PALMDALE WATER DISTRICT

GROUNDWATER ASSESSMENT AND PROTECTION PROGRAM

Produced by:

Standish-Lee Consultants
And
Palmdale Water District

January 1999

Table of Contents

Executive Summary

Source water protection is the first and foremost barrier required for inclusion in a well-developed multiple-barrier protection and treatment plan for public drinking water supplies. A comprehensive source water protection program can prevent contaminants from entering the public water supply, reduce treatment costs, and increase public confidence in the quality, reliability and safety of its drinking water.

Palmdale Water District completed the first step in developing a Wellhead Protection Plan for its groundwater supply. This first step includes the following elements:

- Delineation of the boundaries of the protection areas for wells providing source water for District customers.
- Inventory of the sources of regulated and certain unregulated, contaminants of concern in the delineated areas (to the extent practical).
- Determination of the vulnerability of each well to contamination.
- Public education and outreach.

The delineated area is divided into time of travel zones for 2, 5 and 10 years time of travel. The delineated protection areas will allow the District to focus its protection and management strategies and resources on the areas where most benefit to the water resource will occur.

An essential element of the assessment program is an inventory of Potential Contaminating Activities (PCAs). PCAs are facilities or land uses that can be origins of significant contamination in delineated source water protection areas. The delineated areas and PCAs are presented in the attached map.

The Vulnerability Ranking is a prioritized list of the PCAs identified in the source water assessment and a relative ranking of the well exposure to potential sources of contamination. The order of the ranking is based on the class of PCA, its respective risk ranking (relative risk to drinking water supplies), the protection zone in which the PCA occurs, and the Physical Barrier Effectiveness rating (how effective the source and site are at preventing contaminants from reaching the drinking water). These factors are used to determine the PCAs to which the drinking water source is most vulnerable. The cumulative score of the risk rankings for all the PCAs for a well provide the relative risk ranking for that well. The cumulative score identifies the drinking water sources that need prioritization to address potential contamination problems. Summary tables listing the vulnerability scores and risk ranking for the District's wells are attached (Section 4).

The activities at the top of the Palmdale water District Vulnerability Ranking include: septic tanks believed to have caused the presence of contaminants in well 17 and 5 (nitrate, TDS), Illegal Activities/Dumping, trunk sewer lines, US Air Force Plant 42, Dry Wells, Gas Stations (current and historic), Junk/Scrap yards and Leaking Underground Storage Tanks.

Other activities at the top of the District's Vulnerability Ranking are Detention Basins, Highways, Railroad, a Golf Course, Housing Developments, a Hardware Store and Repair Shops.

The District has invited stakeholders to form the Palmdale Water District Wellhead Protection Advisory Group to help identify, develop and implement local measures that will advance the protection of the District's groundwater supply.

1. INTRODUCTION

Source water protection is the first and foremost barrier required for inclusion in a well-developed multiple-barrier protection and treatment plan for public drinking water supplies. A comprehensive source water protection program can prevent contaminants from entering the public water supply, reduce treatment costs, and increase public confidence in the quality, reliability and safety of its drinking water.

1.1 Background

The 1986 Amendments to the Safe Drinking Water Act (SDWA) established a new Wellhead Protection Program to protect groundwater bodies that supply wells and well fields that serve as sources of water supply for public water systems. Under SDWA Section 1428, each state is required to prepare a Wellhead Protection Program and submit it to EPA by June 19, 1998.

As a result of the SDWA Amendments of 1996, source water protection has become a national priority. The Amendments added to the Act in 1996 provide for a new, more comprehensive, watershed-based "prevention" approach to be applied to improving and preserving water quality at the public water supply source. The key elements of this Source Water Assessment Program (SWAP) apply to protecting surface water supplies, as well as to safeguarding groundwater supplies through the Wellhead Protection Program.

The new prevention approach has two key elements:

- Assignment of primary responsibility to the individual states, in recognition of each state's unique characteristics, flexibility, expertise, and resources needed to achieve optimum results.
- A strong directive to include public information disclosure and involvement within the states' decision making processes.

Involving the public in the Source Water Assessment Program increases the likelihood that the states' source water protection programs will be developed and implemented once the assessments are completed. EPA's goal is to implement full source water protection programs for water supplies serving 60 percent of the population by the year 2005.

A Source Water Assessment Program must include the following four key elements:

- Delineation of the boundaries of the areas providing source water for public water supply systems.

- Inventory of the sources of regulated and certain unregulated, contaminants of concern in the delineated areas (to the extent practical).

- Determination of the susceptibility of each water source to contamination.

- Public education and outreach.

The assessments should lead to development of a comprehensive prevention and protection program that includes monitoring of contaminants, implementing management measures to control or mitigate sources of contamination, and contingency planning. To develop and implement a Source Water Protection Program requires public involvement.

States are required to submit a SWAP program to EPA within 18 months of EPA's publication of the guidance (which occurred on August 6, 1997), or no later than February 1999. EPA then has nine months to approve each State's program (until November 1999), after which the State has two years to complete the assessment for all of the identified sources (by November 2001). Provisions for an 18-month extension are included, if needed for valid reasons (until February 2003).

The State of California is structuring its SWAP program to allow water utilities to conduct their own assessments. Assessment programs may make use of pertinent existing information and data to prevent duplication of effort. Such information and data may be found in multiple sources including watershed sanitary surveys, Vulnerability Assessments, Wellhead Protection Plans (WHP), State watershed management approaches, State Pesticide Management Plans, and programs conducted under the Clean Water Act (CWA) to control both point and non-point sources.

Palmdale Water District has conducted a watershed sanitary survey for its surface water supply and initiated source water protection programs. This report documents the District's Groundwater assessment program and management strategies for the drinking water protection areas of existing wells.

1.2 Purpose

The overriding purpose of this project is to develop a Groundwater and Wellhead protection plan for Palmdale Water District and to meet the State of California requirements for Source Assessment and Protection. The District relays on groundwater to provide at least forty percent of its water supply, contamination of that supply could cause water shortage and clean up is costly and time consuming.

The primary goals of this project are:

- Locate the District's well and prepare an assessment map.

- Delineate the groundwater protection areas.

- Evaluate the drinking water source and its site characteristics in terms of effectiveness of the physical barriers to contaminants reaching the source.

- Conduct an inventory of Potential Contaminating Activities (PCAs) within the delineated areas, rank their risk level and identify them on the assessment map.

- Evaluate the risk from potential contaminating activities to each source.

- Start developing management strategies for the drinking water protection areas of the existing wells.

- Develop a strategy for public involvement and public education.

1.3 STUDY AREA

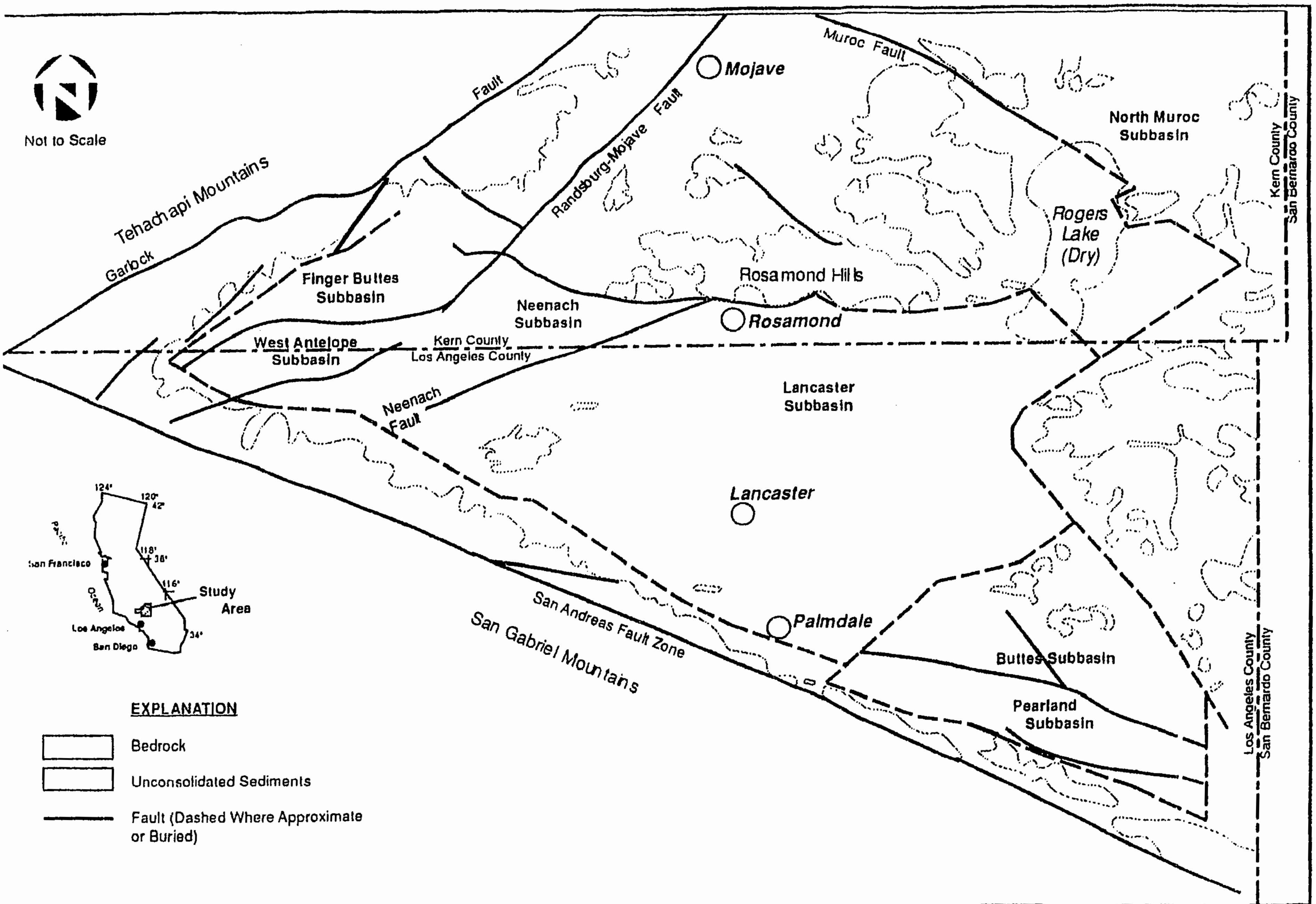
Palmdale Water District is located within the Antelope Valley area of northern Los Angeles County. The Antelope Valley encompasses approximately 2,400 square miles in northern Los Angeles County, southern Kern County and western San Bernardino County. The triangular shaped Valley is bordered on the southwest by the San Gabriel Mountains, on the northwest by the Tehachapi Mountains and on the east by a series of hills and buttes that generally follow the San Bernardino County line (**Figure 1).**

The valley is semiarid, receiving an average of less than 10 inches of precipitation annually on the valley floor and more than 12 inches in the surrounding mountains. Mean- daily summer temperatures range from 63°F to 93°F and mean-daily winter temperatures range from 34°F to 57°F. The land surface elevation in the study area ranges from about 2,300 to 3,500 feet above sea level. Native vegetation includes Joshua trees, saltbrush, mesquite, sagebrush, creosote bush, and other high desert plants.

The District is partially located within the City of Palmdale (City) boundaries and the District's primary service area is completely enclosed within the City's planning area. The District's primary service area is approximately bordered by Avenue P on the North, 70th Street East on the east the Antelope Valley Freeway (Highway 14) on the west and extends into the foothills of the San Gabriel Mountains on the south. The District encompasses an area of about 187 square miles overlaying approximately 30 non-contiguous areas. The general vicinity of the District is shown in **Figure 2**. The District's boundaries are shown in **Figure 3.** The District serves a population of approximately 85,000 people.

The District obtains its water supply from three sources:

- Littlerock Creek
- Groundwater wells
- The State Water Project



dified From
GS. WSP 2046 (1978)

Figure 1 Generalized Geologic Map Antelope Valley, California

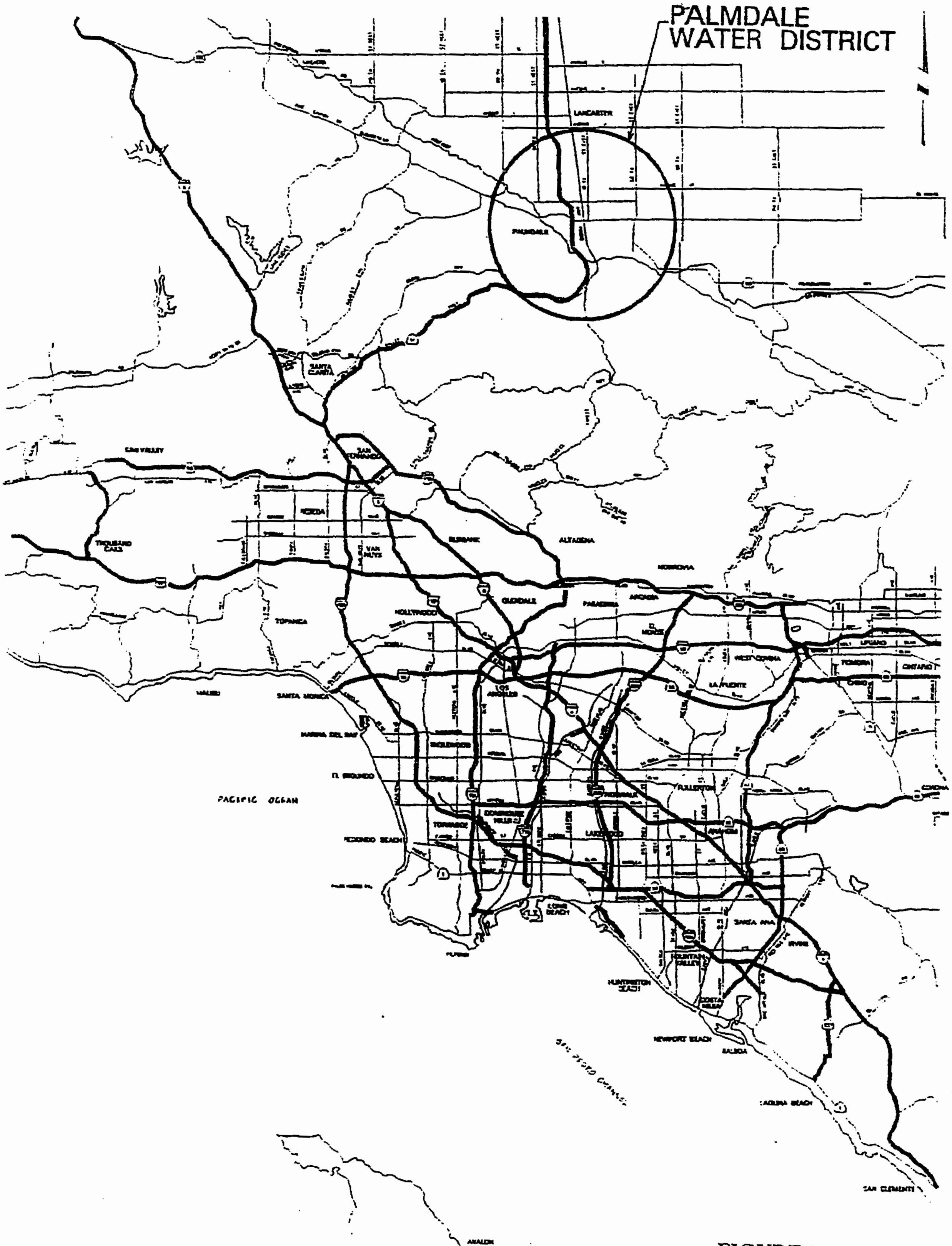


FIGURE 2
VICINITY MAP

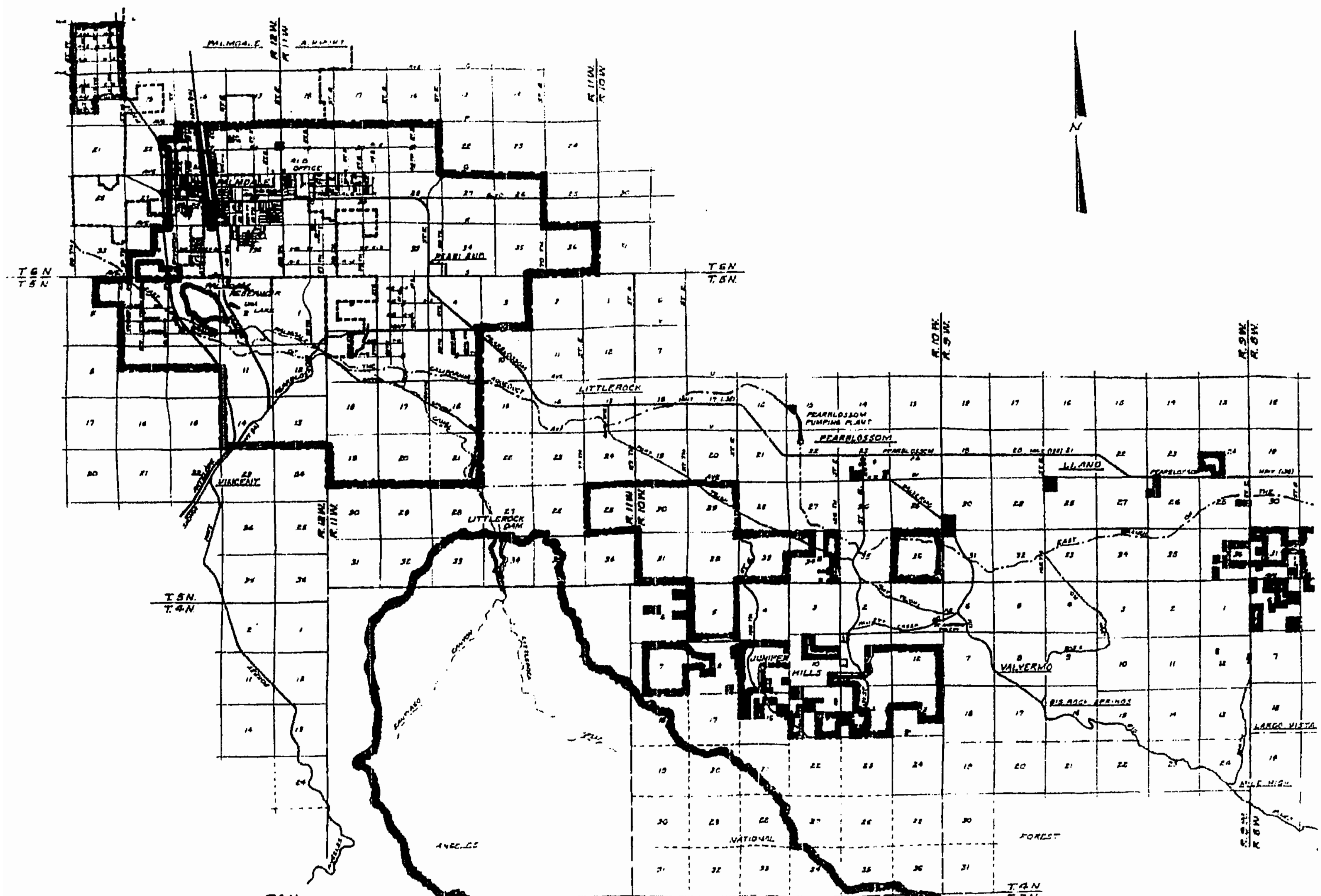


Figure 3. Palmdale Water District Main Service Area

The District pumps groundwater from 22 wells in the Lancaster and Pearland sub-units, and from four wells in the San Andreas sub-unit (four additional wells were drilled in the Pearland sub-unit for future use). The District has a total pumping capacity of approximately 20,700 gpm.

1.4 Water Rights

The Antelope Valley Basin is not adjudicated and the groundwater yield has not been allocated among the water pumpers. Each ground water pumper has a correlative right to pump the water for beneficial uses. In order to protect the groundwater from further overdraft and to protect its future use, the pumpers are pursuing a basin management approach. The District's share of safe yield is estimated at 6,200 ac-ft/yr. Since 1993 the District has been shifting its water use pattern to meet 60 percent of its average demand from surface water and 40 percent from groundwater.

1.5 Hydrogeologic Conditions

The Antelope Valley is a closed basin. Surface water from the surrounding hills and from the valley floor flow primarily toward three dry lakes on Edwards AFB. Except during major rainfall events, surface water flows toward the valley from the surrounding mountains quickly percolating into the streambeds and recharging the groundwater basin.

Underlying the Antelope Valley are three large, sediment-filled basins, which are separated by areas of extensively faulted, elevated bedrock. These depositional basins, West Antelope Basin, East Antelope Basin and Kramer Basin (**Figure 4**) are filled with alluvium, sedimentary and volcanic rock.

The tectonic environment of Antelope Valley is dominated by the San Andreas Fault, which forms the southern boundary of the valley (**Figure 4**). There are several other fault zones in the western Mojave Desert, most notably the active Garlock Fault. The Garlock Fault is a northeast-trending fault at the boundary between the valley and the Tehachapi Mountains. The San Andreas Fault and the Garlock fault intersect near Gorman.

The groundwater basin of the Antelope Valley is comprised of two alluvial aquifers, the principal and the deep aquifer. A confining bed of clay and silt, the aquitard separates these aquifers. In general the principal aquifer is thickest in the southern portion of the valley near the San Gabriel Mountains, while the deep aquifer is thickest in the vicinity of the dry lakes on Edwards AFB. The principal aquifer is an unconfined aquifer; the deep aquifer is confined.

The Antelope Valley groundwater basin is divided into 12 sub-units. Palmdale Water District's primary service area overlies three of these sub-units: the Lancaster, Buttes and Pearland sub-units. In addition the District overlies a portion of the San Andreas Rift Zone which also contains water-bearing deposits. At present the District pumps ground water from the principal aquifer in the Lancaster and Pearland sub-units and from the San Andreas sub-unit.

1.5.1 Lancaster Sub-Unit.

The Lancaster sub-unit is located in the center of the Antelope Valley Basin and consists of alluvial deposits in excess of 2,000 feet thick. The southernmost portion of the Lancaster sub-unit lies within the District service area and is bounded by a bedrock ridge on the south and by the Buttes and Pearland sub-units on the east. Alluvium reaches a thickness of about 1,100 feet in the northern portion of the District service area

Declining water levels in the Lancaster sub-unit have caused concern for many decades. The primary influence on water levels in the Lancaster sub-unit is pumping. Agricultural use has historically represented a significant portion of extraction from the sub-unit. However, since the mid-1960s, agricultural pumping has declined from over 150,000 ac-ft/yr. to less than 40,000 acft/yr. currently. However, groundwater extraction for municipal use has increased substantially in the last 20 years.

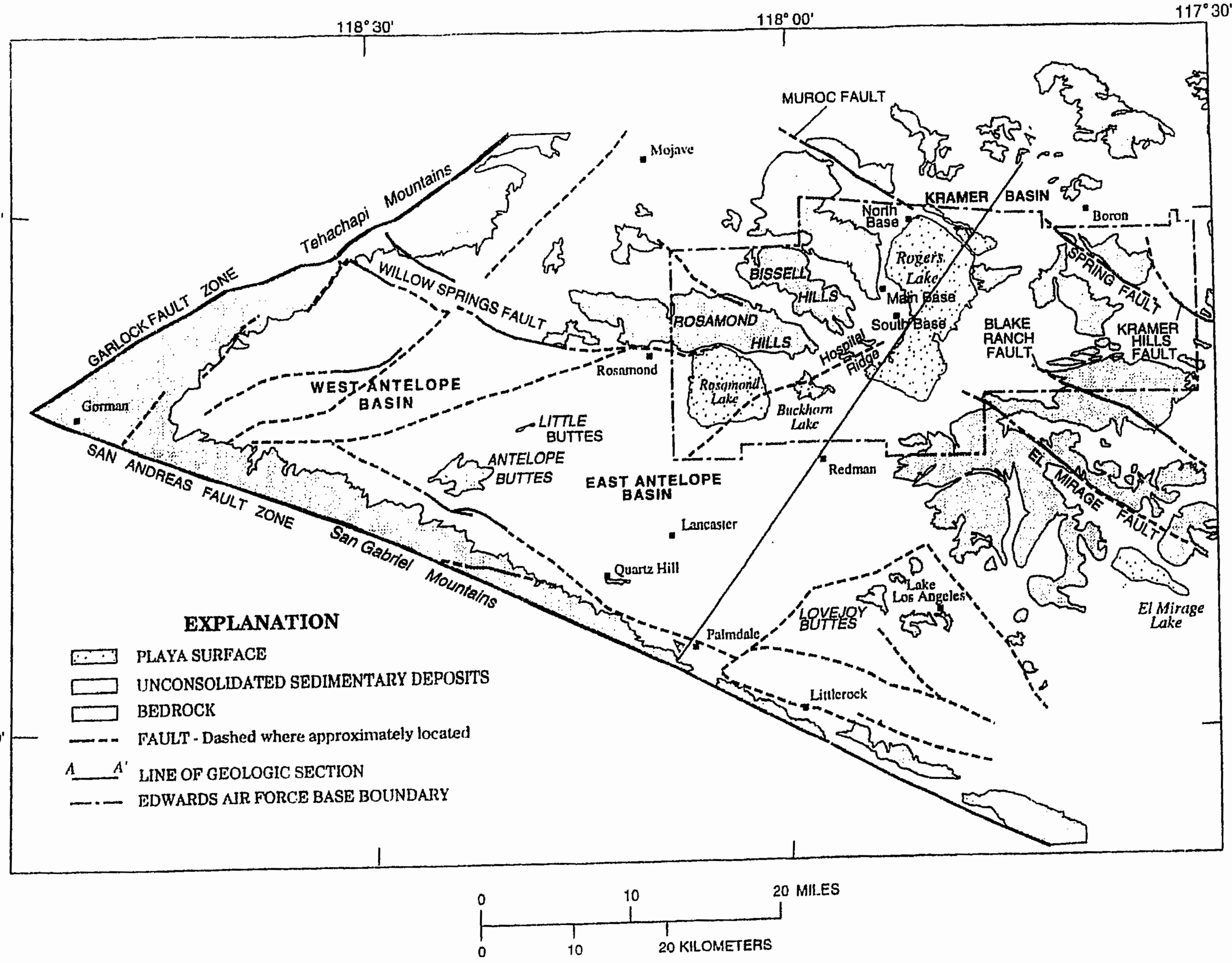


Figure 4 Generalized surficial geology and major faults in Antelope Valley. (Modified from Londquist and others, 1993, fig. 2).

Based on 1989 to 1995 well pump tests, yields and corresponding drawdowns, the saturated alluvium may have transmissivity values as high as 140,000 gallons per day per foot (gpd/ft). Depths to water vary, depending on location and season, but were in the range of 500-600 feet. The seasonal variation on Groundwater levels ranges from about 50 to 60 feet.

At present the District operates 12 wells in the Lancaster sub-unit pumping approximately 9,200 ac-ft/yr., or 44 percent of the District's total annual production. Typical specific capacity of the District wells in this area range from 3 to 76 gallons per minute per foot (gpm/ft) of drawdown.

1.5.2 Pearland Sub-Unit

Pearland sub-unit is located southeast of the Lancaster sub-unit and underlies a portion of the District service area. In the vicinity of the Pearland subdivision, the sub-unit is bounded on the south by bedrock, on the north by a fault separating it from the Buttes sub-unit and on the west by the basin boundary with Lancaster sub-unit. Good recharge during wet years leads to complete recovery from the prior effects of pumping. Groundwater levels respond rapidly to runoff from Big Rock and Little Rock Creeks, which are the main recharge sources to the sub-unit. The single aquifer zone within the Pearland sub-unit consists of alluvial deposits with an average saturated thickness of about 250 feet. Transmissivity values are estimated to be on the order of 40,000 gpd/ft, based on well yield and drawdown data available from 1989 to 1997.

Outflow appears to occur from the Pearland sub-unit into the Lancaster sub-unit, although no quantitative data has been gathered. Generally, groundwater levels are about 150-250 feet below the ground surface. Seasonal fluctuations in the groundwater level are typically less than 10 feet. Over the long term, groundwater levels in monitored wells have remained stable.

Currently the District operates ten wells pumping approximately 2,000 ac-ft/yr. or ten percent of total production. Four wells have been drilled in the basin for future use. Typical specific capacities of wells in the Pearland Sub-Unit are on the order of 10gpm/ft of draw down.

1.5.2 Buttes Sub-Unit

The Buttes sub-unit of the Antelope Valley Basin is located southeast of the Lancaster sub-unit. A small portion of the sub-unit underlies the District service area; however the District does not pump from the sub-unit. The Buttes sub-unit is separated from the Pearland sub-unit by a fault, which impedes flow from one sub-unit to the other. The aquifer zone within the Buttes sub-unit consists of water-bearing alluvial deposits over granite bedrock. Saturated alluvium appears to be 150 feet thick with a fairly low transmissivity. Historical water levels are similar to those of the Pearland sub-unit. Good recharge during wet years leads to complete recovery from the prior effects of pumping. Groundwater levels respond rapidly to runoff from Big Rock and Little Rock Creeks, which are the main recharge sources to the sub-unit.

1.5.3 San Andreas Rift Zone.

Within the San Andreas Rift Zone, two general Groundwater bearing, areas are defined on the basis of geologic mapping and topographic expression. These areas generally lie east and west of the intersection of Pearblossom Highway and Barrel Springs Road. The area to the east is a narrow valley and probably has poor groundwater production potential. The area to the west is a broader valley with more extensive groundwater bearing deposits. District Well Nos. 5 and 17 are located in the western area while District Well Nos. 18 and 19 are located in the eastern area.

Northwest-southeast trending faults may have associated fine-grained gouge zones that separate the groundwater bearing areas into compartments, but the actual location of individual faults and their influence on groundwater movement have not been explored. The groundwater bearing sediments have been formed in the rift zone by alluvial deposition and/or shearing of harder rocks. Information available on the maximum depth of the sediments is insufficient to make generalizations, but the log of one well within the western area shows that sand and gravel were encountered at a depth of 210 feet. The log of District Well No. 19, located within the eastern area, shows that a hard packed sand was encountered at a depth of 340 feet.

The depth to water along the San Andreas Rift Zone is generally about 20 feet below the ground surface. The seasonal groundwater level fluctuations are typically about 10 feet, although water level records show some seasons with fluctuations of as much as 40 feet. Over the long term, groundwater levels in sediments within the fault zone have remained relatively stable, suggesting, that the groundwater bearing sediments have not been overdrawn.

Four District wells (Nos. 5, 17, 18, and 19) produce groundwater from the San Andreas sub-unit. Well logs indicate that the specific capacity of the wells is 3, 4, 13, and 4 gpm/ft of drawdown, respectively. Well yields range from 85 to 358 gpm with Well No.17 having, the highest yield (well 17 is not being pumped into the system at present Due to high nitrate and iron and manganese levels).

1.6 Report Organization

This report is organized into eight chapters:

- **Chapter 1 – Introduction,** provides the background and purpose of the Palmdale Water District Groundwater Assessment and Protection Program. In addition this chapter describes the study area and the geohydrologic conditions.

- **Chapter 2 – Delineation,** provides a summary of the delineation method, process and results.

- **Chapter 3 – Protection Area Inventories,** identifies potential contaminant sources within the drinking water protection zones for existing wells and describes the methods used to gather potential contaminant information.

- **Chapter 4 – Vulnerability Analysis,** summarizes the vulnerability assessment of each source.

- **Chapter 5 – Water Quality Review** a brief review of the groundwater quality.

- **Chapter 6 – Public Participation,** provides the background on the formation of the Groundwater Protection Advisory Committee and how the community was informed of the plan's development.

- **Chapter 7– Management Plan,** includes the goals and general management strategies that can be used to protect the groundwater quality. Specific strategies will be developed during the second phase of the project.

- **Chapter 8 – Contingency Planning,** assesses the ability of the water system to function with the loss of a major supply, identifies alternate water supplies and outlines a spill/incident response plan. A detailed contingency plan will be developed for the District during the second phase of the project.

REFERENCES AND DATA SOURCES

1. Law Environmental Inc., 1991, Water Supply Evaluation – Antelope Valley, California, prepared for Palmdale Water District.

2. Kennedy/Jenks Consultants, 1995, Antelope Valley Water Resource Study, prepared for Antelope Valley Water Group.

3. Montgomery Watson, 1996, Water System Master Plan, prepared for Palmdale Water District.

4. U.S. Geological Survey, 1992, Determination of Land Subsidence Related to Groundwater Level Declines Using Global Positioning System and Leveling Surveys in Antelope Valley Los Angeles and Kern Counties, California, prepared in cooperation with Antelope Valley Water Group.

5. U.S. Geological Survey, 1995, Land Use and Water Use in the Antelope Valley California, prepared in cooperation with the Antelope Valley Water Group.

6. U.S. Geological Survey, 1996, Regional Water Table (1996) and Water-Table Changes in the Antelope Valley Groundwater Basin, California.

7. Palmdale Water District, 1998, personal communication.

8. California Department of Health Services, 1998, Drinking Water Source Assessment and Protection Program, April 1998 (draft).

9. U.S.EPA, 1994, Handbook-Groundwater and Wellhead Protection.

10. U.S.EPA, 1997, State Source Water Assessment and Protection Programs Guidance.

11. Standish-Lee Consultants, 1997, Updated Sanitary Survey for the Littlerock Reservoir and Lake Palmdale Watersheds, prepared for Palmdale Water District.

2. DELINEATION OF PALMDALE WATER DISTRICT'S GROUNDWATER PROTECTION AREAS

Palmdale Water District's wells produce water from the Antelope Valley's principal aquifer. The Recharge Area of a well is defined in the State of California Source Assessment and Protection Program Guidelines as the entire Area contributing surface and/or subsurface flows to the aquifer from which the subject well draws its water supply. In keeping with this definition the recharge area is described in the following paragraph.

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies inside the following hydro-geologic boundaries. As shown in Fig. 1 the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, and further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelope Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are those of Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such as the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws most of its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first with surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

Given that the size of the recharge area, protection of the entire area is impractical. The purpose of the delineation process is to determine the groundwater or wellhead protection areas. These protection areas are defined as "the surface and subsurface areas surrounding a well or well field, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field".

The District also pumps water from four wells in the San Andreas sub-unit. The significant sources of recharge for this sub-unit are direct precipitation, infiltration from the Palmdale ditch and landscape runoff.
Zones are established within a delineated area to provide for different levels of protection.

Technical guidelines for completing the delineation are contained in the State's Guidance manual. The guidance manual provides minimum requirements and direction of how to conduct the delineation but leaves the choice of method to the water utility.

U.S.EPA (1987) defined five criteria that may be used singly or in combination to define the area around a well in which contaminants could represent a threat to drinking water drawn from the well: (1) distance, (2) drawdown, (3) time of travel, (4) flow boundaries, and (5) assimilative capacity.

2.1 Delineation Method

The method used to delineate the protection zones for the District's wells is the Modified Calculated Fixed Radius Method. The delineated area is divided into Time of Travel (TOT) zones. The time of travel criterion requires delineation of *isochrones* (contours of equal time) on a map that indicate how long water or a contaminant will take to reach a well from a point within the zone of contribution. The delineated drinking water protection areas and the TOT zones will allow the District to focus its protection and management strategies and resources on the areas where the most benefit to the water resource will occur.

The Modified Calculated Fixed Radius Method estimates the zone of contribution (ZOC) for a specified time of travel and takes into account the direction of the groundwater flow. The radius is calculated using the following formula:

$$\mathbf{Rt} = \sqrt{\mathbf{Qt/\pi\eta H}}$$

Rt = radius of zone (feet) for time period t
Q = pumping capacity of well (ft^3/year, where ft^3/year = gpm × 70,267
t = travel time (years)(2,5,10 years)
π = 3.1416
η = effective porosity
H = screened interval

The information for calculating the ZOCs was collected from Well reports (well logs), District staff and other data from well files. The screened interval is based on well construction reports and where the actual value is unknown, an initial estimate was made equal to 10 percent of the pumping capacity of the well in gallons per minute.

The effective porosity was estimated using well log soils data and the porosity table **(Appendix B).** For wells that did not have a well log on file a porosity value of 0.2 was used.

The direction of flow was estimated using a USGS groundwater contour map of the Antelope Valley **(Figure 5).** The USGS report is titled " Regional Water Table (1996) and Water Table Changes in the Antelope Valley Groundwater Basin, California".
In the Modified approach the radius of the ZOC is calculated using the above formula. The upgradient extent of the zone is determined as 1.5Rt (e.g., one and half times the calculated radius). The downgradient extent of the zone is 0.5Rt (e.g., one-half times the calculated radius). The resulting shape is a circle with a radius Rt, shifted upgradient by a distance of 0.5Rt.

2.2 Data Collection and Evaluation

To develop the ZOCs, well reports (well logs) on file at the District office were examined for existing wells within the study area. Other sources of information included published reports, discussions with District staff and a field review of each well site.
Well data sheets were completed for each of the well sites. The wells were located on a USGS 7.5-minute quad map. The location of the wells was determined by USGS staff using a Global Positioning System (GPS) unit, and verified in the field. Where a disagreement existed between the USGS data and the location determined in field reconnaissance USGS was consulted to determine the well location.
Three zones of contribution were calculated for each well:

- Zone A (2-year time of travel)
- Zone B5 (5-year time of travel)
- Zone B10 (10-year time of travel)

The zones were plotted on the USGS quad map. The delineated areas are displayed on **attached maps Appendix A.** The data sheets are enclosed in **Appendix B. Table 1** includes a summary of the calculated radiuses for the 2,5, and 10 years time of travel. The table also includes the Physical Barrier Effectiveness determination for each of the wells.
The wells were determined to have a moderate physical barrier effectiveness except for Well 5 which was determined to have a low physical barrier effectiveness and Wells 10, 17, 18 and 19 which were designated Low/Moderate. These wells do not have a well log on file and therefore it cannot be determined if they meet well construction standards.

Table 1 – Delineation of Groundwater Zones and Physical Barrier Effectiveness Summary

Well No.	Well ID	Latitude	Longitude	R2 (ft)	R5 (ft)	R10 (ft)	Effectiveness
2A*	06N/11W-19E05 S	34 35 42.05	118 05 32.24	789	1248	1765	Moderate
3A*	06N/11W-19E06 S	34 35 46.00	118 05 29.00	684	1082	1530	Moderate
4A*	06N/11W-19F01 S	34 35 41.92	118 05 08.57	660	1043	1475	Moderate
6A*	06N/12W-23A01 S	34 36 00.06	118 06 48.76	600	1000	1500	Moderate
7A*	06N/11W-19F02 S	34 35 53.75	118 05 05.31	790	1249	1767	Moderate
8A*	06N/11W-19C01 S	34 36 04.89	118 05 18.80	1154	1824	2578	Moderate
10*	06N/11W-20H01 S	34 35 43.48	118 03 41.79	1488	2352	3326	Low/Moderate
11A*	06N/12W-24C02 S	34 36 01.78	118 06 09.09	612	1000	1500	Moderate
14A*	06N/12W-24A03 S	34 35 56.53	118 05 51.33	638	1008	1500	Moderate
15*	06N/12W-13N01 S	34 36 08.03	118 06 36.37	626	1000	1500	Moderate
23A*	06N/11W-19L01 S	34 35 40.31	118 05 19.50	1010	1597	2259	Moderate
24*	06N/11W-19G01 S	34 35 42.05	118 04 48.33	600	1000	1500	Moderate
16**	05N/11W-05C02 S	34 33 13.69	118 03 18.76	600	1000	1500	Moderate
20**	05N/11W-09A02 S	34 32 26.58	118 01 36.99	1455	2300	3254	Moderate
21**	05N/11W-04P01 S	34 32 42.50	118 02 09.75	1516	2469	3491	Moderate
22**	06N/11W-34Q01 S	34 33 29.88	118 01 51.29	600	1000	1500	Moderate
25**	06N/11W-35J01 S	34 33 50.17	118 00 15.26	600	1000	1500	Moderate
26**	06N/11W-33J01 S	34 33 54.57	118 02 38.02	600	1000	1500	Moderate
27**	06N/11W-35K01 S	34 33 41.19	118 00 34.90	733	1158	1638	Moderate
28**	05N/11W-03A—S	34 33 12.58	118 00 40.27	600	1000	1500	Moderate
29**	06N/11W-35G01 S	34 34 00.32	118 00 29.65	705	1115	1576	Moderate
30**	06N/11W-36C01 S	34 34 21.00	117 59 49.75	846	1337	1891	Moderate
32**	06N/11W-32P03 S	34 33 36.59	118 03 59.56	600	1000	1500	Moderate
33**	06N/11W-36D01 S	34 34 19.04	117 59 56.50	912	1442	2040	Moderate
34A**	05N/11W-03E—S	34 32 59.79	118 01 21.62	600	1000	1500	Moderate
35**	06N/11W-03N01 S	34 32 45.00	118 01 22.50	600	1000	1500	Moderate
5***	05N/12W-02P04 S	34 32 29.58	118 06 25.56	1509	2386	3374	Low
17***	06N/12W-34N04 S	34 33 35.02	118 08 33.04	1515	2396	3388	Low
18***	05N/11W-17H01 S	34 31 21.24	118 02 42.73	600	1000	1500	Low
19***	05N/11W-17H02S	34 31 21.75	118 02 42.95	600	1000	1500	Low

Note: *Wells in the Lancaster sub-unit, ** Wells in the Pearland sub-unit, *** Wells in the San Andreas Rift Zone

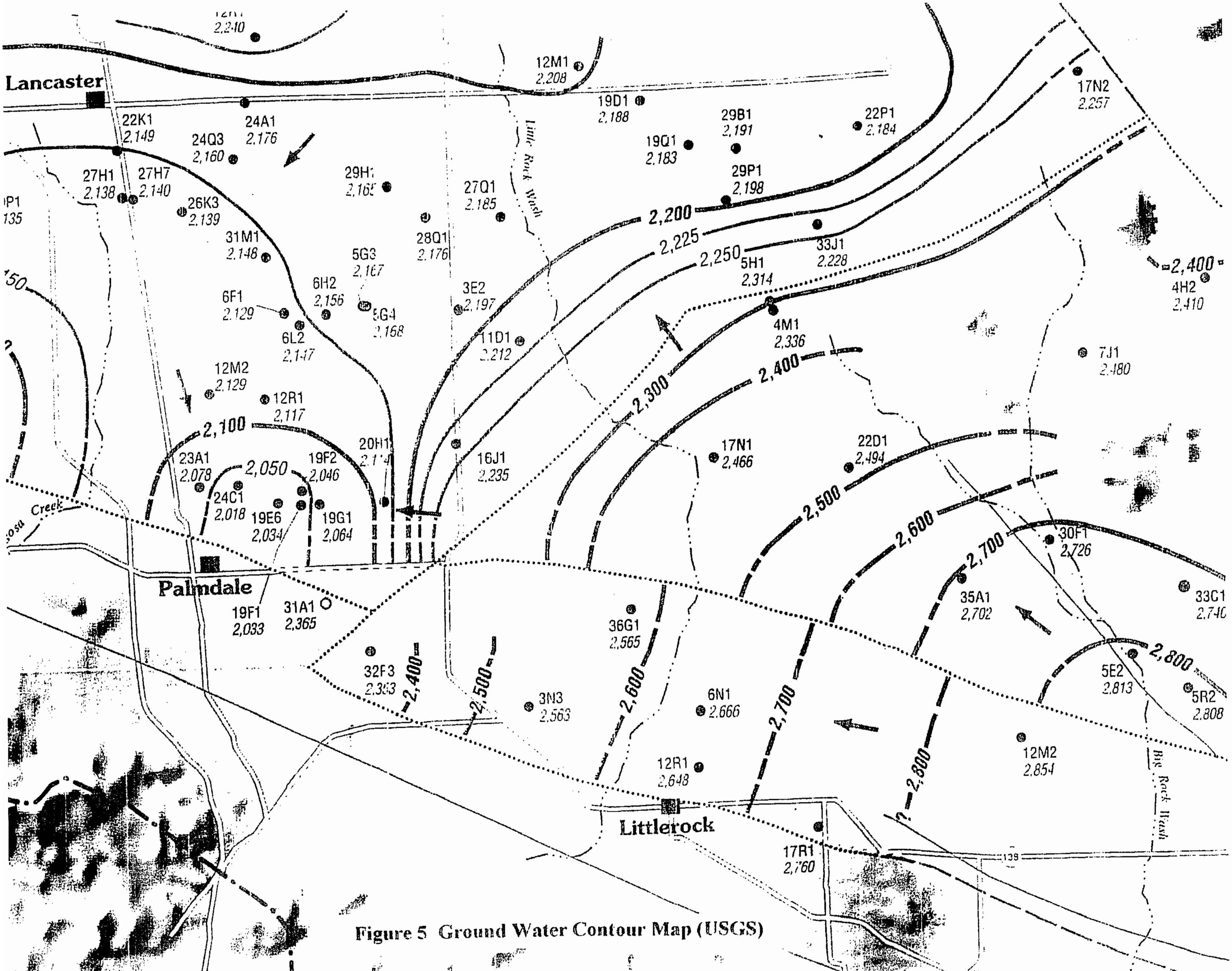


Figure 5 Ground Water Contour Map (USGS)

3. PROTECTION AREA INVENTORIES

An essential element of the drinking water source assessment and protection program is an inventory of Potential Contaminating Activities (PCAs). PCAs are any activities, facilities or land uses that can be origins of significant contamination in delineated source protection areas.

An inventory of PCAs can serve the following functions:

- Identify past and present activities that may pose a threat to the drinking water supply based on their potential for significant contamination of groundwater and surface water.

- Provide information on the locations of PCAs that present the greatest risk to the water supply.

PCAs were inventoried and assigned a risk ranking from the California Drinking Water Source Assessment and Protection (DWSAP) program. The risk rankings of activities are based on EPA and California specific historic information on releases of contaminants, and potential contaminant characteristics. The potential risk rankings assume that the facility or activity does not employ best management practices (BMPs) or pollution prevention. The inventory process also did not include an attempt to identify specific potential contamination problems at specific sites. BMPs and more site specific potential problems can be identified and corrected in the process of developing protection plans and help reduce the risk ranking of a facility or activity.

3.1 Inventory Method

Past and current activities were identified through a variety of methods. The inventory process did not include a site inspection and visit to each individual facility. A field review of each well site did identify categories of land uses and facilities and activities in the immediate vicinity of each well, and a windshield drive identified and/or confirmed other facilities. Information was also gathered from the following contacts:

- United States Department of the Interior, Water Resources Division.
- Los Angeles County Department of Public Works, Industrial Waste Planning and Control, Environmental Programs Division.
- State Water Resources Control Board, Division of Clean Water Programs.
- California Regional Water Quality, Lahontan Region.
- City of Palmdale Public Works Division.

The identified activities were plotted on digitized USGS maps. Summaries of the inventoried facilities within each protection zone and the risk ranking for each facility are included in the appendix.
The attached maps present the identified activities and their location within each zone of protection. The facilities were located by using the street address.
Appendix C includes the list of the inventoried PCAs for each well.

4. Vulnerability Analysis

Vulnerability is an evaluation to determine the greatest (most significant) threats to the water quality of the water supply. The evaluation takes into account the characteristics of the source and site to determine their effectiveness as a physical barrier to contamination. The vulnerability analysis also considers the type and proximity to water supply of activities that could release contaminants. **Table 4** is a matrix showing the correlation between PCAs and groups of contaminants of concern.

4.1 Vulnerability Analysis Procedures

A vulnerability analysis for a drinking water supply consists of evaluating the source and site characteristics together with the PCAs identified in the inventory.

Table –1 includes the physical Barrier Effectiveness (PBE) for each well. The classification of High, Medium and Low were generated using the forms attached in the appendix, using site specific information such as hydrogeology, hydrology, soils, and well construction information.

The vulnerability ranking process uses the PBE and assigns points to each well according to its ranking.

PBE points:

Low	5
Medium	3
High	1

It then assigns points to each activity based on its risk ranking of Very High (VH), High (H), Medium (M) and Low (L).

Risk ranking points:

VH	7
H	5
M	3
L	1

Points are also assigned to each zone in which the PCA occurs.

Zone R2	5

Zone R5	3
Zone R10	1

The points are added together for each PCA. To calculate a relative risk ranking for each well the scores for all the PCAs in the well's protection zones are added up to produce the well vulnerability score.

Example: Well 16

ZONE	PCA	PCA Points	Zone points	PBE points	Vulnerability score for PCA
R2	Sewer lines (H) Housing high density (M) Dry well (VH)	5 3 7	5 5 5	3 3 3	13 11 15
R5	Sewer lines (L) Housing high density (M) Detention basin (M)	1 3 3	3 3 3	3 3 3	7 9 9
R10	Sewer line (L) Housing high density (M) Dry well (VH)	1 3 7	1 1 1	3 3 3	5 7 11
Total					87

Table – 2 includes the risk ranking summaries for PCAs with a score ranking of ≥ 11.
Table - 3 Includes the risk ranking total for each well and the PCA maximum score activity.
Appendix D includes the forms used for calculating the risk ranking scores.

Table - 2 Risk Ranking Summary (Activities with score ≥11):

WELL	ZONE	ACTIVITY	PCA RANKING	VULNERABILITY SCORE
Well 2A	R2	T. Sewer	H	13
Well 3A				
Well 5	R2	Septic S.	VH	17
		Illegal A.	H	15
		Highway	M	13
		Housing	M	13
		P. Ditch	L	11
	R5	Junk/scrap	H	13
		Illegal A.	H	13
		Housing	M	11
		Highway	M	11
		WTP	M	11
	R10	Junk/Scrap	H	11
		Illegal A.	H	11
Well 6A	R2	Junk/scrap	H	13
		Railroad T.	M	11
Well 7A	R2	T. Sewer	H	13
	R5	Military I.	VH	13
	R10	Military I.	VH	11
Well 8	R2	Military I.	VH	15
		T. Sewer	H	13
	R5	Military I.	VH	13
	R10	Military I.	VH	11
		Leaking UST (2)	VH	11
Well 10	R2	Food Proc.	M	11
		Golf Course	M	11
		Inactive ag. Well	H	13
	R10	Dry well	VH	11
Well 11A	R2	Leaking UST	VH	15
		T. Sewer	H	13
		Railroad T.	M	11
		Hardware S.	M	11
	R5	Machine S.	H	11
		Military I.	VH	13
	R10	Military I.	VH	11
Well 14A	R5	Military I.	VH	13
	R10	Military I.	VH	11

Well 15				
Well 16	R2	Sewer L.	H	13
		Dry well	VH	15
		Housing	M	11
	R5	Dry well	VH	13
	R10	Dry well	VH	11
Well 17	R2	Septic S.	VH	17
		Housing H.	M	13
		Road	L	11
	R5	Septic S.	M	11
		Housing H.	M	11
	R10	Parking Lot	H	11
Well 18	R2	Road	L	11
Well 19				
Well 20	R2	Septic S.	VH	15
		Repair shop	H	13
		Highway	M	11
	R10	Gas Station	VH	11
Well 21	R2	Gas Station	VH	15
		Septic S.	VH	15
		Railroad T.	M	11
		Highway	M	11
	R10	Dry well	VH	11
Well 22	R2	Sewer L.	H	13
		Dry well	VH	15
		Housing H.	M	11
	R10	Dry wells(4)	VH	11
Well 23A	R2	Repair shop	H	13
		Diesel/heavy equip.	H	13
Well 24	R10	Leaking UST	VH	11
Well 25	R2	Illegal A.	H	13
	R5	Illegal A.	H	11
Well 26	R2	Sewer L.	H	13
		Highway	M	11
		Housing H.	M	11
		Detention basin	M	11
Well 27				
Well 28	R2	Illegal A.	H	13
	R5	Illegal A.	H	11
Well 29	R2	Sewer L.	H	13

Well 30	R2	Illegal A.	H	13
	R5	Illegal A.	H	11
Well 32	R2	Sewer L.	H	13
		Housing H.	M	11
	R5	Dry well	VH	13
	R10	Dry well	VH	11
Well 33	R2	Illegal A.	H	13
	R5	Illegal A.	H	11
Well 34A	R2	Illegal A.	H	13
	R5	Illegal A.	H	11
Well 35	R2	Railroad T.	M	11

Table – 3 RISK RANKING SCORES AND MAXIMUM ACTIVITY SCORE

WELL NUMBER	TOTAL SCORE	HIGH PCA SCORE
Well 2A	34	13
Well 3A	42	9
Well 4A	33	9
Well 5	193	17
Well 6A	85	13
Well 7A	120	13
Well 8	100	15
Well 10	111	13
Well 11A	152	15
Well 14A	48	13
Well 15	55	9
Well 16	115	15
Well 17	133	17
Well 18	43	11
Well 19	32	9
Well 20	131	15
Well 21	204	15
Well 22	164	15
Well 23A	69	13
Well 24	35	11
Well 25	33	13
Well 26	116	13
Well 27	9	9
Well 28	33	13
Well 29	50	13
Well 30	33	13
Well 32	90	13
Well 33	33	13
Well 34A	33	13
Well 35	36	11

Table – 4 Pollutant/Land-Use Matrix

Land use	Turbidity sediment	N,P	Bacteria Viruses parasites	THM precursors	Pesticides/ herbicides	other SOCs	VOCs	Trace metals	TDS chloride
Cropland irrigation	x	x	x	x	x			x	x
Grazing	x	x	x	x					
Confined animals	x	x	x	x				x	x
Septic tanks		x	x	x	x				
Sewers		x	x	x	x	x	x	x	x
Gas stations						x	x	x	
Dry cleaners							x		
Military						x	x	x	x
Landfills	x	x	x	x	x	x	x	x	x
Urban areas	x	x	x	x	x	x	x	x	
Industrial discharge	x	x		x	x	x	x	x	
LUSTs						x	x		
Roads	x	x	x					x	
WW reuse		x	x	x	x	x		x	x
Airports						x	x	x	
Auto repair						x	x		
Golf courses		x	x	x	x				x
Metal plating						x	x	x	
Motor pools						x	x	x	
Injection/ dry wells		x	x			x	x	x	

5. WATER QUALITY REVIEW

The District analyzes the groundwater supplies to meet or exceed all the DHS requirements for monitoring. The District analyzes the water quality quarterly for general mineral, general physical and inorganic constituents the last three set of samples were analyzed during the last quarter of 1997 and the first two quarters of 1998. These results were summarized in **Table - 4.** The table presents the range and average of chemical constituents found in the groundwater for each sub-unit. The organic constituents are analyzed once every three years and the District analyzes the well source water for total coliform monthly.

5.1 Lancaster Sub-Unit

The overall water quality in the Lancaster Sub-Unit is excellent. The water meets all the primary drinking water standards and meets the secondary drinking water standards accept for iron and manganese in Wells 16 and 4A. The TDS of the water ranges from 104 to 253 mg/L with an average of 174 mg/L. The alkalinity ranges from 64 to 143 mg/L with an average of 102 mg/L. The water quality is generally consistent and does not change much from year to year. Since 1995 there has been a slight improvement of water quality in the sub-unit accept for the increase in iron and manganese concentrations.

5.2 Pearland Sub-Unit

The overall water quality in the Pearland Sub-Unit is excellent. The water meets all the primary and secondary drinking water standards. The TDS of the water ranges from 90 to 308 mg/L with an average of 196.6 mg/L. The alkalinity ranges from 54.4 to 142 mg/L with an average of 114 mg/L. The water quality has improved slightly since 1995. The improvement might be due to the two wet winter seasons and reduced pumping of ground water (the District's goal is to restrict groundwater to 40 percent of total water needs).

5.3 San Andreas Sub-Unit

The water quality in the San Andreas Rift Zone is variable especially in mineral content and nitrate concentrations **Table - 5**. Wells Numbers 5 and 17, which are located in the western area are high in specific conductance, TDS, chloride, calcium and nitrate. The water in that zone is highly mineralized and septic tanks in the area probably contribute to the high nitrate levels. Well 17 exceeds the nitrate MCL, and the upper consumer acceptance limit for TDS and specific conductance. Well number 17 is not pumped into the system. Wells numbers 18 and 19 are located in the eastern area they meet all drinking water standards their TDS is below the recommended level of 500 mg/L.

Table – 5 San Andreas Sub-Unit Water Quality comparison.

Constituent (mg/L)	Well 5	Well 17	Well 18	Well 19
Hardness	385		192	164
Calcium	123	231	57	45.3
Chloride	168		30.2	10.8
Nitrate	26	51	2.7	2.2
Specific Cond. (umhos/cm)	1110	1970	490	400
TDS	697	1110	289	220
Alkalinity	264	178	179	169

Table 4: Groundwater Quality Summary

Constituent	MCL	Lancaster Range	Lancaster Average	Pearland Range	Pearland Average	San Andreas Range	San Andreas Average*
Cations (mg/L)							
Calcium (Ca)		6.89 - 49.3	22.2	12.2 - 72.1	37.24	38.8 – 231	90
Magnesium (Mg)		<1.0 – 11.8	5.5	<1.0 – 11.5	6.36	9.8 – 26.7	14.24
Sodium (Na)		17.9 – 52.8	36.3	8.3 – 35.0	23.64	22.4 – 105	44.2
Potassium (K)		<1.0 – 3.4	1.5	<1.0 – 3.0	1.49	<1.0 – 4.0	1.6
Anions (mg/L)							
Bicarbonate (HCO_3)		78 –175	128.5	66.3 – 173	139.3	196 – 322	229
Carbonate (CO_3)		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide (OH)		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloride (Cl)	250	<2 - 33.8	13.7	2.6 – 38.8	11.67	5.7 – 168	44.3
Sulfate (SO_4)	250	16 – 58.7	29.9	19.5 – 49.4	38.85	22.3 – 88.5	39.6
Fluoride (F),temp. depend.	1.4-2.4	0.1 – 0.44	0.26	<0.1 – 0.3	0.18	0.15 – 0.72	0.29
Nitrate (NO_3)	45	<2 – 6.3	2.64	<2 – 27.2	6.1	<2.0 – 51.0*	17.36
Nitrate+Nitrite as N	10	<0.4 – 1.42	0.46	<0.4 – 6.14	1.36	<0.4 – 6.1	1.63
Nitrite as N	1.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Cyanide	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Inorganic Chemicals (µg/L)							
Aluminum (Al)	1000	<50 – 85	57.8	<50.0 - 91.7	55.4	<50.0 – 69	54.6
Antimony (Sb)	6	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
Arsenic (As)	50	<2 – 4.7	2.2	<2.0	<2.0	<2.0 – 4.4	2.48
Barium (Ba)	1000	<100	<100	<100.0	<100.0	<100.0	<100.0
Beryllium (Be)	4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium (Cd)	5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium (total Cr)	50	<10 – 13.5	10.1	<10.0	<10.0	<10.0	<10.0
Copper (Cu)	1000	<50 – 125	52.7	<50.0	<50.0	<50.0	<50.0
Iron (Fe)	300	<100 – 575(a)	119.8	<100.0	<100.0	<100.0 –127*	125.4
Lead (Pb)		<5 – 5.6	5	<5.0	<5.0	<5.0	<5.0
Manganese (Mn)	50	<30 – 130(b)	36.5	<30.0	<30.0	<30.0 – 88*	47.6
Mercury (Hg)	2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	100	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Selenium (Se)	50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Silver (Ag)	100	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Thallium (Tl)	2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc (Zn)	5000	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
Others							
pH (laboratory)		7.17 – 8.59	8.4	7.53 – 8.56	7.95	7.64 – 7.88	7.80
Specific cond. ,umhos/cm		215 – 450	330	220 – 505	333	360 – 1970*	784
TDS at 180°C		104 – 253	174.3	90.1 – 308	196.6	203 – 1110*	455.3
Color (unfiltered), Units		<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Odor at 60°C, TON		1– 2	1	1– 2	1	1	1
Turbidity (lab), NTU		0.1 – 0.7	0.27	0.1– 1	0.15	0.1 – 0.2	0.14
MBAS (mg/L)	0.5	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total Alkalinity (as $CaCO_3$)		64 – 143	101.6	54.4 – 142	114.3	161 – 264	186.2
Total hardness (as $CaCO_3$)		33.2 - 165	78	50.4 - 152	124.5	138 – 385	208
0rganics		ND	ND	ND	ND	ND	ND
Perchlorate		<5.0	<5.0	<5.0	<5.0	<5.0 – 5.2**	

Notes: * Well 17 (has not been used in the system the last three-quarters)
** Well 5 on 11/19/97 (a) Well 16 (b)Well 4A

6. PUBLIC PARTICIPATION

Public involvement is an integral part of developing a community based Source Water Protection Program. Palmdale Water District completed the initial Source Water Assessment Program and is proceeding with developing a voluntary protection plan. The goal of a local source water protection plan is to identify, develop and implement local measures that advance the protection of the drinking water supply.

A successful source water protection program requires public involvement. The principal reasons for encouraging public involvement are:

- Build support for the Program.
- Ensure that interested parties understand the program and have "ownership" in it.
- Provide technical review of the program elements and build on local knowledge.
- Help develop consensus among parties affected by the program.
- Help promote awareness of source water quality issues and build support for source control activities in the community.

6.1 Forming the Palmdale Water District Wellhead Protection Advisory Group

The District invited the following agencies to participate in the Groundwater Protection Advisory Committee:

City of Los Angeles Department of Airports
City of Palmdale, City Administrator
City of Palmdale Public Works Department
City of Palmdale Planning Department
Building Industry Association
Los Angeles County Supervisor Mike Antonovich
Palmdale Chamber of Commerce
Palmdale School District
Antelope Valley Union High School District
State of California Department of Health Services
US Air Force Plant 42 Environmental Restoration Advisory Board
League of Women Voters
Antelope Valley Board of Realtors
Palmdale Disposal
Los Angeles County Sanitation District
Los Angeles County Fire Department
Mrs. Zona Myers (private citizen)

The District's purpose in initiating the stakeholder participation is to:

1) Enable interested parties understand the assessment program.
2) Provide technical assistance.
3) Help develop a community based Groundwater Protection Plan
4) Develop consensus between affected parties.
5) Address any concerns of the public.
6) Develop public education and outreach programs
7) Encourage a good working relationship between local, state and federal agencies and other effected parties.

The first meeting of the Palmdale Water District Wellhead Protection Advisory Group took place on December 10, 1998 at the Palmdale Water District offices. The meeting was designed to provide an overview of the assessment process, receive comments, discuss follow-up steps and to determine the group's desire to act as an Advisory Committee to the District in developing and implementing a Wellhead Protection Plan.

The participants identified the following goals for the upcoming meetings:

- Gain a better understanding of the District boundaries, well locations, protection zones and geological conditions.
- Identify any abandoned wells and other PCAs not identified in the initial assessment.
- Inform the public and parties responsible for PCAs of the assessment process and protection plans.
- Revisit delineated areas if needed.
- Develop Wellhead protection and contingency plans to protect Palmdale Water District's source water quality.

Additional stakeholders were identified they include:
Los Angeles County Health Department
Los Angeles County HAZMAT
Water Quality Control Board – Lahontan Region
Antelope Valley Emergency Management Council
Soil Conservation District
The Farm Bureau
Antelope Valley East Kern Water Agency
Local well drillers
United States Geological Survey (USGS)

The Advisory Group will meet during 1999 to help develop the Districts Wellhead Protection Plan. **Appendix E** includes the letter sent to the stakeholders, the meeting agenda and minutes. **Appendix F** includes the presentation materials used during the meeting.

7. MANAGEMENT PLAN

Source water protection is not a mandated element of EPA's Source Water Assessment Program. While the 1996 SDWA Amendments do not impose regulatory or enforcement provisions requiring drinking water source protection by or upon the states and water purveyors, many of the amendments require EPA to consider further incorporation of source water protection measures into drinking water regulations, particularly as a basis to move toward increased regulatory flexibility. These provisions are intended to encourage states and local agencies to go beyond source water assessment to the implementation of management techniques to protect sources of drinking water supplies from identified PCAs. Prevention of source water contamination provides great benefits to the public and is almost always less expensive than the treatment and monitoring that is required after a drinking water source has been contaminated.

A drinking water source with an active source water protection program may be eligible for waivers from monitoring. This is because source protection provides one more "barrier" in a multi-barrier protection treatment train. Moreover, a good source water protection program can save the money that would otherwise be required on additional treatment processes and chemicals.

Drinking water purveyors are encouraged to develop management strategies to mitigate the risk of contamination of drinking water supplies and improve water quality. Management strategies are aimed at reducing the risk of contamination through activities such as pollution prevention, use of Best Management Practices (BMPs), and public education.

Watershed management, and management within delineated protection zones are the responsibilities of local governments and public water systems. The State will encourage voluntary source water protection by providing grants and loans for source water protection through the State Revolving Fund (SRF) set aside, provide technical assistance and training.

7.1 State Programs Related to Drinking Water Source Protection

Many existing federal, state and local programs are aimed at protecting water supplies and to regulate, inventory and clean up contaminant sources and spills. Guidelines are in place for siting of new sources of supply, and any newly proposed developments must undergo environmental review.

Some existing source water protection programs and related programs within the state are listed below. The list refers to state, and county programs that are involved with source water protection:

- Activities Undertaken By County and City Governments –

  Hazardous Material Spills Emergency Response
  Hazardous Waste Management Planning
  Land Use Planning and Zoning
  Pesticide Regulations (County Agricultural Commissioners)
  Regulation of Individual Waste Disposal (septic) Systems
  Regulation of Underground Storage Tanks
  Sanitary Landfill Ground Water Monitoring
  Solid Waste Management Planning
  Water Well Permitting

- Activities Undertaken By State Agencies –

  Basin Planning
  National Pollutant Discharge Elimination System (NPDES) and Waste Discharge Requirements
  Waste Discharges to Land
  Hazardous Waste Facility Monitoring
  Underground Storage Tanks
  Non-Point Source Pollution
  Resource Conservation and Recovery Act (RCRA)
  California Superfund Program
  Pesticide Use and Management
  Integrated Waste Management
  And others

The second Phase of this project will identify specific local programs that are in place to help protect Palmdale Water District's groundwater supplies.

7.2 Local Management Actions

After identifying protection areas, zones, and PCAs and prioritizing PCAs and sources, a local community may choose to develop a management strategy for protecting the water supply. These activities will be accomplished at the local level with support from local agencies and stakeholders. Palmdale Water District as described in Chapter 6 opted to proceed with developing a Wellhead Protection Plan.

Regulatory strategies and non-regulatory management strategies can be effective as components of a source water protection programs. **Table 6** lists potential BMPs and strategies and both structural and non-structural BMPs that can be used in a source water protection plan. **Table 7** lists regulatory and non-regulatory approaches to source protection. The non-regulatory BMPs are relatively easier to implement, but in cases where the local community has determined that its source of supply is at highly susceptible to contamination, regulatory management strategies such as overlay groundwater protection districts, special permitting, subdivision controls and others may be necessary to protect the water supply.

The Palmdale Water District Wellhead Protection Advisory Group will consider these options when developing the local program.

Table - 6 Potential Source Water Protection Strategies and BMPs

URBAN AREAS NON-STRUCTURAL	URBAN AREAS STRUCTURAL	RURAL AREAS AGRICULTURAL	FORESTRY
Minimum lot size	Wet ponds	Judicious use of agricultural chemicals	Post disturbance erosion control
Cluster development	Dry detention basins	Grazing restrictions	Seasonal operating restrictions
Buffer setbacks	Infiltration controls	Animal waste management	Stash disposal
Impervious surface limits			
Drainage requirements	Stormwater diversions	Contour farming	Helicopter logging
Prohibited land uses	Oil/water separators	Crop rotation	Design and construction of haul roads
Wastewater restrictions	Constructed wetlands	Conservation tillage	
Conservation easement	Grassed swales	Terraces	
Public education		Public education	
Incentives		Incentives	
Written agreements		Written agreements	
Transfer of development rights			
Hazardous waste collection			
Revegetation		Grassed water ways	

TABLE - 7 Potential local management strategies for source water protection Programs.

Regulatory	Non-Regulatory
Zoning	
Prohibition of various land uses	Conservation easements
Special permitting	**Watershed restoration efforts**
Large-lot zoning	Public education
Cluster development	**Hazardous waste collection**
Growth controls/timing	Local Wellhead Protection Programs
Transfer of development rights	**Revegetation**
	Land transfer/sale/donation
Health Regulations	**Incentives**
Underground fuel Storage Tanks	Written agreements
Injection Wells	
Toxic and Hazardous Materials Handling Regulations	
Wellhead Protection	
Septic system upgrade/ban	

8. CONTINGENCY PLANNING

Contingency planning to protect drinking water supplies is an essential element of a complete source water protection program. It is also required by the Safe Drinking Water Act (SDWA) and the Emergency Planning and Community Right-to-Know Act of 1986, enacted as Title III of the Superfund Amendments and Re-authorization Act (SARA).

Section 1428 (a) (5) of the SDWA states that each state program shall, at a minimum, "include contingency plans for the location and provision of alternate drinking water supplies for each public water system in the event of well or well field contamination".

Local governments are typically given responsibility for implementing components of a drinking water source protection program. While program requirements may vary, a public water supplier should develop a contingency plan to locate and provide alternate drinking water supplies in the event of contamination. A contingency plan should not be limited to planning for alternative supplies; it should be used to identify and prevent both physical and operational threats from contaminating or closing a public water supply.

The following are minimum components for local contingency plans. These will ensure adequate planning, encourage reliability and consistency, and create uniform response protocols. Any local plan should be consistent with Urban Water Plans.

8.1 Minimum Components of Local Contingency Plans

A local contingency plan should include an assessment of the water system's ability to function with a loss of major supply, and it should address alternate supplies in case they are needed. Specific steps are identified in this section.

♦ Assessment of the Ability of the Water System to Function with the Loss of the Largest Source of Supply

In order to assess the ability to function with the loss of its largest source of supply, the water supplier should do the following:
(1) Identify the maximum water system capacity in relation to source, distribution system, and water rights or other restrictions; and
(2) Re-evaluate this capacity assuming the loss of the largest water supply source.

♦ Development of a Plan for Alternate Water Supplies

To develop a plan for alternate water supplies, the water supplier should determine the availability and reliability of both short term and long-term supplies, the additional capacity that could be needed, and the associated costs. The plan should consider such alternatives as: expanding existing sources, identifying existing and potential inter-ties with other public water systems, developing new sources, and installing treatment on sources not currently used because of water quality problems.

- Development of a Spill/Incident Response Plan

Using the results of the PCA inventory, a response plan for spills and emergencies should be developed with local emergency responders. Potential emergency response actions should consider protection of the water supply. For example, chemical spills within the protection area should be soaked up with absorbent materials rather than being washed away to drainage systems. Similarly, in the event of a fire it may be best to allow certain facilities to burn rather than produce contaminated runoff that could pollute the community water supply.

Palmdale Water District has built in flexibility to deal with emergencies. The District obtains its water supply from three sources: Littlerock Creek, the State Water Project and groundwater. The District is also interconnected with the Antelope Valley East Kern (AVEK) Water Agency and has an ongoing cooperative agreement with Littlerock Creek Irrigation District.

In 1991 the District developed a Water Shortage Contingency Plan that includes mandatory prohibitions and penalties and charges for violations of mandatory conservation measures.

The District will develop contingency plans to deal with other emergencies such as a loss of the largest source of supply, contamination of a source, and an emergency response to spills and other incidents as part of their Wellhead Protection Plan.

APPENDIX A

MAPS

APPENDIX B

Drinking Water Source Location
Site Evaluation
Calculation of Delineation Zones
Porosity Table and
Physical Barrier Effectiveness Forms

Last Update: April 17, 1998

Appendix N

Checklist for Drinking Water Source Assessment – Ground Water Source

The following information should be contained in the drinking water source assessment report.

If another report that is the functional equivalent to the drinking water assessment (e.g., parts of an AB 3030 evaluation for a groundwater basin) is included in this assessment, the part of that report that fulfills the requirements of the source water assessment should be clearly indicated.

__X__ Source name, system name, and source and system identification numbers

__X__ Date of assessment and name of person and organization conducting the assessment

__X__ Drinking water source location and accuracy of method used (Appendix H)

__X__ Identification of delineated zones (Appendix I)

__X__ Drinking water source and site evaluation (Appendix J)

__X__ Possible contaminating activities (PCA) inventory forms and checklists (Appendix K).

__X__ PCA evaluation procedures (optional) (Appendix L)

__X__ Vulnerability analysis (Appendix M)

__X__ Assessment map with source location, protection area including zones, the recharge area and its watershed, and high and moderate vulnerability PCAs in zones.

__X__ Means of Public Availability of Report (indicate those that will be used)

- __X__ Notice in the annual water quality/consumer confidence report* (required)
- __X__ Copy in DHS district office (required)
- __X__ Copy in public water supply office (recommended)
- ______ Copy in public library/libraries
- ______ Internet (indicate Internet address: ________________)
- ______ Other (describe)

*The annual report should indicate where customers can review the assessments.

PALMDALE WATER DISTRICT GROUNDWATER SOURCE ASSESSMENT

Groundwater Source Location

Public water system and ID No.: **PALMDALE WATER DISTRICT**
ID No. 1910102

Name of source and ID No.: **Well 2A**
06N/11W-19E05 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**.)

Location of well: Latitude: **34 35 53.60**
Longitude: **118 05 32.24**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

39400 20th St. East
(1/4 mile south of Avenue P; about 100 ft east of 20th St. East)

Location of recharge area, if known: **The well is located in the Lancaster Sub-Unit.**
The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies inside the following hydro-geologic boundaries. As shown in Figure 1 of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, and further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelope Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are those of Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such as the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws most of its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first with surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.
Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number. **1910102**

Source of Information: **Well log, file, field review and District staff**

Collected by: **Perri Standish-Lee** -Date: **June 5, 1998**

Well Number or Name: **Well 2A**

DHS Source Identification Number: **06N/11W-19E05 S**

Location (Agricultural, Rural, Residential, Commercial, Industrial, Municipal, Mixed, other.): **Rural (1/2 mile to FAA)**

Distance to: Sewer Line or Sewage Disposal: **none**

Size of controlled area around well (square feet): **10,000**

Type of access control to well site (ie. Fencing, building, etc.): **fenced and topped with barbed wire**

Site plan on file? (yes or no): **yes**

DWR Ground Water Basin: **Antelope Valley**

DWR Ground Water Sub-basin: **Lancaster Sub-Unit**

Date drilled: **4/18/68**

Drilling method: **Rotary**

Depth of Bore Hole (feet below ground surface): **915 ft**

Finished Well Depth (feet below ground surface): **900 ft**

Casing: Depth (feet below ground surface): **900 ft**

Diameter: **16 inch**

Material: **steel**

Second casing depth (feet below ground surface): **50 ft**

Second casing diameter: **30 inch**

Second casing material: **steel**

Depth to highest perforations (feet below ground surface): **450 ft**

Total length of screened interval: **432 ft**

Sanitary sealed (yes or no): **yes**..Depth (ft): **50 ft**

Concrete slab surface seal (yes or no): **yes**..................................Radius (ft): **2.5 ft**

Gravel pack (yes or no): **yes**

Confining layer: Thickness- **21 ft**

Depth to (feet below ground surface): **345 ft**

Water Levels: Static (feet below ground surface): **548 ft (March 1998)**

When pumping (feet below ground surface): **569 ft**

Pump: Make: **Ingersoll Dresser**

Type: **turbine**

Capacity, g.p.m: **1805 gpm (max.)**

Depth to pump (feet below ground surface): **620 ft**

Lubrication: **oil**

Power: **electric**

Auxiliary power (yes or no): **no**

Operation controlled by – **automatic (SCADA)**

Discharge to: **desert (through air gap)**

Frequency of Use: **daily**

Typical pumping duration (hours/day): **summer 12 to 16 hours/day, winter 4 to 6 hours/day**

Within 100 year flood plain? (yes or no): **no**

Drainage away from well? (yes or no): **yes**

Well log on file? (yes or no): **yes**

Housing: Type : **block and wood**

Condition: **good**

Pit depth (if any): **none**

Floor (material): **concrete**

Drainage: **good (through door)**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale Water District** Identification number: **1910102**

Name of source: **Well 2A** Identification number: **06N/11W-19E05 S**

Assessment date: **June 5,1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep:	**YES**
b. Is the casing a non-porous material (i.e., steel, plastic, PVC)	**YES**
c. Is the well in a pit or subject to flooding or ponding?	**NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions?	**YES**

2. What is the type of source?
   a. **Well**

3. In what type of aquifer is the well located?
   a. **Porous media**

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   C. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge for the Lancaster sub-unit	Approximate Distance from Well •
Pearland sub-unit	30 miles (maximum Distance)
Buttes sub-unit	26 mile (maximum distance)
WWTP discharges	1750 ft. (minimum distance)
Mountain slopes	35 miles
Direct percipitation	0

• North Well Field Center

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO 2b
1b. NO 2c
1c. YES 3b
1d. NO 3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES 2a
1b. YES 4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a.yes, 1b. yes, 1c.no, 1d.yes, 2a., 3a., 4c.)

Physical Barrier Effectiveness (PBE) – Ground Water, page 1 of 2

Source Name: Well 2A

PARAMETER	*POINTS* Unconfined		*POINTS* Confined	
A. TYPE OF AQUIFER Confinement *(up to 40 points maximum)* choose one				
a. Unconfined, Semi-confined, Unknown	0			
b. Confined			40	
B. AQUIFER MATERIAL (Unconfined Aquifer) Type of within the aquifer *(up to 20 points maximum)* choose one				
1. Porous Media (Interbedded sands, silts, clays, gravels) with continuous clay layer minimum 25' thick above water table within Zone A	20			
2. Porous Media (Interbedded sands, silts, clays, and gravels)	(10)	10		
3. Fractured rock * (* Low Physical Barrier Effectiveness - no further questions required)	0			
C. PATHWAYS OF CONTAMINATION (All Aquifers) Presence of Abandoned or Improperly Destroyed Wells *(up to 10 points maximum)*				
1. Are they present within Zone A (2-year time of travel (TOT) distance)?				
a. Yes or unknown	0		0	
b. No	(5)	5	5	
2. Are they present within Zone B5 (2- to 5-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	(3)	3	3	
3. Are they present within Zone B10 (5- to 10-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	(2)	2	2	
D. STATIC WATER CONDITIONS (Unconfined Aquifer) Depth to static Water (DTW) = 548 feet *(up to 10 points maximum)* choose one				
1. 0 to 20 feet	0			
2. 20 to 50 feet	2			
3. 50 to 100 feet	6			
4. > 100 feet	(10)	10		
E. WELL OPERATION (Unconfined Aquifer) Depth to Uppermost Perforations (DUP) DUP = 450 feet Maximum Pumping Rate of Well (Q) Q = 1805 gallons/minute Length of screened interval (H) H = 432 feet				
[(DUP – DTW) / (Q/H)] 450-548 / 1805/432 = ~~[illegible]~~ *(up to 10 points maximum)* choose one				
1. < 5	(0)	0		
2. 5 to 10	5			
3. > 10	10			

Physical Barrier Effectiveness – Ground Water, page 2 of 2

Source Name:____________________

PARAMETER	*POINTS*			
	Unconfined		Confined	
F. HYDRAULIC HEAD (Confined Aquifer) What is the relationship in hydraulic head between the confined aquifer and the overlying unconfined aquifer? (i.e. does the well flow under artesian conditions?) *(up to 20 points maximum)* choose one				
1. head in confined aquifer is higher than head in unconfined aquifer under all conditions			20	
2. head in confined aquifer is higher than head in unconfined aquifer under static conditions			10	
3. head in confined aquifer is lower than or same as head in unconfined aquifer			0	
4. unknown			0	
G. WELL CONSTRUCTION (All Aquifers) 1. Sanitary Seal (Annular Seal) Depth = 50 feet *(up to 10 points maximum)* choose one				
a. None or less than 20 feet deep	0		0	
b. 20 to 50 ft deep	6		10	
c. 50 ft or greater	(10)	10	10	
2. Surface seal (concrete cap) *(up to 4 points maximum)* choose one				
a. Not present or improperly constructed	0		0	
b. Watertight, slopes away from well, at least 2' laterally in all directions	(4)	4	4	
3. Flooding potential at well site *(up to 1 point maximum)* choose one				
a. Subject to localized flooding (i.e. in low area or unsealed pit or vault) or Within 100 year flood plain	0		0	
b. Not subject to flooding	(1)	1	1	
4. Security at well site *(up to 5 points maximum)* choose one				
a. Not secure	0		0	
b. Secure (i.e. housing, fencing, etc.)	5	5	5	
Maximum Points Possible	80		100	
POINT TOTAL FOR THIS SOURCE	50			

Physical Barrier Effectiveness SCORE INTERPRETATION

Point Total		**Effectiveness**	
_____0 to 35	=	Low	(includes all sources in Fractured Rock)
_____36 to 70	=	(Moderate)	
_____71 to 100	=	High	

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System Identification: **1910102**

Source Name: **Well 2A** Source Number: **06N/11W-19E05 S**

Indicate the method used to delineate the zones:

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow) --- **X**

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi\eta H}}$

> **Rt** = R2, **R5,** or **R10** corresponding to t (Calculate R for each of three times of travel TOT)
> Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
> **t** = Time of travel (years), 2, **5** and 10 years
> π = 3.1416
> η = effective porosity (decimal percent) (If unknown, assume 0.2)
> H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 1805 gpm x 70,267=126,831,930 ft^3 /year (max. use last 3 years 30,453,250 ft^3 / year)
t= 2, 5 ,10 years
η = 0.3 (course, medium sand, clay streaks)
H = 432 ft

R2 = 789 ft
R5 = 1248 ft
R10 = 1765 ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by 0.5Rt. The upgradient and downgradient limits of the zone are determined below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **1184 ft**, minimum = 900 ft--use larger: **1184 ft**
downgradient distance = 0.5R2 = **400 ft**, minimum = 300 ft--use larger: **400 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1872 ft**, minimum = 1,500 ft--use larger: **1872 ft**
downgradient distance = 0.5R5 = **624 ft**, minimum = 500 ft--use larger: **624 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **2648 ft**, minimum = 2,250 ft--use larger: **2648 ft**

downgradient distance = 0.5R10 = **883 ft**, minimum = 750 ft--use larger: **883 ft**

Groundwater Source Location

Public water system and ID No.: **PALMDALE WATER DISTRICT**
System ID No.: **1910102**

Name of source and ID No.: **Well 3A**
06N/11W-19E06 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **20 ft)**

Location of well: Latitude: **34 35 46.00**
Longitude: **118 05 29.00**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

2163 East Avenue P-8

Location of recharge area, if known: **The well is located in the Lancaster Sub-Unit**.

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies inside the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, and further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelope Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are those of Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such as the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws most of its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first with surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.
Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**

Source of Information: **Well log, file, field observations and District staff.**

Collected by: **Perri Standish-Lee** **Date: June 5, 1998**

Well Number or Name: **Well 3A**

DHS Source Identification Number: **06N/11W-19E06 S**

Location (Agricultural, Rural, Residential, Commercial, Industrial, Municipal, Mixed, other.): **rural, commercial area on south within 1000 ft.**

Distance to: Sewer Line or Sewage Disposal: **sewer line 300 ft.**

Size of controlled area around well (square feet): **6400**

Type of access control to well site (ie. Fencing, building, etc.): **fenced topped with barbed wire**

Site plan on file? (yes or no): **yes**

DWR Ground Water Basin: **Antelope Valley**

DWR Ground Water Sub-basin: **Lancaster Sub-Unit**

Date drilled: **December 30, 1960**

Drilling method: **Rotary**

Depth of Bore Hole (feet below ground surface): **868 ft**

Finished Well Depth (feet below ground surface): **848 ft**

Casing: Depth (feet below ground surface): **848 ft**

Diameter: **16 inch**

Material: **steel**

Second casing depth (feet below ground surface)

Second casing diameter

Second casing material

Depth to highest perforations (feet below ground surface): **396 ft**

Total length of screened interval: **452 ft**

Sanitary sealed (yes or no) **yes**..Depth (ft): 50 ft

Concrete slab surface seal (yes or no) **yes** ....Radius (ft): **1.7 ft**

Gravel pack (yes or no): **yes**

Confining layer: Thickness **125 ft (clay, streaks of sand)**

Depth to (feet below ground surface): **40 ft**

Water Levels: Static (feet below ground surface): **541 ft (March 1998)**

When pumping (feet below ground surface): **573 ft**

Pump: Make: **Ingersoll Dresser**

Type: **Turbine**

Capacity, g.p.m: **1656 gpm**

Depth to pump (feet below ground surface): **700 ft**

Lubrication: **oil**

Power: **electric**

Auxiliary power (yes or no): **no**

Operation controlled by: **automatic (SCADA)**

Discharge to: **desert ravine (through air gap)**

Frequency of Use: **daily**

Typical pumping duration (hours/day): **summer 12 to 16 hrs./day, winter 4 to 6 hrs./day)**

Within 100 year flood plain? (yes or no): **no**

Drainage away from well? (yes or no): **no**

Well log on file? (yes or no): **yes**

Housing: Type: **block and wood**

Condition: **good**

Pit depth (if any): **none**

Floor (material): **concrete**

Drainage: **yes**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system **Palmdale Water District** Identification number: **1910102**

Name of source: **Well 3A** Identification number: **06N/11W-19E06 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

   Complete DHS Well Data Sheet (attached) and include with Assessment Report

   a. Is there a sanitary seal on well at least 50 feet deep: **YES**

   b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
   c. Is the well in a pit or subject to flooding or ponding? **NO**
   d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
   a. Well

3. In what type of aquifer is the well located?
   a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
See well 2A	

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a. yes, 1b. yes, 1c. no, 1d. yes, 2a., 3a., 4c.)

Physical Barrier Effectiveness (PBE) – Ground Water, page 1 of 2

Source Name: Well 3A

PARAMETER	*POINTS* Unconfined		*POINTS* Confined	
A. TYPE OF AQUIFER Confinement *(up to 40 points maximum)* choose one				
a. Unconfined, Semi-confined, Unknown	0			
b. Confined			40	
B. AQUIFER MATERIAL (Unconfined Aquifer) Type of within the aquifer *(up to 20 points maximum)* choose one				
1. Porous Media (Interbedded sands, silts, clays, gravels) with continuous clay layer minimum 25' thick above water table within Zone A 125 ft	(20)	20		
2. Porous Media (Interbedded sands, silts, clays, and gravels)	10			
3. Fractured rock * (* Low Physical Barrier Effectiveness - no further questions required)	0			
C. PATHWAYS OF CONTAMINATION (All Aquifers) Presence of Abandoned or Improperly Destroyed Wells *(up to 10 points maximum)*				
1. Are they present within Zone A (2-year time of travel (TOT) distance)?				
a. Yes or unknown	0		0	
b. No	(5)	5	5	
2. Are they present within Zone B5 (2- to 5-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	(3)	3	3	
3. Are they present within Zone B10 (5- to 10-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	(2)	2	2	
D. STATIC WATER CONDITIONS (Unconfined Aquifer) Depth to static Water (DTW) = 541 feet *(up to 10 points maximum)* choose one				
1. 0 to 20 feet	0			
2. 20 to 50 feet	2			
3. 50 to 100 feet	6			
4. > 100 feet	(10)	10		
E. WELL OPERATION (Unconfined Aquifer) Depth to Uppermost Perforations (DUP) DUP = 396 feet Maximum Pumping Rate of Well (Q) Q = 1656 gallons/minute Length of screened interval (H) H = 452 feet				
[(DUP – DTW) / (Q/H)] = *(up to 10 points maximum)* choose one				
1. < 5	0	0		
2. 5 to 10	5			
3. > 10	10			

Physical Barrier Effectiveness – Ground Water, page 2 of 2

Source Name:______________________

PARAMETER	*POINTS* Unconfined		Confined	
F. HYDRAULIC HEAD (Confined Aquifer) What is the relationship in hydraulic head between the confined aquifer and the overlying unconfined aquifer? (i.e. does the well flow under artesian conditions?) *(up to 20 points maximum)* choose one				
1. head in confined aquifer is higher than head in unconfined aquifer under all conditions			20	
2. head in confined aquifer is higher than head in unconfined aquifer under static conditions			10	
3. head in confined aquifer is lower than or same as head in unconfined aquifer			0	
4. unknown			0	
G. WELL CONSTRUCTION (All Aquifers) 1. Sanitary Seal (Annular Seal) Depth = 50 feet *(up to 10 points maximum)* choose one				
a. None or less than 20 feet deep	0		0	
b. 20 to 50 ft deep	6		10	
c. 50 ft or greater	(10)	10	10	
2. Surface seal (concrete cap) *(up to 4 points maximum)* choose one				
a. Not present or improperly constructed	0	0	0	
b. Watertight, slopes away from well, at least 2' laterally in all directions	4		4	
3. Flooding potential at well site *(up to 1 point maximum)* choose one				
a. Subject to localized flooding (i.e. in low area or unsealed pit or vault) or Within 100 year flood plain	0		0	
b. Not subject to flooding	(1)	1	1	
4. Security at well site *(up to 5 points maximum)* choose one				
a. Not secure	0		0	
b. Secure (i.e. housing, fencing, etc.)	(5)	5	5	
Maximum Points Possible	80		100	
POINT TOTAL FOR THIS SOURCE	56			

Physical Barrier Effectiveness SCORE INTERPRETATION

Point Total		**Effectiveness**	
_____0 to 35	=	Low	(includes all sources in Fractured Rock)
_____36 to 70	=	(Moderate)	
_____71 to 100	=	High	

Delineation of Ground Water Zones

Public Water System Name: **Palmdale Water District** System ID. Number: **1910102**

Name of Source: **Well 3A** Source Number: **06N/11W-19E06 S**

Indicate the method used to delineate the zones:

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow): **X**

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is **$Rt = \sqrt{Qt/\pi\eta H}$**

Rt = R2, **R5**, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, **5** and 10 years
π= 3.1416
η = Effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 1656 gpm x 70,267 = 116,362,150 ft^3 /year (max. use 50,485,654 ft^3 /year in last 3 years)
t = 2, 5, 10 years
η = 0.35 (sand, gravel, clay streaks of sand)
H = 452 ft

R2 = 684 ft
R5 = 1082 ft
R10 = 1530 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the source.

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: __ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: _ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: __ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determined below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **1026 ft**, minimum = 900 ft--use larger: **1026ft**
downgradient distance = 0.5R2 **342 ft**, minimum = 300 ft--use larger: **342 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1623 ft**, minimum = 1,500 ft--use larger: **1623ft**
downgradient distance = 0.5R5 = **541 ft**, minimum = 500 ft--use larger: **541ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **2295ft**, minimum = 2,250 ft--use larger: **2295ft**

downgradient distance = 0.5R10 = **765 ft**, minimum = 750 ft--use larger: **765ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 4A**
06N/11W-19F01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **20 ft)**

Location of well: Latitude: **34 35 41.92**
Longitude: **118 05 08.57**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

2475 East Avenue P-8
(360 ft West of center of 25th St. East, 110 ft North of center of Avenue P-8)

Location of recharge area, if known: **The well is located in the Lancaster Sub-Unit**.
The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies inside the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, and further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelope Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are those of Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such as the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws most of its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first with surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.
Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **Well log, District files, field investigation and District staff**
Collected by: **Perri Standish-Lee** -Date: **June 5, 1998**

Well Number or Name: **Well 4A**
DHS Source Identification Number: **06N/11W-19F01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **Rural (vacant), commercial area on north side (½ mile to FAA)**
Distance to: Sewer Line or Sewage Disposal : **sewer line approximately 300 ft.**
Size of controlled area around well (square feet): **8800**
Type of access control to well site (ie. Fencing, building, etc.): **fence topped with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Lancaster Sub-Unit**
Date drilled: **7/7/70**
Drilling method: **Rotary**
Depth of Bore Hole (feet below ground surface): **838 ft**
Finished Well Depth (feet below ground surface): **830 ft**
Casing: Depth (feet below ground surface): **830 ft**
Diameter: **16 inch**
Material: **Steel**
Second casing depth (feet below ground surface): **none**
Second casing diameter
Second casing material
Depth to highest perforations (feet below ground surface): **480 ft**
Total length of screened interval: **350 ft**
Sanitary sealed (yes or no): **yes**...Depth (ft): **50 ft**
Concrete slab surface seal (yes or no): **yes** ....Radius (ft): **2.5**
Gravel pack (yes or no): **yes**
Confining layer: Thickness; **5, 14, 10, 28 ft**
Depth to (feet below ground surface): **284, 384, 432, 452 ft**
Water Levels: Static (feet below ground surface): **524 ft (March 1998)**
When pumping (feet below ground surface): **635 ft**
Pump: Make: **Ingresoll Dersser**
Type: **Turbine**
Capacity, g.p.m : **1,124 gpm**
Depth to pump (feet below ground surface): **700 ft**
Lubrication: **oil**
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **automatic (SCADA)**
Discharge to: **desert floor (through air gap)**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **3 to 8 hours/day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type : **metal**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **none (drains through door opening)**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale Water District** ID No.: **1910102**

Name of source: **Well 4A** Identification number: **06N/11W-19F01 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep:	**YES**
b. Is the casing a non-porous material (i.e., steel, plastic, PVC)	**YES**
c. Is the well in a pit or subject to flooding or ponding?	**NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions?	**YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)

c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?
a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
See well 2A	

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a. yes, 1b. yes, 1c. no, 1d. yes, 2a., 3a., 4c.)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 4A** Source Number: **06N/11W-19F01 S**

Indicate the method used to delineate the zones:

Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi\eta H}}$

Rt = R2, **R5**, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, **5** and 10 years
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):
Q = 1124 gpm x 70,267 = 78,980,108 ft^3 /year (max. use 11,771,349 ft^3 /year past 3 years)
t = 2,5,10 years
η= 0.35 (sandy clay, course sand, hard cemented sand)(conservative number)
H = 330 ft

R2 = 660 ft
R5 = 1043 ft
R10 = 1475 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the source.

Porous Media Aquifer

Zone A	(2 year TOT)	R2 = _____	ft, minimum = 600 ft -use larger: _______	ft
Zone B5	(5 year TOT)	R5 = _____	ft, minimum =1,000 ft--use larger: ______	ft
Zone B10	(10 year TOT)	R1O= ____	ft, minimum =1,500 ft-use larger: ______	ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by 0.5Rt. The upgradient and downgradient limits of the zone are determined below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **990 ft**, minimum = 900 ft--use larger: **990 ft**
downgradient distance = 0.5R2 = **495 ft**, minimum = 300 ft--use larger: **495 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1565 ft**, minimum = 1,500 ft--use larger: **1565 ft**
downgradient distance = 0.5R5 = **522 ft**, minimum = 500 ft--use larger: **522 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **2213 ft**, minimum = 2,250 ft--use larger: **2250 ft**

downgradient distance = 0.5R10 = **738 ft**, minimum = 750 ft--use larger: **750 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 6A**
06N/12W-23A01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)
Location of well: Latitude: **34 36 00.06**
Longitude: **118 06 48.76**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

39455 10th St. East
(NE corner of section 23 & 10th St. East)

Location of recharge area, if known: **The well is located in the in the Lancaster Sub-Unit**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies inside the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, and further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelope Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are those of Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such as the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws most of its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first with surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **Well log, district staff, field review**
Collected by: **Perri Standish-Lee** -Date: **June 4, 19**

Well Number or Name: **Well 6A**
DHS Source Identification Number: **06N/12W-23A01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **Residential/commercial**
Distance to: Sewer Line or Sewage Disposal:
Size of controlled area around well (square feet): **12,600**
Type of access control to well site (ie. Fencing, building, etc.): **fenced topped with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Lancaster Sub-Unit**
Date drilled: **3/17/83**
Drilling method: **Rotary**
Depth of bore Hole (feet below ground surface): **1030 ft**
Finished Well Depth (feet below ground surface): **1010 ft**
Casing: Depth (feet below ground surface): **1010 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **100 ft**
Second casing diameter: **32 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **480 ft**
Total length of screened interval: **530 ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **100 ft**
Concrete slab surface seal (yes or no): **yes**...................................Radius (ft): **2 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **no**
Depth to (feet below ground surface)
Water Levels: Static (feet below ground surface): **513 ft (March 1998)**
When pumping (feet below ground surface): **564 ft (March 1998)**
Pump: Make: **Simmons**
Type: **Turbine**
Capacity, g.p.m: **482 gpm**
Depth to pump (feet below ground surface): **733 ft**
Lubrication: **oil**
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **desert floor (through air gap)**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 12 to 16 hrs/day, winter 4 to 6 hrs/day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **aluminum**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **good**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 6A** Identification number: **06N/12W-23AO1 S**

Assessment date: **June 4,1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

   Complete DHS Well Data Sheet (attached) and include with Assessment Report

   a. Is there a sanitary seal on well at least 50 feet deep: **YES**

   b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
   c. Is the well in a pit or subject to flooding or ponding? **NO**
   d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
   a. Well

3. In what type of aquifer is the well located?
   a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
See well 2A	

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a. yes, 1b. yes, 1c. no, 1d. yes, 2a., 3a., 4c.)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No: **1910102**

Source Name: **Well 6A** Source Number: **06N/12W-23A01 S**

Indicate the method used to delineate the zones:

Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi\eta H}}$

Rt = R2, **R5**, or **R10** corresponding to t (Calculate R for each of three times of travel TOT)

Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)

t = Time of travel (years), 2, **5** and 10 years

π = 3.1416

η = effective porosity (decimal percent) (If unknown, assume 0.2)

H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum)

Q = 482 gpm x 70,267 = 33,868,694 ft^3/year (max use 6,027,597 ft^3/year in past 3 years)

t = 2,5,10 years

η= 0.3 (fine to medium to course sand, some clay)

H = 530 ft

R2 = 368 ft

R5 = 582 ft

R10 = 823 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the source.

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: _______ ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: ______ ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: ______ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determined below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **552 ft**, minimum = 900 ft--use larger: **900 ft**
downgradient distance = 0.5R2 = **184 ft**, minimum = 300 ft--use larger: **300 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **873 ft**, minimum = 1,500 ft--use larger: **1500 ft**
downgradient distance = 0.5R5 = **291 ft**, minimum = 500 ft--use larger: **500 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **1235 ft**, minimum = 2,250 ft--use larger: **2250 ft**

downgradient distance = 0.5R10 = **412 ft**, minimum = 750 ft--use larger: **750 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 7A**
06N/11W-19F02 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft)**

Location of well: Latitude: **34 35 53.75**
Longitude: **118 05 05.31**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

39395 25th St. East
(1/4 mile south, 100 ft west from intersection of Avenue P and 25th St. East)

Location of recharge area, if known: **The well is located in the Lancaster Sub-Unit**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies inside the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, and further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelope Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are those of Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such as the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws most of its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first with surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.
Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**

Source of Information: **Well log, District staff, field review**

Collected by: **Perri Standish-Lee** -Date: **June 5,19**

Well Number or Name: **Well 7A**

DHS Source Identification Number: **06N/11W-19F02 S**

Location (Agricultural, Rural, Residential, Commercial, Industrial, Municipal, Mixed, other.): **rural/vacant on three sides, commercial area on north side (FAA ¼ mile)**

Distance to: Sewer Line or Sewage Disposal :

Size of controlled area around well (square feet): **9,500**

Type of access control to well site (ie. Fencing, building, etc.): **fence topped with barbed wire**

Site plan on file? (yes or no): **yes**

DWR Ground Water Basin: **Antelope Valley**

DWR Ground Water Sub-basin: **Lancaster Sub-Unit**

Date drilled: **9/23/85**

Drilling method: **Reverse**

Depth of bore Hole (feet below ground surface): **1020 ft**

Finished Well Depth (feet below ground surface): **920 ft**

Casing: Depth (feet below ground surface): **920 ft**

Diameter: **16 inch**

Material: **steel**

Second casing depth (feet below ground surface): **80 ft**

Second casing diameter: **28 inch**

Second casing material: **steel**

Depth to highest perforations (feet below ground surface): **570 ft**

Total length of screened interval: **330 ft**

Sanitary sealed (yes or no) **yes**..Depth (ft): **80 ft**

Concrete slab surface seal (yes or no): **yes** ....Radius (ft): **1.9 ft**

Gravel pack (yes or no): **yes**

Confining layer: Thickness- **70, 20, 15, 30 ft**

Depth to (feet below ground surface): **305, 451, 530, 550 ft**

Water Levels: Static (feet below ground surface): **501 ft (March 1998)**

When pumping (feet below ground surface): **556 ft (March 1998)**

Pump: Make: **Ingersoll Rand**

Type: **Turbine**

Capacity, g.p.m: **1612 gpm**

Depth to pump (feet below ground surface): **667 ft**

Lubrication: **oil**

Power: **electric**

Auxiliary power (yes or no): **no**

Operation controlled by: **SCADA**

Discharge to: **desert floor (across 25th St.)**

Frequency of Use: **daily**

Typical pumping duration (hours/day): **summer 12 to 16 hrs/day, winter 4 to 6 hrs/day.**

Within 100 year flood plain? (yes or no): **no**

Drainage away from well? (yes or no): **yes**

Well log on file? (yes or no): **yes**

Housing: Type: **aluminum**

Condition: **good**

Pit depth (if any): **none**

Floor (material): **concrete**

Drainage: **none (through door)**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 7A** Identification number: **06N/11W-19FO2 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep: **YES**

b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
c. Is the well in a pit or subject to flooding or ponding? **NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?
a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
See Well 2A	

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a. yes, 1b. yes, 1c. no, 1d. yes, 2a, 3a, 4c)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Source Name: **Well 7A**

Water System ID No.: **1910102**

Source Number: **06N/11W-19F02 S**

Indicate the method used to delineate the zones:

Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi\eta H}}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, 5 and 10 years
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 1,612 gpm x 70,267 = 113,270,400 ft^3/year (max. use 43,888,094 ft^3/year in past 3 years)
t = 2,5,10 years
η= 0.35 (clay, fine to course sand)
H = 330 ft

R2 = 790 ft
R5 = 1249 ft
R10 = 1767 ft

<u>Calculated Fixed Radius Delineation Method (Default)</u>

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the source.

Porous Media Aquifer

Zone A	(2 year TOT)	R2 = _____	ft, minimum = 600 ft -use larger: ______ ft
Zone B5	(5 year TOT)	R5 = _____	ft, minimum =1,000 ft--use larger: _____ft
Zone B10	(10 year TOT)	R10= ____	ft, minimum =1,500 ft-use larger: _____ ft

<u>Modified Calculated Fixed Radius Delineation Method</u>

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by 0.5Rt. The upgradient and downgradient limits of the zone are determined below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **1185 ft**, minimum = 900 ft--use larger: **1185 ft**
downgradient distance = 0.5R2 = **395 ft**, minimum = 300 ft--use larger: **395 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1874 ft**, minimum = 1,500 ft--use larger: **1874 ft**
downgradient distance = 0.5R5 = **625 ft**, minimum = 500 ft--use larger: **625 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **2651 ft**, minimum = 2,250 ft--use larger: **2651 ft**

downgradient distance = 0.5R10 = **884 ft**, minimum = 750 ft--use larger: **884 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 8A**
06N/11W-19C01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft)**

Location of well: Latitude: **34 36 04.89**
Longitude: **118 05 18.80**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

2200 East Ave. P
(1/2 mile west of 25th St. East and 200 yards south of Ave. P)

Location of recharge area, if known: **The well is located in the Lancaster Sub-Unit**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies inside the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, and further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelope Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are those of Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such as the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws most of its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first with surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.
Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**

Source of Information: **Well log, District staff, field review**

Collected by: **Perri Standish-Lee** -Date: **June 5,19**

Well Number or Name: **Well 8A**

DHS Source Identification Number: **06N/11W-19C01 S**

Location (Agricultural, Rural, Residential, Commercial, Industrial, Municipal, Mixed, other.): **rural/vacant, commercial area on north side (FAA- 1900ft, Rockwell- 1 mile)**

Distance to: Sewer Line or Sewage Disposal: **sewer line 300-400 ft (Ave. P)**

Size of controlled area around well (square feet): **15,376**

Type of access control to well site (ie. Fencing, building, etc.): **fenced topped with barbed wire**

Site plan on file? (yes or no): **yes**

DWR Ground Water Basin: **Antelope Valley**

DWR Ground Water Sub-basin: **Lancaster Sub-Unit**

Date drilled: **2/10/1988**

Drilling method: **Reverse**

Depth of bore Hole (feet below ground surface): **1030 ft**

Finished Well Depth (feet below ground surface): **960 ft**

Casing: Depth (feet below ground surface): **960 ft**

Diameter: **16 inch**

Material: **steel**

Second casing depth (feet below ground surface): **80 ft**

Second casing diameter: **30 inch**

Second casing material: **steel**

Depth to highest perforations (feet below ground surface): **560 ft**

Total length of screened interval: **260 ft**

Sanitary sealed (yes or no) **yes**...Depth (ft): **80 ft**

Concrete slab surface seal (yes or no): **yes** ....Radius (ft): **2 ft**

Gravel pack (yes or no): **yes**

Confining layer: Thickness- **10, 30, 10 ft**

Depth to (feet below ground surface): **160, 300, 410 ft**

Water Levels: Static (feet below ground surface): **526 ft (December 1995)**

When pumping (feet below ground surface): **568 ft (December 1995)**

Pump: Make: **Peerless**

Type: **Turbine**

Capacity, g.p.m: **1,934 gpm**

Depth to pump (feet below ground surface): **660 ft**

Lubrication: **oil**

Power: **electric**

Auxiliary power (yes or no): **no**

Operation controlled by: **SCADA**

Discharge to: **desert floor**

Frequency of Use: **daily**

Typical pumping duration (hours/day): **summer 12-16 hrs/day, winter 4-6 hrs/day**

Within 100 year flood plain? (yes or no): **no**

Drainage away from well? (yes or no): **yes**

Well log on file? (yes or no): **yes**

Housing: Type: **aluminum**

Condition: **good**

Pit depth (if any): **none**

Floor (material): **concrete**

Drainage: **none (through door)**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No: **1910102**

Name of source: **Well 8A** Identification number: **06N/11W-19CO1 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

   Complete DHS Well Data Sheet (attached) and include with Assessment Report

   a. Is there a sanitary seal on well at least 50 feet deep: **YES**

   b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
   c. Is the well in a pit or subject to flooding or ponding? **NO**
   d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
   a. Well

3. In what type of aquifer is the well located?
   a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?
a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
See Well 2A	

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a. yes, 1b. yes, 1c. no, 1d. yes, 2a., 4c.)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 8A** Source Number: **06N/11W-19C01 S**

Indicate the method used to delineate the zones:

Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown bel

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi\eta H}}$

Rt = R2, **R5**, or **R10** corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), **2**, **5** and **10** years
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 1, 934 gpm x 70,267 = 135,896,370 ft^3/year (max pumping 67,845,262 ft^3/year, past 3 years)
t = 2,5,10 years
η= 0.25 (clay, sand and gravel)
H = 260 ft

R2 = 1154 ft
R5 = 1824 ft
R10 = 2578 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: _________ ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: _________ft
Zone B10	(10 year TOT)	R_{10}= _____	ft, minimum =1,500 ft-use larger: ________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by 0.5Rt. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **1731 ft**, minimum = 900 ft--use larger: **1731 ft**
downgradient distance = 0.5R2 = **577 ft**, minimum = 300 ft--use larger: **577 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **2736 ft**, minimum = 1,500 ft--use larger: **2736 ft**
downgradient distance = 0.5R5 = **912 ft**, minimum = 500 ft--use larger: **912 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **3867 ft**, minimum = 2,250 ft--use larger: **3867 ft**

downgradient distance = 0.5R10 = **1289 ft**, minimum = 750 ft--use larger: **1289 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 10**
06N/11W-20H01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 35 43.48**
Longitude: **118 03 41.79**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

3701 East Ave. P-8

Location of recharge area, if known: **The well is located in the Lancaster Sub-Unit**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **District staff, file, and field review**
Collected by: **Perri Standish-Lee** -Date: **June 5, 19**

Well Number or Name: **Well 10**
DHS Source Identification Number: **06N/11W-20H01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **rural/vacant (within ¾ mile radius), rural**
Distance to: Sewer Line or Sewage Disposal : **none**
Size of controlled area around well (square feet): **10,000**
Type of access control to well site (ie. Fencing, building, etc.): **fenced topped with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Lancaster Sub-Unit**
Date drilled: **1956**
Drilling method:
Depth of bore Hole (feet below ground surface): **? ft**
Finished Well Depth (feet below ground surface): **694 ft**
Casing: Depth (feet below ground surface): **694 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **? ft**
Second casing diameter:
Second casing material:
Depth to highest perforations (feet below ground surface): **? ft**
Total length of screened interval: **? ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **50 ft (at least)**
Concrete slab surface seal (yes or no): **yes** ....Radius (ft): **2 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **? ft**
Depth to (feet below ground surface): **? ft**
Water Levels: Static (feet below ground surface): **447 ft (March 1998)**
When pumping (feet below ground surface): **493 ft (March 1998)**
Pump: Make: **Ingersoll Rand**
Type: **Turbine**
Capacity, g.p.m: **277 gpm**
Depth to pump (feet below ground surface): **622 ft**
Lubrication: **oil**
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **desert floor**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 12-16 hrs/day, winter 4-6 hrs/day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **no**
Housing: Type: **aluminum**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **through door**

Physical Barrier Effectiveness (PBE) – Ground Water, page 1 of 2

Source Name:____________________________________

PARAMETER	*POINTS*			
	Unconfined		Confined	
A. TYPE OF AQUIFER Confinement *(up to 40 points maximum)* choose one				
a. Unconfined, Semi-confined, Unknown	0			
b. Confined			40	
B. AQUIFER MATERIAL (Unconfined Aquifer) Type of within the aquifer *(up to 20 points maximum)* choose one				
1. Porous Media (Interbedded sands, silts, clays, gravels) with continuous clay layer minimum 25' thick above water table within Zone A	20			
2. Porous Media (Interbedded sands, silts, clays, and gravels)	(10)	10		
3. Fractured rock * (* Low Physical Barrier Effectiveness - no further questions required)	0			
C. PATHWAYS OF CONTAMINATION (All Aquifers) Presence of Abandoned or Improperly Destroyed Wells *(up to 10 points maximum)*				
1. Are they present within Zone A (2-year time of travel (TOT) distance)?				
a. Yes or unknown	(0)	0	0	
b. No	5		5	
2. Are they present within Zone B5 (2- to 5-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	(3)	3	3	
3. Are they present within Zone B10 (5- to 10-year TOT distance)?				
a. Yes or unknown	(0)	0	0	
b. No	2		2	
D. STATIC WATER CONDITIONS (Unconfined Aquifer) Depth to static Water (DTW) = 447 feet *(up to 10 points maximum)* choose one				
1. 0 to 20 feet	0			
2. 20 to 50 feet	2			
3. 50 to 100 feet	6			
4. > 100 feet	(10)	10		
E. WELL OPERATION (Unconfined Aquifer) Depth to Uppermost Perforations (DUP) DUP = unknown feet Maximum Pumping Rate of Well (Q) Q = ______ gallons/minute Length of screened interval (H) H = ______ feet				
[(DUP – DTW) / (Q/H)] = *(up to 10 points maximum)* choose one				
1. < 5	0	0		
2. 5 to 10	5			
3. > 10	10			

Physical Barrier Effectiveness – Ground Water, page 2 of 2

Source Name:________________________

PARAMETER	*POINTS* Unconfined		Confined	
F. HYDRAULIC HEAD (Confined Aquifer) What is the relationship in hydraulic head between the confined aquifer and the overlying unconfined aquifer? (i.e. does the well flow under artesian conditions?) *(up to 20 points maximum)* choose one				
1. head in confined aquifer is higher than head in unconfined aquifer under all conditions			20	
2. head in confined aquifer is higher than head in unconfined aquifer under static conditions			10	
3. head in confined aquifer is lower than or same as head in unconfined aquifer			0	
4. unknown			0	
G. WELL CONSTRUCTION (All Aquifers) 1. Sanitary Seal (Annular Seal) Depth = ______ feet *(up to 10 points maximum)* choose one				
a. None or less than 20 feet deep	0		0	
b. 20 to 50 ft deep	6		10	
c. 50 ft or greater	(10)	10	10	
2. Surface seal (concrete cap) *(up to 4 points maximum)* choose one				
a. Not present or improperly constructed	0		0	
b. Watertight, slopes away from well, at least 2' laterally in all directions	(4)	4	4	
3. Flooding potential at well site *(up to 1 point maximum)* choose one				
a. Subject to localized flooding (i.e. in low area or unsealed pit or vault) or Within 100 year flood plain	0		0	
b. Not subject to flooding	(1)	1	1	
4. Security at well site *(up to 5 points maximum)* choose one				
a. Not secure	0		0	
b. Secure (i.e. housing, fencing, etc.)	(5)	5	5	
Maximum Points Possible	80		100	
POINT TOTAL FOR THIS SOURCE	43			

Physical Barrier Effectiveness SCORE INTERPRETATION

Point Total		**Effectiveness**	
_____0 to 35	=	**Low**	(includes all sources in Fractured Rock)
43 36 to 70	=	**(Moderate)**	
_____71 to 100	=	**High**	

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 10** Identification number: **06N/11W-20HO1 S**

Assessment date: **June 5,1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep: **YES**

b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
c. Is the well in a pit or subject to flooding or ponding? **NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?
a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
See Well 2A	

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a.yes, 1b.yes, 1c.no, 1d.yes, 2a, 4c)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 10** Source Number: **06N/11W-20H01 S**

Indicate the method used to delineate the zones:
Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt} = \sqrt{Qt/\pi\eta H}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, 5 and 10 years
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 277 gpm x 70,267 = 19,463,959 ft^3/year (max. pumped 4,205,132 ft^3/year, in past 3 years)
t = 2,5,10 years
η= 0.2 (unknown use most conservative no.)
H = 28 ft (10% of Q)

R2 = 1488 ft
R5 = 2352 ft
R10 = 3326 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: _________ ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: _________ ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: ________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **2232 ft**, minimum = 900 ft--use larger: **2232 ft**
downgradient distance = 0.5R2 = **744 ft**, minimum = 300 ft--use larger: **744 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **3528 ft**, minimum = 1,500 ft--use larger: **3528 ft**
downgradient distance = 0.5R5 = **1176 ft**, minimum = 500 ft--use larger: **1176 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **4989 ft**, minimum = 2,250 ft--use larger: **4989 ft**

downgradient distance = 0.5R10 = **1663 ft**, minimum = 750 ft--use larger: **1663 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 11A**
06N/12W-24C02 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 36 01.78**
Longitude: **118 06 09.09**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

39501 15th St. East

Location of recharge area, if known: **The well is located in the Lancaster Sub-Unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**

Source of Information: **well log, District staff, field review**

Collected by: **Perri Standish-Lee** -Date: **June 4,19**

.

Well Number or Name: **Well 11A**

DHS Source Identification Number: **06N/12W-24C02 S**

Location (Agricultural, Rural, Residential, Commercial, Industrial, Municipal, Mixed, other.): **rural/commercial (close to lumber yard)**

Distance to: Sewer Line or Sewage Disposal : **sewer line 90 ft**

Size of controlled area around well (square feet): **9,800**

Type of access control to well site (ie. Fencing, building, etc.): **fenced topped with barbed wire**

Site plan on file? (yes or no): **yes**

DWR Ground Water Basin: **Antelope Valley**

DWR Ground Water Sub-basin: **Lancaster Sub-Unit**

Date drilled: **1963**

Drilling method: **Rotary**

Depth of bore Hole (feet below ground surface): **1257 ft**

Finished Well Depth (feet below ground surface): **900 ft**

Casing: Depth (feet below ground surface): **900 ft**

Diameter: **16 inch**

Material: **steel**

Second casing depth (feet below ground surface): **50 ft**

Second casing diameter: **30 inch**

Second casing material: **steel**

Depth to highest perforations (feet below ground surface): **504 ft**

Total length of screened interval: **396 ft**

Sanitary sealed (yes or no) **yes**..Depth (ft): **50 ft**

Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **1.7 ft**

Gravel pack (yes or no): **yes**

Confining layer: Thickness- **46, 8 ft**

Depth to (feet below ground surface): **20, 290 ft**

Water Levels: Static (feet below ground surface): **537 ft (March 1998)**

When pumping (feet below ground surface): **576 ft (March 1998)**

Pump: Make: **Peerless**

Type: **Turbine**

Capacity, g.p.m: **1,161 gpm**

Depth to pump (feet below ground surface): **680 ft**

Lubrication: **oil**

Power: **gas**

Auxiliary power (yes or no): **no**

Operation controlled by: **manual**

Discharge to: **15th St.**

Frequency of Use: **daily**

Typical pumping duration (hours/day): **summer 12-16 hrs/day, winter 4-6 hrs/day**

Within 100 year flood plain? (yes or no): **no**

Drainage away from well? (yes or no): **yes**

Well log on file? (yes or no): **yes**

Housing: Type: **aluminum**

Condition: **good**

Pit depth (if any): **none**

Floor (material): **concrete**

Drainage: **no (through door)**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 11A** Identification number: **06N/12W-24CO2 S**

Assessment date: **June 4, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep: **YES**

b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
c. Is the well in a pit or subject to flooding or ponding? **NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?
a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
See Well 2A	

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with <u>all</u> of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a.yes, 1b. yes, 1c. no, 1d. yes, 2a, 4a)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 11A** Source Number: **06N/12W-24C02 S**

Indicate the method used to delineate the zones:
Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt} = \sqrt{Qt/\pi\eta H}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, **5** and 10 years
$\pi = 3.1416$
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 1,161 gpm x 70,267 = 81,579,987 ft^3/year (max. pumped 79,721,432 ft^3/year in past 3 years)
t = 2,5,10 years
η= 0.3 (clay with streaks of sand, medium sand with streaks of clay)
H = 396 ft

R2 = 661 ft
R5 = 1045 ft
R10 = 1478 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: _________ ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: _________ ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: ________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **992 ft**, minimum = 900 ft--use larger: **992 ft**
downgradient distance = 0.5R2 = **331 ft**, minimum = 300 ft--use larger: **331 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1568 ft**, minimum = 1,500 ft--use larger: **1568 ft**
downgradient distance = 0.5R5 = **523 ft**, minimum = 500 ft--use larger: **523 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **2217 ft**, minimum = 2,250 ft--use larger: **2250 ft**

downgradient distance = 0.5R10 = **739 ft**, minimum = 750 ft--use larger: **750 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 14A**
06N/12W-24A03 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 35 56.53**
Longitude: **118 05 51.33**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

39401 20th St. East

Location of recharge area, if known: **The well is located in the Lancaster Sub-Unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, ; further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **well log, District staff, field review**
Collected by: **Perri Standish-Lee** -Date: **June 4, 1S**

Well Number or Name: **Well 14A**
DHS Source Identification Number: **06N/12W-24A03 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **rural (land belongs to LA County Dept. of Airports, mostly vacant)**
Distance to: Sewer Line or Sewage Disposal: **none**
Size of controlled area around well (square feet): **20,000 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fenced and topped with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Lancaster Sub-Unit**
Date drilled: **1965**
Drilling method: **Rotary**
Depth of bore Hole (feet below ground surface): **900 ft**
Finished Well Depth (feet below ground surface): **900 ft**
Casing: Depth (feet below ground surface): **900 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **50 ft**
Second casing diameter: **30 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **450 ft**
Total length of screened interval: **450 ft**
Sanitary sealed (yes or no) **yes**...Depth (ft): **50 ft**
Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **1.7 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **9 ft**
Depth to (feet below ground surface): **373 ft**
Water Levels: Static (feet below ground surface): **521 ft (May 1988)**
When pumping (feet below ground surface): **536 ft (May 1988)**
Pump: Make: **American Turbine**
Type: **Turbine**
Capacity, g.p.m: **1,227 gpm**
Depth to pump (feet below ground surface): **602 ft**
Lubrication: **oil**
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **desert ravine**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 12-16 hrs/day, winter 4-6 hrs/day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **block and wood**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **yes**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 14A** Identification number: **06N/12W-24AO3 S**

Assessment date: **June 4, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

   Complete DHS Well Data Sheet (attached) and include with Assessment Report

   a. Is there a sanitary seal on well at least 50 feet deep: **YES**

   b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
   c. Is the well in a pit or subject to flooding or ponding? **NO**
   d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
   a. Well

3. In what type of aquifer is the well located?
   a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
See Well 2A	

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO   2b
1b. NO   2c
1c. YES   3b
1d. NO   3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES   2a
1b. YES   4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a.yes, 1b.yes, 1c.no, 1d.yes, 2a, 4c)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 14A** Source Number: **06N/12W-24A03 S**

Indicate the method used to delineate the zones:
Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt} = \sqrt{Qt/\pi\eta H}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, **5** and 10 years
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 1,227 gpm x 70,267 = 86,217,609 ft^3/year (max. pumped 25,093,751 ft^3/year, in past 3 years)
t = 2,5,10 years
η= 0.3 (course to fine sand with streaks of clay, some clay with fine sand)
H = 450 ft

R2 = 638 ft
R5 = 1008 ft
R10 = 1426 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: _________	ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: _________	ft
Zone B10	(10 year TOT)	R_{10}= _____	ft, minimum =1,500 ft-use larger: ________	ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **957 ft**, minimum = 900 ft--use larger: **957 ft**
downgradient distance = 0.5R2 = **319 ft**, minimum = 300 ft--use larger: **319 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1512 ft**, minimum = 1,500 ft--use larger: **1512 ft**
downgradient distance = 0.5R5 = **504 ft**, minimum = 500 ft--use larger: **504 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **2139 ft**, minimum = 2,250 ft--use larger: **2250 ft**

downgradient distance = 0.5R10 = **713 ft**, minimum = 750 ft--use larger: **750 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 15**
06N/12W-13N01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 36 08.03**
Longitude: **118 06 36.37**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

1003 East Avenue P
(10th St. East and Avenue P)

Location of recharge area, if known: **The well is located in the Lancaster Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **Well log, District staff, field review**
Collected by: **Perri Standish-Lee** -Date: **June 4, 1998**

Well Number or Name: **Well 15**
DHS Source Identification Number: **06N/12W-13N01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **commercial/rural**
Distance to: Sewer Line or Sewage Disposal: **sewer line 95 ft.**
Size of controlled area around well (square feet): **9,800 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fenced and topped with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Lancaster Sub-Unit**
Date drilled: **1960**
Drilling method: **Rotary**
Depth of bore Hole (feet below ground surface): **880 ft**
Finished Well Depth (feet below ground surface): **800 ft**
Casing: Depth (feet below ground surface): **800 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **50 ft**
Second casing diameter: **28 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **420 ft**
Total length of screened interval: **380 ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **50 ft**
Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **1.7 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **none**
Depth to (feet below ground surface): **–**
Water Levels: Static (feet below ground surface): **539 ft (March 1998)**
When pumping (feet below ground surface): **634 ft (March 1998)**
Pump: Make: **Ingersoll Rand**
Type: **Turbine**
Capacity, g.p.m: **998 gpm**
Depth to pump (feet below ground surface): **735 ft**
Lubrication: **oil**
Power: **gas**
Auxiliary power (yes or no): **no**
Operation controlled by: **manual**
Discharge to: **desert ravine**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 12-16 hrs/day, winter 4-6 hrs/day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **block**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **no (through door)**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 15** Identification number: **06N/12W-13NO1 S**

Assessment date: **June 4, 1998** Assessment conducted by: **Perri Standish -Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

   Complete DHS Well Data Sheet (attached) and include with Assessment Report

   a. Is there a sanitary seal on well at least 50 feet deep: **YES**

   b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
   c. Is the well in a pit or subject to flooding or ponding? **NO**
   d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
   a. Well

3. In what type of aquifer is the well located?
   a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
See Well 2A	

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a.yes, 1b.yes, 1c.no, 1d.yes, 2a, 4c)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 15** Source Number: **06N/12W-13N01 S**

Indicate the method used to delineate the zones:
Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt} = \sqrt{Qt/\pi\eta H}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, **5** and 10 years
$\pi = 3.1416$
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 998 gpm x 70,267 = 70,126,466 ft^3/year (max. pumped 51,572,502 ft^3/year in last 3 years)
t = 2,5,10 years
η= 0.3 (hard packed sand, fine sand and clay)
H = 380 ft

R2 = 626 ft
R5 = 989 ft
R10 = 1399 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger:	_________ ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger:	_________ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger:	________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **939 ft**, minimum = 900 ft--use larger: **939 ft**
downgradient distance = 0.5R2 = **316 ft**, minimum = 300 ft--use larger: **316 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1484 ft**, minimum = 1,500 ft--use larger: **1500 ft**
downgradient distance = 0.5R5 = **495 ft**, minimum = 500 ft--use larger: **500 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **2099 ft**, minimum = 2,250 ft--use larger: **2250 ft**

downgradient distance = 0.5R10 = **700 ft**, minimum = 750 ft--use larger: **750 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 23A**
06N/11W-19L01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model)

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 35 40.31**
Longitude: **118 05 19.50**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

2202 East Avenue P-8

(Avenue P-8 and 22nd St.)

Location of recharge area, if known: **The well is located in the Lancaster Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **Well log, District staff, field review**
Collected by: **Perri Standish-Lee** -Date: **June 5, 1998**

Well Number or Name: **Well 23A**
DHS Source Identification Number: **06N/11W-19L01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **rural/vacant, small commercial area on west side within 1000 ft.**
Distance to: Sewer Line or Sewage Disposal: **main sewer line (42 inch) approximately 1000 ft**
Size of controlled area around well (square feet): **10,000 sqft**
Type of access control to well site (ie. Fencing, building, etc.):**fenced topped with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Lancaster Sub-Unit**
Date drilled: **4/15/91**
Drilling method: **Reverse Rotary**
Depth of bore Hole (feet below ground surface): **900 ft**
Finished Well Depth (feet below ground surface): **840 ft**
Casing: Depth (feet below ground surface): **840 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **80 ft**
Second casing diameter: **30 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **600 ft**
Total length of screened interval: **240 ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **50 ft**
Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **2 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **none**
Depth to (feet below ground surface): --
Water Levels: Static (feet below ground surface): **542 ft (March 1998)**
When pumping (feet below ground surface): **616 ft (March 1998)**
Pump: Make: **Ingersoll Rand**
Type: **Turbine**
Capacity, g.p.m: **1,369 gpm**
Depth to pump (feet below ground surface): **725 ft**
Lubrication: **oil**
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **desert floor**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **3-4 hrs/day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **aluminum**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **no, through door**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 23A** Identification number: **06N/11W-19LO1 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep: **YES**

b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
c. Is the well in a pit or subject to flooding or ponding? **NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. **Unconfined**

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?
a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
See Well 2A	

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a.yes, 1b.yes, 1c.no, 1d.yes, 2a, 4c)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 23A** Source Number: **06N/11W-19L01 S**

Indicate the method used to delineate the zones:
Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt} = \sqrt{Qt/\pi\eta H}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, 5 and 10 years
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 1369 gpm x 70,267 = 96,195,523 ft^3/year (max. pumped 11,646,339 ft^3/year in last 3 years)
t = 2,5,10 years
η= 0.25 (gravel and clay)
H = 240 ft

R2 = 1010 ft
R5 = 1597 ft
R10 = 2259 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: _________ ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: _________ ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: ________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **1515 ft**, minimum = 900 ft--use larger: **1515 ft**
downgradient distance = 0.5R2 = **505 ft**, minimum = 300 ft--use larger: **505 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **2396 ft**, minimum = 1,500 ft--use larger: **2396 ft**
downgradient distance = 0.5R5 = **799 ft**, minimum = 500 ft--use larger: **799 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **3389 ft**, minimum = 2,250 ft--use larger: **3389 ft**

downgradient distance = 0.5R10 = **1130 ft**, minimum = 750 ft--use larger: **1130 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No. **1910102**

Name of source and ID No.: **Well 24**
06N/11W-19G01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 35 42.05**
Longitude: **118 04 48.33**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

2701 East Avenue P-8

(1/2 mile south, ¼ mile east from intersection of Avenue P and 25th St. East)

Location of recharge area, if known: **The well is located in the Lancaster Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **Well log, district staff and field review**
Collected by: **Perri Standish-Lee** -Date: **June 4, 19**

Well Number or Name: **Well 24**
DHS Source Identification Number: **06N/11W-19G01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **rural/commercial mostly vacant land owned by LA County Dept. of Airport.**
Distance to: Sewer Line or Sewage Disposal: **none (WWTP approximately ½ mile away)**
Size of controlled area around well (square feet): **9,800 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fenced topped with barbed wire.**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Lancaster Sub-Unit**
Date drilled: **9/23/85**
Drilling method: **Reverse Rotary**
Depth of bore Hole (feet below ground surface): **945 ft**
Finished Well Depth (feet below ground surface): **920 ft**
Casing: Depth (feet below ground surface): **920 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **80 ft**
Second casing diameter: **28 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **570 ft**
Total length of screened interval: **330 ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **80 ft**
Concrete slab surface seal (yes or no): **yes** ....Radius (ft): **1.5 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **20, 10, 10, 20, 10 ft**
Depth to (feet below ground surface): **370, 400, 420, 480, 520 ft**
Water Levels: Static (feet below ground surface): **477 ft (March 1998)**
When pumping (feet below ground surface): **517 ft (March 1998)**
Pump: Make: **Simmons**
Type: **Submersible**
Capacity, g.p.m: **525 gpm**
Depth to pump (feet below ground surface): **695 ft**
Lubrication
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **desert floor**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 12-16 hrs/day, winter 4-6 hrs/day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **wood and stacco**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **yes, but connected to drainage pot (to be changed)**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 24** Identification number: **06N/11W-19GO1 S**

Assessment date: **June 4, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep: **YES**

b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
c. Is the well in a pit or subject to flooding or ponding? **NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?
a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
See Well 2A	

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a.yes, 1b.yes, 1c.no, 1d.yes, 2a, 4c)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 24** Source Number: **06N/11W-19G01 S**

Indicate the method used to delineate the zones:
Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown bel

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is **Rt =** $\sqrt{Qt/\pi\eta H}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, **5** and 10 years
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 525 gpm x 70,267 = 36,890,175 ft^3/year (max. pumped 9,037,719 ft^3/year, in past 3 years)
t = 2,5,10 years
η= **0.25 (fine to medium sand, clay and sand, some sand, gravel and clay)**
H = 330 ft

R2 = 534 ft
R5 = 844 ft
R10 = 1193 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: _________ ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: _________ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: ________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **801 ft**, minimum = 900 ft--use larger: **900 ft**
downgradient distance = 0.5R2 = **267 ft**, minimum = 300 ft--use larger: **300 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1,266 ft**, minimum = 1,500 ft--use larger: **1,500 ft**
downgradient distance = 0.5R5 = **422 ft**, minimum = 500 ft--use larger: **500 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **1,790 ft**, minimum = 2,250 ft--use larger: **2,250 ft**

downgradient distance = 0.5R10 = **597 ft**, minimum = 750 ft--use larger: **750 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 30**
06N/11W-36C01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 34 21.00**
Longitude: **117 59 49.75**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

7392 East Avenue R

(1/2 mile south of 75th East)

Location of recharge area, if known: **The well is located in the Pearland Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **Well log, District staff and field review.**
Collected by: **Perri Standish-Lee** -Date: **June 4,19**

Well Number or Name: **Well 30**
DHS Source Identification Number: **06N/11W-36C01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **rural/vacant (cement plant approximately ¾ mile so., gravel pit 1 mile so.)**
Distance to: Sewer Line or Sewage Disposal: **none**
Size of controlled area around well (square feet): **9,604 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fence topped with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Pearland Sub-Unit**
Date drilled: **8/31/89**
Drilling method: **Reverse Rotary**
Depth of bore Hole (feet below ground surface): **425 ft**
Finished Well Depth (feet below ground surface): **410 ft**
Casing: Depth (feet below ground surface): **410 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **50 ft**
Second casing diameter: **30 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **200 ft**
Total length of screened interval: **210 ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **50 ft**
Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **1.5 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **41 ft**
Depth to (feet below ground surface): **156 ft**
Water Levels: Static (feet below ground surface): **156 ft (March 1998)**
When pumping (feet below ground surface): **212 ft (March 1998)**
Pump: Make: **Goulds**
Type: **Submersible**
Capacity, g.p.m: **839 gpm**
Depth to pump (feet below ground surface): **360 ft**
Lubrication
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **desert floor**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 12-16 hrs/day, winter 4-6 hrs/day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **concrete block**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **none (through door)**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 30** Identification number: **06N/11W-36CO1 S**

Assessment date: **June 4, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep: **YES**

b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
c. Is the well in a pit or subject to flooding or ponding? **NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?
a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow;
artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge for the Pearland sub-unit	Approximate Maximum Distance from Well*
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO 2b
1b. NO 2c
1c. YES 3b
1d. NO 3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES 2a
1b. YES 4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a.yes, 1b.yes, 1c.no, 1d.yes, 2a, 4c)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 30** Source Number: **06N/11W-36C01 S**

Indicate the method used to delineate the zones:

Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown bel

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is **$Rt = \sqrt{Qt/\pi\eta H}$**

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, **5** and 10 years
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 839 gpm x 70,267 = 58,954,013 ft^3/year (max. pumped 16,265,059 ft^3/year, in past 3 years)
t = 2,5,10 years
η= 0.25 (clay and sand, some gravel)
H = 210 ft

R2 = 846 ft
R5 = 1337 ft
R10 = 1891 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____ ft,	minimum = 600 ft -use larger: _________ ft
Zone B5	(5 year TOT)	R_5 = _____ ft,	minimum =1,000 ft--use larger: _________ ft
Zone B10	(10 year TOT)	R_{10}= _____ ft,	minimum =1,500 ft-use larger: _________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **1,269 ft**, minimum = 900 ft--use larger: **1,269 ft**
downgradient distance = 0.5R2 = **423 ft**, minimum = 300 ft--use larger: **423 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **2,006 ft**, minimum = 1,500 ft--use larger: **2,006 ft**
downgradient distance = 0.5R5 = **669 ft**, minimum = 500 ft--use larger: **669 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **2,837 ft**, minimum = 2,250 ft--use larger: **2,837 ft**

downgradient distance = 0.5R10 = **946 ft**, minimum = 750 ft--use larger: **946 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 32**
06N/11W-32P03 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 33 36.59**
Longitude: **118 03 59.56**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

37301 35th St. East

(50 ft north of R-8, 50 ft west of 35th St. East)

Location of recharge area, if known: **The well is located in the Pearland Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, ; further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **Well log, District staff, field survey**
Collected by: **Perri Standish-Lee** -Date: **June 5, 1**

Well Number or Name: **Well 32**
DHS Source Identification Number: **06N/11W-32P03 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **residential/rural**
Distance to: Sewer Line or Sewage Disposal: **sewer line 56 ft away**
Size of controlled area around well (square feet): **7,839 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fenced topped with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Pearland Sub-Unit**
Date drilled: **1/9/90**
Drilling method: **Rotary**
Depth of bore Hole (feet below ground surface): **580 ft**
Finished Well Depth (feet below ground surface): **570 ft**
Casing: Depth (feet below ground surface): **570 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **50 ft**
Second casing diameter: **30 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **280 ft**
Total length of screened interval: **290 ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **50 ft**
Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **1.7 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **none**
Depth to (feet below ground surface): --
Water Levels: Static (feet below ground surface): **290 ft (March 1998)**
When pumping (feet below ground surface): **380 ft (March 1998)**
Pump: Make: **Simmons**
Type: **Submersible**
Capacity, g.p.m: **225 gpm**
Depth to pump (feet below ground surface): **462 ft**
Lubrication
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **across 35th St. to storm drain**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 12-16 hrs/day, winter 4-6 hrs/day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **wood and stacco (the well is outside the building)**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **yes**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 32** Identification number: **06N/11W-32PO3 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

   Complete DHS Well Data Sheet (attached) and include with Assessment Report

   a. Is there a sanitary seal on well at least 50 feet deep: **YES**

   b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
   c. Is the well in a pit or subject to flooding or ponding? **NO**
   d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
   a. Well

3. In what type of aquifer is the well located?
   a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO 2b
1b. NO 2c
1c. YES 3b
1d. NO 3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES 2a
1b. YES 4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a.yes, 1b.yes, 1c.no, 1d.yes, 2a, 4c)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 32** Source Number: **06N/11W-32P03 S**

Indicate the method used to delineate the zones:

Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown bel

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is **$Rt = \sqrt{Qt/\pi\eta H}$**

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, **5** and 10 years
$\pi = 3.1416$
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 225 gpm x 70,267 = 15,810,075 ft^3/year (max. pumped 8,737,496 ft^3/year, in past 3 years)
t = 2,5,10 years
η= 0.3 (clay and fine sand)
H = 290 ft

R2 = 340 ft
R5 = 538 ft
R10 = 761 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: _________ ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: _________ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: ________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **510 ft**, minimum = 900 ft--use larger: **900 ft**
downgradient distance = 0.5R2 = **170 ft**, minimum = 300 ft--use larger:**300 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **807 ft**, minimum = 1,500 ft--use larger: **1,500 ft**
downgradient distance = 0.5R5 = **269 ft**, minimum = 500 ft--use larger: **500 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **1,142 ft**, minimum = 2,250 ft--use larger: **2,250 ft**

downgradient distance = 0.5R10 = **381 ft**, minimum = 750 ft--use larger: **750 ft**

Groundwater Source Location

Public water system: **PALMDADLE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 33**
06N/11W-36D01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 34 19.00**
Longitude: **117 59 56.50**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

7160 East Avenue R

(1/4 mile west of 75th St. on R)

Location of recharge area, if known: **The well is located in the Pearland Sub-Unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**

Source of Information: **Well log, District staff and field review**

Collected by: **Perri Standish-Lee** -Date: **June 4, 1**

.

Well Number or Name: **Well 33**

DHS Source Identification Number: **06N/11W-36 DP01 S**

Location (Agricultural, Rural, Residential, Commercial, Industrial, Municipal, Mixed, other.): **rural/vacant (cement factory 11/2 miles away)**

Distance to: Sewer Line or Sewage Disposal: **none**

Size of controlled area around well (square feet): **10,000 sqft**

Type of access control to well site (ie. Fencing, building, etc.): **fence topped with barbed wire**

Site plan on file? (yes or no): **yes**

DWR Ground Water Basin: **Antelope Valley**

DWR Ground Water Sub-basin: **Pearland Sub-Unit**

Date drilled: **5/1/91**

Drilling method: **Reverse Rotary**

Depth of bore Hole (feet below ground surface): **465 ft**

Finished Well Depth (feet below ground surface): **465 ft**

Casing: Depth (feet below ground surface): **465 ft**

Diameter: **16 inch**

Material: **steel**

Second casing depth (feet below ground surface): **80 ft**

Second casing diameter: **30 inch**

Second casing material: **steel**

Depth to highest perforations (feet below ground surface): **220 ft**

Total length of screened interval: **200 ft**

Sanitary sealed (yes or no) **yes**..Depth (ft): **80 ft**

Concrete slab surface seal (yes or no): **yes**...................................Radius (ft): **2 ft**

Gravel pack (yes or no): **yes**

Confining layer: Thickness- **none**

Depth to (feet below ground surface): --

Water Levels: Static (feet below ground surface): **184 ft (March 1998)**

When pumping (feet below ground surface): **272 ft (March 1998)**

Pump: Make: **American Turbine**

Type: **Submersible**

Capacity, g.p.m: **744 gpm**

Depth to pump (feet below ground surface): **420 ft**

Lubrication

Power: **electric**

Auxiliary power (yes or no): **no**

Operation controlled by: **SCADA**

Discharge to: **desert floor**

Frequency of Use: **daily**

Typical pumping duration (hours/day): **summer 12-16 hrs/day, winter 4-6 hrs/day**

Within 100 year flood plain? (yes or no): **no**

Drainage away from well? (yes or no): **yes**

Well log on file? (yes or no): **yes**

Housing: Type: **concrete block (well outside building)**

Condition: **good**

Pit depth (if any): **none**

Floor (material): **concrete**

Drainage: **good**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 33** Identification number: **06N/11W-36DO1 S**

Assessment date: **June 4, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep: **YES**

b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
c. Is the well in a pit or subject to flooding or ponding? **NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?
a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a.yes, 1b.yes, 1c.no, 1d.yes, 2a, 4c)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 33** Source Number**: 06N/11W-36D01 S**

Indicate the method used to delineate the zones:
Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown bel

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi\eta H}}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, 5 and 10 years
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 744 gpm x 70,267 = 52,278,648 ft^3/year (max. pumped 14,816,460 ft^3/year, in past 3 years)
t = 2,5,10 years
η= 0.2 (gravel and sand)
H = 200 ft

R2 = 912 ft
R5 = 1442 ft
R10 = 2040 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: _________ ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: _________ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: ________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **1,368 ft**, minimum = 900 ft--use larger: **1,368 ft**
downgradient distance = 0.5R2 = **456 ft**, minimum = 300 ft--use larger:**456 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **2,163 ft**, minimum = 1,500 ft--use larger: **2,163 ft**
downgradient distance = 0.5R5 = **721 ft**, minimum = 500 ft--use larger: **721 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **3,060 ft**, minimum = 2,250 ft--use larger: **3,060 ft**

downgradient distance = 0.5R10 = **1,020 ft**, minimum = 750 ft--use larger: **1,020 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 35**
06N/11W-03N01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 32 45.00**
Longitude: **118 01 22.50**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

36549 60th St. East

Location of recharge area, if known: **The well is located in the Pearland Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first wit surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **Well log, District staff and field review**
Collected by: **Perri Standish-Lee** -Date: **June 5, 1**

Well Number or Name: **Well 35**
DHS Source Identification Number: **06N/11W-03N01 S**
Location (Agricultural, Rural, Residential, Commercial, Industrial, Municipal, Mixed, other.): **rural (railroad track 200 ft N. of well, gravel mine ¾ mile, residential area on NW)**
Distance to: Sewer Line or Sewage Disposal: **none**
Size of controlled area around well (square feet): **8,820 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fence topped with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Pearland Sub-Unit**
Date drilled: **7/3/91**
Drilling method: **Reverse Rotary**
Depth of bore Hole (feet below ground surface): **500 ft**
Finished Well Depth (feet below ground surface): **500 ft**
Casing: Depth (feet below ground surface): **500 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **100 ft**
Second casing diameter: **30 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **200 ft**
Total length of screened interval: **300 ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **100 ft**
Concrete slab surface seal (yes or no): **yes**...................................Radius (ft): **2 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **none**
Depth to (feet below ground surface): –
Water Levels: Static (feet below ground surface): **200 ft (March 1998)**
When pumping (feet below ground surface): **297 ft (March 1998)**
Pump: Make: **American Turbine**
Type: **Submersible**
Capacity, g.p.m: **582 gpm**
Depth to pump (feet below ground surface): **420 ft**
Lubrication
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **desert floor**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 12-16 hrs/day, winter 4-6 hrs/day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **concrete block (well outside building)**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **good**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 35** Identification number: **06N/11W-03NO1 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep: **YES**

b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
c. Is the well in a pit or subject to flooding or ponding? **NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?
a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME) (1a.yes, 1b.yes, 1c.no, 1d.yes, 2a, 4c)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 35** Source Number: **06N/11W-03N01 S**

Indicate the method used to delineate the zones:

Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown bel

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi\eta H}}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)

Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)

t = Time of travel (years), 2, **5** and 10 years

$\pi = 3.1416$

η = effective porosity (decimal percent) (If unknown, assume 0.2)

H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 582 gpm x 70,267 = 40,895,394 ft^3/year (max. pumped 16,184,037 ft^3/year, in past 3 years)
t = 2,5,10 years
η= 0.25 (sand, gravel and clay)
H = 300 ft

R2 = 589 ft
R5 = 932 ft
R10 = 1317 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____ ft,	minimum = 600 ft -use larger: _________ ft
Zone B5	(5 year TOT)	R_5 = _____ ft,	minimum =1,000 ft--use larger: _________ft
Zone B10	(10 year TOT)	R_{10}= ____ ft,	minimum =1,500 ft-use larger: ________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **884 ft**, minimum = 900 ft--use larger: **900 ft**
downgradient distance = 0.5R2 = **295 ft**, minimum = 300 ft--use larger:**300 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1,398 ft**, minimum = 1,500 ft--use larger: **1,500 ft**
downgradient distance = 0.5R5 = **466 ft**, minimum = 500 ft--use larger: **500 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **1,976 ft**, minimum = 2,250 ft--use larger: **2,250 ft**

downgradient distance = 0.5R10 = **659 ft**, minimum = 750 ft--use larger: **750 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 27 (Future Well)**
06N/11W-35K01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft)**

Location of well: Latitude: **34 33 41.19**
Longitude: **118 00 34.90**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

(1000 ft north of Avenue S, 200 ft east of 60th St.)

Location of recharge area, if known: **The well is located in the Pearland Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **Well log, field visit**
Collected by: **Perri Standish-Lee** -Date: **June 5, 1998**

Well Number or Name: **Well 27 (future well, not equipped)**
DHS Source Identification Number: **06N/11W-35K01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **rural/vacant (garbage dumping in area)**
Distance to: Sewer Line or Sewage Disposal : **none**
Size of controlled area around well (square feet): **? sqft**
Type of access control to well site (ie. Fencing, building, etc.): **no fencing at present**
Site plan on file? (yes or no): (general area map on file)
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Pearland Sub-Unit**
Date drilled: **5/18/89**
Drilling method: **Rotary**
Depth of bore Hole (feet below ground surface): **470 ft**
Finished Well Depth (feet below ground surface): **450 ft**
Casing: Depth (feet below ground surface): **450 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **80 ft**
Second casing diameter: **30 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **250 ft**
Total length of screened interval: **200 ft**
Sanitary sealed (yes or no) **yes**...Depth (ft): **80 ft**
Concrete slab surface seal (yes or no): **yes** ....Radius (ft): **2 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **12 ft**
Depth to (feet below ground surface): **156 ft**
Water Levels: Static (feet below ground surface):
When pumping (feet below ground surface):
Pump: Make: **(not equipped)**
Type:
Capacity, g.p.m: **600 gpm (estimate)**
Depth to pump (feet below ground surface):
Lubrication
Power
Auxiliary power (yes or no)
Operation controlled by
Discharge to
Frequency of Use
Typical pumping duration (hours/day)
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no)
Well log on file? (yes or no): **yes**
Housing: Type: **none at present**
Condition
Pit depth (if any)
Floor (material)
Drainage

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 27** Identification number: **06N/11W-35KO1 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

   Complete DHS Well Data Sheet (attached) and include with Assessment Report

   a. Is there a sanitary seal on well at least 50 feet deep: **YES**

   b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
   c. Is the well in a pit or subject to flooding or ponding? **NO**
   d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
   a. Well

3. In what type of aquifer is the well located?
   a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO 2b
1b. NO 2c
1c. YES 3b
1d. NO 3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES 2a
1b. YES 4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 27 (future well)** Source Number: **06N/11W-35K01 S**

Indicate the method used to delineate the zones:

Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown bel

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is **$Rt = \sqrt{Qt/\pi\eta H}$**

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, **5** and 10 years
$\pi = 3.1416$
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 600 gpm x 70,267 = 42,160,200 ft^3/year
t = 2,5,10 years
η= 0.25 (sand, gravel and clay)
H = 200 ft

R2 = 733 ft
R5 = 1158 ft
R10 = 1638 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger:	_________ ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger:	_________ ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger:	________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **1,100 ft**, minimum = 900 ft--use larger: **1,100 ft**
downgradient distance = 0.5R2 = **367 ft**, minimum = 300 ft--use larger:**367 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1,737 ft**, minimum = 1,500 ft--use larger: **1,737 ft**
downgradient distance = 0.5R5 = **579 ft**, minimum = 500 ft--use larger: **579 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **2,457 ft**, minimum = 2,250 ft--use larger: **2,457 ft**

downgradient distance = 0.5R10 = **819 ft**, minimum = 750 ft--use larger: **819 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 28 (Future Well)**
05N/11W-03A_ S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60ft**)

Location of well: Latitude: **34 33 12.58**
Longitude: **118 00 40.27**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

Location of recharge area, if known: **The well is located in the Pearland Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first wit surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **Well log, District staff and field visit**
Collected by: **Perri Standish-Lee** -Date: **June 5, 1998**

Well Number or Name: **Well 28 (future well, not equipped)**
DHS Source Identification Number: **05N/11W-03A_ S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **rural/vacant (garbage dumping in area)**
Distance to: Sewer Line or Sewage Disposal: **none**
Size of controlled area around well (square feet): **? sqft**
Type of access control to well site (ie. Fencing, building, etc.): **none at present**
Site plan on file? (yes or no):
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Pearland Sub-Unit**
Date drilled: **8/31/89**
Drilling method: **Reverse Rotary**
Depth of bore Hole (feet below ground surface): **640 ft**
Finished Well Depth (feet below ground surface): **625 ft**
Casing: Depth (feet below ground surface): **625 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **50 ft**
Second casing diameter: **30 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **325 ft**
Total length of screened interval: **300 ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **50 ft**
Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **2 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **17, 12, 59 ft**
Depth to (feet below ground surface): **142, 271, 294 ft**
Water Levels: Static (feet below ground surface):
When pumping (feet below ground surface):
Pump: Make: **(not equipped)**
Type:
Capacity, g.p.m: **600 gpm (estimate)**
Depth to pump (feet below ground surface):
Lubrication
Power
Auxiliary power (yes or no)
Operation controlled by
Discharge to
Frequency of Use
Typical pumping duration (hours/day)
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **none at present**
Condition
Pit depth (if any)
Floor (material)
Drainage

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 28** Identification number: **05N/11W-03A_ S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

   Complete DHS Well Data Sheet (attached) and include with Assessment Report

   a. Is there a sanitary seal on well at least 50 feet deep: **YES**

   b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
   c. Is the well in a pit or subject to flooding or ponding? **NO**
   d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
   a. Well

3. In what type of aquifer is the well located?
   a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO 2b
1b. NO 2c
1c. YES 3b
1d. NO 3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES 2a
1b. YES 4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 28 (future well)** Source Number: **05N/11W-03A_ S**

Indicate the method used to delineate the zones:

Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown bel

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi \eta H}}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)

Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)

t = Time of travel (years), 2, **5** and 10 years

$\pi = 3.1416$

η = effective porosity (decimal percent) (If unknown, assume 0.2)

H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 600 gpm x 70,267 = 42,160,200 ft^3/year

t = 2,5,10 years

η= 0.25 (sand, gravel and clay)

H = 300 ft

R2 = 598 ft

R5 = 946 ft

R10 = 1338 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger:	_________ ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger:	_________ft
Zone B10	(10 year TOT)	R_{10}= _____	ft, minimum =1,500 ft-use larger:	________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **897 ft**, minimum = 900 ft--use larger: **900 ft**
downgradient distance = 0.5R2 = **299 ft**, minimum = 300 ft--use larger:**300 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1,419 ft**, minimum = 1,500 ft--use larger: **1,500 ft**
downgradient distance = 0.5R5 = **473 ft**, minimum = 500 ft--use larger: **500 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **2,007 ft**, minimum = 2,250 ft--use larger: **2,250 ft**

downgradient distance = 0.5R10 = **669 ft**, minimum = 750 ft--use larger: **750 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 29 (Future Well)**
06N/11W-35G01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 34 00.32**
Longitude: **118 00 29.65**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

Location of recharge area, if known: **The well is located in the Pearland Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **Well log, District staff and field visit.**
Collected by: **Perri Standish-Lee** -Date: **June 5, 1998**

Well Number or Name: **Well 29 (future well, not equipped)**
DHS Source Identification Number: **06N/11W-35G01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **rural/vacant on three sides, residential west side**
Distance to: Sewer Line or Sewage Disposal : **?**
Size of controlled area around well (square feet): **8,000 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fenced and topped with barbed wire**
Site plan on file? (yes or no): **no**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Pearland Sub-Unit**
Date drilled: **8/31/89**
Drilling method: **Reverse Rotary**
Depth of bore Hole (feet below ground surface): **394 ft**
Finished Well Depth (feet below ground surface): **370 ft**
Casing: Depth (feet below ground surface): **370 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **50 ft**
Second casing diameter: **30 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **190 ft**
Total length of screened interval: **180 ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **50 ft**
Concrete slab surface seal (yes or no): **yes** ....Radius (ft): **1.5 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **none**
Depth to (feet below ground surface): --
Water Levels: Static (feet below ground surface):
When pumping (feet below ground surface):
Pump: Make: **(not equipped)**
Type:
Capacity, g.p.m: **400 gpm (estimate)**
Depth to pump (feet below ground surface):
Lubrication
Power
Auxiliary power (yes or no)
Operation controlled by
Discharge to
Frequency of Use
Typical pumping duration (hours/day)
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no)
Well log on file? (yes or no): **yes**
Housing: Type: **none at present**
Condition
Pit depth (if any)
Floor (material)
Drainage

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 29** Identification number: **06N/11W-35G01 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep:	**YES**
b. Is the casing a non-porous material (i.e., steel, plastic, PVC)	**YES**
c. Is the well in a pit or subject to flooding or ponding?	**NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions?	**YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO
1b. NO
1c. YES
1d. NO

2b
2c
3b
3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES
1b. YES
1c. NO
1d. YES

2a
4a

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 29 (future well)** Source Number: **06N/11W-35G01 S**

Indicate the method used to delineate the zones:
Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown bel

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{R_t = \sqrt{Qt/\pi\eta H}}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, **5** and 10 years
$\pi = 3.1416$
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 400 gpm x 70,267 = 28,106,800 ft^3/year
t = 2,5,10 years
η= 0.2 (sand, gravel and clay)
H = 180 ft

R2 = 705 ft
R5 = 1115 ft
R10 = 1576 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R2 = _____	ft, minimum = 600 ft -use larger: _________ ft
Zone B5	(5 year TOT)	R5 = _____	ft, minimum =1,000 ft--use larger: _________ft
Zone B10	(10 year TOT)	R10= ____	ft, minimum =1,500 ft-use larger: ________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default e circle may be shifted upgradient by 0.5Rt. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **1058 ft**, minimum = 900 ft--use larger: **1058 ft**
downgradient distance = 0.5R2 = **353 ft**, minimum = 300 ft--use larger:**353 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1,673 ft**, minimum = 1,500 ft--use larger: **1,673 ft**
downgradient distance = 0.5R5 = **558 ft**, minimum = 500 ft--use larger: **558 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **2,364 ft**, minimum = 2,250 ft--use larger: **2,364 ft**

downgradient distance = 0.5R10 = **788 ft**, minimum = 750 ft--use larger: **788 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 5**
05N/12W-02P04 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft)**

Location of well: Latitude: **34 32 29.58**
Longitude: **118 06 25.56**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

1036 Barrel Springs Road

Location of recharge area, if known: **The well is located in the San Andreas Sub-Unit.**

The recharge area for the wells in the San Andreas sub-unit is the area that lies east of Pearblossom Highway and Barrel Springs Road. The area to the east is a narrow valley with fairly poor ground water production. Tl area to the west is a broader valley with more extensive water bearing deposits. District Wells Nos. 5 and 17 located in the western area while District Wells Nos. 18 and 19 are located in the eastern area.

The sources of ground water recharge are direct precipitation, percolation from the Palmdale Ditch and irrigation.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **District file, staff and field review**
Collected by: **Perri Standish-Lee** -Date: **June 4, 19**

Well Number or Name: **Well 5**
DHS Source Identification Number: **05N/12W-02P04** S
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **mixed rural and residential (nearest home approximately 1000 ft)**
Distance to: Sewer Line or Sewage Disposal: **area is on septic tanks** (experience high nitrate levels)
Size of controlled area around well (square feet): **9600 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fence topped with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **San Andreas Sub-Unit**
Date drilled: **1963 (exact age unknown)**
Drilling method: **unknown**
Depth of bore Hole (feet below ground surface): **-- ft**
Finished Well Depth (feet below ground surface): **193 ft**
Casing: Depth (feet below ground surface): **193 ft**
Diameter: **8 inch**
Material: **steel**
Second casing depth (feet below ground surface): **unknown**
Second casing diameter: **--**
Second casing material: **--**
Depth to highest perforations (feet below ground surface): **unknown**
Total length of screened interval: **unknown**
Sanitary sealed (yes or no) **unknown**..................................Depth (ft): **--**
Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **0.7 ft**
Gravel pack (yes or no): **--**
Confining layer: Thickness- **unknown**
Depth to (feet below ground surface): **--**
Water Levels: Static (feet below ground surface): **20 ft**
When pumping (feet below ground surface): **33 ft**
Pump: Make: **Berkley**
Type: **Submersible**
Capacity, g.p.m: **112 gpm**
Depth to pump (feet below ground surface): **126 ft**
Lubrication
Power: **electric**
Auxiliary power (yes or no): **yes (quick coupling for portable generator)**
Operation controlled by: **SCADA**
Discharge to: **none (well pump to storage tank)**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 12-16 hrs/day, winter 4-6 hrs/day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **no**
Housing: Type: **wood and stacco**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **yes**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 5** Identification number: **05N/12W-02P04 S**

Assessment date: **June 4, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

   Complete DHS Well Data Sheet (attached) and include with Assessment Report

   a. Is there a sanitary seal on well at least 50 feet deep: **UNKNOWN**

   b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
   c. Is the well in a pit or subject to flooding or ponding? **NO**
   d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **NO**

2. What is the type of source?
   a. Well

3. In what type of aquifer is the well located?
   a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Mountain slopes	2.8 miles
Precipitation	0

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Low (LE) (1a. unknown, 1b.yes, 1c.no, 1d.no, 2a. 3a. 4c)

Physical Barrier Effectiveness (PBE) – Ground Water, page 1 of 2

Source Name: Well 5

PARAMETER	*POINTS* Unconfined		*POINTS* Confined	
A. TYPE OF AQUIFER Confinement *(up to 40 points maximum)* choose one				
a. Unconfined, Semi-confined, Unknown	0			
b. Confined			40	
B. AQUIFER MATERIAL (Unconfined Aquifer) Type of within the aquifer *(up to 20 points maximum)* choose one				
1. Porous Media (Interbedded sands, silts, clays, gravels) with continuous clay layer minimum 25' thick above water table within Zone A	20			
2. Porous Media (Interbedded sands, silts, clays, and gravels)	(10)	10		
3. Fractured rock * (* Low Physical Barrier Effectiveness - no further questions required)	0			
C. PATHWAYS OF CONTAMINATION (All Aquifers) Presence of Abandoned or Improperly Destroyed Wells *(up to 10 points maximum)*				
1. Are they present within Zone A (2-year time of travel (TOT) distance)?				
a. Yes or unknown	0		0	
b. No	(5)	5	5	
2. Are they present within Zone B5 (2- to 5-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	(3)	3	3	
3. Are they present within Zone B10 (5- to 10-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	(2)	2	2	
D. STATIC WATER CONDITIONS (Unconfined Aquifer) Depth to static Water (DTW) = 20 feet *(up to 10 points maximum)* choose one				
1. 0 to 20 feet	0			
2. 20 to 50 feet	2	2		
3. 50 to 100 feet	6			
4. > 100 feet	10			
E. WELL OPERATION (Unconfined Aquifer) Depth to Uppermost Perforations (DUP) DUP = unknown feet; Maximum Pumping Rate of Well (Q) Q = ______ gallons/minute; Length of screened interval (H) H = ______ feet				
[(DUP – DTW) / (Q/H)] = *(up to 10 points maximum)* choose one				
1. < 5	0	0		
2. 5 to 10	5			
3. > 10	10			

Physical Barrier Effectiveness – Ground Water, page 2 of 2
Source Name:______________________

PARAMETER	*POINTS* Unconfined		Confined	
F. HYDRAULIC HEAD (Confined Aquifer) What is the relationship in hydraulic head between the confined aquifer and the overlying unconfined aquifer? (i.e. does the well flow under artesian conditions?) *(up to 20 points maximum)* choose one				
1. head in confined aquifer is higher than head in unconfined aquifer under all conditions			20	
2. head in confined aquifer is higher than head in unconfined aquifer under static conditions			10	
3. head in confined aquifer is lower than or same as head in unconfined aquifer			0	
4. unknown			0	
G. WELL CONSTRUCTION (All Aquifers) 1. Sanitary Seal (Annular Seal) Depth = unknown feet *(up to 10 points maximum)* choose one				
a. None or less than 20 feet deep	(0)	0	0	
b. 20 to 50 ft deep	6		10	
c. 50 ft or greater	10		10	
2. Surface seal (concrete cap) *(up to 4 points maximum)* choose one				
a. Not present or improperly constructed	(0)	0	0	
b. Watertight, slopes away from well, at least 2' laterally in all directions	4		4	
3. Flooding potential at well site *(up to 1 point maximum)* choose one				
a. Subject to localized flooding (i.e. in low area or unsealed pit or vault) or Within 100 year flood plain	0		0	
b. Not subject to flooding	1	1	1	
4. Security at well site *(up to 5 points maximum)* choose one				
a. Not secure	0		0	
b. Secure (i.e. housing, fencing, etc.)	5	5	5	
Maximum Points Possible	80		100	
POINT TOTAL FOR THIS SOURCE	28			

Physical Barrier Effectiveness SCORE INTERPRETATION

Point Total		**Effectiveness**	
____0 to 35	=	**Low** (circled)	(includes all sources in Fractured Rock)
____36 to 70	=	**Moderate**	
____71 to 100	=	**High**	

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 5** Source Number: **05N/12W-02P04 S**

Indicate the method used to delineate the zones:
Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown bel

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi \eta H}}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, **5** and 10 years
$\pi = 3.1416$
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 112 gpm x 70,267 = 7,869,904 ft^3/year (max. pumped 3,964,579 ft^3/year, in past 3 years)
t = 2,5,10 years
η= 0.2 (no well log, conservative no.)
H = 11 ft (10% of Q)

R2 = 1,509 ft
R5 = 2,386 ft
R10 = 3,374 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger:	_________ ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger:	_________ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger:	________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **2,264 ft**, minimum = 900 ft--use larger: **2,264 ft**
downgradient distance = 0.5R2 = **755 ft**, minimum = 300 ft--use larger:**755 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **3,579 ft**, minimum = 1,500 ft--use larger: **3,579 ft**
downgradient distance = 0.5R5 = **1,193 ft**, minimum = 500 ft--use larger: **1,193 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **5,061 ft**, minimum = 2,250 ft--use larger: **5,061 ft**

downgradient distance = 0.5R10 = **1,687 ft**, minimum = 750 ft--use larger: **1,687 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 34A (Future Well)**
05N/11W-03E__ S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger, USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 32 59.79**
Longitude: **118 01 21.62**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:
Rockie Lane and Ave. R

Location of recharge area, if known: **The well is located in the Pearland Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, ; further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **Well log, District staff and field visit.**
Collected by: **Perri Standish-Lee** -Date: **June 5, 1998**

Well Number or Name: **Well 34A (future well, not equipped)**
DHS Source Identification Number: **05N/11W-03E__ S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **rural/open space**
Distance to: Sewer Line or Sewage Disposal : **none**
Size of controlled area around well (square feet): **? sqft**
Type of access control to well site (ie. Fencing, building, etc.): **none at present**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Pearland Sub-Unit**
Date drilled: **1/7/92**
Drilling method: **Reverse Rotary**
Depth of bore Hole (feet below ground surface): **592 ft**
Finished Well Depth (feet below ground surface): **570 ft**
Casing: Depth (feet below ground surface): **570 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **31 ft**
Second casing diameter: **30 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **250 ft**
Total length of screened interval: **320 ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **50 ft**
Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **2 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **none**
Depth to (feet below ground surface): --
Water Levels: Static (feet below ground surface):
When pumping (feet below ground surface):
Pump: Make: **(not equipped)**
Type:
Capacity, g.p.m: **200 gpm (estimate)**
Depth to pump (feet below ground surface):
Lubrication
Power
Auxiliary power (yes or no)
Operation controlled by
Discharge to
Frequency of Use
Typical pumping duration (hours/day)
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **none at present**
Condition
Pit depth (if any)
Floor (material)
Drainage

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 34A** Identification number: **05N/11W-03E__ S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

   Complete DHS Well Data Sheet (attached) and include with Assessment Report

   a. Is there a sanitary seal on well at least 50 feet deep: **YES**

   b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
   c. Is the well in a pit or subject to flooding or ponding? **NO**
   d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
   a. Well

3. In what type of aquifer is the well located?
   a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 34A (future well)** Source Number: **05N/11W-03E__ S**

Indicate the method used to delineate the zones:
Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown bel

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi\eta H}}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), 2, **5** and 10 years
$\pi = 3.1416$
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 200 gpm x 70,267 = 14,053,400 ft^3/year
t = 2,5,10 years
η= 0.2 (sand, gravel and clay)
H = 320 ft

R2 = 374 ft
R5 = 591 ft
R10 = 836 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: _________ ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: _________ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: ________ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by 0.5Rt. The upgradient and downgradient limits of the zone are deter: below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **561 ft**, minimum = 900 ft--use larger: **900 ft**
downgradient distance = 0.5R2 = **187 ft**, minimum = 300 ft--use larger:**300 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **887 ft**, minimum = 1,500 ft--use larger: **1,500 ft**
downgradient distance = 0.5R5 = **296 ft**, minimum = 500 ft--use larger: **500 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **1,254 ft**, minimum = 2,250 ft--use larger: **2,250 ft**

downgradient distance = 0.5R10 = **418 ft**, minimum = 750 ft--use larger: **750 ft**

Additional Wells:
Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 17**
06N/12W-34N04 S

Location date: **8/8/95** Source located by (name of person): **USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 33 35.02**
Longitude: **118 08 33.04**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:
718 Denise Avenue.

Location of recharge area, if known: **The well is located in the San Andreas Sub-Unit.**

The recharge area for the wells in the San Andreas sub-unit is the area that lies east of Pearblossom Highway and Barrel Springs Road. The area to the east is a narrow valley with fairly poor ground water production. Tl area to the west is a broader valley with more extensive water bearing deposits. District Wells Nos. 5 and 17 located in the western area while District Wells Nos. 18 and 19 are located in the eastern area.

The sources of ground water recharge are direct precipitation, percolation from the Palmdale Ditch and irrigation.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **District file, staff and field review**
Collected by: **Perri Standish-Lee** -Date: **June 4, 19**

Well Number or Name: **Well 17**
DHS Source Identification Number: **05N/12W-34N04 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **mixed rural and residential (1 acre lots on septic tanks)**
Distance to: Sewer Line or Sewage Disposal: **area is on septic tanks** (experience high nitrate levels)
Size of controlled area around well (square feet): approximately **10,000 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **no fencing, well is not pumped to system at present**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **San Andreas Sub-Unit**
Date drilled: **1966**
Drilling method: **unknown**
Depth of bore Hole (feet below ground surface): **-- ft**
Finished Well Depth (feet below ground surface): **400 ft**
Casing: Depth (feet below ground surface): **400 ft**
Diameter: **10 inch**
Material: **steel**
Second casing depth (feet below ground surface): **unknown**
Second casing diameter: **--**
Second casing material: **--**
Depth to highest perforations (feet below ground surface): **unknown**
Total length of screened interval: **unknown**
Sanitary sealed (yes or no) **unknown**..................................Depth (ft): **--**
Concrete slab surface seal (yes or no): **yes**...................................Radius (ft): **2.5 ft (less than 12 inch above ground)**
Gravel pack (yes or no): **--**
Confining layer: Thickness- **unknown**
Depth to (feet below ground surface): **--**
Water Levels: Static (feet below ground surface): **37 ft**
When pumping (feet below ground surface): **114 ft**
Pump: Make: **Peerless**
Type: **Turbine**
Capacity, g.p.m: **154 gpm**
Depth to pump (feet below ground surface): **150 ft**
Lubrication: **oil**
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **none (well pumps to storage tank)**
Frequency of Use: **not used in system at present**
Typical pumping duration (hours/day): **--**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **no**
Housing: Type: **wood**
Condition: **fair**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **yes**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 17** Identification number: **06N/12W-34N04 S**

Assessment date: **June 4, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep: **UNKNOWN**

b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
c. Is the well in a pit or subject to flooding or ponding? **NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Physical Barrier Effectiveness (PBE) – Ground Water, page 1 of 2
Source Name: Well 17

PARAMETER	POINTS Unconfined		POINTS Confined	
A. TYPE OF AQUIFER Confinement *(up to 40 points maximum)* choose one				
a. Unconfined, Semi-confined, Unknown	0			
b. Confined			40	
B. AQUIFER MATERIAL (Unconfined Aquifer) Type of within the aquifer *(up to 20 points maximum)* choose one				
1. Porous Media (Interbedded sands, silts, clays, gravels) with continuous clay layer minimum 25' thick above water table within Zone A	20			
2. Porous Media (Interbedded sands, silts, clays, and gravels)	(10)	10		
3. Fractured rock * (* Low Physical Barrier Effectiveness - no further questions required)	0			
C. PATHWAYS OF CONTAMINATION (All Aquifers) Presence of Abandoned or Improperly Destroyed Wells *(up to 10 points maximum)*				
1. Are they present within Zone A (2-year time of travel (TOT) distance)?				
a. Yes or unknown	0		0	
b. No	(5)	5	5	
2. Are they present within Zone B5 (2- to 5-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	(3)	3	3	
3. Are they present within Zone B10 (5- to 10-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	(2)	2	2	
D. STATIC WATER CONDITIONS (Unconfined Aquifer) Depth to static Water (DTW) = 37 feet *(up to 10 points maximum)* choose one				
1. 0 to 20 feet	0			
2. 20 to 50 feet	(2)	2		
3. 50 to 100 feet	6			
4. > 100 feet	10			
E. WELL OPERATION (Unconfined Aquifer) Depth to Uppermost Perforations (DUP) DUP = unknown feet; Maximum Pumping Rate of Well (Q) Q = ______ gallons/minute; Length of screened interval (H) H = ______ feet				
[(DUP – DTW) / (Q/H)] = *(up to 10 points maximum)* choose one				
1. < 5	0	0		
2. 5 to 10	5			
3. > 10	10			

Physical Barrier Effectiveness – Ground Water, page 2 of 2
Source Name:________________________

PARAMETER	*POINTS* Unconfined		Confined	
F. HYDRAULIC HEAD (Confined Aquifer) What is the relationship in hydraulic head between the confined aquifer and the overlying unconfined aquifer? (i.e. does the well flow under artesian conditions?) *(up to 20 points maximum)* choose one				
1. head in confined aquifer is higher than head in unconfined aquifer under all conditions			20	
2. head in confined aquifer is higher than head in unconfined aquifer under static conditions			10	
3. head in confined aquifer is lower than or same as head in unconfined aquifer			0	
4. unknown			0	
G. WELL CONSTRUCTION (All Aquifers) 1. Sanitary Seal (Annular Seal) Depth = unknown feet *(up to 10 points maximum)* choose one				
a. None or less than 20 feet deep	(0)		0	
b. 20 to 50 ft deep	6		10	
c. 50 ft or greater	10		10	
2. Surface seal (concrete cap) *(up to 4 points maximum)* choose one				
a. Not present or improperly constructed	0		0	
b. Watertight, slopes away from well, at least 2' laterally in all directions	(4)	4	4	
3. Flooding potential at well site *(up to 1 point maximum)* choose one				
a. Subject to localized flooding (i.e. in low area or unsealed pit or vault) or Within 100 year flood plain	0		0	
b. Not subject to flooding	1	1	1	
4. Security at well site *(up to 5 points maximum)* choose one				
a. Not secure	0		0	
b. Secure (i.e. housing, fencing, etc.)	5	5	5	
Maximum Points Possible	80		100	
POINT TOTAL FOR THIS SOURCE	32			

Physical Barrier Effectiveness SCORE INTERPRETATION

Point Total		**Effectiveness**	
_____ 0 to 35	=	**Low**	(includes all sources in Fractured Rock)
_____ 36 to 70	=	**Moderate**	
_____ 71 to 100	=	**High**	

Source of Recharge	Approximate Distance from Well
Precipitation	0
Palmdale Ditch	
Mountain Slopes	15 miles

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO 2b
1b. NO 2c
1c. YES 3b
1d. NO 3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES 2a
1b. YES 4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:
Low (LE)/ (1a. unknown, 1b.yes, 1c.no, 1d.yes, 2a. 3a. 4c) (high nitrate/ septic tanks)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** Water System ID No.: **1910102**

Source Name: **Well 17** Source Number: **06N/12W-34N04 S**

Indicate the method used to delineate the zones:

Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction o ground water flow) **X**

More detailed methods, type used (i.e. analytical methods, hydrogeologic mapping, modeling)-.

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi\eta H}}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years)**, 2, 5 and 10** years
$\pi = 3.1416$
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 154 gpm x 70,267 = 10,821,118 ft^3/year (max. pumped 3,404,215 ft^3/year, in past 3 years)
t = 2,5,10 years
η= 0.2 (no well log, conservative no.)
H = 15 ft (10% of Q)

R2 = 1,515 ft
R5 = 2,396 ft
R10 = 3,388 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger:	_________	ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger:	_________	ft
Zone B10	(10 year TOT)	R_{10}= _____	ft, minimum =1,500 ft-use larger:	_________	ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **2,273 ft**, minimum = 900 ft--use larger: **2,273 ft**
downgradient distance = 0.5R2 = **756 ft**, minimum = 300 ft--use larger:**756 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **3,594 ft**, minimum = 1,500 ft--use larger: **3,594 ft**
downgradient distance = 0.5R5 = **1,198 ft**, minimum = 500 ft--use larger: **1,198 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **5,082 ft**, minimum = 2,250 ft--use larger: **5,082 ft**

downgradient distance = 0.5R10 = **1,694 ft**, minimum = 750 ft--use larger: **1,694 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 16**
05N/11W-05C02 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger,USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 33 13.69**
Longitude: **118 03 18.76**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:
4125 East Avenue S-4 (40th St. East and Ave. S-4)

Location of recharge area, if known: **The well is located in the Pearland Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first wit surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **Well log, District staff and field visit.**
Collected by: **Perri Standish-Lee** -Date: **June 5, 1998**

Well Number or Name: **Well 16**
DHS Source Identification Number: **05N/11W-05C02 S**
Location (Agricultural, Rural, Residential, Commercial, Industrial, Municipal, Mixed, other.): **residential/rural**
Distance to: Sewer Line or Sewage Disposal : **sewer line approximately 80 ft.**
Size of controlled area around well (square feet): **10,584 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fenced with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Pearland Sub-Unit**
Date drilled: **1960**
Drilling method: **Rotary**
Depth of bore Hole (feet below ground surface): **585 ft**
Finished Well Depth (feet below ground surface): **550 ft**
Casing: Depth (feet below ground surface): **550 ft**
Diameter: **14 inch**
Material: **steel**
Second casing depth (feet below ground surface): **50 ft**
Second casing diameter: **26 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **220 ft**
Total length of screened interval: **330 ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **50 ft**
Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **2.2 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **none**
Depth to (feet below ground surface): --
Water Levels: Static (feet below ground surface): **217 ft (March 1998)**
When pumping (feet below ground surface): **240 ft**
Pump: Make: **American Turbine**
Type: **submersible**
Capacity, g.p.m: **136 gpm**
Depth to pump (feet below ground surface): **336 ft**
Lubrication
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **Ave. S storm drain**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 8-16 hrs./day, winter 2-4 hrs./day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **wood**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **none**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 16** Identification number: **05N/11W-05C02 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep: **YES**

b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
c. Is the well in a pit or subject to flooding or ponding? **NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO 2b
1b. NO 2c
1c. YES 3b
1d. NO 3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES 2a
1b. YES 4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME)

Physical Barrier Effectiveness (PBE) – Ground Water, page 1 of 2
Source Name: Well 16

PARAMETER	*POINTS*			
	Unconfined		Confined	
A. TYPE OF AQUIFER Confinement *(up to 40 points maximum)* choose one				
a. Unconfined, Semi-confined, Unknown	0			
b. Confined			40	
B. AQUIFER MATERIAL (Unconfined Aquifer) Type of within the aquifer *(up to 20 points maximum)* choose one				
1. Porous Media (Interbedded sands, silts, clays, gravels) with continuous clay layer minimum 25' thick above water table within Zone A	20			
2. Porous Media (Interbedded sands, silts, clays, and gravels)	(10)	10		
3. Fractured rock * (* Low Physical Barrier Effectiveness - no further questions required)	0			
C. PATHWAYS OF CONTAMINATION (All Aquifers) Presence of Abandoned or Improperly Destroyed Wells *(up to 10 points maximum)*				
1. Are they present within Zone A (2-year time of travel (TOT) distance)?				
a. Yes or unknown	0		0	
b. No	(5)	5	5	
2. Are they present within Zone B5 (2- to 5-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	(3)	3	3	
3. Are they present within Zone B10 (5- to 10-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	(2)	2	2	
D. STATIC WATER CONDITIONS (Unconfined Aquifer) Depth to static Water (DTW) = 217 feet *(up to 10 points maximum)* choose one				
1. 0 to 20 feet	0			
2. 20 to 50 feet	2			
3. 50 to 100 feet	6			
4. > 100 feet	(10)	10		
E. WELL OPERATION (Unconfined Aquifer) Depth to Uppermost Perforations (DUP) DUP = 220 feet Maximum Pumping Rate of Well (Q) Q = 136 gallons/minute Length of screened interval (H) H = 330 feet				
[(DUP – DTW) / (Q/H)] $\frac{220-217}{136/330}$ = 7.3 *(up to 10 points maximum)* choose one				
1. < 5	0			
2. 5 to 10	(5)	5		
3. > 10	10			

Physical Barrier Effectiveness – Ground Water, page 2 of 2
Source Name:____________________

PARAMETER	*POINTS* Unconfined		*POINTS* Confined	
F. HYDRAULIC HEAD (Confined Aquifer) What is the relationship in hydraulic head between the confined aquifer and the overlying unconfined aquifer? (i.e. does the well flow under artesian conditions?) *(up to 20 points maximum)* choose one				
1. head in confined aquifer is higher than head in unconfined aquifer under all conditions			20	
2. head in confined aquifer is higher than head in unconfined aquifer under static conditions			10	
3. head in confined aquifer is lower than or same as head in unconfined aquifer			0	
4. unknown			0	
G. WELL CONSTRUCTION (All Aquifers) 1. Sanitary Seal (Annular Seal) Depth = 50 feet *(up to 10 points maximum)* choose one				
a. None or less than 20 feet deep	0		0	
b. 20 to 50 ft deep	6		10	
c. 50 ft or greater	(10)	10	10	
2. Surface seal (concrete cap) *(up to 4 points maximum)* choose one				
a. Not present or improperly constructed	0		0	
b. Watertight, slopes away from well, at least 2' laterally in all directions	(4)	4	4	
3. Flooding potential at well site *(up to 1 point maximum)* choose one				
a. Subject to localized flooding (i.e. in low area or unsealed pit or vault) or Within 100 year flood plain	0		0	
b. Not subject to flooding	1	(1)	1	
4. Security at well site *(up to 5 points maximum)* choose one				
a. Not secure	0		0	
b. Secure (i.e. housing, fencing, etc.)	(5)	5	5	
Maximum Points Possible	80		100	
POINT TOTAL FOR THIS SOURCE	55			

Physical Barrier Effectiveness SCORE INTERPRETATION

Point Total		**Effectiveness**	
____0 to 35	=	**Low**	(includes all sources in Fractured Rock)
____36 to 70	=	**Moderate**	
____71 to 100	=	**High**	

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD**

Water System ID No.: **1910102**

Source Name: **Well 16**   Source No. **05N/11W-05C02 S**

Indicate the method used to delineate the zones:

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow) **X**

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown below)

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is **Rt =** $\sqrt{Qt/\pi\eta H}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), **2, 5 and 10 years**
$\pi = 3.1416$
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 138 gpm x 70,267 = 9,696,846 ft^3/year (max pumped past 3 years 4,866,613 ft^3/year)
t = 2,5,10 years
η= 0.2 (course sand, gravel and clay)
H = 330 ft

R2 = 306 ft
R5 = 484 ft
R10 = 684 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: __ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: __ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: _ _ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **459 ft**, minimum = 900 ft--use larger: **900 ft**
downgradient distance = 0.5R2 = **153 ft**, minimum = 300 ft--use larger:**300 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **726 ft**, minimum = 1,500 ft--use larger: **1,500 ft**
downgradient distance = 0.5R5 = **242 ft**, minimum = 500 ft--use larger: **500 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **1,026 ft**, minimum = 2,250 ft--use larger: **2,250 ft**

downgradient distance = 0.5R10 = **342 ft**, minimum = 750 ft--use larger: **750 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source : **Well 18**
Well ID No.: **05N/11W-17H01 S**

Location date: **8/8/95** Source located by (name of person): **Loren Metzger,USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft)**

Location of well: Latitude: **34 31 21.24**
Longitude: **118 02 42.73**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:
4640 Barrel Springs Road

Location of recharge area, if known: **The well is located in the San Andreas Sub-Unit.**

The recharge area for the wells in the San Andreas sub-unit is the area that lies east of Pearblossom Highway and Barrel Springs Road. The area to the east is a narrow valley with fairly poor ground water production. Tl area to the west is a broader valley with more extensive water bearing deposits. District Wells Nos. 5 and 17 located in the western area while District Wells Nos. 18 and 19 are located in the eastern area.

The sources of ground water recharge are direct precipitation, percolation from the Palmdale Ditch and irrigation.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **District file, staff and field review**
Collected by: **Perri Standish-Lee** -Date: **June 4, 1S**

Well Number or Name: **Well 18**
DHS Source Identification Number: **05N/11W-17H01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **mixed rural and residential (rural on three sides, scattered homes to the North)**
Distance to: Sewer Line or Sewage Disposal: **area is on septic tanks**
Size of controlled area around well (square feet): approximately **5,040 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fenced and topped with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **San Andreas Sub-Unit**
Date drilled: **1954**
Drilling method: **unknown**
Depth of bore Hole (feet below ground surface): **137 ft**
Finished Well Depth (feet below ground surface): **100 ft**
Casing: Depth (feet below ground surface): **100 ft**
Diameter: **8 inch**
Material: **steel**
Second casing depth (feet below ground surface): **unknown**
Second casing diameter: **--**
Second casing material: **--**
Depth to highest perforations (feet below ground surface): **20 ft**
Total length of screened interval: **80 ft**
Sanitary sealed (yes or no) **unknown**..................................Depth (ft): **--**
Concrete slab surface seal (yes or no): **yes**...................................Radius (ft): **0.75 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **unknown**
Depth to (feet below ground surface): **--**
Water Levels: Static (feet below ground surface): **29 ft (march 1998)**
When pumping (feet below ground surface): **33 ft**
Pump: Make: **Peerless**
Type: **submersible**
Capacity, g.p.m: **94 gpm**
Depth to pump (feet below ground surface): **80 ft**
Lubrication:
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **none (well pumps to storage tank)**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 8-16 hrs/day, winter 2-4 hrs./day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **no**
Housing: Type: **wood**
Condition: **fair**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **yes**

Physical Barrier Effectiveness (PBE) – Ground Water, page 1 of 2
Source Name:______________________________

PARAMETER	*POINTS*			
	Unconfined		Confined	
A. TYPE OF AQUIFER Confinement *(up to 40 points maximum)* choose one				
a. Unconfined, Semi-confined, Unknown	0			
b. Confined			40	
B. AQUIFER MATERIAL (Unconfined Aquifer) Type of within the aquifer *(up to 20 points maximum)* choose one				
1. Porous Media (Interbedded sands, silts, clays, gravels) with continuous clay layer minimum 25' thick above water table within Zone A	20			
2. Porous Media (Interbedded sands, silts, clays, and gravels)	(10)	10		
3. Fractured rock * (* Low Physical Barrier Effectiveness - no further questions required)	0			
C. PATHWAYS OF CONTAMINATION (All Aquifers) Presence of Abandoned or Improperly Destroyed Wells *(up to 10 points maximum)*				
1. Are they present within Zone A (2-year time of travel (TOT) distance)?				
a. Yes or unknown	0		0	
b. No	(5)	5	5	
2. Are they present within Zone B5 (2- to 5-year TOT distance)?				
a. Yes or unknown	0		0	
b. (No)	(3)	3	3	
3. Are they present within Zone B10 (5- to 10-year TOT distance)?				
a. Yes or unknown	0		0	
b. (No)	(2)	2	2	
D. STATIC WATER CONDITIONS (Unconfined Aquifer) Depth to static Water (DTW) = 29 feet *(up to 10 points maximum)* choose one				
1. 0 to 20 feet	0			
2. 20 to 50 feet	(2)	2		
3. 50 to 100 feet	6			
4. > 100 feet	10			
E. WELL OPERATION (Unconfined Aquifer) Depth to Uppermost Perforations (DUP) DUP = 20 feet Maximum Pumping Rate of Well (Q) Q = 94 gallons/minute Length of screened interval (H) H = 80 feet				
[(DUP – DTW) / (Q/H)] = *(up to 10 points maximum)* choose one				
1. < 5	0	0		
2. 5 to 10	5			
3. > 10	10			

Physical Barrier Effectiveness – Ground Water, page 2 of 2

Source Name:______________________

PARAMETER	*POINTS*			
	Unconfined		Confined	
F. HYDRAULIC HEAD (Confined Aquifer) What is the relationship in hydraulic head between the confined aquifer and the overlying unconfined aquifer? (i.e. does the well flow under artesian conditions?) *(up to 20 points maximum)* choose one				
1. head in confined aquifer is higher than head in unconfined aquifer <u>under all conditions</u>			20	
2. head in confined aquifer is higher than head in unconfined aquifer <u>under static conditions</u>			10	
3. head in confined aquifer is lower than or same as head in unconfined aquifer			0	
4. unknown			0	
G. WELL CONSTRUCTION (All Aquifers) 1. Sanitary Seal (Annular Seal) Depth = ______ feet *(up to 10 points maximum)* choose one				
a. None or less than 20 feet deep	0	0	0	
b. 20 to 50 ft deep	6		10	
c. 50 ft or greater	10		10	
2. Surface seal (concrete cap) *(up to 4 points maximum)* choose one				
a. Not present or improperly constructed	0	0	0	
b. Watertight, slopes away from well, at least 2' laterally in all directions	4		4	
3. Flooding potential at well site *(up to 1 point maximum)* choose one				
a. Subject to localized flooding (i.e. in low area or unsealed pit or vault) or Within 100 year flood plain	0		0	
b. Not subject to flooding	1	1	1	
4. Security at well site *(up to 5 points maximum)* choose one				
a. Not secure	0		0	
b. Secure (i.e. housing, fencing, etc.)	5	5	5	
Maximum Points Possible	80		100	
POINT TOTAL FOR THIS SOURCE	26			

Physical Barrier Effectiveness SCORE INTERPRETATION

Point Total		**Effectiveness**	
26 0 to 35	=	**Low**	(includes all sources in Fractured Rock)
____36 to 70	=	**Moderate**	
____71 to 100	=	**High**	

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 18** Identification number: **05N/11W-17H01 S**

Assessment date: **June 4, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep: **UNKNOWN**

b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
c. Is the well in a pit or subject to flooding or ponding? **NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **NO**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?
a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Precipitation	0
Palmdale Ditch	200 ft to 1 mile
Mountain Slopes	3.8 miles

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO 2b
1b. NO 2c
1c. YES 3b
1d. NO 3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES 2a
1b. YES 4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Low (LE)/ME (1a. unknown, 1b.yes, 1c.no, 1d.no, 2a. 3a. 4c)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** System ID: **1910102**

Source Name: **Well 18** Source ID: **05N/11W-17H01 S**

Indicate the method used to delineate the zones:

Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow) **X**

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is **Rt** = $\sqrt{Qt/\pi\eta H}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)

Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)

t = Time of travel (years), 2, 5 and 10 years

$\pi = 3.1416$

η = effective porosity (decimal percent) (If unknown, assume 0.2)

H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 94 gpm x 70,267 = 6,605,098 ft^3/year (max. pumped 645,985 ft^3/year, in past 3 years)

t = 2,5,10 years

η= 0.2 (no well log, conservative no.)

H = 80 ft (file record)

R2 = 513 ft

R5 = 811 ft

R10 = 1146

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R2 = _____	ft, minimum = 600 ft -use larger: ______ ft
Zone B5	(5 year TOT)	R5 = _____	ft, minimum =1,000 ft--use larger: _____ft
Zone B10	(10 year TOT)	R10= ____	ft, minimum =1,500 ft-use larger: ______ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by 0.5Rt. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **770 ft**, minimum = 900 ft--use larger: **900 ft**
downgradient distance = 0.5R2 = **257 ft**, minimum = 300 ft--use larger:**300 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1217 ft**, minimum = 1,500 ft--use larger: **1500 ft**
downgradient distance = 0.5R5 = **406 ft**, minimum = 500 ft--use larger: **500 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **1719 ft**, minimum = 2,250 ft--use larger: **2250 ft**

downgradient distance = 0.5R10 = **573 ft**, minimum = 750 ft--use larger: **750 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source : **Well 19**
Well ID No.: **05N/11W-17H02 S**

Location date: **8/8/95** Source located by (name of person): **Loren Metzger,USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 31 21.75**
Longitude: **118 02 42.95**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

4640 Barrel Springs Road

Location of recharge area, if known: **The well is located in the San Andreas Sub-Unit.**

The recharge area for the wells in the San Andreas sub-unit is the area that lies east of Pearblossom Highway and Barrel Springs Road. The area to the east is a narrow valley with fairly poor ground water production. Tl area to the west is a broader valley with more extensive water bearing deposits. District Wells Nos. 5 and 17 located in the western area while District Wells Nos. 18 and 19 are located in the eastern area.

The sources of ground water recharge are direct precipitation, percolation from the Palmdale Ditch and irrigation.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **District file, staff and field review**
Collected by: **Perri Standish-Lee** -Date: **June 4, 1**

Well Number or Name: **Well 19**
DHS Source Identification Number: **05N/11W-17H02 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **mixed rural and residential (rural on three sides, scattered homes to the North)**
Distance to: Sewer Line or Sewage Disposal: **area is on septic tanks**
Size of controlled area around well (square feet): approximately **5,040 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fenced and topped with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **San Andreas Sub-Unit**
Date drilled: **1961**
Drilling method: **Rotary**
Depth of bore Hole (feet below ground surface): **393 ft**
Finished Well Depth (feet below ground surface): **350 ft**
Casing: Depth (feet below ground surface): **350 ft**
Diameter: **14 inch**
Material: **steel**
Second casing depth (feet below ground surface): **none**
Second casing diameter: --
Second casing material: --
Depth to highest perforations (feet below ground surface): **80 ft**
Total length of screened interval: **210 ft**
Sanitary sealed (yes or no) **no**..Depth (ft): --
Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **1.0 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness- **none**
Depth to (feet below ground surface): --
Water Levels: Static (feet below ground surface): **30 ft (February 1998)**
When pumping (feet below ground surface): **58 ft**
Pump: Make: **Peerless**
Type: **Turbine**
Capacity, g.p.m: **127 gpm**
Depth to pump (feet below ground surface): **150 ft**
Lubrication: **water**
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **none (well pumps to storage tank)**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 8-16 hrs/day, winter 2-4 hrs./day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **no**
Housing: Type: **wood**
Condition: **fair**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **yes**

Well 19

Physical Barrier Effectiveness (PBE) – Ground Water, page 1 of 2

Source Name:

PARAMETER	*POINTS* Unconfined		*POINTS* Confined	
A. TYPE OF AQUIFER Confinement *(up to 40 points maximum)* choose one				
a. Unconfined, Semi-confined, Unknown	0			
b. Confined			40	
B. AQUIFER MATERIAL (Unconfined Aquifer) Type of within the aquifer *(up to 20 points maximum)* choose one				
1. Porous Media (Interbedded sands, silts, clays, gravels) with continuous clay layer minimum 25' thick above water table within Zone A	20			
2. Porous Media (Interbedded sands, silts, clays, and gravels)	(10)	10		
3. Fractured rock * (* Low Physical Barrier Effectiveness - no further questions required)	0			
C. PATHWAYS OF CONTAMINATION (All Aquifers) Presence of Abandoned or Improperly Destroyed Wells *(up to 10 points maximum)*				
1. Are they present within Zone A (2-year time of travel (TOT) distance)?				
a. Yes or unknown	0		0	
b. No	(5)	5	5	
2. Are they present within Zone B5 (2- to 5-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	(3)	3	3	
3. Are they present within Zone B10 (5- to 10-year TOT distance)?				
a. Yes or unknown	0		0	
b. No	(2)	2	2	
D. STATIC WATER CONDITIONS (Unconfined Aquifer) Depth to static Water (DTW) = 30 feet *(up to 10 points maximum)* choose one				
1. 0 to 20 feet	0			
2. 20 to 50 feet	(2)	2		
3. 50 to 100 feet	6			
4. > 100 feet	10			
E. WELL OPERATION (Unconfined Aquifer) Depth to Uppermost Perforations (DUP) DUP = 80 feet Maximum Pumping Rate of Well (Q) Q = 127 gallons/minute Length of screened interval (H) H = 210 feet				
[(DUP – DTW) / (Q/H)] = *(up to 10 points maximum)* choose one				
1. < 5	0	0		
2. 5 to 10	5			
3. > 10	10			

Physical Barrier Effectiveness – Ground Water, page 2 of 2

Source Name:__________________________

PARAMETER	*POINTS* Unconfined		Confined	
F. HYDRAULIC HEAD (Confined Aquifer) What is the relationship in hydraulic head between the confined aquifer and the overlying unconfined aquifer? (i.e. does the well flow under artesian conditions?) *(up to 20 points maximum)* choose one				
1. head in confined aquifer is higher than head in unconfined aquifer <u>under all conditions</u>			20	
2. head in confined aquifer is higher than head in unconfined aquifer <u>under static conditions</u>			10	
3. head in confined aquifer is lower than or same as head in unconfined aquifer			0	
4. unknown			0	
G. WELL CONSTRUCTION (All Aquifers) 1. Sanitary Seal (Annular Seal) Depth = _____ feet *(up to 10 points maximum)* choose one				
a. None or less than 20 feet deep	0	0	0	
b. 20 to 50 ft deep	6		10	
c. 50 ft or greater	10		10	
2. Surface seal (concrete cap) *(up to 4 points maximum)* choose one				
a. Not present or improperly constructed	0	0	0	
b. Watertight, slopes away from well, at least 2' laterally in all directions	4		4	
3. Flooding potential at well site *(up to 1 point maximum)* choose one				
a. Subject to localized flooding (i.e. in low area or unsealed pit or vault) or Within 100 year flood plain	0		0	
b. Not subject to flooding	1	1	1	
4. Security at well site *(up to 5 points maximum)* choose one				
a. Not secure	0		0	
b. Secure (i.e. housing, fencing, etc.)	5	5	5	
Maximum Points Possible	80		100	
POINT TOTAL FOR THIS SOURCE	28			

Physical Barrier Effectiveness SCORE INTERPRETATION

Point Total		**Effectiveness**	
28 **0 to 35**	=	**Low** (circled)	(includes all sources in Fractured Rock)
_____**36 to 70**	=	**Moderate**	
_____**71 to 100**	=	**High**	

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 19** Identification number: **05N/11W-17H02 S**

Assessment date: **June 4, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep:	**NO**
b. Is the casing a non-porous material (i.e., steel, plastic, PVC)	**YES**
c. Is the well in a pit or subject to flooding or ponding?	**NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions?	**YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Precipitation	0
Palmdale Ditch	200 ft. to 1 mile
Mountain slopes	3.8 miles

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO 2b
1b. NO 2c
1c. YES 3b
1d. NO 3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES 2a
1b. YES 4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Low (LE)/ME (1a. no, 1b.yes, 1c.no, 1d.yes, 2a. 3a. 4c)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD** System ID: **1910102**

Source Name: **Well 19** Source ID: **05N/11W-17H02 S**

Indicate the method used to delineate the zones:
Calculated Fixed Radius (Default) (Show calculations below)

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow) **X**

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi\eta H}}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), **2, 5 and 10** years
$\pi = 3.1416$
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 127 gpm x 70,267 = 8,923,909 ft^3/year (max. pumped 940,291 ft^3/year, in past 3 years)
t = 2,5,10 years
η= 0.25 (sand, clay streaks, hard packed sand)
H = 210 ft

R2 = 329 ft
R5 = 520 ft
R10 = 736 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R2 = _____	ft, minimum = 600 ft -use larger: ______ ft
Zone B5	(5 year TOT)	R5 = _____	ft, minimum =1,000 ft--use larger: _____ft
Zone B10	(10 year TOT)	R10= ____	ft, minimum =1,500 ft-use larger: ______ ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by 0.5Rt. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **494 ft**, minimum = 900 ft--use larger: **900 ft**
downgradient distance = 0.5R2 = **165 ft**, minimum = 300 ft--use larger:**300 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **780 ft**, minimum = 1,500 ft--use larger: **1500 ft**
downgradient distance = 0.5R5 = **260 ft**, minimum = 500 ft--use larger: **500 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **1104 ft**, minimum = 2,250 ft--use larger: **2250 ft**

downgradient distance = 0.5R10 = **368 ft**, minimum = 750 ft--use larger: **750 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 20**
05N/11W-09A02 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger,USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 32 26.58**
Longitude: **118 01 36.99**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:
5680 Pearblossom Hwy. (Chesboro Rd and Pearblossom Rd.)

Location of recharge area, if known: **The well is located in the Pearland Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first wit surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**

Source of Information: **District staff and field visit, file review.**

Collected by: **Perri Standish-Lee** -Date: **June 5, 1998**

.

Well Number or Name: **Well 20**

DHS Source Identification Number: **05N/11W-09A02 S**

Location (Agricultural, Rural, Residential, Commercial, Industrial, Municipal, Mixed, other.): **rural (corner of two main streets)**

Distance to: Sewer Line or Sewage Disposal : —

Size of controlled area around well (square feet): **1,800 sqft**

Type of access control to well site (ie. Fencing, building, etc.): **fenced with barbed wire (the fence does not protect the buildin**

Site plan on file? (yes or no): **yes**

DWR Ground Water Basin: **Antelope Valley**

DWR Ground Water Sub-basin: **Pearland Sub-Unit**

Date drilled: **1973 (?)**

Drilling method: **unknown**

Depth of bore Hole (feet below ground surface): **— ft**

Finished Well Depth (feet below ground surface): **472 ft**

Casing: Depth (feet below ground surface): **472 ft**

Diameter: **16 inch**

Material: **steel**

Second casing depth (feet below ground surface): **unknown**

Second casing diameter: **— inch**

Second casing material: —

Depth to highest perforations (feet below ground surface): **— ft**

Total length of screened interval: **— ft**

Sanitary sealed (yes or no) **unknown**..................................Depth (ft): **50 ft (?)**

Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **1.7 ft**

Gravel pack (yes or no): —

Confining layer: Thickness- —

Depth to (feet below ground surface): –

Water Levels: Static (feet below ground surface): **224 ft (March 1998)**

When pumping (feet below ground surface): **261 ft**

Pump: Make: **Ingersoll Rand**

Type: **Turbine**

Capacity, g.p.m: **284 gpm**

Depth to pump (feet below ground surface): **360 ft**

Lubrication: **oil**

Power: **electric**

Auxiliary power (yes or no): **no**

Operation controlled by: **SCADA**

Discharge to: **pumps to system (does not discharge to waste)**

Frequency of Use: **daily**

Typical pumping duration (hours/day): **summer 8-16 hrs./day, winter 2-4 hrs./day**

Within 100 year flood plain? (yes or no): **no**

Drainage away from well? (yes or no): **yes**

Well log on file? (yes or no): **no**

Housing: Type: **wood**

Condition: **good**

Pit depth (if any): **none**

Floor (material): **concrete**

Drainage: **none**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 20** Identification number: **05N/11W-09A02 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

   Complete DHS Well Data Sheet (attached) and include with Assessment Report

   a. Is there a sanitary seal on well at least 50 feet deep: **UNKNOWN**

   b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
   c. Is the well in a pit or subject to flooding or ponding? **NO**
   d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
   a. Well

3. In what type of aquifer is the well located?
   a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow;
artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO 2b
1b. NO 2c
1c. YES 3b
1d. NO 3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES 2a
1b. YES 4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD**

Water System ID No.: **1910102**

Source Name: **Well 20** Source No. **05N/11W-05C02 S**

Indicate the method used to delineate the zones:

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow) **X**

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown below)

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi\eta H}}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), **2, 5 and 10 years**
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 284 gpm x 70,267 = 19,955,828 ft^3/year (max pumped past 3 years 8,163,322.2 ft^3/year)
t = 2,5,10 years
η= 0.2 (no well log)
H = 30 ft

R2 = 1455 ft
R5 = 2300 ft
R10 = 3254 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R2 = _____	ft, minimum = 600 ft -use larger: __ft
Zone B5	(5 year TOT)	R5 = _____	ft, minimum =1,000 ft--use larger: __ft
Zone B10	(10 year TOT)	R10= _____	ft, minimum =1,500 ft-use larger: _ _ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by 0.5Rt. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **2,183 ft**, minimum = 900 ft--use larger: **2,183 ft**
downgradient distance = 0.5R2 = **727 ft**, minimum = 300 ft--use larger:**727 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **3,450 ft**, minimum = 1,500 ft--use larger: **3,450 ft**
downgradient distance = 0.5R5 = **1,150 ft**, minimum = 500 ft--use larger: **1,150 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **4,881 ft**, minimum = 2,250 ft--use larger: **4,881 ft**

downgradient distance = 0.5R10 = **1,627 ft**, minimum = 750 ft--use larger: **1,627 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 21**
05N/11W-04P01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger,USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft)**

Location of well: Latitude: **34 32 42.50**
Longitude: **118 02 09.75**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

36525 52nd St. East (52nd St. and Ft. Tejon Rd.)

Location of recharge area, if known: **The well is located in the Pearland Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **District staff and field visit, file review.**
Collected by: **Perri Standish-Lee** -Date: **June 5, 1998**

Well Number or Name: **Well 21**
DHS Source Identification Number: **05N/11W-04P01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **rural (railroad track 250 ft north of well, homes ½ mile away)**
Distance to: Sewer Line or Sewage Disposal : **septic tanks ½ mile**
Size of controlled area around well (square feet): **1,024 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fenced with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Pearland Sub-Unit**
Date drilled: **1973 (?)**
Drilling method: **unknown**
Depth of bore Hole (feet below ground surface): **— ft**
Finished Well Depth (feet below ground surface): **348 ft**
Casing: Depth (feet below ground surface): **348 ft**
Diameter: **10 inch**
Material: **steel**
Second casing depth (feet below ground surface): **unknown**
Second casing diameter: **— inch**
Second casing material: **—**
Depth to highest perforations (feet below ground surface): **— ft**
Total length of screened interval: **— ft**
Sanitary sealed (yes or no) **unknown**....................................Depth (ft): **50 ft (?)**
Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **2.8 ft**
Gravel pack (yes or no): **—**
Confining layer: Thickness- **—**
Depth to (feet below ground surface): **–**
Water Levels: Static (feet below ground surface): **190 ft (March 1998)**
When pumping (feet below ground surface): **204 ft**
Pump: Make: **Reda**
Type: **Submersible**
Capacity, g.p.m: **218 gpm**
Depth to pump (feet below ground surface): **280 ft**
Lubrication: **–**
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **pumps to system (does not discharge to waste)**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 8-16 hrs./day, winter 2-4 hrs./day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **no**
Housing: Type: **wood**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **none**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 21** Identification number: **05N/11W-04P01 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

   Complete DHS Well Data Sheet (attached) and include with Assessment Report

   a. Is there a sanitary seal on well at least 50 feet deep: **UNKNOWN**

   b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
   c. Is the well in a pit or subject to flooding or ponding? **NO**
   d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
   a. Well

3. In what type of aquifer is the well located?
   a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO	2b
1b. NO	2c
1c. YES	3b
1d. NO	3c
	4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES	2a
1b. YES	4a
1c. NO	
1d. YES	

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD**

Water System ID No.: **1910102**

Source Name: **Well 21** Source No. **05N/11W-04P01 S**

Indicate the method used to delineate the zones:

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow) **X**

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown below)

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is **$Rt = \sqrt{Qt/\pi\eta H}$**

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), **2, 5 and 10 years**
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 218 gpm x 70,267 = 15,318,206 ft^3/year (max pumped past 3 years 7,256,859 ft^3/year)
t = 2,5,10 years
η= 0.2 (no well log)
H = 20 ft

R2 = 1561 ft
R5 = 2469 ft
R10 = 3491 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: __ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: __ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: _ _ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **2,274 ft**, minimum = 900 ft--use larger: **2,274 ft**
downgradient distance = 0.5R2 = **758 ft**, minimum = 300 ft--use larger:**758 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **3,740 ft**, minimum = 1,500 ft--use larger: **3,740 ft**
downgradient distance = 0.5R5 = **1,234 ft**, minimum = 500 ft--use larger: **1,234 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **5,237 ft**, minimum = 2,250 ft--use larger: **5,237 ft**

downgradient distance = 0.5R10 = **1,745 ft**, minimum = 750 ft--use larger: **1,745 ft**

Groundwater Source Location

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 22**
06N/11W-34Q01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger,USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 33 29.88**
Longitude: **118 01 51.29**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

5401 East Ave. S (northeast corner of 55th St. East and Ave. S)

Location of recharge area, if known: **The well is located in the Pearland Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **District staff and field visit, file review.**
Collected by: **Perri Standish-Lee** -Date: **June 5, 1998**

Well Number or Name: **Well 22**
DHS Source Identification Number: **06N/11W-34Q01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **residential**
Distance to: Sewer Line or Sewage Disposal : **sewer approximately 100 ft.**
Size of controlled area around well (square feet): **8,832 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fenced and topped with barbed wire, block on one side**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Pearland Sub-Unit**
Date drilled: **1974**
Drilling method: **rotary**
Depth of bore Hole (feet below ground surface): **400 ft**
Finished Well Depth (feet below ground surface): **400 ft**
Casing: Depth (feet below ground surface): **400 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **50 ft.**
Second casing diameter: **32 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **190 ft**
Total length of screened interval: **210 ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **50 ft**
Concrete slab surface seal (yes or no): **yes**...................................Radius (ft): **2.0 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness : **none**
Depth to (feet below ground surface): **--**
Water Levels: Static (feet below ground surface): **133 ft (March 1998)**
When pumping (feet below ground surface): **181 ft**
Pump: Make: **Simmons Ingersoll**
Type: **Submersible**
Capacity, g.p.m: **369 gpm**
Depth to pump (feet below ground surface): **320 ft**
Lubrication: **--**
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **pumps to waste, to street gutter**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 8-16 hrs./day, winter 2-4 hrs./day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **wood**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**

Drainage: **through doors**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 22** Identification number: **06N/11W-34Q01 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep: **YES**

b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
c. Is the well in a pit or subject to flooding or ponding? **NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?
a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO 2b
1b. NO 2c
1c. YES 3b
1d. NO 3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES 2a
1b. YES 4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD**

Water System ID No.: **1910102**

Source Name: **Well 22** Source No. **06N/11W-34Q01 S**

Indicate the method used to delineate the zones:

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow) **X**

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown below)

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is **$Rt = \sqrt{Qt/\pi\eta H}$**

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), **2, 5 and 10 years**
$\pi = 3.1416$
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 369 gpm x 70,267 = 25,928,523 ft^3/year (max pumped past 3 years 15,197,946 ft^3/year)
t = 2,5,10 years
η= 0.25 (med. To course sand with clay streaks)
H = 210 ft

R2 = 561 ft
R5 = 887 ft
R10 = 1254 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: __ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: __ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: _ _ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by 0.5Rt. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **842 ft**, minimum = 900 ft--use larger: **900 ft**
downgradient distance = 0.5R2 = **280 ft**, minimum = 300 ft--use larger:**300 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1,331 ft**, minimum = 1,500 ft--use larger: **1,500 ft**
downgradient distance = 0.5R5 = **443 ft**, minimum = 500 ft--use larger: **500 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **1,881 ft**, minimum = 2,250 ft--use larger: **2,250 ft**

downgradient distance = 0.5R10 = **627 ft**, minimum = 750 ft--use larger: **750 ft**

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 25**
06N/11W-35J01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger,USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 33 50.17**
Longitude: **118 00 15.26**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

37520 70th St. East
Location of recharge area, if known: **The well is located in the Pearland Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, a further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first wit surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **District staff and field visit, file review.**
Collected by: **Perri Standish-Lee** -Date: **June 5, 1998**

Well Number or Name: **Well 25**
DHS Source Identification Number: **06N/11W-35J01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **rural/desert (cement plant 8/10 mile east)**
Distance to: Sewer Line or Sewage Disposal : **none**
Size of controlled area around well (square feet): **7,200 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fenced and topped with barbed wire**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Pearland Sub-Unit**
Date drilled: **1989**
Drilling method: **rotary**
Depth of bore Hole (feet below ground surface): **607 ft**
Finished Well Depth (feet below ground surface): **600 ft**
Casing: Depth (feet below ground surface): **600 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **80 ft.**
Second casing diameter: **30 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **255 ft**
Total length of screened interval: **260 ft**
Sanitary sealed (yes or no) **yes**..Depth (ft): **80 ft**
Concrete slab surface seal (yes or no): **yes**....................................Radius (ft): **1.5 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness : **10, 43 ft.**
Depth to (feet below ground surface): **118, 171 ft.**
Water Levels: Static (feet below ground surface): **151 ft (May 1997)**
When pumping (feet below ground surface): **243 ft**
Pump: Make: **American Turbine**
Type: **Submersible**
Capacity, g.p.m: **447 gpm**
Depth to pump (feet below ground surface): **315 ft**
Lubrication: **--**
Power: **electric**
Auxiliary power (yes or no): **auxiliary power hook-up available**
Operation controlled by: **SCADA**
Discharge to: **pumps to waste to desert wash**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 8-16 hrs./day, winter 2-4 hrs./day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **concrete block**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **through doors**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 25** Identification number: **06N/11W-35J01 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

Complete DHS Well Data Sheet (attached) and include with Assessment Report

a. Is there a sanitary seal on well at least 50 feet deep: **YES**

b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
c. Is the well in a pit or subject to flooding or ponding? **NO**
d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
a. Well

3. In what type of aquifer is the well located?
a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO 2b
1b. NO 2c
1c. YES 3b
1d. NO 3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES 2a
1b. YES 4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD**

Water System ID No.: **1910102**

Source Name: **Well 25** Source No. **06N/11W-35J01 S**

Indicate the method used to delineate the zones:

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow) **X**

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown below)

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is **$Rt = \sqrt{Qt/\pi\eta H}$**

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), **2, 5 and 10 years**
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 447 gpm x 70,267 = 31,409,349 ft^3/year (max pumped past 3 years 16,700,787 ft^3/year)
t = 2,5,10 years
η= 0.25 (sand and clay)
H = 260 ft

R2 = 554 ft
R5 = 877 ft
R10 = 1240 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the sour

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: __ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: __ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: _ _ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determine below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **831 ft**, minimum = 900 ft--use larger: **900 ft**
downgradient distance = 0.5R2 = **277 ft**, minimum = 300 ft--use larger:**300 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1,312 ft**, minimum = 1,500 ft--use larger: **1,500 ft**
downgradient distance = 0.5R5 = **438 ft**, minimum = 500 ft--use larger: **500 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **1,860 ft**, minimum = 2,250 ft--use larger: **2,250 ft**

downgradient distance = 0.5R10 = **620 ft**, minimum = 750 ft--use larger: **750 ft**

Public water system: **PALMDALE WATER DISTRICT** ID No.: **1910102**

Name of source and ID No.: **Well 26**
06N/11W-33J01 S

Location date: **8/8/95** Source located by (name of person): **Loren Metzger,USGS**

Global Positioning System (GPS) Unit (manufacturer/model):

Accuracy of GPS unit (+/- **60 ft**)

Location of well: Latitude: **34 33 54.57**
Longitude: **118 02 38.02**

Physical description of location [Pertinent landmarks, address, or approximate address (cross streets, etc.)]:

4701 Katrina Place (50 ft. east of 47^{th} St. 50 ft south of R-8)

Location of recharge area, if known: **The well is located in the Pearland Sub-unit.**

The Recharge Area is confined to the area of Antelope Valley and adjacent mountainside slopes that lies insi the following hydro-geologic boundaries. As shown in Fig. __ of the Summary of Findings Report, the Recharge Area is a roughly triangular area bounded:

- On the Southwest by the crest of the topographic drainage divide formed by the San Gabriel Mountains, ; further west, the Sierra Pelona Mountains. The two largest surface drainages contributing to the Antelop Valley principal (shallow) aquifer emanate from the northeast flank of this mountain chain; they are thos Big Rock and Little Rock Creeks.
- On the Northeast and North, by a sequence of historically-formed subsurface groundwater divides or groundwater elevation crests separating the Lancaster hydrologic sub-unit from adjacent sub-units such a the Neenach hydrologic sub-unit.
- On the East by the bedrock outcroppings that surround El Mirage Valley.

There are two aquifers in the Antelope Valley basin: the principal or shallow aquifer and the deep confined aquifer beneath it. They are separated by an impermeable clay aquitard. Palmdale Water District draws mos its water supply from the shallow aquifer. There are three hydrologic sub-units in the Recharge area; in addition to the Lancaster sub-unit, they include the Pearland and Buttes subunits. The latter two units are separated from the Lancaster sub-unit by locally-steepened zones of discontinuity. They tend to fill first witl surface drainage from the mountains. In turn they spill over into the Lancaster sub-unit as they fill up.

Other significant sources of recharge to the groundwater basin include direct precipitation, sewage T.P. discharges, and urban landscape runoff.

WELL DATA SHEET **System Name: Palmdale Water District**

System Number: **1910102**
Source of Information: **District staff and field visit, file review.**
Collected by: **Perri Standish-Lee** -Date: **June 5, 1998**

Well Number or Name: **Well 26**
DHS Source Identification Number: **06N/11W-33J01 S**
Location (Agricultural, Rural, Residential, Commercial,
Industrial, Municipal, Mixed, other.): **residential**
Distance to: Sewer Line or Sewage Disposal : **sewer 100-150 ft.**
Size of controlled area around well (square feet): **6,272 sqft**
Type of access control to well site (ie. Fencing, building, etc.): **fenced**
Site plan on file? (yes or no): **yes**
DWR Ground Water Basin: **Antelope Valley**
DWR Ground Water Sub-basin: **Pearland Sub-Unit**
Date drilled: **1989**
Drilling method: **rotary**
Depth of bore Hole (feet below ground surface): **484 ft**
Finished Well Depth (feet below ground surface): **480 ft**
Casing: Depth (feet below ground surface): **480 ft**
Diameter: **16 inch**
Material: **steel**
Second casing depth (feet below ground surface): **50 ft.**
Second casing diameter: **30 inch**
Second casing material: **steel**
Depth to highest perforations (feet below ground surface): **150 ft**
Total length of screened interval: **280 ft**
Sanitary sealed (yes or no) **yes**...Depth (ft):**50 ft**
Concrete slab surface seal (yes or no): **yes** ....Radius (ft): **1.5 ft**
Gravel pack (yes or no): **yes**
Confining layer: Thickness : **28 ft.**
Depth to (feet below ground surface): **149 ft.**
Water Levels: Static (feet below ground surface): **198 ft (April 1997)**
When pumping (feet below ground surface): **251 ft**
Pump: Make: **Peerless**
Type: **Submersible**
Capacity, g.p.m: **251 gpm**
Depth to pump (feet below ground surface): **336 ft**
Lubrication: --
Power: **electric**
Auxiliary power (yes or no): **no**
Operation controlled by: **SCADA**
Discharge to: **storm drain**
Frequency of Use: **daily**
Typical pumping duration (hours/day): **summer 8-16 hrs./day, winter 2-4 hrs./day**
Within 100 year flood plain? (yes or no): **no**
Drainage away from well? (yes or no): **yes**
Well log on file? (yes or no): **yes**
Housing: Type: **wood**
Condition: **good**
Pit depth (if any): **none**
Floor (material): **concrete**
Drainage: **through doors**

Source and Site Characteristics Checklist - Ground Water Source

Physical Barrier Effectiveness Determination

Public water system: **Palmdale WD** ID No.: **1910102**

Name of source: **Well 26** Identification number: **06N/11W-33J01 S**

Assessment date: **June 5, 1998** Assessment conducted by: **Perri Standish-Lee**

Drinking Water Source/Aquifer Information

1. Source Characteristics

   Complete DHS Well Data Sheet (attached) and include with Assessment Report

   a. Is there a sanitary seal on well at least 50 feet deep: **YES**

   b. Is the casing a non-porous material (i.e., steel, plastic, PVC) **YES**
   c. Is the well in a pit or subject to flooding or ponding? **NO**
   d. Is there a concrete slab surface seal on the well extending at least one foot in all directions? **YES**

2. What is the type of source?
   a. Well

3. In what type of aquifer is the well located?
   a. Porous media

4. What is the degree of confinement of the aquifer? (Refer to Table 6-1 for assistance)
   c. Unconfined

5. In a confined aquifer, what is the relationship in hydraulic head between the confined aquifer and overlying unconfined aquifer?

a. Head in confined aquifer is higher than head in unconfined aquifer
b. Head in confined aquifer is lower than head in unconfined aquifer
c. Unknown

6. What are the primary sources of recharge for the well?
(Examples- natural: lakes, wetlands, direct precipitation, stream inflow, sub-surface inflow; artificial: injection wells, spreading grounds, unlined canals, irrigation)

Source of Recharge	Approximate Distance from Well
Pearland sub-unit boundary	24 miles
WWTP discharges	None identified on map
Mountain Slopes	30 miles
Precipitation	0

*Distance from Pearblossom Well field center.

Physical Barrier Effectiveness Determination

Parameters indicating **Low Physical Barrier Effectiveness (LE)**
(A ground water source with any of the parameters listed below would be considered to have less effecti physical barrier properties)

1a. NO 2b
1b. NO 2c
1c. YES 3b
1d. NO 3c
4c

Parameters indicating **High Physical Barrier Effectiveness** (HE)
(A ground water source with all of the parameters listed below would be considered to have highly effective physical barrier properties)

1a. YES 2a
1b. YES 4a
1c. NO
1d. YES

(An additional indicator of High Physical Barrier Effectiveness would be: 5a)

All other sources are considered to have **Moderate Physical Barrier Effectiveness** (ME)

Determination for this source:

Moderate (ME)

Delineation of Ground Water Zones

Public Water System Name: **Palmdale WD**

Water System ID No.: **1910102**

Source Name: **Well 26** Source No. **06N/11W-33J01 S**

Indicate the method used to delineate the zones:

Modified Calculated Fixed Radius (Show calculations below and attach documentation for direction of ground water flow) **X**

Arbitrary Fixed Radius (For use only by or with permission of DHS--use minimum distances shown below)

Calculated Fixed Radius Equation

The equation for the calculated fixed radius (R) is $\mathbf{Rt = \sqrt{Qt/\pi\eta H}}$

Rt = R2, R5, or R10 corresponding to t (Calculate R for each of three times of travel TOT)
Q = Maximum pumping capacity of well (ft^3/year = gpm * 70,267)
t = Time of travel (years), **2, 5 and 10 years**
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2)
H = screened interval of well (feet) (If unknown, assume 10% of Q gpm, 10 ft minimum):

Q = 251 gpm x 70,267 = 17,637,017 ft^3/year (max pumped past 3 years 8,189,847 ft^3/year)
t = 2,5,10 years
η= 0.2 (granite, gravel and clay)
H = 280 ft

R2 = 448 ft
R5 = 708 ft
R10 = 1001 ft

Calculated Fixed Radius Delineation Method (Default)

Using the equation presented above, calculate the size of zones for the appropriate aquifer setting of the source.

Porous Media Aquifer

Zone A	(2 year TOT)	R_2 = _____	ft, minimum = 600 ft -use larger: __ft
Zone B5	(5 year TOT)	R_5 = _____	ft, minimum =1,000 ft--use larger: __ft
Zone B10	(10 year TOT)	R_{10}= ____	ft, minimum =1,500 ft-use larger: _ _ft

Modified Calculated Fixed Radius Delineation Method

In porous media aquifers, if the direction of ground water flow is known (see Section 6.2.3), the default zone circle may be shifted upgradient by $0.5R_t$. The upgradient and downgradient limits of the zone are determined below.

Zone A (2-year TOT)

upgradient distance = 1.5R2 = **672 ft**, minimum = 900 ft--use larger: **900 ft**
downgradient distance = 0.5R2 = **224 ft**, minimum = 300 ft--use larger:**300 ft**

Zone B5 (5-year TOT)

upgradient distance = 1.5R5 = **1,062 ft**, minimum = 1,500 ft--use larger: **1,500 ft**
downgradient distance = 0.5R5 = **354 ft**, minimum = 500 ft--use larger: **500 ft**

Zone B10 (10-year TOT)

upgradient distance = 1.5R10 = **1,502 ft**, minimum = 2,250 ft--use larger: **2,250 ft**

downgradient distance = 0.5R10 = **500 ft**, minimum = 750 ft--use larger: **750 ft**

Table 3-2. Porosity (% of Volume) of Different Aquifer Materials

Soil/Rock Types	(1) P/S*	(2) P/S*	(3)***	(4)	(5)	(6)	(7)****
…olidated Sediments							
(	20/-	30-40/-	23.7-44.1	25-40	25-40		
Coarse						20-35	
Medium						20-35	
Fine						20-40	
Sand and gravel						20-35	
Sand	25/-		26.0-53.3	25-50	15-48		
Gravelly						20-35	
Coarse		30-40/-				25-45	
Medium						25-45	
Medium to fine		30-35/-					
Fine						25-55	
Dune sand						35-45	
Silt		40-50/yes**	33.9-61.1	35-50	35-50	35-60	
Clay	50/-	45-55/yes**	34.2-56.9	40-70	40-70	35-55	
Sandy						30-60	
Till		45-55/yes**				25-45	
Unstratified drift			22.1-40.6				
Stratified drift			34.6-59.3				
̲oess			44.0-57.2			60-80	
ᵓeat						60-80	
ͻoil	55/-						
ͷlluvium							10-40(30)
Basin fill							5-30(20)
Ogalia formation							15-45(35)
ͻonsolidated Sediments							
.ir… e	10/10	1-50/yes**	6.6-55.7	0-20	0-20	5-55	1-20(4)
				5-50	5-50		
Chalk					5-40		
›olomite		1-50/yes**	19.1-32.7	0-20	0-20		
;andstone			13.7-49.3	5-30	5-40		1-20(10)
Semiconsolidated	10/1					1-50	
Coarse, medium		<20/yes**					
Fine, argillite		<10/yes**					
iltstone		-/yes**	21.2-41.0			20-40	
hale		-/yes**	1.4-9.7	0-10	0-10		
rystalline Rocks							
ranite (unaltered)	-/0.1				0-2		
rystalline (fractured)				0-10			
ystalline (dense)				0-5		0-5	
neous/Metamorphic		-/yes**					
Weathered						40-50	
Unaltered gneiss					0-2		
Quartzite					0-1		
Slates/mica schists					0-10		
lcanic Rocks							
salt	10/1	-/yes**					
Fractured				5-50	5-50	5-50	
lcanic tuff					30-40	10-40	
id volcanic rocks							

= primary porosity, S = secondary porosity
Rarely exceeds 10 percent
C… ›d by Barton et al. (1985)
r in parentheses is typical value
…rces: (1) Heath (1983); (2) Brown et al. (1983); (3) Morris and Johnson (compiled by Barton et al., 1985); (4) Freeze and Cherry (1979);) Sevee (1991); (6) Devinny et al. (1990); (7) Wilson (1981)

Rock types	Porosity: Primary (grain)	Porosity: Secondary (fracture)[1]	Permeability range (cm/sec): 10^2 10^0 10^{-2} 10^{-4} 10^{-6} 10^{-8}	Well yields: High Medium Low	Type of water-bearing unit
	%				
Sediments, unconsolidated					
Gravel	30-40		———	———	Aquifer
Coarse sand	30-40		———	———	Aquifer
Medium to fine sand	30-35		———	———	Aquifer
Silt	40-50	Occasional	———	———	Aquiclude
Clay, till	45-55	Rare (mud cracks)	———	———	Aquiclude
Sediments, consolidated					
Limestone, dolomite	1-50	Solution joints, planes	———	———	Aquifer or aquifuge
Coarse, medium sandstone	< 20	Joints and fractures	———	———	Aquifer or aquiclude
Fine sandstone, argillite	< 10	Joints and fractures	———	———	Aquifer or aquifuge
Shale, siltstone	—	Joints and fractures	———	———	Aquifuge or aquifer
Volcanic rocks					
Basalt	—	Joints, fractures	———	———	Aquifer or aquifuge
Acid volcanic rocks	—		———	———	Aquifuge or aquifer
Crystalline rocks					
Plutonic and metamorphic		Weathering and fractures decreasing as depth increases	———	———	Aquifuge or aquifer

1. Rarely exceeds 10 per cent.

Figure 3-3. Porosity, permeability, and well yields of major rock types (from Brown et al., 1983).

related to expansion and compression, but instead comes from gravity drainage and dewatering of the aquifer.

3.1.2 Water-Transmitting Properties: Hydraulic Conductivity and Transmissivity

The terms *permeability* (P) and *hydraulic conductivity* (K) are often used interchangeably to refer to the ease with which water moves through soil or an aquifer under saturated conditions. Hydrogeologists draw a distinction between *intrinsic permeability* (k—a property of the porous medium alone that is independent of the nature of the liquid or potential field) and *hydraulic conductivity* (K—a function of both the medium and the fluid flowing through it). A precise definition of hydraulic conductivity is:

> The quantity of water that will flow through a unit cross-sectional area of a porous material per unit of time under a hydraulic gradient of 1.0 (measured at right angles to the direction of flow) at a specified temperature (Nielsen, 1991).

The terms hydraulic conductivity and permeability in this handbook refer to saturated hydraulic conductivity unless otherwise specified. Soil permeability rates are typically reported in units of inches/hour based on percolation tests. Hydraulic conductivity may be reported in a variety of units: μm/second, cm/second, m/second, ft/day, and gpd/ft^2 (gallons per day per square foot). Currently, centimeters per second is probably the most commonly used unit. Hydraulic conductivity values range widely from one rock type to anothe and even within the same rock. Table 3-4 shows meas ured ranges of hydraulic conductivity for various uncon solidated and consolidated sediments and typical value for unconsolidated materials for which the unified so classification is known.

Figures 3-3 to 3-6 show ranges of hydraulic conductivit and permeability from a number of different source Note also that Figures 3-4 and 3-5 provide nomograph for approximate conversions between different units (intrinsic permeability (k) and hydraulic conductivity (K Figure 3-7 can be used to estimate hydraulic conducti ity of unconsolidated materials based on general clas fication (Figure 3-7a) from particle-size distributic curves of alluvial sands (Figure 3-7b)[3] and from medi grain size of stratified drift aquifers (Figure 3-7c).

[3] To use the nomograph 3-7(b)(ii), on the right-hand side of Fig 3-7b, the particle-size distribution curve 3-7(b)(i) must be plotted us ρ units, where $\rho = -\log_2 d$, d being the grain size diameter in mm. *inclusive standard deviation* must also be calculated as follows:

$\sigma_I = (d_{16} - d_{84})/4 + (d_5 - d_{95})/6.6$

where the subscripts for d (in ρ units) represent the cumulative centage finer than that diameter.

Figure 3-7(b) provides an illustrative example. Median grain d_{50} is first determined from the particle-size curve, 3-7(b)(i) (2.0 in example). The inclusive standard deviation (calculated from the used to plot the curve) in the example (0.8) has been interpol between the curves in the nomograph on the right, 3-7(b)(ii), yiel an approximate K of 0.7 cm/min.

APPENDIX C

PCA Inventory

Well 2A **39400 20th Street East** **Address**
06N/11W-19E05 S

R_2
Trunk sewer **(H)**
R_5
Trunk sewer **(L)**
R_{10}
Trunk sewer **(L)**

Well 3A **2163 East Avenue P-8**
06N/11W-19E06 S

R_2
Transformer on electric pole
R_5
Nothing in area
R_{10}

Trunk sewer **(L)**	2044 East Ave. P-8; Falconer Insulation
Historical insulation & drywall	2044 East Ave. P-8; Chet's Truck Service
Repair **(H)**	2104 East Ave. P-8; P & R Services

Well 4A **2475 East Avenue P-8**
06N/11W-19F01 S

R_2

Roads/streets **(L)**	Avenue P-8/25th Street East

R_5

Trunk sewer **(L)**	
Roads/streets **(L)**	Avenue P-8/25th Street East

R_{10}

Trunk sewer **(L)**	
Roads/streets **(L)**	Avenue P-8/25th Street East

Well 5 **1036 Barrel Springs Road**
05N/12W-02P04 S

R_2

Surface water-streams/lakes/river **(L)** Palmdale Water Ditch
Roads/streets **(L)** Sierra Highway
Housing/low density = 20 houses
Housing/high density = 3 houses **(M)**
Illegal activities/unauthorized dumping **(H)**
Septic systems **(VH)**

R_5

Housing/low density = 2
Junk/scrap/salvage yard **(H)**
Illegal activities, unauthorized dumping **(H)**
Surface water-streams/lakes/rivers **(L)** Palmdale Water Ditch
Housing/high density = 31 **(M)**
Drinking water treatment plant **(M)** 36007 Sierra Hwy: Acton Treatment Plant
Road/streets **(L)** Sierra Hwy

R_{10}

Surface water-streams/lakes/rivers **(L)** Palmdale Water ditch
Road/streets **(L)** Sierra Hwy
Junk/scrap/salvage yard **(H)**
Illegal activities/unauthorized dumping **(H)**
Freeway/state highway **(M)** 14 Freeway
Housing/low density = 4
Housing/high density = 13 **(M)**

Well 6A **37455 10th Street East**
06N/12W-23A01 S

R_2

Junk/scrap/salvage yard **(H)**
Railroad tracks **(M)**

R_5

Railroad tracks **(M)**
Road/streets **(L)** Avenue P

R_{10}

Commercial building **(L)** 39463 N. 10th St. E.; American Legion 771
Railroad tracks **(M)**
Industrial waste connected to local sewer **(L)** 1011 E. Lockheed Way; Lockheed Martin Skunkworks
Full tank permit **(L)** 1011 E. Lockheed Way; Airport Group International
1011 E. Lockheed Way; Lockheed Martin Skunkworks
Photo processing **(H)** ?
Body shop **(H)** ?
Road/streets **(L)** Avenue P

Well 7A **39395 25th Street East**
06N/11W-19F02 S

R_2
Tank removed **(L)** 39441 N. 25th St. E.
Trunk sewer **(H)**
Abandoned Industrial building **(L)** 39441 N. 25th St. E.; Deutrel Lab & OEI Science
Open permit/hazardous waste **(H)** 39616 N. 25th St. E.; Dept. of Airports
Road/streets **(L)** Avenue P

R_5
Road/streets **(L)** Avenue P
Schools **(L)** 2555 E. Ave. P; Just Plane Kids
Trunk sewer **(L)**
Industrial connector to trunk sewer **(L)** 2555 E. Ave. P; F.A.A.
Military installation **(VH)** AFP42

R_{10}
Military installation **(VH)** AFP42
Trunk sewer **(L)**
Road/streets **(L)** Avenue P
Full tank permit **(L)** 2501 E. Ave. P; Cabaco/AFP42, Site 5

Well 8A **2200 East Avenue P**
06N/11W-19C01 S

R_2
Military installation **(VH)** AFP42
Trunk sewer **(H)**

R_5
Military installation **(VH)** AFP42
Trunk sewer **(L)**
Industrial connector to trunk sewer **(L)** 2555 E. Ave. P
2503 E. Ave. P; Dept of the Air Force
Full tank permit/hazardous waste **(L)** 2501 E. Ave. P; Cabaco/ AFP42, Site 5

R_{10}
Sewer lines **(L)**
Military installation **(VH)** AFP42
Leaking underground storage tank = 2 **(VH)** 2555 E. Ave. P; F.A.A.
2501 E. Ave. P; AFP42, Site 5 Fuel Farm

Well 9 **Legally Abandoned**
3347 East Avenue S
06N/11W-32P02 S

Well 10 **3701 East Avenue P-8**
06N/11W-20H01 S

R_2
Inactive well (agricultural)
Food processing **(M)** **?**
Road/streets **(L)** 40 the St. E.
Golf course **(M)** 3620 E. Ave P; Desert Aire Golf Course
R_5
Road/streets **(L)** 40th St. E.
Golf course **(M)** 3620 E. Ave. P; Desert Aire Golf Course
R_{10}
Road/streets **(L)** 40th St E./Ave. P
Wastewater treatment plant **(H)** 39300 30th St. E.; Co. Sanitation Dist. Of L.A.
****Inactive well (agricultural)(H)** **should inactive well be classified as High?**
Golf Course **(M)** 3620 E. Ave. P; Desert Aire Golf Course
Drywell = 1 **(VH)** 40th & Q
Housing/high density = 32 **(M)**
Sewer lines **(L)**

Well 11A **39501 15th Street East**
06N/12W-24C02 S

R_2
Road/streets **(L)** Ave. P/15th St. E.
Leaking underground storage tank **(VH)** 39531 15th St E.; Chandler Lumber Co.
Hardware/lumber/parts store **(M)** 39531 15th St E.; Chandler Lumber Co.
Industrial waste connector to local sewer **(L)** 39531 15th St E.; Chandler Lumber Co.
Full tank permit/hazardous waste **(L)** 39531 15th St E.; Chandler Lumber Co.
Railroad tracks **(M)**
Trunk sewer **(H)**
R_5
Trunk sewer **(L)**
Machine shop **(H)** 39457 15th St. E.; Lust Quality Machine Products
Railroad **(M)**
Road/streets **(L)** Ave. P/15th St. E.
Military installation **(VH)** AFP42
R_{10}
Trunk sewer **(L)**
Railroad tracks **(M)**
Road/streets **(L)** Ave. P/15th St. E.
Military installation **(VH)** AFP42

Well 14A **39401 20th Street East**
06N/12W-24A03 S

R_2
Transformer on electric pole
R_5
Trunk sewer **(L)**
Road/streets **(L)** Ave. P
Military installation **(VH)** AFP42
R_{10}
Military installation **(VH)** AFP42
Trunk sewer **(L)**
Road/streets **(L)** Ave. P

Well 15 **1003 East Avenue P**
06N/12W-13No1 S

R_2
Road/streets **(L)** Ave. P
R_5
Road/streets **(L)** Ave. P
Trunk sewer **(L)**
R_{10}
Road/streets **(L)** Ave. P
Trunk sewer **(L)**

Well 16 **4125 East Avenue S-4**
05N/11W-05C02 S
R_2
Sewer lines **(H)**
Housing/high density = 7 **(M)**
Drywell = 1 **(VH)** Serendipity & S-4
R_5
Sewer line **(L)**
Housing/high density = 21 **(M)**
Detention basin = 1 **(M)** 42nd & S-8
****Drywell = 1 (VH)**
R_{10}
Sewer line **(L)**
Housing/high density = 48 **(M)**
Drywell = 1 **(VH)** Serendipity & S-4
****Detention basin = 2 (M)**

Well 17 **718 Denise Avenue**
06N/12W-34N04 S

R_2
- Housing/low density = 37
- Septic systems (H)
- Road/streets **(L)** Ave. S/Tierra Subida
- Housing/high density = 18 **(M)**

R_5
- Septic systems **(M)**
- Housing/high density = 9 **(M)**
- Housing/low density = 5
- Road/streets **(L)** Ave. S/Tierra Subida

R_{10}
- Cattle <50 head/acre
- Road/streets **(L)** Ave. S/Tierra Subida
- Closed hazardous waste tank **(L)** 1200 City Ranch Rd.;Palmdale Disposal

****Full tank permit/hazardous waste (L)** 1200 City Ranch Rd.;Palmdale Disposal
- Septic system **(M)**
- Parking lot **(M)** **?**

Well 18 **4640 Barrel Springs Road**
05N/11W-17H01 S

R_2
- Road/streets **(L)** Barrel Springs Rd.
- Housing/low density =3

R_5
- Road/streets **(L)** Barrel Springs Rd.
- Housing/low density =3
- Surface water-streams/lakes/rivers **(L)** Palmdale Water Ditch

R_{10}
- Surface water-streams/lakes/rivers **(L)** Palmdale Water Ditch
- Road/streets **(L)** Barrel Springs Rd.
- Housing/low density =3

Well 19 **4640 Barrel Springs Road**
05N/11W-17H02 S

R_2
Housing/low density = 3

R_5
Road/streets **(L)** Barrel Springs Rd.
Housing/low density = 3
Surface water-streams/lakes/rivers **(L)** Palmdale Water Ditch

R_{10}
Surface water-streams/lakes/rivers **(L)** Palmdale Water Ditch
Road/streets **(L)** Barrel Springs Rd
Housing/low density = 3

Well 20 **5680 Pearblossom Highway**
05N/109A02 S

R_2
Repair Shop **(H)** 5603 Pearblossom Hwy.: Four Points Garage
Road/Streets **(L)** Ave. T
Freeway/state highway **(M)** Pearblossom Hwy (SH 138)
Commercial building **(L)** **?**
Septic system **(H)**
Horses
Housing/low density = 9

R_5
Horses
Septic system **(L)**
Road/Streets **(L)** Ave. T
Housing/low density = 16
Freeway/state highway **(M)** Pearblossom (SH 138)

R_{10}
Road/streets **(L)** Ave. T
Septic systems **(L)**
Horses
Mines/gravel pits **(~~V~~H)** **?**
Housing/low density = 5
Gas station **(VH)** 5564 Fort Tejon Rd.; Four Points Mini Market
Full tank permit/hazardous waste **(L)** 5564 Fort Tejon Rd.; Four Points Mini Market

Well 21 **36525 52nd Street East**
05N/11W-04P01 S

R_2

Railroad tracks **(M)**
Freeway/state highway **(M)** Pearblossom Hwy (SH 138)
Swap meet Pearblossom Hwy/Fort Tejon Rd., Four Points Swap Meet
Gas station **(VH)** 5564 Fort Tejon Rd.; Four Points Mini Market
Full Tank permit/hazardous waste **(L)** 5564 Fort Tejon Rd.; Four Points Mini Market
Road/streets **(L)** Ave. T
Commercial buildings **(L)** **?**
Housing/low density = 3
Horses
Septic systems **(H)**

R_5

Housing/low density = 16
Horses
Septic systems **(L)**
Road/streets **(L)** Ave. T
Freeway/state highway **(M)** Pearblossom Hwy (SH 138)
Housing/high density = 232 **(M)**
Sewer lines **(L)**
Railroad tracks **(M)**
Temporary tank permit/hazardous waste **(L)**
****Detention basin = 1**(M)

R_{10}

Septic systems **(L)**
Housing/low density = 5
Horses
Road/streets **(L)** Ave. T
Freeway/state highway **(M)** Pearblossom Hwy (SH 138)
Housing/high density = 394 **(M)**
Sewer lines **(L)**
Railroad Tracks **(M)**
****Drywell = 1**
****Detention basin = 1**

Well 22 **5401 East Avenue S**
06N/11W-34Q01 S

R_2
Housing/high density = 83 **(M)**
Sewer lines **(H)**
Road/streets **(L)** Ave. S
Drywell = 1 **(VH)** 55th East & Ave. S

R_5
Housing/high density = 129 **(M)**
Sewer lines **(L)**
Road/streets **(L)** Ave. S
**** Drywell = 1 (VH)** **Eliminated**
**** Detention basin = 2 (M)** 55th East & Ave. S **(Additional basin added)**
There are two basins instead of one

R_{10}
Housing/high density = 101 **(M)**
Sewer lines **(L)**
Road/streets **(L)** Ave. S
Drywell = 4 **(VH)** 55th East & Ave. S
**** Detention basin = 2 (M)** 55th East & Ave. S**(Additional basin added)**
There are two basins instead of one

Well 23A **2202 East Avenue P-8**
06N/11W-19L01 S

R_2
Repair shop **(H)** 2044 East P-8; Chet's Truck Service
Diesel & Heavy equipment repair **(H)** 2104 E. Ave P-8; P & R Services
Historical insulation & drywall 2044 East P-8; Falconer Insulation

R_5
Sewer Lines **(L)**
Open permit/hazardous waste **(L)** **?**
Road/streets **(L)** 25th St. E./20th St. E.
Trunk sewer **(L)**

R_{10}
Sewer lines **(L)**
Road/streets **(L)** 25th St. E./20th St. E.
Trunk sewer **(L)**

Well 24 **2701 East Avenue P-8**
06N/11W-19G01 S

R_2
Nothing in area

R_5
Trunk sewer **(L)**

R_{10}
Wastewater treatment plant **(H)** 39300 30th St. E.; Co. Sanitation Dist. Of L.A.
Leaking underground storage tank **(VH)** **?**

Trunk sewer **(L)**
Road/streets **(L)** 30th St. E.

Well 25 **37520 70th Street East** **(inactive)**
06N/11W-35J01 S

R_2
Illegal activities/unauthorized dumping **(H)**

R_5
Illegal activities/unauthorized dumping **(H)**

R_{10}
Illegal activities/unauthorized dumping **(H)**

Well 26 **4701 Katrina Place**
06N/11W-33J01 S

R_2
Sewer lines **(H)**
Road/streets **(L)** E. Ave. R-8
Housing/high density = 68 **(M)**
Freeway/state highway **(M)** SH 138
**** Detention basin = 1 (M)**

R_5
Sewer lines **(L)**
Road/streets **(L)** E. Ave. R-8
Housing/high density = 113 **(M)**
Freeway/state highway **(M)** SH 138

R_{10}
Sewer lines **(L)**
Road/streets **(L)** E. Ave. R-8
Housing/high density = 141 **(M)**
Freeway/state highway **(M)** SH 138
School **(L)** 37500 50th St. E.; Chaparral School

Well 27 **Future well**

R_2
No activity in area

R_5
No activity in area

R_{10}
Illegal activities/unauthorized dumping **(H)**

Well 28 **Future well**

R_2
Illegal activities/unauthorized dumping **(H)**

R_5
Illegal activities/unauthorized dumping **(H)**

R_{10}
Illegal activities/unauthorized dumping **(H)**

Well 29 **Future well**

R_2
Sewer lines **(H)**

R_5
Housing/high density = 6 **(M)**
Sewer lines **(L)**

R_{10}
Housing/high density = 10 **(M)**
Sewer lines **(L)**
Illegal activities/unauthorized dumping **(H)**

Well 30 **7392 East Avenue R**
06N/11W-36C01 S

R_2
Illegal activities/unauthorized dumping **(H)**

R_5
Illegal activities/unauthorized dumping **(H)**

R_{10}
Illegal activities/unauthorized dumping **(H)**

Well 32 **37301 35th Street East**
06N/11W-32P03 S

R_2
Sewer lines **(H)**
Housing/high density = 13 **(M)**
Housing/low density = 3

R_5

Sewer lines **(L)**	
Housing/high density = 38 **(M)**	
Housing/low density = 6	
Drywell = 1 **(VH)**	35th & Avenue S

R_{10}

Sewer lines **(L)**	
Road/streets **(L)**	Avenue S
Legally abandoned well	
Housing/high density = 56 **(M)**	
Detention basin = 1 **(M)**	35th & Avenue S
Drywell = 1 **(VH)**	35th & Avenue S
Housing/low density = 6	

Well 33 **7160 East Avenue R**
06N/11W-36D01 S

R_2

Illegal activities/unauthorized dumping **(H)**

R_5

Illegal activities/unauthorized dumping **(H)**

R_{10}

Illegal activities/unauthorized dumping **(H)**

Well 34A Rockie Lane & Avenue R (inactive)

R_2

Illegal activities/unauthorized dumping **(H)**

R_5

Illegal activities/unauthorized dumping **(H)**

R_{10}

Illegal activities/unauthorized dumping **(H)**

Well 35 36549 60th Street East
06N/11W-03N01 S

R_2

Railroad tracks **(M)**

R_5

Railroad tracks **(M)**

R_{10}

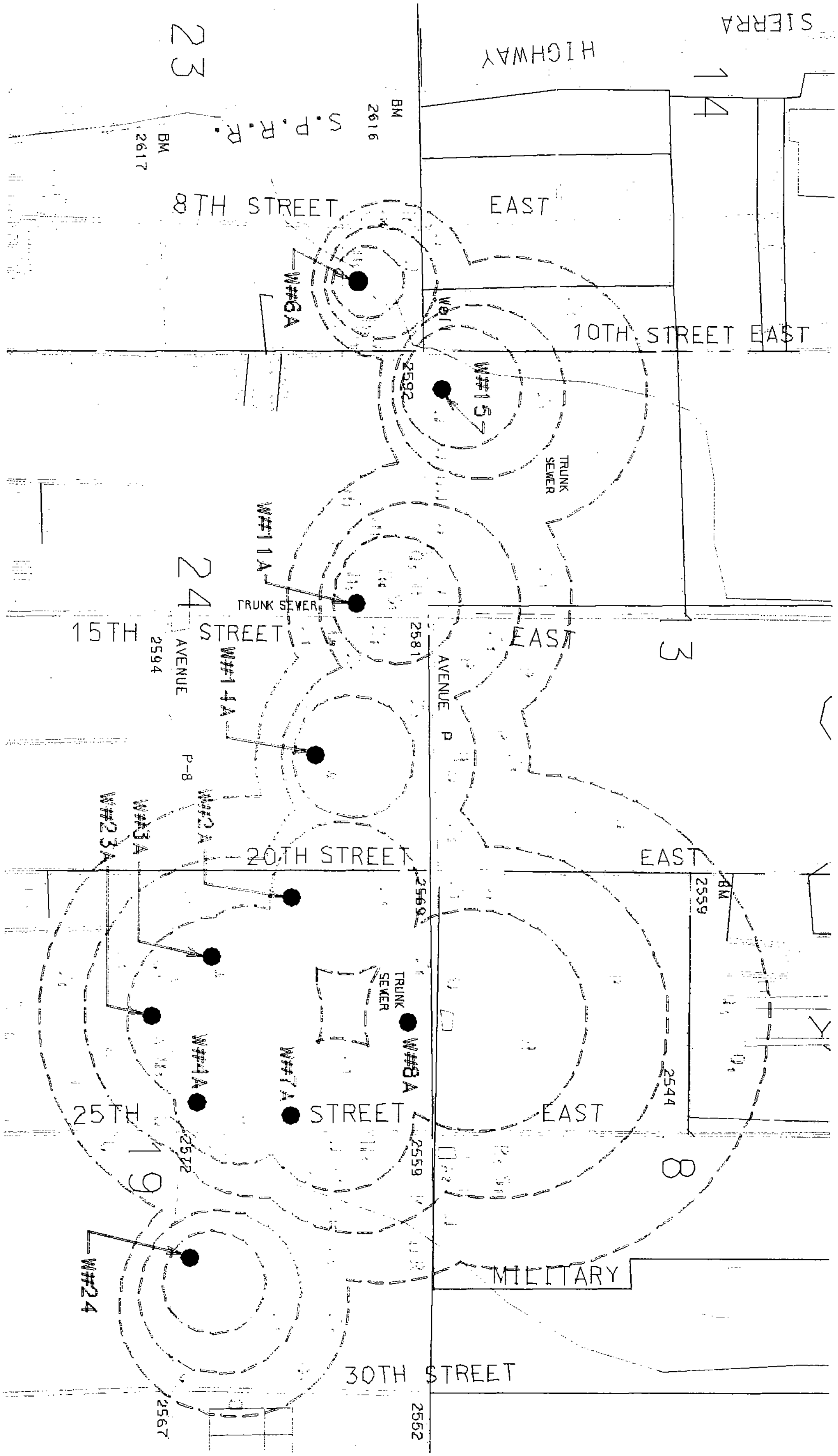
Railroad tracks **(M)**
Mines/gravel pits **(VH)** ?

Groundwater Source Assessment Program 1998

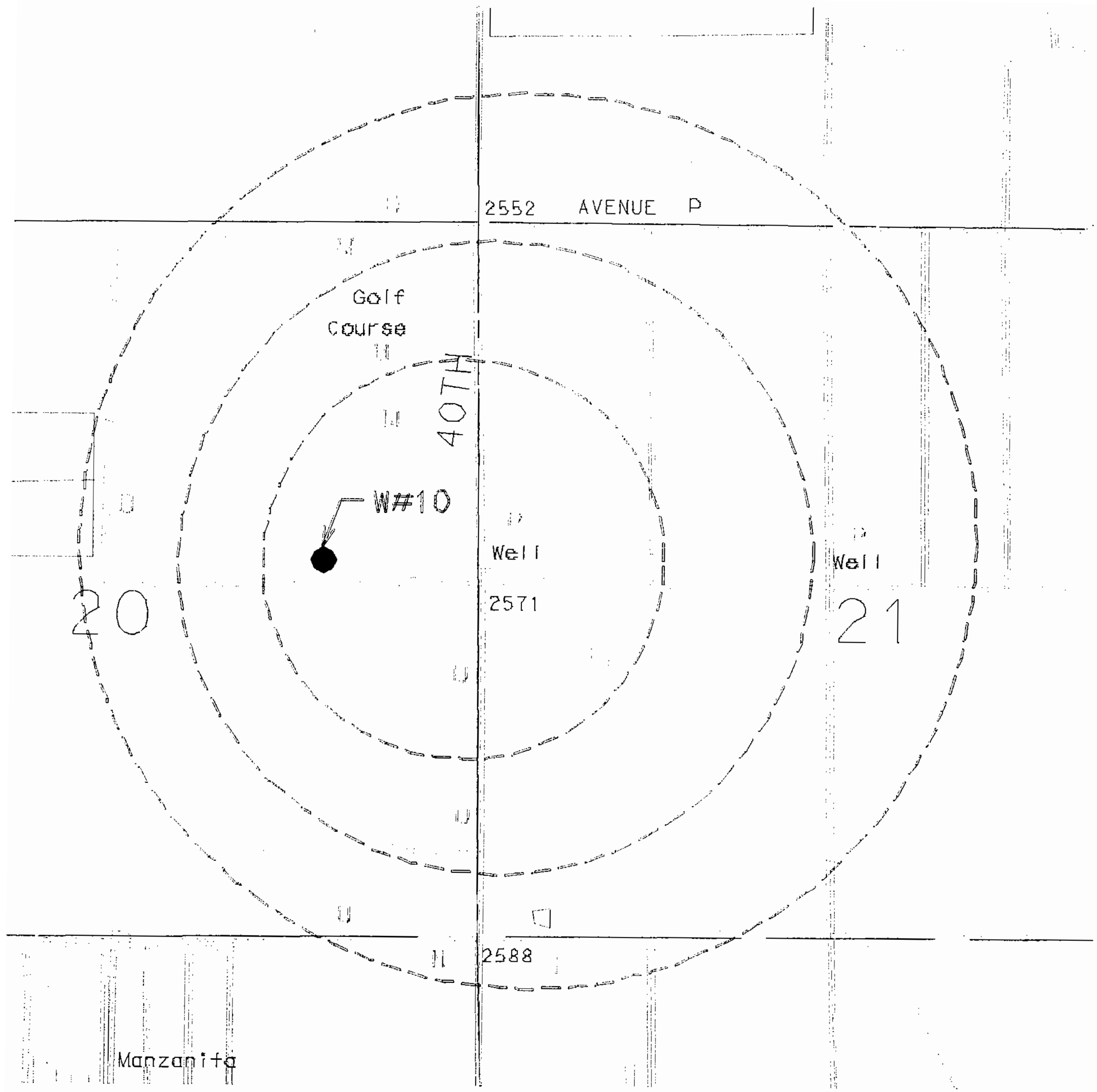
A Repair shop
B Body shops
C Gas stations
D Drywells
E Mines/gravel pits
F Future wells
G Cement/concrete plants
H Hardware/lumber/parts store
I Future wells
J Commercial building
K Septic systems
L Sewer lines
M Golf course
N Housing/high density
O Wastewater treatment plant
P Inactive wells
Q Illegal activities/unauthorized dumping
R Military installation
S Underground storage tanks
T Decommissioned-inactive tanks
U Transportation corridor
V Surface water-streams/lakes/rivers
W Transformer on electric pole
X Industrial building
Y Population
Z Junk/scrap/salvage yard

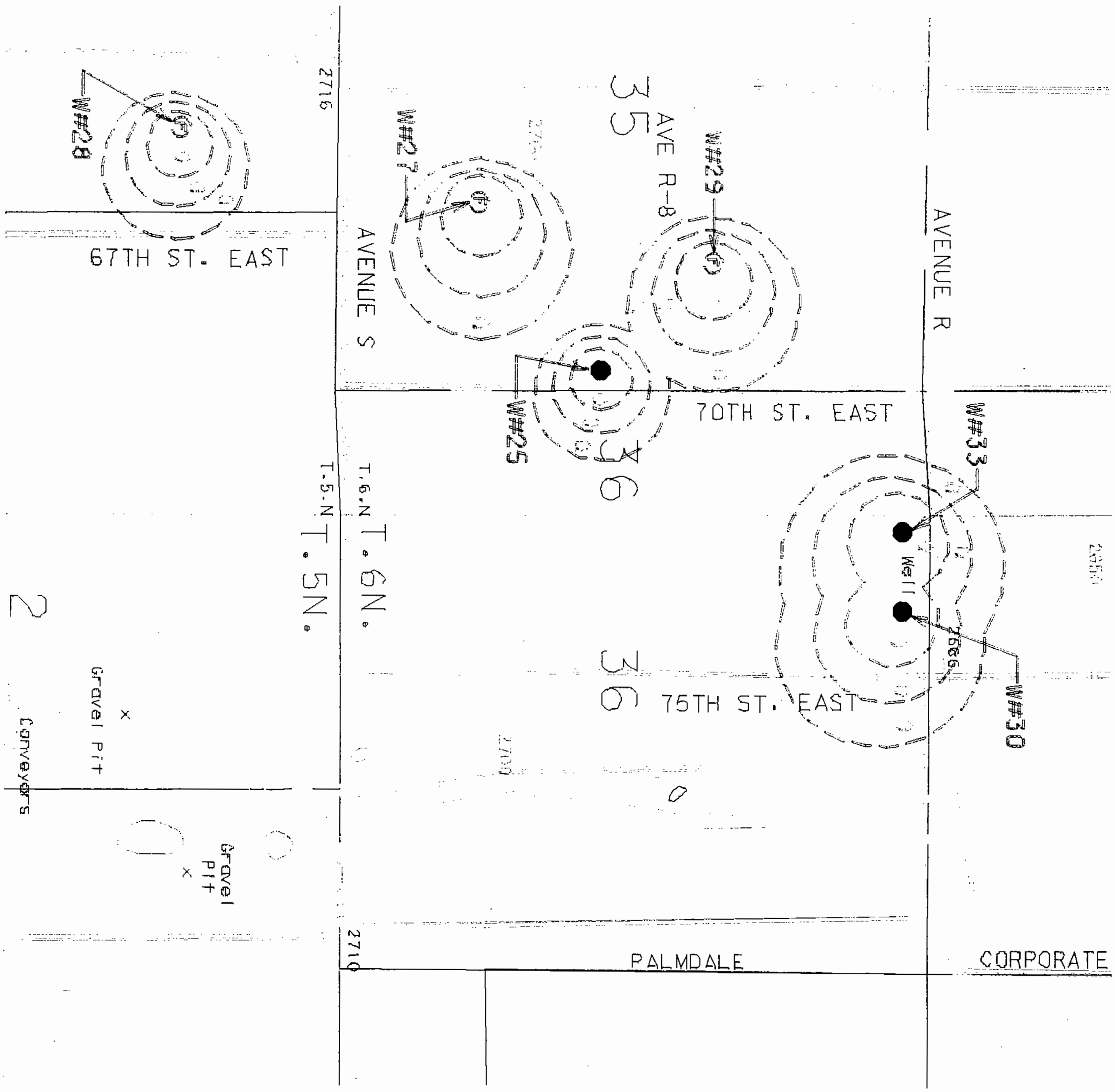
A_1 Auto related activities
B_1 Freeway/state highways
C_1 Parking lots
D_1 Parks
E_1 Cattle < 50 head per acre
F_1 Food processing
G_1 Housing/low density
H_1 Railroad tracks
I_1 Swap meet
J_1 Photo processing
K_1 Office buildings
L_1 Machine shop
M_1 Diesel & heavy equipment repair
N_1 Abandoned industrial building
O_1 Detention basins
P_1 Storage basins
Q_1 Leaking underground storage tanks
R_1 Industrial connected to trunk sewer
S_1 Full tank permit/hazardous waste
T_1 Industrial waste connected to local sewer
U_1 Historical Insulation & drywall
V_1 Open permit/hazardous waste
W_1 Closed tank permit/hazardous waste
X_1 Temporary tank permit/hazardous waste
Y_1 Removed tank
Z_1 Trunk sewer

A_2 Schools
B_2 Drinking water treatment plant
C_2 Legally abandoned well

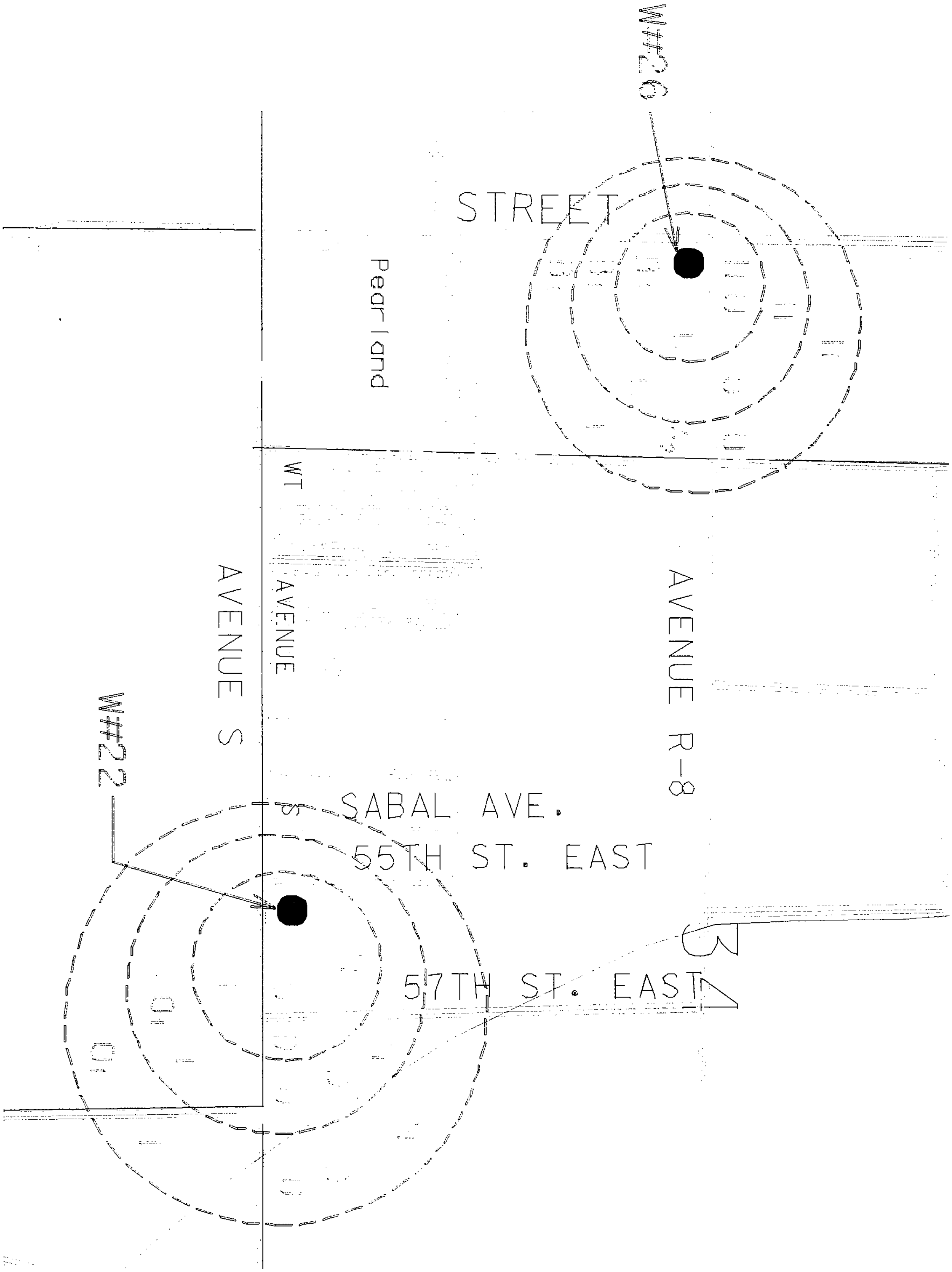


SIERRA
HIGHWAY
14
23
S.P.R.R.
BM 2616
BM 2617
8TH STREET EAST
W#6A
Well
10TH STREET EAST
2592
W#15
TRUNK SEWER
W#11A
24
TRUNK SEWER
15TH STREET EAST
2594
AVENUE
2581
AVENUE P
3
W#14A
P-8
W#2A
W#3A
W#23A
20TH STREET EAST
2569
2559
BM
TRUNK SEWER
W#8A
W#1A
W#7A
2544
25TH STREET EAST
2572
2559
19
8
W#24
MILITARY
30TH STREET
2567
2552

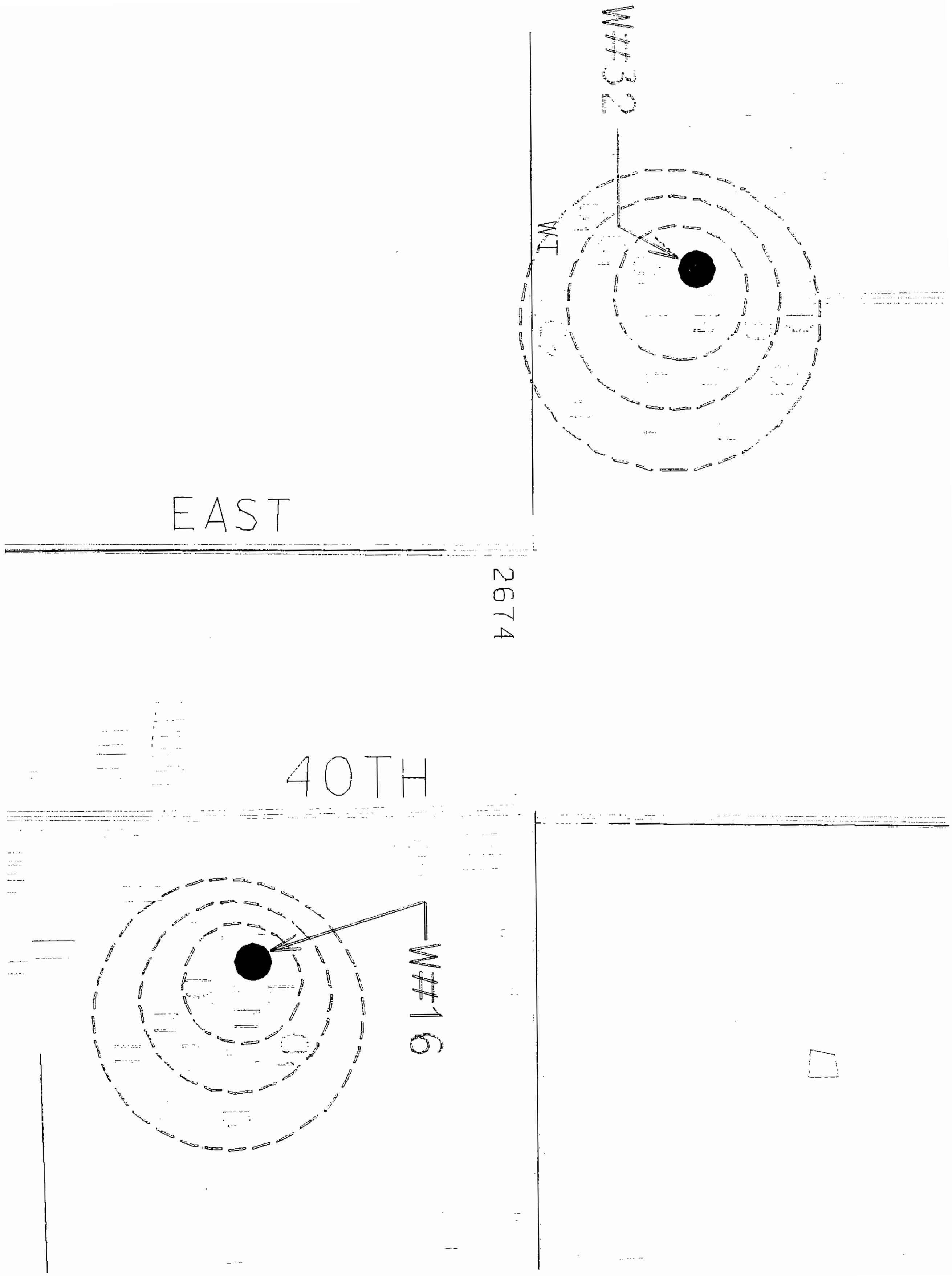

2552
AVENUE P
Golf
Course
40TH
W#10
Well
2571
Well
20
21
2588
Manzanita

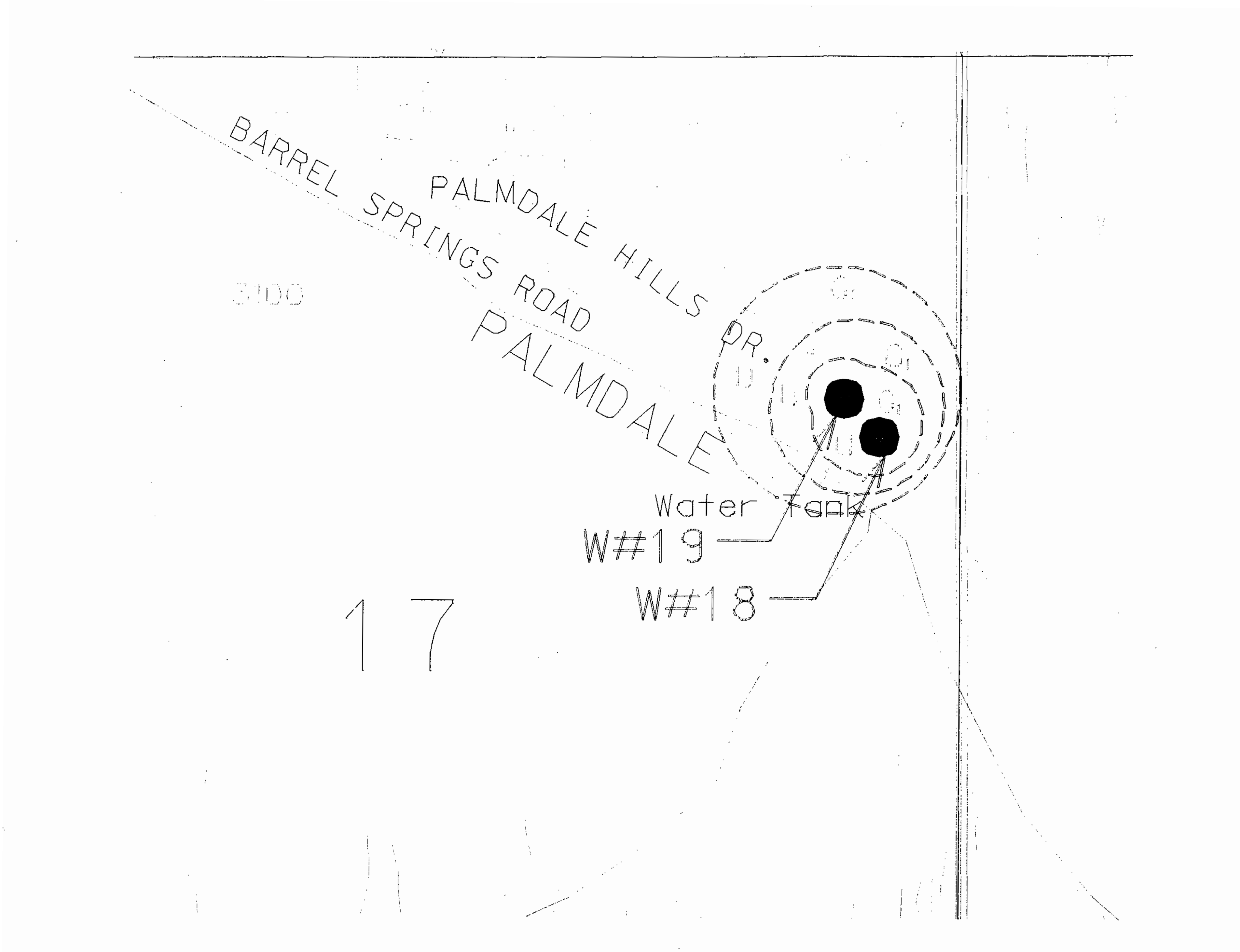


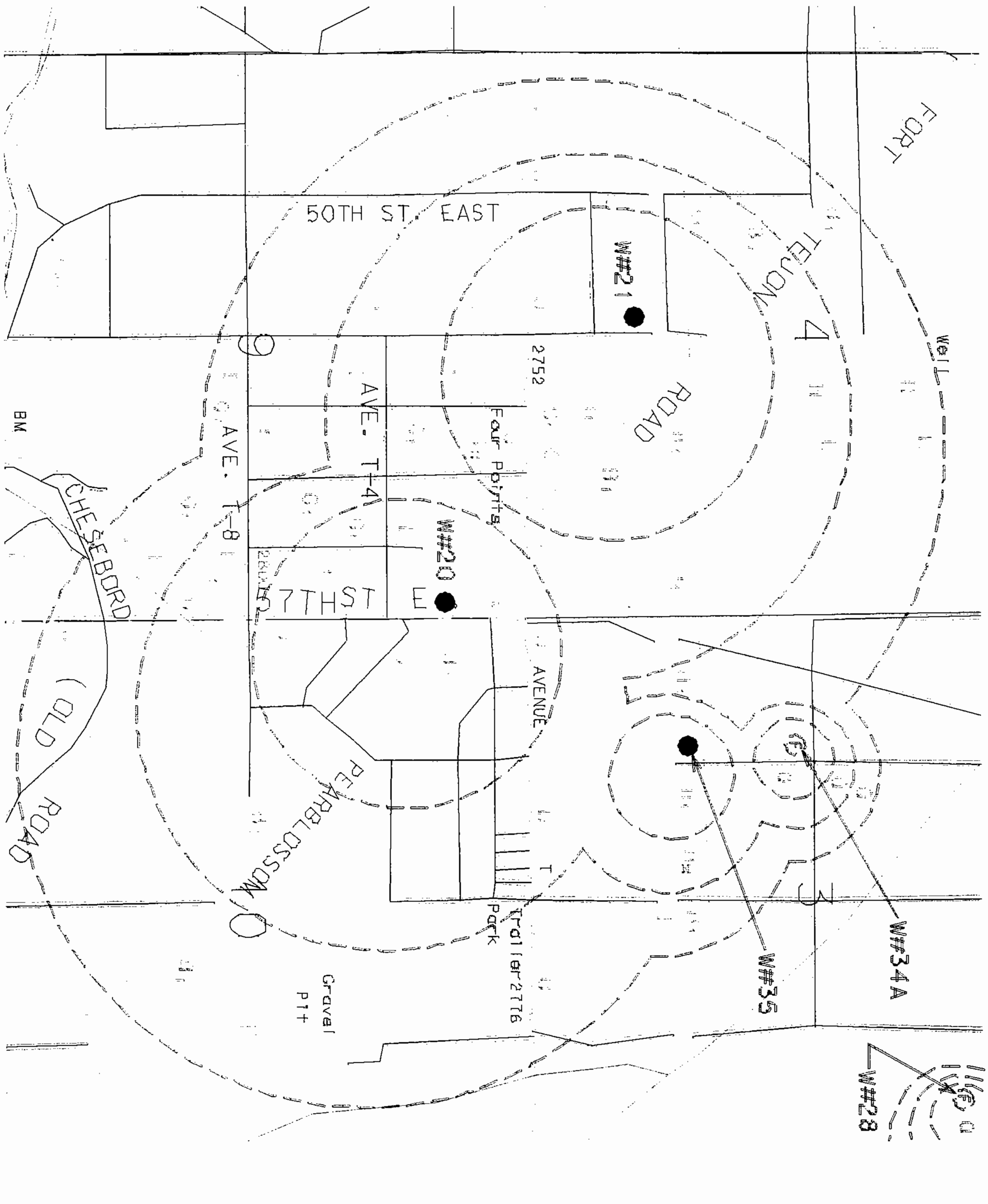
W#28
2716
W#27
35
AVE R-8
W#29
AVENUE R
67TH ST. EAST
AVENUE S
W#25
70TH ST. EAST
W#33
T.6.N
T.5.N
T.6N.
T.5N.
Well
2686
W#30
2
36
75TH ST. EAST
Gravel Pit
Conveyors
Gravel Pit
2710
PALMDALE
CORPORATE



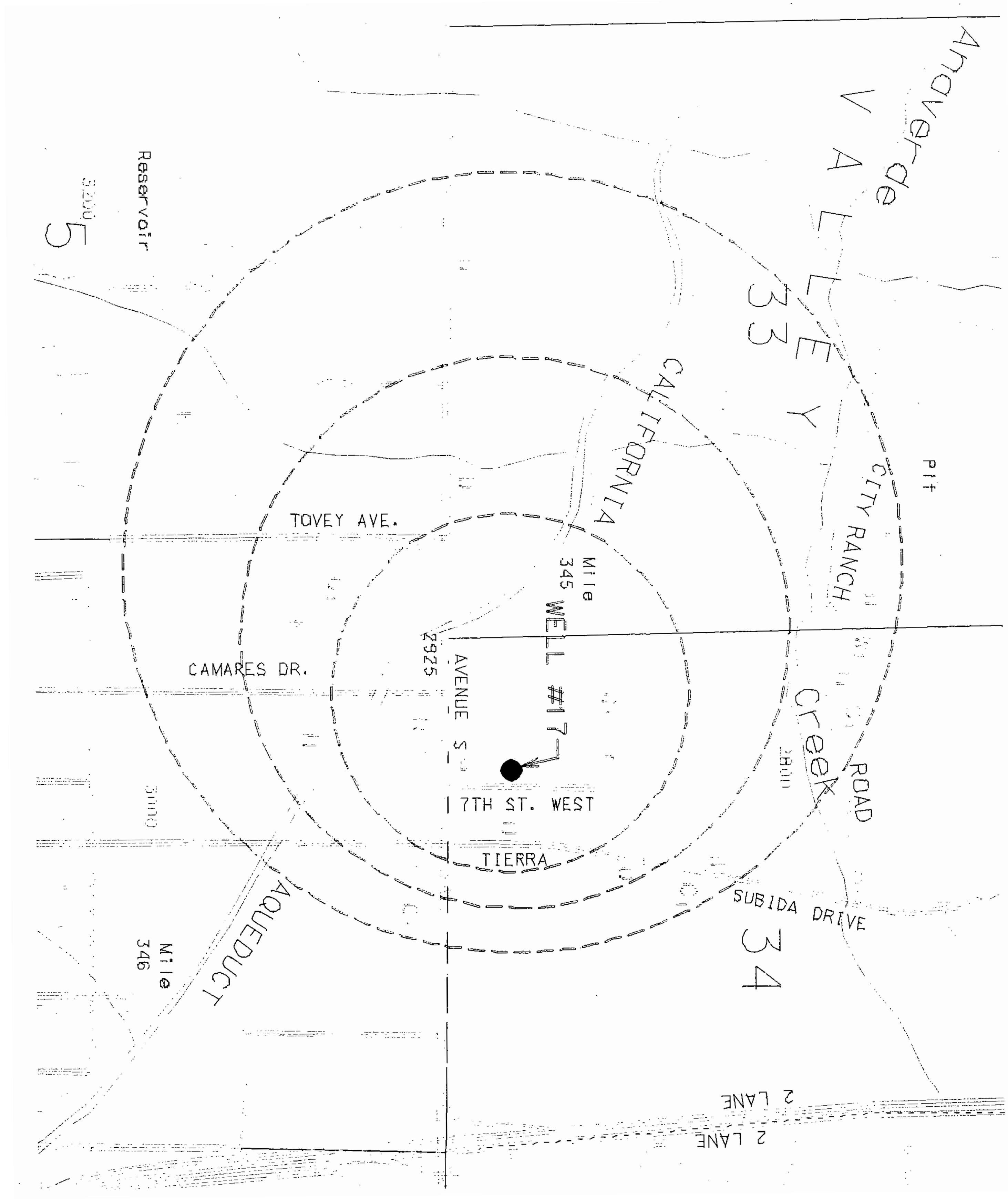
W#26
STREET
Pearland
WT
AVENUE
AVENUE S
AVENUE R-8
W#22
SABAL AVE.
55TH ST. EAST
57TH ST. EAST


W#32
WI
EAST
2674
40TH
W#16


BARREL SPRINGS ROAD
PALMDALE HILLS DR.
PALMDALE
Water Tank
W#19
W#18
17



50TH ST. EAST
FORT
TEJON
ROAD
W#21
2752
Four Points
AVE. T-4
AVE. T-8
BM
CHESEBORD
(OLD ROAD)
W#20
57TH ST E
AVENUE
PEARBLOSSOM
Well
W#35
W#34A
W#28
Trailer Park
Gravel Pit



Anaverde
VALLEY
33
Reservoir
5
CALIFORNIA
CITY RANCH
ROAD
Pit
TOVEY AVE.
Mile
345
WELL #17
2925
AVENUE S
CAMARES DR.
Creek
7TH ST. WEST
TIERRA
SUBIDA DRIVE
34
AQUEDUCT
Mile
346
2 LANE
2 LANE

APPENDIX D

Vulnerability Analysis

Format for Prioritized Listing of PCAs

Well 2A

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Trunk sewer	5	5	3	13
	Road/ Street	1	5	3	9
R5	Trunk sewer	1	3	3	7
R10	Trunk Sewer	1	1	3	5
Total					34

Well 3A

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Road/Street	1	5	3	9
R5	Road/ Street	1	3	3	7
R10	Sewer	1	1	3	5
	Repair Shop	5	1	3	9
	Road/Street	1	1	3	5
	Historical insulation &Dry wall (Truck service)	3	1	3	7
Total					42

Well 4A

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Roads/Street	1	5	3	9
R5	Road/ Street	1	3	3	7
	Trunk sewer	1	3	3	7
R10	Trunk Sewer	1	1	3	5
	Road/Street	1	1	3	5
Total					33

Well 5

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Septic tanks	7	5	5	17
	Illegal activities	5	5	5	15
	Highway	3	5	5	13
	Surface water (Palmdale ditch)	1	5	5	11
	Housing	3	5	5	13
R5	Junk/scrap/salvage	5	3	5	13
	Housing high density	3	3	5	11
	Drinking water TP	3	3	5	11
	Highway	3	3	5	11
	Palmdale ditch	1	3	5	9
R10	Junk/scrap/salvage	5	1	5	11
	Illegal activities	5	1	5	11
	Highway	3	1	5	9
	Freeway	3	1	5	9
	Housing (high density)	3	1	5	9
	Palmdale ditch	1	1	5	7
Total					193

Well 6A

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Junk/scrap/salvage	5	5	3	13
	Railroad tracks	3	5	3	11
R5	Railroad tracks	3	3	3	9
	Road/street	1	3	3	7
R10	Photo processing	5	1	3	9
	Body shop	5	1	3	9
	Railroad tracks	3	1	3	7
	Commercial Build.	1	1	3	5
	Roads	1	1	3	5
	Full tank permit	1	1	3	5
	Industrial waste to sewer	1	1	3	5
Total					85

Well 7A

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Trunk sewer	5	5	3	13
	Open permit hazardous waste	5	5	3	13
	Tank removed	1	5	3	9
	Road/street	1	5	3	9
	Abandoned industrial building	1	5	3	9
R5	Military installation	7	3	3	13
	Road/street	1	3	3	7
	Schools	1	3	3	7
	Trunk sewer	1	3	3	7
	Industrial connector to sewer	1	3	3	7
R10	Military Installation	7	1	3	11

	Trunk sewer	1	1	3	5
	Road street	1	1	3	5
	Full tank permit	1	1	3	5
Total					120

Well 8A

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Military installation	7	5	3	15
	Trunk sewer	5	5	3	13
R5	Military installation	7	3	3	13
	Trunk sewer	1	3	3	7
	Industrial connector to sewer	1	3	3	7
	Full tank permit	1	3	3	7
R10	Military installation	7	1	3	11
	Leaking USTs (2)	7	1	3	11x2=22
	Sewer lines	1	1	3	5
Total					100

Well 10

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Inactive well	5	5	3	13
	Food processing	3	5	3	11
	Golf course	3	5	3	11
	Road/street	1	5	3	9
R5	Golf course	3	3	3	9
	Road/street	1	3	3	7
R10	Dry well	7	1	3	11

	Inactive well	5	1	3	9
	Wastewater TP	3	1	3	7
	Golf course	3	1	3	7
	Housing high density	3	1	3	7
	Sewer line	1	1	3	5
	Road/street	1	1	3	5
Total					111

Well 11A

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Leaking UST	7	5	3	15
	Trunk sewer	5	5	3	13
	Hardware store	3	5	3	11
	Railroad tracks	3	5	3	11
	Road/street	1	5	3	9
	Full tank permit	1	5	3	9
	Industrial waste to local sewer	1	5	3	9
R5	Military installation	7	3	3	13
	Machine shop	5	3	3	11
	Railroad tracks	3	3	3	9
	Trunk sewer	1	3	3	7
	Road/street	1	3	3	7
R10	Military installation	7	1	3	11
	Railroad tracks	3	1	3	7
	Trunk sewer	1	1	3	5
	Road/street	1	1	3	5
Total					152

Well 14A

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	None				
R5	Military installation	7	3	3	13
	Trunk sewer	1	3	3	7
	Road/street	1	3	3	7
R10	Military installation	7	1	3	11
	Trunk sewer	1	1	3	5
	Road/street	1	1	3	5
Total					48

Well 15

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Road/street	1	5	3	9
R5	Trunk sewer	1	3	3	7
	Road/street	1	3	3	7
R10	Trunk sewer	1	1	3	5
	Road/street	1	1	3	5
Total					55

Well 16

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Drywell	7	5	3	15
	Sewer lines	5	5	3	13
	Housing/high density	3	5	3	11

R5	Drywell	7	3	3	13
	Detention basin	3	3	3	9
	Housing/high density	3	3	3	9
	Sewer lines	1	3	3	7
R10	Drywell	7	1	3	11
	Detention basins (2)	3	1	3	7x2 = 14
	Housing/high density	3	1	3	7
	Sewer lines	1	1	3	5
Total					115

Well 17

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Septic system	7	5	5	17
	Housing/high density	3	5	5	13
	Housing/low density	1	5	5	11
	Road/street	1	5	5	11
R5	Septic systems	3	3	5	11
	Housing/ high density	3	3	5	11
	Road/street	1	3	5	9
R10	Parking lot	5	1	5	11
	Septic tanks	3	1	5	9
	Cattle <50 head/acre	3	1	5	9
	Full tank permit	1	1	5	7
	Closed haz/waste tank	1	1	5	7
	Road/street	1	1	5	7
Total					133

Well 18

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Road/street	1	5	5	11
	Housing low density (3)				
R5	Palmdale ditch	1	3	5	9
	Housing low density (3)				
	Road/street	1	3	5	9
R10	Palmdale ditch	1	1	5	7
	Road/street	1	1	5	7
	Housing low density (3)				
Total					43

Well 19

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Housing low density (3)				
R5	Palmdale ditch	1	3	5	9
	Housing low density (3)				
	Road/street	1	3	5	9
R10	Palmdale ditch	1	1	5	7
	Housing low density (3)				
	Road/street	1	1	5	7
Total					32

Well 20

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Septic tanks	7	5	3	15
	Repair shop	5	5	3	13
	Freeway	3	5	3	11
	Road/street	1	5	3	9
	Commercial building	1	5	3	9
	Housing low density (9)	1	5	3	9
	Horses ?				
R5	Freeway	3	3	3	9
	Housing low density (16)	1	3	3	7
	Horses?				
	Septic tanks	1	3	3	7
	Road/street	1	3	3	7
R10	Gas station	7	1	3	11
	Gravel mine	5	1	3	9
	Septic systems	1	1	3	5
	Road/street	1	1	3	5
	Full tank permit	1	1	3	5
	Housing low density (5)				
Total					131

Well 21

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Septic system	7	5	3	15
	Gas station	7	5	3	15
	Freeway	3	5	3	11
	Railroad tracks	3	5	3	11
	Road/street	1	5	3	9

	Full tank permit	1	5	3	9
	Commercial building	1	5	3	9
R5	Freeway	3	3	3	9
	Railroad tracks	3	3	3	9
	Detention basin	3	3	3	9
	Housing high denesity	3	3	3	9
	Sewer	1	3	3	7
	Road/street	1	3	3	7
	Septic tanks	1	3	3	7
	Temporary tank permit	1	3	3	7
	Low density housing (16)	1	3	3	7
R10	Dry well	7	1	3	11
	Railroad tracks	3	1	3	7
	Detention basin	3	1	3	7
	Freeway	3	1	3	7
	High density housing	3	1	3	7
	Sewer lines	1	1	3	5
	Septic tanks	1	1	3	5
	Road/street	1	1	3	5
Total					204

Well 22

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Dry well	7	5	3	15
	Sewer lines	5	5	3	13
	Housing high density	3	5	3	11
	Road/street	1	5	3	9
R5	Detention basins (2)	3	3	3	9x2 = 18
	Housing high density	3	3	3	9
	Sewer	1	3	3	7
	Road/street	1	3	3	7

R10	Dry wells (4)	7	1	3	11x4 = 44
	Detention basins (2)	3	1	3	7x2 = 14
	Housing high density	3	1	3	7
	Trunk sewer	1	1	3	5
	Road/street	1	1	3	5
Total					164

Well 23A

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Repair shop	5	5	3	13
	Diesel heavy equipment repair	5	5	3	13
	Historical installation dry wall				
R5	Open permit/hazardous waste	1	3	3	7
	Sewer lines	1	3	3	7
	Trunk sewer	1	3	3	7
	Road/street	1	3	3	7
R10	Sewer lines	1	1	3	5
	Trunk sewer	1	1	3	5
	Road/street	1	1	3	5
Total					69

Well 24

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Nothing in area				
R5	Trunk sewer	1	3	3	7
R10	Leaking UST	7	1	3	11
	Wastewater TP	3	1	3	7

	Trunk sewer	1	1	3	5
	Road/street	1	1	3	5
Total					35

Well 25

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Illegal activities	5	5	3	13
R5	Illegal activities	5	3	3	11
R10	Illegal activities	5	1	3	9
Total					33

Well 26

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Sewer lines	5	5	3	13
	Detention basin	3	5	3	11
	High density housing	3	5	3	11
	Freeway	3	5	3	11
	Road/street	1	5	3	9
R5	Freeway	3	3	3	9
	High density housing	3	3	3	9
	Sewer lines	1	3	3	7
	Road/street	1	3	3	7
R10	Freeway	3	1	3	7
	High density housing	3	1	3	7
	Sewer lines	1	1	3	5
	Road/street	1	1	3	5
	School	1	1	3	5
Total					116

Well 27

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Nothing in area				
R5	Nothing in area				
R10	Illegal activities	5	1	3	9
Total					9

Well 28

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Illegal activities	5	5	3	13
R5	Illegal activities	5	3	3	11
R10	Illegal activities	5	1	3	9
Total					33

Well 29

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Sewer lines	5	5	3	13
R5	High density housing	3	3	3	9
	Sewer lines	1	3	3	7
R10	Illegal activities	5	1	3	9
	Housing high density	3	1	3	7
	Sewer lines	1	1	3	5
Total					50

Well 30

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Illegal Activities	5	5	3	13
R5	Illegal Activities	5	3	3	11
R10	Illegal Activities	5	1	3	9
Total					33

Well 32

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Sewer lines	5	5	3	13
	High density housing	3	5	3	11
	Low density housing (3)				
R5	Dry well	7	3	3	13
	High density housing	5	3	3	11
	Sewer lines	1	3	3	7
	Low density housing (6)				
R10	Dry well	7	1	3	11
	Detention basin	3	1	3	7
	High density housing	3	1	3	7
	Road/street	1	1	3	5
	Sewer lines	1	1	3	5
	Low housing density (6)				
Total					90

Well 33

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Illegal Activities	5	5	3	13
R5	Illegal Activities	5	3	3	11
R10	Illegal Activities	5	1	3	9
Total					33

Well 34

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Illegal Activities	5	5	3	13
R5	Illegal Activities	5	3	3	11
R10	Illegal Activities	5	1	3	9
Total					33

Well 35

Zone	PCA	PCA Points VH = 7 H = 5 M = 3 L = 1	Zone Points R2 = 5 R5 = 3 R10 = 1 Unknown=0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score
R2	Railroad tracks	3	5	3	11
R5	Railroad tracks	3	3	3	9
R10	Railroad tracks	3	1	3	7
	Gravel mine	5	1	3	9
Total					36

APPENDIX E

Stakeholders Meeting Materials

PALMDALE WATER DISTRICT

2029 East Avenue Q • Palmdale, California 93550 • Telephone (805) 947-4111
Fax (805) 947-8604

LAGERLOF, SENECAL, BRADLEY & SWIFT
Attorneys

ACWA

November 18, 1998

TO: ATTACHED MAILING LIST

RE: PALMDALE WATER DISTRICT GROUND WATER ASSESSMENT AND WELLHEAD PROTECTION PROGRAM – POTENTIAL STAKEHOLDERS MEETING – DECEMBER 10, 1998

Ladies and Gentlemen:

The Palmdale Water District is working toward the establishment of a Drinking Water Source and Wellhead Assessment Program in order to protect ground water sources. The Department of Health Services (DHS') Division of Drinking Water and Environmental Management is the lead agency responsible for the development and implementation of the current California's Drinking Water Source Assessment and Protection Program (DWSAP). The groundwater portion of the DWSAP serves as the State's wellhead protection program as California has not developed a wellhead protection program. The development of this program is required by the 1996 Safe Drinking Water Act Amendments of 1996.

This assessment requires delineation of the area surrounding a drinking water source through which contaminants may migrate and reach a particular drinking water supply. Additionally, inventories were required to determine individual activities that might lead to the release of bacteriological or chemical contaminants within a delineated area.

The steps in conducting drinking water source assessment include:

1. Location of each drinking water source (using Geographic Positioning System [GPS]).
2. Delineation of protection areas and zones for both surface and ground water sources. The ground water source protection areas and zones are delineated based on the most current available hydrologic information provided by the USGS and well drilling logs. The information provided includes ground water flow, soil types, well construction data and additional information regarded appropriate by the State.

3. Identification of Possible Contaminating Activities (PCAs) considered origins of significant contamination located within each drinking water source protection area and individual zones. PCAs include both chemical and microbiological contaminants that could have adverse health effects upon a human life.
4. Vulnerability assessment that describes the likelihood (risk level) that a contaminant from a PCA in a drinking water protection zone will migrate and enter the drinking water source.

The Palmdale Water District would like to invite local, state and federal agencies, the business community, and other interested parties to participate in developing a Wellhead Protection Plan.

The District's aim is to:

1. Enable interested parties to understand the assessment program.
2. Provide technical assistance.
3. Help develop a community based Wellhead Protection Plan.
4. Develop a consensus between affected parties.
5. Address any concerns of the public.
6. Develop public education and outreach programs.
7. Encourage a good working relationship between local, state and federal agencies and other affected parties.

The first meeting is designed to provide an overview of the assessment process, receive comments, discuss follow-up steps and determine the group's desire to act as an Advisory Committee to the District in developing and implementing a Wellhead Protection Plan.

The meeting will take place on December 10, 1998 at the Palmdale Water District main office. An agenda for the meeting and the introduction to the District's assessment report are enclosed.

If you have any questions, please call: Denise Kuhlman (805) 947-0232 ext. 309 or Greg Dluzak (805) 947-0232 ext. 306.

Very truly yours,

Dennis D. LaMoreaux

DENNIS D. LaMOREAUX,
General Manager
DK/DDL/dtd/Enclosures

Denise Kuhlman

DENISE KUHLMAN,
Water Quality Specialist

SOURCE WATER ASSESSMENT MEETING
December 10, 1998

AGENDA

08:30 – 08:45	INTRODUCTIONS
08:45 – 09:45	OVERVIEW OF PALMDALE'S SOURCE WATER ASSESSMENT
09:45 – 10:15	DISCUSSION ON FOLLOW-UP ACTIONS: DO WE FORM AN ADVISORY COMMITTEE?
10:15 – 10:30	BREAK
10:30 – 11:15	WHO NEEDS TO BE ADDED TO THE COMMITTEE? HOW OFTEN DO WE MEET? WHAT ARE THE COMMITTEE'S GOALS?
11:15 – 12:00	BRAIN STORM INITIAL IDEAS FOR WELLHEAD PROTECTION
12:00 – 12:15	PLANS FOR NEXT MEETING

PALMDALE WATER DISTRICT

GROUNDWATER ASSESSMENT AND PROTECTION PROGRAM

Mailing List

City of Los Angeles
Department of Airports
ATTN: Mr. Andrew Haung
One World Way
Los Angeles, CA 90045

City of Palmdale
ATTN: Mr. Robert W. Toone, Jr., City Administrator
38300 North Sierra Highway
Palmdale, CA 93550-4798

City of Palmdale
Planning Department
ATTN: Ms. Lori Lile, Acting Director of Planning
38306 9th Street East
Palmdale, CA 93550

City of Palmdale
Public Works Department
ATTN: Mr. Steve Williams, Director
708 East Palmdale Blvd.
Palmdale, CA 93550

BUILDING INDUSTRY ASSOCIATION
Antelope Valley Region
ATTN: Ms. Gretchen Gutierrez
c/o CCL Engineering
43434 Sahuayo Street
Lancaster, CA 93534

L. A. County Supervisor Mike Antonovich
ATTN: Mrs. Sherry Lasagna, Field Deputy
1113 West Avenue M-4, Suite A
Palmdale, CA 93551

Palmdale Chamber of Commerce
ATTN: Ms. Leigh Engdahl, Chamber CEO
38260 10th Street East
Palmdale, CA 93550

Palmdale School District
ATTN: Ms. Nancy Smith, Superintendent
39149 10th Street East
Palmdale, CA 93550

Antelope Valley Union High School District
ATTN: Dr. Robert Girolamo, Superintendent
44811 N. Sierra Highway
Lancaster, CA 93534

State of California
Department of Health Services
ATTN: Mr. Joseph Crisologo, District Engineer
1449 West Temple Street, Room 202
Los Angeles, CA 90026

U. S. Air Force Plant 42
Environmental Restoration Advisory Board
ATTN: Ms. Larine Barr, Public Affairs Specialist
ASC/EMR
1801 Tenth Street, Building 8, Suite 2
WPAFB, OH 45433-7248

League of Women Voters
ATTN: Ms. Xandra Kayden, President and
Ms. Joann Baltierrez, Executive Director
6030 Wilshire Boulevard, Ste. 301
Los Angeles, CA 90036

Antelope Valley Board of Realtors
43700 N. 17th Street West
Lancaster, CA 93534

Palmdale Disposal
ATTN: Ms. Betty Smith
1200 City Ranch Road
Palmdale, CA 93551

L. A. County Sanitation District
ATTN: Ms. Vicki Conway
1955 Workman Mill Road
Whittier, CA 90607

L. A. County Fire Department
ATTN: Fire Chief William Bell
c/o Fire Station 129
42110 6th Street West
Lancaster, CA 93534-7134

Mrs. Zona Myers
1640 East Avenue Q-6
Palmdale, CA 93550

December 21, 1998

Palmdale Water District Wellhead Protection Advisory Group

December 10, 1998 Meeting
Minutes

The first stakeholders meeting took place on December 10,1998 at the Palmdale Water District board room. The following participants attended the meeting:

James Baker	Palm Ranch Irrigation
Betty Smith	Palmdale Disposal
James Hong	Los Angeles County Department of Public Works
Henry Roediger	Los Angeles County Department of Public Works
Ollie Linson	Los Angeles Fire Department
Jim Bort	Palmdale Regional Airport
Andrew Haung	City of Los Angeles Department of Airports
Steve Williams	City of Palmdale Public Works Department
Zona Myers	Citizen
Lyle Talbot	Desert Citizens Against Pollution
Joseph Yore	Citizen
Estelle Blashak	Citizen
Gloria Alesso	Alesso Farm
Casey Alesso	Los Angeles County Farm Bureau

The meeting was designed to provide an overview of the assessment process, receive comments, discuss follow-up steps and to determine the group's desire to act as an Advisory Committee to the District in developing and implementing a Wellhead Protection Plan.

A copy of the presentation is attached.

Following the presentation and a period of question and answer the group developed goals for the up-coming year.

The participants identified the following goals for the upcoming meetings:

- Gain a better understanding of the District boundaries, well locations, protection zones and geological conditions.

- Identify any abandoned wells and other PCAs not identified in the initial assessment.
- Inform the public and parties responsible for PCAs of the assessment process and protection plans.
- Revisit delineated areas if needed.
- Develop Wellhead protection and contingency plans to protect Palmdale Water District's source water quality.

Additional stakeholders to be included were identified they include:

Los Angeles County Health Department
Los Angeles County HAZMAT
Water Quality Control Board – Lahontan Region
Antelope Valley Emergency Management Council
Soil Conservation District
The Farm Bureau
Antelope Valley East Kern Water Agency
Local well drillers
United States Geological Survey (USGS)

The Advisory Group will meet during 1999 to help develop the Districts Wellhead Protection Plan.

Agenda topics for the meeting suggested by participants include:

- Review of the District's groundwater quality and monitoring program.
- Review case studies of other wellhead protection programs- what works, what does not work.
- Los Angeles County Fire Department's programs and how they relate to specific PCAs in the zones of protection.
- Review of well construction and abandonment requirements.

APPENDIX F

Presentation Materials

Well Head Protection Program

Palmdale Water District
1998

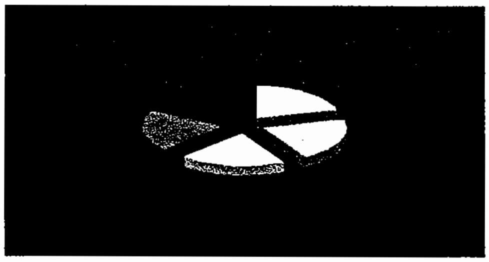
GROUNDWATER ASSESSMENT AND PROTECTION PROGRAM

Palmdale Water District
&
Standish-Lee Consultants

Background

- The 1986 SDWA - Wellhead Protection Program. (46 States have adopted WHPP)
- The 1996 SDWA Reauthorization - Source Water Assessment Program (SWAP).
- EPA's goal is to implement full source water protection for water supplies serving 60% of population by 2005.

Key Elements of SWAP

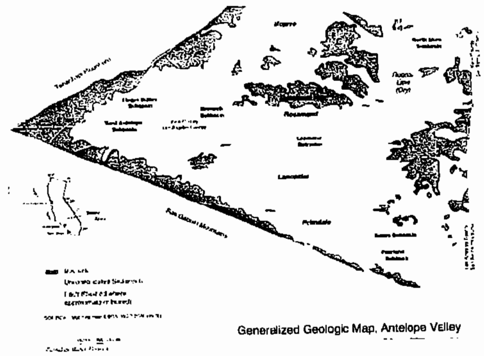


Recharge Area

- A roughly triangular area, bounded:
  - *Southwest* the crest of the San Gabriel and Sierra Pelona Mountains.
  - *Northeast and North* the sub-surface groundwater divides separating the Lancaster sub-unit from the Neenach sub-unit.
  - *East* the bedrock outcroppings surrounding El Mirage Valley.

HYDROGEOLOGIC CONDITIONS

- Closed basin
- Two alluvial aquifers, the principal and deep aquifer separated by a confining bed of clay and silt
- The principal aquifer is unconfined, the deep aquifer is confined
- Palmdale WD pumps water from the principle aquifer



Generalized Geologic Map, Antelope Valley

PALMDALE GROUNDWATER

The District pumps groundwater from:

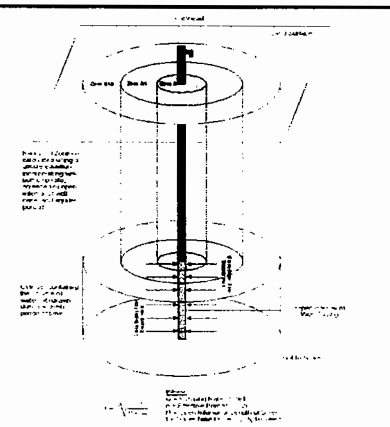
- The Lancaster sub-unit (12 wells pumping 9,200 ac-ft/year)
- The Pearland sub-unit (10 wells pumping 2,000 ac-ft/year)
- The San Andreas sub-unit (4 wells low capacity)

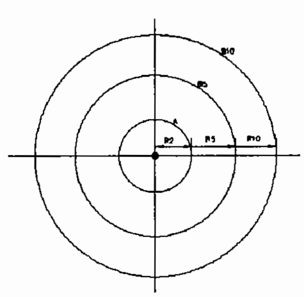
Delineation of Protection Zones

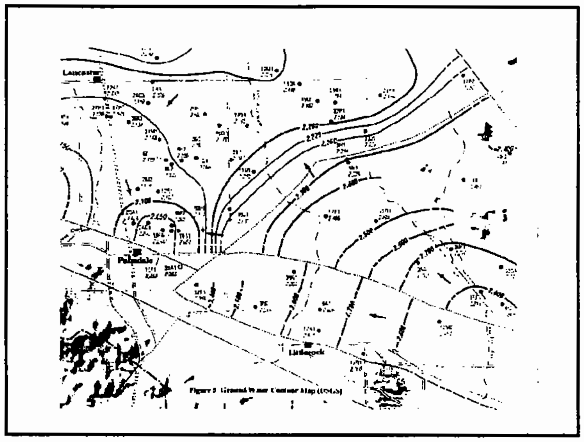
- Delineation Method - **<u>Modified Calculated Fixed Radius Method</u>**
- The method estimates the zone of contribution for a specified time of travel and takes into account groundwater flow direction.

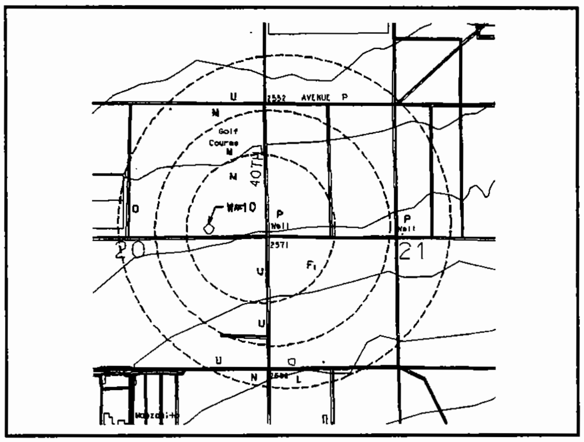
Radius of Protection Zones

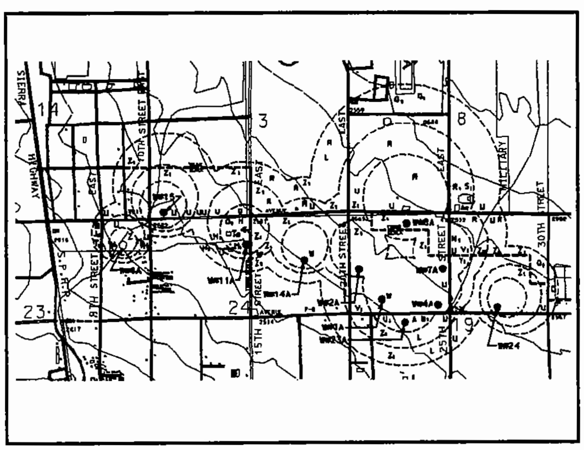
- $Rt = \sqrt{Qt/\pi\eta H}$
- **Rt** = radius of zone (feet) for time period t
- **Q** = pumping capacity of well (ft^3/year, where ft^3/year = gpm × 70,267
- **t** = travel time (years)(2,5,10 years)
- π = 3.1416
- η = effective porosity
- **H** = screened interval






Lancaster
Palmdale
Littlerock


AVENUE P
2552
Golf Course
40TH
WW10
Well
2571
20
21


SIERRA HIGHWAY
14
3
8
23
24
19
10TH STREET WEST
8TH STREET
15TH STREET
20TH STREET
25TH
30TH STREET
MILITARY

Steps in Conducting the Inventory

- Obtain geographical maps from USGS
- Locate each well using longitude/latitude
- Map protection zones
- Locate PCAs (Possible Contaminating Activities) within their respective 2, 5 and 10 year zones of influence

Sources of Information

- **US Dept. of Interior, Water Resources Division**
- **LA County Public Works, Industrial Waste Planning and Control, Environmental Programs Division**
- **State Water Resources Control Board, Division of Clean Water Programs**
- **California Regional Water Quality Control Board**
- **City of Palmdale**
- **Field inspection of each well site**
- **Windshield drive**

Potential Contaminating Activities

- PCAs are classified in accordance with the Possible Contaminating Inventory Form (the classification is based on type of contaminants used/generated by activity, history of past contamination).
- Once classified they are ranked either Very High, High, Moderate, or low risk.

Type of PCAs

- PCAs include:
- Drywells/Detention basins
- Military installations
- Illegal dumping
- Leaking underground storage tanks
- Golf courses
- Septic tanks
- Gas Stations and others

Classification of PCAs

- Each PCA identified in a particular protection area is given a number.
- The number identifies the risk level ; VH=7, H=5, M=3 OR L=1.

Trailer Park
(Well 5)

Wastewater Treatment Plant
(Well 24)

Major Transportation Corridor
(Well 20)

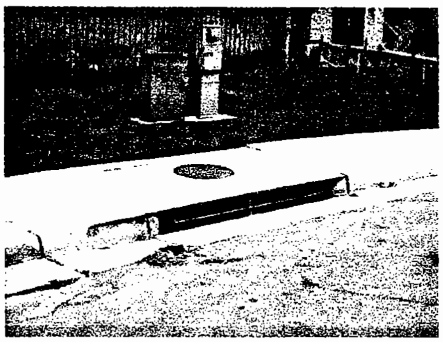
Housing Tract
(Well 26)

Graffiti on Inactive Well
(Well 27)

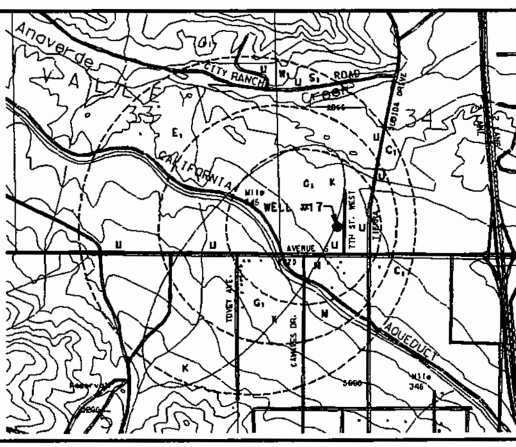
Lumber Yard
(Well 11)

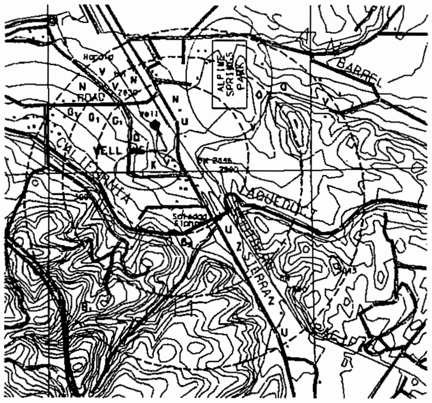
Trash and Debris
(Well 25)

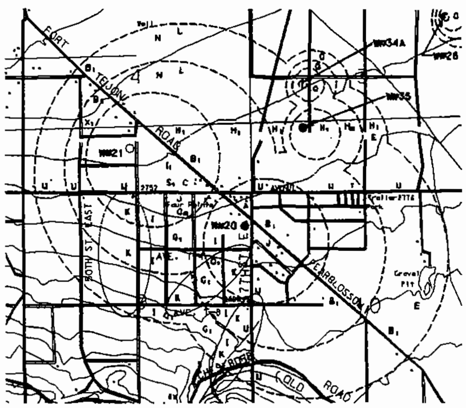
Gas Station
(North-West of Well 20)



Drain Inlet located next to Dry Well
(Approx. location near Well 10)







Vulnerability

- **An evaluation to determine the most significant threats to water quality.**

  It takes into account: characteristics of the source and site to determine their effectiveness as a physical barrier, the type of activities/PCAs in the zone of protection, and their proximity to the source.

Physical Barrier Effectiveness (PBE)

- A qualitative ranking based on:
  - type of aquifer,
  - soil materials,
  - abandoned wells,
  - water level,
  - well construction.

Vulnerability Analysis

- Determine the risk ranking for each PCA.
- Determine the number of points for the PCAs.
- Assign points to the zone in which the PCA occurs.
- Assign points to the PBE for the source.
- Add the above point to determine the PCA score.
- Add the scores for all the PCAs to determine the score for the source.

Example

Table - 2 Risk Ranking Summary (Activities with score ≥11):

Well	Zone	Activity	PCA Ranking	Vulnerability Score
Well 2A	R2	T. Sewer	H	13
Well 3A				
Well 5	R2	Septic S.	VH	17
		Illegal A.	H	15
		Highway	M	13
		Housing	M	13
		P. Ditch	L	11
	R5	Junk/scrap	H	13
		Illegal A.	H	13
		Housing	M	11
		Highway	M	11
		WTP	M	11
	R10	Junk/Scrap	H	11
		Illegal A.	H	11
Well 6A	R2	Junk/scrap	H	13
		Railroad T.	M	11
Well 7A	R2	T. Sewer	H	13
	R5	Military I.	VH	13
	R10	Military I.	VH	11
Well 8	R2	Military I.	VH	15
		T. Sewer	H	13
	R5	Military I.	VH	13
	R10	Military I.	VH	11
		Leaking UST (2)	VH	11
Well 10	R2	Food Proc.	M	11
		Golf Course	M	11
		Inactive ag. Well	H	13
	R10	Dry well	VH	11
Well 11A	R2	Leaking UST	VH	15
		T. Sewer	H	13
		Railroad T.	M	11
		Hardware S.	M	11

Well	Zone	Activity	PCA Ranking	Vulnerability Score
Well 11A	R2	Leaking UST	VH	15
		T. Sewer	H	13
		Railroad T.	M	11
		Hardware S.	M	11
	R5	Machine S.	H	11
		Military I.	VH	13
		Military I.	VH	11
	R10			
Well 14A	R5	Military I.	VH	13
	R10	Military I.	VH	11
Well 15				
Well 16	R2	Sewer L.	H	13
		Dry well	VH	15
		Housing	M	11
	R5	Dry well	VH	13
	R10	Dry well	VH	11
Well 17	R2	Septic S.	VH	17
		Housing H.	M	13
		Road	L	11
	R5	Septic S.	M	11
		Housing H.	M	11
	R10	Parking Lot	H	11
Well 18	R2	Road	L	11
Well 19				
Well 20	R2	Septic S.	VH	15
		Repair shop	H	13
		Highway	M	11
	R10	Gas Station	VH	11
Well 21	R2	Gas Station	VH	15
		Septic S.	VH	15
		Railroad T.	M	11
		Highway	M	11
	R10	Dry well	VH	11
Well 22	R2	Sewer L.	H	13
		Dry well	VH	15
		Housing H.	M	11
	R10	Dry wells(4)	VH	11

Well	Zone	Activity	PCA Ranking	Vulnerability Score
Well 24	R10	Leaking UST	VH	11
Well 25	R2	Illegal A.	H	13
	R5	Illegal A.	H	11
Well 26	R2	Sewer L.	H	13
		Highway	M	11
		Housing H.	M	11
		Detention basin	M	11
Well 27				
Well 28	R2	Illegal A.	H	13
	R5	Illegal A.	H	11
Well 29	R2	Sewer L.	H	13
Well 30	R2	Illegal A.	H	13
	R5	Illegal A.	H	11
Well 32	R2	Sewer L.	H	13
		Housing H.	M	11
	R5	Dry well	VH	13
	R10	Dry well	VH	11
Well 33	R2	Illegal A.	H	13
	R5	Illegal A.	H	11
Well 34A	R2	Illegal A.	H	13
	R5	Illegal A.	H	11
Well 35	R2	Railroad T.	M	11

Well Number	Total Score	High PCA Score
Well 2A	34	13
Well 3A	48	9
Well 4A	33	9
Well 6	193	17
Well 6A	86	13
Well 7A	116	13
Well 8	100	16
Well 10	111	13
Well 11A	162	16
Well 14A	48	13
Well 15	33	9
Well 16	114	15
Well 17	122	17
Well 18	43	11
Well 19	32	9
Well 20	115	15
Well 21	192	16
Well 22	164	15
Well 23A	69	13
Well 24	35	11
Well 25	33	13
Well 26	116	13
Well 27	9	9
Well 28	33	13
Well 29	43	13
Well 30	33	13
Well 32	81	15
Well 33	33	13
Well 34A	33	13
Well 35	36	11

The Next Steps (?)

- Form Stakeholders Group
- Develop management alternatives and Best Management Practices (BMPs).
- Conduct additional research (ex. Do gas stations have double containment?)
- Implement BMPs.
- Public education - pollution prevention.
- Develop Contingency Plans

Groundwater Protection Advisory Committee

- City of Palmdale
- Palmdale Chamber of Commerce
- City of LA Dept. of Airports
- LA County Sanitation District
- LA County Fire Dept.
- Building Industry Ass.
- Antelope Valley High School District

Groundwater Advisory Committee

- Palmdale School District
- State of Calif. Dept. Of Health Services
- US Air Force Plant 42
- League of Women Voters
- Antelope Valley Board of Realtors
- Palmdale Disposal
- Private Citizens

PALMDALE WATER DISTRICT WELLHEAD PROTECTION PLAN

November 2000

PALMDALE WATER DISTRICT WELLHEAD PROTECTION PLAN

November 2000

Produced by

Standish-Lee Consultants

TABLE OF CONTENTS

INTRODUCTION

Groundwater is a precious resource in the Antelope Valley. Palmdale Water District relies on groundwater to provide at least forty percent of its water supply. Contamination of that supply could cause water shortages and clean-up is costly and time consuming. To protect this resource the District embarked in 1998 on a process to develop a Wellhead Protection Plan.

Background

Source water protection is not a mandated element of EPA's Source Water Assessment Program. The 1996 SDWA Amendments do not impose regulatory or enforcement provisions requiring drinking water source protection by or upon the states and water purveyors. However, many of the amendments require EPA to consider further incorporation of source water protection measures into drinking water regulations, particularly as a basis to move toward increased regulatory flexibility. These provisions are intended to encourage states and local agencies to go beyond source water assessment into the implementation of management techniques to protect sources of drinking water supplies from identified Potential Contaminating Activities (PCAs). Prevention of source water contamination, provides great benefits to the public and is almost always less expensive than the treatment and monitoring that is required after a drinking water source has been contaminated.

The goal of a local source water protection program is to identify, develop and implement local measures that provide protection to the drinking water supply. Wellhead protection provides one more "barrier" to contamination in a multi-barrier protection treatment train. Moreover, an active and effective source water protection program can save the money that would otherwise be spent on additional treatment processes and chemicals.

Drinking water purveyors are encouraged to develop management strategies to mitigate the risk of contamination of drinking water supplies and improve water quality. Management strategies are aimed at reducing the risk of contamination through activities such as pollution prevention, use of Best Management Practices (BMPs), and public education.

Watershed management and management of activities in delineated protection zones are the responsibilities of local governments and public water systems. Palmdale Water District started developing their plan during 1999 following the completion of the Groundwater Assessment Program.

Management of wellhead protection areas to prevent groundwater contamination involves several steps:

- Identification of protection options appropriate for the types of PCAs present.
- Selection of those that are technically and politically feasible.

- Implementation
- Monitoring the effectiveness of management options and application of additional Best Management Practices (BMPs), if required.
- Development of contingency plans to address threats to the water supply that could result from accidents.

Purpose

The purpose of this report is to document and complete the Wellhead Protection Plan started in 1999. The Plan is to provide direction and focus for wellhead protection efforts undertaken by the District and the community. The Plan will outline management strategies that provide the keys to a successful contamination prevention program.

Report Organization

The report is organized into the following sections:

- **Introduction** - provides the background and purpose of the Palmdale Water District Wellhead Protection Plan.
- **The Process** - describes the process involved in developing the Plan.
- **Wellhead Protection Goals**
- **Existing Programs**
    - Federal
    - State
    - Local
- **Palmdale Wellhead Protection Plan**
- **Implementation Plan**
- **Contingency Plan**

THE PROCESS

In 1998 the District embarked on a multi-year program to conduct a groundwater assessment and develop a Wellhead Protection Plan.

Source Water Assessment

The first step in the process was conducting the source water assessment. The Plan followed the guidelines the State of California was developing entitled "Drinking Water Source Water Assessment and Protection (DWSAP) Program".

The assessment program included the following steps:

- Delineate the boundaries of the protection areas for those wells providing source water for District customers.
- Locate the District's wells using GPS (Geographic Positioning System) data.
- Evaluate the wells and their characteristics in terms of effectiveness of the physical barrier to contaminants reaching the water supply.
- Inventory the sources of regulated and certain unregulated contaminants of concern in the delineated areas (to the extent practical) and identify them on the assessment map (USGS digitized maps).
- Evaluate the vulnerability of identified PCAs to the source of supply and determine the relative vulnerability of each well to contamination.

The assessment concluded that the activities at the top of the District's vulnerability ranking include:

- Septic tanks believed to have caused the presence of contaminants in Wells 17 and 5 (nitrate, TDS)
- Illegal activities/dumping
- Trunk sewer lines
- US Air Force Plant 42
- Dry wells used by the City to capture nuisance water
- Gas stations
- Junk and scrap yards
- Leaking underground storage tanks and historical leakage

Other activities near the top of the District's vulnerability ranking are: highways, high density housing, the railroad, a golf course, hardware and repair shops, and improperly destroyed and/or operated wells in the recharge area.

Wellhead Protection Areas

The groundwater or wellhead protection areas for the District's wells are defined as "the surface and subsurface areas surrounding a well or well field, supplying the public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field". Zones are established within a delineated area to provide for different levels of protection.

Three zones of contribution were calculated for each well:

- Zone A (2-year time of travel)
- Zone B5 (5-year time of travel)
- Zone B10 (10-year time of travel)

The zones were plotted on the USGS quad map. The delineated areas are displayed in Figure 1.

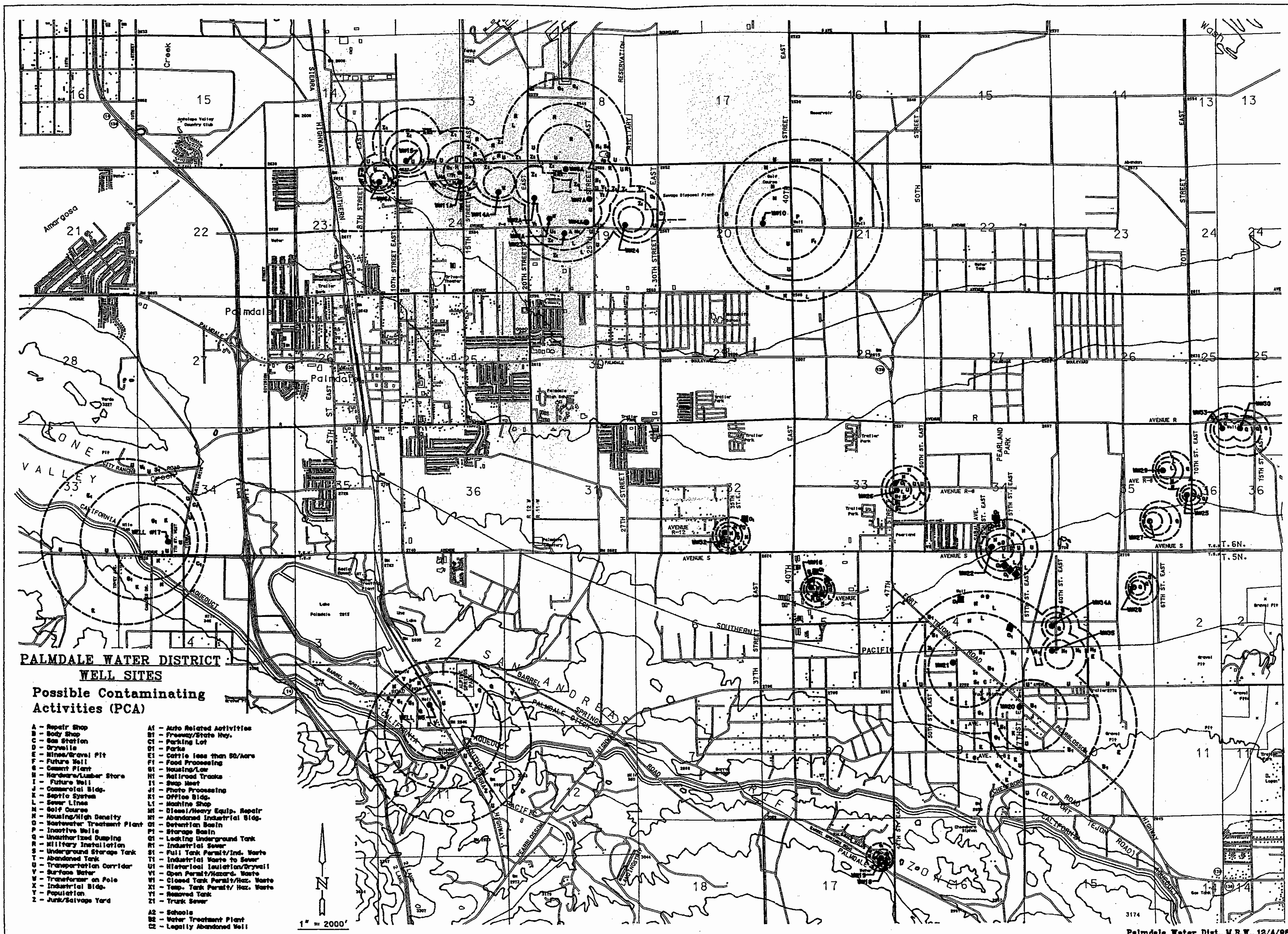
Public Involvement

A successful source water protection program requires public involvement. The principal reasons for encouraging public involvement are to:

- Build support for the Program.
- Ensure that interested parties understand the Program and have "ownership" in it.
- Provide technical review of the Program elements and build on local knowledge.
- Help develop consensus among parties affected by the Program.
- Help promote awareness of source water quality issues and build support for source control activities in the community.

Therefore the next step in the process was the representation of the public through the involvement of stakeholders and private citizens. The District invited stakeholders to form the Palmdale Water District Wellhead Protection Advisory Group. The purpose of the group was to help identify, develop and implement local measures that would advance the protection of the District's groundwater supply.

The District invited the following agencies and entities to participate in the Groundwater Protection Advisory Committee:
City of Los Angeles Department of Airports
City of Palmdale, City Administrator
City of Palmdale Public Works Department
City of Palmdale Planning Department
Building Industry Association
Los Angeles County Supervisor Mike Antonovich
Palmdale Chamber of Commerce
Palmdale School District
Antelope Valley Union High School District



PALMDALE WATER DISTRICT
WELL SITES
Possible Contaminating Activities (PCA)
A - Repair Shop
B - Body Shop
C - Gas Station
D - Drywells
E - Mines/Gravel Pit
F - Future Well
G - Cement Plant
H - Hardware/Lumber Store
I - Future Well
J - Commercial Bldg.
K - Septic System
L - Sewer Lines
M - Golf Course
N - Housing/High Density
O - Wastewater Treatment Plant
P - Inactive Wells
Q - Unauthorized Dumping
R - Military Installation
S - Underground Storage Tank
T - Abandoned Tank
U - Transportation Corridor
V - Surface Water
W - Transformer on Pole
X - Industrial Bldg.
Y - Population
Z - Junk/Salvage Yard
A1 - Auto Related Activities
B1 - Freeway/State Hwy.
C1 - Parking Lot
D1 - Parks
E1 - Cattle less than 50/Acre
F1 - Food Processing
G1 - Housing/Low
H1 - Railroad Tracks
I1 - Swap Meet
J1 - Photo Processing
K1 - Office Bldg.
L1 - Machine Shop
M1 - Diesel/Heavy Equip. Repair
N1 - Abandoned Industrial Bldg.
O1 - Detention Basin
P1 - Storage Basin
Q1 - Leaking Underground Tank
R1 - Industrial Sewer
S1 - Full Tank Permit/Ind. Waste
T1 - Industrial Waste to Sewer
U1 - Historical Isulation/Drywall
V1 - Open Permit/Hazard. Waste
W1 - Closed Tank Permit/Haz. Waste
X1 - Temp. Tank Permit/ Haz. Waste
Y1 - Removed Tank
Z1 - Trunk Sewer
A2 - Schools
B2 - Water Treatment Plant
C2 - Legally Abandoned Well
N
1" = 2000'
Palmdale
Amargosa
Creek
SIERRA HIGHWAY
SOUTHERN PACIFIC
AVENUE R
AVENUE S
T.6N.
T.5N.
Palmdale Water Dist., M.R.W., 12/4/98

State of California Department of Health Services
US Air Force Plant 42 Environmental Restoration Advisory Board
League of Women Voters
Antelope Valley Board of Realtors
Palmdale Disposal
Los Angeles County Sanitation District
Los Angeles County Fire Department
Private citizens
Los Angeles County Health Department
Los Angeles County HAZMAT
Water Quality Control Board – Lahontan Region
Antelope Valley Emergency Management Council
Soil Conservation District
The Farm Bureau
Antelope Valley East Kern Water Agency
Local well drillers
United States Geological Survey (USGS)

The Advisory Group met regularly during 1999 to help develop the District's Wellhead Protection Plan. The District's purpose in initiating the stakeholder participation was to:

- Enable interested parties to understand the assessment program.
- Provide technical assistance.
- Help develop a community based Groundwater Protection Plan
- Develop consensus among affected parties.
- Address any concerns of the public.
- Develop public education and outreach programs
- Encourage a good working relationship among local, state and federal agencies and other affected parties.

Since the District does not regulate land use and does not have the authority to control the storage of hazardous materials, and other activities that can impact groundwater quality, the District needs to rely on agreements and cooperation with stakeholders to build an effective program to protect the quality of the resource.

The stakeholders met four times during 1999 and developed the goals and suggested actions that will provide the framework for the District's Wellhead Protection Plan.

The Stakeholder process included four key elements:

- Educating the stakeholders regarding requirements for well construction and destruction, and the principles of groundwater protection.
- Providing them with information on other programs that can help protect groundwater quality.
- Involve them in the brainstorming of ideas regarding elements that can be included in a community- and District-based Protection Program.
- Start discussing possible agreements with other agencies to enhance existing programs with the goal of providing additional protection in the delineated zones.

WELLHEAD PROTECTION GOALS

Two sets of goals were developed for the program. The first was a long-term set of goals for protecting groundwater quality. The second were a set of goals for the stakeholders' process.

The long-term goals that were developed include:

- Reduce risks of groundwater contamination associated with identified PCAs and future development.
- Educate business and industry about the vulnerability of groundwater to contamination and what they can do to help protect the resource.
- Educate homeowners and the community in general about groundwater vulnerability, residence-based sources of contamination, and how they can help reduce the potential for contamination to occur.
- Promote proper disposal of hazardous wastes.
- Develop agreements with other agencies that have control over land-use, wastewater collection, and others with regulatory authorities that could be utilized to help protect groundwater quality.

The participants identified the following goals for the stakeholders' meetings:

- Gain a better understanding of the District boundaries, well locations, protection zones and geological conditions.
- Identify any abandoned wells and other PCAs not identified in the initial assessment.
- Inform the public and parties responsible for PCAs of the assessment process and Protection Plans.
- Revisit delineated areas if needed.
- Develop a Wellhead Protection Plan and contingency plans to protect Palmdale Water District's source water quality.

The meetings that were held during 1999 were planned to accomplish the second set of goals. At the same time they focused on the identification and employment of candidate cooperative programs and agencies with which the District could partner in the development and implementation of a long term Protection Plan.

EXISTING PROGRAMS

Numerous existing federal, state, and local programs are aimed at protecting water supplies and the regulation, inventory and clean up of contaminant sources and spills. Guidelines are in place for siting new sources of supply, and any newly proposed developments must undergo environmental review. The District and stakeholders agreed that when possible they would rely on existing regulations and processes to help make decisions and enforce requirements for the protection of the groundwater supply.

Federal Programs

There are six primary federal laws designed to help protect groundwater quality by setting standards or permitting uses and activities. The laws, their key elements, and the responsible agencies are identified in the following table:

ACT	KEY ELEMENTS	RESPONSIBLE REGULATORY AGENCIES
Safe Drinking Water Act (SDWA)	Sets maximum contaminant levels in drinking water and establishes flexible protection programs	EPA Region 9, Calif. Department of Health Services
Clean Water Act/Program (CWA)	Sets standards for allowable pollutant discharges to surface water or groundwater.	EPA Region 9, Lahonton Regional Water Quality Control Board
The Resource Conservation and Recovery Act (RCRA)	Regulates the transport, storage, treatment and disposal of hazardous wastes. Establishes the Federal Underground Storage Tank Program.	EPA Region 9, Lahonton RWQCB, Los Angeles County Health Department, Los Angeles County Fire Dept., State Dept. of Toxic Substances Control (DTSC)
The Comprehensive Environmental Response and Liability Act (CERCLA or Superfund)	Regulates clean up of contamination from hazardous wastes.	Dept. of Toxic Substances Control
The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)	Regulates pesticide sale and use and promotes alternative pest control strategies.	Dept. of Pesticide Regulation
The Toxic Substances Control Act (TSCA)	Regulates manufactured chemicals. Protects public health	Dept. of Toxic Substances Control

	and the environment from the improper handling, storage, transport, and disposal of hazardous substances.	

State Programs Related to Drinking Water Source Protection

Some existing source water protection programs and related programs within the State are listed below. The list refers to state programs that involve source water protection:

- Activities undertaken by state agencies in support of federal and local programs include:
  - Basin Planning
  - National Pollutant Discharge Elimination System (NPDES) and Waste Discharge Requirements
  - Waste Discharges to Land
  - Hazardous Waste Facility Monitoring
  - Underground Storage Tanks
  - Non-Point Source Pollution
  - Resource Conservation and Recovery Act (RCRA)
  - California Superfund Program
  - Pesticide Use and Management
  - Integrated Waste Management

The following table summarizes the involved state agencies and their role in the protection of groundwater supplies:

AGENCY	DEPARTMENTS/ BOARDS	RESPONSIBILITY
Health and Welfare	Dept. of Health Services-Division of Drinking Water and Environmental Management	Promotes public health through the regulation and monitoring of public water systems. It implements the SDWA regulations.
California EPA	State Water Resources Control Board	Formulates and controls the State's policy for water quality control, oversees the Regional Water Quality Control Boards and administers California's system of water rights.
	Regional Water Quality Control Boards (RWQCB)	Adopts, and implements water quality control policies and plans. They adopt Basin Plans and, under the authority of the CWA and the Porter – Cologne Act, they regulate point source discharges.

		They regulate any discharge of waste that may affect water quality in California. They also regulate waste discharge to land, carry out groundwater monitoring and surveillance programs and develop regulations, standards and guidelines pursuant to RCRA. They are also responsible for enforcement of: • Underground Storage Tanks • Non-Point Source Pollution • Remediation of surface or groundwater pollution problems • Implementation of the Coastal Zone Act Reauthorization Amendment (CZARA)
	Dept. of Toxic Substances Control (DTSC)	Protects public health from the improper handling, storage, transport and disposal of hazardous substances. Primary activities related to drinking water source protection are included in two programs mandated by federal law: • RCRA • California Superfund Program.
	Department of Pesticide Regulation	Regulates the use and management of pesticides to prevent pollution of surface water bodies and groundwater aquifers. It relies on authorities in the: • California Food and Agricultural Code, and •California Pesticide Contamination Prevention Act
	Dept. of Waste Management Board	Oversees the treatment, storage, recycling, and disposal of solid waste by local agencies
	Office of Environmental Health Hazard Assessment (OEHHA)	Provides information to environmental regulators and the public about adverse health effects that result from environmental exposures to noninfectious agents. It is responsible for implementing the Safe Drinking Water and Toxic Enforcement Acts of 1986 (Proposition 65)
Resources Agency	Dept. of Water Resources	Develops, conserves and manages the water resources of the State. Its mission is to manage the water resources in

		cooperation with other agencies to benefit the people of the State and to protect, restore and enhance the natural and human environments.
	Dept. of Conservation	Among other responsibilities, it acts to prevent groundwater contamination due to the drilling, operation, maintenance, and abandonment of oil, gas and geothermal wells.
	California Dept. of Forestry and Fire Protection	Protects against fires, responds to emergencies, and protects and enhances forest, range and watershed values.
	State Fire Marshal, Pipeline Safety Division	Regulates and enforces safety of all intrastate hazardous liquid pipelines.
	Dept. of Food and Agriculture	Inventories agricultural operations, dairies, and animal feedlots. It also investigates water quality issues involving the accumulation of nitrate in groundwater.

Local Management Actions

After identifying protection areas, zones, and PCAs and prioritizing PCAs and sources, a local community may choose to develop a management strategy for protecting the water supply. These activities will be accomplished at the local level with support from local agencies and stakeholders. Palmdale Water District opted to proceed with developing a Wellhead Protection Plan. The District will work with existing programs at the state and federal level as well as the county and City of Palmdale.

- Activities undertaken by county and city governments include:
  - Hazardous Material Spills Emergency Response
  - Hazardous Waste Management Planning (County)
  - Land Use Planning and Zoning (City and County)
  - Pesticide Regulations (County Agricultural Commissioners)
  - Regulation of Individual Waste Disposal (septic) Systems (County)
  - Regulation of Underground Storage Tanks (RWQCB and the County)
  - Sanitary Landfill Ground Water Monitoring (County and RWQCB)
  - Solid Waste Management Planning (State)
  - Water Well Permitting (County and State)

Regulatory strategies and non-regulatory management strategies can be effective as components of source water protection programs. **Table 1** lists potential BMPs and strategies and both structural and non-structural BMPs that can be used in a source water protection plan. **Table 2** lists regulatory and non-regulatory approaches to source protection. The non-regulatory BMPs are relatively easier to implement, but in cases where the local community has determined that its source of supply is highly susceptible to contamination, regulatory management strategies such as overlay groundwater protection districts, special permitting, subdivision controls and others may be necessary to protect the water supply.

The Palmdale Water District Wellhead Protection Advisory Group considered these options when developing the local program.

Table - 1 Potential Source Water Protection Strategies and BMPs

URBAN AREAS NON-STRUCTURAL	URBAN AREAS STRUCTURAL	RURAL AREAS AGRICULTURAL
Minimum lot size	Wet ponds	Judicious use of agricultural chemicals
Cluster development	Dry detention basins	Grazing restrictions
Buffer setbacks	Infiltration controls	Animal waste management
Impervious surface limits		
Drainage requirements	Stormwater diversions	Contour farming
Prohibited land uses	Oil/water separators	Crop rotation
Wastewater restrictions	Constructed wetlands	Conservation tillage
Conservation easement	Grassed swales	Terraces
Public education		Public education
Incentives		Incentives
Written agreements		Written agreements
Transfer of development rights		Grassed water ways
Hazardous waste collection		
Monitoring and research		
Pollution prevention programs		
Revegetation		

TABLE - 2 Potential local management strategies for source water protection Programs.

REGULATORY	NON-REGULATORY
Zoning	
Prohibition of various land uses	Conservation easements
Special permitting	Watershed restoration efforts
Large-lot zoning	Public education
Cluster development	Hazardous waste collection
Growth controls/timing	Local Wellhead Protection Programs

Transfer of development rights	Revegetation
	Land transfer/sale/donation
Health Regulations	Incentives
Underground Fuel Storage Tanks	Written agreements
Injection Wells	Pollution prevention programs
Toxic and Hazardous Materials Handling Regulations	
Wellhead Protection	
Septic system upgrade/ban	

Palmdale Wellhead Protection Plan

This chapter describes the ideas developed by the stakeholder group and uses them to develop specific recommended actions for dealing with the PCAs identified during the Source Water Assessment process. These activities will be accomplished at the local level with support from local agencies and stakeholders. The District does not have any control over land use so that all actions concerning land use will need to be approved by the City.

The Stakeholders identified a series of activities that will raise awareness of groundwater vulnerability and help promote programs to protect the District's groundwater supply. The key elements of the stakeholders' recommendations are to:

- Develop a groundwater protection ordinance, in coordination with the City of Palmdale, to be adopted by the City council.

- Develop a Protection Plan to be adopted by the District Board.

- Work with the County Sanitation Districts of Los Angeles County on an emergency notification plan and a priority system for dealing with multiple breaks. The Sanitation District will TV-survey sewer trunk lines in the protection zones at higher frequency than other part of the system, will correct any deficiencies, and will notify the District of problem areas.

- Work with the city on a maintenance program for dry wells in the zones of protection. Dry wells for collection of nuisance water can be a conduit for groundwater contamination.

- Pursue grants to study the long-term impacts of dry wells on the groundwater, and to develop alternatives so that dry wells can be replaced in the protection zones with options that will not be a threat to groundwater quality.

- Organize clean-up days for the areas with illegal damping and install signs designating the areas as wellhead protection areas. Clean-up days can be conducted as a community event in cooperation with the landfill owners and help to promote a spirit of groundwater stewardship.

- Send letters to businesses that are in the zones of protection to make them aware of their location in the zone of protection and the corresponding increased risks of groundwater contamination.

- Encourage the prompt identification and clean up of contaminated sites.

- Promote proper hazardous waste disposal for homeowners and small industries by working with the city and other agencies on establishing regular local opportunities for hazardous waste disposal.

- Public education. The District has developed the following programs aimed at public education:
  - Web page that addresses District programs
  - Newsletter
  - Water Fair

Additional programs discussed were:

- Making better use of the District's web page for environmental education (groundwater and surface water protection)
- Get youth groups involved in producing videos on pertinent subjects.
- Environmental service via ROTC (water quality sampling, clean-up, animal surveys, etc.)
- Stenciling dry wells with signs (Do Not Dump)
- Develop an education program for schools utilizing the water conservation materials.
- Develop signs discouraging people from dumping in recharge areas.
- Get groups of retired people to help work with the schools and other children's programs and teach them about protection of groundwater quality.
- Outreach to the business community on the subjects of water conservation and groundwater protection.
- Develop a brochure for homeowners and send them letters letting them know that they are in protected areas.

- Set limits on impervious surface areas in recharge zones (City Planning Department). Impervious surfaces do not allow percolation and contribute to excess stormwater flows and flooding.

- Take proactive steps to be prepared for spill events in the zones of protection.

- Track the TCE plume from Plant 42.The District is working with the Air Force to install additional monitoring wells between the contamination site and the District's wells.

- Limit or prohibit potentially contaminating activities from zones of protection and require pollution prevention measures for all approved activities.

- Assign a part time position for implementation of the Watershed and Wellhead Protection Programs.

- Discuss with the County the septic systems in the unsewered areas and their maintenance program.

- The wells operated by the District and others should be properly operated and maintained to prevent contamination of the water supply. Any new wells should be constructed to meet all well construction standards including a 50-ft. sanitary seal.

- Develop a program to identify abandoned wells and have them properly destroyed following the requirements in County regulations.

- The District should maintain minimum standards for operator certification and distribution system operator certification. Operators should be encouraged to continue their education programs and be recognized for successfully completing certification exams.

- It is recommended that the District acquire additional land around its supply wells where possible to act as buffer zones against contaminating activities. All new well sites should be at least 100'x100'.

- The District should join the Groundwater Guardian Program administered by the Groundwater Foundation and submit entries for AWWA Wellhead Protection Program Awards.

- Use the CEQA process as the vehicle to review the impact of any proposed developments and to avoid or mitigate the impact of those that can threaten groundwater quality.

- Have the Fire Department increase inspections/reports of any facilities storing and handling hazardous materials. Existing regulations require inspection once every three years; a frequency of once a year with follow-up on any violations is more appropriate for a protection zone. Work closely with the Fire Department to develop a monitoring and reporting system for industries in the protection zones that store large quantities of chemicals.

- The District should consider including the imposition of liability for pollution in their Code.

- The District will work closely with the RWQCB and the County to obtain information regarding spills and/or accidents that could impact water quality in the basin. This is an ongoing practice that should be continued to ensure quick responses to spills in order to prevent groundwater contamination.

- Any agreements regarding groundwater quantity should also address the need to protect groundwater quality. It is also recommended that the stakeholders in the valley work towards developing an integrated water management plan to ensure an adequate water supply for the Valley's future.

The table below includes a summary of actions to protect groundwater from specific identified activities on the watershed. It is specific to those activities that were identified during the assessment process.

At the top of the vulnerability list are the following activities:
- Septic tanks believed to have caused the presence of contaminants in Wells 17 and 5 (nitrate, TDS)
- Illegal activities/dumping
- Trunk sewer lines
- US Air Force Plant 42
- Dry Wells used by the City to capture nuisance water
- Gas Stations
- Junk and scrap yards
- Historical leaking underground storage tanks

Other activities near the top of the District's vulnerability ranking are: highways, high density housing, the railroad, a golf course, hardware and repair shops and improperly destroyed and/or operated wells in the recharge area. Table 3 includes a list of mitigation measures/wellhead protection activities recommended for each of the identified PCAs.

Table-3 Wellhead Protection Recommended Activities

ACTIVITY (PCA)	MITIGATION/CONTROL MEASURES
Septic tanks	• Continue monitoring the wells in the areas served by septic tanks on a regular basis to detect any trends in nitrate and TDS increases. • When possible replace wells in the zone with wells in sewered areas.
Illegal activities/dumping	• Organize clean-up days for the areas with illegal damping and install signs designating the areas as wellhead protection areas. Clean-up days can be conducted as a community event in cooperation with the landfill owners and promote groundwater stewardship.
Trunk sewer lines	• Work with County Sanitation Districts of Los Angeles County on an emergency notification plan and a priority system for dealing with multiple breaks. The Sanitation District will TV-survey sewer trunk lines in the protection zones at a higher frequency than other parts of the system, will correct any deficiencies, and

	will notify the District of problem areas.
US Air Force Plant 42	• Track the TCE plume from Plant 42.The District is working with the Air Force to install additional monitoring wells between the contamination site and the Districts wells. • Obtain water quality data regularly and watch for any trends that might threaten water quality.
Dry Wells used by the City to capture nuisance water	• Work with the city to develop a maintenance program for dry wells in the zones of protection. Dry wells for collection of nuisance water can be a conduit for groundwater contamination. • Pursue grants to study the long-term impacts of dry wells on the groundwater, and to develop alternatives so that dry wells can be replaced in the protection zones with options that will not be a threat to groundwater quality.
Gas stations	• Have the Fire Department increase inspections/reports for gas stations. Existing regulations require inspection once every three years; a frequency of once a year with follow-up on any violations is more appropriate for a protection zone. Work closely with the Fire Department to develop a monitoring and reporting system for gas stations in the protection zones. • Develop an agreement with the gas station owners to be notified in case of a spill or other accident that might impact water quality. • Review applications for new gas stations and keep them out of the two-year time of travel zone (R2). All gas stations should meet requirements for containment and monitoring.
Junk and scrap yards	• Recommend that pollution prevention

	plans be developed to prevent spills and operator errors. Good housekeeping guidelines can help prevent accidents and spills. • If they have old cars and other vehicles/containers that can leak oil, gasoline and other chemicals contact the fire Dept. and/or LA County Sanitation – Pretreatment program to have the site inspected. • If the event soil contamination is detected, work with the agency to make sure a monitoring well is installed between the site and the District's closest well.
Historical leakage from underground storage tanks	• Obtain verification from the RWQCB that all clean-up activities were completed.
Highways	• The California Dept. of Transportation employs BMPs for stormwater quality. Meet with them to make sure sections of highways that are in the zones of protection meet the requirements for stormwater management. • Review sections of highways that are close to the wells if runoff drains toward the well site and take actions to correct the problems.
High-density housing	• Public education. • Pollution prevention programs for hotels, lodges and other commercial establishments. • Promote proper hazardous waste disposal for homeowners and small industries by working with the city and other agencies to establish regular local opportunities for hazardous waste disposal. • Send letters to homeowners that are in the zones of protection to make them aware of their location in the zone of protection and the corresponding increased risk to groundwater contamination.
Railroad	• Develop an emergency notification plan. • In case of a spill take samples from the wells closest to the spill site on a weekly

	basis. (discuss actions with DOHS)
Improperly destroyed and/or operated wells in the recharge area.	• Develop a program to identify abandoned wells and have them properly destroyed following County regulations. • The wells operated by the District and others should be properly operated and maintained to prevent contamination of the water supply. Any new wells should be constructed to meet all well construction standards, including provision of a 50-ft. sanitary seal.
Golf course	• Meet with golf course owner to discuss use of fertilizers, pesticides and herbicides. Many golf courses have a management plan that provides for the protection of groundwater aquifers. The plan includes Integrated Pest Management, fertilization plans and other BMPs.
Machine shops, hardware and repair shops	• Recommend that pollution prevention plans be developed by commercial establishments to prevent spills and operator errors. Good housekeeping guidelines can help prevent accidents and spills. • Have the Fire Department increase inspections/reports of any facilities storing and handling hazardous materials. Existing regulation require inspection once every three years; a frequency of once a year with follow-up on any violations is recommended for facilities located in protection zones. • Send letters to businesses that are in the zones of protection to make them aware of their location in the zone of protection, the corresponding increased risk of their causing groundwater contamination, and the need to take preventative measures.

IMPLEMENTATION PLAN

District Proposed Program

Like watershed management programs, wellhead protection programs are ongoing, long-term programs. The program should be reviewed every two years and changes implemented when needed

Steps in plan implementation:

- The District's Board adopts the Palmdale Wellhead Protection Plan.
- Work with the City on adopting a Wellhead Protection Plan Ordinance
- Fund a half time position to administer the program and develop a five-year implementation plan.
- Seek grant/loan funding to help fund priority actions.
- Get written agreements with the Los Angeles County Sanitation Districts and the Los Angeles County Fire Department.
- Continue public education efforts and develop materials focused on groundwater protection that can be available to homeowners and businesses.
- The District should join the Groundwater Guardian Program administered by the Groundwater Foundation and submit entries for AWWA Wellhead Protection Program Awards.

Funding Sources for Source Protection Activities

1. Year 2000 Watershed Assistance Grants

The 2000 grant criteria and proposal guidelines for Watershed Assistance Grants are now available. A major key action of the President's Clean Water Action Plan, Watershed Assistance Grants support the growth and sustainability of local watershed partnerships in the United States.

This year, grant awards will range from $1,500 to $30,000. Grants will be made to local watershed partnerships. Grant awards may be made directly to incorporated watershed partnerships. If the watershed partnership is not incorporated, the grant recipient may be a nonprofit group, tribe and/or local government, or agency that is an active participant in the watershed partnership. Applications must be postmarked no later than August 15, 2000. For more information, visit http://www.epa.gov/OWOW/highlight.html on the Internet.

2. SDWA SRF Loans for Source Protection.

The State Revolving Fund Loan includes funds for source water protection. The set aside for source protection projects was 10% in 1999, 5% for 2000 and between 5-10% for

2001. Funds are to be used for source protection projects as well as land/easement acquisition. The Dept. of Health Services is the contact agency for these loans.

3. Nonpoint Source Implementation Grants (319 Program)

Provides grants to implement nonpoint source projects and programs in accordance with section 319 of the Clean Water Act. The grant can be used to implement BMPs for education programs and others. The RWQCB reviews the applications and administers the program in California.

CONTINGENCY PLANNING

Contingency planning to protect drinking water supplies is an essential element of a complete source water protection program. It is also required by the Safe Drinking Water Act (SDWA) and the Emergency Planning and Community Right-to-Know Act of 1986, enacted as Title III of the Superfund Amendments and Re-authorization Act (SARA).

Section 1428 (a) (5) of the SDWA states that each state program shall, at a minimum, "include contingency plans for the location and provision of alternate drinking water supplies for each public water system in the event of well or well field contamination".

Local governments are typically given responsibility for implementing components of a drinking water source protection program. While program requirements may vary, a public water supplier should develop a contingency plan to locate and provide alternate drinking water supplies in the event of contamination. A contingency plan should not be limited to planning for alternative supplies; it should be used to identify and prevent both physical and operational threats from contaminating or closing a public water supply.

The following are minimum components for local contingency plans. These will ensure adequate planning, encourage reliability and consistency, and create uniform response protocols. Any local plan should be consistent with Urban Water Plans.

Minimum Components of Local Contingency Plans

A local contingency plan should include an assessment of the water system's ability to function with a loss of major supply, and it should address alternate supplies in case they are needed. Specific steps are identified in this section.

- Assessment of the Ability of the Water System to Function with the Loss of the Largest Source of Supply

In order to assess the ability to function with the loss of its largest source of supply, the water supplier should do the following:

(1) Identify the maximum water system capacity in relation to source, distribution system, and water rights or other restrictions; and

(2) Re-evaluate this capacity assuming the loss of the largest water supply source.

♦ Development of a Plan for Alternate Water Supplies

To develop a plan for alternate water supplies, the water supplier should determine the availability and reliability of both short term and long-term supplies, the additional capacity that could be needed, and the associated costs. The plan should consider such alternatives as: expanding existing sources, identifying existing and potential interties with other public water systems, developing new sources, and installing treatment on sources not currently used because of water quality problems.

- Development of a Spill/Incident Response Plan

Using the results of the PCA inventory, a response plan for spills and emergencies should be developed with local emergency responders. Potential emergency response actions should consider protection of the water supply. For example, chemical spills within the protection area should be soaked up with absorbent materials rather than being washed away to drainage systems. Similarly, in the event of a fire it may be best to allow certain facilities to burn rather than produce contaminated runoff that could pollute the community water supply.

Palmdale Water District has built in flexibility to deal with emergencies. The District obtains its water supply from three sources: Littlerock Creek, the State Water Project and groundwater. The District is also interconnected with the Antelope Valley East Kern (AVEK) Water Agency and has an ongoing cooperative agreement with Littlerock Creek Irrigation District.

In 1991 the District developed a Water Shortage Contingency Plan that includes mandatory prohibitions and penalties and charges for violations of mandatory conservation measures.

The District is developing contingency plans to deal with other emergencies such as a loss of the largest source of supply, contamination of a source, and an emergency response to spills and other incidents as part of its Wellhead Protection Plan.