

Section 2: Service Area Information

This section presents details about SBMWD service area, land use, climate, water basin and demographics for the project area.

2.1 Land Use

SBMWD has a service area of approximately 45 square miles (approximately 29,000 acres). As previously shown in Figure 1-1, SBMWD primarily provides water service to customers within the City of San Bernardino, with a small percentage of out-of-city accounts. Given the high percentage of service to City parcels, the land use as defined by the City of San Bernardino's General Plan is used as the primary basis for development in the Department's service area. Table 2-1 describes the different general plan land use categories used as part of this Master Plan study.

Table 2-1: General Plan Land Use Categories

Type	Land Use Designation	Maximum Density (DU/Acre)
Single Family Residential	Residential Estate (RE)	1
	Residential Low (RL)	3.1
	Residential Low-3.5 (RL-3.5)	3.5
	Residential Suburban (RS)	4.5
Multi-Family Residential	Residential Urban-1 (RU-1)	9
	Residential Urban-2 (RU-2)	9
	Residential Medium (RM)	14
	Residential Medium High (RMH)	24
	Residential Medium High/20 (RMH/20)	20
	Residential High (RH)	36
Type	Land Use Designation	Maximum Intensity (Floor Area Ratio)
Commercial	Commercial Office(CO-1, 2)	1
	Commercial General-1 (CG-1)	0.7-1
	Commercial Regional-3 (CR-1, 2, 3, 4)	0.7-3
	Commercial Heavy (CH)	0.7
Industrial	Office Industrial Park (OIP)	1
	Industrial Light (IL)	0.75
	Industrial Heavy (IH)	0.75
	Industrial Extractive (IE)	0.5
Type	Land Use Designation	Maximum Intensity (Floor/Area Ratio)
Other	Publicly owned Flood Control (PFC)	NA
	Public Facilities (PF)	NA
	Railroad (RR) Railroad (RR)	NA
	Public Parks (PP)	NA
	Open Space (OS)	NA
	Public/Commercial Recreation (PCR)	NA

Source: City of San Bernardino 2005 General Plan.

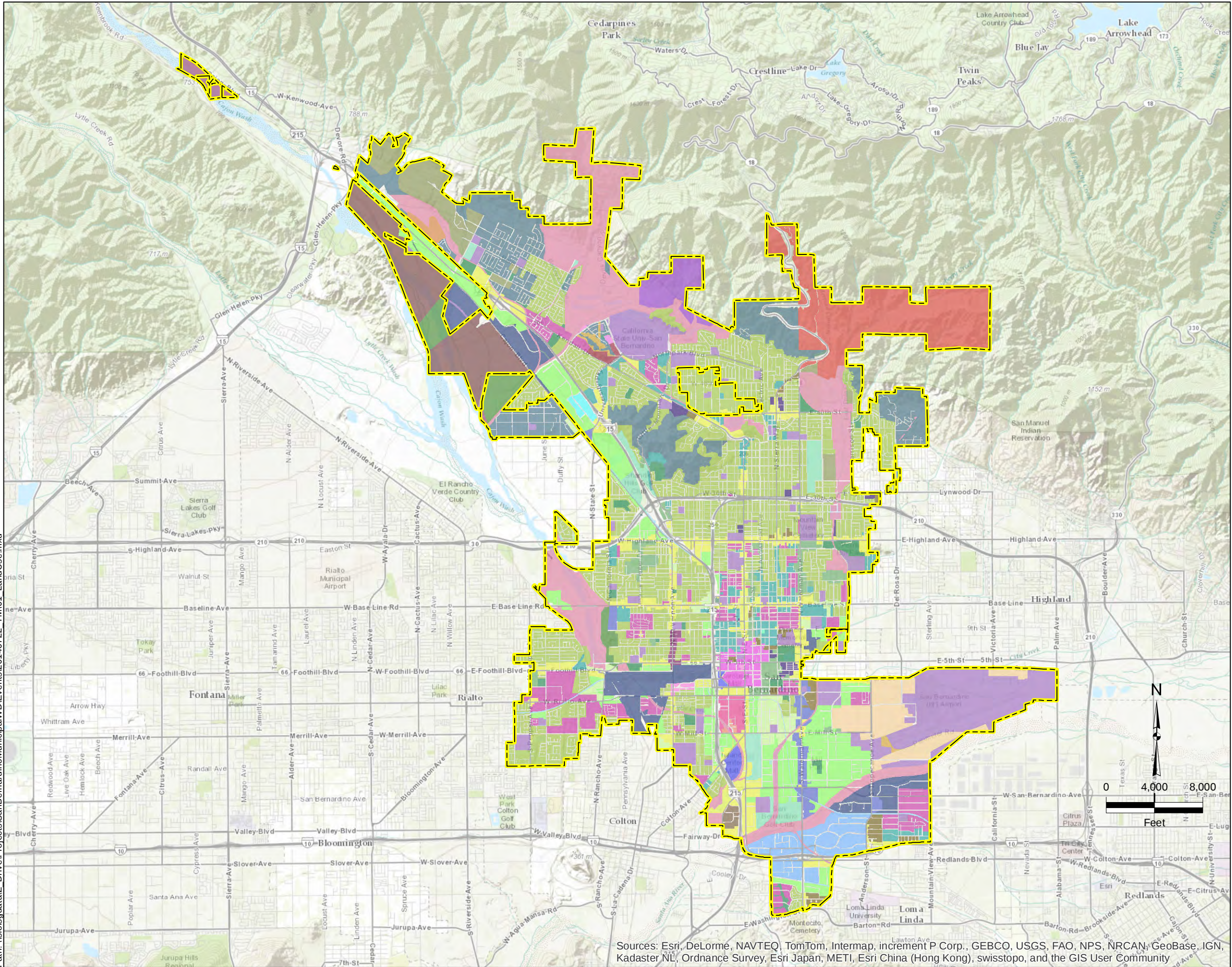
The public land use includes government facilities, parks, and flood protection. Undeveloped land consists of all categories of undeveloped land, including currently undeveloped parks and flood protection areas.

In addition to the City's General Plan, the Department's water system billing database (HTE) and information from the County's General Plan are used to classify land uses for undeveloped and unincorporated areas that fall within the Department's service boundaries. The overall land uses within the Department's service area are shown in Figure 2-1.

2.2 Climate

The climate within the Department's service area is characterized by warm, dry summers and mild winters with moderate amounts of rainfall. Three types of storms produce precipitation in the Santa Ana River Basin: general winter storms, local storms, and general summer storms. General winter storms usually occur from December through March. They originate over the Pacific Ocean as a result of the interaction between polar Pacific and tropical Pacific air masses and move eastward over the basin. These storms, which often last for several days, reflect orographic (i.e., land elevation) influences and are accompanied by widespread precipitation in the form of rain and, at higher elevations, snow. Local storms cover small areas, but can result in high intensity precipitation for durations of approximately six hours. These storms can occur any time of the year, either as isolated events or as part of a general storm, and those occurring during the winter are generally associated with frontal systems (a "front" is the interface between air masses of different temperatures or densities). General summer storms can occur in the late summer and early fall months in the San Bernardino area, although they are infrequent.

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Legend



Service Boundary

Land Use

- Undefined
- Central City South -1
- Central City South -2
- Commercial General -1
- Commercial General -2
- Commercial General -3
- Commercial Heavy
- Commercial Office
- Commercial Regional -1
- Commercial Regional -2
- Commercial Regional -3
- Commercial Regional -4
- Industrial Extractive
- Industrial Heavy
- Industrial Light
- Office Industrial Park
- Public Commercial Recreation
- Public Facilities
- Public Open Space
- Public Park
- Publicly Owned Flood Control
- Railroad
- Residential Estate
- Residential High
- Residential High -1
- Residential Low
- Residential Low 3.5
- Residential Medium
- Residential Medium -1
- Residential Medium High
- Residential Medium High -20
- Residential Suburban
- Residential Urban
- Road Right-of-Way
- Specific Plan Alliance California
- Specific Plan Arrowhead Springs
- Specific Plan Calmat/Cajon Creek
- Specific Plan Paseo Las Placitas
- Specific Plan University Business Park
- Specific Plan University Hills

Kennedy/Jenks Consultants

San Bernardino Water Facilities MP
San Bernardino, California

Land Use Map

1383002*00
July 2014

Figure 1

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Rainfall varies dramatically between seasons and is characterized by a wet season/ dry season pattern. Average rainfall amounts during the period between May and October are typically less than one inch. The majority of rain usually occurs between November and April. Based on weather data readings from San Bernardino Weather Station No. 047723 (latitude: 34:08:04, longitude: 117:15:14), the average annual precipitation recorded is 16.1 inches. Most of the precipitation occurs during the months of December through March. Table 2-2 reflects the average climate data for the service area, including temperature, rainfall and reference ETo. ETo measures the loss of water to the atmosphere by evaporation from soil and plant surfaces and transpiration from plants. ETo serves as an indicator of how much water plants need for healthy growth. The ETo measurements were taken at the U.C. Riverside Station number 44 which is the closest ETo station to the service area.

Table 2-2: Climate Information

	Jan	Feb	Mar	Apr	May	Jun
Standard Monthly Average ETo (inches) ^(a)	2.49	2.91	4.16	5.27	5.94	6.56
Average Rainfall (inches) ^(b)	3.22	3.25	2.86	1.29	0.47	0.09
Average Temperature (°F)	52.4	54.5	56.7	61.0	65.5	71.5

	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Standard Monthly Average ETo	7.22	6.92	5.35	4.05	2.94	2.56	56.37
Average Rainfall (inches)	0.04	0.15	0.33	0.71	1.32	2.38	16.10
Average Temperature (°F)	77.7	77.8	74.0	66.4	58.5	53.2	63.9

Notes:

- (a) Evapotranspiration (ETo) data were obtained from the U.C. Riverside Station as provided on the California Irrigation Management Information System (CIMIS) website at <http://www.cimis.water.ca.gov>, as of 17 December 2010.
- (b) Rainfall and temperature data were obtained from the "San Bernardino 047723" station, as provided on the National Weather Service Western Regional Climate Center website at <http://www.wrcc.dri.edu> for the period of record 1 January 1893 to 22 October 2010.

2.3 Demographics

Current demographics were obtained for the entire City of San Bernardino using census tract level data from the SCAG developed for the 2008 Regional Transportation Plan. Table 2-3 presents these demographics in five year intervals beginning in 2000 and ending in 2035.

Table 2-3: Demographics for City of San Bernardino

Year	2000	2005	2010	2015	2020	2025	2030	2035	Total Growth
Households	56,330	57,698	60,876	65,144	68,783	72,275	75,544	78,619	39.60%
Employment	81,115	94,917	107,023	117,429	124,971	133,641	143,641	157,088	93.70%

Source: SCAG's 2008 Regional Transportation Plan Growth Forecast
 Reflects City of San Bernardino, not the Water Department's service area.
 Projected growth is the total change over the 35 year planning period.

Over the projection period from 2000 to 2035, SCAG asserts that approximately 22,290 new households are projected to be added in the City of San Bernardino. Housing as a whole, in the City, is projected to increase by approximately 40% from 2000 to 2035. It is expected that housing in SBMWD's service area will grow at a similar rate. Total employment within the City of

San Bernardino is expected to dramatically increase, and essentially double (93.7%) from 2000 to 2035. Total employment is expected to have an increase of 75,973 over the 35 year planning period through 2035.

Such high employment growth indicates that workers will commute into the service area to their place of employment. It is expected that employment in the Department's service area will grow at a similar rate.

2.4 Groundwater Basin Description

SBMWD's service area overlies a portion of the Bunker Hill Groundwater (BHG) Basin, which is a sub-basin of the San Bernardino Basin Area (SBBA). Out of the 5 million acre feet (AF) of water contained in the Basin, approximately 1.5 million acre feet are extractable. The BHG Basin is replenished by the natural stream flow from the regular rains and snow melt from the San Bernardino and San Gabriel mountain watersheds every year. The Santa Ana River, Mill Creek, and Lytle Creek contribute a majority of the system. Lesser contributors include Cajon Creek, San Timoteo Creek, and most of the creeks flowing southward out of the San Bernardino Mountains. Artificially recharging of the Basin by rerouting stream flows to recharge basins is also possible.

The BHG Basin consists of the alluvial materials that underlie the San Bernardino Valley. This Basin is bounded by contact with consolidated rocks of the San Gabriel Mountains, San Bernardino Mountains, and Crafton Hills, and by several faults. The southern boundary is the Banning fault, the east boundary is the Redlands fault, the San Andreas fault is roughly the northern boundary, the Glen Helen fault abuts the northwest boundary, and the southwest boundary is the San Jacinto fault. The Santa Ana River, Mill Creek, and Lytle Creek are the main tributary streams in the Basin (California GW Bulletin).

Management of the BHG Basin is coordinated through the San Bernardino Valley Municipal Water District (Valley District or District), which was formed in 1954 to plan long-range water supply for the San Bernardino Valley including the BHG Basin. Valley District is a State Water Project (SWP) contractor that was incorporated under the Municipal Water District Act of 1911 (California Water Code Section 7100 et. seq., as amended). The District's responsibility for long-range water supply planning includes importing supplemental water and management of the groundwater basins within its boundaries. It has specific responsibilities for monitoring groundwater supplies in the San Bernardino and Colton-Rialto basins and maintaining flows at Riverside Narrows on the Santa Ana River.

Prior to 1963, the lack of native surface water and imported water for many years led to groundwater overdraft within the District's boundaries. In more recent years, increased groundwater recharge has led to high groundwater levels in the lower (southern) portion of the BHG Basin, also known as the pressure zone, where the aquifer is confined and artesian. While groundwater levels in the pressure zone are being managed through increased pumping, they may cause artesian flow in local wells, infrastructure infiltration, and the potential for liquefaction during seismic events. Within the past 70 years, a high groundwater condition has occurred at least three (3) times in the area south and east of the intersection of Mill Street and "D" Street in the City. A high groundwater condition occurs when the groundwater elevation exceeds the ground surface elevation. SBMWD participates with other local water agencies in a dewatering program to lower the water levels in the confined pressure zone. Valley District has

sold extracted high groundwater water to downstream water agencies and will likely do so again if high groundwater conditions reoccur.

2.4.1 Hydrologic Information of the Basin

Water Bearing Formations

As discussed in the 2007 Water Master Plan, the water-bearing material in the BHG Basin consists of Holocene and Pleistocene age alluvial deposits of sand, gravel, and boulders interspersed with deposits of silt and clay. The water-bearing material has been divided into upper and lower aquifers. In the central part of the Basin, a poorly permeable clay layer separates the aquifers, creating confined conditions in the lower aquifer under about 25 square miles of the valley. Maximum thickness of the upper aquifer is approximately 350 feet, and maximum thickness of the lower aquifer is approximately 650 feet. Groundwater generally converges toward the Santa Ana River in the southwestern part of the Basin and discharges over the San Jacinto fault at Colton Narrows (USGS 1989). Wells yield up to 5,000 gpm and average about 1,245 gpm. Specific yield of these deposits ranges from 7 to 21 percent and averages 13 percent (WE 2000).

Restrictive Structures

The San Andreas fault zone impedes movement of groundwater, producing springs and a groundwater level change that marks the fault trace line along the northern boundary of the Basin. The San Jacinto fault forms a strong barrier to groundwater that raises the water table nearly to the surface below the course of the Santa Ana River. The combination of alluvial material with a high water table in a seismically active area creates a hazard for liquefaction. The Redlands and Banning faults also impede groundwater movement along the borders of the Basin (Department of Water Resources, DWR 1986).

Groundwater Quality

Groundwater within the Basin is predominately calcium-bicarbonate (USGS 1989) with a TDS averaging less than 350 mg/l (Water Facilities Master Plan WFMP 2007). However, most of the BHG Basin is impaired with one or more contaminants, leading to several contamination plumes. The Redlands plume, located between Judson Street and Mountain View Avenue in Redlands, is primarily composed of TCE, with lower levels of PCE and DBCP, and contaminates approximately 150,000 acre-ft of groundwater. The Newark and Muscoy plumes are spread around the east and west sides of the Shandin Hills in northern San Bernardino. These plumes consist of TCE and PCE, and are designated Superfund sites. Levels of perchlorate slightly exceeding the Maximum Contaminant Level (MCL) are prevalent in a small area near Gilbert St. and Waterman Ave. The perchlorate contamination stems from Chilean fertilizer used in orange groves in and around this area.