Attachment C.

Groundwater Evaluation Technical Memorandum

Environment

Prepared for:
County of San Diego

Prepared by:
AECOM
San Diego, CA
July 2018

Groundwater Evaluation Technical Memorandum

El Monte Sand Mine Project, Lakeside, San Diego County, California

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ACRONYMS AND ABBREVIATIONS

afy	acre-feet per year
amsl	above mean sea level
APN	Assessor's Parcel Number
bgs	below ground surface
CEQA	California Environmental Quality Act
CIMIS	California Irrigation Management Information System
CN	curve number
CNM	curve number method
DTW	depth to water
ET	Evapotranspiration
ETo	reference evapotranspiration
HWD	Helix Water District
MCL	maximum contaminant level
mg/L	milligram per liter
N	Nitrogen
NRCS	Natural Resources Conservation Service
PET	potential evapotranspiration
RO	run-off
S	Soil moisture retention
SMC	soil moisture-holding capacity
SWRCB	State Water Resources Control Board
USDA	United States Department of Agriculture
USGS	United States Geological Survey

Figures

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1.0 Executive Summary

The proposed El Monte Sand Mine Project (project) covers approximately 479.5 acres and is located downstream of the El Capitan Reservoir in San Diego County. The project proposes to mine and export sand and will result in an estimated 228-acre reclaimed mining pit with maximum depths of 33 to 41 feet below ground surface.

Table 1-1: Proposed Activities and Areas of Disturbance

Activity	Area of Disturbance (acres)*
Mining Area (including trails, filled depression, and drop structure within mining footprint)	228
Northern Staging Area	8
Southern Staging Area	7
Subtotal Inside Mining Footprint	*243*
Trails (outside of mining area)	7
Fuel Modification (outside of mining area and not including trails	12
Subtotal Outside Mining Footprint	*19*
Impact Area Total	**262**
Open Space	217.5
MUP Boundary Total	**479.5**

*rounded to the nearest acre
Source: ESA 2018

The project will not use onsite surface water or groundwater per se, but will result in changes to the "water budget" as a consequence of the reclaimed pit topography. These include: 1) inflow of rainfall that runs off from upgradient in the watershed and runs into the pit, 2) potential evaporation losses if exposed water stands within the reclaimed pit, and 3) potential changes in the amount of evapotranspiration from on-site groundwater-dependent habitat. Based on our evaluation, the project is expected to result in a net-benefit to the groundwater system.

2.0 Site Background Information

2.1 Purpose

The purpose of this report is to document the existing groundwater resources of the El Monte Sand Mine Project (project) site and to evaluate potential impacts to groundwater resources as a result of the final configuration of the pit. The report will also document the existing conditions and, if necessary, recommend measures to avoid, minimize, and/or mitigate significant impacts consistent with federal, state, and local rules and regulations including California Environmental Quality Act (CEQA).

2.2 Applicable Groundwater Regulations

CEQA requires the review of all discretionary projects as defined within Section 21080 of CEQA. The project requires discretionary approval from the County of San Diego, and as a result, this evaluation has been completed. This groundwater investigation was performed in conformance with the County's Guidelines for Determining Significance and Report Format and Content Requirements – Groundwater Resources (Guidelines) (County 2007).

2.3 Project Location and Description

The proposed project covers approximately 479.5 acres located parallel to and between El Monte Road and Willow Road downstream of the El Capitan Reservoir in San Diego County (Figure 1). The project site is located on Assessor's Parcel Numbers (APNs) 390-040-51, 391-061-01, 391-071-04, 392-050-47, 392-060-29, 392-130-42, 392-150-17, and 393-011-01.

The tributary watershed area is about 8,862 acres and is located in portions of the San Vicente Reservoir, El Cajon, Alpine and El Cajon Mountain, California, U.S. Geological Survey (USGS) 7.5-minute quadrangles.

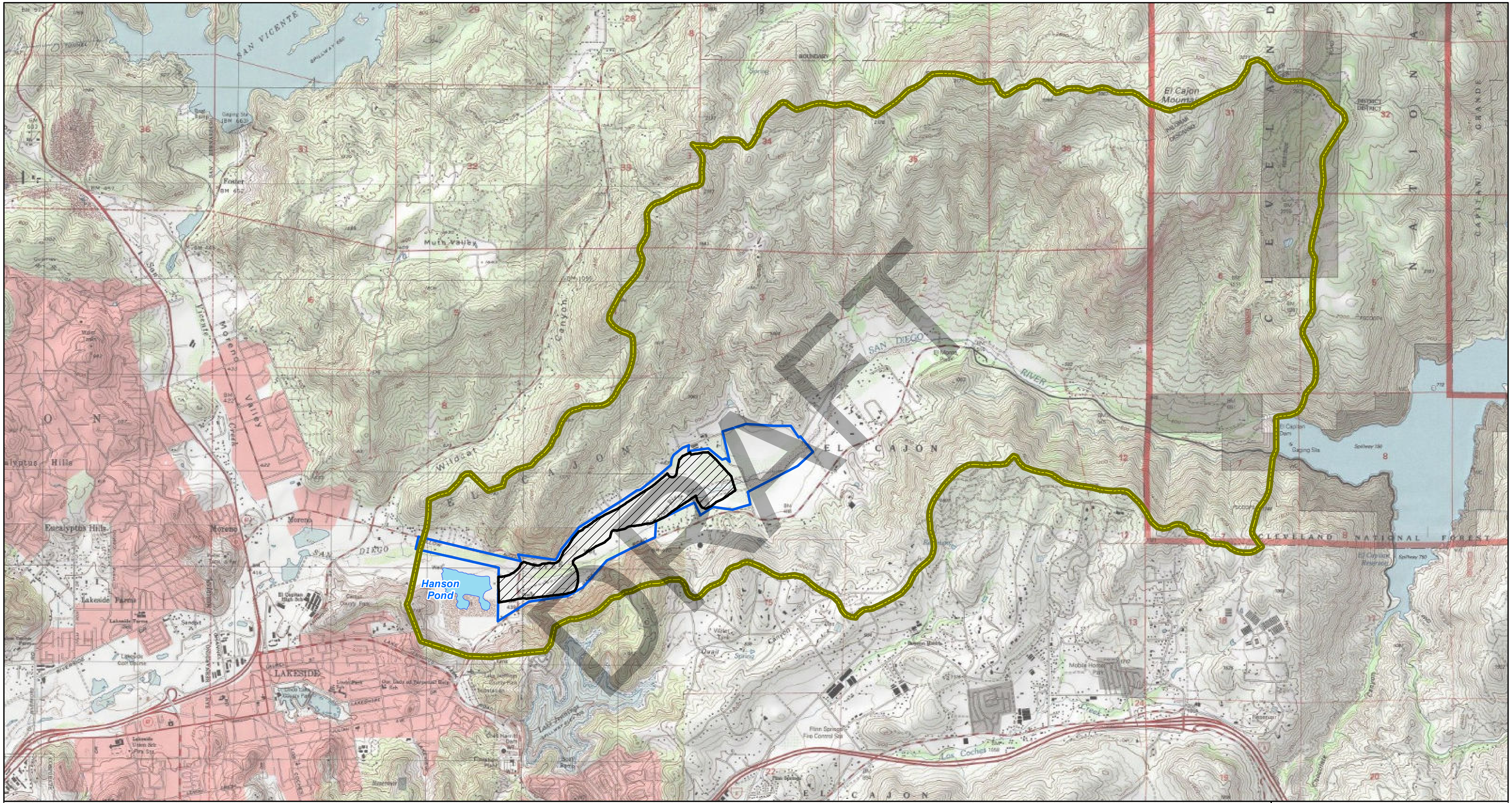
The project proposes to mine sand suitable for Portland cement concrete over an extended period of several designated phases. Excavation of an estimated 228-acre pit area will be to a maximum depth of 33 to 41 feet below ground surface (bgs). The Reclamation Plan estimates about 479.5 acres will be phased with mining operations and will be initiated immediately after the conclusion of resource extraction in an area of the project (EnviroMine, AECOM, and ESA 2017).

The anticipated maximum rate of aggregate production is 1.1 million tons per year. This production rate will be realized after 1 to 3 years of site and market development. Actual production rates and project life will depend on market demand but will not exceed the maximum permitted production level. The project is expected to continue for 16 years. This will include 12 years of extraction and reclamation of previously disturbed areas beginning in year 4. Final reclamation of the Phase 4 area and vegetation monitoring will continue for 4 years after cessation of mining. The site is designed to yield approximately 12.5 million tons of construction aggregate product.

The proposed project will not use groundwater directly. Any water needed for mining operations and habitat establishment will be imported.

If enough water runs off surrounding slopes of the tributary watershed and/or water is released from the El Capitan Reservoir during flood events, a pond would form in the pit. If the pit is filled to capacity, the water in the pit would be a maximum of 25 feet deep at the west end and impound 75 acres of surface water. This would equate to roughly 2,000 acre feet of water stored in the pit onsite [Wayne Chang, Chang Consultants, email communication, July 16, 2018].

The end use in the project area is proposed to be undeveloped open space with recreational trail easements.



Legend

Tributary Watershed Area

Project Boundary

Pit Boundary

Notes:
Watershed boundaries only show those within the project vicinity.

N

0 3,000 6,000
Feet

Figure 1
Tributary Watershed Boundary and Proposed Project

El Monte Sand Mine Project
San Diego, Ca

AECOM
September 2017

Path: L:\ENV\ArcGIS\Shell\Criterion Catalysts\Updated MXDs\Figure 2 Watershed Boundary Proposed Project.mxd

3.0 Existing Conditions

The following paragraphs describe the regional topography, geology, and hydrogeology of the project site.

3.1 Topographic Setting

The site is situated within the San Diego River watershed, in the floodplain. The river flows through the central part of the project. It is located parallel to and between El Monte Road and Willow Road in Lakeside, California; an unincorporated area of San Diego County.

The project site is relatively flat; but grading activities associated with the development of an unfinished golf course in 2005–2006 have created undulating terrain in the eastern portion of the property. This area includes several large pits. Elevations range from approximately 490 feet above mean sea level (amsl) at the eastern portion of the property to approximately 430 feet amsl at the western end of the site. Elevations within the excavation area range from approximately 430 feet amsl to 475 feet amsl. The San Diego River extends in a general east-west direction and consists of a low-flow channel and associated floodplain.

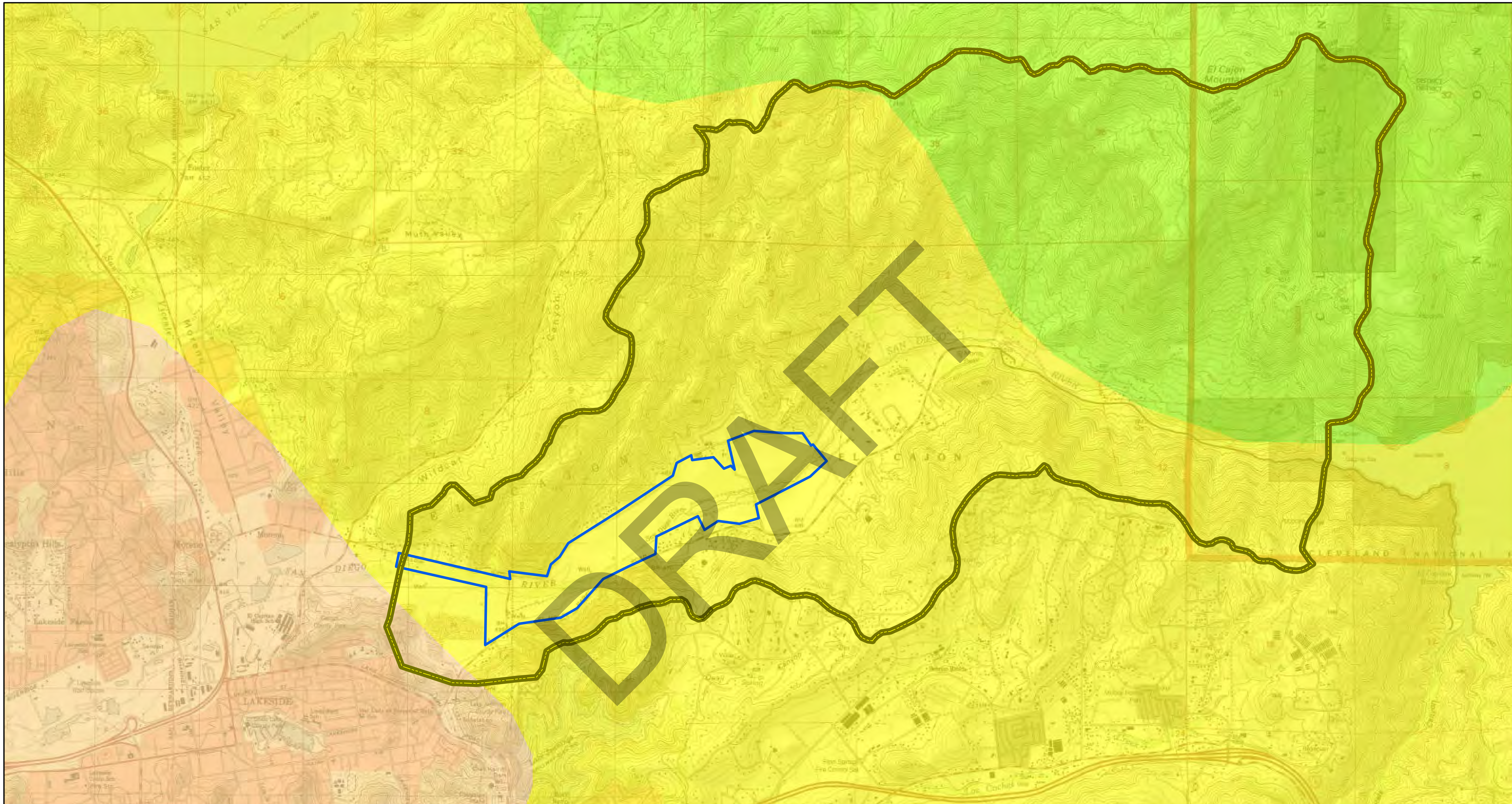
3.2 Climate

Precipitation

Precipitation data were collected from two rainfall gauges within the general area of the project: El Capitan Reservoir rainfall station and Lake Jennings rainfall station. The El Capitan Reservoir provided the majority of the data, with the Lake Jennings Reservoir supplementing the gaps. Complete monthly data were available from at least one of the two gauges for the rainfall years (July through June) 1974/1975 through 2014/2015 with the exception of one month. In that case, a single monthly data point was used from the Alpine rainfall station for December 1997.

The El Capitan rainfall station is located on the eastern edge of the tributary watershed at an elevation of approximately 600 feet amsl. The Lake Jennings rainfall station is located 0.75 miles south of the watershed at an approximate elevation of roughly 700 feet amsl. The Alpine rainfall station is located approximately four miles to the southeast of the project area watershed at an elevation of approximately 500 feet amsl. The average annual rainfall between the El Capitan and Lake Jennings rainfall stations (and one month's data from Alpine) was about 16 inches per year over the last 40 years, and has ranged between 5 and 31 inches.

According to the County's *Groundwater Limitations and Precipitation Map* (County 2004), the project site and the study area are located in the 15-to-18-inch and 18-to-21-inch mean annual rainfall belts (Figure 2).



Legend

Tributary Watershed Area

Project Boundary

Precipitation (Inches)
County of San Diego/SanGIS 2009)

3 - 6	15 - 18	27 - 30
6 - 9	18 - 21	30 - 33
9 - 12	21 -24	33 - 35
12 - 15	24 - 27	

Notes:
Watershed boundaries only show those within the project vicinity.

N

0 3,000 6,000
Feet

Figure 2
County Groundwater Limitations and Precipitation Map

El Monte Sand Mine Project
San Diego, Ca

AECOM
September 2017

Path: P:\ENV\60480712 El Monte\GIS_CAD\MXDs\Sand Extraction Nature Project Report\Figure 3 County Groundwater Limitations and Precipitation Map.mxd

Evapotranspiration

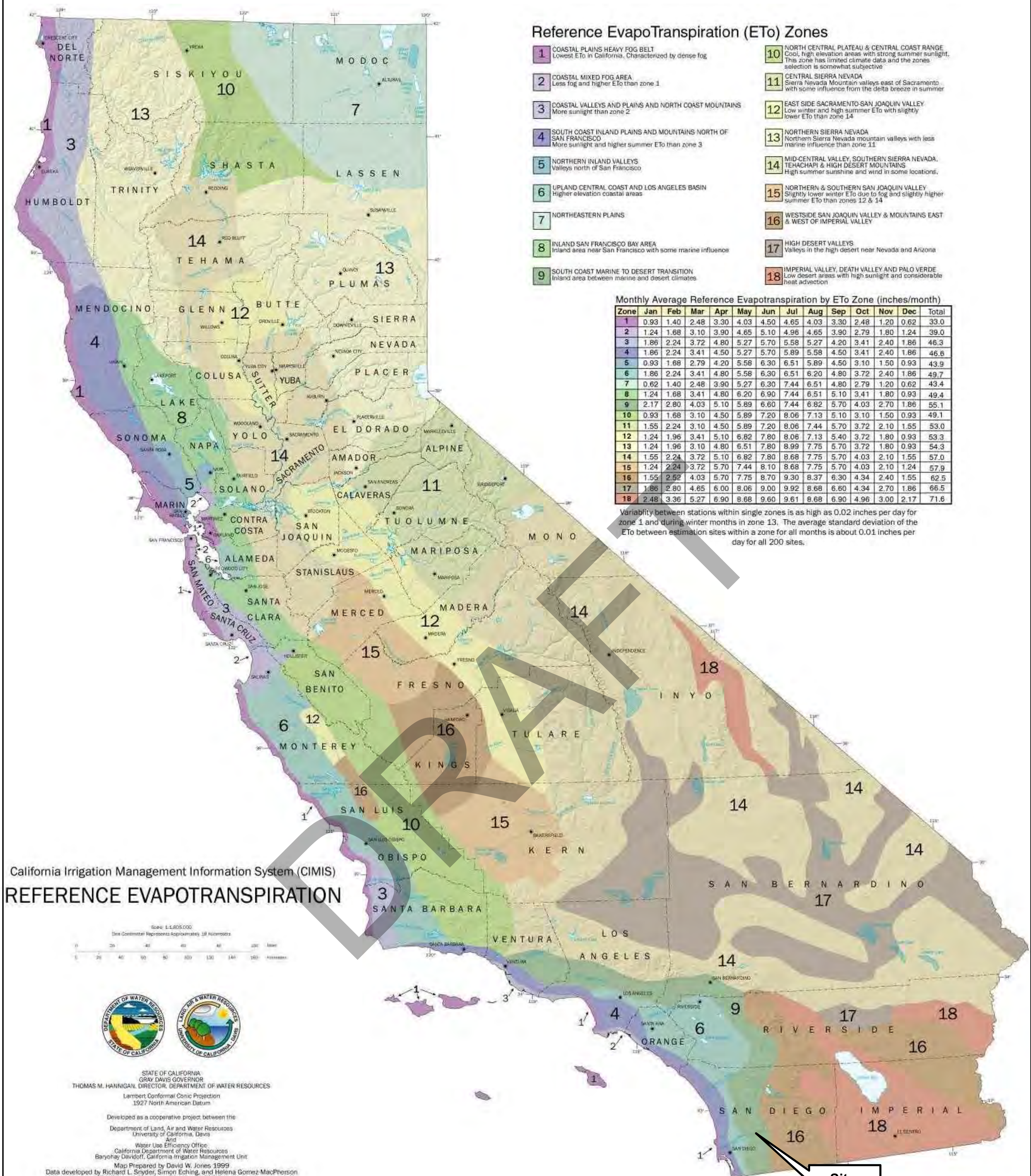
Potential evapotranspiration (PET) is the amount of water that could be evaporated and transpired typically through an irrigated nonspecific short green crop, if there was sufficient water available. Evapotranspiration is defined as the sum of water loss from evaporation from soil and plant surfaces, and plant transpiration. Reference evapotranspiration rates (ET_O), obtained from the California Irrigation Management Information System (CIMIS) ET_O map is a measure of PET from a known surface, such as grass or alfalfa (State of California 1999). The ET_O for this zone (Zone 9) is 55.1 inches as shown on Figure 3 and Table 1.

Evaporation

The reported average (1935 to 2005) annual pan-corrected evaporation rate of 54.63 inches, from the El Capitan Reservoir is also provided on Table 1. El Capitan Reservoir, located approximately 4 miles east of the project site, is within the same CIMIS Zone (Zone 9). Evaporation from the reservoir is reasonable to approximate on-site evaporation from standing water in the proposed excavation pit.

Table 1. Evaporation and Reference Evapotranspiration Rates

	JUL	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**TOTAL**
ET_O (inches)	7.44	6.82	5.70	4.03	2.70	1.86	2.17	2.80	4.03	5.10	5.89	6.60	55.1
Pan-Corrected Evaporation (inches)	7.54	7.37	6.29	4.81	3.13	2,27	2.03	2.13	2.87	4.20	5.41	6.58	54.6



Monthly Average Reference Evapotranspiration by ETo Zone (inches/month)

Zone	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	0.93	1.40	2.48	3.30	4.03	4.50	4.65	4.03	3.30	2.48	1.20	0.62	33.0
2	1.24	1.68	3.10	3.90	4.65	5.10	4.96	4.65	3.90	2.79	1.80	1.24	39.0
3	1.86	2.24	3.72	4.80	5.27	5.70	5.58	5.27	4.20	3.41	2.40	1.86	46.3
4	1.86	2.24	3.41	4.50	5.27	5.70	5.89	5.58	4.50	3.41	2.40	1.86	46.6
5	0.93	1.68	2.79	4.20	5.58	6.30	6.51	5.89	4.50	3.10	1.50	0.93	43.9
6	1.86	2.24	3.41	4.80	5.58	6.30	6.51	6.20	4.80	3.72	2.40	1.86	49.7
7	0.62	1.40	2.48	3.90	5.27	6.30	7.44	6.51	4.80	2.79	1.20	0.62	43.4
8	1.24	1.68	3.41	4.80	6.20	6.90	7.44	6.51	5.10	3.41	1.80	0.93	49.4
9	2.17	2.80	4.03	5.10	5.89	6.60	7.44	6.82	5.70	4.03	2.70	1.86	55.1
10	0.93	1.68	3.10	4.50	5.89	7.20	8.06	7.13	5.10	3.10	1.50	0.93	49.1
11	1.55	2.24	3.10	4.50	5.89	7.20	8.06	7.44	5.70	3.72	2.10	1.55	53.0
12	1.24	1.96	3.41	5.10	6.82	7.80	8.06	7.13	5.40	3.72	1.80	0.93	53.3
13	1.24	1.96	3.10	4.80	6.51	7.80	8.99	7.75	5.70	3.72	1.80	0.93	54.3
14	1.55	2.24	3.72	5.10	6.82	7.80	8.68	7.75	5.70	4.03	2.10	1.55	57.0
15	1.24	2.24	3.72	5.70	7.44	8.10	8.68	7.75	5.70	4.03	2.10	1.24	57.9
16	1.55	2.52	4.03	5.70	7.75	8.70	9.30	8.37	6.30	4.34	2.40	1.55	62.5
17	1.86	2.80	4.65	6.00	8.06	9.00	9.92	8.68	6.60	4.34	2.70	1.86	66.5
18	2.48	3.36	5.27	6.90	8.68	9.60	9.61	8.68	6.90	4.96	3.00	2.17	71.6

Variability between stations within single zones is as high as 0.02 inches per day for zone 1 and during winter months in zone 13. The average standard deviation of the ETo between estimation sites within a zone for all months is about 0.01 inches per day for all 200 sites.

Figure 3
CIMIS ETo Map

El Monte Sand Mine Project
San Diego, Ca

AECOM
September 2017

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3.3 Land Use

Existing land uses within the 8,862-acre tributary watershed area were evaluated by review of current aerial photographs, the Land Use Element of the San Diego County General Plan/Lakeside Community Plan, recorded subdivision maps, and approved Specific Plans. The proposed project site represents approximately 5% of the tributary watershed surface area.

Many factors contribute to the ultimate land use for a vacant general plan land use designated property, including environmental constraints, access, slope, geotechnical considerations, wildfire hazard, and utility availability. Many of the parcels included in the tributary watershed area have already been developed with residential, agriculture, an equestrian facility, or recreational land uses. Large areas of the watershed are in public ownership and/or in permanent conservation/recreation areas. Approximately 4,744 acres (54%) of the watershed area are located within designated open space or public agency lands, and it is assumed that these lands will not be developed.

3.4 Current Water Demand

Total groundwater demands within the tributary watershed over the 40+ years from 1974/1975 to 2016/2017 have been estimated to range from about 1,240 acre feet per year (afy) to about 2,300 afy with a 40-year average annual groundwater demand of about 1,700 afy.

Current annual groundwater consumption within the study area includes residential water usage; Helix Water District (HWD) pumping; City of San Diego pumping; County of San Diego pumping for El Monte County Park; agricultural irrigation, transpiration of groundwater-dependent vegetation (phreatophytes), and surface water evaporation in Hanson Pond. Evapotranspiration losses from native vegetation (non-groundwater-dependent habitat) are accounted for in calculating groundwater recharge from rainfall.

Annual groundwater consumption within the study area over the last 40 years has fluctuated based on area-wide water levels affecting pond evaporation and phreatophyte demand, increase in residential water demand and corresponding decrease in agricultural irrigation, and changes in HWD and City of San Diego pumping. HWD pumping in the basin has varied historically from 0 to 446 afy. The City of San Diego has installed two wells downgradient of the El Capitan Dam. They began pumping one of the wells in 2013 and plan to bring the other online in the coming year. In the future, the City plans to pump these wells whenever water is being transferred from the El Capitan Reservoir to one of its surface water treatment plants via the existing raw water line located in El Monte Road. The County of San Diego receives raw water for irrigation of the El Monte Regional Park from the City of San Diego. The County of San Diego provides water for potable uses to the park from two wells located north of the park. This system is regulated by the County of San Diego Department of Environmental Health Small Water Systems program.

3.5 Geology and Soils

General

The proposed project is located in a complex geologic region that is part of the Peninsular Ranges Geomorphic Province. Prominent in the watershed are metavolcanics, monzogranite, and a few types of tonalite. The steep side slopes are underlain by exposed bedrock.

Bedrock underlying the study area has a mantle of weathered rock known as residuum or colloquially "decomposed granite," which is formed from the in-place chemical weathering of rock. The contact between the residuum and the unweathered bedrock varies throughout the area. In general, weathering is deeper in flat and valley bottom areas, and thinner in steeper upland areas; however, there are many exceptions to this generalization.

The El Monte Basin floor consists of recent alluvium including sand, silt, and gravel in the modern streambed. Recent alluvium is derived by weathering and erosion of granitic rock along the valley slopes and deposited by the San Diego River and tributary streams.

Colluvium, which is derived by rock falls and erosion which accumulates at the base of the slopes, as well as the alluvium underlie the San Diego River valleys and tributary.

Surficial Soils

Based on the San Diego Area Soil Survey (United States Department of Agriculture [USDA] 1973), soils that underlie the study area are grouped and described as follows:

Soil Group A

Comprising Riverwash, Stony land, and Tujunga sand with a slope of 0–5%, these soils underlie about 19% of the basin and are found primarily in the valley floor. This group has high infiltration and permeability rates with a low run-off potential.

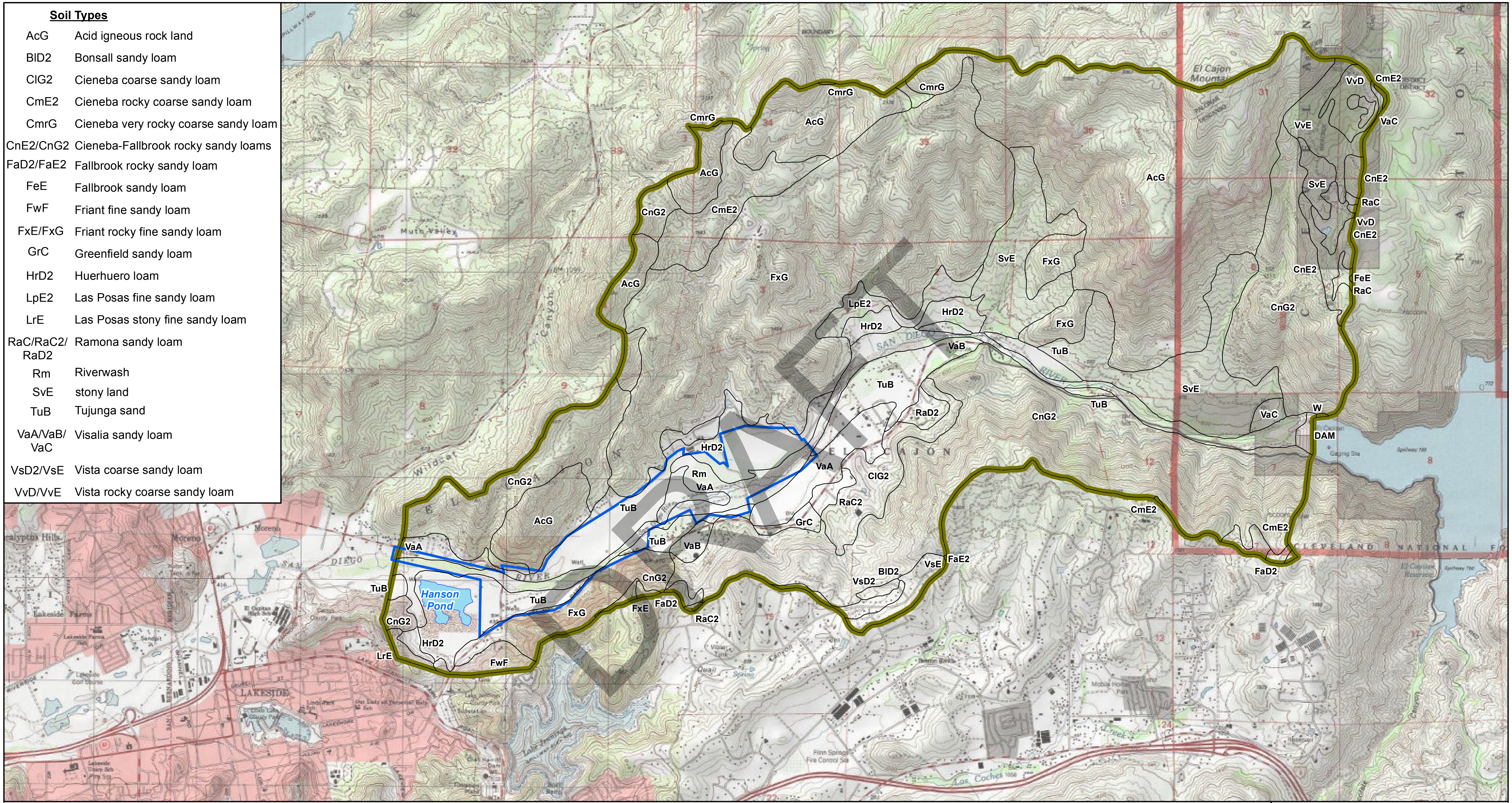
Soil Groups B/C

This group is a combination of soil types B and C and consists primarily of the Cieneba series, with smaller areas of the Greenfield, Visalia, Vista, Fallbrook and Ramona series. These soils underlie about 34% of the basin. These soils are variably shallow to steep rocky sandy loam, and have a moderate to low infiltration rate. These soil groups were combined into one because there was very little soil type C.

Soil Group D

Comprised primarily of Acid igneous rock land and the Friant series with minimal sections of Bonsall sandy loam, Huerhuero loam, and the Las Posas series, this group underlies about 47% of the basin and has a high run-off potential with very low infiltration rates.

A soils map is provided as Figure 4.



Legend

- Tributary Watershed Area
- Project Boundary
- USDA Soil Type Boundaries

N

0 3,000 6,000
Feet

Notes:
Watershed boundaries only show those within the project vicinity.

Figure 4
USDA Soil Types

El Monte Sand Mine Project
San Diego, Ca

AECOM
September 2017

Path: P:\ENV\60480712 El Monte\GIS_CAD\MXDs\Sand Extraction Nature Project Report\Figure 5 USDA Soil Types.mxd

3.6 Hydrogeologic Units

Aquifer watershed boundaries are generally assumed coincident with surface topographic boundaries. The proposed project area is part of the larger El Monte Basin watershed and begins at the toe of the El Capitan Dam on the east and exits to the larger San Diego River watershed to the west. The upper reaches of the watershed were artificially cut off from the downstream portions by the construction of the dam in 1935. The El Monte (907.15), Santee (907.12), and Coches (907.14) Hydrologic Subareas compose the eastern end of the San Diego River hydrologic unit (907.00) as defined in California Regional Water Quality Control Board Basin Plan (RWQCB 1994).

Groundwater levels in upland areas are generally deeper than the alluvium, colluvium, and/or residuum contact with bedrock, therefore fractured bedrock represents the only viable water-bearing unit in side slopes of the study area. Because water can only occupy the fractures (joints and/or faults) in the unweathered rock, specific yields (essentially equivalent to the interconnected [or effective] porosity) in this rock are generally lower than in residuum and alluvium. Specific yields in fractured rock wells are generally reported on the order of 10^{-6} to 10^{-2} (0.0001% to 1%). Specific yield values of 10^{-4} and 10^{-3} (0.01% and 0.1%, respectively) were used for fractured rock in the slopes (greater than or equal to 25%) and flatter areas (slopes flatter than 25%), respectively.

Residuum is a zone of relatively high intergranular porosity and moderate permeability. Water that infiltrates this zone fills the voids and slowly leaks into the underlying fractured rock. Based on review of Bondy and Huntley (2001) saturated residuum is up to 15 feet thick in the lower elevations in the central part of the study area but is nonexistent elsewhere, especially on steeper slopes. Specific yields in residuum were reported to be on the order of 10^{-2} (1%) in nearby Lee Valley (Bondy and Huntley, 2001).

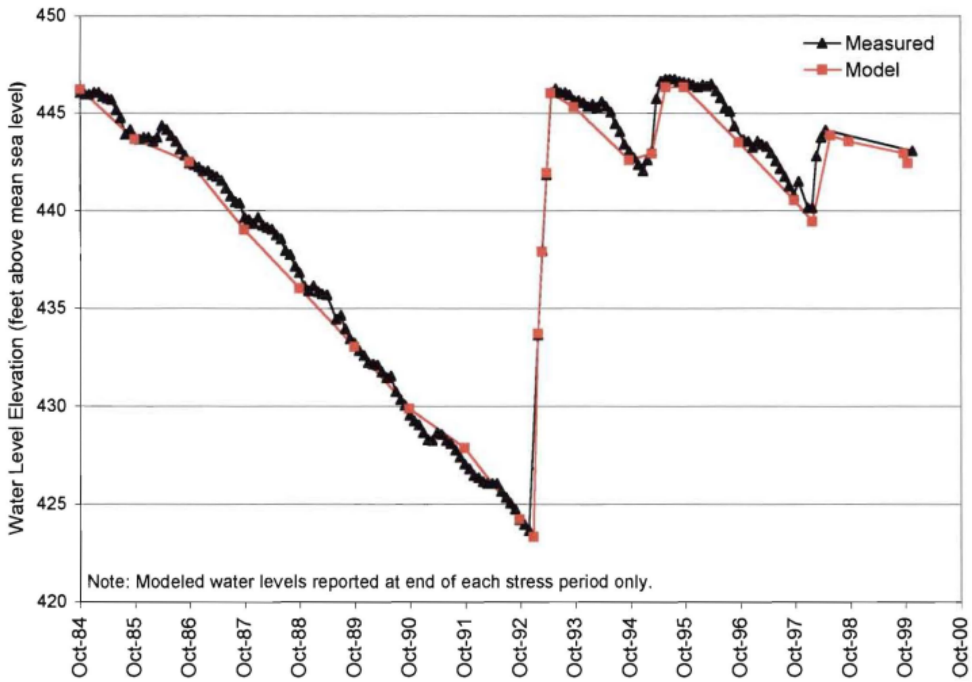
Alluvium ranges up to about 234 feet thick in the tributary watershed (Bondy and Huntley 2001). As developed during calibration of their numerical groundwater flow model, a specific yield value of 0.18 (18%) was used for this investigation. This value is within County Guidelines, where “typical ranges in sediments [are] from approximately 1% to 30%” (County 2007).

3.7 Hydrologic Inventory and Groundwater Levels

Sparse water level records have been maintained in the basin, but those available have been reviewed for this report. Well El Monte #14 water levels, located approximately between 423 and 447 ft amsl was recorded from 1984 to 1999. Inspection of Figure 5 (El Monte #14 hydrograph) reveals that the groundwater rose to an elevation of 446 feet amsl in 1984, 1994, 1995, and 1996. Between 1974/1975 and 2014/2015, the El Capitan Reservoir has spilled in 5 different rain years (1979/1980, 1980/1981, 1982/1983, 1983/1984, and 1992/1993). There were also unmeasured overtopping events in 1937, 1938, 1939, and 1941 (Bondy and Huntley 2001). Releases in the rain years 1979/1980, 1980/1981, 1982/1983, and 1983/1984, were significant (between about 15,900 acre-feet and 98,600 acre-feet) and essentially reset the groundwater storage basin to 100% full. At that point, the groundwater was approximately 5 to 10 feet bgs at El Monte #14. As depicted in Figure 5, groundwater rose to its highest elevation that was roughly equal to the ground surface elevation within the San Diego River at that cross section. Therefore, it was assumed that, at that elevation, the groundwater basin was essentially full.

It should be noted that the most recent dam spill event happened in 1993, and thus, groundwater levels have been declining thereafter. Dam releases are governed by the City of San Diego as a means to manage excess water stored in El Capitan Reservoir. It is in the interest of the City to limit the frequency of releases. Water utilization policy for the City’s reservoirs requires the use of local runoff first before imported water. The City's primary objective for the operation of these reservoirs is to maximize the capture and utilization of local runoff water. For this reason, the City Council has an established policy that requires El Capitan Reservoir to maintain 60 percent of the annual water requirement as active available storage (City of San Diego 1973). This policy sets the lower level of storage. It is a normal practice to maintain minimum water storage in these reservoirs each fall, just before the winter rainy season. This policy has reduced the chances for water releases and for an overtopping even to occur. However, predictions regarding future overtoppings/spills are highly uncertain.

Figure 5. Hydrograph of El Monte #14 vs. Modeled Water Levels



Notes:

Figure from Bondy & Huntley, 2001. Ground elevation at El Monte #14 is at approximately 455 ft amsl.

Well Furrier 1 water levels have been recorded since 1939. Figure 6 below presents the hydrograph from Furrier 1, located just outside the west end of the project site, from the late 1930s through the late 1990s, with a brief interruption in the early 1950s (Bondy & Huntley, 2001). Historic water levels in Furrier 1 ranged from approximately 365 feet above mean sea level to 425 ft above mean sea level. As discussed above, overtopping events occurred in different rain years (1937, 1938, 1939, 1941, 1979/1980, 1980/1981, 1982/1983, 1983/1984, and 1992/1993 [indicated by the yellow bands below]). These overtopping events are apparent in the Furrier 1 graph by the steep increase in groundwater levels over a relatively short period of time.

Figure 6. Hydrograph of Furrier 1

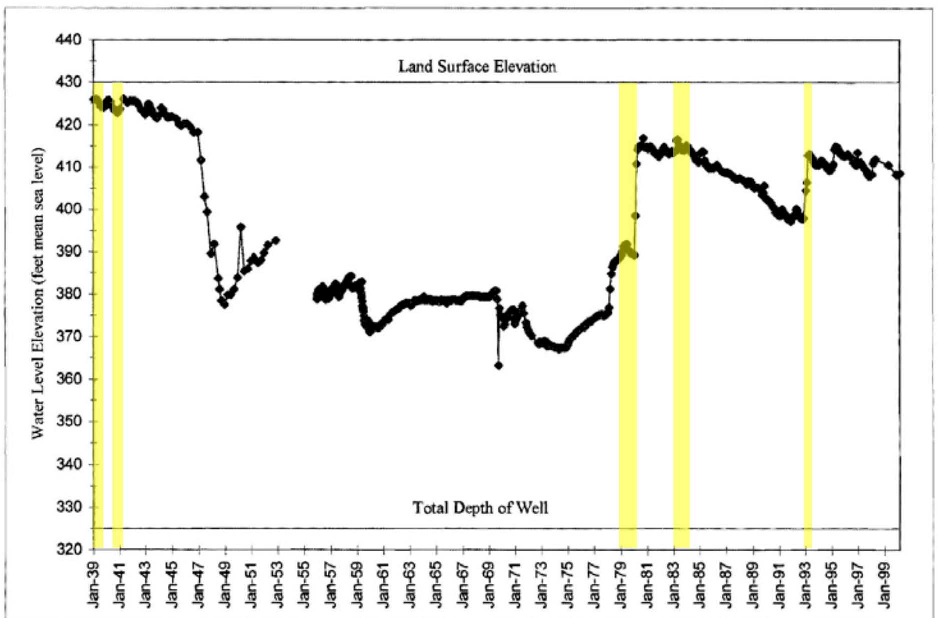
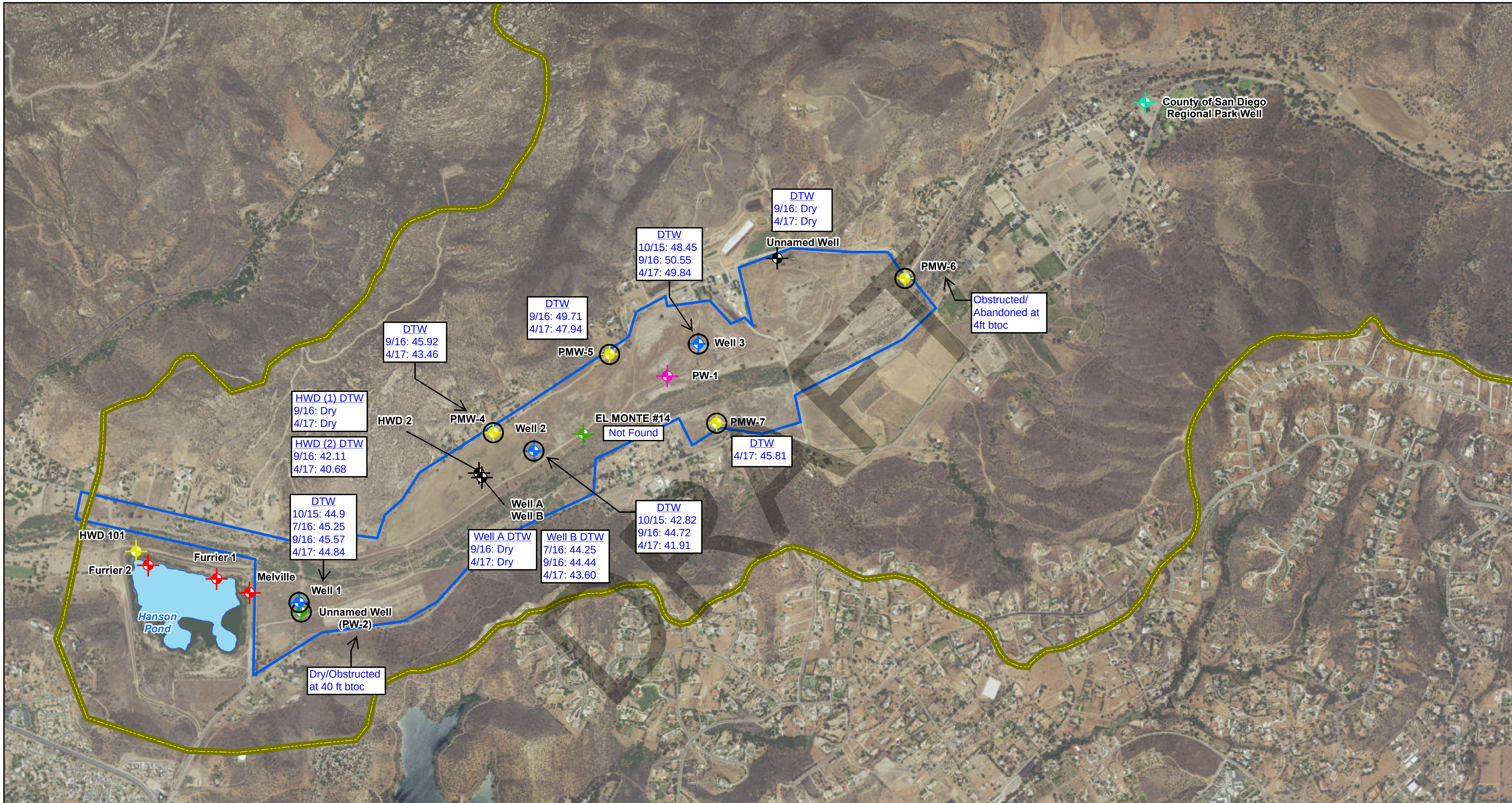


Figure E-2. Water Level Hydrograph Well Furrier 1

Source: Figure E-2 from Bondy and Huntley 2001. Yellow bands represent spill events that occurred between January 1939 and 1999.

Depth to water (DTW) measurements have been collected sporadically across the site. Groundwater levels onsite during the 1990s were approximately 15 to 25 ft bgs, and since then levels have declined to 40-50 ft bgs. A groundwater monitoring network was recently established, and measurements were collected from 2015 to 2017. From the first round of monitoring in 2015 to the second round of monitoring in late 2016, the groundwater elevations dropped sitewide. From late 2016 to the most recent monitoring event in April 2017, groundwater rose roughly half a foot to 2 feet across the site. This will not likely have a significant impact on the overall downward trend in water levels in the basin since the last overtopping event. A site map with the most recent DTW measurements is presented below as Figure 7.



Legend

Tributary Watershed Area

Project Boundary

Well Type

- Installed by Woodward-Clyde
- Installed by Ninyo & Moore
- Identified by Wiedlin & Associates
- Identified by Southern California Soil & Testing
- Identified by Earth Tech (1998)
- Owned and Operated by County of San Diego
- Identified by AECOM
- Wells with circle border verified/found by AECOM

N

0 1,500 3,000

Feet

Notes:
Watershed boundaries only show those within the project vicinity.
Additional wells identified by Bondy & Huntley Were not located or presented on this figure.

Figure 7
Depth to Water Measurements

El Monte Watershed
San Diego County, California.

AECOM

September 2017

Path: P:\ENV\60480712 El Monte\GIS_CAD\MXDs\Figure X El Monte Site Map with Updated Wells.mxd

4.0 Groundwater Impact Analysis

4.1 Groundwater Inflows and Outflows

The components of inflows and outflows of groundwater at the project site are represented below (Table 2). "Existing Conditions" represent current inflows and outflows prior to mining excavation, while "Future Conditions" represent components of inflow and outflow in post mining conditions. There are three significant expected changes to the groundwater system following excavation: (1) inflow to the pit and underlying groundwater system from rainfall run-on, (2) changes in the amount of evapotranspiration from on-site groundwater-dependent plant species, and (3) potential outflow from pit evaporation.

Table 2. Groundwater Fluxes

	Existing Conditions	Future Conditions
Inflows		
Rainfall recharge	X	X
Underflow beneath the El Capitan Dam	X	X
Stream bed infiltration	X	X
Return flows from landscape irrigation and septic systems	X	X
Rainfall Run-on into Mining Pit		XX
Spills and overtopping of El Capitan Reservoir	X	X
Outflows		
Evapotranspiration of groundwater-dependent plant species	X	XX
Groundwater pumping for residential, municipal supply, and irrigation purposes	X	X
Groundwater outflow into the basin to the west.	X	X
Evaporation off of existing water surfaces (e.g., Hanson Pond)	X	X
Evaporation from reclaimed pit pond (El Monte Sand Mine project)		XX

Note: double X's (XX) denotes a change in the groundwater flow component

These are described further below:

4.1.1 Inflow - Rainfall Run-on into Mining Pit

Following reclamation of the mining pit, a new source recharge is expected as a consequence of rainfall run-on into the pit. This is water that would have otherwise run out of the basin as surface water during periods of heavy rainfall not accompanied by overtopping of the El Capitan Dam. In addition to the recharge, the reclaimed pit has the potential to reduce damage further downstream due to catastrophic flooding events. This is a function of precipitation, run-off, and soil type. Precipitation was described in section 3.0, and the other components are described below:

The tributary watershed falls within the 18-to-21-inch and 15-to-18-inch rainfall belts on the San Diego County Groundwater Limitations Map (Figure 2). As discussed in Section 3.0, the average annual rainfall between El Capitan and Lake Jennings stations was about 16 inches per year over the last 40 years, and has ranged between 5 and 31 inches.

Run-on

Run-off to the pit, also called pit run-on (RO), can be estimated using the USDA Natural Resources Conservation Service (NRCS) curve number method (CNM) as expounded in the County of San Diego Hydrology Manual (County 2003). The CNM was designed to estimate run-off for watersheds in which no direct measurement was available. The CNM is based on a simplified infiltration model of run-off and empirical approximations. To compute RO using the CNM, two parameters must be known: precipitation (P) and the maximum soil moisture retention (S) after run-off has begun based on the following relationship.

$$RO = (P-.2S)^2 / (P+0.8S)$$

S is a function of soil type, with all soils having been classified by the NRCS into one of four hydrologic groups, A through D, based on the soil's run-off potential. Group A generally has the smallest run-off potential and highest infiltration rates and group D the greatest run-off potential, lowest infiltration rates, and lowest soil moisture retention. As discussed in Section 3.5, the soils within the project watershed were generally split into one of three hydrologic soil groups based on their respective soil moisture holding capacities and the *San Diego County Hydrology Manual* (County 2003) mapping (Figure 8).

The CNM requires the selection of a curve number (CN) based on a combination of soil conditions, land use (ground cover), and hydrologic conditions. These run-off factors, called run-off CNs, indicate the run-off potential of an area. The higher the CN is, the higher the run-off potential (County 2003).

CNs were selected from Table 3-2 (*Linking Land Uses and Hydrologic Soil Groups to Soil Curve Number*) of the *County of San Diego General Plan Update Groundwater Study* (County 2010) based on the 0.2 dwelling unit per acre cover code for each hydrologic soil group.

S is calculated from the CNs based on the following relationship:

$$S = 1000/CN-10$$

Soils

The soil types, average moisture holding capacities (SMCs), curve numbers, their corresponding hydrologic groups, and respective areas for each USDA soil group are shown in Table 3.

Table 3. Project Study Area Hydrologic Soil Groups

USDA Soil Group	Average SMC (inches)	NRCS CN	S	Approximate Area (acres)
Soil Group A	2.05	39	15.64	1,648
Soil Group B/C	2.18	67	5.15	3,028
Soil Group D	0.93	80	2.50	4,173

Using the monthly precipitation record and the assigned CNs, anticipated monthly run-off values for the project area were calculated for the 42-year period of record (1974–2016) of the precipitation data. A calibration analysis included in the County of San Diego General Plan Update Groundwater Study (County 2010) compared the run-off values using the CNM to existing conditions for periods when historical groundwater level data were available in the Lee Valley Basin. The County concluded that run-off values calculated using the CNM is generally overestimated. A reasonable relative match between calculated groundwater in storage compared to historical groundwater levels was obtained by applying an adjustment factor of 0.5 to the calculated run-off values. This adjustment factor of 0.5 was also used in the General Plan Update Groundwater Study (County 2010). A similar exercise was performed in the 22.5-square-mile Guejito Basin on the north side of San Pasqual Valley in San Diego County. In that relatively undeveloped basin (with available rainfall and stream gauge data) an adjustment value of 0.2 gave the best match.

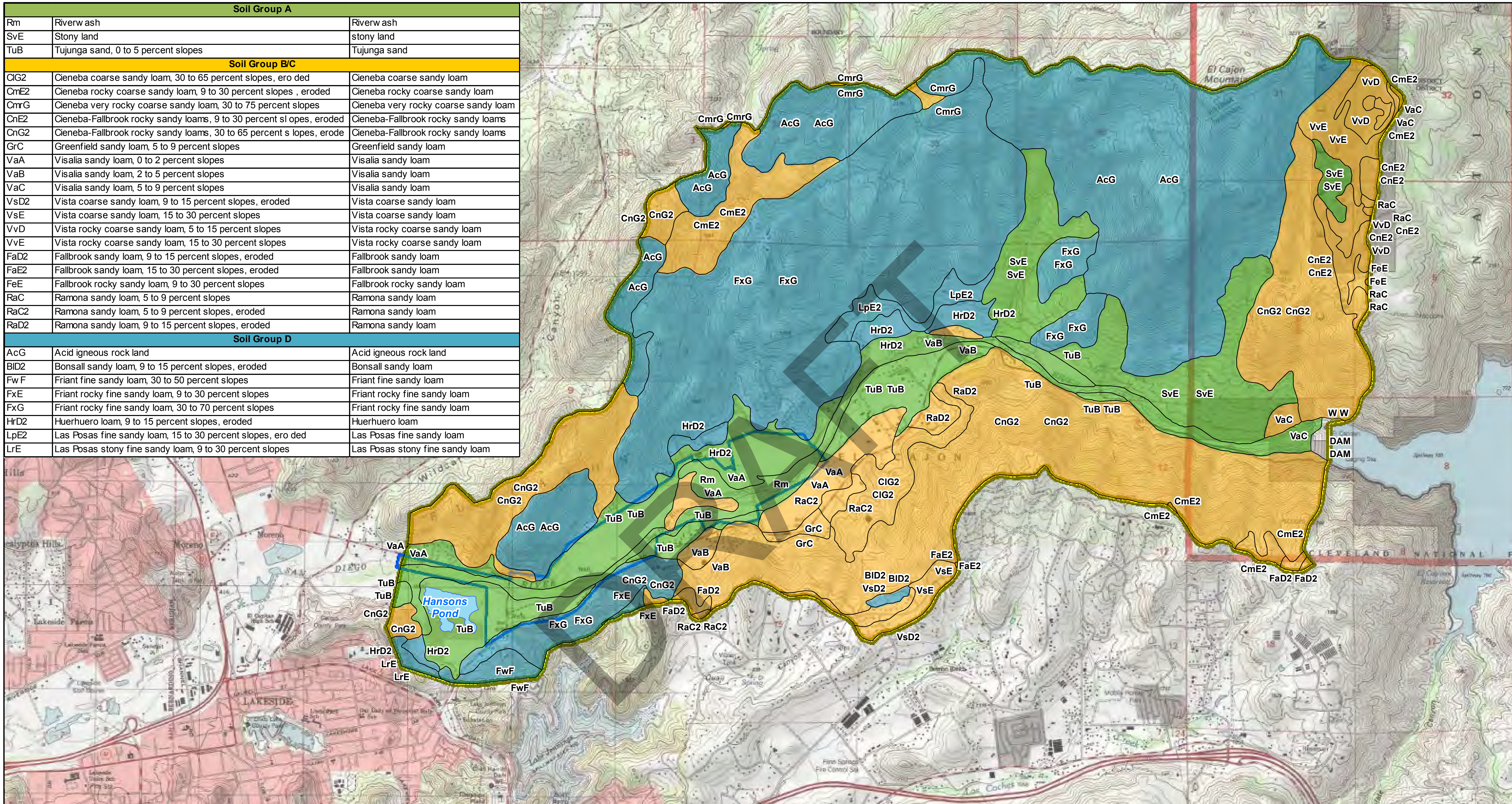
Due to potential overestimation using the CNM, a run-on adjustment coefficient of 0.1 was used to conservatively constrain the results. Using this method and the 1974/1975 to 2016/2017 rainfall record, it was estimated that pit run-on would range from about 19 to 1061 afy with an average of about 368 afy (Table 4).

Table 4. Estimated Run On

Rain Year	Total Rainfall (inches)	Pit Run-on (afy)
1974-1975	17.20	317
1975-1976	12.64	250
1976-1977	15.18	189
1977-1978	30.29	935
1978-1979	22.75	586
1979-1980	27.73	927
1980-1981	11.34	169
1981-1982	18.74	420
1982-1983	30.98	926
1983-1984	8.15	122
1984-1985	14.92	250
1985-1986	19.24	497
1986-1987	12.45	127

1987-1988	15.86	269
1988-1989	8.87	91
1989-1990	9.63	113
1990-1991	16.60	511
1991-1992	16.61	304
1992-1993	28.29	1061
1993-1994	9.42	246
1994-1995	29.18	939
1995-1996	10.82	193
1996-1997	10.12	262
1997-1998	27.29	884
1998-1999	9.53	99
1999-2000	9.86	171
2000-2001	13.80	233
2001-2002	5.04	19
2002-2003	17.79	334
2003-2004	10.34	191
2004-2005	26.29	846
2005-2006	3.36	44
2006-2007	7.88	76
2007-2008	9.27	300
2008-2009	12.03	291
2009-2010	21.39	573
2010-2011	22.71	611
2011-2012	12.27	199
2012-2013	9.92	115
2013-2014	7.91	52
2014-2015	11.94	154
2015-2016	16.41	257
2016-2017	22.58	657
Mean	**15.7**	**368**

Soil Group A		
Rm	Riverw ash	Riverw ash
SvE	Stony land	stony land
TuB	Tujunga sand, 0 to 5 percent slopes	Tujunga sand
Soil Group B/C		
ClG2	Cieneba coarse sandy loam, 30 to 65 percent slopes, ero ded	Cieneba coarse sandy loam
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes , eroded	Cieneba rocky coarse sandy loam
CmrG	Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes	Cieneba very rocky coarse sandy loam
CnE2	Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent sl opes, eroded	Cieneba-Fallbrook rocky sandy loams
CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent s lopes, erode	Cieneba-Fallbrook rocky sandy loams
GrC	Greenfield sandy loam, 5 to 9 percent slopes	Greenfield sandy loam
VaA	Visalia sandy loam, 0 to 2 percent slopes	Visalia sandy loam
VaB	Visalia sandy loam, 2 to 5 percent slopes	Visalia sandy loam
VaC	Visalia sandy loam, 5 to 9 percent slopes	Visalia sandy loam
VsD2	Vista coarse sandy loam, 9 to 15 percent slopes, eroded	Vista coarse sandy loam
VsE	Vista coarse sandy loam, 15 to 30 percent slopes	Vista coarse sandy loam
VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes	Vista rocky coarse sandy loam
VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes	Vista rocky coarse sandy loam
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded	Fallbrook sandy loam
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded	Fallbrook sandy loam
FeE	Fallbrook rocky sandy loam, 9 to 30 percent slopes	Fallbrook rocky sandy loam
RaC	Ramona sandy loam, 5 to 9 percent slopes	Ramona sandy loam
RaC2	Ramona sandy loam, 5 to 9 percent slopes, eroded	Ramona sandy loam
RaD2	Ramona sandy loam, 9 to 15 percent slopes, eroded	Ramona sandy loam
Soil Group D		
AcG	Acid igneous rock land	Acid igneous rock land
BlD2	Bonsall sandy loam, 9 to 15 percent slopes, eroded	Bonsall sandy loam
Fw F	Friant fine sandy loam, 30 to 50 percent slopes	Friant fine sandy loam
FxE	Friant rocky fine sandy loam, 9 to 30 percent slopes	Friant rocky fine sandy loam
FxG	Friant rocky fine sandy loam, 30 to 70 percent slopes	Friant rocky fine sandy loam
HrD2	Huerhuero loam, 9 to 15 percent slopes, eroded	Huerhuero loam
LpE2	Las Posas fine sandy loam, 15 to 30 percent slopes, ero ded	Las Posas fine sandy loam
LrE	Las Posas stony fine sandy loam, 9 to 30 percent slopes	Las Posas stony fine sandy loam



Legend

Watershed Area

Project Boundary

USDA Soil Type Boundaries

N

0 3,000 6,000

Feet

Figure 8
Hydrological Soil Group

El Monte Sand Mine Project
San Diego, Ca

AECOM

September 2017

Notes:
Watershed boundaries only show those within the project vicinity.

Path: P:\ENV\60480712 El Monte\GIS_CAD\MXDs\Sand Extraction Nature Project Report\Figure 10 Hydro Soil Groups.mxd

4.1.2 Outflow - Potential Evaporation From Within Pit

As noted above, the project proposes to excavate a portion of the basin's aquifer, which will result in the removal of alluvium and create a 228-acre mining pit. While this enhances the run-on and infiltration of precipitation into the groundwater system, it will also have the potential to create standing water in the pit following wet years that will evaporate an estimated 4.55 afy per acre of exposed water (pan-corrected evaporation from Table 1). As groundwater levels in the basin fluctuate, so will the volume of groundwater within the pit (until groundwater is deeper than the pit floor) and thus evaporative loss each year is expected to vary. However, water level elevations in April of 2017 ranged from about 390 ft msl to 425 ft msl, which is approximately 40 to 50 feet below ground surface (Figure 7). This would be equal to approximately 5 to10 feet below the bottom of the reclaimed mining pit on the west end and 10 to 15 feet below the bottom of the reclaimed mining pit. The average decline in water level of 1.7 ft/yr was calculated from the hydrographs presented in Bondy & Huntley. If there is not another overtopping event within the next 15 years, water levels will decline approximately an additional 25 feet. Thus, water level elevations would be approximately 365 to 400 ft msl (65 to 75 feet below the ground surface), or roughly 30 to 35 feet below the bottom of the reclaimed mining pit on the west end and 35 to 40 feet below the bottom of the reclaimed mining pit. Unless another overtopping/spill event occurs, no standing water will exist within the pit, and therefore, no evaporation losses are assumed.

4.1.3 Outflow - Groundwater-dependent Habitat Demand

To determine potential significant impacts of the proposed El Monte project, the team biologist looked at the following groundwater-dependent habitat: Southern Cottonwood-Willow Riparian Forest, Vegetated Channel, Southern Willow Scrub, and Tamarisk Scrub (for current conditions only)[Jim Prine ESA, email communication, August 15, 2017].

During post-mining conditions, groundwater is anticipated to be approximately 30 to 40 feet below the bottom of the pit. Approximately 325 afy is predicted to be lost to evapotranspiration (ET) onsite. During post-mining if water conditions were the same as existing conditions where groundwater is approximately 5 to 15 feet below the bottom of the pit, approximately 366 afy is predicted to be lost to ET onsite [Jim Prine ESA, email communication, September 6, 2017]. The amount of phreatophyte loss depends on several factors, including depth of groundwater, species factor, density factor, microclimate factor, and the reference evapotranspiration rate as shown in Table 5 below.

Table 5. On-site Phreatophyte Evapotranspiration Estimates

Vegetation Community[2]	**Species Factor (K_s)**	**Density Factor (K_d)**	**Microclimate Factor (K_{mc})**	**Landscape Coefficient (K_L)[2]**	**Reference Evapotranspiration Rate (inches/year)**	**Estimated Evapotranspiration (inches/year)[3]**	**Mapped Area (acres)**	**ET Loss (afy)**
On-site Phreatophytes (Future Conditions) Depth to Water 30 to 40' below pit, 65 to 75' below ground outside pit[6]								
Southern Cottonwood-Willow Riparian Forest	0.44	1	1	0.44	55.1	24.24	58.86	118.9
Southern Willow Scrub	0.37	1	1	0.37	55.1	20.39	99.1	168.4
Southern Cottonwood-Willow Riparian Forest (existing - to remain)	0.42	1	1	0.42	55.1	23.14	11.26	21.7
Southern Willow Scrub (existing - to remain)	0.35	1	1	0.35	55.1	19.28	0.71	1.1
Vegetated Channel*	0.35	1	1	0.35	55.1	19.28	8.92	14.3
							Total Loss:	**324.4**

Vegetation Community[2]	**Species Factor (K_s)**	**Density Factor (K_d)**	**Microclimate Factor (K_{mc})**	**Landscape Coefficient (K_L)[2]**	**Reference Evapotranspiration Rate (inches/year)**	**Estimated Evapotranspiration (inches/year)[3]**	**Mapped Area (acres)**	**ET Loss (afy)**
On-site Phreatophytes (Future Conditions) Depth to Water 5 to 15' below pit, 40 to 50' below ground outside pit[5]								
Southern Cottonwood-Willow Riparian Forest	0.52	1	1	0.52	55.1	28.65	58.86	140.5
Southern Willow Scrub	0.41	1	1	0.41	55.1	22.59	99.1	186.6

Southern Cottonwood-Willow Riparian Forest (existing - to remain)	0.42	1	1	0.42	55.1	23.14	11.26	21.7
Southern Willow Scrub (existing - to remain)	0.35	1	1	0.35	55.1	19.28	0.71	1.1
Vegetated Channel*	0.39	1	1	0.39	55.1	21.49	8.92	16.0
							Total Loss:	**365.9**

Notes:

1. The Landscape Coefficients (K_L) for the vegetation communities was determined using The Landscape Coefficient Method and Water Use Classification of Landscape Species (WUCOLS) III in A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California (University of California Cooperative Extension, California Department of Water Resources, August 2000).

2. K_S x K_d x K_{mc} = K_L. Landscape coefficient values for the project factor in site conditions and groundwater elevations, and post-mining planting palettes which include riparian species and transitional upland species due to conditions that are drier than typical riverine systems. As groundwater elevation drops, fewer riparian species are expected to persist and landscape coefficient values would be reduced.

3. Landscape Coefficient (K_L) x Reference Evapotranspiration = Evapotranspiration (inches/year).

4. Landscape coefficients for the existing condition assume much of the vegetation cannot access the deep groundwater.

5. Non-Vegetated Channel currently occurs on-site. In post-mining areas (lowered approximately 33 to 41 feet) the central channel will be revegetated with lower-growing species (i.e., Douglas mugwort, Deergrass, etc.) that are considered non-phreatophytes. However, species such as cottonwood, willow and mule fat, which are phreatophytes, are expected to volunteer in low numbers in the channel area from adjacent Cottonwood-Willow Riparian Forest habitat.

6. Existing Tamarisk Scrub in the river channel will either be removed by mining and the area will be revegetated post-mining with Cottonwood-Willow Riparian Forest habitat, or enhanced outside of mining areas as part of project mitigation (i.e., removal of tamarisk and other exotic species) and converted to non-phreatophytic alluvial scrub habitat.

7. The Species Factor and Landscape Coefficient are expected to decrease within Vegetated Channel as groundwater level decreases.

4.2 Groundwater Storage

The surface mining and resultant pit will remove material that would have otherwise had the potential to store groundwater. Under current conditions groundwater levels would be below the bottom of the pit, in which case, the excavated material would not affect groundwater storage. In the event of a dam overtopping, the water table may rise above the pit bottom and a pond would form. The quantity of water stored as surface water (approximately 2,000 acre-feet) would be greater than if it was stored as groundwater. However, this increase in available storage would be subject to evaporation and induce groundwater inflow into the pit.

Because the first operations occurring onsite will be to clear the vegetation out of the mining pit area and the area east of the dairy, phreatophyte ET should be significantly less at that time than existing conditions. And since no groundwater will be used during mining operations, it is expected that impacts during mining will be less than significant.

4.3 Water Quality

In August 2016, AECOM collected water samples from Wells 1, 2, and 3 and analyzed for nitrate (as nitrogen [N]) and total dissolved solids (TDS). In addition, we obtained water quality data from one of the El Monte Regional Park supply wells. Sample results relative to the Primary State or Federal Maximum Contaminant Levels (MCLs) are summarized in Table 6.

Table 6. Summary of TDS and Nitrate Analytical Results – September 2016

Well	**Analytical Results**	
	TDS (mg/L)	**Nitrate (mg/L as N)**
Primary MCL	**1000**	**10**
County of San Diego El Monte Regional Park Well	N/A	2.5*
Well 1	350	0.21
Well 2	550	6.0
Well 3	500	10

Notes: * Well sampled April 18, 2016 by County of San Diego

Bondy and Huntley (2001) reviewed TDS data sourced from the U.S. Geological Survey from 1959 and 1983 (Figures 25 and 26 below, referenced from Bondy and Huntley [2001]). Those results indicate TDS concentrations of 290 to 1310 mg/L in the El Monte Basin.

Figures 25 and 26 from Bondy and Huntley (2001)

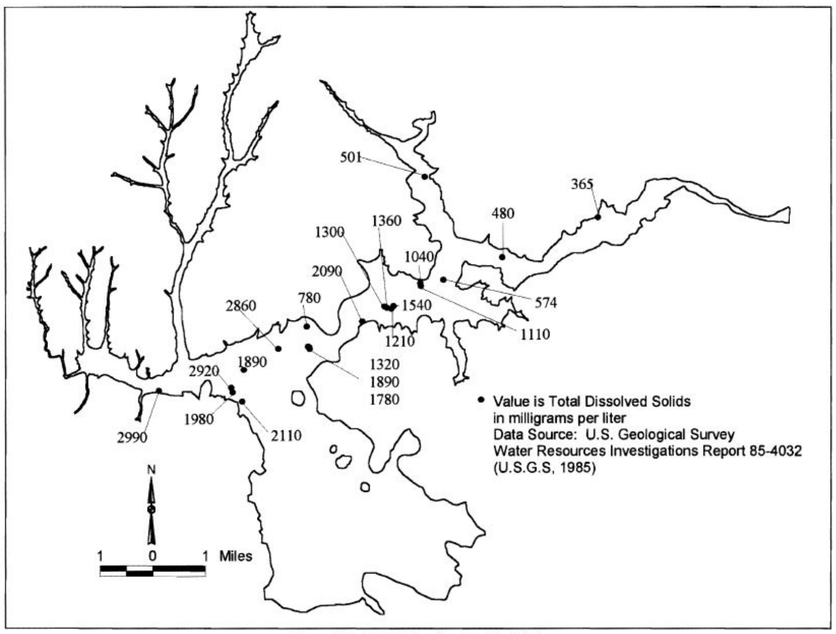


Figure 25. Total Dissolved Solids 1959

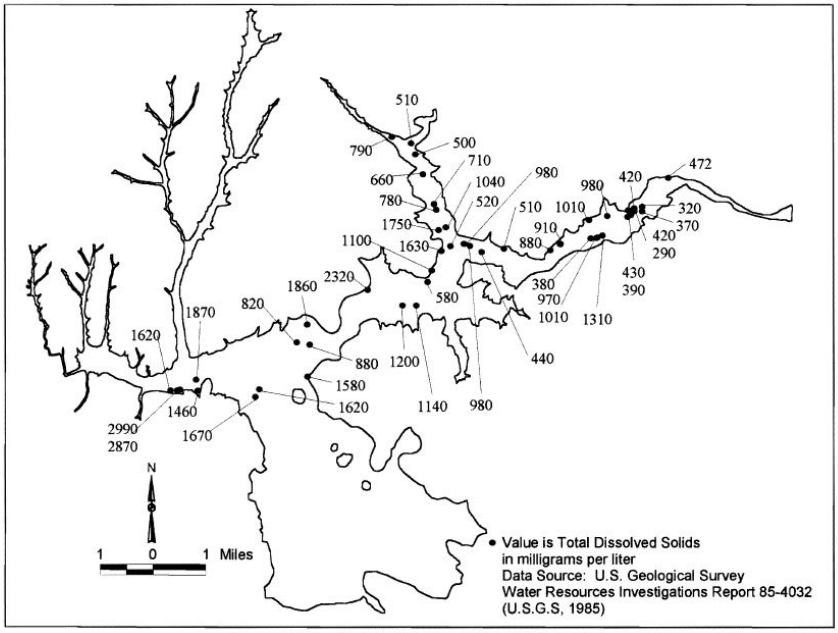


Figure 26. Total Dissolved Solids 1983

These data were provided to establish baseline conditions. Accordingly these results are not addressed further.

5.0 Summary of Project Impacts

Based upon the results of our study, we provide the following conclusions:

- El Capitan reservoir has spilled water episodically since its construction. Based on review of historic groundwater levels it appears that following in overtopping event the basin water levels rise to approximately 5 to 10 feet from the ground surface in the El Monte basin.

- In the absence of another spill event basin water levels have historically declined approximately 1.7 feet per year on average.

- Water levels today are currently about 40 to 50 feet below ground surface. This would be equal to approximately 5 to 15 to feet below the bottom of the reclaimed mining pit.

- If there is not another spill event within the next 15 years water levels will decline approximately another 25 feet. That would mean water levels would be approximately 65 to 75 feet below the ground surface. That would be equal to 30 to 40 feet below the bottom of the reclaimed mining pit.

- In the event that another dam spill were to occur, the reclaimed pit will have another benefit and that is the storage of surface water within the pit. Approximately 2,000 acre-feet would be temporarily stored if the pit were completely filled. Because the pit would be filling 100% of the air space in the 75 acres that would be inundated, this would provide significantly more surface water in the basin in the years following the overtopping event. While this water would also then be subject to evaporative losses, the temporary storage of surface water in the pit (until basin water levels decline below the bottom of the pit) could be an environmental benefit.

- Because the first operations occurring onsite will be to clear the vegetation out of the mining pit area and the area east of the dairy, phreatophyte ET should be significantly less at that time than existing conditions. And since no groundwater will be used during mining operations, it is expected that impacts during mining will be less than significant.

- The reclaimed pit has the potential to slightly reduce damage further downstream (e.g., Mission Valley) during catastrophic flooding events.

- Following reclamation, the project is expected to result in approximately 368 afy of rainfall run-on into the reclaimed mining pit

- Evapotranspiration from phreatophytes is expected range from about 325 to 366 afy assuming there are no more reservoir spills/overtopping in the next 15 years.

- **The *project can be considered a net benefit to the basin*** because induced run-on is greater than the anticipated evapotranspiration loss. The net effect of the induced run-on to the reclaimed pit would be a benefit to the groundwater system by allowing capture of water that would otherwise leave the basin.

6.0 Recommendations

We recommend that since all open wells could provide a conduit for groundwater contamination and could present a safety hazard, existing (and any future) on-site wells should be secured with locking covers. Wells that will not be used in the future should be properly abandoned.

7.0 References

Bondy, B. T. and D. Huntley. 2001. *Groundwater Management Planning Study, Santee – El Monte Basin*. January.

Chang, Wayne. "Re: El Monte Draft EIR." Message to Doug Roff. July 16, 2018. Email.

City of San Diego. 1973. Council Policy. Emergency Storage of Water. Policy No. 400-04. December 27, 1973.

County of San Diego (County). 2003. *San Diego County Hydrology Manual*.

County of San Diego (County). 2004. Groundwater Limitations Map. San Diego County, California. May.

County of San Diego (County). 2007. *Guidelines for Determining Significance and Report Format and Content Requirements – Groundwater Resources*. March.

County of San Diego (County). 2010. *Guidelines for Determining Significance and Report Format and Content Requirements – Biological Resources.* Fourth Revision, September 15, 2010.

County of San Diego (County). 2010. *County of San Diego Department of Planning and Land Use General Plan Update Groundwater Study*. April.

County of San Diego (County). 2013. San Diego County Groundwater Ordinance Number 10249. Sections 67.701 through 67.750. Amended March 1.

County of San Diego (County). 2016. Department of Planning and Development Services. *Groundwater Scoping; Project Number TM 5459 Star Ranch*, dated February 23, 2016.

EnviroMine, AECOM, and ESA. 2017. *Reclamation Plan for El Monte Sand Mining Project*. Prepared February 2016, revised September 2017.

ESA Associates (ESA). 2016. *El Monte Valley Sand Mining Project Watershed Land Use Buildout Analysis*. September 6.

Prine, Jim. “Re: El Monte Phreatophyte Table.” Message to Doug Roff. August 15, 2017. Email.

Prine, Jim. “Re: El Monte Sand Mine - Groundwater.” Message to Doug Roff. September 6, 2017. Email.

San Diego Regional Water Quality Control Board (REQCB). 1994. Regional Water Quality Control Plan for the San Diego Basin (9), with amendments effective on or before May 17, 2016.

State of California. 1999. California Irrigation Management Information System (CIMIS) Reference Evapotranspiration (ETo) Zones Map. Available at http://www.cimis.water.ca.gov/App_Themes/images/etozonemap.jpg.

Thornthwaite, C. W., and J. R. Mather. 1955. The Water Balance. *Publications in Climatology*, Vol. 8, No. 1, pp. 5–86. Laboratory of Climatology, Drexel Institute of Technology, Centerton, New Jersey.

United States Department of Agriculture (USDA). 1973. *Soil Survey San Diego Area, California*.