ATTACHMENT #1

ATTACHMENT #1

PROJECT DESCRIPTION CONTINUED

The recharge facility would be comprised of two in-channel basins and six off-channel basins designed to hold water and allow it to infiltrate into the ground. A percolation demonstration test was conducted at the project site and measured infiltration rates ranging from three to eleven feet per day. The long-term infiltration rate may be one-half the maximum or approximately 5 feet per day, based on similar locations in Southern California. Maximum groundwater recharge estimates range from approximately 22,000 AFY to 80,000 AFY, and may be 36,500 AFY in the long-term, based on a full year operation schedule and not accounting for maintenance when basins would be out of service. A typical operation schedule is that one-third of the total basin area would be out of service for maintenance, on average each year. The recharge facilities operated in this manner would have a capacity to recharge the groundwater aquifer at a rate between 14,500 AFY to 53,000 AFY, and may typically be 24,000 AFY.

The recharge facility would receive water from two sources, the State Water Project (SWP) and the Amargosa Creek watershed. The three local state water project contractors (Antelope Valley-East Kern Water Agency [AVEK], Palmdale Water District [PWD], and Littlerock Creek Irrigation District [LCID]) would deliver a portion of their available SWP water supply to the UAP recharge facility. The project, under planned Memoranda of Understanding (MOUs) with AVEK, PWD, LCID, would divert an average of approximately 24,300 AFY (Kennedy/Jenks 2008) of their currently used SWP allocations for recharge. There is also a potential to obtain additional water from other SWP contractors when their SWP allocations exceed their water demands.

The project also may divert water from Amargosa Creek to the UAP recharge facilities under a diversion permit/license that will be obtained from the State Water Resources Control Board (SWRCB) pursuant to an application to divert stream water to be submitted to the SWRCB. All water diverted to recharge the aquifer of the Antelope Valley Groundwater Basin could then be extracted at a later date for use within the City and surrounding communities.

Amargosa Creek is an isolated stream system beginning in the Sierra Pelona Mountains and traversing the San Andreas Rift Valley to the Antelope Valley. The creek channel trends east through the foothills, then north-east through the City of Palmdale, then north terminating in Rosamond Dry Lake on Edwards Air Force Base. The U.S. Army Corps of Engineers (Corps) has determined that Amargosa Creek is not a jurisdictional water of the U.S. based on isolation from navigable waters of the U.S. (Corps Determination of No Jurisdiction 2004-01298-AOA). The Corps determined that Amargosa Creek is an isolated water of the State. Therefore, the creek is considered jurisdictional water regulated by the California Department of Fish and Game (CDFG) and the Lahontan Regional Water Quality Control Board (RWQCB). Any improvements to a State jurisdictional water requires review by CDFG per Fish and Game Code Section 1600 et seq. permitting process and the RWQCB General Waste Discharge permit.

The water recharge facilities would include six off-channel recharge basins located north of Amargosa Creek and two in-channel recharge basins located west of

the 25th Street West Bridge and north of Elizabeth Lake Road. Two in-channel recharge basins would total approximately 5.4 acres. They would be created by two earthen or "sand" dams which would be 300 feet in length and three feet in height. The dams would be located west of the 25th Street West Bridge. This is an area in which the stream reach is wide and would allow stream flow to be spread over a large area, increasing the time and area available for water to infiltrate and recharge the aquifer.

Each of the off-channel recharge basins would be connected to the Collector Pipeline to allow delivery of SWP water and Amargosa Creek water. Three basins would be located east of 25th Street West (Recharge Basins 1,2, and 3) and another three basins (Recharge Basins 4,5, and 6) would be located within the northeastern portion of the project site. The off-channel recharge basins would be separated from Amargosa Creek by exterior berms and from one another by interior berms. Balance pipelines with valves would be installed through the interior berms to control water flow between individual basins. Additional return flow pipes (one per basin) would be installed in the berms adjacent to the creek to permit excess water to return to the creek. Engineered bank stabilization would be installed on the discharge end of all return flow pipes to control erosion along Amargosa Creek. In addition, emergency spillways with erosion control features would be constructed on each of the exterior basin berms to permit overflow of excess water while preventing water from overtopping the berms to minimize the potential for berm damage and erosion.

The design of the off-channel basins would allow a basin to be taken out of operation for routine maintenance while the others remain active for recharge. Each basin would be taken out of service for maintenance at least once annually or when the infiltration rate diminishes substantially. On average, about 1/3 of the basins would be out of service for maintenance or to permit them to dry out and minimize excess plant or algal growth.

In conjunction with the recharge facility, a community nature park would be created within the boundaries of the project site. The nature park would provide recreational and educational opportunities, including 2.5 miles of multi-use pathways weaving through the nature park and around the proposed recharge basins. The pathways would facilitate the community's continued use of the area and link to existing trails and bike pathways throughout the City. Passive recreational amenities (i.e., ramadas and picnic tables) would be placed in select locations throughout the park. The nature park would involve the enhancement and restoration of previously disturbed habitat to remove non-native vegetation and restore native Mojave Desert scrub, riparian vegetation, and wildlife habitat. Educational displays and interpretive plaques would be located throughout the project area to provide information on local biological and water resources (desert environment, native plants and animals, watershed processes, urban runoff, and the recharge facilities).

Twenty-two (22) acres of upland area in the northwestern portion of the project site would be dedicated as a Native Habitat Conservation Area. This area would preserve in perpetuity the existing and mostly undisturbed habitat which includes low shrubs, cacti, mature juniper and annual wildflowers. The project would also include 10 acres of currently unclassified open land and 7 acres of open stream channel.

ATTACHMENT #2

ATTACHMENT #2

AMARGOSA CREEK WATER AVAILABILIY REPORT

TO: Chief, Division of Water Rights, State Water Resources Control Board

FROM: City of Palmdale

DATE: January 7, 2009

SUBJECT: WATER AVAILABILITY ANALYSIS (WAA) FOR APPLICATION OR PETITION ON APPLICATION [Number] OF CITY OF PALMDALE

1.0 INTRODUCTION

The purpose of this report is to summarize the results of the water availability analysis conducted for the subject application located within the Amargosa Creek watershed in Los Angeles County. The objectives of the analysis are as follows:

- To provide information required under California Water Code section 1275 (a), 1375 (d), 1243, 1243.5 and California Code of Regulations, Title 23, section 782, to demonstrate whether water is available for appropriation; and
- To determine the impact of the applications/project on streamflow in order to evaluate potential impacts to Public Trust Resources and provisions for compliance with various federal and state requirements. Examples include the California Environmental Quality Act (CEQA), the California Endangered Species Act (CESA), California Fish and Game Code and the federal Endangered Species Act (ESA).

2.0 PROJECT DESCRIPTION

The Upper Amargosa Creek Recharge and Nature Park project (UAP) is located at the transition between the mountain front and alluvial fan on the Amargosa Creek southwest of the City of Palmdale on approximately 87 acres located within the City limits. The UAP would include the following components:

(1) a recharge facility, including 20 acres of recharge basins and infrastructure;
(2) a community nature park containing multi-use pathways, picnic tables, interpretive plaques, and habitat enhancement/restoration areas developed on 28 acres of suitable areas of the UAP project site;
(3) a 22 acre native habitat conservation area; and
(4) 10 acres of open land and 7 acres of stream channel.

The purpose of this recharge facility is to provide a beneficial increase in groundwater to the Antelope Valley Groundwater Basin. The result of the recharge facility operation will be an increase in groundwater elevations in the project vicinity and, therefore, the availability of groundwater in general to the Antelope Valley. The recharge facility would be comprised of two in-channel basins and six off-channel basins designed

to hold water and allow it to infiltrate into the ground. A percolation demonstration test was conducted at the project site and measured infiltration rates ranging from three to eleven feet per day (SAIC, 2007). The long-term infiltration rate may be one-half the maximum or approximately 5 feet per day, based on similar locations in Southern California. Maximum groundwater recharge estimates range from approximately 22,000 AFY to 80,000 AFY, and may be 36,500 AFY in the long-term, based on a full year operation schedule and not accounting for maintenance when basins would be out of service. A typical operation schedule is that one-third of the total basin area would be out of service for maintenance, on average each year. The recharge facilities operated in this manner would have a capacity to recharge the groundwater aquifer at a rate between 14,500 AFY to 53,000 AFY, and may typically be 24,000 AFY.

The recharge facility would receive water from two sources, the State Water Project (SWP) and the Amargosa Creek watershed. The three local state water project contractors (Antelope Valley-East Kern Water Agency [AVEK], Palmdale Water District [PWD], and Littlerock Creek Irrigation District [LCID]) would deliver a portion of their available SWP water supply to the UAP recharge facility. The project, under planned Memoranda of Understanding (MOUs) with AVEK, PWD, LCID, would divert an average of approximately 24,300 AFY (Kennedy/Jenks 2008) of their currently used SWP allocations for recharge. There is also a potential to obtain additional water from other SWP contractors when their SWP allocations exceed their water demands.

The project also may divert water from Amargosa Creek to the UAP recharge facilities under a diversion permit/license that will be obtained from the State Water Resources Control Board (SWRCB) pursuant to an application to divert stream water to be submitted to the SWRCB. All water diverted to recharge the aquifer of the Antelope Valley Groundwater Basin could then be extracted at a later date for use within the City and surrounding communities.

Amargosa Creek is an isolated stream system beginning in the Sierra Pelona Mountains and traversing the San Andreas Rift Valley to the Antelope Valley. The creek channel trends east through the foothills, then north-east through the City of Palmdale, then north terminating in Rosamond Dry Lake on Edwards Air Force Base. The U.S. Army Corps of Engineers (Corps) has determined that Amargosa Creek is not a jurisdictional water of the U.S. based on isolation from navigable waters of the U.S. (Corps Determination of No Jurisdiction 2004-01298-AOA). The Corps determined that Amargosa Creek is an isolated water of the State. Therefore, the creek is considered jurisdictional water regulated by the California Department of Fish and Game (CDFG) and the Lahontan Regional Water Quality Control Board (RWQCB). Any improvements to a State jurisdictional water requires review by CDFG per Fish and Game Code Section 1600 et seq. permitting process and the RWQCB General Waste Discharge permit.

The water recharge facilities would include six off-channel recharge basins located north of Amargosa Creek and two in-channel recharge basins located west of the 25th Street West Bridge and north of Elizabeth Lake Road (Figure WAA-1).

Two in-channel recharge basins would total approximately 5.4 acres (Figure WAA-1). They would be created by two earthen or "sand" dams which would be 300 feet in length and three feet in height. The dams would be located west of the 25th Street West Bridge. This is an area in which the stream reach is wide and would allow stream flow to be spread over a large area, increasing the time and area available for water to infiltrate and recharge the aquifer.

Each of the off-channel recharge basins would be connected to the Collector Pipeline to allow delivery of SWP water and Amargosa Creek water. Three basins would be located east of 25th Street West (Recharge Basins 1,2, and 3) and another three basins (Recharge Basins 4,5, and 6) would be located within the northeastern portion of the project site (Figure WAA-1). The off-channel recharge basins would be separated from Amargosa Creek by exterior berms and from one another by interior berms. Balance pipelines with valves would be installed through the interior berms to control water flow between individual basins (Figure WAA-1). Additional return flow pipes (one per basin) would be installed in the berms adjacent to the creek to permit excess water to return to the creek. Engineered bank stabilization would be installed on the discharge end of all return flow pipes to control erosion along Amargosa Creek. In addition, emergency spillways with erosion control features would be constructed on each of the exterior basin berms to permit overflow of excess water while preventing water from overtopping the berms to minimize the potential for berm damage and erosion.

The design of the off-channel basins would allow a basin to be taken out of operation for routine maintenance while the others remain active for recharge. Each basin would be taken out of service for maintenance at least once annually or when the infiltration rate diminishes substantially. On average, about 1/3 of the basins would be out of service for maintenance or to permit them to dry out and minimize excess plant or algal growth.

In conjunction with the recharge facility, a community nature park would be created within the boundaries of the project site. The nature park would provide recreational and educational opportunities, including 2.5 miles of multi-use pathways weaving through the nature park and around the proposed recharge basins. The pathways would facilitate the community's continued use of the area and link to existing trails and bike pathways throughout the City. Passive recreational amenities (i.e., ramadas and picnic tables) would be placed in select locations throughout the park. The nature park would involve the enhancement and restoration of previously disturbed habitat to remove non-native vegetation and restore native Mojave Desert scrub, riparian vegetation, and wildlife habitat. Educational displays and interpretive plaques would be located throughout the project area to provide information on local biological and water resources (desert environment, native plants and animals, watershed processes, urban runoff, and the recharge facilities).

Twenty-two (22) acres of upland area in the northwestern portion of the project site would be dedicated as a Native Habitat Conservation Area. This area would preserve in perpetuity the existing and mostly undisturbed habitat which includes low shrubs, cacti, mature juniper and annual wildflowers. The project would also include 10 acres of currently unclassified open land and 7 acres of open stream channel.

2.1 Points of Interest (POI)

The point of interest is the Point of Diversion #1 (POD), which is located in Amargosa Creek 1,500 feet downstream of the Leona Siphon of the California Aqueduct (Figure WAA-1). The Amargosa Creek watershed above the point of diversion is 18,600 acres (Figure WAA-2). Downstream of the point of diversion Amargosa Creek reaches its terminus in Rosamond Dry Lake.

3.0 METHODS

Amargosa Creek is an ephemeral stream and is dry throughout most the year. Precipitation that occurs on the watershed produces runoff for a short duration. There is no historical gaging station runoff data from the mainstem of Amargosa Creek to provide an understanding of the frequency, magnitude and duration of the flows at Amargosa Creek near the UAP. Presented in this section is the description of a daily runoff paired watershed model that uses the Little Rock Creek gage to simulate the daily runoff from the Amargosa Creek watershed for assistance with the planning of the UAP.

Amargosa Creek Watershed

The Amargosa Creek watershed is defined as all the area that contributes surface runoff to the POD located in western portion of the project area. A 10-meter digital elevation model (DEM) representing the topography across the Amargosa Creek watershed and surrounding area was obtained from the National Elevation Dataset (USGS 2008). The watershed was delineated from the DEM with HEC-GeoHMS, a GIS software developed by the United States Army Corps of Engineers. The watershed boundary was checked against USGS topographic map of the watershed (Figure WAA-2).

Table 1: Amargosa Creek Watershed Characteristics

Characteristic	Value
Area (sq miles)	29
Highest point (feet above sea level, ft asl)	5,176
Lowest point (ft asl)	2,765
Flow length from highest to lowest(ft)	57,398
Highest flow path average gradient	0.042
Longest flow length (ft)	76,410
Longest flow path average gradient	0.02

Amargosa Creek watershed has an elongate shape with the highest elevation near the middle of its length. The watershed area is 29 square miles (18,600 acres) above the point of diversion. The highest elevation within the watershed is 5,176 feet above mean sea level (ft msl) and the lowest elevation is 2,765 ft msl at the point of diversion. The flow length from highest to lowest elevation is 57,398 ft. From these data, the average stream gradient is 0.04. However, the longest flow path is 76,410 ft, with an average gradient of 0.02.

Daily runoff is estimated by pro-ration of a paired watershed discharge with the ratio of watershed areas and precipitation using the following formula (SWRCB 2006):

$$Q_2 = Q_1 \times (A_2/A_1) \times (I_2/I_1)$$

where:

Q_2 = Daily runoff (cfs) at point of interest on tributary watershed;

Q_1 = Daily runoff (cfs) at nearby gage;

A_2 = Watershed area above point of interest;

A_1 = Watershed area above nearby gage;

I_2 = Precipitation at point of interest; and

I_1 = Precipitation at nearby gage.

4.0 ANNUAL UNIMPAIRED FLOW

Over the 13-year period of analysis, the average runoff is estimated to be 2,600 AFY (Table 2). The maximum annual runoff for the period of analysis occurred in Water Year 1968-69 and is estimated to be from 10,000 AFY.

Table 2. Amargosa Creek Paired Watershed Estimated Monthly Stream Flows

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Water Year
1964									0	0	0	62	
1965	16	0	6	152	0	0	0	0	0	0	4,168	4,045	236
1966	75	254	0	0	0	0	0	0	0	0	147	2,177	8,541
1967	239	0	345	1,106	0	0	0	0	2	0	1,061	120	4,016
1968	45	140	130	51	0	0	0	0	0	0	6	20	1,547
1969	4,979	3,877	347	736	0	0	40	0	0	0	64	0	10,004
1970	11	186	824	0	0	0	0	0	0	0	569	286	1,085
1971	120	61	75	64	9	0	0	0	0	0	6	1,139	1,185
1972	0	0	0	0	0	0	0	0	0	0	16	0	1,145
1973	146	2,042	868	0	0	0	0	0	0	0	21	0	3,071
1974	53	0	347	225	0	0	0	0	0	4	0	71	646
1975	0	79	644	451	0	0	0	0	0	0	0	0	1,249
1976	0	389	179	87	0	0	0	0	218	0	8	3	874
1977	117	27	43	0	214	0	0	0	0	0	0	0	413
Average	446	543	293	221	17	0	3	0	16	0	433	566	2,616

4.1 Data and Assumptions

The nearest streams to Amargosa Creek with runoff measurements are Little Rock Creek and Big Rock Creek. Little Rock Creek was selected because of its proximity (11 miles to the east) to Amargosa Creek and more similar watershed characteristics, principally gradient and elevation (Table 3).

Table 3: Paired Watershed Characteristics

Characteristic	Amargosa Creek	Little Rock Creek	Big Rock Creek
Area (sq miles)	29	49	23
Longest Flow Path Upstream Elevation (feet above sea level, ft asl)	4,218	7,979	8,600
Longest Flow Path Downstream Elevation (ft asl)	2,766	3,280	4,064
Flow length (ft)	76,400	91,080	43,350
Stream Gradient	0.02	0.05	0.11

The Leona Valley Station 122 was used to estimate the daily rainfall for the Amargosa Creek Watershed. An area-weighted daily rainfall was estimated for Little Rock Creek watershed based on available daily records from Los Angeles County Department of Public Works. The Thiessen Polygon method was used to calculate the area-weighted daily rainfall for the watershed, by subdividing the watershed into the areas covered by each rain gage and area-weighting the daily rainfall for the watershed. The period of analysis, water year 1964-65 to water year 1976-77, was selected based on the available runoff and rain gage records. The record was limited by the Little Rock Creek gage (10264000) period of record, which is 10/1930 to 02/1938; 09/1939 to 09/1977; 10/1978 to 09/1979; and, 01/2002 to 09/2005. The period of analysis from water year 1964-65 to 1976-77 is slightly drier than mean according to the cumulative departure from the mean graph of Station 261 - Acton-Escondido, the longest rainfall record in the area. The mean rainfall from water year 1964-65 to 1976-77 is 10.0 inches per year, six percent less than period of record mean rainfall of 10.6 inches/year.

4.2 Calculations

As stated in the Section 3.0, Daily runoff is estimated by pro-ration of a paired watershed discharge with the ratio of watershed areas and precipitation using the following formula (SWRCB 2006):

$$Q_2 = Q_1 \times (A_2/A_1) \times (I_2/I_1)$$

where:
Q_2 = Daily runoff (cfs) at point of interest on tributary watershed;
Q_1 = Daily runoff (cfs) at nearby gage;
A_2 = Watershed area above point of interest;
A_1 = Watershed area above nearby gage;
I_2 = Precipitation at point of interest; and
I_1 = Precipitation at nearby gage.

Amargosa Creek is an ephemeral stream, with runoff occurring only during periods of intense rainfall. The historical stream flow gage for Little Rock Creek contains flow most days throughout the year, with base flow through late spring and early summer. To account for the lack of base flow in Amargosa Creek, the estimated runoff at Amargosa Creek is reduced to zero if the three day running-average of the weighted average rainfall in the Amargosa Creek watershed is less than one-tenth of an inch. The selection of a three-day running average is based on the empirical formula $N = A^{0.2}$, where N is the number of days from the time of the peak to end of the event flow and A is the watershed area in square miles. For Amargosa Creek watershed above the point of diversion, N = 1.96 days. Therefore a three-day running average of rainfall accounts for potential runoff from a storm event in the prior two days. The selection of a tenth of an inch for the cutoff for a precipitation event to produce runoff is based on the historical relation of the stream flow response of Little Rock Creek to precipitation events. In addition if the area-weighted average rainfall for either Little Rock Creek or Amargosa Creek is less than a tenth of an inch, the rainfall factor ((I_2/I_1)) is set equal to 1 and does not affect the stream flow for those days.

5.0 UNIMPAIRED FLOW DURING THE PROJECT'S DIVERSION SEASON

Unimpaired flow during the project's diversion season is the total volume of water, on average, that would flow past a selected point of interest on a seasonal basis if no diversions (impairments) were taking place in the watershed above that point. Flow is measured in units of acre-feet. The unimpaired flow during the project's diversion season is the same as the annual unimpaired flow, 2,600 AF per year on average. The diversion season is from October to May.

5.1 Data and Assumptions

See Sections 3.0 and 4.0.

5.2 Calculations

See Sections 3.0 and 4.0.

6.0 BYPASS FLOW

The bypass flow is the minimum flow rate to be maintained past a project's point of diversion, in units of cubic feet per second (cfs). Amargosa Creek is "non-coastal" watershed and is an ephemereal wash with no fish habitat in the creek. The example bypass flow of the median February flow is zero for Amargosa using the paired watershed approach (Section 3.0) for the 13-year period of analysis. Therefore, bypass flows are not needed to maintain any fish habitat. Meetings have been held with California Department of Fish and Game representatives to brief them on the UAP and discuss requirements they may have regarding environmental resources.

7.0 CUMULATIVE FLOW IMPAIRMENT INDEX (CFII)

Pursuant to CEQA, CESA and ESA, the Division is required to evaluate cumulative impacts to natural hydrology. The CFII is an index that is used to evaluate the cumulative flow impairment demand of all existing and pending projects in a watershed of interest. The CFII is a percentage obtained by dividing **Demand** in acre-feet by **Supply** in acre-feet at a specified **POI**[5], and for a specified time period, where:

> **Demand** is the "face" value entitlements of all existing and pending water rights, under all bases of right, above the POI in acre-feet, using the Division's Water Rights Information Management System (WRIMS) database and water right files (See Appendix A). For the "coastal" watersheds in the counties of Mendocino, Sonoma, Marin and Napa, the season of October 1 to March 31 is used to compute demand. Demand includes existing and pending water right applications for "Post-1914" appropriators, Statements of Water Diversion and Use for "Riparian" and

[5] Points of interest (POIs), are designated by Division staff in consultation with DFG..

"Pre-1914" appropriators, small domestic use registrations, stockpond registrations, and any other known authorized diversions; and

Supply is the seasonal average unimpaired flow above the POI in acre-feet. For the "coastal" watersheds in the counties of Mendocino, Sonoma, Marin and Napa the season of December 15 through March 31 is used to compute supply[6].

Based on the WRIMS database, as of January 6, 2009, the face amounts of the total entitlements of recorded water rights above the POIs are estimated to be 180 acre-feet for POI 1. (See Appendix A). The total unimpaired water available at the POIs was estimated to be **2,600** acre-feet at POI 1. For Case A, the CFII values were estimated as follows:

CFII @ POI 1 = Demand (af) ÷ Supply (af)) x 100% = 180 af /2,600 af x 100% = **7%;**

For Case B, the maximum amount of diversion for the pending application by the City of Palmdale is 2,700 af in the maximum runoff year. The estimated average annual diversion is 1,150 af over the 13-year period of analysis (Table 4). Note, recognizing that the diversion from the Amargosa Creek will likely occur over periods of hours, rather than days, the diversion rate of 100 cfs is requested in order to capture up to 50 cfs on average per day which is the estimated capacity of the recharge basins.

Table 4. Estimated Annual Diverted Volume

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Water Year
1964										0	0	62	
1965	16	0	6	152	0	0	0	0	0	0	914	647	236
1966	75	254	0	0	0	0	0	0	0	0	147	497	1,889
1967	239	0	329	1,069	0	0	0	0	2	0	567	120	2,283
1968	45	140	130	51	0	0	0	0	0	0	6	20	1,053
1969	931	988	285	496	0	0	40	0	0	0	64	0	2,766
1970	11	186	484	0	0	0	0	0	0	0	192	286	745
1971	120	61	75	64	9	0	0	0	0	0	6	578	807
1972	0	0	0	0	0	0	0	0	0	0	16	0	584
1973	146	638	791	0	0	0	0	0	0	0	21	0	1,590
1974	53	0	347	201	0	0	0	0	0	4	0	71	622
1975	0	79	602	392	0	0	0	0	0	0	0	0	1,148
1976	0	329	179	87	0	0	0	0	191	0	8	3	787
1977	117	27	43	0	214	0	0	0	0				413
Average	135	208	252	193	17	0	3	0	15	0	149	176	1,148

For Case B, the existing licensed water right (180 af) and the City of Palmdale pending application (1,150 af on average), the CFII values were estimated as follows:

CFII @ POI 1 = Demand (af) ÷ Supply (af)) x 100% = 1,330 af /2,600 af x 100% = **52%**

[6] National Marine Fisheries Service and The California Department of Fish and Game, *Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams*, June 17, 2002 (Errata note, dated 8-19-02).

APPENDIX A
Demand above POI

POI #1 – Point of Diversion . Licensed appropriative water rights in the Amargosa Creek watershed upstream from POI #1

Application ID	Holder Name	Date	Face Amt (AFY)	Max Direct Diversion (MDD)	MDD (in AFY)
(1)	(2)	(3)	(4)	(5)	(6)
A000016	LILAC HILLS ESTATES LP	2/19/1915	18.1	0.025 cfs	18.1
A001136	CITY OF LOS ANGELES DWP	12/5/1918	72.4	0.1 cfs	72.4
A003739	JOHN LOWE	12/3/1923	0	1950 gal/day	2.2
A004773	RONALD C HOWELL	9/15/1925	0	2400 gal/day	2.7
A005759	CITY OF LOS ANGELES DWP	11/17/1927	25.3	0.035 cfs	25.4
A006056	STEPHEN S CHANG	9/17/1928	16.7	15000 gal/day	16.8
A006625	STANLEY FIRESTONE	4/7/1930	0	10000 gal/day	11.2
A001137	CITY OF LOS ANGELES DWP	12/7/1938	36.2	0.05 cfs	36.2
A010464	FRANCISCO CELEDON	5/19/1942	11.6	0.016 cfs	11.6
A017426	LILAC HILLS ESTATES LP	1/18/1957	0	1440 gal/day	1.6
A022700	BRYAN BOBROSKY	2/14/1967	0	300 gal/day	0.3
A027457	AVELINO GONZALES	7/27/1982	0.3	750 gal/day	0.8
		Sum =	180.6	Sum =	199

State Water Resources Control Board eWRIMS Database (SWRCB). Accessed January 6, 2009. http://www.waterboards.ca.gov/ewrims/

Upper Amargosa Project

- Groundwater Recharge Facilities -

- Project Boundary (87 acres)
- Recharge Basin (20 acres)
- Nature Park (28 acres)
- Native Hab. Conserv. (22 acres)
- Open Stream Channel (7 acres)
- Unclassified (10 acres)
- Push-Up Dam
- Conveyance Pipe
- Storm Drain with Outlet Structure
- Basin Inlet Pipe/Valve with Flow Measurement
- Interpond Pipe/Gate/Weir with Flow Measurement
- Return Flow Pipe/Gate/Weir with Outlet Protection/Flow Measurement
- Stream Diversion Intake Structure/Headgate
- Flow Measurement Device

0 250 500 750 1,000

Feet

N

NOTES:

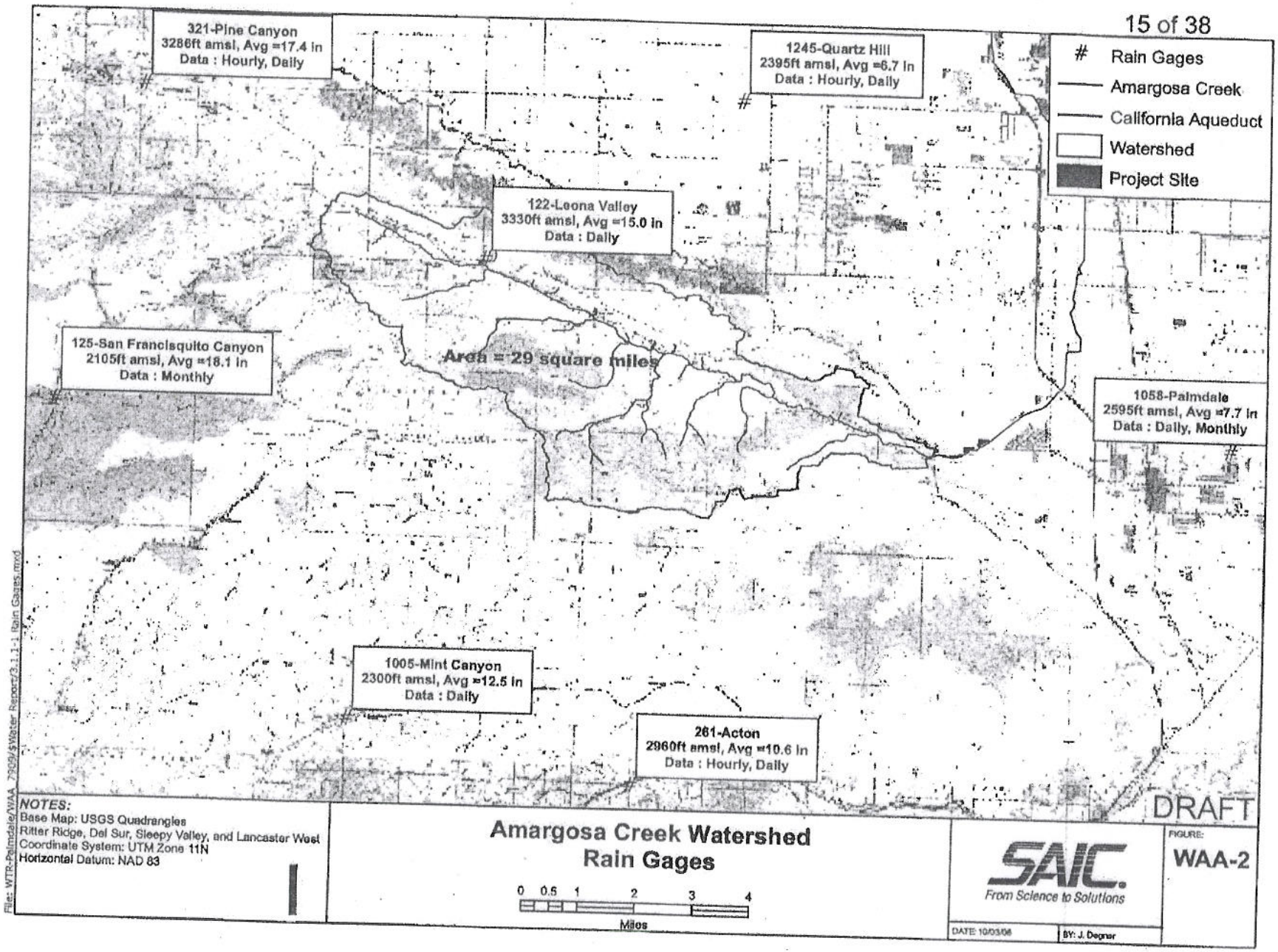
Coord Sys: State Plane NAD 83 Zone 5 U.S. Foot
Basemap: LARIAC 4-in resolution Airphoto, 2006

SAIC®
From Science to Solutions

FIGURE: WAA-1

DATE: 12/31/08 | BY: D Beckwith

File: Palmdale\EIR_7SXX\Projects\123108 GW Facilities_w_EngineeringStamp.mxd



File: WTR-Palmdale/WAA_2009/$Water Report/3.1.1-1 Rain Gages.mxd

NOTES:
Base Map: USGS Quadrangles
Ritter Ridge, Del Sur, Sleepy Valley, and Lancaster West
Coordinate System: UTM Zone 11N
Horizontal Datum: NAD 83

Amargosa Creek Watershed
Rain Gages

0 0.5 1 2 3 4
Miles

SAIC
From Science to Solutions

DATE: 10/03/08 | BY: J. Degner

FIGURE:
WAA-2

ATTACHMENT #3

ATTACHMENT #3

MUNICIPAL USE CONTINUED

Presented in Section 9e is a table showing the projected population and water use for the City of Palmdale. A portion of these diversion rates and annual use will be met from the diversion and recharge of Amargosa Creek flows. Because of the intermittent nature of Amargosa Creek flows, most of the City water demand is supplied through Los Angeles County Waterworks District No. 40 and Palmdale Water District.

ATTACHMENT #4

State Water Resources Control Board

Division of Water Rights
1001 I Street, 14th Floor ♦ Sacramento, California 95814 ♦ 916.341.5300
Mailing Address: P.O. Box 2000 ♦ Sacramento, California 95812-2000
FAX: 916.341.5400 ♦ www.waterrights.ca.gov

Alan C. Lloyd, Ph.D.
Agency Secretary

Arnold Schwarzenegger
Governor

APPLICATION NO. _____
(Leave blank)

ATTACHMENT #4
UNDERGROUND STORAGE SUPPLEMENT
to APPLICATION TO APPROPRIATE WATER BY PERMIT

1. **State amount of water to be diverted to underground storage from each point of diversion in item 3b of form APP.**
   a. Maximum Rate of diversions (1) 100 (2) _____ (3) _____ cfs
   b. Maximum Annual Amount (1) 2,700 (2) _____ (3) _____ acre-feet

2. **Describe any works used to divert to offstream spreading grounds or injection wells not identified in item 7 of form APP.**

The Collector Pipeline would extend from the Amargosa Creek Diversion to the off-channel recharge basins (Figure UGSTOR-1). The Collector Pipeline would be installed in a trench approximately 1,700 feet (ft) along the slope that flanks the northern edge of Amargosa Creek, passing beneath the 25th Street West Bridge and connecting to off-channel recharge basin 1.

The Balance Pipeline would then extend an additional 3,400 ft to convey water to each of the off-channel recharge basins. The pipeline would be buried within the northern perimeter berms of the recharge basins. The terminus of the pipeline, near the northeastern corner of the project site, would include a valve or gate structure to control return flows into Amargosa Creek. Each recharge basin would have 36 inch "feeder pipe" inlet from the Balance Pipeline and would include a valve or gate structure to control flow into the basins. This would allow each basin to operate independently such that it could be isolated from operations and left to dry for maintenance purposes while other basins continue to receive water. Each recharge basin would have engineered bank stabilization installed at the inflow gates and at the spillways into Amargosa Creek to control erosion.

The slope of Collector and Balance Pipelines would be designed to produce sufficient head for gravity flow and sufficient velocity to self-cleanse sediment from the pipeline with State Water Project (SWP) water. Manholes and/or cleanouts would be located at regular intervals to provide a secondary means of cleaning out sediment and provide access for inspections and maintenance.

3. **Describe spreading grounds and identify its location and number of acres or location of upstream and downstream limits if onstream.**

Two in-channel recharge basins would total approximately 5.4 acres. They would be created by two earthen or "sand" dams which would be approximately 300 ft in length and three ft in height. The dams would be located west of the 25th Street West Bridge downstream of the point of diversion. This is an area in which the stream reach is wide and would allow stream flow to be spread over a large area, increasing the time and area available for water to infiltrate and recharge the aquifer.

The off-channel recharge basins would be connected to the Collector and Balance Pipelines to allow delivery of SWP water and Amargosa Creek water. Three basins would be located east of 25th Street West (Recharge Basins 1, 2, and 3) and another three basins (Recharge Basins 4, 5, and 6) would be located within the northeastern portion of the project site. The off-channel recharge basins would be separated from Amargosa Creek by exterior berms and from one another by interior berms. Pipes with valves would be installed through the interior berms to control water flow between individual basins. Additional return flow pipes (one per basin) would be installed in the berms adjacent to the creek to permit excess water to return to the creek. Engineered bank stabilization would be installed on the discharge end of all return flow pipes to control erosion along Amargosa Creek. In addition, emergency spillways with erosion control features would be constructed on each of the exterior basin berms to permit overflow of excess water while preventing water from overtopping the berms to minimize the potential for berm damage and erosion.

4. **State depth of groundwater table in spreading grounds or immediate vicinity:** 345 **feet below ground surface on** December 2, 1941 **measured at a point located within the** SW ¼ **of** NW ¼ **of Section** 21 **,** T 6N **,** R 12W **,** S **B&M**

Note: Historical groundwater elevation measurements are limited near the spreading grounds. Monitoring well(s) will be constructed at the spreading ground to monitor the groundwater levels.

5. Give any historic maximum and or minimum depths to the groundwater table in the area.

Location: within the SW ¼ of _NW ¼ of Section 21, T 6N, R 12W, S B&M
Maximum 348.5 ft below ground surface on May 1, 1940
Minimum 345.3 ft bgs on December 2, 1941
Location: within the NE ¼ of NE ¼ of Section 21, T 6N, R 12W, S B&M
Maximum 401.5 ft bgs on November 20, 1962
Minimum 340 ft bgs on June 1, 1950

Note: The City of Palmdale has contracted the USGS to complete a gravity survey of the spreading grounds area to determine the depth to bedrock near the project site and will be collaborating with the USGS on monitoring wells near the site to determine the depth of the groundwater table.

6. Describe proposed spreading operation.

All basins would operate at full capacity when excess stormwater is available in order to capture the maximum practicable amount of water from Amargosa Creek. Thus, all basins would be prepared for winter stormwater diversions prior to the start of the rainy season. Typical stormwater flow rates for Amargosa Creek are large and brief. During these events, water would be diverted at a rate of up to 100 cfs and delivered into all basins until either the event ceases or until the basins are full. When stormwater flows are not present in Amargosa Creek, and SWP water is being diverted, the basins would periodically be rotated with one-third kept out of operation (dry) to provide for regular basin maintenance (removal of silt and weeds) and drying to maintain percolation rates while maximizing recharge.

7. Describe location, capacity and features of proposed pretreatment facilities and/or injected wells.

SWP water and diverted stormwater are anticipated to be of higher quality than current groundwater basin water quality. Thus, pre-treatment facilities and injection wells are not part of the project. Monitoring wells to be installed by the City and USGS will monitor for changes in groundwater quality.

8. Reference any available engineering reports, studies, or data on the aquifer involved.

California Department of Water Resources (DWR). February 2004. California's Groundwater Bulletin 118, South Lahontan Hydrologic Region, Antelope Valley Groundwater Basin.

United States Geologic Survey (USGS). 2003. Simulation of Ground-water Flow and Land Subsidence, Antelope Valley Ground-Water Basin, California.

USGS. 1995. Land Use and Water Use in the Antelope Valley, California. WaterResources Investigations Report 94-4208.

9. Describe underground reservoir and attach a map or sketch of its location.

The Antelope Valley Groundwater Basin is a large sediment-filled structural depression that is a down-faulted block between the Garlock and the San Andreas faults (Figure UGSTOR-2). The basin is filled with unconsolidated alluvium and lacustrine deposits. The fine-grained lacustrine deposits accumulated in a large lake or marsh that at times covered the area. Alluvial fans that formed by the deposition of eroding materials from the up-faulted block of the Sierra Pelona and San Gabriel Mountains encroached upon the ancient lake where the lacustrine deposits were accumulating, forcing the ancient lake and associated lacustrine deposits to the north and to its present location at Rosamond Dry Lake and Rogers Dry Lake (USGS 2003). These lacustrine deposits are overlain by as much as 800 ft of alluvium in the southern part of the Lancaster subunit near Palmdale and become progressively shallower northward, being exposed at the surface near the southern edge of Rosamond Dry Lake and Rogers Dry Lake. A cross-section of the subsurface geology underneath Amargosa Creek from the UAP to Rosamond Dry Lake was prepared from available well logs and borings and shows the dominant geologic features including the significant aquifers and aquitards (Figure UGSTOR-3).

The principal aquifer is unconfined alluvium mostly composed of unconsolidated sand and gravel that overlies ancient lake bed deposits. The closest well log to the UAP (approximately ½ mile downstream) shows bedrock at 285 ft bgs (2,425 ft elevation). Further downstream (1¼ mile downstream of UAP), bedrock occurs at 700 ft bgs (1,910 ft elevation), suggesting that the bedrock dips steeply from the southwest to the northeast. The unconfined principal aquifer reaches depths of 800 ft bgs downstream from the UAP. Below the unconfined alluvium is a series of clay layers deposited as an ancient lake bed with thickness ranging from 100 to 300 ft. The deep aquifer is confined below the ancient lake bed deposits and its depth is unknown. Approximately ten miles downstream of the UAP evidence of middle and upper lake beds occur in the lithologic logs. Near Avenue J, silts and clays begin to dominate the surface sediments based on the borehole data and the boundary of the playa deposits. The silts and clays are less permeable and impede seepage in the Amargosa Creek channel bed downstream of Avenue J.

10. State estimated storage capacity of underground reservoir.

The total storage capacity of the Antelope Valley Groundwater Basin has been reported at 68 million acrefeet in the DWR Groundwater Bulletin 118 for the Antelope Valley Groundwater Basin.

11. Describe existing use of the underground storage reservoir and any proposed change in its use.

Groundwater use of the Antelope Valley Groundwater Basin has been, and continues to be, an important resource within the Antelope Valley Region. The rapid increase in urban growth in the 1980s resulted in an increase in the demand for municipal and industrial (M&I) water and an increase in groundwater use. Projected urban growth and limits on the available local and imported water supply are likely to continue to increase the reliance on groundwater. Although the groundwater basin is not currently adjudicated, an adjudication process has begun and is in the early stages of development. Although there are no existing restrictions on groundwater pumping, pumping may be altered or reduced as part of the adjudication process.

12. Describe the proposed method and location of measurement of water placed into and withdrawn from underground storage.

Flow measurement devices would be installed at key locations in all water conveyance facilities to monitor flow rates into and out of the water conveyance system. Flow measurement devices would be located at the Upper Amargosa Creek Turnout, the Amargosa Creek Diversion, the Balance Pipeline return flow to Amargosa Creek, all recharge basin inflow and outflow facilities, and along Amargosa Creek upstream and downstream of the project area. The participating contractors will work with the operator of the UAP to deliver available SWP water in accordance with the priorities established in the agreements that govern UAP operations. The UAP will maintain daily delivery records of the amount of water delivered by each participant and will provide a monthly summary to each. An annual report of all recharge activities will be prepared and submitted to all participants. It is anticipated that each participant will report their extractions from the "banked" water so cumulative storage values can be reported in the annual report. Extraction of the water banked in the Upper Amargosa Project is the responsibility of the project participants. The operation of the project itself, including extraction of water recharged to the basin will be subject to conditions imposed by the Court in connection with the ongoing adjudication.

Upper Amargosa Project
- Groundwater Recharge Facilities -

- Project Boundary (87 acres)
- Recharge Basin (20 acres)
- Nature Park (28 acres)
- Native Hab. Conserv. (22 acres)
- Open Stream Channel (7 acres)
- Unclassified (10 acres)
- Push-Up Dam
- Conveyance Pipe
- Storm Drain with Outlet Structure
- Basin Inlet Pipe/Valve with Flow Measurement
- Interpond Pipe/Gate/Weir with Flow Measurement
- Return Flow Pipe/Gate/Weir with Outlet Protection/Flow Measurement
- Stream Diversion Intake Structure/Headgate
- Flow Measurement Device

0 250 500 750 1,000
Feet

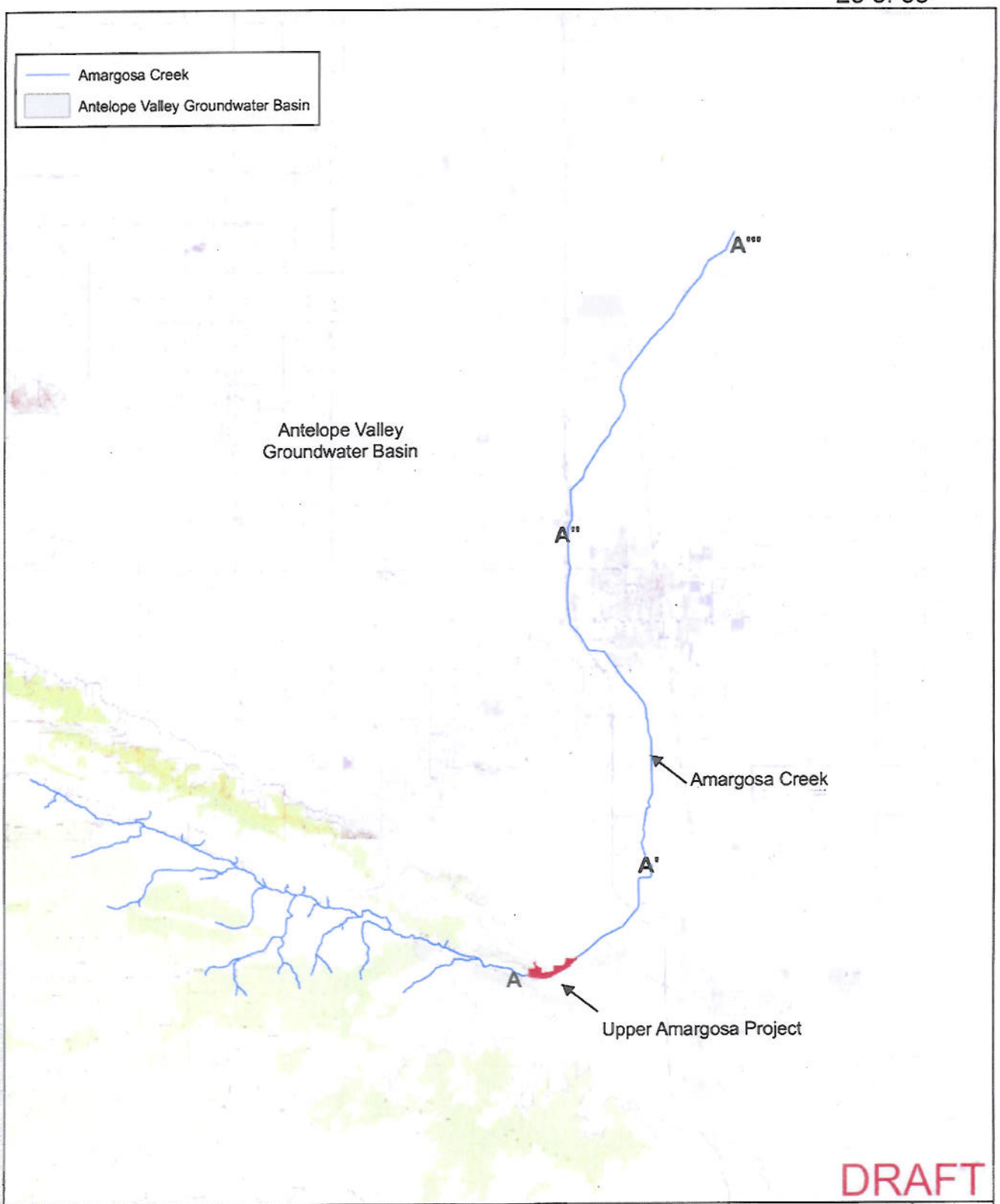
N

NOTES:
Coord Sys: State Plane NAD 83 Zone 5 U.S. Foot
Basemap: LARIAC 4-in resolution Airphoto, 2006

REGISTERED PROFESSIONAL ENGINEER ROBERT GLENN BEEBY No. 20997 Exp. 9/30/09 CIVIL STATE OF CALIFORNIA

SAIC® From Science to Solutions

FIGURE:	UGSTOR-1
DATE: 12/31/08	BY: D Beckwith



DRAFT

NOTES:
Coordinate System: UTM Zone 11N
Horizontal Datum: NAD 83
Topo Map: USGS 24K
Qpl - Ponti and Others

Antelope Valley Groundwater Basin

0 0.5 1 2 3 4
Miles

SAIC
From Science to Solutions

DATE: 12/31/08 BY: D Beckwith

FIGURE:
UGSTOR-2

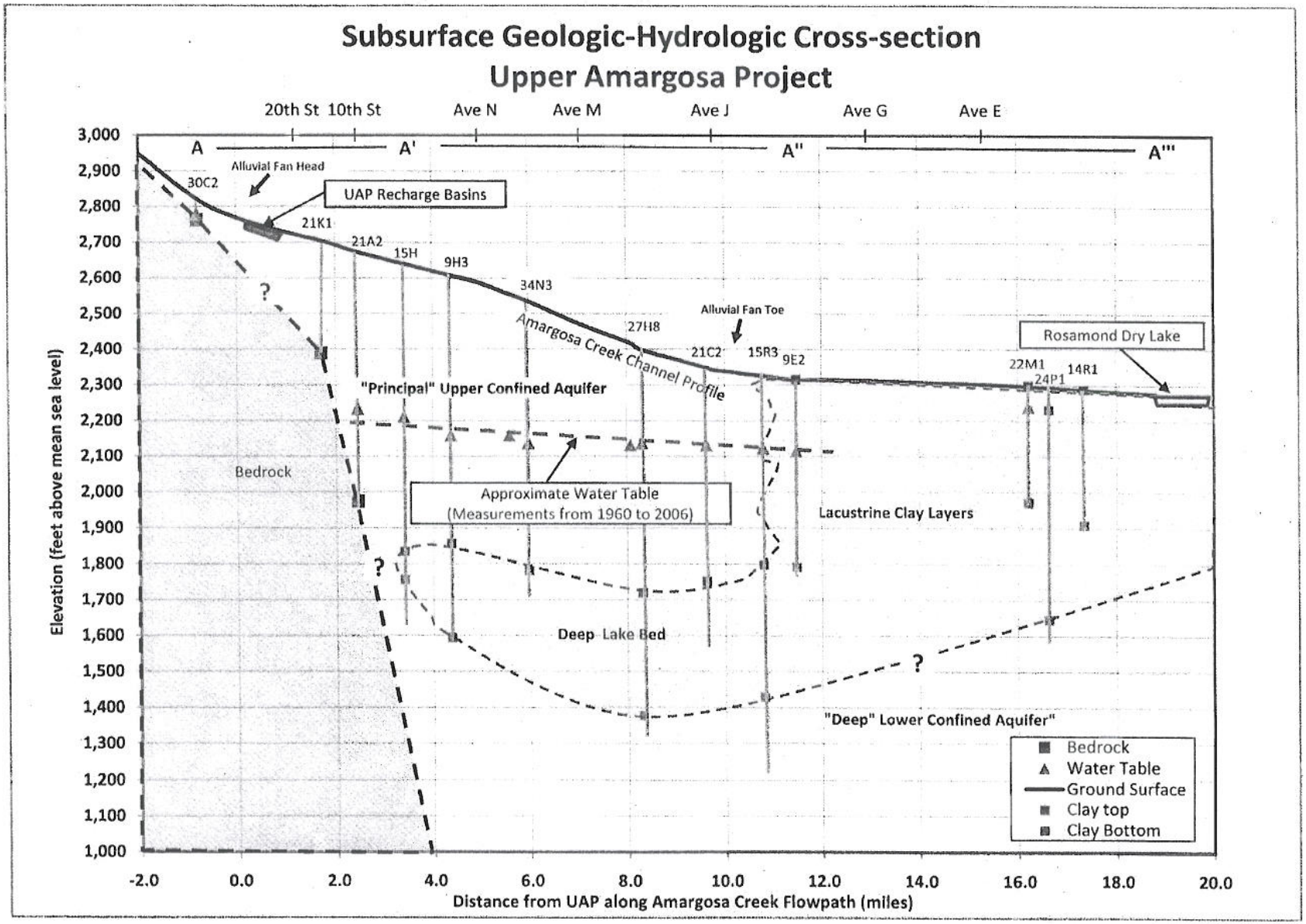


Figure: UGSTOR-3

Amargosa Creek Aquifer Storage

Amargosa Creek Recharge Project

- Recharge Basins
- 2005 Ground Water Elevation (ft)
- Place of Use - City of Palmdale
- Amargosa Creek
- Stream Diversion Intake Structure/Headgate

(1) Point of Diversion
CA Zone 5 NAD83 Feet
2035088N, 6507814E

Aquifer and Diversion Totals
Estimated Aquifer Storage Capacity: 103,500 AF
Estimated Annual Diversion: 2,800 AF

0 2 4 6 8
Miles

N

NOTES:
Coord Sys: State Plane NAD 83 Zone 5 U.S. Foot

REGISTERED PROFESSIONAL ENGINEER
ROBERT GLENN BEERY
No. 20997
Exp. 12/31/09
CIVIL
STATE OF CALIFORNIA

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ATTACHMENT
UGSTOR-4

DATE: 12/31/2008 | BY: C Woods

ATTACHMENT #5

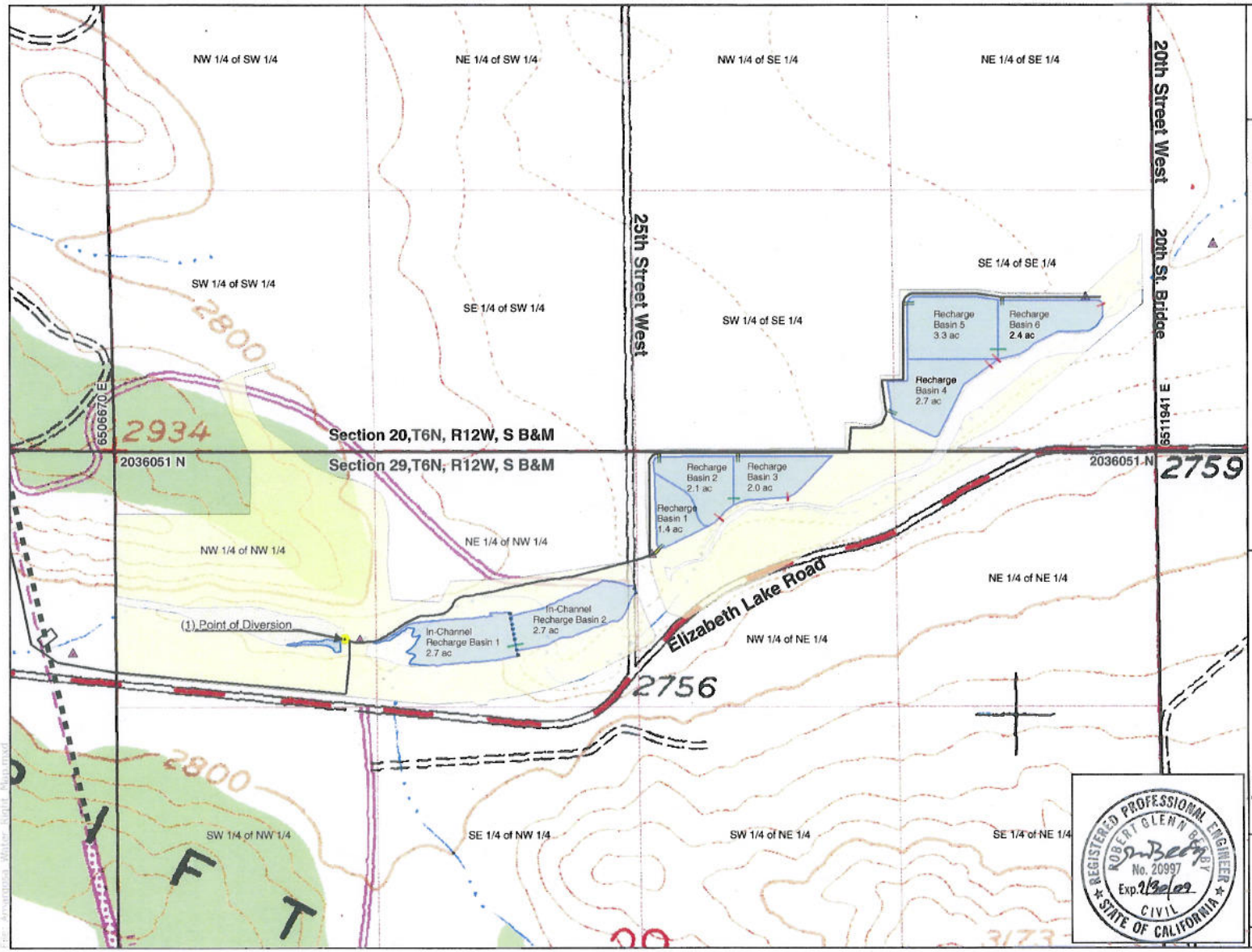
ATTACHMENT #5
Demand above POD

POD#1 – Point of Diversion . Licensed appropriative water rights in the Amargosa Creek watershed upstream from POD#1

Application ID	Holder Name	Date	Face Amt (AFY)	Max Direct Diversion (MDD)	MDD (in AFY)
(1)	(2)	(3)	(4)	(5)	(6)
A000016	LILAC HILLS ESTATES LP	2/19/1915	18.1	0.025 cfs	18.1
A001136	CITY OF LOS ANGELES DWP	12/5/1918	72.4	0.1 cfs	72.4
A003739	JOHN LOWE	12/3/1923	0	1950 gal/day	2.2
A004773	RONALD C HOWELL	9/15/1925	0	2400 gal/day	2.7
A005759	CITY OF LOS ANGELES DWP	11/17/1927	25.3	0.035 cfs	25.4
A006056	STEPHEN S CHANG	9/17/1928	16.7	15000 gal/day	16.8
A006625	STANLEY FIRESTONE	4/7/1930	0	10000 gal/day	11.2
A001137	CITY OF LOS ANGELES DWP	12/7/1938	36.2	0.05 cfs	36.2
A010464	FRANCISCO CELEDON	5/19/1942	11.6	0.016 cfs	11.6
A017426	LILAC HILLS ESTATES LP	1/18/1957	0	1440 gal/day	1.6
A022700	BRYAN BOBROSKY	2/14/1967	0	300 gal/day	0.3
A027457	AVELINO GONZALES	7/27/1982	0.3	750 gal/day	0.8
		Sum =	180.6	Sum =	199

State Water Resources Control Board eWRIMS Database (SWRCB). Accessed January 6, 2009. http://www.waterboards.ca.gov/ewrims/

ATTACHMENT #6



Amargosa Creek Project Map

Amargosa Creek Recharge Project - Conceptual Design -

- Project Area
- Recharge and Settling Basin
- Gravel Push-Up Dam
- Conveyance Pipe
- Stream Diversion Intake Structure/Headgate

(1) Point of Diversion
CA Zone 5 NAD83 Feet
2035088N, 6507814E

0 250 500 750 1,000
Feet

N

NOTES:
Coord Sys: State Plane NAD 83 Zone 5 U.S. Foot

REGISTERED PROFESSIONAL ENGINEER
ROBERT GLENN BECKBY
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Exp. 2/30/09
CIVIL
STATE OF CALIFORNIA

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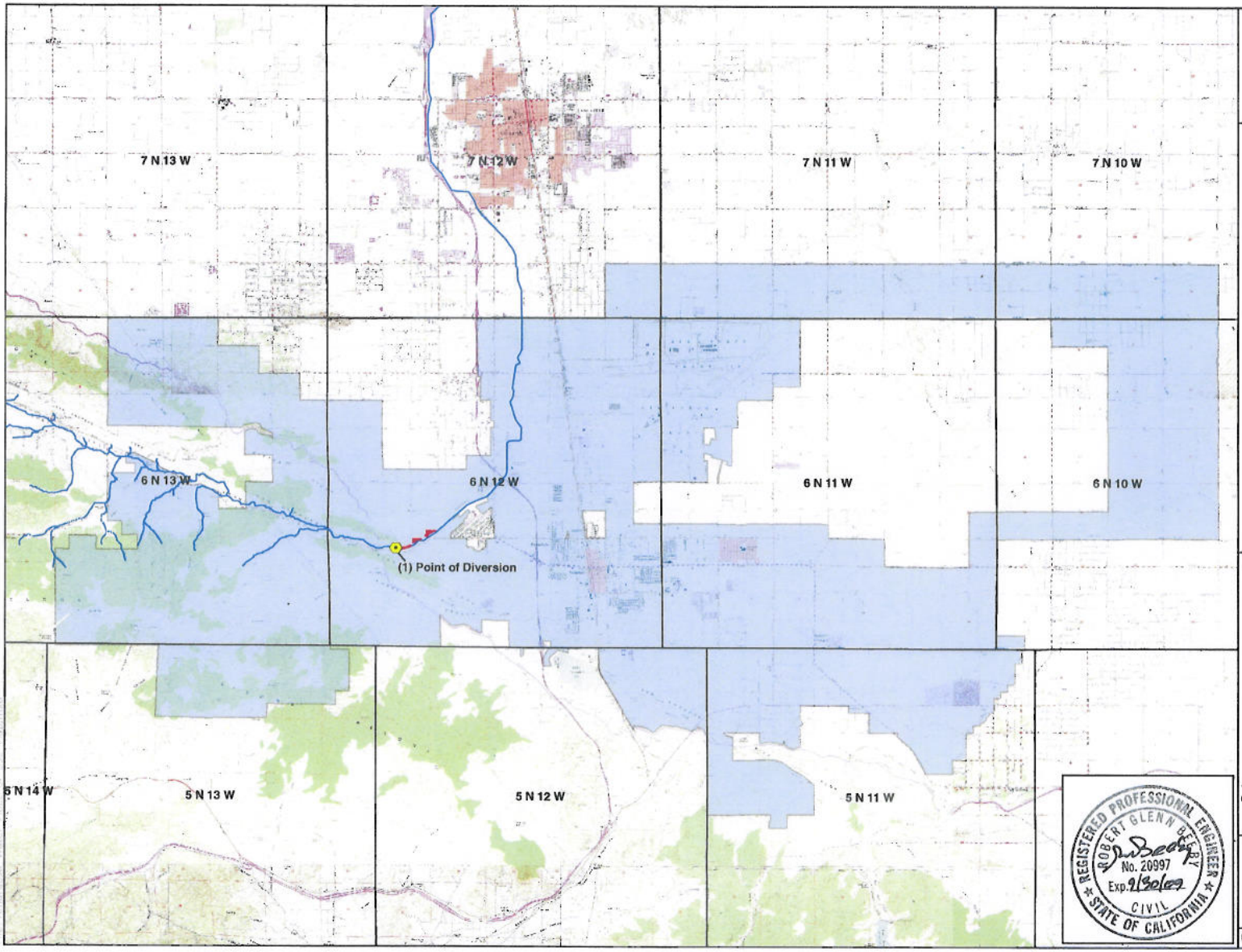
DATE: 12/31/2008 | BY: C Woods

ATTACHMENT
6A



Amargosa Creek Place of Use

Amargosa Creek Recharge Project

- Amargosa Creek
- Recharge Basins
- Township and Range
- Place of Use - City of Palmdale
- Stream Diversion Intake Structure/Headgate

(1) Point of Diversion
CA Zone 5 NAD83 Feet
2035088N, 6507814E

0 1 2 3 4
Miles

N

NOTES:
Coord Sys: State Plane NAD 83 Zone 5 U.S. Foot

REGISTERED PROFESSIONAL ENGINEER
ROBERT GLENN BERRY
No. 20997
Exp. 9/30/09
CIVIL
STATE OF CALIFORNIA

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DATE: 03/06/2009 | BY: C.Woods

ATTACHMENT
6B
(Revised)

ATTACHMENT #7

ATTACHMENT #7

Point of Diversion

Proposed POD is on river left, immediately upstream of rip rap armoring. October 2007.

Point of Diversion – Downstream

Looking east, 25th Street Bridge in background at left. June 2008.

Point of Diversion – Upstream

Looking west, California Aqueduct Leona Siphon passes from upper right across the valley. June 2008.

Off-channel Recharge Basin 1

Looking north from south side of creek, Basin 1 is adjacent 25th Street. October 2007.

Off-channel Recharge Basin 2

Looking north from south side of creek, Basin 2 would be sited in scrub. October 2007.

Off-channel Recharge Basin 3

Looking north from south side of creek, Basin 3 would be sited in scrub on river left. October 2007.

ATTACHMENT #7

Point of Diversion

Proposed POD is on river left, immediately upstream of rip rap armoring. October 2007.

Point of Diversion – Downstream

Looking east, 25th Street Bridge in background at left. June 2008.

Point of Diversion – Upstream

Looking west, California Aqueduct Leona Siphon passes from upper right across the valley. June 2008.

Off-channel Recharge Basin 1

Looking north from south side of creek, Basin 1 is adjacent 25th Street. October 2007.

Off-channel Recharge Basin 2

Looking north from south side of creek, Basin 2 would be sited in scrub. October 2007.

Off-channel Recharge Basin 3

Looking north from south side of creek, Basin 3 would be sited in scrub on river left. October 2007.