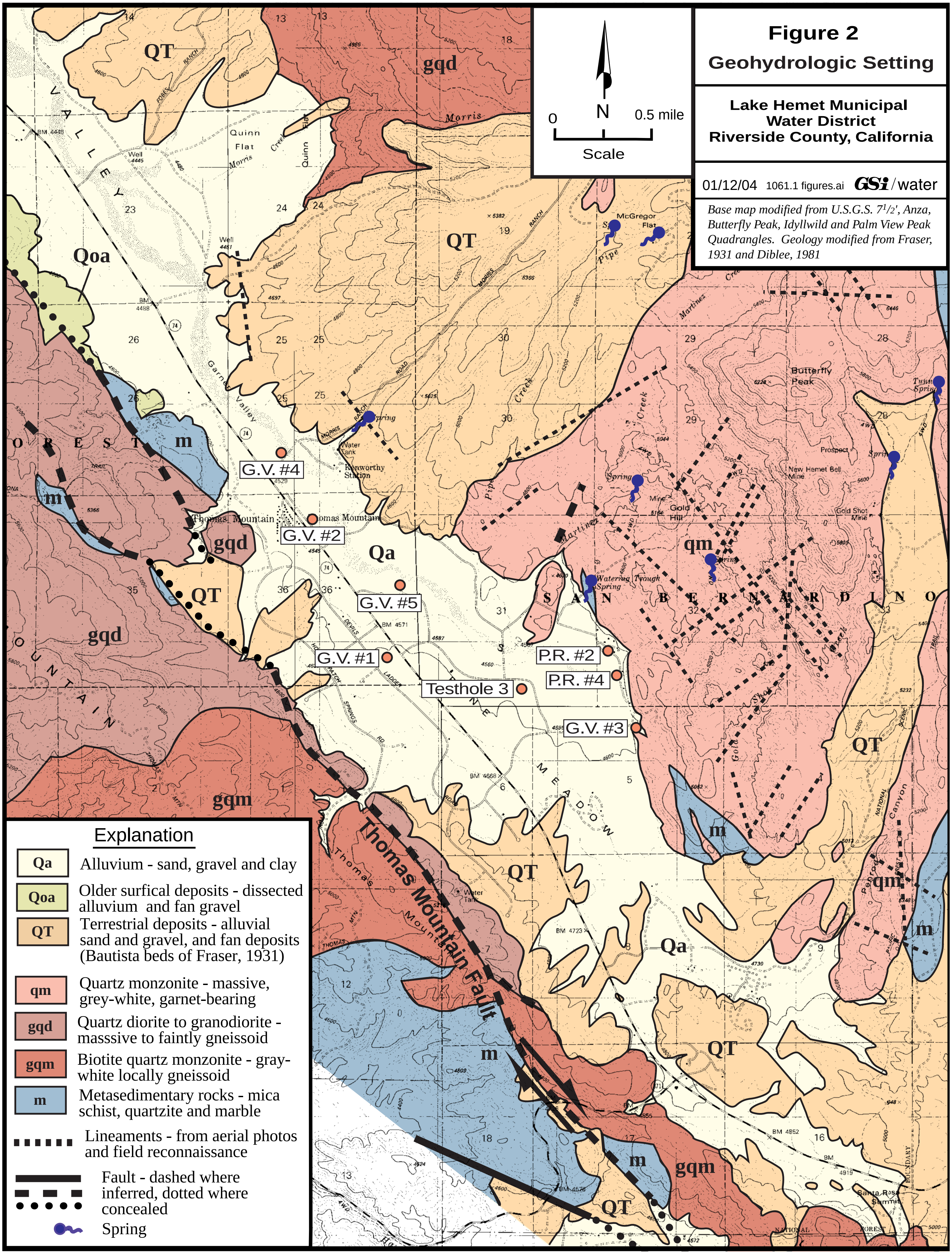


Figure 2
Geohydrologic Setting
Lake Hemet Municipal Water District
Riverside County, California
01/12/04 1061.1 figures.ai GSi/water
Base map modified from U.S.G.S. 7 1/2', Anza, Butterfly Peak, Idyllwild and Palm View Peak Quadrangles. Geology modified from Fraser, 1931 and Diblee, 1981
N
0 0.5 mile
Scale
Explanation
Qa Alluvium - sand, gravel and clay
Qoa Older surfical deposits - dissected alluvium and fan gravel
QT Terrestrial deposits - alluvial sand and gravel, and fan deposits (Bautista beds of Fraser, 1931)
qm Quartz monzonite - massive, grey-white, garnet-bearing
gqd Quartz diorite to granodiorite - masssive to faintly gneissoid
gqm Biotite quartz monzonite - gray-white locally gneissoid
m Metasedimentary rocks - mica schist, quartzite and marble
Lineaments - from aerial photos and field reconnaissance
Fault - dashed where inferred, dotted where concealed
Spring
Thomas Mountain Fault
G.V. #1
G.V. #2
G.V. #3
G.V. #4
G.V. #5
P.R. #2
P.R. #4
Testhole 3
McGregor Flat
Butterfly Peak
Thomas Mountain
Quinn Flat
Garner Valley
Kenworthy Station
Gold Hill
Santa Rosa Summit

EXISTING WELLS

Figure 3a: Water Levels
Figure 3b: Production Record

LHMWD currently owns five wells in the Pine Meadows basin and four of those are active.

G.V. #1 and #2 were drilled in 1969 to a depths of 477ft and 328ft respectively (Appendix A). Well G.V. #1 produces 110gpm and Well G.V.#2 produces 90 gpm. G.V. #1 has a static water level (SWL) of approximately 110ft below ground – the lowest of all the LHMWD wells (Figure 3a).

No information is available on the drilling or construction of G.V. #3. Only water quality information is available up to 1984. The well has not been used since 1984 because of the "sulfurous" taste and smell of the water produced. Drilling and construction information for a Testhole #3 is reported by Bookman-Edmonston Engineering, Inc. (1970), but this testhole is not the same as G.V. #3.

G.V. #4 was drilled in 1985 to a depth of 323ft and is currently LHMWD's highest producing well in the Pine Meadows basin at 175gpm.

G.V. #5 was drilled to a depth of 465ft in 2002. The well can reportedly sustain 50 - 80gpm, but the water produced also has a "sulfurous" taste and smell.

The mean total production from the Pine Meadows basin wells is 233 acre-feet/year.

The Pathfinder Ranch also owns several relatively shallow wells on their property, one of which produces water with a "sulfurous" taste and smell.

The static water levels in G.V. #1, #2 and #4 exhibit an overall decline since 1987, overprinted by a cyclical pattern that reflects climatic variations. It is unclear whether the decline indicates a steadily dropping water table or is simply due to the present low precipitation. The cyclical precipitation change will be reflected in the static water levels in a well after a time delay, termed the lag period. Well G.V. #1 has the deepest water level, the longest lag period (approximately 3 years) and the greatest amount of response to increased precipitation (approximately 25 feet). Wells G.V. #2 and #4 have much shallower static water levels, a shorter (2 year) lag period and less response (approximately 15 feet).

To date there is insufficient data available to identify recovery response times and static water level decline for G.V. #5.

The similar, relatively stable water levels and pumping rates in G.V. #2 and #4 suggest that these wells draw water from the same aquifer. The variable water levels and pumping rates, and "sulfurous" taste and smell of water from G.V. #3 and #5 and the Pathfinder Ranch well suggests that these wells are drawing water from a different aquifer than G.V. #2 and #4.

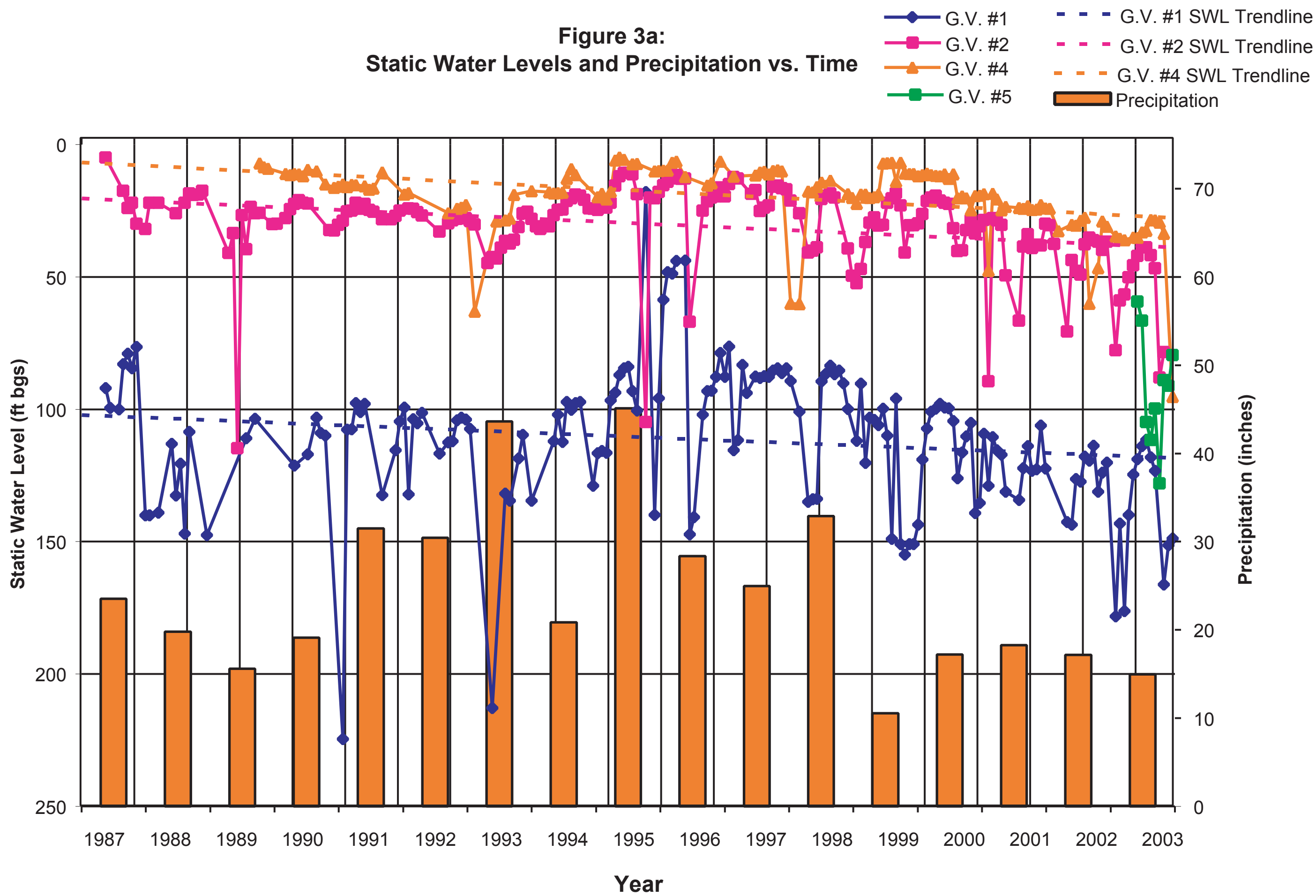


Figure 3a:
Static Water Levels and Precipitation vs. Time
G.V. #1
G.V. #2
G.V. #4
G.V. #5
G.V. #1 SWL Trendline
G.V. #2 SWL Trendline
G.V. #4 SWL Trendline
Precipitation
Static Water Level (ft bgs)
Precipitation (inches)
0
50
100
150
200
250
70
60
50
40
30
20
10
0
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Year

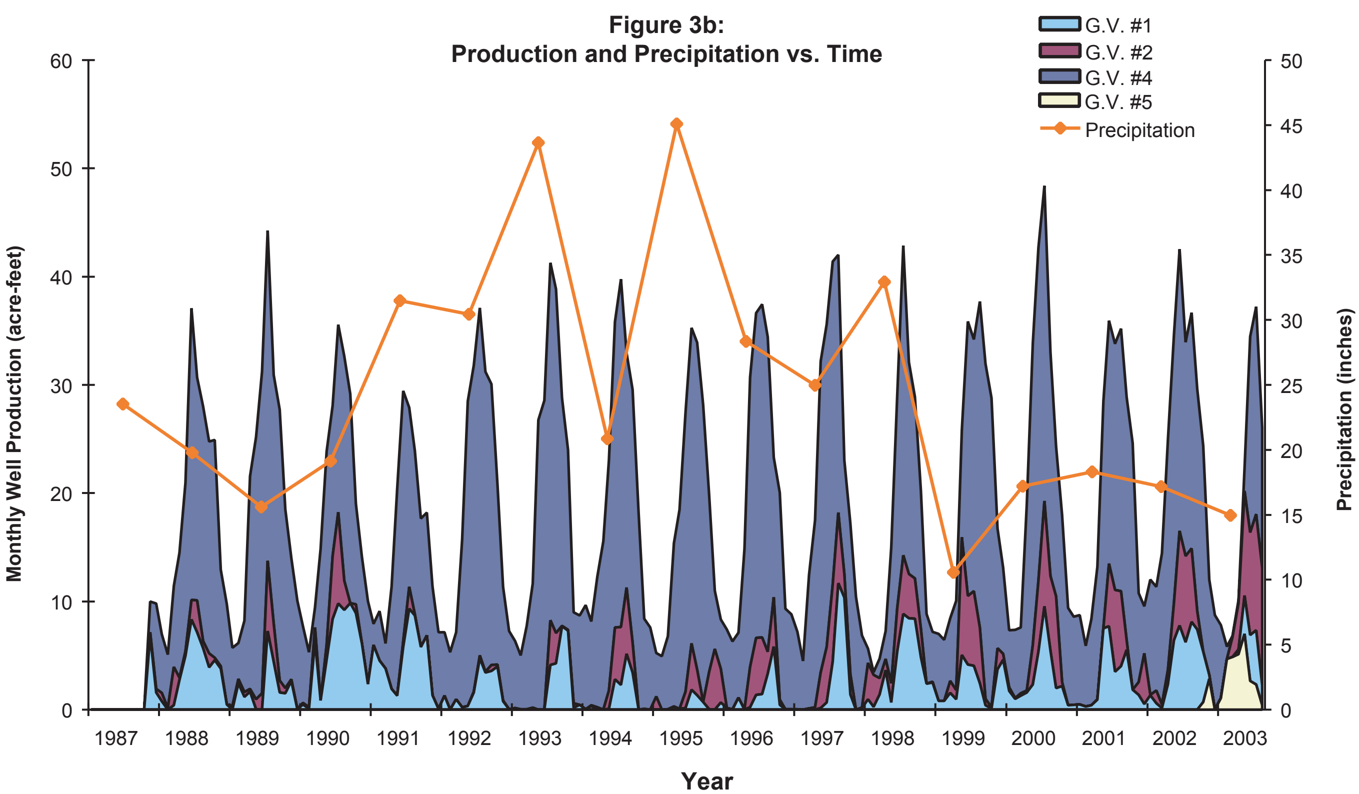


Figure 3b:
Production and Precipitation vs. Time
G.V. #1
G.V. #2
G.V. #4
G.V. #5
Precipitation
Monthly Well Production (acre-feet)
Precipitation (inches)
60
50
40
30
20
10
0
45
35
25
15
5
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Year

WATER BUDGET

Figure 4: Water Budget

The amount of ground water in storage in Pine Meadow was calculated by estimating the volume and porosity of the different geologic units between the northern end of Pine Meadow and the drainage divide at Santa Rosa Summit. Our calculations suggest Pine Meadow has an approximate storage capacity of 86,500 acre-feet. This is the total volume of ground water that is present in the aquifer. However, due to retention, it is not possible to extract all this ground water. If extraction of ground water exceeds the amount of recharge to the basin, water in storage begins to be depleted. Removal of ground water storage in acceptable on a short-term basis. However, if done as a long-term practice, it can result in the lowering of water levels, compaction of the aquifer, bacteria problems in wells, and other detrimental effects. Therefore, excessive depletion of ground water in storage is not advisable.

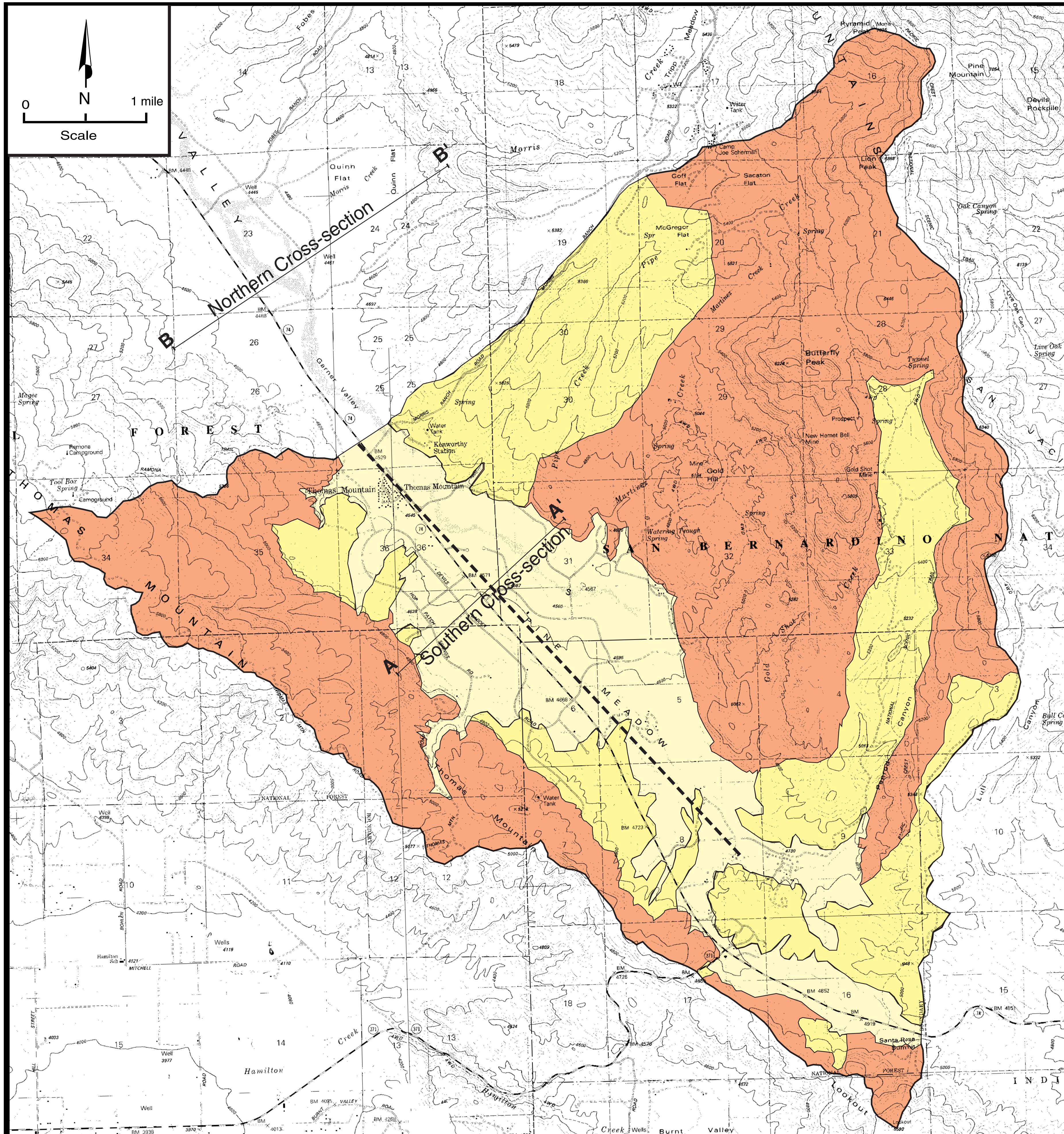
To avoid excessive depletion, a water budget was done to the Pine Meadow area. The water budget calculates the amount of ground water recharge for the basin and how much water is being extracted. If recharge exceeds extraction, there is sufficient ground water to support demand. If extraction exceeds recharge, the basin is in overdraft and ground water has begun to be removed from storage.

Figure 4 shows the catchment area for the Pine Meadow. The mean annual precipitation of 19.91 inches/year for the total catchment area was calculated by averaging 32 years of precipitation data for Lake Hemet (data provided by Riverside County Flood Control). In order to estimate precipitation in a drought, only data from 1999-2002 was used. The calculated precipitation for a drought period is 10.44 inches per year.

A range of estimated infiltration rates was used, taking into account relative differences in the permeability of ground surfaces within the catchment area. The mean infiltration value calculated for the above range was 1186 acre-feet/year for an average year or 622 acre-feet/year in a drought (Appendix C). The "most probable" infiltration value (1389 acre-feet/year for an average year, 729 acre-feet/year in a drought) is an estimate based on the most likely infiltration rates.

Information from LHMWD of current residential water demand was used to estimate the amount of water that would be required to support 307 residences in Pine Meadow. This projected demand was calculated to be 343 acre-feet/year. In addition, the ranches at the southern end of Garner Valley were estimated to be extracting 297 acre-feet/year based on estimates of the amount of water that would be required to maintain livestock, pastureland and for residential use.

The water budget calculations indicate that there is sufficient ground water in the Pine Meadow basin to supply more than the projected 307 residences in a drought year.



Explanation

- Alluvium catchment area
- Older alluvium (Bautista beds of Fraser, 1931) catchment area
- Bedrock catchment area
- A —— A' Outflow calculation line of section (see Appendix A)
- Valley length used for storage calculation

Figure 4
Water Budget

Lake Hemet Municipal Water District
Riverside County, California

03/13/03 1061.1 fig3wbgt.ai GSi/water

Base map modified from U.S.G.S. 7½', Anza, Butterfly Peak, Idyllwild and Palm View Peak Quadrangles.

Storage Capacity: 86,500 acre-feet

Water Budget (Appendix C):

	Average Precipitation Year *(acre-feet/year)*	Drought Year *(acre-feet/year)*
Recharge		
Infiltration from Precipitation:		
Most Probable*:	1389	729
Mean:	1186	622
Current Extraction		
LHMWD:		
Range:	219 - 267	
Mean:	243	
Other Users:		
Range:	151 - 442	
Mean:	297	
Currently Available Ground Water (Recharge minus Extraction)		
Mean*:	850	189
% of probable infiltration:	61%	26%

Currently a surplus of available water exists

	Average Precipitation Year	Drought Year
Projected Extraction		
LHMWD:		
Range:	260.8 - 426	
Mean:	343	
Other Users:		
Range:	151 - 442	
Mean:	297	
Projected Available Ground Water (Recharge minus Projected Extraction)		
Mean:	**749**	**88**
% of most probable:	**54%**	**12%**

A surplus of available water will likely exist after the projected increase in extraction

* Based on infiltration rates of 1%, 10% and 15% for granitic, Bautista beds and alluvium respectively.

WATER QUALITY

Figure 5: Water Quality

Water quality analyses were used to identify different sources of water being produced by the LHMWD wells. Water quality analyses are available from 2002 for all wells except G.V. #3. The most recent water quality analysis for G.V. #3 is from 1984.

Stiff diagrams were constructed for water from each well and are presented in Figure 5 and Appendix D. Stiff diagrams are a way of representing the chemical characteristics of a water sample by plotting anions and cations on positive and negative side of the y-axis. The resulting polygonal shape, and the primary anion and cation, indicate the type of water and similar shapes indicate similar water type.

The water from G.V. #2 and #4 is of calcium-bicarbonate type. The water from G.V. #3 and #5 is of sodium-bicarbonate and sodium-sulfate type. This suggests that water being produced in the northerly (G.V. #2 and #4) and southerly (G.V. #3 and #5) wells may be from two different aquifers.

High aluminum and iron concentrations were measured in water from G.V. #5. High aluminum is unusual in ground water and may be an indication that the samples were not filtered by the laboratory prior to analysis. The resulting values therefore, may be lower than reported.

The water from G.V. #1 is of sodium-bicarbonate type. The source of this water may be a mixture of the water being extracted from G.V. #3 and #5.

There are several possibilities to explain these variations in water quality.

- One possibility may be related to the fact that the bottom of wells G.V. #1 and #5 are approximately 100ft lower in elevation than the other wells. Water of a different quality may be produced from a lower elevation.

- There is also a spatial difference between the southerly and northerly wells. This may suggest that a geological subsurface barrier exists trending northeast-southwest, approximately aligned with the contact of the Bautista beds and quartz monzonite and the two lineations identified to the north of Pine Meadow.

- The sulfurous taste and smell was reported from G.V. #3, #5 and one of the Pathfinder Ranch wells, all of which are more southerly than the other wells. The source of this sulfurous smell is likely to be due to a geological process, rather than a bacteriological process since only three wells in the area are apparently affected. Water quality testing of G.V. #3 and #5 should include tests for sulfides because sulfate does not appear to be consistently high in either of these wells.

Our preferred hypothesis at this time relates to the possible extension of the Hot Springs Fault. To the north of Garner Valley, mineralized water rises along the Hot Springs Fault. The same may be occurring here - but to a much smaller degree. If this is occurring, a potential site for a new well may be on the upgradient (eastern) side of the suspected fault trace.

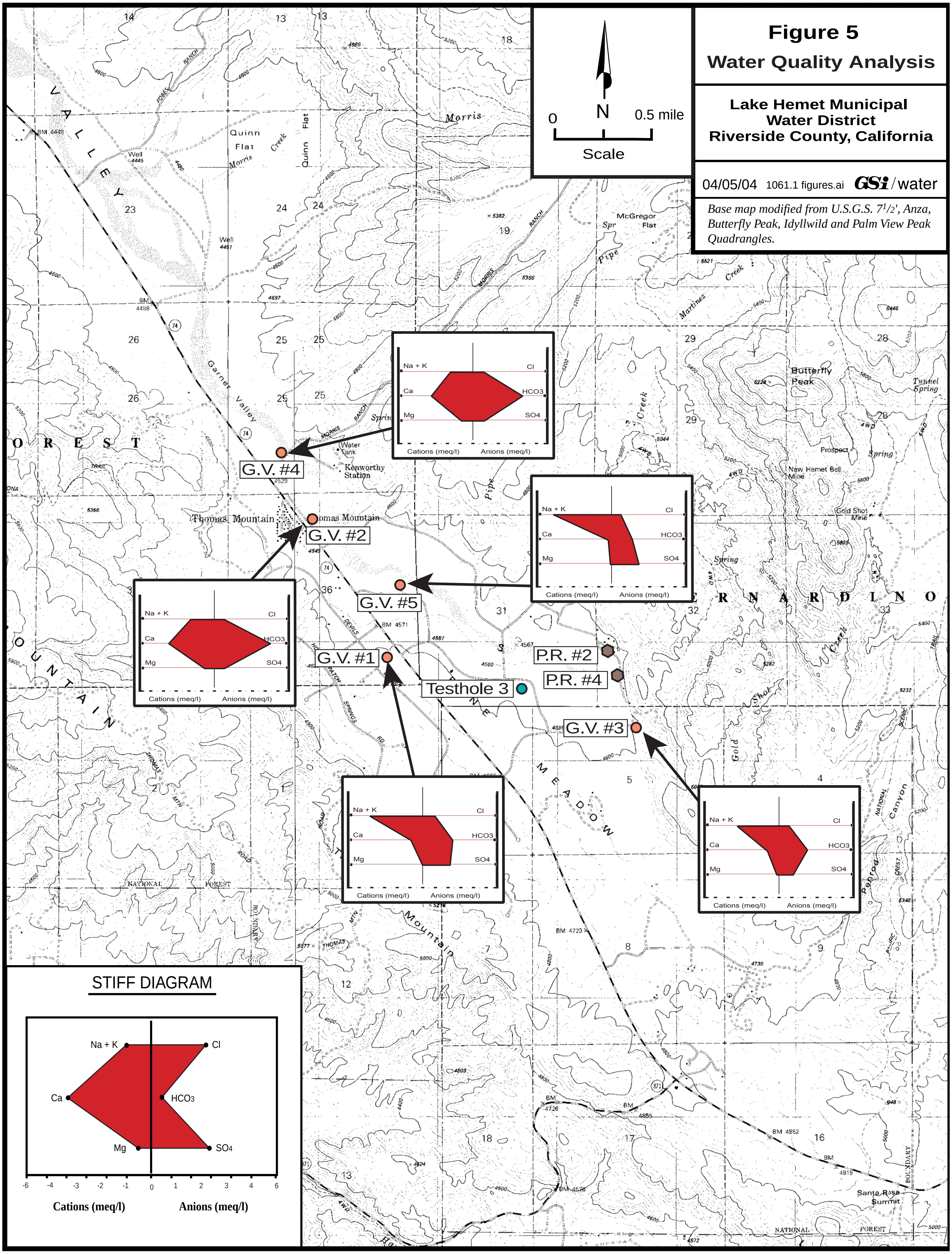


Figure 5
Water Quality Analysis
Lake Hemet Municipal Water District
Riverside County, California
04/05/04 1061.1 figures.ai GSi/water
Base map modified from U.S.G.S. 7 1/2', Anza, Butterfly Peak, Idyllwild and Palm View Peak Quadrangles.
N
0
0.5 mile
Scale
G.V. #4
G.V. #2
G.V. #5
G.V. #1
G.V. #3
P.R. #2
P.R. #4
Testhole 3
Na + K
Ca
Mg
Cl
HCO3
SO4
Cations (meq/l)
Anions (meq/l)
STIFF DIAGRAM
Thomas Mountain
Butterfly Peak
Garner Valley
Quinn Flat
Kenworthy Station
McGregor Flat
Santa Rosa Summit

INTERPRETATIONS

- The highest likelihood for obtaining additional ground water production is the surficial alluvium and the Bautista beds. Surficial exposures of the granitic rocks in the vicinity have few significant fracture zones.

- Although the Thomas Mountain Fault, where exposed, shows little indication of a significant fracture zone, it may be acting as a barrier to ground water flow and additional production may be attainable by drilling near the fault.

- Currently LHMWD extracts a mean total of 243 acre-feet/year from four active wells.

    - G.V. #4 is the highest producer.
    - G.V. #1 has a relatively deep static water level and pumping level.
    - Water from G.V. #5 has a sulfurous taste and smell.

- The storage capacity of the Pine Meadows basin is about 86,500 acre-feet.

- The most probable amount of infiltration from precipitation in the Pine Meadow catchment area is about 1390 acre-feet/year during and average year of precipitation. Approximately 640 acre-feet/year is estimated will be extracted by LHMWD and other users with an increase in the number of residences to 307. This would leave 54% of the available water during an average year or 12% during a drought year. **Therefore, there should be sufficient water flowing through Pine Meadow to support the proposed 307 residences during a drought year.**

- The southerly (G.V. #1, #3 and #5) and northerly (G.V. #2 and #4) appear to have significantly different characteristics. The northerly wells have consistently high static and pumping water levels and similar water quality. The southerly wells have lower static and pumping water levels, are of different water quality type, and are reported to have a sulfurous taste and smell. These differences may be due to differing depths of the wells, but may be associated with an extension of the Hot Springs Fault.

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RECOMMENDATIONS AND POTENTIAL TESTHOLE LOCATIONS
Figure 6: Prioritized Testhole Locations

Figure 6 shows prioritized recommended testhole locations based on the information in this report. Our highest priority testhole location coincides with the current anticipated location of G.V. #6, to be drilled later in 2004. Potential testhole locations were selected for the following reasons:

- TH-1: Good potential for significant production of good quality water due to proximity to G.V. #2 and #4 and because the location is north of the inferred subsurface barrier. The site is close to the current water supply system and has easy access. Significant bedrock fractures are unlikely at this location and the well should only be drilled to solid bedrock (approximately 500ft depth). Interference with the G.V. #2 and #4 may occur during pumping.
- TH-2: Good potential for significant production of good quality water because a well at this site will likely tap the same aquifer as G.V. #2 and #4. Access is reasonable but the site is some distance from the current water supply system. There should be minimal interference with G.V. #2 and #4. This well should also be drilled to solid bedrock (approximately 500ft depth) because significant bedrock fractures are unlikely to exist at depth.
- TH-3: Some potential for tapping a zone of ground water flow associated with the geologic contact, and lineations in the bedrock in this vicinity. Access is good and the location is close to the existing water supply system. The objective is to drill on the east of the suspected Hot Springs Fault trace. Wells to the northwest of Garner Valley have been successful by being located within the shattered zone, and on the upgradient side, of this fault. There is a possibility of poor water quality, however, and if bedrock production is not significant, alluvial production is unlikely to be good. A 300ft testhole should be sufficient to determine if significant production is available, but the final depth should be determined by examining data collected during drilling.
- TH-3: Some potential for tapping a zone of ground water flow associated with the Thomas Mountain Fault (TMF) that could potentially provide reasonable production. Water quality from such a source is unknown. Alluvial production is likely to be significant. Access to this site may be difficult. A 300ft testhole should be sufficient to determine if any significant production is available from this location, but the final depth should be determined by examining data collected during drilling.

Further recommendations for LHMWD are:

- Allow wells to recover for longer periods after pumping prior to measuring the static water level. This will help to ensure complete recovery to static conditions and may eliminate some of the variations in the static water level data.

- Conduct a test pumping program on G.V. #5. This should include an 8-hr step-drawdown test, a 24-hr constant rate test and up to 12-hr recovery test and use of G.V. #2 as a monitoring well. The test results should indicate subsurface variations in aquifer characteristics and the sustainable pumping rate. During the step-drawdown test, samples should be taken for laboratory analysis of water quality at different levels of drawdown. This would help identify potential water quality problems at depth.

We recommend continuing the project with the drilling of G.V. #6. The drilling phase should be carefully monitored for subtle changes in lithology, identification of zones of production and water quality variations. The design of the production well should be based on observations made during drilling. A carefully conducted test pumping program should be completed and a pump and pumping rate should be selected for maximum efficiency by analyzing the results.

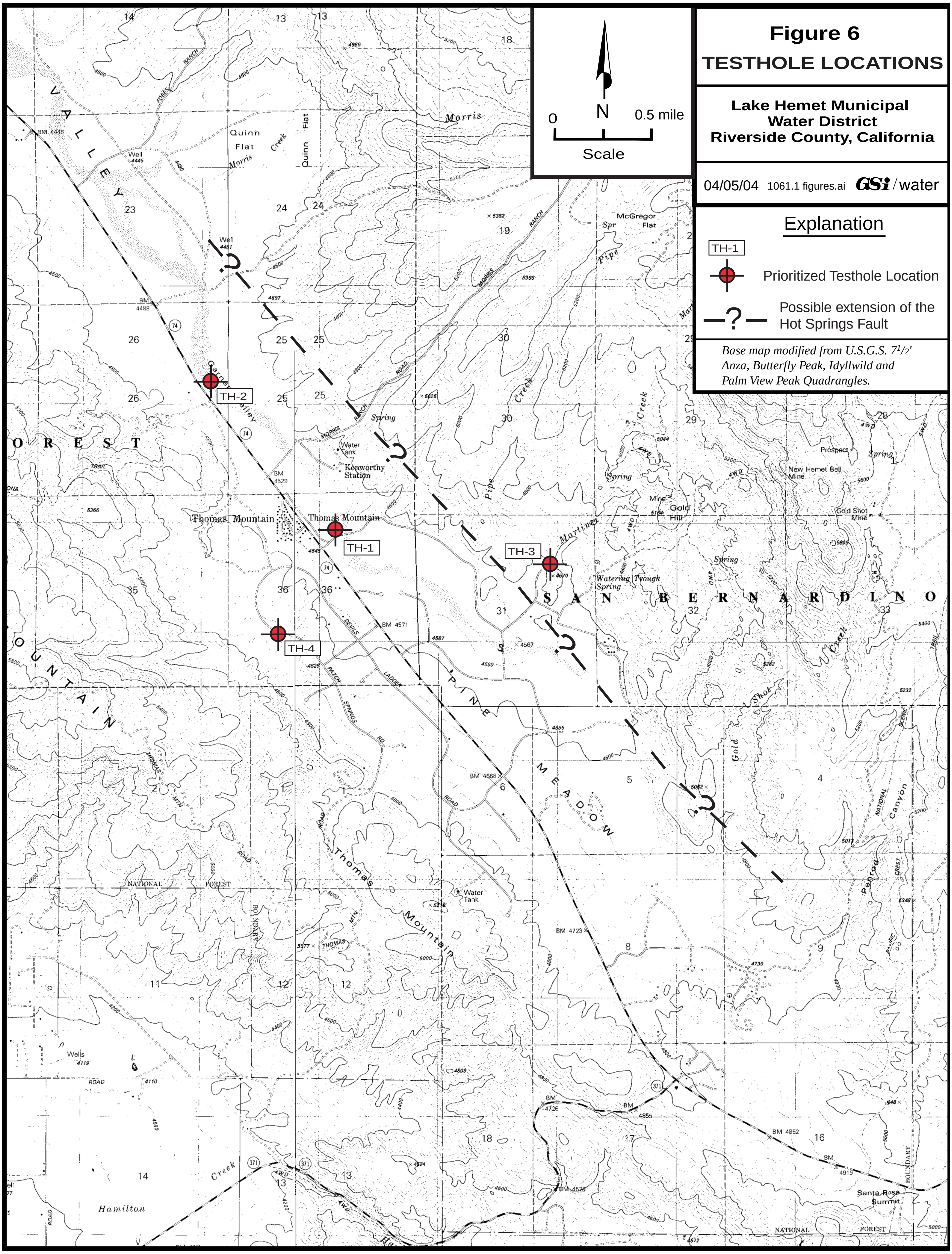


Figure 6
TESTHOLE LOCATIONS

APPENDIX A

Well Summary, Drillers' Logs and As-built Diagrams

LHMWD Pine Meadow Well and Testhole Summary

LHMWD Well No. and status	General Information				Casing and Screen						Completion					
	Year Drilled	Contracted Driller	Latitude Longitude Elevation AMSL	Borehole Size	Total Depth Drilled (ft)	Total Depth of Casing (ft)	Casing Diameter	Screened Interval (From - To)	Slot Size and Type	Seal Depth (ft)	Pump Setting Depth (ft)	Pump Size, Type and Installation Date	Production History (af/month)	Recent Production (af/month)	Recent SWL (ft bgs, date)	Well History
G.V. # 1 **Active** **(Pine Meadows Well No. 1)**	1969	Unknown	33.36.106N 116.37.011W 4552	30" (0 to 50ft) 18.625" (50 to 477ft)	477	431	20" O.D. to 50ft 10.75" O.D. to 430ft	140 - 250 310 - 330 360 - 420	0.06" mill cut 0.06" mill cut 0.06" mill cut	50	380	25Hp Submersible 1974	8 ...5	5	110 07/10/97	drilled 3/69, installed new pump 7/97, videolog 7/10/97 (restricted perfs and iron deposits),cleaned perfs with Sonar-jet 7/15/97, lowered pump to 380' 8/00
G.V. # 2 **Active** **(Pine Meadows Well No. 2)**	1969	Bill Belknap, Reedley, CA	33.36.785N 116.37.485W 4521	28" (0 to 50ft) 17.5" (50 to 350ft)	350	Originally 328 Now 318	20" O.D. to 50ft 10.75" O.D. to 328ft	78 - 328	3/32" louvers	50	280	Goulds 90L-30 submersible 2003	2 .. 11	11	45 09/01	drilled 10/69, installed 30HP pump 09/82, videolog (small hole in casing @ 71') + sonar jet + brush + acidify 4/88, videologs 01/99 (large encrustations) and 09/01 (perfs almost closed below 190, hole at 307'), sonar-jet and videolog and install Goulds 90L-30 30HP @ 280ft 01/03
G.V. # 3 **Inactive**	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	None		Discontinued use in 1984 because of sulfurous taste and smell
Testhole #3 **Inactive (Pine Meadows Well No. 3)**	1969	Bill Belknap, Reedley, CA	4560	28" (0 to 50ft) 17.5" (50ft to 356ft)	356	192	20.5" O.D. to 50ft 10.75" O.D. to 192ft	82 - 180	1/8" louvers	50	None	None	None	None	30 04/24/73	drilled 11/69, production was low because dd was to pump depth and pump could not be set lower because of open hole below 192' - open hole left to allow caving and widening of cavity, unknown if borehole still exists
G.V. # 4 **Active**	1985	Rottman Drilling Co.	33.37.031N 116.37.624W 4500	12.25" (0 to 323ft)	323	285	20" nominal to 50ft 10" nominal to 285ft	60 - 280	0.06" Johnson screen	50	220	Goulds 7WAHC275 submersible 2003	23 .. 33	19	12 12/85	drilled 11/85, install Grunfos SP75-2 05/86, replace motor 4/87 and 8/95, replace pump with Goulds 330L 3/98, replace motor and pump 8/99, install to 170' 15HP pump 11/99, lowered to 212'? 7/02, replaced pump, lowered pump to 220' 05/03
G.V. # 5 **Active**	2002	L.O. Lynch Quality Wells & Pumps, Inc.	33.36.484N 116.37.019W 4548	34" (0 to 80ft) 18" (80 to 465ft)	465 e-logger	460	20.5" O.D. to 80ft 11.25" O.D. to 460ft	80 - 460	0.60"	80	315	Goulds 5CHC0404 Submersible 2002	5	5	40 8/02	drilled 07/02

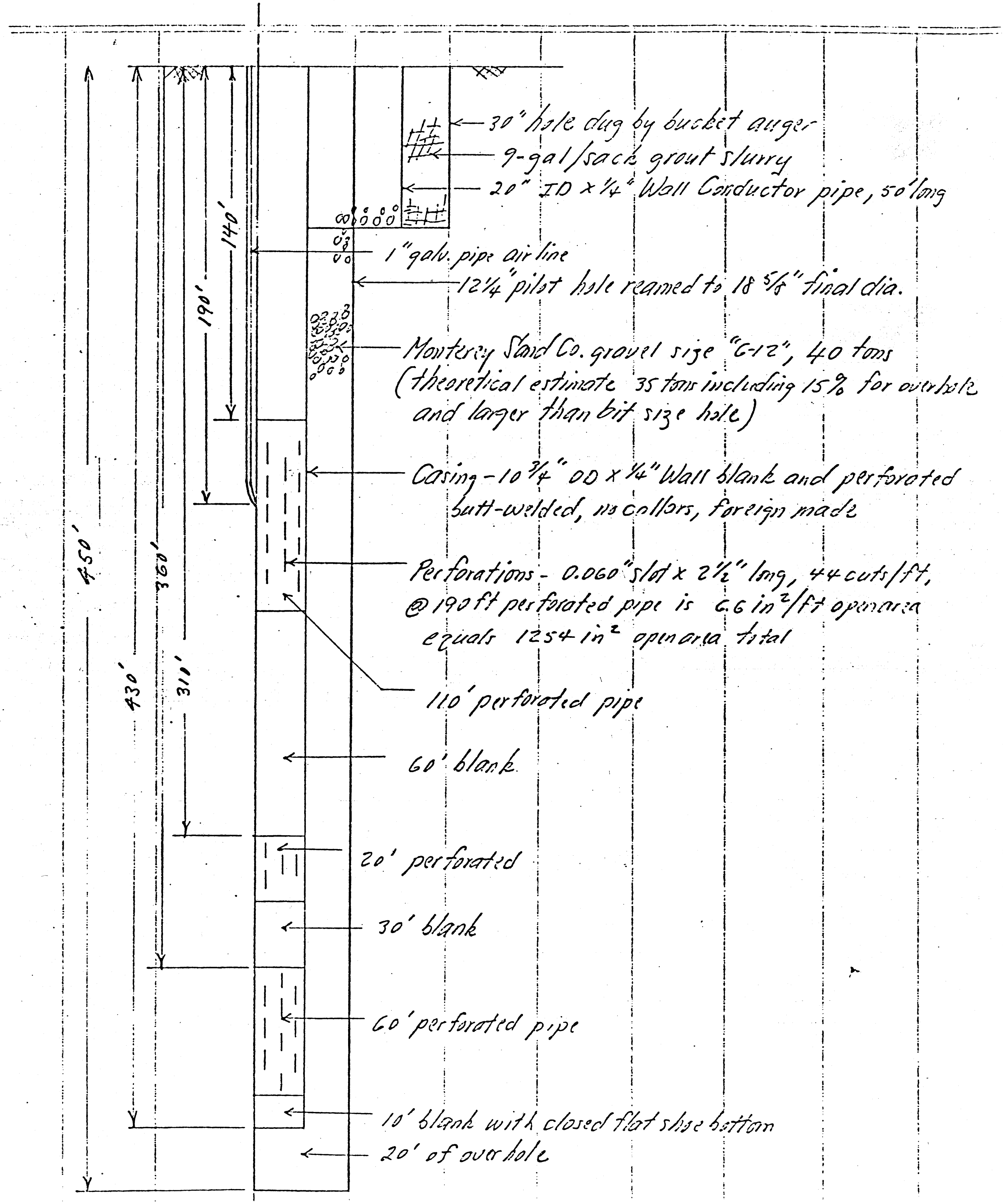
DRILLERS LOG

Pine Meadow Well No. 1

Drilling method:	Direct rotary with aquagel mud (0-50 feet drilled dry by bucket augar)
Bit size:	12-1/2 inch tricone
Drilling commenced:	March 20, 1969 Ended: March 23, 1969
Logged by:	David A. Lawrence, Bookman-Edmonston Engineering, Inc.

Depth	
0 - 32	Sand, medium, well sorted, 20% fine to coarse, moist, mica, brown, gravel and boulders to 1-1/2 ft.
32 - 34	Silty sand, medium, nonplastic, brown, scattered gravels, cobbles and boulders
34 - 45	Sand, fine to medium, white, moist, some biotite
45 - 48	Sandy silt, hard, brownish green
48 - 49-1/2	Silt, brown, platy, very hard, water seeping in hole
49-1/2 - 58	Sand, very coarse, poorly graded fine to coarse, streaks brown silt
58 - 63-1/2	Sandy clay, very coarse sand, sticky grayish brown clay
63-1/2 - 73	Sand and clay, reddish brown sticky clay, fine to medium sand
73 - 86	Clayey sand, fine to coarse, brown clay
86 - 91	Sandy clay, medium to coarse sand, brown clay
91 - 101	Clay, some medium to coarse sand, greenish brown, sticky, easy drilling
101 - 108	Sandy clay, medium to coarse sand, grayisn green, soft
108 - 141	Sandy clay, fine to coarse sand 5-15%, green, soft and sticky
141 - 146	Sand with blue clay, angular fine to coarse sand clay washes easily from sand, probably occurs in layers
146 - 181	Sand, fine to coarse, well graded, blue (predominantly plagioclase) some clay layers (about 24 ft. of sand from E-log)
181 - 219	Sand, fine to coarse, mostly coarse, poorly graded, blue, clay layers (about 25 ft. of sand from E-log)
219 - 237	Sandy clay, fine to coarse brown sand, brown clay, angular sand
237 - 263	Clayey sand, fine to coarse, well graded, brown clay
263 - 306	Clay, 5% sand, brown, sticky slow drilling
306 - 333	Sand, fine to coarse, brown, well graded, some clay shows Bit chatter at 322
333 - 364	Sandy clay, brown, sticky, sand fine to medium
364 - 437	Sand, fine to coarse, brown, very angular, very slow drilling, sand grains are broken (fresh), some clay layers, subrounded gravel about 1/4-inch sampled, either hard sandstone or dull bit
437 - 468	Clay, slightly sandy, brown become very yellow, flecks of pure white clay easily dissolved, brown sand
468 - 477	Sand or sandstone, very hard, slow drilling, fine to medium, angular

PINE MEADOW WELL No. 1 - DETAILS OF CONSTRUCTION



DRILLERS LOG

Pine Meadow Well No. 2

0-31	Sand with decomposed gravel
31-46	Sand and boulders
46-55	Interbedded sand and clay
55-61	Clay, silty, brown
61-64	Sand and gravel, gravel, gravel to 1/2 inch, sand fine to coarse, easy drilling
64-72	Sand and boulders, black chips, white orthoclase sand
72-76	Sand with residual clay, coarse sand, subangular to subrounded, white clay balls with sand, easy drilling
76-79	Sandy clay, white clay, very fine sand
79-81	Sand and gravel, very coarse sand, gravel to 1/2 inch
81-83	Sand clay, very fine to medium sand, silty white clay
83-90	Sand and gravel, very coarse sand
90-93	Sandy clay, hard, fine sand, white clay
93-98	Sand and gravel, coarse sand
98-99-1/2	Sandy clay
99-1/2 - 104	Sand and gravel, very coarse sand, pea gravel
104-109	Clay, brown
109-111	Sand and gravel
111-112	Sandstone, slow drilling
112-114	Sand and gravel
114-132	Clay, brown, very sandy, fine sand, packed
132-138	Sand, coarse, tight
138-141	Silty clay, brown
141-143	Sand, coarse, tight, subangular to subrounded
143-145	Clay, silty with sand, tight
145-146	Sand and gravel
146-148	Clay, silty
148-152	Sand and gravel, very coarse sand
152-153	Clay with sand, tight, silty clay
153-156	Sand and gravel, fine to coarse sand
156-166	Clay with sand, fine to coarse sand, brown clay, sand stread @ 159
174-175	Sand
175-180	Sand and clay
180-182	Sand and gravel
182-184	Clay, brown
184-186	Sand and gravel
186-187	Sandy clay
187-189	Sand and gravel
189-191	Sand clay, scattered gravel

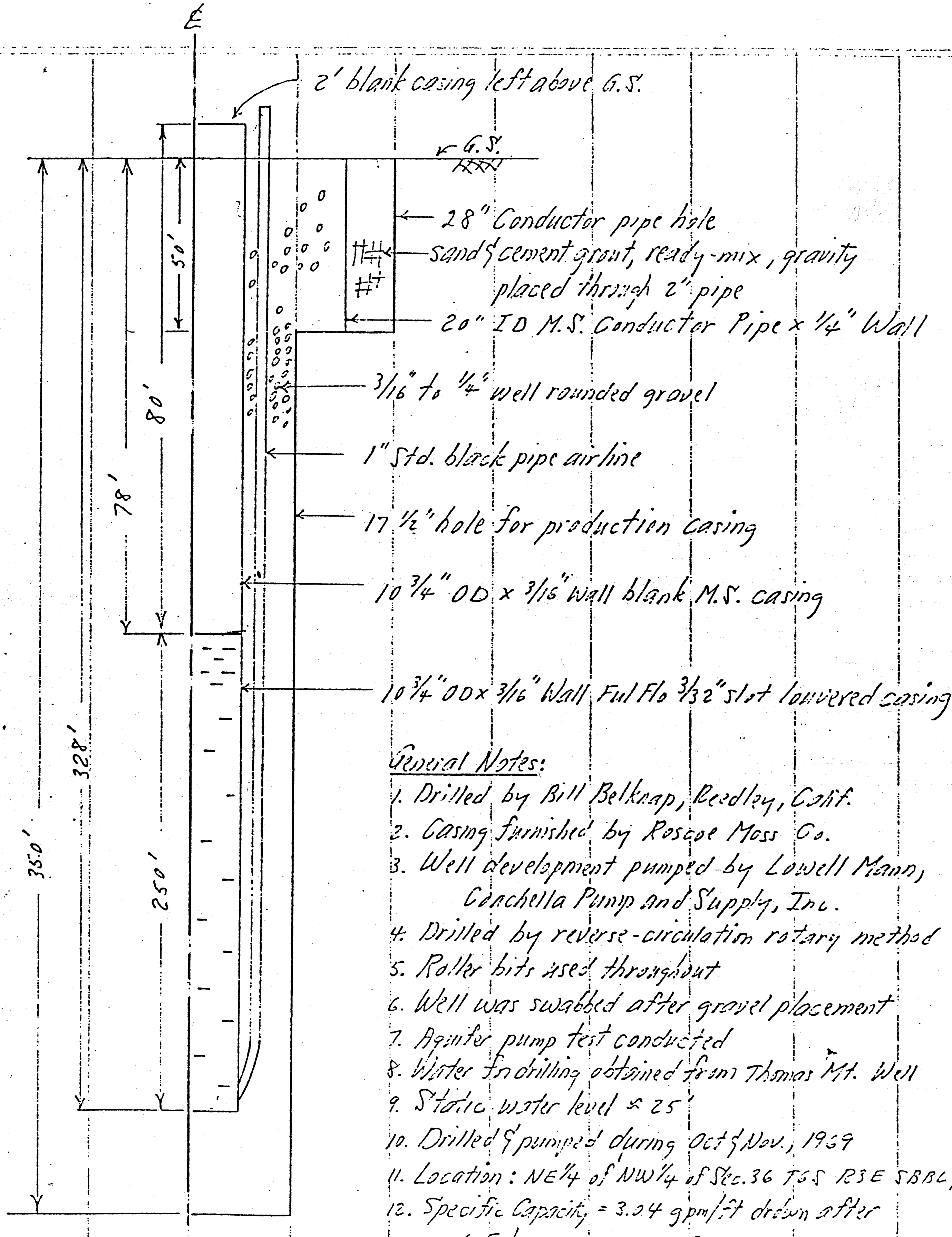
(Cont.)

DRILLERS LOG

Pine Meadow Well No. 2 (Cont.)

191-201	Sand and gravel
201-206	Sandy clay
206-210	Sand and gravel, very coarse sand
210-212	Sandy clay, brown
212-214	Sand and gravel, packed
214-215	Brown clay
215-217	Boulders
217-220	Brown sandy clay
220-224	Boulders in clay
224-231	Clay, brown with boulders, very sandy clay
231-237	Clay, brown, lean, some cobbles
237-238	Sand and boulder, chips of diorite and mafic minerals
238-256	Clay, brown with boulders, very sandy clay
256-260	Boulders, very soft, easy drilling, black rock chips
260-265	Clay, very sandy
265-266	Sand, medium, angular, brown, soft
266-267	Clay, sandy, brown
267-270	Sand and gravel, very coarse, easy drilling
270-271	Cobbles and boulders
271-272	Clay, brown, sandy
272-274	Sand and gravel, brown and black
274-284	Sand and gravel, green, easy drilling, angular to subangular
284-285	Clay, silty, bluish green, hard
285-289	Sand and gravel, graded, green, angular
289-290	Clay, silty, bluish green, hard, some sand
290-312	Sand and clay, packed
312-313	Sand, packed
313-314	Rocks and boulders
314-315	White sand
315-317	Clay, brown
317-318	Clay, blue
318-322	Sand and gravel
322-325	Rocks and gravel and sandy clay
325-330	Boulders and sandy clay
330-332	Sand and gravel
332-349	Rocks and boulders
349-350	Rocks and clay, black chips

Details of Construction



General Notes:

1. Drilled by Bill Belknap, Reedley, Calif.
2. Casing furnished by Roscoe Moss Co.
3. Well development pumped by Lowell Mann, Coachella Pump and Supply, Inc.
4. Drilled by reverse-circulation rotary method
5. Roller bits used throughout
6. Well was swabbed after gravel placement
7. Aquifer pump test conducted
8. Water for drilling obtained from Thomas Mt. Well
9. Static water level ≈ 25'
10. Drilled & pumped during Oct & Nov., 1969
11. Location: NE1/4 of NW1/4 of Sec. 36 T5S R3E SBBLM
12. Specific Capacity = 3.04 gpm/ft drawn after 6.5 hours pumping 108 gpm
13. Well designed for 165 gpm @ static W.L. of 25', S.C. of 3, and having no falling water

DRILLERS LOG

Pine Meadow No. 3

0-6	Topsoil
6-12	Sand
12-44	Silty clay, brown, some decomposed granite
44-48	Gravel and cobbles to 4"
48-55	Clay, brown
55-58	Sandy clay, blue
58-64	Clay, brown
64-65	Sandy gray clay with granitic rocks
65-67	Clay, brown
67-68	Clay, blue
68-69	Sand
69-74	Sandy clay, blue
74-77	Sand
77-79	Clay, blue
79-81	Sand and rocks
81-82	Clay, blue with sand layers
82-85	Sand and rocks, very coarse sand
85-86	Sandy clay, blue
86-90	Sand and gravel, coarse
90-92	Clay, blue
92-110	Clay and gravel, blue clay
110-112	Sand and gravel, coarse
112-114	Sandy clay, blue
114-119	Sand and gravel, coarse
119-125	Sandy clay, blue with gravel
125-129	Sand and gravel, coarse
129-135	Sandy clay, brown
135-138	Sandy clay, blue, with gravel
138-143	Clay, grayish brown
143-145	Clay, blue, silty with fine sand
145-151	Sand, fine to medium, bluish brown, some clay
151-154	Sand, coarse, green and white, easy drilling
154-158	Clay and sand, interbedded, brown and blue sand and clay
158-160	Sand, medium to coarse, brownish blue, easy drilling
160-164	Sand, coarse
164-166	Sandy clay
166-168	Sand
168-171	Clay and sand, grayish blue clay, brown sand
171-174	Sand, brown to green, medium to coarse
174-175	Sand and clay, blue clay, brown sand
175-177	Sand, clean quartz, white, medium to coarse

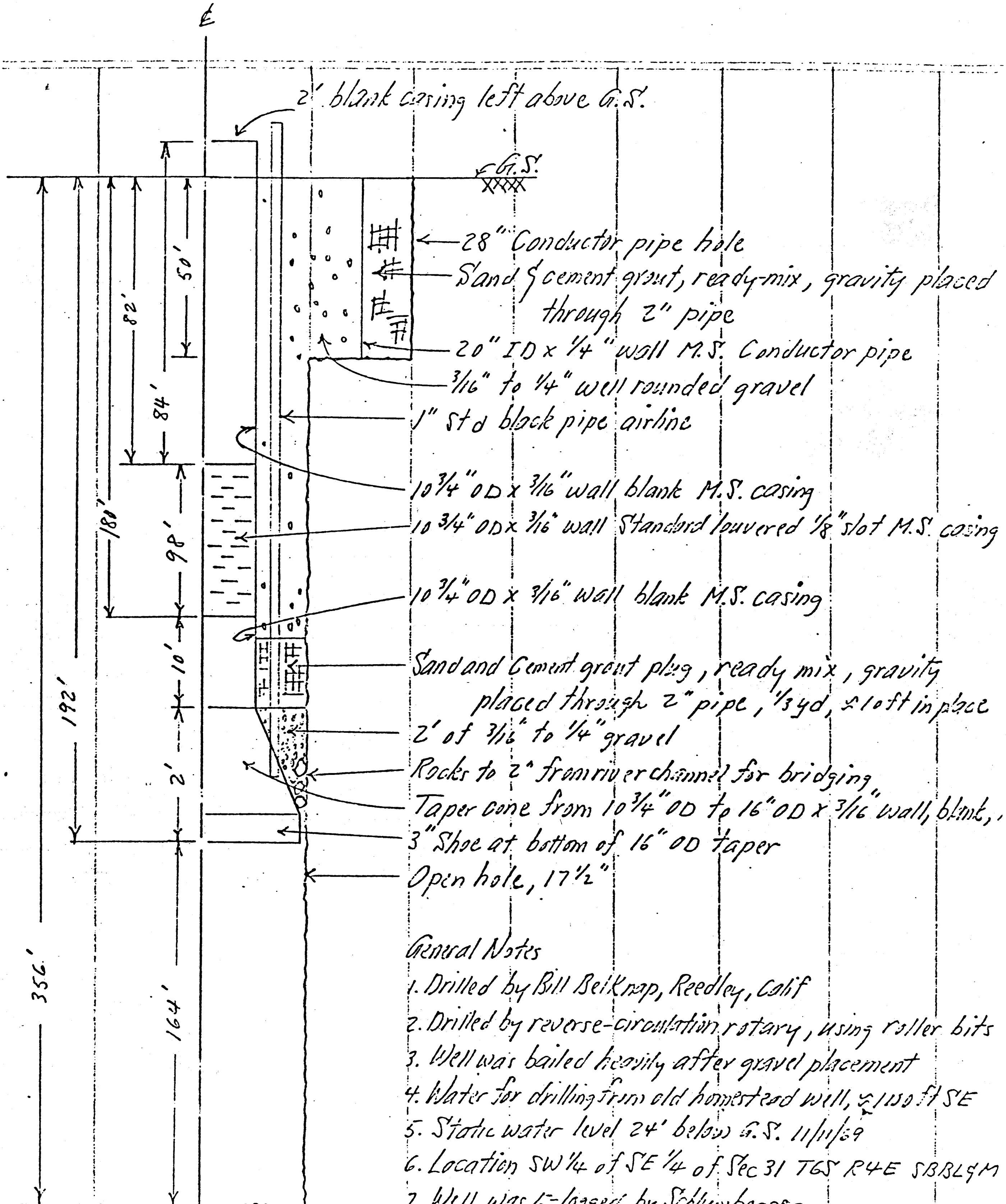
(Cont.)

DRILLERS LOG

Pine Meadow No. 3 (Cont.)

177-179	Sand and clay, very sandy silty clay, gray with coarse sand
179-180	Sandy gray clay, fine to very coarse sand
180-182	Clay, sandy, dark brown clay
182-197	Clay, gray, very sandy, coarse sand
197-201	Sand, coarse brown
201-206	Sand, medium to coarse, with clay, 80% sand
206-208	Sand, medium to coarse, uniform, bluish white
208-209	Clay with sand
209-216	Sand, medium to coarse, bluish white, uniform, easy drilling
216-220	Clay with sand, medium to coarse sand, white sand, gray clay
220-236	Sandy clay, hard, gray, fine to medium sand
236-237	Sand, coarse
237-238	Sandy clay, blue
238-242	Sand, coarse
242-245	Sandy clay, blue
245-246	Sand, coarse
246-247	Sandy clay, blue
247-250	Sandy clay, brown
250-256	Sandy clay, blue
256-257	Sand, coarse
257-259	Clay, brown
259-269	Sandy clay, blue
269-270	Sand, coarse
270-271	Clay, brown
271-273	Clay, blue
273-275	Sand, coarse
275-283	Clay, blue
283-285	Clay, brown
285-291	Sandy clay, blue
291-302	Sandstone, bluish green, some clay
302-316	Sand, brown, with white and brown clay
316-321	Sand, green, with white clay
321-325	Sandy clay with rocks and gravel
325-327	Clay
327-329	Boulders, hard, green quartz
329-330	Clay and cobbles, brown and blue clay
330-332	Sand and gravel, green, easy drilling
332-337	Sandstone, green, angular with mafic minerals
337-356	Quartzite, brown, hard, iron stains

Details of Construction



General Notes

1. Drilled by Bill Belknap, Reedley, Calif
2. Drilled by reverse-circulation rotary, using roller bits
3. Well was bailed heavily after gravel placement
4. Water for drilling from old homestead well, ±1100 ft SE
5. Static water level 24' below G.S. 11/11/59
6. Location SW 1/4 of SE 1/4 of Sec 31 T6S R4E SBBL&M
7. Well was E-logged by Schlumberger
8. Production was low on this well because water levels could not be drawn down below the pump setting at the bottom of the casing. The pump was not set lower for fear of the well caving in. The purpose of leaving the hole open was so that it would cave in creating a larger cavity

8. (con't) liner should be put inside the existing casing opposite the open hole and the well re-pumped with the pump setting at the

TRIPLICATE
Owner's Copy

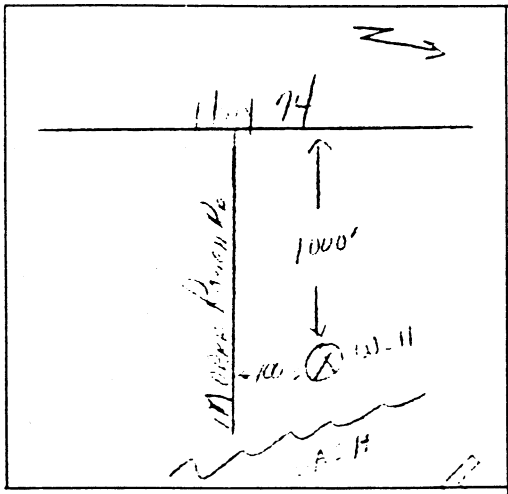
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in
No. 157536

Notice of Intent No. 147241
Lo[illegible] mit No. or Date
State Well No.
Other Well No.

(1) OWNER: Name Lake Hemet Municipal Water District
Address 40983 Florida Ave., P.O. Box 5038
City Hemet, California Zip 92344

(2) LOCATION OF WELL (See instructions):
County Riverside Owner's Well Number
Well address if different from above Garner Valley #4
Township Range Section
Distance from cities, roads, railroads, fences, etc. Hwy 74 & Morris RAnch Rd., Lake Hemet, CA. - Approx. 1000' East of Intersection & 100' North of Morris Ranch Rd.



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☐
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☒
Other ☐

(5) EQUIPMENT:
Rotary ☒ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK: Monterey Sand
Yes ☒ No ☐ Size 6 x 12
Diameter of bore 18"
Packed from 0 to 285 ft.

(7) CASING INSTALLED:
Steel ☒ Plastic ☐ Concrete ☐

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	285	10	.250	60	280	.060
0	50	20	.250	Johnson Hi-Cap Screen X-HD		
280	285	10	.250			

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 50 ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval ft.
Method of sealing neat cement

(10) WATER LEVELS:
Depth of first water, if known 12 ft.
Standing level after well completion 12 ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? Rottman Drlg. Co.
Type of test Pump ☒ Bailer ☐ Air lift ☐
Depth to water at start of test 95 ft. At end of test 85 ft
Di[illegible]e 310 gal/min after 3 hours Water temperature
Ch[illegible]al analysis made? Yes ☐ No ☒ If yes, by whom?
Was electric log made? Yes ☒ No ☐ If yes, attach copy to this report

(12) WELL LOG: Total depth 323 ft. Depth of completed well 285 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	50	Fine to coarse sand 1/4 to 5 gravel lenses
50	60	Med. coarse sand
60	70	fine sand
70	75	Clayey sand
75	80	Sandy clay
80	85	Brown clay
85	99	Sand clay
99	130	Brown clay
130	140	Sandy clay
140	144	Sticky brown clay
144	145	Sandy clay
145	155	Med. to fine sand
155	175	Sandy clay
175	180	Hard brown clay
180	185	Sandy clay
185	188	Sticky brown clay
188	190	Sandy clay
190	191	Clayey sand
191	200	Med. sand
200	216	Sandy clay
216	220	Clayey sand
220	252	Sandy clay
252	260	Med. coarse sand
260	265	Med. fine sand
265	285	Silty sand
285	300	Sandy clay
300	307	Brown clay
307	323	Sandstone

Work started Nov. 27 1985 Completed Dec. 16 1985

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED [signature]
Larry W. Rottman, President
NAME Rottman Drilling Co.
(Person, firm, or corporation) (Typed or printed)
Address 46471 N. Division
City Lancaster, CA Zip 93534
License No. 316599 Date of this report Jan 22, 1986

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

Owner's Well No. ____ No. 792470

Date Work Began 7/29/02 Ended 3/16/02

Local Permit Agency RiversideCountyDdpt of Environmental Health

Permit No. 25079 Permit Date 7/25/02

LATITUDE | LONGITUDE

APN TRS OTHER

GEOLOGIC LOG

ORIENTATION (✓) x VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD Rotary FLUID

DEPTH FROM SURFACE — DESCRIPTION (Describe material, grain size, color, etc.)

Ft.	to Ft.	Description
0	24	top soil
24	39	course fine sands
39	84	course sand clay cobbles
84	114	course sands clay sweels cobbles
114	129	course sands cobbles clay
129	144	course sands hard
144	174	course sands hard dry clay
174	219	black & white sands hard clay
219	249	course sands dry clay
249	309	sands cobbles clay
309	324	bad cobbles & sand
324	339	cobbles and clay some silica
339	354	some silicasand clay
354	369	sands clay
369	384	course sand clay
384	444	cobbles silica sand
444	460	sands harder rock

Perforations:

0' -110 ' blank
110' -160 ' perf.
160' -200 ' blank
200' -290' perf.
290' -310' blank
310' - 460'perf
10 3/4" steel end cap on the bottom.

TOTAL DEPTH OF BORING 460 Feet

TOTAL DEPTH OF COMPLETED WELL 460 Feet

WELL OWNER

Name Lake Hemet Municipal Water Dst.

Mailing Address P.O. Box 5039

Hemet CA 92544 CITY STATE ZIP

WELL LOCATION

Address 35379 Penrod Canyon Rd

City Garner Valley

County Riverside

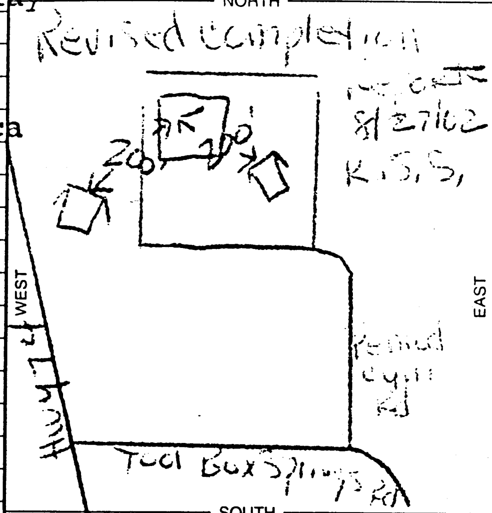
APN Book 563 Page 220 Parcel 014

Township 6S Range 3E Section 36

Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH

NORTH



WEST / EAST / SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

x NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
X Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 40 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 40 (Ft.) & DATE MEASURED ____

ESTIMATED YIELD * 100 (GPM) & TEST TYPE test pump

TEST LENGTH 16 (Hrs.) TOTAL DRAWDOWN ____ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING (S)

Depth From Surface Ft.	to Ft.	Bore-Hole Dia. (Inches)	Blank	Screen	Conductor	Fill Pipe	Material / Grade	Internal Diameter (Inches)	Gauge or Wall Thickness	Slot Size If Any (Inches)
0	80	34"			x		steel	20"	.250	
80	460	18"								
0	460		x	x			steel	10 3/4	.250	.60
0	460									

ANNULAR MATERIAL

Depth From Surface Ft.	to Ft.	Cement (✓)	Bentonite (✓)	Fill (✓)	Filter Pack (Type/Size)
0	80'	x			
				x	3 x 16 rock

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ____

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME L.O. Lynch Quality Wells & Pumps, Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

856 W. Seventh Street, San Jacinto CA 92582
ADDRESS CITY STATE ZIP

Signed [signature] WELL DRILLER/AUTHORIZED REPRESENTATIVE 3/26/02 DATE SIGNED 741133 C-57 LICENSE NUMBER

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

APPENDIX B

LHMWD Water Level and Production Records

Pine Meadows Water Levels (Feet Below Surface)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1983												
G.V. #1						92	99.5		100	83	79	84.5
G.V. #2						5				17.5	24	22
1984												
G.V. #1	76.5		140	140		139			113	132.6	120.5	147
G.V. #2	30		32	22		22				26		22
1985												
G.V. #1	108.5				147.6							
G.V. #2	18.5	19.1	19	17.5						41	33.5	114.8
1986												
G.V. #1		111		103.6								
G.V. #2	26.7	39.5	23.6	26	25.9			30.1	30		27.8	24.5
G.V. #4					7	8.5	9				11	11.4
1987												
G.V. #1	121.2			117		103.1	109	110				224.5
G.V. #2	22.4	21.1	22	22.3					32.3	32.5	30.4	28.8
G.V. #4	11	11.2	11.9	9.5		10		15		16.3	15.8	15
1988												
G.V. #1	107.7	107.5	97.7	101	97.9				132.4			115.4
G.V. #2	25.3	25	22	24.3	22.4	24.8	25.4		28.2		28.2	27
G.V. #4	15.9	15.1	15.2		15.7	16.9	16.5		10.4			
1989												
G.V. #1	104.6	99.4	132.2	103.8	105.3	101.3				116.8		112.5
G.V. #2	25		24.2	24.3	25.6	26.8				32.9		29.8
G.V. #4		18.8	18.2									25.9

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990												
G.V. #1	112	104.1	103.1	103.9	107.4					212.8		
G.V. #2	28.7	28.1	28	27.9	29	30.3			44.8	42.5	43.1	39
G.V. #4		24.1	23.7	22.7		63.1					29	
1991												
G.V. #1	131.9	134.5		118.5	109.7		134.6					112
G.V. #2	36.4	37.4	36.1	31.2	26	25.5	28.1	30.9	31.9	30.9	30.9	26.7
G.V. #4	28.5	27.8	19				17.5				18	18.4
1992												
G.V. #1	102	112..3	97.2	100.2	97.6	97.2			128.9	116.6	115.7	116.4
G.V. #2	24.8	24.6	21.4	20.3	18.9	19.3	20.9	24.2	24.3	24.8	23.3	23.9
G.V. #4	18.2	18.1	12.8	9.2	11.4					19.8	18.5	20.6
1993												
G.V. #1	96.7	93.7	87	84.5	84	93.2	100.5		17.9		139.9	95.8
G.V. #2	22	15.6	12	10.7	10.8	11.3	18.8		104.9	20	20.4	18
G.V. #4	17.8	5.9	4.8	5.6		7.3	7.2				10.1	9.9
1994												
G.V. #1	58.6	48.2	48.8	44		43.8	147.3	140.8		102.1	93.1	93
G.V. #2	15.4	14.1	12.8	11.6	13	12.9	67			25	21.5	20
G.V. #4	9.7	9.7	6.8	6.4		12.1					15.4	14.6
1995												
G.V. #1	87.8	78.7	87.8	76.3	115.5	111.6	83.2	93.8		87.6	88.2	87.5
G.V. #2	19.6	16.2	19.6	15	12.3	12.9			18.7	17.3	25.1	23.9
G.V. #4		6.4			12					11.6	10.5	10.2
1996												
G.V. #1	87.8	85.3	84.5	86.3	84.5	89.3		100.9		134.9	134	133.9
G.V. #2	23	16	15.6	16.5	16.9	21.2		26		40.8	40.1	38.8
G.V. #4	11.1	9.9	9.6	10		60.1		60.2		17.6	18	15.9
1997												
G.V. #1	89.4	86.7	83.5	86.8	85.4	90.1	99.9		111.9	90.3	120.3	103.2
G.V. #2	20.6	19.4	18.5	20.1			39.3	49.6	52.4	47	36.9	29.6
G.V. #4	14.3		13.5				18.7	20.1	22.3	18.8	18.8	20

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998												
G.V. #1	104	106	99.8	110	149	95.9	151	154.9	151	151	143.6	119
G.V. #2	27.5	30.6	30.4	22	20.4	18.4	23	40.9	30.5	30.5	29.8	26.3
G.V. #4	19.8	18.8	7.1	6.9	6.8	14	6.8	10.9	11	11	11.9	11.4
1999												
G.V. #1	107.3	100.9	99.8	98	99.3	99.6	104.4	126	116.3	110.3	105.2	139.2
G.V. #2	21.3	20.1	19.4	21.2	22	22.4	31.6	40.3	40	32.4	28.6	33.7
G.V. #4	10.9	11.5	11.7	11.9	11.1	12.9	11.1	20.2	19.5	20.2	24.7	19.4
2000												
G.V. #1	135.4	109.3	128.9	110.5	115.5	117.2	131.2			134.3	122.3	113.9
G.V. #2	31	28.6	89.4	27.8	28.7	30.4	49.5			66.6	38.6	33.9
G.V. #4	19.2	18.7	47.6	18.5	20.6	24.8	23.4			23.9	24.1	23.2
2001												
G.V. #1	123.2	122.6	106.1	122.4					142.6	143.6	126.3	127.3
G.V. #2	39.1	37.9	38.1	30	30.5	37.6			70.6	43.6	47.7	49.2
G.V. #4	24.6	24.4	22.7	24	24.2		32.6			30.3	30.5	28.7
2002												
G.V. #1	117.9	119.4	113.7	131.1	123.9	120.1		178.2	143.2	176.2	139.9	124.7
G.V. #2	37.7	35.2	36.2	36.7	39.9	36.7		77.7	59	56.6	50.2	45.7
G.V. #4	27.6	60		46.7	29	31		34.6	35.5	36.1		35.1
2003												
G.V. #1	118.9	113.9	111.5	118.2	123.3		166.2	151.3	148.8			
G.V. #2	42.1	38.9	38.8	41.9	46.8	88.1	78.5					
G.V. #4	35.2	33	32.5	28.4	28.6	29.4	33.6		95.3			
G.V. #5	59.3	66.6	104.9	111.7	99.8	128	89	91.2	79.5			

Pine Meadows Wells - Pumping Water Levels

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1983												
G.V. #1												
G.V. #2						25.5	74	75	78.5			
1984												
G.V. #1							219					
G.V. #2							109.2	89.1	76	42	88.1	
1985												
G.V. #1		194	191	190.5		143.2	155	147		146.2	178	
G.V. #2					141	74.5	77	74.5				
1986												
G.V. #1	141.5		152		144		163.5	173.8	140.1		153.9	148
G.V. #2						94	128					
G.V. #4								50.2	33.1			
1987												
G.V. #1		128.1	138.2						139.6	144.6	143.5	
G.V. #2						89	93	75				
G.V. #4							50.4					
1988												
G.V. #1						148.1	148	232.5		148.2	148	
G.V. #2								61.4		35.3		
G.V. #4				61.4				61.5		61	60.8	60.5
1989												
G.V. #1							185.1	189.1	191.5		189.8	
G.V. #2		82.9					112.1	103.5	104.1		74.2	
G.V. #4	60.6			61.1	60.8	64.5	80.8	62	63.5	60.5	61.1	
1990												
G.V. #1						264	153.9	211	197		281.1	256.5
G.V. #2							94.8	138				
G.V. #4	61.5				62.6		60.5	62.7	63.2	64		62.3

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991												
G.V. #1			272.5			243		239.2	285.4	251.1	260.2	
G.V. #2												
G.V. #4				44.4	45.8	58.3		31.2	60.7	60.5		
1992												
G.V. #1							228.6	221.4				
G.V. #2												
G.V. #4						60.2	60.3	60.8	60.5			
1993												
G.V. #1								146.6		145		
G.V. #2								96.4				
G.V. #4					54.5			57.5	58.6	58		
1994												
G.V. #1									218.2			
G.V. #2								132.7	99.6			
G.V. #4							91.7	93	53.1	60.5		
1995												
G.V. #1									145			
G.V. #2							93.7	102.5				
G.V. #4	57.8			30.1	53.3	53.3	53.9	54.3	56.8			
1996												
G.V. #1							154.2		225			
G.V. #2							100.3		109.8			
G.V. #4	57.8			30.1	59.6		60.1		60.6	60.8		59.3
1997												
G.V. #1												
G.V. #2					84.1							
G.V. #4		57.4		60.4	59.3							
1998												
G.V. #1												
G.V. #2												
G.V. #4												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1999												
G.V. #1												
G.V. #2												
G.V. #4												
2000												
G.V. #1												
G.V. #2												
G.V. #4												
2001												
G.V. #1							316.4	316.6				
G.V. #2							180.4	179.9				
G.V. #4							59.1	59.3	60.3			60.5
2002												
G.V. #1							321.4					
G.V. #2							185.6					
G.V. #4			60.8				182				60.3	
2003												
G.V. #1												
G.V. #2												
G.V. #4												
G.V. #5												

	Well Production (acre-feet)				
	G.V. #1	**G.V. #2**	**G.V. #4**	**G.V. #5**	**TOTAL**
1987	8.44	0.64	10.71		19.79
1988	42.80	12.21	172.07		227.08
1989	22.71	15.71	205.06		243.48
1990	67.01	20.62	142.18		229.81
1991	55.31	2.69	132.60		190.60
1992	20.91	1.22	211.28		233.41
1993	24.16	7.66	204.82		236.64
1994	14.13	21.09	205.74		240.96
1995	4.89	21.73	188.00		214.62
1996	13.95	21.34	201.06		236.35
1997	28.94	26.44	194.94		250.32
1998	47.74	30.57	126.97		205.28
1999	28.73	34.35	192.95		256.03
2000	33.30	36.50	189.68		259.48
2001	34.08	27.04	182.26		243.38
2002	45.36	31.52	204.88	3.54	285.30
2003	15.13	46.75	60.64	27.94	150.46
Average (1988 - 2002)	32.27	20.71	183.63	3.54	236.85

APPENDIX C

Darcy's Law, Storage Calculations and Precipitation Data

Darcy's Law Calculations

Darcy's Law: $Q = K * i * A$

where Q is discharge, K is hydraulic conductivity, *i* is hydraulic gradient, and A is the cross-sectional area. Hydraulic conductivity is a coefficient of proportionality describing the rate at which water can move through a permeable medium (Fetter, p. 142).

Our calculations used the following:

1 acre-ft = 43,560ft^3

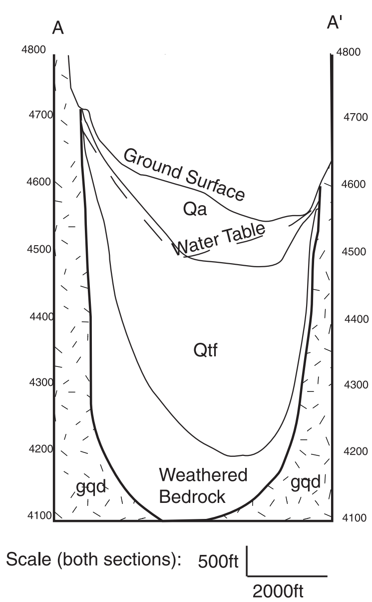
Two cross-sections were completed across Garner Valley. The cross-sections were based on available gravity, well log, water level and geological information. Sufficient information was available in the area around cross-section A to attempt a section that included four different units. Only two units were used in cross-section B because less data was available. However, a cross-section produced by Durbin was located very close to cross-section B allowing confdence in the accuracy of depth to bedrock. These two cross-sections were used to double-check each other and an average of the two outflow values was used in the budget synthesis.

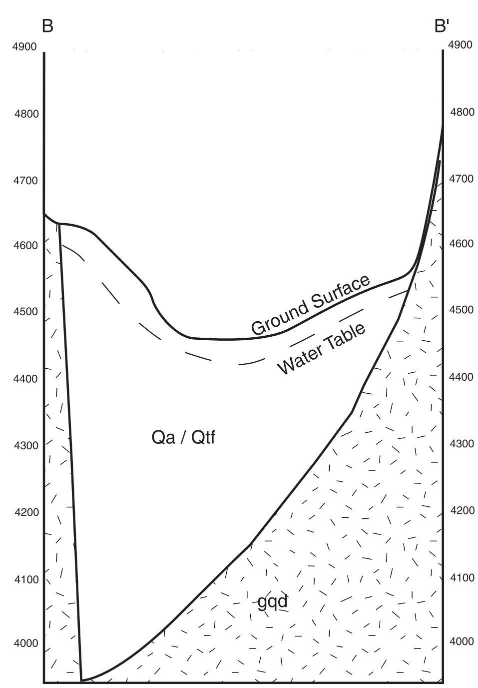
Cross-Section A (southern):

$K_{alluvium}$ = 100gpd/ft^2 (based on the moderate value of clean sand/high end of silty sand from Freeze & Cherry)
$K_{Bautista\ beds}$ = 5gpd/ft^2 (based on low values for silty sand/medium values of silt from Freeze &Cherry)
$K_{weathered\ bedrock}$ = 1 gpd/ft^2 (based on low end of fractured rock values from Freeze & Cherry)
$K_{granitic\ bedrock}$ = 0.2583gpd/ft^2 (based on unweathered bedrock average from Kaehler and Hsieh)
Cross-sectional area$_{(alluvium)}$ = 259,600 ft^2
Cross-sectional area$_{(Bautista\ beds)}$ = 1,392,160 ft^2
Cross-sectional area$_{(Weathered\ Bedrock)}$ = 916,960 ft^2
Cross-sectional gqd$_{(granitic\ bedrock)}$ = 1,104,460 ft^2

Cross-Section B (northern):

$K_{alluvium\ \&\ Bautista\ beds}$ = 10gpd/ft^2 (based on low end of clean sand/medium value of silty sand from Freeze & Cherry)
$K_{granitic\ bedrock}$ = 0.2583gpd/ft^2 (based on unweathered bedrock average from Kaehler and Hsieh)
Cross-sectional area$_{(alluvium\ \&\ Bautista\ beds)}$ = 3,226,080 ft^2
Cross-sectional area$_{(granitic\ bedrock)}$ = 3,014,480 ft^2





<u>Storage Calculation</u>

The volume of Pine Meadow was calculated using the following method:

The cross-sectional area from the southerly cross-section divided by two (to account for the reduction in valley depth towards the Santa Rosa drainage divide) and multiplied by the length of the valley (to an arbitrary point where the valley gets quite narrow and the Bautista beds are exposed on the surface).

This volume was then multiplied by the effective porosity (10-20% for the alluvium, and 1-3% for the bedrock) to produce an estimate of the storage capacity. The storage capacity of Pine Meadow was calculated to be about 86,500 acre-feet.

This value corresponds well to the 200,000 acre-feet calculated by Durbin (1975) for the whole of Garner Valley. Bookman-Edmonston Engineering, Inc. (1970) calculated a storage capacity of 15,000 acre-feet for Pine Meadow. This value is probably an underestimate that resulted from their assumption of depth to bedrock being 300ft. In fact, Durbin (1975) measured the depth to bedrock as up to 550ft using gravity data.

Riverside County Flood Control (Lake Hemet station)
Annual Precipitation

Year	Average Precip. (inches)	Average Precip. (acre-ft)
1970	23.35	9430
1971	15.02	6066
1972	12.24	4943
1973	18.38	7422
1974	14.27	5763
1975	15.6	6300
1976	19.28	7786
1977	17.82	7196
1978	36.97	14930
1979	21.54	8699
1980	37.92	15313
1981	14.48	5848
1982	34.1	13771
1983	37.48	15136
1984	17.68	7140
1985	16.65	6724
1986	17.33	6998
1987	18	7269
1988	15.75	6360
1989	7.47	3017
1990	12.93	5222
1991	27.74	11202
1992	22.26	8989
1993	31.56	12745
1994	15.97	6449
1995	31.7	12802
1996	17.39	7023
1997	16.4	6623
1998	28.01	11311
1999	13.39	5407
2000	14.13	5706
2001	8.72	3521
2002	5.53	2233

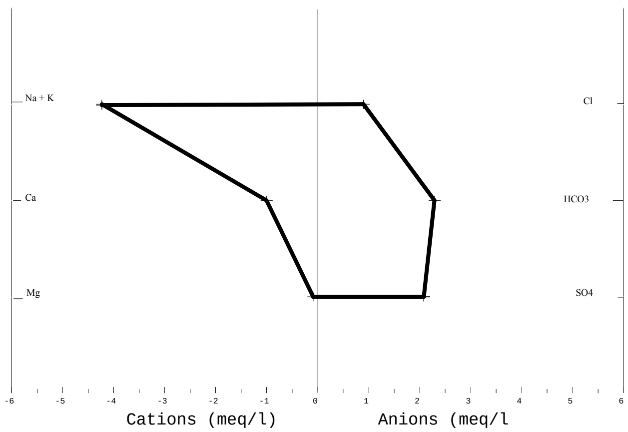
APPENDIX D

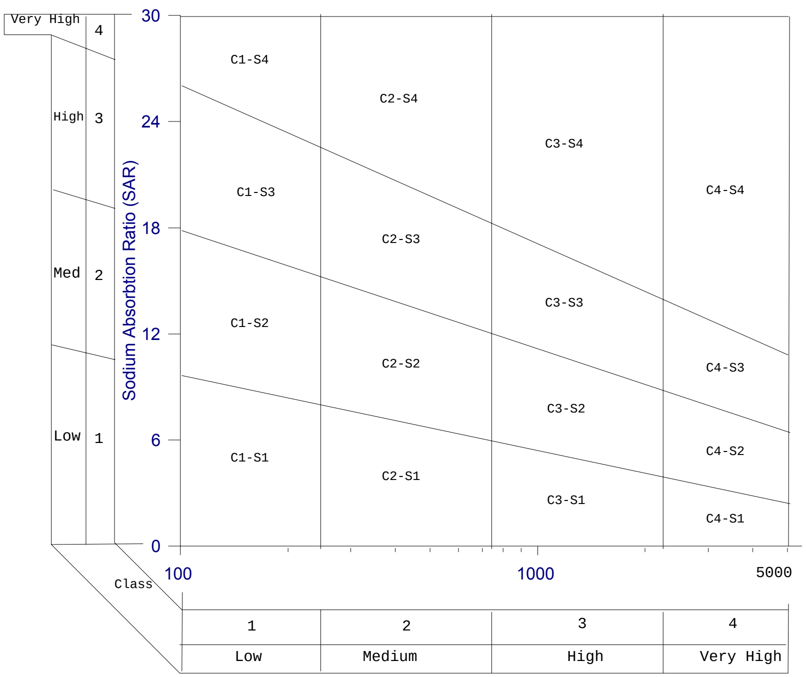
Water Quality Analyses and Stiff Diagrams

G.V. #1
Sample collected 03/13/2002

Water Classification

Stiff Diagram





Chloride (Cl)	32	mg/l	0.9	meq/l
Sulfate (SO4)	100	mg/l	2.1	meq/l
Bicarbonate (HCO3)	140	mg/l	2.3	meq/l
Potassium (K)	2	mg/l	0.1	meq/l
Sodium (Na)	96	mg/l	4.2	meq/l
Calcium (Ca)	20	mg/l	1.0	meq/l
Calcium hardness	52	mg/l		
Magnesium (Mg)	1	mg/l	0.1	meq/l
Total filterable residue as CaCO3	330	mg/l		
Temperature	15	deg C		
pH	8.30	pH Units		
Total Alkalinity as CaCO3	110	mg/l		
Total Dissolved Solids	330	mg/l		
Electrical Conductivity	560	umhos/cm		

Langlier Index	-0.43
Will the water form carbonate scale?	NO

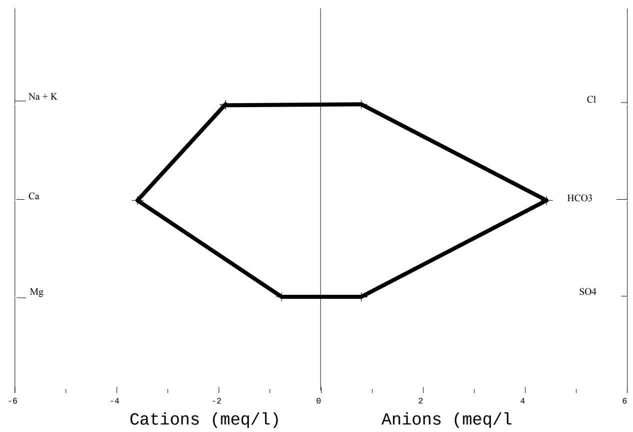
Ryzner Index	8.20
Is the water corrosive?	YES

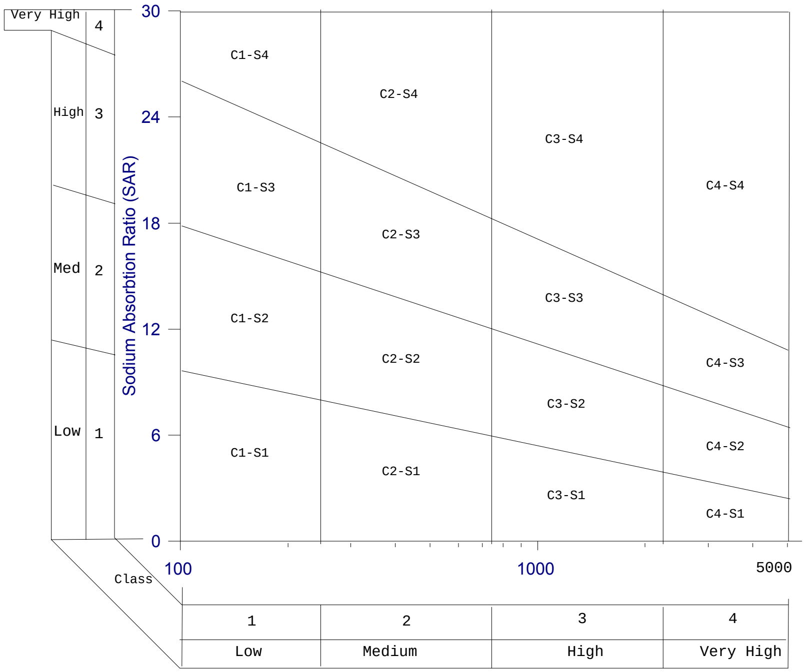
SAR	5.68

G.V. #2
Sample collected 03/13/2002

Water Classification

Stiff Diagram





Chloride (Cl)	28	mg/l	0.8	meq/l
Sulfate (SO4)	38	mg/l	0.8	meq/l
Bicarbonate (HCO3)	270	mg/l	4.4	meq/l
Potassium (K)	2	mg/l	0.0	meq/l
Sodium (Na)	42	mg/l	1.8	meq/l
Calcium (Ca)	72	mg/l	3.6	meq/l
Calcium hardness	220	mg/l		
Magnesium (Mg)	9	mg/l	0.8	meq/l
Total filterable residue as CaCO3	380	mg/l		
Temperature	15	deg C		
pH	7.40	pH Units		
Total Alkalinity as CaCO3	220	mg/l		
Total Dissolved Solids	380	mg/l		
Electrical Conductivity	610	umhos/cm		

Langlier Index	-0.48
Will the water form carbonate scale?	NO

Ryzner Index	7.32
Is the water corrosive?	YES

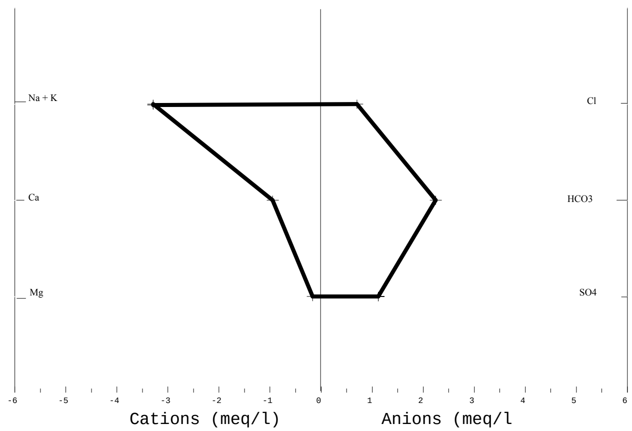
SAR	1.24

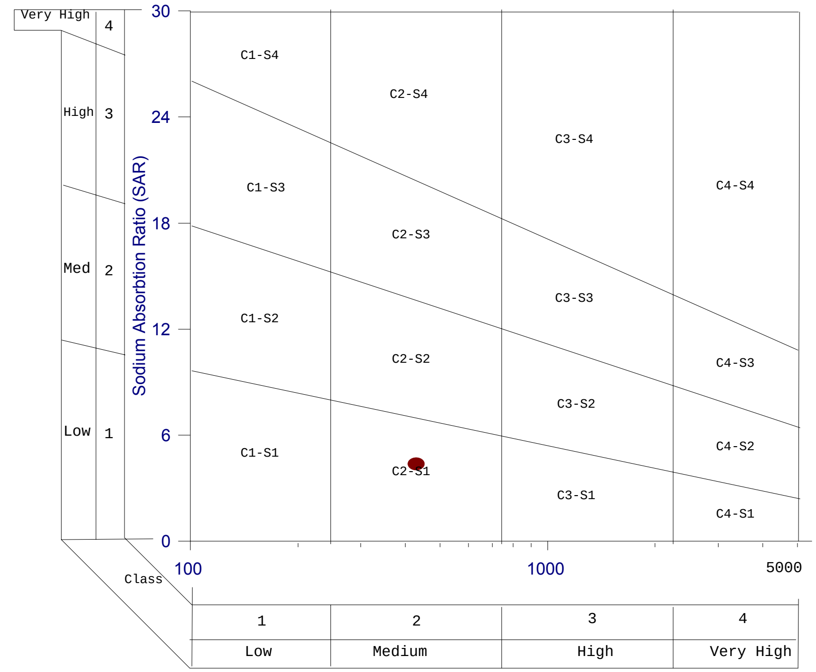
G.V. #3

Sample collected 26/04/1984

Water Classification

Stiff Diagram





Chloride (Cl)	25	mg/l	0.7	meq/l
Sulfate (SO4)	54	mg/l	1.1	meq/l
Bicarbonate (HCO3)	137	mg/l	2.2	meq/l
Potassium (K)	1	mg/l	0.0	meq/l
Sodium (Na)	75	mg/l	3.3	meq/l
Calcium (Ca)	19	mg/l	0.9	meq/l
Calcium hardness	57	mg/l		
Magnesium (Mg)	2	mg/l	0.2	meq/l
Total filterable residue as CaCO3	245	mg/l		
Temperature	15	deg C		
pH	8.40	pH Units		
Total Alkalinity as CaCO3	123	mg/l		
Total Dissolved Solids	245	mg/l		
Electrical Conductivity	430	umhos/cm		

Langlier Index	-0.29
Will the water form carbonate scale?	NO

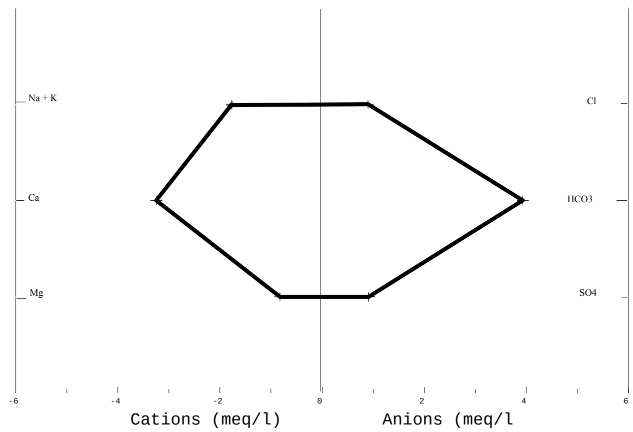
Ryzner Index	7.88
Is the water corrosive?	YES

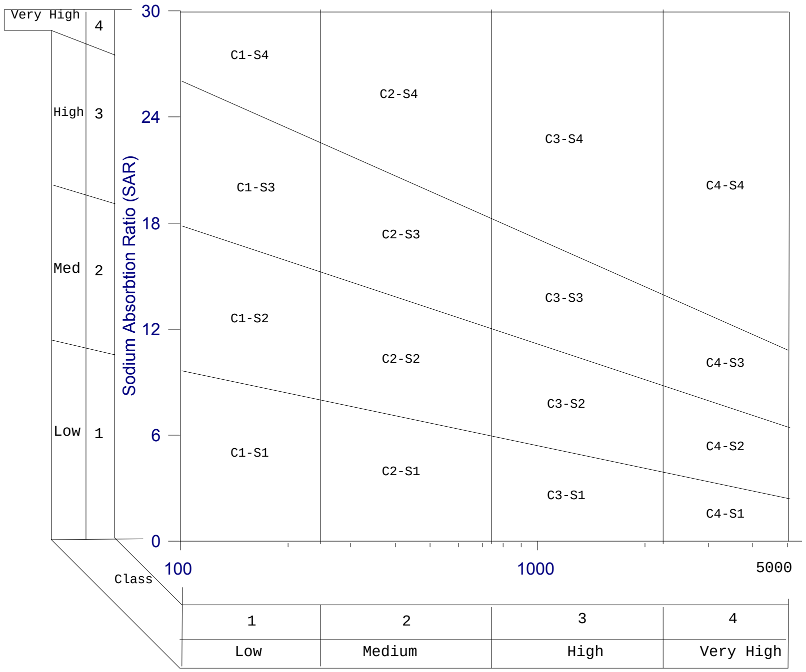
SAR	4.37

G.V. #4
Sample collected 03/21/2001

Water Classification

Stiff Diagram





Chloride (Cl)	32	mg/l	0.9	meq/l
Sulfate (SO4)	44	mg/l	0.9	meq/l
Bicarbonate (HCO3)	240	mg/l	3.9	meq/l
Potassium (K)	1	mg/l	0.0	meq/l
Sodium (Na)	40	mg/l	1.7	meq/l
Calcium (Ca)	65	mg/l	3.2	meq/l
Calcium hardness	200	mg/l		
Magnesium (Mg)	10	mg/l	0.8	meq/l
Total filterable residue as CaCO3	340	mg/l		
Temperature	15	deg C		
pH	7.20	pH Units		
Total Alkalinity as CaCO3	200	mg/l		
Total Dissolved Solids	340	mg/l		
Electrical Conductivity	550	umhos/cm		

Langlier Index	-0.76
Will the water form carbonate scale?	NO

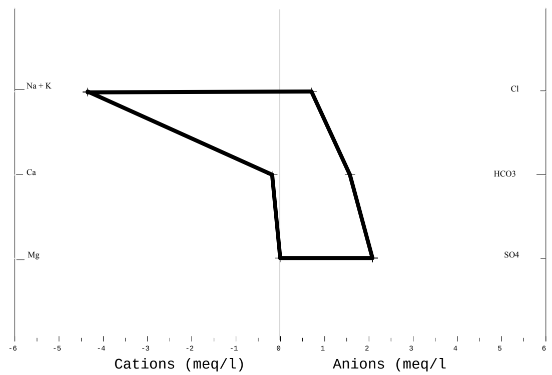
Ryzner Index	7.51
Is the water corrosive?	YES

SAR	1.22

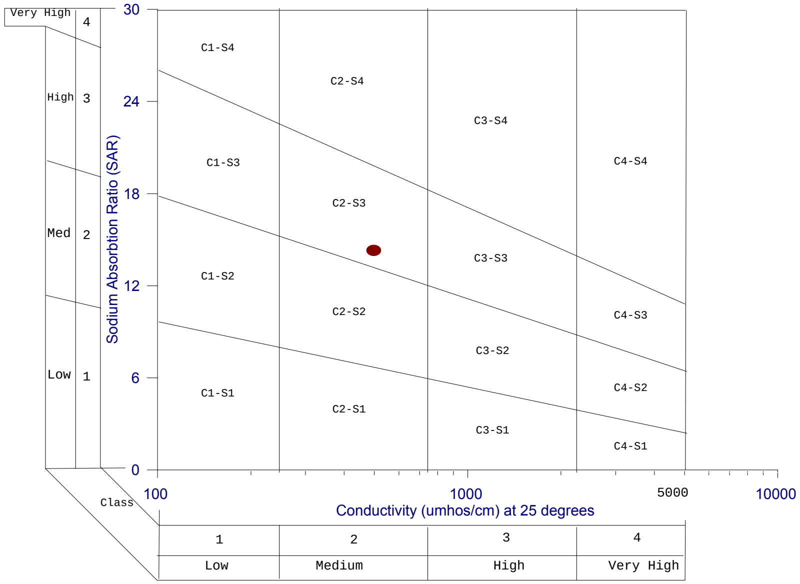
G.V. #5
Sample collected 08/28/2002

Water Classification

Stiff Diagram



Irrigation Water Classification



Chloride (Cl)	25	mg/l	0.7	meq/l
Sulfate (SO4)	100	mg/l	2.1	meq/l
Bicarbonate (HCO3)	96	mg/l	1.6	meq/l
Potassium (K)	0	mg/l	0.0	meq/l
Sodium (Na)	100	mg/l	4.3	meq/l
Calcium (Ca)	4	mg/l	0.2	meq/l
Calcium hardness	10	mg/l		
Magnesium (Mg)	0	mg/l	0.0	meq/l
Total filterable residue as CaCO3	270	mg/l		
Temperature	15	deg C		
pH	9.00	pH Units		
Total Alkalinity as CaCO3	85	mg/l		
Total Dissolved Solids	270	mg/l		
Electrical Conductivity	500	umhos/cm		

Langlier Index	-0.57
Will the water form carbonate scale?	NO

Ryzner Index	9.09
Is the water corrosive?	YES

SAR	14.32