ILLUSTRATIONS

TABLES

Geology

The San Pasqual hydrologic subarea lies entirely within the Peninsular Range Province. Crystalline rocks of the southern California batholith are exposed in or underlie the entire subarea (fig. 23).

The most extensive rocks are granodiorites which cover slightly over 50 percent of the subarea. These rocks are resistant to weathering and form prominent hills and ridgetops.

Green Valley Tonalite is exposed in approximately 30 percent of the subarea. Green Valley Tonalite is not resistant to erosion and forms deeply weathered lowlands and hilly topography, especially in the vicinity of faults. Green Valley Tonalite may weather to several hundred feet in depth, forming a material known locally as residuum, or decomposed granite (DG). These deeply weathered exposures occupy 1,550 acres, or slightly over 8 percent of the subarea.

Small exposures of gabbro and diorite and metamorphic rock occur as scattered remnants or roof pendants within the more extensive crystalline rocks of the subarea. In some instances these rocks, particularly the gabbro, are deeply weathered and resemble weathered outcrops of Green Valley Tonalite.

Quaternary alluvium stretches across the southern half of the San Pasqual hydrologic subarea. Three smaller alluvium-filled valleys join the main valley from the northwest, northeast, and south. In total, alluvium covers almost 15 percent of the subarea.

Soils

There are three major soil associations within the San Pasqual hydrologic subarea. Fallbrook-Vista and Cienba-Fallbrook soils are found in upland areas. Visalia-Tujunga soils are found in the valley floor (fig. 24).

Soils of the Fallbrook-Vista association have developed along the western edge of the subarea and near San Diego Wild Animal Park. This association is characterized by Fallbrook and Vista soils, between 1.5 to 4 feet thick, and shallow Cienba soils, generally less than 1.5 feet thick. Deep soils are atypical of this association and only small areas of Ramona soils, developed over weathered tonalite, attain thicknesses greater than 5 feet. Infiltration capacities are high to moderate throughout most of the Fallbrook-Vista association, ranging from 0.6 to 2.0 in/h for Fallbrook soils, to 20 in/h for Cienba soils. Ramona soils are characterized by a clay hardpan at a depth of 1.5 feet; consequently, infiltration rates for Ramona soils are poor and range between 0.2 to 0.6 in/h.

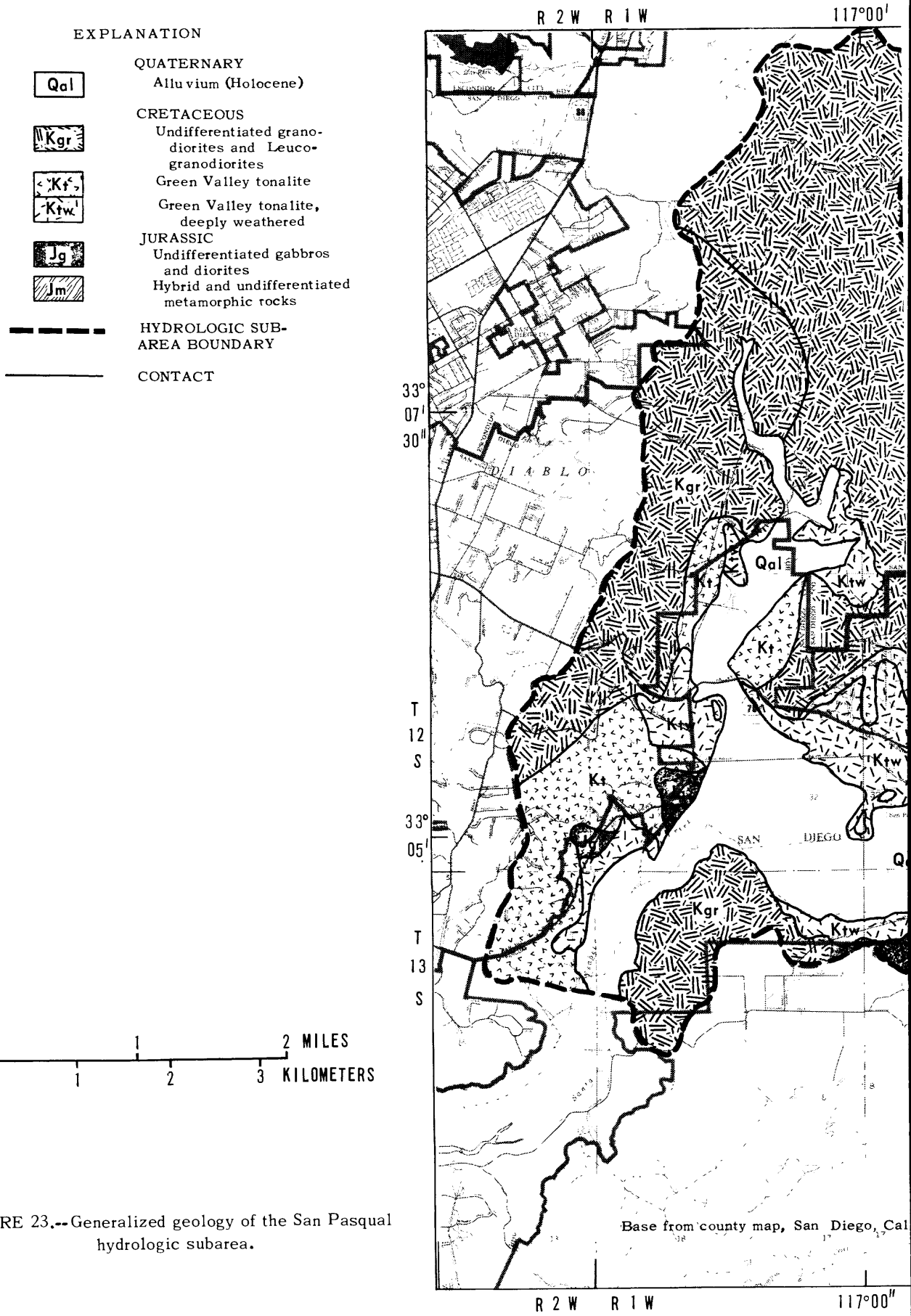
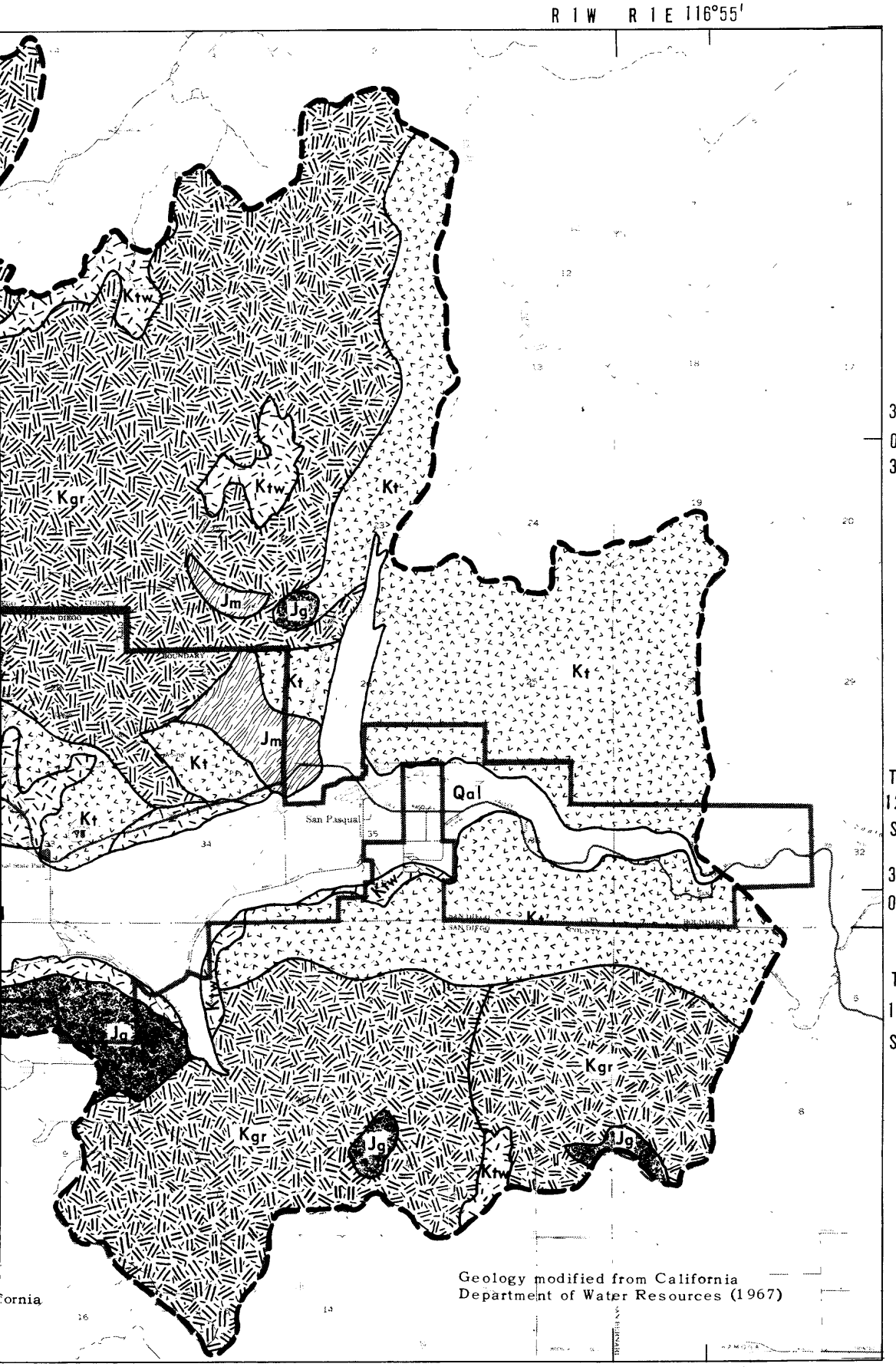


FIGURE 23.--Generalized geology of the San Pasqual hydrologic subarea.


R 1W R 1E 116°55'
33° 07' 30"
T 12 S
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San Pasqual
Geology modified from California Department of Water Resources (1967)
R 1W R 1E 116°55'

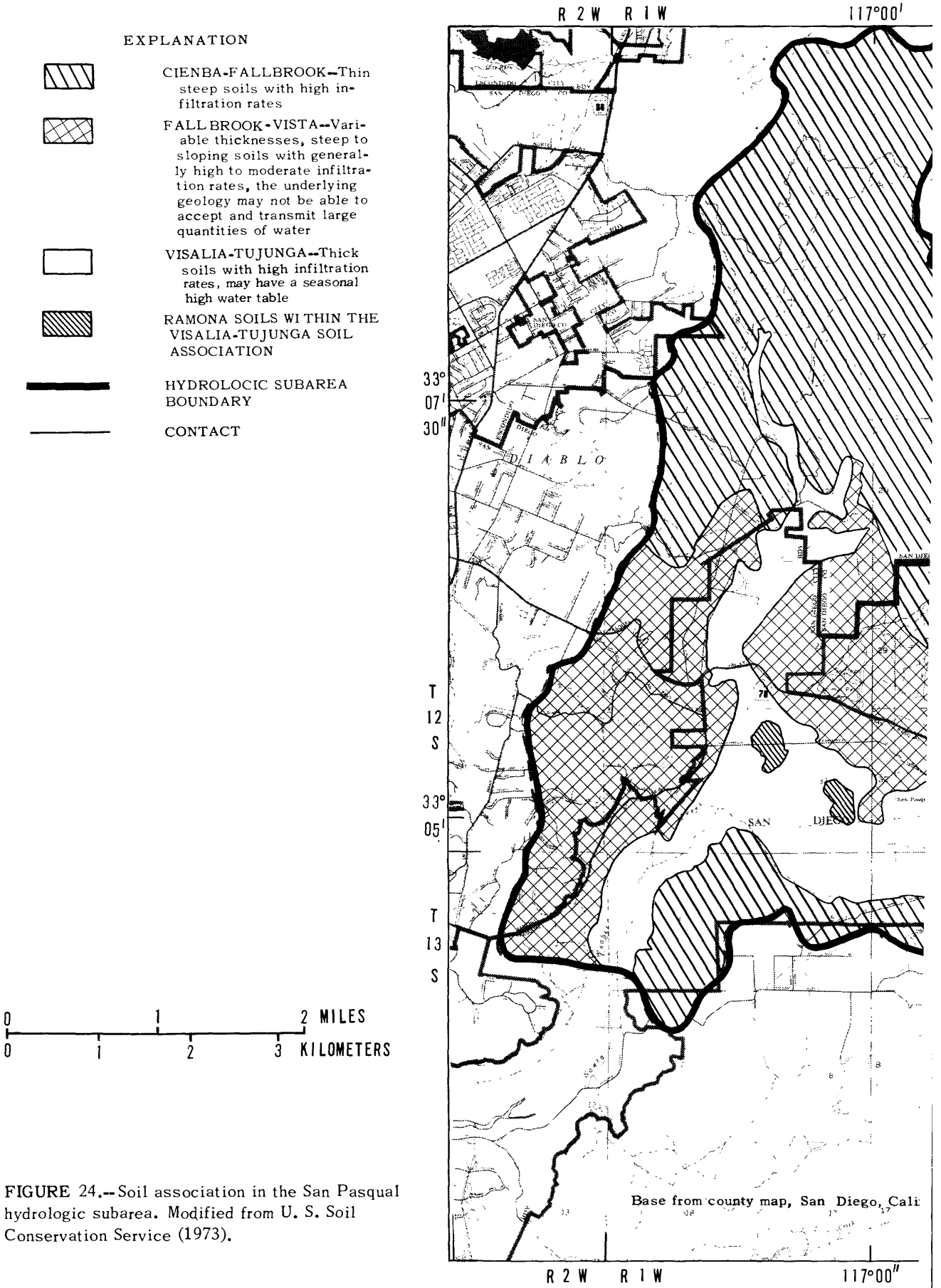
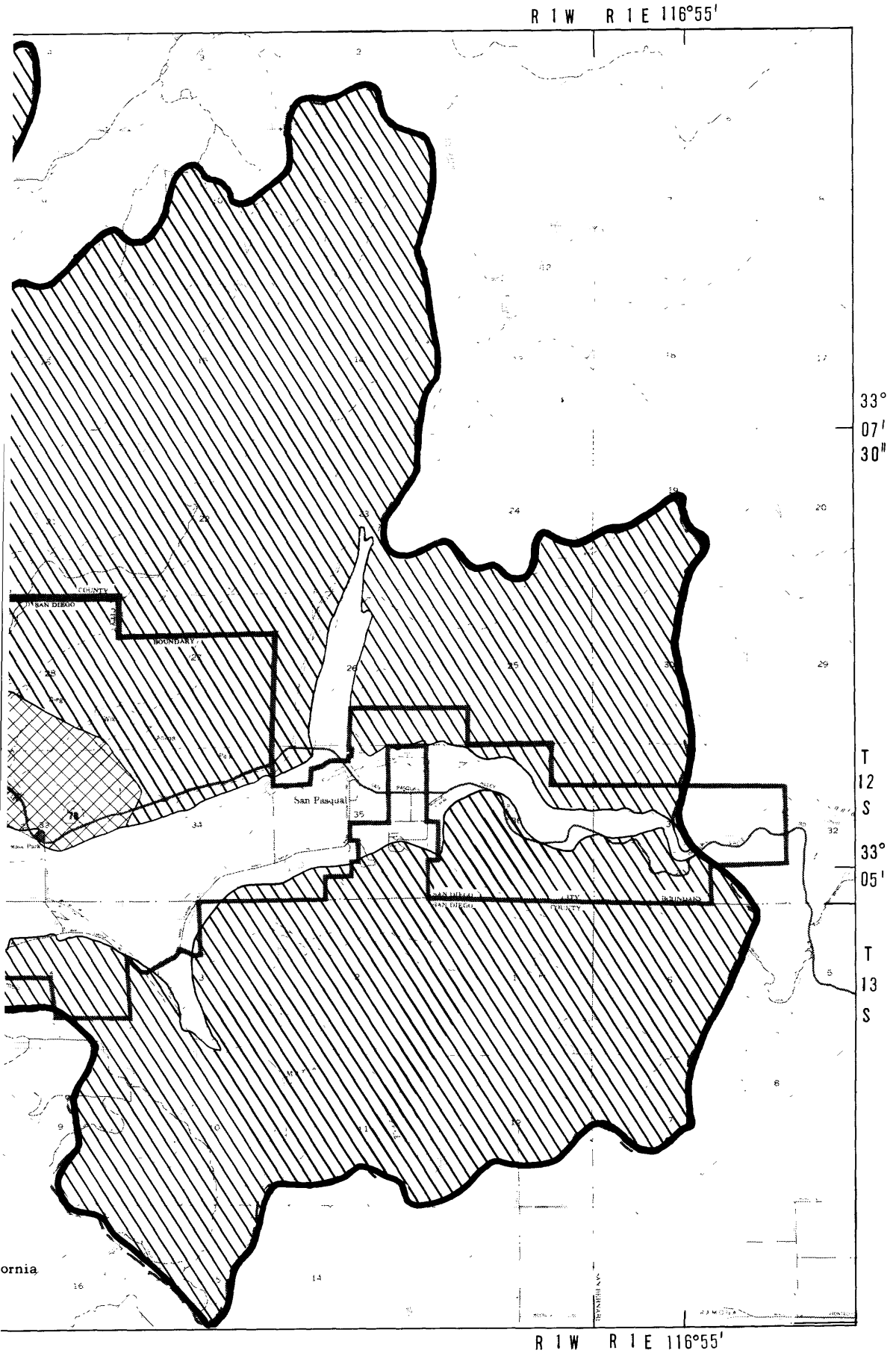


FIGURE 24.--Soil association in the San Pasqual hydrologic subarea. Modified from U. S. Soil Conservation Service (1973).


R 1W R 1E 116°55'
33° 07' 30"
T 12 S
33° 05'
T 13 S
San Pasqual
COUNTY OF SAN DIEGO
BOUNDARY
R 1W R 1E 116°55'

The Cienba-Fallbrook association has many of the same soils as the Fallbrook-Vista association, but in different proportions. Shallow Cienba soils developed over granodiorite dominate this association. However, small areas of Fallbrook and Vista soils have developed over exposures of tonalite and gabbro.

Limitations on applying reclaimed water to upland soils are soil thickness and the ability of the underlying soil profile and geology to accept, filter, and transmit water. Presently, many agricultural areas in the uplands are able to transmit irrigation return water from hillside avocado groves only through shallow circulation and subsurface discharge to springs. If this were reclaimed water, there could be health hazards associated with viruses not killed by wastewater treatment processes or removed by limited soil contact. Proper choice of application sites, methods, rates, and amounts should minimize shallow circulation and surface discharge of reclaimed water, thus minimizing health concerns associated with reclaimed water use on upland soils.

Soils of the Visalia-Tujunga association have developed over the alluvium. All soils within this association are greater than 5 feet thick. In general, infiltration capacities are high and range from 2.0 to 6.3 in/h for Visalia soils, to greater than 20 in/h for Tujunga soils. Small areas of Ramona soils are also present in the Visalia-Tujunga association, particularly where alluvial fill is thin. The primary limitation on application of reclaimed water to soils of the Visalia-Tujunga association is a high water table, within several feet of land surface much of the year.

Surface Water

Streamflow Characteristics

Streamflow data are summarized in table 7, and the locations of stream gages are shown in figure 25. Streamflow into the San Pasqual hydrologic subarea is from Santa Ysabel, Guejito, Santa Maria, and Cloverdale Creeks. A small amount of streamflow originates as springs in uplands of the hydrologic subarea. All surface-water flow leaves the hydrologic subarea through the San Dieguito River at San Pasqual Narrows.

Santa Ysabel Creek is the largest stream, draining 128 mi^2 of largely undeveloped land above the San Pasqual hydrologic subarea. Large parts of its watershed are within Cleveland National Forest and several Indian reservations. Streamflow in Santa Ysabel Creek has been regulated since July 1954 by Sutherland Reservoir, which has a capacity of 29,680 acre-ft, and may further be controlled by the proposed Palmo Dam, which will have a capacity of 30,000 acre-ft and an average annual yield of 8,500 acre-ft.

TABLE 7.--Summary of flow data for the San Pasqual hydrologic subarea

[USGS, U.S. Geological Survey]

Station name	USGS No.	Period of record	Drainage area (mi^2)	Annual discharge (acre-ft) average	Annual discharge (acre-ft) median	Median number of days with flow greater than 0.1 ft^3/s	Maximum discharge for period of record instantaneous (ft^3/s)	Maximum discharge for period of record annual (acre-ft)
Santa Ysabel Creek near Ramona[1]	11025500	02-1912 to 02-1923 10-1943 to 09-1981	112	14,900	3,912	180	28,400	149,000
Santa Ysabel Creek near San Pasqual[1]	11026000	12-1905 to 09-1910 03-1911 to 09-1912 [2]04-1947 to 11-1955 04-1956 to 03-1980	128	5,000	507	102	12,500	29,700
Guejito Creek near San Pasqual	11027000	12-1946 to 09-1981	22	2,110	290	148	3,940	23,900
Santa Maria Creek near Ramona	11028500	11-1912 to 09-1920 10-1946 to 09-1981	58	4,050	145	53	15,200	43,500
San Dieguito River near San Pasqual[1]	11029000	[2]04-1947 to 04-1956 05-1956 to 09-1965	250	[3]1,610	0	0	[3]3,600	[3]14,500

[1]Flow in stream has been regulated since July 1954 by Sutherland Reservoir which has a capacity of 29,680 acre-ft. There are additional small diversions above the station.
[2]Records compiled for irrigation season only.
[3]Based on one flow event in 1958.

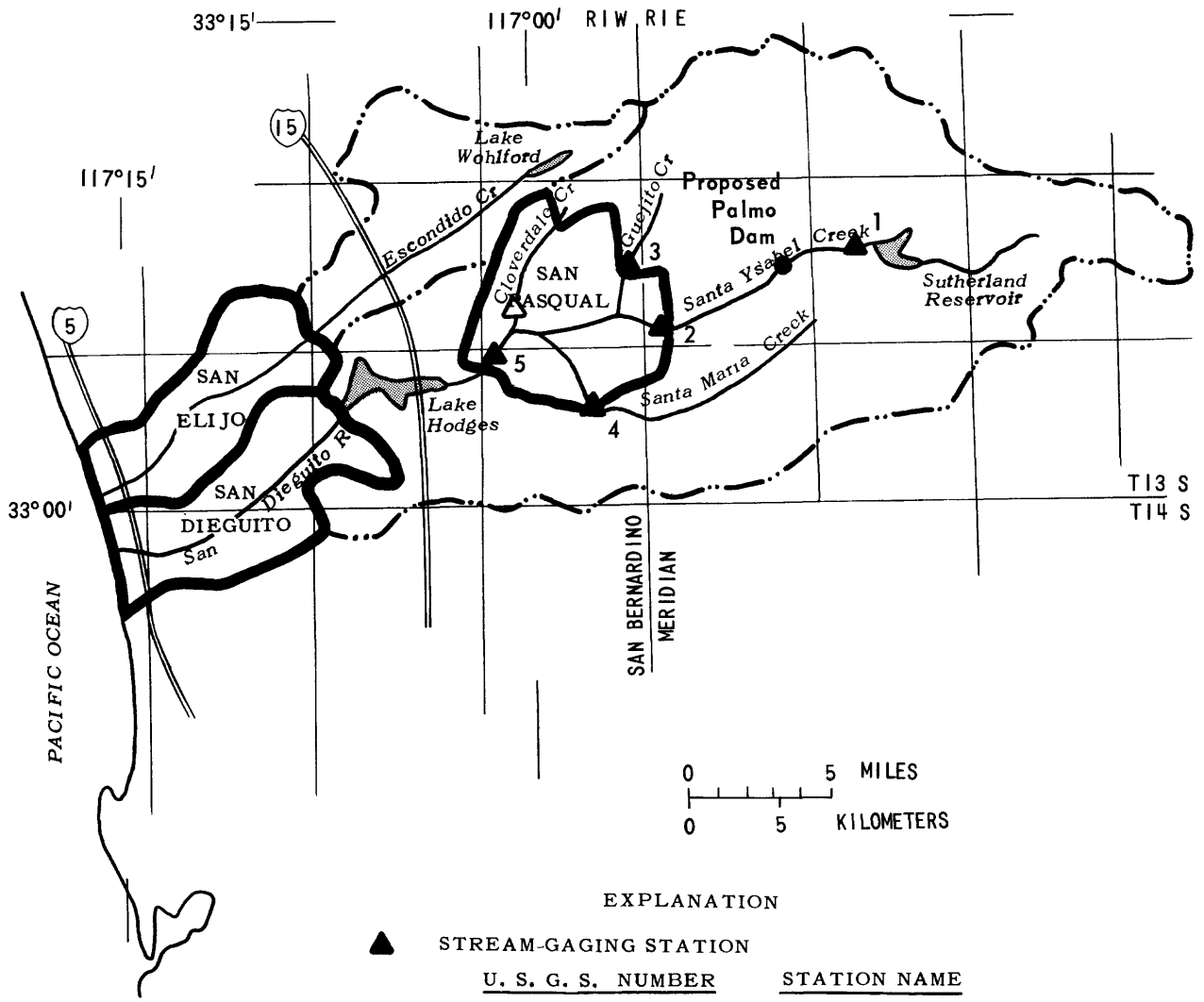


FIGURE 25.--Location of stream-gaging stations in the San Pasqual hydrologic subarea.

Santa Ysabel Creek near San Pasqual typically flows 102 days during the year and median annual discharge is 510 acre-ft. Maximum annual flow in Santa Ysabel Creek was 29,700 acre-ft in 1979. Data for Santa Ysabel Creek near Ramona (table 7) indicate Santa Ysabel Creek may actually flow for a much longer period each year, and may discharge as much as 3,900 acre-ft of water annually. However, these data reflect natural flow regime before completion of Sutherland Dam, and a generally wetter period of record.

With respect to median annual discharge, Guejito Creek is the second largest stream in the hydrologic subarea. Guejito Creek near San Pasqual drains a largely undeveloped watershed of 22 mi^2, with flow unregulated except for several small diversions. This stream flows about 148 days each year (median value) and has a median annual discharge of 290 acre-ft. Maximum annual flow from Guejito Creek was 23,900 acre-ft in 1978, almost as much as the maximum annual flow from Santa Ysabel Creek.

Santa Maria Creek drains a largely agricultural watershed of 58 mi^2. Streamflow is unregulated except for several small diversions. Although the drainage area is much larger than that of Guejito Creek, flows in Santa Maria Creek are dampened by another ground-water basin farther upstream. Santa Maria Creek near Ramona flows about 53 days each year (median value) and in many years it does not flow at all. Median annual flow from Santa Maria Creek is 145 acre-ft and the maximum annual flow was 43,500 acre-ft in 1916.

Cloverdale Creek drains an 18 mi^2 agricultural watershed. Streamflow is unregulated and ungaged. Irrigation return water from hillside avocado groves has turned Cloverdale Creek into a perennial stream. Instantaneous discharge measured on November 24, 1981, and March 25, 1982, was 2.0 and 3.6 ft^3/s, respectively. This water was primarily irrigation return water, and will be discussed in the section on recharge.

Median annual surface-water flow into the hydrologic subarea, excluding Cloverdale Creek, is about 940 acre-ft. In a typical year, no surface-water flow leaves the subarea. In wet years and during floods, enough surface water is available to provide flow in the San Dieguito River at San Pasqual Narrows. Because the period of record includes years 1946-77, the driest period in the last 400 years (Larry Michaels, San Diego County Water Authority, written commun., 1982), estimates of streamflow characteristics may be low.

Surface-Water Quality

Historical water-quality data for Santa Ysabel Creek below Sutherland Dam from 1956-81 are summarized in table 8. No discharge data are available to determine the relation between water quality and discharge, and to separate baseflow from stormflow. However, minimum concentrations given in table 8 probably reflect quality of stormflow, and maximum concentrations probably reflect quality of baseflow. Throughout the period of record, water in Santa Ysabel Creek has been a mixed type, dominated by bicarbonate on the anionic side; relative concentrations of dissolved species have remained constant. Historical water-quality data are not available for Guejito, Santa Maria, or Cloverdale Creeks.

Surface-water-quality data for the San Pasqual hydrologic subarea were collected in 1981-82. Two samples were collected from Santa Maria, Guejito, and Cloverdale Creeks, one in autumn to reflect baseflow, and another during the recessional flow of a late spring storm. Only one sample was collected from Santa Maria Creek, as there was no flow in autumn 1981. Dissolved-solids concentrations were lowest in Santa Ysabel and Guejito Creeks, 321 and 366 mg/L, respectively, and were highest in Cloverdale Creek, 1,040 mg/L. Santa Maria Creek had an intermediate dissolved-solids concentration of 734 mg/L. Water was a mixed type in all streams. However, water from Cloverdale and Santa Maria Creeks was dominated by sodium chloride and bore a strong resemblance to imported water. Water from Santa Ysabel and Guejito Creeks was well mixed on the cationic side, but dominated by bicarbonate on the anionic side. No stream seems to contribute large amounts of sulfate to the hydrologic subarea. Water-quality analyses are listed in appendix A.

TABLE 8.--Summary of water-quality data for Santa Ysabel Creek below Sutherland Dam, 1956-81

[<, less than; --, no data]

	Number of observations	Minimum	Median	Maximum
Instantaneous discharge----------ft^3/s--	0	--	--	--
Specific conductance µmho/cm at 25°C----------	41	260	480	642
pH----------	40	7.0	8.4	10
Dissolved solids-------mg/L--	39	180	306	406
Sodium----------mg/L--	41	17	38	160
Calcium----------mg/L--	41	22	32	100
Magnesium----------mg/L--	41	5	15	31
Chloride----------mg/L--	41	19	49	140
Sulfate----------mg/L--	41	5	36	360
Alkalinity as $CaCO_3$----mg/L--	36	85	130	157
Boron----------µg/L--	10	<10	90	220

Ground Water

Crystalline Rocks

Granodiorite and much of the Green Valley Tonalite are weathered to only a shallow depth, but may have fractures which can yield small quantities of water to wells. In the San Pasqual area, well yields from fractured crystalline rocks are as high as 15 gal/min, but typically less than 2 gal/min. Specific capacities for wells in fractured crystalline rocks of the San Pasqual subarea are less than 0.04 (gal/min)/ft of drawdown.

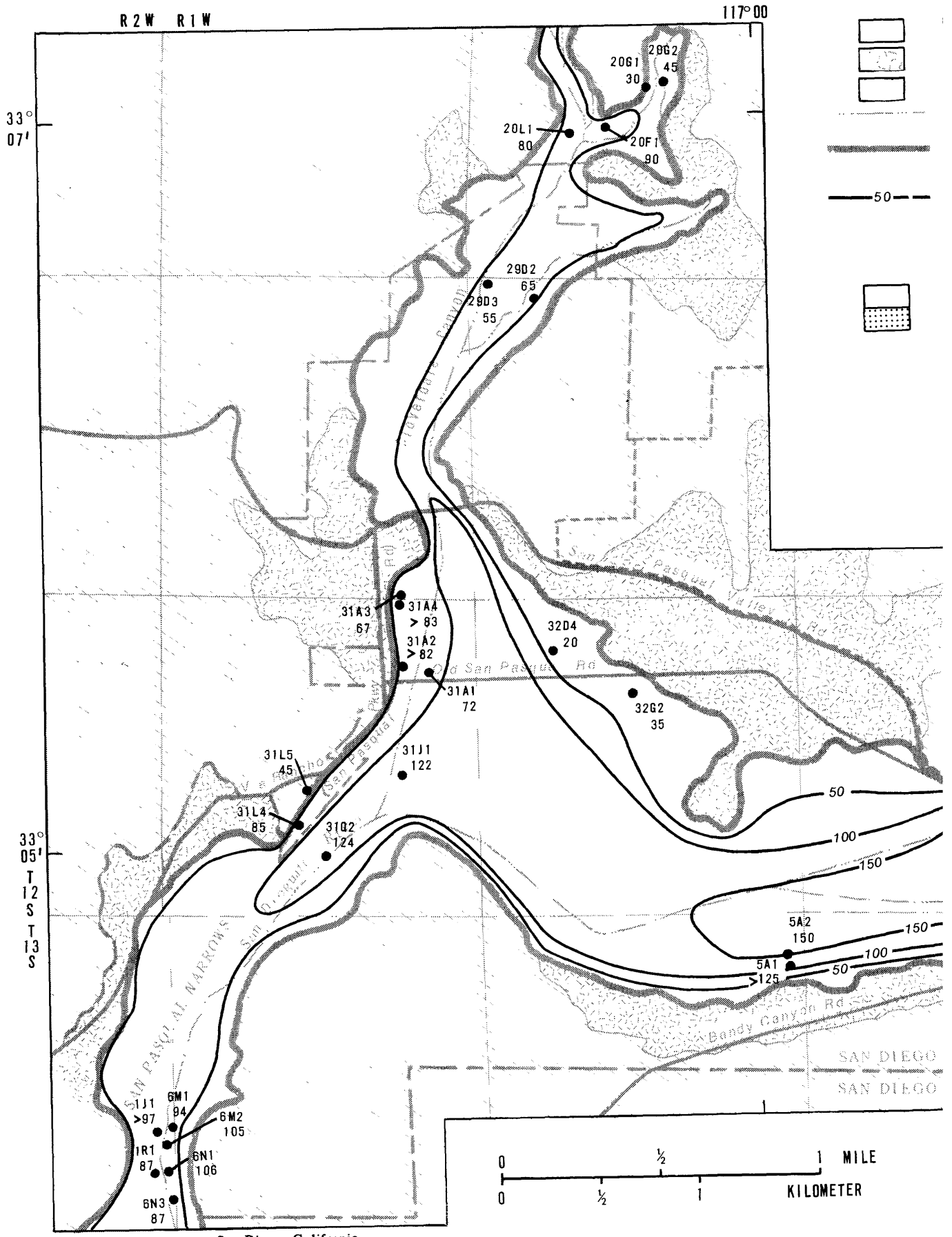
Residual Aquifer

Deeply weathered exposures of Green Valley Tonalite form the residual aquifer. Water-yielding characteristics are summarized in table 9. In the San Pasqual subarea, well yields are as high as 600 gal/min and the median yield is 40 gal/min. Specific capacities for wells in weathered tonalite are as high as 0.7 (gal/min)/ft of drawdown with a median value of 0.4 (gal/min)/ft of drawdown. In addition to surface exposures, drillers' logs reveal considerable weathered tonalite buried beneath alluvial fill. If this material is accounted for and the average depth of weathered material is assumed to be 100 feet, by using an average specific yield of 0.01 (Ramsahoye and Lang, 1961) the total storage in the residual aquifer is estimated to be less than 5,000 acre-ft.

Water generally moves from the residual aquifer downgradient into the alluvial fill. Movement between the two is accelerated during periods of low ground-water levels in the alluvium. Although the residual aquifer contains only a small quantity of water, it may be locally important during such times.

Alluvial Aquifer

Alluvial fill covers 3,410 acres or almost 15 percent of the San Pasqual subarea. Alluvial thickness exceeds 120 feet in San Pasqual Narrows and increases to over 200 feet in the upper part of the basin (fig. 26). The alluvial aquifer contains 364,000 acre-ft of fill. Drillers' logs and specific-capacity data indicate alluvial fill in the San Pasqual subarea has better water-yielding characteristics than the San Dieguito subarea farther downstream, therefore an average specific yield of 0.16 was used to estimate storage. Total ground-water storage in the alluvial aquifer is approximately 58,000 acre-ft. The alluvial fill is a water-table aquifer and ground water is not confined.



Base from county map, San Diego, California

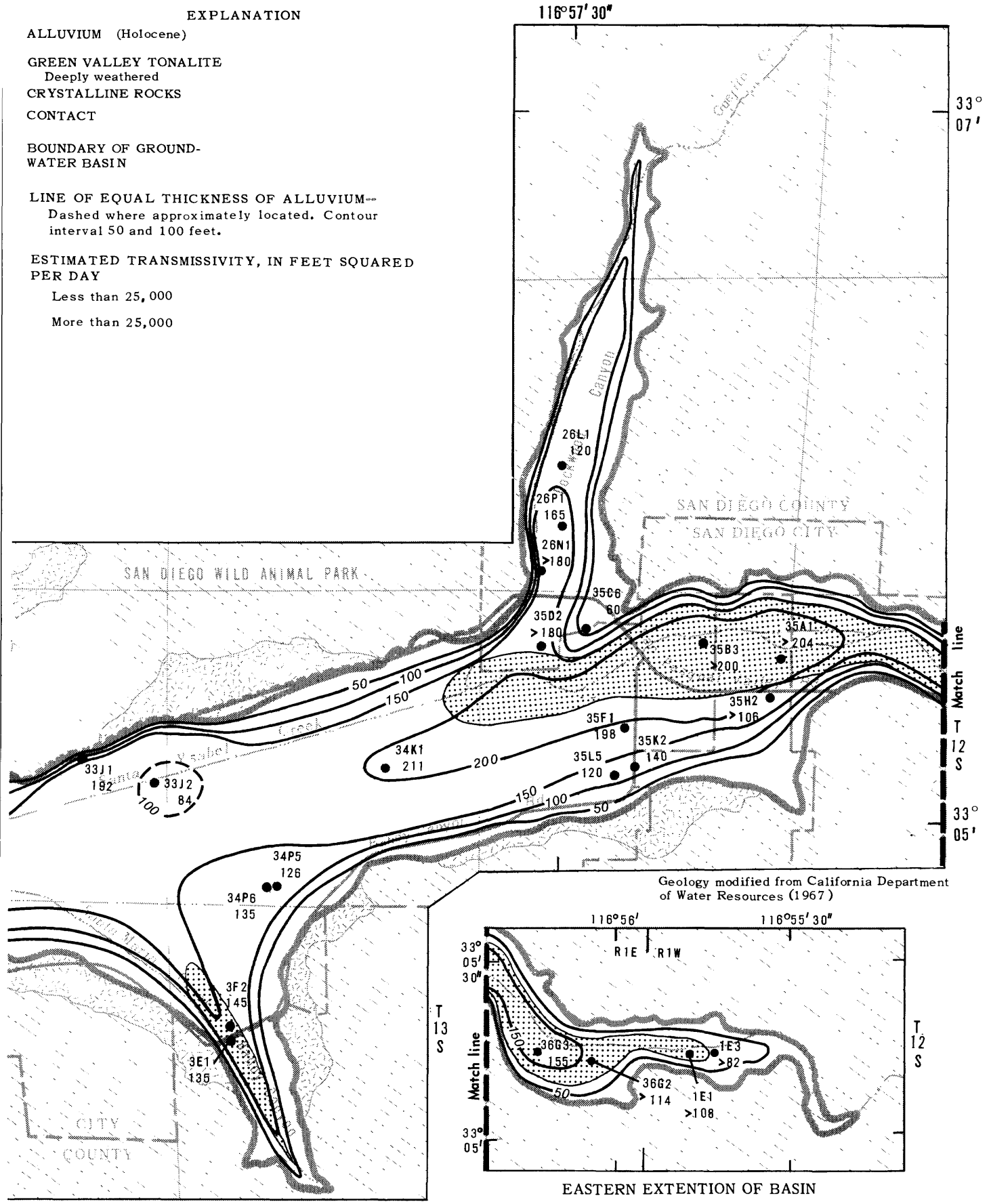


FIGURE 26.--Thickness of the San Pasqual alluvial aquifer.

TABLE 9.--Water-yielding characteristics of aquifers

[Data from drillers' information.

Geologic unit	Map symbol	Exposure in subarea (acres)	Maximum thickness (feet)	Description
Alluvium	Qal	3,410	>200	River and stream deposits of gravel, sand, silt, and clay.
Crystalline rocks of the southern California batholith	Kgr, Kt, Jg, Jm	15,040	Basement complex	Primarily unweathered granodiorite and tonalite.
Deeply weathered exposures of Green Valley Tonalite	Kt_1	1,550	Plus or minus 100, variable	Deeply weathered Green Valley Tonalite, frequently covered by a thin layer of alluvium.

Wells in the alluvium yield as much as 1,600 gal/min. Although highest yields are in the upper part of the basin, wells yielding almost 1,000 gal/min are found throughout the main canyon and Rockwood and Bandy Canyons.

Well logs show a mixture of clean sand, gravel, and silt throughout the alluvium. In general, well logs indicate a greater percentage of clean sand and gravel in the upper basin and a greater percentage of silt in the lower basin and San Pasqual Narrows (Kohler and Miller, 1982).

Specific-capacity data reflect generalized distribution of sand, gravel, and silt within the aquifer. Several wells, most located in a line along the northern edge of the upper basin from the mouth of Rockwood Canyon east to the inflow of Santa Ysabel Creek, have specific capacities

in the San Pasqual hydrologic subarea

>, greater than; --, no data]

Water-yielding characteristics			
General	Well yield (gal/min)	Specific capacity ((gal/min)/ft of drawdown)	Transmissivity (ft^2/d)
Yields water freely to wells.	As much as 1,600.	Typically 16, but may exceed 100.	Typically 4,000, but may exceed 25,000.
Yields small quantities of water to wells from fractures.	Less than 2, but may be as much as 15.	Less than 0.1.	--
Yields water to wells from weathered granite matrix and fractures.	Typically less than 40, but may be as much as 600.	Typically less than 0.4, but may be as much as 0.7.	--

greater than 100 (gal/min)/ft of drawdown. One well in Bandy Canyon also has a specific capacity greater than 100 (gal/min)/ft of drawdown. Specific-capacity data from wells in the remainder of the aquifer average 16 (gal/min)/ft of drawdown with a maximum of 75 (gal/min)/ft.

Estimates of transmissivity can be obtained by multiplying specific capacity by 250. This value is based on statistical correlations done by Thomasson and others (1960) in California's Central Valley, and has been routinely extended to California's coastal and desert basins. Using this method, aquifer transmissivities along the northern edge of the upper San Pasqual basin and Bandy Canyon exceed 25,000 ft^2/d (fig. 26). In the remainder of the alluvium, transmissivities are less than 20,000 ft^2/d and average 4,000 ft^2/d.

Recharge.--Recharge to the alluvial aquifer originates primarily outside the hydrologic subarea as flow in Santa Ysabel, Guejito, and Santa Maria Creeks. In a typical year no flow leaves the subarea and all surface water becomes ground-water recharge, about 940 acre-ft/yr. During wet years flow may be great enough to fill the alluvial aquifer, with the excess leaving the subarea as flow in the San Dieguito River. Additional recharge is provided by water imported to the subarea for agricultural use. Streamflow originating inside the subarea, leakage from the surrounding residual aquifer, and precipitation contribute small amounts of recharge that may be locally important.

Imported water use in the San Pasqual subarea has grown in recent years. In 1970, 2,140 acre-ft of water was imported to the subarea and in 1980, 3,560 acre-ft of imported water was used. Currently, imported water is used primarily in San Diego Wild Animal Park and hillside avocado groves west of Cloverdale Canyon.

Based on calculations by the California Department of Water Resouces (California Department of Water Resources, 1983), 710 acre-ft of imported water used for irrigation was available for deep percolation and recharge to the alluvial aquifer in 1970. By 1980 this figure increased to 1,160 acre-ft. This was sufficient to turn Cloverdale Creek into a perennial stream in 1977 and to maintain water levels in Cloverdale Canyon near land surface. At that time, water levels throughout the remainder of the alluvial aquifer were generally greater than 40 feet, and occasionally as deep as 85 feet below land surface.

Occurrence and movement.--Movement of ground water is from the major source of recharge at the inflow of Santa Ysabel Creek and from smaller recharge areas in Rockwood, Bandy, and Cloverdale Canyons, downgradient to the discharge area in San Pasqual Narrows. With the exception of evapotranspiration losses, all water entering the alluvial aquifer exits through San Pasqual Narrows.

In the early 1900's before the beginning of extensive ground-water development, water levels were very near land surface throughout much of the alluvial aquifer (fig. 27 and 28). Water levels remained high throughout the 1930's, and declined only gradually during the 1940's and 1950's. Rate of water-level decline increased in the early 1960's and historically low water levels occurred in 1965 and 1977.

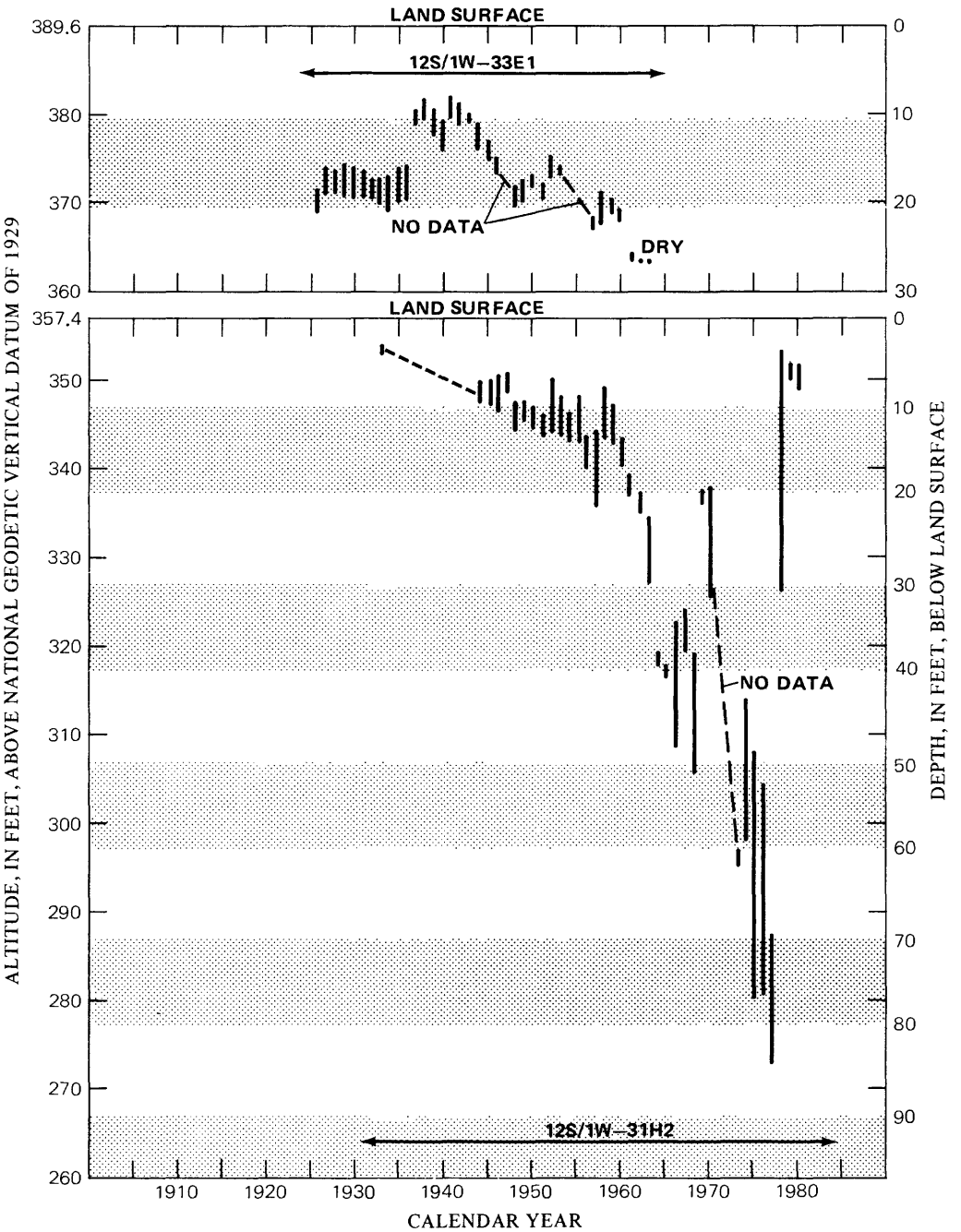


FIGURE 27. – Hydrographs for wells in the lower part of the San Pasqual basin. Vertical bar indicates range of water–level fluctuation during year. (Location of wells shown in appendix C.).

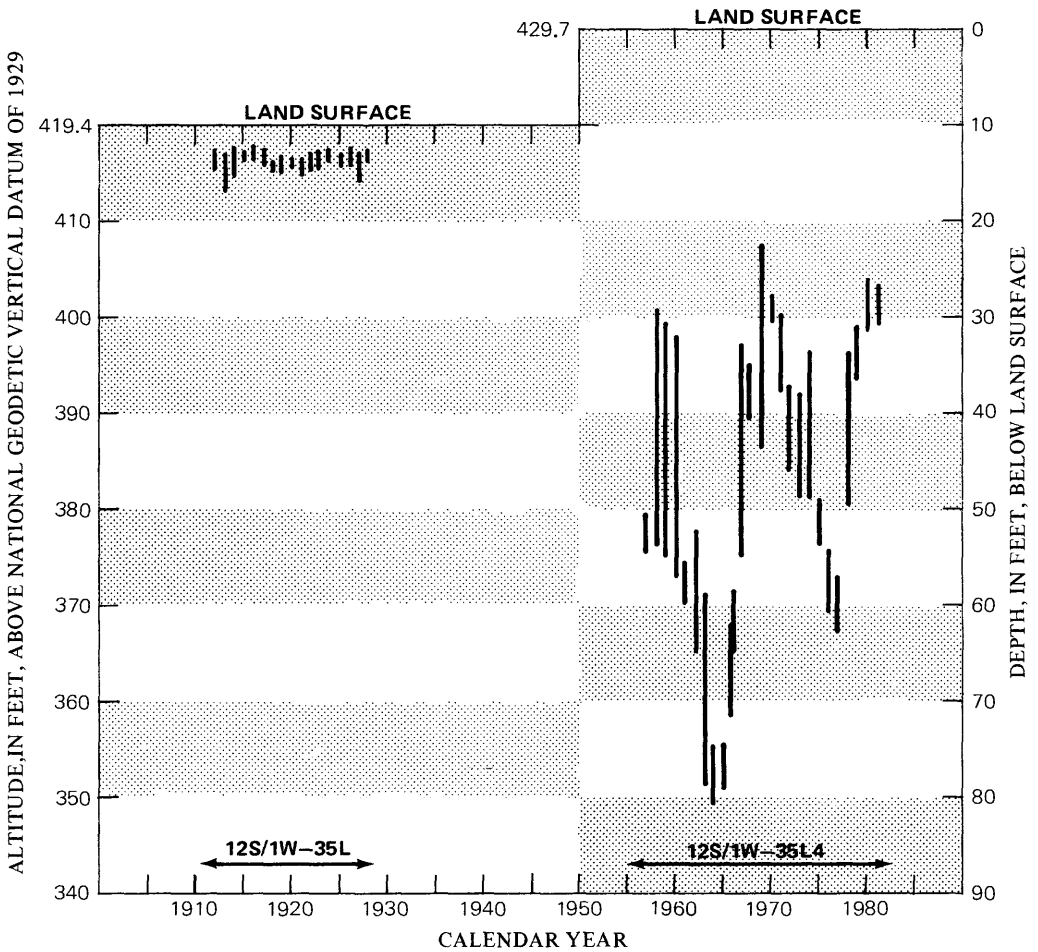


FIGURE 28. – Hydrographs for wells in the upper part of the San Pasqual basin. Vertical bar indicates range of water–level fluctuation during year. (Location of wells shown in appendix C.).

Figure 29 is a water-level-contour map for spring 1977. At that time, water levels in the San Pasqual alluvium were the lowest ever recorded prior to the beginning of an irrigation season. The hydraulic gradient through San Pasqual Narrows was reversed, and ground water was moving into the basin from outside the hydrologic subarea. The only discharge from the San Pasqual subarea was through evapotranspiration of agricultural crops. Depth to water was greater than 40 feet throughout most of the alluvium and exceeded 80 feet in some places. This represented a reduction in storage of 23,800 acre-ft. Storage remaining in the basin was 34,200 acre-ft, or 60 percent capacity.

Water levels rose rapidly in 1978 in response to a wet year. The alluvial aquifer filled, and ground-water movement returned to normal.

Figure 30 is a spring 1982 water-level-contour map. Ground-water movement was again downgradient from major sources of recharge at Santa Ysabel Creek, Rockwood Canyon, and Bandy Canyon to the discharge area in San Pasqual Narrows. A new source of recharge was irrigation return from avocado groves along the western edge of the lower basin and Cloverdale Canyon. Irrigation return moves from hillsides through the residual aquifer, surfacing as springs in many places, eventually entering the alluvial aquifer. In only a small part of the alluvium were depths to water greater than 10 feet, and nowhere was depth to water greater than 30 feet (fig. 30). The aquifer was full in spring 1982.

Ground-Water Quality

Crystalline Rocks

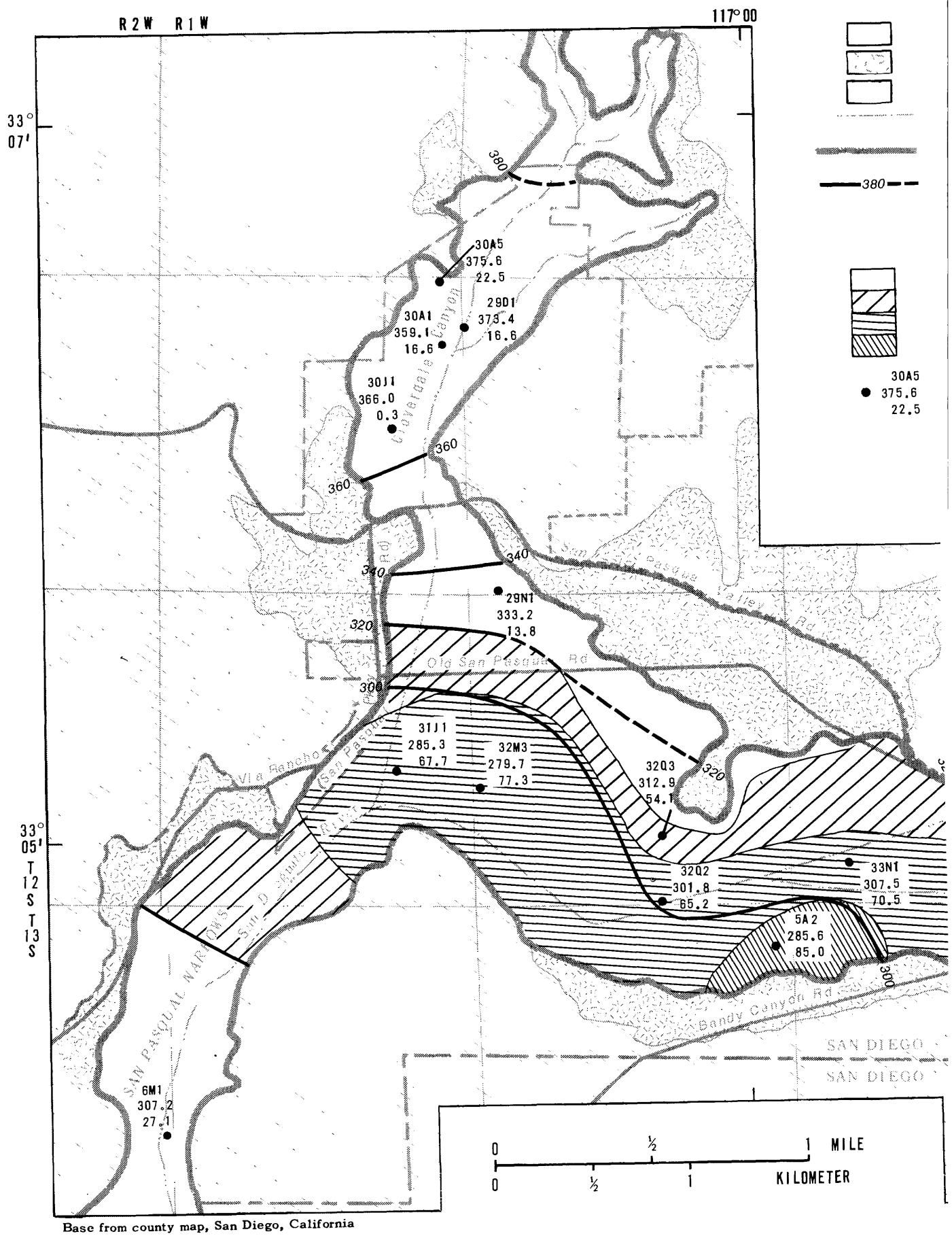
Water from wells in fractured crystalline rocks in San Diego County has a median dissolved-solids concentration less than 500 mg/L (California Department of Water Resources, 1967). However, because wells in this material yield water from fractures which have little ability to adsorb or filter pollutants, quality of the water is easily degraded. Little information is available on current water-quality problems in crystalline areas of the San Pasqual hydrologic subarea.

Residual Aquifer

Prior to 1967, water from weathered granite aquifers in San Diego County had a median dissolved-solids concentration between 500 and 600 mg/L (California Department of Water Resources, 1967). In the San Pasqual subarea, dissolved-solids concentrations in 1981 and 1982, estimated from specific conductance, were as high as 1,430 mg/L, with a median concentration of 1,040 mg/L. In the residual aquifer dissolved solids (as reflected by specific conductance) tend to be higher downgradient from agricultural land.

Dissolved-solids concentrations in water from the residual aquifer are on the average somewhat lower than dissolved-solids concentrations in water from the alluvium in Cloverdale Canyon and the lower part of the basin. Several wells in shallow alluvial fill (12S/1W-20M1 and 12S/1W-30A5) which were completed in the residual aquifer yield water lower in dissolved solids than nearby wells completed only in the surrounding alluvium (fig. 33). When ground-water levels are low in Cloverdale Canyon and the lower basin, the residual aquifer contributes water with a lower average dissolved-solids concentration to the alluvial aquifer, and may actually improve water quality (with respect to dissolved-solids concentration) in some wells.

Water in some areas of the residual aquifer has elevated concentrations of nitrate that could move into the alluvium when ground-water levels are low, particularly in the vicinity of San Diego Wild Animal Park.



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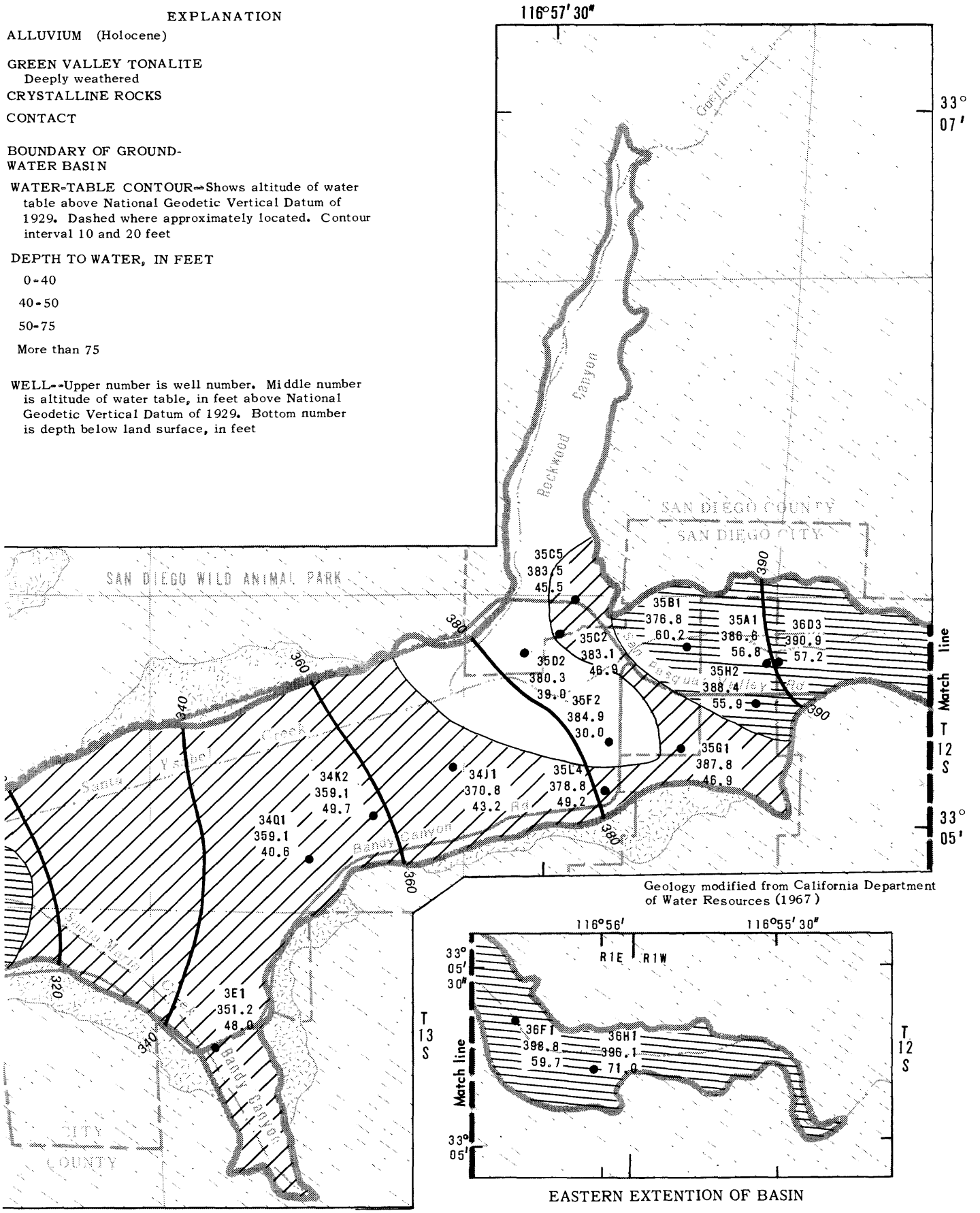
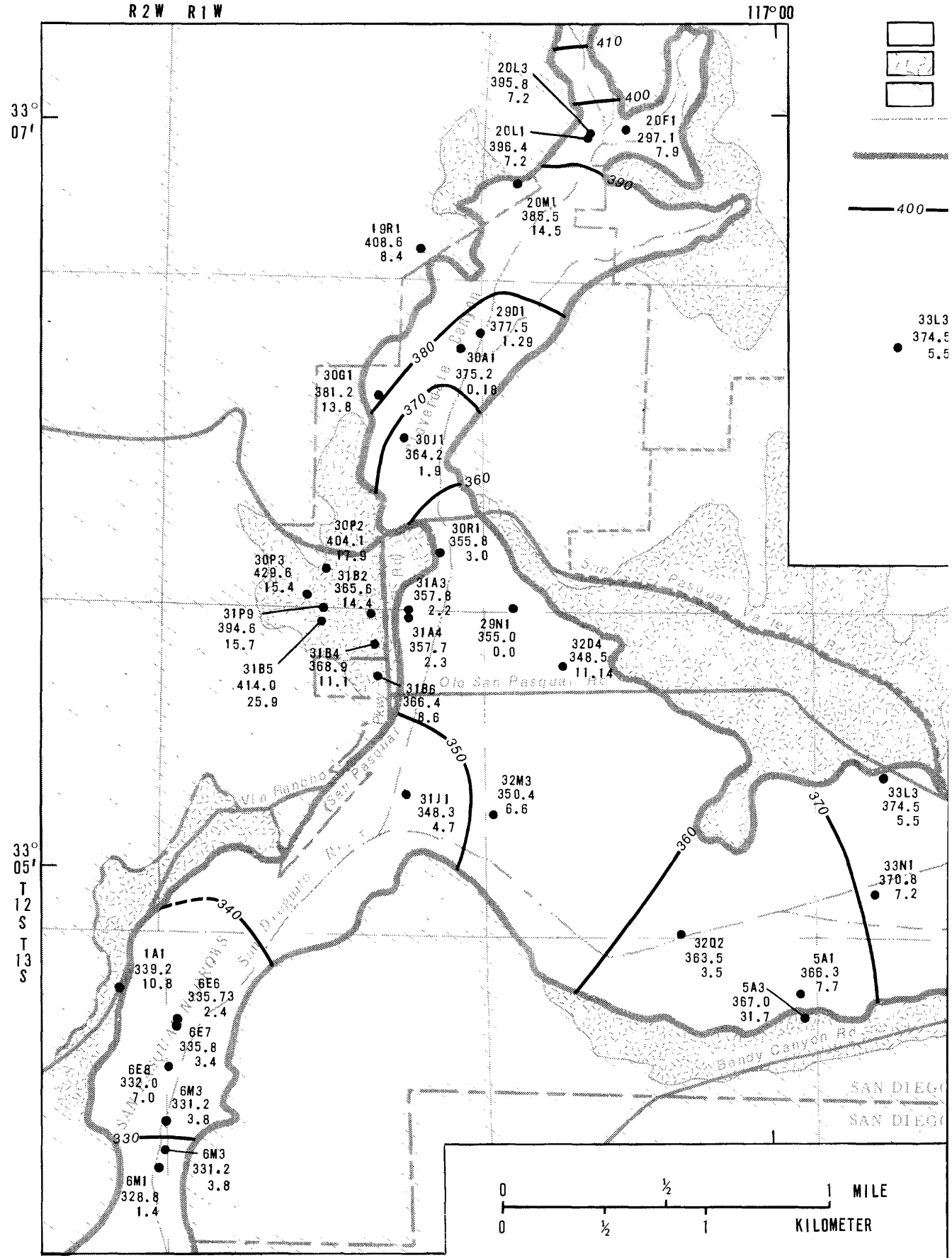
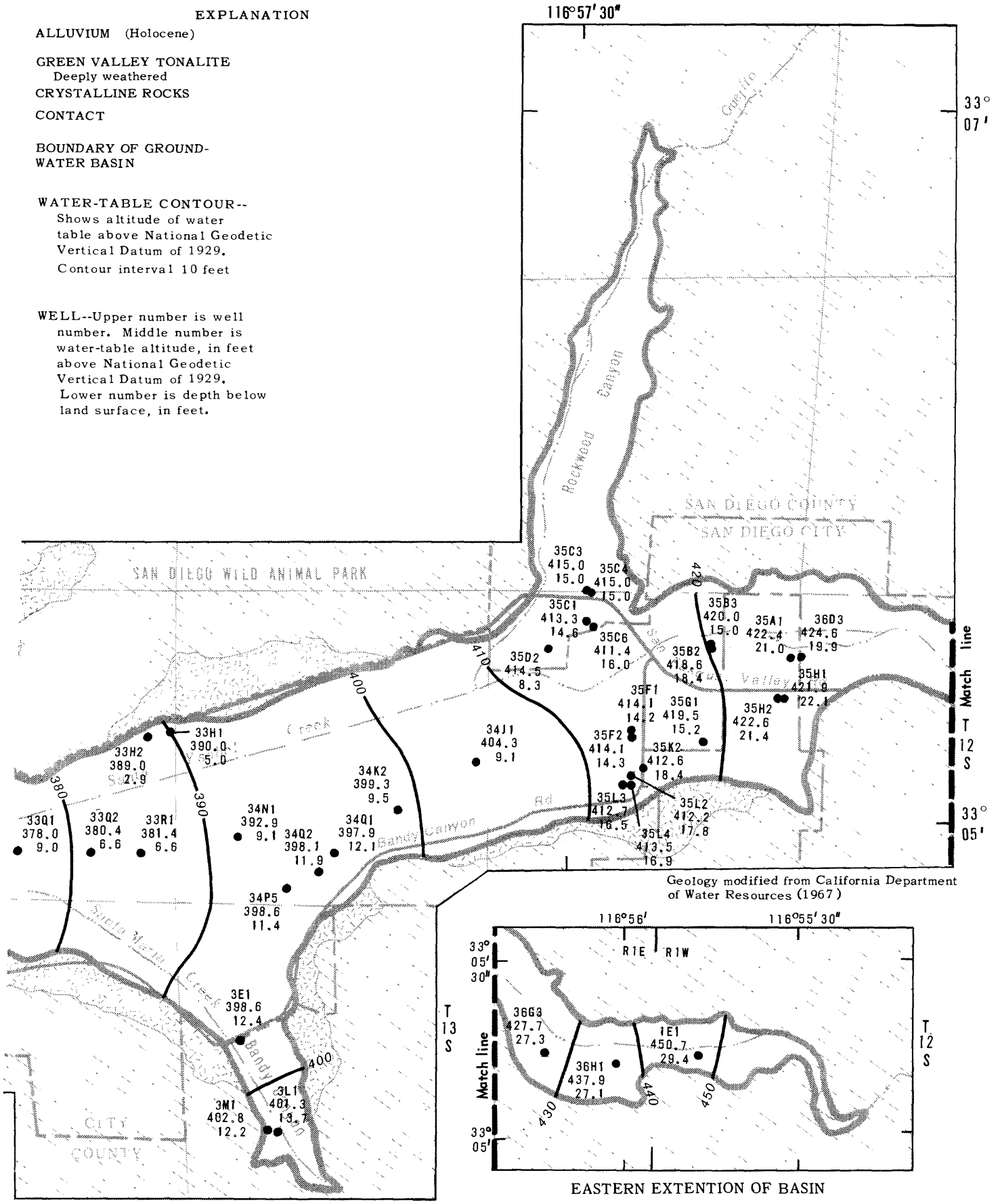


FIGURE 29.--Water-level contours and depth to water in the San Pasqual alluvial aquifer, spring 1977.



Base from county map, San Diego, California



Geology modified from California Department of Water Resources (1967)

FIGURE 30.-- Water-level contours and depth to water in the San Pasqual alluvial aquifer, spring 1982.

Alluvial Aquifer

Historical water quality.--Figure 31 is a ground-water-quality map of the alluvial aquifer in spring 1957, prior to the increased water-level declines of the 1960's. At that time, only one of the sampled wells (12S/1W-30R1) yielded water with dissolved-solids concentrations greater than 1,000 mg/L. Dissolved-solids concentrations from highly transmissive areas in the upper basin were less than 500 mg/L.

During spring 1957, ground water in the alluvium was generally a mixed type. Calcium and sodium were the predominant cations. Calcium predominanted in the highly transmissive areas of the upper basin and sodium predominanted downgradient. Bicarbonate was the predominant anion and sulfate was of minor importance throughout the aquifer.

Water from upper reaches of Cloverdale Canyon was a sodium chloride bicarbonate type. Sodium and chloride increased as water moved downgradient through Cloverdale Canyon, becoming a sodium chloride type as it left the canyon to enter the main body of the aquifer.

By the time ground water left the subarea at San Pasqual Narrows, dissolved solids increased but did not exceed 1,000 mg/L. The percentage of sulfate also increased and ground water was again a mixed type.

Historically, nitrate has been a problem in the alluvial aquifer. Figure 32 shows wells which have yielded water with nitrate concentrations greater than EPA drinking water limits of 10 mg/L as N. Most of the wells are located in the upper part of the basin and may be associated with dairy and poultry operations in that area.

Present water quality.--Present water quality in the alluvium is variable (fig. 33). Lowest dissolved-solids concentrations are found in highly transmissive parts of the upper basin and Rockwood Canyon. Ground water from these areas generally has less than 500 mg/L dissolved solids. Downgradient from highly transmissive parts of the upper basin dissolved-solids concentrations increase, but generally remain below the basin objective of 1,000 mg/L. Dissolved-solids concentrations in water in the lower basin and San Pasqual Narrows are generally above 1,000 mg/L and are as high as 1,550 mg/L. Dissolved-solids concentrations in Cloverdale Canyon and in parts of the upper basin also exceed 1,000 mg/L. Increasing dissolved-solids concentrations in these areas may be related to land use. Irrigation return water appears to contribute to high concentrations of dissolved solids in ground water from Cloverdale Canyon.

Field measurements of specific conductance were converted to dissolved-solids concentration using the following relation:

$$DS=0.7SC-40,$$

where

DS is dissolved-solids concentration, in milligrams per liter; and
SC is specific conductance, in micromhos per centimeter at 25°C.

This relation was developed using linear regression on data collected by the U.S. Geological Survey and the city of San Diego between autumn 1981

and spring 1982. Twenty-three samples with dissolved-solids concentrations ranging from 414 to 2,480 mg/L were used and an R^2 of 0.96 was obtained. This relation is basin specific and care should be used when extrapolating to other areas.

Chloride and sulfate exceed the EPA suggested limit for drinking water of 250 mg/L in ground water from San Pasqual Narrows and Cloverdale Canyon.

Ground water in highly transmissive areas of the alluvial aquifer is a mixed type and resembles recharge water from Santa Ysabel and Guejito Creeks. Cations are well mixed and the percent difference between calcium, sodium, and magnesium is only a few milliequivalents. Bicarbonate and chloride are the dominant anions in the upper basin. Sulfate is relatively unimportant in ground water from highly transmissive areas of the upper basin. Downgradient, the relative importance of sulfate increases. This is probably due to agricultural water use, soil amendments (particularly calcium sulfate, used when irrigating with water high in sodium), and irrigation return water. Increasing importance of sulfate does not seem to be related to recharge water from Santa Maria Creek.

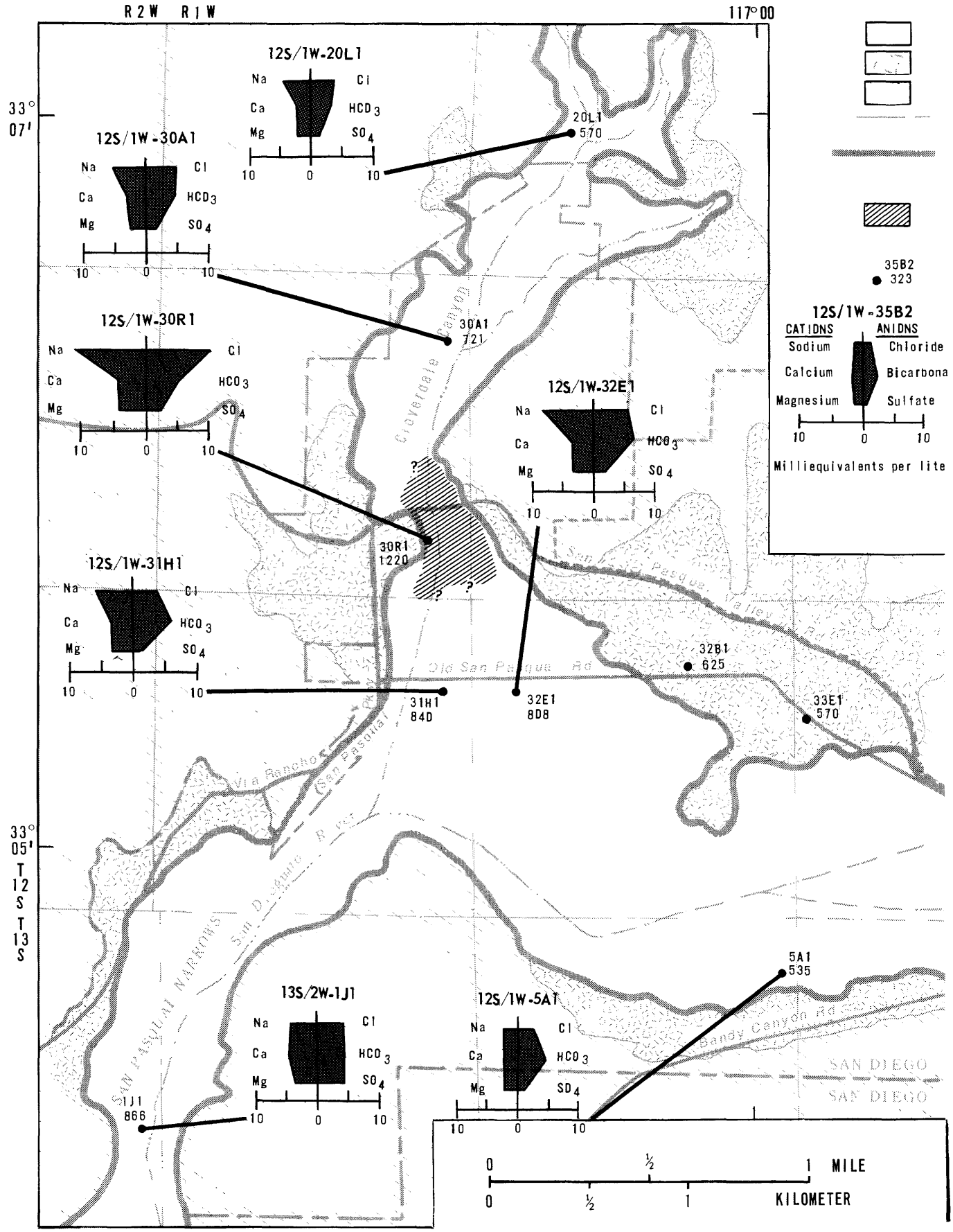
When ground water leaves the subarea at San Pasqual Narrows, it is different from its original composition. Ground water in the Narrows is a sodium chloride sulfate type and reflects agricultural water use in the San Pasqual subarea, and mixing of native water with irrigation return water imported from the Colorado River and northern California.

In 1981 and 1982, only two wells for which chemical analyses were available (12S/1W-34K2 and 12S/1W-35H2) yielded water with nitrate concentrations greater than the EPA recommended limit for drinking water of 10 mg/L nitrate as nitrogen (45 mg/L nitrate as nitrate). Both wells are in the upper part of the basin where dissolved-solids concentrations are below 1,000 mg/L. High nitrate levels in these wells indicate there is still a nitrate problem in the alluvial aquifer, particularly the upper basin, despite the recent filling of the aquifer after floods in 1978.

Impact of Reclaimed Water Use

The impact of reclaimed water use in the San Pasqual hydrologic subarea will depend greatly upon the reclaimed-water management scheme ultimately used. To be properly evaluated, the impact of reclaimed water use should be compared to and contrasted with possible future trends in water quantity and quality for the San Pasqual hydrologic subarea.

If reclaimed water is not used, the amount of ground water in storage in the alluvial aquifer will follow historic patterns of filling and subsequent depletion that are closely associated with long-term trends in precipitation (fig. 27 and 28). During prolonged dry spells, such as occurred prior to 1966 and 1978, ground-water levels will decline and many wells will go dry. The value of the ground-water resource will be greatly diminished when needed most.



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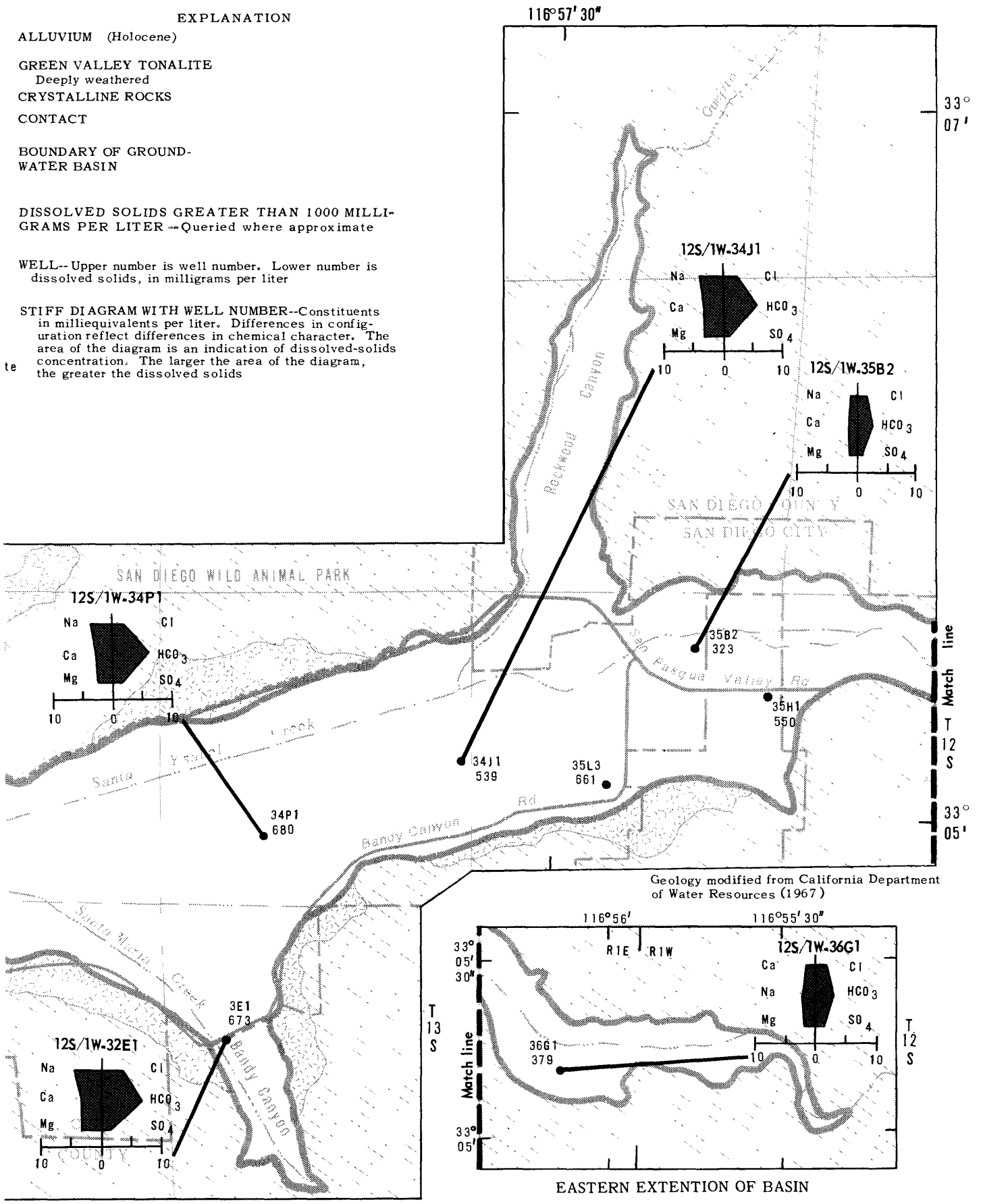

Geology modified from California Department of Water Resources (1967)

FIGURE 31.--Water quality in the San Pasqual alluvial aquifer, spring 1957.

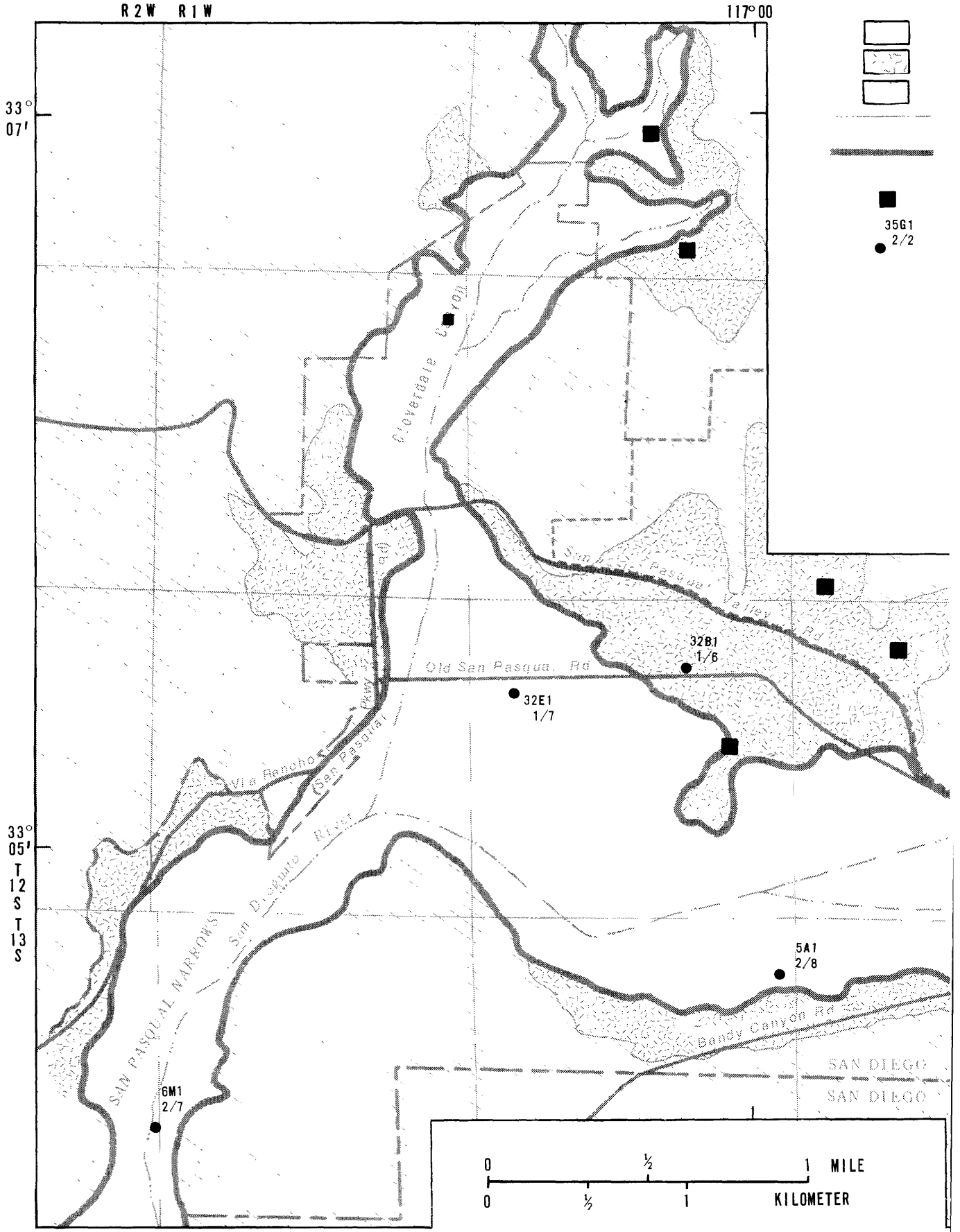

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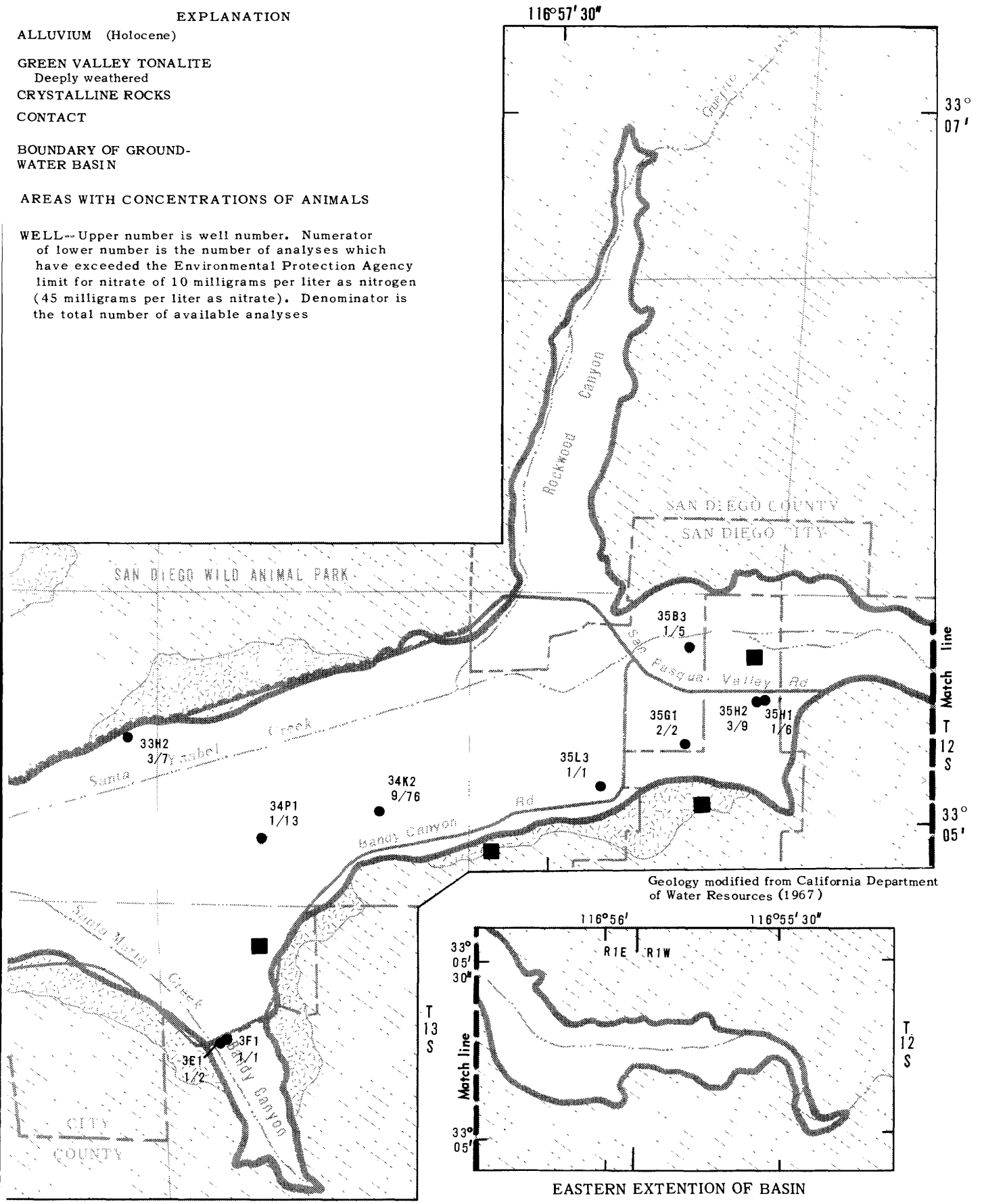
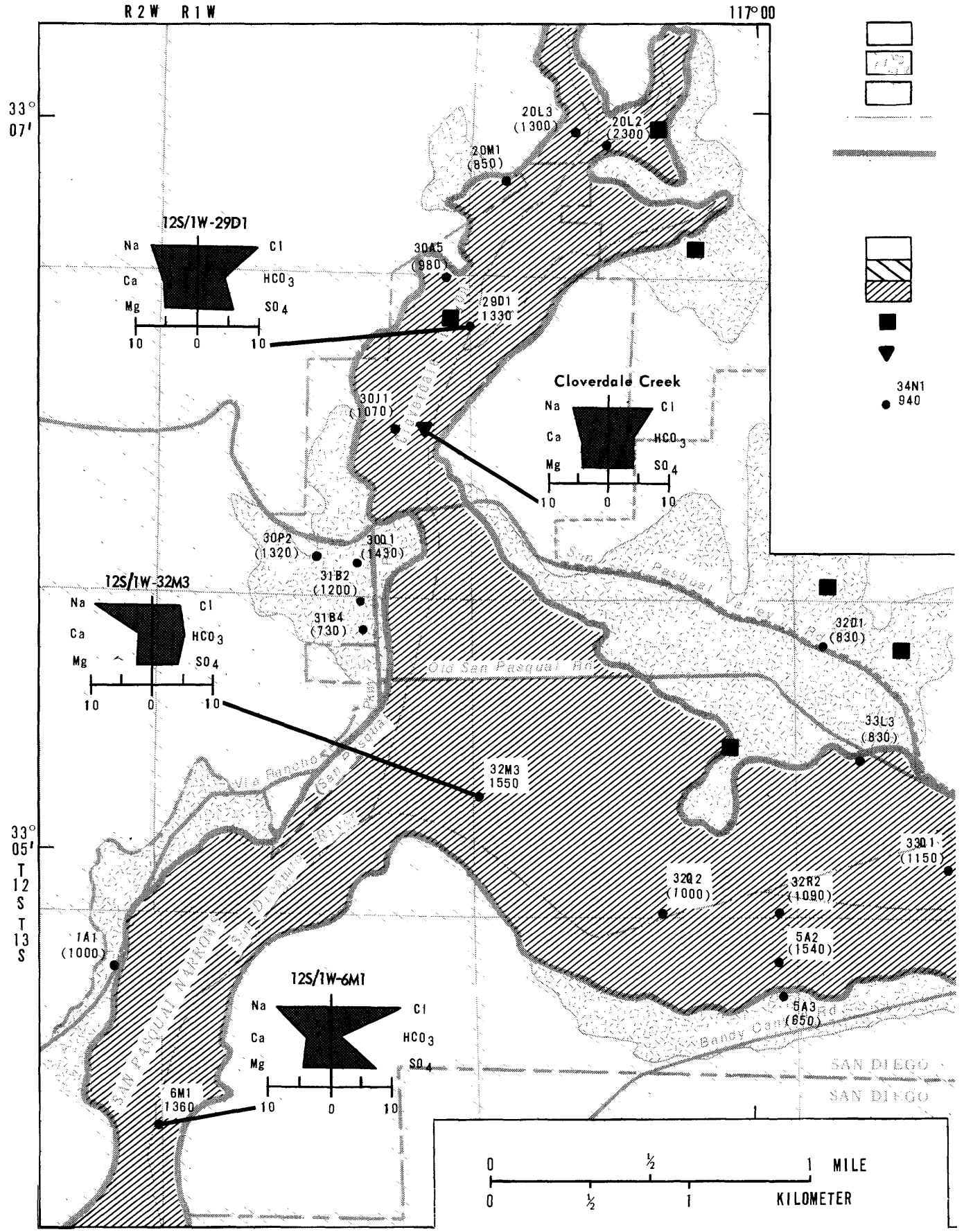
FIGURE 32.--Location of wells that have yielded water with



Geology modified from California Department of Water Resources (1967)

EASTERN EXTENTION OF BASIN

high concentrations of nitrate, San Pasqual alluvial aquifer, 1950-81.



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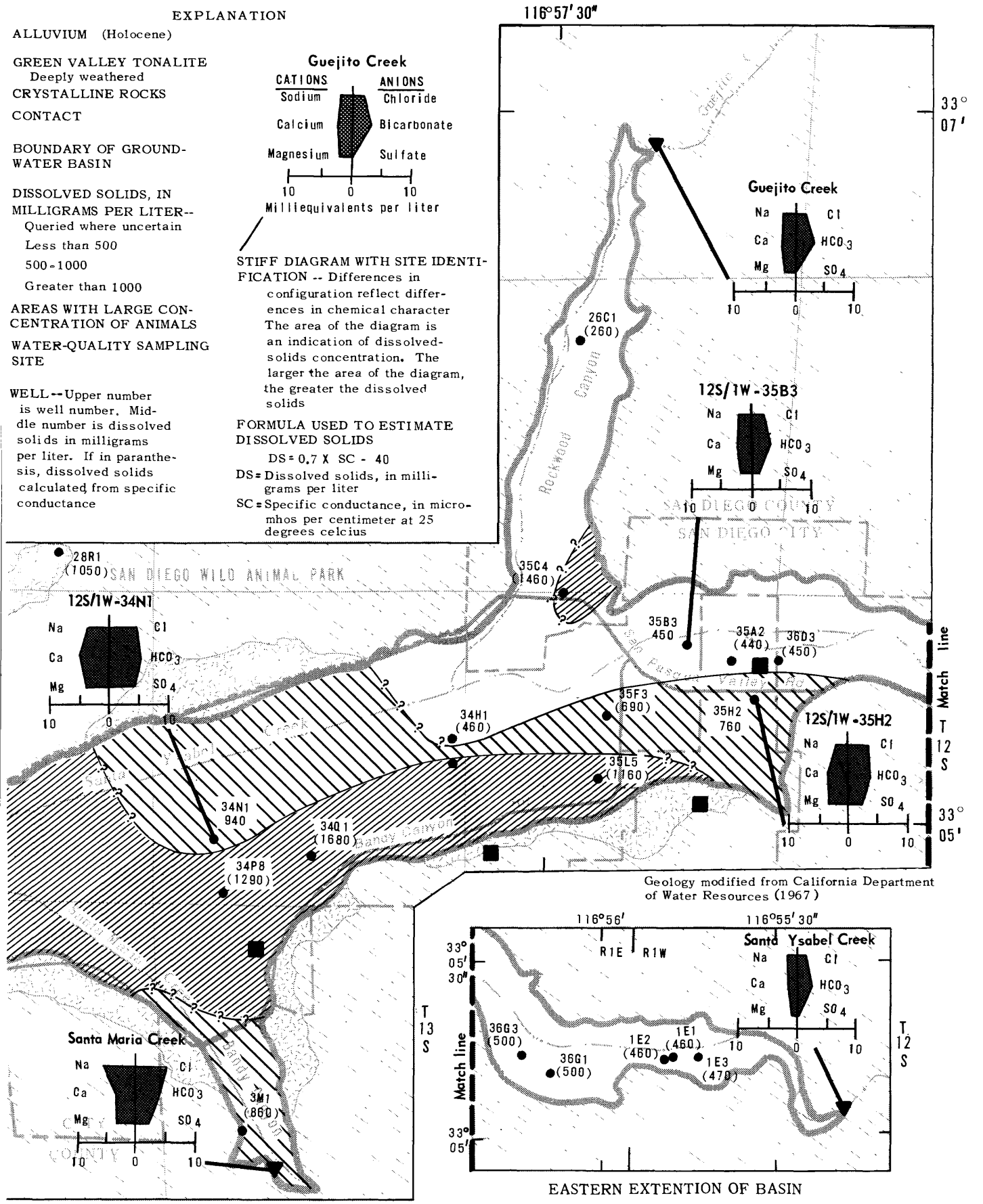


FIGURE 33.—Water quality in the San Pasqual alluvial aquifer, spring 1982.

The quality of the water in the alluvial aquifer has deteriorated since 1957. Changes in ground-water quality are evident when comparing ground-water-quality maps for 1957 and 1982 (fig. 31 and 33). During this period, dissolved-solids concentrations increased in much of the aquifer and now exceed the basin objective of 1,000 mg/L. Sulfate and chloride concentrations also increased and now exceed the EPA suggested limit of 250 mg/L for public water supplies by the time ground water leaves the subarea at San Pasqual Narrows. Ground-water types in Cloverdale Canyon and the lower part of the basin have changed and now resemble irrigation return water that comprises a significant part of the recharge. Water quality in the alluvium will probably continue to deteriorate through agricultural water use.

Changes in agricultural practices may further degrade ground-water quality. Currently, slopes surrounding the upper part of the basin are not used for agriculture. However, many of these slopes, particularly in the neighborhood of Bandy and Rockwood Canyons and the northeastern edge of the upper basin, are being converted to avocado groves and are being irrigated with imported water. Springs and seeps below these groves now flow year round and ground-water quality in the Rockwood Canyon area has already been affected (fig. 33). If this trend continues, water quality throughout the alluvial aquifer may deteriorate and begin to resemble ground-water quality now found in Cloverdale Canyon.

Further development of surface-water resources along Santa Ysabel Creek at Palmo Dam may affect the quantity of recharge available to the alluvial aquifer, particularly during dry years. This may affect water quality and ground-water movement in the upper part of the basin.

Reclaimed Water Quality

Reclaimed water will be secondary treated sewage effluent from the Hale Avenue Wastewater Treatment Plant in Escondido. Reclaimed water has an average dissolved-solids concentration ranging from 650 to 950 mg/L, and is a sodium chloride type, chemically resembling imported water rather than native ground water (California Department of Water Resources, 1983). Nitrate concentrations in the reclaimed water would not exceed EPA limits of 10 mg/L as nitrogen (45 mg/L as nitrate) (Larry Michaels, San Diego County Water Authority, oral commun., 1982).

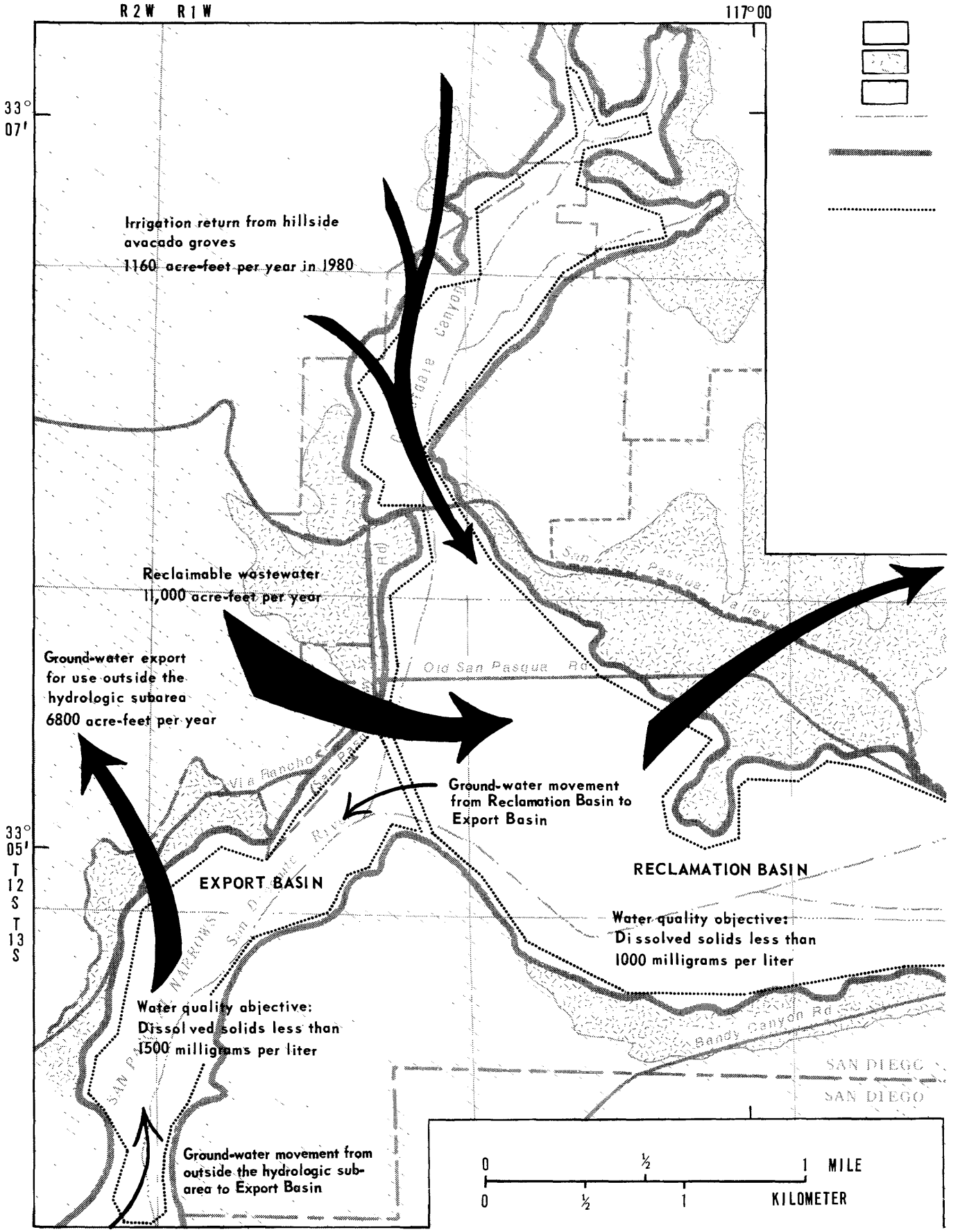
Reclaimed Water Use Plans

Use of reclaimed water in upland areas surrounding Cloverdale Canyon and the lower part of the basin as a substitute for irrigation with imported water has been proposed by the California Department of Water Resources (1983). Upland soils may be suitable for reclaimed water use if application rates and techniques are selected on a site-specific basis so that shallow circulation and discharge of water to surface seeps can be avoided. In many upland areas where reclaimed water use is possible, the underlying residual aquifer has already been impacted by agricultural irrigation return and would not be further degraded by applications of reclaimed water unless application techniques are used that allow evaporative and transpirative concentration to become excessive.

Reclaimed water applied to upland areas in the San Pasqual hydrologic subarea will eventually enter the alluvial aquifer.

Current reclaimed water use plans for the alluvial aquifer, proposed by the San Diego County Water Authority, divide the aquifer into three subareas (fig. 34) (Larry Michaels, San Diego County Water Authority, written commun., 1982). The upper part of the basin will not receive reclaimed water. The lower basin will be managed as a reclamation basin and will receive large quantities (up to 11,000 acre-ft/yr) of reclaimed water. San Pasqual Narrows will be managed as an export basin. Ground-water discharge through the narrows will be intercepted and exported for use outside the hydrologic subarea to prevent reclaimed water from entering Lake Hodges, a public water-supply reservoir.

Objectives of this management plan are to obtain ground water having dissolved-solids concentrations less than 1,000 mg/L in the lower part of the basin. The plan also tries to maintain high ground-water quality in the upper part of the basin. Irrigation return water from Cloverdale Canyon and hills along the western edge of the lower basin, and possible future reclaimed water use in those areas will be important considerations in successful management.



Base from county map, San Diego, California

106 San Pasqual Hydrologic Subarea

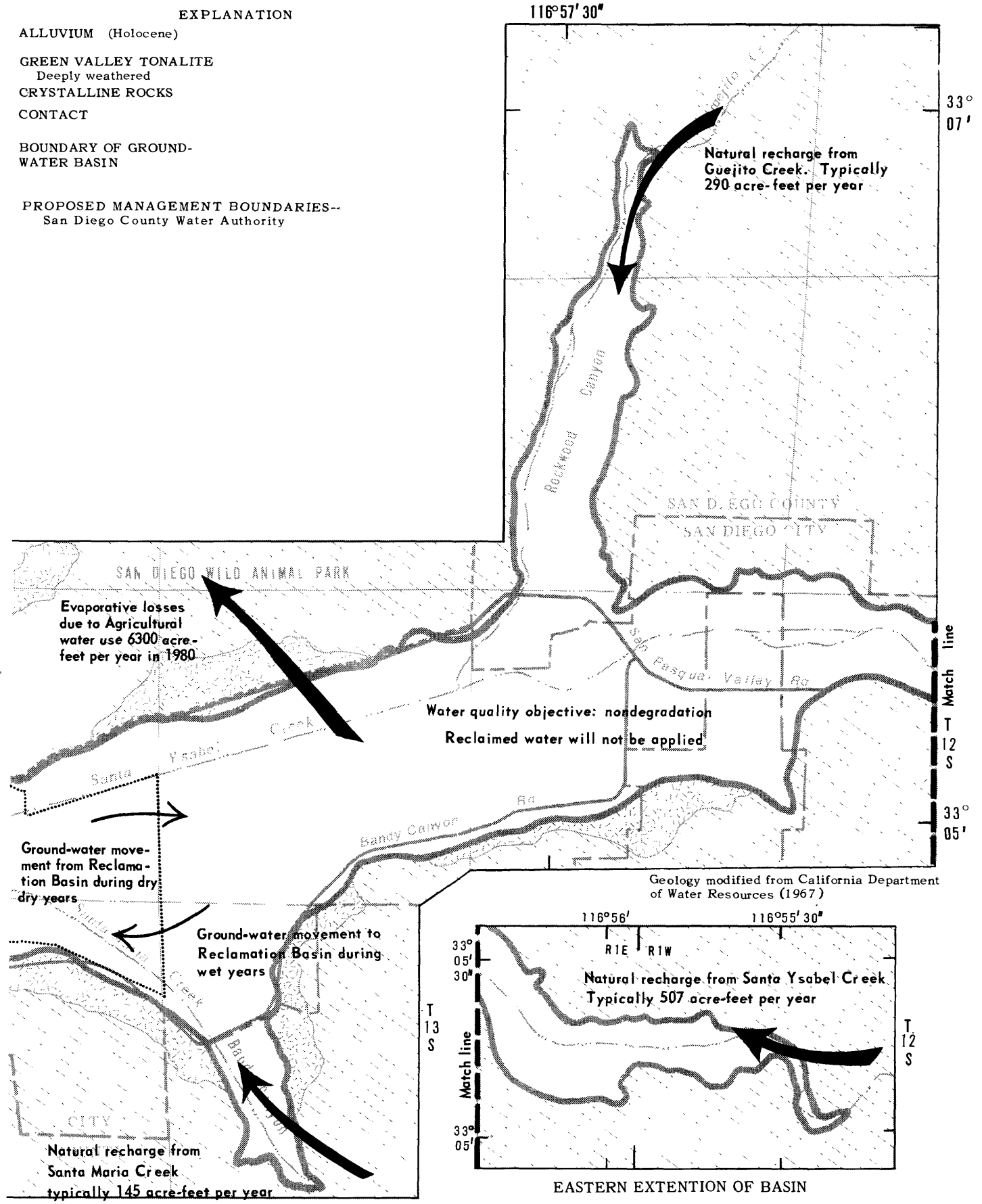


FIGURE 34.--A possible reclaimed water management plan for the San Pasqual alluvial aquifer.

In 1982, water levels in the alluvial aquifer were near land surface and little additional storage capacity was available for reclaimed water. If reclaimed water is applied during a wet cycle when ground-water levels are high, waterlogging of the soil and surface runoff could occur. To combat this problem, the reclaimed water use plan proposes to lower water levels by pumping ground water presently stored in the lower part of the basin. This water would then be exported for use outside the hydrologic subarea. Ground water presently in storage has dissolved-solids concentrations greater than 1,000 mg/L. Under current management proposals, this water would be replaced by reclaimed water with dissolved-solids concentrations between 650 and 950 mg/L. Therefore, transfer of ground water from the hydrologic subarea also represents a net transfer of dissolved solids. Water quality, with respect to dissolved solids, may improve with time. Salt-balance calculations by the San Diego County Water Authority indicate dissolved-solids concentrations may be reduced to below 1,000 mg/L (Larry Michaels, San Diego County Water Authority, 1982).

Because storage in the alluvial aquifer is small (58,000 acre-ft) when compared to the maximum annual streamflow into the subarea of 110,000 acre-ft[2], the alluvial aquifer could fill in one rainy season (as it did in 1978), and despite intensive management efforts, there may not always be sufficient storage available to accept reclaimed water. Reclaimed water use would have to be adjusted accordingly.

In dry years such as 1977, there would be ample available storage in the lower part of the basin to accept reclaimed water (fig. 27). However, during dry periods, ground-water levels would be low throughout the entire aquifer except where reclaimed water is being applied. Applied water would create a local ground-water high, with some reclaimed water flowing to the export area in San Pasqual Narrows and some flowing to the upper part of the basin. Because ground-water movement is slow, only a small potential exists for reclaimed water to move from the reclamation basin to the upper part of the basin where it could contaminate potable water supplies, except during periods of extended drought. During drought periods, movement of reclaimed water and ground-water quality could be monitored to protect water quality in the upper part of the basin.

The current reclaimed water use plan proposed by the San Diego County Water Authority does not incorporate changes in land use practices and surface-water development which may alter the hydrologic system. However, changes in water quality will occur with or without reclaimed water use and reclaimed water may act to partly alleviate future water-quality problems.

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[2]Calculated as the sum of maximum measured annual recharge from Santa Ysabel, Guejito, and Santa Maria Creeks (table 7).

SUMMARY

Reclaimed water could be used to augment water supplies in the San Diego area. Of the three hydrologic subareas studied, San Elijo has the least opportunities for reclaimed water use, and San Pasqual the most. The San Dieguito hydrologic subarea has possibilities for reclaimed water use, but presents several difficulties to effective implementation of reclaimed water use plans.

In the San Dieguito hydrologic subarea the greatest possibility for reclaimed water use is in the alluvial aquifer (52,000 acre-ft of storage). Ground-water quality within the alluvium has deteriorated as a result of seawater intrusion, intrusion of ground water from surrounding marine sedimentary rock, and changes in natural recharge patterns. Currently, the aquifer is of limited value as a water supply, and dissolved-solids concentrations typically exceed the basin objective of 1,000 mg/L and may exceed 5,000 mg/L. Application of large quantities of reclaimed water may, in time, improve water quality within the aquifer and increase its usefulness.

During dry years, considerable storage would be available to accept reclaimed water. During wet years when recharge is available from the San Dieguito River, ground-water levels and storage would have to be manipulated to avoid waterlogging of soils and surface runoff of applied reclaimed water. If ground-water levels are lowered below sea level, seawater intrusion would have to be controlled. It will not be possible to eliminate intrusion of ground water from surrounding marine sedimentary rock.

Limited use of reclaimed water may be made in upland areas of the San Dieguito hydrologic subarea.

Reclaimed water use possibilities in the San Elijo hydrologic subarea are confined primarily to upland areas of the Pacific Coastal Plain having deep soils, high infiltration rates, and a gently rolling topography. In some areas reclaimed water applied to upland areas may enter the alluvial aquifer.

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Exhibit 13

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Estimated Infiltration, Percolation, and Recharge Rates at the Rillito Creek Focused Recharge Investigation Site, Pima County, Arizona

By John P. Hoffmann, Kyle W. Blasch, Don R. Pool, Matthew A. Bailey, and James B. Callegary

Abstract

A large fraction of ground water stored in the alluvial aquifers in the Southwest is recharged by water that percolates through ephemeral stream-channel deposits. The amount of water currently recharging many of these aquifers is insufficient to meet current and future demands. Improving the understanding of streambed infiltration and the subsequent redistribution of water within the unsaturated zone is fundamental to quantifying and forming an accurate description of streambed recharge. In addition, improved estimates of recharge from ephemeral-stream channels will reduce uncertainties in water-budget components used in current ground-water models.

This chapter presents a summary of findings related to a focused recharge investigation along Rillito Creek in Tucson, Arizona. A variety of approaches used to estimate infiltration, percolation, and recharge fluxes are presented that provide a wide range of temporal- and spatial-scale measurements of recharge beneath Rillito Creek. The approaches discussed include analyses of (1) cores and cuttings for hydraulic and textural properties, (2) environmental tracers from the water extracted from the cores and cuttings, (3) seepage measurements made during sustained streamflow, (4) heat as a tracer and numerical simulations of the movement of heat through the streambed sediments, (5) water-content variations, (6) water-level responses to streamflow in piezometers within the stream channel, and (7) gravity changes in response to recharge events. Hydraulic properties of the materials underlying Rillito Creek were used to estimate long-term potential recharge rates. Seepage measurements and analyses of temperature and water content were used to estimate infiltration rates, and environmental tracers were used to estimate percolation rates through the thick unsaturated zone. The presence or lack of tritium in the water was used to determine whether or not water in the unsaturated zone infiltrated within the past 40 years. Analysis of water-level and temporal-gravity data were used to estimate recharge volumes. Data presented in this chapter were collected from 1999 though 2002. Precipitation and streamflow during this period were less than the long-term average; however, two periods of significant streamflow resulted in recharge—one in the summer of 1999 and the other in the fall/winter of 2000.

Flux estimates of infiltration and recharge vary from less than 0.1 to 1.0 cubic meter per second per kilometer of streamflow. Recharge-flux estimates are larger than infiltration estimates. Larger recharge fluxes than infiltration fluxes are explained by the scale of measurements. Methods used to estimate recharge rates incorporate the largest volumetric and temporal scales and are likely to have fluxes from other nearby sources, such as unmeasured tributaries, whereas the methods used to estimate infiltration incorporate the smallest scales, reflecting infiltration rates at individual measurement sites.

Introduction

The city of Tucson and surrounding areas obtain most of their municipal, agricultural, and industrial water from ground water that is withdrawn from thick, alluvial-basin aquifers. The amount of water currently recharging the aquifers within the Tucson area is insufficient to meet current and future demands. Resultant ground-water deficits are manifested in water-level declines of more than 60 m since the middle of the 20th century. These declines are largest where ground-water withdrawals are greatest.

The alluvial aquifers are recharged by infiltration from irrigation and industrial returns and by seepage losses through stream channels. In the Tucson area, where the climate is semiarid, diffuse recharge through the basin sediments from precipitation is considered a negligible component of total recharge owing to low precipitation rates and high evapotranspiration (ET) rates (Scott and others, 2000). For instance, annual precipitation averages 31.5 cm on the valley floor, and annual potential ET ranges from 90 to 190 cm (Yitayew, 1990). Additionally, depth to ground water in the underlying alluvial basin can be tens of meters, providing opportunity for ample storage of infiltrated water. Because of these conditions, concentrated infiltration repeated over time, such as infiltration from irrigation and industrial returns, is necessary for recharge to occur. A large fraction of ground water stored in the allu-

vial aquifer was recharged by water that percolated through ephemeral stream-channel deposits (Davidson, 1973; Hanson and Benedict, 1994).

Rillito Creek, located in the Upper Santa Cruz Basin in southern Arizona (fig. 1), is typical of a large, ephemeral stream in the Southwest. In many basins of the Southwest, such as in the Upper Santa Cruz Basin, streams originating at higher elevations coalesce downstream to form larger ephemeral streams. Streams originating near mountain fronts typically flow over thick, alluvial valleys, lose hydraulic connection with the underlying aquifer, and are ephemeral in their lower reaches. Underlying many of these ephemeral streams is a coarse-grained stream-channel deposit that overlies a basin-fill deposit. The coarse-grained stream-channel deposit typically has high permeability and infiltration rates (Anderson and others, 1992; Hanson and Benedict, 1994).

Although recharge from infiltration of streamflow is known to occur in ephemeral-stream channels in the Southwest, such as Rillito Creek, the processes that control the spatial distribution and volume of infiltration that recharges the underlying aquifers are poorly understood. The Rillito Creek focused recharge investigation site was selected as one of six sites to study recharge processes in the Southwest (see chapter C) as part of the U.S. Geological Survey (USGS) Ground-Water Resources Program and generally is representative of ephemeral washes within the Sonoran Desert. Improving the understanding of streambed infiltration and the subsequent redistribution of water within the unsaturated zone is fundamental to quantifying and forming an accurate description of streambed recharge. Improved estimates of recharge from ephemeral stream channels will reduce uncertainties in water-budget components used in current ground-water models. In addition, recharge augmentation has been proposed along several reaches of ephemeral streams in the Tucson area, including Rillito Creek, and understanding processes that control recharge is important to the construction of recharge facilities.

Purpose and Scope

The purpose of this chapter is to present a summary of findings related to a focused recharge investigation along Rillito Creek, Pima County, Arizona. One of the challenges of quantitatively studying recharge beneath ephemeral streams is the need to integrate measurements made over a wide range of spatial and temporal scales. No single method of measurement or analysis can resolve the complex physical processes that contribute to infiltration, percolation, and recharge beneath ephemeral streams; therefore, a variety of approaches are presented that provide a wide range of temporal- and spatial-scale measurements of recharge beneath Rillito Creek.

Six approaches were used to evaluate infiltration, percolation, and recharge to the aquifer beneath Rillito Creek. Cores and cuttings were collected during the drilling of five boreholes. Laboratory measurements used to determine physical and hydraulic properties of these cored subsurface materials (Hoffmann and others, 2002) represent the smallest spatial scale in this investigation. The core-based data typically are on the order of several centimeters, but are scaled up to meters in this report. Water content extracted from the cores, and environmental tracers measured in these waters, represent a temporal scale that is a function of the thickness and hydraulic properties of the unsaturated zone: in general, these data represent a time scale of less than 2 years in this investigation. Seepage measurements made during sustained streamflow represent portions of a streamflow event and typically have time scales of a few hours to several days. Measurements of temperature and water content in vertical (one-dimensional) and two-dimensional profiles represent spatial scales that are typically less than 5 m and have temporal scales that vary from seconds to several days. Vertically nested piezometers were installed in the boreholes drilled in the stream channel to monitor water-level responses to streamflow. These measurements also represent a temporal scale that is a function of the thickness and hydraulic properties of the unsaturated zone and, in general, represents a time scale of weeks to several months in this investigation. Measurements of ground-water storage changes using temporal-gravity measurements have the largest spatial and temporal scales spanning several square kilometers and a period of record of several months to years. Data presented in this chapter were collected from 1999 through 2002.

Previous Investigations

Smith (1910) probably was the first investigator to examine recharge along Rillito Creek. He concluded there was a difference in infiltration rates between the flashy, silt-laden summer flows, and the steady, long-duration flows of the winter snowmelt runoff. This conclusion was based partly on seasonal well hydrographs and ground-water temperature data. Investigators to follow, such as Schwalen and Shaw (1957) and Matlock (1965), also concluded that winter streamflow was the most effective source of recharge to the Tucson Basin. Burkham (1970) developed an empirical formula to estimate infiltration along a 15-km reach of Rillito Creek on the basis of streamflow losses between discharge measurement points. Davidson (1973) suggested that at least 90 percent of the amount of infiltrated water results in recharge. The remaining 10 percent is lost to ET. Although not necessarily specific to Rillito Creek, the work of Wallace and Lane (1978) related infiltration potential to stream-channel order. Wallace and Lane concluded that the greatest infiltration potential occurs in the large-order streams because these streams contain the greatest volume of alluvium. Hanson and Benedict (1994) summarized previous estimates of recharge and developed new estimates on the basis of work by previous investigators and numerical simulation.

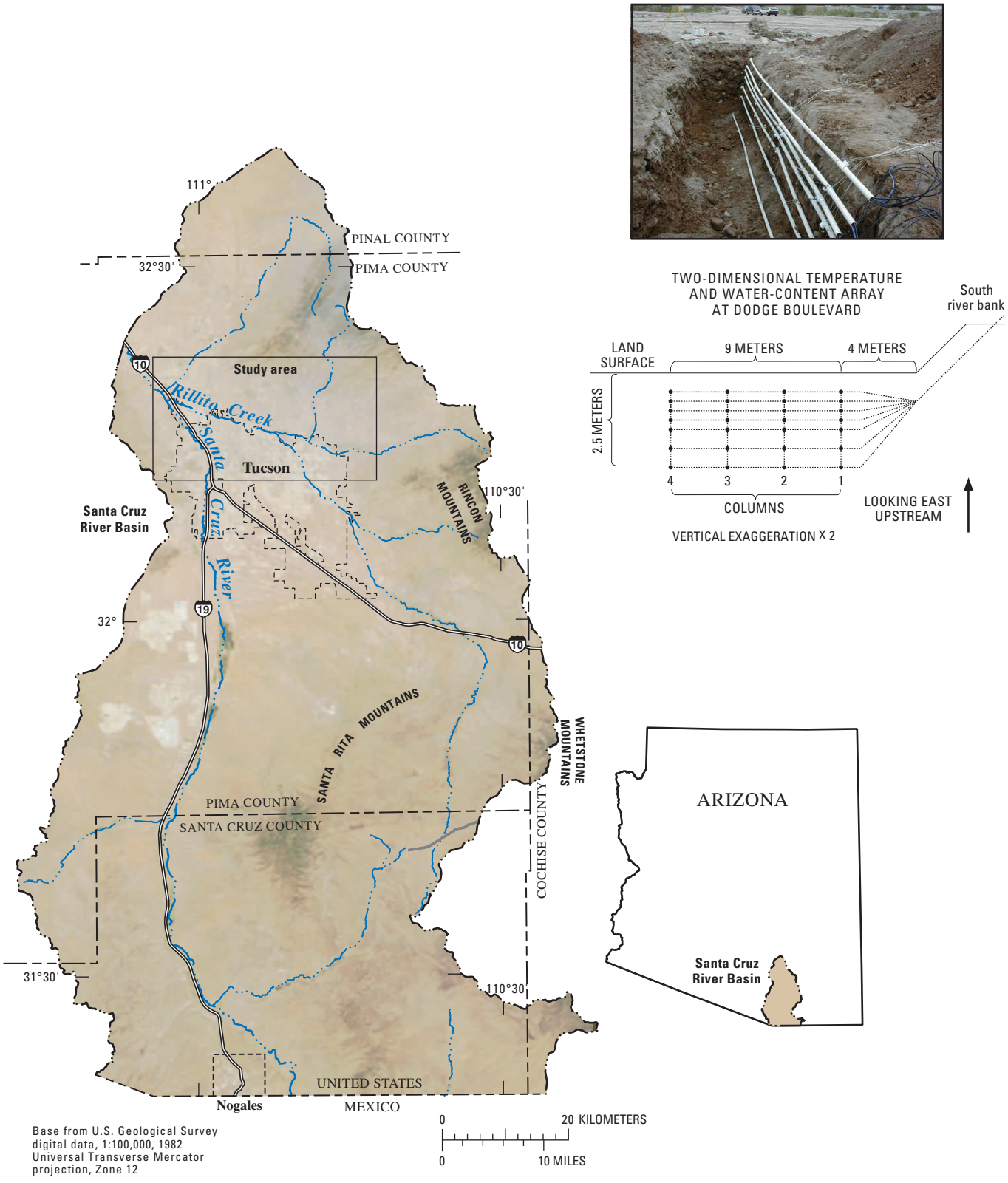

Figure 1. Location of study area, Pima County, Arizona.

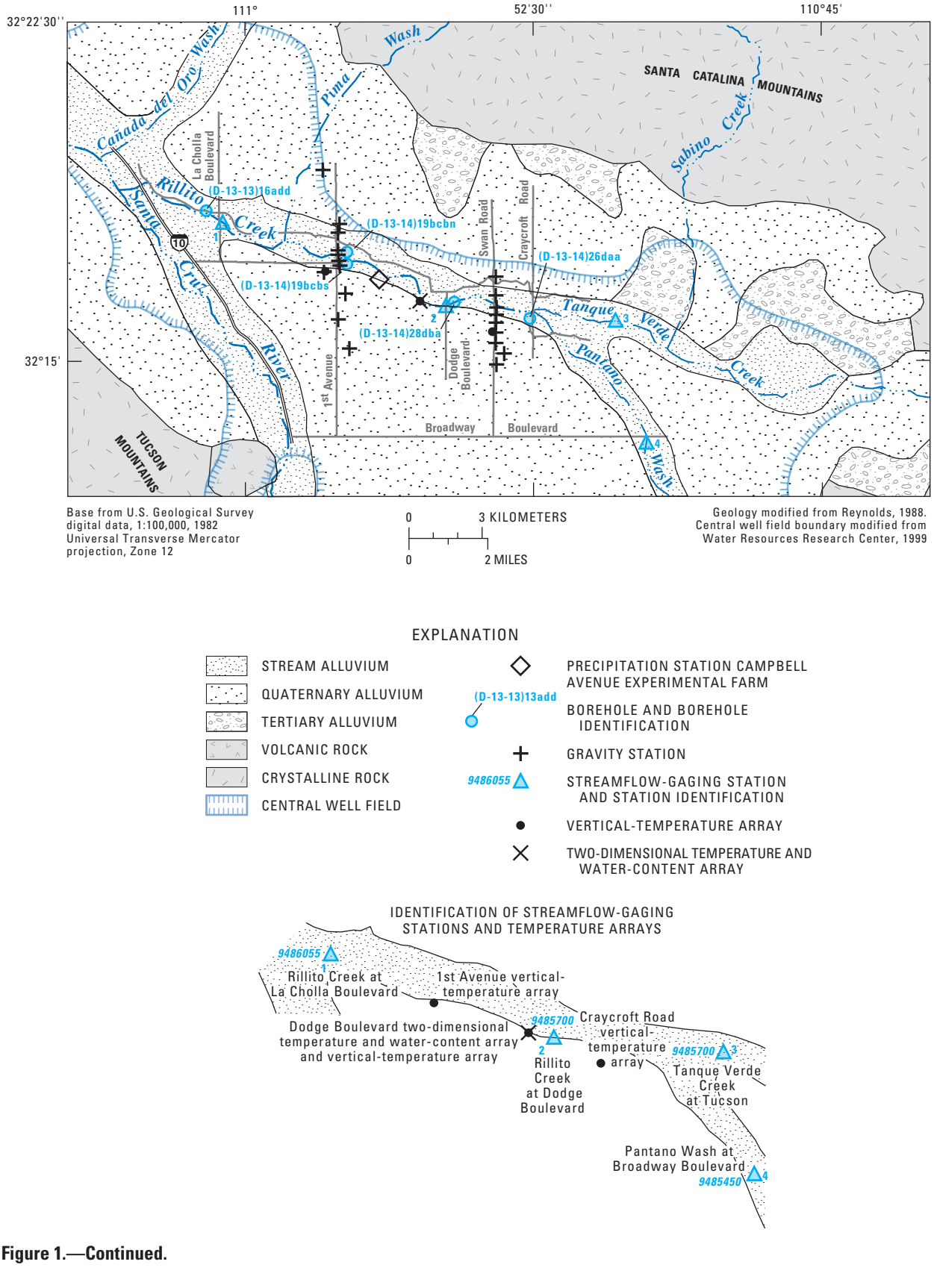

Figure 1.—Continued.

Hydrologic Setting

The climate of the study area is semiarid; annual rainfall averages 315 mm on the valley floor (fig. 2). There are two distinct seasons that account for most of the total precipitation; one (generally from July through September) is characterized by large summer convection and the other (generally from November through February) is characterized by frontal storms (fig. 2). The mean temperatures in January and July are 10°C and 29.6°C, respectively. To a lesser extent, there is a fall season of precipitation associated with tropical storms and climatic oscillations.

Rillito Creek is a tributary of the Santa Cruz River, which drains the Upper Santa Cruz Basin in southern Arizona. The Upper Santa Cruz Basin is in the Basin and Range Physiographic Province, which is characterized by block-faulted mountains separated by basins filled with alluvial sediments. The block-faulted mountains comprise Precambrian through Tertiary granitic, metamorphic, volcanic, and consolidated sedimentary rocks. The sediments that fill the basins are collectively termed alluvial basin-fill deposits and are composed of gravel, sand, silt, clay, and minor amounts of anhydrous sediments of Tertiary to Quaternary age. The basin-fill deposits generally are coarse grained along the basin margins and grade into finer-grained deposits and anhydrite deposits in the central parts of the basins. In the Upper Santa Cruz River Basin, thickness of the alluvium ranges from a thin veneer (a few meters) along the mountain fronts to as much as 3,400 m in the central parts of the basin (Davidson, 1973; Anderson, 1987, 1988; Hanson and Benedict, 1994).

Recent stream-channel deposits and basin-fill deposits underlie Rillito Creek. The recent stream-channel deposits, consisting of fine- to coarse-grained alluvium, are about 10 m thick and are detritus from the surrounding mountain ranges. The basin-fill deposits, which underlie the stream-channel deposits, are regionally extensive sedimentary units that form the regional aquifer system. Previous investigators have divided the basin-fill deposits into upper and lower basin-fill units on the basis of their general hydrogeologic characteristics (Pool, 1986; Hanson and Benedict, 1994). The upper basin-fill unit can be as much as 300 m thick. It consists mostly of unconsolidated to semiconsolidated gravel, sands, and clayey silt and is correlated to the upper Tinaja beds and the Fort Lowell Formation described by Anderson (1987, 1988). The lower basin-fill unit is a few thousand meters thick and consists of conglomerates, gravels, sands, silts, anhydritic clayey silts, and mudstones (Anderson, 1988). The lower basin-fill unit is represented by the Pantano Formation and the lower and middle Tinaja beds described by Anderson (1987, 1988).

Stream-channel infiltration is the predominant mechanism of recharge to the regional aquifer in the basin-fill deposits and, combined with contributions from other sources of recharge for the area, is less than the amount of water withdrawn to support the growing metropolitan population. As a result, water-level declines and related land subsidence have occurred in some areas. Depth to ground water immediately beneath Rillito Creek ranges from less than 6 m in the upper reach (near the mountain front) to 45 m near the Santa Cruz River (Hoffmann and others, 2002). Flow of ground water generally is northwestward; water-table elevations range from about 760 m in the southeast to 640 m in the northwest (Tucson Water, 2000). Ground water flows southwestward near the upper reach of Rillito Creek toward the major pumping center within the city of Tucson.

Rillito Creek has a drainage area of 2,256 km^2. It is ephemeral and most flows occur during the summer monsoon (July–September) and winter frontal storms (December–March; fig. 2). Characteristic monsoon streamflows result from localized short-duration convective storms, whereas winter streamflows are produced by longer-duration frontal storms and accumulated snowmelt. To a lesser extent, there also is a fall season in which tropical storms and climatic oscillations often result in streamflow.

The creek has two major tributaries, Tanque Verde Creek and Pantano Wash; Rillito Creek begins at the confluence of these two tributaries. Tanque Verde Creek drains a 702 km^2 area from the Santa Catalina and Rincon Mountains; Pantano Wash drains a 1,554 km^2 area between the Rincon, Santa Rita, and Whetstone Mountains. Several small washes divert runoff from the northeastern suburbs of Tucson into Rillito Creek. Rainfall runoff and snowmelt runoff from the Santa Catalina and Rincon Mountains contribute most of the flow to Rillito Creek. The creek flows westward to the Santa Cruz River from an elevation of 762 m at the confluence of Tanque Verde Creek and Pantano Wash to 657 m at its confluence with the Santa Cruz River. The creek is about 100 m wide and the channel slopes toward the Santa Cruz River at approximately 5.2 m/km with little variation in the slope. Flows in Rillito Creek typically are less than 28 m^3/s; the maximum recorded discharge was 680 m^3/s during the 1993 El Niño season (Tadayon and others, 2000). On average, Rillito Creek flows about 36 days per year at the streamflow-gaging station Rillito Creek at Dodge Boulevard (09485700). The average annual flow is approximately 33.3×10^6 m^3; about 44 percent of the flow occurs from the summer monsoonal storms, whereas about 56 percent of the flow occurs from the winter frontal storms.

The amount of water flowing in Rillito Creek, and therefore the amount available for recharge, is primarily related to precipitation frequency, distribution, and intensity, as well as to basin/channel runoff characteristics. The temporal distribution of flow in ephemeral streams is highly variable with observed decadal oscillations (Webb and Betancourt, 1992; Don Pool, Hydrologist, U.S. Geological Survey, written commun., 2003). Because of this, it is particularly difficult to estimate or predict recharge rates for ephemeral-stream channels on the basis of limited temporal observations. During the period of investigation there were two significant streamflow periods (fig. 3); one occurred in the summer of 1999 and the other in the fall of 2000 (mostly after September 30, or during water year 2001). Annual streamflow in Rillito Creek for the period of study was somewhat less frequent and smaller in volume than the long-term average (table 1). Prior to this study, a significant streamflow period occurred in the winter

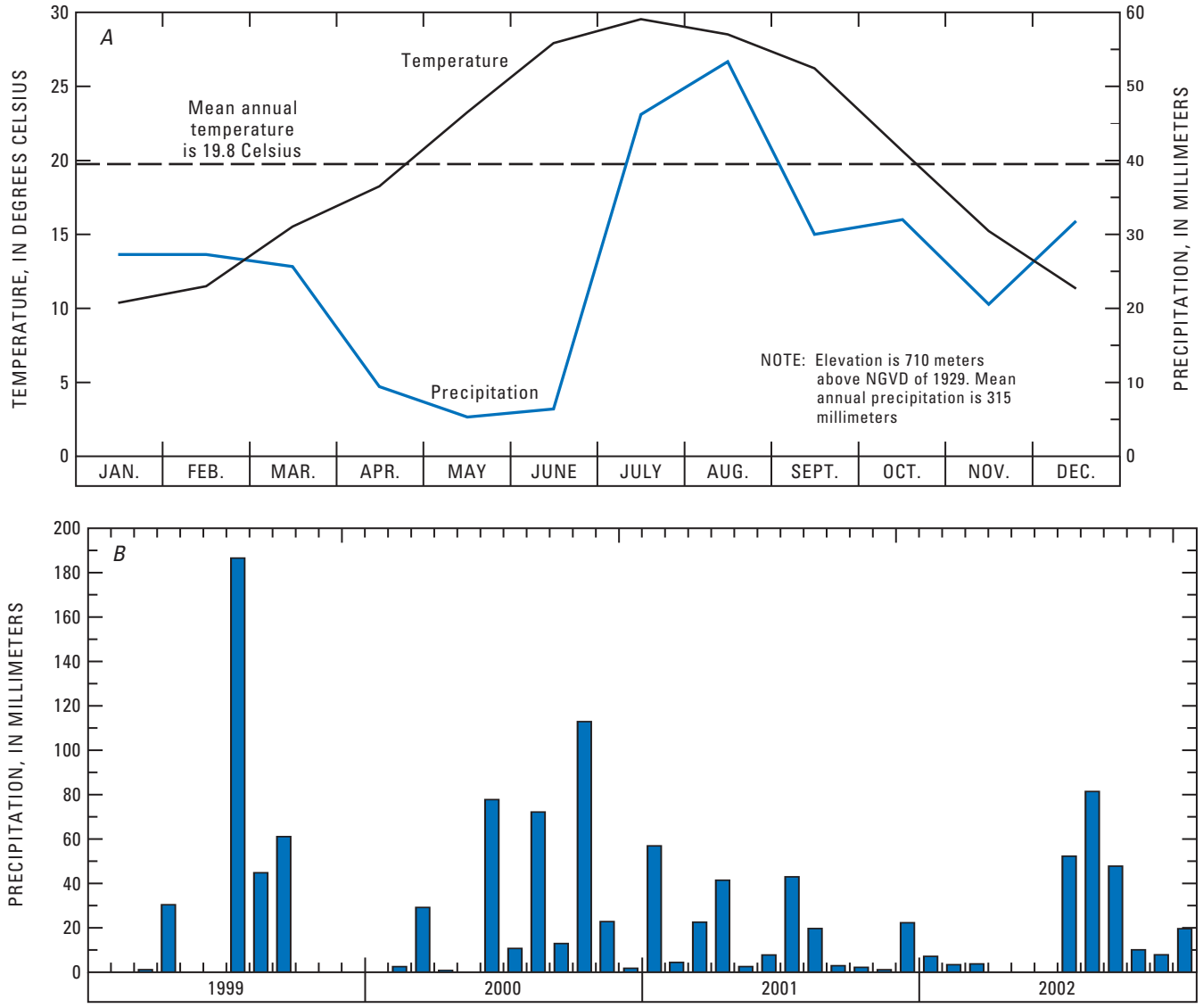

Figure 2. *A*, Monthly average temperature and precipitation, 1972–2002, at National Weather Service Station Campell Avenue Experimental Farm near Rillito Creek, Pima County, Arizona; *B*, monthly precipitation near Rillito Creek during period of study, 1999–2002.

and spring of 1998 (water year 1998) that was associated with El Niño precipitation and snowmelt. From February through April 1998, a total of 28.7×10^6 m^3 flowed past the streamflow-gaging station at Dodge Boulevard.

Infiltration, Percolation, and Recharge Rates

Physical and Hydraulic Properties of Stream-Channel and Basin-Fill Deposits

In March and April 1999, five boreholes were drilled at four sites in the active channel of Rillito Creek (fig. 1) to determine the physical and hydraulic properties of the stream-channel and basin-fill sediments down to about 10 m below the water table (Hoffmann and others, 2002). Each borehole was drilled using the ODEX air-hammer method, which is also known as the under-reamer method (Driscoll, 1986; Hammermeister and others, 1986). The ODEX method was used because it does not use fluids, thereby minimizing disturbance of the subsurface materials. At each hole, cuttings were collected about every 0.3 m. Fifty-one cores also were collected from these boreholes at 2- to 6-m intervals. The cores and cuttings were analyzed for physical properties, such as particle-size distribution, bulk density, particle density, porosity, volumetric water content, and percent saturation, and for hydraulic properties, such as saturated and unsaturated hydraulic conductivity, matric potential, and water-retention fitting terms. The detailed findings of these analyses are

described in Hoffmann and others (2002). This section of the chapter focuses on the hydraulic properties of the sediments and their role in infiltration rates, velocity of the wetting front, and potential recharge.

In order for ephemeral streamflow within Rillito Creek to recharge the underlying aquifer, the water must first infiltrate into the stream-channel deposits and percolate downward through the underlying deposits. The ability of water to infiltrate and percolate through these deposits is primarily a function of stream discharge and hydraulic properties of the deposits. One-dimensional steady-state vertical flow through a homogeneous, isotropic medium can be described by a form of Darcy's Law as:

$$q = -K(\theta)\left(\partial\psi/\partial z + 1\right) , \qquad (1)$$

where

q is the flux [L/T],
θ is the volumetric water content,
$K(\theta)$ is the hydraulic conductivity [L/T] as a function of the volumetric water content,
ψ is the pressure head of the water phase [L], and
z is the vertical dimension [L].

Determination of the rate of flow requires knowledge of the hydraulic conductivity and saturation of the porous media, and the head gradient. Water continues to move within the unsaturated zone after it has infiltrated across the ground surface. This subsurface redistribution is described by the unsaturated-flow equation:

$$\partial\theta/\partial t = \nabla q , \qquad (2)$$

with the flux, q, as defined above. Because redistribution is inherently transient and multidimensional, fewer simplifying assumptions can be applied in the analysis of redistribution than can be applied to infiltration. To fully characterize subsurface redistribution, measurements of both water flux and changes in subsurface water storage must be made repeatedly throughout the unsaturated zone.

As shown in the section titled "Temperature and Water Content," vertical infiltration rates at the onset of infiltration were as high as 22 mm/s because of high hydraulic permeability, low antecedent water content, and resulting large capillary gradients. Two-dimensional flow is also evident, and lateral velocities were about the same as vertical velocities. Shortly after the onset of infiltration, however, the near-surface stream-channel deposits are saturated, and large capillary gradients decline. Flow of water becomes predominantly vertical, as gravity is the dominant process controlling the

Table 1. Annual streamflow measured at Rillito Creek at Dodge Boulevard (streamflow-gaging station 09485700), Pima County, Arizona, during period of study.

Water year[1]	Total annual streamflow, in cubic meters	Annual flow as a percentage of long-term annual streamflow	Percentage of annual stream-flow that occurred in summer	Percentage of annual stream-flow that occurred in winter
1999	11×10^6	33	98	2
2000	3.5×10^6	10.5	100	0
2001	19.6×10^6	59	5	95
2002	2×10^6	6	99	1

[1]Water year extends from October 1 through September 30 and is designated by the calendar year in which it ends.

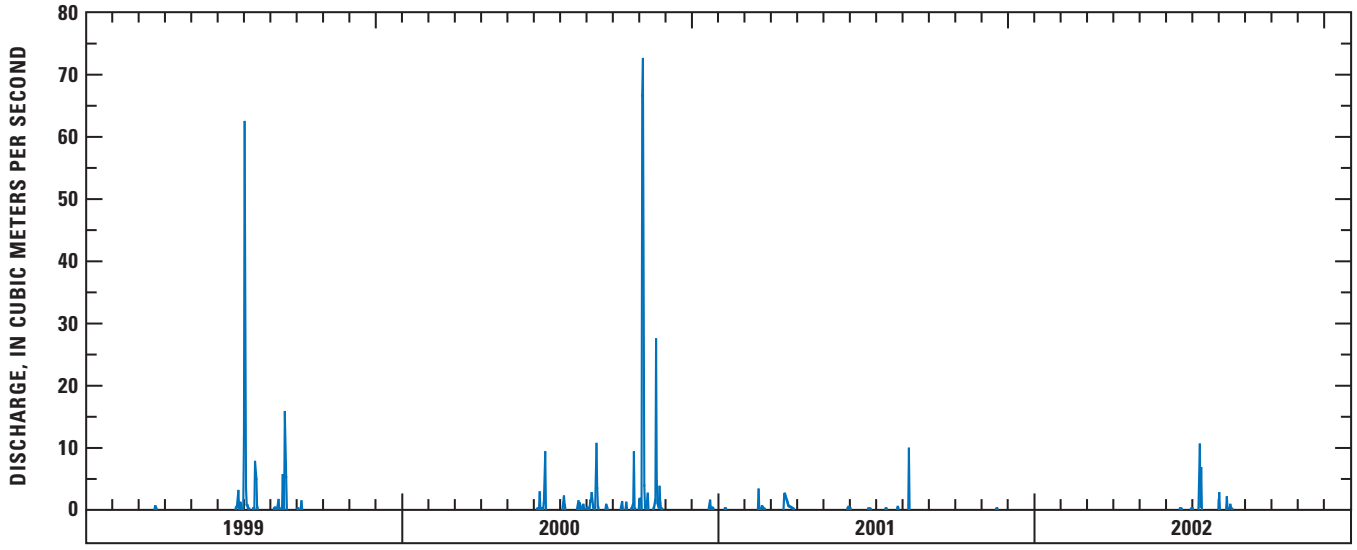

Figure 3. Mean discharge at Rillito Creek at Dodge Boulevard (streamflow-gaging station 09485700), 1999–2002, Pima County, Arizona.

direction of flow. From Darcy's Law, the flow rate through the sediments under saturated conditions is equal to the product of the hydraulic conductivity and the hydraulic gradient. If both hydraulic conductivity and gradient are known, then the flow rate can be calculated. This method of flow-rate estimation can be used for saturated and unsaturated conditions. Assuming properties of the pore water are constant, saturated hydraulic conductivity (K_{sat}) is a constant and is related to the texture and structure of the sediment. Unsaturated hydraulic conductivity is not a constant as it decreases rapidly as water content decreases. As surface flow proceeds, the infiltrated water moves farther below the surface of the streambed, capillary forces become less significant, and the hydraulic gradient approaches unity. If a unit gradient is assumed, the rate of infiltration becomes equivalent to the saturated hydraulic conductivity of the channel deposits.

On the basis of findings from the cuttings and cores, the stream-channel deposits beneath Rillito Creek are coarse grained, typically consisting of more than 95 percent gravel and sand. The underlying basin-fill deposits also are sandy gravels or gravelly sands, but typically contain more silt and clay than the stream-channel deposits.

Saturated vertical hydraulic conductivity of the deposits positively correlates with grain size (fig. 4). Values for the stream-channel deposits range from 0.3 to 2.5 m/d, whereas values for the basin-fill deposits tend to be less than about 0.6 m/d and in places are as low as 0.012 m/d. For heterogeneous media, such as the deposits beneath Rillito Creek, the equivalent vertical hydraulic conductivity is calculated as the harmonic mean of the K_{sat} for each layer within the deposits and is always less than the arithmetic mean (Freeze and Cherry, 1979). Although differing at each borehole, the overall average equivalent hydraulic conductivity of the stream-channel deposits is 1.2 m/d; the overall average equivalent hydraulic conductivity of the basin-fill deposits is 0.19 m/d; and the equivalent hydraulic conductivity of the combined sediments (stream-channel and basin-fill deposits) is 0.23 m/d. The calculated average vertical hydraulic conductivity for the basin-fill sediments reported by Hoffmann and others (2002) includes values associated with a fine-grained unit found in a lower reach of Rillito Creek near the Santa Cruz River. These values typically are as low as 0.012 m/d and may not be representative of the hydraulic conductivity in upstream reaches. Excluding the hydraulic-conductivity values for the basin-fill sediments in the lower reaches where the fine-grained unit was present, the average vertical hydraulic conductivity of the study area is 0.3 m/d. Assuming a unit gradient, equivalent vertical hydraulic conductivity values are equivalent to the rate of infiltration and provide an estimate of potential recharge rates under saturated conditions.

Saturated conditions will exist only after sustained periods of streamflow infiltration at a rate that enables water to fully saturate the underlying sediments from the streambed to the aquifer. Once a saturated hydraulic connection is achieved between the stream and underlying aquifer, the system behaves as though the stream were perennial. Unsaturated hydraulic-

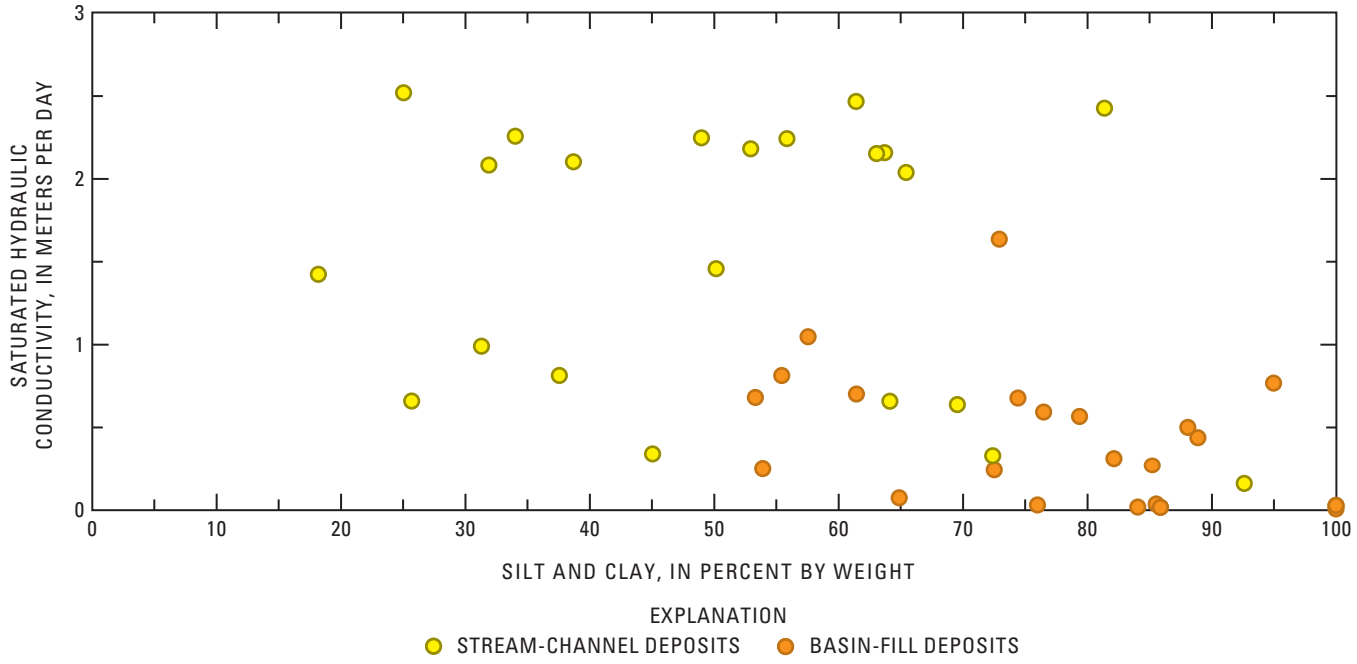

Figure 4. Relation of saturated hydraulic conductivity to sand, silt, and clay content for cores collected from boreholes drilled along Rillito Creek, Pima County, Arizona.

conductivity values need to be considered when estimating potential recharge rates for conditions prior to full saturation. Unsaturated hydraulic conductivity of the deposits beneath Rillito Creek varies by several orders of magnitude as a function of water content. For water-content conditions at the time of core collection, the unsaturated hydraulic conductivity was generally two or more orders of magnitude less than the saturated hydraulic conductivity (Hoffmann and others, 2002).

Antecedent pore water underlying Rillito Creek derives from streamflow infiltration and subsequent percolation. In this study, cores were collected in late March 1999; therefore, antecedent pore water was derived from streamflows prior to March 1999. Several flow events prior to 1999 could have been sources of the antecedent water. On the basis of streamflow records at the streamflow-gaging station at Dodge Boulevard, the most recent flow prior to core collection occurred in November 1998 and lasted for 2 days (average streamflow was less than 0.82 m^3/s). The last recorded flow prior to November 1998 occurred in the summer of 1998 and lasted for about 1 day. The most voluminous and long-lasting flow within a few years of the core collection was the sustained flow from February to April 1998, which was related to the 1998 El Niño precipitation.

Volumetric water content in the unsaturated zone ranged from 0.02 to 0.46 at the time of core collection (fig. 5). Variability in water content primarily is controlled by differences in sediment texture and is positively correlated with the percentage of fine-grained material (fig. 5). The stream-channel deposits averaged 17.8 percent water content and 57.6 percent saturation; the basin-fill deposits averaged 24 percent water content and 69.3 percent saturation. Integrating the water content over the thickness of the unsaturated zone, cumulatively, the unsaturated sediments beneath Rillito Creek contained 0.5 to 12.2 m of water. The smallest amount of water was in the upstream area at the borehole ((D-13-14)26daa) near Craycroft Road where the unsaturated zone was about 3 m thick; the largest amount of water was in the downstream area at the borehole ((D-12-14)26add) near La Cholla Boulevard where a 12-m thick fine-grained unit lies above the water table. The sites probably most representative of the unsaturated zone beneath Rillito Creek are in the middle reaches where the unsaturated zone was 30 to 40 m thick and had 6.1 m of water (boreholes (D-13-14)19bcbn, (D-13-14)19bcbs, and (D-13-14)28dba). The large amount of water stored in the unsaturated zone indicates that much of this water probably originated from the sustained flows prior to the summer of 1998, that the stored water is likely to be from several different streamflow and infiltration events, and that the sediments beneath Rillito Creek drain slowly.

Environmental Tracers

Environmental tracers of tritium (^3H), oxygen-18 (^{18}O), deuterium (^2H or D), and chloride from the pore waters in the unsaturated and saturated zones were analyzed to evaluate spatial variations in infiltration and recharge patterns along Rillito Creek. Tritium is a naturally occurring radioactive isotope of hydrogen with a half life of 12.43 years. Large concentrations of tritium were introduced into the atmosphere beginning in 1952 as a result of the atmospheric testing of nuclear

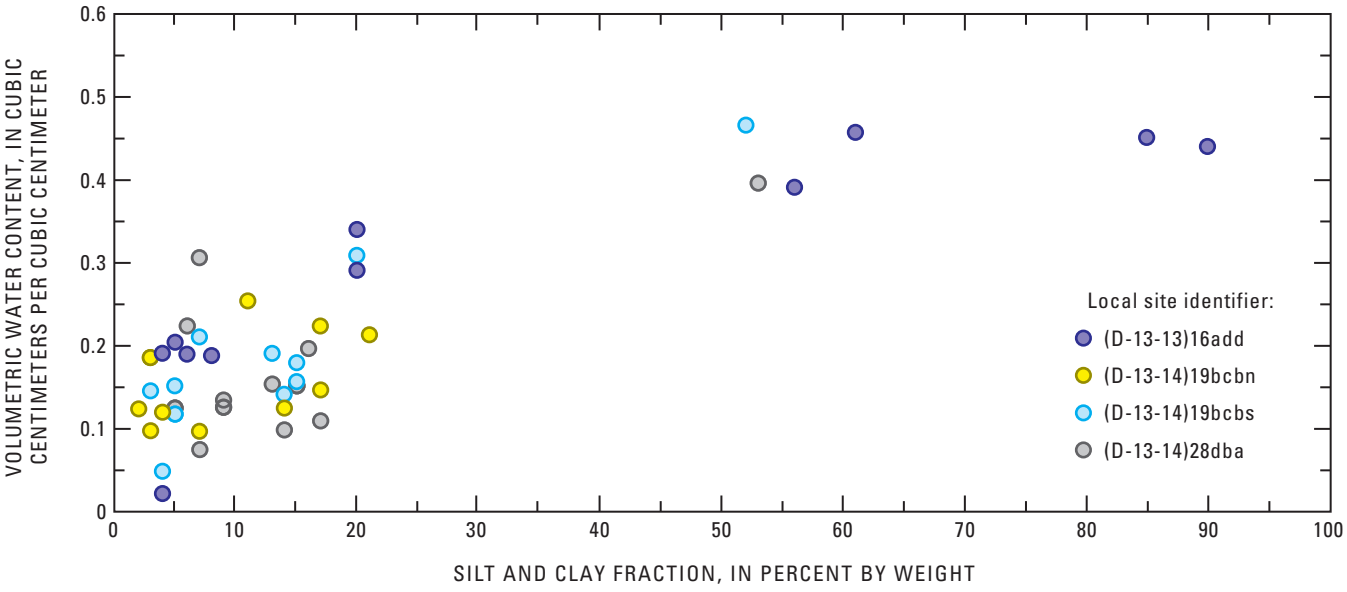

Figure 5. Relation of volumetric water content to sand, silt, and clay content for cores collected from boreholes drilled along Rillito Creek, Pima County, Arizona.

weapons. The input of tritium into the atmosphere related to nuclear weapon testing peaked at nearly 6,000 tritium units (TU) in 1963–64 prior to a ban on the tests. Atmospheric tritium concentrations returned to natural conditions by 1992 (Dr. Chris Eastoe, geochemist, University of Arizona, written commun., 2003), and the concentration of tritium in precipitation today is about 5 to 7 TU. Tritium concentrations are often used for dating ground water and to detect events, such as the 1963–64 peak. In this study, tritium was measured in water vacuum extracted from cores and analyzed by liquid scintillation with electrolytic enrichment (Thatcher and others, 1977) at the USGS laboratory in Menlo Park, California. Tritium was detected in pore water extracted from each core sample and ranged in concentration from 2 to 11 TU (fig. 6). The precision of individual measurements was ±0.3 TU. For the purposes of this study, waters having tritium concentrations in this range are interpreted as having infiltrated within the past 40 years. Tritium concentrations within a given profile could not be used to identify an event marker, such as the 1963 peak.

Given the presence of tritium in the unsaturated zone, the locally high vertical hydraulic conductivity values of more than 1 m/d in the stream-channel deposits, and depths to the water table of generally less than 40 m, it is likely that most of the pore water extracted from the cores was derived from runoff events during the few years prior to 1999.

Assuming negligible mixing of infiltrated waters, variations in isotopic signatures and chloride concentrations can be used to identify individual runoff and infiltration events. These unique signatures remain intact during infiltration and allow direct identification of runoff events as the infiltrated water migrates through the unsaturated profile. Sampling through the unsaturated zone at a point in time provides a snapshot of the isotopic and chemical signatures throughout the profile. This snapshot represents the composition of the water that infiltrated into the sediment over a period of time—the deepest water representing the beginning of the period. The downward rate of water movement at a particular site is calculated using the time elapsed between the runoff event and depth of infiltration of the water in the profile.

Oxygen and hydrogen isotopic compositions were determined for water extracted from cores by azeotropic distillation (Revesz and Woods, 1990) with toluene at the USGS laboratory in Reston, Virginia, using analytical methods described by Epstein and Mayeda (1953). Isotopic variations in water are expressed as a per mil ratio (δ value), which is a ratio of $^{18}O/^{16}O$ and $D/^{1}H$ in a sample relative to the ratio in an ocean water standard (Clark and Fritz, 1997). The delta symbol in this report is followed by the chemical symbol for the heavier isotope measured during isotopic analysis. Isotopic values are described as lighter or heavier in relation to each other. Lighter isotopic values are smaller or more negative per mil values, and heavier isotopic values are larger or more positive per mil values.

The source of precipitation is evaporation of seawater; therefore, the $\delta^{18}O$ and δD composition of precipitation is linearly correlated, which is known as the meteoric water line

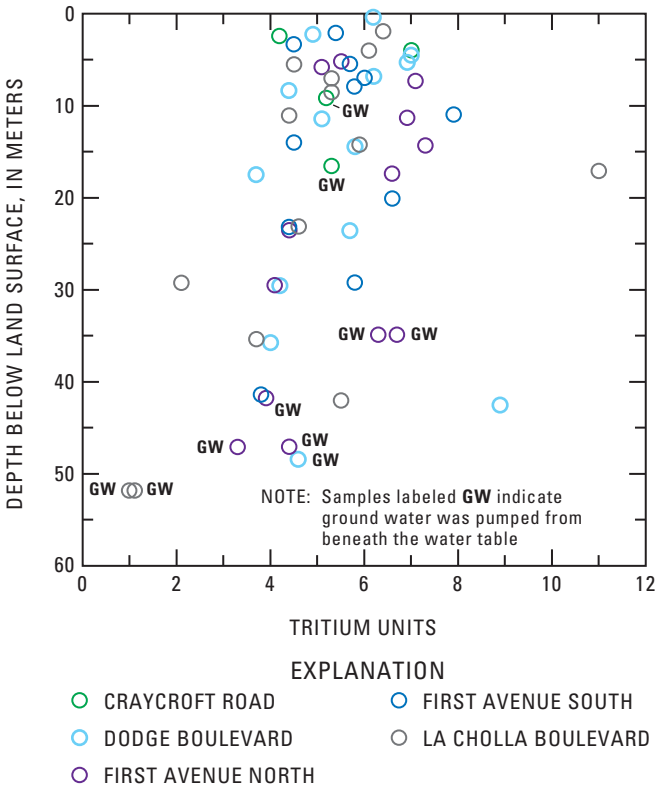

Figure 6. Profile of tritium content in water collected from boreholes drilled along Rillito Creek, Pima County, Arizona.

(MWL; Craig, 1961). Values of $\delta^{18}O$ and δD in precipitation vary from event to event and also seasonally. Many variables influence the isotopic signature of a precipitation event, including the origin, travel path, and duration of the storm, and the elevation and temperature of condensation prior to rainfall. In general, however, variations in isotopic signature are predominately temperature dependent. The cool, high-altitude precipitation events produce water having lighter isotopic ratios than water from the warm precipitation events. In addition, evaporation will result in $\delta^{18}O$–δD data for the remaining water that plot to the right of the MWL. A more detailed discussion on variations of isotopic ratios can be found in Clark and Fritz (1997).

Values of $\delta^{18}O$ and δD in waters extracted from the unsaturated zone range from about -12 to -6 per mil, and -80 to -37 per mil, respectively (fig. 7). Data for many of the samples indicate the effect of evaporation (fig. 7). Isotopic compositions from the Dodge Boulevard site generally indicate the greatest amount of evaporation, and isotopic data from a sample collected at First Avenue North from a depth of less than 1 m indicated the greatest amount of evaporation for any sample (fig. 7). Variations in isotopic compositions of water from the unsaturated zone beneath Rillito Creek are, therefore, attributed to both changes in the isotopic signatures of the source water and to evaporation. Those samples that lack an evaporative signal indicate that percolating waters were not exposed to significant evaporation prior to infiltration.

Several trends were evident in the isotopic ratios of Rillito Creek pore water. One trend is related to the location in the stream reach where the samples were collected. The water-weighted mean isotopic signature of the pore water in the unsaturated zone generally becomes lighter in the downstream direction (fig. 8). The water weighted mean uses the water content of the core as a weight that is multiplied by the isotopic ratio of the extracted water. Pore water in the borehole near Dodge Boulevard ((D-13-14)28dba) had $\delta^{18}O$ and δD values of -8.0 of -55.0 per mil, respectively, whereas pore water downstream in the borehole near LaCholla ((D-13-13)16add) had $\delta^{18}O$ and δD values of -9.5 and -64.0 per mil, respectively. At the intermediate boreholes near First Avenue ((D-13-14)bcbn and (D-13-14)19bcbs), $\delta^{18}O$ and δD values were -8.8 of -60.3 per mil, respectively. These variations are larger than the analytical precision (2-sigma values of 0.2 and 2 for $\delta^{18}O$ and δD, respectively; thus, in 95 percent of repeat analyses the same sample would result in $\delta^{18}O$ within 0.2 per mil of the originally reported value and the δD values would be within 2 per mil of the originally reported value). Evaporative effects would cause a trend opposite to the observed data; therefore, the trend is likely a function of the origin and season of precipitation events that resulted in streamflow and subsequent infiltration at the downstream sites. Specifically, for the time period represented by the unsaturated zone pore water, it is the longer duration and isotopically lighter winter storms that were more important contributors to infiltration in the downstream reaches than in the upstream reaches. The exception to this trend is at the uppermost borehole near Craycroft Road ((D-13-14)26daa) where the lightest values, a $\delta^{18}O$ of -10 per mil, and a δD of –65 per mil, were measured. Depth to water at this site, however, is commonly only a few meters below the streambed; therefore, water in the unsaturated zone at the time of core collection probably is representative of infiltration only from the most recent streamflows.

Another trend in the isotopic data is that water from the saturated zone has $\delta^{18}O$ and δD values that are consistently lighter than those in water from the unsaturated zone and do not reflect evaporation effects as do those in water from the

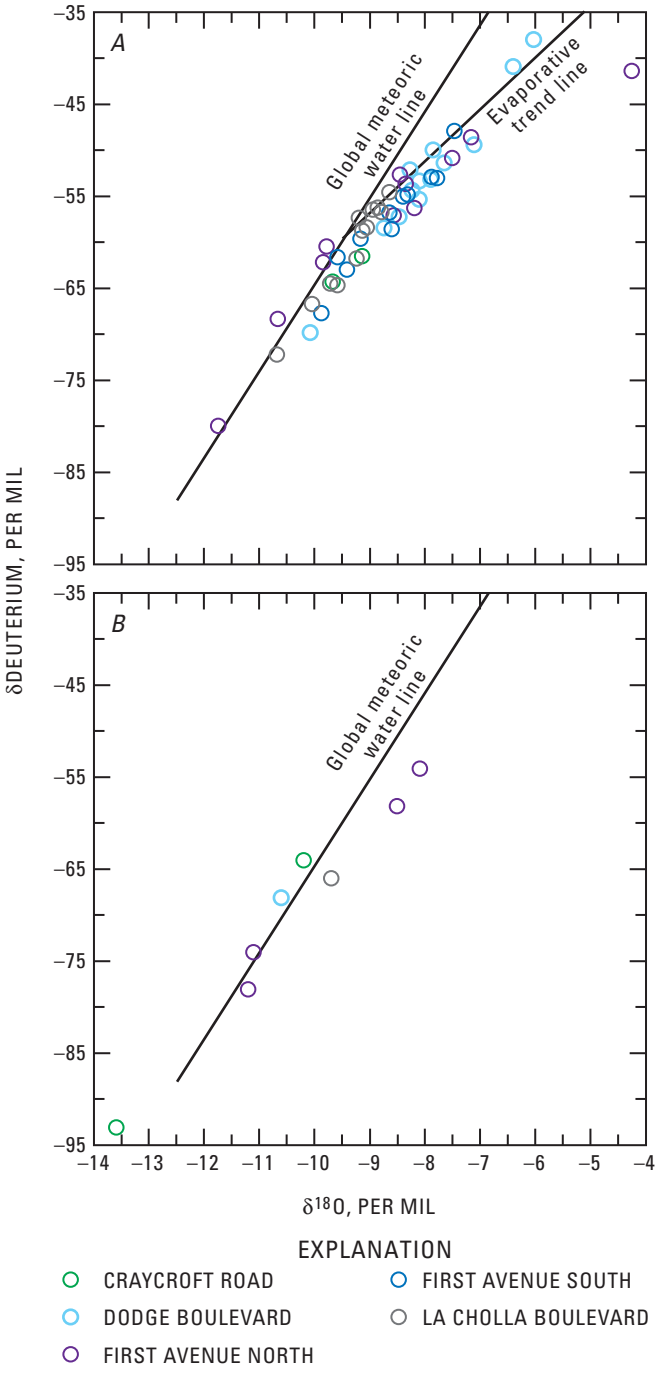

Figure 7. Stable isotope data of pore water collected from cores collected from boreholes drilled along Rillito Creek, Pima County, Arizona. *A*, unsaturated zone; *B*, below the water table.

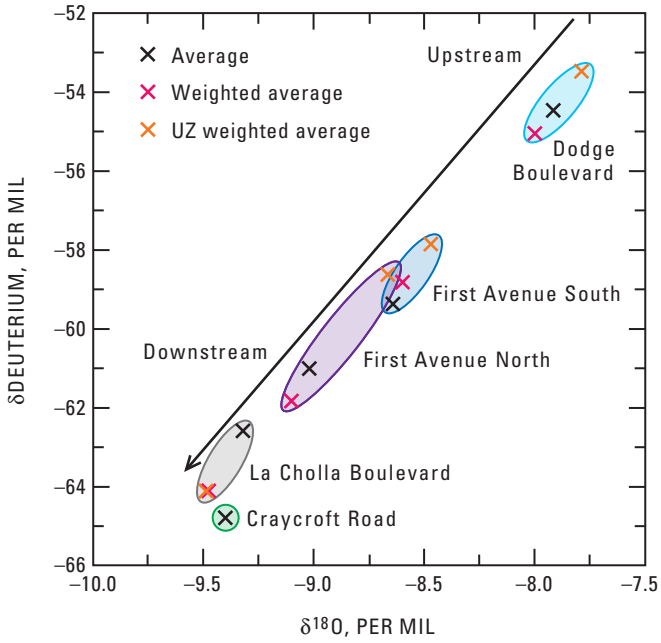

Figure 8. Weighted average of stable isotope values from pore water collected from boreholes along Rillito Creek Pima County, Arizona.

unsaturated zone (fig. 8). This lighter isotopic composition in the ground water from beneath the water table indicates a greater influence of winter and (or) higher elevation precipitation in the ground water than for the water in the unsaturated zone at the time of collection. The lack of an evaporative signal indicates that water that reaches the water table is exposed to minimal evaporation.

Oxygen-18 ($\delta^{18}O$) and δD data for precipitation in the Tucson Basin collected prior to the study period were analyzed to define a possible isotopic input function to the system. Isotopic compositions for precipitation in the Tucson Basin that resulted in Rillito Creek streamflow indicate that light compositions are associated with the winter 1998 El Niño weather pattern, whereas compositions are varied for the summer precipitation events of 1997 and 1998 (fig. 9).

A substantially heavy isotopic signal was associated with precipitation in April and August 1998. Assuming conservative behavior, isotopic compositions measured in the precipitation are possible event markers that might be identified in the unsaturated zone. In order to identify event markers in the unsaturated zone, vertical profiles of $\delta^{18}O$ and δD were compared to $\delta^{18}O$ and δD in samples of runoff (fig. 10). This analysis was done for the borehole near Dodge Boulevard because it is near the streamflow-gaging station at Dodge

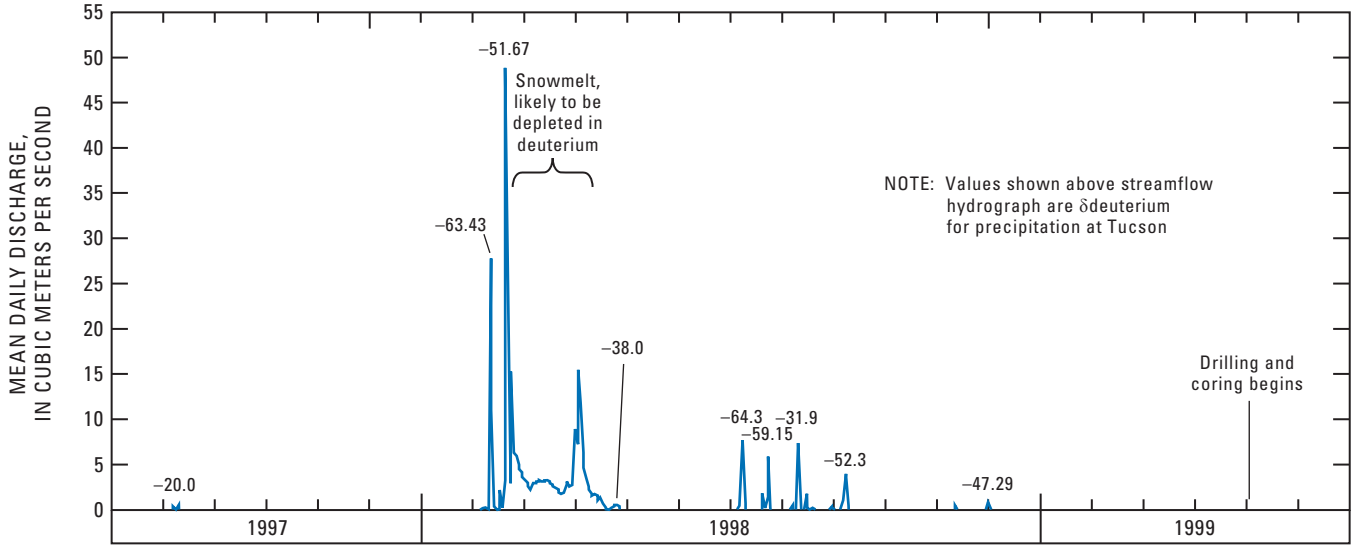

Figure 9. Hydrograph of streamflow gaging station 09485700 Rillito Creek near Dodge Boulevard (09485700) and associated stable isotope values determined for precipitation.

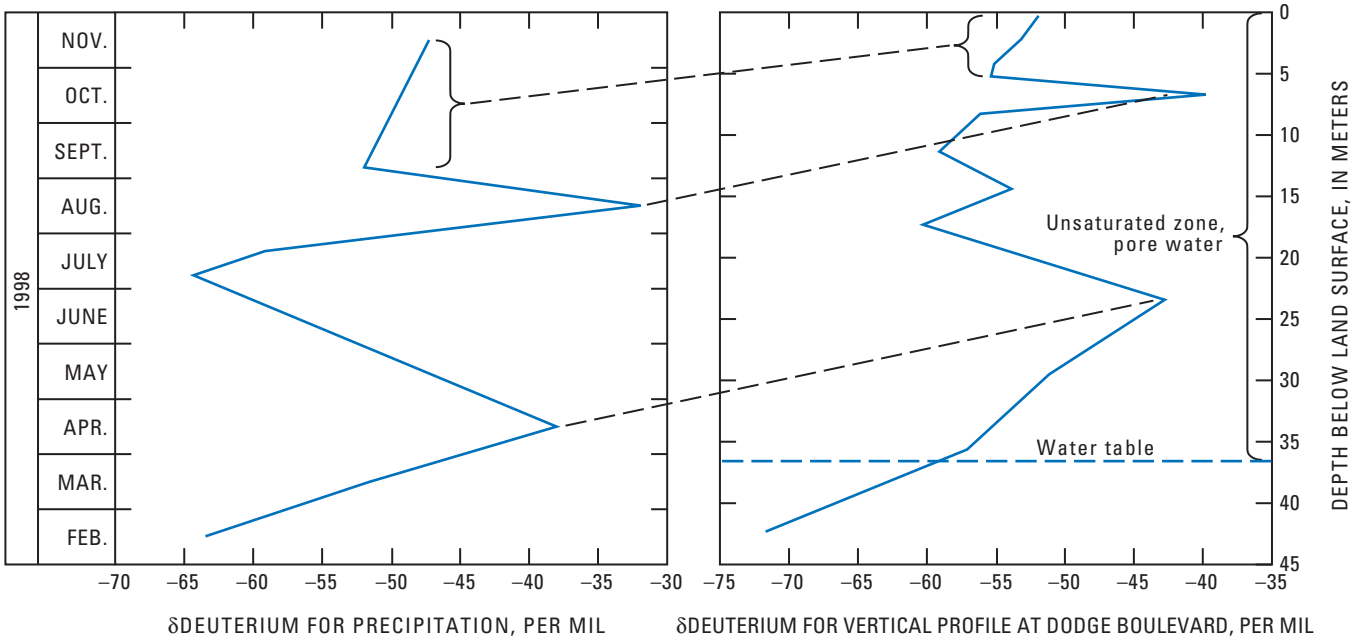

Figure 10. Comparison of stable isotope values in vertical profile to stable isotopic values of precipitation.

Boulevard (09485700). The hydrograph for this gaging station was used to determine timing of streamflow prior to drilling and coring. The trends in isotopic compositions measured in the pore-water cores approximately match the pattern of signatures in the basin precipitation from particular storms that occurred from February to November 1998. For instance, the heavy isotopic compositions in precipitation in April and August 1998 are possibly identified in pore water from depths of 6.5 and 23 m, respectively (fig. 10). Below 23 m, the compositions become lighter and are similar to those of the El Niño precipitation events about 14 months prior to the drilling and coring. If this interpretation is correct, water in the unsaturated zone below about 23 m is likely to have originated from sustained flows related to 1998 El Niño precipitation. Discrete pore-water sampling and minor mixing of pore water within the unsaturated zone can explain why the values for precipitation tend to have a wider range (-32 to -65 δD) than values for the unsaturated zone pore water (-40 to -61 δD). Correlation between the precipitation events and depths of infiltration, on the basis of corresponding isotopic signatures, indicates an average vertical linear velocity of approximately 0.049 m/d at the borehole near Dodge Boulevard. This velocity represents the downward percolation rate of water. Percolation is defined here as the flow of water that has infiltrated and is moving downward or lateral toward the water table. Note that infiltration connotes movement of water into sediments, in contrast to percolation, which connotes movement through sediments. Owing to the decrease in hydraulic conductivity with decreasing water content, the percolation rate is less than the measured saturated hydraulic conductivity.

Chloride concentrations in pore-water leachate were determined from drill cuttings at 0.3-m depth intervals. To derive the leachate, 50 mL of distilled water was mixed with 50 g of sieved cuttings having a particle size of less than 1 mm. The mixture was stirred and the specific conductance measured. An ion-specific probe was used to measure the chloride concentration after the specific conductance stabilized. Chloride concentrations are reported for the boreholes near Dodge Boulevard and near First Avenue (fig. 11).

Chloride concentrations at the borehole near La Cholla Boulevard between about 10 and 30 m are not presented because the fine-grained unit at this depth made leaching and sieving difficult, and therefore the results were suspect. Chloride concentrations are not presented for the borehole near Craycroft Road because of the shallow water table there.

Chloride concentration in runoff varies as a function of the precipitation location and the runoff travel path and surface-contact time. Chloride concentrations measured in the profile varied substantially through the upper 18 m at all sites (fig. 11). Below about 18 m, the variation in concentration declined considerably. On the basis of δ^{18}O and δD data discussed previously, this zone of smaller variation corresponds to the infiltration depth of the 1998 El Niño water. The small variation and low mean chloride concentration are attributed to infiltration from sustained streamflow having a low chloride concentration. In addition, the low chloride concentration indicates the water had little exposure to evaporation. The greater variation and higher concentration observed in post-El Niño pore water are likely due to mobilization of chloride from evaporative concentrates and dry fallout on the streambed and tributaries deposited between precipitation events. Calculation of a downward percolation rate using an event marker in the chloride profile at Dodge Boulevard yields an average linear velocity of 0.055 m/d, and corresponds closely to the rate calculated using the stable-isotope data. On the basis of the environmental tracers measured at the borehole near Dodge Boulevard, pore water in the unsaturated zone represents water that infiltrated into the sediments within the 12 to 14 months prior to drilling, and approximately half of the water (water in the deeper half of the unsaturated zone) infiltrated from the previous El Niño runoff event.

Multiplying the downward percolation rate by the volumetric water content results in the flux of recharge that reaches the water table. Using a percolation-rate estimate of 0.05 m/d, an average volumetric water content of 13 percent measured in the cores from the borehole near Dodge Boulevard borehole (Hoffmann and others, 2002), and a wetted perimeter of 25 m, results in a flux across the water table of 0.002 cubic meters per second per linear kilometer of streamflow ($m^3/s/km$).

Seepage Measurements

Seepage measurements were made at several sites along Rillito Creek during the El Niño-related sustained flows of March through April 1998 to determine infiltration rates for different stream reaches (Don Pool, hydrologist, U.S. Geological Survey, written commun., 2003). Findings from the 1998 seepage measurements are summarized here because, on the basis of stable-isotope ratios and chloride-concentration profiles, infiltration from the sustained El Niño flow is likely to have provided most of the water stored in the unsaturated zone at the time of borehole drilling and core collection. Streamflow losses owing to infiltration along Rillito Creek ranged from 0.07 to 0.9 $m^3/s/km$ and were largest downstream from Swan Road (fig. 1). The small streamflow losses in the upstream area were attributed to rejected recharge; depth to ground water upstream from Swan Road was near land surface after several days of sustained flow, whereas the depth downstream from Swan Road was typically greater than 30 m.

Seepage measurements were made again at four sites along Rillito Creek during an 8-hr period on October 24, 2000. Unlike the 1998 seepage measurements, the October 2000 seepage measurements did not isolate streamflow-infiltration rates relative to Swan Road; however, measured streamflow-infiltration rates generally agreed with those measured in 1998, as they ranged from 0.09 to 0.4 $m^3/s/km$ and averaged 0.22 $m^3/s/km$ (fig. 12). The October 2000 seepage measurements were made during an 8-hr period along a 14-km reach having an average wetted perimeter of about 25 m. Using a wetted perimeter of 25 m results in an average infiltration rate of 0.75 m/d, which is

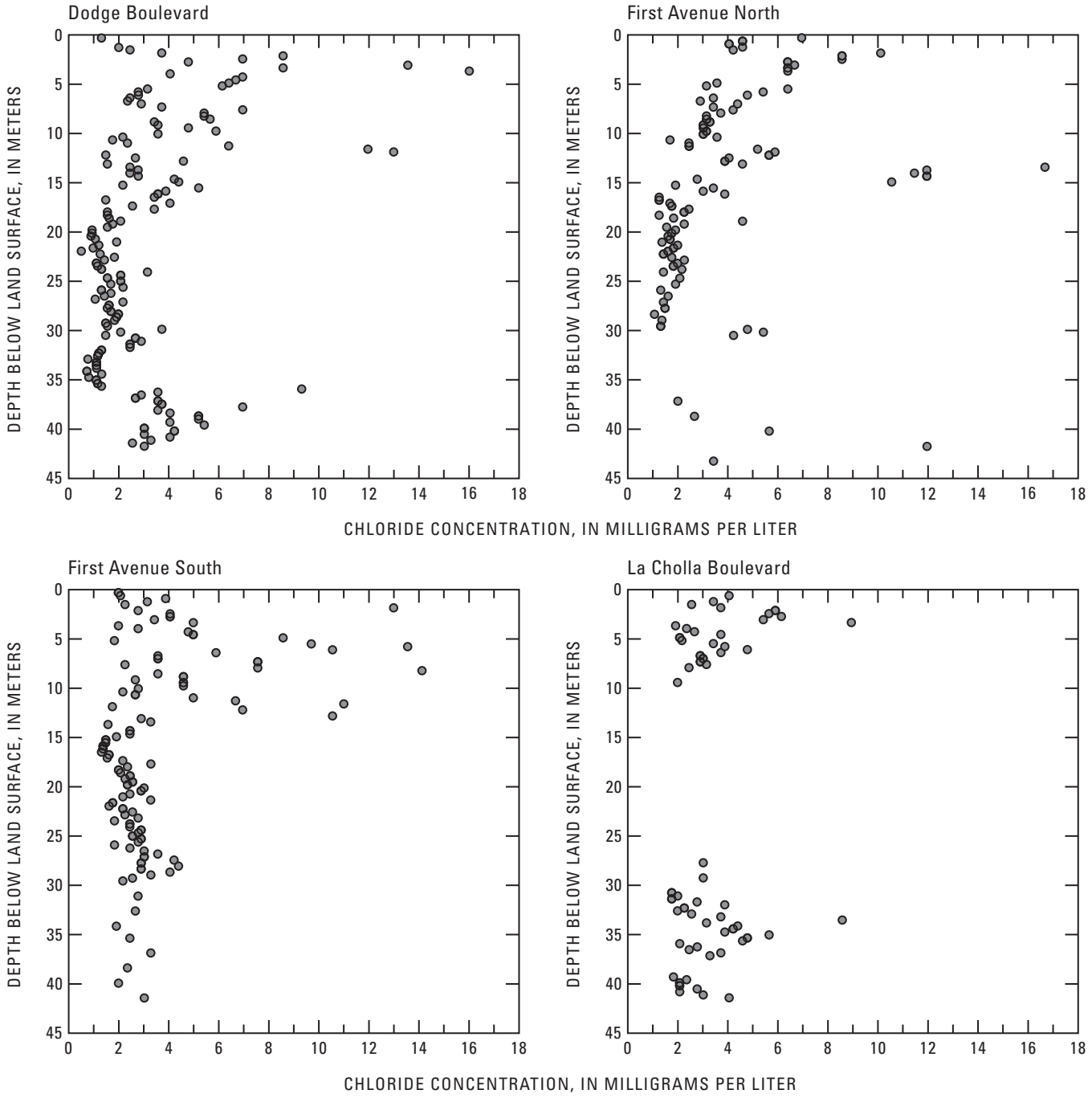

Figure 11. Profile of concentration of chloride from cuttings leachate from boreholes drilled along Rillito Creek, Pima County, Arizona.

similar to the measured saturated hydraulic conductivity of the stream-channel deposits (1.2 m/d), but more than an order of magnitude greater than percolation rates determined by tracers. The difference between the estimated infiltration and percolation rates probably is due to several factors, such as (1) the variably saturated nature of the sediments—the near-surface stream-channel deposits are likely to be nearly saturated during streamflow and, therefore, are approaching their saturated hydraulic conductivity, whereas the deeper sediments are less than fully saturated and will, therefore, have a lower hydraulic conductivity; (2) some water will spread laterally reducing the downward flux, and (3) percolation rates determined by tracers reflect average rates over longer periods of time than infiltration rates, including periods when the creek is not flowing.

Assuming 6 m of water in storage in the unsaturated zone beneath the creek (as determined by volumetric water-content measurements made on the cores; fig. 5) and a stream width of 100 m, the amount of pore water beneath every kilometer of the creek at the time of drilling and

coring was 6×10^5 m^3. There was less water in the upper reach where the unsaturated zone is shallower and more water in the downstream reach where there is an 18-m-thick fine-grained unit having high water content. Assuming an average streamflow loss rate of 0.22 $m^3/s/km$, about 33 days of streamflow infiltration would be needed to infiltrate the amount of water stored in the unsaturated zone. There were about 31 days of cumulative flow in the creek in the 12 months prior to drilling and coring; about two-thirds of the flow days were associated with the El Niño snowmelt runoff that occurred about 1 year before the drilling and coring. Assuming the water in the bottom two-thirds of the unsaturated zone collected in 1999 originated from surface water flowing a year earlier, the average downward percolation rate would be about 0.04 to 0.09 m/d, which brackets the percolation rate estimated by environmental tracers. This analysis of seepage and cumulative streamflow duration required to provide the amount of water held in storage in the unsaturated zone provides an independent method of estimating the age of water in the unsaturated zone, estimating infiltration and percolation rates, and substantiates the interpretation made on the basis of the environmental tracers.

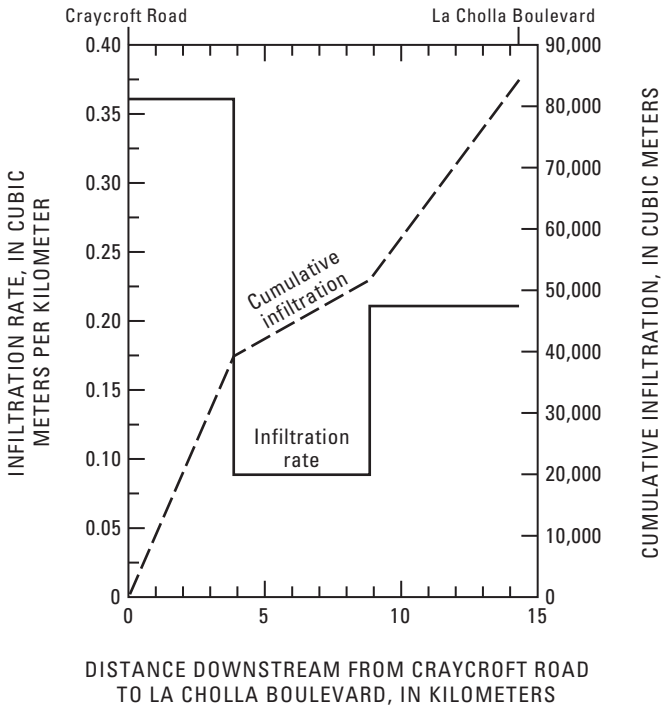

Figure 12. Seepage loses during October 8, 2000 streamflow in Rillito Creek, Pima County, Arizona.

Temperature and Water Content

One-Dimensional Temperature Monitoring and Modeling

Heat can be transferred through sediments by a combination of advection and conduction. Although both advective and conductive heat transport occur during infiltration, advective heat transport is more prevalent in high water-flux settings, whereas conductive heat transport is more prevalent in very low or no water-flux conditions. For most hydrologic applications related to infiltration through alluvial sediments, advection is the primary mechanism for the transport of heat by flowing water, and conductive heat transport is regarded as a negligible component of heat transfer (Constantz and others, 2003).

In this study, heat as a tracer was used to estimate one-dimensional vertical infiltration by inversely determining the vertical saturated hydraulic-conductivity profiles beneath the streambed. Stream-channel deposits were instrumented with vertical nests of thermistors at three sites along Rillito Creek (fig. 1). Thermographs predicted by numerical simulations were fitted to measured thermographs from the field by adjusting model parameters within appropriate ranges until the least error (best match) was found between simulated and measured thermographs. The three vertical-temperature arrays are buried in the stream-channel deposits near the boreholes (fig. 1). One array is near Craycroft Road in the upper reach of the study area; one is near Dodge Boulevard in the middle reach of the study area; and the other is near First Avenue also in the middle reach of the study area.

The simulation domains for the Rillito Creek models were represented numerically in one dimension, oriented vertically. The upper boundary and datum of the simulation domains was the streambed. The lower boundary was at or near the depth of the deepest measurements of temperature or pressure, or both. For the simulations, time-varying hydraulic and temperature potentials were defined at the upper- and lower-domain boundaries.

The hydraulic head at the streambed is equivalent to the stream stage. USGS streamflow-gaging stations provided measurements of stage after correction for the datum elevation. Streambed temperatures were measured by thermistors buried about 0.2 m below the streambed in the most active part of the channel. Pressure-head measurements from piezometers were used to define heads at the lower boundary of the three study sites. The lower-boundary temperatures for the Craycroft Road site were inferred from thermistor measurements near the lower-boundary depth. The lower-boundary temperatures coinciding with the water table for the Dodge Boulevard and First Avenue sites were approximated from ground-water temperatures measured within 5 meters of the water table at those sites. The inverse simulations were made with a numerical coupled water-flow and heat-transport model, VS2DH (Healy and Ronan, 1996), that was linked with parameter estimation software (PEST). A detailed description of the theory, modeling approach, and findings of this investigation is documented in Bailey (2002).

Infiltration at Craycroft Road Site

Infiltration for two periods of sustained streamflow were modeled for the upstream-most site (near Craycroft

Road). The first model period extends from July 20, 1999, to July 27, 1999. The second modeled period extends from July 29, 1999, to August 2, 1999. Streamflow and stage at the nearby streamflow-gaging station (Tanque Verde Creek at Tucson) fluctuated between 2.23 and 0.33 m^3/s, and between 0.26 and 0.11 m, respectively, during the first modeled flow period. Streamflow decreased from 1.11 to 0.05 m^3/s and stage decreased from 0.20 to 0.03 m during the second modeled flow period. The wetted perimeter of the streambed near the Craycroft Road site during these periods was about 10 m.

The measured thermograph at a depth of 1.2 m for the first modeled period shows a characteristic sinusoidal pattern that varies between about 24 and 26.5°C, whereas the thermograph for the second modeled period is generally flat and varies only between 25 and 25.5°C. Model simulation at the Craycroft Road site approximately reproduced the thermograph of the observed data for both model periods (fig. 13). Model simulations were optimized on vertical saturated hydraulic conductivity. Simulated vertical saturated hydraulic-conductivity values were in general agreement with those measured in the laboratory (Bailey, 2002; Hoffmann and others, 2002). A physical change within the streambed between flow periods at this site required the addition of a thin surface layer having a low vertical hydraulic conductivity within the model domain. The addition of this surface layer resulted in a lowering of the simulated equivalent saturated hydraulic conductivity by four orders of magnitude, from about 4 m/d to 3×10^{-4} m/d. The four orders of magnitude change in hydraulic conductivity is too large to result solely from changes in water viscosity owing to temperature changes. Given the tranquil flow conditions during the first flow period, it is possible that the change was the deposition of a fine-grained layer at the streambed surface. In fact, a thin layer of fine-grained material commonly was observed at the Craycroft Road site after small streamflow events.

Flow in the creek typically resulted in hydraulic connection between streamflows and ground water (see section titled "Water-Level Responses"). Thus, vertical gradients measured at the vertically nested piezometer at the borehole near Craycroft Road enabled estimation of infiltration rates using simulated equivalent vertical saturated hydraulic conductivity. Vertical hydraulic gradients measured from these piezometers typically ranged from 0.06 to 0.2 m/m and averaged 0.1 m/m. The highest gradients occurred during and shortly after streamflow. Assuming a typical gradient during and shortly after streamflow (0.2 m/m) and a wetted perimeter of 10 m, estimated infiltration rates ranged from 0.09 $m^3/s/km$ during the first modeled period to 8×10^{-6} $m^3/s/km$ during the second modeled period. The first modeled period is probably most representative of the typical ephemeral-streamflow conditions; the second period of streamflow modeled is probably most representative of small flows that occur after a layer of fine-grained deposits has been deposited. The infiltration rate of 0.09 $m^3/s/km$ for the first modeled period is about half of that estimated by seepage measurements (average of 0.21 $m^3/s/km$).

Infiltration at Dodge Boulevard and First Avenue sites

Infiltration also was modeled for two time periods at the Dodge Boulevard and First Avenue sites: the first modeled period extends from July 14, 1999, to July 17, 1999, and the second modeled period extends from July 25, 1999, to July 29, 1999. The proximity of the thermistors to the streamflow-gaging station 09485700 at Dodge Boulevard allowed direct use of the gaging-station measurements to define the hydraulic head at the upper boundary within the Dodge Boulevard model domain. These boundary conditions also were used for the First Avenue model domain. Discharge and stage for these two periods reached maximums of 254 m^3/s and 2.7 m, respectively. The wetted perimeter for these flows was about 10 m. An important difference between these sites and the site near Craycroft Road is that the depth to the water table near the Dodge Boulevard and First Avenue sites is greater than 30 m; therefore, ephemeral flow in the stream channel at these sites may never result in hydraulic connection between the stream and the aquifer.

Thermographs from a depth of 0.8 m at the Dodge Boulevard site for the two modeled periods have contrasting signals. The thermograph for the first period shows a decline in temperature associated with streamflow from about 29.5 to 20.5°C that is followed by a gradual increase to 26°C; the thermograph for the second period shows a rapid increase in temperature associated with streamflow from about 29 to 32°C that is followed by a gradual decrease to 27°C (fig. 14). The most accurate prediction of the observed thermograph for the first modeled time period at the Dodge Boulevard site resulted in an equivalent vertical saturated hydraulic conductivity of about 5 m/d, which is similar to, yet slightly higher than, the equivalent vertical saturated hydraulic conductivity simulated at the Craycroft Road site. Vertical hydraulic gradients were not measured at the Dodge Boulevard site, thus, infiltration rates can not be estimated; however, by assuming a vertical gradient of 0.2 m/m (on the basis of the measured gradient at the Craycroft Road site), an equivalent vertical hydraulic conductivity of 5 m/d, and a wetted perimeter of 10 m, the infiltration flux was calculated as 0.12 $m^3/s/km$.

To match the simulated thermograph to the measured thermograph for the second modeled period, a thin surface layer having a low-vertical hydraulic conductivity needed to be added during the modeled period. During the first part of the second simulation, the equivalent vertical saturated hydraulic conductivity was 0.7 mm/s, which, if sustained, would equate to 66 m/d. After about 3 hours of streamflow, the addition of the low-conductivity surface layer reduced the equivalent vertical hydraulic conductivity to about 0.25 m/d. The decrease in hydraulic conductivity during a flow event is consistent with the deposition and accumulation of fine sediments on the receding limb of a hydrograph.

Model simulations for the site near First Avenue relied on stage data from the streamflow gaging-station 09485700 at Dodge Boulevard (Bailey, 2002). Simulations for this site covered the same two time periods and resulted in equivalent

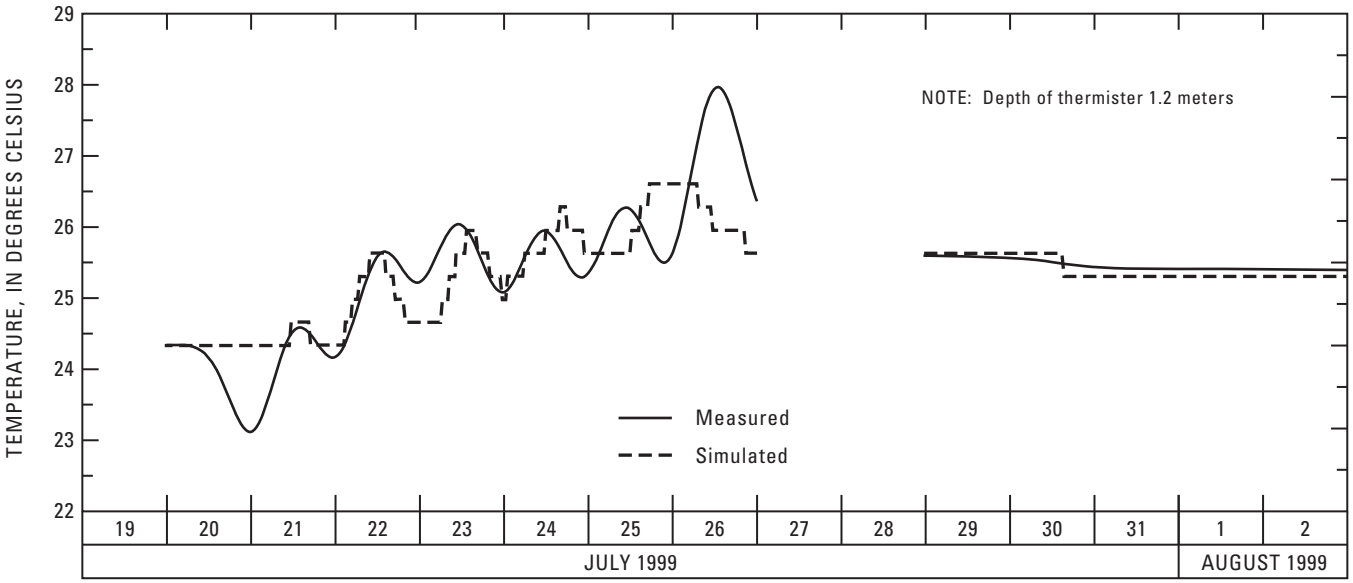

Figure 13. Measured and simulated thermographs in Rillito Creek near Craycroft Road, Pima County, Arizona.

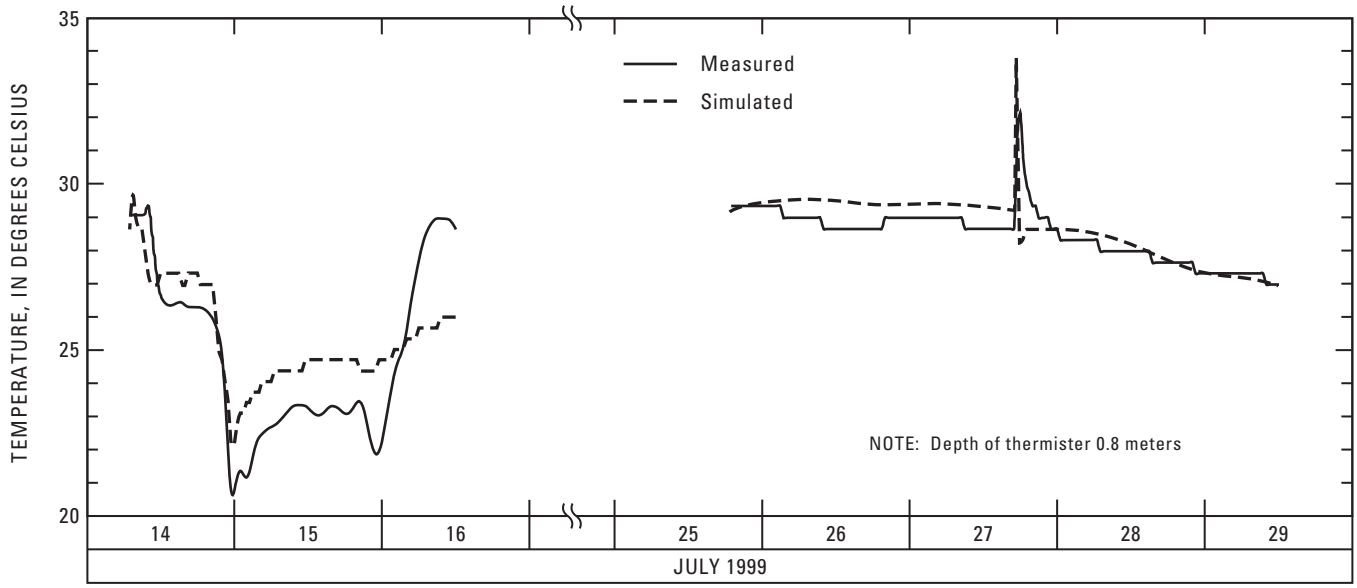

Figure 14. Measured and simulated thermographs in Rillito Creek near Dodge Boulevard, Pima County, Arizona.

vertical hydraulic conductivity values that were similar to those estimated for the site near Dodge Boulevard. In addition, the simulation for the second modeled period required the addition of a low vertical hydraulic conductivity surficial layer during the latter part of the period. The model simulations for the site near First Avenue, however, were less successful in matching the observed data than the simulations for the site near Dodge Boulevard. The inability of the simulations to match the magnitude and changes in the temperature measured at the site near First Avenue indicates the numerical model likely is not representing some of the infiltration processes, such as multidimensional flow beneath the streambed, the model has poorly constrained sediment and hydraulic parameters, or a combination of these factors.

Results of this investigation indicate that, under well-constrained conditions where predominantly vertical infiltration can be assumed, a one-dimensional inverse numerical model can be used to estimate infiltration rates. One-dimensional modeling, however, assumes lateral spreading does not occur. If lateral spreading does occur, the estimated rates predicted by one-dimensional modeling will be smaller than actual rates. The results also indicate that streambed hydraulic conductivity can limit infiltration and that hydraulic conductivity can vary significantly between and during flow events. Erosion

and deposition associated with low-frequency, high-intensity ephemeral streamflow can result in large variations in the hydraulic conductivity of the streambed surface owing to an accumulation or removal of fine-grained sediments. This variability affects the cumulative infiltration, which could vary greatly as a function of the amount of streamflow and a function of the nature of the streamflow and the accumulation or removal of fine-grained sediments. Additionally, these results indicate that simulation of streambed infiltration should allow for temporal variation of the streambed hydraulic conductivity or should be done using short time periods to account for rapid changes in the streambed hydraulic conductivity.

Two-Dimensional Temperature and Water-Content Monitoring

For the purpose of measuring infiltration fluxes at the onset and throughout the duration of streamflow events, Blasch and others (2003) instrumented the stream-channel deposits beneath Rillito Creek near Dodge Boulevard with a two-dimensional vertical array of 28 paired thermocouples, temperature probes, and time-domain reflectometry (TDR) water-content probes placed perpendicular to flow (fig. 1). The paired probes were arranged in four columns (profiles C1, C2, C3, and C4 in figure 1) spaced 3 m apart. There are seven rows (depths) within the array at depths of about 0.50, 0.75, 1.0, 1.25, 1.50, 2.0, and 2.5 m below the streambed. Depths of the probes varied by as much as 0.25 m owing to deposition and erosion during flow events. A near-surface temperature sensor also was placed adjacent to the paired two-dimensional array at a depth of 0.05 m.

The highly transient conditions that exist during the onset of streamflow are more difficult to simulate using temperature measurements exclusively than the saturated conditions presented in the previous section because of the rapid changes in water fluxes and increased multidimensional infiltration. Combined water-content and temperature measurements are needed to simulate initial transient infiltration rates in unsaturated sediments. Additionally, infiltration rates can be estimated using wetting-front arrival times and changes in water content at successive TDR probes.

Water-content data show rapid changes shortly after the onset of streamflow (fig. 15). Volumetric water content increases throughout the measured profiles from about 20 percent to 40 percent within minutes of the onset of streamflow. Initial infiltration rates measured as the change in volumetric water content over time per unit area were as high as 2 mm/s, which if sustained would be equivalent to 166 m/d. The high rates are likely to include vertical and lateral flow components. Temperature and water-content data for a September 2000 event indicate that infiltration occurs in both the horizontal and vertical directions at the onset of streamflow (figs. 16 and 17). Measured lateral wetting-front velocities between profiles were similar in magnitude to vertical velocities. The similar velocities measured at the onset of streamflow probably were due to tension gradients being much larger than the gravitational gradient. Water traveled laterally almost the entire 9-m

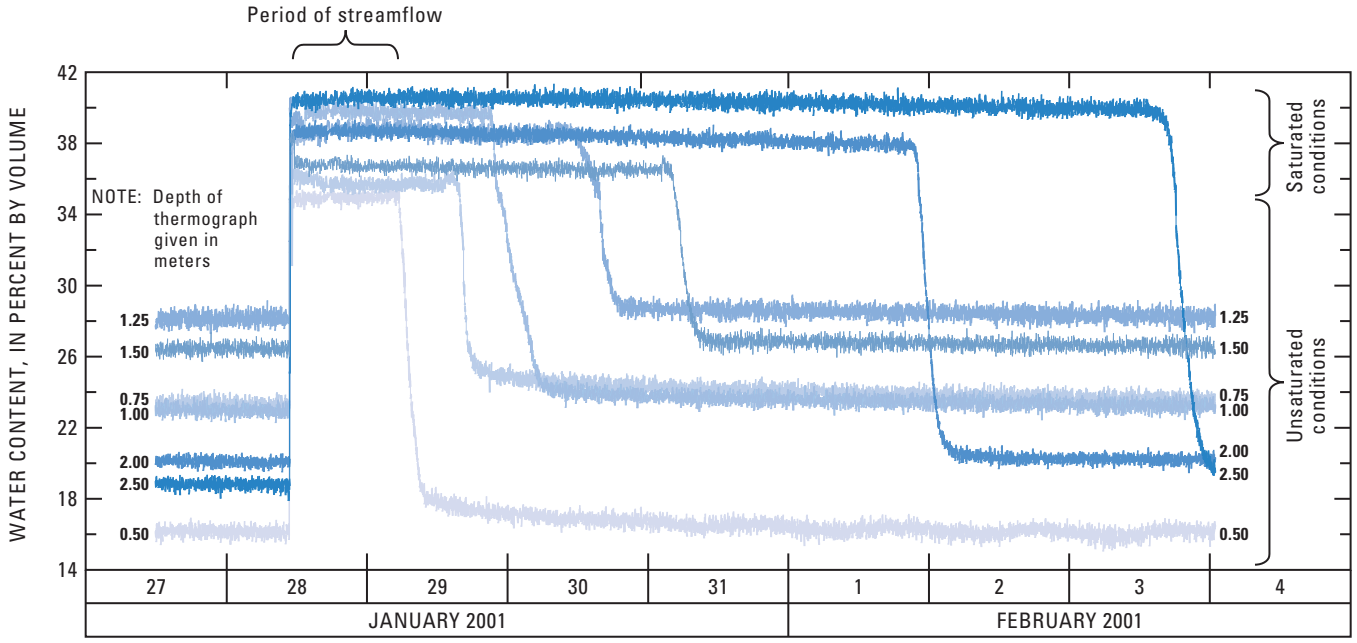

Figure 15. Water content of stream-channel sediments for duration of a streamflow event including onset and cessation, from within two-dimensional array in Rillito Creek near Dodge Boulevard, Pima County, Arizona.

distance between profiles within the first few minutes of the onset of streamflow.

Multidimensional-flow simulations are required to accurately represent the full volume of water infiltrating into a porous, heterogeneous medium near the margins of the advancing wetting front where capillary flow dominates. Infiltration, however, is increasingly vertical near the center of streamflow in a homogeneous medium, and lateral flow diminishes as capillary gradients decline with distance from the boundary of the wetted perimeter. The time from the onset of flow required for vertical infiltration to dominate varies depending on streamflow conditions and the texture of the streambed material. For instance, small braided-ribbon flows over fine material may never result in predominantly vertical infiltration, whereas large bank-to-bank flows over coarse material may produce predominantly vertical infiltration beneath the streambed within minutes on the basis of the large wetted perimeter and conductivity of the sediments.

A typical set of measured Rillito Creek thermographs from an April 2001 event and from a November 2000 event were simulated using a variably saturated heat and mass transport model, VS2DH (Healy and Ronan, 1996). The thermographs for the 0.5- and 2.5-m depths were used as boundary conditions, and the thermographs for the remaining five depths were used as observation points. One-dimensional models were created. Parameter optimization software, PEST, was used to calibrate thermal and hydraulic properties. Numerical simulations shown for data from the two-dimensional array are for a 10-m wide flow event starting on April 6, 2001 (fig. 18). The assumption of vertical one-dimensional flow was considered valid because temperature changes were predominantly in the vertical direction. The simulated infiltration rates varied from about 0.35 to 0.39 m/d throughout the initial 2 days of flow (fig. 19) and average 0.37 m/d. This represents a variation in predicted infiltration rates of less than 10 percent among the four columns, indicating that infiltration was uniform and predominantly vertical. Although the simulated and measured thermographs are in general agreement, departures do exist. Simulated temperatures differ from measured temperatures for several reasons, such as error in the measured boundary conditions, error in hydraulic and thermal property assignments, or an inability of the models to fully represent multidimensional infiltration.

The infiltration rate generally declines as the streamflow event proceeds. The declining infiltration rate is attributed to a declining pressure head and (or) development of a thin, fine-grained surface layer. Infiltration rates continued to decline during the flow event and averaged 0.32 m/d for the 12 days measured. By converting to flux units that are comparable with those estimates made at the vertical temperature nests described above and using a wetted perimeter of 10 m, an average infiltration rate of 0.32 m/d equates to a flux of 0.04 $m^3/s/km$. There are two important differences between these estimates and estimates made at the one-dimensional temperature-array sites near Craycroft Road and Dodge Boulevard. First, the estimated infiltration rates at the vertical-array sites near Craycroft Road and Dodge Boulevard are about twice that of the infiltration estimates made at the two-dimensional array. Second, the infiltration rates at the vertical-array sites required a low-hydraulic conductivity layer be incorporated into the model in the later stages of infiltration. The addition of a low-conductivity layer resulted in significantly reduced infiltration rates during the later stages of streamflow. The two-dimensional array was at the lowest part of the cross section, whereas the vertical nest was near a depositional fringe within the streambed, which may account for the deposition of the low-conductivity layer at the vertical nests.

An estimated sustained infiltration rate of about 0.32 m/d for the April 2000 streamflow event agrees with simulation results for a November 2000 event lasting 10 days. An average infiltration rate of 0.37 m/d was simulated for the November event. These rates show general agreement with infiltration rates of 0.41 to 0.50 m/d estimated by other investigators along Rillito Creek (Burkham, 1970; Katz, 1987). Simulations were also extended about 2 days beyond the periods of streamflow to estimate the redistribution of water in the subsurface. Redistribution rates, similar to infiltration rates, are determined from the elapsed time between sharp decreases in water content at each depth (fig. 15). After the cessation of streamflow, temperature measurements indicated the simulated dewatering flux was 0.33 and 0.30 m/d for the April and November events, respectively. Estimated redistribution rates using water-content changes were 0.08 and 0.1 m/d for the April and November events, respectively. Thus, redistribution rates were slightly less than infiltration fluxes during steady-state flow, and estimates of dewatering using water-content measurements were less than the simulated fluxes using temperature methods.

The variety of physical and chemical methods presented in this chapter (and elsewhere) are used to estimate rates of infiltration and percolation under steady-state conditions. For long-duration events (several days to months) steady-state conditions may be an accurate assumption, but for short-duration events (less than 24 hrs) typical of those in Rillito Creek and other streams in southern Arizona, infiltration fluxes that occur shortly after the onset of flow may differ substantially in magnitude from those throughout the duration of the event. For detailed water-budget analyses and hydrologic models dependent on infiltration flux estimates, the infiltration flux has to be estimated more accurately than is possible when using the assumption of steady-state conditions. Infiltration fluxes through the first 2 m of unsaturated sediments at the onset of streamflow calculated for 20 events ranged from 13 to 166 m/d. Variability in antecedent water content and fluid temperature were examined as possible factors contributing to the range in onset fluxes. Onset infiltration rates were inversely correlated to antecedent water content with a log-linear relation (fig. 20). Measured onset infiltration fluxes differed from those of the steady-state infiltration fluxes by four orders of magnitude. Infiltration rates after onset declined more quickly for events in which the antecedent water content was high; events starting with higher antecedent water content required 3.7 hours to achieve near steady-state conditions, whereas events with lower antecedent water content required 6.8 hrs.

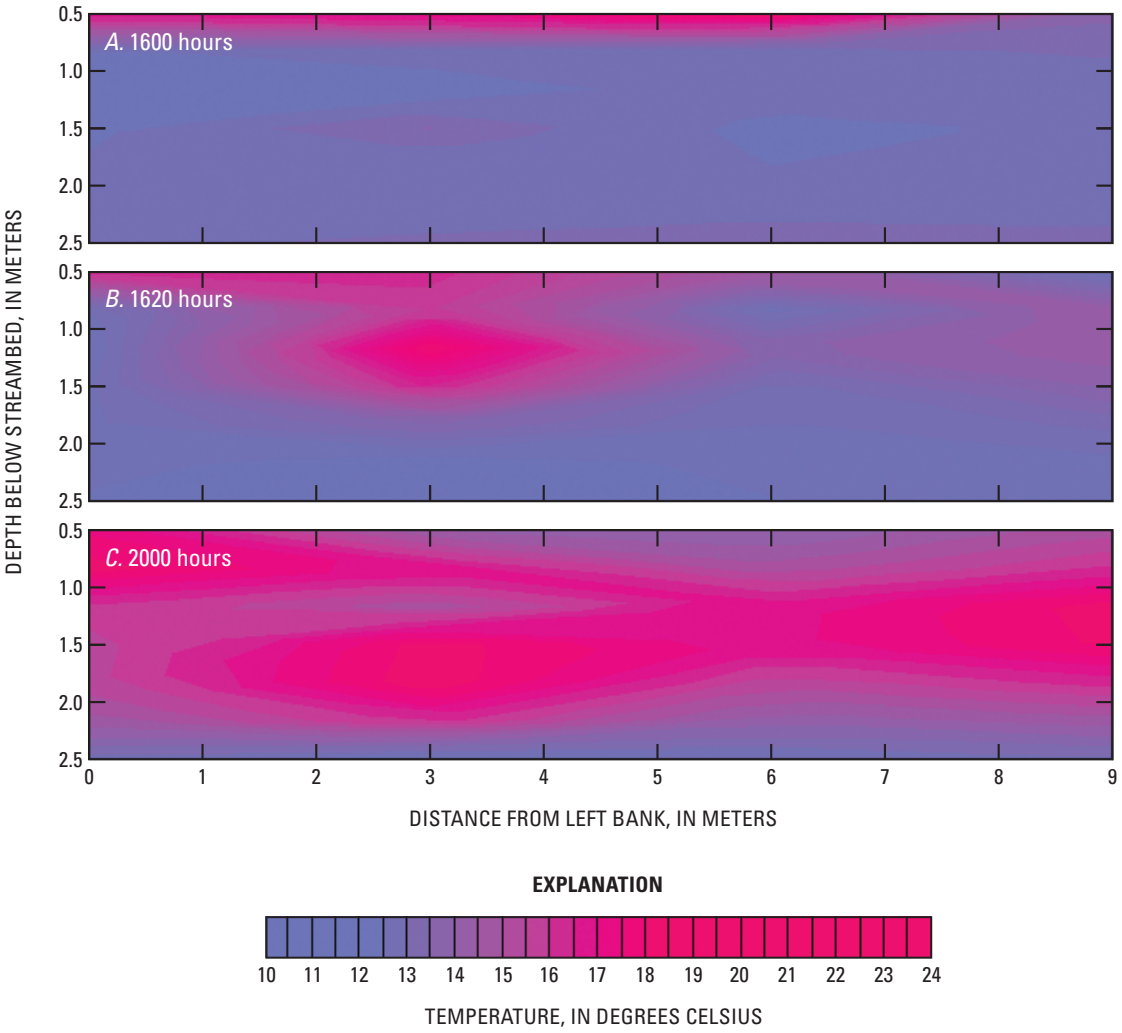

Figure 16. Two-dimensional distribution of temperature during different streamflow conditions in Rillito Creek on September 10, 2000, near Dodge Boulevard, Pima County, Arizona. *A*, Thermal transport through conduction before the onset of streamflow; *B*, thermal transport through a combination of advection and conduction at the onset of streamflow exhibiting multidimensional flow through the sediments; *C*, combined advection and conduction thermal transport to the deeper sediments several hours after the onset of streamflow.

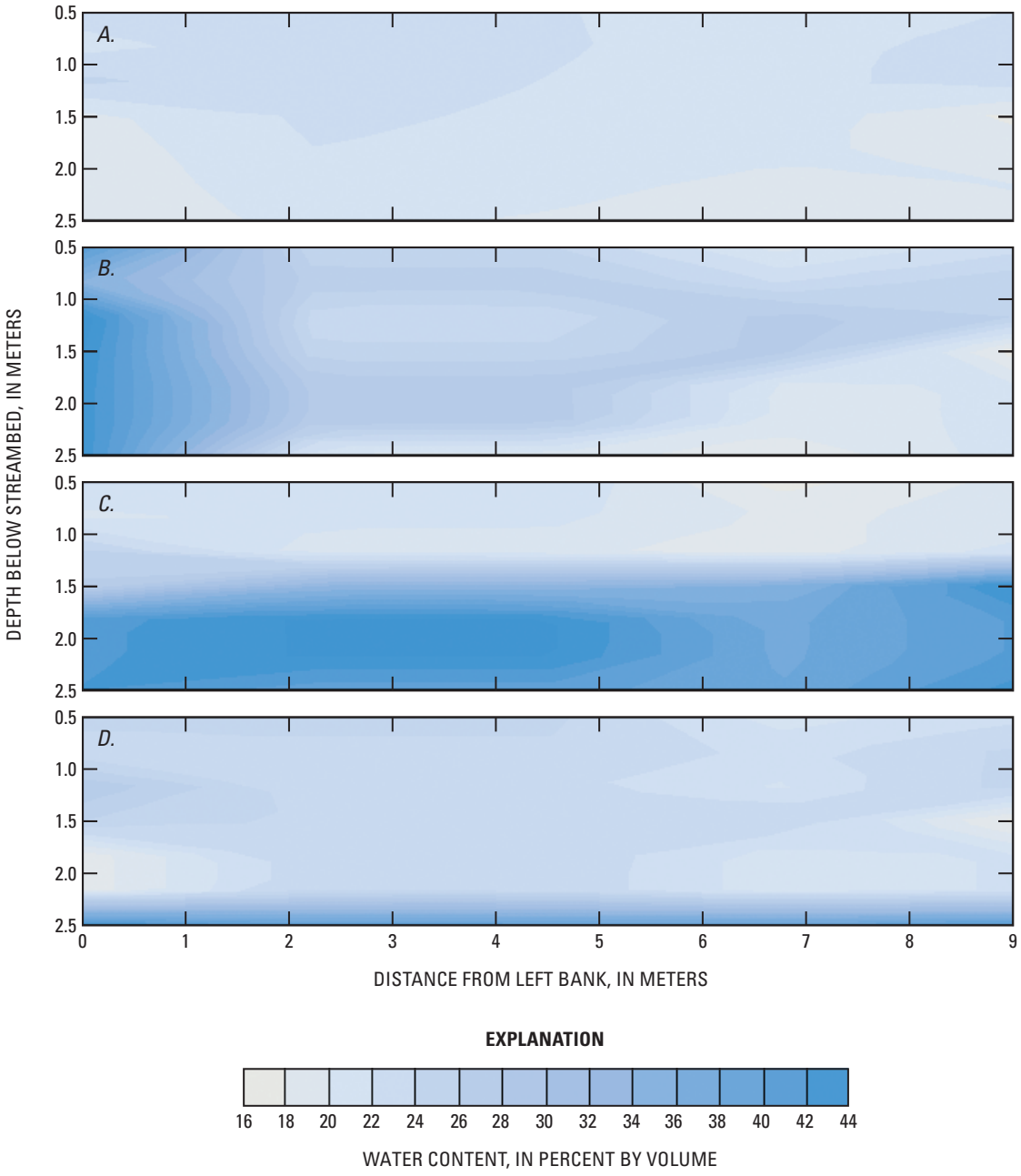

Figure 17. Two-dimensional plot of soil-water content during different streamflow conditions in Rillito Creek near Dodge Boulevard, Pima County, Arizona; *A*, Before the onset of streamflow, September 10, 2000, at 1600; *B*, five minutes after the onset of streamflow, September 10, 2000, at 1605; *C* , immediately after the cessation of streamflow September 12, 2000; *D*, approximately 2 days after the cessation of streamflow, September 14, 2000.

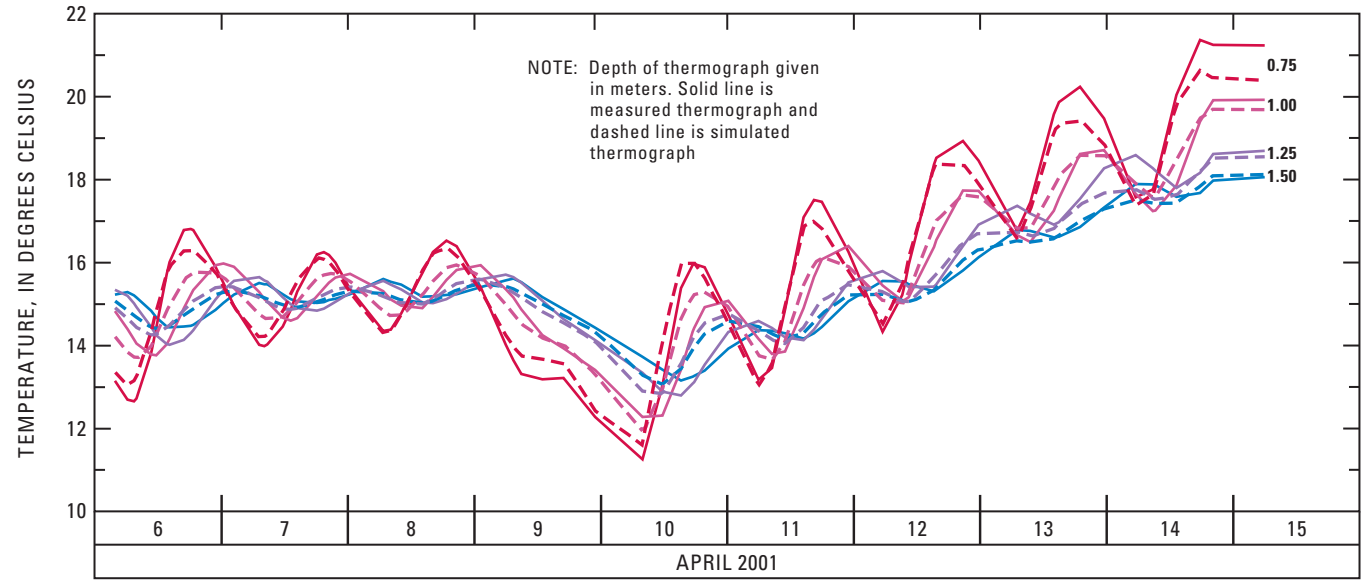

Figure 18. Typical measured and simulated thermographs from two-dimensional temperature array from column 1 (see fig. 1 for column location) in Rillito Creek near Dodge Boulevard, Pima County, Arizona.

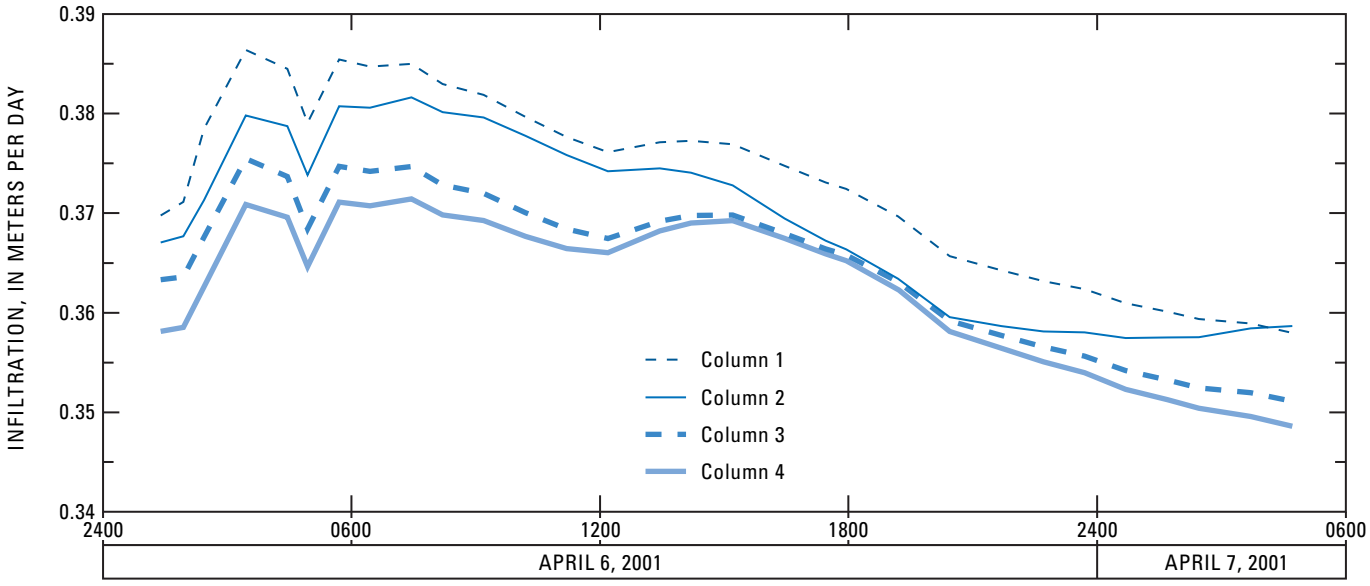

Figure 19. Simulated infiltration rates during period of flow at the two-dimensional temperature array near Dodge Boulevard, Pima County, Arizona.

The general agreement in infiltration estimates among these independent temperature and water-content methods indicates that these methods provide accurate estimates of infiltration. As such, vertical arrays of temperature probes can be located along stream reaches to estimate the potential for in-stream recharge and to provide guidance on citing recharge facilities. High infiltration rates at shallow depths, however, are not sufficient to ensure that water will percolate to deeper depths and recharge the deep aquifer at a high rate. Infiltration rates determined from shallow measurements should be considered an upper limit of the potential recharge rate for a particular site.

Water-Level Responses

Piezometer nests were installed in the stream-channel boreholes and monitored for water-level variations in response to streamflow. Nested piezometers included one shallow piezometer completed in what is usually the unsaturated zone,

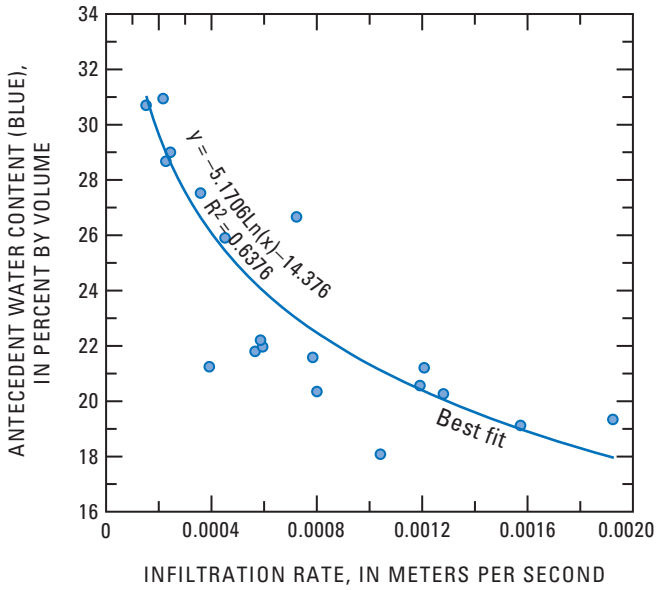

Figure 20. Correlation of onset infiltration rate to antecedent water content.

near the contact between the recent stream-channel alluvium and the basin-fill deposits, and a pair of deep piezometers—one near the water table and one about 10 m below the water table. With the exception of the piezometer near Craycroft Road, the shallow piezometers generally were dry except shortly after streamflow (fig. 21) and contained water for periods of days to several weeks. The magnitude of water-level variation and the period of time the shallow wells contained water varied. For instance, the water level in the shallow piezometer near Dodge Boulevard varied the least (usually less than 1 m), whereas the water level in the shallow piezometer near La Cholla Boulevard varied the most (usually between 6 and 7 m); water-level variations in the shallow piezometer near First Avenue were usually between 2 and 6 m. Duration in which the water level remained above the bottom of the piezometer was longest in the piezometer near La Cholla Boulevard where saturation persisted for 6 months after the summer 1999 streamflow and 12 months after the winter 2000 streamflow; saturation time was shortest at the shallow piezometer near Dodge Boulevard where it was typically less than 2 months (fig. 21). The long duration of saturation at the shallow piezometer near La Cholla Boulevard probably was due to the fine-grained unit at depth of about 12 to 30 m (Hoffmann and others, 2002).

Water levels in each of the pairs of deep piezometers responded several days to weeks later than the shallow piezometers and generally after the shallow piezometers became dry. There were little to no vertical gradients measured in the pairs of deep piezometers. These responses suggest gravity flow predominates, and that no hydraulic connection is established between streamflow and the underlying deep aquifer. Given the low-permeability of the basin-fill deposits, relative to that of the stream-channel deposits, it also is likely that temporary perched conditions existed near the contact between these two units for a period of several days to weeks after cessation of streamflow.

Water levels in the deep piezometers showed an overall decline during the period of investigation. Water-level declines between spring 1999 and summer 2002 ranged from about 2 m at the deep piezometer near Craycroft Road, to 8 m at the deep piezometer near Dodge Boulevard (fig. 21). The declines probably are related to ground-water pumpage from the basin-fill aquifer. Superimposed on the declines are a series of rises that range from about 0.5 to 3.9 m. These rises are in response to the two most significant streamflow periods that occurred in summer 1999 and fall/winter 2000.

The initial response of the water table in the deep piezometers lags the onset of streamflow by about 2 weeks at the piezometer nests near Dodge Boulevard and near First Avenue, whereas the initial response of the water table at the piezometer nests near Craycroft Road and near La Cholla Boulevard is more rapid—within about a day of streamflow in summer 1999. Lag time for the initial response at the piezometers near Dodge Boulevard and near First Avenue is related to the presence of a thick unsaturated zone at these sites. The short lag time between the onset of streamflow and the initial water-table response could be related to factors such as preferential flow and uniformly high water content throughout the unsaturated zone (Hoffmann and others, 2002). The occurrence of preferential flow is supported by the rapid response of the water table to streamflow despite the presence of the fine-grained unit.

Timing of the water-level peak also varies with location, and the peak occurs several weeks to months after the onset of streamflow. The longest lag time for the peak occurs near La Cholla Boulevard where it was about 7 months. Dissipation to prerecharge-event water levels also required several months at each site (fig. 21).

The magnitude of the water-table response in the deep piezometers is greatest at the piezometer nests near Dodge Boulevard and First Avenue. The water-table response in the piezometer nest near Craycroft Road is reduced relative to the water-table responses near Dodge Boulevard and First Avenue. Shallow piezometers near Craycroft Road indicate the water table often reaches land surface during streamflow events; therefore, the reduced water-level response probably is related to rejected recharge. The magnitude of the water-table response at the piezometer nest near La Cholla is the smallest and is related to a smaller recharge rate related to less frequent and smaller streamflows near La Cholla, relative to the other sites, and the presence of the fine-grained layer in the unsaturated zone. The lack of vertical gradients between the middle and deep piezometers at each nest indicates flow is predominantly horizontal in the saturated zone, except in the piezometer nest near Craycroft Road where the vertical gradient averages about 0.1m/m.

A series of recharge estimates were calculated on the basis of the water-level responses using an analyti-

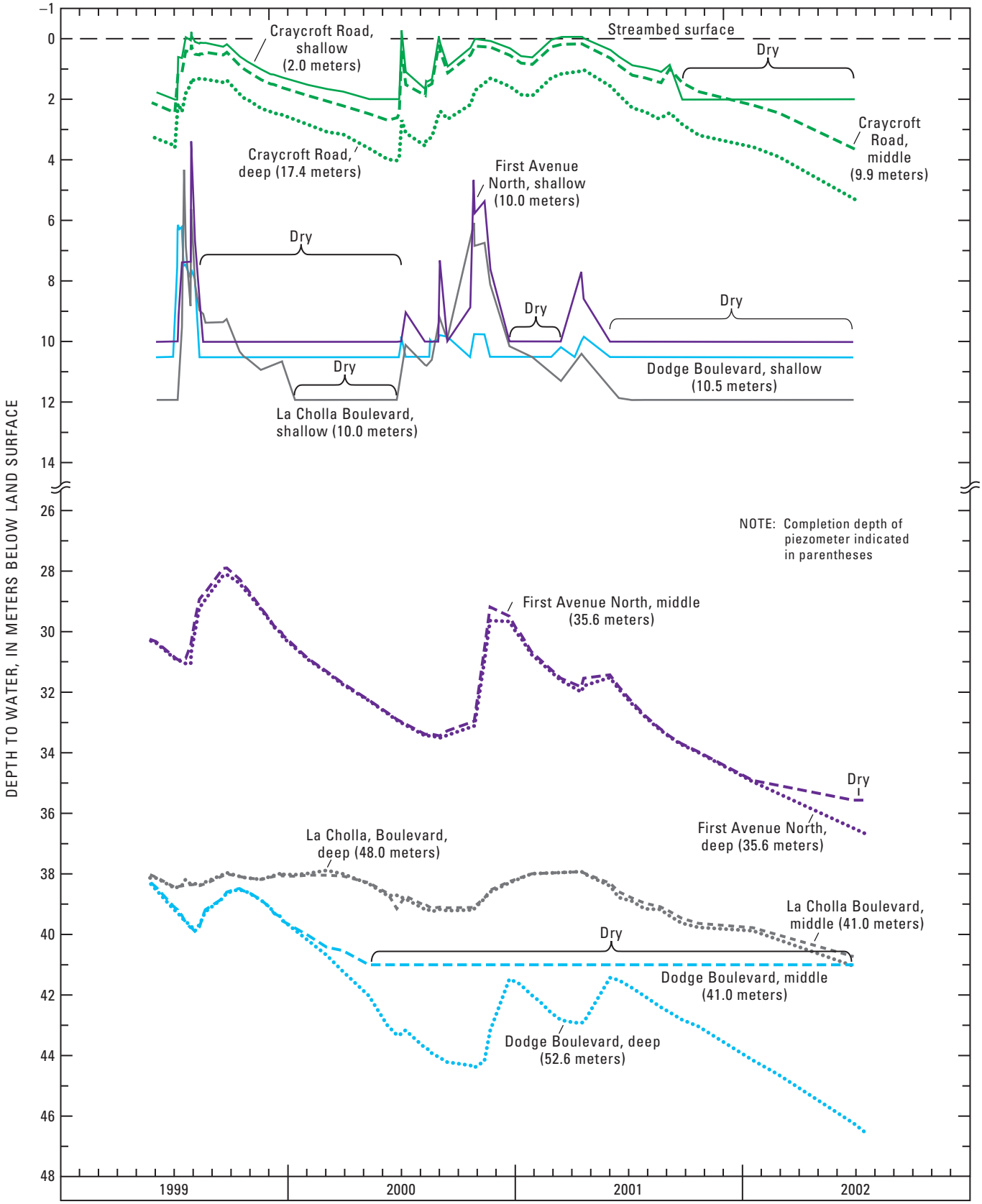

Figure 21. Hydrographs of selected piezometers within Rillito Creek, Pima County, Arizona.

cal approach developed by Moench and Kisiel (1970). In this analytical model, changes in water levels over time near an ephemeral-stream channel are assumed to reflect actual recharge. This is advantageous in that no information or assumptions regarding unsaturated-zone processes are required in order to make the calculations.

For any given streamflow event, a certain amount of water may recharge the aquifer and thereby cause water levels in nearby wells to rise. The water-level rise results in a mound that slowly dissipates normal to the line source. Subsurface sediments will act to slow the dispersal. The variation in rate and duration of recharge can thus be viewed as an input function, the aquifer as a filter or impulse-response function, and the water levels as output. The variation in the rate and duration of recharge can be calculated from a combination of water-level data and the impulse-response function, which is derived from parameters of aquifer geometry, aquifer storage, and hydraulic properties, using the groundwater flow equations. By summing these rates of recharge for the time period being studied, the volume of water recharged can be determined.

Various assumptions about the aquifer flow-system are required to implement the analytical model deveolpoed by Moench and Kisiel (1970). Flow is assumed to be one dimensional and horizontal. The aquifer is assumed to be homogeneous and isotropic, to be infinite in horizontal extent, and to receive recharge from a finite width source. Aquifer characteristics are assumed to be invariant with time and water-level fluctuations.

Input to the model includes temporal variations in water levels, channel width, distance of the well from the center of the stream channel, specific yield, and transmissivity. The output is recharge calculated as cubic meters per second per linear kilometer of stream channel ($m^3/s/km$) over the period of record. Variations in measured water levels were assumed to be recharge events superimposed upon a generally declining water table. In order to find the amount of water recharged without the bias of the decline, the data were detrended (fig. 22). Detrending consisted, first, of calculating the trend in the data using a linear regression. This trend was then removed from the data under the assumption that all other deviations from a constant water level were caused by recharge. The period of record for the recharge calculations was based on the time required for the water-level response to return to prerecharge levels; therefore, the period of record includes both the rise in water level associated with recharge and the dissipation of the water level. A specific yield of 0.15 was used on the basis of measurements made by Pool and Schmidt (1997). Bounding transmissivities of 1.6×10^{-3} and 6.5×10^{-3} m^2/s estimated from Hanson and Benedict (1994) were used to show the uncertainty in the recharge values. The only difference between input data for the various sites was the individual water-level records and the distance of the well from the stream channel (to which the model showed little sensitivity in comparison with its sensitivity to transmissivity).

Recharge estimates were calculated for the sites near Dodge Boulevard, First Avenue, and La Cholla Boulevard for the recharge events of 1999 and 2000. The recharge event in 1999 was caused by summer streamflows, whereas the recharge event in 2000 was due predominantly to fall and winter streamflows and only partly to summer flows (table 1). The site near Craycroft Road was excluded from this analysis because the presence of vertical water-level gradients violated the assumptions of the analytical model. The largest cumulative recharge estimates for the 1999 event at the site near First Avenue range from 3.0×10^5 to 6.0×10^5 m^3/km, which is about two to three times larger than those from the other two sites (near Dodge Boulevard, 1.7×10^5 to 3.4×10^5 m^3/km; near La Cholla Boulevard, 1.3×10^5 to 2.5×10^5 m^3/km; table 2). Cumulative recharge estimates for the 2000 recharge event were greatest at the site near Dodge Boulevard and decreased in the downstream direction. At the site near Dodge Boulevard, recharge estimates range from 7.1×10^5 to 1.4×10^6 m^3/km, which are slightly larger than those estimated at the site near First Avenue (5.3×10^5 to 1.1×10^6 m^3/km) and about three times larger than those estimated at the site near La Cholla Boulevard (2.2×10^5 to 4.3×10^5 m^3/km). The recharge estimates for the 2000 event at the sites near First Avenue and near La Cholla Boulevard were about twice those for the 1999 event at these sites and were more than five times that of the 1999 event at the site near Dodge Boulevard. The trends revealed in this analysis are consistent with the fact that the winter 2000 streamflows were more voluminous and longer in duration than the summer 1999 streamflows (table 1), and that water levels in the piezometers rose higher in response to the winter 2000 streamflows than to the summer 1999 flows (fig. 21).

Volumetric recharge rates were estimated by dividing the cumulative-recharge estimates by the cumulative duration of streamflow at each site during the period of record. Streamflow duration at the streamflow-gaging station at Dodge Boulevard totaled about 9 days between July 1, 1999 and September 30, 1999, whereas streamflow duration at streamflow-gaging station 09486055, near La Cholla Boulevard, for the same period totaled about 4.5 days. No streamflow-gaging station existed near First Avenue; however, in this analysis, a total of about 7 days of cumulative flow was assumed to have occurred at the site near First Avenue during 1999—a duration less than that at the upstream gage, at Dodge Boulevard, and greater than that at the downstream gage, near La Cholla Boulevard. Using the values of estimated cumulative-recharge determined using the Moench and Kisiel (1970) method and of cumulative-streamflow duration, recharge rates range from 0.2 to 1.0 $m^3/s/km$ for 1999 (table 2). During the period of June 15 to December 31, 2000, a span that includes most of the streamflow for the second recharge period, cumulative-streamflow duration ranged from a high of 43 days at the streamflow-gaging station at Dodge Boulevard, to a low of 14 days at the streamflow-gaging station near La Cholla Boulevard. In this analysis, a flow duration of 30 days was assumed to have occurred at the site near First Avenue. Using these values, volumetric-recharge rates range from 0.2 to 0.4 $m^3/s/km$ for 2000 (table 2). These rates are generally greater than volumetric-infiltration estimates

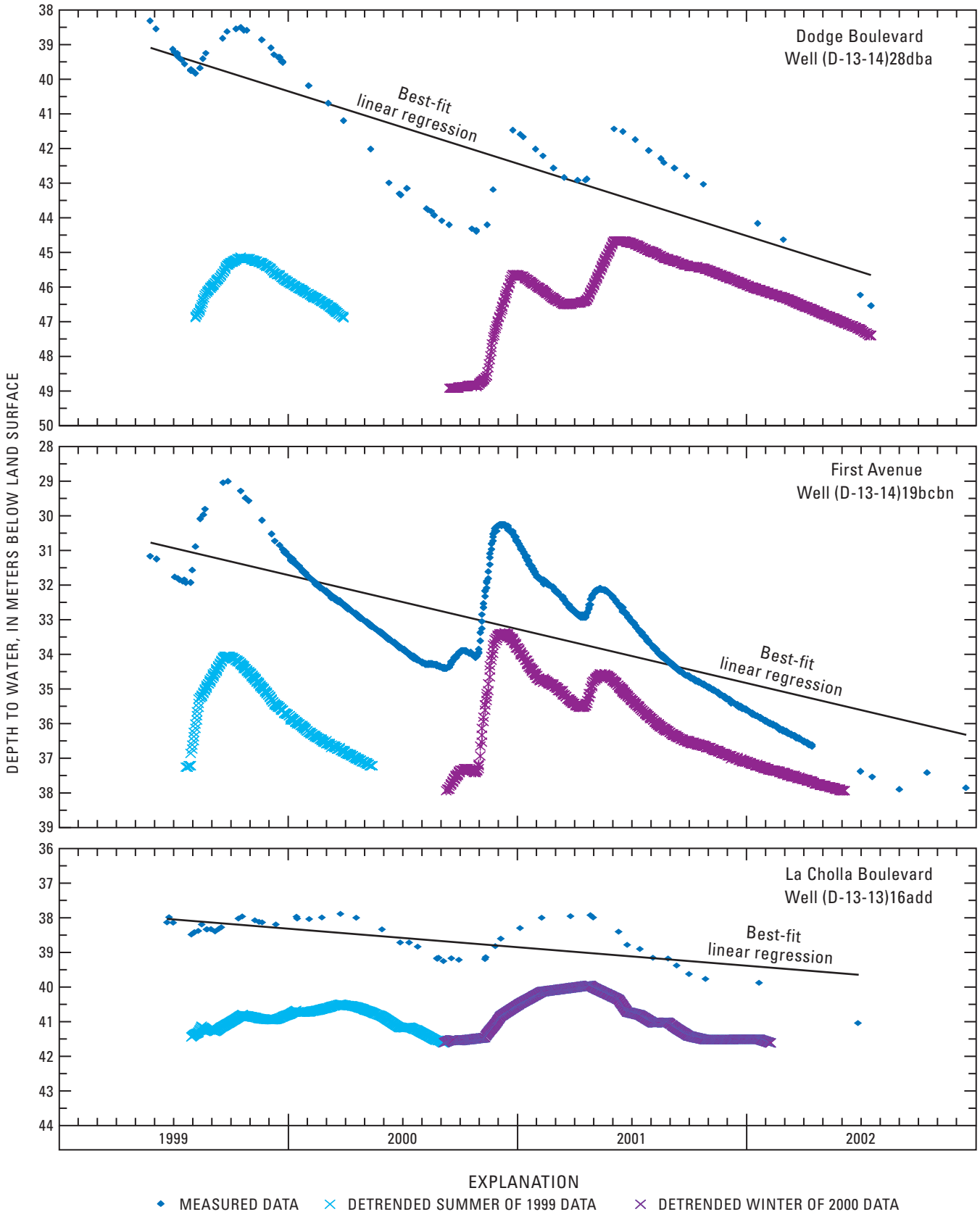

Figure 22. Measured and detrended hydrographs of selected piezometers within Rillito Creek, Pima County, Arizona.

Table 2. Recharge estimates for sites in Rillito Creek, Pima County, Arizona, using the Moench and Kisiel (1970) analytical-model method.

[m^2/sec, square meters per second; m^3/km, cubic meters per kilometer; m^3/s/km, cubic meters per second per kilometer]

Site location	Distance of well from center of Rillito Creek channel, in meters	Recharge	1999		2000	
			Transmissivity = 1.6×10^{-3} m^2/s	Transmissivity = 6.5×10^{-3} m^2/s	Transmissivity = 1.6×10^{-3} m^2/s	Transmissivity = 6.5×10^{-3} m^2/s
Dodge Boulevard	3	Length of recharge period, in days[1]	9		43	
		Total, in m^3/km	1.7×10^5	3.4×10^5	7.1×10^5	1.4×10^6
		Rate, in m^3/s/km	0.2	0.4	0.2	0.4
First Avenue	45.7	Length of recharge period, in days[1]	7		30	
		Total, in m^3/km	3.0×10^5	6.0×10^5	5.3×10^5	1.1×10^6
		Rate, in m^3/s/km	0.5	1	0.2	0.4
La Cholla Boulevard	3	Length of recharge period, in days[1]	4.5		14	
		Total, in m^3/km	1.3×10^5	2.5×10^5	2.2×10^5	4.3×10^5
		Rate, in m^3/s/km	0.3	0.7	0.2	0.4

[1]Refers to the cumulative time streamflow existed in Rillito Creek. Streamflow durations were calculated using data from the streamflow-gaging stations near Dodge and La Cholla Boulevards.

made using temperature, water-content, and seepage-loss methods. Because infiltrated water can be stored in the shallow subsurface it is available for subsequent evaporation and (or) transpiration; therefore, infiltration rates typically provide an upper bound for recharge rates. Estimated recharge rates in excess of infiltration rates indicate unaccounted sources of water. These unaccounted sources likely are inputs from adjacent tributaries, many of which drain the pediment north of Rillito Creek.

Temporal Gravity Measurements

Ground-water storage was monitored along two gravity profiles across Rillito Creek at Swan Road (5-km length) and First Avenue (6.4-km length). The profiles included 11 gravity stations that are closely spaced near Rillito Creek and at wells where water levels are monitored (fig. 1). Gravity changes along both profiles after summer 1999 show that increases in ground-water storage were primarily within the flood plain coincident with the stream alluvium (fig. 23). Gravity increases on the First Avenue profile were largest between these measurement dateswere at the station nearest Rillito Creek. The largest increase between June 199 and August 1999 was 48 microgals, which is equivalent to about 1.1 m of water, assuming the mass change occurs within a horizontal slab of infinite extent. Gravity increase on the Swan Road profile also was largest between the June 1999 and August 1999 measurements at the station about 0.5 km south of Rillito Creek. The greatest change between these measurement dates was 42 microgals (equivalent to about 1 m of water). The gravity changes and associated water-level rises indicate that the highly permeable stream-channel and flood-plain deposits act as a ground-water reservoir that readily accepts infiltrated streamflow.

Estimates of recharge through infiltration along Rillito Creek were made by assuming the storage changes measured by gravity at each profile were equivalent to recharge and by integrating the two-dimensional gravity change for the length of the creek. Similar to that shown with water-level trends, the overall storage-change estimates during the period of study steadily declined with two periods of recharge superimposed on the longer-term rate of decline (fig. 24). The long-term storage decline shown in figure 24 is related to the dissipation of a water-table mound produced in 1998, from sustained flows related to the El Niño precipitation, and to ground-water pumpage from nearby public and private wells. The periods of increased storage that reduce the rate of long-term declines were associated with the summer 1999 and fall/winter 2000 streamflows (figs. 3 and 24). The increase in storage for the summer 1999 period is about 7.5×10^6 m^3 ; for the fall/winter 2000–2001 period it is about 11.1×10^6 m^3 for the 14-km reach between Craycroft Road and La Cholla Boulevard. Although measurable, these seasonal storage increases are small compared to the storage increases associated with the 1998 El Niño event, which were about 5×10^7 m^3 (fig. 24).

Assuming that the increases in storage measured in summer 1999 and fall/winter 2000–2001 were uniform throughout the 14-km reach between Craycroft Road and La Cholla Boulevard, they would equate to 5×10^5 m^3/km and

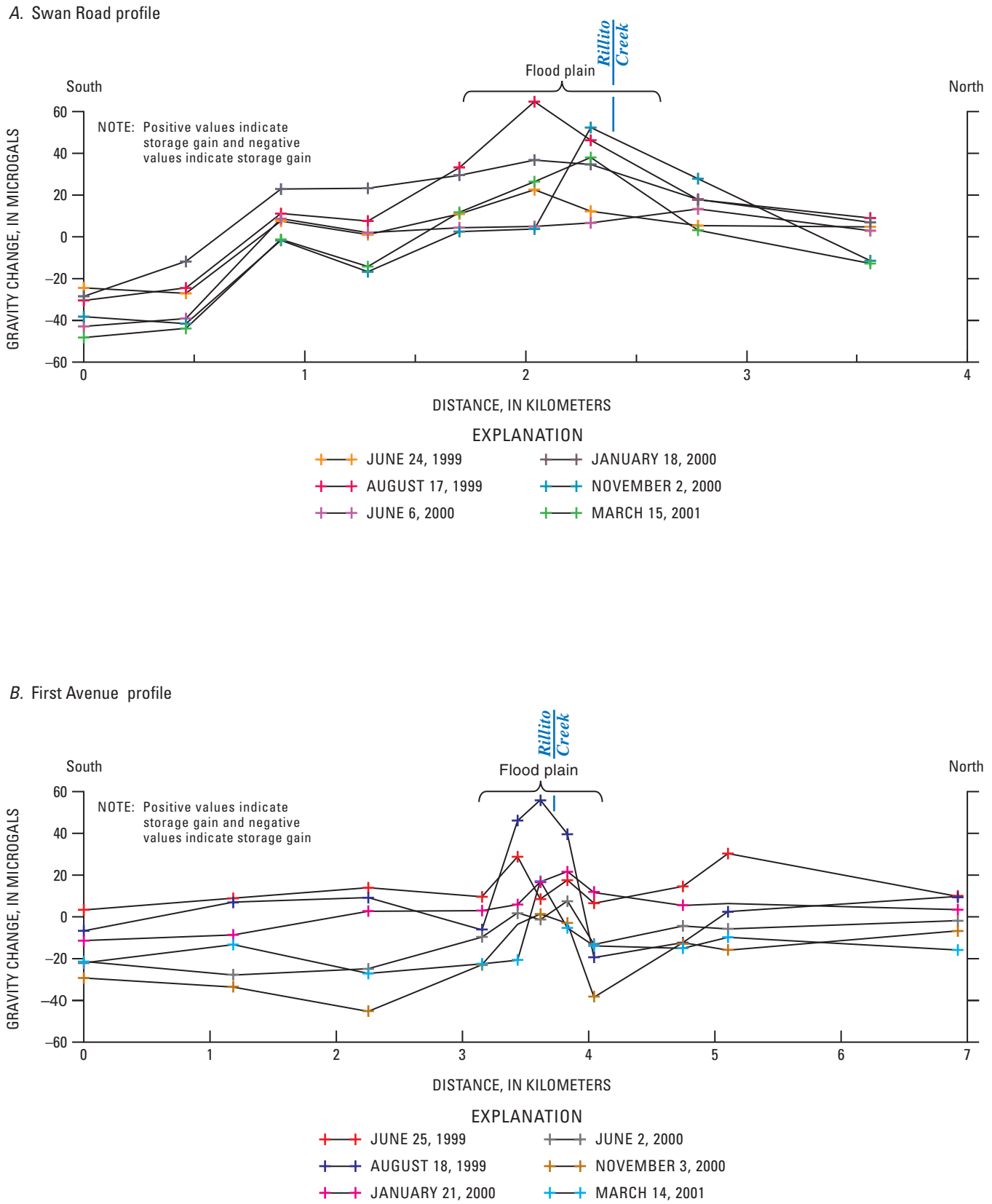

Figure 23. Gravity changes along profiles crossing Rillito Creek, Pima County, Arizona, since December 1997. *A*, Swan Road; *B*, First Avenue.

8×10^5 m^3/km, respectively. Using 7 days of flow (as estimated at First Avenue; table 2) for the summer 1999 event and 30 days of flow for the fall/winter 2000-2001 event, these recharge volumes equate to 0.9 m^3/s/km in the 1999 event, and 0.3 m^3/s/km in the 2000–2001 event.

These rates are generally similar to those estimated using water-level methods, yet greater than volumetric-infiltration estimates made using temperature, water-content, and seepage-loss methods. As discussed previously, recharge-rate estimates in excess of infiltration-rate estimates indicate unaccounted sources of water. These unaccounted sources likely are inputs from adjacent tributaries, many of which drain the mountain-front area north of Rillito Creek.

Two-dimensional simulations of the change in water distribution in the subsurface required to produce the change in gravity for the period June 24, 1999 to August 18, 1999, along both profiles are shown in figure 25. Simulations used GM-SYS software (version 4.6) developed by Northwest Geophysical Associates, Inc. The software calculates the gravity field response of polygonal features of variable subsurface density using the theory and algorithms of Talwani and others (1959), and Won and Bevis (1987). Simulation of the two-dimensional vertical polygons requires simplifying assumptions about the distribution of storage change in the third dimension, in this case along the stream channel, and at the margin of the simulated region. This application assumed the two-dimensional polygons of storage change extended in infinite length along the stream channel. Storage change in the crystalline rocks adjacent to the northern boundary of the aquifer was assumed to be insignificant. Storage change in the aquifer adjacent to the southern end of the profiles was assumed to extend laterally to an infinite distance. Each of these assumptions likely contributes little to no errors in the simulation. Available water-level data and gravity-derived estimates of specific yield were used to constrain the vertical distribution of saturated storage change at many gravity-station wells. Gravity changes along the First Avenue profile are explained by a combination of higher water levels and increases in water content in the unsaturated zone. A 10-percent increase in unsaturated water content was required to match the observed gravity change at gravity stations near the channel. The resulting model (fig. 25*A*) resulted in simulation errors of less than 1 microgal at each station.

Simulation of gravity change along the Swan Road profile could be explained by storage change within the zone of water-level change: no changes in water content in the unsaturated zone were required. Increases in gravity at all stations along the Swan Road profile during June 24, 1999, to August 17, 1999, (fig. 25*B*) indicated that infiltration and recharge during the intervening period between gravity surveys resulted in storage increases within about 2 km of the stream channel. The greatest increases in gravity occurred at the two stations within about 0.5 km south of the channel. Gravity increases at stations farther from the channel ranged from 2 to 23 microgal. The resulting model (fig. 25*B*) resulted in simulation errors of generally less than 1 microgal at each station.

Summary and Conclusions

The amount of water currently recharging the aquifers within the Tucson area is insufficient to meet current and future demands. Resultant ground-water deficits are manifested in water-level declines of more than 60 m since the middle of the twentieth century. The accurate determination of recharge is critical to establishing a sustainable water budget on the basin scale. In semiarid regions, recharge beneath ephemeral-stream

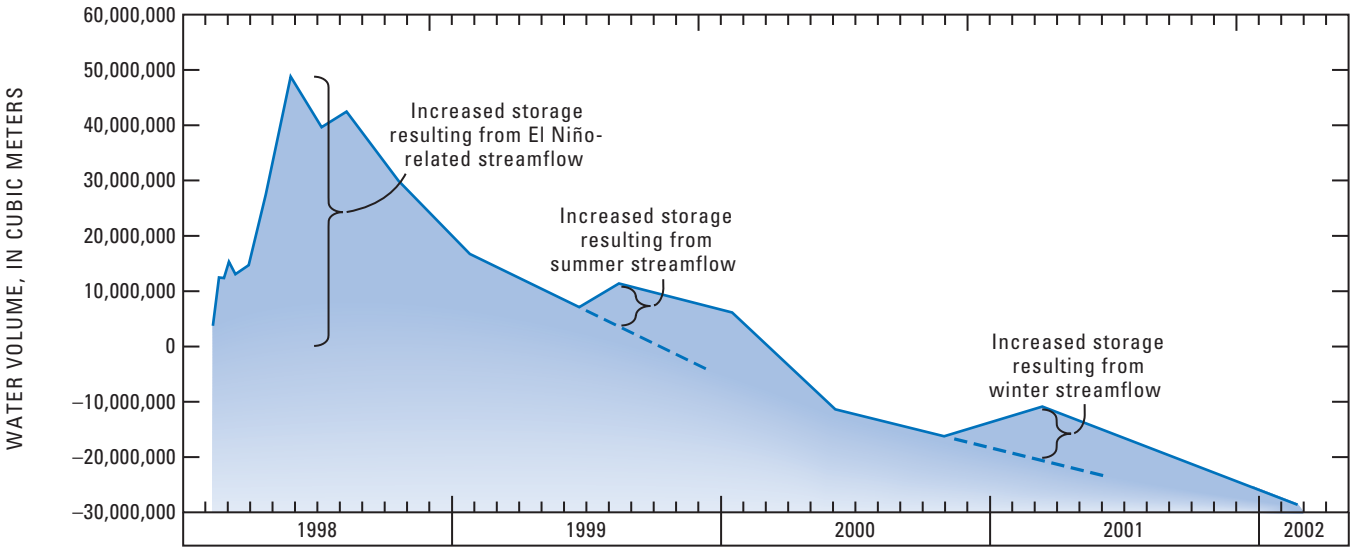

Figure 24. Storage changes measured along Rillito Creek, Pima County, Arizona, from Craycroft Road to La Cholla Boulevard relative to a measurement made in December 1997.

channels typically represents a major component of the total recharge. Improved understanding of streambed infiltration and the subsequent redistribution of water within the unsaturated zone is fundamental to quantifying and forming an accurate description of streambed recharge.

One of the challenges of quantitatively studying recharge beneath ephemeral-stream channels is the need to integrate measurements made over a wide range of spatial and temporal scales. No single method of measurement or analysis can resolve the complex physical processes that contribute to infiltration, percolation, and recharge beneath these channels; therefore, various approaches that provide a wide range of temporal and spatial scale measurements of recharge beneath Rillito Creek were used in this study. The approaches discussed in this chapter included analyses of cores and cuttings for hydraulic and textural properties, environmental tracers from the water extracted from the cores and cuttings, seepage measurements made during sustained streamflow, heat as a tracer and numerical simulations of the movement of heat through the streambed sediments, water-content variations within a two-dimensional array, water-level responses to streamflow in piezometers within the stream channel, and gravity changes in response to recharge.

The amount of water flowing in Rillito Creek, and therefore the amount available for ground-water recharge, is primarily related to precipitation frequency, distribution, and intensity, as well as to streamflow and basin/channel runoff characteristics. The temporal distribution of flow in ephemeral streams is highly varied. Because of this, estimating or predicting recharge rates for ephemeral-stream channels on the basis of limited temporal observations is particularly difficult. This investigation extended from 1999 through most of 2002 and represented a time of lower than average precipitation and streamflow on the basis of data from the previous 30 years. Estimates of cumulative infiltration and recharge during this study period may differ from long-term averages; however, estimates of infiltration and recharge rates for streamflow events during the study period can be extrapolated to a variety of climatic conditions.

In order for ephemeral streamflow within Rillito Creek to recharge the underlying aquifer, the water must first infiltrate into the stream-channel deposits and percolate downward through the underlying deposits. The ability of water to infiltrate and percolate through these deposits is a function of the availability of streamflow and the hydraulic properties of the deposits. Study results indicate that the ver-

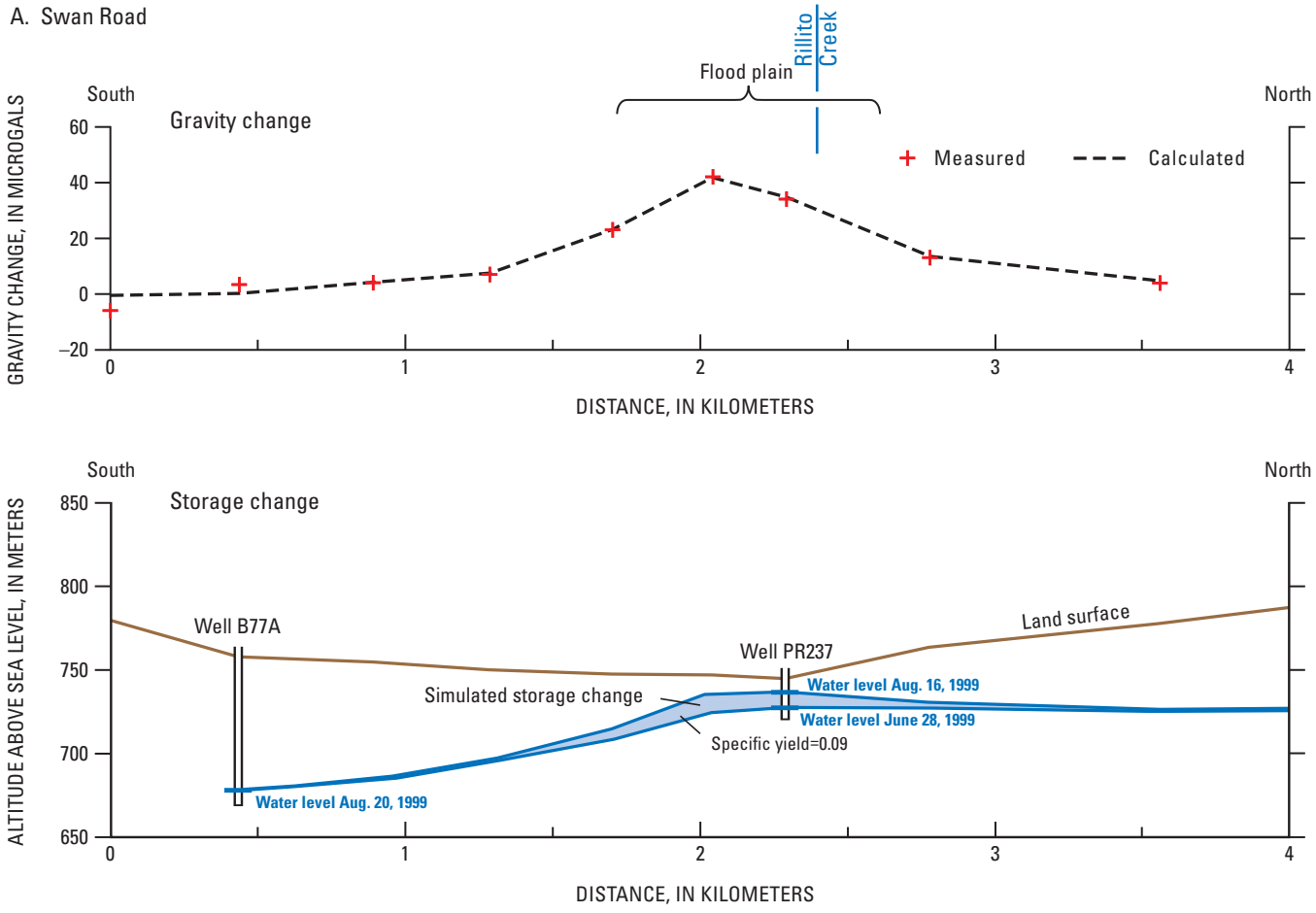

Figure 25. Gravity-model results for profiles crossing Rillito Creek, Pima County, Arizona. *A*, Swan Road; *B*, First Avenue.

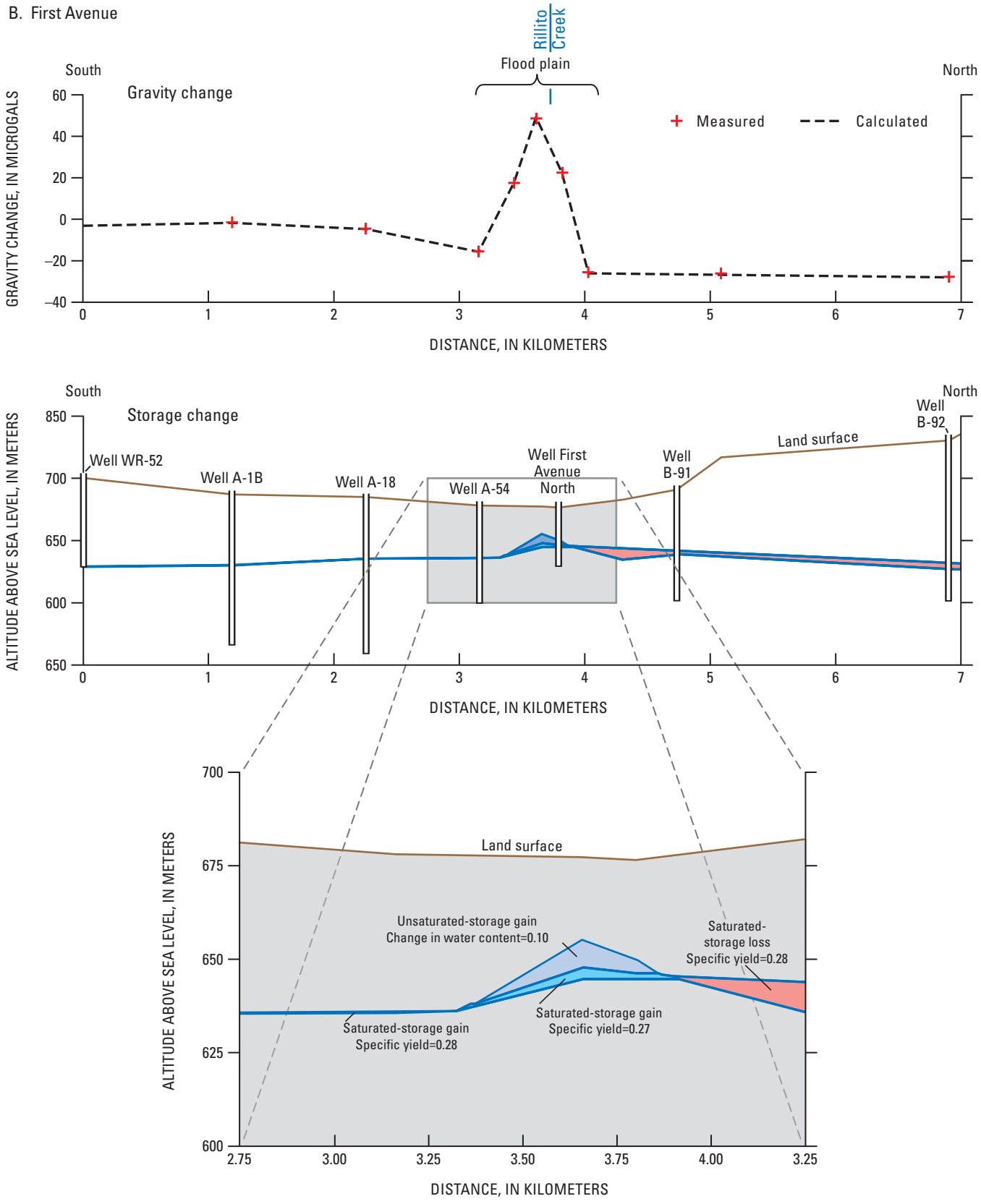

Figure 25.—Continued.

tical hydraulic conductivity of the stream-channel deposits ranges from 0.3 to 2.5 m/d, whereas hydraulic conductivity of the the basin-fill deposits ranges from 0.012 to 0.61 m/d. For heterogeneous media, such as the deposits beneath Rillito Creek, the equivalent vertical hydraulic conductivity is calculated as the harmonic mean of the Ksat for each textural layer within the deposits. Although differing at each borehole, the overall average equivalent saturated hydraulic conductivity of the stream-channel deposits is 1.2 m/d; the overall average equivalent saturated hydraulic conductivity of the basin-fill deposits is 0.19 m/d; and the equivalent hydraulic conductivity of the stream-channel and basin-fill deposits together is about 0.23 m/d (table 3). Assuming no preferential flow occurs and unit gradient conditions, these equivalent vertical hydraulic conductivity values provide an estimate of long-term potential recharge rates under saturated conditions. To convert these values into potential recharge volumes, assumptions of flow duration and average wetted perimeter and length must be made. For example, using an annual cumulative flow duration of 36 days per year for Rillito Creek, an average wetted perimeter of 20 m and a wetted length of 20 km, yields an annual volumetric recharge of 4.3×10^6 m^3/y, which is about two-thirds of the commonly reported long-term average recharge of 6×10^6 m^3/y (Hanson and Benedict, 1994).

Environmental tracers were used to evaluate spatial variations in infiltration and recharge patterns along Rillito Creek and estimate percolation rates through the unsaturated zone. Tritium was detected in pore water extracted from all core samples and ranged from 2 to 11 TU, indicating that water in the unsaturated zone infiltrated during the past 40 years. Given the presence of tritium in the unsaturated zone, the locally high vertical hydraulic conductivity values greater than 1 m/d in the stream-channel deposits, and a depth to the water table of generally less than 40 m, it is likely that most of the pore water extracted from the cores infiltrated during runoff events in the past few years. Variations in isotopic compositions of ground water beneath Rillito Creek are attributed to changes in the compositions of the source water and to evaporation. The lack of an evaporative signal for some samples indicates that percolating water was exposed to minimal evaporation.

Isotopic ratios measured in the pore water during the study are representative of the isotopic ratios in the infiltrating waters of the recent past. Isotopic ratios in Rillito Creek pore water become lighter in the downstream direction indicating that for the time period represented by the unsaturated-zone pore water, the longer duration and isotopically lighter winter storms were more important contributors to infiltration in the downstream reaches than in the upstream reaches. The trends in isotopic ratios measured in the pore-water cores approximately match the trends in ratios in the basin precipitation from particular storms during the year prior to drilling. Correlation between the precipitation events and depths of infiltration, on the basis of corresponding isotopic signatures, indicates an average vertical-percolation rate of approximately 0.049 m/d at the Dodge Boulevard borehole site (table 3). Chloride concentrations in pore-water leachate determined from drill cuttings varied substantially through the upper 18 m at all sites. Below about 18 m, variation in chloride concentration declined considerably. This zone of smaller variation is interpreted as corresponding to the infiltration depth of the 1998 El Niño water. The low variability and low mean value of chloride concentration is attributed to a constant supply of runoff having a low chloride concentration. In addition, the low chloride concentration indicates the water had little exposure to evaporation. The higher variability and concentration observed in post-El Niño pore water above 18 m likely is due to mobilization of chloride from evaporative concentrates and dry fallout deposited between precipitation events that resulted in runoff along a variety of surface-water flow paths. Calculation of a downward percolation rate using the El Niño event marker in the chloride profile yields an average percolation rate of 0.055 m/d (table 3). Although the estimates of recharge determined by hydraulic properties and environmental tracers required the assumption of no preferential flow, the water-level responses measured in the deep piezometers indicate that factors such as preferential flow likely influence recharge rates. Estimates made using these techniques, therefore, are likely representative of minimum values.

Infiltration rates are typically assumed to provide an upper bound for recharge rates. Infiltration rates were estimated using seepage-loss, temperature, and water-content methods. Seepage measurements made at several sites along Rillito Creek during the El Niño-related sustained flows of March through April 1998 and again on October 24, 2000, indicate that streamflow losses owing to infiltration along Rillito Creek ranged from 0.07 to 0.9 m^3/s/km and averaged 0.21 m^3/s/km (table 3). Streamflow losses were smallest in the upstream reaches. The losses in these reaches were attributed to a shallow water table and rejected recharge. Using a wetted perimeter of 25 m, which was the average width of the flow that occurred during October 2000, the calculated average infiltration rate is 0.7 m/d, (table 3) which is similar to the measured saturated hydraulic conductivity of the stream-channel deposits but more than an order of magnitude greater than percolation rates determined by tracers. The difference between the estimated infiltration and percolation rates probably is due to the variably saturated nature of the sediments. The near-surface stream-channel deposits are likely to be nearly saturated during streamflow and therefore are approaching their saturated hydraulic conductivity, whereas the deeper sediments are less saturated and will therefore have a lower hydraulic conductivity.

Infiltration-rate estimates made using temperature and water-content methods in this study are one dimensional; information on stream width and length are required to estimate volumetric rates from the infiltration estimates. Model simulations using streambed-temperature data indicate the likelihood of a thin surface layer having a low vertical

hydraulic conductivity at the site near Craycroft Road. The addition of this surface layer to the model domain resulted in a lowering of the simulated equivalent saturated hydraulic conductivity by four orders of magnitude from about 4 m/d to 3×10^{-4} m/d. The four orders of magnitude change is too large to result solely from changes in water viscosity owing to temperature changes. Given the tranquil flow conditions during the first modeled flow period near Craycroft Road, it is possible that the change resulted from the deposition of a fine-grained layer of sediment on the streambed surface. In fact, a thin layer of fine-grained material commonly was observed at the sites after small streamflows. Vertical hydraulic gradients measured in the nested piezometers at the site near Craycroft Road allowed for estimation of infiltration rates using simulated equivalent vertical saturated hydraulic conductivity. Vertical hydraulic gradients during and shortly after streamflow were typically 0.1 m/m. Estimated infiltration rates ranged from 0.09 $m^3/s/km$ during the period probably most representative of ephemeral-streamflow conditions. The infiltration rate of 0.09 $m^3/s/km$ (table 3) is about half of that estimated using seepage-measurement data. The difference between these methods is primarily the wetted-perimeter value used in the calculation. The seepage-measurement estimates used a wetted perimeter of 25 m that was based on measured stream width, whereas a wetted perimeter of 10 m was used for flows during the period modeled with the temperature method because flows during this period were smaller than those during the seepage measurements. If hydraulic conductivity and vertical gradient are assumed not to change with increasing wetted perimeter and these rates are extrapolated to a wetted perimeter of 25 m, infiltration rates estimated with the temperature method are 0.23 $m^3/s/km$—virtually the same that measured by the seepage-loss method.

Two-dimensional arrays of temperature and water-content sensors indicated that water-content measurements enable better estimates of rapid-infiltration rates associated with the onset of streamflow. Infiltration rates within the first few minutes after the onset of streamflow were as large as 166 m/d; however, saturation within the relatively homogeneous stream-channel deposits of Rillito Creek was established in less than 10 minutes and subsequent infiltration rates declined significantly. Simplified one-dimensional model simulations used to estimate infiltration as soon as the sediments were saturated indicate infiltration rates declined as streamflow duration increased and averaged 0.32 m/d for the 12-day event in April 2000 and 0.37 m/d for the 10-day event in November (table 3). The declining infiltration rate is attributed to a declining pressure head and (or) development of a thin fine-grained surface layer. On the basis of a wetted perimeter of 10 m, an average infiltration rate of 0.32 m/d equates to a flux of 0.04 $m^3/s/km$ (table 3).

Water levels in the stream-channel piezometers showed an overall decline during the period of investigation in relation to long-term records. The water-level decline probably is related to ground-water pumpage from the basin-fill deposits. Superimposed on the water-level decline is a series of water-level rises that range from about 0.5 to 3.9 m. These rises were in response to the two periods of greatest streamflow occurring in the summer of 1999 and the fall/winter of 2000. The water-level responses to streamflow were followed by gradual water-level dissipation.

Water-level responses were analyzed by using an analytical model to simulate cumulative recharge for the water-level rises measured in 1999 and 2000. The largest cumulative-recharge estimates for the 1999 event were for a piezometer site near the middle of the study reach and range from 3.0×10^5 to 6.0×10^5 m^3/km. This range is about two to three times as large as that for the other two sites. Estimates of recharge for 2000 were about two- to five-times that of the estimates for 1999. The trends revealed in this analysis are consistent with streamflow volumes and duration, and the magnitude of water-level changes that occurred in the piezometers in response to the streamflow. Cumulative-recharge estimates for the 2000 recharge event were greatest at the upstream-most site and decreased in the downstream direction. Recharge estimates for the upstream-most site range from 7.1×10^5 to 1.4×10^6 m^3/km; these values are slightly larger than those estimated for the middle-reach site and about three times greater than that estimated for the site farthest downstream. Recharge rates, estimated by dividing the cumulative-recharge estimates by the cumulative duration of streamflow, resulted in rates that range from 0.2 to 1.0 $m^3/s/km$ for 1999 and from 0.2 to 0.4 $m^3/s/km$ for 2000 (table 3).

Gravity methods used to estimate recharge through infiltration along Rillito Creek provide values similar to those made by using the water-level method. Both gravity- and water level-derived estimates, however, are higher than the infiltration-rate estimates made by using seepage, temperature, or water-content change methods. Typically, infiltration-rate estimates provide an upper bound for recharge-rate estimates as some of the infiltrated water is stored in the shallow subsurface and used by vegetation, or is subsequently evaporated. The relatively high estimates of recharge determined by the gravity and water-level methods compared to estimates of infiltration determined by use of the seepage, temperature, and water-content methods probably is due to recharge from ungaged tributaries. The ungaged tributaries provide additional wetted perimeter and channel length not accounted for in the recharge estimates made by using the seepage, temperature, and water-content methods.

Table 3. Summary of methods used and estimated rates of infiltration, percolation, and recharge along Rillito Creek, Pima County, Tucson, Arizona.

[m/d, meters per day; m^3/s, cubic meters per second; m^3/yr, cubic meters per year]

Method	One-dimensional infiltration rate, m/d	Vertical percolation rate, m/d	Volumetric rate, m^3/s per kilometer of streamflow (wetted perimeter of 25 meters is used for temperature-method estimates)	Potential annual average recharge; assumes 36 days of flow in the 20 kilometer reach, m^3/yr	Comments
Physical: equivalent saturated hydraulic conductivity	0.23	Not calculated	Not calculated	4.1×10^6	From Darcy's Law the flow rate through the sediments under saturated conditions is equal to the product of the hydraulic conductivity and the hydraulic gradient. This method uses the average vertical equivalent saturated hydraulic conductivity of the combined stream-channel and basin-fill deposits multiplied by a unit gradient to estimate a recharge rate in meters per day.
Stable-isotope profiles	Not calculated	0.049	Not calculated	Not calculated	Method uses isotopic signatures associated with specific streamflow events and correlates pore water at depth with timing of introduction of water to unsaturated zone.
Chloride profiles	Not calculated	0.055	Not calculated	Not calculated	Method uses chloride concentrations associated with streamflow seasons and correlates pore water at depth with season (timing) water was introduced to unsaturated zone.
Seepage losses	0.75	Not calculated	0.07 to 0.9; average of 0.21	13.7×10^6	Method uses differences in streamflow measurements to calculate streamflow losses. Seepage losses represent infiltration rates in cubic meters per kilometer per second of streamflow. The one-dimensional rate (0.75 meter per day) was calculated by using the average (0.21 cubic meters per kilometer per second).
One-dimensional temperature modeling	0.8 to 1.0	Not calculated	0.23	14.3×10^6	Rates shown are representative of infiltration rates prior to the reduced rates simulated to occur owing to the accumulation of fine sediments on the streambed surface. One-dimensional rates are based on a modeled hydraulic conductivity of 4 to 5 meters per day and a measured vertical hydraulic gradient of 0.2.
Temperature data from two-dimensional trench	0.32 (April 2000) 0.37 (November 2001)	Not calculated	0.09	5.8×10^6	Temperature modeling results in vertical infiltration rates of 0.32 to 0.37 meters per day; drainage-rate measurements after cessation of streamflow result in a vertical velocity of 0.46 meters per day.
Water level	Not calculated	Not calculated	0.2 to 1.0 for 1999; 0.2 to 0.4 for 2000–2001	Not calculated	Method uses an analytical solution to simulate recharge on the basis of a hydrograph response. Volumetric rates represent recharge rates for the period of streamflow in respective years.
Gravity integrated from Craycroft Road to La Cholla Boulevard	Not calculated	Not calculated	0.8 for 1999; 0.3 for 2000–2001	Not calculated	Method uses ground-water storage changes measured at Swan Road and First Avenue, and extents the storage changes upstream to Craycroft Road and downstream to La Cholla Boulevard. An average flow duration listed in table 2 is used to estimate the rate.

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Exhibit 14

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San Pasqual Groundwater Management

State of the Basin Report Update

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City of San Diego

September 2015

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San Pasqual Groundwater Management State of the Basin Report Update

Prepared for

City of San Diego

Public Utilities Department
Long Range Planning and Water Resources
525 B Street, Suite 300, MS906
San Diego, CA 92101-4409

September 2015

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Figure 2-4
CASGEM Depth to Groundwater Levels
San Pasqual Groundwater Management State of the Basin Report Update

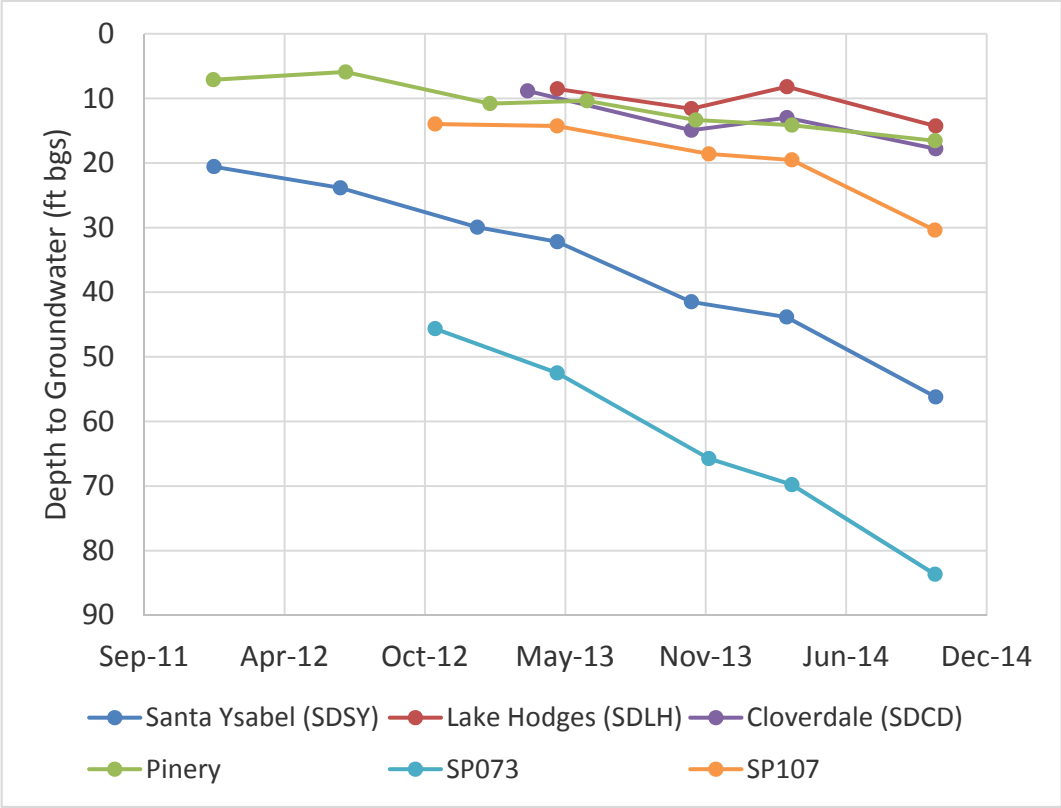

Figure 2-4 shows the depth-to-water measurements of the monitoring wells included in the CASGEM Program. The deepest groundwater is in the eastern part of the Basin, east of the confluence of Guejito Creek. Groundwater in this area is as deep as 83 feet below ground surface (bgs) (at SP073). The shallowest groundwater measured was adjacent to Lake Hodges (14 feet bgs at SDLH).

2.2.2 Groundwater Elevations

Figure 2-5 shows groundwater elevations for the City monitoring network measured between 2010 and 2014. Groundwater generally flows from the east to the west through the Basin. The highest groundwater elevation was measured to be 440 feet msl, at SP093. The lowest groundwater elevation was measured at 318 feet msl, at SP106.

2.3 Water Quality

The City has measured and monitored groundwater quality in the Basin for decades, including as part of the SPGMP. Groundwater monitoring is ongoing at several locations, because total dissolved solids (TDS) and nitrogen (as nitrate [NO_3]) concentrations have been of particular concern.

2.3.1 Groundwater Quality

Water quality objectives (WQO) for the Basin were established by the San Diego Regional Water Quality Control Board (RWQCB) as part of the Water Quality Control Plan for the San Diego Basin (RWQCB, 1994), which is available online (http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/). Groundwater quality in some areas of the Basin does not meet the objective and include chloride, nitrate (as NO_3), sulfate, TDS, iron, and manganese, as noted in Table 2-1. The groundwater WQOs are protective of beneficial uses that are consistent with the Basin management objectives and Basin utilization goals of the City.

The City attempts to collect and analyze groundwater samples quarterly; however, often only one or two sampling events occur in a year. The samples are analyzed for a variety of inorganics, organics, and metals. Because TDS and NO_3 have been evaluated as the constituents of interest, the most recent concentrations in groundwater have been graphed (see Figures 2-6 and 2-7). The overall trend shows that nitrate increases from east to west, and TDS is highest toward the middle of the Basin, which can be attributed to the variety of land uses in the Basin and general movement of groundwater through the aquifer. However, the westernmost sampling location, SP010, has much lower concentrations than the other western groundwater sites. Table 2-1 presents a summary of groundwater quality in the Basin.

2.3.1.1 Total Dissolved Solids

TDS concentrations is one way to quantify groundwater salinity within the Basin. More salts are currently entering the aquifer than are being removed, which has resulted in an overall increase in groundwater concentrations of TDS over time. Evapoconcentration of groundwater salts from irrigation pumping and passive use by riparian vegetation is a significant factor contributing to elevated TDS concentrations in groundwater. In addition, with more than 90 percent of the total nitrogen (TN) contributions to the Basin coming from fertilizer and manure use, and given the historical elevated nitrate concentrations in groundwater, effective nutrient management across agricultural and urban landscapes has been identified as an important component of Basin water quality management.

TDS concentrations in the westernmost well (SP010) range from 604 to 1,050 milligrams per liter (mg/L), which indicates that groundwater is leaving the Basin with TDS concentrations that exceed the recommended secondary maximum contaminant level (MCL) of 500 mg/L and in some instances exceed the WQO of 1,000 mg/L. An analysis of existing historical data indicates that TDS concentrations in the western portion of the Basin have generally increased since 1950; however, constituent concentration trends seem to have become more constant in the western portion of the Basin over approximately the last decade.

2.3.1.2 Nitrates

Although the most recent nitrate concentrations in well SP010 are relatively low, average NO_3 concentrations in the western Basin are 40 mg/L, with a maximum concentration of 174 mg/L; thus, the primary MCL for nitrate (as NO_3) of 45 mg/L as well as the WQO of 10 mg/L is exceeded in some areas. Historical data show that the general trend for nitrate concentrations has increased, with the exception of wells SP089 and SP061, which have decreased.

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August 12, 2021

Via Electronic Mail and Online Submission

Ms. Karina Danek
Public Utilities Department
City of San Diego
525 B Street
San Diego, CA 92101
KDanek@sandiego.gov

Subject: Comments on the San Pasqual Valley Basin Groundwater Sustainability Plan

Dear Ms. Danek:

The California Department of Fish and Wildlife (CDFW) is providing comments on the draft San Pasqual Valley Basin Groundwater Sustainability Plan (SPV-GSP). As Trustee Agency for the State's fish and wildlife resources, CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of such species [Fish & Game Code Sections §§ 711.7 and 1802]. CDFW has an interest in the sustainable management of groundwater, as many sensitive ecosystems and public trust resources depend on groundwater and interconnected surface waters.

The San Pasqual Valley Groundwater Sustainability Agency (SPV GSA) was developed through a Memorandum of Understanding (MOU) between the City of San Diego (City) and the County of San Diego (County) and developed to comply with California's Sustainable Groundwater Management Act (SGMA) and its requirement to sustainably manage the San Pasqual Valley Groundwater Basin (Basin). SGMA, which became effective January 1, 2015, provides a framework to regulate groundwater by requiring local agencies to form Groundwater Sustainability Agencies (GSAs) and providing those GSAs with the necessary tools to manage groundwater use (California Water Code [CWC] Section 10720, et seq.)

COMMENT OVERVIEW

CDFW is writing to support ecosystem preservation and enhancement under SGMA implementation in the context of the following SGMA statutory mandates and CDFW ecological and biological expertise.

SGMA affords ecosystems specific statutory and regulatory consideration:

- GSPs must consider **impacts to groundwater dependent ecosystems** [Water Code §10727.4(l)].
- GSPs must identify potential **effects on all beneficial uses and users of groundwater**, including fish and wildlife preservation and enhancement [Title 23 California Code of Regulations § 666], that may occur from undesirable results [Title 23 California Code of Regulations § 354.26(b)(3)].

- GSPs must **account for groundwater extraction for all Water Use Sectors** including managed wetlands, managed recharge, and native vegetation [Title 23 California Code of Regulations § 351(al), § 356.2(b)(4)].

Furthermore, the Public Trust Doctrine imposes a related but distinct obligation to consider how groundwater management affects public trust resources, including navigable surface waters and fisheries. Groundwater hydrologically connected to surface waters are also subject to the Public Trust Doctrine to the extent that groundwater extractions or diversions affect or may affect public trust uses (*Environmental Law Foundation v. State Water Resources Control Board* (2018), 26 Cal. App. 5th 844; *National Audubon Society v. Superior Court* (1983), 33 Cal. 3d 419). Accordingly, groundwater plans should consider potential impacts to and appropriate protections for interconnected surface waters and their tributaries, and interconnected surface waters that support fisheries, including the level of groundwater contribution to those waters.

In the context of SGMA statutes and regulations, and Public Trust Doctrine considerations, groundwater planning should carefully consider and protect environmental beneficial uses and users of groundwater, including fish and wildlife and their habitats, groundwater dependent ecosystems, and interconnected surface waters. CDFW supports ecosystem preservation and enhancement in compliance with SGMA and its implementing regulations based on CDFW expertise and best available information and science. CDFW offers the following comments and recommendations to assist SPV GSA in evaluating effects to GDEs.

COMMENTS AND RECOMMENDATIONS

Groundwater Dependent Ecosystems

Comment #1: Assessment of Interconnected Streams and Groundwater Dependent Ecosystems (GDEs). (SPV-GSP Volume 1 Section 4.6, SPV-GSP Volume 2 Appendices J and L, page 4-42)

Issue: The SPV-GSP conclusion that streams and wetlands in the eastern portion of the Basin (eastern Basin) are disconnected from the Basin's aquifer (i.e., not GDEs) is not fully supported by the data provided in the SPV-GSP or in Appendices J and L. Readily available scientific data indicates that the riparian and wetland vegetation in the eastern Basin likely maintain some connectivity to groundwater and should still be considered GDEs. Under SGMA, a GSP is required to avoid unreasonable adverse impacts on the beneficial uses of interconnected surface waters, defined as, "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer, and the overlying surface water is not completely depleted" (Water Code §§ 10721(x)(6) and 10727.2(b); 23 CCR § 351(o).).

Concern: The SPV-GSP's reliance on the 2015 to 2019 baseline analysis to identify disconnected portions of the Basin and eliminate potential GDEs with a depth to groundwater greater than 30 feet is not representative of current climate conditions. The 2015 to 2019 baseline analysis begins several years into a historic drought when groundwater levels throughout the Basin were trending lower than usual due to reduced surface water availability. As such, this period of groundwater elevations does not account for GDEs that can survive a finite period without groundwater access (Naumburg et al. 2005). The following are additional factors which support the need to further analyze GDEs and groundwater levels:

a. The distance to groundwater within the riparian/wetland habitat may be less than the distance to groundwater at the well location, given that riparian and wetlands are located in

topographical depressions compared to adjacent well locations; therefore, calculations for GDE's should be corrected for actual ground surface elevation (The Nature Conservancy 2019). The corrected distance to groundwater elevation should be used in the GDE analysis.

b. As shown in Appendix L, some hydrographs in the eastern Basin show measurement at or around 30 feet in 2019, yet the SPV-GSP categorized streams in the eastern Basin as disconnected due to depth to groundwater being greater than 30 feet since 2015. Wells in the eastern reaches show recent connection to groundwater and should be considered GDEs.

c. Appendix J notes that, "[t]he major drainages in the San Pasqual Valley have significant riparian or wetland vegetative communities with an abundance of woody phreatophytes such as willows (*Salix* spp.), salt cedar (*Tamarisk ramosissima*), Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), and California fan palm (*Washingtonia filifera*)" (pg. 14). Some of these trees, such salt cedar, can have a rooting depth up to 70 feet (Gries et al. 2003). These species, while not native to southern California, provide habitat for the California Endangered Species Act (CESA)-listed least Bell's vireo (*Vireo bellii pusillus*).

d. Riparian areas in the eastern Basin remain functional without perennial surface flow and were able to persist through drought conditions; for these reasons, they are likely connected to groundwater. The GDE Pulse tool by The Nature Conservancy (TNC) also identifies the eastern Basin's riparian and wetland habitats as GDEs (Klausmeyer et al. 2019). Naumburg et al. (2005) presents several models that evaluate how GDEs rely on fluctuating groundwater elevations for long-term survival. GDEs have been sustained by groundwater, despite the depth of the groundwater table being greater than 30 feet below ground surface (bgs), due to these fluctuating groundwater elevations. Figure 3-25 shows that the Santa Ysabel catchment, which is in the watershed furthest east, provided more than 20 acre-feet of groundwater recharge even at the height of the drought in 2014. This surface to groundwater connection sustains the riparian vegetation that is habitat for various endangered species, such as the CESA-listed least Bell's vireo and CESA-listed tricolored blackbird (*Agelaius tricolor)*. This should be identified as a beneficial use.

e. Riparian areas that are considered gaining reaches may be considered GDEs even if groundwater levels are greater than 30 feet bgs. Further guidance on riparian vegetation as GDEs can be found in Groundwater Dependent Ecosystems Under the Sustainable Groundwater Management Act Guidance for Preparing Groundwater Sustainability Plans and Identifying GDEs Under SGMA Best Practices for Using the NC Dataset. (The Nature Conservancy 2018 and 2019 respectively).

Recommendation: The SPV GSA should clarify depth to groundwater for GDEs in the eastern Basin and conduct additional studies as recommended in Appendix J. CDFW also recommends including areas classified as wetland and riparian habitats as GDEs. This includes areas where groundwater depth is greater than 30 feet bgs but habitat is still sustained by groundwater. CDFW suggests these habitat areas be identified as GDEs in the final GDE map in the SPV-GSP.

Water Budgets

Comment #2: Water Budgets and Projected Deficits and Sustainability Goals (SPV-GSP Section 5.5.3, page 5-15)

Issue: Figure 5-5 of Appendix H shows that project groundwater surface levels at the representative wells in the eastern Basin will hit their planning or minimum threshold by 2035, which is prior to the sustainable planning horizon of 2040 required under SGMA. Additionally, the SPV-GSP already has identified a small deficit in groundwater storage. The model seems to indicate that diminishing groundwater storages may be a long-term trend based on projected data.

Concern: The SPV-GSP fails to identify specific actions which will determine if the deficit is a trend, and potential management actions which will be implemented if the deficit is determined to be a trend.

Recommendation: Thresholds should be revised to provide an earlier indicator of undesirable reductions in groundwater storage. Management actions may need to be implemented to prevent undesirable results both for chronic lowering of groundwater storage and potential impacts to interconnected surface waters and GDEs.

Comment #3: Water Budgets and Impacts to GDEs (GSP Section 5.5.3, page 5-15)

Issue: The Average Annual Surface Water System Water Budget (Table 5-4) shows that during SPV-GSP implementation, groundwater discharge to streams will decrease significantly, while stream inflow from adjacent areas will double due to a few large storms. Fay et al. (2000) found that, “[a]boveground net primary productivity, soil carbon dioxide flux, and flowering duration were reduced by the increased inter rainfall intervals and were mostly unaffected by reduced rainfall quantity” (pg. 308). It is unclear in the SPV-GSP how the change in water timing and type will affect beneficial uses in the stream, such as vegetative growth and blooming periods, especially during drought conditions.

Concern: Changes in water inputs that may impact GDE health should be monitored as part of the SPV-GSP. This monitoring data will help to inform future water budgets.

Recommendation: Annual monitoring of GDE health, the use of Normalized Derived Vegetation Index (NDVI) which estimates greenness, and Normalized Derived Moisture Index (NDMI) which estimates vegetation moisture, should be used as metrics for interconnected surface water and GDE impacts.

Undesirable Results

Comment #4: Groundwater Level as a Proxy for Interconnected Surface Waters and GDE’s. (SPV-GSP Section 6.3.6, page 6-7)

Issue: Although groundwater levels are a simple proxy for many sustainability indicators, it is not sensitive to changes in ecosystem health and noticeable changes to groundwater levels as representative wells may lag real time impacts to GDEs due to relative location to the groundwater surface.

Concern: Current sustainability indicators will not detect changes, which will affect other beneficial uses and GDEs.

Recommendation: NDVI and NDMI should be used as early indicators of water stress on GDEs. NDVI and NDMI are remotely sensed color data that can be used as a refined proxy for vegetation health in the Basin. The TNC GDE Pulse tool provides both a web viewer and access to the raw data to analyze these metrics over different periods of time (Klausmeyer et al. 2019).

Comment #5: Degraded Water Quality (SPV-GSP Section ES, 4.1.6, 6.3.4, pages ES-4, 4-16, 6-5)

Issue: Water quality within the Basin is being impacted by land use practices adjacent to the Basin.

Concern: The SPV-GSP notes that the SPV GSA only has authority over issues related to groundwater pumping in the Basin. Although nitrogen and Total Dissolved Solids sources are outside of the Basin, CDFW is concerned that there are downstream impacts to water quality in the Basin that could be addressed by managing entities outside of the MOU for the SPV GSA.

Recommendation: Although the SPV GSA only has authority over issues pertaining to groundwater pumping, both the City and the County have planery authority and can address water quality issues within their management areas, including upstream watersheds. CDFW recommends that the SPV GSA coordinate with relevant municipal jurisdictions and landowners on potential water quality projects to ameliorate the water quality issues upstream of the Basin.

Minimum Thresholds

Comment #6: Minimum Thresholds Are Set Lower Than Historic Baseline (SPV-GSP Section 8.2.1, page 8-2)

Issue: Minimum thresholds are set well below historic minimums and are not protective of beneficial uses. Setting minimum and planning thresholds at 50 to 100 percent lower than historic minimums does not account for how current conditions may already be trending towards a groundwater storage deficit (Comment #3). Additionally, the future range of groundwater levels may fall within or near the historic range, which also included severe drought conditions.

Concern: Setting the minimum and planning thresholds below the historic range may not be enough to allow for protection against undesirable results. Furthermore, as presented in the SPV-GSP, the planning threshold for wells adjacent to GDEs is less protective than the threshold set for wells that are further from GDEs. Given CDFW's concern that riparian and wetland vegetation in the eastern Basin may also be GDEs, the absence of established protective thresholds is of particular concern. Although the SPV GSA is not currently experiencing an overdraft, trends of overdraft conditions, if they persist, may cause undesirable results prior to reaching either the proposed planning or minimum threshold.

Recommendation: CDFW recommends following TNC's guidance by setting minimum thresholds at levels that prevent adverse impacts to GDEs (TNC 2018). The planning and minimum thresholds for wells closer to GDEs should also be more protective of the GDEs than

wells that are further, and the planning threshold should be closer to the measurable objective rather than the minimum threshold in areas adjacent to GDEs.

Comment #7: Monitor GDEs Should Be A Tier 0 Project (SPV-GSP Figure 9-2, page 9-3)

Issue: Section 9 of the SPV-GSP includes monitoring of GDEs as a Tier 1 project that would be implemented once the planning threshold is reached.

Concern: Given CDFW's many concerns pertaining to interconnected surface waters and GDEs for the Basin, we are concerned that undesirable results may occur well before Tier 1 projects are implemented, particularly given that planning and minimum thresholds set for the representative wells is not protective of GDEs and beneficial uses.

Recommendation: Additional studies and monitoring pertaining to GDE's should be implemented, as identified in Appendix J, as a Tier 0 project that can be implemented at any time after plan adoption. Again, NDVI and NDMI should be used to assess habitat health on an annual basis and should inform the revision of both the planning and minimum thresholds for the representative wells to within or near the historic baseline.

Comment #8: Use of CNDDB Data to Presume Absence (SPV-GSP Volume 2 Appendix J Groundwater Dependent Ecosystems Technical Memo Table 1, page 6)

Issue: Appendix J notes that presence and/or absence of sensitive species is based on California Natural Diversity Database (CNDDB) occurrence data. CNDDB only provides positive occurrence data where studies have been conducted and cannot be relied upon to presume absence due to lack of data in a specific location.

Concern: Species-specific studies conducted in suitable habitat according to species-specific protocols are required to determine species absence from a particular area. Only presence can be assumed and should be assumed in suitable habitat where species-specific surveys have not been conducted.

Recommendation: In the absence of species-specific protocol surveys, the GSP should assume presence for sensitive species in areas where suitable habitat exists.

Comment #9: Species Dependence on Groundwater and Mischaracterization as Not Applicable (SPV-GSP Volume 2 Appendix J Groundwater Dependent Ecosystems Technical Memo Table 1, page 6)

Issue: Table 1 of Appendix J states that the reliance of many of the sensitive plants and invertebrates on groundwater is Not Applicable (NA) based on omission from the Critical Species LookBook (Rohde et al. 2019). The Critical Species LookBook Appendix I *Other Threatened or Endangered Species Relevant to SGMA* includes many of the species noted as NA. Although groundwater relationships may be less apparent and not fully discussed in the LookBook, groundwater relationships between plants and vernal pool habitats do exist and have been described in the scientific literature. In one study in the Central Valley, "[p]erched groundwater discharge accounted for 30–60% of the inflow to the vernal pools during and immediately following storm events. (Rains et al. 2006, pg. 1157). Endangered plants such as the threadleaf brodiaea (*Brodiaea filifolia*) which CNDDB notes as potentially present in the eastern Basin may also be impacted by changes to groundwater.

Concern: Although these groundwater relationships are not well understood for the Basin, CDFW is concerned that additional monitoring of known sensitive populations have not been included in the SPV-GSP.

Recommendation: Sensitive plants and invertebrates should be included in Appendix I of the Critical Species LookBook as having a potential reliance on groundwater rather than 'NA.' The SPV GSA should also coordinate with the City and County to include periodic monitoring of sensitive species populations within the Basin, beginning with baseline studies where suitable habitat exists.

Editorial Comments

Comment #10: Pictures Were Not Provided for Eastern Field Data Points That Were Determined to Not Be GDEs (GSP Volume 2 Appendix J Groundwater Dependent Ecosystems Technical Memo Attachment 1)

Issue: Appendix J does not include representative photos of field surveys in the eastern Basin. The SPV-GSP makes the conclusion that the riparian and wetland habitat in the eastern portion are not GDEs due to the depth of groundwater being greater than 30 feet.

Concern: Pictographic evidence regarding GDEs was not included to support the GDE analysis provided.

Recommendation: Representative photographs of the field surveys conducted in the eastern Basin should be included in Appendix J. The Final SPV-GSP should contain updated analysis in Appendix J to addressed issues discussed in this letter.

CONCLUSION

In conclusion, the SPV-GSP does not comply with all aspects of SGMA statute and regulations, and CDFW deems the SPV-GSP inadequate to protect fish and wildlife beneficial users of groundwater. CDFW recommends that the SPV-GSP consider CDFW's comments for the following reasons:

1. the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are not reasonable and/or not supported by the best available information and best available science. [CCR § 355.4(b)(1)] (See Comments # 1, 2, and 6);

2. the SPV-GSP does not identify reasonable measures and schedules to eliminate data gaps. [CCR § 355.4(b)(2)] (See Comments # 1, 2, 8, and 9);

3. the sustainable management criteria and projects and management actions are not commensurate with the level of understanding of the Basin setting, based on the level of uncertainty, as reflected in the SPV-GSP. [CCR § 355.4(b)(3)] (See Comments # 1, 2, and 7);

4. the interests of the beneficial uses that are potentially affected by the use of groundwater in the Basin have not been considered. [CCR § 355.4(b)(4)] (See Comments # 1, 8, and 9); and,

5. the SPV-GSP does not include a reasonable assessment of overdraft conditions and includes reasonable means to mitigate overdraft if present. [CCR § 355.4(b)(6)] (See Comment # 2, 3, 4, and 6)

CDFW appreciates the opportunity to provide comments. Please contact Mary Ngo, Senior Environmental Scientist (Specialist) at Mary.Ngo@wildlife.ca.gov or (562) 477-0743 with any questions.

Sincerely,

DocuSigned by:
David Mayer
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Enclosures (Literature Cited)

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Literature Cited

Fay, P.A., Carlisle, J.D., Knapp, A.K., Blair, J.M., and S.L. Collins. 2000. Altering Rainfall Timing and Quantity in a Mesic Grassland Ecosystem: Design and Performance of Rainfall Manipulation Shelters. National Science Foundation, Arlington, Virginia. Ecosystems (2000) 3: 308-319.

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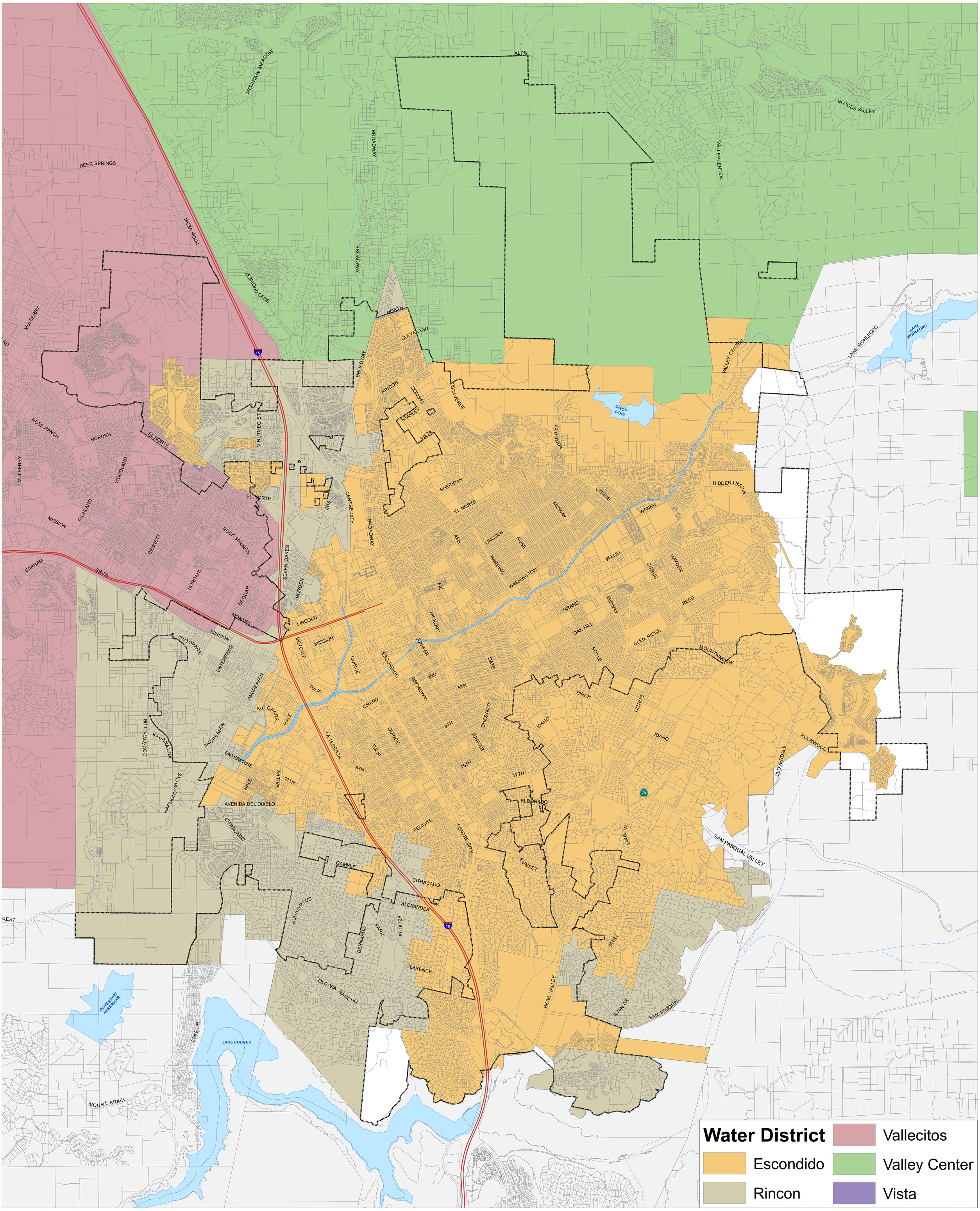
The Nature Conservancy. 2019. Identifying GDEs Under SGMA Best Practices for Using the NC Dataset. Available from: https://groundwaterresourcehub.org/public/uploads/pdfs/TNC_NCdataset_BestPracticesGuide_2019.pdf.

From: Alicia Appel <aappel@escondido.org>
Sent: Tuesday, August 17, 2021 10:54 AM
To: Danek, Karina <KDanek@sandiego.gov>
Subject: San Pasqual GSP comments

Hi Karina,
My sincere apologies -something came up last week and I failed to send our comments on the Draft GSP. I hope they may still be considered for the final version.
Hope you're well!
Alicia

Page #	Section	Figure/Table/ Paragraph	Comment
4-4	4.1.2	Fig 4-2	Update map or add footnote to denote errors on this map. Santa Ysabel should be named San Dieguito and San Dieguito River should read Cloverdale Creek. The map on the next page is correct.
5-3	5.1	Title	Approach (sp)
8-1	8	General	Is there a different term that can be used rather than "exceedance"? Exceedance is going "over" a limit but in the case of groundwater levels it would be falling below a threshold. This term is often used in stormwater compliance. It would make sense for the water quality metrics (e.g. nitrate and TDS)
9-7	9.5	Last paragraph	Delete repeated table reference (9-2)
Vol 2 Pdf Page 648		Figure 3-27	Water District Source map does not match the Escondido Water boundaries. See attached map and contact me if you want the GIS layer.

Alicia Appel
Environmental Programs Manager
Utilities | City of Escondido
Direct: 760-839-6315 | Mobile: 760-215-2339
www.escondido.org



Source: City of Escondido GIS

0 0.5 1 Miles

City Of Escondido Water Service District Operation Areas

S:\GIS\Projects\Utilities\20150609 Water District Maps\District Operation Areas.mxd

Appendix G
Well Completion Reports Used to Construct Geological Cross Sections

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Appendix G
Well Completion Reports Used to Construct Geological Cross Sections

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COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

WELL PERMIT APPLICATION # 12183 APN 760 170 18
Control # W62041

TYPE OF WORK (Check)		USE (Check)			EQUIPMENT (Check)	
New Well	X	Individual Domestic			Rotary	X
Repair or Modification		Agricultural	X	Community	Cable Tool	
Time Extension		Industrial		Other	Other	
Destruction						

PROPOSED WELL DEPTH
Max. 200' Min. 175 (Feet)

PROPOSED CASING
Type Steel Depth 200 Diameter 12" Wall or Gage .375

PROPOSED SEALING ZONE(S)
From 0 to 20 Feet
From _____ to _____ Feet
From _____ to _____ Feet

PROPOSED PERFORATIONS OR SCREEN
From 160 to 200 Feet
From _____ to _____ Feet
From _____ to _____ Feet
From _____ to _____ Feet

SEALING MATERIAL (Check)
Neat Cement Grout ☐ Bentonite Clay ☐
Sand Cement Grout ☐ Concrete ☒
Other-Specify: _____

DATE OF WORK
Start Jan. 27, 1992
Completion Feb. 10, 1992

NAME OF WELL OWNER
Witman Ranches Inc. 747-3632
mail: PO 1959, Esc 92033

NAME OF WELL DRILLER
Joe R. Fain 749-0701

LOCATION OF WELL
16789 Highway 78 San Pasqual Valley Rd. San Diego (Escondido)

COMPANY
Fain Drilling & Pump Co., Inc.

BUSINESS ADDRESS
12029 Oldcastle Rd. Valley Center

LICENSE NUMBER
328287

Cash Deposit ☐
Bond Posted ☒

$220 Fee paid on 1-22-92 ph

DISPOSITION OF APPLICATION
(FOR HEALTH OFFICERS USE ONLY)

☐ APPROVED ☐ DENIED

☒ APPROVED WITH CONDITIONS

Report Reason(s) for Denial or Necessary Conditions Here:
1) well to be installed to all State & County water well Standards Bulletin 74-81.
On sites served with public water, contact the local water agency for meter irrigation requirements
This well site is located in an area where groundwater is known to have high nitrate levels. This completed well can be used for irrigation purposes only until it has been tested and approved as safe by this Department. Unless it can be demonstrated that potable water standards can be met, septic tank and/or building permits cannot be issued.

M. Sedgh UNKNOWN
HEALTH OFFICER

1-23-92
DATE

I hereby agree to comply with all regulations of the Department of Health Services and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Health Services with a complete and accurate log of the well.

Joe R. Fain
APPLICANT'S SIGNATURE

1-22-92
DATE

WELL 12183

WITMAN RANCHES, INC

DHS:EHP-731 (3/85)

1-22-92

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

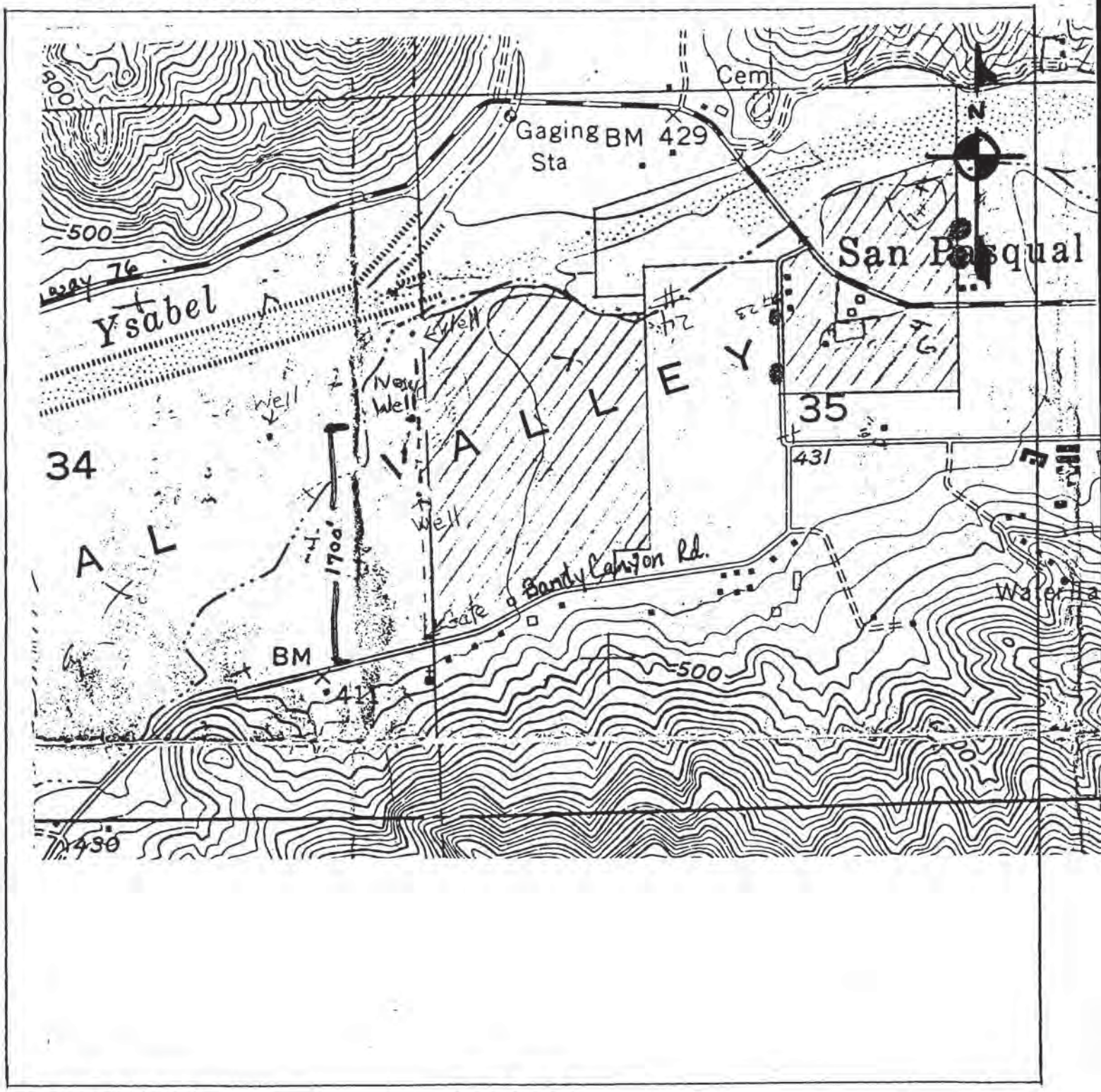
WELL PERMIT APPLICATION

Control # W62041

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



QUADRUPLICATE
For Local Requirements

WDR in SM sent to Ruffin 3-16-92 pl

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 487208

Page 1 of 1
Owner's Well No. 2-92
Date Work Began 2-13-92 Ended 2-24-92
Local Permit Agency San Diego County Health Dept
Permit No. W62081 Permit Date 1-22-92

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER 50 (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
		Alluvial fill as follows
0	45	Fine to coarse sand with some small gravel - brown color
45	80	Fine to coarse sand with boulders
80	90	Black silt - "old tule bed" with some wood from trees
90	190	Fine to coarse sand with some boulders and gravel steaks
190	202	decomposed and weathered rock granite

Completed Well Construction
Date 3-24-92
Date Inspected 3-24-92
Comments evidence of Camadian Seal observed Ag. well
Water Sample Taken? NO
Reviewed By M. Seigh

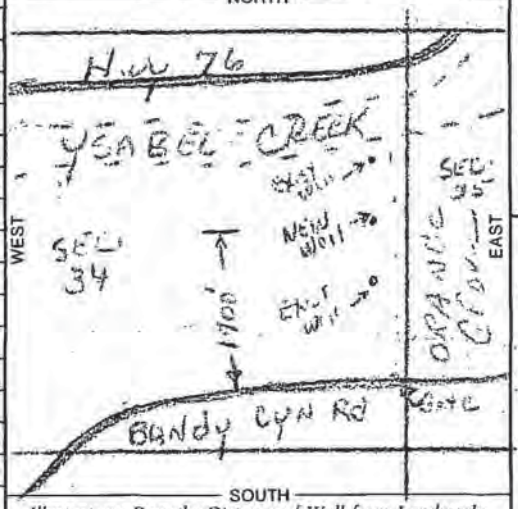
TOTAL DEPTH OF BORING 205 (Feet)
TOTAL DEPTH OF COMPLETED WELL 202 (Feet)

WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Address 16789 Hwy 76
City San Pasqual Rd San Diego
County San Diego
APN Book 760 Page 170 Parcel 18
or Township or Range Section 34
Latitude DEG. MIN. SEC. NORTH Longitude DEG. MIN. SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)
X NEW WELL
___ MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USE(S) (✓)
___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
X Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 40 (Ft.) & DATE MEASURED 2-24-92
ESTIMATED YIELD* 1000 (GPM) & TEST TYPE airlift
TEST LENGTH 6 (Hrs.) TOTAL DRAWDOWN 150 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	21	36	X				A-120	24	.250	
0	92	24	X				A-120	12	.375	
92	112	24		X			SS304	12	.250	.060
132	152	24		X			SS304	12	.250	.060
172	192	24		X			SS304	12	.250	.060

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	202				5/16x4

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 (PERSON, FIRM OR CORPORATION) (TYPED OR PRINTED) Fain Drilling & Pump Co Inc.
ADDRESS 12099 Old Castle Rd. CITY Valley Center, STATE California ZIP 92082
Signed (WELL DRILLER/AUTHORIZED REPRESENTATIVE) DATE SIGNED 3/1/92
C-57 LICENSE NUMBER 328287

DWR 188 REV. 7-90 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

012S001E31E001S

Do not fill in

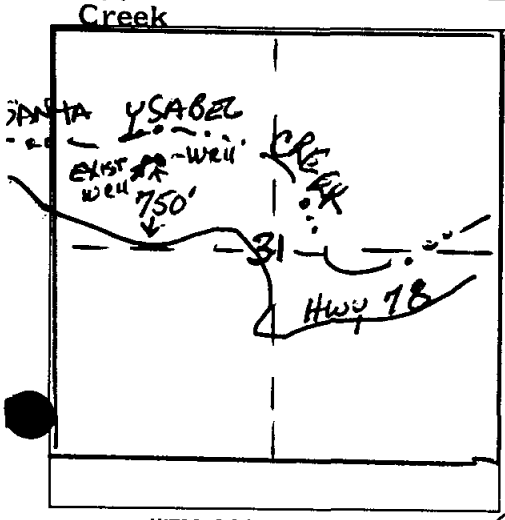
No. 341175

Notice of Intent No. _____
Local Permit No. or Date W61261

State Well No. _____
Other Well No. _____

(1) OWNER: Name ~~Witman Ranch~~
Address P.O. Box 1959
City Escondido, California ZIP 92025

(2) LOCATION OF WELL (See instructions):
County San Diego Owner's Well Number A&W #1
Well address if different from above Hwy 78 Ramona (City S.D.)
Township 12S Range 1 E Section 31
Distance from cities, roads, railroads, fences, etc. Approx 750' N. Hwy 78 and 1100' E. westerly border of sec 31 Approx 20 ft. from bank of Santa Ysabel Creek



WELL LOCATION SKETCH

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

(4) PROPOSED USE:
Domestic [ ]
Irrigation [X]
Industrial [ ]
Test Well [ ]
Municipal [ ]
Other [ ]
(Describe)

(5) EQUIPMENT:
Rotary [X] Reverse [ ]
Cable [ ] Air [ ]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:
Yes [X] No [ ] Size 5/16x4
Diameter of bore 18
Packed from 20 to 98 ft.

(7) CASING INSTALLED:
Steel [X] Plastic [ ] Concrete [ ]

From ft.	To ft.	Dia. in.	Gage or Wall
0	20	18	.250
0	99	10	.365

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

From ft.	To ft.	Slot size
63	93	.050

(9) WELL SEAL:
Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 20 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval _____ ft.
Method of sealing cemented

(10) WATER LEVELS:
Depth of first water, if known ukn ft.
Standing level after well completion 68 ft.

(11) WELL TESTS:
Was well test made? Yes [X] No [ ] If yes, by whom? Same
Type of test Pump [ ] Bailer [ ] Air lift [X]
Depth to water at start of test 68 ft. At end of test 98 ft.
Discharge 45 gal/min after 4 hours Water temperature ukn
Chemical analysis made? Yes [ ] No [X] If yes, by whom? _____
Was electric log made Yes [ ] No [X] If yes, attach copy to this report

(12) WELL LOG: Total depth 98 ft. Completed depth 98 ft.

from ft.	to	ft.	Formation (Describe by color, character, size or material)
0	–	20	fine to coarse sand - brown colc
20	–	27	sand & boulders
27	–	51	fine to coarse sand
51	–	52	boulder
52	–	80	fine to coarse sand
80	–	98	partly cemented

Work started March 19 90 Completed March 19 90

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 _____ (Well Driller)
NAME Fain Drilling & Pump Co. Inc. (Person, firm, or corporation) (Typed or printed)
Address 12029 Old Castle Rd.
City Valley center, Calif. ZIP 92082
License No. 328287 Date of this report 4/10/90

DWR 188 (REV. 12-86) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

86 96355

APR 10 1968

12S/01W-31J0025

ORIGINAL
File with DWR

WATER WELL DRILLERS REPORT

(Sections 7079, 7080, 7081, 7082, Water Code)

THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Do Not Fill In

No. 39872

State Well No. 12S/01W-31J02

Other Well No.

(2) LOCATION OF WELL:

County San Diego Owner's number, if any

Township, Range, and Section

Distance from cities, roads, railroads, etc. Four miles from Escondido on Highway 78 East (San Pasqual Valley)

(3) TYPE OF WORK *(check)*:

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE *(check)*:

Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary ☐
Cable ☒
Other ☐

(6) CASING INSTALLED:

STEEL: OTHER:
SINGLE ☒ DOUBLE ☐

From ft.	To ft.	Diam.	Gage or Wall
0	50	12	.250
50	134	12	.219

If gravel packed

Diameter of Bore	From ft.	To ft.
20"	0	132

Size of shoe or well ring: None

Size of gravel: 3/8 Round

Describe joint Welded

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen Louvre & Johnson #100 Slot

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
50	100	8	1½	1/8 x 23/8
100	105	Johnson's well screen		
105	119	8	1½	1/8 x 2 3/8
119	124	Johnson well screen		
124	132	8	1½	1/8 x 2 3/8

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☐ No ☒ To what depth ft.

Were any strata sealed against pollution? Yes ☐ No ☒ If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing

(9) WATER LEVELS:

Depth at which water was first found, if known 55 ft.

Standing level before perforating, if known 49 ft.

Standing level after perforating and developing 49 ft.

(10) WELL TESTS:

Was pump test made? Yes ☒ No ☐ If yes, by whom? Webb Pump Co.

Yield: 1200 gal./min. with 50 ft. drawdown after 3 hrs.

Temperature of water Was a chemical analysis made? Yes ☐ No ☒

Was electric log made of well? Yes ☐ No ☒ If yes, attach copy

(11) WELL LOG:

Total depth 134 ft. Depth of completed well 134 ft.

Formation: *Describe by color, character, size of material, and structure*

ft. to	ft.
0 - 15	Sand, light brown color - fine to medium size
15 - 35	Sand, dark brown color - fine to medium size
35 - 37	Silt, black color
37 - 44	Sand, grey color - fine to medium size
44 - 45	Silt, black color
45 - 55	Sand, grey color - fine to medium size
55 - 63	"Toolie Bed" Fine black sands, old logs
63 - 73	Sand & gravel, fine to coarse 1/8" to 1" round
73 - 80	Sand dark grey color - fine to medium size
80 - 90	Sand brown color fine to medium size
90 - 100	Sand, brown color fine to medium size
100 - 105	Sand & Gravel Fine to coarse sand 1/8" to 1" gravel round
105 - 119	Sand, partly cemented - fine to medium size
119 - 124	Sand & gravel
124 - 127	Sand, Brown, fine to medium
127 - 132	Decomposed granite

Average Sp. Yield = 20.2

CONFIDENTIAL - NOT FOR PUBLIC RELEASE

Work started Oct 30 19 67 Completed Nov 9 19 67

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Acme Drilling Company
(Person, firm, or corporation) *(Typed or printed)*

Address P.O. Box 835
Valley Center, California 92082

[SIGNED] W. Z. Doughty
(Well Driller)

License No. 174287 Dated Apr 4, 1968

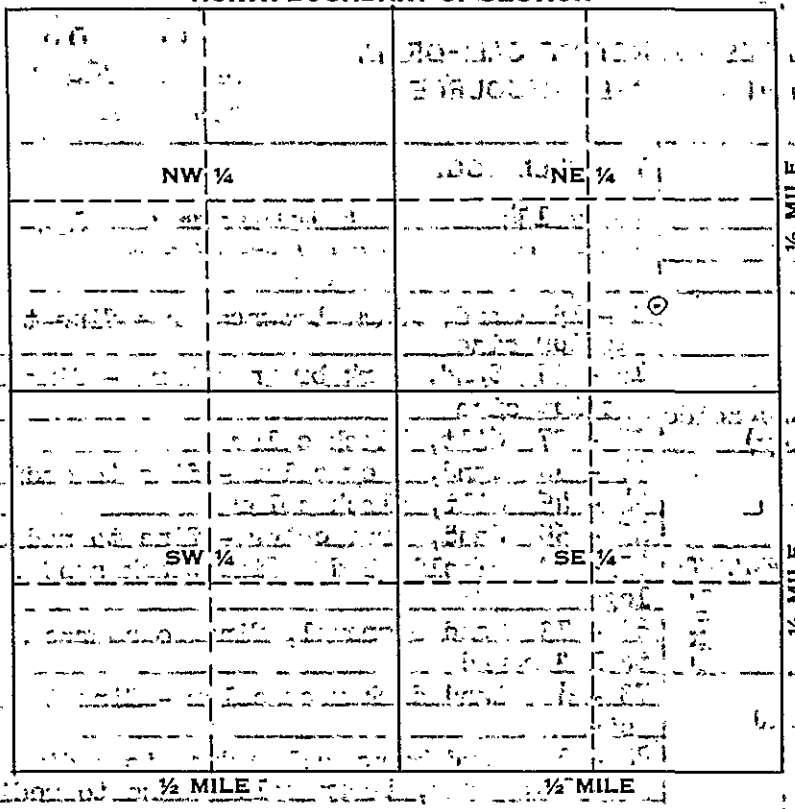
SKETCH LOCATION OF WELL ON REVERSE SIDE

DWR 188 (REV. 9-65)

36391-950 10-65 50M TRIP ① △ OSP

WELL LOCATION SKETCH

39872

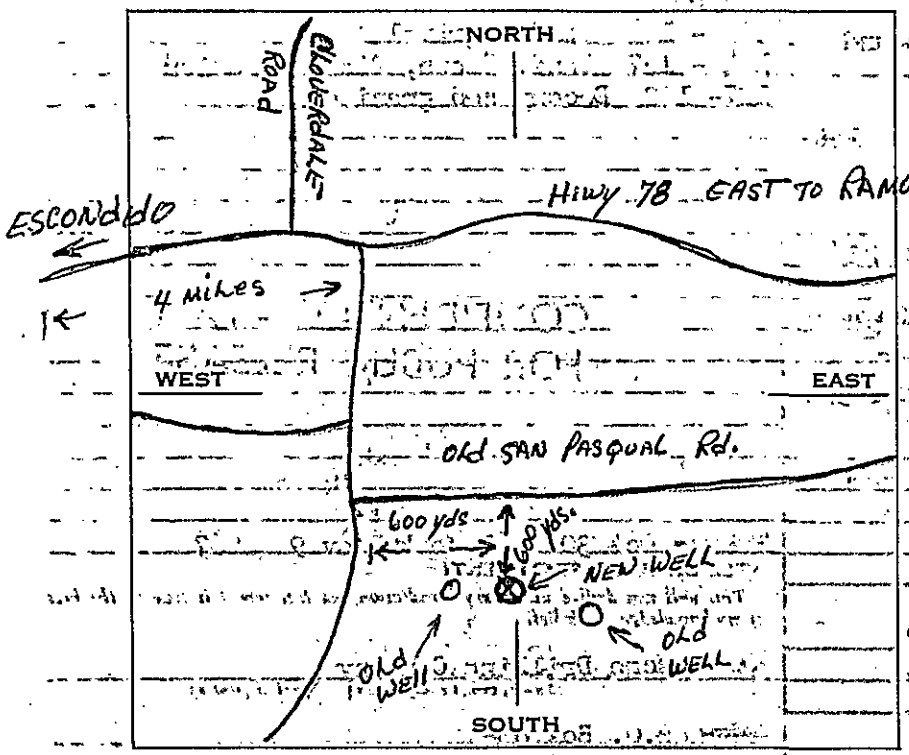


Township _____ N/S

Range _____ E/W

Section No. 30

A. Location of well in sectionized areas.
Sketch roads, railroads, streams, or other features as necessary.



SAN PASQUAL VALLEY (West End)

B. Location of well in areas not sectionized.
Sketch roads, railroads, streams, or other features as necessary.
Indicate distances.

APR 10 1968

12S/01W-31Q002S

ORIGINAL
File with DWR

WATER WELL DRILLERS REPORT

(Sections 7079, 7080, 7081, 7082, Water Code)

THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Do Not Fill In

No 39875

State Well No. 12S/01W-31Q02

Other Well No.

(2) LOCATION OF WELL:

County San Diego Owner's number, if any

Township, Range, and Section Four miles from Escondido on

Distance from cities, roads, railroads, etc. Four Miles from Escondido on Highway 78 east (San Pasqual

(3) TYPE OF WORK (*check*):

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (*check*):

Domestic ☐ Industrial ☐ Municipal ☐

Irrigation ☒ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary ☐

Cable ☒

Other ☐

(6) CASING INSTALLED:

STEEL: OTHER:

SINGLE ☒ DOUBLE ☐

From ft.	To ft.	Diam.	Gage or Wall
0	40	12	.250
40	93	12	.219
93	138	12	.250

If gravel packed

Diameter of Bore	From ft.	To ft.
20"	0	135

Size of shoe or well ring: None Size of gravel: 3/8" round

Describe joint Welded

(7) PERFORATIONS OR SCREEN: 100 Slot Screen

Type of perforation or name of screen Mill slot-Louvre-Johnson

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
40	70	8	1½	1/8 & ½" x 2 3/8
70	75	Well Screen		
75	80	8	1½	1/8 & ½ x 2 3/8
80	85	Well Screen		
85	135	6	4	1/8 & ½ x 2 3/8

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☐ No ☒ To what depth ft.

Were any strata sealed against pollution? Yes ☐ No ☒ If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing

(9) WATER LEVELS:

Depth at which water was first found, if known 55' ft.

Standing level before perforating, if known 44 ft.

Standing level after perforating and developing 44 ft.

(10) WELL TESTS:

Was pump test made? Yes ☒ No ☐ If yes, by whom? Webb Pump Co.

Yield: 500 gal./min. with 88 - 98 ft. drawdown after 3 23 hrs.

Temperature of water Was a chemical analysis made? Yes ☐ No ☒

Was electric log made of well? Yes ☐ No ☒ If yes, attach copy

(11) WELL LOG:

Total depth ft. Depth of completed well ft.

Formation: *Describe by color, character, size of material, and structure*

ft. to	ft.	
0	30	Sand, brown color, fine to coarse
30	40	Sand, brown, fine to coarse
40	50	Sand, black color, fine
50	65	Sand, dark grey, fine to medium size
65	75	Sand, dark grey, some small gravel 1/8" to 1" size
75	80	Silt, black "Toolie Layer"
80	85	Sand & gravel
85	90	Sand, grey color, fine to medium size
90	100	Sand, lighter color grey, fine to medium size
100	124	Sand, brown color, partly cemented fine to medium size
124	135	Decomposed granite

CONFIDENTIAL - NOT FOR PUBLIC RELEASE

Work started Nov 9 19 67 , Completed Nov 24 19 67

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Acme Drilling Company
(Person, firm, or corporation) (*Typed or printed*)

Address P.O. Box 835
Valley Center, Calif. 92082

[SIGNED] W. F. Davis
(Well Driller)

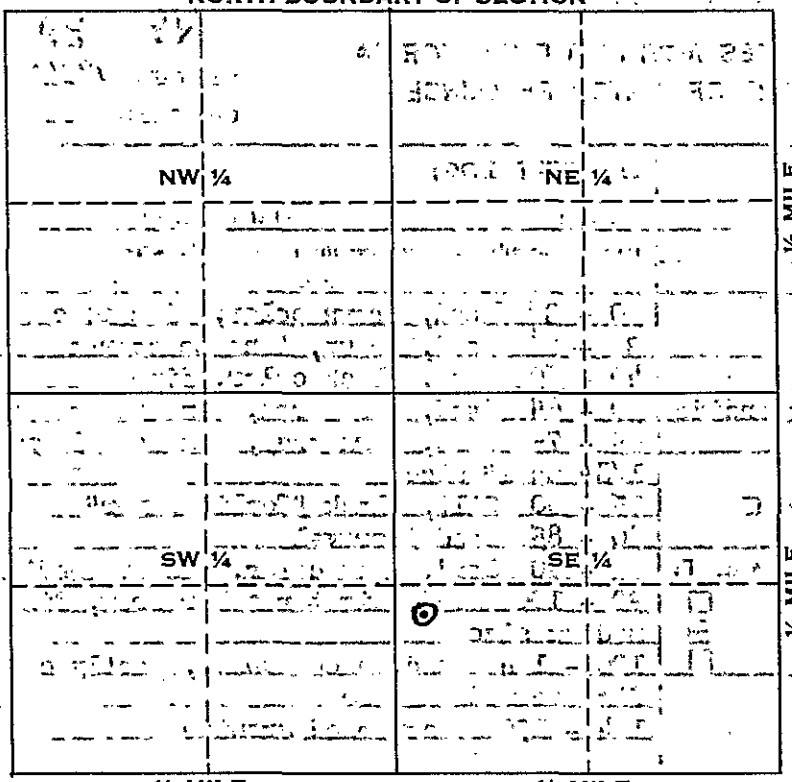
License No 174289 Dated , 19

SKETCH LOCATION OF WELL ON REVERSE SIDE

WELL LOCATION SKETCH

39875

NORTH BOUNDARY OF SECTION

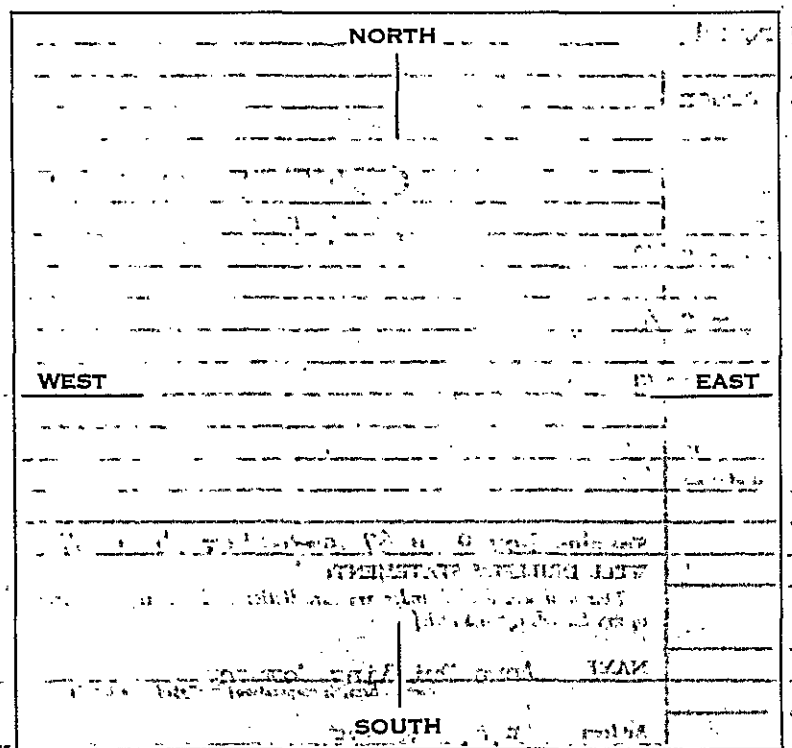


Township _____ N/S

Range _____ E/W

Section No. _____

A. Location of well in sectionized areas.
Sketch roads, railroads, streams, or other features as necessary.



B. Location of well in areas not sectionized.
Sketch roads, railroads, streams, or other features as necessary.
Indicate distances.

'68 APR 8 AM 7 53

ORIGINAL
File with DWR

Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 449191

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. MW - 1
Date Work Began 6/30/97, Ended 7/2/97
Local Permit Agency Dept of Env. Health
Permit No. W63391 Permit Date 6/27/97

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER ukn (Ft) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
		Alluvial fill as follows:
		(see attached geologic log)
0	30	Fine grained silt with some coarse grained sand - brown color
30	60	Medium grained sand with some silt - grey / brown color
60	70	Medium to coarse sand
70	80	Claey silt - black color
80	110	Fine to very coarse sand grey color
110	126	silty sand with some rock fragments
126	158	Fine to coarse sand and silt some rock fragments - brown color
158	165	tonalite/quartz diorite grey color

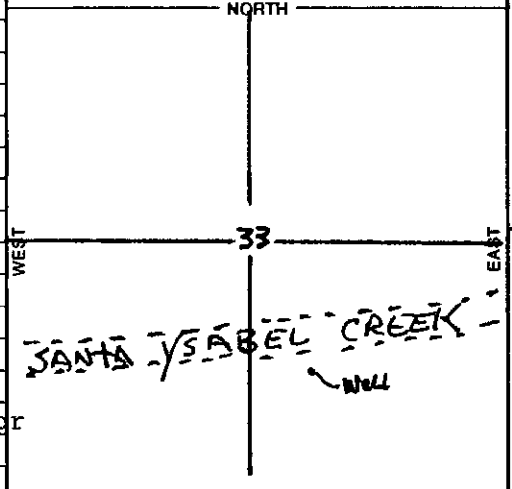
TOTAL DEPTH OF BORING 165 (Feet)
TOTAL DEPTH OF COMPLETED WELL 160 (Feet)

WELL OWNER

WELL LOCATION

Address Battle Monument Rd & Hwy 78
City San Diego (San Pasqual Valley)
County San Diego
APN Book 760 Page 170 Parcel 03
Township 12S Range 1W Section 33
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USE(S) (✓)

X MONITORING
WATER SUPPLY
___ Domestic
___ Public
___ Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 21 (Ft.) & DATE MEASURED 7/2/97
ESTIMATED YIELD* 100+ (GPM) & TEST TYPE pump
TEST LENGTH 3 (Hrs.) TOTAL DRAWDOWN 15 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	25	15	X				A-53	8.125	.188	
0	80	8	X				F480	4	sch 40	
80	160	8		X			F480	4	sch 40	.040

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	10	X			
10	25		X		
0	160				6X16

ATTACHMENTS (✓)

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

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 Fain Drilling & Pump Co Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 12029 Old Castle Rd. CITY Valley Center, STATE califoria ZIP 92082

Signed Joe R Fain
WELL DRILLER/AUTHORIZED REPRESENTATIVE

DATE SIGNED 7/7/97

C-57 LICENSE NUMBER 328287

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: WO 3391

Assessor's Parcel Number: 760-170-03

44919)

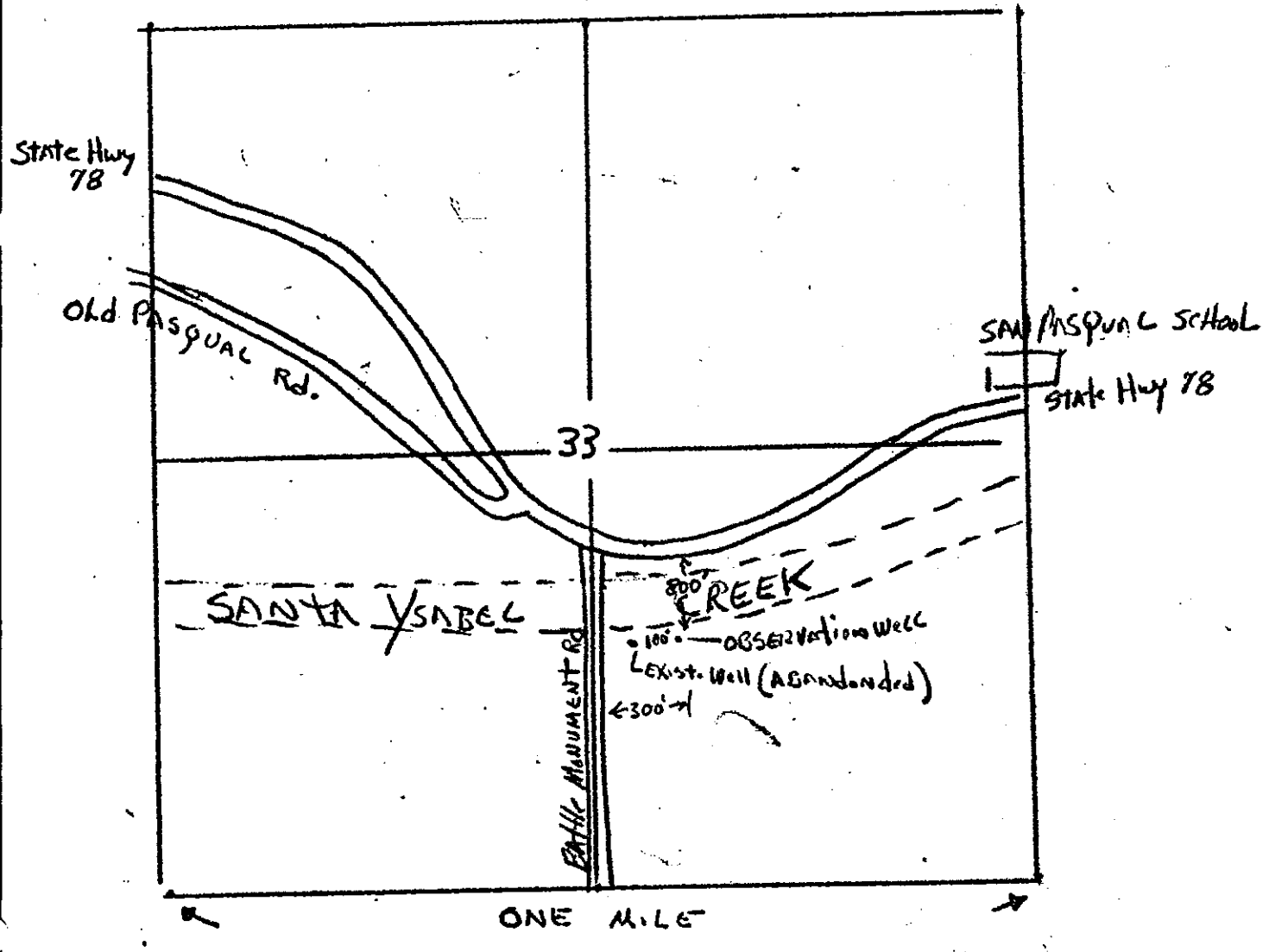
LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

12-S
1-W
S-33

SAN DIEGO WILD ANIMAL PARK

SAN PASQUAL VALLEY
City of SAN DIEGO



ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

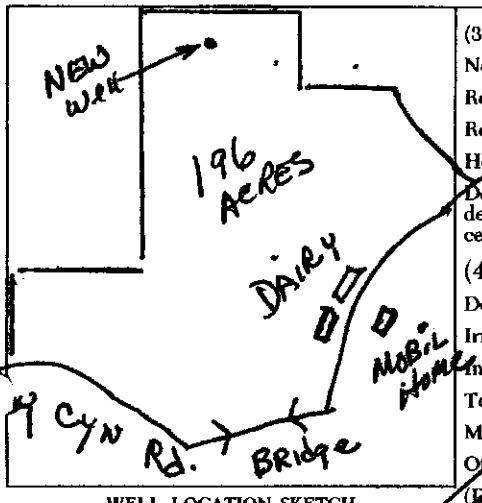
WATER WELL DRILLERS REPORT

Do not fill in
No. 341173

Notice of Intent No. _____
Local Permit No. or Date WC 12.41

State Well No. _____
Other Well No. _____

(2) LOCATION OF WELL (See instructions):
County San Diego Owner's Well Number _____
Well address if different from above same
Township 12 S Range 1 W Section 34
Distance from cities, roads, railroads, fences, etc.: approx 2000' N. Bandy Cyn Rd Bridge (on Bandy Cyn Rd.) behind dairy



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 ☐
Municipal ☐
Other ☐
(Describe)

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

(6) GRAVEL PACK:
Yes ☒ No ☐ Size 5/16x8
Diameter of bore 24
Packed from 20 to 174 ft.

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

From ft.	To ft.	Dia. in.	Gage or Wall
0	21	24	.250
0	176	12	.375

(8) PERFORATIONS:
Stainless steel screens

From ft.	To ft.	Slot size
110	170	.060

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval _____ ft.
Method of sealing cemented

(10) WATER LEVELS:
Depth of first water, if known ukn ft.
Standing level after well completion 35 ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? Same
Type of test Pump ☒ Bailer ☐ Air lift ☐
Depth to water at start of test 35 ft. At end of test 90 ft.
Discharge 700 gal/min after 6 hours Water temperature ukn
Chemical 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 174 ft. Completed depth 174 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	40	fine to coarse sand
40	60	silty sand (black color)
60	80	fine to coarse sand with some gravel lenses
80	90	fine black silt
90	105	fine to coarse sand with some small boulders
105	123	sand and boulders
123	155	partly cemented sand and boulders
155	164	fine to coarse sand with gravel
164	174	decomposed granite and boulders

Work started 2/5/ 19 90 Completed 2/11/ 19 90

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 Joe R. Fain (Well Driller)
NAME Fain drilling & Pump Co., Inc. (Person, Firm, or corporation) (Typed or printed)
Address 12029 Old Castle Rd.
City Valley Center, California ZIP 92082
License No. 328287 Date of this report 3/10/90

DWR 188 (REV. 12-86) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 86 96355

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

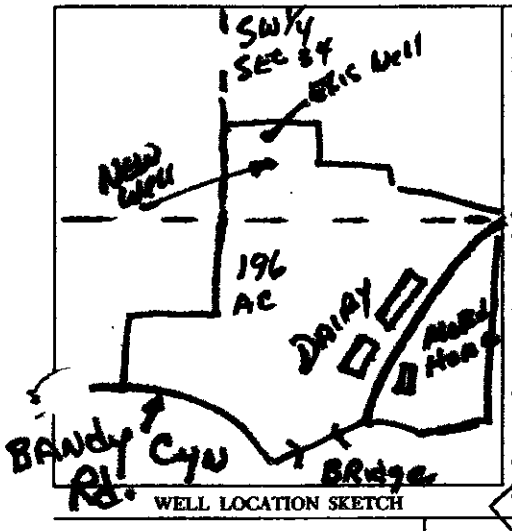
WATER WELL DRILLERS REPORT

Do not fill in
No. 353081

Notice of Intent No. _____ State Well No. _____
Local Permit No. or Date W61888 Other Well No. _____

(2) LOCATION OF WELL (See instructions):

County San Diego Owner's Well Number _____
Well address if different from above Same
Township 12 S Range 1 W Section 34
Distance from cities, roads, railroads, fences, etc. Approx. .5 miles South Hwy 76 off Bandy Cyn Rd. SW¼ sec 34 Thos Bros map 28N-B-1



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 ☐
Municipal ☐
Other ☐
(Describe)

(5) EQUIPMENT:

Rotary ☒ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☒ No ☐ Size 3/16x1
Diameter of bore 18
Packed from 20 ft. to 160 ft.

(7) CASING INSTALLED:

Steel ☒ Plastic ☐ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0	21	18	.250
0	160	10	.375

(8) PERFORATIONS:

Type of perforation or size of screen Screen SS

From ft.	To ft.	Slot size
100	150	.060

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval _____ ft.
Method of sealing cemented

(10) WATER LEVELS:

Depth of first water, if known 50± ft.
Standing level after well completion 45 ft.

(11) WELL TESTS:

Was well test made? Yes ☒ No ☐ If yes, by whom? Same
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test 45 ft. At end of test 150 ft.
Discharge 800+ gal/min after 6 hours Water temperature ukn
Chemical 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 160 ft. Completed depth 160 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
		Alluvial fill as follows:
0	35	Fine to coarse sand and silt Grey color
35	45	Reddish clay and gravel
45	75	fine to coarse sand with lenses of clay and silt - dark grey color
75	95	Partly cemented sand with some boulders - dark grey color
95	135	fine to coarse sand with small rocks and boulders
135	160	fine to coarse sand - partly cemented - dark grey color

Work started 8/6/ 19 91 Completed 8/13/ 19 91

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 Joe R Fain (Well Driller)
NAME Fain Drilling & Pump Co. Inc. (Person, firm, or corporation) (Typed or printed)
Address 12029 Old Castle Rd.
City Valley Center, California ZIP 92082
License No. 328287 Date of this report 8/23/91

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

DWR 188 (REV. 12-86) 86 96355

ORIGINAL
File with DWR

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Page 1 of 1

Owner's Well No. _____

Date Work Began 7-29-91, Ended 8-10-91

Local Permit Agency S. D. County Health Dept

Permit No. W61867 Permit Date 7-29-91

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 485441

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

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

DEPTH TO FIRST WATER Ukn (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	35	Alluvial fill as follows: fine grained sand and silt - brown color
35	70	Fine to coarse sand - brown color with lenses of grey silt
70	115	Fine to coarse sand with some boulders
115	165	coarse sand with lenses of gravel and some boulders - grey color
165	180	Fine to coarse sand with some boulders - partly cemented grey color
180	195	Hard decomposed granite

TOTAL DEPTH OF BORING 195 (Feet)

TOTAL DEPTH OF COMPLETED WELL 195 (Feet)

WELL OWNER

Name Witman Ranch

Mailing Address P.O. Box 1959

CITY Escondido, California 92025 STATE ZIP

WELL LOCATION

Address 18118 Bandy Canyon Rd

City San Diego

County San Diego

APN Book 760 Page 170 Parcel 38

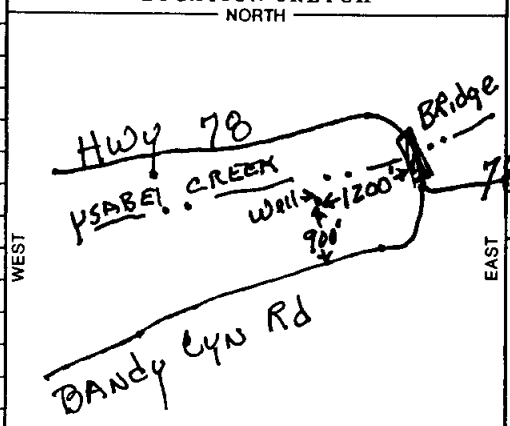
or

Township 12 S Range 1 W Section 34

or

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

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (Describe Procedures and Materia Under "GEOLOGIC LOG

PLANNED USE(S) (✓)

___ MONITORING

WATER SUPPLY

___ Domestic

___ Public

X Irrigation

___ Industrial

___ "TEST WELL"

___ CATHODIC PROTEC TION

___ OTHER (Specify)

DRILLING METHOD Roatary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 48 (Ft.) & DATE MEASURED 7-29-91

ESTIMATED YIELD* 1500 (GPM) & TEST TYPE air lift

TEST LENGTH 8 (Hrs.) TOTAL DRAWDOWN 140 (Ft.)

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

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	21	36"	X				A-120	23.5	.250	
0	100	24"	X				A-120	12	.375	
100	180	24"		X			SS 304	12	.250	.060
180	195	24"	X				A-120	12	.375	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	195			X	5/16x4

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 Fain Drilling & Pump Co. Inc. (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 12029 Old Castle Rd. CITY Valley Center, STATE Ca ZIP 92082

Signed Joe R Fain (WELL DRILLER/AUTHORIZED REPRESENTATIVE) DATE SIGNED 10/10/91

C-57 LICENSE NUMBER 328287

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

FEB 2 8 1978

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

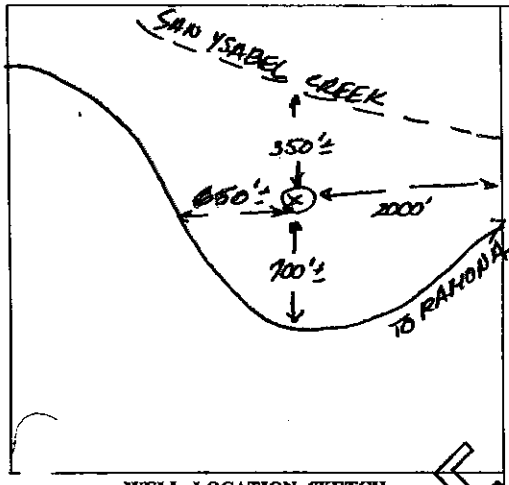
Do not fill in
No. 04702

Notice of Intent No. 13552
Local Permit No. or Date 24282

State Well No.
Other Well No.

(2) LOCATION OF WELL (See instructions):

County SAN DIEGO Owner's Well Number
Well address if different from above NONE
Township 12S Range 1W Section 36
Distance from cities, roads, railroads, fences, etc. 10 MILES E. OF ESC. OFF HWY 78 (THOMAS BROS 404 E-2)



WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic [ ]
Irrigation [X]
Industrial [ ]
Test Well [ ]
Stock [ ]
Municipal [ ]
Other [ ]

(5) EQUIPMENT:

Rotary [X] Reverse [ ]
Cable [ ] Air [ ]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:

Yes [X] No [ ] Size 1/4 X 3/8
Diameter of bore 24"
Packed from 20' to 164 ft.

(7) CASING INSTALLED:

Steel [X] Plastic [ ] Concrete [ ]

From ft.	To ft.	Dia. in.	Gage or Wall
0	164	18"	.219

(8) PERFORATIONS:

Type of perforation or size of screen

From ft.	To ft.	Slot size
20'	164	1/16" X 2 1/2"

(9) WELL SEAL:

Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 80 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval ft.
Method of sealing

(10) WATER LEVELS:

Depth of first water, if known 70 ft.
Standing level after well completion 65 ft.

(11) WELL TESTS:

Was well test made? Yes [X] No [ ] If yes, by whom? Hoth Water Systems
Type of test Pump [X] Bailer [ ] Air lift [ ]
Depth to water at start of test 65 ft. At end of test 65 ft
Discharge 1000 gal/min after 32 hours Water temperature 60°
Chemical analysis made? Yes [ ] No [X] If yes, by whom?
Electric log made? Yes [ ] No [ ] If yes, attach copy to this report.

(12) WELL LOG:

Total depth 164-3 ft. Depth of completed well 163 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	48	FINE SAND W/ 1/8 TO 1/4 BLUE GRAVEL
48	99	LAYERED GRAVEL & SAND 1" TO 6" THICK
99	155	FINE SAND W/ SMALL AMOUNT BLUE CLAY
155	158	GRANITE LAYER BLUE STREAK W/ WHITE QUARTZITE
158	164	LOOSE ROCK W/ GRAVEL & SAND

Work started 4-19 19 77 Completed 4-24 19 77

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 John A. Kraft (Well Driller)
NAME HOWARD PUMP INC. (Person, firm, or corporation) (Typed or printed)
Address 28753 W. HWY 58
City BARSTOW CAL. Zip 92311
License No. 328184 Date of this report 1-6-79

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 43816-950 7-76 50M QUAD (1) T OSP

ORIGINAL
File with DWR

FEB 2 o 1978

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

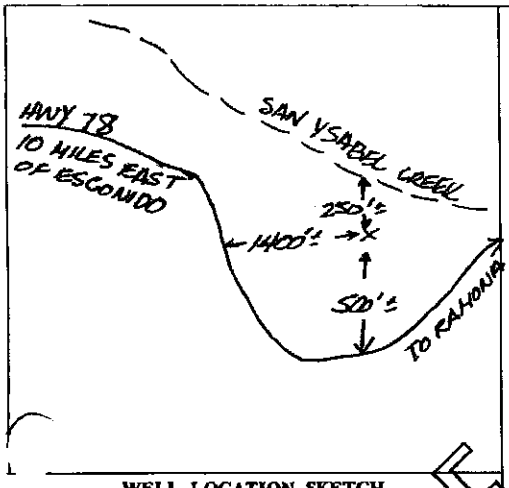
Do not fill in
No. 04703

Notice of Intent No. 101406
Permit No. or Date 24248

State Well No.
Other Well No.

(2) LOCATION OF WELL (See instructions):

County SAN DIEGO Owner's Well Number #2
Well address if different from above NONE
Township 12S Range 1W Section 36
Distance from cities, roads, railroads, fences, etc. 10 MILES EAST OF ESCONDIDO OFF HWY 78



WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic [ ]
Irrigation [X]
Industrial [ ]
Test Well [ ]
Stock [ ]
Municipal [ ]
Other [ ]

(5) EQUIPMENT:

Rotary [X] Reverse [ ]
Cable [ ] Air [ ]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:

Yes [X] No [ ] Size 1/4" x 1/2"
Diameter of bore 18"
Packed from 20 to 135 ft.

(7) CASING INSTALLED:

Steel [X] Plastic [ ] Concrete [ ]

From ft.	To ft.	Dia. in.	Gage or Wall
0	135	18"	.188

(8) PERFORATIONS:

Type of perforation or size of screen

From ft.	To ft.	Slot size
90	135	1/16"

(9) WELL SEAL:

Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 90 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval ft.
Method of sealing

(10) WATER LEVELS:

Depth of first water, if known 80 ft.
Standing level after well completion 75 ft.

(11) WELL TESTS:

Was well test made? Yes [X] No [ ] If yes, by whom? Mutt Water Systems
Type of test Pump [X] Bailer [ ] Air lift [ ]
Depth to water at start of test 75 ft. At end of test 97 ft
Discharge 350 gal/min after 16 hours Water temperature 61°
Chemical analysis made? Yes [ ] No [X] If yes, by whom?
electric log made? Yes [ ] No [X] If yes, attach copy to this report

(12) WELL LOG:

Total depth 136-6 ft. Depth of completed well 135 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	9	FINE TO MED BROWN SAND
9	33	MED TO HEAVY BROWN SAND
33	92	FINE SAND W/ BLUE BLACK SMALL GRAVEL W/ SOME BROWN CLAY
92	92-6	LAYER OF 1/4" GRAVEL
92-6	114	COARSE SAND W/ FINE GRAVEL

Work started 3-29 19 77 Completed 3-31 19 77

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 John F. Kratz (Well Driller)
NAME HOWARD PUMP INC. (Person, firm, or corporation) (Typed or printed)
Address 28753 W. HWY 58
City BARSTOW, CAL. Zip 92311
License No. 281814 Date of this report 1-6-78

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 45816-950 7-76 50M QUAD OT OSP

ORIGINAL
File with DWR

KP
9/2002

Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 757095

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. 7/02
Date Work Began 7/25/02, Ended 8/2/02
Local Permit Agency Dept of Env. Health
Permit No. W64529 Permit Date 7/11/02

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Gel

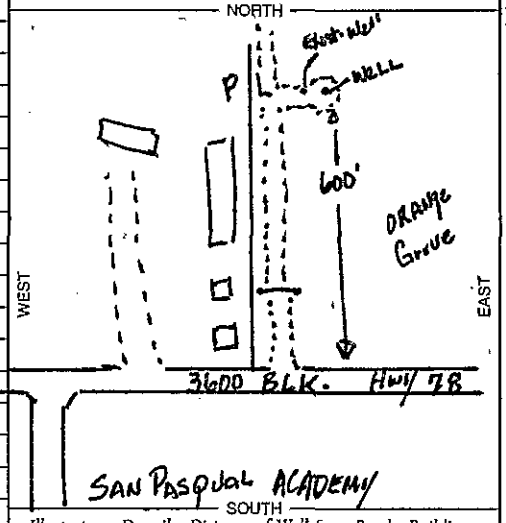
DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0 – 10	Fine grained sand - brown color
10 – 51	Fine to coarse sand - brown color
51 – 70	Coarse sand and gravel
70 – 73	Hard packed silt
73 – 94	Coarse sand some gravel brown color
94 – 114	Hard, firm partly cemented grey color
114 – 134	Fine to coarse sand, hard, firm grey to black color
134 – 174	Fine to medium grained sand hard, compacted grey color
174 – 180	Weathered granite, grey color

TOTAL DEPTH OF BORING 180 (Feet)
TOTAL DEPTH OF COMPLETED WELL 174 (Feet)

WELL LOCATION

Address 3600 blk San Pasqual Vly. Rd. Hwy 78
City San Diego - San Pasqual
County San Diego
APN Book 760 Page 170 Parcel 49
Township 12S Range 1W Section 36 D
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



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
___ Domestic ___ Public
X 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 70 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 70 (Ft.) & DATE MEASURED 8/2/02
ESTIMATED YIELD * 700+ (GPM) & TEST TYPE airlift
TEST LENGTH 4 (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)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 – 20	32	X				Steel A53	23.5	.250	
20 – 93	23	X				Steel A53	12	.375	
93 – 133	23		X			304 SS	12	.250	.060
133 – 143	23	X				Steel A-53	12	.375	
143 – 163	23		X			304 SS	12	.250	.060
163 – 173	23	X				steel A-53	12	.375	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	TYPE: CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 – 20	X			
20 – 180				5/16 X 16

ATTACHMENTS (✓)

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

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.

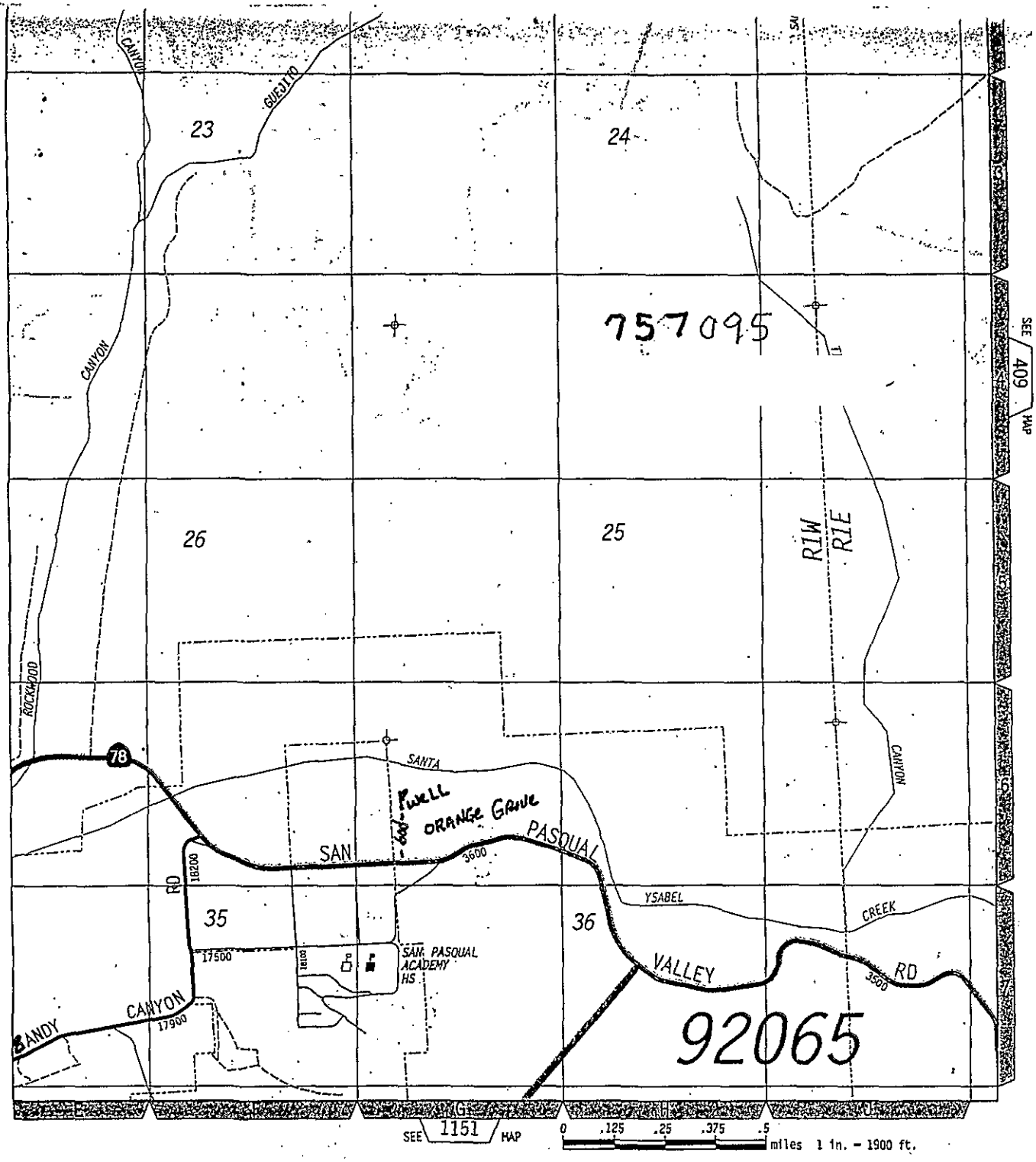
NAME Fain Drilling & Pump Co Inc
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 12029 Old Castle Rd. CITY Valley Center STATE California ZIP 92082

Signed Joe R Fain (WELL DRILLER/AUTHORIZED REPRESENTATIVE) DATE SIGNED 8/5/02 C-57 LICENSE NUMBER 328287

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM


757095
92065
23
24
26
25
35
36
SANTA
ORANGE GROVE
SAN
PASQUAL
YSABEL
CREEK
VALLEY
RD
CANYON
SANDY
ROCKWOOD
GUEJITO
SAN PASQUAL ACADEMY HS
78
17500
17900
18200
3600
SEE 409 MAP
SEE 1151 MAP
0 .125 .25 .375 .5 miles 1 in. = 1900 ft.

well #1

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

SCANNED

DATE: 9/7/14

DEH USE ONLY
DEH2014-LWELL-000675
PERMIT #
FEE: 535.00
WATER DIST:

1. Property Owner (lessee): BE WISE RANCH INC. Phone: BILL 760-746-60006
   Mailing Address: 20505 SAN PASQUAL VALLEY RD. City: ESCONDIDO State: CA Zip: 92026
2. Well Location - Assessors Parcel Number: 760-170-82
   GPS Coordinates: (WGS-84 Decimal Degrees): 33.0727 / 117.0323
   Site Address: SAN PASQUAL VALLEY RD. City: ESCONDIDO State: CA Zip: 92026
3. Well Contractor/Driller: DAVE MATTHEWS Company Name: FAIN DRILLING
   Mailing Address: 12029 OLDCASTLE RD City: VALLEY CENTER State: CA Zip: 92082
   Phone: 760-749-0701 C-57 License No: 328287 ☐ Cash Deposit ☒ Bond Posted
4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Other: IRRIGATION WELL
5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: MOD. ROTARY
7. Depth of Well: Proposed: 100 ft. Existing:
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel	☒ Yes ☐ No	☒ Yes ☐ No	From: 50 To: 100
Depth: 100	Depth: 20	From: 0 To: 100	From: ____ To: ____
Diameter: 14 in.	Diameter: 24 in.	Type: #6	From: ____ To: ____
Wall/Gauge: .250	Wall/Gauge: .250		

9. Annular Seal: Depth: 20 ft. Sealing Material: cement
   Borehole Diameter: 30 in. Conductor Diameter: 24 in. Annular Thickness: 3 in.
10. Best Management Plan for confining well drilling waste on the project site provided? ☒ Yes ☐ No
11. Date of Work: Start: 10/14 Complete: 10/14

On sites served by public water, contact the local water agency for meter protection requirements.
I hereby agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's report). I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Date:

DISPOSITION OF APPLICATION (Department of Environmental Health Use Only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: Date: 9-11-14

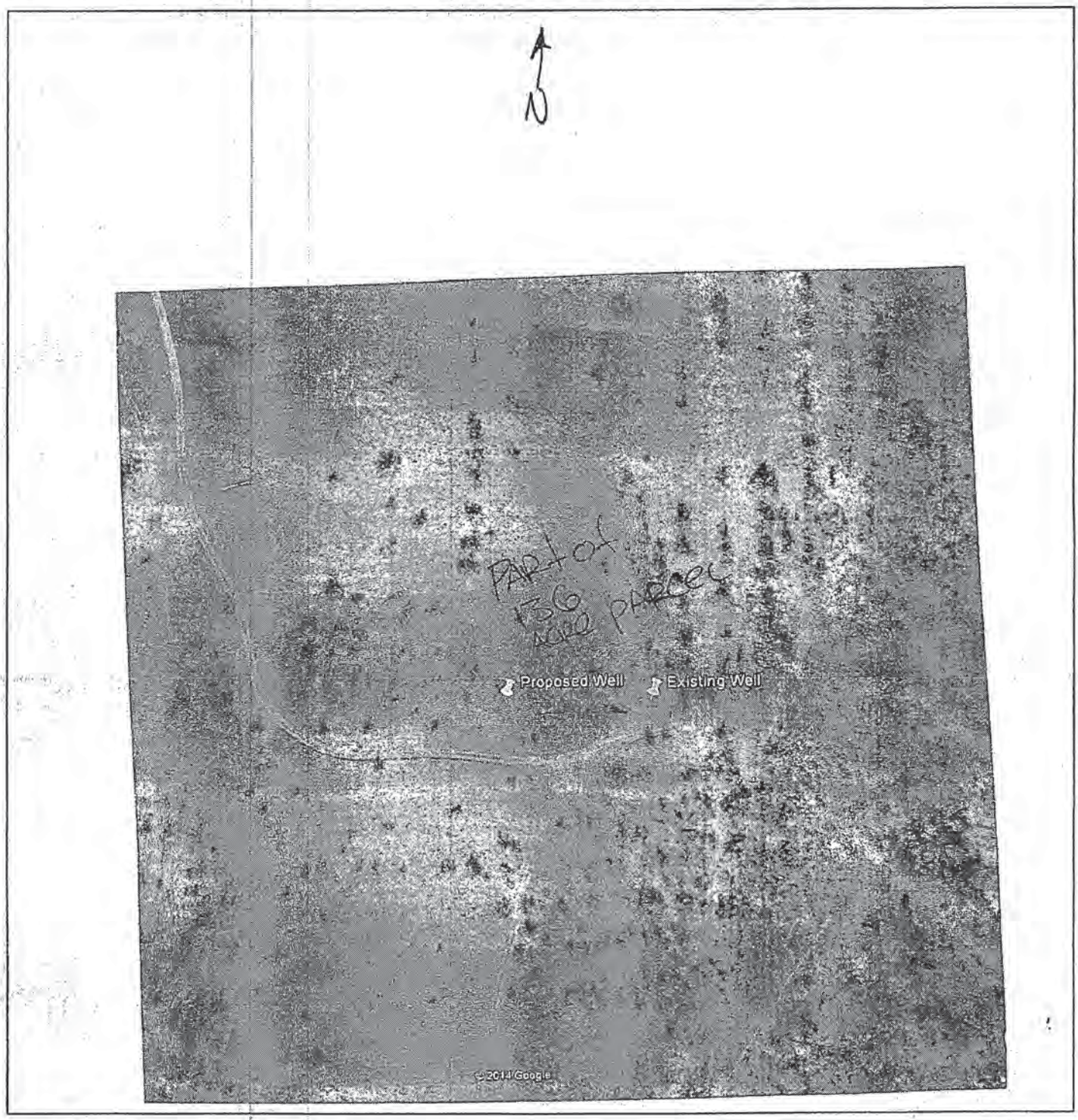
LWI11-000675

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # DEH2014-LWELL-000675
APN: 760-170-82

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.



County of San Diego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only

Well Permit Application Number: LWELL-000675 Assessor's Parcel Number: 760-170-82

SECTION 1: Required Information from Contractor or Consultant:

Longitude & Latitude: 33.0727 x 117.0323 How obtained? GPS Map Other

1. Are there any watercourses or water bodies within 50 feet of the limits of soil disturbance?	YES	(NO)
2. Does the plat show the project boundaries? (A "detail inset" is acceptable for a large parcel or lot.).	(YES)	NO
3. Does the plat show footprints of any existing structures and facilities within 100 feet of the wellhead position?	YES	(NO)
4. Does the plat show locations where run-off may enter stormdrains, drainage courses and/or receiving waters?	YES	(NO)
5. Is grading required to access site or install well?	YES	(NO)
6. Does the project conform to the local grading ordinance?	(YES)	NO
7. Will drilling additives be used to drill the well?	YES	(NO)
8. Are the Best Management Practices attached to this permit application? Containment pits to keep All spoils on property	(YES)	NO

SECTION 2: Best Management Practices

The goal of stormwater and discharge control management planning while drilling and installing wells is to reduce pollution to the maximum extent practicable using Best Management Practices (BMPs). Construction related materials, sediments, chemical residues such as drilling foam, wastes, and spills must be retained within the property boundaries to eliminate transport from the site to nearby streets, drainage courses, receiving waters and adjacent properties. It is the responsibility of the property owner and the contractor to determine which BMPs will be used in order to ensure that all contaminants are retained on-site.

Examples of Best Management Practices to contain well installation run-off include, but are not limited to, installation of a sediment basin to contain run-off, using geotextile fabric to contain sediments and drilling mud, or eliminating the use of drilling foam. (Website information is available at www.projectcleanwater.org)

SECTION 3: Certification

I have read and understand the following: *(Please check each box after concurrence.)*

- ☑ Selected BMP's will be implemented so that water quality is not negatively impacted by well construction activities.
- ☑ I am aware the selected BMP's must be installed, maintained, monitored and revised as necessary so they are effective.
- ☑ I understand that non-compliance with the San Diego County Watershed Protection Ordinance may result in enforcement actions by the County. These may include fines, citations, stop-work orders, or other actions.
- ☑ DEH inspectors and personnel from other regulatory agencies are authorized to enter my property at any time for purposes associated with this well permit until such time the well is completed to the satisfaction of DEH.
- ☑ Should DEH determine during the field review that the well installation procedures contradict this Discharge Management Plan or the well permit application, the well drilling permit may be suspended or revoked. Further activity will require a new permit fee and amendment to the existing permit.

Contractor _____ *Date* 9/5/14

Property Owner _____ *Date* 8-5-14

Reviewed by DEH _____ *Date* 9-11-14

DUPLICATE, ORIGINAL

DEH2014-LWELL-00067S

THE CITY OF SAN DIEGO

WILLIAM BRAMMER
d/b/a BRAMMER FARMS

Flat Rate Lease

DOCUMENT NO. RR-301867

FILED SEP 12 2016

OFFICE OF THE CITY CLERK
SAN DIEGO, CALIFORNIA

CITY OF SAN DIEGO
FLAT RATE LEASE

THIS LEASE AGREEMENT is executed between THE CITY OF SAN DIEGO, a municipal corporation, hereinafter called "CITY," and WILLIAM BRAMMER d.b.a. BRAMMER FARMS, hereinafter called "LESSEE."

SECTION 1: USES

1.1 Premises. CITY hereby leases to LESSEE and LESSEE leases from CITY all of that certain real property situated in City of San Diego, County of San Diego, State of California, described as consisting of approximately 136.4 acres and further described in Section 11.1, Exhibit A - Premises attached hereto and by this reference made part of this agreement and four (4) wells, including the right to use the water which may be available underneath the Premises for the purposes provided for in Section 1.2 Uses, subject to Section 8.8, Water Rights, hereof. Said real property is hereinafter called the "premises" or "leased premises." It is further agreed that the leasehold has not been surveyed however CITY and LESSEE agree to approximate acreage.

1.2 Uses. It is expressly agreed that the premises are leased to LESSEE solely and exclusively for the purposes of growing organic vegetables, related agricultural crops on an ongoing basis, business office, vegetable washing and packing area/building and for such other related or incidental purposes as may be first approved in writing by the City Manager and for no other purpose whatsoever.

The use of the premises for any unauthorized purpose shall constitute a substantial default and subject this lease to termination at the sole option of the CITY.

LESSEE covenants and agrees to use the premises for the above-specified purposes and to diligently pursue said purposes throughout the term hereof. Failure to continuously use the premises for said purposes, or the use thereof for purposes not expressly authorized herein, shall be grounds for termination by CITY.

1.3 Related Council Actions. By the granting of this lease, neither CITY nor the Council of CITY is obligating itself to any other governmental agent, board, commission, or agency with regard to any other discretionary action relating to development or operation of the premises. Discretionary action includes but is not limited to rezonings, variances, environmental clearances, or any other

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR County

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0242697

Page 1 of 1

Owner's Well Number One

Date Work Began 11/03/2014 Date Work Ended 11/17/2014

Local Permit Agency SD DEH

Permit Number LWELL-000675 Permit Date 9/11/14

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N W

Latitude Longitude

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	16	Brown Silty Sand
16	41	Brown Sand
41	64	Course Sand And Gravel
64	66	Grey Clay
66	96	Course Sand And Gravel
96	100	Hard Decomposed Granite
100	101	Granite

Completed Well Construction

Date 6/30/16

Date Inspected 6/30/16

Comments

Water Sample Taken?

Reviewed By

Total Depth of Boring 101 Feet

Total Depth of Completed Well 100 Feet

Well Owner

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Well Location

Address San Pasqual Valley Road

City Escondido County San Diego

Latitude ___ ___ ___ N Longitude ___ ___ ___ W

Deg. Min. Sec. Deg. Min. Sec.

Datum ___ Dec. Lat. 33.0727 Dec. Long. 117.0323

APN Book 760 Page 170 Parcel 82

Township ___ Range ___ Section ___

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North

SEE ATTATCHED MAP

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 and complete.

Activity

◉ New Well

○ Modification/Repair

○ Deepen

○ Other

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

◉ Water Supply

☐ Domestic ☐ Public

☑ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

○ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other

Water Level and Yield of Completed Well

Depth to first water UKN (Feet below surface)

Depth to Static Water Level 12 (Feet) Date Measured 11/17/14

Estimated Yield * 700 +/- (GPM) Test Type AIR LIFT

Test Length 6 (Hours) Total Drawdown ___ (Feet)

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

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size If Any (Inches)
0	20	32	Conductor	Low Carbon Steel	.250	24		
0	60	23	Blank	PVC F480	.750	12 3/4		
60	100	23	Screen	304 Stainless Steel	.250	12 3/4	Wire Wrap	0.060

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	20	Cement	
0	100	Filter Pack	#6

Attachments

☐ Geologic Log

☐ Well Construction Diagram

☐ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☑ Other Site Map

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 Fain Drilling and Pump Company, Inc.

Person, Firm or Corporation

12029 Old Castle Road Valley Center CA 92082

Address City State Zip

Signed ___ 11/20/14 328287

C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

EQ, 1/15/15, DEH 2/5

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

Wed 1/14/15 (PM) Okay per AW

DEH USE ONLY
PERMIT # LWELL-000807
FEE:
WATER DIST: 8

1. Property Owner: WIFMAN RANCH (Lessee) Phone: 760-644-6887
   Mailing Address: PO BOX 1959 City: ESCONDIDO State: CA Zip: 92025
2. Well Location - Assessors Parcel Number: ~~235-041-11~~ 760-170-43 or -242-130-07
   GPS Coordinates: (WGS-84 Decimal Degrees): 33.0914 / ~~244-55~~ 116.9559
   Site Address: Hwy 78 W/O BANDY CANYON City: ESCONDIDO State: CA Zip: 92025
3. Well Contractor/Driller: DAVE MATTHEWS Company Name: FAIN DRILLING
   Mailing Address: 12029 OLDCASTLE RD City: VALLEYCENTER State: CA Zip: 92082
   Phone: 760-749-0701 C-57 License No: 328287 ☐ Cash Deposit ☒ Bond Posted
4. Use: ☒ Private ☐ Public ☐ Industrial ~~☒~~ Other: IRRIGATION (test well)
5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: MUD ROTARY
7. Depth of Well: Proposed: 190' Existing: 0
8. Proposed: test well to be ~~destroyed~~ OR Finished upon results

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: _____	☐ Yes ☐ No	☐ Yes ☐ No	From: ____ To: ____
Depth: _____	Depth: _____	From: ____ To: ____	From: ____ To: ____
Diameter: _____ in.	Diameter: _____ in.	Type: _____	From: ____ To: ____
Wall/Gauge: ____	Wall/Gauge: ____		

9. Annular Seal: Depth: _____ ft. Sealing Material: _____
   Borehole Diameter: _____ in. Conductor Diameter: _____ in. Annular Thickness: _____ in.
10. Best Management Plan for confining well drilling waste on the project site provided? ☐ Yes ☐ No
11. Date of Work: Start: 1/13/15 Complete: 1/23/15

On sites served by public water, contact the local water agency for meter protection requirements.
I hereby agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's report). I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: _____ Date: 1/13/15

DISPOSITION OF APPLICATION (Department of Environmental Health Use Only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: Jessica Hagerman Date: JAN 13, 2015

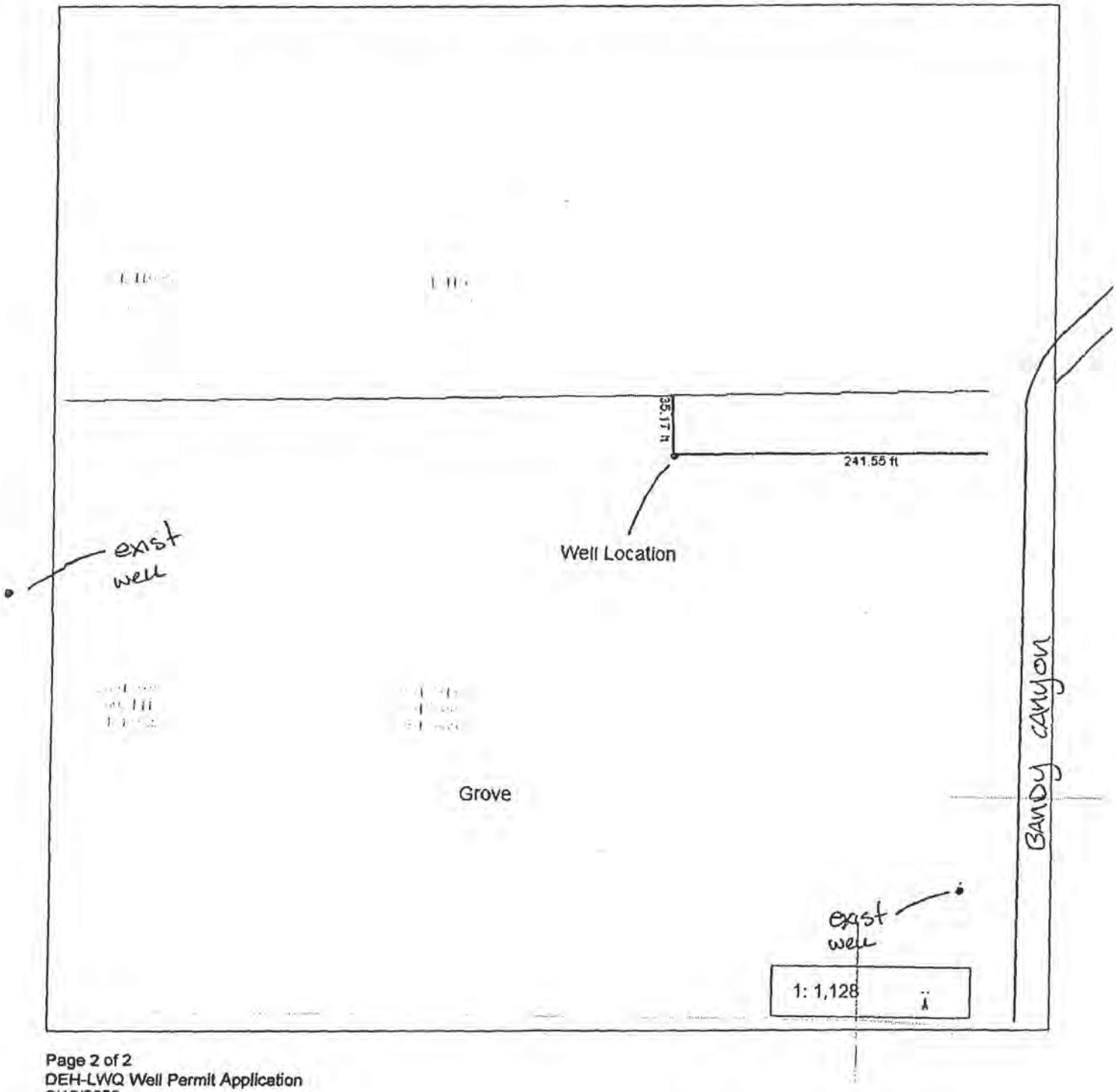
EOL, 1/15/15, DEH2015

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # LWELL-000807
APN: _____

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.



E01, 1/15/15
DEH 2015

County of San Diego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only

Well Permit Application Number: 000807 Assessor's Parcel Number: 242-130-27 [redacted]

SECTION 1. Required Information from Contractor or Consultant:

Longitude & Latitude 33.0914 / -116.9559 How obtained? GPS / Map / Other

1. Are there any watercourses or water bodies within 50 feet of the limits of soil disturbance? YES / NO
2. Does the plat show the project boundaries? (A "detail inset" is acceptable for a large parcel or lot.). YES / NO
3. Does the plat show footprints of any existing structures and facilities within 100 feet of the wellhead position? YES / NO
4. Does the plat show locations where run-off may enter stormdrains drainage courses and/or receiving waters? YES / NO
5. Is grading required to access site or install well? YES / NO
6. Does the project conform to the local grading ordinance? YES / NO
7. Will drilling additives be used to drill the well? YES / NO
8. Are the Best Management Practices attached to this permit application? YES / NO

- MOBILE/Ag operations contain all spills in tanks/pits

SECTION 2. Best Management Practices

The goal of stormwater and discharge control management planning while drilling and installing wells is to reduce pollution to the maximum extent practicable using Best Management Practices (BMPs). Construction related materials, sediments, chemical residues such as drilling foam, wastes, and spills must be retained within the property boundaries to eliminate transport from the site to nearby streets, drainage courses, receiving waters and adjacent properties. It is the responsibility of the property owner and the contractor to determine which BMPs will be used in order to ensure that all contaminants are retained on-site.

Examples of Best Management Practices to contain well installation run-off include but are not limited to installation of a sediment basin to contain run-off, using geotextile fabric to contain sediments and drilling mud, or eliminating the use of drilling foam. (Website information is available at www.projectcleanwater.org.)

SECTION 3. Certification

I have read and understand the following: *(Please check each box after concurrence.)*

- ✓ Selected BMP's will be implemented so that water quality is not negatively impacted by well construction activities.
- ✓ I am aware the selected BMP's must be installed, maintained, monitored and revised as necessary so they are effective.
- ✓ I understand that non-compliance with the San Diego County Watershed Protection Ordinance may result in enforcement actions by the County. These may include fines, citations, stop-work orders, or other actions.
- ✓ DEH inspectors and personnel from other regulatory agencies are authorized to enter my property at any time for purposes associated with this well permit until such time the well is completed to the satisfaction of DEH.
- ✓ Should DEH determine during the field review that the well installation procedures contradict this Discharge Management Plan or the well permit application, the well drilling permit may be suspended or revoked. Further activity will require a new permit fee and amendment to the existing permit.

Contractor [signature] Date 11/13/14

Property Owner [signature] Date 11-3-14

Reviewed by DEH _____ Date _____

County

RECEIVED

FEB 23 2015

ENVIRONMENTAL HEALTH

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0255061

Page 1 of 1

Owner's Well Number One

Date Work Began 01/14/2015 Date Work Ended 1/22/2015

Local Permit Agency SD DEH

Permit Number LWELL-000807 Permit Date 1/13/15

DWR Use Only – Do Not Fill In

State Well Number/Site Number

Latitude N Longitude W

APN/TRS/Other

Geologic Log

Orientation ⊙ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	13	Silty Grey Sand
13	66	Course Brown Sand
66	92	Grey Sand And Silt
92	96	Grey Silty Clay
96	167	Course Grey Sand
167	188	Course Sand Grey / White
188	190	Weathered Rock
190		Granite

Completed Well Construction

Date

Date Inspected

Comments

W33.09136°

W116.95601°

Well Specs

Water Sample 8/4/14

Reviewed By

Total Depth of Boring 190 Feet

Total Depth of Completed Well 190 Feet

Well Owner

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Well Location

Address Hwy 78 e/o Bandy Canyon

City Escondido County San Diego

Latitude Deg. Min. Sec. N Longitude Deg. Min. Sec. W

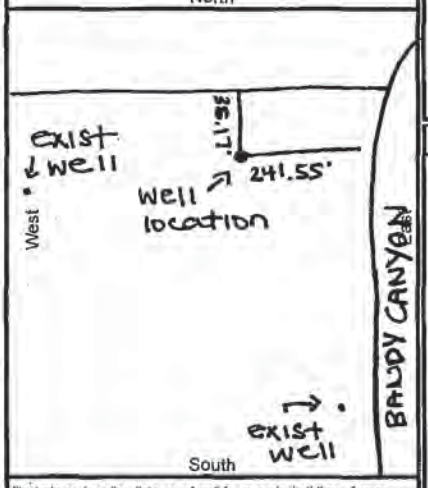
Datum Dec. Lat. 33.0914 Dec. Long. 116.9559

APN Book 760 Page 170 Parcel 43

Township Range Section

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

⊙ New Well

○ Modification/Repair

○ Deepen

○ Other

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

⊙ Water Supply

☐ Domestic ☐ Public

☑ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

○ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level 72 (Feet) Date Measured

Estimated Yield * 500 + (GPM) Test Type Air Lift

Test Length 8.0 (Hours) Total Drawdown (Feet)

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

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	20	30	Conductor	Low Carbon Steel	.250	24"		
0	90	23"	Blank	PVC F480	.750	12 3/4"		
90	190	23"	Screen	304 Stainless Steel	.250	12 3/4"	Wire Wrap	0.060

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	20	Cement	
0	190	Gravel Pack	#6

Attachments

☐ Geologic Log

☐ Well Construction Diagram

☐ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☑ Other Site Map

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 Fain Drilling and Pump Company, Inc.
Person, Firm or Corporation

Valley Center Address California City CA State 92082 Zip

Signed C-57 Licensed Water Well Contractor

2/17/15 Date Signed

328287 C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

#906

WELL PERMIT APPLICATION

WITMAN RANCH INC.

APN 760-170-18

Control # W 02917

TYPE OF WORK (Check)		USE (Check)			EQUIPMENT (Check)	
New Well	☒	Individual Domestic	☐		Rotary	☒
Repair or Modification	☐	Agricultural	☒	Community ☐	Cable Tool	☐
Time Extension	☐	Industrial	☐	Other _____	Other	☐
Destruction	☐					

PROPOSED WELL DEPTH

Max. 160 Min. 150 (Feet)

PROPOSED CASING

Type STEEL Depth 150 Diameter 12" Wall or Gage .365

PROPOSED SEALING ZONE(S)

From 0 to 20 Feet
From _____ to _____ Feet
From _____ to _____ Feet

PROPOSED PERFORATIONS OR SCREEN

From 100 to 160 Feet
From _____ to _____ Feet
From _____ to _____ Feet
From _____ to _____ Feet

SEALING MATERIAL (Check)

Neat Cement Grout ☒ Bentonite Clay ☐
Sand Cement Grout ☐ Concrete ☒
Other-Specify: _____

DATE OF WORK

Start 2-27-95
Completion 3-5-95

NAME OF WELL OWNER
WITMAN RANCH, INC.

NAME OF WELL DRILLER
Joe FAIN

LOCATION OF WELL
16789 SAN PASQUAL VLY Rd - ESC.

COMPANY
FAIN DRILLING & PUMP Co. INC.

DISPOSITION OF APPLICATION
(FOR HEALTH OFFICERS USE ONLY)

☐ APPROVED ☐ DENIED
☒ APPROVED WITH CONDITIONS

Report Reason(s) for Denial or Necessary Conditions Here:

Well to be installed to all state & County water well standards.

On sites served with public water, contact the local water agency for meter protection requirements.

M. Sedgl
HEALTH OFFICER

2-23-95
DATE

BUSINESS ADDRESS
12029 Old CASTLE Rd - VALLEY CENTER

LICENSE NUMBER
328287

Cash Deposit ☐
Bond Posted ☒

$175.00 Fee paid on 2-23-95 CK

I hereby agree to comply with all regulations of the Department of Health Services and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Health Services with a complete and accurate log of the well.

Joe R. Fain
APPLICANT'S SIGNATURE

2-23-95
DATE

WELL 906 Mail: PO BOX 1459 - ESC. 92033

1 - No prod

Witman Ranch

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

WELL PERMIT APPLICATION

Control # W12917

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.

QUADRUPLICATE
For Local Requirements

Copy to Ruffin
Orig in SR 6/23/95 DT

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 463759

Page 1 of 2
Owner's Well No. W62917
Date Work Began 3/2/95, Ended 3/16/95
Local Permit Agency Env. Health Dept
Permit No. W62917 Permit Date 2/23/95

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER 18 (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
		Alluvial Fill as Follows:
0	20	fine to coarse sand
20	70	fine grained sand with some small aggregate
70	96	fine grained sand with lenses of black silt
96	160	fine to coarse sand with some small gravel
160	166	decomposed granite

Completed Well Construction
Date 7-25-95
Date Inspected 7-21-95
Comments Ag. Well
Water Sample Taken? No
Reviewed By M. Seifert

TOTAL DEPTH OF BORING 166 (Feet)
TOTAL DEPTH OF COMPLETED WELL 162 (Feet)

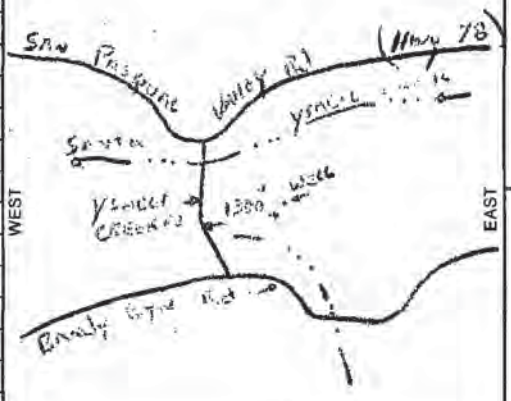
WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

WELL LOCATION

Address 16789 Hwy 78
City San Diego
County San Diego
APN Book 760 Page 170 Parcel 18
Township 13S Range 1W Section 33
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)
X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")
PLANNED USE(S) (✓)
___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
X Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 9 (Ft.) & DATE MEASURED 3/16/95
ESTIMATED YIELD* 1000+ (GPM) & TEST TYPE airlift
TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN 100 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL/GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	36	X				A-52	25.5	.250	
20	100	23	X				A-52	12	.365	
100	160	23		X			304SS	12	.250	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	160	pea gravel			5/16 x 7

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
✓ Other ASTM
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 Fain Drilling & Pump Co Inc (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 12029 Old Castle Rd. CITY Valley Center, STATE Ca ZIP 92082
Signed [signature] WELL DRILLER/AUTHORIZED REPRESENTATIVE
DATE SIGNED 4/17/95
C-57 LICENSE NUMBER 328287

DWR 188 REV. 7-90
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

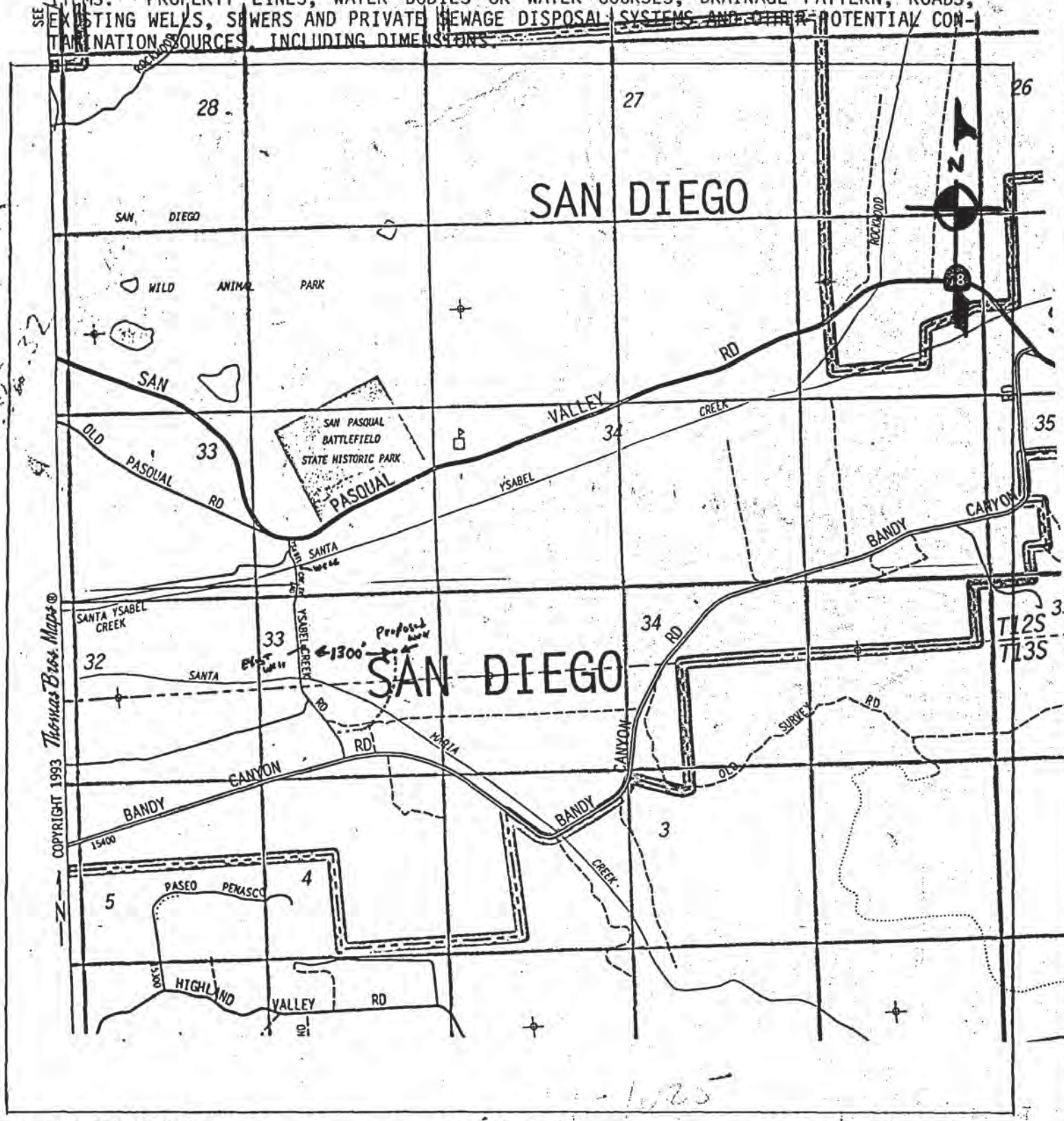
WELL PERMIT APPLICATION

Control # WW2917

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



DHS:EHP-731 (3/85)

WC#1823

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

WELL PERMIT APPLICATION

APN 760-170-18
Control # 462322

TYPE OF WORK (Check)		USE (Check)			EQUIPMENT (Check)	
New Well	☒	Individual Domestic	☐		Rotary	☒
Repair or Modification	☐	Agricultural	☒	Community ☐	Cable Tool	☐
Time Extension	☐	Industrial	☐	Other _____	Other	☐
Destruction	☐					

PROPOSED WELL DEPTH
Max. 200 Min. 180 (Feet)

PROPOSED CASING
Type STEEL Depth 200' Diameter 12" Wall or Gage .375

PROPOSED SEALING ZONE(S)
From 0 to 50 Feet
From _____ to _____ Feet
From _____ to _____ Feet

PROPOSED PERFORATIONS OR SCREEN
From 140 to 200 Feet
From _____ to _____ Feet
From _____ to _____ Feet
From _____ to _____ Feet

SEALING MATERIAL (Check)
Neat Cement Grout ☐ Bentonite Clay ☐
Sand Cement Grout ☐ Concrete ☒
Other-Specify: _____

DATE OF WORK
Start 1-4-93
Completion 1-10-93

NAME OF WELL OWNER
KAY BISHOP

NAME OF WELL DRILLER
Joe FAIN 749-0701

LOCATION OF WELL
BANDY CYN Rd-ESC (Hwy 78) SAN PASQUAL (SAN Diego)
17707 Bandy Cyn Rd ESC 92025

COMPANY
FAIN Drilling & Pump CO. INC.

BISHOP KAY

DISPOSITION OF APPLICATION (FOR HEALTH OFFICERS USE ONLY)

☐ APPROVED ☐ DENIED

☒ APPROVED WITH CONDITIONS

Report Reason(s) for Denial or Necessary Conditions Here:
1. Well is for agricultural use only.

[illegible] water protection requirements.

Scott W Kline
HEALTH OFFICER
1-4-93
DATE

BUSINESS ADDRESS
12029 OLD CASTLE Rd-VALLEY CENTER

LICENSE NUMBER
388887

Cash Deposit ☐
Bond Posted ☒

$235 Fee paid on 01/04-93

I hereby agree to comply with all regulations of the Department of Health Services and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Health Services with a complete and accurate log of the well.

Joe R. Fain
APPLICANT'S SIGNATURE
12-24-92
DATE

WEL-1823

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

01-0493

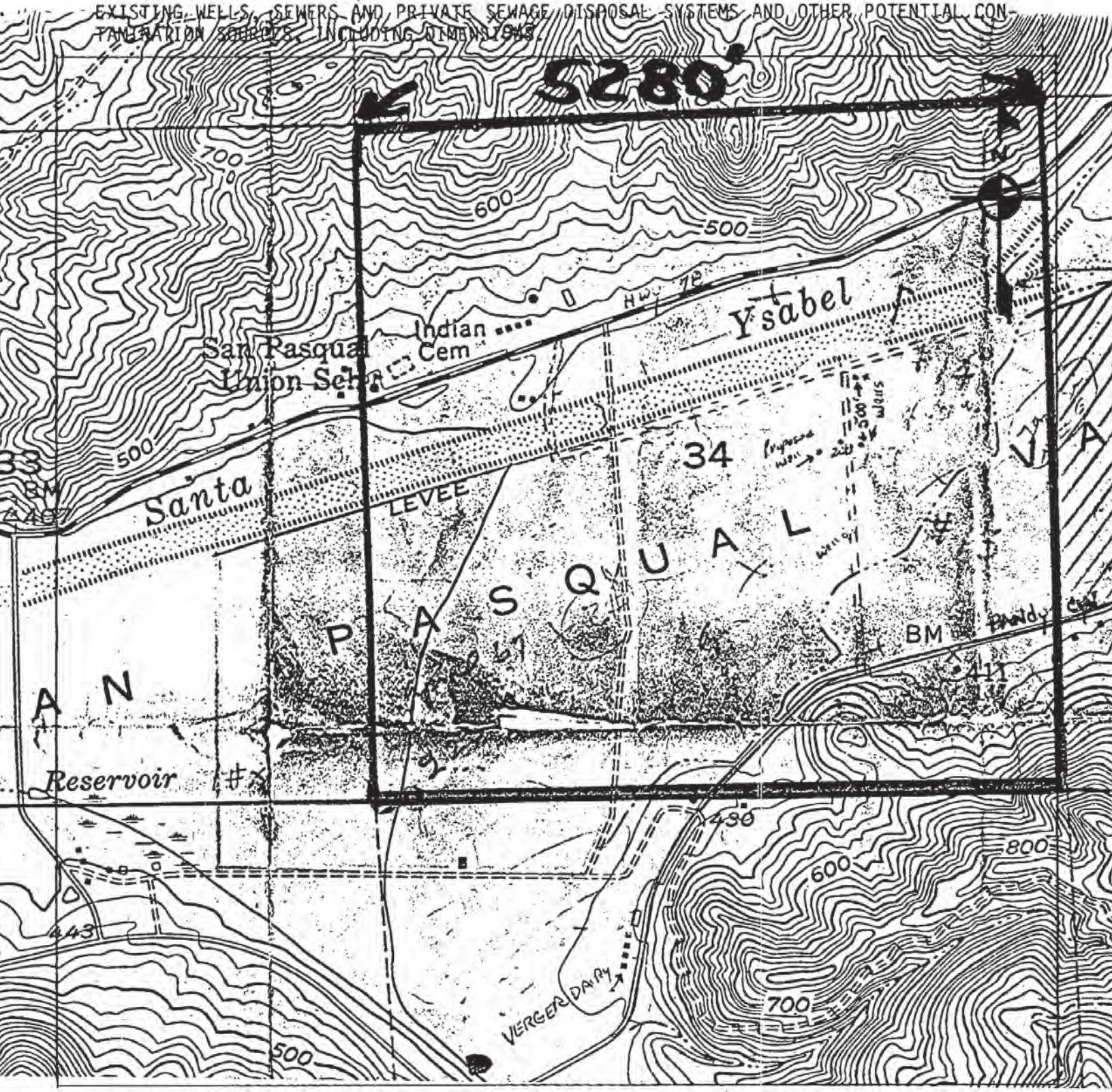
WELL PERMIT APPLICATION

Control # W62322

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



DHS:EHP-731 (3/85)

T-12-S
R-1W
S-34

QUADRUPLICATE
For Local Requirements

WDR sent to Ruffin 3-12-93 pcr

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 477925

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Page 1 of 1
Owner's Well No. 1-93
Date Work Began 1/8/93 Ended 1/22/93
Local Permit Agency County Health Dept.
Permit No. W62322 Permit Date 1/4/93

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER ukn (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	70	Alluvial fill as follows: Fine to coarse sand - grey color
70	85	Fine grained, silty sand Grey color
85	110	Fine to coarse sand, partly cemented - grey color
110	135	Corase Sand
135	155	Partly Cemented sand - fine to coarse
155	190	Fine to coarse sand with some gravel and boulders - overall color
190	198	Hard Rock, granite

* See approved stamp on the back

TOTAL DEPTH OF BORING 198 (Feet)
TOTAL DEPTH OF COMPLETED WELL 195 (Feet)

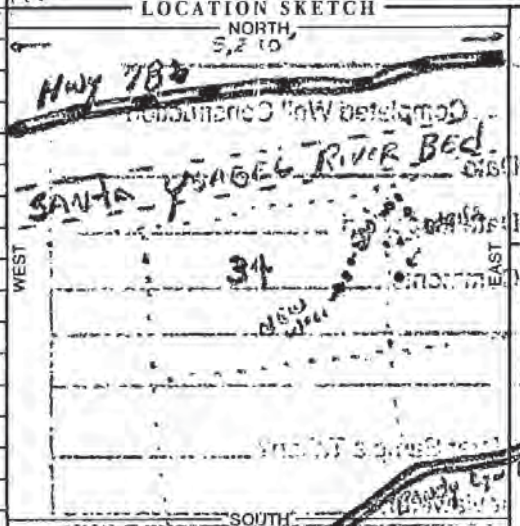
WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

WELL LOCATION

Address Bandy Cyn Rd
City Escondido
County San Diego
APN Book 760 Page 170 Parcel 18J
or
Township 12 S Range 1 W Section 34
or
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USE(S) (✓)

___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
X Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 39 (Ft.) & DATE MEASURED 1-22-93
ESTIMATED YIELD* 1000 (GPM) & TEST TYPE Airlift
TEST LENGTH 6 (Hrs.) TOTAL DRAWDOWN 100 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	36	X				A120	24	.250	
0	110	24	X				A252	12	.375	
110	130	24		X			304 SS	12	.250	.060
130	150	24	X				A252	12	.375	
150	190	24		X			304 SS	12	.250	.060
190	195	24	X				A252	12	.375	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
0	195			X	5/16 x 4 Gravel

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 Fain Drilling & Pump Co Inc (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 12029 Old Castle Rd. Valley Center, Ca 92082 (CITY, STATE, ZIP)
Signed Joe R Fain (WELL DRILLER/AUTHORIZED REPRESENTATIVE)
DATE SIGNED 1-26-93
C-57 LICENSE NUMBER 328287

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

Completed Well Construction

Date 3-16-93

Date Inspected 3-16-93

Comments Ag. well / evidence of annular seal observed

Water Sample Taken? NO

Reviewed By M. Sedghi

Well 2 #8743

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # W 63475
WELL COMPUTER #
FEE: 235.00 11/14/97
WATER DIST:

1. **Property Owner:** CHONGS FLOWERS **Phone:** 760-737-5089
15850 YSABEL CREEK Rd - (Mailing Address) ESCONDIDO (City) 92025 (Zip)

2. **Well Location - Assessors Parcel Number:** 760-170-58
15850 YSABEL CREEK Rd (Site Address) ESC (City) 92025 (Zip)

3. **Well Contractor - Well Driller** Joe FAIN **Company Name:** FAIN DRILLING
12029 OLD CASTLE Rd - (Mailing Address) VALLEY CENTER (City) 92082 (Zip)
Phone #: 760-749-0701 **C-57 #:** 328287 **Cash Deposit:** ☒ **Bond Posted:** ☐

4. **Use:** ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other _____

5. **Type of Work:** ☒ New ☐ Reconstruction ☐ Destruction **Time Extension: 1st:** ☐ **2nd:** ☐

6. **Type of Equipment:** ROTARY

7. **Depth of Well:** **Proposed:** 150 **Existing:** —0—

8.

Proposed: Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: PVC	☒ Yes ☐ No	☒ Yes ☐ No	
Depth: 150'	Depth: 20 ft.	From: 20 To: 150	From: 70 To: 150'
Diameter: 12" in.	Diameter 24 in.	Type: PEA GRAVEL	From: ____ To: ____
Wall/Gauge: CLASS 200	Wall/Gauge: .250		From: ____ To: ____

9. **Annular Seal: Depth** 20 **Ft.** **Sealing Material:** CONCRETE
Borehole Diameter: 32 **In.** **Conductor Diameter:** ____ **In.** **Annular Thickness:** ____ **In.**

10. **Date of Work: Start:** NOV-24-97 **Complete:** ~~Nov~~ Dec-3-97

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Joe R. Fain **Date:** Nov-14-97

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ Approved ☐ Denied **Special Conditions:** _____

Approved by: R. Quayle **Date:** 11-14-97

LWEL-8743

Chongs Flowers

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

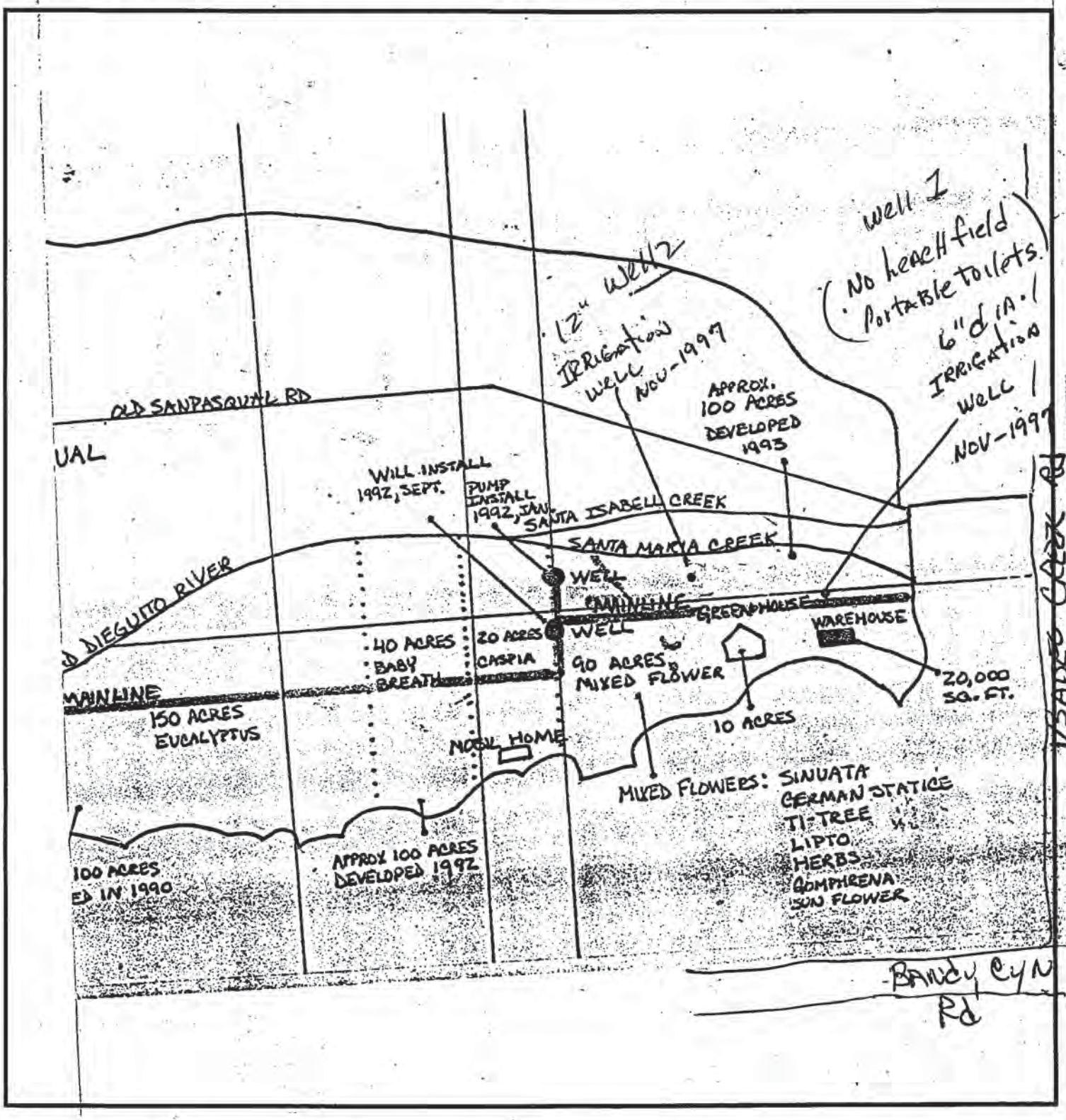
Well 2

Control #: W63475

Assessor's Parcel Number: 760-170-58

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



QUADRUPLICATE
For Local Requirements

Page 1 of 1

Owner's Well No. 2-97

Date Work Began 12-12-97 Ended 12-18-97

Local Permit Agency Dept of Env. Health

Permit No. W63475 Permit Date 11-14-97

in SM - Copy to RR

STATE OF CALIFORNIA
COMPLETION REPORT
Refer to Instruction Pamphlet

No. 445735

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

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

DEPTH TO FIRST WATER 20 (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	25	Alluvial fill as follows: Loose sand and silt - brown color
25	70	Fine to coarse sand with some small aggregates - brown color
70	80	Fine to COARSE sand - grey color
80	92	Black sand and silt
92	130	Fine to coarse sand - PARTLY cemented - dark grey color
130	155	fine COARSE Sand with some hard boulders
155	160	Weathered granite - brown color
160	165	rock

Completed Well Construction
Date 8-10-98
Date Inspected 8-7-98
Comments Well completed

TOTAL DEPTH OF BORING 165 (Feet)
TOTAL DEPTH OF COMPLETED WELL 165 (Feet)

Water Sample Taken? ___
Reviewed By Stogsdill

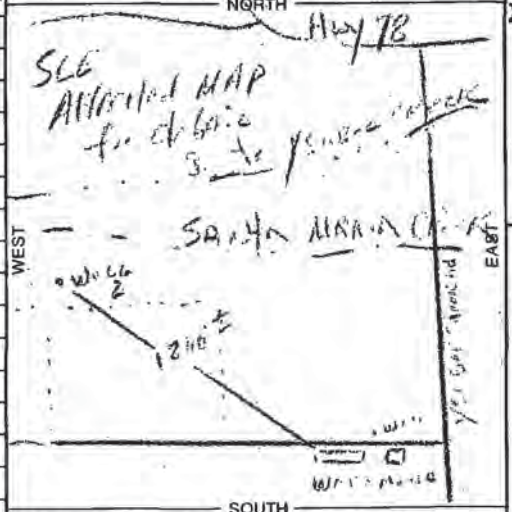
WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

WELL LOCATION

Address Same
City San Diego (San Pasqual Valley)
County San Diego
APN Book 760 Page 170 Parcel 58
or Township 12S Range 1W Section 33
or Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)
X NEW WELL
___ MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USE(S) (✓)
___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
X Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 13 (Ft.) & DATE MEASURED 12-18-97
ESTIMATED YIELD* 1200+ (GPM) & TEST TYPE airlift
TEST LENGTH 8 (Hrs.) TOTAL DRAWDOWN 80 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILLER	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	32	X				A-53	23.5	.250	
0	55	24	X				F480	12	C-200	
55	75	24		X			F480	12	C-200	
75	95	24	X				F480	12	C-200	
95	155	24		X			F480	12	C-200	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	155			pea gravel	5/16 x7

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 Fain Drilling & Pump Co Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 12029 Old Castle Rd. Valley center, Ca 92082

Signed [signature] 12-19-97 526287
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF PUBLIC HEALTH

Page 1 of 2 pages

#10606

WELL PERMIT APPLICATION

1600 PACIFIC HIGHWAY SAN DIEGO, CA. 92101

Permit No. W30021

TYPE OF WORK (Check)		USE (Check)			EQUIPMENT (Check)	
New Well	☒	Individual Domestic	☐	Commercial ☐	Rotary	☒
Repair or Modification	☐				Cable Tool	☐
Time Extension	☐	Agricultural	☐	Community ☒	Other	☐
Destruction	☐	Industrial	☐	Other ____		

PROPOSED WELL DEPTH

Max. 400 Min. 100 (Feet)

PROPOSED CASING

Type ~~☒~~ STEEL Depth TOTAL Diameter 14 Wall or Gage .250

PROPOSED SEALING ZONE(S) SEE COMMENTS PG 2

From ZERO to FIFTY Feet

From ____ to ____ Feet

From ____ to ____ Feet

PROPOSED PERFORATIONS OR SCREEN

From ____ to ____ Feet

From ____ to ____ Feet

From ____ to ____ Feet

From ____ to ____ Feet

SEALING MATERIAL (Check)

Neat Cement	☐	Puddled Clay	☐
Cement Grout	☒	Concrete	☒

DATE OF WORK

Start ____

Completion ____

242-131-01

NAME OF WELL OWNER

SAN PASQUAL ACADEMY

NAME OF WELL DRILLER

JOHN KRATZ

LOCATION OF WELL

242-131-06 17701 SAN PASQUAL VALLEY RD.

COMPANY

MULTI WATER SYSTEMS

DISPOSITION OF APPLICATION (FOR HEALTH OFFICERS USE ONLY) ESCONDIDO

☐ APPROVED ☐ DENIED

☑ APPROVED WITH CONDITIONS

Report Reason(s) for Denial or Necessary Conditions Here:

SEE COMMENTS ON PAGE 2

BERQUIST

HEALTH OFFICER

30 MARCH 1984

DATE

BUSINESS ADDRESS

RT 1 BOX 66 ESCONDIDO, CAL. 92025

LICENSE NUMBER		
355283-A	Cash Deposit	☒
	Bond Posted	☐

60.00
~~$25~~ Fee paid on ____

I hereby agree to comply with all regulations of the Department of the Public Health and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Public Health with a complete and accurate log of the well

Sheryl L. Kratz

APPLICANT'S SIGNATURE

3-30-84

DATE

LWEL 10606

San Pasqual Academy

SAN 53 (5-74)

COUNTY OF SAN DIEGO
DEPARTMENT OF PUBLIC HEALTH
1600 PACIFIC HIGHWAY
SAN DIEGO, CALIF. 92101

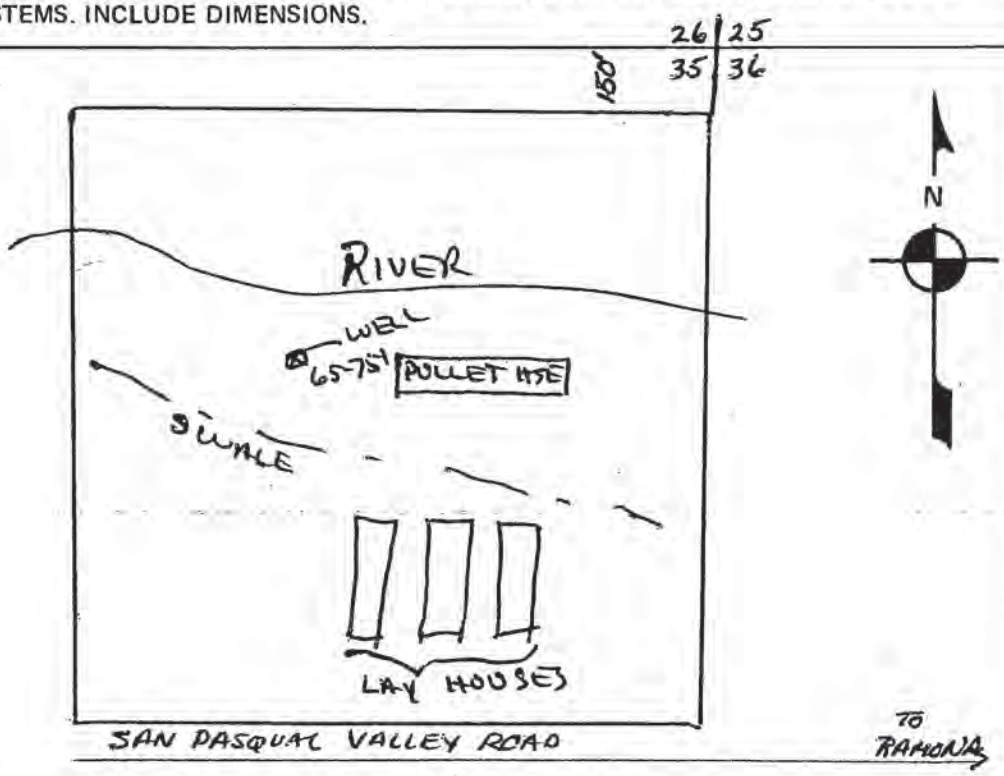
WELL PERMIT APPLICATION

Permit No. W30021

Assessor's Parcel No. 242-131-06

LOCATION

INDICATE BELOW THE EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS. INCLUDE DIMENSIONS.



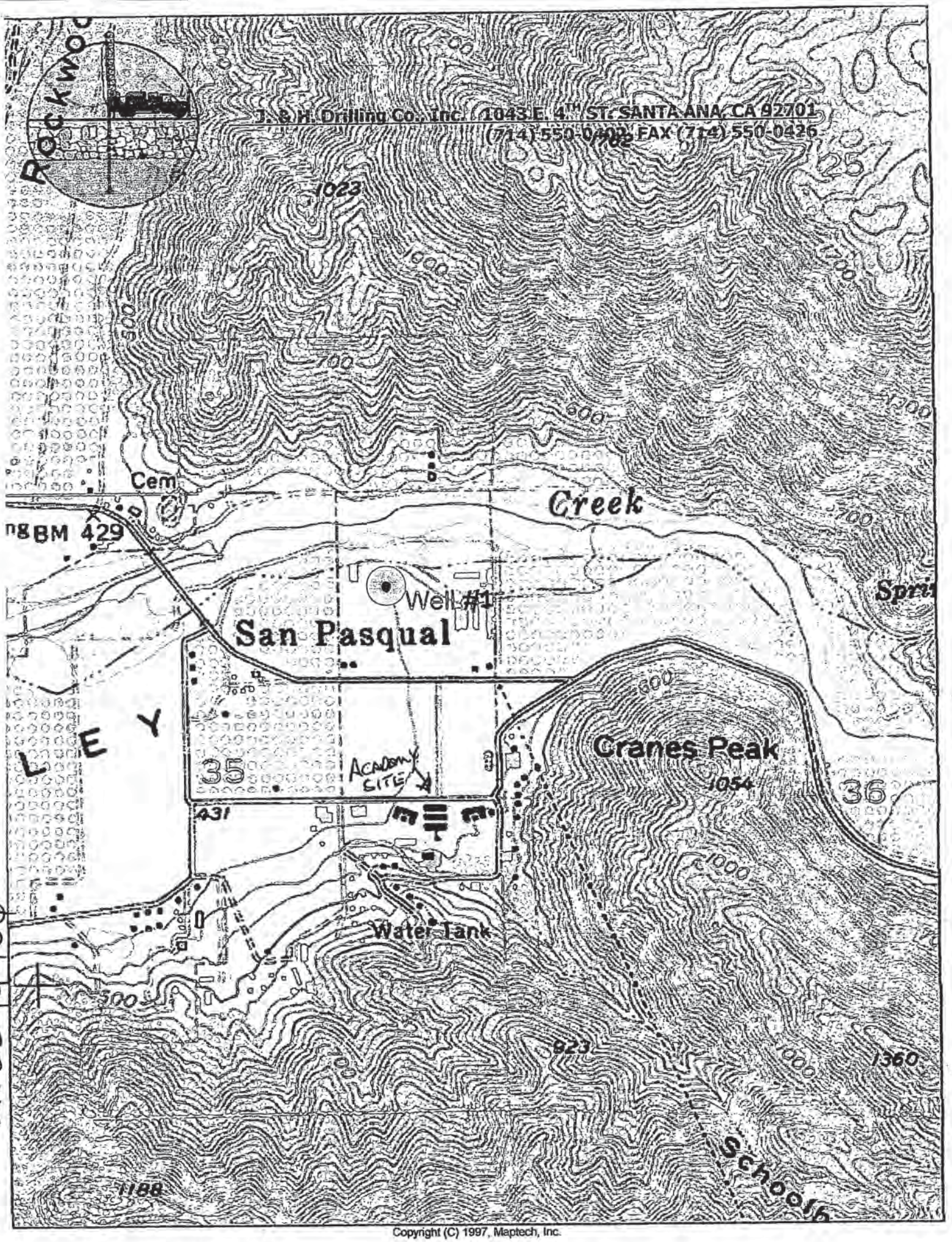
1. Well to be constructed to community well standards with required fifty feet of casing and annular seal. If impervious strata is encountered within five feet of required annular seal depth, then casing and seal to be extended five feet into impervious strata.

2. Well to be minimum of 100 feet from all sources of pollution and contamination i.e. sewage plant effluent disposal, animal enclosures and manure. A BERM must be provided so as to prevent contamination from being within 100 feet of well.

3. The existing pullet house to be re-located within 18 months so as to be 100 feet from well.

4. Provide impervious seal for ground used for manure storage so as to prevent percolation into soil.

5. Provide water devices for chicken lay houses that will not discharge waste water to ground in area of manure storage. Water device conversion to be completed within one year.


J. & H. Drilling Co., Inc. 1043 E. 4TH ST. SANTA ANA, CA 92701
(714) 550-0402 FAX (714) 550-0426
Rockwood
1023
Cem
Creek
BM 429
Well #1
San Pasqual
LEY
35
ACADEMY SITE
431
Cranes Peak
1054
36
Water Tank
823
1360
1188
Schools
LWEL 19706
Copyright (C) 1997, Maptech, Inc.

County Mail Station —A-21

FIRST CARBON COPY
send to County Health Dept. Room 104

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES
1700 PACIFIC HIGHWAY, SAN DIEGO, CA 92101

ASSESSORS PARCEL NUMBER:
242 131 06

Notice of Intent No. 194101
Local Permit No. or Date #30021

WATER WELL DRILLERS REPORT
(INSERT under ORIGINAL PAGE w/carbon of State Form)

State Well No. _____
Other Well No. _____

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

(2) LOCATION OF WELL (See instructions):
County San Diego Owner's Well Number _____
Well address if different from above _____
Township 12S Range 1W Section 35
Distance from cities, roads, railroads, fences, etc. approx. 600 feet south of sec. 35/36 & 400 feet west of property line
S.D. Thom. Bros. page 404 E-2

FOR HEALTH DEPARTMENT USE ONLY
Completed Well Construction:
Date 6-29-84
Date Inspected
Comments
Water Sample Taken? Bergquist
Sanitarian's Approval:
Part of community water system.

(3) TYPE OF WORK:
New Well ☐ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item (2)

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

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

(6) Gravel Pack:
Yes ☑ No ☐ Size 5/16x4
Diameter of above 23"
Packed from 0 to 183 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	60	24	.250	blank		
0	183	14	.250	60	183	2"x3/32

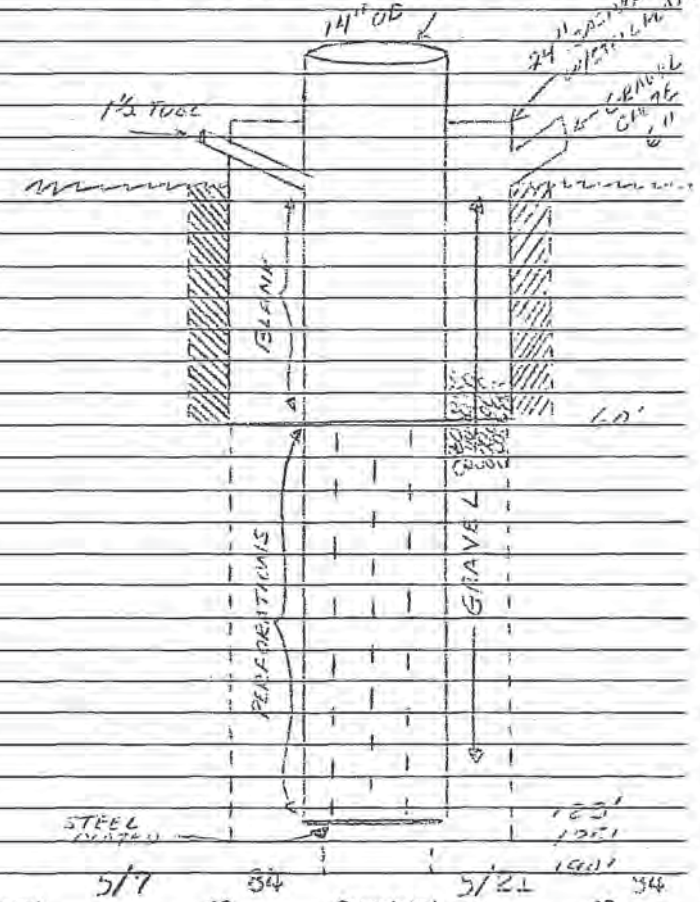
(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 60 ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval _____ ft.
Method of sealing cement

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

(11) WELL TESTS:
Was well test made? Yes ☐ No ☐ If yes, by whom?
Type of test Pump ☐ Bailer ☐ Air lift ☐
Depth to water at start of test _____ ft. At end of test _____ ft.
Discharge _____ gal/min after _____ hours Water temperature _____
Chemical 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 190 ft. Depth of completed well 183 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	15	overburden, topsoil progress to fine conglomerate
15	40	conglomerate w/fine sand-brn.
40	65	same
65	90	½" conglomerate to fine sand @ 89'
90	115	small layer of ine sand-grey
115	140	fine ½" conglomerate w/sand
140	165	same
165	190	harder rock - 182' / progresses to very hard rock - 190'



Work started 5/7 19 84 Completed 5/21 19 84

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 Multi Water Systems
(Well Driller)
NAME Rt. 1 Box 66
(Person, firm, or corporation) (Typed or printed)
Address Esc., Calif. 92025
City 355283 Zip
License No. _____ Date of this report _____

SAN 52 (2-81) **CONFIDENTIAL — NOT FOR PUBLIC USE — WATER CODE SEC. 13752**

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

RECEIVED
SEP 01 2004
County of San Diego
Dept. of Environmental Health

DEH USE ONLY
PERMIT # WLWEL 16208
WELL COMPUTER #
FEE: #390
WATER DIST: n/a

OWNER- City of San Diego
LEASEE

1. Property Owner: AM-Sod Phone: 760 497-8873
P.O. Box 300638 (Mailing Address) Escondido (City) 92027 (Zip)

2. Well Location - Assessors Parcel Number 241-100-31
15023 Old San Pasqual Rd (Site Address) San Diego (City) (Zip)

3. Well Contractor - Well Driller Joe Fain Company Name: Fain Drilling
12029 Old Castle Rd (Mailing Address) Valley Center (City) 92082 (Zip)
Phone#: 760-749-0701 C-57#: 328287 ☐ Cash Deposit ☒ Bond Posted

4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other AG-WEL

5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd

6. Type of Equipment: Rotary

7. Depth of Well: Proposed: 130' Existing: 0

8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: PVC	☒ Yes ☐ No	☒ Yes ☐ No	
Depth: 130	Depth: 20 ft.	From: 20 To: 130	From: 170 To: 130
Diameter 16 in.	Diameter 24 in.	Type: 5/16 X 16	From: To:
Wall/Gauge: .616	Wall/Gauge: .250	Wall/Gauge: N/A	From: To:

9. Annular Seal: Depth: 20 ft. Sealing Material: CEMENT
Borehole diameter: 32 in. Conductor diameter: 24 in. Annular Thickness 4 in.

10. Date of Work: Start: SEPT. 2004 Complete: SEPT. 2004

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Joe R. Fain Date: Aug-31-2004

LWEL-16208

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

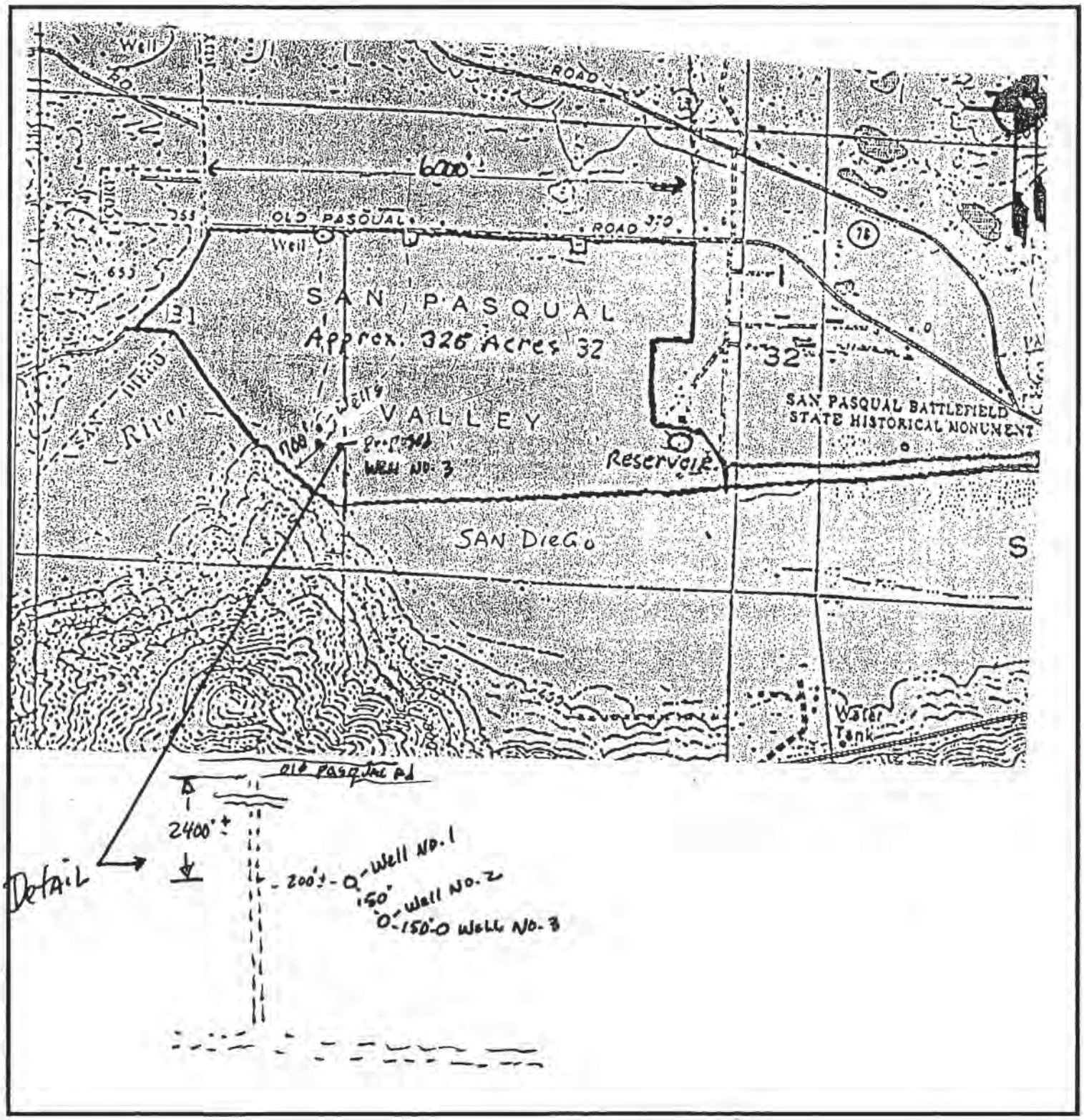
Specialist: N. Learning Date: 9/1/04

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWQ 16208
Assessor's Parcel Number: 241-100-31

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



LWL 16208 Kiva ent. 2/2/05 NS File 241-100-31

QUADRUPLICATE
For Local Requirements

Page 1 of 1
Owner's Well No. 3

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 0909563

Date Work Began 10-8-04, Ended 10-16-04
Local Permit Agency DEH
Permit No. 16209 Permit Date 9-1-04

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Gel

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
		ALLUVIAL FILL AS FOLLOWS:
0	15	Fine grained sand and silt Brown Color
15	40	Fine to coarse sand with small boulders
40	69	Grey silty sand
69	75	Coarse sand - some small gravel
75	90	Sand - partly cemented
90	136	Fine to coarse sand with some boulders

Completed Well Construction
Date 2/2/05
Date Inspected 2/1/05
Comments
W. Stearns
Water Sample Taken? N
Reviewed By

TOTAL DEPTH OF BORING 136 (Feet)
TOTAL DEPTH OF COMPLETED WELL 136 (Feet)

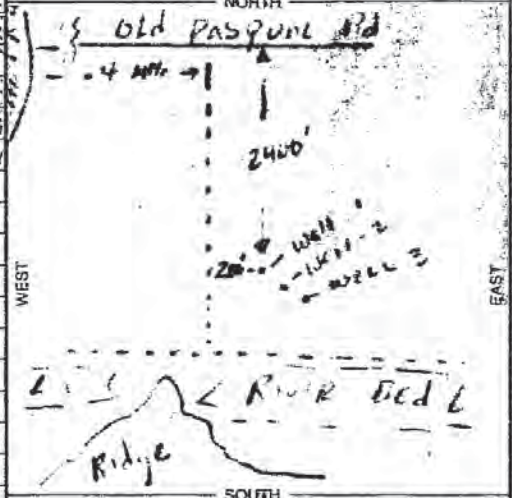
WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

WELL LOCATION

Address [redacted] ESCONDIDO
City San Diego
County San Diego
APN Book 241 Page 100 Parcel 24
Township 13S Range 3W Section 31
Lat ___ DEG. ___ MIN. ___ SEC. N Long ___ DEG. ___ MIN. ___ SEC. W

LOCATION SKETCH



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")

USES (✓)

WATER SUPPLY
___ Domestic ___ Public
X 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 UKN (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 36 (Ft.) & DATE MEASURED 10/16/04
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (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)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	32	X				Steel	23.5	.375	
0	78	24	X				PVCF480	15	.661	
78	138	24		X			PVCF480	15	.661	.125

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	136				3/8 Gravel

ATTACHMENTS (✓)

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

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 Pain Drilling & Pump Co. Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 12029 Old Castle Rd. CITY Valley Center STATE Ca ZIP 92082

Signed [signature] 10/19/04
C-57 LICENSED WATER WELL CONTRACTOR — DATE SIGNED — C-57 LICENSE NUMBER

DWR 155 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # W 19769
WELL COMPUTER #
FEE:
WATER DIST:

1. Property Owner: City of San Diego, Contact: Surraya Rashid, P.E., Proj. Mgr Phone: (619) 533-5306
   600 B Street, Suite 700, MS 906 (Mailing Address) San Diego, CA (City) 92101 (Zip)
2. Well Location - Assessors Parcel Number 272-131-08 (Well #4B)
   Approx 280' North of 14103 Highland Valley Rd. (Site Address) Escondido, CA (City) 92025 (Zip)
   13102 HIGHLAND VALLEY
3. Well Contractor - Well Driller Boart Longyear Company Name: Boart Longyear
   12464 McCann Drive (Mailing Address) Santa Fe Springs, CA (City) 90670 (Zip)
   Phone#: (562) 906-1960 C-57#: 694686 ☐ Cash Deposit ☒ Bond Posted
4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other RO demonstration project Source water for brackish water
5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: Rotosonic Rig - Vertical Well
7. Depth of Well: Proposed: 75 feet BGL Existing:
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel	☐ Yes ☒ No	☒ Yes ☐ No	
Depth: 0 to 30	Depth: ft.	From: 22 To: 70	From: 30 To: 75
Diameter 8.625 in.	Diameter in.	Type:	From: To:
Wall/Gauge: 0.188 in	Wall/Gauge:	Wall/Gauge:	From: To:

9. Annular Seal: Depth: 20 ft. Sealing Material: Neat Cement
   Borehole diameter: 12.625 in. Conductor diameter: in. Annular Thickness 2 in.
10. Date of Work: Start: Anticipated July 11, 2008 Complete: Anticipated July 25, 2008

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Date: 7-11-08

* Contact DEH at (760) 471-0730, 48 hours prior to installation of annular seal so that we may witness placement.

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: Date: 7-16-08

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

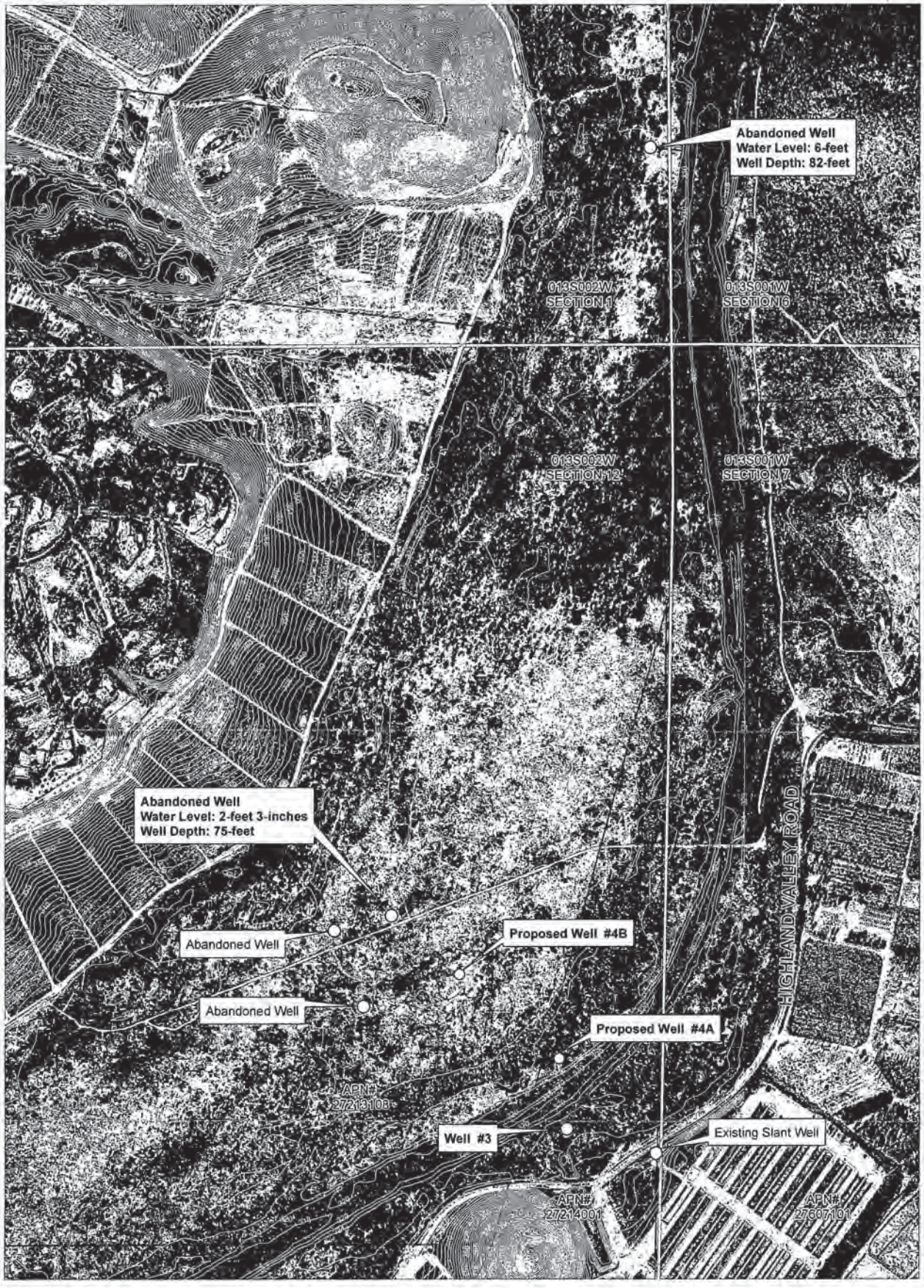
Control #: LWEL 19769
Assessor's Parcel Number: 272-131-08

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

SEE ATTACHED FOR PROPOSED WELL #4B

LWEL 19769



0 200 400 800 Feet

N

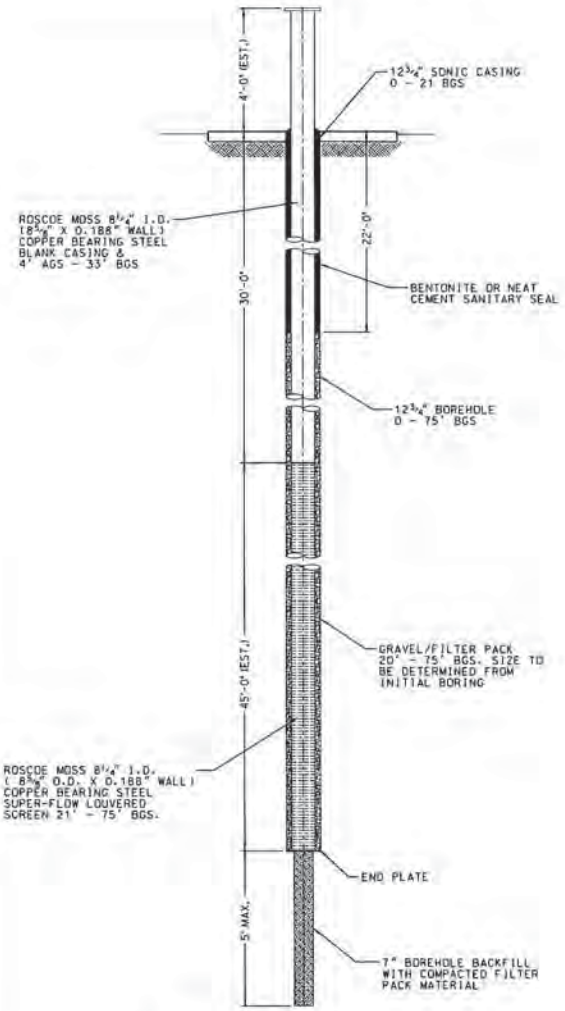
RBF CONSULTING PLANNING & DESIGN & CONSTRUCTION GIS

272-131-08

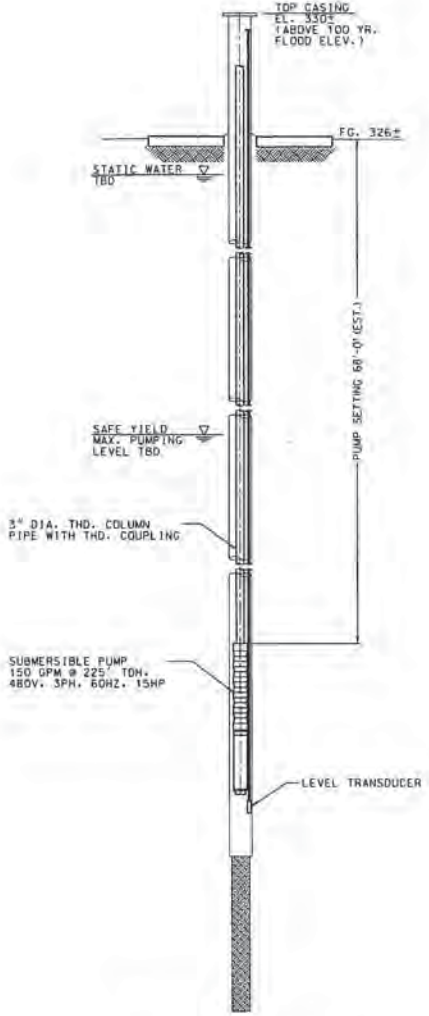
SAN PASQUAL BRACKISH GROUNDWATER DESALINATION DEMONSTRATION

ALTERNATIVE WATER SUPPLY ANALYSIS
TECHNICAL MEMORANDUM
FIGURE-1

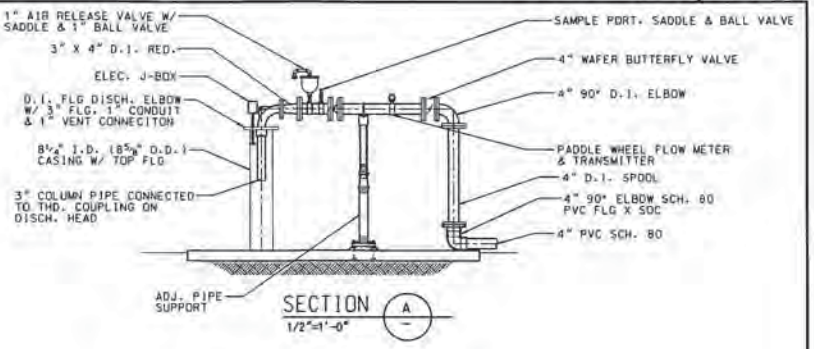
LWEL 19769



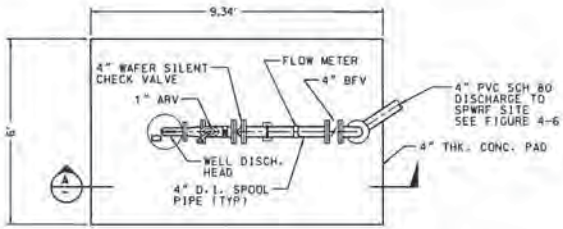
WELL CONSTRUCTION DETAIL
1/2"=1'-0"



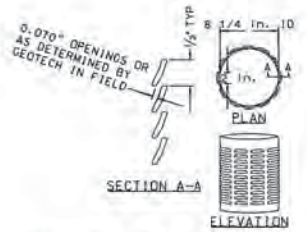
WELL EQUIPPING DETAIL
1/2"=1'-0"



SECTION A
1/2"=1'-0"



MECHANICAL PLAN
1/2"=1'-0"



HORIZ. SUPER-FLO LOUVERED SCREEN DETAIL
NOT TO SCALE

C-9

SAN PASQUAL BRACKISH WATER
TDDF PROJECT
OFF-SITE VERTICAL WELL CONSTRUCTION

CITY OF SAN DIEGO, CALIFORNIA
SHEET OF XX SHEETS

WATER W.O. 00000

DRAWING STATUS

NO.	DATE	REVISION DESCRIPTION	DWN	CKD	PVD	PE

CONSULTANT: RBF CONSULTING

ENGINEER OF WORK

DES
DWN
CKD

WATER DEPARTMENT
City of San Diego

SCALE:
VERT:
HOR: 0 ½ 1

FOR CITY ENGINEER
ASSOCIATE ENGINEER
INSPECTOR

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	XX/XX			

SENIOR CIVIL ENGINEER ____ DATE ____
CONTRACTOR ____ DATE STARTED ____
INSPECTOR ____ DATE COMPLETED ____

ASSOCIATE ENGINEER
ASSISTANT ENGINEER
CONTROL CERTIFICATION
DDD-0000
LAMBERT COORDINATES
75932-

272-131-08

LWEL 19769

THE CITY OF SAN DIEGO
MAYOR JERRY SANDERS

July10, 2008

Bob Geiseck
County of San Diego
Department of Environmental Health
Land and Water Quality Division
P.O. Box 129261
San Diego, CA 92112-9261

Dear Mr. Geiseck:

Subject: Property Owner Consent (POC)

The City of San Diego, owner of the property 14103 Highland Valley Road, San Diego, CA 92102, APN# 272-131-08, grants permission to Geoscience Support Services, Inc. (consulting company, contractor) and Boart Longyear, drilling company to enter City-owned property to conduct drilling and install a 70' to 75' deep vertical well on or near the area indicated on the attached Drawing C-2, "Offsite Well Site Plan".

I understand that Dennis E. Williams registered professional of Geoscience Support Services, Inc. consulting company and an authorized signer for Boart Longyear, drilling company have submitted a signed application to the County of San Diego, Department of Environmental Health, in which they have agreed to complete the above-stated work according to the applicable ordinances and laws of the County of San Diego and the State of California pertaining to water well construction and destruction. I have arranged with Surraya Rashid, City of San Diego, project manager overseeing the wells/borings installed on this property, to ensure proper destruction of the well should it become no longer usable or is abandoned at the conclusion of our demonstration project.

Sincerely,

Marsi A. Steirer

Enclosure: Drawing, C-2, Offsite Well Site Plan

DIVERSITY BRINGS US ALL TOGETHER

Water Department
600 B Street, Suite 600, MS 906 • San Diego, CA 92101
Tel (619) 533-7595 Fax (619) 533-5325

LWEL 19769

bcc: Robert McCullough, Principal Water Resources Specialist, Water Resources & Planning Division
Surraya Rashid, Associate Civil Engineer, Water Resources & Planning Division
Larry Aburtin, Assistant Engineer, Water Resources & Planning Division
Joel E. Bowdan III, Associate-Project Manager, RBF Consulting

Rec'd in SM on 10/29/08.

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0081241

Page 1 of 1

Owner's Well Number BH-4B

Date Work Began 07/11/2008 Date Work Ended 8/26/2008

Local Permit Agency County of San Diego Department of Environmental Health

Permit Number LWEL 19769 Permit Date 7/16/08

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N Latitude W Longitude

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Sonic Drilling Fluid

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	42	Sand, fine, med., coarse
42	44	Silty sand
44	49	Sand
49	55	Interbedded layers of sand and gravel
55	59	Sand
59	61	Gravel w/ sand
61	82	Sand w/ occasional gravel
82	84	Silty sand w/ gravel
84	85	Cobbles
85	88	Sand w/ cobbles
88	89	Clayey sand w/ cobbles
89	90	Weak cemented rock
90	92	Silty sand
92	95	Bedrock - granodiorite

Total Depth of Boring 95 Feet

Total Depth of Completed Well 84 Feet

Well Owner

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Well Location

Address 1,060' NW of entrance of 14103 Highland Valley Rd

City Escondido County San Diego

Latitude 33 03 33.82 N Longitude 117 02 06.90 W (Deg. Min. Sec.)

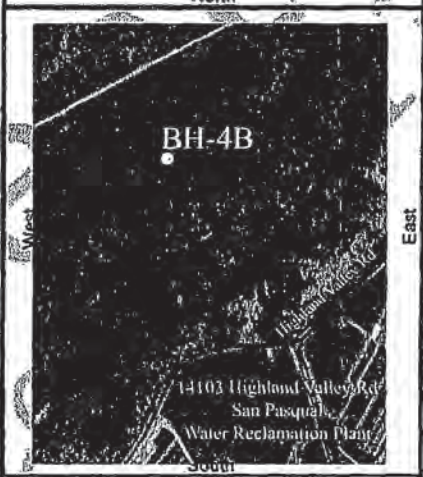
Datum NAD83 Decimal Lat. 33.05889 Decimal Long. 117.03500

APN Book 272 Page 131 Parcel 08

Township 13 S Range 2 W Section 12 J

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

◉ Water Supply
☑ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water 8 (Feet below surface)

Depth to Static Water Level 8 (Feet) Date Measured 08/25/2008

Estimated Yield * 150 (GPM) Test Type Constant Rate

Test Length 24.0 (Hours) Total Drawdown 31 (Feet)

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

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	25	12.625	Blank	Copper bearing steel	0.188	8 5/8		
25	41	12.625	Screen	Copper bearing steel	0.188	8 5/8	Louver	0.080
41	45	12.625	Blank	Copper bearing steel	0.188	8 5/8		
45	84	12.625	Screen	Copper bearing steel	0.188	8 5/8	Louver	0.080

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	20	Cement	neat cement
20	84	Filter Pack	4x16 custom blend
84	95	Native fill	

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 Boart Longyear Corporation (Person, Firm or Corporation)

12464 McCann Dr. (Address) Santa Fe Springs (City) CA (State) 90670 (Zip)

Signed [signature] (C-57 Licensed Water Well Contractor) 10/20/08 (Date Signed) 694686 (C-57 License Number)

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

DEH2016-LWELL-001332

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

Received
MAR 28
County of San Diego
Dept. of Environmental Health
Land & Water Quality Div

DEH USE ONLY
PERMIT #
FEE: $535.00
WATER DIST:

1. Property Owner: WHMAN RANCH Phone: WH - 760-644-6887
Mailing Address: PO BOX 1959 City: ESCONDIDO State: CA Zip: 92025

2. Well Location - Assessors Parcel Number: 760-170-48 / 242-100-10
GPS Coordinates: (WGS-84 Decimal Degrees): 33°05'17"N / 116°58'31"W
Site Address: 0 Hwy 78 City: ESCONDIDO State: CA. Zip: 92025

3. Well Contractor/Driller: DAVE MATTHEWS Company Name: FAN DRILLING
Mailing Address: 12029 OLDCASTLE RD. City: VALLEY CENTER State: CA Zip: 92082
Phone: 760-749-0701 C-57 License No: 328287 ☐ Cash Deposit ☒ Bond Posted

4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Other:

5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd

6. Type of Equipment: MUD ROTARY

7. Depth of Well: Proposed: 160 Existing:

8: Proposed:

	Casing	Conductor Casing	Filter/Filler Material	Perforations
	Type: SS/LCS	☒ Yes ☐ No	☒ Yes ☐ No	From: 100 To: 160
	Depth: 160	Depth: 20	From: 0 To: 160	From: ____ To: ____
	Diameter: 10 in.	Diameter: 24 in.	Type: RANCHO	From: ____ To: ____
	Wall/Gauge: .375	Wall/Gauge: .250		

9. Annular Seal: Depth: 20 ft. Sealing Material: cement
Borehole Diameter: 32 in. Conductor Diameter: 24 in. Annular Thickness: 4 in.

10: Best Management Plan for confining well drilling waste on the project site provided? ☒ Yes ☐ No

11. Date of Work: Start: 3/28/16 Complete: 4/ 2016

On sites served by public water, contact the local water agency for meter protection requirements.
I hereby agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's report). I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Date: 3/21/16

DISPOSITION OF APPLICATION (Department of Environmental Health Use Only)

☒ Approved ☐ Denied Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

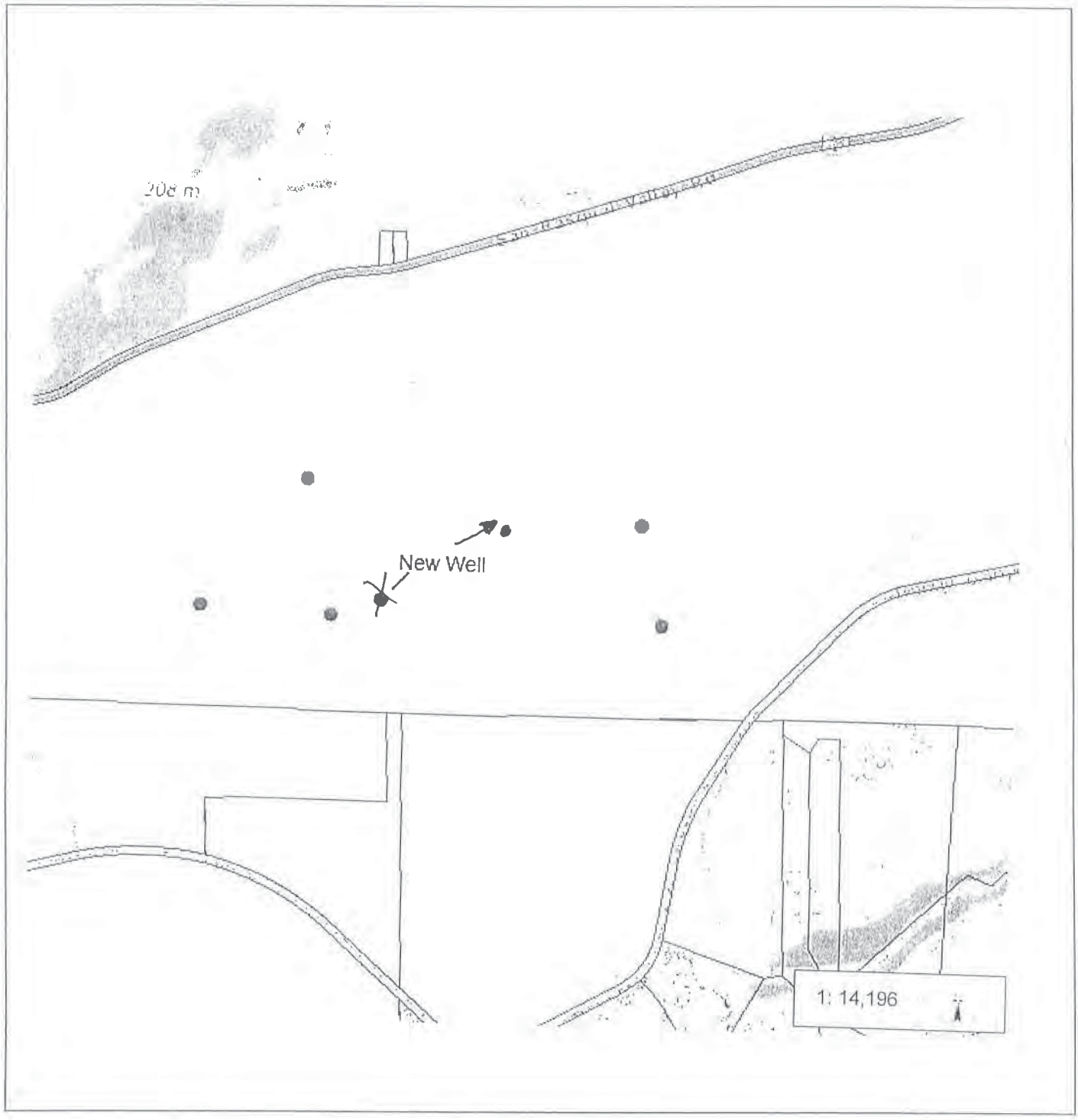
Specialist: Irina Portnaia Date: 3/28/16

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # LWELL - 001332
APN: 242-100-10

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.




33° 05' 01.77"N
116° 58' 31.61" W
new production well location
1745'
ed production well Location
© 2016 Google
Google earth
1994
Imagery Date: 4/14/2015 33°05'02.53" N 116°58'41.48" W elev 396 ft eye alt 2718 ft

County of San Diego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only

Well Permit Application Number: _____ Assessor's Parcel Number: 760-170-48
242-100-10

SECTION 1: Required Information from Contractor or Consultant:

Longitude & Latitude: 33.0501.177 N 116 58' 31.61 W How obtained? GPS Map Other

1. Are there any watercourses or water bodies within 50 feet of the limits of soil disturbance?	YES	NO
2. Does the plat show the project boundaries? (A "detail inset" is acceptable for a large parcel or lot.).	YES	NO
3. Does the plat show footprints of any existing structures and facilities within 100 feet of the wellhead position?	YES	NO
4. Does the plat show locations where run-off may enter stormdrains, drainage courses and/or receiving waters?	YES	NO
5. Is grading required to access site or install well?	YES	NO
6. Does the project conform to the local grading ordinance?	YES	NO
7. Will drilling additives be used to drill the well?	YES	NO
8. Are the Best Management Practices attached to this permit application? LARGE FIELD FOR DISCHARGE	YES	NO

SECTION 2. Best Management Practices

The goal of stormwater and discharge control management planning while drilling and installing wells is to reduce pollution to the maximum extent practicable using Best Management Practices (BMPs). Construction related materials, sediments, chemical residues such as drilling foam, wastes, and spills must be retained within the property boundaries to eliminate transport from the site to nearby streets, drainage courses, receiving waters and adjacent properties. It is the responsibility of the property owner and the contractor to determine which BMPs will be used in order to ensure that all contaminants are retained on-site.

Examples of Best Management Practices to contain well installation run-off include, but are not limited to, installation of a sediment basin to contain run-off, using geotextile fabric to contain sediments and drilling mud, or eliminating the use of drilling foam. (Website information is available at www.projectcleanwater.org)

SECTION 3. Certification

I have read and understand the following: *(Please check each box after concurrence.)*

- ☑ Selected BMP's will be implemented so that water quality is not negatively impacted by well construction activities.
- ☑ I am aware the selected BMP's must be installed, maintained, monitored and revised as necessary so they are effective.
- ☑ I understand that non-compliance with the San Diego County Watershed Protection Ordinance may result in enforcement actions by the County. These may include fines, citations, stop-work orders, or other actions.
- ☑ DEH inspectors and personnel from other regulatory agencies are authorized to enter my property at any time for purposes associated with this well permit until such time the well is completed to the satisfaction of DEH.
- ☑ Should DEH determine during the field review that the well installation procedures contradict this Discharge Management Plan or the well permit application, the well drilling permit may be suspended or revoked. Further activity will require a new permit fee and amendment to the existing permit.

Contractor _____ *Date* 3/21/16

Property Owner _____ *Date* 3-21-16

Reviewed by DEH _____ *Date* 3/28/16

*This free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0306251

Page One of One

Owner's Well Number 1332

Date Work Began 03/29/2016 Date Work Ended 4/5/2016

Local Permit Agency SD DEH

Permit Number LWELL-001332 Permit Date 3/28/16

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N W

Latitude Longitude

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	14	Grey Silty Sand
14	31	Grey Silty Sand w/ Grey Clay
31	46	Grey Clay
46	77	Course Grey Sand
77	88	Grey Clay
88	127	Grey & White Course Sand
127	129	Grey Clay & Wood
129	154	Compact Grey Sand
154	161	Grey Clay
161	167	Granite

Completed Well Construction

Date

Date Inspected Well present & in use via generator

Comments Pencil seal

N 33.08379°

W 116.97559°

Water Sample Taken? Yes 8/16/16

Reviewed By

Total Depth of Boring 167 Feet

Total Depth of Completed Well 165 Feet

Well Owner

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Well Location

Address 0 Hwy 78

City Escondido County San Diego

Latitude ___ ___ ___ N Longitude ___ ___ ___ W

Deg. Min. Sec. Deg. Min. Sec.

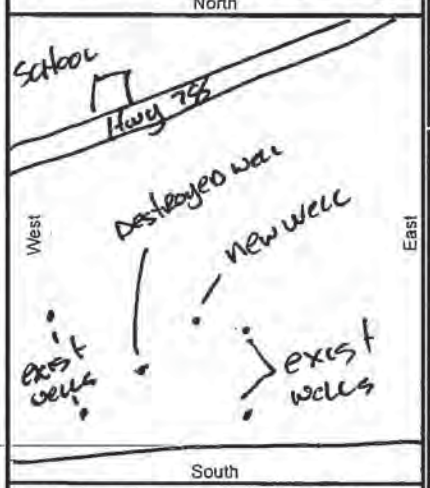
Datum ___ Dec. Lat. 33.0501 Dec. Long. 116.5831

APN Book 242 Page 100 Parcel 10

Township ___ Range ___ Section ___

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well

○ Modification/Repair

○ Deepen

○ Other

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

◉ Water Supply

☐ Domestic ☐ Public

☑ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

○ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other

Water Level and Yield of Completed Well

Depth to first water ___ (Feet below surface)

Depth to Static Water Level 72 (Feet) Date Measured 04/05/2016

Estimated Yield * 400 (GPM) Test Type Air Lift

Test Length 10.0 (Hours) Total Drawdown ___ (Feet)

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

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	20	32	Conductor	Low Carbon Steel	.250	24		
0	95	24	Blank	Low Carbon Steel	.375	12.75		
95	155	24	Screen	304 Stainless Steel	.250	12.75	Wire Wrap	0.060

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	95	Cement	
0	167	Filter Pack	Rancho

Attachments

☐ Geologic Log

☐ Well Construction Diagram

☐ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☑ Other Site Map

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 Fain Drilling & Pump Co., Inc

Person, Firm or Corporation

12029 Old Castle Rd Valley Center CA 92082

Address City State Zip

Signed ___ 4/7/2016 328287

C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

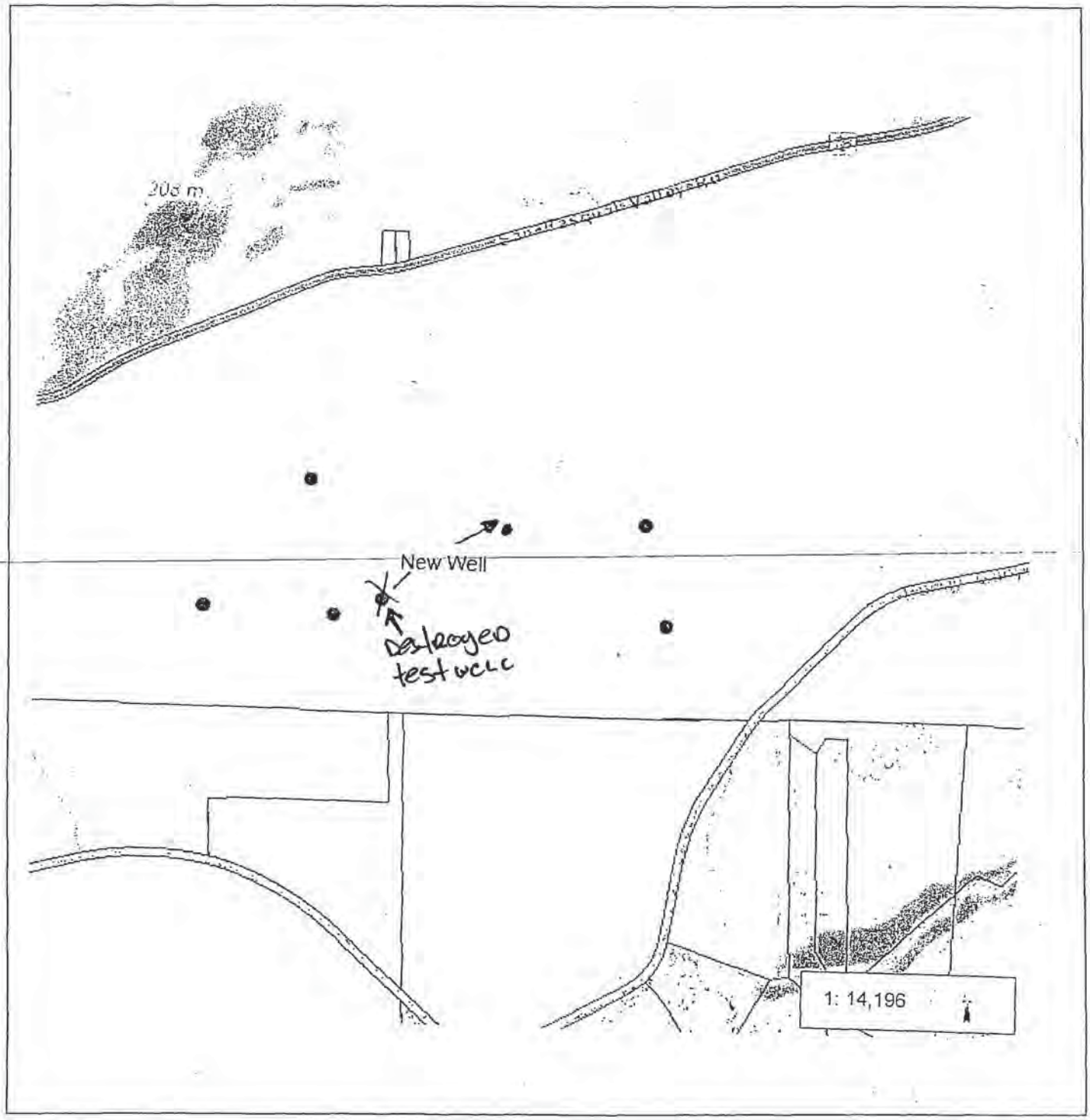
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # LWELL - 001332
APN: 242-100-10

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.



COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

WELL PERMIT APPLICATION # 12183 APN 760 170 18
Control # W62041

TYPE OF WORK (Check)		USE (Check)			EQUIPMENT (Check)	
New Well	X	Individual Domestic			Rotary	X
Repair or Modification		Agricultural	X	Community	Cable Tool	
Time Extension		Industrial		Other	Other	
Destruction						

PROPOSED WELL DEPTH
Max. 200' Min. 175 (Feet)

PROPOSED CASING
Type Steel Depth 200 Diameter 12" Wall or Gage .375

PROPOSED SEALING ZONE(S)
From 0 to 20 Feet
From _____ to _____ Feet
From _____ to _____ Feet

PROPOSED PERFORATIONS OR SCREEN
From 160 to 200 Feet
From _____ to _____ Feet
From _____ to _____ Feet
From _____ to _____ Feet

SEALING MATERIAL (Check)
Neat Cement Grout ☐ Bentonite Clay ☐
Sand Cement Grout ☐ Concrete ☒
Other-Specify: _____

DATE OF WORK
Start Jan. 27, 1992
Completion Feb. 10, 1992

NAME OF WELL OWNER
Witman Ranches Inc. 747-3632
mail: PO 1959, Esc 92033

NAME OF WELL DRILLER
Joe R. Fain 749-0701

LOCATION OF WELL
16789 Highway 78 San Pasqual Valley Rd. San Diego (Escondido)

COMPANY
Fain Drilling & Pump Co., Inc.

BUSINESS ADDRESS
12029 Oldcastle Rd. Valley Center

LICENSE NUMBER
328287

Cash Deposit ☐
Bond Posted ☒

$220 Fee paid on 1-22-92 ph

DISPOSITION OF APPLICATION
(FOR HEALTH OFFICERS USE ONLY)

☐ APPROVED ☐ DENIED

☒ APPROVED WITH CONDITIONS

Report Reason(s) for Denial or Necessary Conditions Here:
1) well to be installed to all State & County water well Standards Bulletin 74-81.
On sites served with public water, contact the local water agency for meter irrigation requirements
This well site is located in an area where groundwater is known to have high nitrate levels. This completed well can be used for irrigation purposes only until it has been tested and approved as safe by this Department. Unless it can be demonstrated that potable water standards can be met, septic tank and/or building permits cannot be issued.

M. Sedgh UNKNOWN
HEALTH OFFICER

1-23-92
DATE

I hereby agree to comply with all regulations of the Department of Health Services and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Health Services with a complete and accurate log of the well.

Joe R. Fain
APPLICANT'S SIGNATURE

1-22-92
DATE

WELL 12183

WITMAN RANCHES, INC

DHS:EHP-731 (3/85)

1-22-92

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

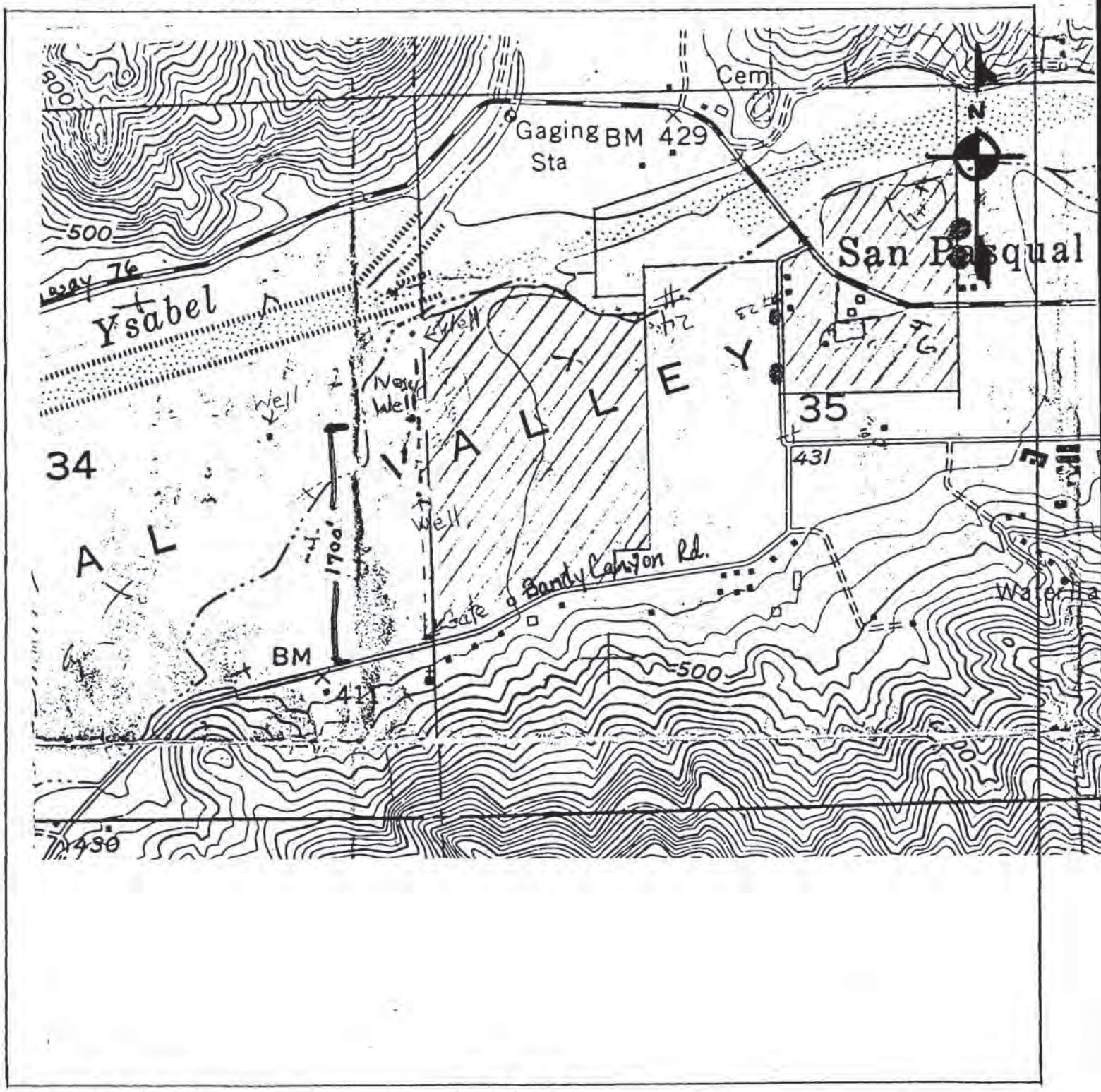
WELL PERMIT APPLICATION

Control # W62041

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



QUADRUPLICATE
For Local Requirements

WDR in SM sent to Ruffin 3-16-92 pl

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 487208

Page 1 of 1
Owner's Well No. 2-92
Date Work Began 2-13-92 Ended 2-24-92
Local Permit Agency San Diego County Health Dept
Permit No. W62081 Permit Date 1-22-92

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER 50 (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
		Alluvial fill as follows
0	45	Fine to coarse sand with some small gravel - brown color
45	80	Fine to coarse sand with boulders
80	90	Black silt - "old tule bed" with some wood from trees
90	190	Fine to coarse sand with some boulders and gravel steaks
190	202	decomposed and weathered rock granite

Completed Well Construction
Date 3-24-92
Date Inspected 3-24-92
Comments evidence of Camadian Seal observed Ag. well
Water Sample Taken? NO
Reviewed By M. Seigh

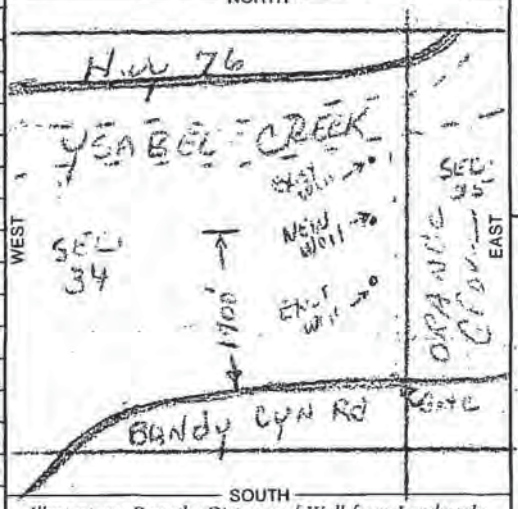
TOTAL DEPTH OF BORING 205 (Feet)
TOTAL DEPTH OF COMPLETED WELL 202 (Feet)

WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Address 16789 Hwy 76
City San Pasqual Rd San Diego
County San Diego
APN Book 760 Page 170 Parcel 18
or Township or Range Section 34
Latitude DEG. MIN. SEC. NORTH Longitude DEG. MIN. SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)
X NEW WELL
___ MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USE(S) (✓)
___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
X Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 40 (Ft.) & DATE MEASURED 2-24-92
ESTIMATED YIELD* 1000 (GPM) & TEST TYPE airlift
TEST LENGTH 6 (Hrs.) TOTAL DRAWDOWN 150 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	21	36	X				A-120	24	.250	
0	92	24	X				A-120	12	.375	
92	112	24		X			SS304	12	.250	.060
132	152	24		X			SS304	12	.250	.060
172	192	24		X			SS304	12	.250	.060

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	202				5/16x4

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 (PERSON, FIRM OR CORPORATION) (TYPED OR PRINTED) Fain Drilling & Pump Co Inc.
ADDRESS 12099 Old Castle Rd. CITY Valley Center, STATE California ZIP 92082
Signed (WELL DRILLER/AUTHORIZED REPRESENTATIVE) DATE SIGNED 3/1/92
C-57 LICENSE NUMBER 328287

DWR 188 REV. 7-90 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

EQ, 1/15/15, DEH 2/5

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

Wed 1/14/15 (PM) Okay per AW

DEH USE ONLY
PERMIT # LWELL-000807
FEE:
WATER DIST: 8

1. Property Owner: WIFMAN RANCH (Lessee) Phone: 760-644-6887
   Mailing Address: PO BOX 1959 City: ESCONDIDO State: CA Zip: 92025
2. Well Location - Assessors Parcel Number: ~~235-041-11~~ 760-170-43 or -242-130-07
   GPS Coordinates: (WGS-84 Decimal Degrees): 33.0914 / ~~244-55~~ 116.9559
   Site Address: Hwy 78 W/O BANDY CANYON City: ESCONDIDO State: CA Zip: 92025
3. Well Contractor/Driller: DAVE MATTHEWS Company Name: FAIN DRILLING
   Mailing Address: 12029 OLDCASTLE RD City: VALLEYCENTER State: CA Zip: 92082
   Phone: 760-749-0701 C-57 License No: 328287 ☐ Cash Deposit ☒ Bond Posted
4. Use: ☒ Private ☐ Public ☐ Industrial ~~☒~~ Other: IRRIGATION (test well)
5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: MUD ROTARY
7. Depth of Well: Proposed: 190' Existing: 0
8. Proposed: test well to be ~~destroyed~~ OR Finished upon results

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: _____	☐ Yes ☐ No	☐ Yes ☐ No	From: ____ To: ____
Depth: _____	Depth: _____	From: ____ To: ____	From: ____ To: ____
Diameter: _____ in.	Diameter: _____ in.	Type: _____	From: ____ To: ____
Wall/Gauge: ____	Wall/Gauge: ____		

9. Annular Seal: Depth: _____ ft. Sealing Material: _____
   Borehole Diameter: _____ in. Conductor Diameter: _____ in. Annular Thickness: _____ in.
10. Best Management Plan for confining well drilling waste on the project site provided? ☐ Yes ☐ No
11. Date of Work: Start: 1/13/15 Complete: 1/23/15

On sites served by public water, contact the local water agency for meter protection requirements.
I hereby agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's report). I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: _____ Date: 1/13/15

DISPOSITION OF APPLICATION (Department of Environmental Health Use Only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: Jessica Hagerman Date: JAN 13, 2015

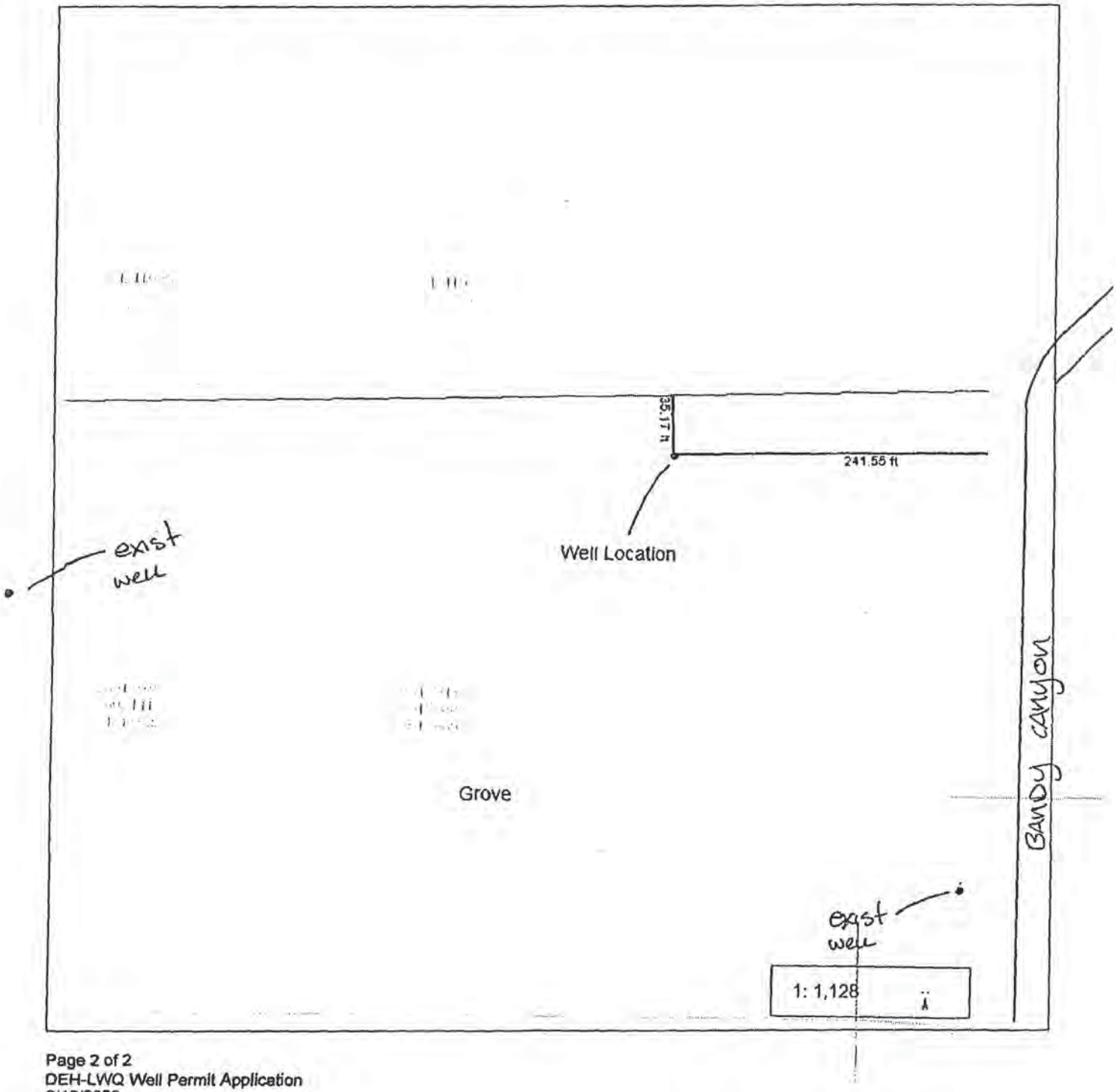
EOL, 1/15/15, DEH2015

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # LWELL-000807
APN: _____

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.



E01, 1/15/15
DEH 2015

County of San Diego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only

Well Permit Application Number: 000807 Assessor's Parcel Number: 242-130-27 [redacted]

SECTION 1. Required Information from Contractor or Consultant:

Longitude & Latitude 33.0914 / -116.9559 How obtained? GPS / Map / Other

1. Are there any watercourses or water bodies within 50 feet of the limits of soil disturbance? YES / NO
2. Does the plat show the project boundaries? (A "detail inset" is acceptable for a large parcel or lot.). YES / NO
3. Does the plat show footprints of any existing structures and facilities within 100 feet of the wellhead position? YES / NO
4. Does the plat show locations where run-off may enter stormdrains drainage courses and/or receiving waters? YES / NO
5. Is grading required to access site or install well? YES / NO
6. Does the project conform to the local grading ordinance? YES / NO
7. Will drilling additives be used to drill the well? YES / NO
8. Are the Best Management Practices attached to this permit application? YES / NO

- MOBILE/Ag operations contain all spills in tanks/pits

SECTION 2. Best Management Practices

The goal of stormwater and discharge control management planning while drilling and installing wells is to reduce pollution to the maximum extent practicable using Best Management Practices (BMPs). Construction related materials, sediments, chemical residues such as drilling foam, wastes, and spills must be retained within the property boundaries to eliminate transport from the site to nearby streets, drainage courses, receiving waters and adjacent properties. It is the responsibility of the property owner and the contractor to determine which BMPs will be used in order to ensure that all contaminants are retained on-site.

Examples of Best Management Practices to contain well installation run-off include but are not limited to installation of a sediment basin to contain run-off, using geotextile fabric to contain sediments and drilling mud, or eliminating the use of drilling foam. (Website information is available at www.projectcleanwater.org.)

SECTION 3. Certification

I have read and understand the following: *(Please check each box after concurrence.)*

- ✓ Selected BMP's will be implemented so that water quality is not negatively impacted by well construction activities.
- ✓ I am aware the selected BMP's must be installed, maintained, monitored and revised as necessary so they are effective.
- ✓ I understand that non-compliance with the San Diego County Watershed Protection Ordinance may result in enforcement actions by the County. These may include fines, citations, stop-work orders, or other actions.
- ✓ DEH inspectors and personnel from other regulatory agencies are authorized to enter my property at any time for purposes associated with this well permit until such time the well is completed to the satisfaction of DEH.
- ✓ Should DEH determine during the field review that the well installation procedures contradict this Discharge Management Plan or the well permit application, the well drilling permit may be suspended or revoked. Further activity will require a new permit fee and amendment to the existing permit.

Contractor [signature] Date 11/13/14

Property Owner [signature] Date 11-3-14

Reviewed by DEH _____ Date _____

County

RECEIVED

FEB 23 2015

ENVIRONMENTAL HEALTH

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0255061

Page 1 of 1

Owner's Well Number One

Date Work Began 01/14/2015 Date Work Ended 1/22/2015

Local Permit Agency SD DEH

Permit Number LWELL-000807 Permit Date 1/13/15

DWR Use Only – Do Not Fill In

State Well Number/Site Number

Latitude N Longitude W

APN/TRS/Other

Geologic Log

Orientation ⊙ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	13	Silty Grey Sand
13	66	Course Brown Sand
66	92	Grey Sand And Silt
92	96	Grey Silty Clay
96	167	Course Grey Sand
167	188	Course Sand Grey / White
188	190	Weathered Rock
190		Granite

Completed Well Construction

Date

Date Inspected

Comments

W33.09136°

W116.95601°

Well Specs

Water Sample 8/4/14

Reviewed By

Total Depth of Boring 190 Feet

Total Depth of Completed Well 190 Feet

Well Owner

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Well Location

Address Hwy 78 e/o Bandy Canyon

City Escondido County San Diego

Latitude Deg. Min. Sec. N Longitude Deg. Min. Sec. W

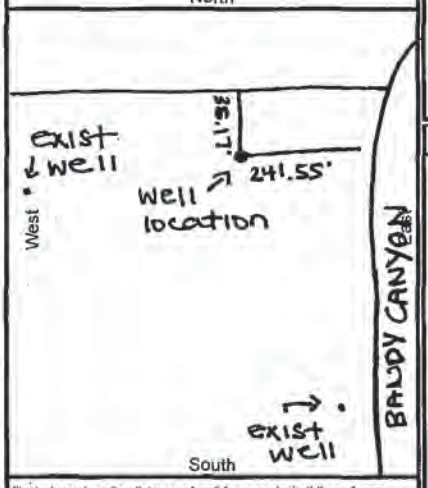
Datum Dec. Lat. 33.0914 Dec. Long. 116.9559

APN Book 760 Page 170 Parcel 43

Township Range Section

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

⊙ New Well

○ Modification/Repair

○ Deepen

○ Other

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

⊙ Water Supply

☐ Domestic ☐ Public

☑ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

○ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level 72 (Feet) Date Measured

Estimated Yield * 500 + (GPM) Test Type Air Lift

Test Length 8.0 (Hours) Total Drawdown (Feet)

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

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	20	30	Conductor	Low Carbon Steel	.250	24"		
0	90	23"	Blank	PVC F480	.750	12 3/4"		
90	190	23"	Screen	304 Stainless Steel	.250	12 3/4"	Wire Wrap	0.060

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	20	Cement	
0	190	Gravel Pack	#6

Attachments

☐ Geologic Log

☐ Well Construction Diagram

☐ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☑ Other Site Map

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 Fain Drilling and Pump Company, Inc.
Person, Firm or Corporation

Valley Center Address California City CA State 92082 Zip

Signed C-57 Licensed Water Well Contractor

2/17/15 Date Signed

328287 C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

#906

WELL PERMIT APPLICATION

WITMAN RANCH INC.

APN 760-170-18

Control # W 02917

TYPE OF WORK (Check)		USE (Check)			EQUIPMENT (Check)	
New Well	☒	Individual Domestic	☐		Rotary	☒
Repair or Modification	☐	Agricultural	☒	Community ☐	Cable Tool	☐
Time Extension	☐	Industrial	☐	Other _____	Other	☐
Destruction	☐					

PROPOSED WELL DEPTH

Max. 160 Min. 150 (Feet)

PROPOSED CASING

Type STEEL Depth 150 Diameter 12" Wall or Gage .365

PROPOSED SEALING ZONE(S)

From 0 to 20 Feet
From _____ to _____ Feet
From _____ to _____ Feet

PROPOSED PERFORATIONS OR SCREEN

From 100 to 160 Feet
From _____ to _____ Feet
From _____ to _____ Feet
From _____ to _____ Feet

SEALING MATERIAL (Check)

Neat Cement Grout ☒ Bentonite Clay ☐
Sand Cement Grout ☐ Concrete ☒
Other-Specify: _____

DATE OF WORK

Start 2-27-95
Completion 3-5-95

NAME OF WELL OWNER
WITMAN RANCH, INC.

NAME OF WELL DRILLER
Joe FAIN

LOCATION OF WELL
16789 SAN PASQUAL VLY Rd - ESC.

COMPANY
FAIN DRILLING & PUMP Co. INC.

DISPOSITION OF APPLICATION
(FOR HEALTH OFFICERS USE ONLY)

☐ APPROVED ☐ DENIED
☒ APPROVED WITH CONDITIONS

Report Reason(s) for Denial or Necessary Conditions Here:

Well to be installed to all state & County water well standards.

On sites served with public water, contact the local water agency for meter protection requirements.

M. Sedgl
HEALTH OFFICER

2-23-95
DATE

BUSINESS ADDRESS
12029 Old CASTLE Rd - VALLEY CENTER

LICENSE NUMBER
328287

Cash Deposit ☐
Bond Posted ☒

$175.00 Fee paid on 2-23-95 CK

I hereby agree to comply with all regulations of the Department of Health Services and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Health Services with a complete and accurate log of the well.

Joe R. Fain
APPLICANT'S SIGNATURE

2-23-95
DATE

WELL 906 Mail: PO BOX 1459 - ESC. 92033

1 - No prod

Witman Ranch

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

WELL PERMIT APPLICATION

Control # W12917

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.

QUADRUPLICATE
For Local Requirements

Copy to Ruffin
Orig in SR 6/23/95 DT

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 463759

Page 1 of 2
Owner's Well No. W62917
Date Work Began 3/2/95, Ended 3/16/95
Local Permit Agency Env. Health Dept
Permit No. W62917 Permit Date 2/23/95

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER 18 (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
		Alluvial Fill as Follows:
0	20	fine to coarse sand
20	70	fine grained sand with some small aggregate
70	96	fine grained sand with lenses of black silt
96	160	fine to coarse sand with some small gravel
160	166	decomposed granite

Completed Well Construction
Date 7-25-95
Date Inspected 7-21-95
Comments Ag. Well
Water Sample Taken? No
Reviewed By M. Seifert

TOTAL DEPTH OF BORING 166 (Feet)
TOTAL DEPTH OF COMPLETED WELL 162 (Feet)

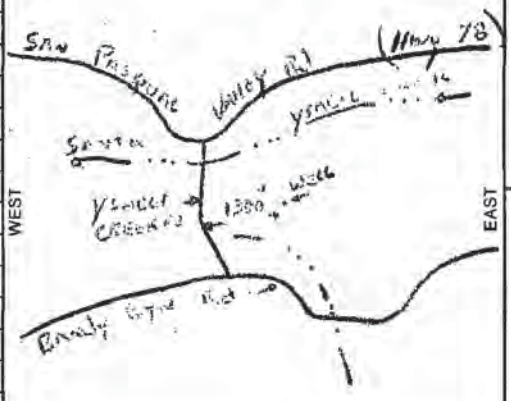
WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

WELL LOCATION

Address 16789 Hwy 78
City San Diego
County San Diego
APN Book 760 Page 170 Parcel 18
Township 13S Range 1W Section 33
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)
X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")
PLANNED USE(S) (✓)
___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
X Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 9 (Ft.) & DATE MEASURED 3/16/95
ESTIMATED YIELD* 1000+ (GPM) & TEST TYPE airlift
TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN 100 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL/GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	36	X				A-52	25.5	.250	
20	100	23	X				A-52	12	.365	
100	160	23		X			304SS	12	.250	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	160	pea gravel			5/16 x 7

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
✓ Other ASTM
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 Fain Drilling & Pump Co Inc (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 12029 Old Castle Rd. CITY Valley Center, STATE Ca ZIP 92082
Signed [signature] WELL DRILLER/AUTHORIZED REPRESENTATIVE
DATE SIGNED 4/17/95
C-57 LICENSE NUMBER 328287

DWR 188 REV. 7-90
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

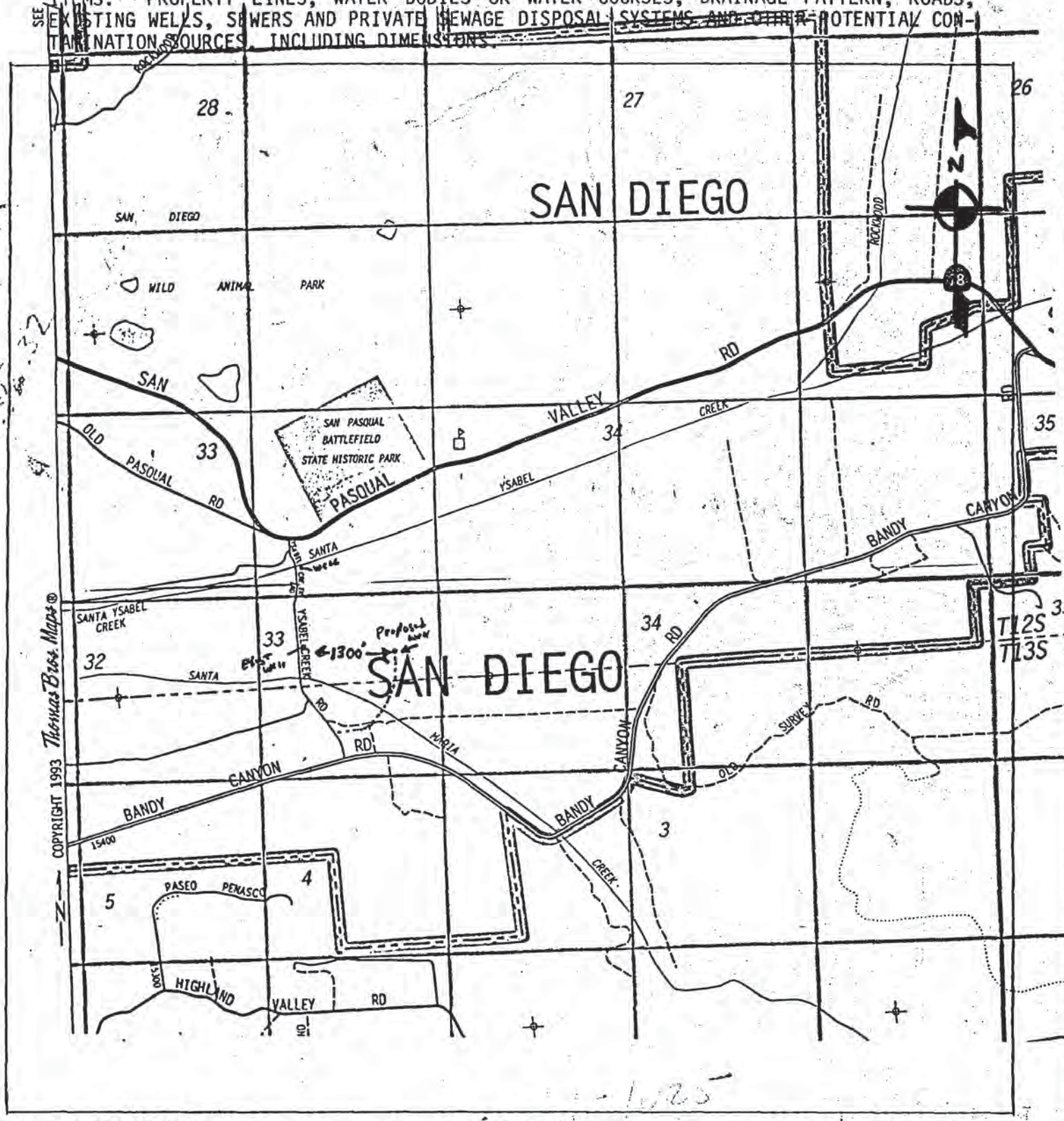
WELL PERMIT APPLICATION

Control # WW2917

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



DHS:EHP-731 (3/85)

WC#1823

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

WELL PERMIT APPLICATION

APN 760-170-18
Control # 462322

TYPE OF WORK (Check)		USE (Check)			EQUIPMENT (Check)	
New Well	☒	Individual Domestic	☐		Rotary	☒
Repair or Modification	☐	Agricultural	☒	Community ☐	Cable Tool	☐
Time Extension	☐	Industrial	☐	Other _____	Other	☐
Destruction	☐					

PROPOSED WELL DEPTH
Max. 200 Min. 180 (Feet)

PROPOSED CASING
Type STEEL Depth 200' Diameter 12" Wall or Gage .375

PROPOSED SEALING ZONE(S)
From 0 to 50 Feet
From _____ to _____ Feet
From _____ to _____ Feet

PROPOSED PERFORATIONS OR SCREEN
From 140 to 200 Feet
From _____ to _____ Feet
From _____ to _____ Feet
From _____ to _____ Feet

SEALING MATERIAL (Check)
Neat Cement Grout ☐ Bentonite Clay ☐
Sand Cement Grout ☐ Concrete ☒
Other-Specify: _____

DATE OF WORK
Start 1-4-93
Completion 1-10-93

NAME OF WELL OWNER
KAY BISHOP

NAME OF WELL DRILLER
Joe FAIN 749-0701

LOCATION OF WELL
BANDY CYN Rd-ESC (Hwy 78) SAN PASQUAL (SAN Diego)
17707 Bandy Cyn Rd ESC 92025

COMPANY
FAIN Drilling & Pump CO. INC.

BISHOP KAY

DISPOSITION OF APPLICATION (FOR HEALTH OFFICERS USE ONLY)

☐ APPROVED ☐ DENIED

☒ APPROVED WITH CONDITIONS

Report Reason(s) for Denial or Necessary Conditions Here:
1. Well is for agricultural use only.

[illegible] water protection requirements.

Scott W Kline
HEALTH OFFICER
1-4-93
DATE

BUSINESS ADDRESS
12029 OLD CASTLE Rd-VALLEY CENTER

LICENSE NUMBER
388887

Cash Deposit ☐
Bond Posted ☒

$235 Fee paid on 01/04-93

I hereby agree to comply with all regulations of the Department of Health Services and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Health Services with a complete and accurate log of the well.

Joe R. Fain
APPLICANT'S SIGNATURE
12-24-92
DATE

WEL-1823

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

01-0493

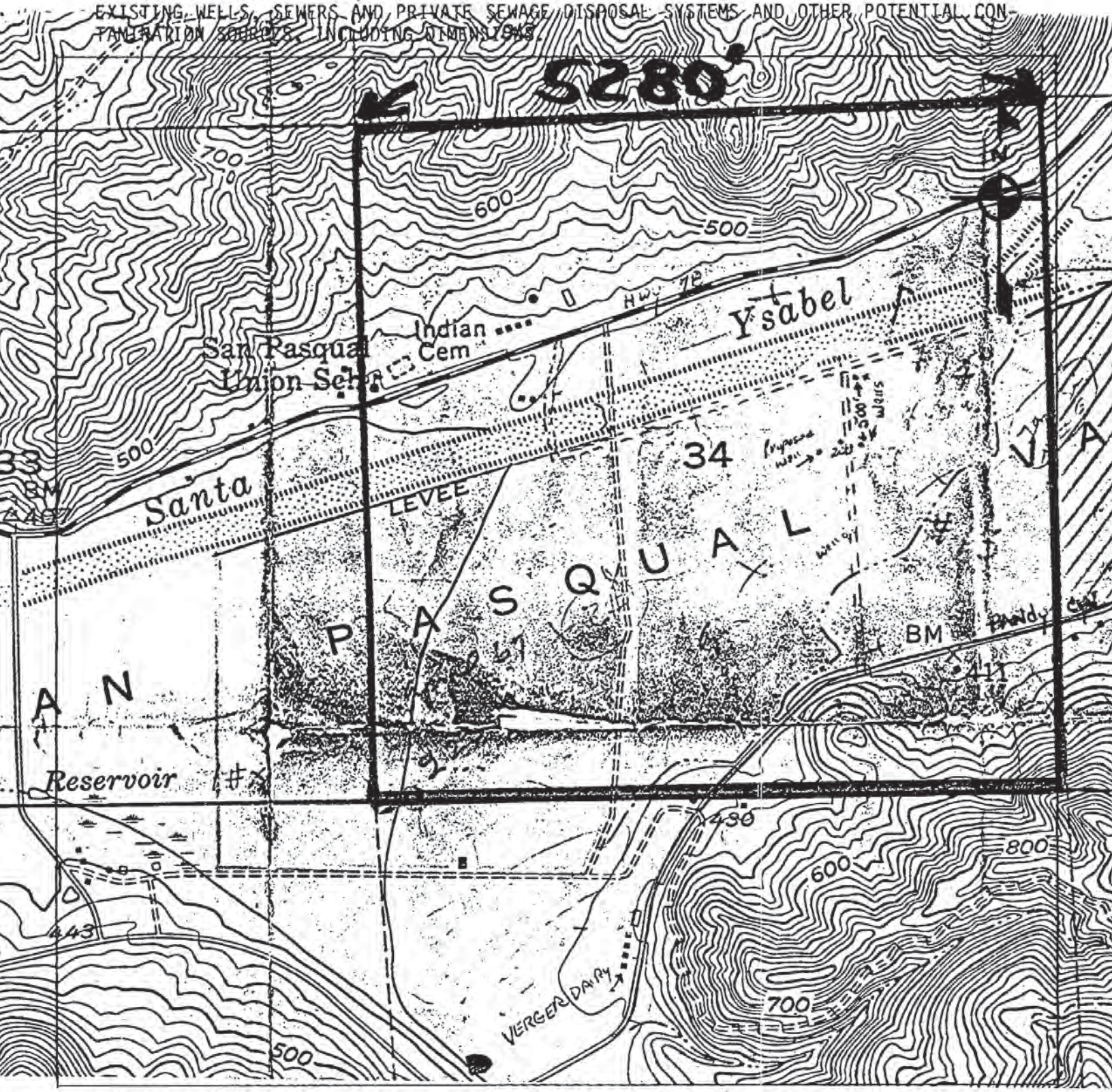
WELL PERMIT APPLICATION

Control # W62322

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



DHS:EHP-731 (3/85)

T-12-S
R-1W
S-34

QUADRUPLICATE
For Local Requirements

WDR sent to Ruffin 3-12-93 pcr

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 477925

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Page 1 of 1
Owner's Well No. 1-93
Date Work Began 1/8/93 Ended 1/22/93
Local Permit Agency County Health Dept.
Permit No. W62322 Permit Date 1/4/93

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER ukn (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	70	Alluvial fill as follows: Fine to coarse sand - grey color
70	85	Fine grained, silty sand Grey color
85	110	Fine to coarse sand, partly cemented - grey color
110	135	Corase Sand
135	155	Partly Cemented sand - fine to coarse
155	190	Fine to coarse sand with some gravel and boulders - overall color
190	198	Hard Rock, granite

* See approved stamp on the back

TOTAL DEPTH OF BORING 198 (Feet)
TOTAL DEPTH OF COMPLETED WELL 195 (Feet)

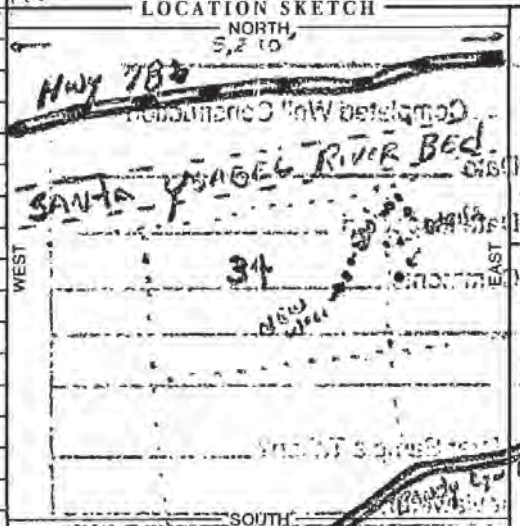
WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

WELL LOCATION

Address Bandy Cyn Rd
City Escondido
County San Diego
APN Book 760 Page 170 Parcel 18J
or
Township 12 S Range 1 W Section 34
or
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USE(S) (✓)

___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
X Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 39 (Ft.) & DATE MEASURED 1-22-93
ESTIMATED YIELD* 1000 (GPM) & TEST TYPE Airlift
TEST LENGTH 6 (Hrs.) TOTAL DRAWDOWN 100 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	36	X				A120	24	.250	
0	110	24	X				A252	12	.375	
110	130	24		X			304 SS	12	.250	.060
130	150	24	X				A252	12	.375	
150	190	24		X			304 SS	12	.250	.060
190	195	24	X				A252	12	.375	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
0	195			X	5/16 x 4 Gravel

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 Fain Drilling & Pump Co Inc (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 12029 Old Castle Rd. Valley Center, Ca 92082 (CITY, STATE, ZIP)
Signed Joe R Fain (WELL DRILLER/AUTHORIZED REPRESENTATIVE)
DATE SIGNED 1-26-93
C-57 LICENSE NUMBER 328287

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

Completed Well Construction

Date 3-16-93

Date Inspected 3-16-93

Comments Ag. well / evidence of annular seal observed

Water Sample Taken? NO

Reviewed By M. Sedghi

Well 2 #8743

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # W 63475
WELL COMPUTER #
FEE: 235.00 11/14/97
WATER DIST:

1. **Property Owner:** CHONGS FLOWERS **Phone:** 760-737-5089
15850 YSABEL CREEK Rd - (Mailing Address) ESCONDIDO (City) 92025 (Zip)

2. **Well Location - Assessors Parcel Number:** 760-170-58
15850 YSABEL CREEK Rd (Site Address) ESC (City) 92025 (Zip)

3. **Well Contractor - Well Driller** Joe FAIN **Company Name:** FAIN DRILLING
12029 OLD CASTLE Rd - (Mailing Address) VALLEY CENTER (City) 92082 (Zip)
Phone #: 760-749-0701 **C-57 #:** 328287 **Cash Deposit:** ☒ **Bond Posted:** ☐

4. **Use:** ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other _____

5. **Type of Work:** ☒ New ☐ Reconstruction ☐ Destruction **Time Extension: 1st:** ☐ **2nd:** ☐

6. **Type of Equipment:** ROTARY

7. **Depth of Well:** **Proposed:** 150 **Existing:** —0—

8.

Proposed: Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: PVC	☒ Yes ☐ No	☒ Yes ☐ No	
Depth: 150'	Depth: 20 ft.	From: 20 To: 150	From: 70 To: 150'
Diameter: 12" in.	Diameter 24 in.	Type: PEA GRAVEL	From: ____ To: ____
Wall/Gauge: CLASS 200	Wall/Gauge: .250		From: ____ To: ____

9. **Annular Seal: Depth** 20 **Ft.** **Sealing Material:** CONCRETE
Borehole Diameter: 32 **In.** **Conductor Diameter:** ____ **In.** **Annular Thickness:** ____ **In.**

10. **Date of Work: Start:** NOV-24-97 **Complete:** ~~Nov~~ Dec-3-97

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Joe R. Fain **Date:** Nov-14-97

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ Approved ☐ Denied **Special Conditions:** _____

Approved by: R. Quayle **Date:** 11-14-97

LWEL-8743

Chongs Flowers

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

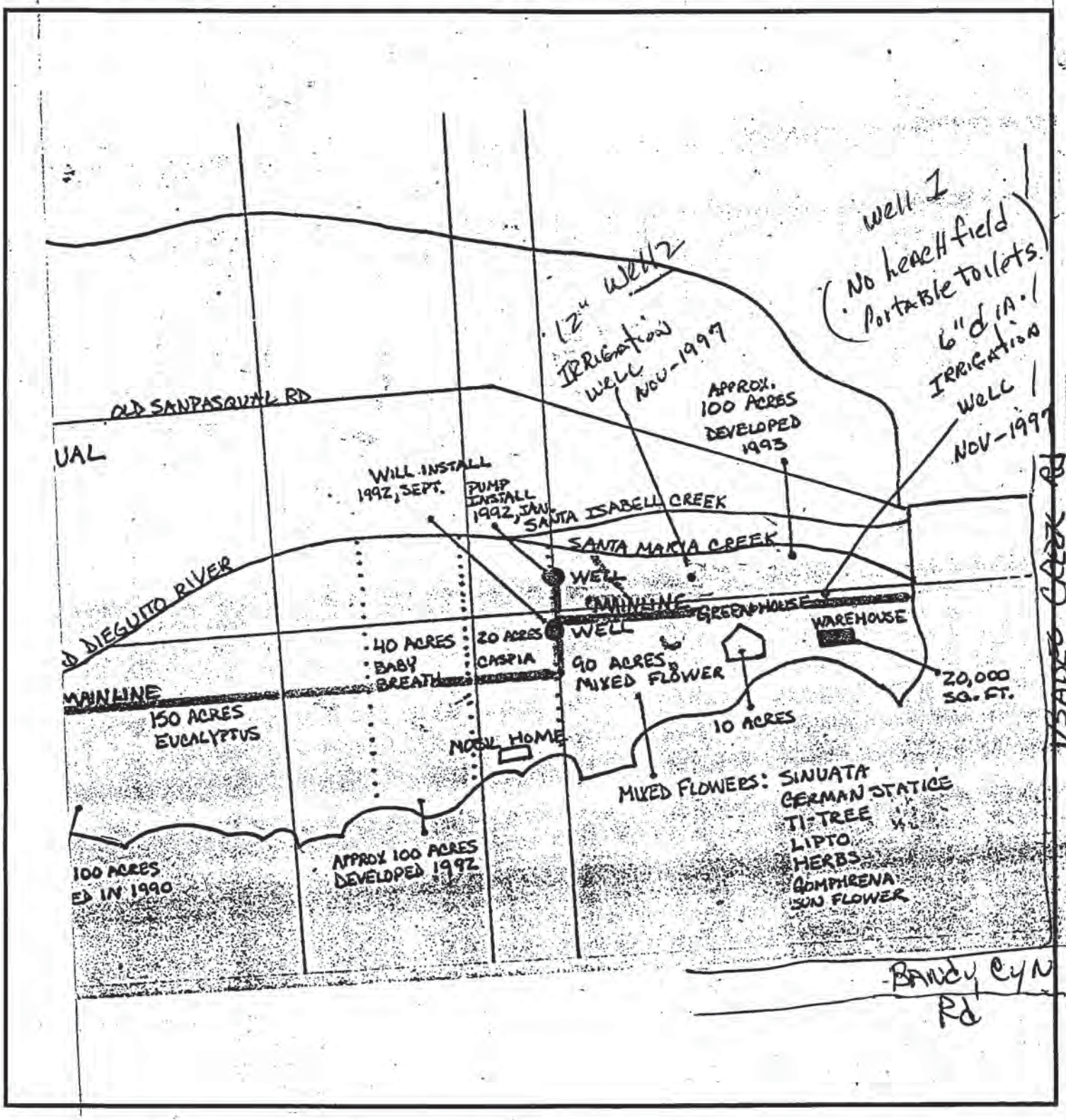
Well 2

Control #: W63475

Assessor's Parcel Number: 760-170-58

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



QUADRUPLICATE
For Local Requirements

Page 1 of 1

Owner's Well No. 2-97

Date Work Began 12-12-97 Ended 12-18-97

Local Permit Agency Dept of Env. Health

Permit No. W63475 Permit Date 11-14-97

in SM - Copy to RR

STATE OF CALIFORNIA
COMPLETION REPORT
Refer to Instruction Pamphlet

No. 445735

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

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

DEPTH TO FIRST WATER 20 (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	25	Alluvial fill as follows: Loose sand and silt - brown color
25	70	Fine to coarse sand with some small aggregates - brown color
70	80	Fine to COARSE sand - grey color
80	92	Black sand and silt
92	130	Fine to coarse sand - PARTLY cemented - dark grey color
130	155	fine COARSE Sand with some hard boulders
155	160	Weathered granite - brown color
160	165	rock

Completed Well Construction
Date 8-10-98
Date Inspected 8-7-98
Comments Well completed

TOTAL DEPTH OF BORING 165 (Feet)
TOTAL DEPTH OF COMPLETED WELL 165 (Feet)

Water Sample Taken? ___
Reviewed By Stogsdill

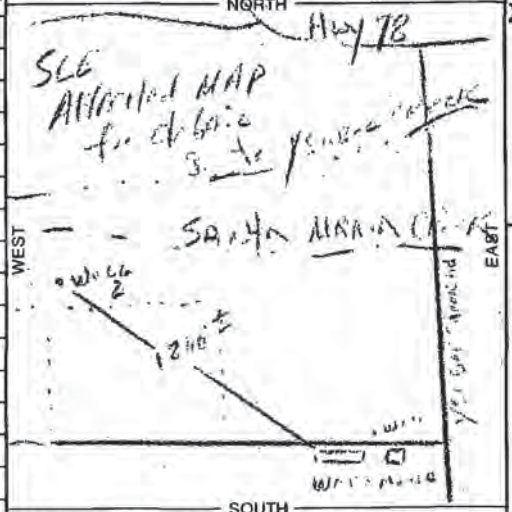
WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

WELL LOCATION

Address Same
City San Diego (San Pasqual Valley)
County San Diego
APN Book 760 Page 170 Parcel 58
or Township 12S Range 1W Section 33
or Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)
X NEW WELL
___ MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USE(S) (✓)
___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
X Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 13 (Ft.) & DATE MEASURED 12-18-97
ESTIMATED YIELD* 1200+ (GPM) & TEST TYPE airlift
TEST LENGTH 8 (Hrs.) TOTAL DRAWDOWN 80 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILLER	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	32	X				A-53	23.5	.250	
0	55	24	X				F480	12	C-200	
55	75	24		X			F480	12	C-200	
75	95	24	X				F480	12	C-200	
95	155	24		X			F480	12	C-200	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	155			pea gravel	5/16 x7

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 Fain Drilling & Pump Co Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 12029 Old Castle Rd. Valley center, Ca 92082

Signed [signature] 12-19-97 526287
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF PUBLIC HEALTH

Page 1 of 2 pages

#10606

WELL PERMIT APPLICATION

1600 PACIFIC HIGHWAY SAN DIEGO, CA. 92101

Permit No. W30021

TYPE OF WORK (Check)		USE (Check)			EQUIPMENT (Check)	
New Well	☒	Individual Domestic	☐	Commercial ☐	Rotary	☒
Repair or Modification	☐				Cable Tool	☐
Time Extension	☐	Agricultural	☐	Community ☒	Other	☐
Destruction	☐	Industrial	☐	Other ____		

PROPOSED WELL DEPTH

Max. 400 Min. 100 (Feet)

PROPOSED CASING

Type ~~☒~~ STEEL Depth TOTAL Diameter 14 Wall or Gage .250

PROPOSED SEALING ZONE(S) SEE COMMENTS PG 2

From ZERO to FIFTY Feet

From ____ to ____ Feet

From ____ to ____ Feet

PROPOSED PERFORATIONS OR SCREEN

From ____ to ____ Feet

From ____ to ____ Feet

From ____ to ____ Feet

From ____ to ____ Feet

SEALING MATERIAL (Check)

Neat Cement	☐	Puddled Clay	☐
Cement Grout	☒	Concrete	☒

DATE OF WORK

Start ____

Completion ____

242-131-01

NAME OF WELL OWNER

SAN PASQUAL ACADEMY

NAME OF WELL DRILLER

JOHN KRATZ

LOCATION OF WELL

242-131-06 17701 SAN PASQUAL VALLEY RD.

COMPANY

MULTI WATER SYSTEMS

DISPOSITION OF APPLICATION (FOR HEALTH OFFICERS USE ONLY) ESCONDIDO

☐ APPROVED ☐ DENIED

☑ APPROVED WITH CONDITIONS

Report Reason(s) for Denial or Necessary Conditions Here:

SEE COMMENTS ON PAGE 2

BERQUIST

HEALTH OFFICER

30 MARCH 1984

DATE

BUSINESS ADDRESS

RT 1 BOX 66 ESCONDIDO, CAL. 92025

LICENSE NUMBER		
355283-A	Cash Deposit	☒
	Bond Posted	☐

60.00
~~$25~~ Fee paid on ____

I hereby agree to comply with all regulations of the Department of the Public Health and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Public Health with a complete and accurate log of the well

Sheryl L. Kratz

APPLICANT'S SIGNATURE

3-30-84

DATE

LWEL 10606

San Pasqual Academy

SAN 53 (5-74)

COUNTY OF SAN DIEGO
DEPARTMENT OF PUBLIC HEALTH
1600 PACIFIC HIGHWAY
SAN DIEGO, CALIF. 92101

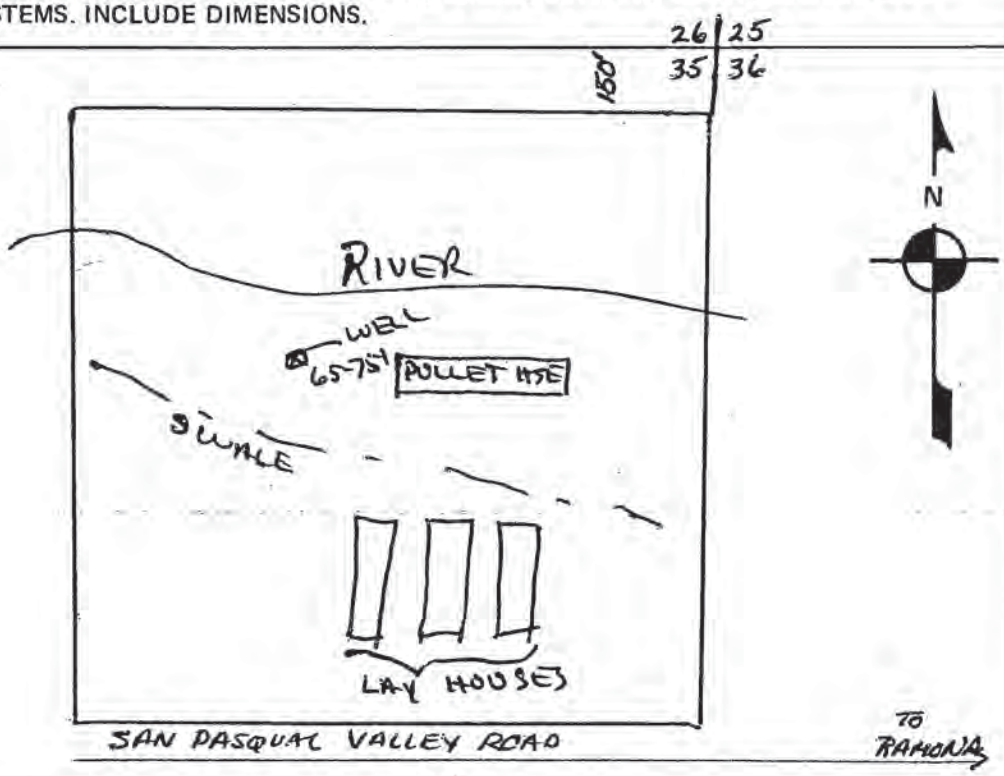
WELL PERMIT APPLICATION

Permit No. W30021

Assessor's Parcel No. 242-131-06

LOCATION

INDICATE BELOW THE EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS. INCLUDE DIMENSIONS.



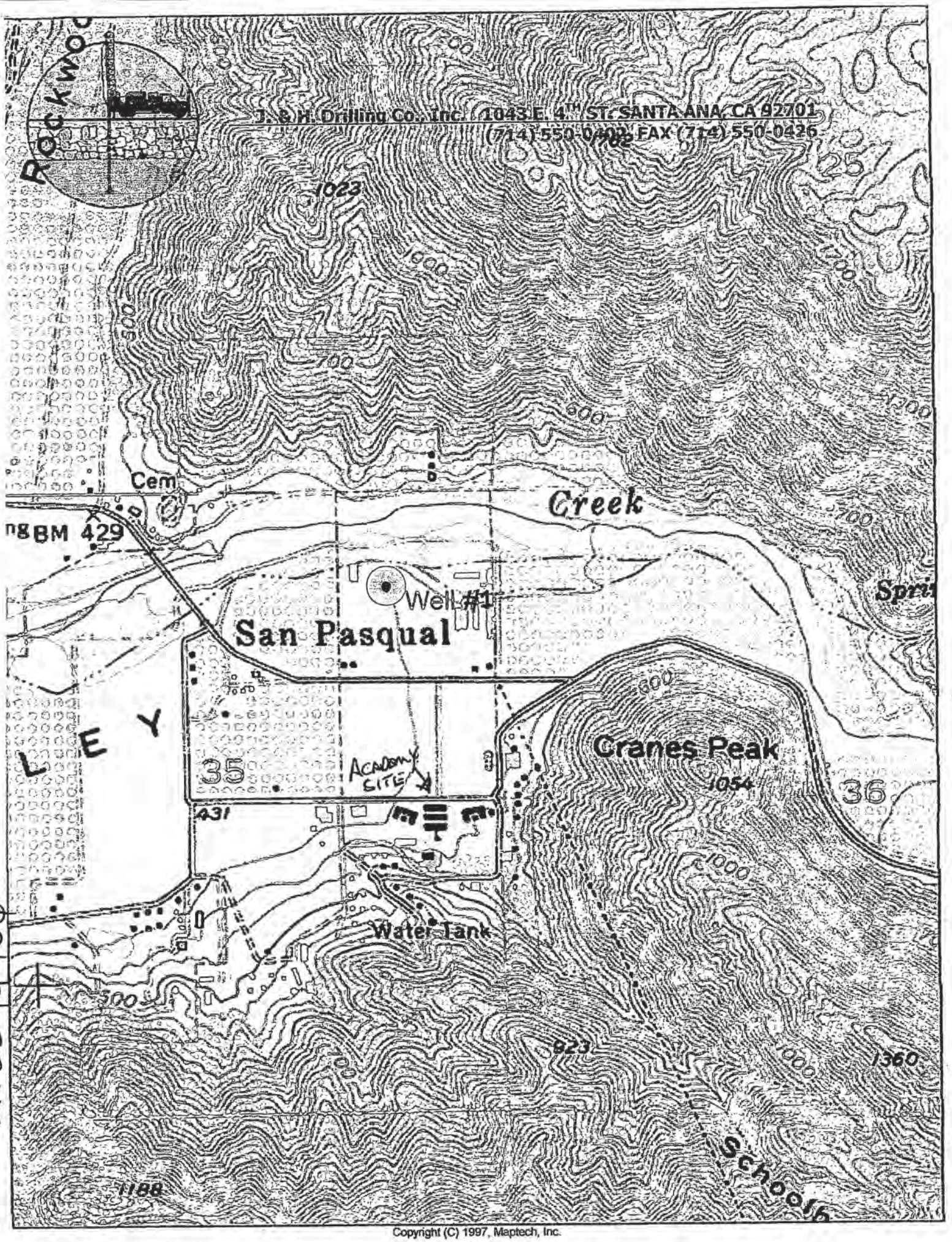
1. Well to be constructed to community well standards with required fifty feet of casing and annular seal. If impervious strata is encountered within five feet of required annular seal depth, then casing and seal to be extended five feet into impervious strata.

2. Well to be minimum of 100 feet from all sources of pollution and contamination i.e. sewage plant effluent disposal, animal enclosures and manure. A BERM must be provided so as to prevent contamination from being within 100 feet of well.

3. The existing pullet house to be re-located within 18 months so as to be 100 feet from well.

4. Provide impervious seal for ground used for manure storage so as to prevent percolation into soil.

5. Provide water devices for chicken lay houses that will not discharge waste water to ground in area of manure storage. Water device conversion to be completed within one year.


J. & H. Drilling Co., Inc. 1043 E. 4TH ST. SANTA ANA, CA 92701
(714) 550-0402 FAX (714) 550-0426
Rockwood
1023
Cem
Creek
BM 429
Well #1
San Pasqual
LEY
35
ACADEMY SITE
431
Cranes Peak
1054
36
Water Tank
823
1360
1188
Schools
LWEL 19706
Copyright (C) 1997, Maptech, Inc.

County Mail Station —A-21

FIRST CARBON COPY
send to County Health Dept. Room 104

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES
1700 PACIFIC HIGHWAY, SAN DIEGO, CA 92101

ASSESSORS PARCEL NUMBER:
242 131 06

Notice of Intent No. 194101
Local Permit No. or Date #30021

WATER WELL DRILLERS REPORT
(INSERT under ORIGINAL PAGE w/carbon of State Form)

State Well No. _____
Other Well No. _____

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

(2) LOCATION OF WELL (See instructions):
County San Diego Owner's Well Number _____
Well address if different from above _____
Township 12S Range 1W Section 35
Distance from cities, roads, railroads, fences, etc. approx. 600 feet south of sec. 35/36 & 400 feet west of property line
S.D. Thom. Bros. page 404 E-2

FOR HEALTH DEPARTMENT USE ONLY
Completed Well Construction:
Date 6-29-84
Date Inspected
Comments
Water Sample Taken? Bergquist
Sanitarian's Approval:
Part of community water system.

(3) TYPE OF WORK:
New Well ☐ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item (2)

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

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

(6) Gravel Pack:
Yes ☑ No ☐ Size 5/16x4
Diameter of above 23"
Packed from 0 to 183 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	60	24	.250	blank		
0	183	14	.250	60	183	2"x3/32

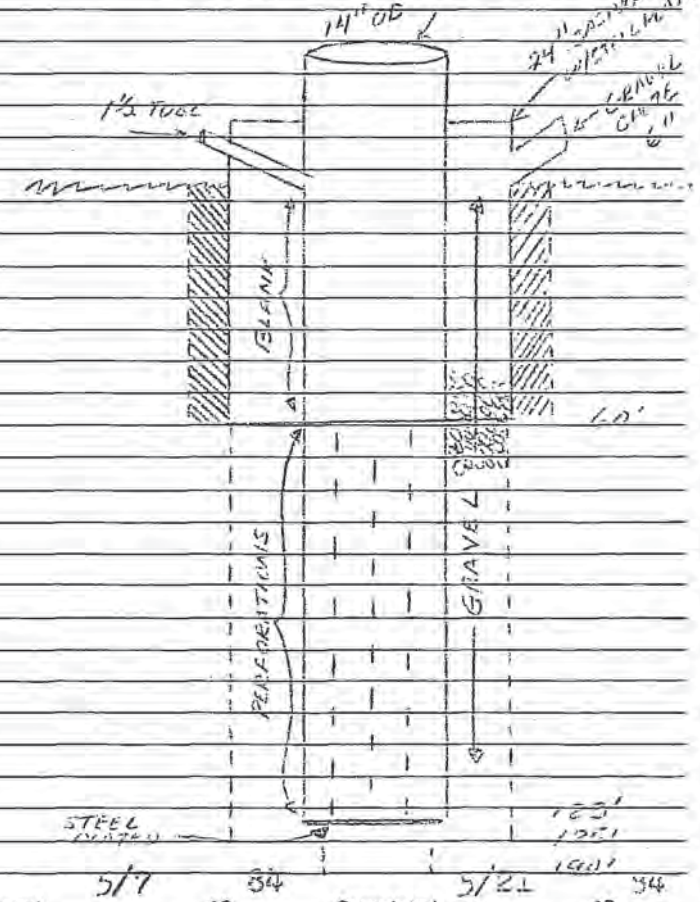
(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 60 ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval _____ ft.
Method of sealing cement

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

(11) WELL TESTS:
Was well test made? Yes ☐ No ☐ If yes, by whom?
Type of test Pump ☐ Bailer ☐ Air lift ☐
Depth to water at start of test _____ ft. At end of test _____ ft.
Discharge _____ gal/min after _____ hours Water temperature _____
Chemical 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 190 ft. Depth of completed well 183 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	15	overburden, topsoil progress to fine conglomerate
15	40	conglomerate w/fine sand-brn.
40	65	same
65	90	½" conglomerate to fine sand @ 89'
90	115	small layer of ine sand-grey
115	140	fine ½" conglomerate w/sand
140	165	same
165	190	harder rock - 182' / progresses to very hard rock - 190'



Work started 5/7 19 84 Completed 5/21 19 84

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 Multi Water Systems
(Well Driller)
NAME Rt. 1 Box 66
(Person, firm, or corporation) (Typed or printed)
Address Esc., Calif. 92025
City 355283 Zip
License No. _____ Date of this report _____

SAN 52 (2-81) **CONFIDENTIAL — NOT FOR PUBLIC USE — WATER CODE SEC. 13752**

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # W 19769
WELL COMPUTER #
FEE:
WATER DIST:

1. Property Owner: City of San Diego, Contact: Surraya Rashid, P.E., Proj. Mgr Phone: (619) 533-5306
   600 B Street, Suite 700, MS 906 (Mailing Address) San Diego, CA (City) 92101 (Zip)
2. Well Location - Assessors Parcel Number 272-131-08 (Well #4B)
   Approx 280' North of 14103 Highland Valley Rd. (Site Address) Escondido, CA (City) 92025 (Zip)
   13102 HIGHLAND VALLEY
3. Well Contractor - Well Driller Boart Longyear Company Name: Boart Longyear
   12464 McCann Drive (Mailing Address) Santa Fe Springs, CA (City) 90670 (Zip)
   Phone#: (562) 906-1960 C-57#: 694686 ☐ Cash Deposit ☒ Bond Posted
4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other RO demonstration project Source water for brackish water
5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: Rotosonic Rig - Vertical Well
7. Depth of Well: Proposed: 75 feet BGL Existing:
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel	☐ Yes ☒ No	☒ Yes ☐ No	
Depth: 0 to 30	Depth: ft.	From: 22 To: 70	From: 30 To: 75
Diameter 8.625 in.	Diameter in.	Type:	From: To:
Wall/Gauge: 0.188 in	Wall/Gauge:	Wall/Gauge:	From: To:

9. Annular Seal: Depth: 20 ft. Sealing Material: Neat Cement
   Borehole diameter: 12.625 in. Conductor diameter: in. Annular Thickness 2 in.
10. Date of Work: Start: Anticipated July 11, 2008 Complete: Anticipated July 25, 2008

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Date: 7-11-08

* Contact DEH at (760) 471-0730, 48 hours prior to installation of annular seal so that we may witness placement.

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: Date: 7-16-08

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

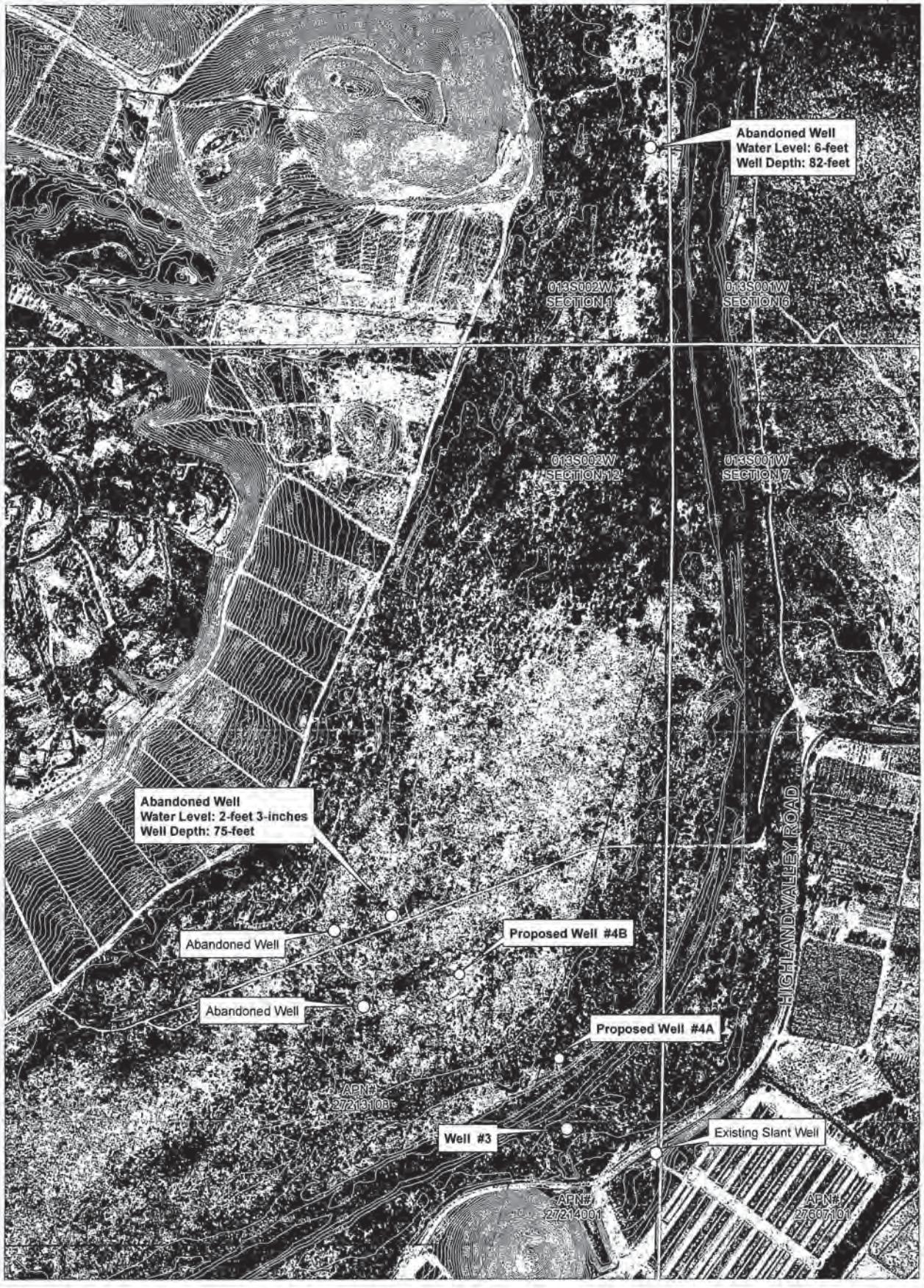
Control #: LWEL 19769
Assessor's Parcel Number: 272-131-08

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

SEE ATTACHED FOR PROPOSED WELL #4B

LWEL 19769



0 200 400 800 Feet

N

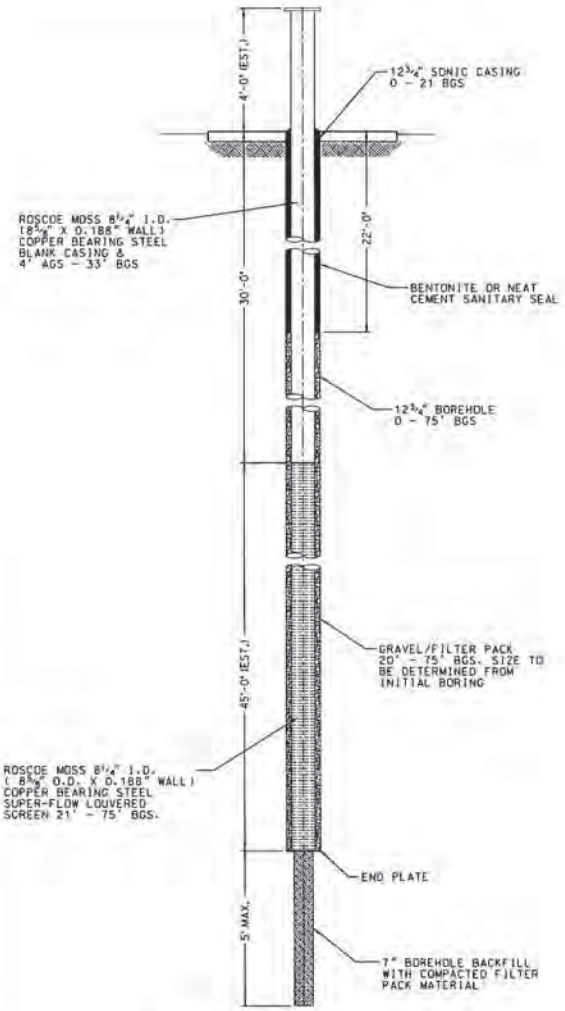
RBF CONSULTING PLANNING & DESIGN & CONSTRUCTION GIS

272-131-08

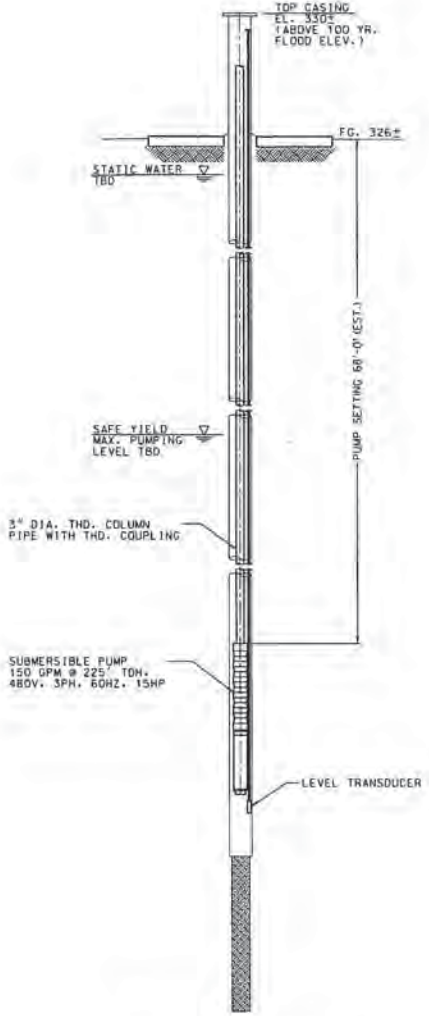
SAN PASQUAL BRACKISH GROUNDWATER DESALINATION DEMONSTRATION

ALTERNATIVE WATER SUPPLY ANALYSIS
TECHNICAL MEMORANDUM
FIGURE-1

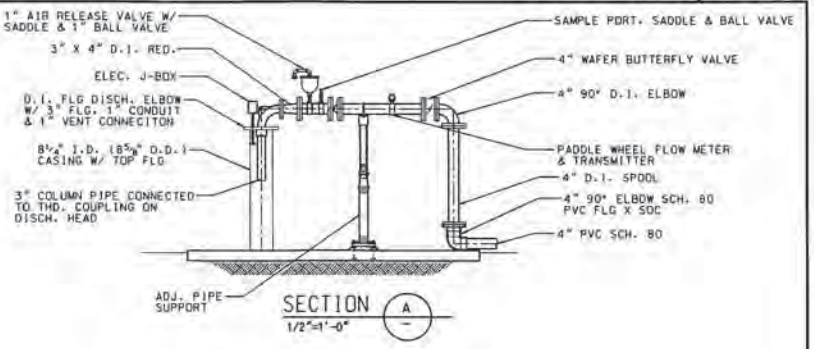
LWEL 19769



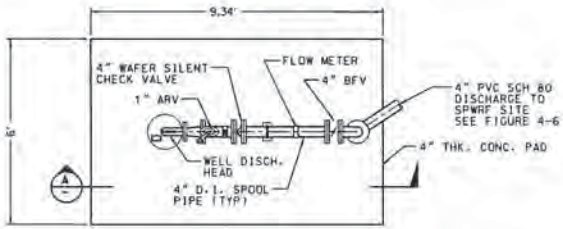
WELL CONSTRUCTION DETAIL
1/2"=1'-0"



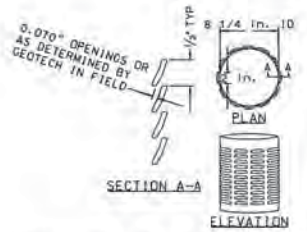
WELL EQUIPPING DETAIL
1/2"=1'-0"



SECTION A
1/2"=1'-0"



MECHANICAL PLAN
1/2"=1'-0"



HORIZ. SUPER-FLO LOUVERED SCREEN DETAIL
NOT TO SCALE

C-9

SAN PASQUAL BRACKISH WATER
TDDF PROJECT
OFF-SITE VERTICAL WELL CONSTRUCTION

CITY OF SAN DIEGO, CALIFORNIA
SHEET OF XX SHEETS

WATER W.O. 00000

DRAWING STATUS

NO.	DATE	REVISION DESCRIPTION	DWN	CKD	PVD	PE

CONSULTANT: RBF CONSULTING

ENGINEER OF WORK

DES
DWN
CKD

WATER DEPARTMENT
City of San Diego

SCALE:
VERT:
HOR: 0 ½ 1

FOR CITY ENGINEER
ASSOCIATE ENGINEER
INSPECTOR

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	XX/XX			

SENIOR CIVIL ENGINEER ____ DATE ____
CONTRACTOR ____ DATE STARTED ____
INSPECTOR ____ DATE COMPLETED ____

ASSOCIATE ENGINEER
ASSISTANT ENGINEER
CONTROL CERTIFICATION
DDD-0000
LAMBERT COORDINATES
75932-

272-131-08

LWEL 19769

THE CITY OF SAN DIEGO
MAYOR JERRY SANDERS

July10, 2008

Bob Geiseck
County of San Diego
Department of Environmental Health
Land and Water Quality Division
P.O. Box 129261
San Diego, CA 92112-9261

Dear Mr. Geiseck:

Subject: Property Owner Consent (POC)

The City of San Diego, owner of the property 14103 Highland Valley Road, San Diego, CA 92102, APN# 272-131-08, grants permission to Geoscience Support Services, Inc. (consulting company, contractor) and Boart Longyear, drilling company to enter City-owned property to conduct drilling and install a 70' to 75' deep vertical well on or near the area indicated on the attached Drawing C-2, "Offsite Well Site Plan".

I understand that Dennis E. Williams registered professional of Geoscience Support Services, Inc. consulting company and an authorized signer for Boart Longyear, drilling company have submitted a signed application to the County of San Diego, Department of Environmental Health, in which they have agreed to complete the above-stated work according to the applicable ordinances and laws of the County of San Diego and the State of California pertaining to water well construction and destruction. I have arranged with Surraya Rashid, City of San Diego, project manager overseeing the wells/borings installed on this property, to ensure proper destruction of the well should it become no longer usable or is abandoned at the conclusion of our demonstration project.

Sincerely,

Marsi A. Steirer

Enclosure: Drawing, C-2, Offsite Well Site Plan

DIVERSITY BRINGS US ALL TOGETHER

Water Department
600 B Street, Suite 600, MS 906 • San Diego, CA 92101
Tel (619) 533-7595 Fax (619) 533-5325

LWEL 19769

bcc: Robert McCullough, Principal Water Resources Specialist, Water Resources & Planning Division
Surraya Rashid, Associate Civil Engineer, Water Resources & Planning Division
Larry Aburtin, Assistant Engineer, Water Resources & Planning Division
Joel E. Bowdan III, Associate-Project Manager, RBF Consulting

Rec'd in SM on 10/29/08.

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0081241

Page 1 of 1

Owner's Well Number BH-4B

Date Work Began 07/11/2008 Date Work Ended 8/26/2008

Local Permit Agency County of San Diego Department of Environmental Health

Permit Number LWEL 19769 Permit Date 7/16/08

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N Latitude W Longitude

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Sonic Drilling Fluid

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	42	Sand, fine, med., coarse
42	44	Silty sand
44	49	Sand
49	55	Interbedded layers of sand and gravel
55	59	Sand
59	61	Gravel w/ sand
61	82	Sand w/ occasional gravel
82	84	Silty sand w/ gravel
84	85	Cobbles
85	88	Sand w/ cobbles
88	89	Clayey sand w/ cobbles
89	90	Weak cemented rock
90	92	Silty sand
92	95	Bedrock - granodiorite

Total Depth of Boring 95 Feet

Total Depth of Completed Well 84 Feet

Well Owner

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Well Location

Address 1,060' NW of entrance of 14103 Highland Valley Rd

City Escondido County San Diego

Latitude 33 03 33.82 N Longitude 117 02 06.90 W (Deg. Min. Sec.)

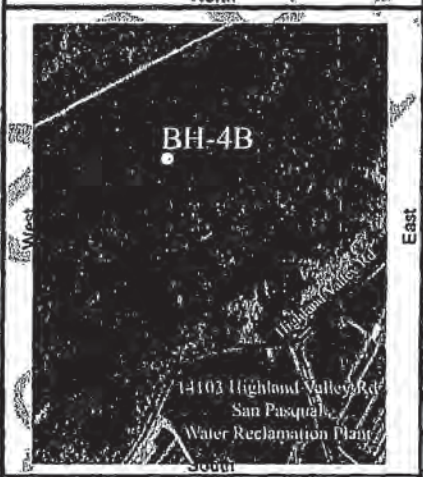
Datum NAD83 Decimal Lat. 33.05889 Decimal Long. 117.03500

APN Book 272 Page 131 Parcel 08

Township 13 S Range 2 W Section 12 J

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

◉ Water Supply
☑ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water 8 (Feet below surface)

Depth to Static Water Level 8 (Feet) Date Measured 08/25/2008

Estimated Yield * 150 (GPM) Test Type Constant Rate

Test Length 24.0 (Hours) Total Drawdown 31 (Feet)

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

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	25	12.625	Blank	Copper bearing steel	0.188	8 5/8		
25	41	12.625	Screen	Copper bearing steel	0.188	8 5/8	Louver	0.080
41	45	12.625	Blank	Copper bearing steel	0.188	8 5/8		
45	84	12.625	Screen	Copper bearing steel	0.188	8 5/8	Louver	0.080

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	20	Cement	neat cement
20	84	Filter Pack	4x16 custom blend
84	95	Native fill	

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 Boart Longyear Corporation (Person, Firm or Corporation)

12464 McCann Dr. (Address) Santa Fe Springs (City) CA (State) 90670 (Zip)

Signed [signature] (C-57 Licensed Water Well Contractor) 10/20/08 (Date Signed) 694686 (C-57 License Number)

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

DEH2016-LWELL-001332

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

Received
MAR 28
County of San Diego
Dept. of Environmental Health
Land & Water Quality Div

DEH USE ONLY
PERMIT #
FEE: $535.00
WATER DIST:

1. Property Owner: WHMAN RANCH Phone: WH - 760-644-6887
Mailing Address: PO BOX 1959 City: ESCONDIDO State: CA Zip: 92025

2. Well Location - Assessors Parcel Number: 760-170-48 / 242-100-10
GPS Coordinates: (WGS-84 Decimal Degrees): 33°05'17"N / 116°58'31"W
Site Address: 0 Hwy 78 City: ESCONDIDO State: CA. Zip: 92025

3. Well Contractor/Driller: DAVE MATTHEWS Company Name: FAN DRILLING
Mailing Address: 12029 OLDCASTLE RD. City: VALLEY CENTER State: CA Zip: 92082
Phone: 760-749-0701 C-57 License No: 328287 ☐ Cash Deposit ☒ Bond Posted

4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Other:

5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd

6. Type of Equipment: MUD ROTARY

7. Depth of Well: Proposed: 160 Existing:

8: Proposed:

	Casing	Conductor Casing	Filter/Filler Material	Perforations
	Type: SS/LCS	☒ Yes ☐ No	☒ Yes ☐ No	From: 100 To: 160
	Depth: 160	Depth: 20	From: 0 To: 160	From: ____ To: ____
	Diameter: 10 in.	Diameter: 24 in.	Type: RANCHO	From: ____ To: ____
	Wall/Gauge: .375	Wall/Gauge: .250		

9. Annular Seal: Depth: 20 ft. Sealing Material: cement
Borehole Diameter: 32 in. Conductor Diameter: 24 in. Annular Thickness: 4 in.

10: Best Management Plan for confining well drilling waste on the project site provided? ☒ Yes ☐ No

11. Date of Work: Start: 3/28/16 Complete: 4/ 2016

On sites served by public water, contact the local water agency for meter protection requirements.
I hereby agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's report). I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Date: 3/21/16

DISPOSITION OF APPLICATION (Department of Environmental Health Use Only)

☒ Approved ☐ Denied Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

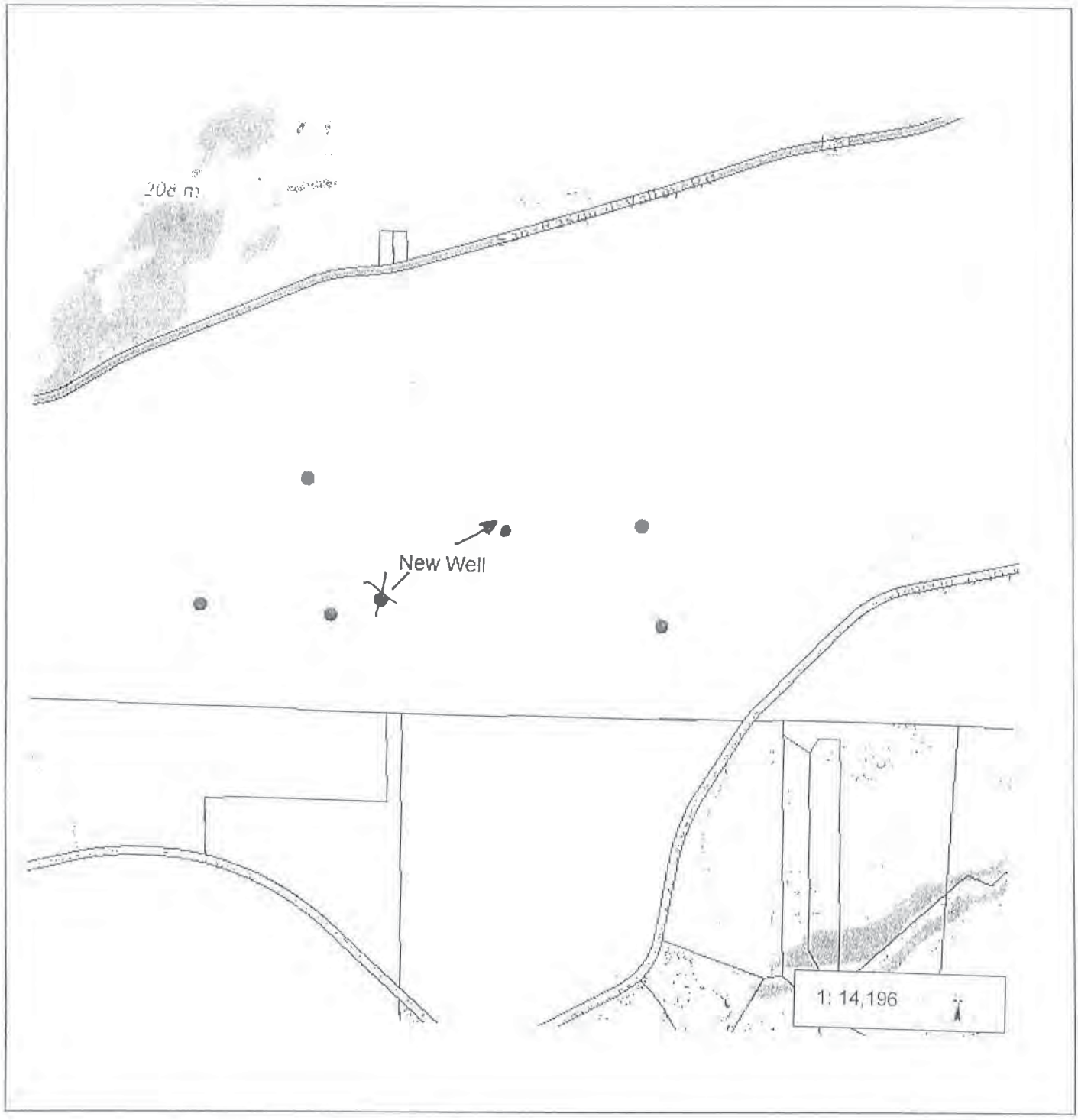
Specialist: Irina Portnaia Date: 3/28/16

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # LWELL - 001332
APN: 242-100-10

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.




33° 05' 01.77"N
116° 58' 31.61" W
new production well location
1745'
ed production well Location
© 2016 Google
Google earth
1994
Imagery Date: 4/14/2015 33°05'02.53" N 116°58'41.48" W elev 396 ft eye alt 2718 ft

County of San Diego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only

Well Permit Application Number: _____ Assessor's Parcel Number: 760-170-48
242-100-10

SECTION 1: Required Information from Contractor or Consultant:

Longitude & Latitude: 33.0501.177 N 116 58' 31.61 W How obtained? GPS Map Other

1. Are there any watercourses or water bodies within 50 feet of the limits of soil disturbance?	YES	NO
2. Does the plat show the project boundaries? (A "detail inset" is acceptable for a large parcel or lot.).	YES	NO
3. Does the plat show footprints of any existing structures and facilities within 100 feet of the wellhead position?	YES	NO
4. Does the plat show locations where run-off may enter stormdrains, drainage courses and/or receiving waters?	YES	NO
5. Is grading required to access site or install well?	YES	NO
6. Does the project conform to the local grading ordinance?	YES	NO
7. Will drilling additives be used to drill the well?	YES	NO
8. Are the Best Management Practices attached to this permit application? LARGE FIELD FOR DISCHARGE	YES	NO

SECTION 2. Best Management Practices

The goal of stormwater and discharge control management planning while drilling and installing wells is to reduce pollution to the maximum extent practicable using Best Management Practices (BMPs). Construction related materials, sediments, chemical residues such as drilling foam, wastes, and spills must be retained within the property boundaries to eliminate transport from the site to nearby streets, drainage courses, receiving waters and adjacent properties. It is the responsibility of the property owner and the contractor to determine which BMPs will be used in order to ensure that all contaminants are retained on-site.

Examples of Best Management Practices to contain well installation run-off include, but are not limited to, installation of a sediment basin to contain run-off, using geotextile fabric to contain sediments and drilling mud, or eliminating the use of drilling foam. (Website information is available at www.projectcleanwater.org)

SECTION 3. Certification

I have read and understand the following: *(Please check each box after concurrence.)*

- ☑ Selected BMP's will be implemented so that water quality is not negatively impacted by well construction activities.
- ☑ I am aware the selected BMP's must be installed, maintained, monitored and revised as necessary so they are effective.
- ☑ I understand that non-compliance with the San Diego County Watershed Protection Ordinance may result in enforcement actions by the County. These may include fines, citations, stop-work orders, or other actions.
- ☑ DEH inspectors and personnel from other regulatory agencies are authorized to enter my property at any time for purposes associated with this well permit until such time the well is completed to the satisfaction of DEH.
- ☑ Should DEH determine during the field review that the well installation procedures contradict this Discharge Management Plan or the well permit application, the well drilling permit may be suspended or revoked. Further activity will require a new permit fee and amendment to the existing permit.

Contractor _____ *Date* 3/21/16

Property Owner _____ *Date* 3-21-16

Reviewed by DEH _____ *Date* 3/28/16

*This free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0306251

Page One of One

Owner's Well Number 1332

Date Work Began 03/29/2016 Date Work Ended 4/5/2016

Local Permit Agency SD DEH

Permit Number LWELL-001332 Permit Date 3/28/16

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N W

Latitude Longitude

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	14	Grey Silty Sand
14	31	Grey Silty Sand w/ Grey Clay
31	46	Grey Clay
46	77	Course Grey Sand
77	88	Grey Clay
88	127	Grey & White Course Sand
127	129	Grey Clay & Wood
129	154	Compact Grey Sand
154	161	Grey Clay
161	167	Granite

Completed Well Construction

Date

Date Inspected Well present & in use via generator

Comments Pencil seal

N 33.08379°

W 116.97559°

Water Sample Taken? Yes 8/16/16

Reviewed By

Total Depth of Boring 167 Feet

Total Depth of Completed Well 165 Feet

Well Owner

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Well Location

Address 0 Hwy 78

City Escondido County San Diego

Latitude ___ ___ ___ N Longitude ___ ___ ___ W

Deg. Min. Sec. Deg. Min. Sec.

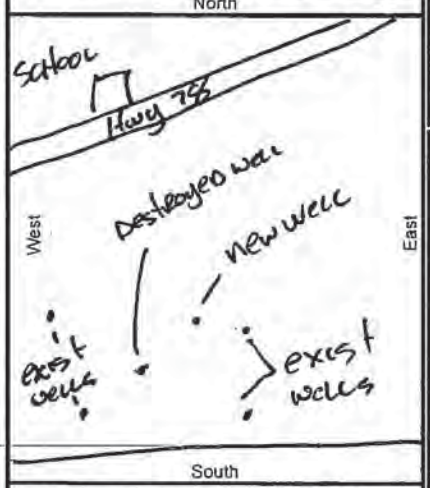
Datum ___ Dec. Lat. 33.0501 Dec. Long. 116.5831

APN Book 242 Page 100 Parcel 10

Township ___ Range ___ Section ___

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well

○ Modification/Repair

○ Deepen

○ Other

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

◉ Water Supply

☐ Domestic ☐ Public

☑ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

○ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other

Water Level and Yield of Completed Well

Depth to first water ___ (Feet below surface)

Depth to Static Water Level 72 (Feet) Date Measured 04/05/2016

Estimated Yield * 400 (GPM) Test Type Air Lift

Test Length 10.0 (Hours) Total Drawdown ___ (Feet)

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

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	20	32	Conductor	Low Carbon Steel	.250	24		
0	95	24	Blank	Low Carbon Steel	.375	12.75		
95	155	24	Screen	304 Stainless Steel	.250	12.75	Wire Wrap	0.060

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	95	Cement	
0	167	Filter Pack	Rancho

Attachments

☐ Geologic Log

☐ Well Construction Diagram

☐ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☑ Other Site Map

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 Fain Drilling & Pump Co., Inc

Person, Firm or Corporation

12029 Old Castle Rd Valley Center CA 92082

Address City State Zip

Signed ___ 4/7/2016 328287

C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

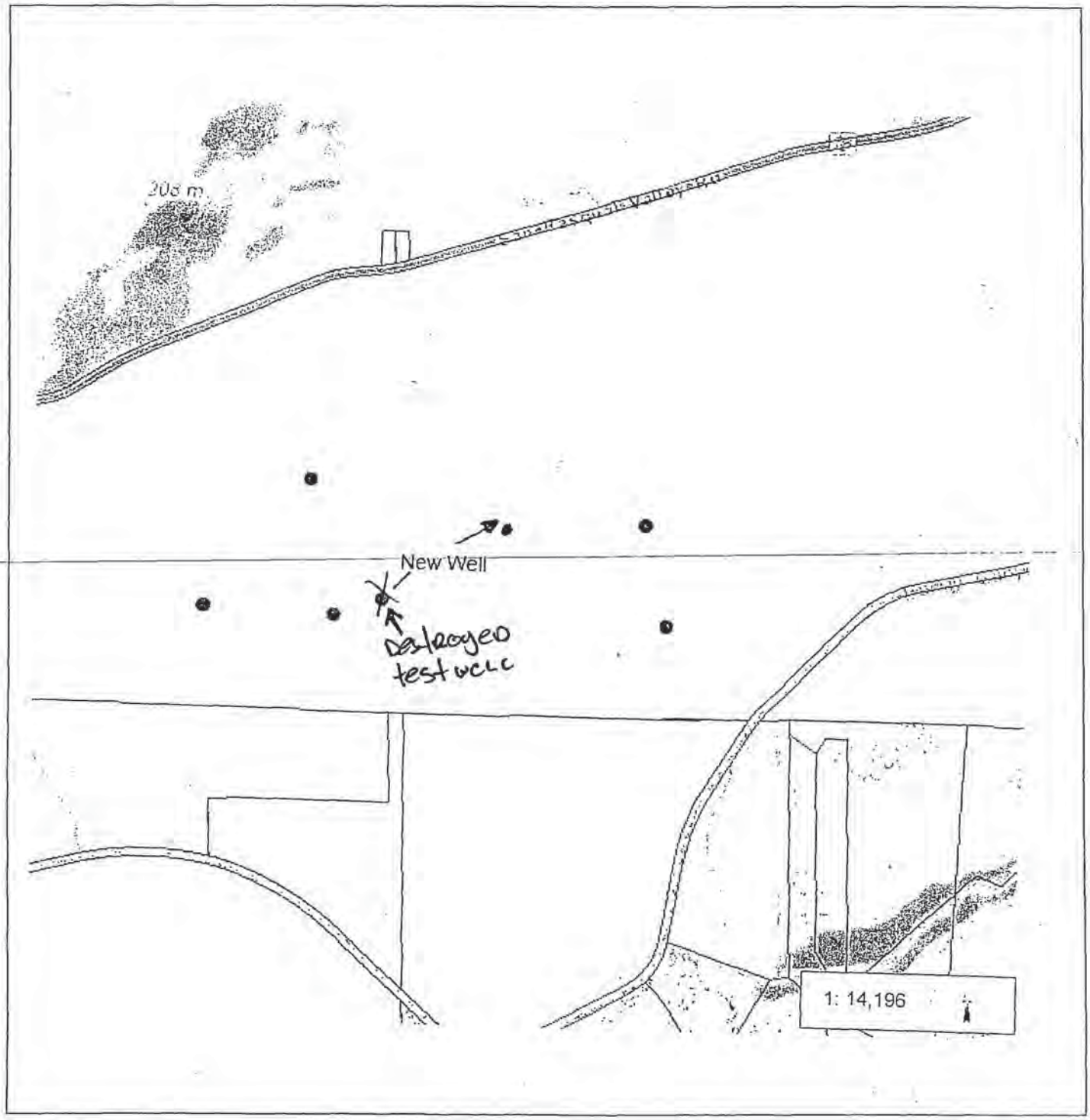
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # LWELL - 001332
APN: 242-100-10

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.



well #1

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

SCANNED

DATE: 9/7/14

DEH USE ONLY
DEH2014-LWELL-000675
PERMIT #
FEE: 535.00
WATER DIST:

1. Property Owner (lessee): BE WISE RANCH INC. Phone: BILL 760-746-60006
   Mailing Address: 20505 SAN PASQUAL VALLEY RD. City: ESCONDIDO State: CA Zip: 92026
2. Well Location - Assessors Parcel Number: 760-170-82
   GPS Coordinates: (WGS-84 Decimal Degrees): 33.0727 / 117.0323
   Site Address: SAN PASQUAL VALLEY RD. City: ESCONDIDO State: CA Zip: 92026
3. Well Contractor/Driller: DAVE MATTHEWS Company Name: FAIN DRILLING
   Mailing Address: 12029 OLDCASTLE RD City: VALLEY CENTER State: CA Zip: 92082
   Phone: 760-749-0701 C-57 License No: 328287 ☐ Cash Deposit ☒ Bond Posted
4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Other: IRRIGATION WELL
5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: MOD. ROTARY
7. Depth of Well: Proposed: 100 ft. Existing:
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel	☒ Yes ☐ No	☒ Yes ☐ No	From: 50 To: 100
Depth: 100	Depth: 20	From: 0 To: 100	From: ____ To: ____
Diameter: 14 in.	Diameter: 24 in.	Type: #6	From: ____ To: ____
Wall/Gauge: .250	Wall/Gauge: .250		

9. Annular Seal: Depth: 20 ft. Sealing Material: cement
   Borehole Diameter: 30 in. Conductor Diameter: 24 in. Annular Thickness: 3 in.
10. Best Management Plan for confining well drilling waste on the project site provided? ☒ Yes ☐ No
11. Date of Work: Start: 10/14 Complete: 10/14

On sites served by public water, contact the local water agency for meter protection requirements.
I hereby agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's report). I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Date:

DISPOSITION OF APPLICATION (Department of Environmental Health Use Only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: Date: 9-11-14

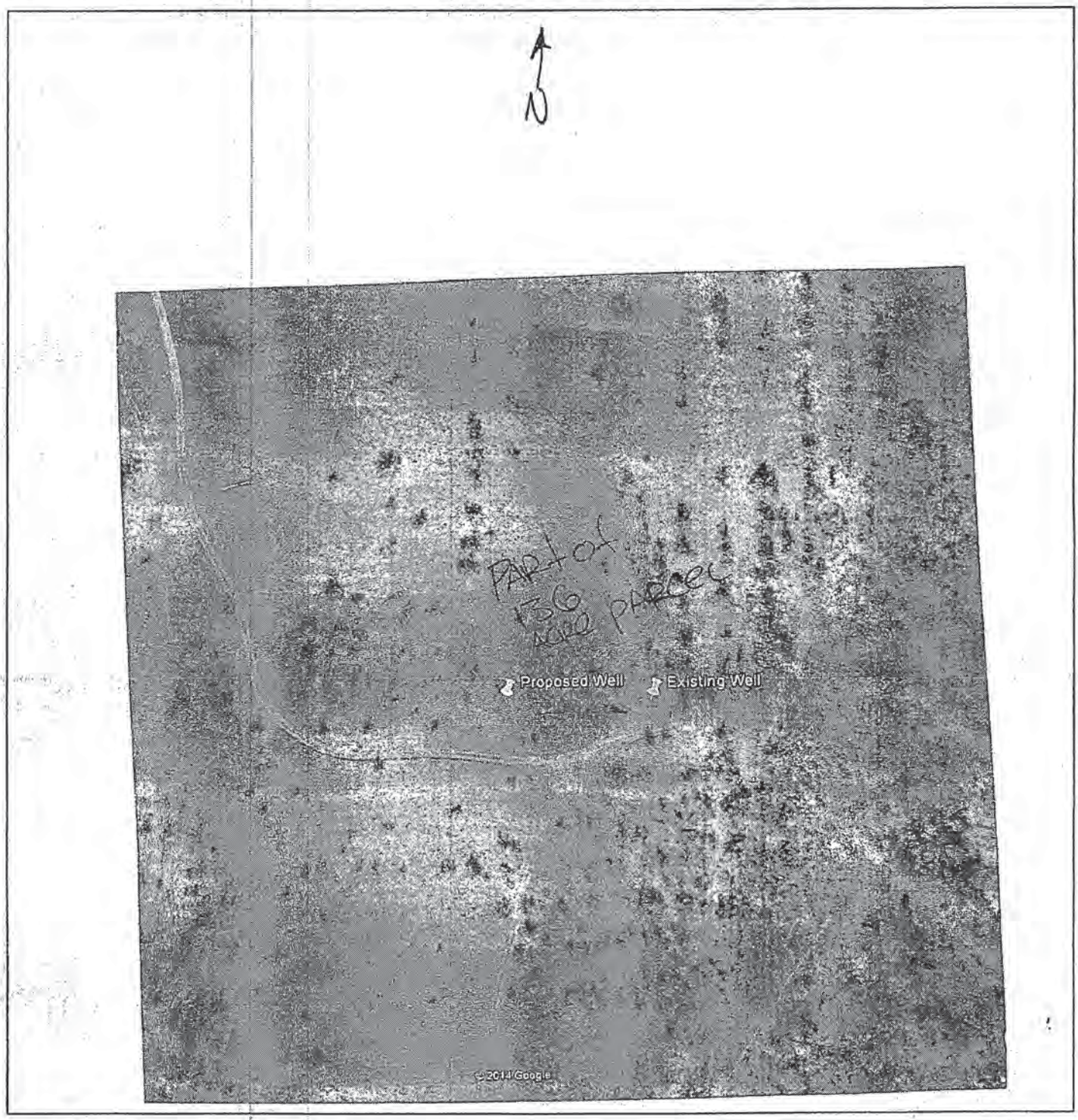
LWELL-000675

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # DEH2014-LWELL-000675
APN: 760-170-82

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.



County of San Diego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only

Well Permit Application Number: LWELL-000675 Assessor's Parcel Number: 760-170-82

SECTION 1: Required Information from Contractor or Consultant:

Longitude & Latitude: 33.0727 x 117.0323 How obtained? GPS Map Other

1. Are there any watercourses or water bodies within 50 feet of the limits of soil disturbance?	YES	(NO)
2. Does the plat show the project boundaries? (A "detail inset" is acceptable for a large parcel or lot.).	(YES)	NO
3. Does the plat show footprints of any existing structures and facilities within 100 feet of the wellhead position?	YES	(NO)
4. Does the plat show locations where run-off may enter stormdrains, drainage courses and/or receiving waters?	YES	(NO)
5. Is grading required to access site or install well?	YES	(NO)
6. Does the project conform to the local grading ordinance?	(YES)	NO
7. Will drilling additives be used to drill the well?	YES	(NO)
8. Are the Best Management Practices attached to this permit application? Containment pits to keep All spoils on property	(YES)	NO

SECTION 2: Best Management Practices

The goal of stormwater and discharge control management planning while drilling and installing wells is to reduce pollution to the maximum extent practicable using Best Management Practices (BMPs). Construction related materials, sediments, chemical residues such as drilling foam, wastes, and spills must be retained within the property boundaries to eliminate transport from the site to nearby streets, drainage courses, receiving waters and adjacent properties. It is the responsibility of the property owner and the contractor to determine which BMPs will be used in order to ensure that all contaminants are retained on-site.

Examples of Best Management Practices to contain well installation run-off include, but are not limited to, installation of a sediment basin to contain run-off, using geotextile fabric to contain sediments and drilling mud, or eliminating the use of drilling foam. (Website information is available at www.projectcleanwater.org)

SECTION 3: Certification

I have read and understand the following: *(Please check each box after concurrence.)*

- ☑ Selected BMP's will be implemented so that water quality is not negatively impacted by well construction activities.
- ☑ I am aware the selected BMP's must be installed, maintained, monitored and revised as necessary so they are effective.
- ☑ I understand that non-compliance with the San Diego County Watershed Protection Ordinance may result in enforcement actions by the County. These may include fines, citations, stop-work orders, or other actions.
- ☑ DEH inspectors and personnel from other regulatory agencies are authorized to enter my property at any time for purposes associated with this well permit until such time the well is completed to the satisfaction of DEH.
- ☑ Should DEH determine during the field review that the well installation procedures contradict this Discharge Management Plan or the well permit application, the well drilling permit may be suspended or revoked. Further activity will require a new permit fee and amendment to the existing permit.

Contractor _____ *Date* 9/5/14

Property Owner _____ *Date* 8-5-14

Reviewed by DEH _____ *Date* 9-11-14

DUPLICATE, ORIGINAL

DEH2014-LWELL-00067S

THE CITY OF SAN DIEGO

WILLIAM BRAMMER
d/b/a BRAMMER FARMS

Flat Rate Lease

DOCUMENT NO. RR-301867

FILED SEP 12 2016

OFFICE OF THE CITY CLERK
SAN DIEGO, CALIFORNIA

CITY OF SAN DIEGO
FLAT RATE LEASE

THIS LEASE AGREEMENT is executed between THE CITY OF SAN DIEGO, a municipal corporation, hereinafter called "CITY," and WILLIAM BRAMMER d.b.a. BRAMMER FARMS, hereinafter called "LESSEE."

SECTION 1: USES

1.1 Premises. CITY hereby leases to LESSEE and LESSEE leases from CITY all of that certain real property situated in City of San Diego, County of San Diego, State of California, described as consisting of approximately 136.4 acres and further described in Section 11.1, Exhibit A - Premises attached hereto and by this reference made part of this agreement and four (4) wells, including the right to use the water which may be available underneath the Premises for the purposes provided for in Section 1.2 Uses, subject to Section 8.8, Water Rights, hereof. Said real property is hereinafter called the "premises" or "leased premises." It is further agreed that the leasehold has not been surveyed however CITY and LESSEE agree to approximate acreage.

1.2 Uses. It is expressly agreed that the premises are leased to LESSEE solely and exclusively for the purposes of growing organic vegetables, related agricultural crops on an ongoing basis, business office, vegetable washing and packing area/building and for such other related or incidental purposes as may be first approved in writing by the City Manager and for no other purpose whatsoever.

The use of the premises for any unauthorized purpose shall constitute a substantial default and subject this lease to termination at the sole option of the CITY.

LESSEE covenants and agrees to use the premises for the above-specified purposes and to diligently pursue said purposes throughout the term hereof. Failure to continuously use the premises for said purposes, or the use thereof for purposes not expressly authorized herein, shall be grounds for termination by CITY.

1.3 Related Council Actions. By the granting of this lease, neither CITY nor the Council of CITY is obligating itself to any other governmental agent, board, commission, or agency with regard to any other discretionary action relating to development or operation of the premises. Discretionary action includes but is not limited to rezonings, variances, environmental clearances, or any other

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR County

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0242697

Page 1 of 1

Owner's Well Number One

Date Work Began 11/03/2014 Date Work Ended 11/17/2014

Local Permit Agency SD DEH

Permit Number LWELL-000675 Permit Date 9/11/14

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N W

Latitude Longitude

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	16	Brown Silty Sand
16	41	Brown Sand
41	64	Course Sand And Gravel
64	66	Grey Clay
66	96	Course Sand And Gravel
96	100	Hard Decomposed Granite
100	101	Granite

Completed Well Construction

Date 6/30/16

Date Inspected 6/30/16

Comments

Water Sample Taken?

Reviewed By

Total Depth of Boring 101 Feet

Total Depth of Completed Well 100 Feet

Well Owner

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Well Location

Address San Pasqual Valley Road

City Escondido County San Diego

Latitude ___ ___ ___ N Longitude ___ ___ ___ W

Deg. Min. Sec. Deg. Min. Sec.

Datum ___ Dec. Lat. 33.0727 Dec. Long. 117.0323

APN Book 760 Page 170 Parcel 82

Township ___ Range ___ Section ___

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North

SEE ATTATCHED MAP

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 and complete.

Activity

◉ New Well

○ Modification/Repair

○ Deepen

○ Other

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

◉ Water Supply

☐ Domestic ☐ Public

☑ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

○ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other

Water Level and Yield of Completed Well

Depth to first water UKN (Feet below surface)

Depth to Static Water Level 12 (Feet) Date Measured 11/17/14

Estimated Yield * 700 +/- (GPM) Test Type AIR LIFT

Test Length 6 (Hours) Total Drawdown ___ (Feet)

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

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size If Any (Inches)
0	20	32	Conductor	Low Carbon Steel	.250	24		
0	60	23	Blank	PVC F480	.750	12 3/4		
60	100	23	Screen	304 Stainless Steel	.250	12 3/4	Wire Wrap	0.060

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	20	Cement	
0	100	Filter Pack	#6

Attachments

☐ Geologic Log

☐ Well Construction Diagram

☐ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☑ Other Site Map

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 Fain Drilling and Pump Company, Inc.

Person, Firm or Corporation

12029 Old Castle Road Valley Center CA 92082

Address City State Zip

Signed ___ 11/20/14 328287

C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

RECEIVED
SEP 01 2004
County of San Diego
Dept. of Environmental Health

DEH USE ONLY
PERMIT # WLWEL 16208
WELL COMPUTER #
FEE: #390
WATER DIST: n/a

OWNER- City of San Diego
LEASEE

1. Property Owner: AM-Sod Phone: 760 497-8873
P.O. Box 300638 (Mailing Address) Escondido (City) 92027 (Zip)

2. Well Location - Assessors Parcel Number 241-100-31
15023 Old San Pasqual Rd (Site Address) San Diego (City) (Zip)

3. Well Contractor - Well Driller Joe Fain Company Name: Fain Drilling
12029 Old Castle Rd (Mailing Address) Valley Center (City) 92082 (Zip)
Phone#: 760-749-0701 C-57#: 328287 ☐ Cash Deposit ☒ Bond Posted

4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other AG-WEL

5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd

6. Type of Equipment: Rotary

7. Depth of Well: Proposed: 130' Existing: 0

8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: PVC	☒ Yes ☐ No	☒ Yes ☐ No	
Depth: 130	Depth: 20 ft.	From: 20 To: 130	From: 170 To: 130
Diameter 16 in.	Diameter 24 in.	Type: 5/16 X 16	From: To:
Wall/Gauge: .616	Wall/Gauge: .250	Wall/Gauge: N/A	From: To:

9. Annular Seal: Depth: 20 ft. Sealing Material: CEMENT
Borehole diameter: 32 in. Conductor diameter: 24 in. Annular Thickness 4 in.

10. Date of Work: Start: SEPT. 2004 Complete: SEPT. 2004

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Joe R. Fain Date: Aug-31-2004

LWEL-16208

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

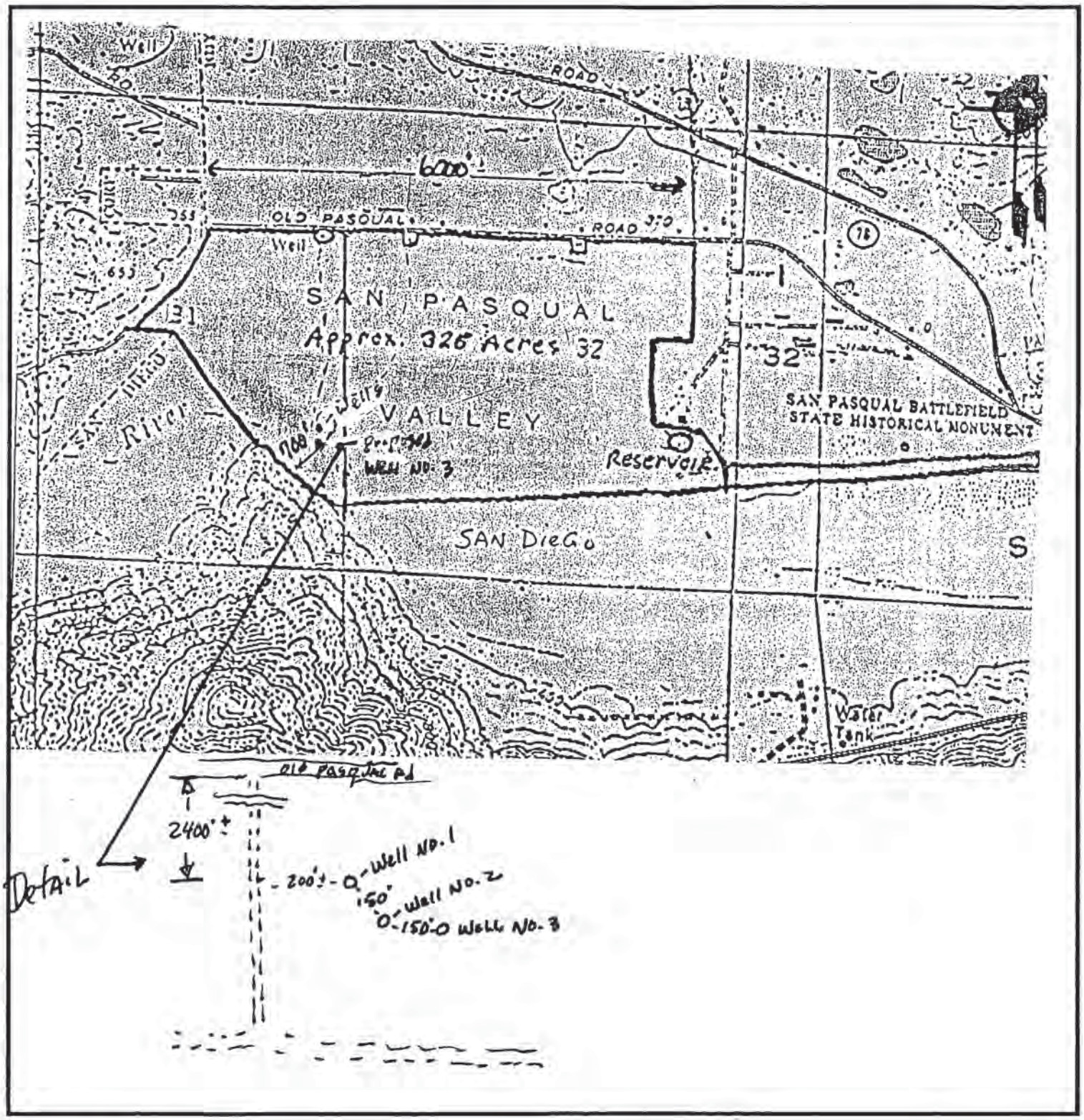
Specialist: N. Learning Date: 9/1/04

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWQ 16208
Assessor's Parcel Number: 241-100-31

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



LWL 16208 Kiva ent. 2/2/05 NS File 241-100-31

QUADRUPLICATE
For Local Requirements

Page 1 of 1
Owner's Well No. 3

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 0909563

Date Work Began 10-8-04, Ended 10-16-04
Local Permit Agency DEH
Permit No. 16209 Permit Date 9-1-04

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Gel

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
		ALLUVIAL FILL AS FOLLOWS:
0	15	Fine grained sand and silt Brown Color
15	40	Fine to coarse sand with small boulders
40	69	Grey silty sand
69	75	Coarse sand - some small gravel
75	90	Sand - partly cemented
90	136	Fine to coarse sand with some boulders

Completed Well Construction
Date 2/2/05
Date Inspected 2/1/05
Comments
W. Stearns
Water Sample Taken? N
Reviewed By

TOTAL DEPTH OF BORING 136 (Feet)
TOTAL DEPTH OF COMPLETED WELL 136 (Feet)

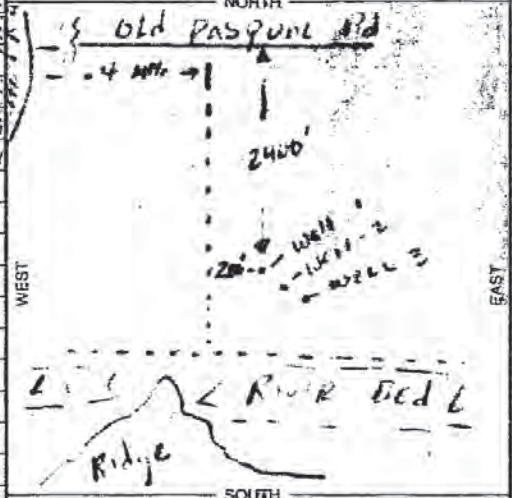
WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

WELL LOCATION

Address [redacted] ESCONDIDO
City San Diego
County San Diego
APN Book 241 Page 100 Parcel 24
Township 13S Range 3W Section 31
Lat ___ DEG. ___ MIN. ___ SEC. N Long ___ DEG. ___ MIN. ___ SEC. W

LOCATION SKETCH



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")

USES (✓)

WATER SUPPLY
___ Domestic ___ Public
X 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 UKN (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 36 (Ft.) & DATE MEASURED 10/16/04
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (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)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	32	X				Steel	23.5	.375	
0	78	24	X				PVCF480	15	.661	
78	138	24		X			PVCF480	15	.661	.125

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	136				3/8 Gravel

ATTACHMENTS (✓)

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

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 Pain Drilling & Pump Co. Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 12029 Old Castle Rd. CITY Valley Center STATE Ca ZIP 92082

Signed [signature] 10/19/04
C-57 LICENSED WATER WELL CONTRACTOR — DATE SIGNED — C-57 LICENSE NUMBER

DWR 155 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

APR 10 1968

12S/01W-31J0025

ORIGINAL
File with DWR

WATER WELL DRILLERS REPORT

(Sections 7079, 7080, 7081, 7082, Water Code)

THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Do Not Fill In

No. 39872

State Well No. 12S/01W-31J02

Other Well No.

(2) LOCATION OF WELL:

County San Diego Owner's number, if any

Township, Range, and Section

Distance from cities, roads, railroads, etc. Four miles from Escondido on Highway 78 East (San Pasqual Valley)

(3) TYPE OF WORK *(check)*:

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE *(check)*:

Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary ☐
Cable ☒
Other ☐

(6) CASING INSTALLED:

STEEL: OTHER:
SINGLE ☒ DOUBLE ☐

From ft.	To ft.	Diam.	Gage or Wall
0	50	12	.250
50	134	12	.219

If gravel packed

Diameter of Bore	From ft.	To ft.
20"	0	132

Size of shoe or well ring: None

Size of gravel: 3/8 Round

Describe joint Welded

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen Louvre & Johnson #100 Slot

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
50	100	8	1½	1/8 x 23/8
100	105	Johnson's well screen		
105	119	8	1½	1/8 x 2 3/8
119	124	Johnson well screen		
124	132	8	1½	1/8 x 2 3/8

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☐ No ☒ To what depth ft.

Were any strata sealed against pollution? Yes ☐ No ☒ If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing

(9) WATER LEVELS:

Depth at which water was first found, if known 55 ft.

Standing level before perforating, if known 49 ft.

Standing level after perforating and developing 49 ft.

(10) WELL TESTS:

Was pump test made? Yes ☒ No ☐ If yes, by whom? Webb Pump Co.

Yield: 1200 gal./min. with 50 ft. drawdown after 3 hrs.

Temperature of water Was a chemical analysis made? Yes ☐ No ☒

Was electric log made of well? Yes ☐ No ☒ If yes, attach copy

(11) WELL LOG:

Total depth 134 ft. Depth of completed well 134 ft.

Formation: *Describe by color, character, size of material, and structure*

ft. to	ft.
0 - 15	Sand, light brown color - fine to medium size
15 - 35	Sand, dark brown color - fine to medium size
35 - 37	Silt, black color
37 - 44	Sand, grey color - fine to medium size
44 - 45	Silt, black color
45 - 55	Sand, grey color - fine to medium size
55 - 63	"Toolie Bed" Fine black sands, old logs
63 - 73	Sand & gravel, fine to coarse 1/8" to 1" round
73 - 80	Sand dark grey color - fine to medium size
80 - 90	Sand brown color fine to medium size
90 - 100	Sand, brown color fine to medium size
100 - 105	Sand & Gravel Fine to coarse sand 1/8" to 1" gravel round
105 - 119	Sand, partly cemented - fine to medium size
119 - 124	Sand & gravel
124 - 127	Sand, Brown, fine to medium
127 - 132	Decomposed granite

Average Sp. Yield = 20.2

CONFIDENTIAL - NOT FOR PUBLIC RELEASE

Work started Oct 30 19 67 Completed Nov 9 19 67

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Acme Drilling Company
(Person, firm, or corporation) *(Typed or printed)*

Address P.O. Box 835
Valley Center, California 92082

[SIGNED] W. Z. Doughty
(Well Driller)

License No. 174287 Dated Apr 4, 1968

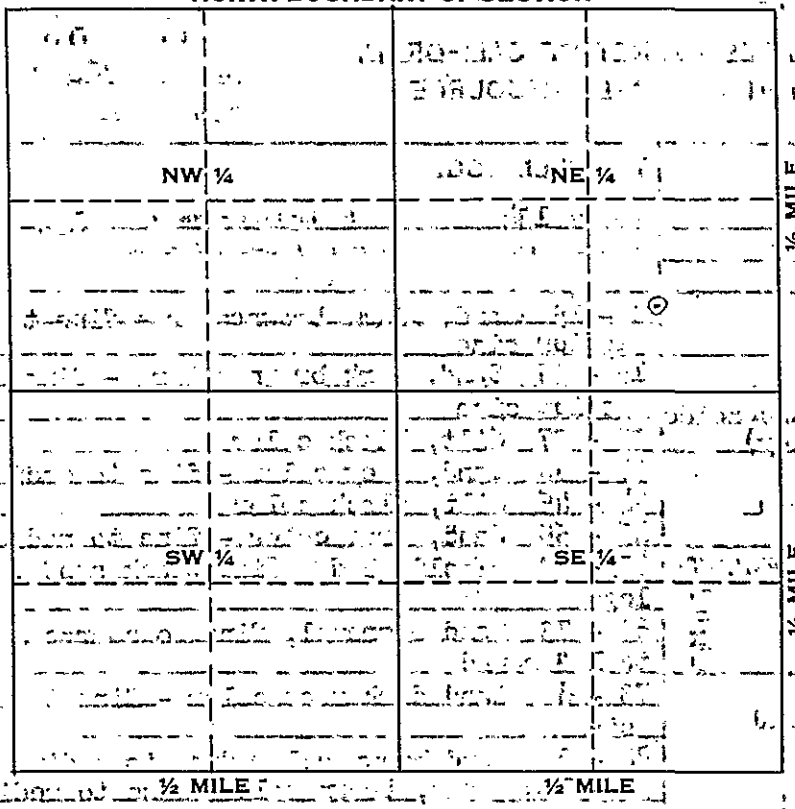
SKETCH LOCATION OF WELL ON REVERSE SIDE

DWR 188 (REV. 9-65)

36391-950 10-65 50M TRIP ① △ OSP

WELL LOCATION SKETCH

39872

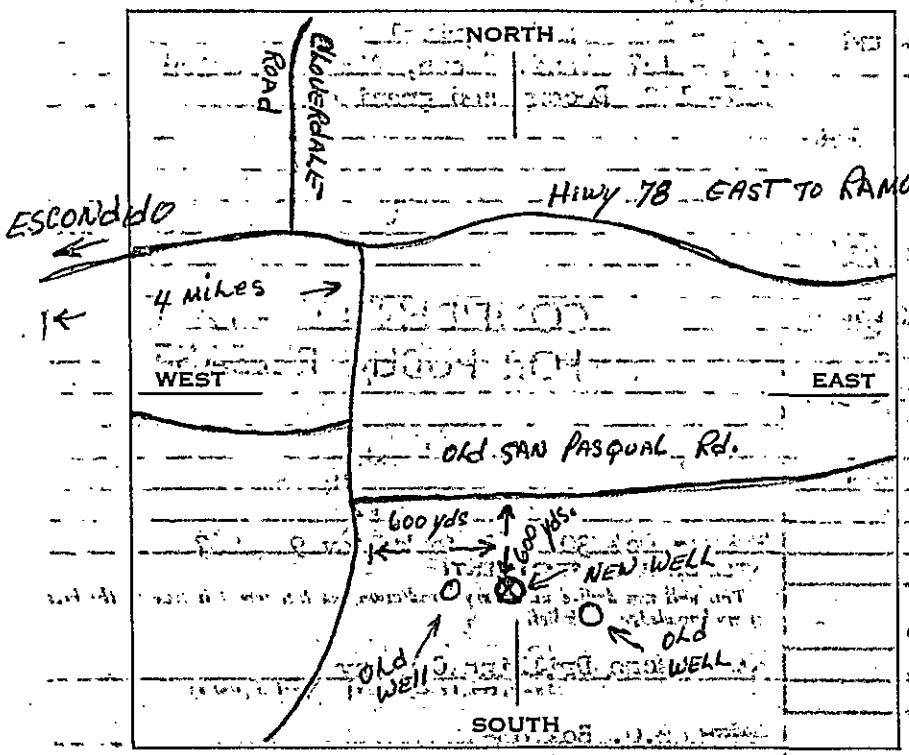


Township _____ N/S

Range _____ E/W

Section No. 30

A. Location of well in sectionized areas.
Sketch roads, railroads, streams, or other features as necessary.



SAN PASQUAL VALLEY (West End)

B. Location of well in areas not sectionized.
Sketch roads, railroads, streams, or other features as necessary.
Indicate distances.

ORIGINAL
File with DWR

Likely SP022

Page 1 of 1

012S001W31B005S

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 459843

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. Am-Sod
Date Work Began 7/22/93 Ended 7/27/93
Local Permit Agency County Health Dept
Permit No. W62480 Permit Date 7/20/93

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER ukn (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	35	Alluvial fill as follows: Fine to coarse sand with lenses of small gravel
35	65	Fine to coarse sand with lenses of black silt
65	75	silt lense - grey color
75	132	Fine to coarse sand with gravel streaks and small boulders - red/brown color
132	135	Rock Granite - grey color

TOTAL DEPTH OF BORING 135 (Feet)
TOTAL DEPTH OF COMPLETED WELL 132 (Feet)

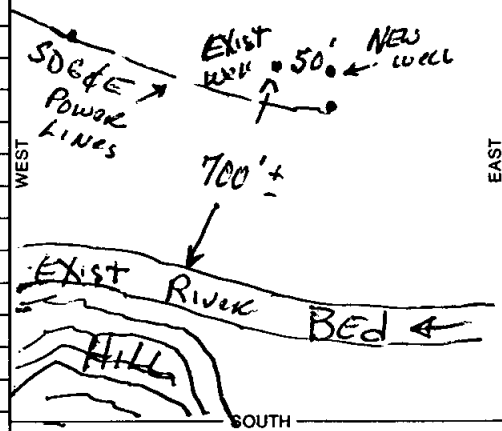
WELL OWNER

Name City of San Diego
Mailing Address Mail Sta 51 A Security Pacific
CITY San Diego Calif. 92101-4199 STATE ZIP

WELL LOCATION

Address Old San Pasqual Rd'
City San Diego
County San Diego
APN Book 241 Page 100 Parcel 31
Township 12S Range 1W Section 31
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Material Under "GEOLOGIC LOG")

PLANNED USE(S) (✓)

___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
X Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 12 (Ft.) & DATE MEASURED 7/27/93
ESTIMATED YIELD* 700± (GPM) & TEST TYPE airlift
TEST LENGTH 6 (Hrs.) TOTAL DRAWDOWN 100 (Ft.)
** May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	36			X		A0120	23.5	.250	
0	72	24	X				ASTMF480	12	C-150	
72	132	24		X			ASTMF480	12	C-150	.097

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
0	132				3/8 pac

ATTACHMENTS (✓)

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

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 Fain Drilling & Pump Co Inc (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
12029 Old Castle Rd. Valley Center, Ca 92082
ADDRESS CITY STATE ZIP

Signed Joe R Fain (WELL DRILLER/AUTHORIZED REPRESENTATIVE) 7/30/93 (DATE SIGNED) 328287 (C-57 LICENSE NUMBER)

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR 012S001W31B006S

Page 1 of 1

Owner's Well No. 2

Date Work Began 6/17/94, Ended 6/24/94

Local Permit Agency County Health Dept

Permit No. W62747 Permit Date 6/15/94

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 463737

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

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

DEPTH TO FIRST WATER ukn (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	15	fine grained sand - brown colo
15	40	fine to coarse sand with small boulders
40	68	Grey silty sand
68	75	coarse sand and gravel
75	90	partly cemented sand
90	131	fine to coarse sand with some boulders

TOTAL DEPTH OF BORING 131 (Feet)

TOTAL DEPTH OF COMPLETED WELL 128 (Feet)

WELL OWNER

Name Am-Sod Floyd Wirthlin

Mailing Address 2606 Hollister Street

San Diego, Calif. 92154

CITY STATE ZIP

WELL LOCATION

Address 15023 Old San Pasqual Rd

City San Diego

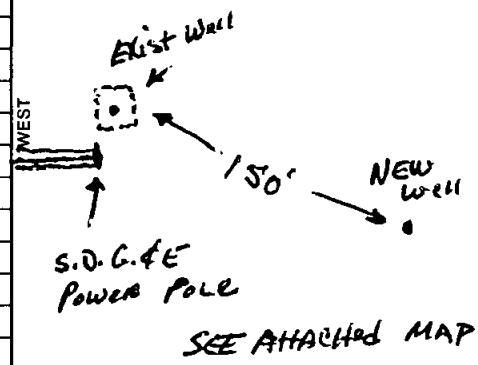
County San Diego

APN Book 241 Page 100 Parcel 31

Township 13S Range 2W Section 31

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

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

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

PLANNED USE(S) (✓)

___ MONITORING

WATER SUPPLY

___ Domestic

___ Public

X Irrigation

___ Industrial

___ "TEST WELL"

___ CATHODIC PROTECTION

___ OTHER (Specify)

DRILLING METHOD Rotary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 26 (Ft.) & DATE MEASURED 6/24/94

ESTIMATED YIELD* 1000 (GPM) & TEST TYPE pump

TEST LENGTH 8 (Hrs.) TOTAL DRAWDOWN 65 (Ft.)

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

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL/ GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	32	X				A-53-B	23.5	.250	
0 68	68 128	23 23		X	X		F480 F480	11.5 11.5	C150 C150	.094

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	128	Gravel			5/16x7

ATTACHMENTS (✓)

___ Geologic Log

___ Well Construction Diagram

___ Geophysical Log(s)

___ Soil/Water Chemical Analyses

X Other Map

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 Fain Drilling & Pump Co Inc
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

12029 Old Castle Rd. Valley Center, Ca 92082
ADDRESS CITY STATE ZIP

Signed Joe R Fain
WELL DRILLER/AUTHORIZED REPRESENTATIVE

7/20/94 DATE SIGNED

328387 C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

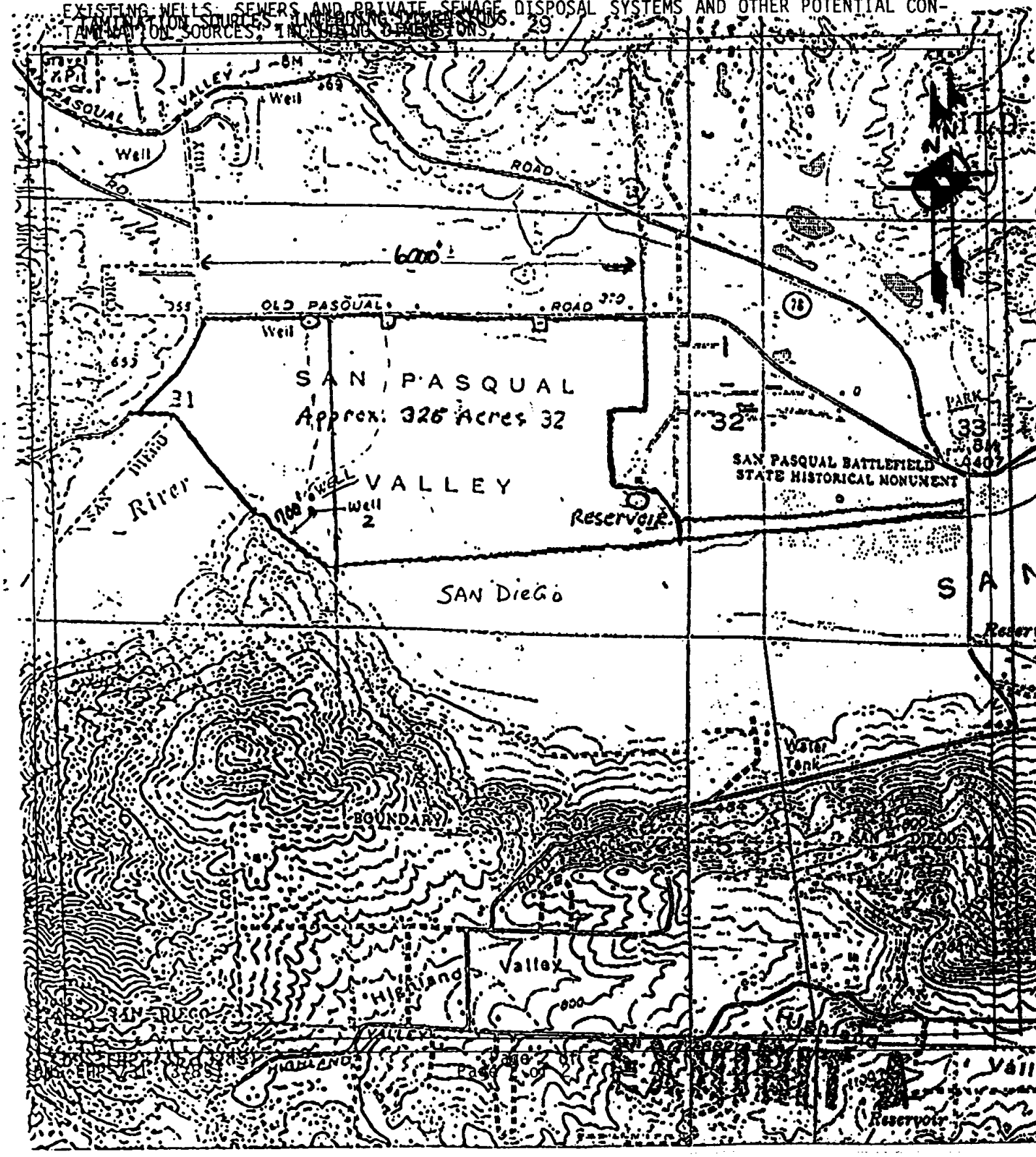
WELL PERMIT APPLICATION

Control # W62747

Assessor's Parcel No. 241-100-31

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

RECEIVED
SEP 01 2004
County of San Diego
Dept. of Environmental Health

DEH USE ONLY
PERMIT # WLWEL 16208
WELL COMPUTER #
FEE: #390
WATER DIST: n/a

OWNER- City of San Diego
LEASEE

1. Property Owner: AM-Sod Phone: 760 497-8873
P.O. Box 300638 (Mailing Address) Escondido (City) 92027 (Zip)

2. Well Location - Assessors Parcel Number 241-100-31
15023 Old San Pasqual Rd (Site Address) San Diego (City) (Zip)

3. Well Contractor - Well Driller Joe Fain Company Name: Fain Drilling
12029 Old Castle Rd (Mailing Address) Valley Center (City) 92082 (Zip)
Phone#: 760-749-0701 C-57#: 328287 ☐ Cash Deposit ☒ Bond Posted

4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other AG-WEL

5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd

6. Type of Equipment: Rotary

7. Depth of Well: Proposed: 130' Existing: 0

8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: PVC	☒ Yes ☐ No	☒ Yes ☐ No	
Depth: 130	Depth: 20 ft.	From: 20 To: 130	From: 170 To: 130
Diameter 16 in.	Diameter 24 in.	Type: 5/16 X 16	From: To:
Wall/Gauge: .616	Wall/Gauge: .250	Wall/Gauge: N/A	From: To:

9. Annular Seal: Depth: 20 ft. Sealing Material: CEMENT
Borehole diameter: 32 in. Conductor diameter: 24 in. Annular Thickness 4 in.

10. Date of Work: Start: SEPT. 2004 Complete: SEPT. 2004

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Joe R. Fain Date: Aug-31-2004

LWEL-16208

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

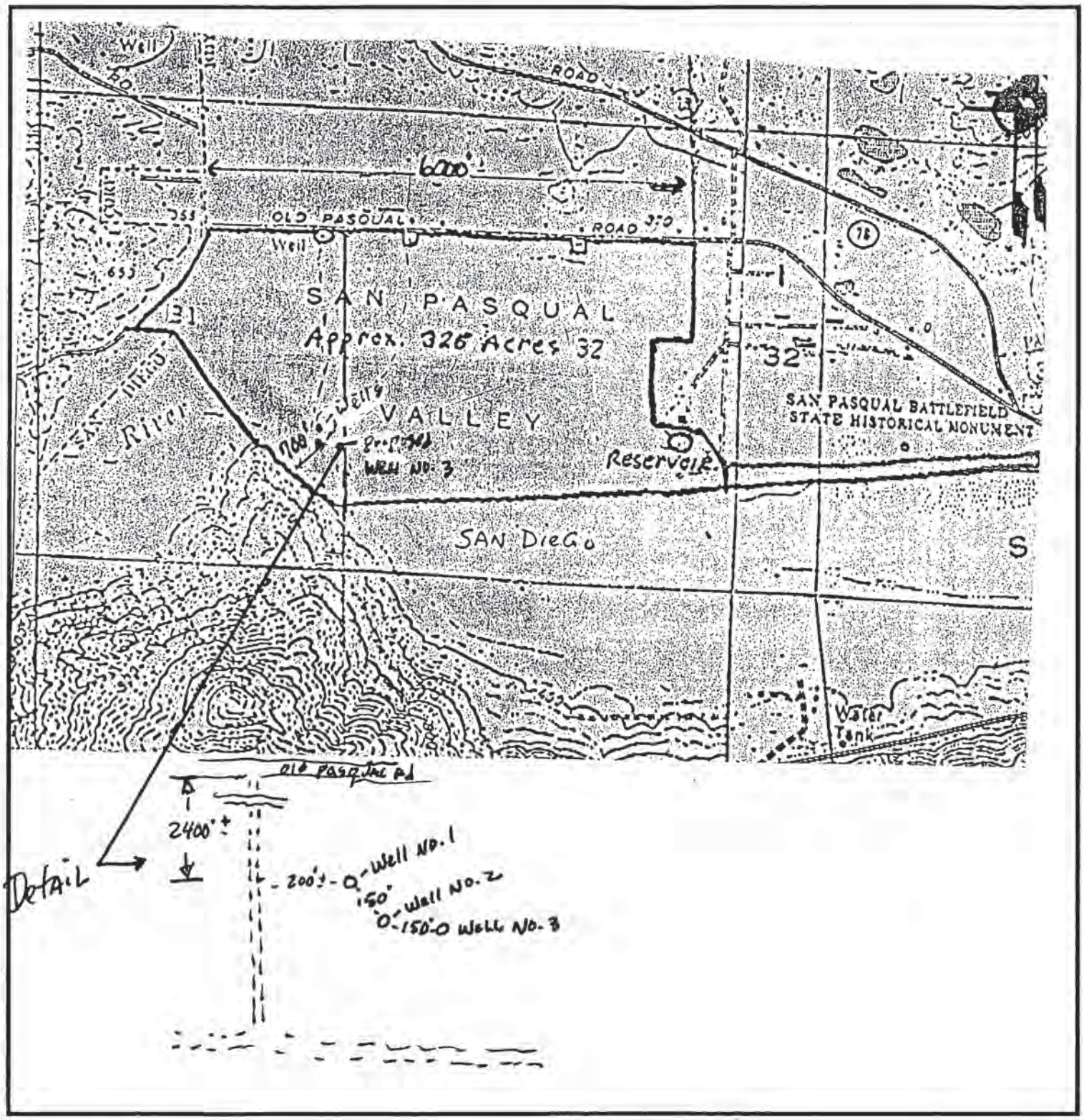
Specialist: N. Learning Date: 9/1/04

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWQ 16208
Assessor's Parcel Number: 241-100-31

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



LWL 16208 Kiva ent. 2/2/05 NS File 241-100-31

QUADRUPLICATE
For Local Requirements

Page 1 of 1
Owner's Well No. 3

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 0909563

Date Work Began 10-8-04, Ended 10-16-04
Local Permit Agency DEH
Permit No. 16209 Permit Date 9-1-04

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Gel

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
		ALLUVIAL FILL AS FOLLOWS:
0	15	Fine grained sand and silt Brown Color
15	40	Fine to coarse sand with small boulders
40	69	Grey silty sand
69	75	Coarse sand - some small gravel
75	90	Sand - partly cemented
90	136	Fine to coarse sand with some boulders

Completed Well Construction
Date 2/2/05
Date Inspected 2/1/05
Comments
W. Stearns
Water Sample Taken? N
Reviewed By

TOTAL DEPTH OF BORING 136 (Feet)
TOTAL DEPTH OF COMPLETED WELL 136 (Feet)

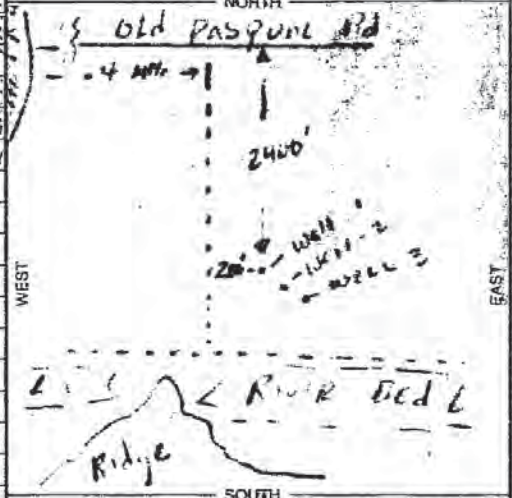
WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

WELL LOCATION

Address [redacted] ESCONDIDO
City San Diego
County San Diego
APN Book 241 Page 100 Parcel 24
Township 13S Range 3W Section 31
Lat ___ DEG. ___ MIN. ___ SEC. N Long ___ DEG. ___ MIN. ___ SEC. W

LOCATION SKETCH



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")

USES (✓)

WATER SUPPLY
___ Domestic ___ Public
X 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 UKN (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 36 (Ft.) & DATE MEASURED 10/16/04
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (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)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	32	X				Steel	23.5	.375	
0	78	24	X				PVCF480	15	.661	
78	138	24		X			PVCF480	15	.661	.125

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	136				3/8 Gravel

ATTACHMENTS (✓)

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

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 Pain Drilling & Pump Co. Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 12029 Old Castle Rd. CITY Valley Center STATE Ca ZIP 92082

Signed [signature] 10/19/04
C-57 LICENSED WATER WELL CONTRACTOR — DATE SIGNED — C-57 LICENSE NUMBER

DWR 155 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # WEL 18465
WELL COMPUTER #
FEE:
WATER DIST:

1. Property Owner: SAN PASQUAL VALLEY RANCH Phone: 760 743-2377
2460 CLOVERDALE RD (Mailing Address) ESCONDIDO (City) 92027 (Zip)

2. Well Location - Assessors Parcel Number 241-081-08
SAME (Site Address) (City) (Zip)

3. Well Contractor - Well Driller JOHN A. WARDEN Company Name: WARDEN DRILLING
P.O. BOX 177 (Mailing Address) RAMONA (City) 92065 (Zip)
Phone#: 760-789-2539 C-57#: 681782 ☑ Cash Deposit ☐ Bond Posted

4. Use: ☐ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other AG.

5. Type of Work: ☑ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd

6. Type of Equipment: MUD ROTARY

7. Depth of Well: Proposed: 200' Existing: 0'

8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: PVC	☐ Yes ☑ No	☐ Yes ☑ No	
Depth: 60'	Depth: ft.	From: To:	From: To:
Diameter 6" in.	Diameter in.	Type:	From: To:
Wall/Gauge: SCH 40	Wall/Gauge:	Wall/Gauge:	From: To:

9. Annular Seal: Depth: 60 ft. Sealing Material: BENTONITE
Borehole diameter: 12 3/4" in. Conductor diameter: in. Annular Thickness 24 in.

10. Date of Work: Start: 8-13-07 Complete: 8-16-07

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: John A. Warden Date: 8-13-07

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

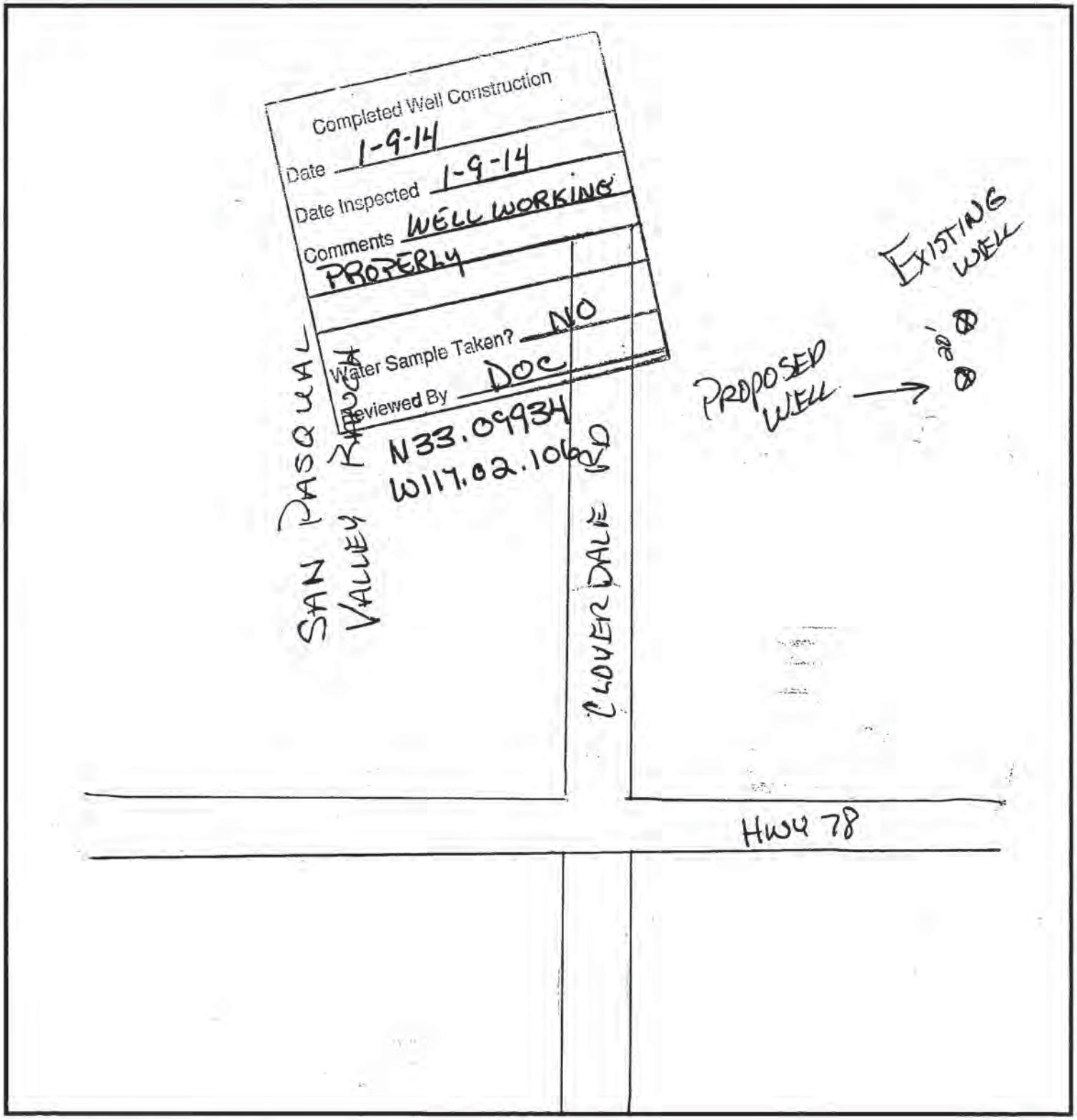
Specialist: N. Sean Date: 8/13/07

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWEL 18465
Assessor's Parcel Number: 241-081-08

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

RECEIVED
SEP 01 2004
County of San Diego
Dept. of Environmental Health

DEH USE ONLY
PERMIT # WLWEL 16208
WELL COMPUTER #
FEE: #390
WATER DIST: n/a

OWNER- City of San Diego
LEASEE

1. Property Owner: AM-Sod Phone: 760 497-8873
P.O. Box 300638 (Mailing Address) Escondido (City) 92027 (Zip)

2. Well Location - Assessors Parcel Number 241-100-31
15023 Old San Pasqual Rd (Site Address) San Diego (City) (Zip)

3. Well Contractor - Well Driller Joe Fain Company Name: Fain Drilling
12029 Old Castle Rd (Mailing Address) Valley Center (City) 92082 (Zip)
Phone#: 760-749-0701 C-57#: 328287 ☐ Cash Deposit ☒ Bond Posted

4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other AG-WEL

5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd

6. Type of Equipment: Rotary

7. Depth of Well: Proposed: 130' Existing: 0

8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: PVC	☒ Yes ☐ No	☒ Yes ☐ No	
Depth: 130	Depth: 20 ft.	From: 20 To: 130	From: 170 To: 130
Diameter 16 in.	Diameter 24 in.	Type: 5/16 X 16	From: To:
Wall/Gauge: .616	Wall/Gauge: .250	Wall/Gauge: N/A	From: To:

9. Annular Seal: Depth: 20 ft. Sealing Material: CEMENT
Borehole diameter: 32 in. Conductor diameter: 24 in. Annular Thickness 4 in.

10. Date of Work: Start: SEPT. 2004 Complete: SEPT. 2004

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Joe R. Fain Date: Aug-31-2004

LWEL-16208

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

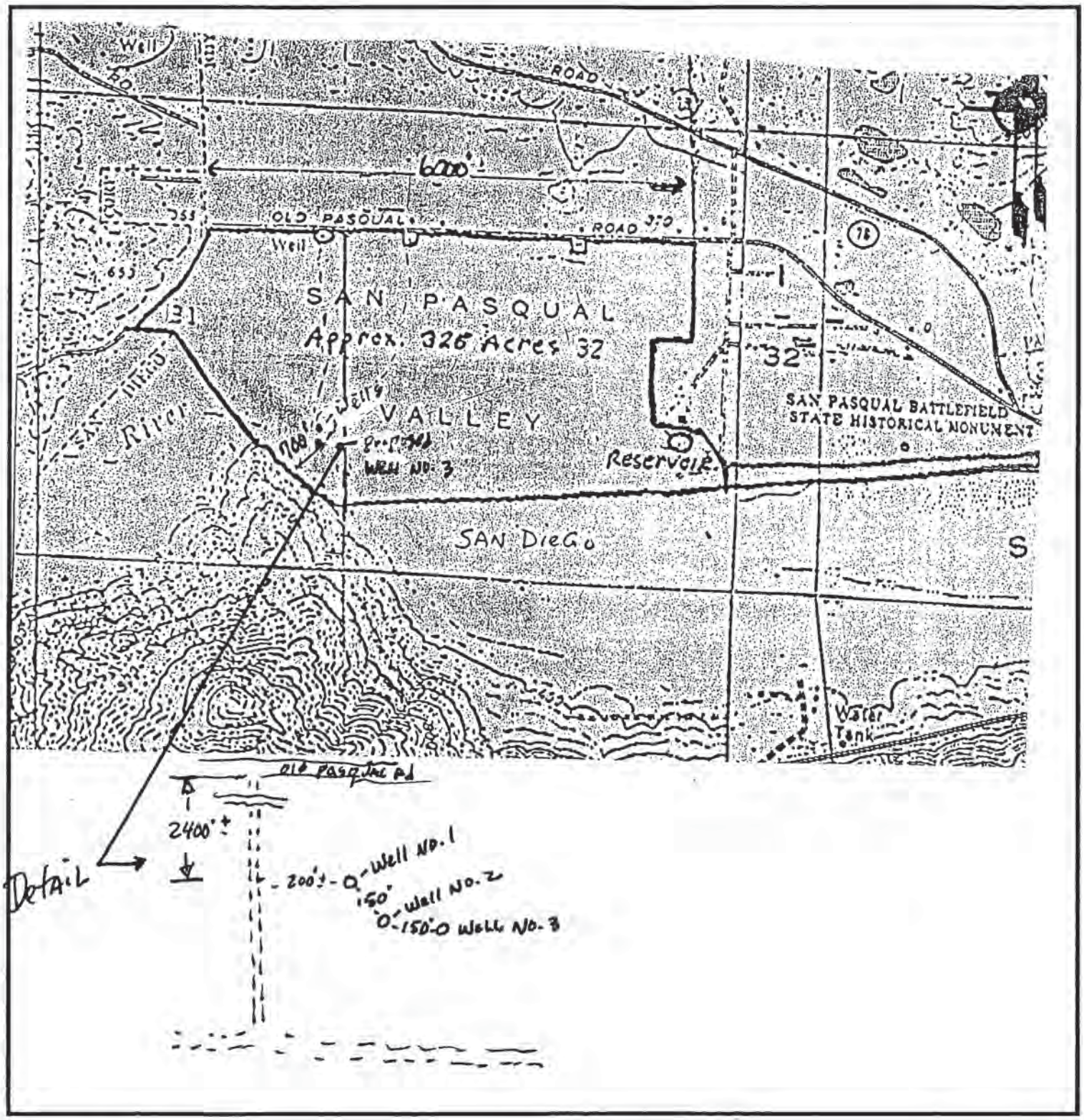
Specialist: N. Learning Date: 9/1/04

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWQ 16208
Assessor's Parcel Number: 241-100-31

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



LWL 16208 Kiva ent. 2/2/05 NS File 241-100-31

QUADRUPLICATE
For Local Requirements

Page 1 of 1
Owner's Well No. 3

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 0909563

Date Work Began 10-8-04, Ended 10-16-04
Local Permit Agency DEH
Permit No. 16209 Permit Date 9-1-04

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Gel

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
		ALLUVIAL FILL AS FOLLOWS:
0	15	Fine grained sand and silt Brown Color
15	40	Fine to coarse sand with small boulders
40	69	Grey silty sand
69	75	Coarse sand - some small gravel
75	90	Sand - partly cemented
90	136	Fine to coarse sand with some boulders

Completed Well Construction
Date 2/2/05
Date Inspected 2/1/05
Comments
W. Stearns
Water Sample Taken? N
Reviewed By

TOTAL DEPTH OF BORING 136 (Feet)
TOTAL DEPTH OF COMPLETED WELL 136 (Feet)

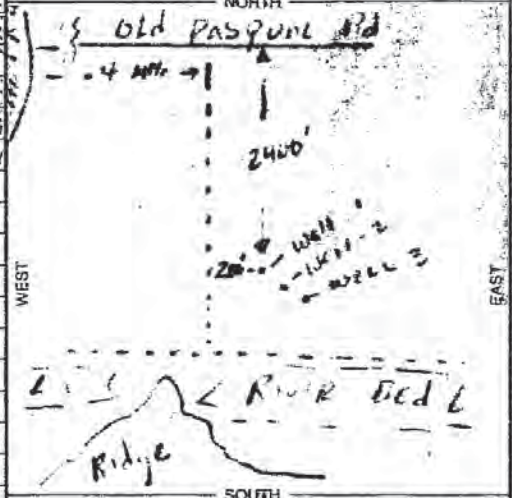
WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

WELL LOCATION

Address [redacted] ESCONDIDO
City San Diego
County San Diego
APN Book 241 Page 100 Parcel 24
Township 13S Range 3W Section 31
Lat ___ DEG. ___ MIN. ___ SEC. N Long ___ DEG. ___ MIN. ___ SEC. W

LOCATION SKETCH



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")

USES (✓)

WATER SUPPLY
___ Domestic ___ Public
X 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 UKN (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 36 (Ft.) & DATE MEASURED 10/16/04
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (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)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	32	X				Steel	23.5	.375	
0	78	24	X				PVCF480	15	.661	
78	138	24		X			PVCF480	15	.661	.125

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	136				3/8 Gravel

ATTACHMENTS (✓)

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

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 Pain Drilling & Pump Co. Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 12029 Old Castle Rd. CITY Valley Center STATE Ca ZIP 92082

Signed [signature] 10/19/04
C-57 LICENSED WATER WELL CONTRACTOR — DATE SIGNED — C-57 LICENSE NUMBER

DWR 155 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # WEL 18465
WELL COMPUTER #
FEE:
WATER DIST:

1. Property Owner: SAN PASQUAL VALLEY RANCH Phone: 760 743-2377
2460 CLOVERDALE RD (Mailing Address) ESCONDIDO (City) 92027 (Zip)

2. Well Location - Assessors Parcel Number 241-081-08
SAME (Site Address) (City) (Zip)

3. Well Contractor - Well Driller JOHN A. WARDEN Company Name: WARDEN DRILLING
P.O. BOX 177 (Mailing Address) RAMONA (City) 92065 (Zip)
Phone#: 760-789-2539 C-57#: 681782 ☑ Cash Deposit ☐ Bond Posted

4. Use: ☐ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other AG.

5. Type of Work: ☑ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd

6. Type of Equipment: MUD ROTARY

7. Depth of Well: Proposed: 200' Existing: 0'

8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: PVC	☐ Yes ☑ No	☐ Yes ☑ No	
Depth: 60'	Depth: ft.	From: To:	From: To:
Diameter 6" in.	Diameter in.	Type:	From: To:
Wall/Gauge: SCH 40	Wall/Gauge:	Wall/Gauge:	From: To:

9. Annular Seal: Depth: 60 ft. Sealing Material: BENTONITE
Borehole diameter: 12 3/4" in. Conductor diameter: in. Annular Thickness 24 in.

10. Date of Work: Start: 8-13-07 Complete: 8-16-07

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: John A. Warden Date: 8-13-07

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

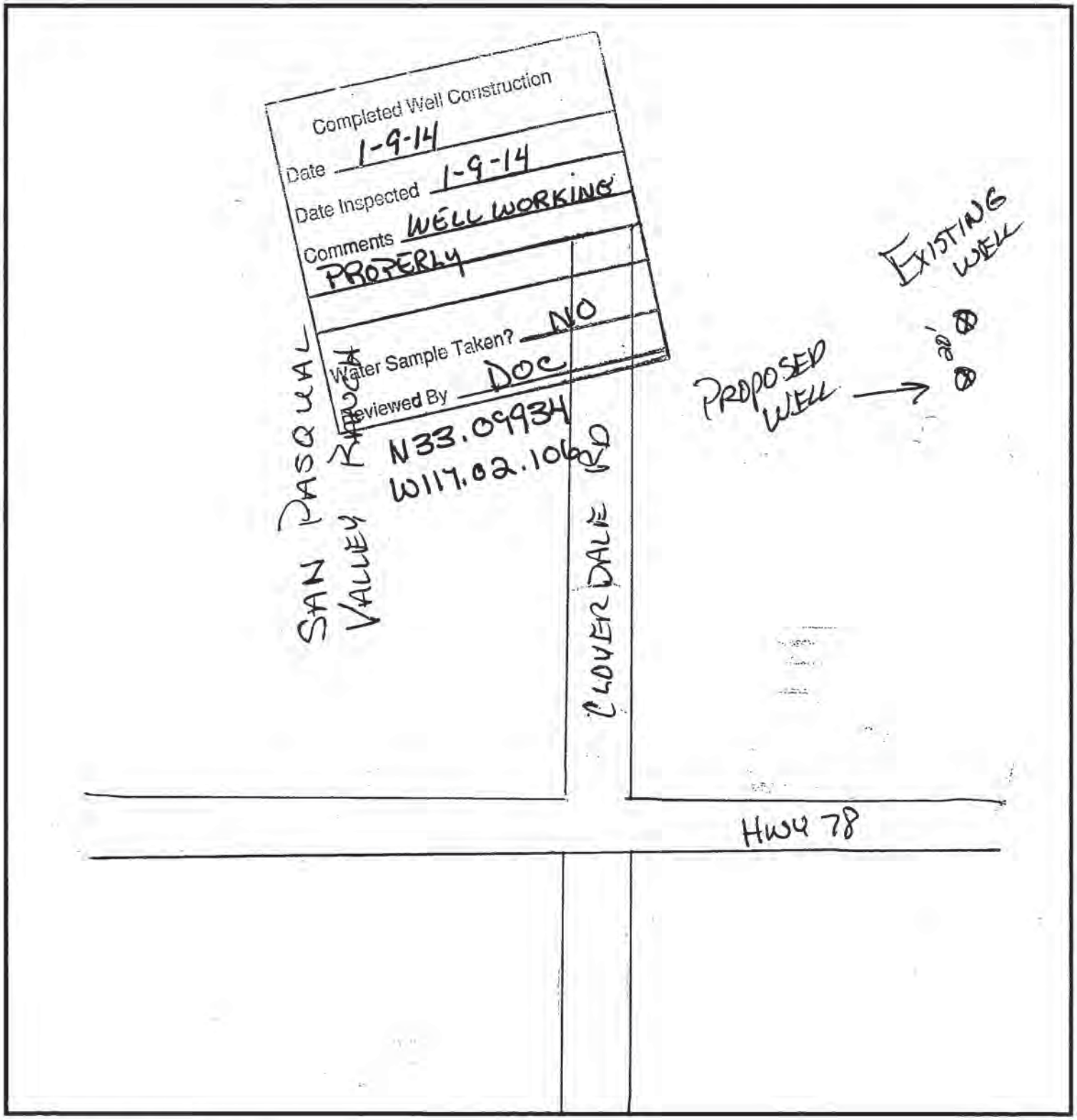
Specialist: N. Sean Date: 8/13/07

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWEL 18465
Assessor's Parcel Number: 241-081-08

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

013S001W04H001S

Do not fill in

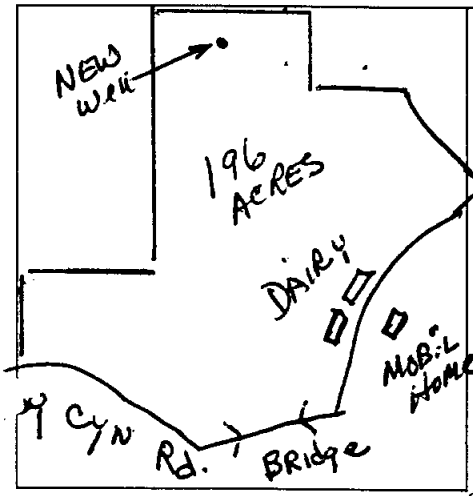
No. 341173

Notice of Intent No. _____
Local Permit No. or Date W6/241

State Well No. _____
Other Well No. _____

(1) OWNER: Name Bert Verger Dairy
Address 16777 Bandy Canyon Rd
City Escondido, California ZIP 92025

(2) LOCATION OF WELL (See instructions):
County San Diego Owner's Well Number _____
Well address if different from above same
Township 12 S Range 1 W Section 34
Distance from cities, roads, railroads, fences, etc.: approx 2000' N. Bandy Cyn Rd Bridge (on Bandy Cyn Rd.) behind dairy



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 ☐
Municipal ☐
Other ☐
(Describe)

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

(6) GRAVEL PACK:
Yes ☒ No ☐ Size 5/16x4
Diameter of bore 24
Packed from 20 to 174 ft.

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

From ft.	To ft.	Dia. in.	Gage or Wall
0	21	24	.250
0	176	12	.375

(8) PERFORATIONS:
Stainless steel screens

From ft.	To ft.	Slot size
110	170	.060

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval _____ ft.
Method of sealing cemented

(10) WATER LEVELS:
Depth of first water, if known ukn ft.
Standing level after well completion 35 ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? Same
Type of test Pump ☒ Bailer ☐ Air lift ☐
Depth to water at start of test 35 ft. At end of test 90 ft.
Discharge 700 gal/min after 6 hours Water temperature ukn
Chemical 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 174 ft. Completed depth 174 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	40	fine to coarse sand
40	60	silty sand (black color)
60	80	fine to coarse sand with some gravel lenses
80	90	fine black silt
90	105	fine to coarse sand with some small boulders
105	123	sand and boulders
123	155	partly cemented sand and boulders
155	164	fine to coarse sand with gravel
164	174	decomposed granite and boulders

Work started 2/5/ 19 90 Completed 2/11/ 19 90

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 Joe R Fain (Well Driller)
NAME Fain drilling & Pump Co. Inc. (Person, firm, or corporation) (Typed or printed)
Address 12029 Old Castle Rd.
City Valley Center, California ZIP 92082
License No. 328287 Date of this report 3/10/90

DWR 188 (REV. 12-86) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 86 96355

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

WELL PERMIT APPLICATION

WC#1785

APN 760-170-48
Control # 4161888

TYPE OF WORK (Check)		USE (Check)				EQUIPMENT (Check)	
New Well	☒	Individual Domestic	☐			Rotary	☒
Repair or Modification	☐	Agricultural	☒	Community	☐	Cable Tool	☐
Time Extension	☐	Industrial	☐	Other		Other	☐
Destruction	☐						

PROPOSED WELL DEPTH
Max. 170 Min. 160 (Feet)

PROPOSED CASING
Type STEEL Depth 160 Diameter 10" Wall or Gage .375"

PROPOSED SEALING ZONE(S)
From 0 to 20 Feet
From _____ to _____ Feet
From _____ to _____ Feet

PROPOSED PERFORATIONS OR SCREEN
From 120 to 150 Feet
From _____ to _____ Feet
From _____ to _____ Feet
From _____ to _____ Feet

SEALING MATERIAL (Check)
Neat Cement Grout ☐ Bentonite Clay ☐
Sand Cement Grout ☒ Concrete ☐
Other-Specify: _____

DATE OF WORK
Start AUG- 1991
Completion AUG- 1991

NAME OF WELL OWNER
BERT VERGER DAIRY 747-3827

NAME OF WELL DRILLER
Joe R. Fain 749-0701

LOCATION OF WELL VERGER DAIRY FARM
16777 Bandy Cyn Rd - ESC

COMPANY
Fain Drilling & Pump Co.

BUSINESS ADDRESS
12029 Old Castle Rd - Valley Center

LICENSE NUMBER
328287

Cash Deposit ☐
Bond Posted ☒

$220 Fee paid on 08-14-91

DISPOSITION OF APPLICATION
(FOR HEALTH OFFICERS USE ONLY)

☐ APPROVED ☐ DENIED

☒ APPROVED WITH CONDITIONS

Report Reason(s) for Denial or Necessary Conditions Here:
1) Well to be installed to all County & State water well Standards Bulletin 74-81.
2) This well will not meet the minimal standards of a public water supply source and shall not be used as a source of water for uses requiring an approved public water supply.

M. Ledgh
HEALTH OFFICER

8-19-91
DATE

I hereby agree to comply with all regulations of the Department of Health Services and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Health Services with a complete and accurate log of the well.

Joe R. Fain
APPLICANT'S SIGNATURE

Aug - 7 - 91
DATE

VERGER DAIRY FARM

LWEL-1785

08-14-91

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

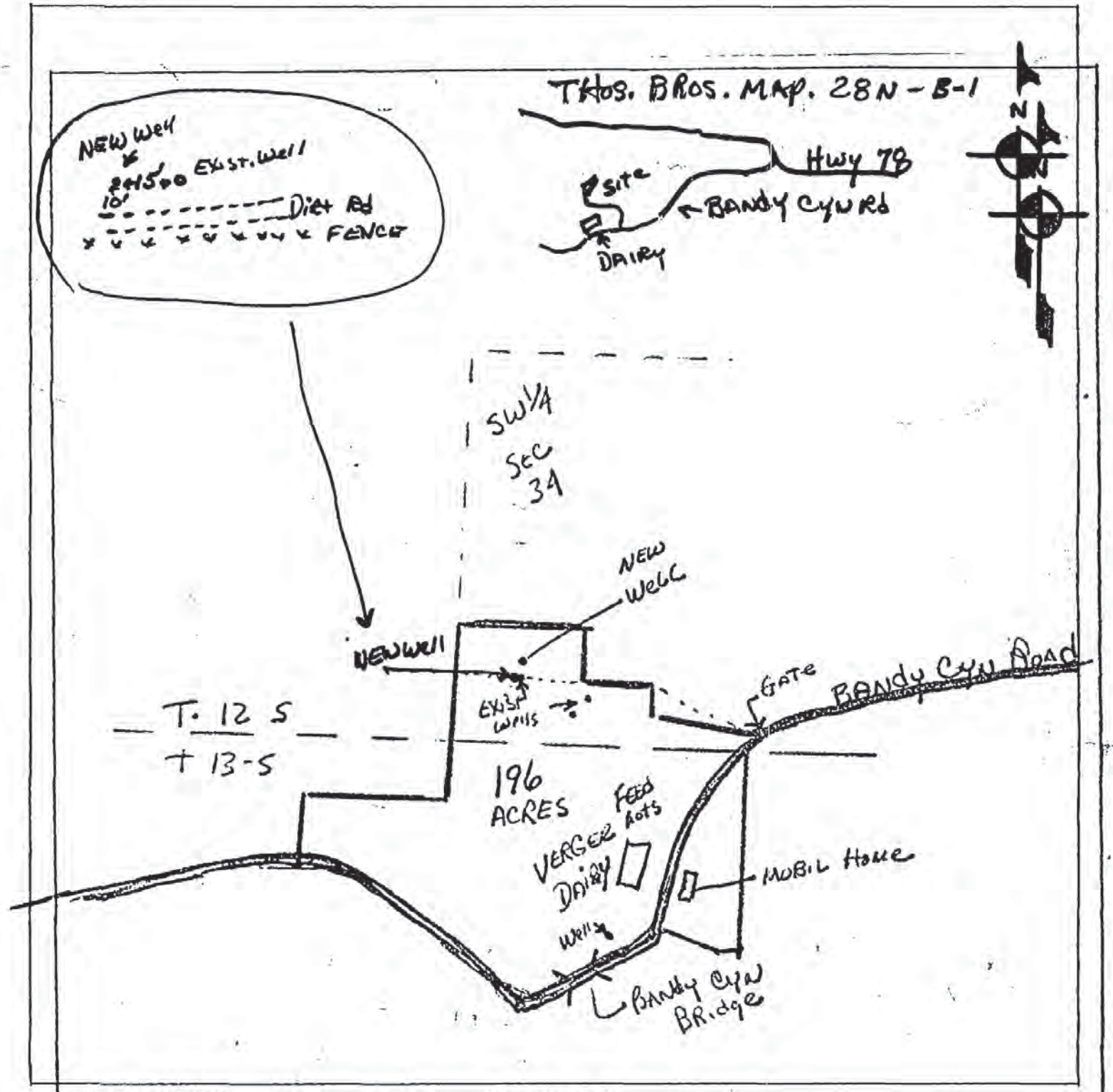
WELL PERMIT APPLICATION

Control # W618 88

Assessor's Parcel No. 760-170-48

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



DHS:EHP-731 (3/85) Page 2 of 2

WDR to Regn
10-18-91
ph

QUADRUPLICATE
Use to comply with local requirements

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

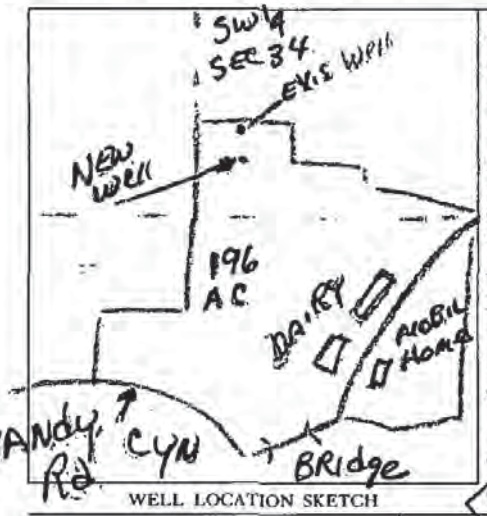
Do not fill in
No. 353081

Notice of Intent No.
Local Permit No. or Date W61888

State Well No.
Other Well No.

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

(2) LOCATION OF WELL (See instructions):
County San Diego Owner's Well Number
Well address if different from above Same
Township 12 S Range 1 W Section 34
Distance from cities, roads, railroads, fences, etc. Approx. .5 miles South Hwy 76 off Bandy Cyn Rd. SW¼ sec 34 Thos Bros map 28N-B-1



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 ☐
Municipal ☐
Other ☐
(Describe)

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

(6) GRAVEL PACK:
Yes ☒ No ☐ Size 5/16x4
Diameter of bore 18
Packed from 20 ft. to 160 ft.

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

From ft.	To ft.	Dia. in.	Gage or Wall
0	21	18	.250
0	160	10	.375

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

From ft.	To ft.	Slot size
100	150	.060

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval ft.
Method of sealing cemented

(10) WATER LEVELS:
Depth of first water, if known 50? ft.
Standing level after well completion 45 ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? Same
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test 45 ft. At end of test 150 ft.
Discharge 800+ gal/min after 6 hours Water temperature ukn
Chemical 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 160 ft. Completed depth 160 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
		Alluvial fill as follows:
0	35	Fine to coarse sand and silt Grey color
35	45	Reddish clay and gravel
45	75	fine to coarse sand with lenses of clay and silt - dark grey color
75	95	Partly cemented sand with some boulders - dark grey color
95	135	fine to coarse sand with small rocks and boulders
135	160	fine to coarse sand - partly cemented - dark grey color

Completed Well Construction
Date 10-28-91
Date Inspected 10-28-91
Comments Ag. Well / evidence of Annular Seal verified.
Water Sample Taken? NO
Reviewed By M. Sedgh

Work started 8/6/ 19 91 Completed 8/13/ 19 91

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 (Well Driller)
NAME Fain Drilling & Pump Co. Inc. (Person, firm, or corporation) (Typed or printed)
Address 12029 Old Castle Rd.
City Valley Center, California ZIP 92082
License No. 328287 Date of this report 8/23/91

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

DEH2016-LWELL-001332

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

Received
MAR 28
County of San Diego
Dept. of Environmental Health
Land & Water Quality Div

DEH USE ONLY
PERMIT #
FEE: $535.00
WATER DIST:

1. Property Owner: WHMAN RANCH Phone: WH - 760-644-6887
Mailing Address: PO BOX 1959 City: ESCONDIDO State: CA Zip: 92025

2. Well Location - Assessors Parcel Number: 760-170-48 / 242-100-10
GPS Coordinates: (WGS-84 Decimal Degrees): 33°05'17"N / 116°58'31"W
Site Address: 0 Hwy 78 City: ESCONDIDO State: CA. Zip: 92025

3. Well Contractor/Driller: DAVE MATTHEWS Company Name: FAN DRILLING
Mailing Address: 12029 OLDCASTLE RD. City: VALLEY CENTER State: CA Zip: 92082
Phone: 760-749-0701 C-57 License No: 328287 ☐ Cash Deposit ☒ Bond Posted

4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Other:

5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd

6. Type of Equipment: MUD ROTARY

7. Depth of Well: Proposed: 160 Existing:

8: Proposed:

	Casing	Conductor Casing	Filter/Filler Material	Perforations
	Type: SS/LCS	☒ Yes ☐ No	☒ Yes ☐ No	From: 100 To: 160
	Depth: 160	Depth: 20	From: 0 To: 160	From: ____ To: ____
	Diameter: 10 in.	Diameter: 24 in.	Type: RANCHO	From: ____ To: ____
	Wall/Gauge: .375	Wall/Gauge: .250		

9. Annular Seal: Depth: 20 ft. Sealing Material: cement
Borehole Diameter: 32 in. Conductor Diameter: 24 in. Annular Thickness: 4 in.

10: Best Management Plan for confining well drilling waste on the project site provided? ☒ Yes ☐ No

11. Date of Work: Start: 3/28/16 Complete: 4/ 2016

On sites served by public water, contact the local water agency for meter protection requirements.
I hereby agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's report). I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Date: 3/21/16

DISPOSITION OF APPLICATION (Department of Environmental Health Use Only)

☒ Approved ☐ Denied Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

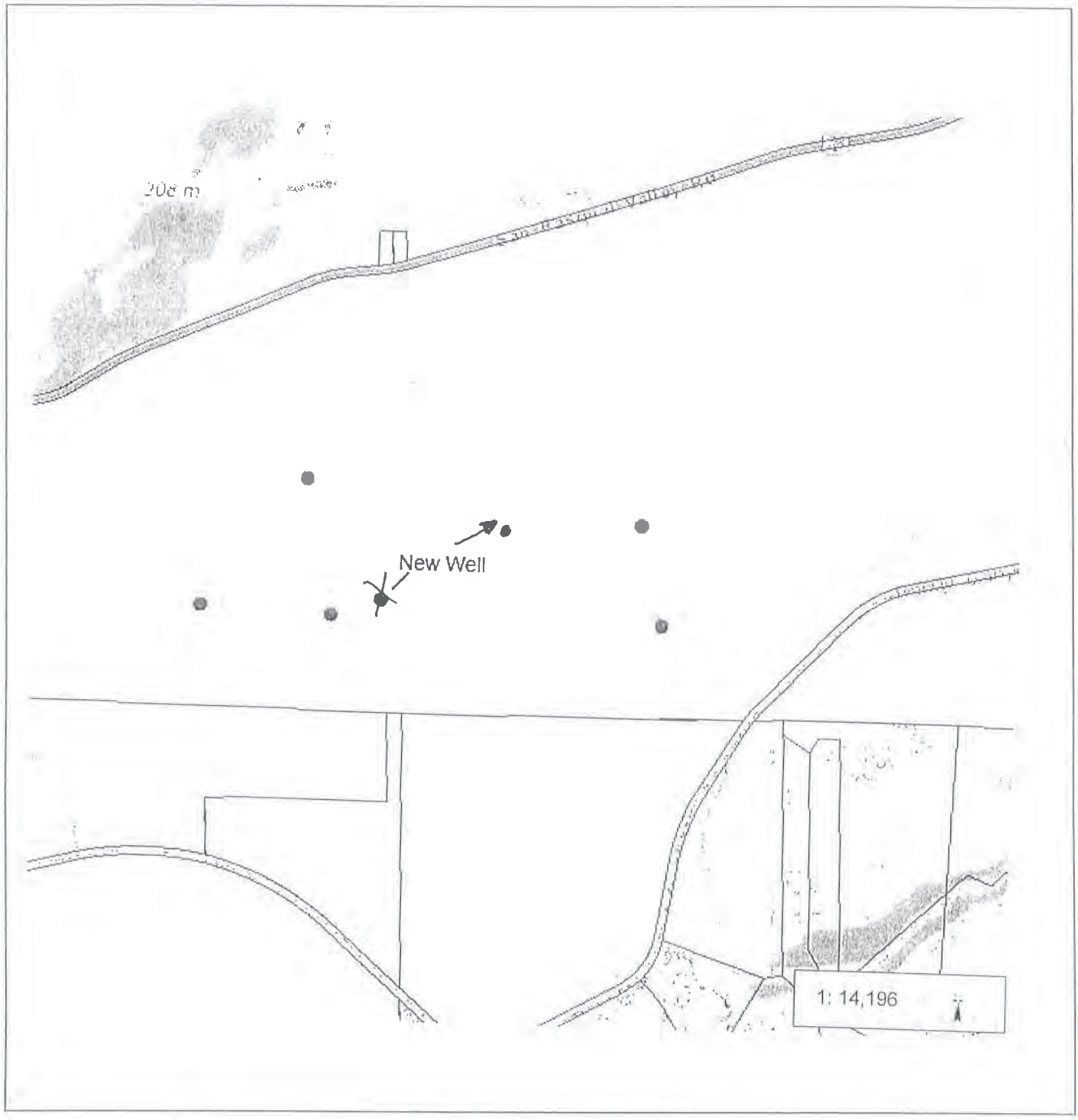
Specialist: Irina Portnaia Date: 3/28/16

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # LWELL - 001332
APN: 242-100-10

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.




33° 05' 01.77"N
116° 58' 31.61" W
new production well location
1745'
ed production well Location
© 2016 Google
Google earth
1994
Imagery Date: 4/14/2015 33°05'02.53" N 116°58'41.48" W elev 396 ft eye alt 2718 ft

County of San Diego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only

Well Permit Application Number: _____ Assessor's Parcel Number: 760-170-48
242-100-10

SECTION 1: Required Information from Contractor or Consultant:

Longitude & Latitude: 33.0501.177 N 116 58' 31.61 W How obtained? GPS Map Other

1. Are there any watercourses or water bodies within 50 feet of the limits of soil disturbance?	YES	NO
2. Does the plat show the project boundaries? (A "detail inset" is acceptable for a large parcel or lot.).	YES	NO
3. Does the plat show footprints of any existing structures and facilities within 100 feet of the wellhead position?	YES	NO
4. Does the plat show locations where run-off may enter stormdrains, drainage courses and/or receiving waters?	YES	NO
5. Is grading required to access site or install well?	YES	NO
6. Does the project conform to the local grading ordinance?	YES	NO
7. Will drilling additives be used to drill the well?	YES	NO
8. Are the Best Management Practices attached to this permit application? LARGE FIELD FOR DISCHARGE	YES	NO

SECTION 2. Best Management Practices

The goal of stormwater and discharge control management planning while drilling and installing wells is to reduce pollution to the maximum extent practicable using Best Management Practices (BMPs). Construction related materials, sediments, chemical residues such as drilling foam, wastes, and spills must be retained within the property boundaries to eliminate transport from the site to nearby streets, drainage courses, receiving waters and adjacent properties. It is the responsibility of the property owner and the contractor to determine which BMPs will be used in order to ensure that all contaminants are retained on-site.

Examples of Best Management Practices to contain well installation run-off include, but are not limited to, installation of a sediment basin to contain run-off, using geotextile fabric to contain sediments and drilling mud, or eliminating the use of drilling foam. (Website information is available at www.projectcleanwater.org)

SECTION 3. Certification

I have read and understand the following: *(Please check each box after concurrence.)*

- ☑ Selected BMP's will be implemented so that water quality is not negatively impacted by well construction activities.
- ☑ I am aware the selected BMP's must be installed, maintained, monitored and revised as necessary so they are effective.
- ☑ I understand that non-compliance with the San Diego County Watershed Protection Ordinance may result in enforcement actions by the County. These may include fines, citations, stop-work orders, or other actions.
- ☑ DEH inspectors and personnel from other regulatory agencies are authorized to enter my property at any time for purposes associated with this well permit until such time the well is completed to the satisfaction of DEH.
- ☑ Should DEH determine during the field review that the well installation procedures contradict this Discharge Management Plan or the well permit application, the well drilling permit may be suspended or revoked. Further activity will require a new permit fee and amendment to the existing permit.

Contractor _____ *Date* 3/21/16

Property Owner _____ *Date* 3-21-16

Reviewed by DEH _____ *Date* 3/28/16

*This free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0306251

Page One of One

Owner's Well Number 1332

Date Work Began 03/29/2016 Date Work Ended 4/5/2016

Local Permit Agency SD DEH

Permit Number LWELL-001332 Permit Date 3/28/16

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N W

Latitude Longitude

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	14	Grey Silty Sand
14	31	Grey Silty Sand w/ Grey Clay
31	46	Grey Clay
46	77	Course Grey Sand
77	88	Grey Clay
88	127	Grey & White Course Sand
127	129	Grey Clay & Wood
129	154	Compact Grey Sand
154	161	Grey Clay
161	167	Granite

Completed Well Construction

Date

Date Inspected Well present & in use via generator

Comments Pencil seal

N 33.08379°

W 116.97559°

Water Sample Taken? Yes 8/16/16

Reviewed By

Total Depth of Boring 167 Feet

Total Depth of Completed Well 165 Feet

Well Owner

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Well Location

Address 0 Hwy 78

City Escondido County San Diego

Latitude ___ ___ ___ N Longitude ___ ___ ___ W

Deg. Min. Sec. Deg. Min. Sec.

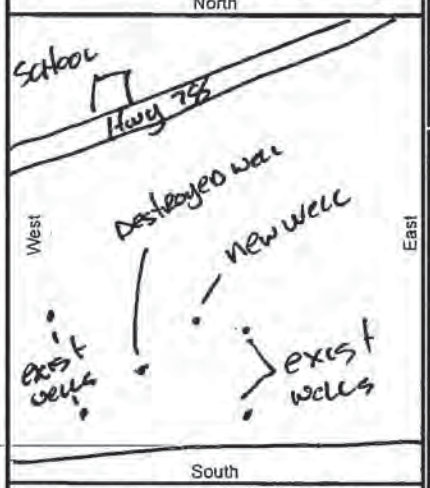
Datum ___ Dec. Lat. 33.0501 Dec. Long. 116.5831

APN Book 242 Page 100 Parcel 10

Township ___ Range ___ Section ___

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well

○ Modification/Repair

○ Deepen

○ Other

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

◉ Water Supply

☐ Domestic ☐ Public

☑ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

○ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other

Water Level and Yield of Completed Well

Depth to first water ___ (Feet below surface)

Depth to Static Water Level 72 (Feet) Date Measured 04/05/2016

Estimated Yield * 400 (GPM) Test Type Air Lift

Test Length 10.0 (Hours) Total Drawdown ___ (Feet)

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

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	20	32	Conductor	Low Carbon Steel	.250	24		
0	95	24	Blank	Low Carbon Steel	.375	12.75		
95	155	24	Screen	304 Stainless Steel	.250	12.75	Wire Wrap	0.060

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	95	Cement	
0	167	Filter Pack	Rancho

Attachments

☐ Geologic Log

☐ Well Construction Diagram

☐ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☑ Other Site Map

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 Fain Drilling & Pump Co., Inc

Person, Firm or Corporation

12029 Old Castle Rd Valley Center CA 92082

Address City State Zip

Signed ___ 4/7/2016 328287

C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

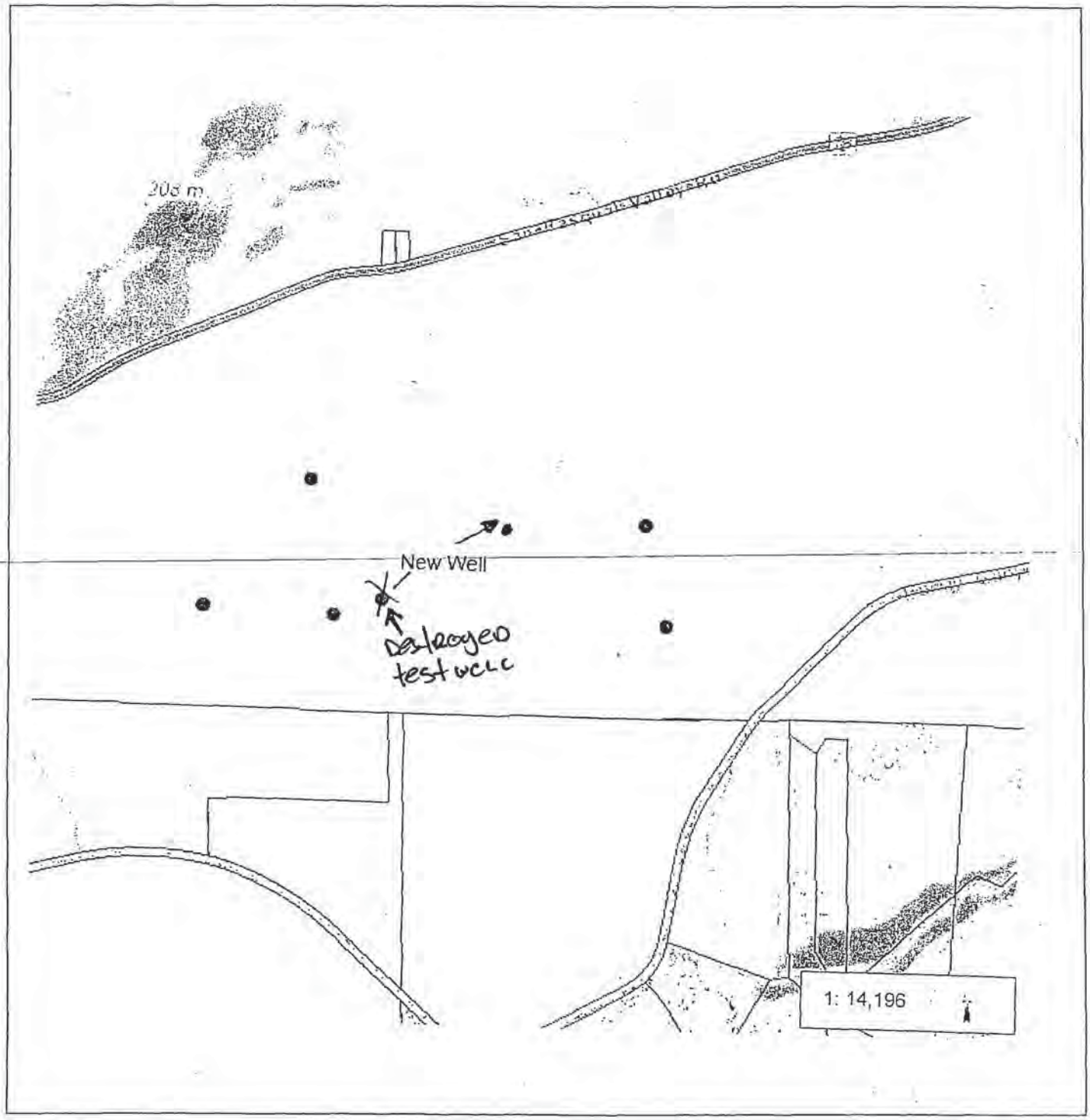
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # LWELL - 001332
APN: 242-100-10

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.



COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

RECEIVED
SEP 08 2004
County of San Diego
Dept of Environmental Health

DEH USE ONLY
PERMIT # WW 2L 16216
WELL COMPUTER #
FEE: #390
WATER DIST:

1. Property Owner: City of San Diego Phone: 4192366066
1200 3rd Ave Suite 1700 (Mailing Address) San Diego (City) 92101 (Zip)

2. Well Location - Assessors Parcel Number 276-04-001
16777 Bandy Cyn Rd (Site Address) Escondido (City) 92025 (Zip)

3. Well Contractor - Well Driller Art Widner Company Name: Art Widner Drilling
PO Box 300497 (Mailing Address) Escondido (City) 92030 (Zip)
Phone#: 760 749 2681 C-57#: 528518 ☒ Cash Deposit ☐ Bond Posted

4. Use: ☐ Private ☐ Public ☐ Industrial ☐ Cathodic ☒ Other Irrigation

5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd

6. Type of Equipment: Rotary

7. Depth of Well: Proposed: 125' Existing: —

8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel	☒ Yes ☐ No	☒ Yes ☐ No	
Depth: 120'	Depth: 22 ft.	From: 0 To: 125'	From: 45 To: 125
Diameter 12" in.	Diameter 24 in.	Type: 4x8	From: ____ To: ____
Wall/Gauge: 250	Wall/Gauge: 250	Wall/Gauge: ____	From: ____ To: ____

9. Annular Seal: Depth: 22 ft. Sealing Material: concrete
Borehole diameter: 34 in. Conductor diameter: 24 in. Annular Thickness 5" in.

10. Date of Work: Start: 9-13-04 Complete: 9-20-04

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: [signature] Date: 9-8-04

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: N. Seaman Date: 9/8/04

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

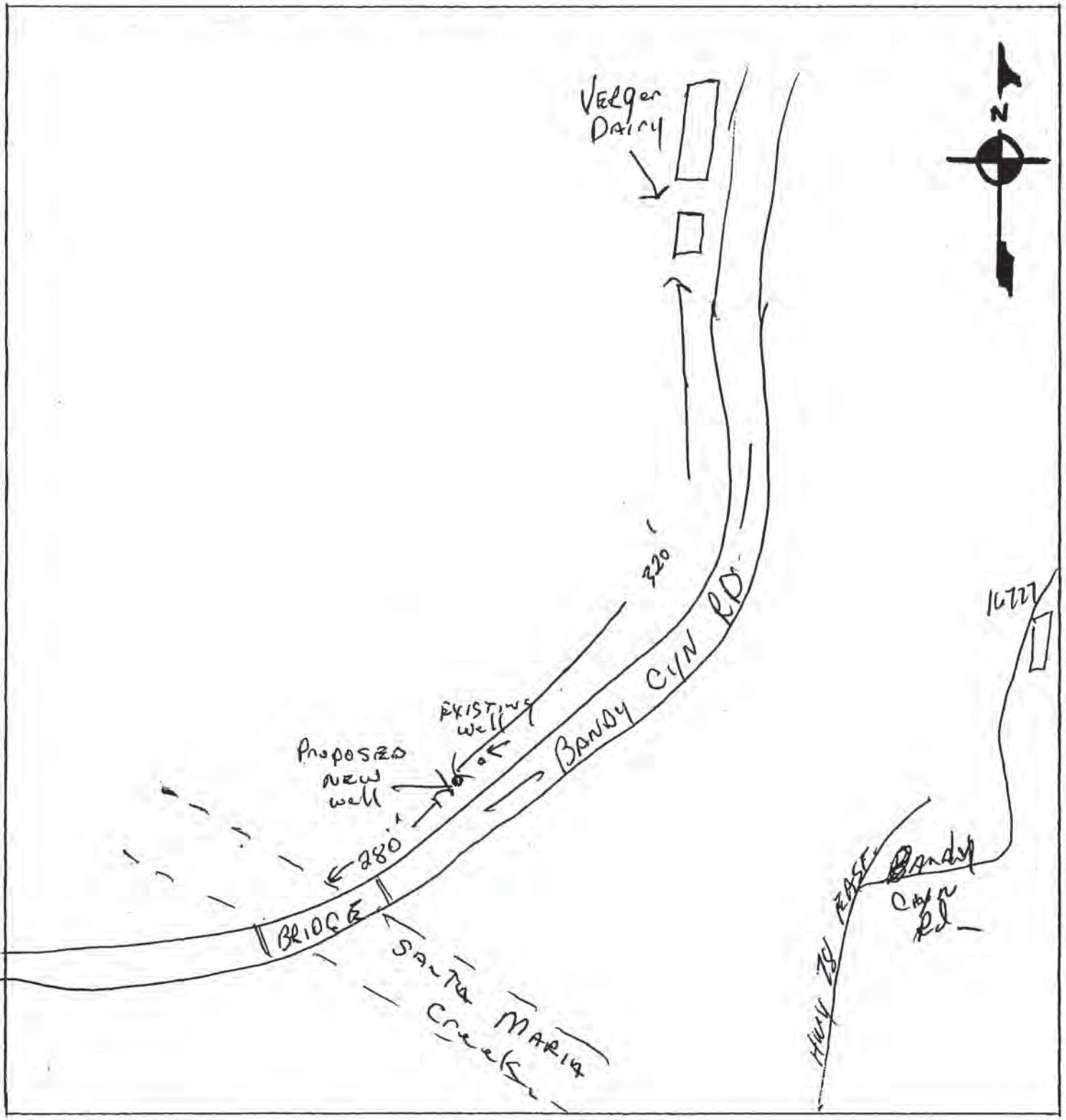
WELL PERMIT APPLICATION

Control # LWEL 16216

Assessor's Parcel No. 276-04-001

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



QUADRUPLICATE
For Local Requirements

Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 742809

Owner's Well No. _____

Date Work Began 9-8-04, Ended 9-15-04

Local Permit Agency San Marcos

Permit No. LWEL 16216 Permit Date 9-8-04

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

GEOLOGIC LOG

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

DRILLING METHOD mud rotary FLUID bentonite

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	5	top soil sand
6	17	sand, clay, boulders
18	28	sand, clay, boulders
29	51	sand, clay, some boulders
52	110	coarse gray sand&boulders
111	120	granite

TOTAL DEPTH OF BORING 120' (Feet)
TOTAL DEPTH OF COMPLETED WELL 112' (Feet)

WELL LOCATION

Address same as above
City _____
County _____
APN Book 276 Page 040 Parcel 01-00
Township 13-s Range 1w Section 7
Latitude 33.07545 DEG. MIN. SEC. Longitude 116.97439 DEG. MIN. SEC.

LOCATION SKETCH

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 (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USES (✓)

WATER SUPPLY
___ 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 unkn (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 20' (Ft.) & DATE MEASURED _____
ESTIMATED YIELD * _____ (GPM) & TEST TYPE _____
TEST LENGTH _____ (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)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	22	32"	x				steel	24"	250	-
0	52	24"	x				steel	10"	250	
52	112	24"		x			st. steel	10"	250	.040

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	22	x			
					#3 will m

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 Art Widner Drilling (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS P.O. Box 300497 CITY Escondido STATE ca ZIP 92030

Signed _____ (WELL DRILLER/AUTHORIZED REPRESENTATIVE)

DATE SIGNED 9-17-04 C-57 LICENSE NUMBER 520518

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR
Page ___ of ___
Owner's Well No. ___
Date Work Began 9-8-04 , Ended 9-15-04
Local Permit Agency San Marcos
Permit No. LWEL 16216 Permit Date 9-8-04

$ rec'd 10-7-05 LG

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 742809

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

GEOLOGIC LOG

ORIENTATION (✓) ___ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD mud rotary FLUID bentonite

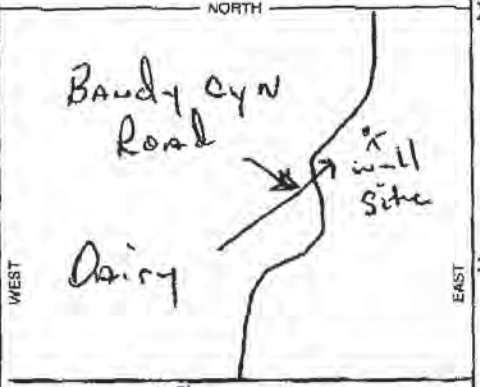
DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	5	top soil sand
6	17	sand, clay, boulders
18	28	sand, clay, boulders
29	51	sand, clay, some boulders
52	110	coarse gray sand&boulders
111	120	granite

TOTAL DEPTH OF BORING 120' (Feet)
TOTAL DEPTH OF COMPLETED WELL 112' (Feet)

WELL LOCATION

Address same as above
City ___
County ___
APN Book 276 Page 040 Parcel 01-00
Township 13-s Range 1w Section 7
Latitude 33 DEG. 07 MIN. 44 SEC. NORTH Longitude 59 DEG. 07 MIN. 116 SEC. WEST

LOCATION SKETCH



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
___ Domestic ___ Public
X 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 unkn (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 20' (Ft.) & DATE MEASURED ___
ESTIMATED YIELD unkn (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
* *May not be representative of a well's long-term yield.*

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	CASING (S) TYPE (✓) BLANK	SCREEN	CONDUCTOR	ALL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	22	32"	x				steel	24"	250	-
0	52	24"	x				steel	10"	250	
52	112	24"		x			st. steel	10"	250	.040

DEPTH FROM SURFACE Ft.	to Ft.	ANNULAR MATERIAL TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	22	x			
					418 will mi

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 Art Widner Drilling (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS P.O. Box 300497 CITY Escondido STATE ca ZIP 92030
Signed ___ (WELL DRILLER/AUTHORIZED REPRESENTATIVE)
DATE SIGNED 9-17-04
C-57 LICENSE NUMBER 528518

DWR 188 REV. 11-97 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

DEH2016-LWELL-001332

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

Received
MAR 28
County of San Diego
Dept. of Environmental Health
Land & Water Quality Div

DEH USE ONLY
PERMIT #
FEE: $535.00
WATER DIST:

1. Property Owner: WHMAN RANCH Phone: WH - 760-644-6887
Mailing Address: PO BOX 1959 City: ESCONDIDO State: CA Zip: 92025

2. Well Location - Assessors Parcel Number: 760-170-48 / 242-100-10
GPS Coordinates: (WGS-84 Decimal Degrees): 33°05'17"N / 116°58'31"W
Site Address: 0 Hwy 78 City: ESCONDIDO State: CA. Zip: 92025

3. Well Contractor/Driller: DAVE MATTHEWS Company Name: FAN DRILLING
Mailing Address: 12029 OLDCASTLE RD. City: VALLEY CENTER State: CA Zip: 92082
Phone: 760-749-0701 C-57 License No: 328287 ☐ Cash Deposit ☒ Bond Posted

4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Other:

5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd

6. Type of Equipment: MUD ROTARY

7. Depth of Well: Proposed: 160 Existing:

8: Proposed:

	Casing	Conductor Casing	Filter/Filler Material	Perforations
	Type: SS/LCS	☒ Yes ☐ No	☒ Yes ☐ No	From: 100 To: 160
	Depth: 160	Depth: 20	From: 0 To: 160	From: ____ To: ____
	Diameter: 10 in.	Diameter: 24 in.	Type: RANCHO	From: ____ To: ____
	Wall/Gauge: .375	Wall/Gauge: .250		

9. Annular Seal: Depth: 20 ft. Sealing Material: cement
Borehole Diameter: 32 in. Conductor Diameter: 24 in. Annular Thickness: 4 in.

10: Best Management Plan for confining well drilling waste on the project site provided? ☒ Yes ☐ No

11. Date of Work: Start: 3/28/16 Complete: 4/ 2016

On sites served by public water, contact the local water agency for meter protection requirements.
I hereby agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's report). I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Date: 3/21/16

DISPOSITION OF APPLICATION (Department of Environmental Health Use Only)

☒ Approved ☐ Denied Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

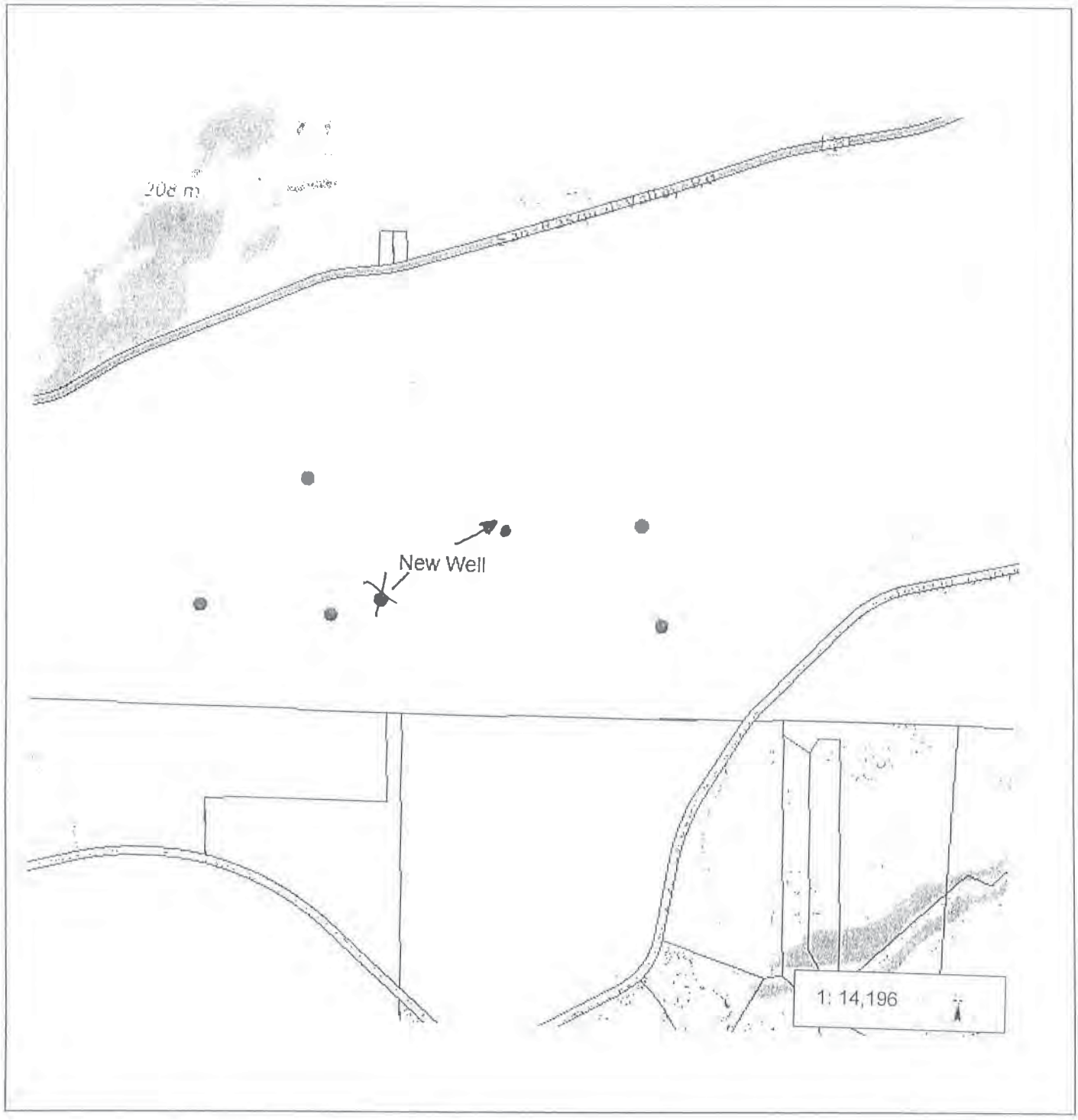
Specialist: Irina Portnaia Date: 3/28/16

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # LWELL - 001332
APN: 242-100-10

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.




33° 05' 01.77"N
116° 58' 31.61" W
new production well location
1745'
ed production well Location
© 2016 Google
Google earth
1994
Imagery Date: 4/14/2015 33°05'02.53" N 116°58'41.48" W elev 396 ft eye alt 2718 ft

County of San Diego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only

Well Permit Application Number: _____ Assessor's Parcel Number: 760-170-48
242-100-10

SECTION 1: Required Information from Contractor or Consultant:

Longitude & Latitude: 33.0501.177 N 116 58' 31.61 W How obtained? GPS Map Other

1. Are there any watercourses or water bodies within 50 feet of the limits of soil disturbance?	YES	NO
2. Does the plat show the project boundaries? (A "detail inset" is acceptable for a large parcel or lot.).	YES	NO
3. Does the plat show footprints of any existing structures and facilities within 100 feet of the wellhead position?	YES	NO
4. Does the plat show locations where run-off may enter stormdrains, drainage courses and/or receiving waters?	YES	NO
5. Is grading required to access site or install well?	YES	NO
6. Does the project conform to the local grading ordinance?	YES	NO
7. Will drilling additives be used to drill the well?	YES	NO
8. Are the Best Management Practices attached to this permit application? LARGE FIELD FOR DISCHARGE	YES	NO

SECTION 2. Best Management Practices

The goal of stormwater and discharge control management planning while drilling and installing wells is to reduce pollution to the maximum extent practicable using Best Management Practices (BMPs). Construction related materials, sediments, chemical residues such as drilling foam, wastes, and spills must be retained within the property boundaries to eliminate transport from the site to nearby streets, drainage courses, receiving waters and adjacent properties. It is the responsibility of the property owner and the contractor to determine which BMPs will be used in order to ensure that all contaminants are retained on-site.

Examples of Best Management Practices to contain well installation run-off include, but are not limited to, installation of a sediment basin to contain run-off, using geotextile fabric to contain sediments and drilling mud, or eliminating the use of drilling foam. (Website information is available at www.projectcleanwater.org)

SECTION 3. Certification

I have read and understand the following: *(Please check each box after concurrence.)*

- ☑ Selected BMP's will be implemented so that water quality is not negatively impacted by well construction activities.
- ☑ I am aware the selected BMP's must be installed, maintained, monitored and revised as necessary so they are effective.
- ☑ I understand that non-compliance with the San Diego County Watershed Protection Ordinance may result in enforcement actions by the County. These may include fines, citations, stop-work orders, or other actions.
- ☑ DEH inspectors and personnel from other regulatory agencies are authorized to enter my property at any time for purposes associated with this well permit until such time the well is completed to the satisfaction of DEH.
- ☑ Should DEH determine during the field review that the well installation procedures contradict this Discharge Management Plan or the well permit application, the well drilling permit may be suspended or revoked. Further activity will require a new permit fee and amendment to the existing permit.

Contractor _____ *Date* 3/21/16

Property Owner _____ *Date* 3-21-16

Reviewed by DEH _____ *Date* 3/28/16

*This free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0306251

Page One of One

Owner's Well Number 1332

Date Work Began 03/29/2016 Date Work Ended 4/5/2016

Local Permit Agency SD DEH

Permit Number LWELL-001332 Permit Date 3/28/16

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N W

Latitude Longitude

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	14	Grey Silty Sand
14	31	Grey Silty Sand w/ Grey Clay
31	46	Grey Clay
46	77	Course Grey Sand
77	88	Grey Clay
88	127	Grey & White Course Sand
127	129	Grey Clay & Wood
129	154	Compact Grey Sand
154	161	Grey Clay
161	167	Granite

Completed Well Construction

Date

Date Inspected Well present & in use via generator

Comments Pencil seal

N 33.08379°

W 116.97559°

Water Sample Taken? Yes 8/16/16

Reviewed By

Total Depth of Boring 167 Feet

Total Depth of Completed Well 165 Feet

Well Owner

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Well Location

Address 0 Hwy 78

City Escondido County San Diego

Latitude ___ ___ ___ N Longitude ___ ___ ___ W

Deg. Min. Sec. Deg. Min. Sec.

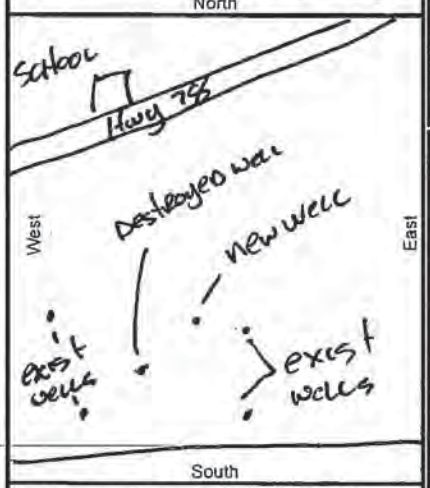
Datum ___ Dec. Lat. 33.0501 Dec. Long. 116.5831

APN Book 242 Page 100 Parcel 10

Township ___ Range ___ Section ___

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well

○ Modification/Repair

○ Deepen

○ Other

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

◉ Water Supply

☐ Domestic ☐ Public

☑ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

○ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other

Water Level and Yield of Completed Well

Depth to first water ___ (Feet below surface)

Depth to Static Water Level 72 (Feet) Date Measured 04/05/2016

Estimated Yield * 400 (GPM) Test Type Air Lift

Test Length 10.0 (Hours) Total Drawdown ___ (Feet)

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

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	20	32	Conductor	Low Carbon Steel	.250	24		
0	95	24	Blank	Low Carbon Steel	.375	12.75		
95	155	24	Screen	304 Stainless Steel	.250	12.75	Wire Wrap	0.060

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	95	Cement	
0	167	Filter Pack	Rancho

Attachments

☐ Geologic Log

☐ Well Construction Diagram

☐ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☑ Other Site Map

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 Fain Drilling & Pump Co., Inc

Person, Firm or Corporation

12029 Old Castle Rd Valley Center CA 92082

Address City State Zip

Signed ___ 4/7/2016 328287

C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

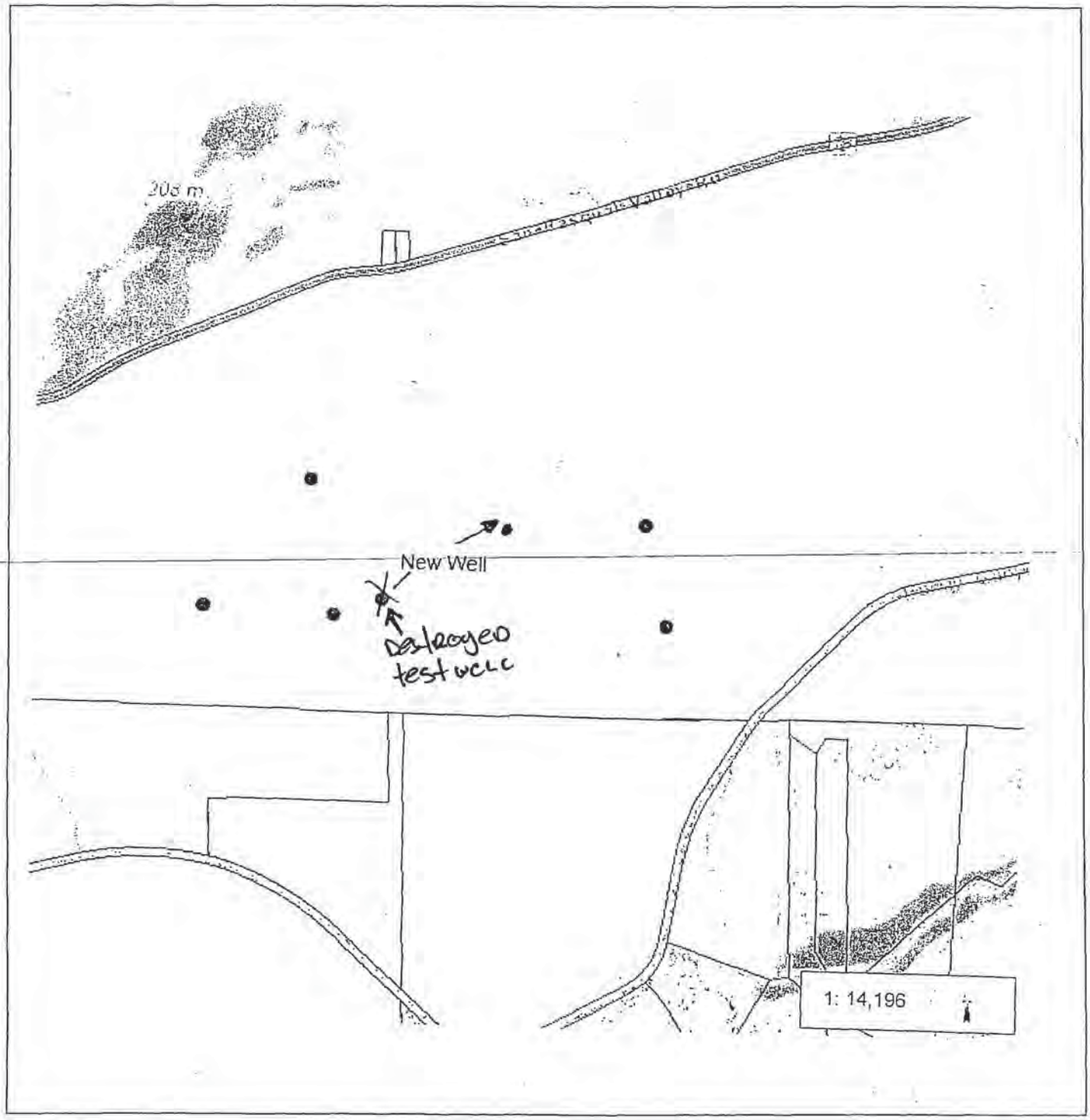
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION
WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # LWELL - 001332
APN: 242-100-10

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.



COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

WELL PERMIT APPLICATION

WC#1785

APN 760-170-48
Control # 4161888

TYPE OF WORK (Check)		USE (Check)				EQUIPMENT (Check)	
New Well	☒	Individual Domestic	☐			Rotary	☒
Repair or Modification	☐	Agricultural	☒	Community	☐	Cable Tool	☐
Time Extension	☐	Industrial	☐	Other		Other	☐
Destruction	☐						

PROPOSED WELL DEPTH
Max. 170 Min. 160 (Feet)

PROPOSED CASING
Type STEEL Depth 160 Diameter 10" Wall or Gage .375"

PROPOSED SEALING ZONE(S)
From 0 to 20 Feet
From _____ to _____ Feet
From _____ to _____ Feet

PROPOSED PERFORATIONS OR SCREEN
From 120 to 150 Feet
From _____ to _____ Feet
From _____ to _____ Feet
From _____ to _____ Feet

SEALING MATERIAL (Check)
Neat Cement Grout ☐ Bentonite Clay ☐
Sand Cement Grout ☒ Concrete ☐
Other-Specify: _____

DATE OF WORK
Start AUG- 1991
Completion AUG- 1991

NAME OF WELL OWNER
BERT VERGER DAIRY 747-3827

NAME OF WELL DRILLER
Joe R. Fain 749-0701

LOCATION OF WELL VERGER DAIRY FARM
16777 Bandy Cyn Rd - ESC

COMPANY
Fain Drilling & Pump Co.

BUSINESS ADDRESS
12029 Old Castle Rd - Valley Center

LICENSE NUMBER
328287

Cash Deposit ☐
Bond Posted ☒

$220 Fee paid on 08-14-91

DISPOSITION OF APPLICATION
(FOR HEALTH OFFICERS USE ONLY)

☐ APPROVED ☐ DENIED

☒ APPROVED WITH CONDITIONS

Report Reason(s) for Denial or Necessary Conditions Here:
1) Well to be installed to all County & State water well Standards Bulletin 74-81.
2) This well will not meet the minimal standards of a public water supply source and shall not be used as a source of water for uses requiring an approved public water supply.

M. Ledgh
HEALTH OFFICER

8-19-91
DATE

I hereby agree to comply with all regulations of the Department of Health Services and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Health Services with a complete and accurate log of the well.

Joe R. Fain
APPLICANT'S SIGNATURE

Aug - 7 - 91
DATE

VERGER DAIRY FARM

LWEL-1785

08-14-91

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

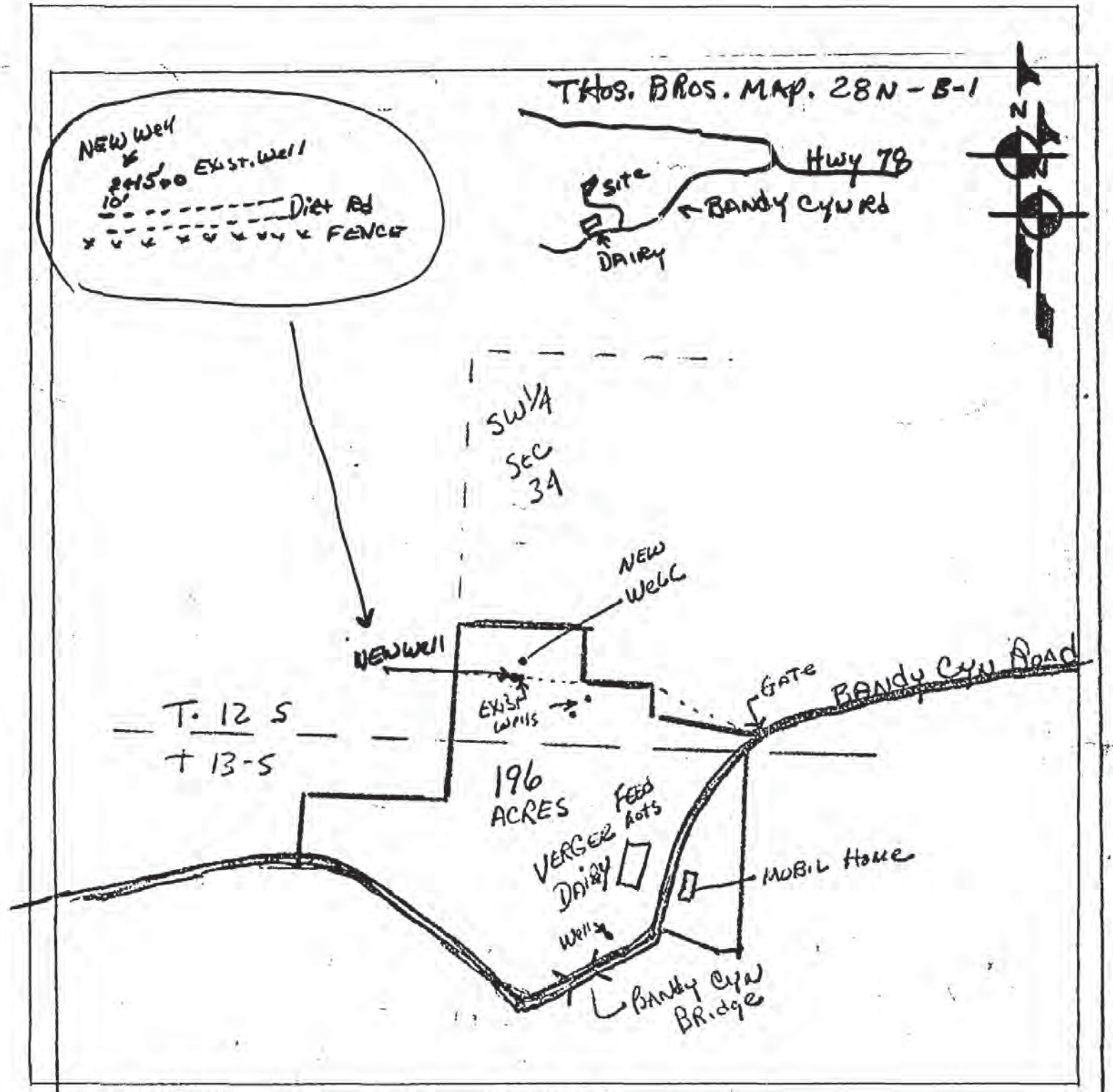
WELL PERMIT APPLICATION

Control # W618 88

Assessor's Parcel No. 760-170-48

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



DHS:EHP-731 (3/85) Page 2 of 2

WDR to Regn
10-18-91
ph

QUADRUPLICATE
Use to comply with local requirements

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

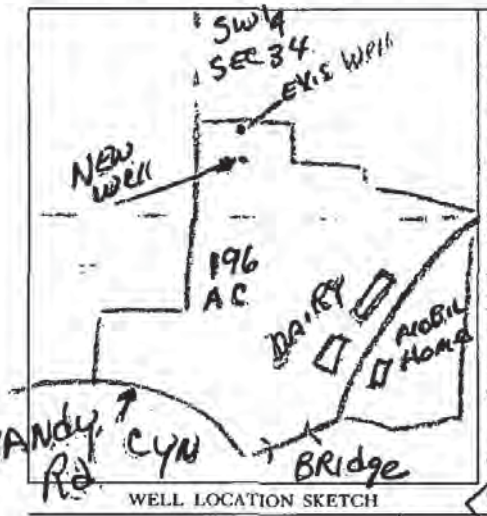
Do not fill in
No. 353081

Notice of Intent No.
Local Permit No. or Date W61888

State Well No.
Other Well No.

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

(2) LOCATION OF WELL (See instructions):
County San Diego Owner's Well Number
Well address if different from above Same
Township 12 S Range 1 W Section 34
Distance from cities, roads, railroads, fences, etc. Approx. .5 miles South Hwy 76 off Bandy Cyn Rd. SW¼ sec 34 Thos Bros map 28N-B-1



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 ☐
Municipal ☐
Other ☐
(Describe)

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

(6) GRAVEL PACK:
Yes ☒ No ☐ Size 5/16x4
Diameter of bore 18
Packed from 20 ft. to 160 ft.

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

From ft.	To ft.	Dia. in.	Gage or Wall
0	21	18	.250
0	160	10	.375

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

From ft.	To ft.	Slot size
100	150	.060

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval ft.
Method of sealing cemented

(10) WATER LEVELS:
Depth of first water, if known 50? ft.
Standing level after well completion 45 ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? Same
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test 45 ft. At end of test 150 ft.
Discharge 800+ gal/min after 6 hours Water temperature ukn
Chemical 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 160 ft. Completed depth 160 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
		Alluvial fill as follows:
0	35	Fine to coarse sand and silt Grey color
35	45	Reddish clay and gravel
45	75	fine to coarse sand with lenses of clay and silt - dark grey color
75	95	Partly cemented sand with some boulders - dark grey color
95	135	fine to coarse sand with small rocks and boulders
135	160	fine to coarse sand - partly cemented - dark grey color

Completed Well Construction
Date 10-28-91
Date Inspected 10-28-91
Comments Ag. Well / evidence of Annular Seal verified.
Water Sample Taken? NO
Reviewed By M. Sedgh

Work started 8/6/ 19 91 Completed 8/13/ 19 91

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 (Well Driller)
NAME Fain Drilling & Pump Co. Inc. (Person, firm, or corporation) (Typed or printed)
Address 12029 Old Castle Rd.
City Valley Center, California ZIP 92082
License No. 328287 Date of this report 8/23/91

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0320160

Page 1 of 2

Owner's Well Number RK-11

Date Work Began 08/31/2015 Date Work Ended 10/7/2015

Local Permit Agency County of San Diego

Permit Number LWEL 001137 Permit Date 9/29/15

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N Latitude W Longitude

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Air & Mud Rotary Drilling Fluid

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	20	Sand
20	90	D.G. Sand
90	160	Black & White (B&W) and Brown Granite D.G.
160	225	B&W Granite
225	250	Fractured B&W Granite
250	260	Fractured B&W Granite and Brown Granite
		Water: 80 GPM
260	385	B&W Granite
385	390	Fractured B&W Granite Water: 100GPM Total
390	415	B&W Granite Medium Soft
415	420	Fractured B&W Granite Water: 120GPM Total
420	430	B&W Granite Medium Soft
430	440	B&W and Rose Granite Medium Soft
440	900	B&W Granite
900	940	Fractured B&W Granite Medium Soft
940	1,050	B&W Granite

Total Depth of Boring 1050 Feet

Total Depth of Completed Well 1050 Feet

Well Owner

[redacted]

Well Location

Address 17202San Pasqual Valley Road #FEH

City Escondido County San Diego

Latitude Deg. Min. Sec. N Longitude Deg. Min. Sec. W

Datum Dec. Lat. 33.109733 Dec. Long. 116.955900

APN Book 242 Page 070 Parcel 13

Township 12S Range 1W Section 26

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North

See attached

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 and complete.**

Activity

◉ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

◉ Water Supply
☐ Domestic ☐ Public
☑ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water 250 (Feet below surface)

Depth to Static Water Level 136 (Feet) Date Measured 10/08/2015

Estimated Yield * 120 (GPM) Test Type Air Lift

Test Length (Hours) Total Drawdown (Feet)

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

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	127	20	Blank	Low Carbon Steel	.250	16		

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	127	Cement	

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☑ Other Location Sketch

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 Stehly Brothers Drilling, Inc.
Person, Firm or Corporation

13268 McNally Road Address Valley Center City CA State 92082 Zip

Signed Paul Stehly C-57 Licensed Water Well Contractor

08/16/2016 Date Signed

709686 C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

AUG 22 2016

e0320160

RC-11

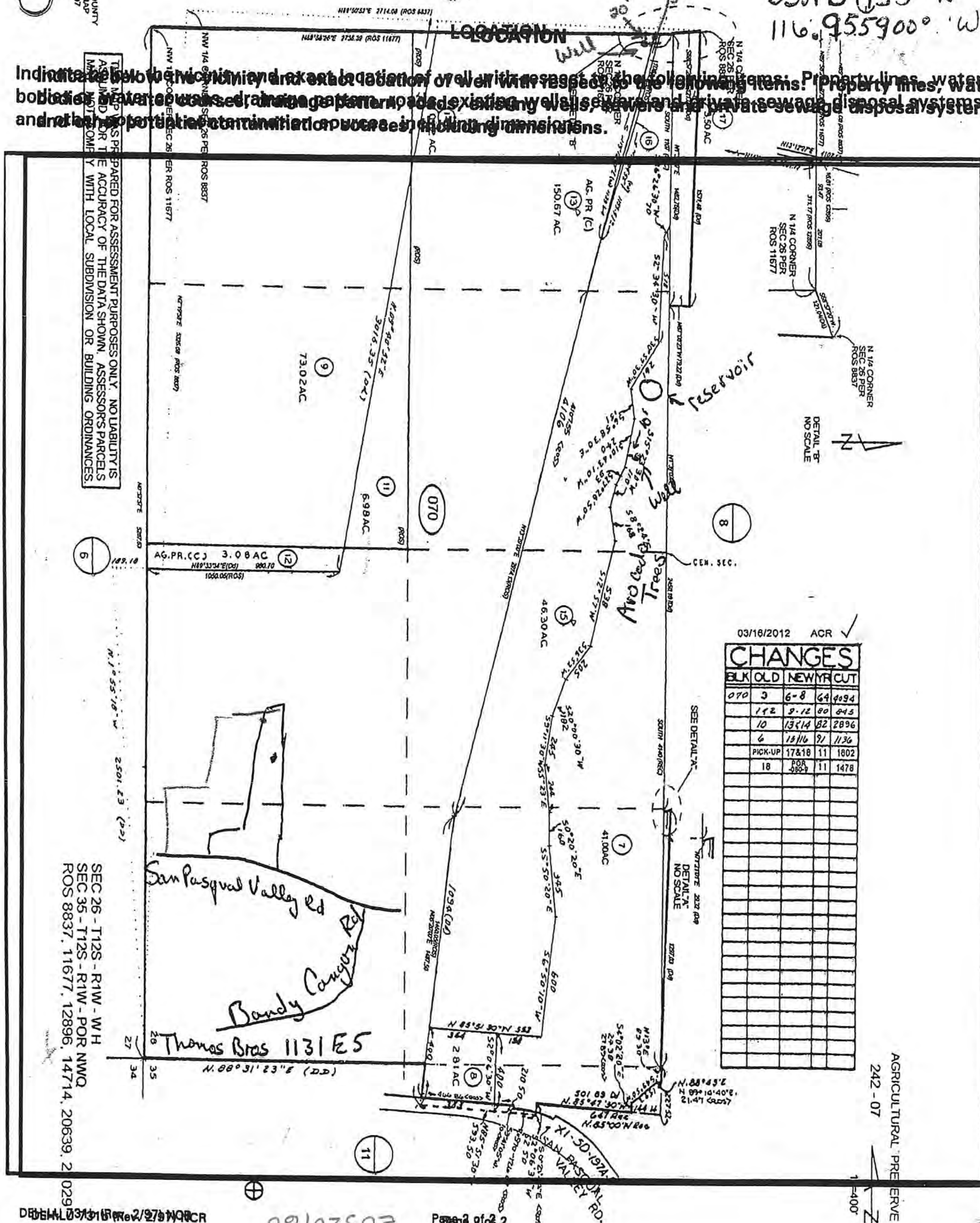
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: ______

Assessor's Parcel Number: 242-070-13

33.109133° N
116.955900° W

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



CHANGES				
BLK	OLD	NEW	YR	CUT
070	3	6-8	64	4094
	112	9-12	80	845
	10	13&14	82	2896
	6	15&16	91	1136
	PICK-UP	17&18	11	1602
	18	POR -080-9	11	1478

e0320160

ORIGINAL
File with DWR

012S001W35F002S

Page 1 of 1

Owner's Well No. _____

Date Work Began 7-29-91, Ended 8-10-91

Local Permit Agency S. D. County Health Dept

Permit No. W61867 Permit Date 7-29-91

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 485441

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

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

DEPTH TO FIRST WATER Ukn (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	35	Alluvial fill as follows: fine grained sand and silt - brown color
35	70	Fine to coarse sand - brown color with lenses of grey silt
70	115	Fine to coarse sand with some boulders
115	165	coarse sand with lenses of gravel and some boulders - grey color
165	180	Fine to coarse sand with some boulders - partly cemented grey color
180	195	Hard decomposed granite

TOTAL DEPTH OF BORING 195 (Feet)

TOTAL DEPTH OF COMPLETED WELL 195 (Feet)

WELL OWNER

Name Witman Ranch

Mailing Address P.O. Box 1959

CITY Escondido, California 92025 STATE ZIP

WELL LOCATION

Address 18118 Bandy Canyon Rd

City San Diego

County San Diego

APN Book 760 Page 170 Parcel 38

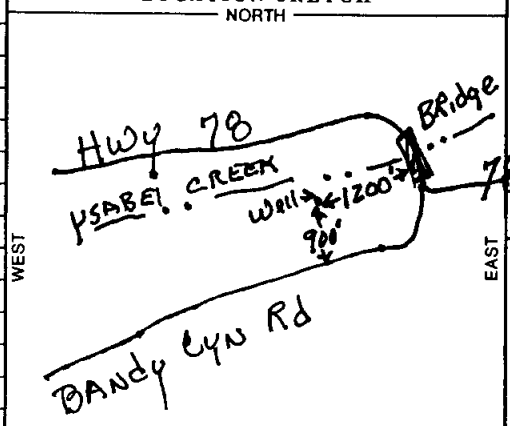
or

Township 12 S Range 1 W Section 34

or

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

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (Describe Procedures and Materia Under "GEOLOGIC LOG

PLANNED USE(S) (✓)

___ MONITORING

WATER SUPPLY

___ Domestic

___ Public

X Irrigation

___ Industrial

___ "TEST WELL"

___ CATHODIC PROTEC TION

___ OTHER (Specify)

DRILLING METHOD Roatary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 48 (Ft.) & DATE MEASURED 7-29-91

ESTIMATED YIELD* 1500 (GPM) & TEST TYPE air lift

TEST LENGTH 8 (Hrs.) TOTAL DRAWDOWN 140 (Ft.)

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

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	21	36"	X				A-120	23.5	.250	
0	100	24"	X				A-120	12	.375	
100	180	24"		X			SS 304	12	.250	.060
180	195	24"	X				A-120	12	.375	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	195			X	5/16x4

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 Fain Drilling & Pump Co. Inc. (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 12029 Old Castle Rd. CITY Valley Center, STATE Ca ZIP 92082

Signed Joe R Fain (WELL DRILLER/AUTHORIZED REPRESENTATIVE) DATE SIGNED 10/10/91

C-57 LICENSE NUMBER 328287

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

WELL PERMIT APPLICATION

~~LOC#~~ ~~828~~

APN 242-070-~~64~~07

Control # W18874

TYPE OF WORK (Check)		USE (Check)			EQUIPMENT (Check)	
New Well	☒	Individual Domestic	☒		Rotary	☒
Repair or Modification	☐	Agricultural	☐	Community ☐	Cable Tool	☐
Time Extension	☐	Industrial	☐	Other _____	Other	☐
Destruction	☐					

PROPOSED WELL DEPTH
Max. 100 Min. 80 (Feet)

PROPOSED CASING
Type PVC F480 Depth 100' Diameter 5" Wall or Gage .25 C-200

PROPOSED SEALING ZONE(S)
From 0 to 20 Feet
From _____ to _____ Feet
From _____ to _____ Feet

PROPOSED PERFORATIONS OR SCREEN
From 60 to 100 Feet
From _____ to _____ Feet
From _____ to _____ Feet
From _____ to _____ Feet

SEALING MATERIAL (Check)
Neat Cement Grout ☒ Bentonite Clay ☐
Sand Cement Grout ☐ Concrete ☐
Other-Specify: _____

DATE OF WORK
Start Dec-9-94
Completion Dec-13-94

NAME OF WELL OWNER 714-661-1755
RON HANSEN - ROCKWOOD RANCH

NAME OF WELL DRILLER
RANDY STEVENS

LOCATION OF WELL
Hwy 78 - SAN PASQUAL VLY Rd - ESC

COMPANY 749-0701
FAIN DRILLING & PUMP CO. INC.

BUSINESS ADDRESS
12029 Old CASTLE Rd-VALLEY CENTER

LICENSE NUMBER
328287

Cash Deposit ☐
Bond Posted ☐

$135 Fee paid on 12/1/94 CK

DISPOSITION OF APPLICATION
(FOR HEALTH OFFICERS USE ONLY)

☐ APPROVED ☐ DENIED

☒ APPROVED WITH CONDITIONS

Report Reason(s) for Denial or Necessary Conditions Here:

On sites served with public water, contact the local water agency for meter protection requirements.

* This area is known for high nitrate levels, it is recommended that a 50 ft. seal be applied

* Final Pending on approved H_2O sample

M. Sedghi
HEALTH OFFICER

12-7-94
DATE

I hereby agree to comply with all regulations of the Department of Health Services and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Health Services with a complete and accurate log of the well.

Joe R. Fain
APPLICANT'S SIGNATURE

12-7-94
DATE

DHS:EHP-731 (3/85)

15 or 07

242-070-~~64~~08

28-07-15

34032 BLUE LANTERN - DANA POINT, CA 92629

HANSEN, RON

WDL - 53416

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

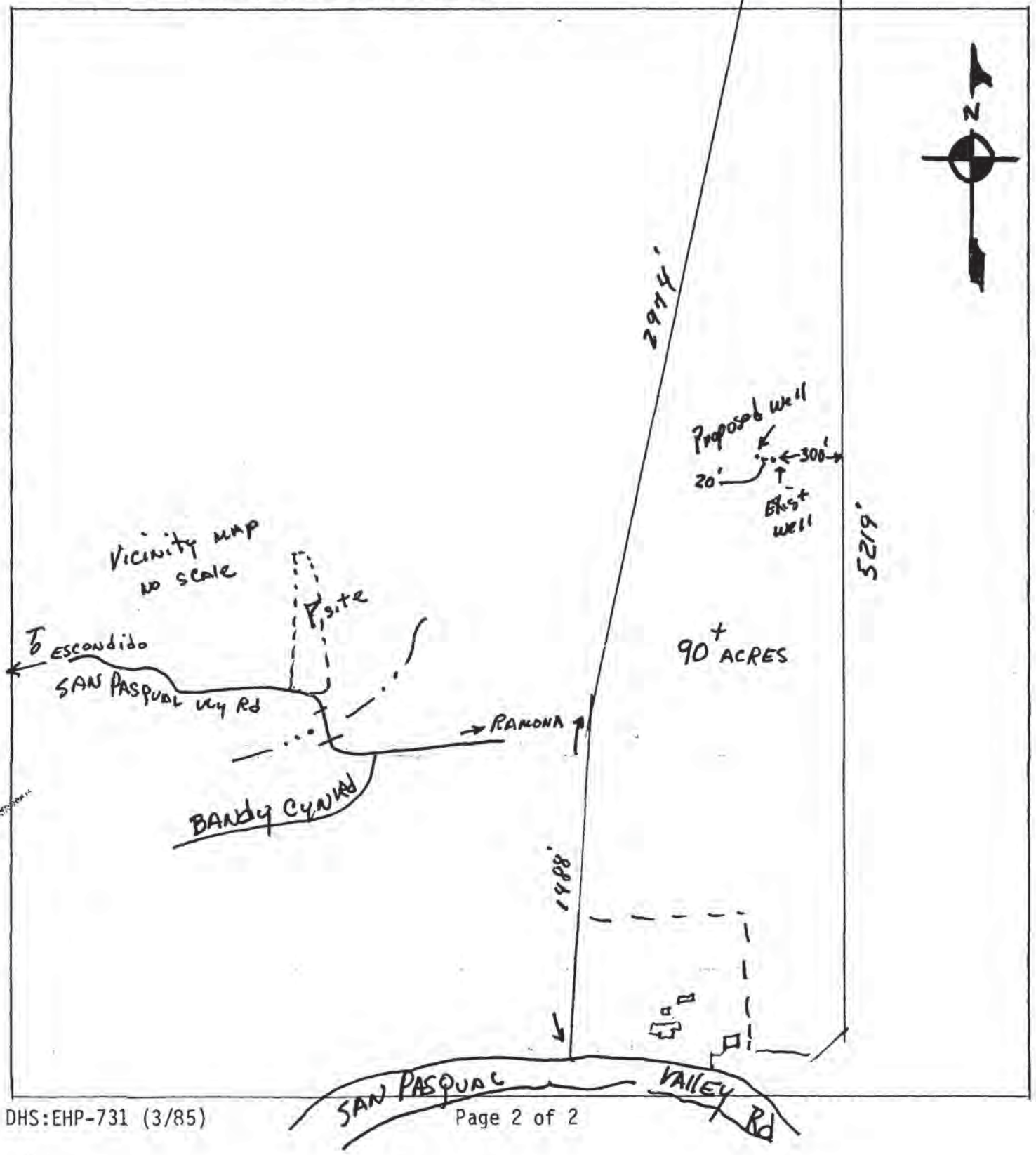
WELL PERMIT APPLICATION

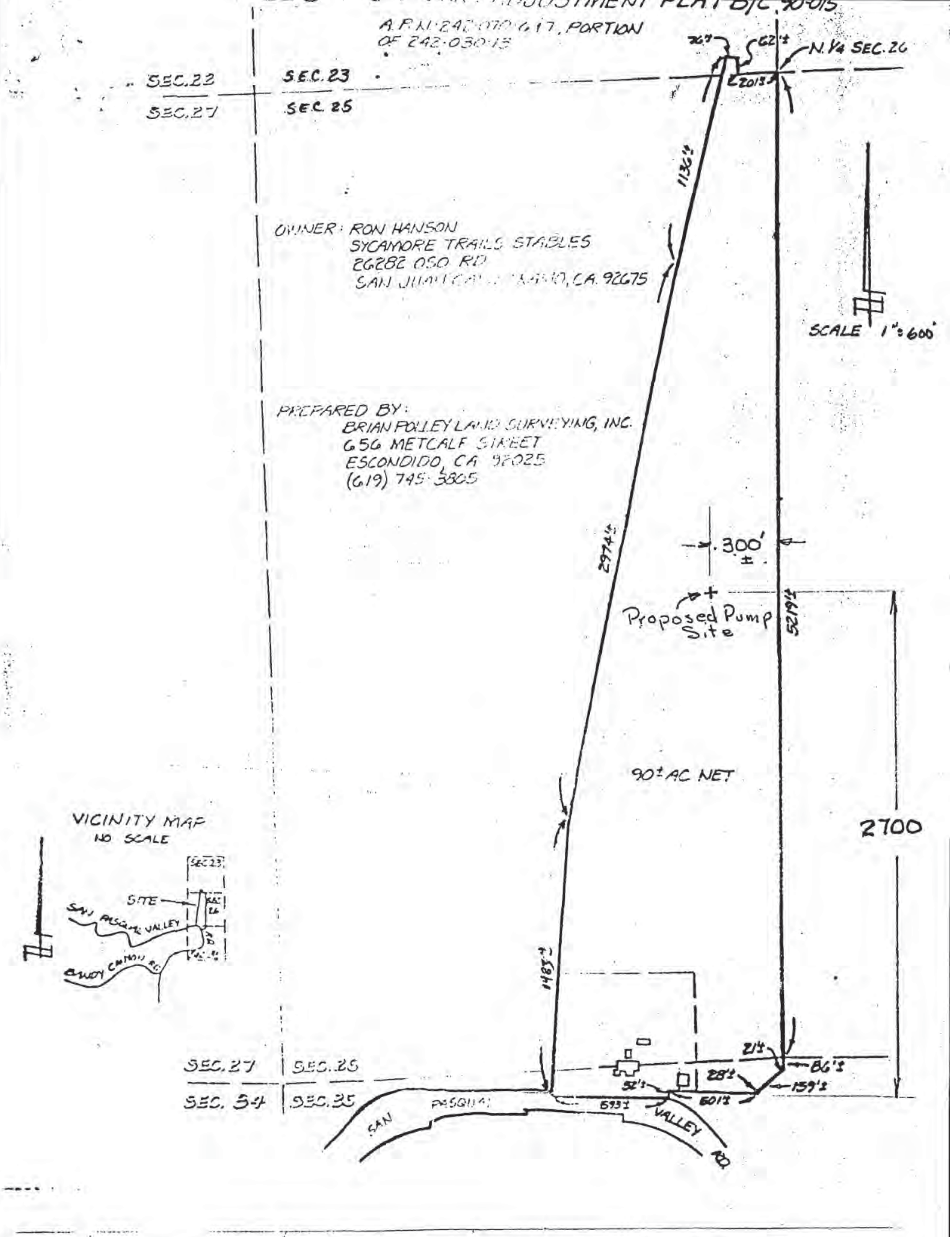
Control # W62874

Assessor's Parcel No. 242-070-~~15~~ 15 & 07

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.





ADJUSTMENT PLAT B/C 90-015
A.P.N. 242-070-617, PORTION
OF 242-030-13
SEC. 22
SEC. 27
SEC. 23
SEC. 25
N. 1/4 SEC. 26
1136'±
OWNER: RON HANSON
SYCAMORE TRAILS STABLES
26282 OSO RD
SAN JUAN CAPISTRANO, CA. 92675
SCALE 1" = 600'
PREPARED BY:
BRIAN POLLEY LAND SURVEYING, INC.
656 METCALF STREET
ESCONDIDO, CA 92025
(619) 745-3805
2974'±
300' ±
Proposed Pump Site
5219'±
90± AC NET
2700
VICINITY MAP
NO SCALE
SEC 23
SITE
SAN PASQUAL VALLEY
BANDY CANYON RD
1483'±
SEC. 27
SEC. 25
SEC. 34
SEC. 35
SAN PASQUAL VALLEY RD
28'±
52'±
593'±
601'±
86'±
159'±

QUADRUPLICATE
For Local Requirements

WDR CB 4-18-95

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

Page ___ of ___
Owner's Well No. 1
No. 463662

Date Work Began Three, Ended 12-14-94 12-19-94
Local Permit Agency Environmental Health Dept
Permit No. 462874 Permit Date 12-7-94

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ___ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY) X
DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE 50

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	45	alluvial fill as follows: fine grained, sand and silt dark brown color
45	74	fine to coarse sand - partly cemented - brown color
74	116	Fine to coarse sand with some small rocks - partly cemented brown to grey color

Completed Well Construction
Date 5-4-95
Date Inspected 5-3-95
Comments Final Pending an approved water sample
Water Sample Taken? NO
Reviewed By M. Sedgh

TOTAL DEPTH OF BORING 116 (Feet)
TOTAL DEPTH OF COMPLETED WELL 116 (Feet)

WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

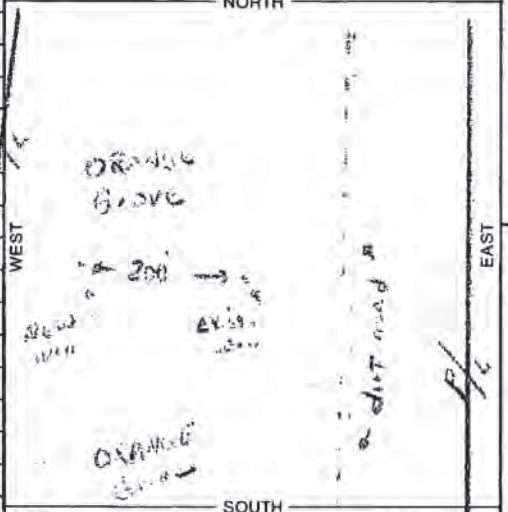
The information in this grayed area has been

ZIP

WELL LOCATION

Address
City Same
County San Diego
APN Book ___ Page ___ Parcel ___
or Township 12S Range 1W Section 25
or Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)
X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USE(S) (✓)
___ MONITORING
WATER SUPPLY
X Domestic
___ Public
___ Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary FLUID Gel

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 29 (Ft.) & DATE MEASURED 12-17-94
ESTIMATED YIELD* 50+ (GPM) & TEST TYPE airlift
TEST LENGTH 3 (Hrs.) TOTAL DRAWDOWN 70 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL/ GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	14	X				A-53	8	.188	
0	56	10	X				F480	5	.250	
56	116	10		X			F480	5	.250	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	115				Pea Gravel 5/16x7

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
X Other Report
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 Fair Drilling & Pump Co Inc.
(PERSON, FIRM OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 12029 Old Castle Rd. Valley Center, Ca 92082 STATE ZIP

Signed [signature] 12/19/94
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER 526287

DWR 188 REV. 7-90 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

WELL PERMIT APPLICATION

WC #5915 APN 242 070 1300 Control # W61615

242-070-13

TYPE OF WORK (Check)	USE (Check)	EQUIPMENT (Check)
New Well ☐	Individual Domestic ☐	Rotary ☒
Repair or Modification ☒	Agricultural ☒ Community ☐	Cable Tool ☐
Time Extension ☐	Industrial ☐ Other ____	Other ☐
Destruction ☐	DEEPEN EXISTING WELL	

PROPOSED WELL DEPTH
Max. 1000 Min. 150 (Feet)

PROPOSED CASING
Type STEEL Depth 160' Diameter 10" Wall or Gage 250

PROPOSED SEALING ZONE(S)
From 0 to 20 Feet
From ____ to ____ Feet
From ____ to ____ Feet

SEALING MATERIAL (Check)
Neat Cement Grout ☐ Bentonite Clay ☐
Sand Cement Grout ☐ Concrete ☒
Other-Specify: ____

PROPOSED PERFORATIONS OR SCREEN
From NONE. to ____ Feet
From ____ to ____ Feet
From ____ to ____ Feet
From ____ to ____ Feet

DATE OF WORK
Start 3-25-91
Completion 4-1-91

NAME OF WELL OWNER 745-4948 call to get Ga+unlocked
BEN HILLEBRECHT.

NAME OF WELL DRILLER
Art Widner

LOCATION OF WELL
17204 San Pasqual Valley Rd. Escondido CA.

COMPANY
Hidden Valley Pump Systems

BUSINESS ADDRESS
27932 Valley Center Rd VC

DISPOSITION OF APPLICATION
(FOR HEALTH OFFICERS USE ONLY)

☐ APPROVED ☐ DENIED
☒ APPROVED WITH CONDITIONS

LICENSE NUMBER
487325.

Cash Deposit ☒
Bond Posted ☐

180 Fee paid on 03-21-91 MD

Report Reason(s) for Denial or Necessary Conditions Here:
1. Well is to be deepened per Bulletin 74-81
2. Well is for agricultural use only. This well will not meet the minimal standards of a public water supply source and shall not be used as a source of water for uses requiring an approved public water supply.

I hereby agree to comply with all regulations of the Department of Health Services and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Health Services with a complete and accurate log of the well.

Scott A. Walker
HEALTH OFFICER
3-25-91
DATE

Art Widner
APPLICANT'S SIGNATURE
3-21-91
DATE

WEL-5915

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

03-21-91

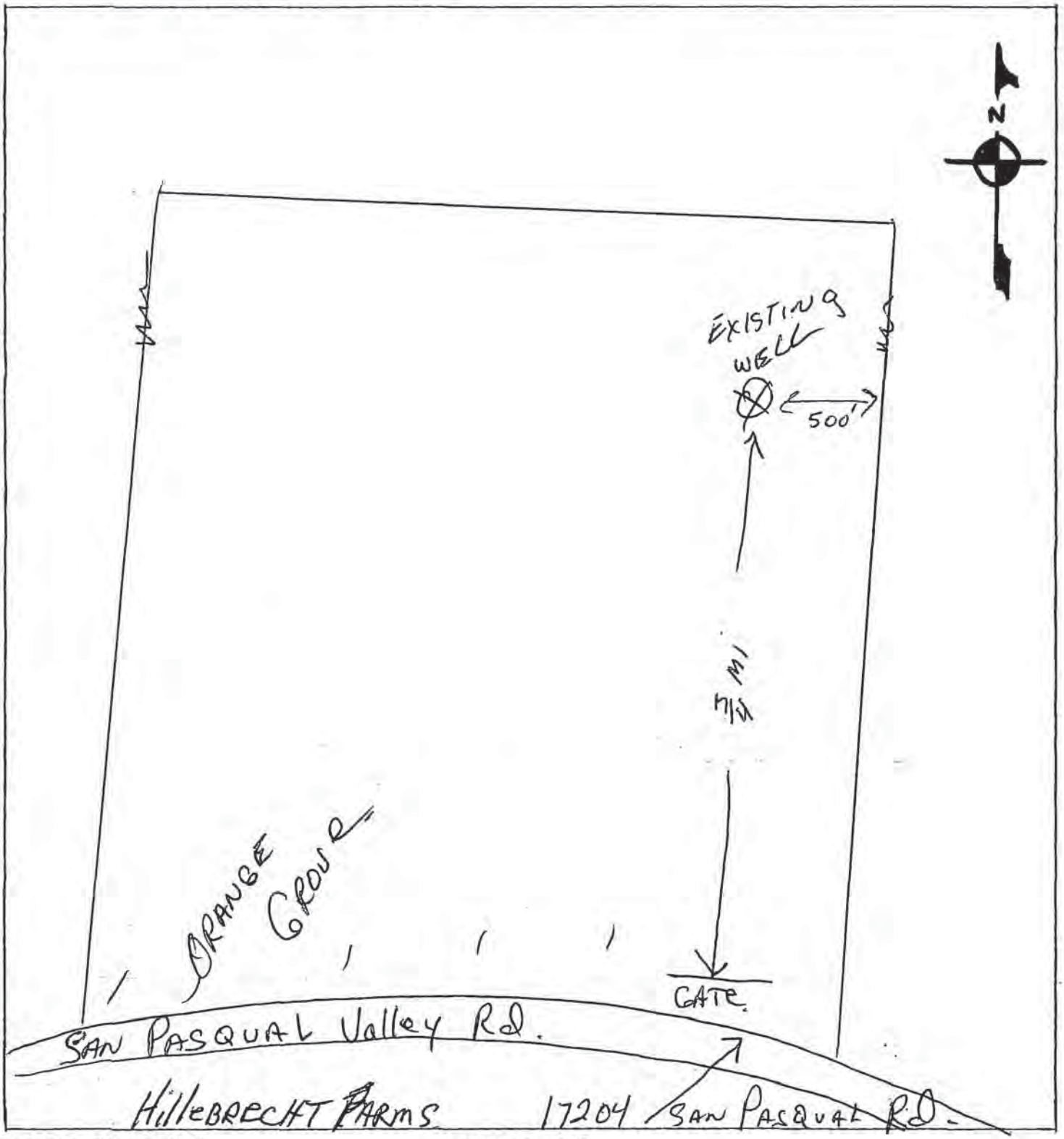
WELL PERMIT APPLICATION

Control # W61615

Assessor's Parcel No. 242-070-43-00

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



County Mail Station —A-21

FIRST CARBON COPY

WDR to 5mm
4/29/91 JGL

ASSESSORS PARCEL NUMBER
242-070-13

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES
1700 PACIFIC HIGHWAY, SAN DIEGO, CA 92101-2417

WATER WELL DRILLERS REPORT

Notice of Intent No. _____ State Well No. _____

Local Permit No. or Date 4/16/15 (INSERT under ORIGINAL PAGE w/carbon of State Form) Other Well No. _____

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

(2) LOCATION OF WELL (See instructions):

County San Diego Owner's Well Number _____

Well address if different from above 17204 San Pasqual Valley Rd.

Township 1W Range 12S Section 26

Distance from cities, roads, railroads, fences, etc. _____

DEPARTMENT USE ONLY

Completed Well Construction:

Date _____

Date Inspected 5-9-91

Comments approval is for deepening only

Water Sample Taken? NO

Sanitarian's Approval: Seth Wilder

(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:

Yes ☐ No ☐ Size _____

Diameter of above _____

Packed from _____ to _____ ft.

(7) Casing Installed:

Steel ☒ Plastic ☐ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0	151	10	.188

(8) Perforations:

Type of perforation or size of screen

From ft.	To ft.	Slot Size

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.

Were strata sealed against pollution? Yes ☐ No ☐ Interval _____ ft.

Method of sealing _____

(10) WATER LEVELS:

Depth of first water, if known 60 ft.

Standing level after well completion 60 ft.

(11) WELL TESTS:

Was well test made? Yes ☐ No ☒ If yes, by whom?

Type of test Pump ☐ Bailer ☐ Air lift ☐

Depth to water at start of test _____ ft. At end of test _____ ft.

Discharge _____ gal/min after _____ hours Water temperature _____

Chemical 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 638 ft. Depth of completed well 638 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
122	140	cemented sand & clay formation
140	149	broken granite
149	167	cont. broken granite, 167' hard granite
167	200	hard granite w/fractures at 170, 174, 183, 188, 193, 194
200	240	fractured B & W with red colored rock.
240	275	B & W, many fracs.
275	278	very large frac. B & W
278	300	fractured B & W, some green clay at 289'
300	378	hard B & W, some small fracs, grey clay layer at 377', picked up 250 gpm in frac at 377'
378	490	hard B & W, fracs at 423', 449', 474'.
490	491	B & W frac, picked up 75 gpm
491	638	B & W, fracs at 529, 530, 553, 568, 575. Picked up 205 gpm at 575'. More fracs at 582, 610, hard B & W to 638'.
		Deepened existing well 122' to 638'. Existing well had 14" casing 0' to 122'.

Work Started 3/23 19 91 Completed 4/2 19 91

WELL DRILLERS STATEMENT: I hereby declare under penalty of perjury that the information provided in this report is true. This water well was installed in compliance with San Diego County Code and State of California, Department of Water Resources, Bulletin No. 74.

SIGNED Mike Jones (Well Driller)

NAME HIDDEN VALLEY PUMP SYSTEMS INC. (Person, firm, or Corporation) (Type or Print)

ADDRESS 27932 Valley Center Road

CITY Valley Center ZIP 92082

LICENSE NO. 487325 DATE THIS REPORT 4/23/91

DHS:EHP-732 (83) CONFIDENTIAL — NOT FOR PUBLIC USE — WATER CODE SEC. 13752

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # W CWL 16379
WELL COMPUTER #
FEE: ~~Ltr~~ 390.00
WATER DIST:

RECEIVED
DEC 13 2004
Dept. of Environmental Health

1. Property Owner: TYSON SHORT Phone:
17331 SAN PASQUAL VLY Rd. ESCONDIDO 92027
Mailing Address City Zip

2. Well Location - Assessors Parcel Number 242 - 110 - 10
17331 SAN PASQUAL VLY RD ESCONDIDO 92027
Site Address City Zip

3. Well Contractor - Well Driller JOE EDWARDS Company Name: FAIRDRILLING
12029 OLD CASTLE RD VALLEY CENTER 92082
Mailing Address City Zip
Phone#: 760-749-0701 C-57#: 328287 ☐ Cash Deposit ☒ Bond Posted

4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other
5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: ROTARY
7. Depth of Well: Proposed: 140'-160' Existing: ~~0~~
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: PVC	☒ Yes ☐ No	☒ Yes ☐ No	
Depth: 140-160	Depth: 20 ft.	From: 20 To: 140	From: 90 To: 140
Diameter 8 in.	Diameter 16 in.	Type: PEA GRAVEL	From: To:
Wall/Gauge: .500	Wall/Gauge: .250	~~Wall/Gauge:~~	From: To:

9. Annular Seal: Depth: 20 ft. Sealing Material: CEMENT
Borehole diameter: 22 in. Conductor diameter: 16 in. Annular Thickness 3+ in.
10. Date of Work: Start: Dec - 2004 Complete: Dec - 2004

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Joe B. Davis Date: 12-10-04

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies. City of San Diego

Specialist: Date: 13 DEC 04

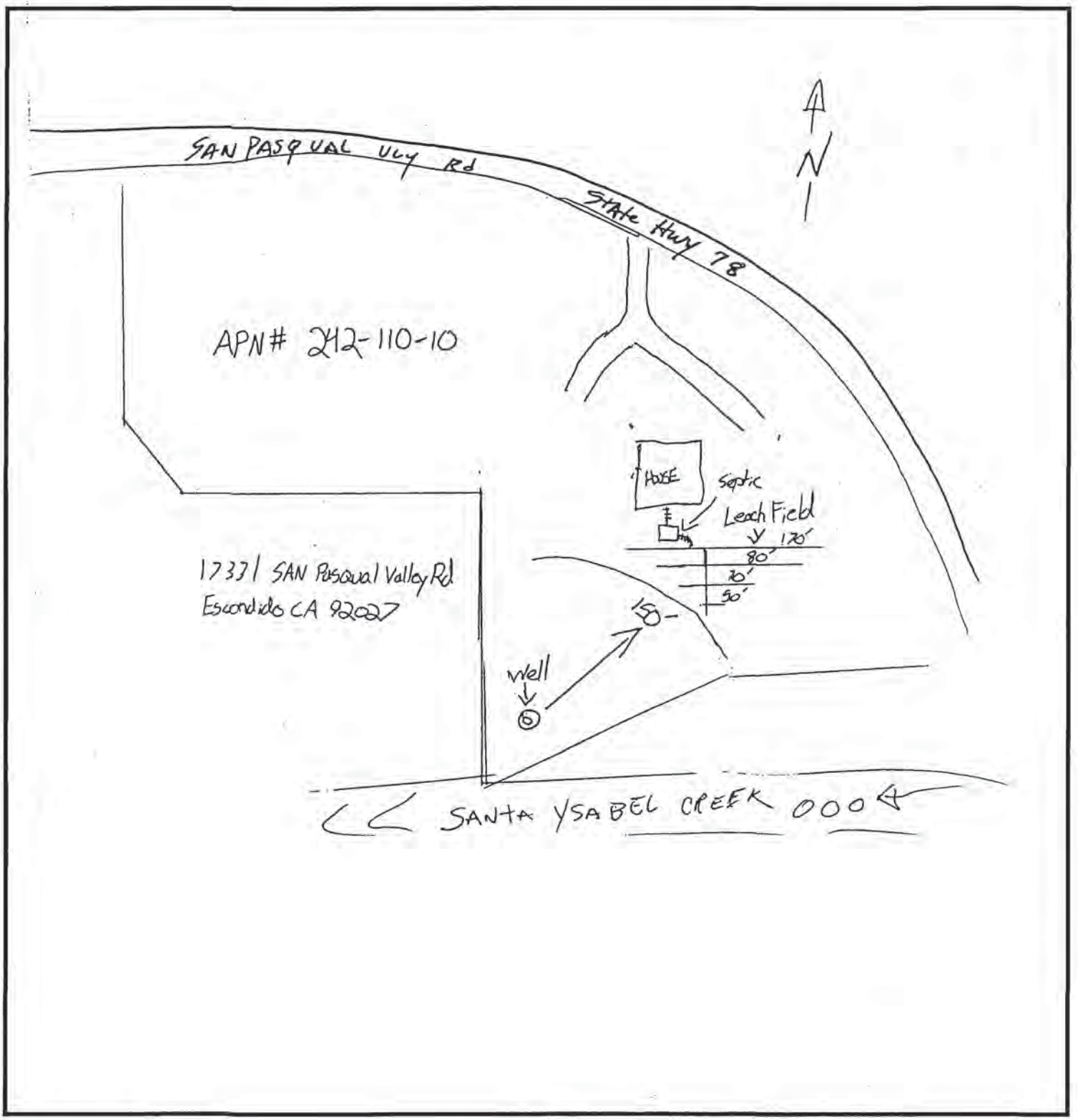
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

RECEIVED
DEC 13 2004

Control #: LWQ 16379
Assessor's Parcel Number: 242-110-10

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



QUADRUPLICATE
For Local Requirements

Page 1 of 1
Owner's Well No. T-30

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 0909553

Date Work Began 12/21/04, Ended 1/6/05
Local Permit Agency DEH
Permit No. 16379 Permit Date 12/13/04

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Gel & Air

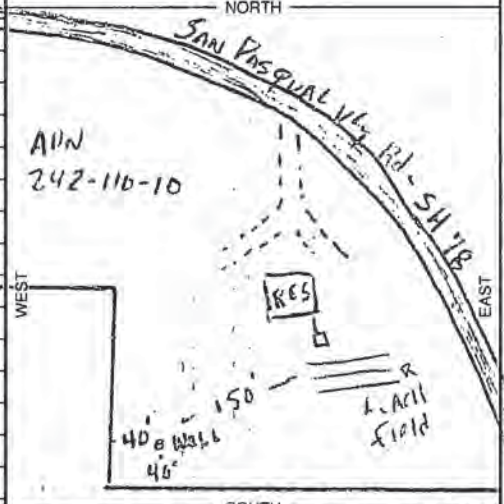
DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0 to 70	Sand, fine grained, partly cemented
70 to 110	Decomposed granite, hard Brown turning to gray color
110 to 113	Hard hard rock - granite gray color
113 to 180	Granite, hard
180 to 192	Fracture - water 10 gpm
192 to 360	Hard, massive, granidiorite, grey color with black and white minerals
360 to 385	Fracture zone - most water approx 150 GPM obtained here
385 to 410	Granidiorite

TOTAL DEPTH OF BORING 410 (Feet)
TOTAL DEPTH OF COMPLETED WELL 410 (Feet)

WELL LOCATION

Address 17331 San Pasqual Valley Rd.
City Escondido
County San Diego
APN Book 242 Page 110 Parcel 10
Township 12 S Range 1 W Section 35
Lat 33° 05 ' 601 " N (DEG. MIN. SEC.) Long 116° 57 ' 475 " W (DEG. MIN. SEC.)

LOCATION SKETCH



*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")*

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 90 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 68 (Ft.) & DATE MEASURED 1/6/05
ESTIMATED YIELD * 150+ (GPM) & TEST TYPE airlift
TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN 300 (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 to 20	22	X				steel	15.5	.250	
0 to 75	15	X				PVCF480	7.8	.500	
75 to 115	15		X			PVCF480	7.8	.500	.032
115 to 410	6.5					Open Hole			

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 to 20	X			
20 to 113				6/16.1

ATTACHMENTS (✓)

___ Geologic Log
X 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 Fain Drilling & Pump Co Inc
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 12029 Old Castle Rd. CITY Valley Center, STATE Ca ZIP 92082
Signed [signature] DATE SIGNED 1-8-05
C-57 LICENSED WATER WELL CONTRACTOR C-57 LICENSE NUMBER 324227

DWR 188 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 0943827

Page ___ of ___
Owner's Well No. RWOBS-1
Date Work Began 4/8/13 Ended 4/11/13
Local Permit Agency San Diego
Permit No. EWEL 000157 Permit Date 4/11/13

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Mud Rotary ID ___

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	14	Top Soil and Fine Sand, Dark Brown
14	25	Coarse Sand, Quartz, Granitic Fragments
25	45	Coarse Sand, Gravel with Some Silt
45	50	Silt-like Sand, Trace Clay Slight Plasticity
50	75	Silt-like Sand Slight Clay
75	85	Coarse Sand, Trace Silt
85	90	Silt-like Sand with Clay
90	110	Hard D.G.
110	117	Granite, Biotite, Quartz Fragments
117	130	Granodiorite, Quartz, Biotite

TOTAL DEPTH OF BORING 130 (Feet)
TOTAL DEPTH OF COMPLETED WELL 110 (Feet)

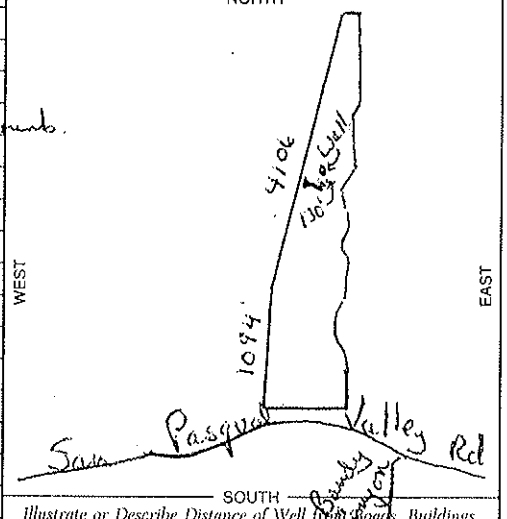
WELL OWNER

Name Rodney Co. N.V. Rancho Encinito
Mailing Address 17224 San Pasqual Valley Rd
CITY Escondido STATE CA ZIP 92027

WELL LOCATION

Address 17224 San Pasqual Valley Rd
City Escondido, CA 92027
County San Diego
APN Book 242 Page 870 Parcel 15
Township 12S Range 1W Section 26
Lat 33° 06' 11.63" N (DEG. MIN. SEC.) Long 116° 57' 25.97" W (DEG. MIN. SEC.)

LOCATION SKETCH



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 (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

USES (✓)

WATER SUPPLY
___ 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 ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 43 (Ft.) & DATE MEASURED 4/11/13
ESTIMATED YIELD * 25 (GPM) & TEST TYPE Air Lift
TEST LENGTH ___ (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)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	52	15	✓				Steel	10	.250	
0	50	10	✓				PVC	5	SDR17	
50	90	10		✓			PVC	5	SDR17	.032
90	110	10	✓				PVC	5	SDR17	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	51	✓			

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 Stehly Brothers Drilling, Inc
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 13268 McNally Rd. CITY Valley Center, STATE CA ZIP 92082
Signed Paul Stehly
C-57 LICENSED WATER WELL CONTRACTOR
DATE SIGNED 4-24-13
C-57 LICENSE NUMBER 709686

DWR 188 REV. 05-03 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM OSP 03 78836

STEHLY BROTHERS DRILLING, INC.

License: C-57 #709686
13268 McNally Road
Valley Center, California 92082
760-742-3668 / 760-742-4564 Fax

4/15/13

Attn: Dudek
Rodney Corporation
605 Third Street
Encinitas, CA 92024
760-942-5147

Well Site: Rockwood Observation Well
Guejito Ranch Well#RWOBS-1 (#16-2013)
APN: 242-070-15
17224 San Pasqual Valley Road
Escondido, CA 92027
Permit: LWEL000157 4/11/13

Guejito Ranch Well#RWOBS-1 – Rockwood Observation Well - (#16-2013) drilled for Rodney Co. N.V. at 17224 San Pasqual Valley Road in Escondido, CA 92027. Started Drilling 4/8/13 and Finished Well 4/11/13. APN: 242-070-15 Permit LWEL000157 4/11/13.

0-14	Top Soil and Fine Sand Dark Brown
14-25	Coarse Sand, Quartz, Granitic Fragments
25-45	Coarse Sand, Gravel with Some Silt
45-50	Silt-like Sand, Trace Clay, Slight Plasticity
50-75	Silt-like Sand, Slight Clay
75-85	Coarse Sand, Trace Silt
85-90	Silt-like Sand with Clay
90-110	Hard D.G.
110-117	Granite, Biotite and Quartz Fragments
117-130	Granodiorite, Quartz and Biotite

Comments:

Total Depth Drilled:	130'		
Total Well Depth:	110'		
Hole Diameter:	10" Mud Hole	0-50'	Solid
Liner:	40' of 5" SDR17 Screen	50-90'	Screen
	70' of 5" SDR17 Solid	90-110'	Solid
Gravel Pack:	2 cu yds		
Surface Seal:	Cement		
Water:	25+ GPM		

Well Development: