DRAFT Technical Memorandum

Malibu Civic Center Wastewater Treatment Facility Project

Subject: **Assimilative Capacity and Anti-Degradation Analysis for Proposed Injection Dispersal**

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This Technical Memorandum (TM) was prepared to evaluate the potential groundwater quality impacts of recycled water injections into the Malibu Valley Groundwater Basin and to evaluate those potential impacts against water quality objectives set forth for the groundwater basin in the Los Angeles Regional Water Quality Control Board's (LARWQCB's) *Water Quality Control Plan for the Coastal Watersheds of Los Angeles and Ventura Counties* (Basin Plan, 1994).

1 Introduction

On-site wastewater disposal systems (OWDS) have allegedly contributed to the non-point source pollution of Malibu Creek and Lagoon, resulting in the LARWQCB adopting Resolution R4-2009-007 in November 2009. This resolution approved an amendment to Chapter IV of the *Water Quality Control Plan for the Coastal Watersheds of Los Angeles and Ventura Counties* prohibiting OWDS and OWDS discharges in the Malibu Civic Center Area. In 2010, the State Water Resources Control Board (SWRCB) adopted Resolution 2010-0045 which approved the amendment and established a phased schedule for compliance. The resolutions prohibit all new OWDS and discharges from existing systems based on a phased schedule to cease discharges from Phase 1 systems by November 5, 2015 and Phase 2 systems by November 5, 2019. A third phase may be implemented, if necessary, following operation of Phase 1 and 2, and upon completion of a water quality sampling program to determine if implementation of Phases 1 and 2 have resulted in a meaningful decrease in bacteria and nitrogen in Malibu Lagoon.

The Phase 1 and 2 boundaries were defined in the resolutions and have become known as "The Prohibition Zone." An August 2011 Memorandum of Understanding (MOU), signed by both the City of Malibu (City) and the LARWQCB, memorializes the requirements of the resolutions and defines the Prohibition Zone areas. Following execution of the MOU, the City embarked on a program to design and construct a centralized wastewater collection, treatment and disposal system for the Prohibition Zone. This program includes the construction of the Civic Center Wastewater Treatment Facility (CCWTF), where wastewater from the Prohibition Zone will be collected and treated to a standard set forth in Title 22 of the California Code of Regulations (CCR) for unrestricted reuse of disinfected tertiary recycled water. The resultant recycled water will be used for landscape irrigation within the Civic Center and surrounding areas to the maximum extent possible; however, anticipated irrigation demands are not expected to utilize all recycled water generated by the CCWTF. Recycled water not used for landscape irrigation will be injected into the underlying Malibu Valley Groundwater Basin for dispersal or percolated into the separate Winter Canyon aquifer.

2 Summary of Groundwater Basin Characteristics

The Malibu Valley Groundwater Basin (DWR Groundwater Basin No. 4-22) is a small alluvial basin, approximately 613 acres in size, located along the Los Angeles County coastline. The basin is bounded by the Pacific Ocean on the south, and by the Santa Monica Mountains, composed of non-water-bearing Tertiary age rocks, on all remaining sides. The valley is typified by steep canyons that generally run north to south, and is flanked on both sides by canyons - Sweetwater Canyon to the east, and Winter Canyon to the west. The basin is drained by Malibu Creek to the Pacific Ocean (DWR, 2003).

Water-bearing formations in the Malibu Valley Groundwater Basin are composed of Holocene alluvium, consisting of clays, silts, sands and gravels, overlying impermeable bedrock. Alluvial sediments deposited in the Civic Center area by Malibu Creek and other small drainages are estimated to range in thickness from a feather edge near the valley walls to around 175 feet in the central part of the main body of alluvium, and can be generally subdivided into three categories or strata (layers): (1) a shallow zone of permeable alluvial sediments, (2) underlain by a sequence of fine-grained estuarine deposits, with (3) an underlying coarse-grained stratum commonly referred to as the "Civic Center Gravels" (GeoSoils, 1989; Leighton, 1994; ECI, 2000; Ambrose and Orme, 2000; Fugro West, Inc., 2005; Geosyntec Consultants, 2007). Depth to the water table is typically on the order of 5 to 13 feet below ground surface and is deeper in upland canyon areas (such as Winter Canyon).

<u>Alluvium</u>

The shallow alluvial zone is capped by modern floodplain deposits and, in some locations, with artificial fill. This zone generally consists of silts and sands, and is underlain by a very fine grained, low-permeability zone containing clay and silt layers, especially in the central part of the alluvium. The shallow alluvium deposits tend to be coarser grained near the valley walls, along the northern edge of the alluvium, and to the east along the present day course of Malibu Creek and Lagoon. This zone appears to be in connection with Malibu Creek and Lagoon.

<u>Low Permeability Zone</u>

The low-permeability zone underlying the shallow alluvium consists of very fine grained clay and silt deposits that have been interpreted as extending from just north of Civic Center Way, south to Malibu Colony Road, and from the western edge of the groundwater basin (west of Stuart Ranch Road), to the west side of Cross Creek Road. This zone retards the downward movement of groundwater from the shallow alluvium to the underlying Civic Center Gravels, and appears to be deeper and somewhat thicker on the southeastern side of the basin.

<u>Civic Center Gravels</u>

The Civic Center Gravels underlie the shallow estuarine deposits and low permeability zone over much of the Civic Center area. These deposits are described (Leighton, 1994) and confirmed with subsequent borings in 2011 and 2013 as consisting of predominantly sands with gravel and cobbles. The top of the Civic Center Gravels is relatively flat, dipping slightly to the south and west. The Civic Center Gravels are interpreted to extend from just north of Civic Center Way, south to Malibu Road on the west side of the basin, and from just north of Civic Center Way to the Pacific Coast Highway near the eastern edge of Legacy Park. The full thickness and horizontal extent of the Civic Center Gravels is not known because of a lack of deep borings at the northern and western ends of the groundwater basin but they are estimated to be on the order of 10 to 140 feet thick.

In the summer of 2013, an electrical resistivity survey was conducted along the Malibu shoreline and immediately offshore of the Civic Center area. This survey used electrical current to identify high and low resistivity materials, indicating either the types of soils through which the current traveled (with clays and silts being less resistive than sands and gravels) and/or the type of water contained in the soils (with saltier water being less resistive than fresher water). The survey identified the Civic Center Gravels as a higher resistivity zone (i.e., consisting of sands and gravels) present below a shallow zone consisting of low resistivity material. This low resistivity material layer is thought to consist of clay-rich unconsolidated material (Cardno Entrix, 2013), similar to materials identified in onshore borings, and correlates with the low permeability zone previously identified. The resistivity of the Civic Center Gravels was higher on the west side of the groundwater basin than on the east, suggesting that the aquifer contains fresher water and is more permeable on the west side of the basin, correlating with one of the identified ancient Malibu Creek channels (McDonald Morrissey Associates, 2014). The resistivity of the Civic Center Gravels zone was lower by about an order of magnitude on the east side, suggesting that the groundwater in this area is brackish or the aquifer contains more silt and clay, or both. Based on the survey results, the fresh to brackish water zone appears to rise towards the sea floor offshore and south of the beach on the western side of the groundwater basin, suggesting that groundwater is discharging through the sea floor offshore and that the Civic Center Gravels continue offshore beneath the sea floor.

<u>Bedrock</u>

A large bedrock valley lies beneath the City of Malibu and is overlain by unconsolidated materials containing zones of permeable sand and gravel deposits as previously described. Bedrock mapping shows that the lowest bedrock elevations occur in the western and central part of the basin, to the west of the current location of Malibu Creek and Lagoon. Onshore geophysical surveys conducted in 2009 show the bedrock layer dropping in elevation from -20 feet below the ground surface level at the foot of the hills on the north side of the Civic Center area, to an elevation of -120 to -140 feet from Legacy Park to Malibu Road (Cardno Entrix, 2013). The shape and characteristics of the bedrock layer are consistent with two ancient water courses carved by Malibu Creek 60,000 and 20,000 years ago, leading to the ocean.

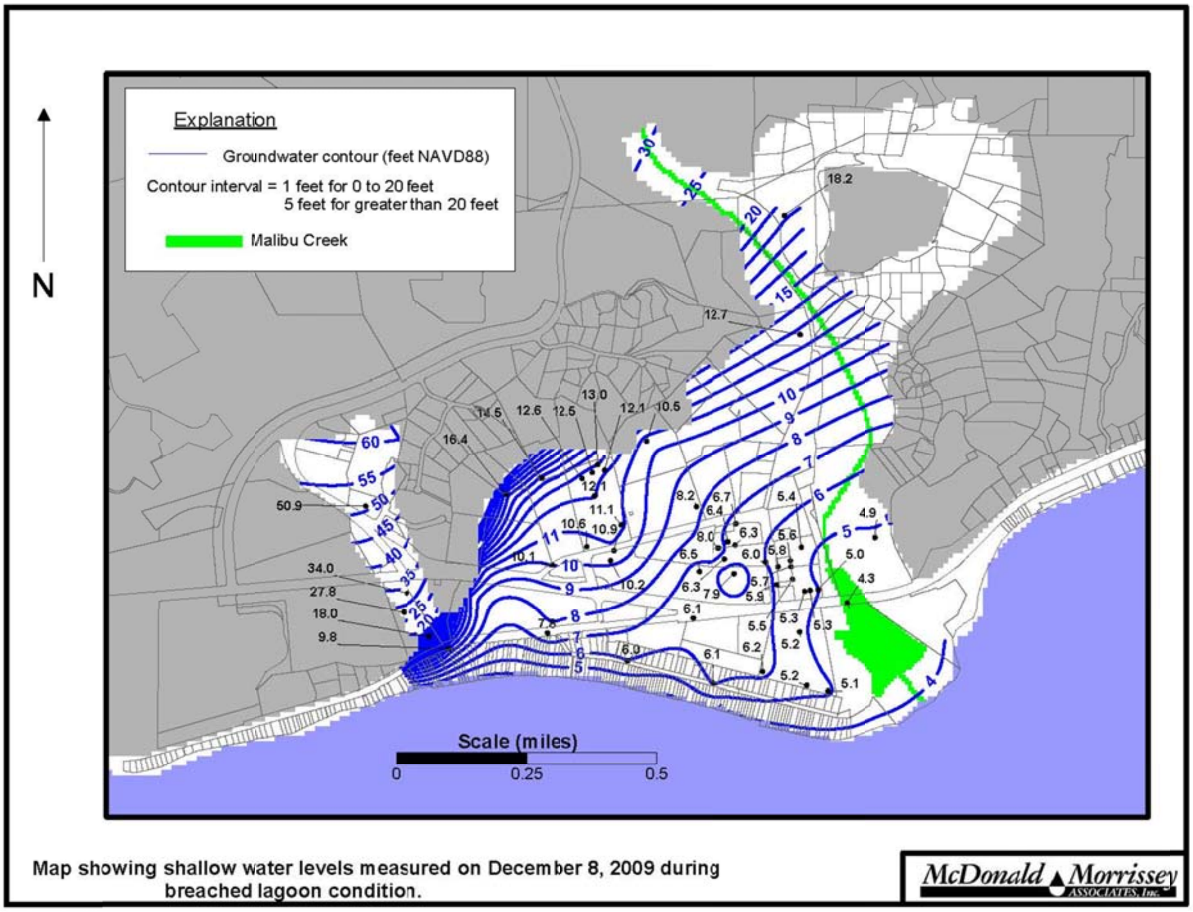
McDonald Morrissey and Associates (2013) estimated that the total average annual inflow to the Malibu Valley Groundwater Basin is approximately 222,000 cubic feet per day (ft^3/d) or 1.7 million gallons per day (mgd). Sources of recharge to the system are infiltration from Malibu Creek, infiltration from OWDSs, irrigation return, upland runoff, and infiltration of precipitation.

Groundwater flow directions are generally from upland areas to the south and southeast toward the Pacific Ocean and Malibu Lagoon (Figure 2-1). Groundwater elevations are influenced by tidal fluctuations and by lagoon stage elevation (as determined by breached or open conditions). In general, groundwater level variations in Winter Canyon, and on the west side of the alluvium, are most closely related to variations in precipitation. Groundwater levels at wells in the vicinity of the lagoon, especially east of Cross Creek Road, are closely related to variations in lagoon stage. Groundwater levels in wells completed in the Civic Center Gravels also exhibit water-level variations that are affected by lagoon stage. Groundwater levels in wells closest to the coast, especially those wells south of the Pacific Coast Highway, are most directly influenced by tidal variations.

Average groundwater travel times to Malibu Creek and Lagoon in the shallow alluvium are generally faster than to the ocean because of the high hydraulic conductivity of subsurface materials near the Creek and Lagoon. McDonald Morrissey and Associates estimated that groundwater discharges to Malibu Creek and Lagoon at an annual average rate of 75,000 ft^3/d. Analysis under both conditions (breached or open lagoon) revealed a very-slow-moving groundwater flow system, with as great as a 50-year travel time from the upstream OWDSs to the Lagoon and/or ocean (RMC, 2013).

Field and modeling studies have concluded that the shallow depth to the groundwater table (shallow alluvium) in the Project area is essentially under the influence of surface water. Approximately 23 percent of the groundwater flowing into the alluvium beneath the Project area is from percolation of OWDS discharges.

Figure 2-1: Groundwater Flow Direction



Previous groundwater modeling efforts in the basin indicated that 208 monitoring wells were known within the basin; however, none are deep wells that intersected the Civic Center Gravels. Therefore, in order to gain direct information regarding deeper hydrogeologic formations, three deep test/monitoring wells were installed in 2011 and nine additional deep monitoring wells were installed in 2013 to provide more information about the Civic Center Gravels. Aquifer pumping and injection testing was conducted in these wells, in addition to the geophysical surveys previously described.

3 Existing Groundwater Quality Analysis

Determining the existing (baseline) groundwater quality is a critical step in evaluating the potential impacts of the proposed recycled water injections on groundwater basin quality. A summary of the existing groundwater quality is presented below; additional details are provided in Appendix A to this TM.

3.1 Indicator Parameters of Salts and Nutrients

The major dissolved ions potentially included in recycled water that reflect its salinity and nutrient content are many and varied, and include sulfate, chloride, nitrate, iron, boron and manganese. Simulation of each constituent is beyond the scope of this study; therefore, indicators of salt and nutrient loading to the Malibu Valley Groundwater Basin were selected for further study.

In choosing which constituents to consider in this analysis, the following criteria/questions were used to identify a select number of constituents for further consideration:

1. Is the constituent regularly monitored and detected in source waters?
2. Is the constituent representative of other salts and nutrients?
3. Is the constituent conservative and mobile in the environment?
4. Is the constituent found in source waters at concentrations above those found in ambient groundwater?
5. Does the constituent have high toxicity for human health or will it otherwise affect beneficial use?
6. Is the constituent a known contaminant in groundwater in the study area?
7. Have the concentrations of the constituents been shown to be increasing in the study area?
8. Is the constituent subject to a water quality objective (WQO) within the Basin Plan?

Each selected indicator constituent of salts and nutrients is not required to meet all the criteria, but as a group, at least one should meet each criterion.

Very little groundwater quality data current exist for the Civic Center Gravels; therefore, to a great extent, the selection of indicator constituents was driven by what data are presently available for use in establishing background water quality. To that end, total dissolved solids (TDS) and nitrate were selected as the indicator constituents for salts and nutrients, respectively, for the Malibu Valley Groundwater Basin. These selections are justifiable as total salinity is commonly expressed in terms of TDS in milligrams per liter (mg/L). TDS (and electrical conductivity data that can be converted to TDS) are available for source waters (both inflows and outflows) into and from the groundwater basin. While TDS can be an indicator of anthropogenic impacts, such as infiltration of runoff, soil leaching, saltwater intrusion and land use, there is also a natural background TDS concentration in groundwater.

Nitrate is a widespread contaminant in California groundwater. High levels of nitrate in groundwater are generally associated with agricultural activities, septic systems, landscape fertilization, and wastewater treatment facility discharges. Nitrate is the primary form of nitrogen detected in groundwater. Natural nitrate levels in groundwater are generally very low, with concentrations typically less than 10 mg/L for nitrate as nitrate (nitrate-NO3) or 2 to 3 mg/L for nitrate as nitrogen (nitrate-N). Nitrate is commonly reported as either nitrate-NO3 or nitrate-N; and one can be converted to the other. Nitrate-N is selected for the assessment of nutrients in this analysis.

3.2 Water Quality Objectives

Water quality objectives (WQOs) provide a reference for assessing groundwater quality in the Malibu Valley Groundwater Basin. The California Department of Public Health (CDPH) has adopted a Secondary Maximum Contaminant Level (SMCL) for TDS. SMCLs address aesthetic issues related to taste, odor, or appearance of the water and are not related to health effects, although elevated TDS concentrations in water can damage crops, affect plant growth, and damage municipal and industrial equipment. While the U.S. Environmental Protection Agency (USEPA) recommended SMCL for TDS is 500 mg/L, the SWRCB has established a Basin Plan WQO of 2,000 mg/L for TDS in the Malibu Valley Groundwater Basin.

The Primary Maximum Contaminant Level (PMCL) for nitrate-nitrogen plus nitrite-nitrogen (as N) is 10 mg/L. Unlike SMCLs, PMCLs are set to be protective of human health. The SWRCB has utilized the PMCL for nitrate-N as the numerical WQO for the Malibu Valley Groundwater Basin in its Basin Plan for groundwater. Water Quality Objectives for nitrate-N are not included in the California Ocean Plan; however, numeric limits for ammonia are included (600 micrograms per liter [μg/L] for a 6-month median, 2,400 μg/L for a daily maximum, and 6,000 μg/L as an instantaneous maximum). For the assimilative capacity analysis and subsequent anti-degradation analysis, a reference value of 10 mg/L of nitrate-N is used. Ammonia is not considered in this analysis as the recycled water is expected to contain little to no ammonia. Table 3-1 summarizes the numerical WQOs for the Malibu Valley Groundwater Basin, designated as a Potential Municipal (MUN) supply in the LARWQCB Basin Plan.

Table 3-1: Basin Plan Objectives

Constituent	Units	WQOs
TDS	mg/L	2,000
Nitrate-N	mg/L	10

3.3 TDS and Nitrate Fate and Transport

Salt and nutrient fate and transport describes the way salts and nutrients move and change through an environment or media. In groundwater, it is determined by groundwater flow directions and rate, the characteristics of individual salts and nutrients, and the characteristics of the aquifer media.

Water has the ability to naturally dissolve salts and nutrients along its journey in the hydrologic cycle. The types and quantity of salts and nutrients present determine whether the water is of suitable quality for its intended uses. Salts and nutrients present in natural water result from many different sources, including atmospheric gases and aerosols, weathering and erosion of soil and rocks, and from dissolution of existing minerals below the ground surface. Additional changes in concentrations can result from ion exchange, precipitation of minerals previously dissolved, and reactions resulting in conversion of some solutes from one form to another (such as the conversion of nitrate to gaseous nitrogen). In addition to naturally occurring salts and nutrients, anthropogenic activities can add salts and nutrients to groundwater.

TDS and nitrate are contained in source waters that recharge the Malibu Valley Groundwater Basin. Addition of new water supply sources, either through intentional or unintentional recharge, can change the groundwater quality either for the worse, by introducing contamination, or for the better, by diluting some existing contaminants in the aquifer. This effect can occur, for example, when irrigation water exceeds evaporation and plant needs and infiltrates into the aquifer (i.e., irrigation return flow). Irrigation return flows can carry fertilizers high in nitrogen and soil amendments high in salts from the yard or field into the aquifer. Similarly, recycled water used for irrigation also introduces salts and nutrients.

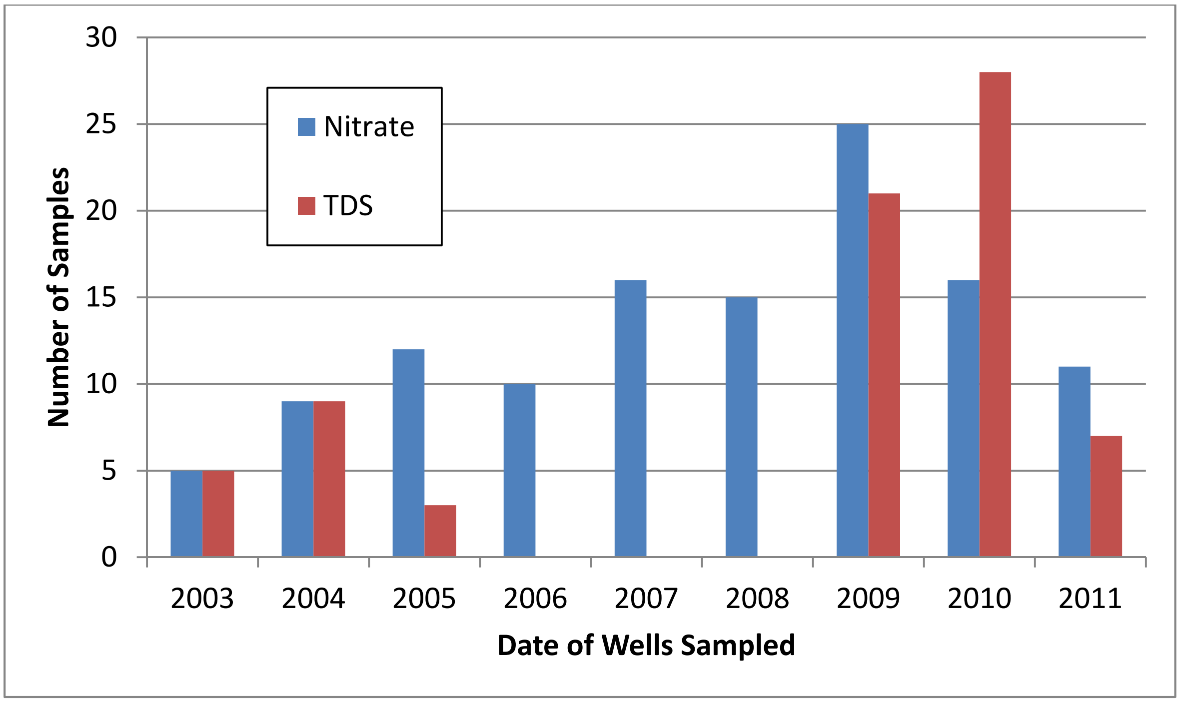
TDS is considered conservative in that it does not readily attenuate in the environment. In contrast, processes that affect the fate and transport of nitrogen compounds are complex, with transformation, attenuation, uptake, and leaching in various environments. Nitrogen is relatively stable once in the saturated groundwater zone, and nitrate is the primary form of nitrogen detected in groundwater. It is soluble in water and can easily pass through soil to the groundwater table.

3.4 Indicator Parameter Analysis Methodologies

3.4.1 Groundwater Quality Averaging Period

Initial characteristics of ambient (existing) groundwater quality were developed though the analysis of historical salt and nutrient concentrations in the groundwater basin over the available historical record of data extending back to 2003. While the Statewide Recycled Water Policy requires existing conditions to be established using only the last five years of data, the baseline period for this analysis utilizes roughly the last ten years of data to provide a more robust data set, given the lack of information available for the basin. Figure 3-1 shows the number of wells sampled over the history of sampling data available for the Malibu Valley Groundwater Basin. Water quality data were compiled from a variety of sources, primarily, but not limited to, monitoring and test wells installed as part of the conceptual feasibility testing for the CCWTF Project, monitoring wells at the commercial development commonly referred to as the "Lumber Yard," wells sampled by the United States Geological Survey (USGS), and wells owned by private parties whose groundwater quality data were publicly available. A number of private, shallow wells are believed to exist within the groundwater basin for irrigation purposes, but data from these wells were unavailable for this analysis. In addition, a number of environmental remediation site monitoring wells exist; however, data from these wells were not used in the baseline water quality analysis as these wells are typically in place to monitor contaminant plumes and thus do not show average ambient conditions. Figures 3-2 and 3-3, shown in subsequent sections, depict the locations of wells (as black dots) whose data were used to determine baseline water quality.

Figure 3-1: Summary of Available Water Quality Data



3.4.2 Evaluation of Existing Ambient Groundwater Quality

The median groundwater concentrations for both TDS and nitrate were developed by averaging concentrations from individual wells basinwide (both shallow and deep wells), and then employing a spatial averaging and interpolation across the entire groundwater basin. The results of these analyses, shown below in Figures 3-2 and 3-3 for TDS and nitrate, respectively, shows average groundwater concentrations of approximately 2,100 mg/L for TDS and 3.23 mg/L for nitrate-N.

3.5 Existing Groundwater Quality

3.5.1 Total Dissolved Solids

Table 3-2 summarizes the average TDS concentration in the Malibu Valley Groundwater Basin and compares it against the Basin Plan WQO for that constituent. The difference between these two values, if the WQO is higher than the average groundwater quality concentration, is known as the assimilative capacity of the groundwater basin for that constituent (SWRCB, 2009). Assimilative capacity is the groundwater basin's ability to absorb constituents without exceeding WQOs. In this case, the average

TDS concentration of groundwater in the Malibu Valley Groundwater Basin presently exceeds the Basin Plan WQO and therefore no assimilative capacity exists for TDS in the groundwater basin.

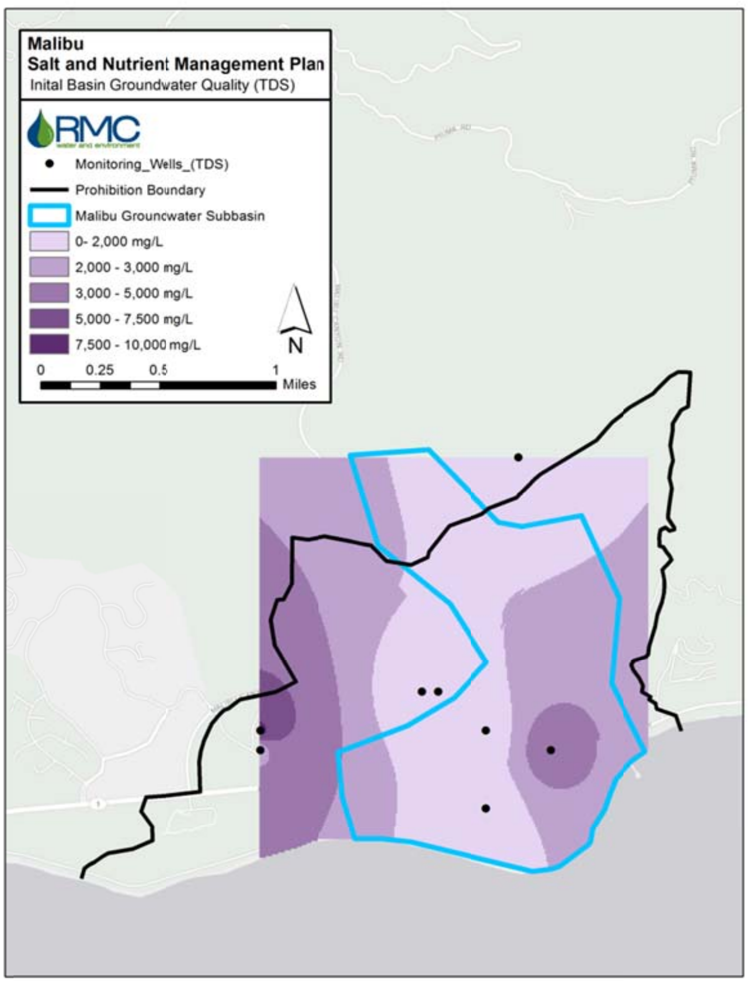
Figure 3-2 shows TDS concentration contours across the groundwater basin. Generally, relatively low TDS concentrations (less than 2,000 mg/L) are observed throughout most of the basin; however some areas of the groundwater basin do have elevated TDS levels, primarily as a result of either direct connection with ocean waters and/or as a result of historical sea water intrusion. One well in particular, on the east side of the basin shows elevated concentrations (above 4,000 mg/L) and results in a significant impact on the groundwater basin's spatial average.

Table 3-2: Average TDS Concentrations and Water Quality Objective

Malibu Valley Groundwater Basin	
Average Concentration	2,100
WQO	2,000
Available Assimilative Capacity	0

Note: All concentrations are in mg/L

Figure 3-2: Total Dissolved Solids Concentrations in the Malibu Valley Groundwater Basin



3.5.2 Nitrate in Groundwater

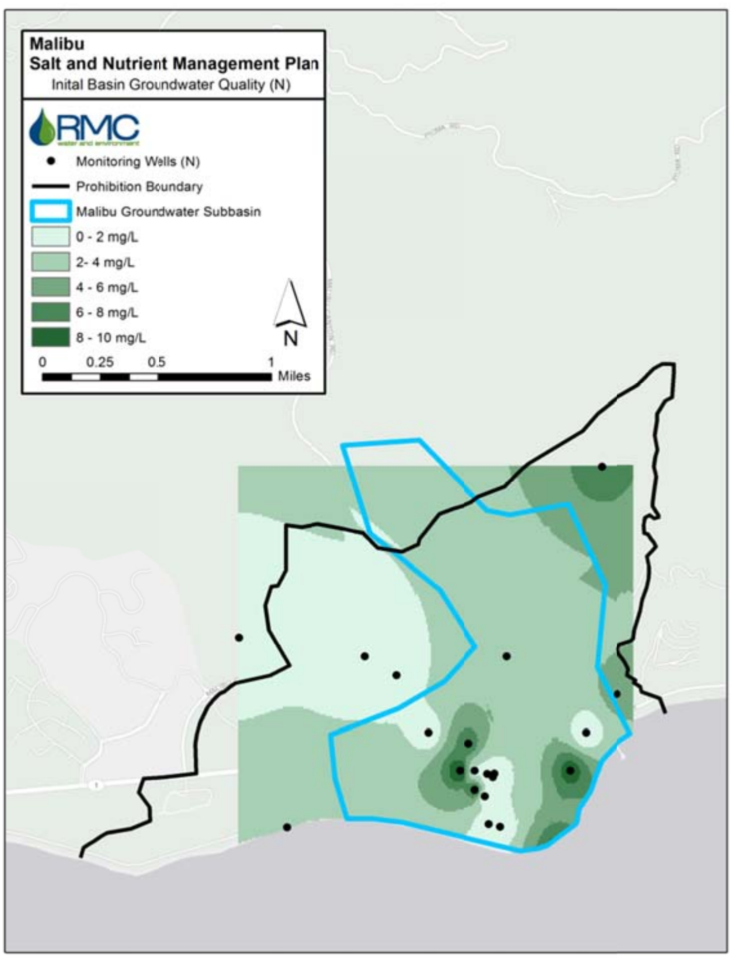
Table 3-3 summarizes the average nitrate-N concentration in the Malibu Valley Groundwater Basin and compares it against the Basin Plan WQO for that constituent. Based on these concentrations, there is an assimilative capacity of 6.77 mg/L for nitrate in the groundwater basin. A nitrate concentration contour map is shown in Figure 3-3. Generally low nitrate concentrations are observed throughout most of the groundwater basin, with higher readings outside of the basin near the western boundary of the Prohibition Zone, and higher concentrations found in the shallow groundwater as compared to the deeper aquifer. Background data is limited, so time concentration plots could not be developed to determine if nitrate-N concentrations across the groundwater basin have been increasing, decreasing, or showing no significant change (stable).

Table 3-3: Average Nitrate-N Concentrations and Available Assimilative Capacity

Malibu Valley Groundwater Basin	
Average Concentration	3.23
WQO	10.00
Available Assimilative Capacity	6.77

Note: All concentrations are in mg/L

Figure 3-3: Nitrate-N Concentration in the Malibu Valley Groundwater Basin



4 Source Identification and Loading Analysis

An analysis of salt and nutrient loadings to the groundwater basin occurring as a result of surface activities is presented to identify sources of salt and nutrients, evaluate their linkages with the groundwater system, and estimate the mass of salts and nutrients loaded to the Malibu Valley Groundwater Basin as associated with those sources.

Salt and nutrient loading from land surface activities to the groundwater basin are due to a variety of sources, predominantly:

- Irrigation water (potable water, surface water and recycled water)
- Residential and commercial inputs (septic systems, fertilizer, soil amendments, and applied water)

Most of these sources, or "inputs," are associated with urban septic and turf irrigation in commercial and residential areas. Urban area salt and nutrient loads due to indoor water use are initially assumed to be primarily percolated though individual parcel-operated OWDSs; although future conditions will involve the centralized collection and treatment of wastewater with subsequent groundwater injection of disinfected tertiary-treated recycled water. Other surface inputs of salts and nutrients, such as atmospheric loading, are not considered a significant source contributing salts and nutrients and are not captured in the loading analysis. In addition to surface salinity loading, other potential inputs of salts and nutrients to the groundwater basin include precipitation, infiltration water from Malibu Creek/Lagoon, and seepage from the Pacific Ocean.

4.1 Loading Analysis Methodology

To better understand the significance of various surface loading factors to the concentrations of salts and nutrients in the groundwater basin, a GIS-based loading model was developed. The loading model is a simple, spatially-based mass balance tool that represents TDS and nitrogen loading on an annual-average basis. Stakeholder coordination was performed to refine the parameters in the loading model, including land use, applied water, TDS and nitrogen application (in applied water, as well as fertilizers and amendments), and source water quality. Given these activities, the model is considered suitable for this analysis of basin groundwater quality conditions.

Primary inputs to the loading model are land use, source water volume and quality, septic system areas and loading, and soil characteristics. These datasets are described in the following sections. The general process used to arrive at the salt and nutrient loads was to:

- Identify the analysis units to be used in the model. In the case of the Malibu Valley Groundwater Basin, land use parcels from the City of Malibu are the analysis units.
- Categorize land use into discrete groups. These land use groups represent land uses that have similar water demands as well as salt and nutrient loading and uptake characteristics.
- Apply the land use group characteristics to the analysis units.
- Apply the irrigation water source to the analysis units. Each water source is assigned concentrations of TDS and nitrogen.
- Apply the septic system assumption to the analysis units.
- Estimate the water demand for the parcel based on the irrigated area of the parcel, the land use group, billed water data, and evapotranspiration (ET) requirements.
- Estimate the TDS load applied to each parcel based on the land use practices, irrigation water source and quantity, septic load, and infrastructure load. The loading model makes the conservative assumption that no salt is removed from the system once it enters the system. Other transport mechanisms (such as runoff draining to creeks exiting the basin) likely reduce

the total quantity of salt in the groundwater basin; however, this methodology provides conservative results.

- Estimate the nitrogen load applied to each parcel based on the land use practices, irrigation water source and quantity, and septic load. The loading model assumes that a portion of the applied nitrogen is taken up by plants and (in some cases) removed from the system (through harvest of plant material). Additional nitrogen is converted to gaseous forms and lost to the atmosphere. Remaining nitrogen is assumed to convert to nitrate and to be subject to leaching. A basin-wide attenuation value is used to estimate and account for mobility of leaching water and the efficiency of nitrate transport through the root zone.

4.2 Data Inputs

Data inputs to the loading model include the spatial distribution of land uses (with associated loading factors), applied water sources (with associated water quality), septic inputs, and water use data. These inputs are summarized below.

4.2.1 Land Use

Land use data were obtained from the Los Angeles County Department of Regional Planning (2013). This dataset contains nearly 150 discrete land use categories. These categories are consolidated into the following land use groups for the Malibu Valley Groundwater Basin:

- Urban Commercial and Industrial – areas containing both commercial and industrial parcels
- Urban Residential (Low Water Use) – areas where parcels are smaller with much less landscaping that other residential areas
- Urban Residential – residential areas where parcels have a significant portion of lawn/turf
- Urban Landscape – large turf areas such as parks and golf courses
- Vacant and Beaches – open space areas (upland), and beach areas

These land use classifications were updated and confirmed to be within the accuracy requirements of this type of analysis using aerial imagery. The spatial distribution of land uses is shown in Figure 4-1.

Each land use group is assigned characteristics including:

- Applied water
- Percent irrigated
- Applied nitrogen
- Used nitrogen
- Leachable nitrogen
- Applied TDS

An estimated loss of nitrogen in gaseous form in the soil is assumed to be approximately 10 percent for this analysis. This value was developed by an agronomist through an extensive nutrient loading study for a groundwater basin in Northern California with very similar land uses, and is an appropriate proxy value for this planning-level analysis in-lieu of extensive site-specific soil chemistry information within the Malibu Valley Groundwater Basin. Table 4-1 consists of a matrix of values for the land use categories and characteristics.

Figure 4-1: Land Use

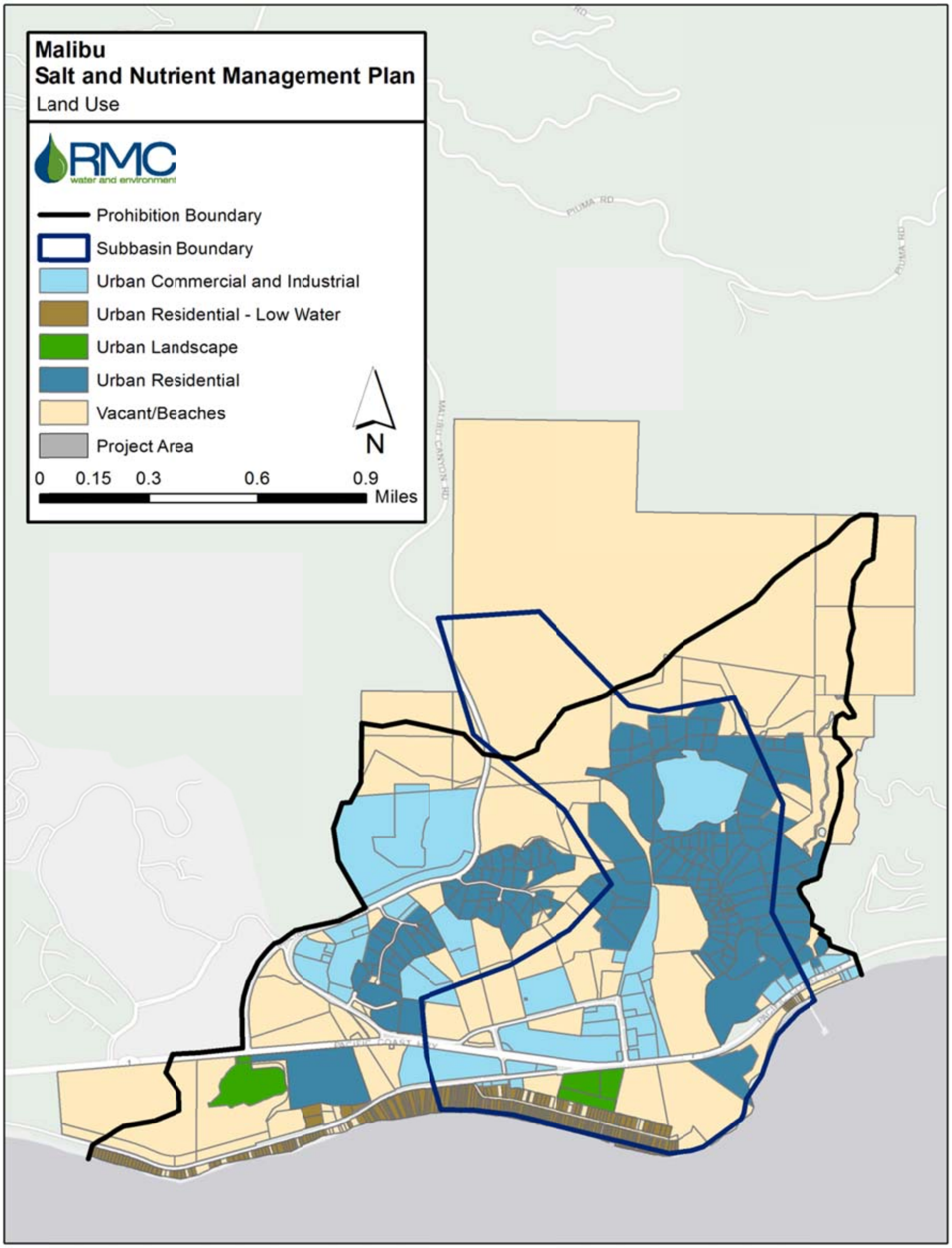


Table 4-1: Land Use-Related Loading Factors

Land Use Group	Total Area (acres)	Percent Irrigated[1]	Applied Water[2] (in/yr)	Applied Nitrogen[3] (lbs/ac-yr)	Nitrogen Uptake[4] (lbs/ac-yr)	Leachable Nitrogen[5] (lbs/ac-yr)	Applied TDS[6] (lbs/ac-yr)
Urban Commercial & Industrial	97	6%	47	44	35	8	245
Urban Residential (Low Water)	26	-	-	-	-	-	-
Urban Residential	173	20%	47	44	35	8	245
Urban Landscape	10	100%	47	44	35	8	245
Vacant/Beaches	272	-	-	-	-	-	-

Notes:

1 Percent of land area assumed to be irrigated within each class is estimated based on review of aerial photography and professional judgment of a reasonable, broad average for each class.

2 Applied water values were calculated to reflect localized water billing data, and verified with 20-year averaged ET from CIMIS stations near the Malibu Valley Groundwater Basin.

3 Applied nitrogen estimates are based on the literature review of the University of California's Publication 8065 *Practical Lawn Fertilization*

4 Uptake of nitrogen was estimated from available literature by multiplying reported yield figures by reported nitrogen concentrations for harvested plant parts.

5 Maximum nitrogen leaching calculations for each land cover unit were calculated based on the balance between application, gaseous loss (volatilization and denitrification), and uptake. The maximum was then reduced based on soil conditions mapped for the area.

6 Applied TDS estimates are based on literature review for individual land cover classes, verified by the U.S. Bureau of Reclamation (2003) *Central Arizona Salinity Study*, and professional judgment.

4.2.2 Applied Water Source

Applied water sources form the basis for determining the TDS and nitrate loads that result from irrigation of the land uses described above. Parcels within the Malibu Valley Groundwater Basin are primarily supplied from potable municipal water sources (imported by Los Angeles County Waterworks District 29) and/or potentially, for future conditions, recycled water. Table 4-2 summarizes the water quality inputs used for each irrigation water source. Recycled water TDS concentration is estimated based on a potable water concentration approximately 290 mg/L, which is then concentrated through wastewater treatment processes resulting in the addition of approximately 200 mg/L of additional TDS; therefore, the resulting TDS of recycled water is estimated to be approximately 500 mg/L. The nitrate-N concentration for recycled water is estimated based on treatment process efficacy.

Table 4-2: Water Quality Parameters for Loading Model Water Sources

Source	TDS (mg/L)	Nitrate (as N) (mg/L)
Potable Water from Water District 29	290	0.5
Recycled Water	500	7 - 8

4.2.3 Ocean Water Quality

Ocean water quality was modeled using publically-available data from near-shore water quality sampling that has occurred in the Project area, and from published average concentrations. Ocean water is assumed to have a TDS concentration of 33,500 mg/L and a nitrate-N concentration of 1.50 mg/L (consistent with groundwater nitrate concentrations from the deeper Civic Center Gravels).

4.2.4 Septic Systems

Salt and nutrient loads due to septic systems were estimated based on typical wastewater production and TDS and nitrate concentrations. All developed parcels within the groundwater basin presently utilize either an individual or combined septic or treatment system. Each residential parcel with a septic system is assumed to produce up to 400 gallons per day (gpd), based on billed potable water data and landscaped area. Septic wastewater discharge is assumed to have TDS concentrations of 490 mg/L based on potable water quality plus an assumed household contribution of 200 mg/L (Metcalf & Eddy, 2003), with nitrate-N concentrations of 20 mg/L for residential and commercial systems. These nitrate-N concentrations are based on typical wastewater concentrations for medium strength wastewater (Metcalf & Eddy, 2003) of 40 mg/L minus an assumed volatization rate of 25 percent within the OWDS and another 15 percent for attenuation in the soils.

4.2.5 Wastewater/Recycled Water Infrastructure

Under current conditions, there are no centralized wastewater treatment facilities within the groundwater basin. However, with implementation of the CCWTF, existing septic loadings to the groundwater will cease over time with implementation of the centralized collection and treatment of wastewaters. The resulting treated effluent from the new wastewater treatment facility will meet Title 22 standards for disinfected tertiary-treated effluent and will be used for irrigation and other non-potable water uses in the groundwater basin to the maximum extent possible, with remaining, unused recycled water injected into the Civic Center Gravels. Project implementation will occur over three distinct phases with a delineated time series by parcel as required by the MOU. In the case of recycled injection, recycled water treatment standards of 8 mg/L and 7 mg/L were both evaluated.

4.2.6 Soil Textures

Soil textures were obtained from the National Resources Conservation Service (NRCS) Soil Survey (NRCS, 2013). Each soil texture was assigned a hydraulic conductivity (NRCS, 1993), with that value used to develop an adjustment factor with a basin-wide average of 0.15. The adjustment factor is used to represent the proportion of nitrate that will migrate to the aquifer, relative to the other textural classes. Where conductivity is lower, it is reasoned (and observed) that nitrogen resides longer in the soil, increasing the proportion that is either taken up or lost through conversion to gaseous species. Similar logic is not applied to TDS as salts are conservative, mostly not subject to conversion to gaseous forms, and rapidly saturate soil capacity to absorb and retain them.

4.3 Loading Model Results

Based on the loading parameters and methodology described above, the loading model was used to develop TDS and nitrogen loading rates across the Malibu Valley Groundwater Basin. Table 4-3 summarizes the overall contribution of each land use group to total TDS and nitrogen loading. The spatial distribution of TDS and nitrogen loading rates are shown in Figure 4-2 and Figure 4-3, respectively. The highest levels of nitrogen loading, per area, occur in low water residential areas while urban landscaping parcels develop the highest densities of TDS loading.

Table 4-3: TDS and Nitrate Loading Results

Land Use Group	Total Area **(acres)**	Percent of Total Area	Percentage of Total TDS Loading	Percentage of Nitrogen Loading
Urban Commercial & Industrial	97	17%	25%	34%
Urban Residential (Low Water)	26	5%	12%	7%
Urban Residential	173	30%	41%	49%
Urban Landscape	10	2%	15%	7%
Vacant/Beaches	272	47%	7%	2%

The relative proportion of the land uses by area, TDS loading, and nitrate-N loading are shown in Figures 4-4, 4-5 and 4-6, respectively.

Figure 4-2: TDS Loading in the Malibu Valley Groundwater Basin

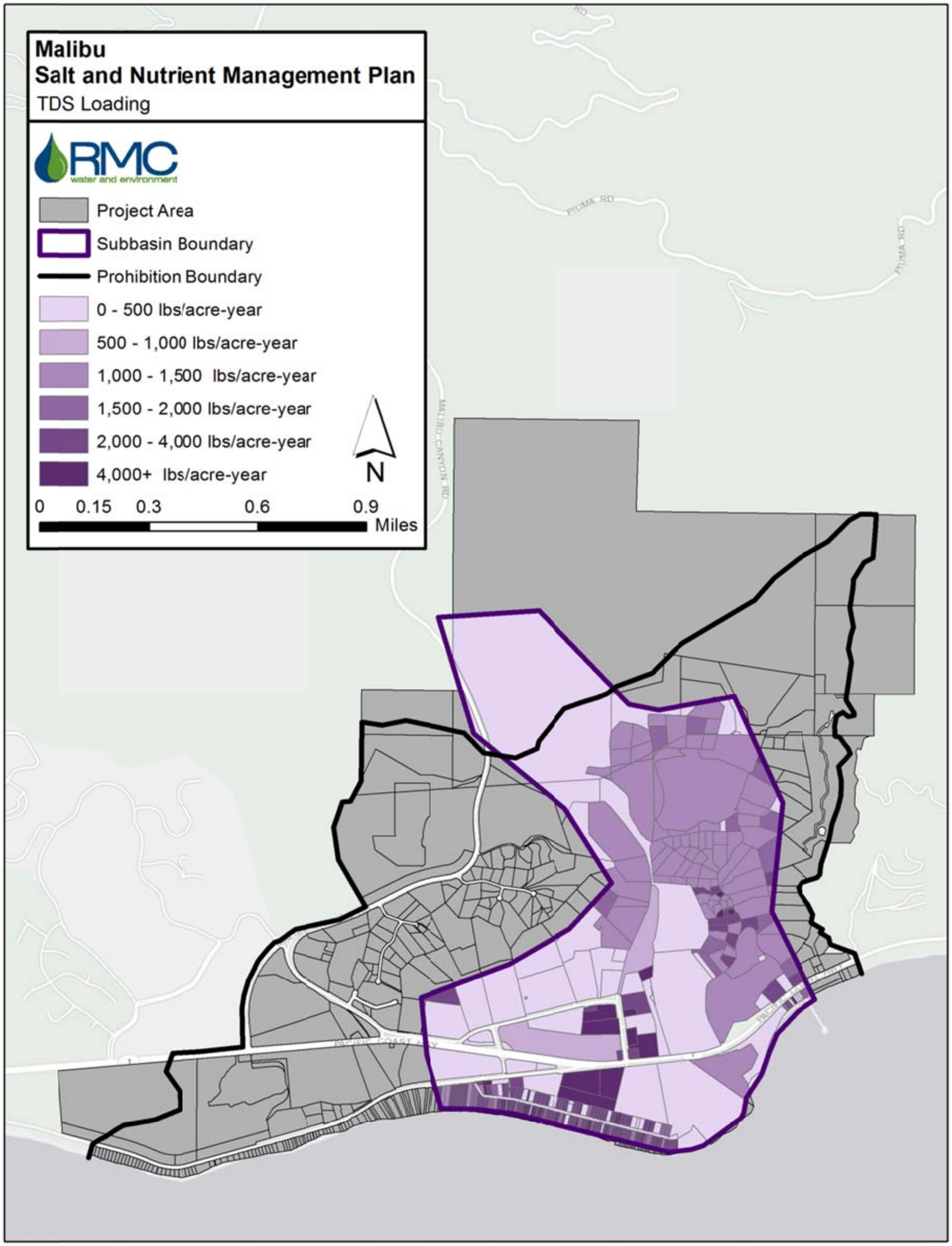


Figure 4-3: Nitrate-N Loading in the Malibu Valley Groundwater Basin

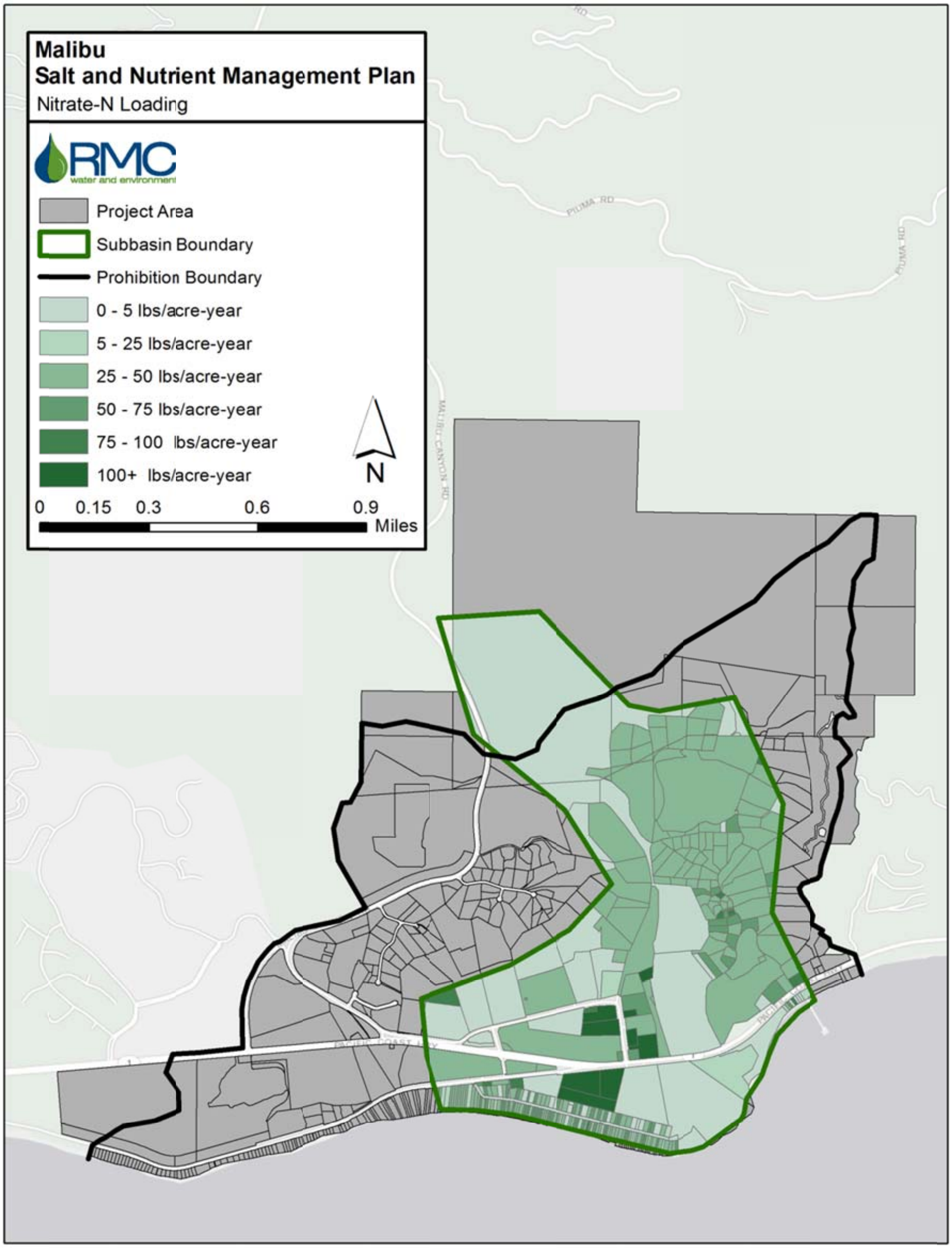


Figure 4-4: Percentage of Land Use in Study Area

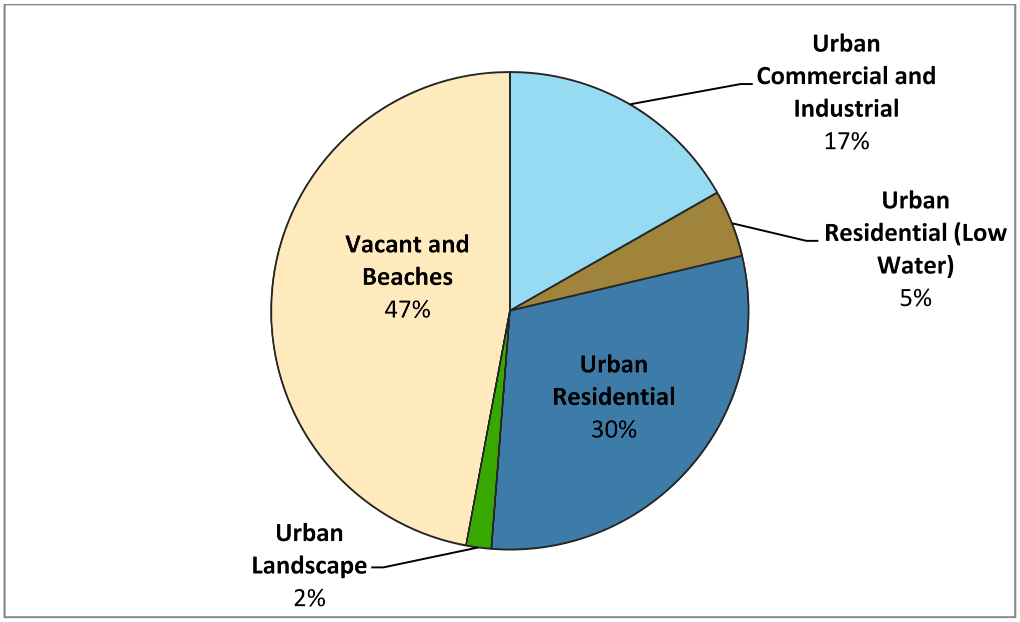


Figure 4-5: Percentage of TDS Loading in Study Area, by Land Use

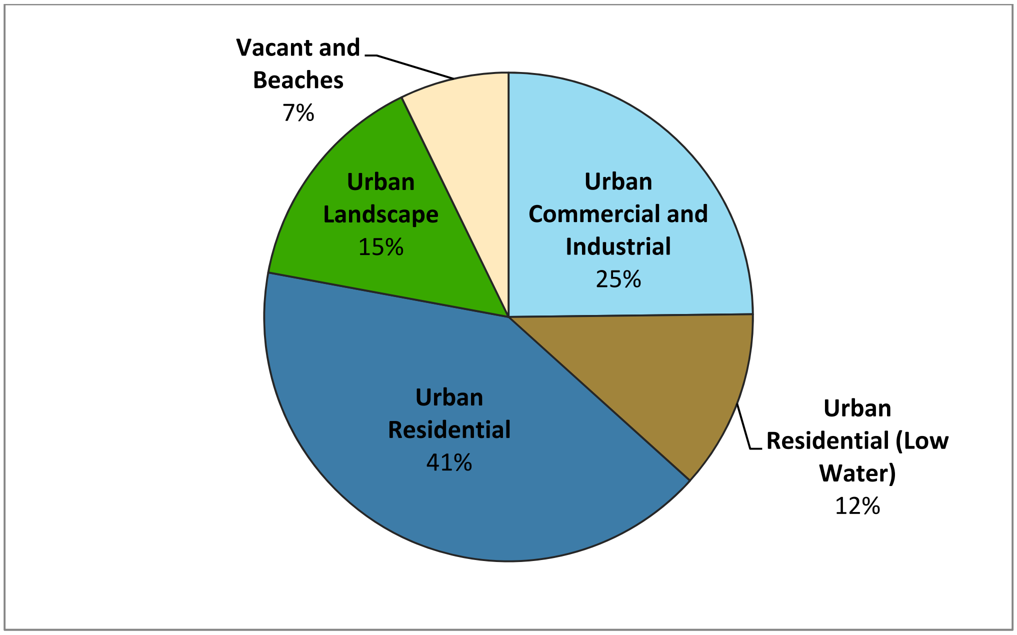
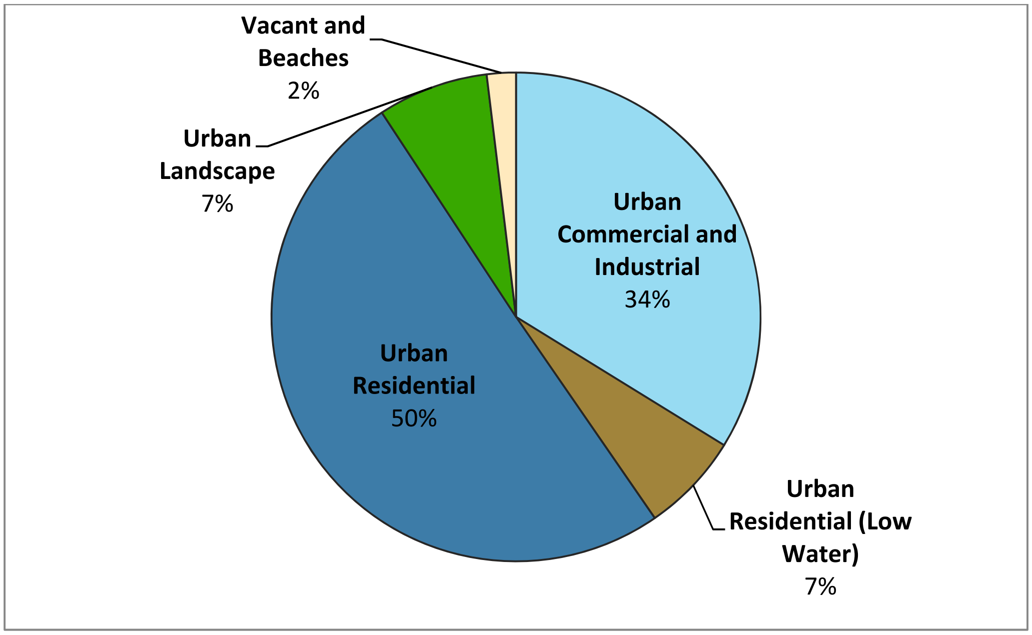


Figure 4-6: Percentage of Nitrogen Loading in Study Area, by Land Use



5 Future Groundwater Quality Analysis

This section describes the results from the analysis of future groundwater quality as a result of Project implementation. The future groundwater quality analysis is described in more detail in Appendix A.

5.1 Simulation of Baseline and Future Groundwater Quality

Groundwater quality concentrations for TDS and nitrate were simulated for the baseline (current) period and for the future (planning) period using a spreadsheet-based analytical mixing model. Concentration estimates were based on water and mass inflows and outflows (balances), mixed with the volume of water in storage in the groundwater basin and the average ambient groundwater quality (as previously described). The water balance components are based upon groundwater historic flow models (2003-2013) and are further extrapolated such that the future groundwater quality analysis simulates the period of 2010 to 2039.

The baseline (current) period water balances estimate all groundwater inflows and outflows for the baseline period and the associated change in storage based on estimates provided by the MODFLOW groundwater flow model of the basin. Future changes in water balance components simulated the cessation of septic system use by phase and the introduction of recycled water reuse (irrigation) and well injection.

TDS and nitrate concentrations are associated with each water balance inflow and outflow component. In order to simulate the effect of current and future salt and nutrient loading on groundwater quality in the groundwater basin, the spreadsheet mixing model 'mixed' the volume and quality of each inflow and outflow with the existing volume of groundwater and mass of TDS and nitrate in storage and tracked the annual change in groundwater storage and salt and nutrient masses for each year of simulation.

5.2 Baseline Analysis

The baseline (current) simulation period provided estimates of groundwater inflows and outflows to/from the groundwater basin and changes in groundwater storage from 2003 to 2013. This period represents existing groundwater basin conditions as characterized by average climatic conditions. The primary source of data for the water balance components was the Malibu MODFLOW groundwater flow model (McDonald Morrissey and Associates, 2014).

Major inflows in the baseline water balance include:

- Well injection of recycled water
- Ocean water inflow
- Precipitation recharge
- Inflow from septic systems
- Deep percolation from irrigation
- Natural stream inflow from Malibu Creek and Lagoon

Figures 5-1, 5-2, 5-3 and 5-4 show the breakdown of inflows to the groundwater basin by component for each phase.

Figure 5-1: Inflows to Malibu Valley Groundwater Basin by Component - Baseline

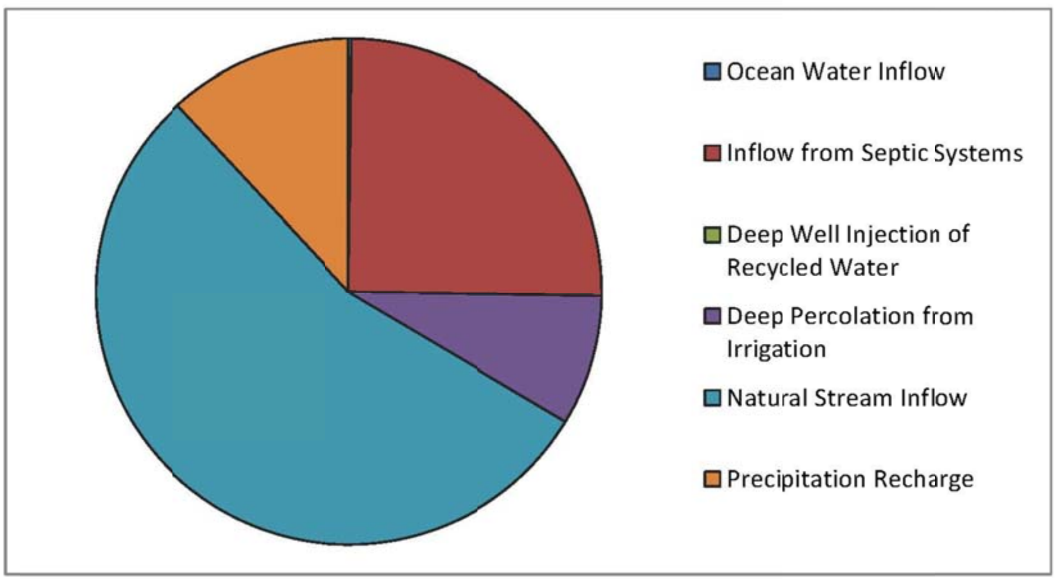


Figure 5-2: Inflows to Malibu Valley Groundwater Basin by Component – Phase 1

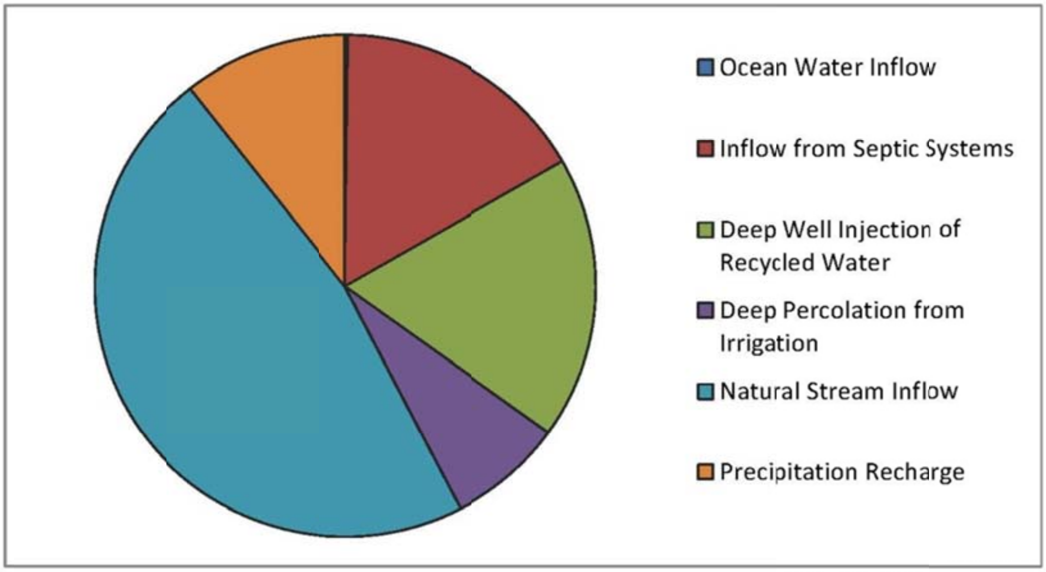


Figure 5-3: Inflows to Malibu Valley Groundwater Basin by Component – Phase 2

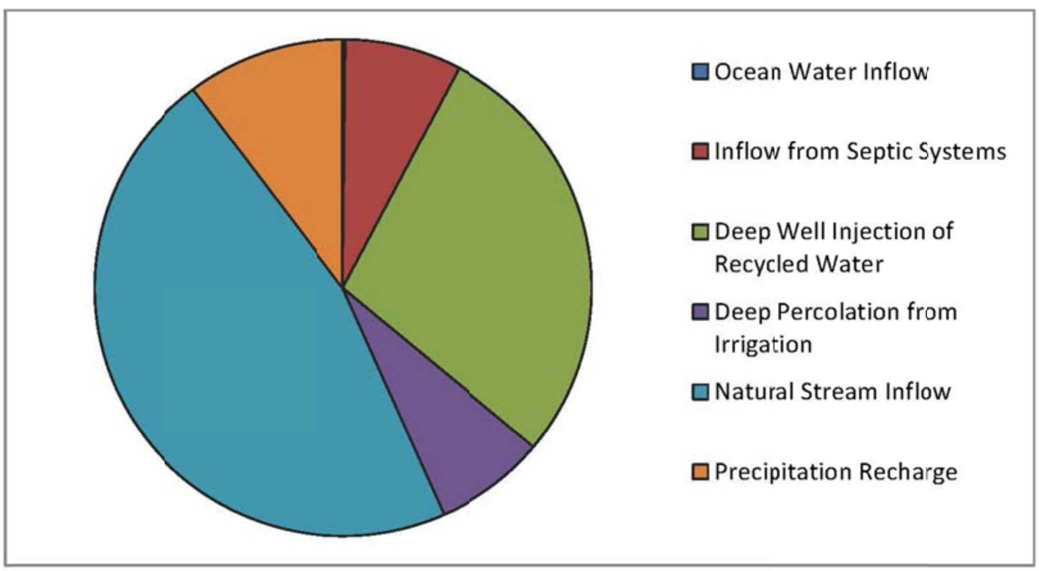
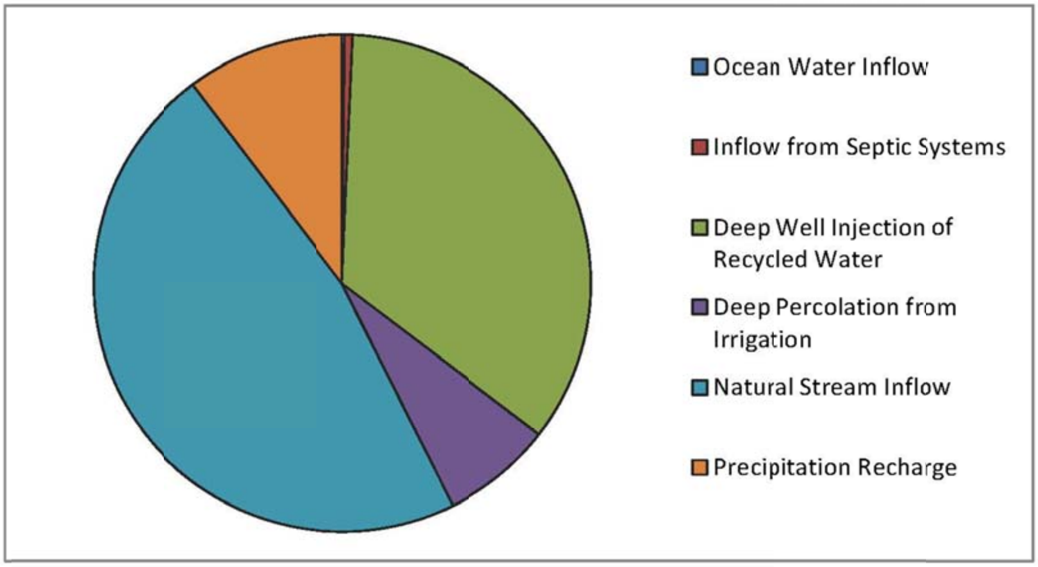


Figure 5-4: Inflows to Malibu Valley Groundwater Basin by Component – Phase 3



Major outflows in the baseline water balance include:

- Subsurface drainage to land features (e.g. wetlands)
- Evapotranspiration
- Groundwater flow to the ocean
- Stream gain from groundwater to the Malibu Creek and Lagoon

Areal anthropogenic recharge sources (irrigation deep percolation and septic systems) are not independently considered in the flow model but instead are subsumed within the model areal recharge rates. Model areal recharge rates were apportioned into natural sources (precipitation) and anthropogenic sources (return flows) based on the results of the surface loading model.

5.3 Water Quality of Inflows and Outflows

TDS and nitrate concentration estimates for groundwater basin inflows and outflows in the water balance are described below, followed by a discussion of the baseline mixing model calibration and results.

5.3.1 Natural Interface with Groundwater System

TDS and nitrate data from available surface water quality monitoring stations in the watershed were assessed to characterize the water quality of stream leakage from Malibu Creek and Lagoon. Based on recent water quality sampling, an average TDS concentration of 1,275 mg/L and average nitrate-N concentration of 2.46 mg/L were applied to Malibu Creek/Lagoon leakage for the baseline period (data were based on water quality testing completed as part of the Malibu Creek and Lagoon Total Maximum Daily Load (TMDL) setting process, USEPA, 2013). The coastal interface primarily facilitates a basin outflow; based on available data, ocean water quality facilitates a nitrogen input of 1.50 mg/L to the groundwater basin. Additionally, basin-wide nitrogen precipitation concentrations of 0.56 mg/L contribute further loading to the basin (NADP, 2014).

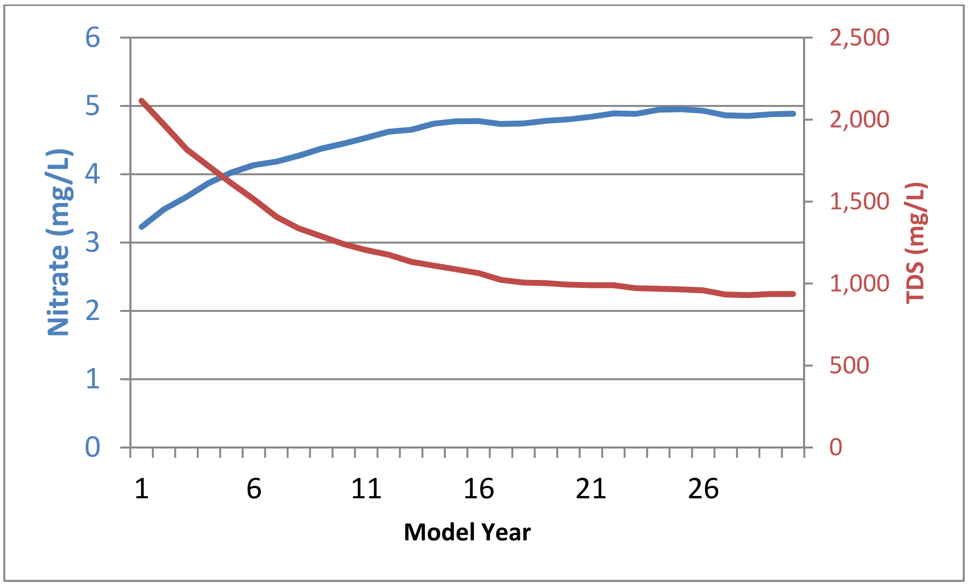
5.3.2 Anthropogenic Interface with Groundwater System

Salt and nutrient loads from agricultural, municipal, and septic sources are described in Section 4 - Source Identification and Loading Analysis. For the mixing model, the TDS and nitrogen mass loads for each return flow component were mixed with their respective annual return flow volumes to obtain an associated concentration. For the loading estimate, it was conservatively assumed that all nitrogen mass is converted to nitrate.

5.4 Mixing Model and Salt and Nutrient Balance

A spreadsheet mixing model was developed in order to simulate the effects of current salt and nutrient loading on groundwater quality in the Malibu Valley Groundwater Basin. In the mixing model, the simulated baseline period concentrations and trends were compared to the predominant pattern of observed concentrations and trends. Figure 5-5 shows the simulated average groundwater TDS and nitrate concentrations over the 30-year simulation period.

Figure 5-5: Final Simulated Baseline Average Groundwater Concentrations for Inland Area of the Malibu Valley Groundwater Basin



5.5 Future Conditions and Scenario Analysis

The spreadsheet mixing model developed for the baseline analysis was subsequently modified to evaluate the effects of planned changes to the study area, including future salt and nutrient loadings on overall groundwater quality in the Malibu Valley Groundwater Basin for the future planning period from 2010 to 2039. Future Project changes are superimposed over average water balance conditions during the 30-year baseline period (described above) to simulate future groundwater quality.

The mixing model was used to predict future water quality trends. This model is designed to incorporate the existing volume of groundwater and masses of TDS and nitrate in storage, and to track the annual change in groundwater storage and salt and nutrient mass for the groundwater basin as a whole over the study period. Three future scenarios were simulated using the mixing model assuming build-out conditions:

- Future Baseline (No-Project): Assumes average baseline water balance conditions with no additional wastewater treatment (i.e., continued use of OWDSs) or recycled water injection.

- Future Scenario 1: Assumes recycled water injection with centralized wastewater treatment/recycled water generation resulting in a total nitrogen concentration of 7 mg/L. No percolation in Winter Canyon is included in this scenario.
- Future Scenario 2: Assumes recycled water injection with centralized wastewater treatment/recycled water generation resulting in a total nitrogen concentration of 8 mg/L. No percolation in Winter Canyon is included in this scenario.

The average TDS and nitrate concentrations for the baseline period which were held constant across the three scenarios were:

- Deep percolation of areal precipitation
- Leakage from Malibu Creek and Lagoon
- Subsurface inflow from the Pacific Ocean

5.5.1 Simulated Water Quality Results

Simulated TDS Groundwater Concentrations

Future changes in land use and implementation of the proposed Project will not result in significant adverse changes to TDS loading to the groundwater basin. In fact, the TDS concentration of recycled water to be injected into the Malibu Valley Groundwater Basin will be less than existing ambient groundwater concentrations. Consequently, the proposed recycled water injection will not result in an altered future groundwater quality, and if anything, will result in improvements to groundwater quality with respect to TDS in the injection area (see Figure 5-5).

Simulated Nitrate-N Groundwater Concentrations

Figure 5-6 shows the results of the mixing model for nitrate-N for the three future conditions simulated. This figure plots the simulated future concentration trends for each scenario against the Basin Plan WQO of 10 mg/L. Table 5-1 summarizes the simulated average groundwater nitrate-N concentration at the end of the modeled period.

Figure 5-6: Simulated Future Groundwater Nitrate-N Concentrations

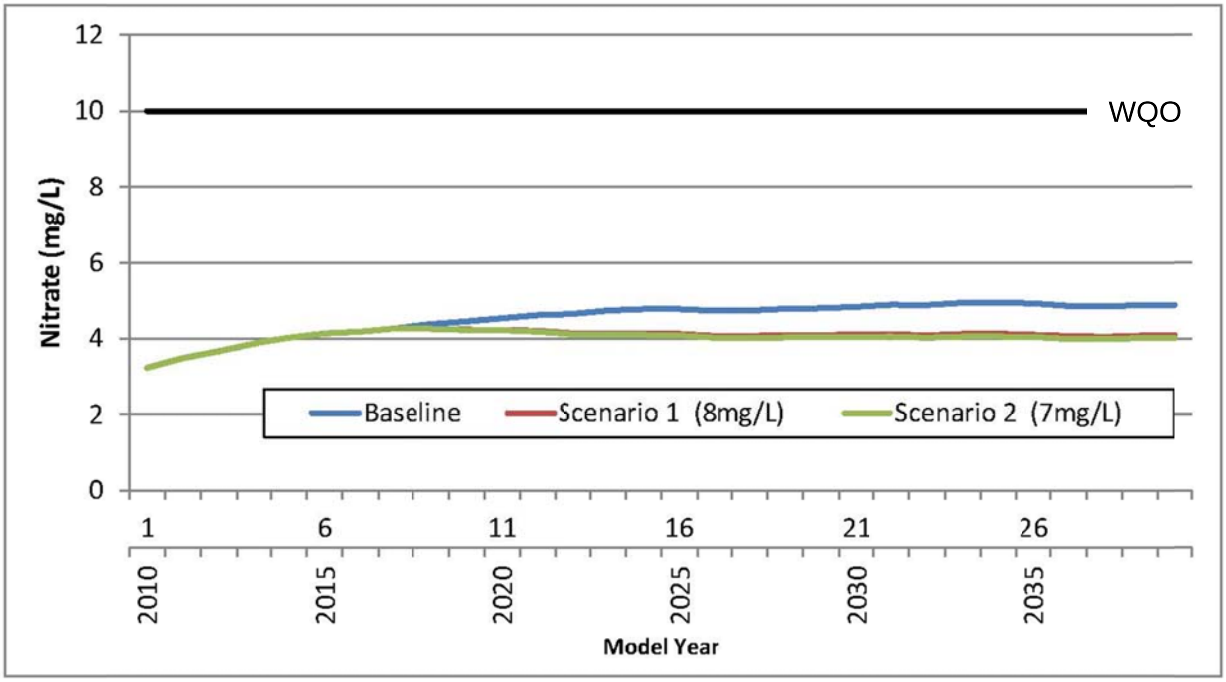


Table 5-1: Long-Term Nitrate-N Concentrations in Groundwater

Scenario	Nitrate- N (mg/L) at End of Model Period
Baseline (Current) Conditions	4.91
Injection of Effluent with 8 mg/L nitrate-N	4.10
Injection of Effluent with 7 mg/L nitrate-N	4.03

6 Modeling Findings

Based on the analysis documented herein, the following findings can be made:

- Proposed recycled water injections into the Malibu Valley Groundwater Basin will have no apparent negative impact on average TDS concentrations in the Malibu Valley Groundwater Basin. If anything, the injections will reduce groundwater TDS concentrations as the injected water will contain a lower TDS concentration than the ambient background quality.
- Since recycled water injection represents only about a third of the nitrogen loading to the groundwater basin, only about 13 percent of the groundwater basin's assimilative capacity for nitrate-N is utilized by the Project.
- Average nitrate concentrations in the Malibu Valley Groundwater Basin are projected to increase similarly under all three scenarios for the simulation period from 2010 to 2019 (by which point, the first two phases of the Project will have been implemented). Starting around 2019, the proposed Project will have significant enough effects on groundwater quality such that the

concentration trends diverge from baseline conditions and approach lower steady-state concentration at the end of the model period (2039).

- When considering the difference in modeled results between Scenarios 1 and 2 (reduction in groundwater nitrate-N concentrations resulting from a 1 mg/L nitrate-N concentration reduction in recycled water), the degree of treatment (nitrogen removal) relative to the resulting impacts on groundwater quality is minor (0.07 mg/L) as compared to scale of groundwater nitrate-N concentration reduction resulting from Project implementation (or the No-Project scenario, reducing average groundwater nitrate-N concentration by 0.81 mg/L).
- Reducing recycled water effluent standards for nitrate-N from 8 mg/L to 7 mg/L has a very small change on future groundwater quality, with long-term resultant groundwater concentrations of 4.10 mg/L and 4.03 mg/L, respectively.

In summary, the projected future increases in nitrate-N concentrations in the Malibu Valley Groundwater Basin remain below the WQO established for nitrate-N in the Basin Plan. Approximately 13 percent of the groundwater basin's overall assimilative capacity will be utilized by the Project and planned future land uses, of which only about 7 percent of the assimilative capacity for nitrate-N is utilized by the Project and the remaining portion is utilized by future land uses (i.e. development of currently vacant lands and changes to existing land uses). Finally, it is important to note that the modeling documented herein is conservative, given the assumptions incorporated in the mixing model for nitrate, and will therefore overestimate the actual nitrogen loadings to the groundwater basin.

7 Anti-Degradation Analysis

7.1 Summary

The SWRCB's *Statement of Policy with Respect to Maintaining High Quality of Waters in California* (otherwise known as Resolution No. 68-16) states that it is the policy of the State to maintain and promote high water quality. The purpose of this Resolution is to allow the State of California to grant permits and licenses for water and waste disposals into water bodies while providing maximum benefit and maintaining the health, safety, and welfare of Californians. In general, Resolution 68-16 establishes that:

- Whenever the existing water quality is better than the quality prescribed in policies, such high quality shall be maintained unless it can be demonstrated that any change is consistent with the maximum benefit to the people, will not affect present and future beneficial use of such water and will not result in water quality less than that prescribed in the policies.
- Waste discharges that lead to increased volume or concentration of waste is required to meet waste discharge requirements which will result in the best practicable treatment of control of discharges necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people will be maintained.

In summary, the California Anti-Degradation Policy requires that existing high quality waters be maintained to the maximum extent possible. However, there is leniency in discharge quality if the action is part of the best overall solution that provides benefits that outweigh the costs of lowered water quality.

The Recycled Water Policy, adopted by the SWRCB in 2009, established evaluation criteria for projects utilizing recycled water for groundwater recharge, such that a single recycled water project may use less than 10 percent of the available assimilative capacity, and multiple recycled water projects may use less than 20 percent of the available assimilative capacity, until such time as a Salt and Nutrient Management Plan is adopted.

- A project that utilizes less than 10 percent of the available assimilative capacity in a basin/sub-basin (or multiple projects utilizing less than 20 percent of the available assimilative capacity in a basin/sub-basin) need only conduct an anti-degradation analysis verifying the use of the assimilative capacity. For those basins/sub-basins where the Regional Water Boards have not determined the baseline assimilative capacity, the baseline assimilative capacity shall be calculated by the initial project proponent, with review and approval by the Regional Water Board, until such time as the salt/nutrient plan is approved by the Regional Water Board and is in effect. For compliance with this subparagraph, the available assimilative capacity shall be calculated by comparing the mineral water quality objective with the average concentration of the basin/sub-basin, either over the most recent five years of data available or using a data set approved by the Regional Water Board Executive Officer. In determining whether the available assimilative capacity will be exceeded by the project or projects, the Regional Water Board shall calculate the impacts of the project or projects over at least a ten year time frame.
- In the event a project or multiple projects utilize more than the fraction of the assimilative capacity designated, then a Regional Water Board-deemed acceptable anti-degradation analysis shall be performed to comply with the Resolution No. 68-16.

7.2 Applicability to Project

Overall, the net effect of the proposed Project will be to significantly reduce the mass of nitrogen loading to the Malibu Valley Groundwater Basin. Under current conditions, the existing OWDSs are contributing approximately 7,266 lbs of nitrogen per year to the groundwater basin, whereas recycled water injections associated with the proposed Project will contribute approximately 2,925 lbs per year at buildout (assuming an effluent nitrate concentration of 8 mg/L), a reduction of 4,340 lbs of nitrogen each year (an approximate reduction of 60%). Other significant findings applicable to the proposed Project include the following:

- The proposed Project will minimally increase the concentration of nitrate (measured as N) within the groundwater basin (specifically the deeper Civic Center Gravels zone); however, the net increase of nutrients will not exceed WQOs and therefore will "not result in water quality less than that prescribed in the policies."
- The portion of the groundwater basin downgradient of the proposed injection well locations is adjacent to the shoreline and would not be used for potable water supply in the future due to elevated TDS levels and high connectedness with the ocean (and associated increased risk for seawater intrusion).

Three injection wells are planned along Malibu Road, all of which will penetrate the Civic Center Gravels to a maximum depth of approximately 160 feet and all of which will be located within approximately 1,200 feet of the ocean. As shown in Figure 2-1, an offshore hydraulic gradient exits this area of the groundwater basin and therefore the discharge from the injection wells will be directed south toward the ocean/Santa Monica Bay where it will exit the groundwater basin at the southwestern edge of the basin through ocean floor seeps. Given the location of the injection wells and presence of an offshore gradient, the majority of the groundwater basin will be unaffected by the injected recycled water with higher nutrient concentrations and is viability as a future potential potable supply as required by the municipal designation in the Basin Plan will not be compromised by the Project. Additional water quality benefits anticipated from the Project include:

1. A seawater intrusion barrier will be created by the injections to further protect the municipal designation; and
2. The reduction in nutrient loadings to the shallow alluvial aquifer and Malibu Creek and Lagoon (and areas immediately downstream from the Lagoon) by the elimination of OWDS discharges.

However, as a precaution due to the Project's contribution of nitrate to the groundwater basin, conservative measures to protect public health are planned as part of the Project. Specifically, public health will be protected by a new well ordinance proposed by the City that will restrict the installation of news wells and pumping of groundwater in the Civic Center area.

In summary, the benefits to be achieved by the Project, which include the removal of OWDS discharges with high nutrients from shallow groundwater and connected surface water, groundwater basin protection from seawater intrusion, and potable water offset through the use of recycled water for irrigation (including indirect impacts such as reduced treatment costs and greenhouse gas emissions), far outweigh the anticipated slight increase in groundwater nutrient concentrations.

It is our conclusion that, while a slight degradation of groundwater water quality within the Malibu Valley Groundwater Basin is anticipated as a result of Project implementation, the overall water quality changes associated with the Project are consistent with the maximum benefit of the people of the State and the use of the groundwater basin's assimilative capacity should be granted.

Table 7-1: Summary of Anti-Degradation Assessment

<table>
<tr><th>SWRCB Resolution No. 68-16 Component</th><th>Anti-Degradation Assessment</th></tr>
<tr><td>Water quality changes associated with proposed project are consistent with the maximum benefit of the people of the State.</td><td rowspan="3">• The Project will not cause groundwater quality to exceed applicable WQOs
• Use of recycled water for irrigation reduces groundwater pumping, while injection of recycled water helps mitigate saline water intrusion into the basin to protect municipal use designation</td></tr>
<tr><td>The water quality changes associated with proposed project will not unreasonably affect present and anticipated beneficial uses.</td></tr>
<tr><td>The water quality changes will not result in water quality less than prescribed in the Basin Plan.</td></tr>
<tr><td>The projects are consistent with the use of best practicable treatment or control to avoid pollution or nuisance and maintain the highest water quality consistent with maximum benefit to the people of the State.</td><td>• The concentration of nitrate-N in recycled water produced by the Project will be 8 mg/L; this concentration is well below the Basin Plan WQO of 10 mg/L</td></tr>
<tr><td>The proposed project is necessary to accommodate important economic or social development.</td><td>• The Project is necessary to help achieve the TMDLs established for Malibu Creek and Lagoon
• The recycled water supply and potable offset are an integral part of the City's water supply portfolio
• A de facto building moratorium has been created due to the OWDS prohibition, creating economic uncertainty for property owners affected by the Prohibition Resolution.</td></tr>
</table>

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Appendix A – Results of Malibu Valley Groundwater Basin Loading and Mixing Model

Nitrogen Loading to Malibu Valley Groundwater Basin
Baseline (Current) Conditions

					Inflow									
		Initial Basin Characteristics			Stream Seepage			Surface Loading		Precipitation			Ocean Inflow	
	Year	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)
1	2010	3.23	1.48E+10	4.78E+10	2.46	1.19E+09	2.93E+09	5.93E+08	6.87E+09	0.56	2.47E+08	1.37E+08	1.50	4.60E+06
2	2011	3.49	1.48E+10	5.15E+10	2.46	1.07E+09	2.64E+09	6.46E+08	6.87E+09	0.56	3.71E+08	2.06E+08	1.50	4.79E+06
3	2012	3.67	1.48E+10	5.43E+10	2.46	9.86E+08	2.42E+09	6.78E+08	6.87E+09	0.56	1.60E+08	8.88E+07	1.50	4.72E+06
4	2013	3.87	1.48E+10	5.71E+10	2.46	1.17E+09	2.89E+09	7.22E+08	6.87E+09	0.56	1.81E+08	1.00E+08	1.50	4.61E+06
5	2014	4.03	1.47E+10	5.93E+10	2.46	1.22E+09	3.00E+09	7.89E+08	6.87E+09	0.56	2.03E+08	1.13E+08	1.50	4.70E+06
6	2015	4.13	1.48E+10	6.11E+10	2.46	1.07E+09	2.64E+09	7.20E+08	6.87E+09	0.56	5.24E+08	2.91E+08	1.50	4.56E+06
7	2016	4.19	1.48E+10	6.19E+10	2.46	1.19E+09	2.94E+09	7.30E+08	6.87E+09	0.56	3.06E+08	1.70E+08	1.50	4.44E+06
8	2017	4.27	1.48E+10	6.31E+10	2.46	1.25E+09	3.07E+09	7.61E+08	6.87E+09	0.56	1.20E+08	6.69E+07	1.50	4.51E+06
9	2018	4.37	1.48E+10	6.45E+10	2.46	1.18E+09	2.91E+09	7.43E+08	6.87E+09	0.56	1.84E+08	1.02E+08	1.50	4.74E+06
10	2019	4.45	1.47E+10	6.55E+10	2.46	1.19E+09	2.94E+09	6.73E+08	6.87E+09	0.56	1.99E+08	1.11E+08	1.50	4.70E+06
11	2020	4.53	1.47E+10	6.69E+10	2.46	1.19E+09	2.93E+09	5.93E+08	6.87E+09	0.56	2.47E+08	1.37E+08	1.50	4.60E+06
12	2021	4.62	1.47E+10	6.81E+10	2.46	1.07E+09	2.64E+09	6.46E+08	6.87E+09	0.56	3.71E+08	2.06E+08	1.50	4.79E+06
13	2022	4.65	1.47E+10	6.86E+10	2.46	9.86E+08	2.42E+09	6.78E+08	6.87E+09	0.56	1.60E+08	8.88E+07	1.50	4.72E+06
14	2023	4.74	1.47E+10	6.97E+10	2.46	1.17E+09	2.89E+09	7.22E+08	6.87E+09	0.56	1.81E+08	1.00E+08	1.50	4.61E+06
15	2024	4.78	1.47E+10	7.01E+10	2.46	1.22E+09	3.00E+09	7.89E+08	6.87E+09	0.56	2.03E+08	1.13E+08	1.50	4.70E+06
16	2025	4.78	1.47E+10	7.04E+10	2.46	1.07E+09	2.64E+09	7.20E+08	6.87E+09	0.56	5.24E+08	2.91E+08	1.50	4.56E+06
17	2026	4.74	1.47E+10	6.97E+10	2.46	1.19E+09	2.94E+09	7.30E+08	6.87E+09	0.56	3.06E+08	1.70E+08	1.50	4.44E+06
18	2027	4.74	1.47E+10	6.98E+10	2.46	1.25E+09	3.07E+09	7.61E+08	6.87E+09	0.56	1.20E+08	6.69E+07	1.50	4.51E+06
19	2028	4.78	1.47E+10	7.03E+10	2.46	1.18E+09	2.91E+09	7.43E+08	6.87E+09	0.56	1.84E+08	1.02E+08	1.50	4.74E+06
20	2029	4.80	1.47E+10	7.05E+10	2.46	1.19E+09	2.94E+09	6.73E+08	6.87E+09	0.56	1.99E+08	1.11E+08	1.50	4.70E+06
21	2030	4.84	1.47E+10	7.11E+10	2.46	1.19E+09	2.93E+09	5.93E+08	6.87E+09	0.56	2.47E+08	1.37E+08	1.50	4.60E+06
22	2031	4.89	1.47E+10	7.17E+10	2.46	1.07E+09	2.64E+09	6.46E+08	6.87E+09	0.56	3.71E+08	2.06E+08	1.50	4.79E+06
23	2032	4.88	1.47E+10	7.17E+10	2.46	9.86E+08	2.42E+09	6.78E+08	6.87E+09	0.56	1.60E+08	8.88E+07	1.50	4.72E+06
24	2033	4.94	1.46E+10	7.24E+10	2.46	1.17E+09	2.89E+09	7.22E+08	6.87E+09	0.56	1.81E+08	1.00E+08	1.50	4.61E+06
25	2034	4.95	1.46E+10	7.24E+10	2.46	1.22E+09	3.00E+09	7.89E+08	6.87E+09	0.56	2.03E+08	1.13E+08	1.50	4.70E+06
26	2035	4.93	1.47E+10	7.23E+10	2.46	1.07E+09	2.64E+09	7.20E+08	6.87E+09	0.56	5.24E+08	2.91E+08	1.50	4.56E+06
27	2036	4.86	1.47E+10	7.14E+10	2.46	1.19E+09	2.94E+09	7.30E+08	6.87E+09	0.56	3.06E+08	1.70E+08	1.50	4.44E+06
28	2037	4.85	1.47E+10	7.11E+10	2.46	1.25E+09	3.07E+09	7.61E+08	6.87E+09	0.56	1.20E+08	6.69E+07	1.50	4.51E+06
29	2038	4.88	1.46E+10	7.14E+10	2.46	1.18E+09	2.91E+09	7.43E+08	6.87E+09	0.56	1.84E+08	1.02E+08	1.50	4.74E+06
30	2039	4.89	1.46E+10	7.14E+10	2.46	1.19E+09	2.94E+09	6.73E+08	6.87E+09	0.56	1.99E+08	1.11E+08	1.50	4.70E+06

Nitrogen Loading to Malibu Valley Groundwater Basin
Baseline (Current) Conditions

					Outflow						
	Water Balance	Ocean Outflow			Stream Outflow			ET	Concluding Basin Characteristics		
Mass (mg)	Volume (L)	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Volume (L)	Volume (L)	Mass (mg)	Concentration (mg/L)
6.91E+06	0.00E+00	3.23	1.18E+09	3.81E+09	3.23	7.47E+08	2.41E+09	1.29E+08	1.48E+10	5.15E+10	3.49
7.19E+06	0.00E+00	3.49	1.12E+09	3.92E+09	3.49	8.68E+08	3.03E+09	8.50E+07	1.48E+10	5.43E+10	3.67
7.08E+06	0.00E+00	3.67	9.79E+08	3.59E+09	3.67	8.10E+08	2.97E+09	8.81E+07	1.48E+10	5.71E+10	3.87
6.92E+06	0.00E+00	3.87	1.20E+09	4.66E+09	3.87	7.82E+08	3.03E+09	1.10E+08	1.47E+10	5.93E+10	4.03
7.05E+06	0.00E+00	4.03	1.30E+09	5.22E+09	4.03	7.35E+08	2.96E+09	1.32E+08	1.48E+10	6.11E+10	4.13
6.84E+06	0.00E+00	4.13	1.19E+09	4.90E+09	4.13	1.00E+09	4.15E+09	1.34E+08	1.48E+10	6.19E+10	4.19
6.66E+06	0.00E+00	4.19	1.29E+09	5.38E+09	4.19	8.12E+08	3.40E+09	1.51E+08	1.48E+10	6.31E+10	4.27
6.76E+06	0.00E+00	4.27	1.39E+09	5.93E+09	4.27	6.15E+08	2.63E+09	1.47E+08	1.48E+10	6.45E+10	4.37
7.11E+06	0.00E+00	4.37	1.29E+09	5.65E+09	4.37	7.42E+08	3.25E+09	1.11E+08	1.47E+10	6.55E+10	4.45
7.05E+06	0.00E+00	4.45	1.23E+09	5.48E+09	4.45	7.02E+08	3.12E+09	1.17E+08	1.47E+10	6.69E+10	4.53
6.91E+06	0.00E+00	4.53	1.18E+09	5.35E+09	4.53	7.47E+08	3.39E+09	1.29E+08	1.47E+10	6.81E+10	4.62
7.19E+06	0.00E+00	4.62	1.12E+09	5.19E+09	4.62	8.68E+08	4.02E+09	8.50E+07	1.47E+10	6.86E+10	4.65
7.08E+06	0.00E+00	4.65	9.79E+08	4.56E+09	4.65	8.10E+08	3.77E+09	8.81E+07	1.47E+10	6.97E+10	4.74
6.92E+06	0.00E+00	4.74	1.20E+09	5.71E+09	4.74	7.82E+08	3.71E+09	1.10E+08	1.47E+10	7.01E+10	4.78
7.05E+06	0.00E+00	4.78	1.30E+09	6.19E+09	4.78	7.35E+08	3.51E+09	1.32E+08	1.47E+10	7.04E+10	4.78
6.84E+06	0.00E+00	4.78	1.19E+09	5.66E+09	4.78	1.00E+09	4.80E+09	1.34E+08	1.47E+10	6.97E+10	4.74
6.66E+06	0.00E+00	4.74	1.29E+09	6.09E+09	4.74	8.12E+08	3.84E+09	1.51E+08	1.47E+10	6.98E+10	4.74
6.76E+06	0.00E+00	4.74	1.39E+09	6.59E+09	4.74	6.15E+08	2.92E+09	1.47E+08	1.47E+10	7.03E+10	4.78
7.11E+06	0.00E+00	4.78	1.29E+09	6.18E+09	4.78	7.42E+08	3.55E+09	1.11E+08	1.47E+10	7.05E+10	4.80
7.05E+06	0.00E+00	4.80	1.23E+09	5.91E+09	4.80	7.02E+08	3.37E+09	1.17E+08	1.47E+10	7.11E+10	4.84
6.91E+06	0.00E+00	4.84	1.18E+09	5.72E+09	4.84	7.47E+08	3.62E+09	1.29E+08	1.47E+10	7.17E+10	4.89
7.19E+06	0.00E+00	4.89	1.12E+09	5.49E+09	4.89	8.68E+08	4.25E+09	8.50E+07	1.47E+10	7.17E+10	4.88
7.08E+06	0.00E+00	4.88	9.79E+08	4.78E+09	4.88	8.10E+08	3.95E+09	8.81E+07	1.46E+10	7.24E+10	4.94
6.92E+06	0.00E+00	4.94	1.20E+09	5.95E+09	4.94	7.82E+08	3.87E+09	1.10E+08	1.46E+10	7.24E+10	4.95
7.05E+06	0.00E+00	4.95	1.30E+09	6.42E+09	4.95	7.35E+08	3.64E+09	1.32E+08	1.47E+10	7.23E+10	4.93
6.84E+06	0.00E+00	4.93	1.19E+09	5.84E+09	4.93	1.00E+09	4.95E+09	1.34E+08	1.47E+10	7.14E+10	4.86
6.66E+06	0.00E+00	4.86	1.29E+09	6.25E+09	4.86	8.12E+08	3.95E+09	1.51E+08	1.47E+10	7.11E+10	4.85
6.76E+06	0.00E+00	4.85	1.39E+09	6.74E+09	4.85	6.15E+08	2.99E+09	1.47E+08	1.46E+10	7.14E+10	4.88
7.11E+06	0.00E+00	4.88	1.29E+09	6.30E+09	4.88	7.42E+08	3.62E+09	1.11E+08	1.46E+10	7.14E+10	4.89
7.05E+06	0.00E+00	4.89	1.23E+09	6.01E+09	4.89	7.02E+08	3.43E+09	1.17E+08	1.46E+10	7.19E+10	4.91

Nitrogen Loading to Malibu Valley Groundwater Model
Future Scenario with Effluent at 8 mg/L Nitrate-N

					Inflow										
		Initial Basin Characteristics			Stream Seepage			Surface Loading		Precipitation			Ocean Inflow		
	Year	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)
1	2010	3.23	1.48E+10	4.78E+10	2.46	1.19E+09	2.93E+09	5.93E+08	6.87E+09	0.56	2.47E+08	1.37E+08	1.50	4.60E+06	6.91E+06
2	2011	3.49	1.48E+10	5.15E+10	2.46	1.07E+09	2.64E+09	6.46E+08	6.87E+09	0.56	3.71E+08	2.06E+08	1.50	4.79E+06	7.19E+06
3	2012	3.67	1.48E+10	5.43E+10	2.46	9.86E+08	2.42E+09	6.78E+08	6.87E+09	0.56	1.60E+08	8.88E+07	1.50	4.72E+06	7.08E+06
4	2013	3.87	1.48E+10	5.71E+10	2.46	1.17E+09	2.89E+09	7.22E+08	6.87E+09	0.56	1.81E+08	1.00E+08	1.50	4.61E+06	6.92E+06
5	2014	4.03	1.47E+10	5.93E+10	2.46	1.22E+09	3.00E+09	7.89E+08	6.87E+09	0.56	2.03E+08	1.13E+08	1.50	4.70E+06	7.05E+06
6	2015	4.13	1.48E+10	6.11E+10	2.46	1.07E+09	2.64E+09	7.20E+08	6.87E+09	0.56	5.24E+08	2.91E+08	1.50	4.56E+06	6.84E+06
7	2016	4.19	1.48E+10	6.19E+10	2.46	1.19E+09	2.94E+09	7.30E+08	6.87E+09	0.56	3.06E+08	1.70E+08	1.50	4.44E+06	6.66E+06
8	2017	4.27	1.48E+10	6.31E+10	2.46	1.22E+09	3.00E+09	7.78E+08	6.30E+09	0.56	1.20E+08	6.69E+07	1.50	4.45E+06	6.67E+06
9	2018	4.26	1.48E+10	6.29E+10	2.46	1.14E+09	2.81E+09	7.65E+08	6.30E+09	0.56	1.84E+08	1.02E+08	1.50	4.76E+06	7.14E+06
10	2019	4.24	1.47E+10	6.24E+10	2.46	1.14E+09	2.80E+09	7.13E+08	6.30E+09	0.56	1.99E+08	1.11E+08	1.50	4.64E+06	6.95E+06
11	2020	4.23	1.47E+10	6.23E+10	2.46	1.13E+09	2.78E+09	5.56E+08	6.18E+09	0.56	2.47E+08	1.37E+08	1.50	4.56E+06	6.84E+06
12	2021	4.20	1.47E+10	6.18E+10	2.46	1.05E+09	2.58E+09	5.89E+08	6.18E+09	0.56	3.71E+08	2.06E+08	1.50	4.86E+06	7.29E+06
13	2022	4.14	1.47E+10	6.09E+10	2.46	9.65E+08	2.37E+09	6.13E+08	6.18E+09	0.56	1.60E+08	8.88E+07	1.50	4.65E+06	6.97E+06
14	2023	4.14	1.47E+10	6.07E+10	2.46	1.17E+09	2.88E+09	4.92E+08	6.50E+09	0.56	1.81E+08	1.00E+08	1.50	4.63E+06	6.95E+06
15	2024	4.14	1.46E+10	6.06E+10	2.46	1.22E+09	2.99E+09	5.23E+08	6.50E+09	0.56	2.03E+08	1.13E+08	1.50	4.93E+06	7.39E+06
16	2025	4.12	1.47E+10	6.06E+10	2.46	1.07E+09	2.63E+09	4.54E+08	6.50E+09	0.56	5.24E+08	2.91E+08	1.50	4.51E+06	6.77E+06
17	2026	4.07	1.47E+10	5.98E+10	2.46	1.19E+09	2.94E+09	4.69E+08	6.50E+09	0.56	3.06E+08	1.70E+08	1.50	4.39E+06	6.58E+06
18	2027	4.07	1.47E+10	5.97E+10	2.46	1.25E+09	3.09E+09	5.04E+08	6.50E+09	0.56	1.20E+08	6.69E+07	1.50	4.51E+06	6.76E+06
19	2028	4.09	1.47E+10	6.00E+10	2.46	1.18E+09	2.90E+09	4.97E+08	6.50E+09	0.56	1.84E+08	1.02E+08	1.50	4.98E+06	7.47E+06
20	2029	4.09	1.46E+10	5.98E+10	2.46	1.18E+09	2.90E+09	4.64E+08	6.50E+09	0.56	1.99E+08	1.11E+08	1.50	4.87E+06	7.30E+06
21	2030	4.10	1.46E+10	6.01E+10	2.46	1.15E+09	2.83E+09	4.34E+08	6.50E+09	0.56	2.47E+08	1.37E+08	1.50	4.66E+06	6.99E+06
22	2031	4.12	1.46E+10	6.01E+10	2.46	1.07E+09	2.63E+09	4.60E+08	6.50E+09	0.56	3.71E+08	2.06E+08	1.50	4.95E+06	7.43E+06
23	2032	4.09	1.46E+10	5.97E+10	2.46	9.83E+08	2.42E+09	4.70E+08	6.50E+09	0.56	1.60E+08	8.88E+07	1.50	4.74E+06	7.11E+06
24	2033	4.12	1.46E+10	6.00E+10	2.46	1.17E+09	2.88E+09	4.92E+08	6.50E+09	0.56	1.81E+08	1.00E+08	1.50	4.63E+06	6.95E+06
25	2034	4.12	1.45E+10	5.99E+10	2.46	1.22E+09	2.99E+09	5.23E+08	6.50E+09	0.56	2.03E+08	1.13E+08	1.50	4.93E+06	7.39E+06
26	2035	4.11	1.46E+10	6.00E+10	2.46	1.07E+09	2.63E+09	4.54E+08	6.50E+09	0.56	5.24E+08	2.91E+08	1.50	4.51E+06	6.77E+06
27	2036	4.06	1.46E+10	5.92E+10	2.46	1.19E+09	2.94E+09	4.69E+08	6.50E+09	0.56	3.06E+08	1.70E+08	1.50	4.39E+06	6.58E+06
28	2037	4.06	1.46E+10	5.91E+10	2.46	1.25E+09	3.09E+09	5.04E+08	6.50E+09	0.56	1.20E+08	6.69E+07	1.50	4.51E+06	6.76E+06
29	2038	4.08	1.46E+10	5.94E+10	2.46	1.18E+09	2.90E+09	4.97E+08	6.50E+09	0.56	1.84E+08	1.02E+08	1.50	4.98E+06	7.47E+06
30	2039	4.09	1.45E+10	5.93E+10	2.46	1.18E+09	2.90E+09	4.64E+08	6.50E+09	0.56	1.99E+08	1.11E+08	1.50	4.87E+06	7.30E+06

**** Scenario 1 utilizes an injection effluent limit of 8 mg/L**

Nitrogen Loading to Malibu Valley Groundwater Model
Future Scenario with Effluent at 8 mg/L Nitrate-N

	Outflow									
Water Balance	Ocean Outflow			Stream Outflow			ET	Concluding Basin Characteristics		
Volume (L)	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Volume (L)	Volume (L)	Mass (mg)	Concentration (mg/L)
0.00E+00	3.23	1.18E+09	3.81E+09	3.23	7.47E+08	2.41E+09	1.29E+08	1.48E+10	5.15E+10	3.49
0.00E+00	3.49	1.12E+09	3.92E+09	3.49	8.68E+08	3.03E+09	8.50E+07	1.48E+10	5.43E+10	3.67
0.00E+00	3.67	9.79E+08	3.59E+09	3.67	8.10E+08	2.97E+09	8.81E+07	1.48E+10	5.71E+10	3.87
0.00E+00	3.87	1.20E+09	4.66E+09	3.87	7.82E+08	3.03E+09	1.10E+08	1.47E+10	5.93E+10	4.03
0.00E+00	4.03	1.30E+09	5.22E+09	4.03	7.35E+08	2.96E+09	1.32E+08	1.48E+10	6.11E+10	4.13
0.00E+00	4.13	1.19E+09	4.90E+09	4.13	1.00E+09	4.15E+09	1.34E+08	1.48E+10	6.19E+10	4.19
0.00E+00	4.19	1.29E+09	5.38E+09	4.19	8.12E+08	3.40E+09	1.51E+08	1.48E+10	6.31E+10	4.27
2.60E+08	4.27	1.52E+09	6.48E+09	4.27	7.27E+08	3.10E+09	1.47E+08	1.48E+10	6.29E+10	4.26
2.60E+08	4.26	1.43E+09	6.08E+09	4.26	8.59E+08	3.66E+09	1.11E+08	1.47E+10	6.24E+10	4.24
2.60E+08	4.24	1.37E+09	5.78E+09	4.24	8.22E+08	3.48E+09	1.17E+08	1.47E+10	6.23E+10	4.23
4.32E+08	4.23	1.36E+09	5.77E+09	4.23	9.16E+08	3.87E+09	1.29E+08	1.47E+10	6.18E+10	4.20
4.32E+08	4.20	1.31E+09	5.49E+09	4.20	1.03E+09	4.34E+09	8.50E+07	1.47E+10	6.09E+10	4.14
4.32E+08	4.14	1.16E+09	4.82E+09	4.14	9.76E+08	4.04E+09	8.81E+07	1.47E+10	6.07E+10	4.14
5.58E+08	4.14	1.40E+09	5.79E+09	4.14	9.16E+08	3.79E+09	1.10E+08	1.46E+10	6.06E+10	4.14
5.58E+08	4.14	1.47E+09	6.07E+09	4.14	8.55E+08	3.54E+09	1.32E+08	1.47E+10	6.06E+10	4.12
5.58E+08	4.12	1.35E+09	5.58E+09	4.12	1.13E+09	4.65E+09	1.34E+08	1.47E+10	5.98E+10	4.07
5.58E+08	4.07	1.46E+09	5.96E+09	4.07	9.19E+08	3.74E+09	1.51E+08	1.47E+10	5.97E+10	4.07
5.58E+08	4.07	1.57E+09	6.38E+09	4.07	7.48E+08	3.04E+09	1.47E+08	1.47E+10	6.00E+10	4.09
5.58E+08	4.09	1.48E+09	6.04E+09	4.09	8.78E+08	3.59E+09	1.11E+08	1.46E+10	5.98E+10	4.09
5.58E+08	4.09	1.42E+09	5.82E+09	4.09	8.50E+08	3.48E+09	1.17E+08	1.46E+10	6.01E+10	4.10
5.58E+08	4.10	1.39E+09	5.72E+09	4.10	9.10E+08	3.73E+09	1.29E+08	1.46E+10	6.01E+10	4.12
5.58E+08	4.12	1.33E+09	5.49E+09	4.12	1.02E+09	4.20E+09	8.50E+07	1.46E+10	5.97E+10	4.09
5.58E+08	4.09	1.19E+09	4.85E+09	4.09	9.61E+08	3.93E+09	8.81E+07	1.46E+10	6.00E+10	4.12
5.58E+08	4.12	1.40E+09	5.77E+09	4.12	9.16E+08	3.77E+09	1.10E+08	1.45E+10	5.99E+10	4.12
5.58E+08	4.12	1.47E+09	6.05E+09	4.12	8.55E+08	3.52E+09	1.32E+08	1.46E+10	6.00E+10	4.11
5.58E+08	4.11	1.35E+09	5.56E+09	4.11	1.13E+09	4.64E+09	1.34E+08	1.46E+10	5.92E+10	4.06
5.58E+08	4.06	1.46E+09	5.94E+09	4.06	9.19E+08	3.73E+09	1.51E+08	1.46E+10	5.91E+10	4.06
5.58E+08	4.06	1.57E+09	6.36E+09	4.06	7.48E+08	3.04E+09	1.47E+08	1.46E+10	5.94E+10	4.08
5.58E+08	4.08	1.48E+09	6.02E+09	4.08	8.78E+08	3.58E+09	1.11E+08	1.45E+10	5.93E+10	4.09
5.58E+08	4.09	1.42E+09	5.81E+09	4.09	8.50E+08	3.47E+09	1.17E+08	1.45E+10	5.95E+10	4.10

Nitrogen Loading to Malibu Valley Groundwater Model
Future Scenario with Effluent at 7 mg/L Nitrate-N

					Inflow										
		Initial Basin Characteristics			Stream Seepage			Surface Loading		Precipitation			Ocean Inflow		
	Year	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)
1	2010	3.23	1.48E+10	4.78E+10	2.46	1.19E+09	2.93E+09	5.93E+08	6.87E+09	0.56	2.47E+08	1.37E+08	1.50	4.60E+06	6.91E+06
2	2011	3.49	1.48E+10	5.15E+10	2.46	1.07E+09	2.64E+09	6.46E+08	6.87E+09	0.56	3.71E+08	2.06E+08	1.50	4.79E+06	7.19E+06
3	2012	3.67	1.48E+10	5.43E+10	2.46	9.86E+08	2.42E+09	6.78E+08	6.87E+09	0.56	1.60E+08	8.88E+07	1.50	4.72E+06	7.08E+06
4	2013	3.87	1.48E+10	5.71E+10	2.46	1.17E+09	2.89E+09	7.22E+08	6.87E+09	0.56	1.81E+08	1.00E+08	1.50	4.61E+06	6.92E+06
5	2014	4.03	1.47E+10	5.93E+10	2.46	1.22E+09	3.00E+09	7.89E+08	6.87E+09	0.56	2.03E+08	1.13E+08	1.50	4.70E+06	7.05E+06
6	2015	4.13	1.48E+10	6.11E+10	2.46	1.07E+09	2.64E+09	7.20E+08	6.87E+09	0.56	5.24E+08	2.91E+08	1.50	4.56E+06	6.84E+06
7	2016	4.19	1.48E+10	6.19E+10	2.46	1.19E+09	2.94E+09	7.30E+08	6.87E+09	0.56	3.06E+08	1.70E+08	1.50	4.44E+06	6.66E+06
8	2017	4.27	1.48E+10	6.31E+10	2.46	1.22E+09	3.00E+09	7.78E+08	6.24E+09	0.56	1.20E+08	6.69E+07	1.50	4.45E+06	6.67E+06
9	2018	4.26	1.48E+10	6.28E+10	2.46	1.14E+09	2.81E+09	7.65E+08	6.24E+09	0.56	1.84E+08	1.02E+08	1.50	4.76E+06	7.14E+06
10	2019	4.23	1.47E+10	6.22E+10	2.46	1.14E+09	2.80E+09	7.13E+08	6.24E+09	0.56	1.99E+08	1.11E+08	1.50	4.64E+06	6.95E+06
11	2020	4.22	1.47E+10	6.22E+10	2.46	1.13E+09	2.78E+09	5.56E+08	6.04E+09	0.56	2.47E+08	1.37E+08	1.50	4.56E+06	6.84E+06
12	2021	4.19	1.47E+10	6.15E+10	2.46	1.05E+09	2.58E+09	5.89E+08	6.04E+09	0.56	3.71E+08	2.06E+08	1.50	4.86E+06	7.29E+06
13	2022	4.11	1.47E+10	6.05E+10	2.46	9.65E+08	2.37E+09	6.13E+08	6.04E+09	0.56	1.60E+08	8.88E+07	1.50	4.65E+06	6.97E+06
14	2023	4.11	1.47E+10	6.02E+10	2.46	1.17E+09	2.88E+09	4.92E+08	6.34E+09	0.56	1.81E+08	1.00E+08	1.50	4.63E+06	6.95E+06
15	2024	4.10	1.46E+10	6.01E+10	2.46	1.22E+09	2.99E+09	5.23E+08	6.34E+09	0.56	2.03E+08	1.13E+08	1.50	4.93E+06	7.39E+06
16	2025	4.08	1.47E+10	6.00E+10	2.46	1.07E+09	2.63E+09	4.54E+08	6.34E+09	0.56	5.24E+08	2.91E+08	1.50	4.51E+06	6.77E+06
17	2026	4.02	1.47E+10	5.91E+10	2.46	1.19E+09	2.94E+09	4.69E+08	6.34E+09	0.56	3.06E+08	1.70E+08	1.50	4.39E+06	6.58E+06
18	2027	4.02	1.47E+10	5.90E+10	2.46	1.25E+09	3.09E+09	5.04E+08	6.34E+09	0.56	1.20E+08	6.69E+07	1.50	4.51E+06	6.76E+06
19	2028	4.03	1.47E+10	5.92E+10	2.46	1.18E+09	2.90E+09	4.97E+08	6.34E+09	0.56	1.84E+08	1.02E+08	1.50	4.98E+06	7.47E+06
20	2029	4.04	1.46E+10	5.90E+10	2.46	1.18E+09	2.90E+09	4.64E+08	6.34E+09	0.56	1.99E+08	1.11E+08	1.50	4.87E+06	7.30E+06
21	2030	4.04	1.46E+10	5.92E+10	2.46	1.15E+09	2.83E+09	4.34E+08	6.34E+09	0.56	2.47E+08	1.37E+08	1.50	4.66E+06	6.99E+06
22	2031	4.06	1.46E+10	5.92E+10	2.46	1.07E+09	2.63E+09	4.60E+08	6.34E+09	0.56	3.71E+08	2.06E+08	1.50	4.95E+06	7.43E+06
23	2032	4.02	1.46E+10	5.88E+10	2.46	9.83E+08	2.42E+09	4.70E+08	6.34E+09	0.56	1.60E+08	8.88E+07	1.50	4.74E+06	7.11E+06
24	2033	4.05	1.46E+10	5.90E+10	2.46	1.17E+09	2.88E+09	4.92E+08	6.34E+09	0.56	1.81E+08	1.00E+08	1.50	4.63E+06	6.95E+06
25	2034	4.06	1.45E+10	5.90E+10	2.46	1.22E+09	2.99E+09	5.23E+08	6.34E+09	0.56	2.03E+08	1.13E+08	1.50	4.93E+06	7.39E+06
26	2035	4.04	1.46E+10	5.90E+10	2.46	1.07E+09	2.63E+09	4.54E+08	6.34E+09	0.56	5.24E+08	2.91E+08	1.50	4.51E+06	6.77E+06
27	2036	3.99	1.46E+10	5.82E+10	2.46	1.19E+09	2.94E+09	4.69E+08	6.34E+09	0.56	3.06E+08	1.70E+08	1.50	4.39E+06	6.58E+06
28	2037	3.99	1.46E+10	5.82E+10	2.46	1.25E+09	3.09E+09	5.04E+08	6.34E+09	0.56	1.20E+08	6.69E+07	1.50	4.51E+06	6.76E+06
29	2038	4.01	1.46E+10	5.84E+10	2.46	1.18E+09	2.90E+09	4.97E+08	6.34E+09	0.56	1.84E+08	1.02E+08	1.50	4.98E+06	7.47E+06
30	2039	4.02	1.45E+10	5.83E+10	2.46	1.18E+09	2.90E+09	4.64E+08	6.34E+09	0.56	1.99E+08	1.11E+08	1.50	4.87E+06	7.30E+06

**** Scenario 2 utilizes an injection effluent limit of 7 mg/L**

Nitrogen Loading to Malibu Valley Groundwater Model
Future Scenario with Effluent at 7 mg/L Nitrate-N

	Outflow									
Water Balance	Ocean Outflow			Stream Outflow			ET	Concluding Basin Characteristics		
Volume (L)	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Volume (L)	Volume (L)	Mass (mg)	Concentration (mg/L)
0.00E+00	3.23	1.18E+09	3.81E+09	3.23	7.47E+08	2.41E+09	1.29E+08	1.48E+10	5.15E+10	3.49
0.00E+00	3.49	1.12E+09	3.92E+09	3.49	8.68E+08	3.03E+09	8.50E+07	1.48E+10	5.43E+10	3.67
0.00E+00	3.67	9.79E+08	3.59E+09	3.67	8.10E+08	2.97E+09	8.81E+07	1.48E+10	5.71E+10	3.87
0.00E+00	3.87	1.20E+09	4.66E+09	3.87	7.82E+08	3.03E+09	1.10E+08	1.47E+10	5.93E+10	4.03
0.00E+00	4.03	1.30E+09	5.22E+09	4.03	7.35E+08	2.96E+09	1.32E+08	1.48E+10	6.11E+10	4.13
0.00E+00	4.13	1.19E+09	4.90E+09	4.13	1.00E+09	4.15E+09	1.34E+08	1.48E+10	6.19E+10	4.19
0.00E+00	4.19	1.29E+09	5.38E+09	4.19	8.12E+08	3.40E+09	1.51E+08	1.48E+10	6.31E+10	4.27
2.60E+08	4.27	1.52E+09	6.48E+09	4.27	7.27E+08	3.10E+09	1.47E+08	1.48E+10	6.28E+10	4.26
2.60E+08	4.26	1.43E+09	6.07E+09	4.26	8.59E+08	3.66E+09	1.11E+08	1.47E+10	6.22E+10	4.23
2.60E+08	4.23	1.37E+09	5.77E+09	4.23	8.22E+08	3.48E+09	1.17E+08	1.47E+10	6.22E+10	4.22
4.32E+08	4.22	1.36E+09	5.76E+09	4.22	9.16E+08	3.86E+09	1.29E+08	1.47E+10	6.15E+10	4.19
4.32E+08	4.19	1.31E+09	5.47E+09	4.19	1.03E+09	4.32E+09	8.50E+07	1.47E+10	6.05E+10	4.11
4.32E+08	4.11	1.16E+09	4.79E+09	4.11	9.76E+08	4.02E+09	8.81E+07	1.47E+10	6.02E+10	4.11
5.58E+08	4.11	1.40E+09	5.75E+09	4.11	9.16E+08	3.76E+09	1.10E+08	1.46E+10	6.01E+10	4.10
5.58E+08	4.10	1.47E+09	6.02E+09	4.10	8.55E+08	3.51E+09	1.32E+08	1.47E+10	6.00E+10	4.08
5.58E+08	4.08	1.35E+09	5.52E+09	4.08	1.13E+09	4.60E+09	1.34E+08	1.47E+10	5.91E+10	4.02
5.58E+08	4.02	1.46E+09	5.89E+09	4.02	9.19E+08	3.70E+09	1.51E+08	1.47E+10	5.90E+10	4.02
5.58E+08	4.02	1.57E+09	6.30E+09	4.02	7.48E+08	3.01E+09	1.47E+08	1.47E+10	5.92E+10	4.03
5.58E+08	4.03	1.48E+09	5.96E+09	4.03	8.78E+08	3.54E+09	1.11E+08	1.46E+10	5.90E+10	4.04
5.58E+08	4.04	1.42E+09	5.74E+09	4.04	8.50E+08	3.43E+09	1.17E+08	1.46E+10	5.92E+10	4.04
5.58E+08	4.04	1.39E+09	5.64E+09	4.04	9.10E+08	3.68E+09	1.29E+08	1.46E+10	5.92E+10	4.06
5.58E+08	4.06	1.33E+09	5.41E+09	4.06	1.02E+09	4.14E+09	8.50E+07	1.46E+10	5.88E+10	4.02
5.58E+08	4.02	1.19E+09	4.78E+09	4.02	9.61E+08	3.87E+09	8.81E+07	1.46E+10	5.90E+10	4.05
5.58E+08	4.05	1.40E+09	5.68E+09	4.05	9.16E+08	3.71E+09	1.10E+08	1.45E+10	5.90E+10	4.06
5.58E+08	4.06	1.47E+09	5.95E+09	4.06	8.55E+08	3.47E+09	1.32E+08	1.46E+10	5.90E+10	4.04
5.58E+08	4.04	1.35E+09	5.47E+09	4.04	1.13E+09	4.56E+09	1.34E+08	1.46E+10	5.82E+10	3.99
5.58E+08	3.99	1.46E+09	5.84E+09	3.99	9.19E+08	3.67E+09	1.51E+08	1.46E+10	5.82E+10	3.99
5.58E+08	3.99	1.57E+09	6.26E+09	3.99	7.48E+08	2.99E+09	1.47E+08	1.46E+10	5.84E+10	4.01
5.58E+08	4.01	1.48E+09	5.92E+09	4.01	8.78E+08	3.52E+09	1.11E+08	1.45E+10	5.83E+10	4.02
5.58E+08	4.02	1.42E+09	5.72E+09	4.02	8.50E+08	3.41E+09	1.17E+08	1.45E+10	5.85E+10	4.03

Total Dissolved Solids Loading to Malibu Valley Groundwater Model
Baseline (Current) Conditions

					Inflow										
		Initial Basin Characteristics			Stream Seepage			Surface Loading		Precipitation			Ocean Inflow		
	Year	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)
1	2010	2,115	1.48E+10	3.13E+13	1,275	1.19E+09	1.52E+12	5.93E+08	2.08E+11	0.00	2.47E+08	0.00E+00	33500.00	4.60E+06	1.54E+11
2	2011	1,969	1.48E+10	2.91E+13	1,275	1.07E+09	1.37E+12	6.46E+08	2.08E+11	0.00	3.71E+08	0.00E+00	33500.00	4.79E+06	1.61E+11
3	2012	1,819	1.48E+10	2.69E+13	1,275	9.86E+08	1.26E+12	6.78E+08	2.08E+11	0.00	1.60E+08	0.00E+00	33500.00	4.72E+06	1.58E+11
4	2013	1,715	1.48E+10	2.53E+13	1,275	1.17E+09	1.50E+12	7.22E+08	2.08E+11	0.00	1.81E+08	0.00E+00	33500.00	4.61E+06	1.55E+11
5	2014	1,611	1.47E+10	2.37E+13	1,275	1.22E+09	1.55E+12	7.89E+08	2.08E+11	0.00	2.03E+08	0.00E+00	33500.00	4.70E+06	1.58E+11
6	2015	1,514	1.48E+10	2.24E+13	1,275	1.07E+09	1.37E+12	7.20E+08	2.08E+11	0.00	5.24E+08	0.00E+00	33500.00	4.56E+06	1.53E+11
7	2016	1,407	1.48E+10	2.08E+13	1,275	1.19E+09	1.52E+12	7.30E+08	2.08E+11	0.00	3.06E+08	0.00E+00	33500.00	4.44E+06	1.49E+11
8	2017	1,336	1.48E+10	1.97E+13	1,275	1.25E+09	1.59E+12	7.61E+08	2.08E+11	0.00	1.20E+08	0.00E+00	33500.00	4.51E+06	1.51E+11
9	2018	1,288	1.48E+10	1.90E+13	1,275	1.18E+09	1.51E+12	7.43E+08	2.08E+11	0.00	1.84E+08	0.00E+00	33500.00	4.74E+06	1.59E+11
10	2019	1,240	1.47E+10	1.83E+13	1,275	1.19E+09	1.52E+12	6.73E+08	2.08E+11	0.00	1.99E+08	0.00E+00	33500.00	4.70E+06	1.57E+11
11	2020	1,204	1.47E+10	1.78E+13	1,275	1.19E+09	1.52E+12	5.93E+08	2.08E+11	0.00	2.47E+08	0.00E+00	33500.00	4.60E+06	1.54E+11
12	2021	1,176	1.47E+10	1.73E+13	1,275	1.07E+09	1.37E+12	6.46E+08	2.08E+11	0.00	3.71E+08	0.00E+00	33500.00	4.79E+06	1.61E+11
13	2022	1,133	1.47E+10	1.67E+13	1,275	9.86E+08	1.26E+12	6.78E+08	2.08E+11	0.00	1.60E+08	0.00E+00	33500.00	4.72E+06	1.58E+11
14	2023	1,110	1.47E+10	1.63E+13	1,275	1.17E+09	1.50E+12	7.22E+08	2.08E+11	0.00	1.81E+08	0.00E+00	33500.00	4.61E+06	1.55E+11
15	2024	1,087	1.47E+10	1.60E+13	1,275	1.22E+09	1.55E+12	7.89E+08	2.08E+11	0.00	2.03E+08	0.00E+00	33500.00	4.70E+06	1.58E+11
16	2025	1,064	1.47E+10	1.57E+13	1,275	1.07E+09	1.37E+12	7.20E+08	2.08E+11	0.00	5.24E+08	0.00E+00	33500.00	4.56E+06	1.53E+11
17	2026	1,023	1.47E+10	1.51E+13	1,275	1.19E+09	1.52E+12	7.30E+08	2.08E+11	0.00	3.06E+08	0.00E+00	33500.00	4.44E+06	1.49E+11
18	2027	1,006	1.47E+10	1.48E+13	1,275	1.25E+09	1.59E+12	7.61E+08	2.08E+11	0.00	1.20E+08	0.00E+00	33500.00	4.51E+06	1.51E+11
19	2028	1,003	1.47E+10	1.47E+13	1,275	1.18E+09	1.51E+12	7.43E+08	2.08E+11	0.00	1.84E+08	0.00E+00	33500.00	4.74E+06	1.59E+11
20	2029	994	1.47E+10	1.46E+13	1,275	1.19E+09	1.52E+12	6.73E+08	2.08E+11	0.00	1.99E+08	0.00E+00	33500.00	4.70E+06	1.57E+11
21	2030	990	1.47E+10	1.45E+13	1,275	1.19E+09	1.52E+12	5.93E+08	2.08E+11	0.00	2.47E+08	0.00E+00	33500.00	4.60E+06	1.54E+11
22	2031	990	1.47E+10	1.45E+13	1,275	1.07E+09	1.37E+12	6.46E+08	2.08E+11	0.00	3.71E+08	0.00E+00	33500.00	4.79E+06	1.61E+11
23	2032	972	1.47E+10	1.43E+13	1,275	9.86E+08	1.26E+12	6.78E+08	2.08E+11	0.00	1.60E+08	0.00E+00	33500.00	4.72E+06	1.58E+11
24	2033	968	1.46E+10	1.42E+13	1,275	1.17E+09	1.50E+12	7.22E+08	2.08E+11	0.00	1.81E+08	0.00E+00	33500.00	4.61E+06	1.55E+11
25	2034	965	1.46E+10	1.41E+13	1,275	1.22E+09	1.55E+12	7.89E+08	2.08E+11	0.00	2.03E+08	0.00E+00	33500.00	4.70E+06	1.58E+11
26	2035	958	1.47E+10	1.41E+13	1,275	1.07E+09	1.37E+12	7.20E+08	2.08E+11	0.00	5.24E+08	0.00E+00	33500.00	4.56E+06	1.53E+11
27	2036	933	1.47E+10	1.37E+13	1,275	1.19E+09	1.52E+12	7.30E+08	2.08E+11	0.00	3.06E+08	0.00E+00	33500.00	4.44E+06	1.49E+11
28	2037	929	1.47E+10	1.36E+13	1,275	1.25E+09	1.59E+12	7.61E+08	2.08E+11	0.00	1.20E+08	0.00E+00	33500.00	4.51E+06	1.51E+11
29	2038	936	1.46E+10	1.37E+13	1,275	1.18E+09	1.51E+12	7.43E+08	2.08E+11	0.00	1.84E+08	0.00E+00	33500.00	4.74E+06	1.59E+11
30	2039	936	1.46E+10	1.37E+13	1,275	1.19E+09	1.52E+12	6.73E+08	2.08E+11	0.00	1.99E+08	0.00E+00	33500.00	4.70E+06	1.57E+11

Total Dissolved Solids Loading to Malibu Valley Groundwater Model
Baseline (Current) Conditions

	Outflow										
Water Balance	Ocean Outflow			Stream Outflow			ET	Concluding Basin Characteristics			
Volume (L)	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Volume (L)	Volume (L)	Mass (mg)	Concentration (mg/L)	
0.00E+00	2114.70	1.18E+09	2.50E+12	2114.70	7.47E+08	1.58E+12	1.29E+08	1.48E+10	2.91E+13	1969.25	
0.00E+00	1969.25	1.12E+09	2.21E+12	1969.25	8.68E+08	1.71E+12	8.50E+07	1.48E+10	2.69E+13	1819.11	
0.00E+00	1819.11	9.79E+08	1.78E+12	1819.11	8.10E+08	1.47E+12	8.81E+07	1.48E+10	2.53E+13	1714.56	
0.00E+00	1714.56	1.20E+09	2.06E+12	1714.56	7.82E+08	1.34E+12	1.10E+08	1.47E+10	2.37E+13	1611.45	
0.00E+00	1611.45	1.30E+09	2.09E+12	1611.45	7.35E+08	1.18E+12	1.32E+08	1.48E+10	2.24E+13	1514.22	
0.00E+00	1514.22	1.19E+09	1.79E+12	1514.22	1.00E+09	1.52E+12	1.34E+08	1.48E+10	2.08E+13	1407.19	
0.00E+00	1407.19	1.29E+09	1.81E+12	1407.19	8.12E+08	1.14E+12	1.51E+08	1.48E+10	1.97E+13	1335.96	
0.00E+00	1335.96	1.39E+09	1.86E+12	1335.96	6.15E+08	8.22E+11	1.47E+08	1.48E+10	1.90E+13	1288.19	
0.00E+00	1288.19	1.29E+09	1.66E+12	1288.19	7.42E+08	9.56E+11	1.11E+08	1.47E+10	1.83E+13	1240.23	
0.00E+00	1240.23	1.23E+09	1.53E+12	1240.23	7.02E+08	8.70E+11	1.17E+08	1.47E+10	1.78E+13	1203.95	
0.00E+00	1203.95	1.18E+09	1.42E+12	1203.95	7.47E+08	8.99E+11	1.29E+08	1.47E+10	1.73E+13	1175.85	
0.00E+00	1175.85	1.12E+09	1.32E+12	1175.85	8.68E+08	1.02E+12	8.50E+07	1.47E+10	1.67E+13	1133.38	
0.00E+00	1133.38	9.79E+08	1.11E+12	1133.38	8.10E+08	9.18E+11	8.81E+07	1.47E+10	1.63E+13	1109.64	
0.00E+00	1109.64	1.20E+09	1.34E+12	1109.64	7.82E+08	8.68E+11	1.10E+08	1.47E+10	1.60E+13	1087.36	
0.00E+00	1087.36	1.30E+09	1.41E+12	1087.36	7.35E+08	7.99E+11	1.32E+08	1.47E+10	1.57E+13	1063.91	
0.00E+00	1063.91	1.19E+09	1.26E+12	1063.91	1.00E+09	1.07E+12	1.34E+08	1.47E+10	1.51E+13	1023.33	
0.00E+00	1023.33	1.29E+09	1.32E+12	1023.33	8.12E+08	8.30E+11	1.51E+08	1.47E+10	1.48E+13	1006.18	
0.00E+00	1006.18	1.39E+09	1.40E+12	1006.18	6.15E+08	6.19E+11	1.47E+08	1.47E+10	1.47E+13	1002.82	
0.00E+00	1002.82	1.29E+09	1.30E+12	1002.82	7.42E+08	7.44E+11	1.11E+08	1.47E+10	1.46E+13	993.65	
0.00E+00	993.65	1.23E+09	1.22E+12	993.65	7.02E+08	6.97E+11	1.17E+08	1.47E+10	1.45E+13	990.02	
0.00E+00	990.02	1.18E+09	1.17E+12	990.02	7.47E+08	7.39E+11	1.29E+08	1.47E+10	1.45E+13	989.61	
0.00E+00	989.61	1.12E+09	1.11E+12	989.61	8.68E+08	8.59E+11	8.50E+07	1.47E+10	1.43E+13	972.49	
0.00E+00	972.49	9.79E+08	9.52E+11	972.49	8.10E+08	7.87E+11	8.81E+07	1.46E+10	1.42E+13	967.78	
0.00E+00	967.78	1.20E+09	1.16E+12	967.78	7.82E+08	7.57E+11	1.10E+08	1.46E+10	1.41E+13	964.54	
0.00E+00	964.54	1.30E+09	1.25E+12	964.54	7.35E+08	7.09E+11	1.32E+08	1.47E+10	1.41E+13	958.45	
0.00E+00	958.45	1.19E+09	1.14E+12	958.45	1.00E+09	9.62E+11	1.34E+08	1.47E+10	1.37E+13	933.43	
0.00E+00	933.43	1.29E+09	1.20E+12	933.43	8.12E+08	7.58E+11	1.51E+08	1.47E+10	1.36E+13	928.99	
0.00E+00	928.99	1.39E+09	1.29E+12	928.99	6.15E+08	5.72E+11	1.47E+08	1.46E+10	1.37E+13	936.09	
0.00E+00	936.09	1.29E+09	1.21E+12	936.09	7.42E+08	6.95E+11	1.11E+08	1.46E+10	1.37E+13	936.04	
0.00E+00	936.04	1.23E+09	1.15E+12	936.04	7.02E+08	6.57E+11	1.17E+08	1.46E+10	1.38E+13	940.08	

Total Dissolved Solids Loading to Malibu Valley Groundwater Model
Future Scenario

					Inflow										
		Initial Basin Characteristics			Stream Seepage			Surface Loading		Precipitation			Ocean Inflow		
Year		Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)
1	2010	2,115	1.48E+10	3.13E+13	1,275	1.19E+09	1.52E+12	5.93E+08	2.08E+11	0.00	2.47E+08	0.00E+00	33500.00	4.60E+06	1.54E+11
2	2011	1,969	1.48E+10	2.91E+13	1,275	1.07E+09	1.37E+12	6.46E+08	2.08E+11	0.00	3.71E+08	0.00E+00	33500.00	4.79E+06	1.61E+11
3	2012	1,819	1.48E+10	2.69E+13	1,275	9.86E+08	1.26E+12	6.78E+08	2.08E+11	0.00	1.60E+08	0.00E+00	33500.00	4.72E+06	1.58E+11
4	2013	1,715	1.48E+10	2.53E+13	1,275	1.17E+09	1.50E+12	7.22E+08	2.08E+11	0.00	1.81E+08	0.00E+00	33500.00	4.61E+06	1.55E+11
5	2014	1,611	1.47E+10	2.37E+13	1,275	1.22E+09	1.55E+12	7.89E+08	2.08E+11	0.00	2.03E+08	0.00E+00	33500.00	4.70E+06	1.58E+11
6	2015	1,514	1.48E+10	2.24E+13	1,275	1.07E+09	1.37E+12	7.20E+08	2.08E+11	0.00	5.24E+08	0.00E+00	33500.00	4.56E+06	1.53E+11
7	2016	1,407	1.48E+10	2.08E+13	1,275	1.19E+09	1.52E+12	7.30E+08	2.08E+11	0.00	3.06E+08	0.00E+00	33500.00	4.44E+06	1.49E+11
8	2017	1,336	1.48E+10	1.97E+13	1,275	1.22E+09	1.55E+12	7.78E+08	2.12E+11	0.00	1.20E+08	0.00E+00	33500.00	4.45E+06	1.49E+11
9	2018	1,271	1.47E+10	1.87E+13	1,275	1.14E+09	1.46E+12	7.65E+08	2.12E+11	0.00	1.84E+08	0.00E+00	33500.00	4.76E+06	1.59E+11
10	2019	1,209	1.45E+10	1.76E+13	1,275	1.14E+09	1.45E+12	7.13E+08	2.12E+11	0.00	1.99E+08	0.00E+00	33500.00	4.64E+06	1.55E+11
11	2020	1,159	1.45E+10	1.67E+13	1,275	1.13E+09	1.44E+12	5.56E+08	2.42E+11	0.00	2.47E+08	0.00E+00	33500.00	4.56E+06	1.53E+11
12	2021	1,120	1.42E+10	1.59E+13	1,275	1.05E+09	1.34E+12	5.89E+08	2.42E+11	0.00	3.71E+08	0.00E+00	33500.00	4.86E+06	1.63E+11
13	2022	1,070	1.41E+10	1.51E+13	1,275	9.65E+08	1.23E+12	6.13E+08	2.42E+11	0.00	1.60E+08	0.00E+00	33500.00	4.65E+06	1.56E+11
14	2023	1,040	1.39E+10	1.44E+13	1,275	1.17E+09	1.49E+12	4.92E+08	2.66E+11	0.00	1.81E+08	0.00E+00	33500.00	4.63E+06	1.55E+11
15	2024	1,026	1.36E+10	1.39E+13	1,275	1.22E+09	1.55E+12	5.23E+08	2.66E+11	0.00	2.03E+08	0.00E+00	33500.00	4.93E+06	1.65E+11
16	2025	1,013	1.33E+10	1.35E+13	1,275	1.07E+09	1.36E+12	4.54E+08	2.66E+11	0.00	5.24E+08	0.00E+00	33500.00	4.51E+06	1.51E+11
17	2026	978	1.31E+10	1.28E+13	1,275	1.19E+09	1.52E+12	4.69E+08	2.66E+11	0.00	3.06E+08	0.00E+00	33500.00	4.39E+06	1.47E+11
18	2027	968	1.28E+10	1.24E+13	1,275	1.25E+09	1.60E+12	5.04E+08	2.66E+11	0.00	1.20E+08	0.00E+00	33500.00	4.51E+06	1.51E+11
19	2028	972	1.25E+10	1.22E+13	1,275	1.18E+09	1.50E+12	4.97E+08	2.66E+11	0.00	1.84E+08	0.00E+00	33500.00	4.98E+06	1.67E+11
20	2029	968	1.22E+10	1.18E+13	1,275	1.18E+09	1.50E+12	4.64E+08	2.66E+11	0.00	1.99E+08	0.00E+00	33500.00	4.87E+06	1.63E+11
21	2030	966	1.19E+10	1.15E+13	1,275	1.15E+09	1.47E+12	4.34E+08	2.66E+11	0.00	2.47E+08	0.00E+00	33500.00	4.66E+06	1.56E+11
22	2031	963	1.16E+10	1.12E+13	1,275	1.07E+09	1.36E+12	4.60E+08	2.66E+11	0.00	3.71E+08	0.00E+00	33500.00	4.95E+06	1.66E+11
23	2032	942	1.14E+10	1.07E+13	1,275	9.83E+08	1.25E+12	4.70E+08	2.66E+11	0.00	1.60E+08	0.00E+00	33500.00	4.74E+06	1.59E+11
24	2033	939	1.10E+10	1.04E+13	1,275	1.17E+09	1.49E+12	4.92E+08	2.66E+11	0.00	1.81E+08	0.00E+00	33500.00	4.63E+06	1.55E+11
25	2034	940	1.08E+10	1.01E+13	1,275	1.22E+09	1.55E+12	5.23E+08	2.66E+11	0.00	2.03E+08	0.00E+00	33500.00	4.93E+06	1.65E+11
26	2035	941	1.05E+10	9.91E+12	1,275	1.07E+09	1.36E+12	4.54E+08	2.66E+11	0.00	5.24E+08	0.00E+00	33500.00	4.51E+06	1.51E+11
27	2036	912	1.03E+10	9.35E+12	1,275	1.19E+09	1.52E+12	4.69E+08	2.66E+11	0.00	3.06E+08	0.00E+00	33500.00	4.39E+06	1.47E+11
28	2037	913	9.98E+09	9.11E+12	1,275	1.25E+09	1.60E+12	5.04E+08	2.66E+11	0.00	1.20E+08	0.00E+00	33500.00	4.51E+06	1.51E+11
29	2038	930	9.69E+09	9.01E+12	1,275	1.18E+09	1.50E+12	4.97E+08	2.66E+11	0.00	1.84E+08	0.00E+00	33500.00	4.98E+06	1.67E+11
30	2039	934	9.38E+09	8.76E+12	1,275	1.18E+09	1.50E+12	4.64E+08	2.66E+11	0.00	1.99E+08	0.00E+00	33500.00	4.87E+06	1.63E+11

Total Dissolved Solids Loading to Malibu Valley Groundwater Model
Future Scenario

				Outflow							
Water Balance	Ocean Outflow			Stream Outflow			ET	Concluding Basin Characteristics			
Volume (L)	Concentration (mg/L)	Volume (L)	Mass (mg)	Concentration (mg/L)	Volume (L)	Mass (mg)	Volume (L)	Concentration (mg/L)	Volume (L)	Mass (mg)
0.00E+00	2114.70	1.18E+09	2.50E+12	2114.70	7.47E+08	1.58E+12	1.29E+08	1969.25	1.48E+10	2.91E+13
0.00E+00	1969.25	1.12E+09	2.21E+12	1969.25	8.68E+08	1.71E+12	8.50E+07	1819.11	1.48E+10	2.69E+13
0.00E+00	1819.11	9.79E+08	1.78E+12	1819.11	8.10E+08	1.47E+12	8.81E+07	1714.56	1.48E+10	2.53E+13
0.00E+00	1714.56	1.20E+09	2.06E+12	1714.56	7.82E+08	1.34E+12	1.10E+08	1611.45	1.47E+10	2.37E+13
0.00E+00	1611.45	1.30E+09	2.09E+12	1611.45	7.35E+08	1.18E+12	1.32E+08	1514.22	1.48E+10	2.24E+13
0.00E+00	1514.22	1.19E+09	1.79E+12	1514.22	1.00E+09	1.52E+12	1.34E+08	1407.19	1.48E+10	2.08E+13
0.00E+00	1407.19	1.29E+09	1.81E+12	1407.19	8.12E+08	1.14E+12	1.51E+08	1335.96	1.48E+10	1.97E+13
1.70E+08	1335.96	1.52E+09	2.03E+12	1335.96	7.27E+08	9.71E+11	1.50E+08	1271.47	1.47E+10	1.87E+13
1.70E+08	1271.47	1.43E+09	1.82E+12	1271.47	8.59E+08	1.09E+12	1.13E+08	1208.85	1.45E+10	1.76E+13
1.70E+08	1208.85	1.37E+09	1.65E+12	1208.85	8.22E+08	9.94E+11	1.20E+08	1158.56	1.45E+10	1.67E+13
2.56E+08	1158.56	1.36E+09	1.58E+12	1158.56	9.16E+08	1.06E+12	1.32E+08	1119.83	1.42E+10	1.59E+13
2.56E+08	1119.83	1.31E+09	1.46E+12	1119.83	1.03E+09	1.15E+12	8.67E+07	1069.97	1.41E+10	1.51E+13
2.56E+08	1069.97	1.16E+09	1.24E+12	1069.97	9.76E+08	1.04E+12	9.01E+07	1040.15	1.39E+10	1.44E+13
2.88E+08	1040.15	1.40E+09	1.46E+12	1040.15	9.16E+08	9.53E+11	1.10E+08	1025.81	1.36E+10	1.39E+13
2.88E+08	1025.81	1.47E+09	1.51E+12	1025.81	8.55E+08	8.77E+11	1.31E+08	1012.65	1.33E+10	1.35E+13
2.88E+08	1012.65	1.35E+09	1.37E+12	1012.65	1.13E+09	1.14E+12	1.34E+08	977.90	1.31E+10	1.28E+13
2.88E+08	977.90	1.46E+09	1.43E+12	977.90	9.19E+08	8.99E+11	1.50E+08	967.75	1.28E+10	1.24E+13
2.88E+08	967.75	1.57E+09	1.52E+12	967.75	7.48E+08	7.24E+11	1.46E+08	972.20	1.25E+10	1.22E+13
2.88E+08	972.20	1.48E+09	1.44E+12	972.20	8.78E+08	8.54E+11	1.10E+08	968.13	1.22E+10	1.18E+13
2.88E+08	968.13	1.42E+09	1.38E+12	968.13	8.50E+08	8.23E+11	1.17E+08	966.29	1.19E+10	1.15E+13
2.88E+08	966.29	1.39E+09	1.35E+12	966.29	9.10E+08	8.79E+11	1.30E+08	962.99	1.16E+10	1.12E+13
2.88E+08	962.99	1.33E+09	1.29E+12	962.99	1.02E+09	9.83E+11	8.51E+07	942.34	1.14E+10	1.07E+13
2.88E+08	942.34	1.19E+09	1.12E+12	942.34	9.61E+08	9.06E+11	8.77E+07	939.15	1.10E+10	1.04E+13
2.88E+08	939.15	1.40E+09	1.31E+12	939.15	9.16E+08	8.60E+11	1.10E+08	940.08	1.08E+10	1.01E+13
2.88E+08	940.08	1.47E+09	1.38E+12	940.08	8.55E+08	8.04E+11	1.31E+08	940.54	1.05E+10	9.91E+12
2.88E+08	940.54	1.35E+09	1.27E+12	940.54	1.13E+09	1.06E+12	1.34E+08	911.78	1.03E+10	9.35E+12
2.88E+08	911.78	1.46E+09	1.33E+12	911.78	9.19E+08	8.38E+11	1.50E+08	912.75	9.98E+09	9.11E+12
2.88E+08	912.75	1.57E+09	1.43E+12	912.75	7.48E+08	6.83E+11	1.46E+08	929.98	9.69E+09	9.01E+12
2.88E+08	929.98	1.48E+09	1.37E+12	929.98	8.78E+08	8.17E+11	1.10E+08	933.89	9.38E+09	8.76E+12
2.88E+08	933.89	1.42E+09	1.33E+12	933.89	8.50E+08	7.94E+11	1.17E+08	939.05	9.12E+09	8.57E+12