APPENDIX 7a

Antidegradation Analysis – Phase I Discharges

ANTIDEGRADATION ANALYSIS – PHASE I DISCHARGES

Proposed West Valley Water Reclamation Facility
Desert Hot Springs, California

March 13, 2019

Prepared for

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This report has been prepared by *EnviroLogic Resources, Inc*., of Signal Hill, California.

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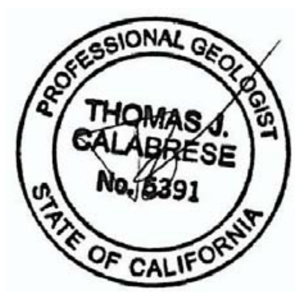

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EXECUTIVE SUMMARY

The objective of this antidegradation analysis is to evaluate the potential for ambient groundwater quality degradation associated with anticipated Mission Springs Water District (MSWD) proposed West Valley Water Reclamation Facility (WVWRF) percolation pond Phase I discharges for its first 15 years of operation, and determine whether such degradation would have an unreasonable impact on relevant groundwater quality objectives. The California Regional Water Quality Control Board, Colorado River Basin Region, Water Quality Control Plan (or "Basin Plan"), including amendments through August 2017, establishes water quality objectives (WQO) for both surface water and groundwater. Numeric criteria for total nitrogen, nitrate, total dissolved solids (TDS), sulfate, and chloride in groundwater have not been established for the Coachella Valley.

However, the Basin Plan requires preserving and protecting the quality of Colorado River Region waters to optimize the anticipated beneficial uses and antidegradation. This analysis specifies total nitrogen/nitrate-as nitrogen, TDS, sulfate, and chloride WQO for the WVWRF relating to groundwater given an evaluation of ambient Mission Springs Sub-Basin and/or Garnet Hill Sub-Basin background concentrations, potential beneficial uses, and other reviewed information, including the evolving Coachella Valley Salt & Nutrient Management Plan (CV-SNMP). The groundwater WQO for Colorado River Region Water Quality Control Board (CRRWQCB) consideration of Waste Discharge Requirements for the planned WVWRF are shown to be attainable through this analysis, and continue to be attained in the future, or in the case of incremental TDS exceedence, it is demonstrated that the identified and anticipated beneficial groundwater uses are still adequately protected. Other strategies relating to TDS are also discussed in the conclusions and recommendations.

This antidegradation analysis is based on the results of updates to the existing groundwater model for the MSWD WVWRF located in Desert Hot Springs, Riverside County, California. Background ambient groundwater quality was reviewed for nearby wells and baseline groundwater quality benchmarks for the established chemicals of concern (COC). Estimated COC concentrations in effluent at the water table were input to the groundwater models to support other mass balance and modeling evaluations and the potential for effects on established or anticipated potential future beneficial uses. The groundwater fate and transport model updates reflect the proposed operating conditions of the percolation ponds and Well 33. A qualitative aquifer mass balance analysis was also completed to confirm mass of COC is conserved relating to those with corresponding U.S. EPA primary (health-based) Maximum Contaminant Levels (MCLs) and other relevant standards for drinking water. The continued assimilative capacity of the aquifer beneath the WVWRF percolation ponds is essentially demonstrated for total nitrogen/nitrate-as nitrogen, chloride, and sulfide. However, the anticipated increase in TDS above levels the aquifer can effectively assimilate and remain below Title 22 Recommended Contaminant Levels in the future may require implementation of an effluent limit feasibility study based on actual WVWRF discharges and/or an influent TDS study to characterize influent TDS/salt and the potential sources. The goal of each study would be to evaluate for, develop, and implement, cost-effective alternatives for minimizing TDS concentrations or removing TDS/salt to minimize effects on potential future beneficial uses. It is reasoned that such alternatives would need to identify options for lowering TDS concentrations to meet the established WQO for TDS. The Title 22 Upper Contaminant Level for TDS is met for the 15-year period.

This antidegradation analysis also contains recommendation relating to a potential future groundwater monitoring well network as the aquifer point of compliance.

1.0 INTRODUCTION

Mission Springs Water District (MSWD) is proposing to construct the West Valley Water Reclamation Facility (WVWRF) in Desert Hot Springs, Riverside County, California. This new wastewater treatment plant would generate effluent discharges that have been subject to secondary treatment for the first 15 years (Phase I) of WVWRF operation.

In developing communities, the dilemma of how to cost effectively construct and grow a wastewater treatment plant efficiently is a common one, and is generally resolved by including system flexibility and cost-effectiveness into the long-term facility needs in decision-making. Important benefits to the State, MSWD, Desert Hot Springs, and the local community would occur given the phased approach to the proposed WVWRF. More costly Phase II capital investments would be timely invested in additional fixed assets when most usable and useful. Also, the proposed WVWRF capacity would be able to be used at or above minimum operating norms at all times. Very nominal asset values would be lost in transition to greater capacity, and maximizing efficiencies in facility operations by configuration needs.

A phased approach to facility construction and operation would result in:

- Cost-effective implementation
- Achievement of select goals of the Mission Creek and Garnet Hill Subbasins Water Management Plan
- Implementation of the MSWD Groundwater Quality Protection Program (GQPP) that involves removing from service individual septic tank systems that overlie groundwater subbasins within MSWD
- Optimized facility efficiency and performance as flows and capacity follow parallel growth
- Facility treatment objectives would remain at a constant standard for at least the

proposed Phase I permit period of 15 years

- Groundwater resources and present and anticipated potential future beneficial uses are equally protected during the Phase I permit period
- Additional facility improvements will be completed during Phase II expansion to decrease effluent COC loads with a resulting increase in aquifer water quality

The proposed WVWRF is the planned regional MSWD WWTP capital improvement project (CIP) prescribed by the Mission Creek and Garnet Hill Subbasins Water Management Plan. The plan outlines nearly $1-billion in water/wastewater, imported water, and recycled/reuse water CIPs and future operating costs between 2012 and 2045 (MWH, 2013) in the Mission Creek and Garnet Hill Subbasins. Secondary treatment effluent wastewater and imported water directed for percolation/infiltration is generally of lesser quality (e.g., higher dissolved solids and salt content) than the receiving aquifers. This analysis evaluates for potential WVWRF Phase I operations related water quality degradation.

The preliminary groundwater model previously developed for WVWRF has been updated at the request of the MSWD and is the foundation for this antidegradation analysis (*EnviroLogic Resources*, 2018). Presented are the results of aquifer mass balance analysis and available assimilative capacity evaluation, and updated numerical groundwater flow and transport modeling to evaluate the effects of infiltrating secondary treated effluent from the proposed WVWRF through the vadose zone into the Garnet Hill Subbasin unconfined aquifer. Not all the effluent water discharged to the proposed infiltration basins will discharge to groundwater, with portions lost to evaporation from standing water and/or moisture from the upper layer of surficial, or vadose zone, soils as the basins are allowed to cyclically rest and dry out (AECOM, 2018). The worst case site physical, chemical, and aquifer parameters utilized in the preliminary modeling were adjusted to reflect likely conditions. Changes to the preliminary groundwater modeling include for recharge rates to adjust for water lost to evaporation, and changes to the Well 33 pumping rate to 700 gpm for 8 hours per day, which simulates the actual operational conditions, change to the hydraulic conductivity, 7.6 ft/day, in the Garnet Hill Subbasin and changes to dispersion.

1.1 FACILITY DESCRIPTION AND INITIAL OPERATION

The recommended Phase I configuration and treatment/process level for the planned WVWRF are described in detail the Preliminary Design Report (AECOM, 2018), including summaries of influent and effluent design values. The recommended Phase I configuration consists of the following facilities at the planned WVWRF are as follows, per the PDR:

- *Influent Pump Station*
- *Preliminary Treatment – Metering, screening, and grit removal*
- *Secondary Treatment – Sequential Batch Reactors with submerged mixers, diffused aeration, waste sludge pumping*
- *Effluent Pumps*
- *Infiltration Basins*
- *Aerated Sludge Storage with Solids Thickening*
- *Solids Dewatering Building*
- *Odor Control*
- *Emergency Stand-by Power Generator*
- *Administration/Electrical Building*

Provisions will be made for adding future facilities in anticipation of the MSWD advancing their goals to recycle water, including:

- *Fine Screens*
- *Membrane Bioreactors*
- *Return Pumping*
- *Coagulation/Filtration*
- *Disinfection*

The WVWRF is planned to serve Desert Hot Springs and surrounding communities, and in its proposed Phase I configuration will have a future Phase II design tertiary treatment capacity of 3 million gallons per day (MGD) with additional options for expansion. The facility is to be located along Little Morongo Road, between 18th Avenue and 20th Avenue. Initially, for Phase I, secondary effluent is proposed to be discharged to percolation basins at the south end of the site. Per the PDR for WVWRF, these Phase I discharges are anticipated to occur daily with flows gradually increasing from around 0.2-MGD initially to 0.29-MGD in Year 1, increasing to 1.0-MGD in Year 7, increasing to 1.2-MGD in Year 9, increasing to 1.5-MGD by Year 15 as local urbanization increases. A site vicinity map is presented on Figure 1. A drawing showing the layout of the proposed WVWRF is presented on Figure 2.

1.2 PHASE I EFFLUENT DESIGN VALUES

The PDR includes descriptions of target effluent concentrations given the present status of the proposed WVWRF design concept, which includes additional secondary treatment denitrification in comparison with the Horton WWTP. The following table presents a summary of the reviewed background and annual effluent averages (**emphasis** added for the selected assimilative capacity evaluation and modeling inputs):

Background Concentrations vs Proposed WVWRF Phase I Effluent Summary [1]

	Background Range	Citation(s)	Annual Effluent Average	Citation(s)
TDS (mg/L)	156-933 217 **230** 250 300-400 350 480 540	CVWD GH Well Data *.xls CVSNMP for GH **MSWD Well 33** MWH GH MSWD Well 32 MC near GH study Horton WDR CVSNMP for MC	**+400**	**PDR**/Horton WWTP
Total Nitrogen (mg/L)	2.0-6.0 **0.72**	EPA on TN (2013 factsheet) **MSWD 2017 CCR for DHS**	**<10**	**PDR**/Horton WWTP
Nitrate-As Nitrogen (mg/L)	ND ≤ 0.01 0.113-14.3 **0.72** 3.5-6.0	MSWD Well 32 CVWD GH Wells Data *.xls **MSWD 2017 CCR for DHS** CVWD MC Wells Data *.xls	**<10**	PDR/**Horton WWTP**
Coliform Bacteria	**0**	**MSWD 2017 CCR for DHS**	**0**	**MCL**
Chloride (mg/L)	13 **30.1**	MSWD Well 32 **MSWD 2017 CCR for DHS**	**+40**	**AECOM**/Horton WWTP
Sulfate (mg/L)	**160.4** 180	**MSWD 2017 CCR for DHS** MSWD Well 32	**+40**	**AECOM**/Horton WWTP

[1]= facility design concentrations, per the FINAL Preliminary Design Report for the Proposed WVWRF (AECOM, 2018) prepared for MSWD

1.3 FUTURE IMPROVEMENTS & TREATMENT CAPACITY EXPANSION

Local urbanization will have increased by Year 15, along with the associated revenue for infrastructure, such that Phase II tertiary treatment effluent and discharge volumes will begin to increase above 1.5-MGD. MSWD will initiate Phase II projects to upgrade the WVWRF to expand the treatment and discharge capacity in a timely manner, including the ability to divert to an effluent storage reservoir/basin, under the following "abnormal" operating conditions: 1) wet weather secondary effluent flow rate has potential to exceed capacity of tertiary treatment capacity; and 2) when final effluent quality does not meet permit limits and cannot be discharged to the Mission Creek Spreading Grounds. These Phase II improvements are scheduled to be initiated by Year 15. Phase II improvements will initially include additional facility upgrades for tertiary treatment levels and expansion of the WVWRF that will increase the permitted treatment and discharge capacity from 1.5-MGD to 3.0-MGD. A re-evaluation and separate antidegradation analysis may need to be completed in the future to support best practicable technology improvements, discharge capacity expansion and related permitting.

1.3 PURPOSE OF ANTIDEGRADATION ANALYSIS

This antidegradation analysis is intended to address Federal and State antidegradation review requirements relating to Phase I discharges at the proposed WVWRF. The updated groundwater model is the foundation to support evaluation of: a) whether infiltration of Phase I percolation pond discharges through the vadose zone at the proposed WVWRF would cause impacts above aquifer water quality objectives/standards/criterion; b) potential effects of lowered aquifer water quality on beneficial uses; and, c) if allowing incremental degradation of aquifer water quality during Phase I is acceptable given the significant economic and social benefits of the proposed WVWRF project in lieu of costly technologies to further minimize aquifer water quality impacts.

2.0 REGULATORY SETTING AND TECHNICAL APPROACH

The proposed WVWRF is located in the Garnet Hill Subbasin of the Coachella Valley Groundwater Basin. This section briefly summarizes the regulatory setting and technical approach for the proposed WVWRF subject of this antidegradation analysis.

2.1 ANTIDEGRADATION POLICY AND GUIDANCE

Both Federal and State level antidegradation policies are designed to meet or exceed water quality objectives, and be protective of existing and anticipated future potential beneficial water uses, while potentially allowing lower water quality in the area of affected waters where necessary to accommodate important economic or social development. According to EPA, the State is to assure that the highest level of regulatory requirements are achieved for all point sources, and that cost-effective and reasonable best management practices be used for non-point source control.

The U.S. EPA, Region 9 *Guidance on Implementing the Antidegradation Provisions of 40 CFR §131.12* (USEPA, 1987) provides general guidance for Region 9 states for developing procedures for implementing antidegradation policies.

The (California) State Water Resources Control Board (SWRCB) has developed (1968) Resolution No. 68-16 to incorporate its interpretation of federal policy and guidance, including: a) maintaining high water quality, unless any change is consistent with the maximum benefit to the people of the State and will not affect beneficial water uses or result in ambient groundwater quality less than prescribed in policies and objectives; and b), proposed discharges to high quality groundwater will meet permitted waste discharge requirements and result in the best practicable treatment or control to assure that pollution/nuisance does not occur, and the highest achievable groundwater quality will be maintained. Discharges that range between background and the specified WQOs are to be considered consistent with the resolution, where best practicable treatment and control technology are needed to maintain ambient groundwater quality a lower treatment level may not be appropriate. However, SWRCB does not expect for discharges to treat to levels that are better than background/ambient groundwater quality.

A 1987 SWRCB policy issued to the Regional Water Quality Control Boards (Regional Board) provided guidance on establishing WQO, issuing of NPDES permits, waivers, and exceptions to the objectives or controls. This guidance indicates the Regional Boards must assure that any lowering of groundwater quality is necessary to accommodate important economic or social development. SWRCB acknowledges within policy that while changes to groundwater quality may have occurred over time, its use is still a benefit by providing an alternate supply. For example, irrigation with recycled water is considered a maximum benefit to the people of the State. Phase II WVWRF tertiary treatment effluent discharges may divert to a recycled/reuse water conveyance system, lowering flow volumes to percolation ponds and available COC for infiltration to the aquifer after evaporation and vadose zone residence time.

The Desert Hot Springs community and areas served with water and sewer by MSWD has experienced rapid development and high population growth since the 1970s when there were approximately 2,700 residents, having doubled in the 1980s. The population was 25,938 at the 2010 census, up from 16,582 at the 2000 census (www.census.gov). Future population growth is anticipated to continue at 2.1-percent annually; as of 2014 there were a reported 28,164 residents (https://population.us/ca/desert-hot-springs/), with an estimated 2019 population of 31,217. Given the present MSWD infrastructure that is in place, future development in the Desert Hot Springs community will also be reliant on MSWD for wastewater collection, treatment, and recycled/reuse water services. Phase I of the proposed WVWRF is anticipated to account for the next 15 years of community growth, along with the other two existing MSWD WWTPs (Horton WWTP and Desert Crest WWTP) in the Desert Hot Springs community, as treatment and discharge flows approaches the 1.5-MGD Phase I design capacity. Build-out of the service area and the MSWD GQPP are intricately tied to the proposed WVWRF Phase I operation, and eventual Phase II expansion. Phase I permitting of the proposed WVWRF is necessary to accommodate the near-term planned and approved growth of the Desert Hot Springs community. Growth in the community strengthens the tax base of the cities and County, increases tourism, and provides improved community services, quality of life, and retail benefits to residents and visitors. In addition, the MSWD GQPP has converted 7,800 parcels from septic to sewer, with approximately 3,200 parcels remaining. The GQPP improves groundwater quality and protect the drinking and hot mineral water supply which is the economic basis of the community's spa industry.

In addition, the proposed WVWRF Phase II tertiary treatment effluent discharges would support groundwater replenishment and recycling/reuse projects, reduce secondary effluent discharges for infiltration, and lessen the potential need for emergency use, if any, of temporary outfalls to surface waters. This antidegradation analysis provides substantial evidence that the proposed WVWRF Phase I effluent discharge impacts for TDS would be *de minimus* and total nitrogen/nitrate as nitrogen, chloride, and sulfate concentrations above background levels should not degrade existing or anticipated potential future beneficial uses of groundwater in the vicinity of the proposed WVWRF. MSWD believes that the proposed WVWRF represents significant socioeconomic and public benefits, and the Phase I discharges by not exceeding established WQO or water quality criterion, except incrementally for TDS, and not unreasonably affecting beneficial groundwater uses would therefore meet the relevant goals of State and Federal antidegradation policies.

2.2 TECHNICAL APPROACH

EnviroLogic Resources, Inc., was tasked with completing an antidegradation analyses related to effluent discharges associated with the proposed WVWRF. The overall objective of this Phase I antidegradation analysis is to evaluate the potential for groundwater quality degradation associated with anticipated WVWRF percolation pond discharges, and determine whether any such degradation would have an unreasonable impact on background/ambient groundwater quality in the remainder of the site groundwater management zone – the Garnet Hill Subbasin. Where the agreed upon WQO can be shown to be attainable it would be demonstrated that future beneficial uses are protected.

While numeric groundwater quality criteria for some constituents have not been established for the Coachella Valley groundwater basin or its groundwater management zones, the policy and legal framework for specifying numeric WQO is established in the Colorado River Region Basin Plan. In addition, effluent limits set forth in permitted Waste Discharge Requirements (WDRs) for other local wastewater discharges provided additional background information on WVWRF Phase I secondary treatment effluent discharge type COC.

The following effluent COC were identified for further evaluation in this antidegradation analysis:

- Total Nitrogen/Nitrate-as nitrogen
- Total Dissolved Solids
- Total Coliform
- Chloride
- Sulfate

A qualitative measure of the assimilative capacity of the aquifer and estimated project water quality impacts was made for the key indicators total nitrogen/nitrate-as nitrogen, TDS, chloride and sulfate. Nitrate-as nitrogen, the major component of total nitrogen is the COC with an anticipated discharge concentration closest to relevant numerical water quality criterion, MCLs, and WQOs discussed further in Section 3. Total Nitrogen/Nitrate-as Nitrogen along with TDS are the primary indicator COC as the TDS concentration trends are a corollary for chloride, and sulfate concentration trends. Baseline concentrations of indicator COC total nitrogen/nitrate-as nitrogen, TDS, chloride, and sulfate in the receiving aquifer were compared to groundwater concentration model results for the 15 years of the proposed WVWRF Phase I discharges. Coliform was not modeled as its WQO is zero. The point of compliance is the aquifer and a future WVWRF site monitoring well network that will be established to verify the nature and degree of COC in the groundwater system and to evaluate for background/ambient groundwater quality effects and potential migration.

Background/ambient ground water quality defines a baseline for evaluation of degradation from known or anticipated beneficial uses, as ambient groundwater quality in the Garnet Hill Subbasin and Mission Creek Subbasin within the site vicinity is very high (i.e. below recommended "safe" contaminant levels). Data from Coachella Valley Water District (CVWD) and nearby MSWD wells in the Garnet Hill Subbasin and Mission Creek Subbasin were reviewed. A subbasin-specific comparison of water quality would likely be acceptable to the CRRWQCB, however, the combined water quality of both subbasins was considered, given the lack of data for certain water quality parameters or locales.

An aquifer mass balance analysis by an assimilative capacity evaluation (Section 4) shows that mass of COC loading is conserved in the aquifer(s) for the relevant COC with primary MCLs. The existing groundwater flow and transport model (Section 6) was updated to more adequately reflect the alluvial aquifer(s) beneath the proposed MSWD WVWRF percolation ponds given the site-specific operating conditions of the percolation ponds and nearby MSWD Well 33. These analyses considered the planned operational criteria for the percolation ponds and Well 33 during the first 15 years of operation (Phase I) on the basis of the PDR. This Phase I antidegradation analysis groundwater modeling updated includes a description of relevant and/or modified input parameters and results of the output in text and graphic formats, and recommendations on necessary next steps, including design and specifications on a future groundwater monitoring well network.

3.0 BENEFICIAL USES AND GROUNDWATER QUALITY OBJECTIVES

The master plan proposed West Valley Water Reclamation Facility is a wastewater collection, treatment, and disposal system and proposed by MSWD to provide sewerage service for the City of Desert Hot Springs and surrounding community.

3.1 BENEFICIAL USES

For the Phase I proposed WVWRF secondary effluent discharges, the beneficial uses of water were reviewed for the Garnet Hill Subbasin and Mission Creek Subbasin per the Colorado River Basin Plan. The applicable beneficial water uses are limited to groundwater for the Phase I secondary effluent discharges. For Phase II tertiary treatment discharges to the Mission Creek spreading grounds, potential surface water beneficial uses will likely require future review and re-evaluation.

3.1.1 Surface Water Uses

Potential future use of the Mission Creek spreading grounds are not applicable to the proposed WVWRF Phase I discharges to percolation ponds for infiltration to the upper alluvial aquifer. Surface water beneficial uses are not applicable to the Phase I effluent discharges, but may be relevant to Phase II.

3.1.2 Groundwater Uses

Municipal and domestic supply, agricultural supply, and industrial service supply are the identified beneficial uses of groundwater in the vicinity of the Coachella Valley per the Basin Plan. MSWD provides potable quality water, and plans for reuse of recycled water, within its service area that include Desert Hot Springs, and local community, residences and businesses. MSWD Well 33 is the nearest supply well to the proposed WVWRF percolation ponds secondary effluent discharge locations. It is not anticipated that future supply wells will be installed within the site vicinity, though wells could theoretically be constructed on predominantly vacant lands to the east, south, and west of the proposed WVWRF infiltration basins/percolation ponds within the inferred direction of flow and extent of groundwater impacts. Of note, much of the area near the planned WVWRF south of I-10 and east of Little Morongo Road are identified within dedicated conservation areas (e.g, Willow Hole Conservation Area, etc), which include certain protections and development restrictions; refer to the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP), for more information see http://www.cvmshcp.org/Plan%20Documents/_system_files/d2-4.pdf.

3.2 NUMERIC GROUNDWATER QUALITY OBJECTIVES

The following table summarizes the relevant specified groundwater quality criterion:

	Garnet Subbasin		Mission Creek Subbasin		WVWRF	
	Water Quality Criterion	Maximum Contaminant Level	Water Quality Criterion	Maximum Contaminant Level	Protective Water Quality Objective	Water Quality Impact
TDS (mg/L)	500 [1]	1,000 [2]	500 [1]	1,000 [2]	**500** [3]	**+400**[4]
Total Nitrogen (mg/L)	10	10	10	10	**10**	**<10** [4]
Nitrate-As Nitrogen (mg/L)	10	10	10	10	**10**	**<10** [4]
Coliform Bacteria (cfu)	0	< 5%	0	< 5%	**0**	**+0** [4]
Chloride (mg/L)	250 [5]	500 [6]	250 [5]	500 [6]	**250**	**+40** [4]
Sulfate (mg/L)	250 [5]	500 [6]	250 [5]	500 [6]	**250**	**+40** [4]

[1]= the 500 mg/L WQO for TDS is the "recommended contaminant level" (RCL) based on the Title 22 CCR "Consumer Acceptance" for municipal beneficial use

[2] = the 1,000 mg/L WQC for TDS is the "upper contaminant level" based on the Title 22 CCR "Consumer Acceptance" for municipal beneficial use

[3] = the 500 mg/L WQO for TDS is the selected concentration to maintain available assimilative capacity per the Basin Plan

[4] = the cumulative WQI above background levels associated with the proposed WVWRF discharge per the Preliminary Design Report, AECOM, or Horton WWTP data averages

[5] = the 250 mg/L secondary MCL for Chloride/Sulfate is a recommended level

[6] = the 500 mg/L primary MCL for Chloride/Sulfate is the upper level

4.0 MASS BALANCE ANALYSIS

The following is a qualitative analysis and discussion on the available attenuation capacity or "assimilative capacity" of the Garnet Hill Subbasin aquifer(s) relating to total nitrogen/nitrate-as nitrogen, TDS, chloride, and sulfate as indicator COC.

While coliform has an WQO/MCL of zero, it has never been detected in the Horton WWTP groundwater monitoring dataset. The resulting available assimilative capacity for total coliform would be zero. Total coliform was not evaluated for assimilative capacity.

4.1 ASSIMILATIVE CAPACITY

The assimilative capacity of the Garnet Hill Subbasin groundwater is the capacity for the aquifer to absorb the proposed Phase I WVWRF secondary treatment effluent discharges without impending existing or anticipated potential future beneficial groundwater uses. Agricultural use generally has low numerical thresholds for salinity-type parameters, with an assimilative capacity of 460 mg/L identified for TDS in the CV-SNMP for the Mission Creek Subbasin. While a threshold has not been established for Garnet Hill Subbasin the health risk-based Title 22 Upper Contaminant Level for TDS of 1,000 mg/L is identified as the WQO in the Basin Plan/Colorado River Basin Water Quality Control Plan-Region 7 (California State Water Resources Control Board, 2017).

Lacking the generally higher intensity agricultural, industrial, or commercial/residential land uses in the Mission Creek Subbasin, the Garnet Hill Subbasin being of higher aquifer water quality is expected to have a higher relative assimilative capacity for the associated COC. For conservative purposes, the aesthetics-based 500 mg/L Recommended Contaminant Level for TDS was chosen as the project WQO for the Garnet Hill Subbasin.

The following WQO threshold values of 500 mg/L for TDS, 10 mg/L for total nitrogen/nitrate-as nitrogen, and 250 mg/L for both chloride and sulfate were utilized for an initial comparison of COC mass balance for the proposed Phase I WVWRF discharges.

4.2 AVAILABLE ASSIMILATIVE CAPACITY

The TDS 270 mg/L of available assimilative capacity for the Garnet Hill Subbasin is simply the difference in the 500 mg/L WQO threshhold for TDS and the locally identified ambient/background TDS concentration of 230 mg/L measured in Well 33 within the locality of the proposed WVWRF. Concentrations of chloride and sulfate are included in TDS measurements, though fewer data on these analytes are available for the wells in both the Garnet Hill Subbasin and Mission Creek Subbasin.

Available Assimilative Capacity (AAC)

	TDS [1] (mg/L)			Total Nitrogen/Nitrate-as Nitrogen [2] (mg/L)			Chloride [3] (mg/L)			Sulfate [4] (mg/L)		
Subbasin	**WQO**	**Back.**	**AAC**	**WQO**	**Back.**	**AAC**	**WQO**	**Back.**	**AAC**	**WQO**	**Back.**	**AAC**
Garnet Hill	500	230	270	10	0.72	9.28	250	30	220	250	160	90
Project Impact	**WQI**		**%AAC**	**WQI**		**%AAC**	**WQI**		**%AAC**	**WQI**		**%AAC**
P1 WVWRF	+ 400		148.1%	8		86.2%	+ 40		18.2%	+ 40		44.4%
GW Modeling [5]			**Yes**			**Yes**			**Yes**			**Yes**

[1] = 1,000 mg/L WQO obtained from Colorado River Basin Water Quality Control Plan-Region 7 and MCLs. 230 mg/L background TDS concentration obtained from (2008) Well 33 data. Project TDS +400 mg/L above background concentrations as anticipated WQI per (2018) MSWD WVWRF Preliminary Design Report.

[2] = 10 mg/L WQO obtained from Colorado River Basin Water Quality Control Plan-Region 7 and MCLs. 0.72 mg/L background Nitrate-as N concentration obtained from (2018) MSWD 2017 CCR. Project anticipated WQI similar to Horton WWTP effluent characterization in Board Order R7-2014-0049. Total Nitrogen assumed as Nitrate-As Nitrogen

[3] = 500 mg/L WQO obtained from Colorado River Basin Water Quality Control Plan-Region 7 and MCLs. 30 mg/L background Chloride concentration obtained from (2018) MSWD 2017 CCR. Project Chloride WQI obtained as difference between monitoring well network data averages at Horton WWTP and cited background concentrations.

[4] = 500 mg/L WQO obtained from Colorado River Basin Water Quality Control Plan-Region 7 and MCLs. 160 mg/L background Sulfate concentration obtained from (2018) MSWD 2017 CCR. Project Sulfate WQI obtained as difference between monitoring well network data averages at Horton WWTP and cited background concentrations.

[5] = Project COC using less than the available assimilative capacity were not considered for additional groundwater modeling, as Chloride and Sulfate are covered in the TDS criteria.

The total coliform dataset is even more limited, though coliform has been demonstrated to be not detected in the monitoring wells at the MSWD Horton WWTP, which is of similar design, flows, and operation to the proposed WVWRF and is located in the Mission Creek Subbasin with similar hydrogeology. The WQI due to coliform concentrations is anticipated to be zero for the proposed WVWRF, given monitoring well data for the Horton WWTP.

The proposed WVWRF is in the Garnet Hill Subbasin near the Mission Creek Subbasin; these subbasins are separated by the groundwater-damming Banning Fault. Groundwater flows over the Banning Fault in some locations, with water-level drops of up to approximately 200-feet south of the fault. The geology in the vicinity of the site is shown on Figure 3. The Coachella Valley Groundwater Basin Salt and Nutrient Management Plan (MWH, 2015) identifies a range of TDS values from 300-1,096 mg/L and average 540 mg/L for Mission Creek Subbasin; for Garnet Hill Subbasin, TDS values range from 156-288 mg/L and average 217 mg/L (Well 33 TDS is reported at 230 mg/L and TDS for the Coachella Valley basin at 250 mg/L).

For the Garnet Hills Subbasin, the TDS total assimilative capacity is the difference between the assessment threshold 500 mg/L and the 230 mg/L average background/ambient concentration, which equates to 270 mg/L. In mass balance terms, the assimilative capacity in the Garnet Hill Subbasin aquifer(s) is the annual mass of TDS loading that would raise the background concentration by 270 mg/L to the 500 mg/L WQO. For streamlined permitting of recycled water projects, the Regional Board has considered 10-percent of available assimilative capacity as a level below which additional analyses is unnecessary. For this Phase I antidegradation analysis, if the WVWRF project COC may use greater than 10-percent of available assimilative capacity for a select indicator COC, that COC was further evaluated via groundwater fate and transport modeling (e.g, TDS, total nitrogen/nitrate-as nitrogen, chloride, and sulfate) to establish the likely to be affected areas.

4.3 MASS BALANCE VIA AVAILABLE ASSIMILATIVE CAPACITY

The presented groundwater fate and transport modeling analysis, does not incorporate estimates of COC storage/decay that occurs through biodegradation processes in the percolation ponds and vadose zone soil before reaching aquifers, which would have realistically resulted in a much higher Garnet Hill Subbasin assimilative capacity. Not all the COC leached to the vadose zone would reach the groundwater system, as a portion is lost to percolation pond evaporation (e.g, loss of nitrogen-as ammonia during evaporation) and/or assimilated/denitrified in the subsurface. While denitrification processes may be occurring in the deeper part of the unsaturated zone and at the soil/groundwater interface, such attenuation effects are not included in the assimilative capacity mass balance for simplicity in initial screening.

The amount of total nitrogen/nitrate that can be assimilated, for example, without exceeding WQOs depends on biogeochemical and hydrogeological factors. Attenuation of nitrate, occurs through a key denitrification process (conversion of nitrate to gaseous forms of nitrogen) in the subsurface in the presence of oxygen-depleted conditions, available electron donors, and a microbial community with the metabolic capacity for denitrification. Mixing and dilution of nitrate-rich groundwater with higher quality water from natural recharge sources is a secondary attenuation process in comparison, and is particularly relevant where groundwater flow paths for higher quality recharge areas and higher land use intensity areas converge, such as in the vicinity of the proposed WVWRF.

This aquifer mass balance comparison is based on estimates of average ambient background concentrations obtained for well locations in the subbasin(s) that may not be reflective of the site-/subbasin-specific conditions, which may result in a lower assimiliative capacity of the aquifer for the proposed WVWRF than presented in this antidegradation analysis. Uncertainties in assimilative capacity are mitigated by the relative insignificance of the proposed WVWRF COC mass additions and probability of increased dispersion/dilution effects at further distances from the discharge/mounding zone in comparison to the total Garnet Hill Subbasin COC balance.

The groundwater fate and transport modeling includes changes relating to the proposed WVWRF Phase I and Well 33 operational conditions and, therefore, is considered more real-world than the results of preliminary modeling efforts or this initial qualitative assimilative capacity evaluation. Phase II site conditions and the resulting effluent discharge quality and locations would change drastically as tertiary treatment is applied.

Aquifer water quality will be improved during Phase II WVWRF operations as higher quality tertiary treatment effluent will be discharged, and significant portions of which may be diverted for conveyance to MSWD recycled/reuse water customers. Tertiary treatment effluent may be conveyed and made available for infiltrating off-site at the Mission Creek spreading grounds.

The project Phase I discharges are projected to utilize more than 10-percent of the available assimilative capacity of the Garnet Hill Subbasin alluvial aquifer(s) for TDS, total nitrogen/nitrate-as nitrogen, chloride, and sulfate with reduced effects as aquifer water quality improves during Phase II operations at the higher tertiary levels of effluent treatment. In addition, phased WVWRF operations will facilitate and support decreasing flows to the existing Horton WWTP to maintain its flow capacity and eventual decommissioning of the Desert Crest WWTP. Decreased effluent discharges at the Horton WWTP will also result in lower total ambient background TDS and nitrogen concentrations being added to aquifers in the adjacent Mission Creek Subbasin. MSWD long-term plans for wastewater handling in Desert Hot Springs and local community includes significant efforts toward increased capabilities for tertiary treatment effluent recycling/reuse and/or infiltration at spreading grounds. It does not appear cost-effective to consider additional treatment technologies for the proposed Phase I WVWRF operations with these long-term offsets that minimize degradation of aquifer water quality to the extent practicable.

Available attenuation capacity or "assimilative capacity" of total nitrogen/nitrate-as nitrogen, chloride, and sulfate in the aquifer(s) is shown to be maintained when the cumulative impacts from the Phase I WVWRF secondary effluent discharges are accounted for, and the associated COC demonstrated to not significantly lower background/ambient groundwater quality in the subbasin or migrate. Adding 400 mg/L in TDS concentrations to the background 230 mg/L in the Garnet Hill Subbasin could exceed the projected assimilative capacity of the aquifer by roughly 50-percent.

5.0 VADOSE ZONE TRANSPORT EVALUATION

The Regional Board indicated credit would not be given for vadose zone degradation, when considering extrapolations of end-of-pipe effluent concentrations to groundwater impacts at the water table. A review of site-specific groundwater data and inferences is preferred.

An indirect evaluation of the degree of the anticipated vadose zone COC storage/decay of Phase I WVWRF discharges was completed using data available for the Horton WWTP in the adjoining Mission Creek Subbasin for a qualitative comparison. At Horton WWTP, secondary treatment effluent discharges are presently occurring at approximately 1.56-MGD of its total design capacity of 2.2-MGD. With the proposed WVWRF Phase I flows approaching 1.5-MGD in Year 15 of operation, the Horton WWTP was evaluated as a corollary given very similar hydrogeology and aquifer water quality in the Garnet Hill Subbasin and the Mission Creek Subbasin.

A prior statistical analysis of the Horton WWTP (*EnviroLogics Resources*, 2017) reflects that over 15 years of data suggest “end-of-pipe” average effluent and average groundwater monitoring well network concentrations for total nitrogen/nitrate-as nitrogen are below 10 mg/L and do not reach the aquifer at levels exceeding WQOs/MCLs, showing evidence of COC degradation in the infiltration ponds and subsurface.

Groundwater modeling was completed for the proposed WVWRF as a conservative measure for assessing total nitrogen/nitrate-as nitrogen, TDS, chloride, and sulfate, impacts to known and anticipated potential future beneficial/potable uses. Total nitrogen was selected for modeling with the assumption that the nitrate-as nitrogen comprised all of the total nitrogen.

6.0 GROUNDWATER FLOW MODEL

The groundwater model is constructed using Visual MODFLOW Build 4.6.0.168. The model uses MODFLOW 2005, a public domain numerical model created by the United States Geologic Survey (USGS). The model uses MODPATH for particle tracking and MT3DMS for the Mass Transport. Zone Budget calculates the flow budgets in and out of storage, wells, and recharge.

The base maps used for the model are the Desert Hot Springs and Seven Palms USGS 7.5 minute quadrangle topographic maps. The ground elevation is set at an elevation of 800 feet. The basement bedrock is set at a depth of 4,400-feet, or an elevation of -3,600 feet MSL (Figure 4). A model with 112 rows, 108 columns, and 4 layers was constructed on the basis of the Groundwater Flow Model of the Mission Creek, Garnet Hill, and Upper Whitewater River Subbasins (Psomas, 2013).

In order to reduce model run time and refine the input and output data to the area of the percolation ponds and wells in the vicinity of the study area, inactive flow and transfer cells are created. These cells are identified in Figure A-2 in *Appendix A* as light green and block the view of the map areas that are inactive.

6.1 MODEL PROPERTIES

The following describes the input parameters used to construct the model. *Appendix A* includes supporting information on the modeling inputs

6.1.1 Initial Heads

The initial heads for the model are based on 1936 heads from Psomas (2013), which are originally from Tyley (1974). These heads represent a reasonable initial condition and the overall groundwater flow direction is similar to current conditions.

6.1.2 Hydraulic Conductivity

The hydraulic conductivity (K) used in the model is an average of the range of values presented in Psomas (2013). For the Desert Hot Springs Subbasin, a horizontal hydraulic conductivity of 25 ft/day and a vertical hydraulic conductivity 2.5 ft/day are used. For the Mission Creek Subbasin, a horizontal conductivity of 59 ft/day and a vertical hydraulic conductivity of 5.9 ft/day are used. For the Palm Springs Whitewater Subbasin, horizontal hydraulic conductivity of 52 ft/day and a vertical hydraulic conductivity of 5.2 ft/day are used.

The range of hydraulic conductivity used by Psomas in the Garnet Hill Subbasin was 1 ft/d to 8 ft/d. A horizontal hydraulic conductivity of 7.6 ft/day and a vertical hydraulic conductivity of 0.76 ft/day are used in the model. The range of values is evaluated in a sensitivity analysis of the groundwater model using transmissivity, storage coefficient, and recharge.

6.1.3 Storage Coefficient

A storage coefficient value of 0.15 was used on the basis of values presented in Psomas (2013), which is derived from Tyley (1974).

6.2 WELLS

Simulated wells are Wells 27, 29, 31, 32, 33, and 37 in the MSWD and Coachella Valley Water District wells 11A2_3405, 12C1_3406, 12F1_3410, and 12H1_3409. MSWD Well 33 is simulated to pump at a schedule of 700 gallons per minute, 8 hours per day scenario, per MSWD provided information. Figure 5 presents a hydrograph for Well 33.

6.3 BOUNDARIES

Boundaries types simulated in the model include recharge from rainfall and percolation basins, and flow across fault boundaries.

6.3.1 Recharge

Due to low annual rainfall, recharge from direct precipitation is considered negligible. There is no simulated recharge from constant head boundaries or other recharge sources.

6.3.2 Evaporation

Evaporation is simulated as 70 inches per year to an extinction depth of 2 feet

6.3.2 Percolation Basins

The four simulated WVWRF percolation basins are each 220 feet by 220 feet for a total of 193,600 ft^2 area. Based on information provided, the Final PDR (AECOM, 2018), for a design flow of 1.5 MGD, 3 infiltration basins plus 1 spare basin for redundancy for a total of four basins are identified. Each basin has dimensions of 220 feet square and are loaded to a maximum of one foot of water depth. The rotation cycle will depend on actual percolation performance. As a starting point for the purpose of groundwater modeling, we can assume the ponds receive effluent in sequence. One pond receives effluent (active) while the other three ponds do not receive effluent (rest). The rotation schedule for each pond is assumed to be two weeks “active” followed by four weeks of “rest”. The loading frequency, number and sizes of ponds, and pond locations can be adjusted during the modeling if a more optimal configuration can be determined. Recharge is assigned to the percolation basins, at rates presented in Table 1. The recharge rates are based on the anticipated wastewater flows to the

WVWRF provided by project engineers (TKE, 2017). Initially, the WVWRF will have an average daily flow of 0.29 MGD to year 1. The average daily flows are projected to gradually increase to, 1.0 MGD by Year 7, and 1.2 MGD Year 9 and MGD by year 15. The selected WVWRF Phase I capacity of 1.5 MGD would take the plant capacity up to the flow projections for Year 15 (TKE, 2017). The model is run for a 15 year period. Table 1 presents operational information on WVWRF recharge rates.

Recharge Rates Applied to Percolation Basins

TIME (YEARS)	VOLUME MILLION GALLONS PER DAY (MGD)	RECHARGE RATE (INCHES PER YEAR)
0 - 1	0.29	877
1 -7	1.0	3,024
7-9	1.2	3,629
9-15	1.5	4,537

NOTE: TIME AND VOLUME SCHEDULE PROVIDED BY MSWD

A constant total nitrogen/nitrate-as nitrogen concentration of 9 mg/L is used for the recharge into the percolation basins; based on the average effluent from the MSWD Horton WWTP from January 2007 to December 2016. This is considered a conservative value as the same amount of treatment is expected at the WVWRF and typical nitrate effluent concentration is expected to be in the range of 5-7 mg/L, of the 10 mg/L total nitrogen, based on the Final PDR (AECOM, 2018), project engineer provided information, and our understanding of the planned Phase I operations.

6.3.4 Horizontal Flux Boundaries

The Subbasins in the Coachella Valley are separated by strike-slip faults that strike in a west by northwest direction. The faults impede the groundwater flow. In order to represent the faults, the Horizontal Flux Boundary (HFB) package is used. Based on the acre-feet per year indicated in the groundwater model by Psomas (2013), the hydraulic conductivity for each fault using the HFB package was calculated from the length of the fault represented in the Psomas model and a thickness of 1,100 feet for the unconfined, unconsolidated aquifer.

The value used for hydraulic conductivity across the Mission Creek fault is 0.0049 ft/day. The value used for the hydraulic conductivity across the Banning fault is 0.0170 ft/day. The value used for the hydraulic conductivity across the Garnet Hill fault is 0.0387 ft/day.

7.0 GROUNDWATER MODEL SIMULATIONS

Model simulation output graphics are presented for the final, 15 year, time period. The pumping of Well 33 scheduled at 700 gallons per minute 8 hours per day for the duration of the simulation - 15 years. Output files present a chemical constituent transport output using a mass transport output using MT3DMS for Layer 1 (unconfined aquifer to depths of top of screen for MSWD Well 33) and MT3DMS for Layer 2 (unconfined aquifer from top of screen for MSWD Well 33 to bottom of aquifer). The concentrations presented in the model output include ambient background concentrations, which were included as background in the model. These results are shown in *Appendix B*.

7.1 TDS

A recharge concentration of 630 mg/L is simulated based on adding the planned Phase I WVWRF effluent design value (+400 mg/L) to the background concentration (230 mg/L) for Well 33. The volume simulated into the percolation basins from 9 to 15 years is 1.243 MGD. The output of the simulation at the end of 15 years shows that the mass continues to track southeast and the chemical concentration under the recharge percolation basins enlarges toward the south. The concentration increases is greatest under the percolation basins. Based on the results of the groundwater model, the near background 250 mg/L concentration influence extends no more than approximately 2,000 feet to the southeast of the percolation ponds.

7.2 NITRATE-AS NITROGEN

A total nitrogen/nitrate-as nitrogen recharge concentration of 9 mg/L was used in the modeling, given the average of total nitrogen and nitrate-as nitrogen effluent concentrations measured for the Horton WWTP from January 2007 to December 2016 (8-9 mg/L) compared with background concentrations (0.72 mg/L) from the MSWD 2017 CCR. The output of the simulation at the end of 15 years shows that the mass continues to track southeast and the chemical concentration under the recharge percolation basins enlarges toward the south. The concentration increases is greatest under the percolation basins. Based on the results of the groundwater model, the near background 1 mg/L concentration influence extends no more than approximately 2,300 feet to the southeast of the percolation ponds.

7.3 CHLORIDE

A recharge chloride concentration of 70 mg/L is simulated based on adding the planned Phase I chloride effluent concentrations specified by AECOM (+40 mg/L) to the background concentration (30 mg/L) per the 2017 MSWD CCR (MSWD, 2018). The output of the simulation at the end of 15 years shows that the mass continues to track southeast and the chemical concentration under the recharge percolation basins enlarges toward the south. The concentration increases is greatest under the percolation basins. Based on the results of the groundwater model, the near background 30 mg/L concentration influence extends no more than approximately 1,750 feet to the southeast of the percolation ponds.

7.4 SULFATE

A recharge sulfate concentration of 200 mg/L is simulated based on adding the planned Phase I sulfate effluent concentrations specified by AECOM (+40 mg/L) to the background concentration (160 mg/L) per the 2017 MSWD CCR (MSWD, 2018). The output of the simulation at the end of 15 years shows that the mass continues to track southeast and the chemical concentration under the recharge percolation basins enlarges toward the south. The concentration increases is greatest under the percolation basins. Based on the results of the groundwater model, the near background 170 mg/L concentration influence extends approximately 1,225 feet to the southeast of the percolation ponds.

No kinetic reaction, sorption, or density variable is simulated for each of the parameters.

8.0 GROUNDWATER MODEL SENSITIVITY ANALYSIS

Longitudinal, horizontal and vertical dispersion variance resulted in changes to the directions of mass transport of chemical constituents. A longitudinal dispersion value of 200, a horizontal dispersion value of 0.5 and a vertical dispersion value of 0.1 resulted in the most reasonable shape considering the direction of groundwater flow and the existing groundwater gradient. As the longitudinal dispersion was reduced, a wider cross gradient migration was indicated. Groundwater flow sensitivity to hydraulic conductivity, and other variables has been demonstrated in previous reports. *Appendix C* includes supporting information relating to the range of simulation inputs and affects on outputs contemplated for the groundwater flow and transport modeling.

9.0 CONCLUSIONS & RECOMMENDATIONS

This antidegradation analysis consists of: 1) background information to support a finding that the proposed Phase I WVWRF secondary effluent denitrification discharges are necessary to accommodate important economical and social development in Desert Hot Springs and the local community; 2) a means for intergovernmental coordination and public participation; and, 3) initial planned Phase I WVWRF operation and discharge details for a two-phased approach for achieving point source regulatory framework requirements.

9.1 LONG-TERM AQUIFER WATER QUALITY IMPROVEMENTS

Based on the results of groundwater flow and transport modeling output presenting the particle path line tracking and aquifer mass transport results for Layer 1 and Layer 2, the Phase I secondary treatment effluent discharges to the percolation basins for evaporation and aquifer infiltration is not predicted to significantly degrade background/ambient groundwater quality of the Garnet Hill Subbasin, except for potentially TDS, or to effect existing or anticipated potential future beneficial groundwater uses, considering other future strategies exist. Aquifer water quality at the point of compliance and monitoring well network is expected to demonstrate that the assimilative capacity of the Subbasin is not unacceptably degraded, and to continue to evaluate TDS and other COC trends.

The TDS WQO threshold concentration of 500 mg/L modeled in the simulations at 15 years would extend to about 1,000-feet from the WVWRF percolation ponds, while other COC total nitrogen/nitrate-as nitrogen, chloride, and sulfate, concentrations do not migrate from the site above WQO/MCLs. Well 33 remains protected. If additional modeling was completed beyond Year 15 relating to implementation of Phase II tertiary treatment, the area of TDS concentrations above the 500 mg/L threshold would decrease concurrent with the reduction in comparison to Phase I discharge concentrations. Were Phase II WVWRF tertiary treatment discharges to be conveyed as recycled water that meets Disinfected Tertiary

Recycled Water standards per Title 22 for reuse at other locations (e.g. commercial businesses), a portion of WVWRF flows would be diverted from subsurface percolation.

Despite the potential for an incremental degradation of groundwater quality beneath the percolation ponds in comparison to established objectives as the proposed WVWRF Phase I mass discharges occur short-term for the identified contaminants, effluent flow and water quality is expected to increase as planned Phase II projects are implemented (i.e, flows increase to beyond 1.5-MGD capacity and tertiary treatment become operational). However flows directed to percolation ponds may not increase as greatly or may even be reduced, were tertiary-treated effluent to be directed for reuse. The Phase I proposed WVWRF discharges will not use more than the available assimilative capacity of the aquifer(s) for the Garnet Hill Subbasin, except for TDS in the immediate area adjacent the site. It is in the long-term best interest of the people of the State to allow the anticipated Phase I discharge related changes in water quality given the stated public interests, as anticipated beneficial uses are not unreasonably affected (unlikely for future beneficial uses to occur to the east and south within the site vicinity dedicated conservation areas).

9.2 GROUNDWATER MONITORING

Although there are few negative impacts to existing or known planned beneficial uses, given the potential for degradation of high quality groundwater in the Garnet Hill Subbasin, periodic groundwater monitoring and analyses should be performed to verify the modeling results and continuing achievements of the established WQOs.

Reviews of groundwater monitoring and sampling results should be completed every 5 years based on data obtained from WVWRF site monitoring wells, to verify our inputs to the groundwater fate and transport modeling and relevant antidegradation analysis extrapolations from years of data for the similarly sized and operated MSWD Horton WWTP at a similar hydrogeological location in the site vicinity.

Two years prior to WVWRF startup, a Groundwater Monitoring Well Network Work Plan should be developed and submittal for Regional Board review with info on monitoring well locations and specifications. Figure 6 shows the locations of proposed groundwater monitoring wells on the basis of the model results. One of the groundwater monitoring wells should be placed as a sentinel well between the percolation ponds and MSWD Well 33. At least three monitoring wells should be installed, and the groundwater monitoring and sampling program initiated at least one year prior to WVWRF startup to establish baseline groundwater quality for future comparisons, including statistical analyses to demonstrate representative COC concentrations:

- A minimum of one upgradient and two down-gradient wells should be installed;
- Groundwater monitoring well network COC to be sampled and evaluated: TDS, Total Nitrogen/Nitrate-As Nitrogen, Chloride, Sulfate, and Total Coliform;
- Within 6-months of Regional Board Order: Submit Groundwater Monitoring Network Work Plan; and
- After Startup: Technical Report with descriptions of present conditions, adequacy of monitoring effects of the percolation ponds discharge on groundwater, including necessary figures/maps tables, and appendices, for relevant COC and any recommended changes to monitoring locations, frequency, protocol, or QA/QC.

9.3 OTHER STRATEGIES

The Regional Board may request additional work, or other options that would be acceptable, toward meeting WQOs/MCLs, potentially relating to the following.

9.3.1 Effluent Limit Feasibility Study

The first 6-months to 1-year of actual WVWRF effluent quality and groundwater monitoring well data after startup could be used to perform a cost-benefit analysis of effluent TDS/salt removal alternatives that may be appropriate in future. If it is deemed necessary depending on the results, complete an influent TDS study.

9.3.2 Influent TDS Study

A Influent TDS Study may be warranted to evaluate the proposed incremental increase in TDS/salt as WQI above source water background levels and the impact that such discharge could have on the beneficial uses of the receiving aquifer: characterize influent TDS/salt and domestic/commercial sources within sewage collection system, alternatives for minimizing TDS/salt contribution from identified sources with costs comparison in dollars per ton to remove salt from influent (MSWD may need to work toward reducing combined the proposed WVWRF influent and effluent TDS/salt concentrations).

MSWD may also have to consider practicality of achieving a reduced incremental TDS increase, and if the increase is not practicable, MSWD would have to show 1) impacts of proposed TDS/salt input each year in terms of tons per year and concentration; 2) cost per ton of TDS/salt removed for each alternative; 3) capability of minimizing TDS/salt discharges; 4) proposed values for the practical incremental increase; and, 5) justification for the proposed practical incremental increased values.

9.3.3 Prohibition of Well Installations

An interim local (city/county/district) regulation/ordinance could be set forth to prevent the installation of additional wells in a specified area of the Garnet Hills Subbasin as a form of administrative/governmental control. As a potable municipal supply would be alternately be available for relevant properties, an interim ordinance would serve as an assurance on providing for aquifer quality for the known and anticipated beneficial groundwater uses during the time of Phase I WVWRF discharges. A review and re-evaluation of the needs for continuing any such prohibition should be completed as the Phase II tertiary treatment discharges are planned.

10.0 LIMITATIONS

These results are limited by the quality and quantity of the data provided. The greater the data entered, the more accurate the analysis.

A limitation is due to the fact that the constituent of concern, nitrogen, in groundwater has several possible sources other than the discharge from the WVWRF. For example, septic leachate from private residences, fertilizer, and *in situ* decomposition of organics are potential sources of total dissolved solids, total nitrogen/nitrate, chloride, and sulfate.

The analysis is geologically limited by the lithology and hydraulic conductivity assumed in the construction of the models.

Changes in groundwater elevation and direction may have an impact on the results, as would potential changes in land uses proximal to the site.

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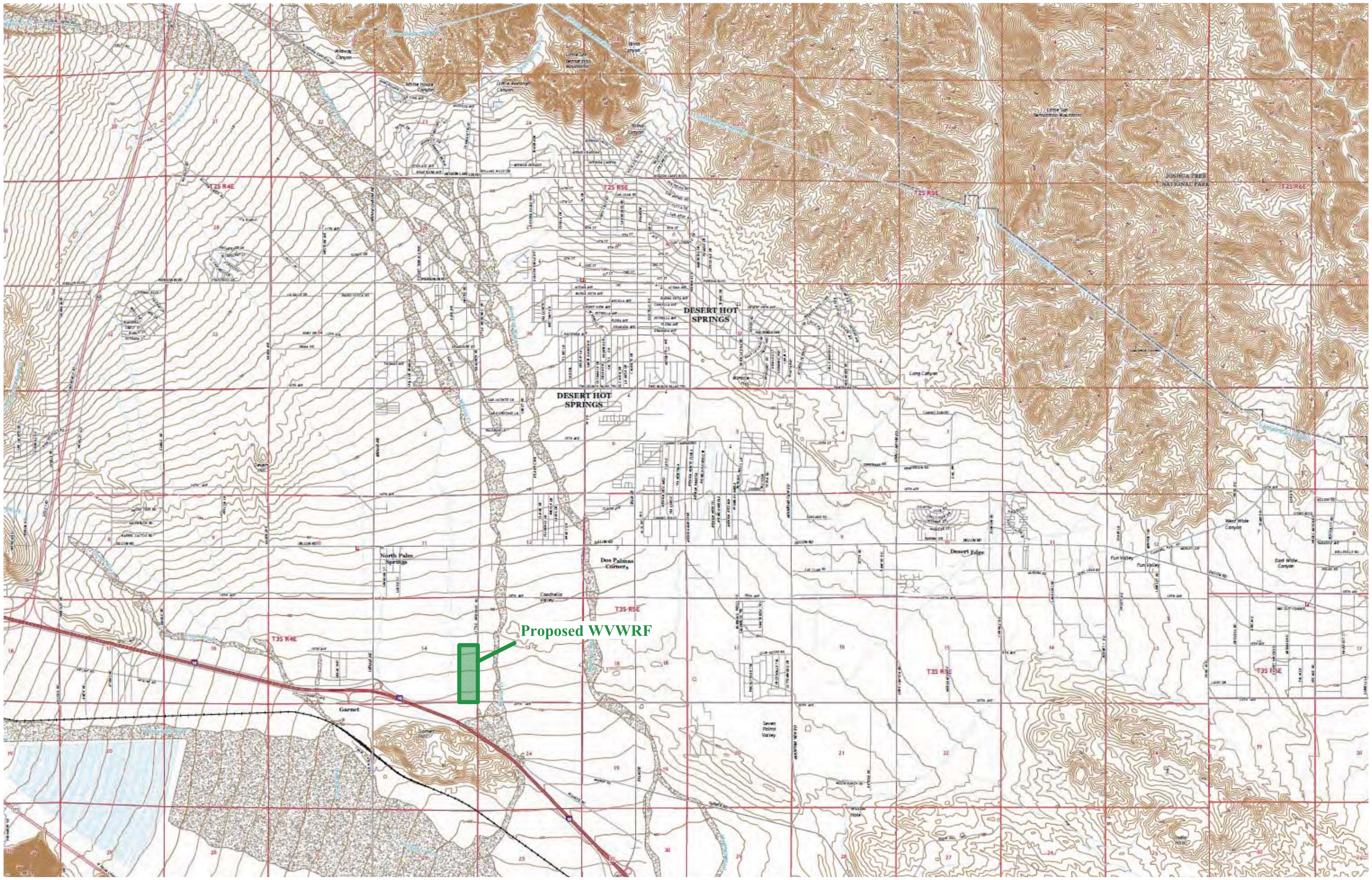
FIGURES



Map Base: Desert Hot Springs and Seven Palms Valley Topographic Maps, USGS, 2015

MISSION SPRINGS WATER DISTRICT

PROPOSED WEST VALLEY WATER RECLAMATION FACILITY

North

Scale: 1 Inch = Approximately 1 Mile

FIGURE 1
SITE VICINITY MAP

Desert Hot Springs, California

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PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

Map Base: Overall Plant Layout (AECOM, 2017)

North

Scale: 1 Inch = Approximately 200-feet

FIGURE 2
SITE LAYOUT

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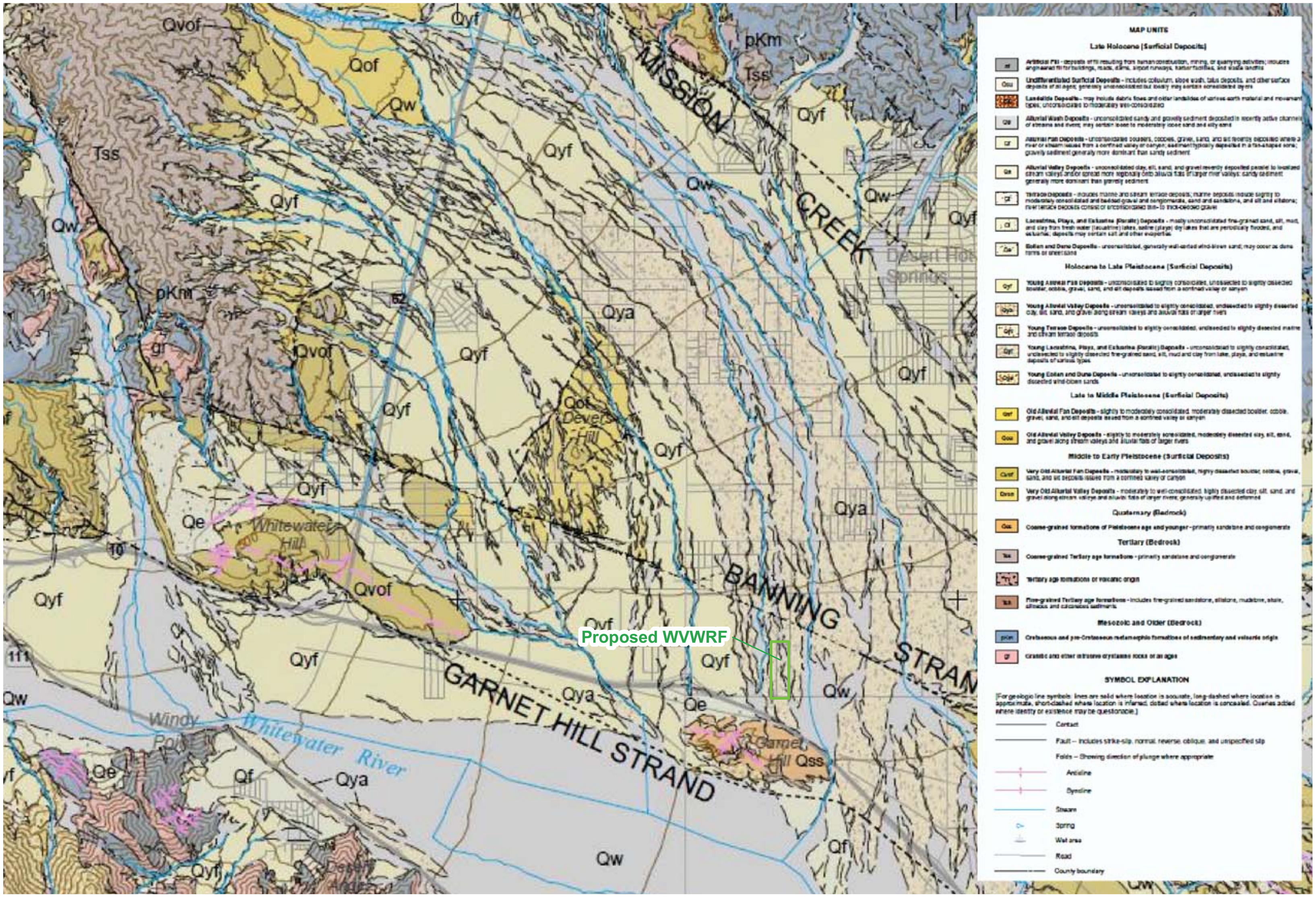
T3S, R5E
San Bernardino Meridian
Riverside County,
California

PROPOSED WEST VALLEY WATER RECLAMATION FACILITY



1 inch = 1 mile

0 0.25 0.5 0.75 1 Miles

FIGURE 3
AREAL GEOLOGY

Mission Springs Water District
Desert Hot Springs, California

EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS

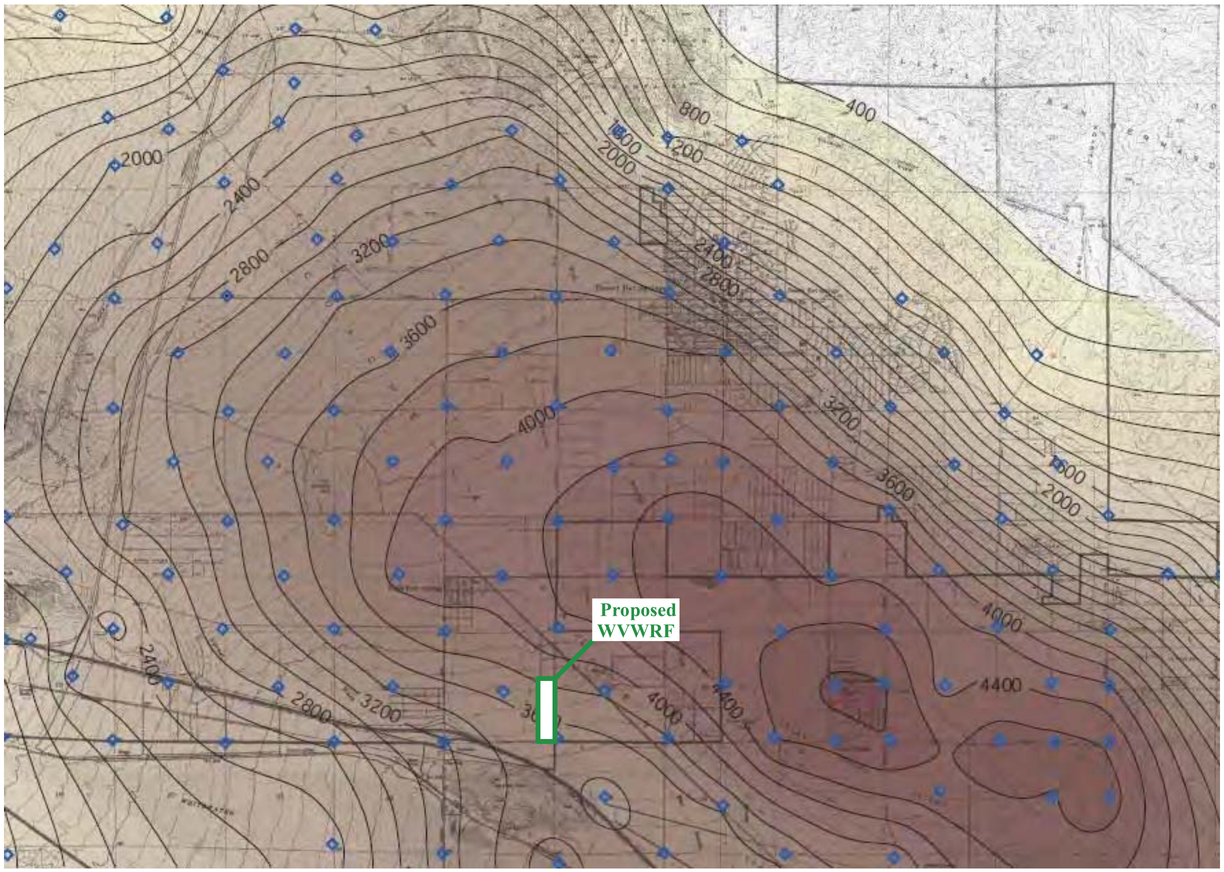
This map was prepared for the purpose of identifying the location of general site features and water resources only and is not intended to provide a legal description or location of property ownership lines.

World Geodetic System (WGS)
Datum of 1984
Prepared: March 23, 2018

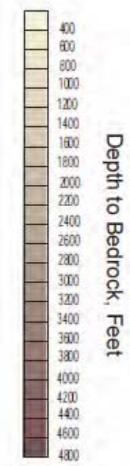
Sources: CGS Preliminary Geologic Map of Quaternary Surficial Deposits in Southern California Palm Spring 30' x 60' Quadrangle (CGS Special Report 217, Plate 24, 2012)

PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California



Map Base: Individual Depth to Crystalline Bedrock (GSI/Water, 2003)



North

Scale: 1 Inch = Approximately 6,000-feet

FIGURE 4
DEPTH TO
CRYSTALLINE
BEDROCK

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**PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY**

Desert Hot Springs, California

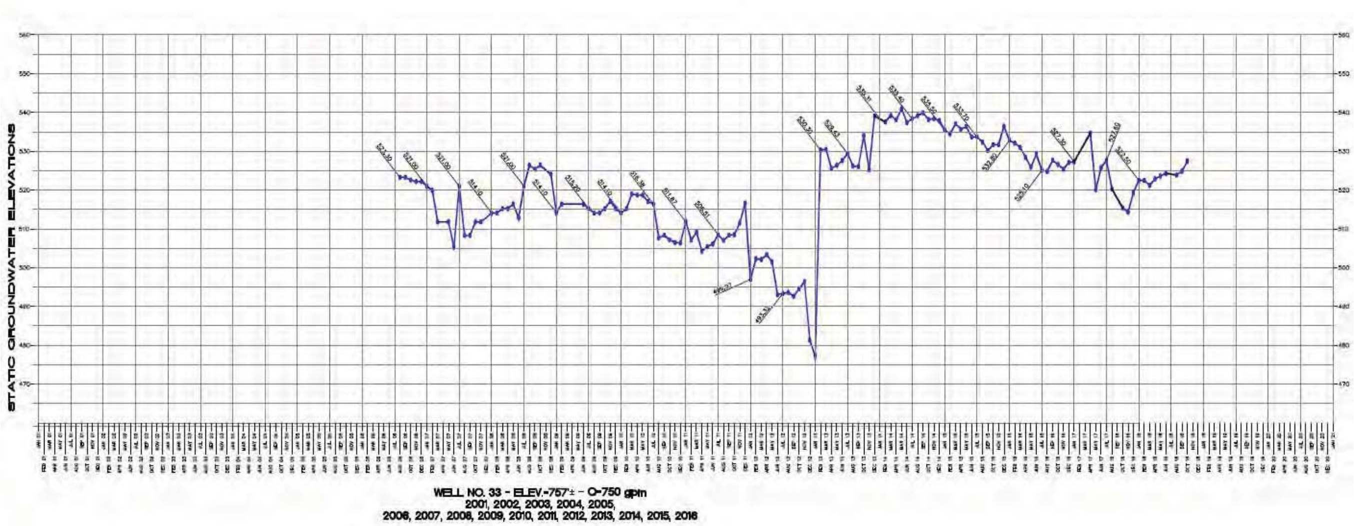

**FIGURE 5
WELL 33
HYDROGRAPH**

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PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

Map Base: Overall Plant Layout (AECOM, 2017)

Explanation

- Existing MSWD Well 33
- Proposed WVWRF Monitoring Well Locations

North

Scale: 1 Inch = Approximately 200-feet

FIGURE 6
PROPOSED GROUNDWATER
MONITORING WELL NETWORK

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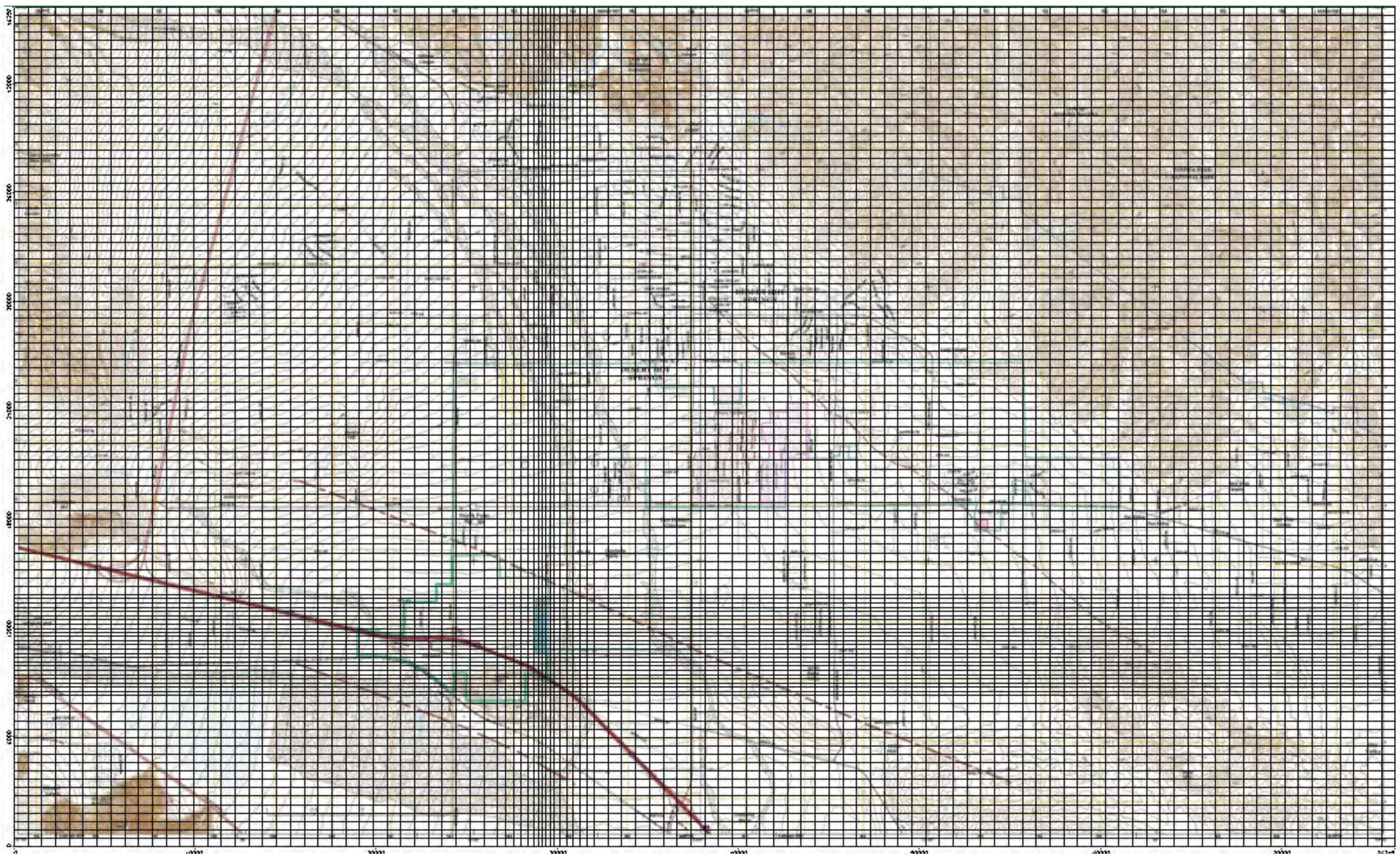
APPENDIX A

MODEL GRAPHIC
INPUT PARAMETERS



PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

North

Scale: 1 Inch = Approximately 6,000-feet

FIGURE 1
MODEL GRID

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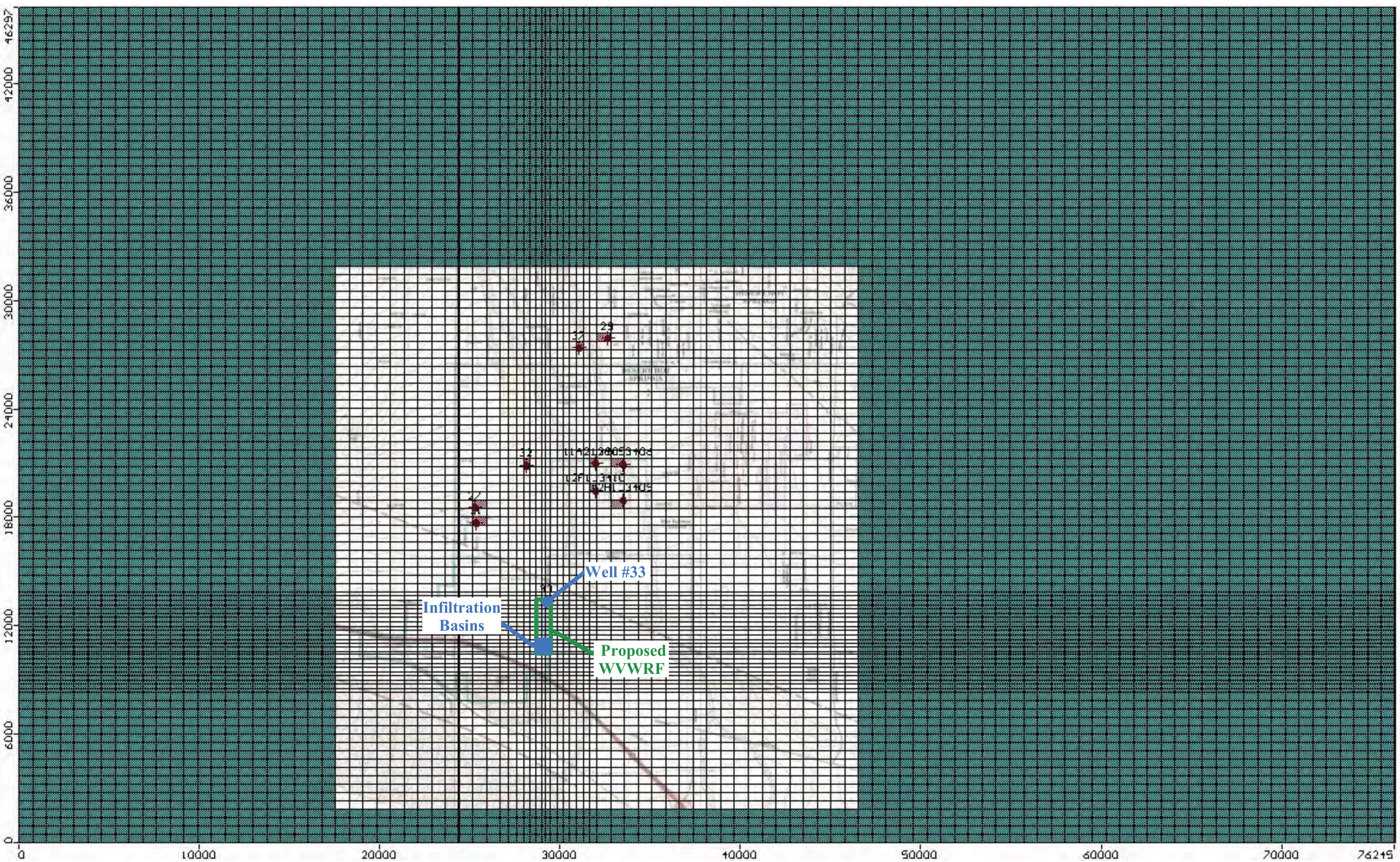

Map Base: MODFLOW finite-difference grid on topographic map domain

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**PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY**

Desert Hot Springs, California

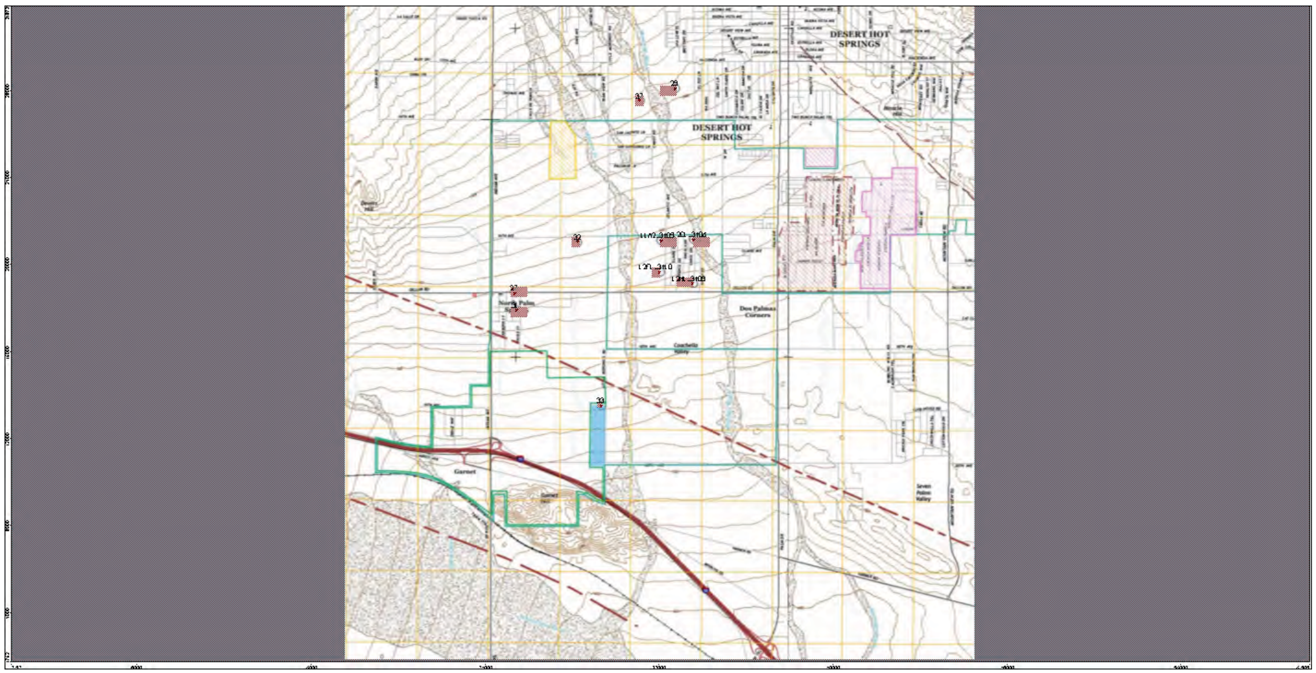
North

Scale: 1 Inch = Approximately 6,000-feet

**FIGURE 2
INACTIVE FLOW**

PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California



North

Scale: 1 Inch = Approximately 6,000-feet

FIGURE 3
WELLS

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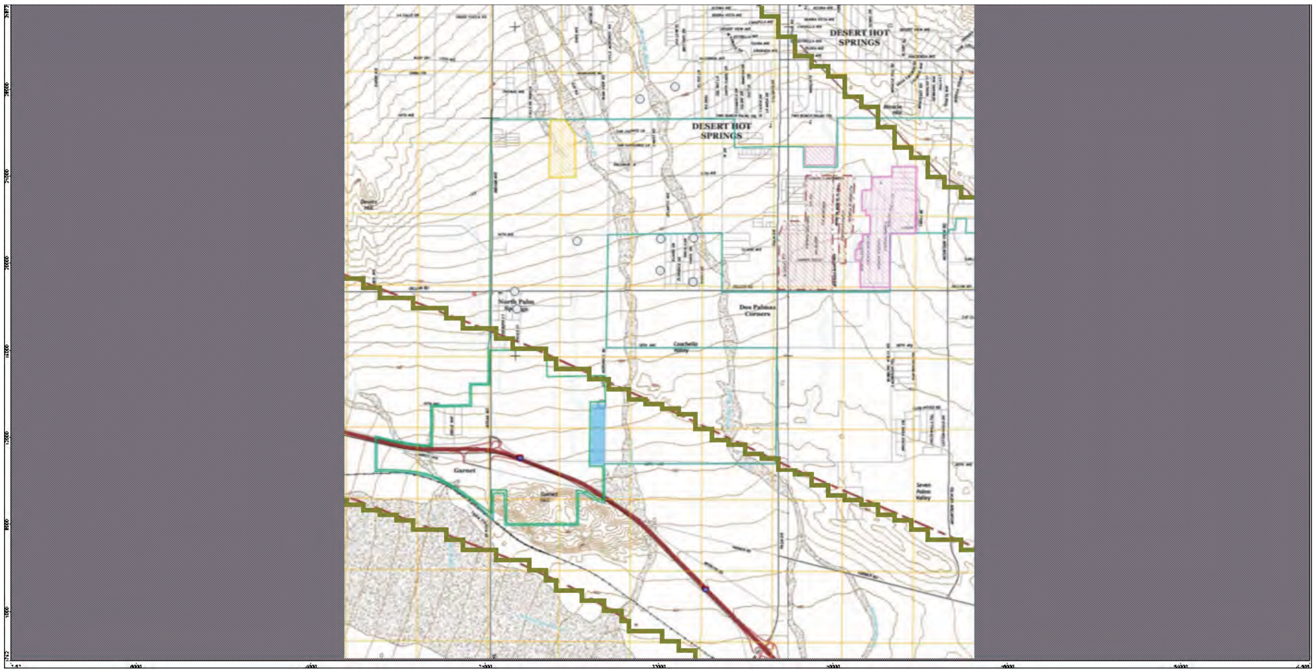
PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

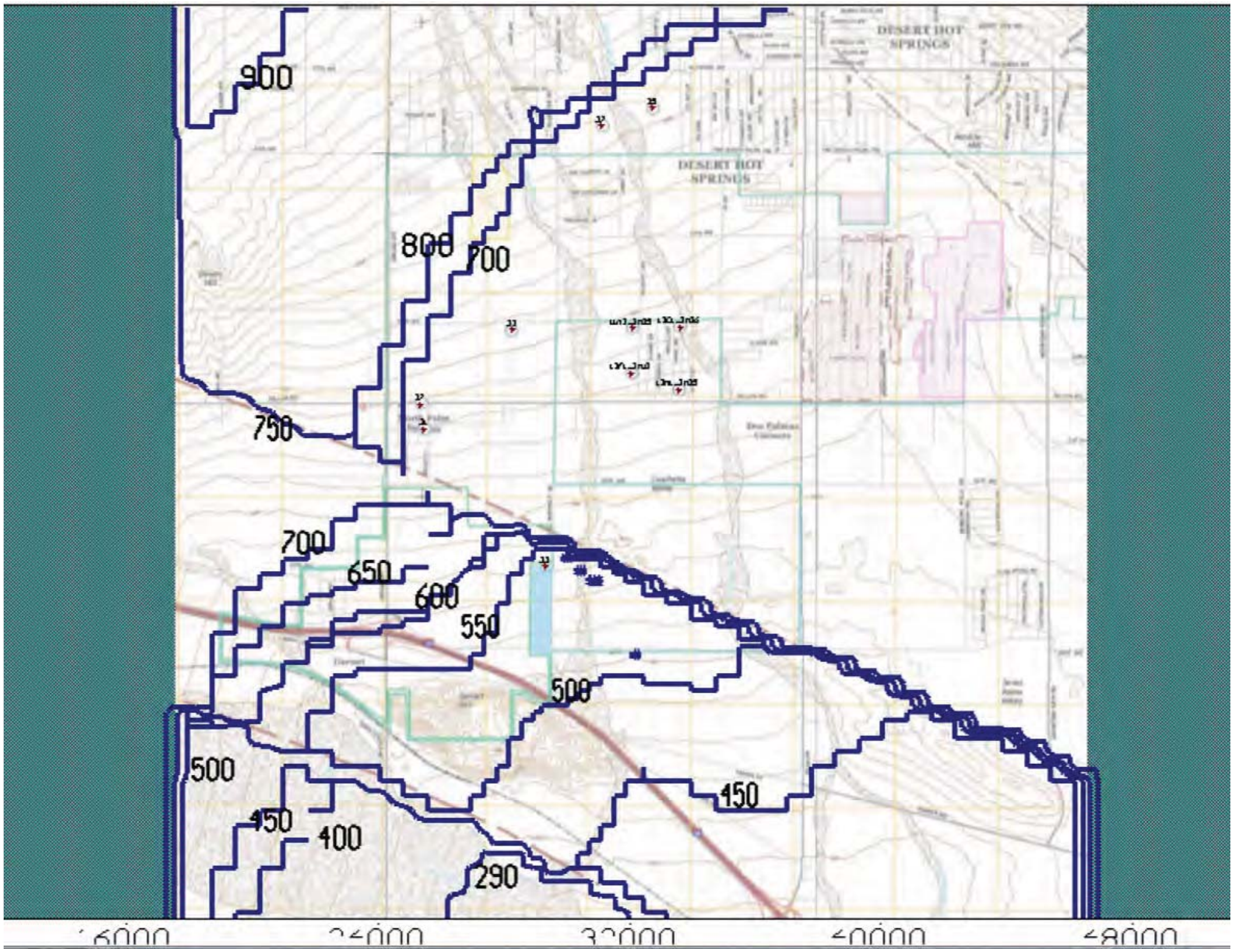


North

Scale: 1 Inch = Approximately 6,000-feet

EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS

FIGURE 4
HORIZONTAL FLUX
BOUNDARIES



PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

North

Scale: 1 Inch = Approximately 3,500-feet

FIGURE 5
INITIAL HEADS

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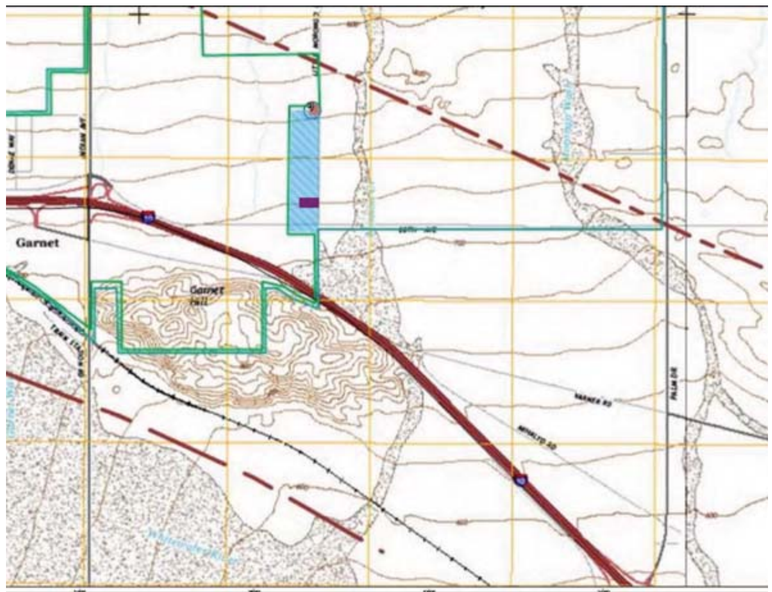
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California



North

Scale: 1 Inch = Approximately 3,000-feet

FIGURE 6
PERCOLATION
PONDS

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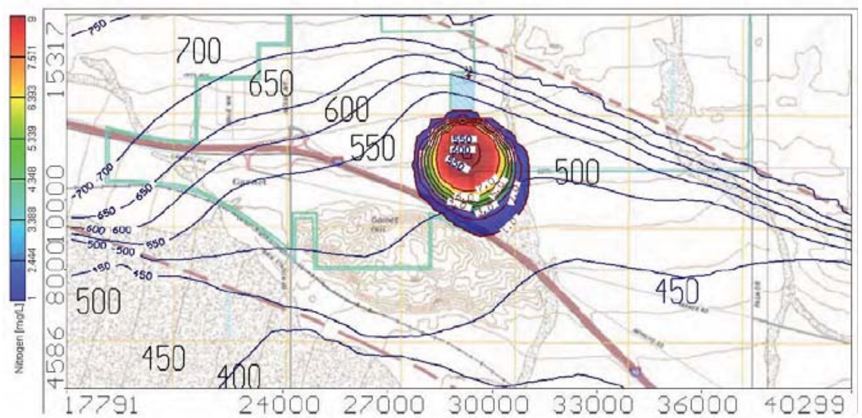
APPENDIX B

MODEL GRAPHIC OUTPUT

PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California



North

Scale: 1 Inch = Approximately 3,500-feet

FIGURE B-1
MODEL NITRATE
CONCENTRATION
AFTER 15 YEARS
(LAYER 1)

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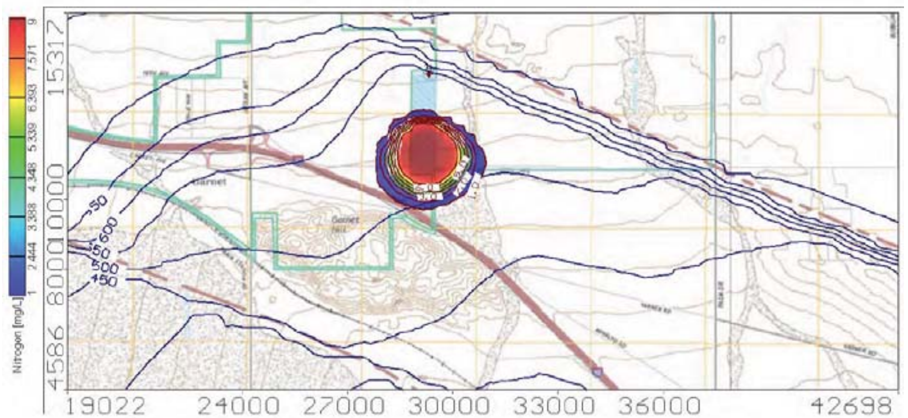
PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California



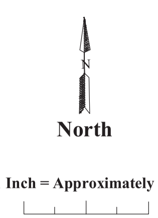
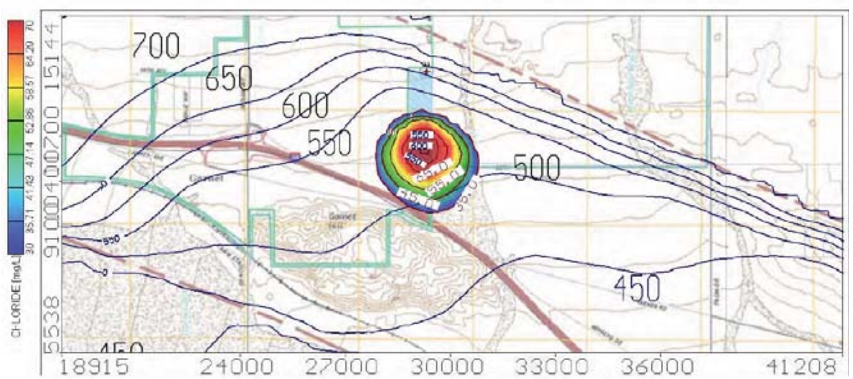


FIGURE B-2
MODEL NITRATE
CONCENTRATION
AFTER 15 YEARS
(LAYER 2)

EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS

PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California



North

Scale: 1 Inch = Approximately 3,500-feet

FIGURE B-3
MODEL CHLORIDE
CONCENTRATION
AFTER 15 YEARS
(LAYER 1)

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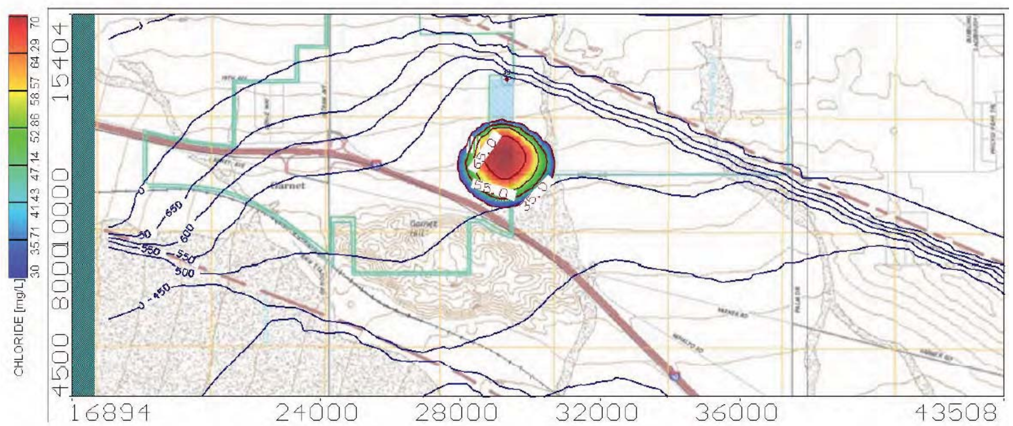
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California



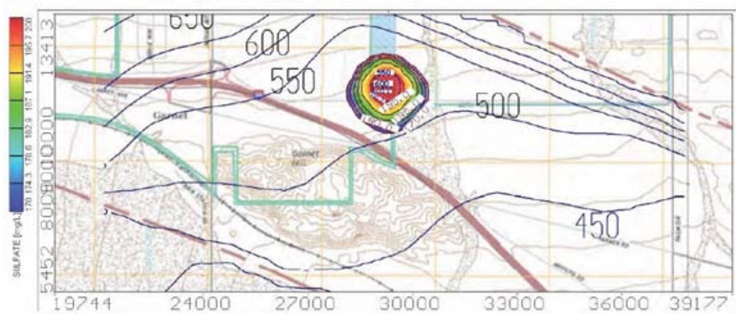
Scale: 1 Inch = Approximately 3,500-feet

FIGURE B-4
MODEL CHLORIDE
CONCENTRATION
AFTER 15 YEARS
(LAYER 2)

EnviroLogic Resources, Inc.
ENVIRONMENTAL • WATER RESOURCES SCIENTISTS

PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California



North

Scale: 1 Inch = Approximately 3,500-feet

FIGURE B-5
MODEL SULFATE
CONCENTRATION
AFTER 15 YEARS
(LAYER 1)

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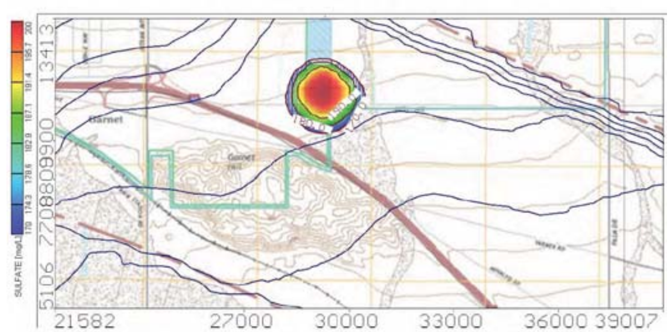
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California



North

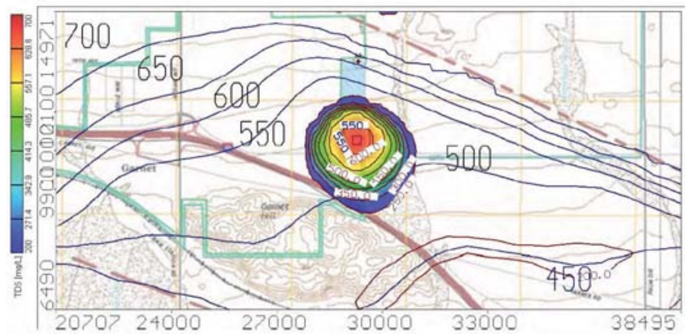
Scale: 1 Inch = Approximately 3,500-feet

FIGURE 6
MODEL SULFATE
CONCENTRATION
AFTER 15 YEARS
(LAYER 2)

EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS

PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California



North

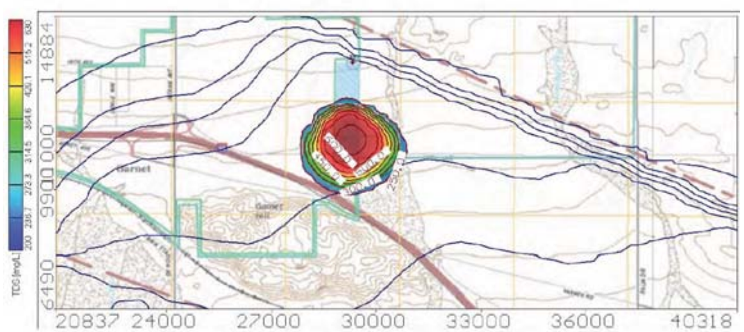
Scale: 1 Inch = Approximately 3,500-feet

FIGURE B-7
MODEL TDS
CONCENTRATION
AFTER 15 YEARS
(LAYER 1)

EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS

PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California



North

Scale: 1 Inch = Approximately 3,500-feet

FIGURE B-8
MODEL TDS
CONCENTRATION
AFTER 15 YEARS
(LAYER 2)

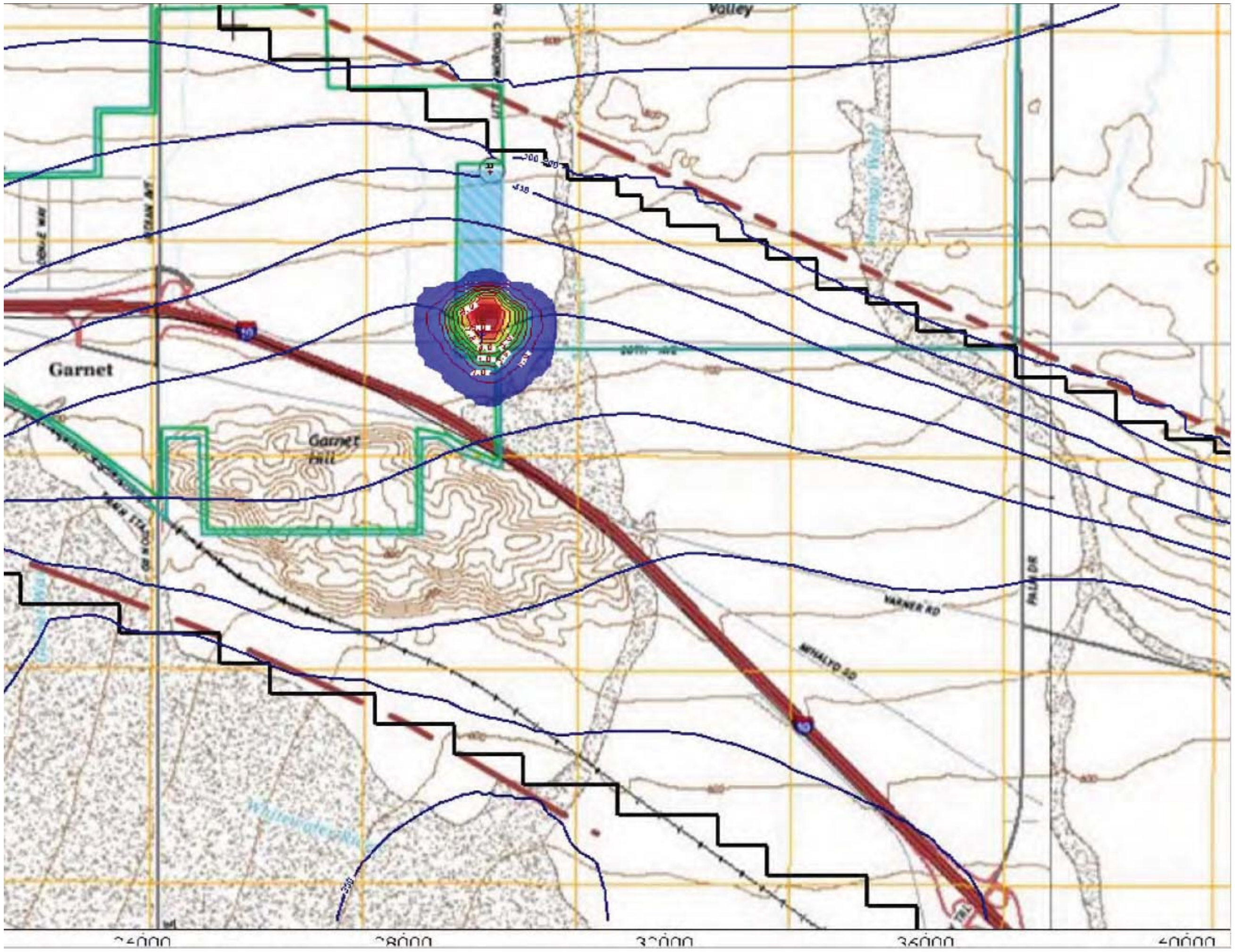
EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS

APPENDIX C

MODEL SENSITIVITY ANALYSIS

PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

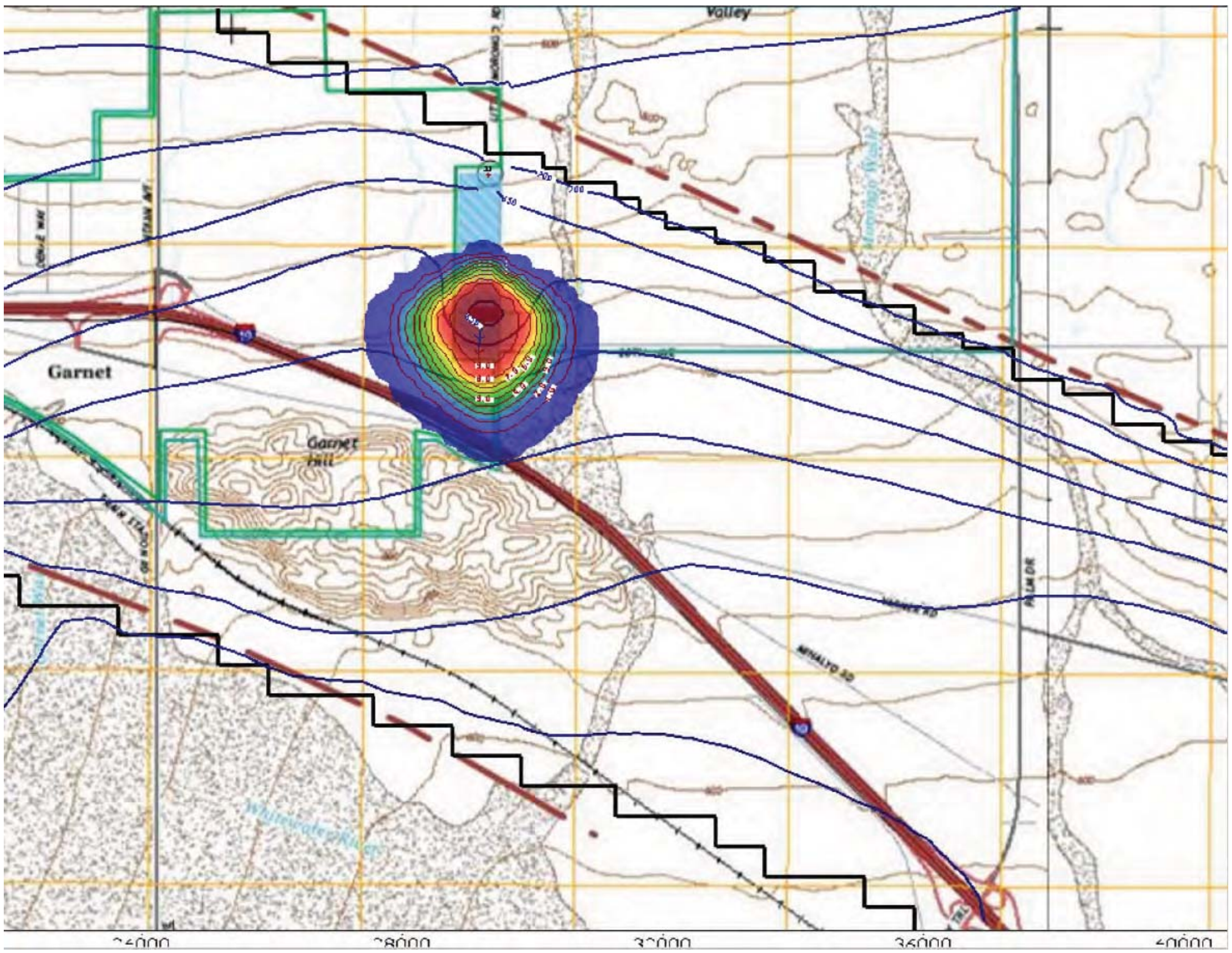


North

Scale: 1 Inch = Approximately 1,750-feet

FIGURE 1
5 YEARS NITROGEN
CONCENTRATION (LOWER
LIMIT SENSITIVITY)

EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS



EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS

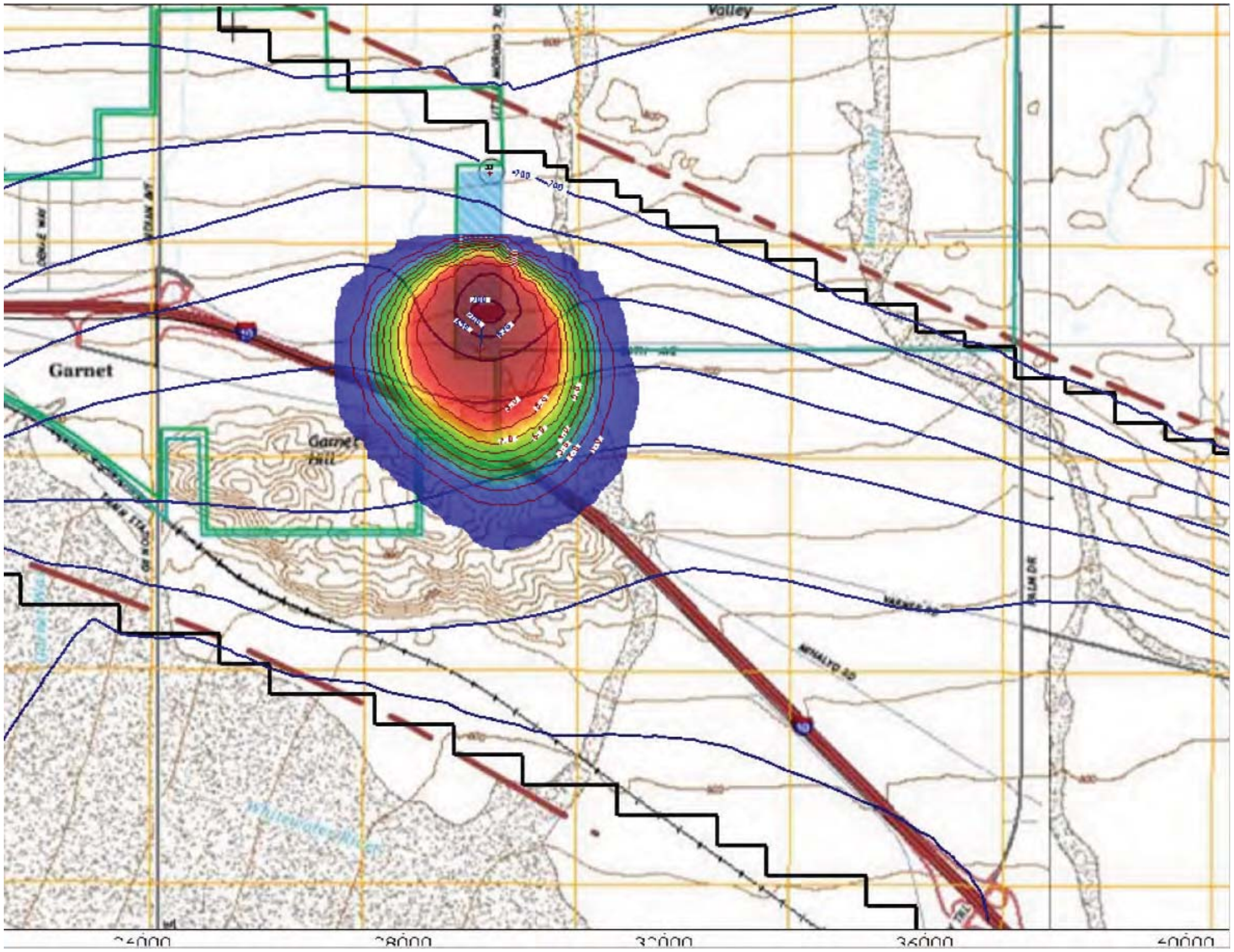
**PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY**

Desert Hot Springs, California

North

Scale: 1 Inch = Approximately 1,750-feet

**FIGURE 2
10 YEARS NITROGEN
CONCENTRATION (LOWER
LIMIT SENSITIVITY)**



PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

North

Scale: 1 Inch = Approximately 1,750-feet

FIGURE 3
20 YEARS NITROGEN CONCENTRATION (LOWER LIMIT SENSITIVITY)

EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS

PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

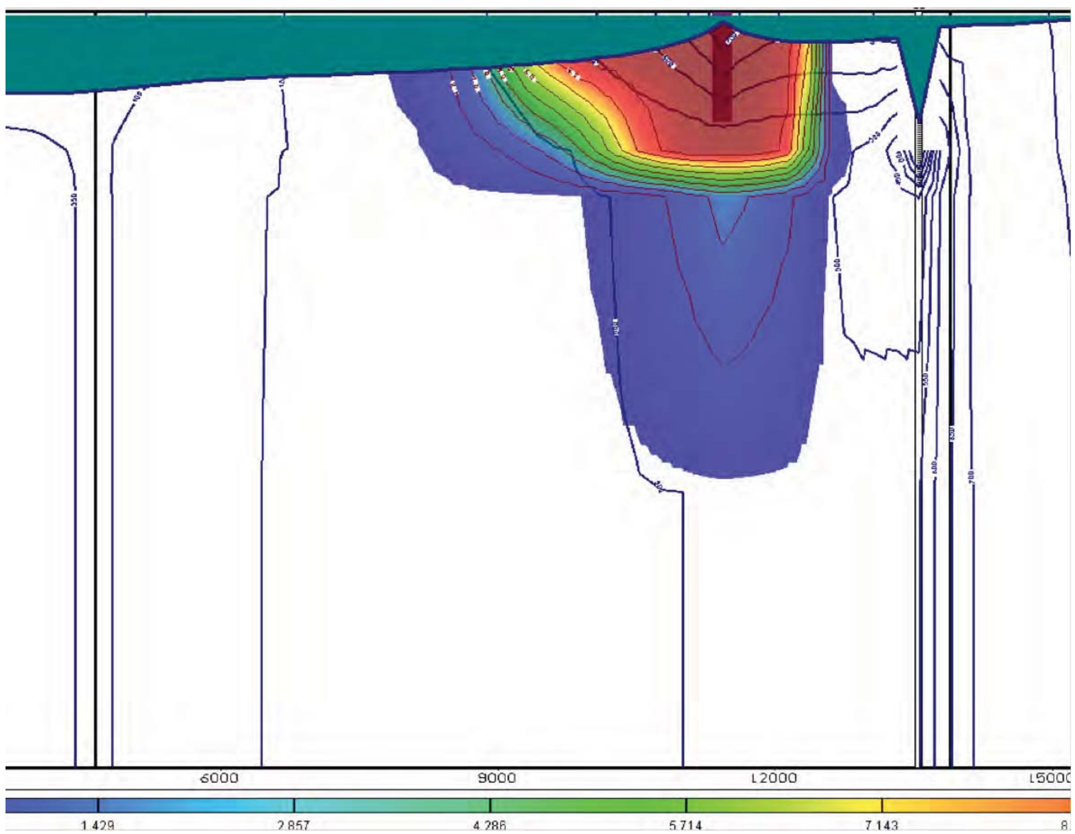
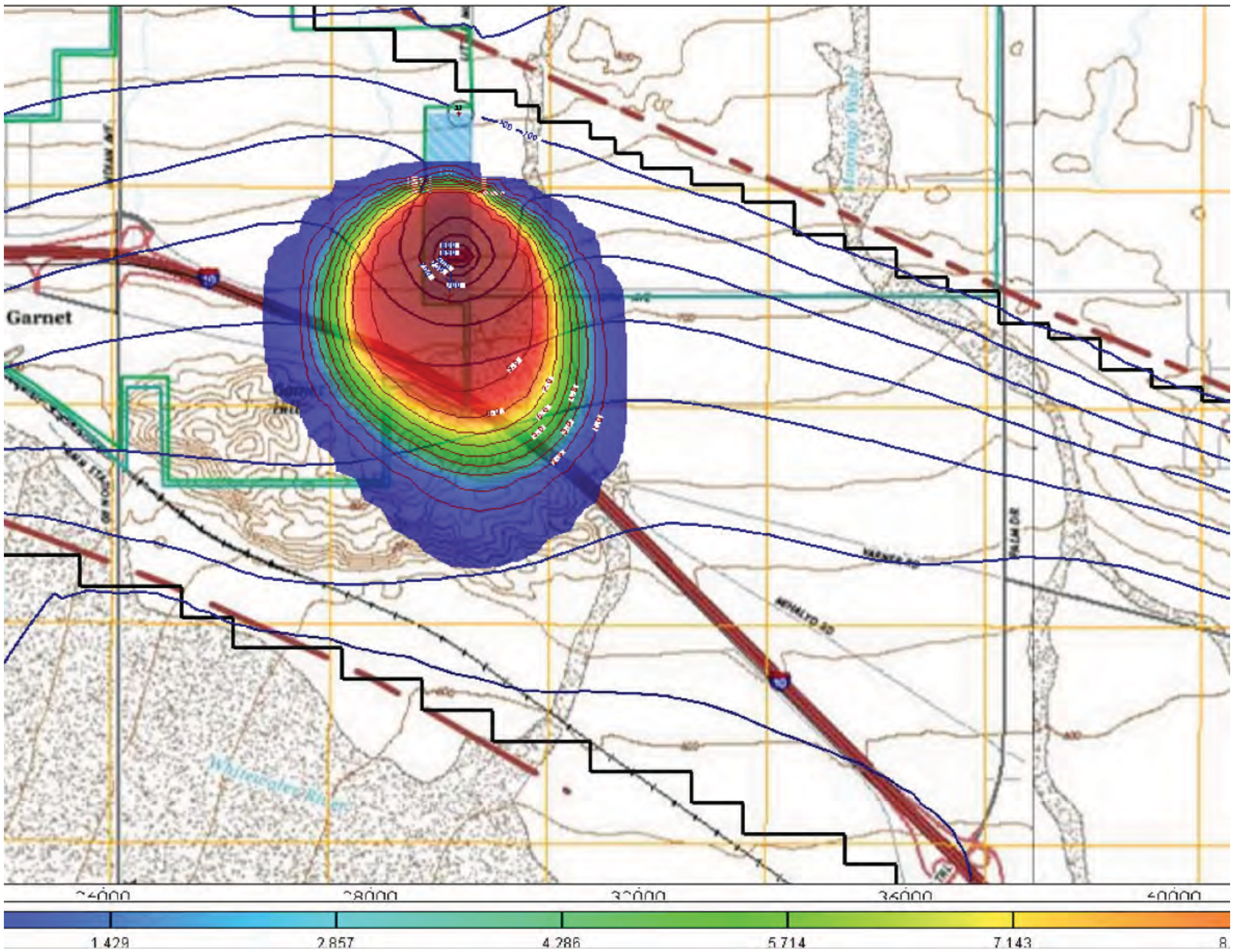


FIGURE 4
20 YEARS NITROGEN
CONCENTRATION CROSS-SECTION
(LOWER LIMIT SENSITIVITY)

EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS



PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

North

Scale: 1 Inch = Approximately 1,750-feet

FIGURE 5
30 YEARS NITROGEN CONCENTRATION (LOWER LIMIT SENSITIVITY)

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ENVIRONMENTAL · WATER RESOURCES SCIENTISTS

PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

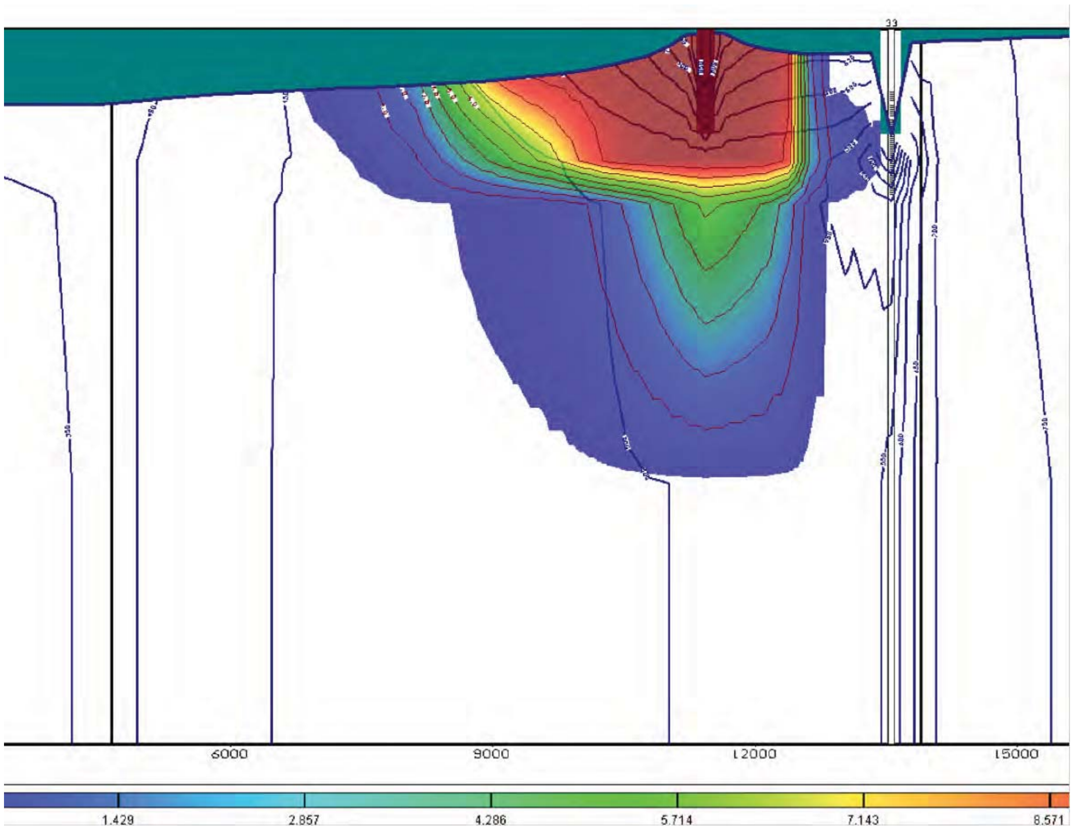
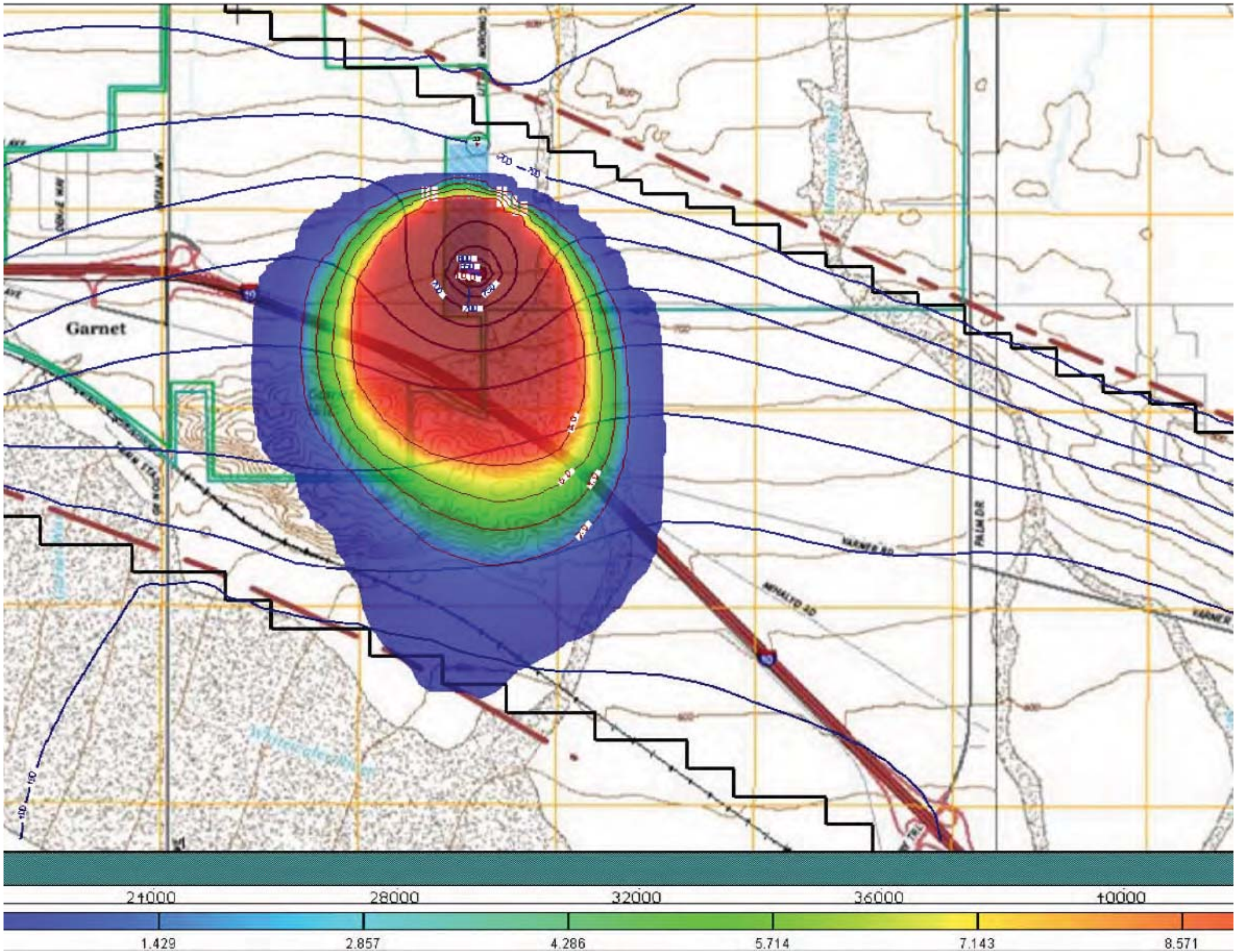


FIGURE 6
30 YEARS NITROGEN
CONCENTRATION CROSS-SECTION
(LOWER LIMIT SENSITIVITY)

EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS



EnviroLogic Resources, Inc.
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PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

North

Scale: 1 Inch = Approximately 1,750-feet

FIGURE 7
50 YEARS NITROGEN
CONCENTRATION (LOWER
LIMIT SENSITIVITY)

PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

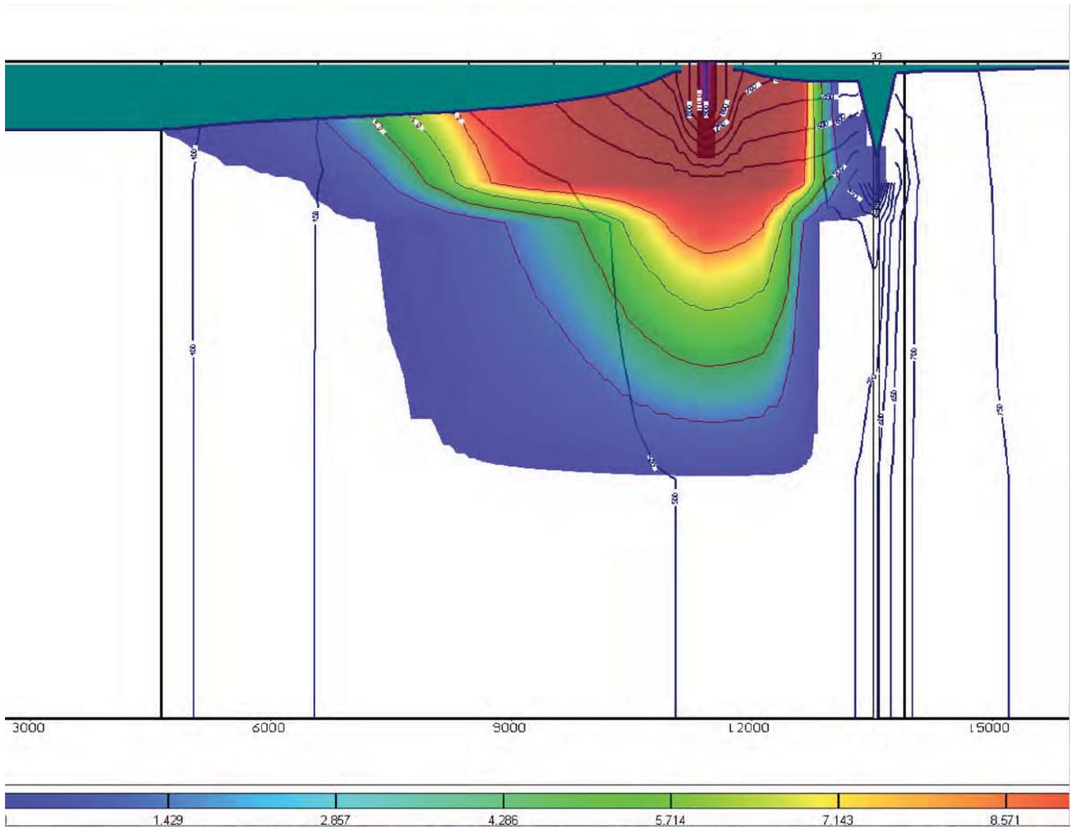
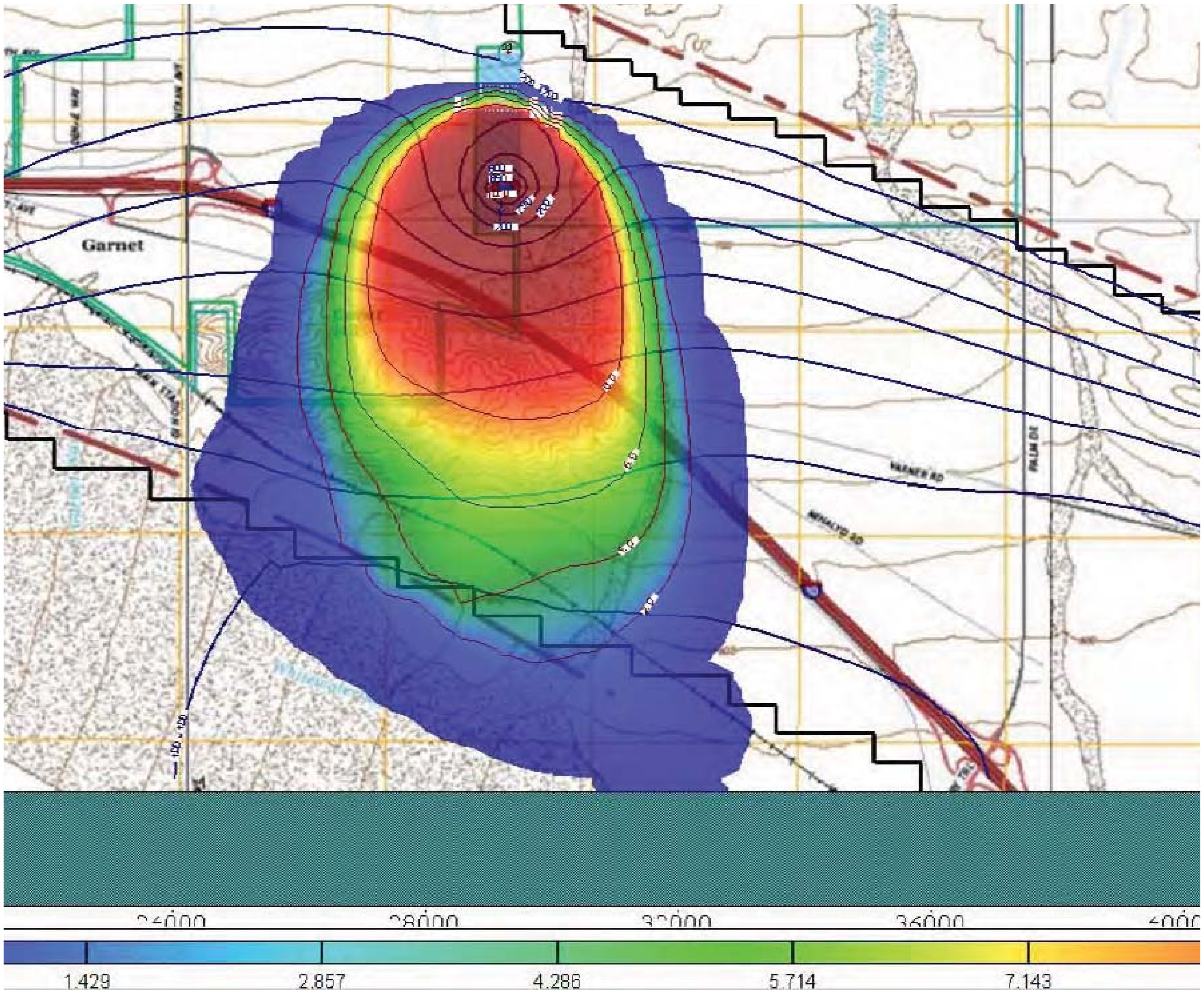


FIGURE 8
50 YEARS NITROGEN
CONCENTRATION CROSS-SECTION
(LOWER LIMIT SENSITIVITY)

EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS



PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

Scale: 1 Inch = Approximately 1,750-feet

FIGURE 9
100 YEARS NITROGEN CONCENTRATION (LOWER LIMIT SENSITIVITY)

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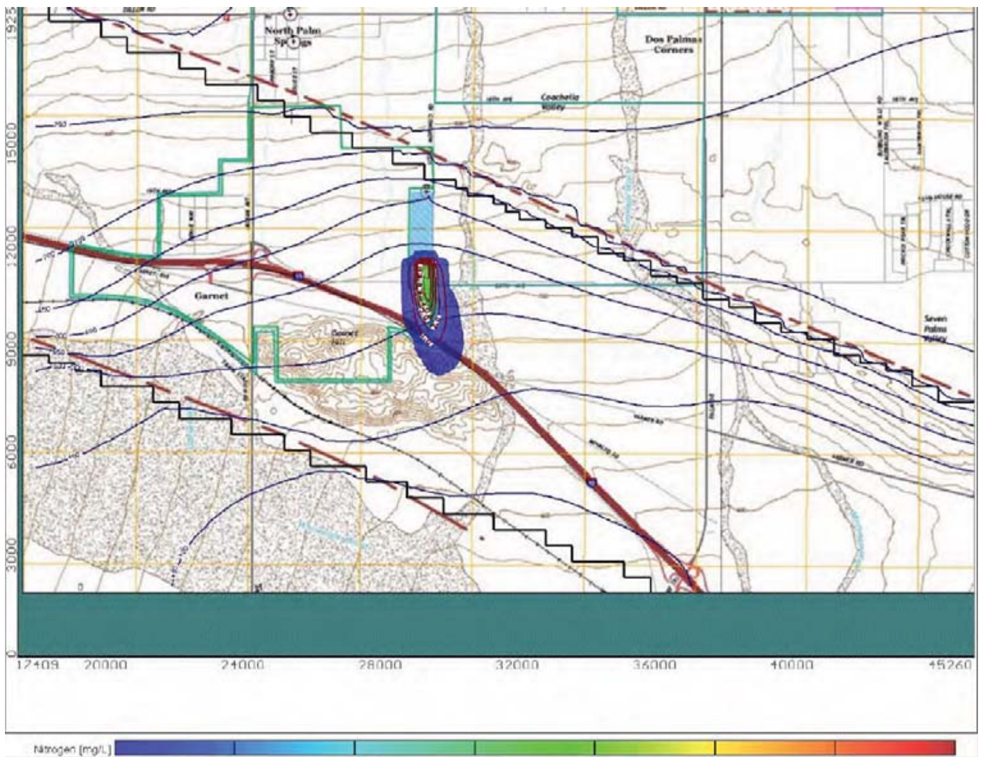
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California



Scale: 1 Inch = Approximately 3,500-feet

FIGURE 10
5 YEARS NITROGEN
CONCENTRATION (UPPER LIMIT SENSITIVITY)

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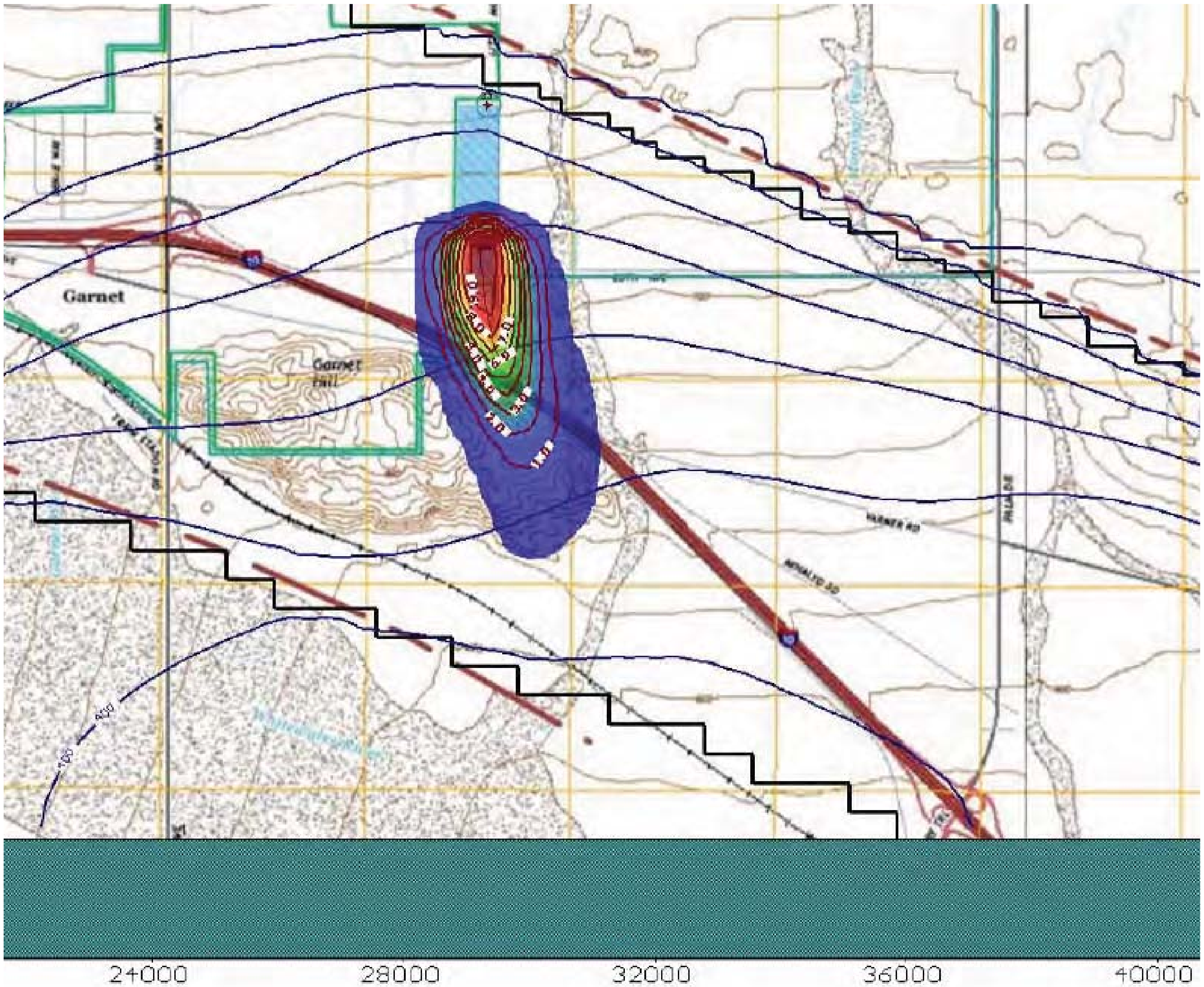

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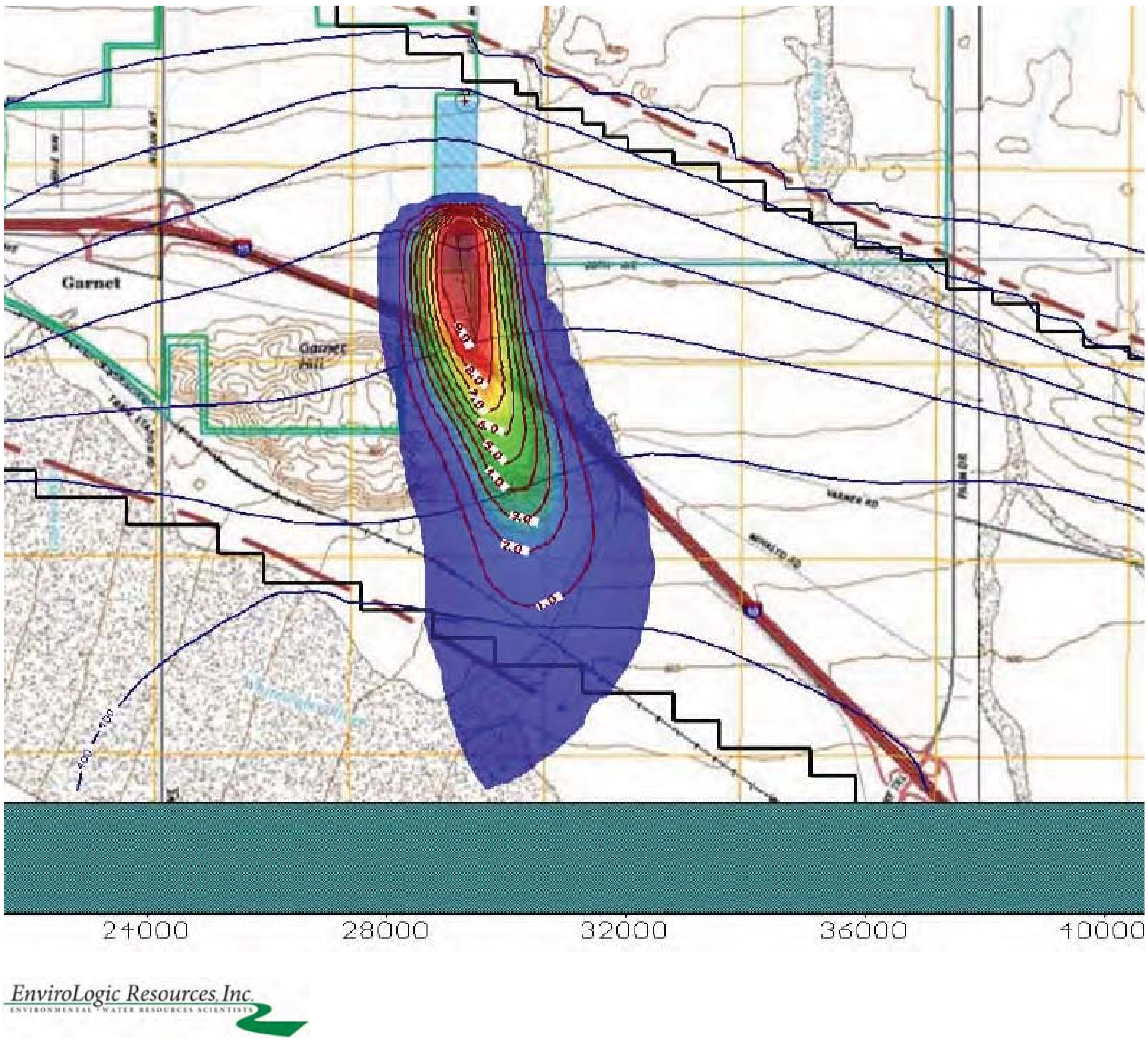
WEST VALLEY WATER
RECLAMATION FACILITY**

Desert Hot Springs, California

**FIGURE 11
10 YEARS NITROGEN
CONCENTRATION (UPPER
LIMIT SENSITIVITY)**



PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

North

Scale: 1 Inch = Approximately 1,750-feet

FIGURE 12
20 YEARS NITROGEN CONCENTRATION (UPPER LIMIT SENSITIVITY)

PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

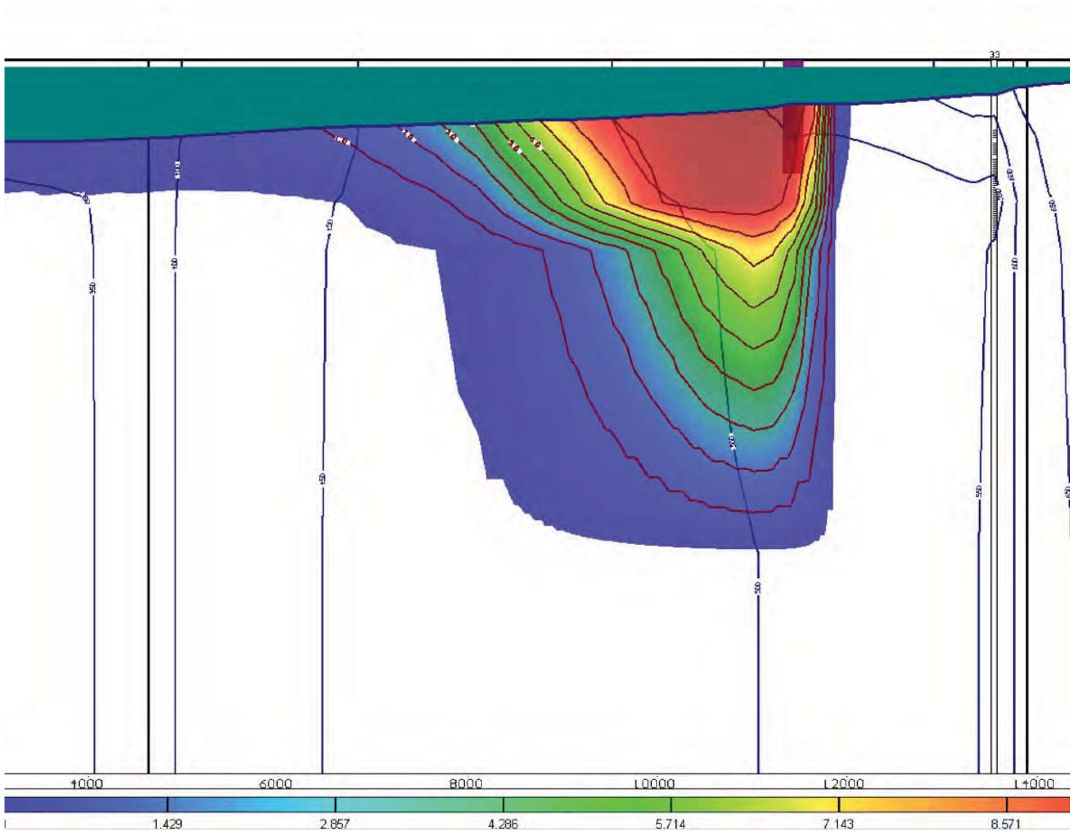


FIGURE 13
20 YEARS NITROGEN
CONCENTRATION CROSS-SECTION
(UPPER LIMIT SENSITIVITY)

EnviroLogic Resources, Inc.
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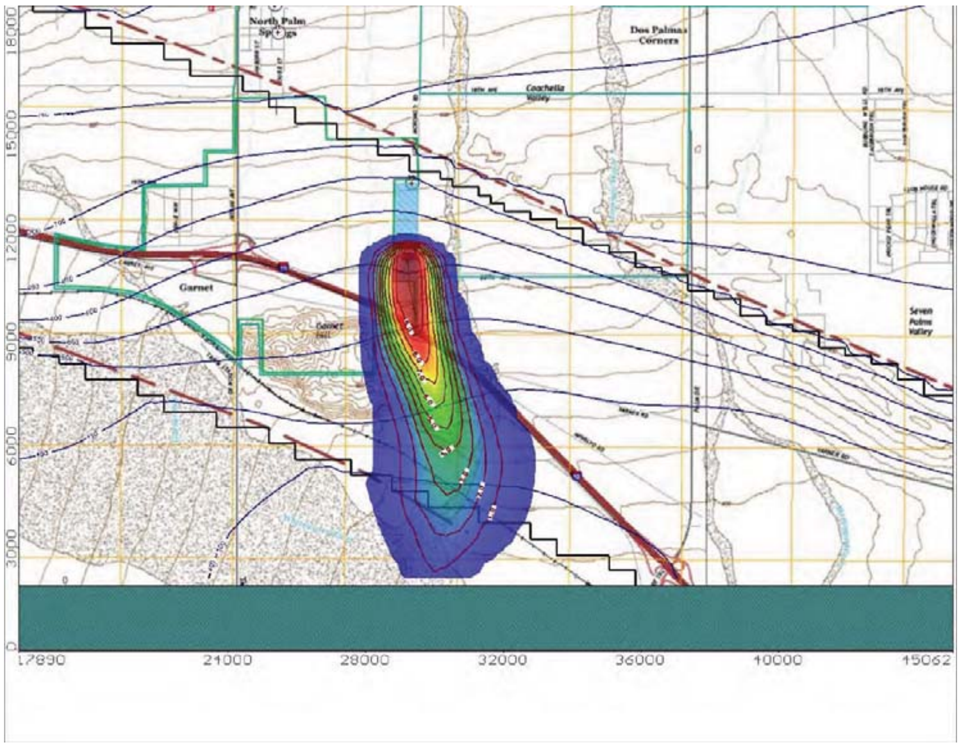
PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California



North

Scale: 1 Inch = Approximately 3,500-feet

FIGURE 14
30 YEARS NITROGEN
CONCENTRATION (UPPER LIMIT SENSITIVITY)

EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS

PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

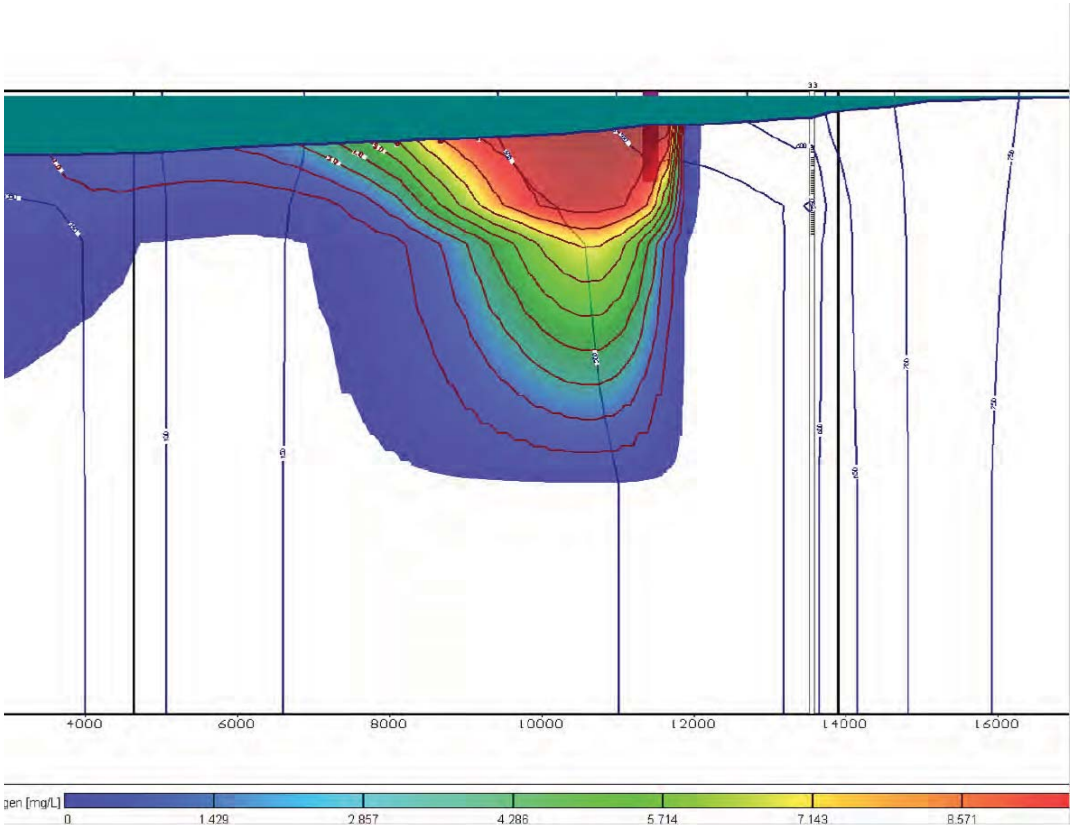
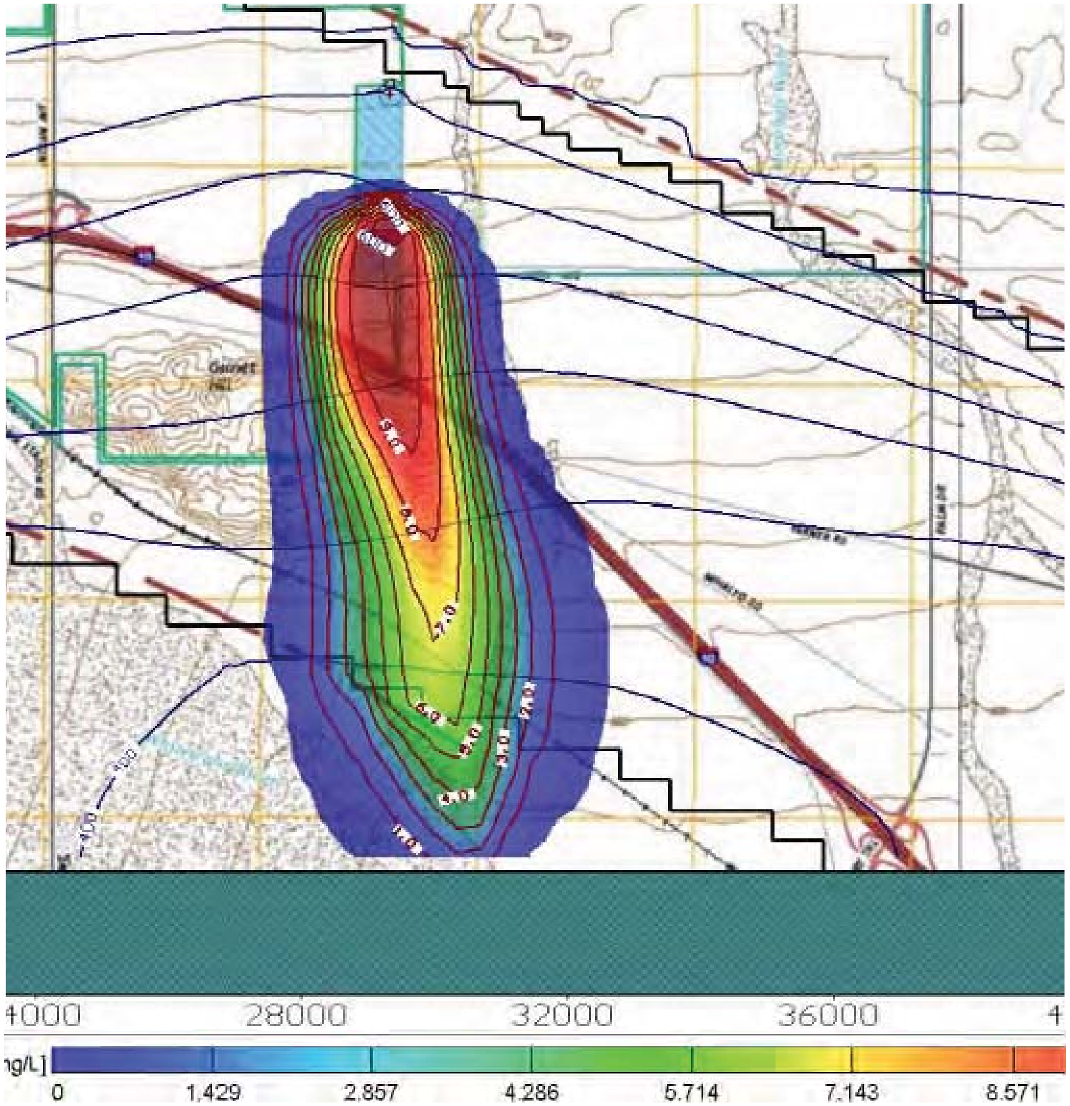


FIGURE 15
30 YEARS NITROGEN
CONCENTRATION CROSS-SECTION
(UPPER LIMIT SENSITIVITY)

EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS



PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

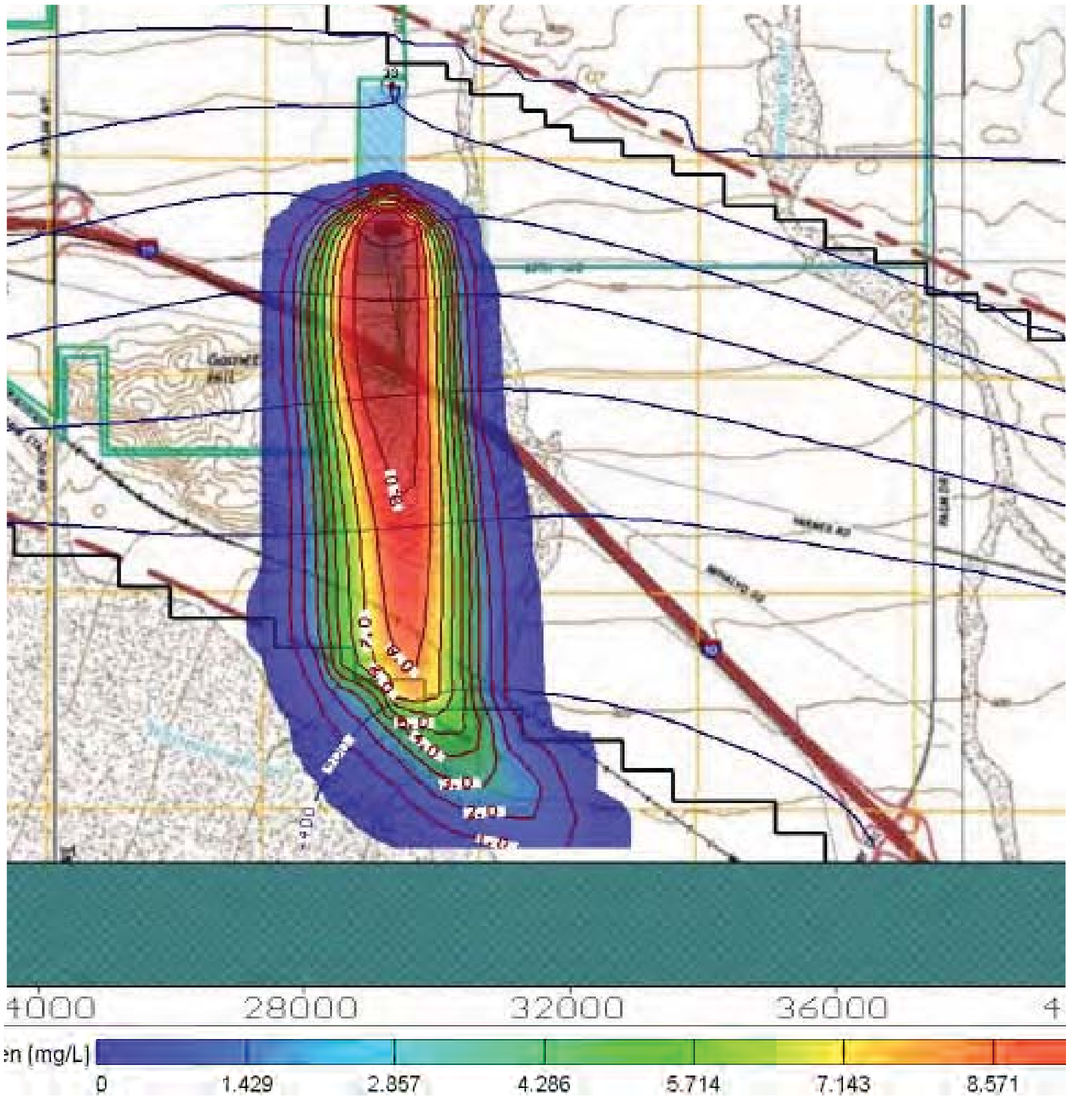
Desert Hot Springs, California

North

Scale: 1 Inch = Approximately 1,750-feet

FIGURE 16
50 YEARS NITROGEN CONCENTRATION (UPPER LIMIT SENSITIVITY)

EnviroLogic Resources, Inc.
ENVIRONMENTAL · WATER RESOURCES SCIENTISTS



PROPOSED
WEST VALLEY WATER
RECLAMATION FACILITY

Desert Hot Springs, California

North

Scale: 1 Inch = Approximately 1,750-feet

FIGURE 17
100 YEARS NITROGEN CONCENTRATION (UPPER LIMIT SENSITIVITY)

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