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Tahoe Valley South Basin (6-5.01) 2014 Groundwater Management Plan

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Prepared for

South Tahoe Public Utility District
1275 Meadow Crest Drive
South Lake Tahoe, CA 96150

K/J Project No. 1470005*00

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List of Abbreviations and Acronyms

1,2-DCA	1,2-Dichloroethane
1,4-DCB	1,4-Dichlorobenzene
208 Plan	Lake Tahoe Water Quality Management Plan
AB	Assembly Bill
AB 3030	Assembly Bill 3030 - Groundwater Management Act
AF	Acre-feet
AFY	Acre-feet per year
amsl	Above mean sea level
AS	Air sparge
AZ	Angora water-bearing zone

bgs	below ground surface
BMO	Basin Management Objective
BMP	Best Management Practice
BTEX	Benzene, toluene, ethylbenzene and xylene
BZ	Bijou water-bearing zone
CalARP	California Accidental Release Prevention
Cal-EPA	California Environmental Protection Agency
Caltrans	California Department of Transportation
CASGEM	California Statewide Groundwater Elevation Monitoring
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	Cubic feet per second
cis 1,2-DCE	cis-1,2-Dichloroethene
cm/sec	Centimeters per second
Compact	California-Nevada Interstate Compact Concerning Water of Lake Tahoe, Truckee River, Carson River, and Walker River Basins
COOP	Cooperative Observer Program
County	El Dorado County
CSLT	City of South Lake Tahoe
CTC	California Tahoe Conservancy
CUPA	Certified Unified Program Agency
CVZ	Christmas Valley water-bearing zone
CWC	California Water Code
CWA	Clean Water Act
DDW	State Water Resources Control Board Division of Drinking Water
deg F	Degrees Fahrenheit
District	South Tahoe Public Utilities District
DWR	California Department of Water Resources
EDC-DEH	El Dorado County Department of Environmental Health
EDCEMD	El Dorado County Environmental Management Department
EDIR	Early Detection Immediate Response
EIP	Environmental Improvement Program
ETo	Reference evapotranspiration
DWSAP	Drinking Water Source Assessment and Protection
ft	Feet
FSM	Forest Service Manual
GIC	Groundwater Information Center
g/cm^3	grams per cubic centimeter
gpm	Gallons per minute
GW	Groundwater
GWMP	Groundwater Management Plan
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HMERP	El Dorado County Hazardous Materials Emergency Response Program
in	Inches
IRWM	Integrated Regional Water Management
lb	Pound
LBWC	Lukins Brothers Water Company

LMWC	Lakeside Mutual Water Company
LRMP	Land and Resource Management Plan
LRWQCB	Lahontan Regional Water Quality Control Board
LTBMU	Lake Tahoe Basin Management Unit
LTCP	Low Threat Underground Storage Tank Case Closure Policy
MCL	Maximum Contaminant Level
MG	Million gallons
MGD	Million gallons per day
MtBE	Methyl tert-butyl ether
MZ	Meyers water-bearing zone
µg/L	Micrograms per liter
mg/L	Milligrams per liter
NCDC	National Climate Data Center
NFAR	No Further Action Required
NPDES	National Pollutant Discharge Elimination System
NWIS	National Water Information System
NWS	National Weather Service
NOAA	National Oceanic and Atmospheric Administration
PCA	Potentially Contaminating Activity
PCE	Tetrachloroethylene
pCi/L	Picocuries per liter
Policy	Policy for Water Allocation in the Lake Tahoe Basin
RWQCB	Regional Water Quality Control Board
SAG	Stakeholder Advisory Group
SB	Senate Bill
SB 1938	Groundwater Management and Planning Act of 2002
SEZ	Stream Environment Zone
SCP	Site Cleanup Program
SGMA	Sustainable Groundwater Management Act of 2014
SLTZ	South Lake Tahoe water-bearing zone
SNOTEL	Snow Telemetry
SPCC	Spill Prevention, Control and Countermeasure
STPUD	South Tahoe Public Utilities District
SVE	Soil vapor extraction system
SWRCB	State Water Resources Control Board
TBA	Tert-butyl alcohol
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TERC	Tahoe Environmental Research Center
TKWC	Tahoe Keys Water Company
TKZ	Tahoe Keys water-bearing zone
TMDL	Total Maximum Daily Load
TRCD	Tahoe Resource Conservation District
TRPA	Tahoe Regional Planning Agency
TVS	Tahoe Valley South
UIC	Underground Injection Control
USCB	United States Census Bureau
USDA	United States Department of Agriculture

USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
UST	Underground storage tank
UWMP	Urban Water Management Plan
VC	Vinyl chloride
VOC	Volatile organic compounds
WBZ	Water bearing zone
WDL	Water Data Library
WQCA	Porter-Cologne Water Quality Control Act
The “Y”	Intersection of Highway 89 and Highway 50 in South Lake Tahoe

Executive Summary

The District has developed this updated Groundwater Management Plan (GWMP) for the Tahoe South Subbasin of the Tahoe Valley Groundwater Basin listed as California Department of Water Resources (DWR) Groundwater Basin 6-5.01, or more conveniently referred to as the Tahoe Valley South (TVS) Basin. This GWMP is in accordance with Assembly Bill 3030 (AB 3030), also known as the Groundwater Management Act under California Water Code (CWC) Section 10750 *et. seq*. The area covered by this GWMP includes portions of El Dorado County, the City of South Lake Tahoe, the Community of Meyers and Christmas Valley situated within the TVS Basin to the extent that they lie within the El Dorado County portion of the District's service area.

The District and its customers, including the business community and economic vitality of South Lake Tahoe, are almost entirely dependent on groundwater. The purpose of the GWMP is to implement the goals and objectives to manage groundwater supplies, protect groundwater quality, and foster stakeholder involvement.

Stakeholder Involvement

This GWMP is updated within the context of an existing, on-going coordination and collaboration with water issues in the TVS Basin. A key objective of this GWMP update is to continue to build on these existing relationships to further enhance groundwater management and protection.

A Stakeholder Advisory Group (SAG) was formed to provide input for the development of this GWMP that represented the District, local water purveyors, governmental agencies, business interests, and ratepayers. Four workshops were held from April through September 2014 to present information on the development of the GWMP, provide a forum to discuss local groundwater issues, and discuss areas of future collaboration among the stakeholders to improve groundwater management and groundwater quality protection.

The GWMP is considered a "living document" that the District intends to update periodically as progress is made in managing groundwater resources and to reflect legislative amendments to the CWC regarding groundwater management in California. Input from the SAG is considered an important function in the ongoing groundwater management in the TVS Basin; therefore, the District plans to host regular SAG meetings starting in 2015 to continue to build off of the collaborative efforts of the current SAG.

State of the Groundwater Basin

The TVS Basin is a sedimentary geologic basin within the South Lake Tahoe area that occupies a structural valley or graben located between the main range of the Sierra Nevada on the west and the Carson Range on the east. The basin-fill deposits consist of sequences of sand and gravels which are inter-layered with silts and clays. The sand and gravel deposits form the principal water-bearing reservoirs (aquifers), while the silt and clay deposits form confining layers (aquitards) which retard the movement of groundwater. Where these confining layers separate adjoining aquifers, the aquifer is composed of multiple water bearing zones (WBZs) with differing groundwater levels.

Snowmelt is the primary source of groundwater recharge for the TVS Basin. Other sources of groundwater recharge include stream-flow seepage and groundwater inflow from surrounding bedrock. Rising snow level elevations in response to climate change are expected to reduce snow pack volumes and snowmelt. Additionally, changes in stream flow timing are trending toward earlier snowmelt and peak stream flow discharges. Alternate hydrologic methods for estimating groundwater recharge should be considered to improve estimates used in the preliminary groundwater budget and to monitor climate change effects.

Evaluation of water level data indicates that groundwater flow patterns appear to be relatively complex influenced by vertical gradients, aquifer heterogeneity, distribution of surface water features, and pumping effects from drinking water wells. In general, groundwater movement is south to north from the basin margins toward Lake Tahoe. Areas of groundwater discharge occur along the upper reaches of the Upper Truckee River and Trout Creek, in wetland areas situated near the south shore of Lake Tahoe and directly into Lake Tahoe, where basin-fill deposits intersect the shoreline.

More than 95 percent of the drinking water supply in the greater South Lake Tahoe area is derived from groundwater. Currently, the combined pumping by public water system wells, private water company wells, small water systems wells and private wells is estimated to be about 8,400 AFY. Assuming that groundwater recharge from the surrounding bedrock is negligible; a preliminary estimate for total groundwater recharge to the TVS Basin is about 9,876 AFY. Allocations defined in the California-Nevada Interstate Compact for use in the South Lake Tahoe Area (see Section 3.2.1) exceed the estimated total groundwater recharge to the TVS Basin. Therefore, allocation amounts would not appear to be an appropriate objective to use for sustainable groundwater management of the TVS Basin.

Inspection of groundwater elevation hydrographs indicates that groundwater levels are relatively stable. Groundwater withdrawals do not appear to be causing any long-term declines in groundwater levels, or overdraft, in the TVS Basin. The water balance summary indicates that groundwater withdrawals are inferred to remove about 85 percent of the total groundwater recharge. As groundwater levels are remaining stable, there appears to be no net long-term change in groundwater storage. Even with the high density of groundwater use within the TVS Basin, the regulatory policies restricting growth throughout the Lake Tahoe Basin will help to ensure that future overdraft conditions do not develop.

Review of the pumping effects of public water system wells on neighboring surface waters appear to indicate that the greatest declines in shallow groundwater elevations could potentially result from increased groundwater withdrawals neighboring the Upper Truckee Marsh. Currently, groundwater withdrawals from neighboring public water system wells do not appear to have a detrimental effect on shallow groundwater elevations through this area.

Groundwater in the TVS Basin is generally of excellent chemical quality, suitable for the designated beneficial uses of municipal, industrial and agricultural water use and for any other uses to which it might be put. For most constituents, Groundwater quality meets all current drinking water quality standards. Arsenic is the most common inorganic constituent that has been found at concentrations exceeding the primary or secondary maximum contaminant levels (MCLs) within localized areas of the TVS Basin. High arsenic concentrations in public water system wells are believed to be contributed from deep confined water-bearing zones, which have impaired water supplies in the South Lake Tahoe Area, Angora Area, Meyers Area and Christmas Valley Area. Future adoption of the proposed MCL for radon could potentially have a significant effect on water supplies throughout the TVS Basin.

Groundwater quality in the TVS Basin has been adversely affected by past releases of man-made contaminants and resultant degradation of groundwater quality beneath sites located along the main commercial business district from the intersection of Highway 89 and Highway 50 (i.e., the “Y”) along Highway 50 to Stateline. Man-made contaminants which occur most frequently include petroleum hydrocarbon and chlorinated hydrocarbon compounds.

Although there has been notable progress towards the cleanup of PCE and MtBE contaminant plumes that have impacted public water system wells, significant areas of degraded water quality remains and continues to impair water supplies in the South Lake Tahoe area (South Y PCE Site) and in the Bijou area (Tahoe Tom's Gas Station and Private Residences Sites). In addition, contamination sites closed under the Limited Threat Closure Policy allows residual levels of soil contamination and degraded water quality to remain that may affect the operation of current public water system wells and development of future water supplies under the District's MtBE Policy.

Basin Management Objectives

Basin Management Objectives (BMOs) are required in the GWMP under the CWC§ 10753.7(a) (1). The BMOs included in the GWMP include the following:

- Maintain a sustainable long-term groundwater supply
- Maintain and protect groundwater quality
- Build Collaborative Capacity with Local Agencies, Businesses, Private Property Owners and the Public
- Integrate Groundwater Quality Protection into Local Land Use Planning Activities
- Assess the interaction of water supply activities with environmental conditions
- Convene an Ongoing SAG as a forum for future groundwater issues
- Conduct studies to assess future groundwater needs and issues
- Identify and obtain funding for groundwater projects

Maintaining and protecting groundwater quality is the primary BMO for the TVS Basin. Implementation includes, but is not limited to: the regular monitoring and review of groundwater quality data; the continued implementation of Well Standards for well construction, abandonment and destruction; and update of the District's Groundwater Ordinance to address current groundwater quality concerns. Other actions being proposed include taking action(s) to prevent the significant and unreasonable degradation of water quality. Under this action, immediate support is needed to renew investigation and clean-up of groundwater contamination, with special emphasis on PCE and MtBE contaminant plumes that currently impair water supplies in the South Lake Tahoe and Bijou areas. Another goal of this BMO is to improve integration of groundwater management into existing regulatory and land use planning programs.

Building collaborative capacity with Local Agencies, Businesses, Private Property Owners and the Public is another key BMO for the TVS Basin. The District will continue to provide educational services to the public through public presentations, public informational items on relevant groundwater issues affecting the community. Continued stakeholder involvement with regional groundwater management is a key aspect for implementing the updated GWMP. The District will continue to support an ongoing Stakeholder Advisory Group that may advise the District on groundwater issues and to continue to foster an overall spirit of collaboration.

Conducting technical studies to assess future groundwater needs and issues is another key BMO for the TVS Basin. Actions proposed under this BMO include: monitor evolving requirements under the Sustainable Groundwater Management Act to insure conformance between the adopted regulations and the groundwater sustainability plan needed to be developed for the TVS Basin; support of future groundwater studies that may include improving groundwater cleanup activities to mitigate on-going impairment of water supplies, further evaluation of potential pumping effects on groundwater –surface water interactions, refining the groundwater budget, further evaluating groundwater flow conditions in significant water-bearing zones used for drinking water supply; assessing areas of degraded water quality including areas with natural constituents above MCLs for future water supply; updating the District's current groundwater flow model; expanding the District's monitoring well network; and assessing the potential future need and feasibility of groundwater replenishment facilities for the TVS Basin.

Monitoring and Reporting

The District's Basin Monitoring Program collects data on a regular basis to assess groundwater conditions within the Basin. Groundwater level measurements are collected by the District at designated groundwater supply and monitoring wells as designated by the GWMP using protocols identified in the GWMP and other supporting documents. Samples for groundwater quality are collected by the District at all public water system wells in accordance with the requirements of DDW. Groundwater quality samples may be collected at monitoring wells as designated by the GWMP, and collected consistent with protocols provided in the GWMP and the District's Laboratory QA/QC Plan. Additional groundwater level and quality data may be compiled from other agencies that collect data in the TVS Basin. This District will coordinate the collection of groundwater pumping volumes in the TVS Basin by the District and other water systems.

The District will review the collected data with respect to historical data for each sampling location to assess changes in trends. Groundwater quality data will be compared to drinking water quality standards as defined by the DDW, and the water quality objectives for groundwater in the TVS Basin provided in the LRWQCB Basin Plan. The Basin Monitoring Program may be modified by adding/removing wells over time based on the ongoing assessment of basin conditions and modifications will be addressed in the Annual Reports and GWMP updates.

The District will prepare an Annual Report on the implementation of the GMWP to assess the groundwater supplies and conditions in the TVS Basin, including progress on implementation of Basin Management Objectives. The results from the Basin Monitoring Program and data review will be included in the Annual Report. The report will identify and prioritize any groundwater quality issues including proposed actions or inter-governmental agency coordination. The report may include such other information as the District determines applicable to groundwater supplies in the TVS Basin. The District shall hold a public hearing at a regularly scheduled Board of Directors meeting regarding the annual report on groundwater supplies and conditions.

Section 1: Introduction

1.1 Introduction

This updated Groundwater Management Plan (GWMP or Plan) applies to the Tahoe South Subbasin of the Tahoe Valley Groundwater Basin (DWR Groundwater Basin 6-5.01) and is prepared in accordance with AB 3030, also known as the Groundwater Management Act (CWC Section 10750 *et. seq.*). For convenience, DWR Basin 6-5.01 will be referred to as the Tahoe Valley South Basin (TVS Basin) in the GWMP. This GWMP is a product of the South Tahoe Public Utilities District (STPUD or District), developed in collaboration with local stakeholders to better protect the quantity and quality of groundwater within the TVS Basin.

1.2 Plan Authorization

The District is an authorized groundwater management agency within the meaning of CWC Section 10753(a) and assumes responsibility as the lead agency for managing the quantity and quality of the Groundwater resources within the TVS Basin pursuant to this GWMP. As such, the District has the authority to adopt rules, regulations and procedures to implement and enforce this Plan pursuant to CWC Section 10753.8. The District, acting by and through its Board of Directors, shall have jurisdiction over groundwater within the Plan Area defined as the TVS Basin and shall have the powers provided by this Division or any other provision of law.

The goal of this Plan is to maintain groundwater supplies and protect groundwater quality in the TVS Basin. The purpose of this Plan is to manage, conserve and protect the groundwater resources available to the District and other water users so that the groundwater will remain a viable potable water resource and be available to be put to the most efficient and beneficial use by the District and its customers.

This GWMP update for the TVS Basin is a regional effort facilitated by STPUD. In developing this Plan the District has collaborated with other South Lake Tahoe area water purveyors, including Lukins Brothers Water Company (LBWC) and Tahoe Keys Water Company (TKWC), along with other governmental agencies and authorities, including the City of South Lake Tahoe (CSLT), El Dorado County Environmental Management Department (EDCEMD), the Tahoe Regional Planning Agency (TRPA) and the Lahontan Regional Water Quality Control Board (LRWQCB). This collaboration has been undertaken to better achieve comprehensive groundwater management, minimize duplication of effort and apply consistent standards to the extent reasonably possible.

1.3 Background

The previous version of the GWMP was developed in 2000 by STPUD in the form of a groundwater ordinance. In December 2000, the District enacted Ordinance No. 477-00 adding Division 7 to the Administrative Code authorizing the Administration of a GWMP as sanctioned under CWC Section 10750, *et seq*. The GWMP was developed for the purpose of regulating and protecting local groundwater resources. The 2000 Plan focused attention on the impacts of man-made contamination on the District and its customers and included an ordinance for implementing rules, regulations and procedures to identify potential contamination before it impacted the District's wells. A central component of the 2000 GWMP was the establishment of a Basin Monitoring Program to provide a means for the early detection and immediate response to the release of petroleum products into groundwater. The District has installed several sentinel wells and used existing inactive public wells to monitor water level and water quality conditions within the TVS Basin. However, installations of Early Detection Immediate Response (EDIR) monitoring wells adjacent to active underground storage tank (UST) facilities was not implemented. The District has, to the extent practicable and consistent with the protection of groundwater resources, minimized any adverse impacts on the affected business activities. The GWMP has not been amended since it was originally adopted in 2000.

1.4 Updated Plan Goals and Objectives

The GWMP serves as a planning tool enabling the District to maintain safe, sustainable, and high quality groundwater resources in the long-term. Groundwater management is planned and coordinated locally to ensure a sustainable groundwater basin to meet future water supply needs. The objective of the updated GWMP is to address issues of “aquifer health” and “groundwater sustainability”. These issues include:

- Maintain sustainable long-term water supplies
- Protect groundwater quality from contamination
- Develop better collaboration between water purveyors and local agencies in addressing groundwater issues
- Coordinate groundwater protection actions with existing activities of land use and regulatory agencies.

In order to provide a regional perspective and collaboration, the District will coordinate and host ongoing SAG meetings starting in 2015 that will meet regularly to provide a forum to discuss and propose actions related to groundwater issues.

The GWMP is considered a “living document” that the District intends to update periodically to report on the progress made in managing groundwater resources and to reflect amendments to the California Water Code. Importantly, this Plan will need to be updated by 2020 or 2022 (depending on the TVS Basin’s DWR prioritization) in order to comply with the recently passed Sustainable Groundwater Management Act (SGMA). Tracking the SGMA’s requirements, this GWMP update was prepared to plan for expansion of the role of the District in the management of the local groundwater resources and water quality based on the substantial work that has been completed since the 2000 GWMP.

Review and revision of Ordinance No. 477-00 is being conducted concurrent with this update. Since 2000, considerable progress has been made with the remediation of petroleum sites (the primary focus of the 2000 Ordinance). The updated ordinance will maintain the framework for local control for groundwater protection including the requirements of the Basin Monitoring Program, so as to address broader groundwater protection concerns. The goal for this Ordinance revision is to provide the District with a mechanism for enforcing groundwater protection in collaboration with other local agencies that minimizes duplicative regulatory oversight or monitoring requirements.

1.5 Plan Requirements and Organization

A GWMP is a required "baseline" document for agencies seeking State grant funding opportunities. The Groundwater Management and Planning Act of 2002 (SB 1938) requires that state funding eligibility from the DWR rely upon incorporation of the mandatory components listed in Table 1-1 (DWR, 2003) in the local GWMP. The TVS Basin GWMP includes three types of components: SB 1938 and AB 359 mandatory components, AB 3030 and SB 1938 voluntary components, and DWR Bulletin 118-suggested components (DWR 2003). These components are addressed in the GWMP, and Table 1-1 identifies where in this GWMP the information addressing each of these components can be found.

AB 3030 was intended to provide local public agencies increased management authority over groundwater resources. Any local public agency which provides water service to all or a portion of its service area and whose service area includes all or a portion of a groundwater basin may adopt a GWMP. AB 3030 was amended in 2002 with the passage of SB 1938. Since the existing 2000 GWMP was prepared, DWR has developed new requirements and guidelines for the content of a GWMP. The 2000 GWMP was not fully compliant with those post-adoption changes. It is an objective of this update to bring the Plan into full compliance with DWR requirements.

1.6 Plan Preparation and Adoption Process

The District announced its intention to amend the District GWMP and to form the SAG in local media and through direct contact with key stakeholders. Water managers at neighboring water agencies were also notified of the GWMP process.

The SAG was convened to receive input from the public, local and state agencies and business owners in order to provide input to the development and implementation of the GWMP document. Citizens, business interests and regulatory agency representatives selected to serve on the SAG. Four meetings were held in 2014 (April 16, May 14, June 4 and September 24). The role of the SAG, as discussed in more detail in Section 7, in the GWMP process included:

- contribute advice regarding GWMP content
- provide information and insight regarding regional groundwater issues, and
- provide review and recommendations to the GWMP document.

The District Board of Directors held a public hearing on November 20, 2014 to present a Draft GWMP to the public and solicit comments to the plan. The public review period extended from October 30 to December 1, 2014. The public was given an opportunity to ask questions and provide comment at the hearing and interested parties were invited to participate in development of the GWMP. If the parties could not attend the public hearing, they could express their questions, interest and concerns in writing to the District as explained in the public notice. The Notice of Availability (NOA), Public Meeting agenda, and minutes are included in Appendix A.

The District Board of Directors held a second public hearing on December 4, 2014 to consider adoption of the final GWMP and enactment of the updated Groundwater Management Ordinance No. 558-14. Following the public hearing the GWMP was adopted by the District Board of Directors by passing Resolution No. 2969-14. A copy of this Resolution is provided in Appendix A and the updated STPUD Ordinance No. 558-14 is provided in Appendix G.

TABLE 1-1
LEGISLATIVE REQUIREMENTS SUMMARY

GWMP Components	Section
SB 1938 and AB 359 Mandatory Components	
1. Documentation of public involvement statement	Sec. 7, App. A and E
2. Basin Management Objectives (BMOs)	Sec. 8
3. Monitoring and management of groundwater elevations, groundwater quality, inelastic land subsidence, and changes in surface water flows	Sec. 9, App. D
4. Involve other agencies located in the groundwater basin	Sec. 7, 8.3, 8.4 & 8.6
5. Adoption of monitoring protocols	Sec. 9, App. D
6. Map of groundwater basin boundary, as delineated by DWR Bulletin 18	Sec 2.1, Fig. 2-1 and 2-2
7. Apply appropriate geologic and hydrogeologic principles	Sec. 2, 3, 5 & 6, App. C & D
8. Map identifying the substantial recharge areas for local planning agencies	Sec. 6.4.2, Fig. 6.3
AB 3030 and SB 1938 Voluntary Components	
1. Control of saline water intrusion	Sec. 6.2.3
2. Identify and manage well protection and recharge areas	Sec 6.4, Fig 6-4, 6-5, & 6-6
3. Regulate the migration of contaminated groundwater	Sec 4.2
4. Administer well abandonment and destruction program	Sec 4.5.3
5. Control and mitigate groundwater overdraft	Sec 5.4
6. Replenish groundwater	n/a
7. Monitor groundwater levels	Sec 5.2, Sec. 9, App. D
8. Develop and operate conjunctive use projects	n/a
9. Identify well-construction policies	Sec 4.4.3
10. Identify potential projects to support long-term groundwater management	Sec 8.7
11. Develop relationships with State and federal regulatory agencies	Sec 4, 7, 8.3
12. Coordinate with land use planning agencies for groundwater protection	Sec 4, 7, 8.4
DWR Bulletin 118 Suggested Components	
1. Manage with guidance of advisory committee	Sec 7, 8.6
2. Describe area to be managed under GWMP	Sec 2, 3, 5 & 6
3. Create links between BMOs and goals and actions of GWMP	Sec 8, 10
4. Describe GWMP monitoring programs	Sec. 5, 6, 9, App. D
5. Describe integrated water management planning efforts	Sec 4, 7
6. Report of implementation of GWMP	Sec 10
7. Evaluate GWMP periodically	Sec 10

Section 2: Groundwater Basin

This section provides the required delineation of the groundwater basin and a description of the TVS Basin to help support the development of the Basin Management Objectives (BMOs).

2.1 TVS Basin Delineation

The TVS Basin is part of the larger Tahoe Valley Groundwater Basin, which is located within the Lake Tahoe Hydrologic Basin and incorporates the sediment-filled basins bordering Lake Tahoe. The Tahoe Valley Groundwater Basin is subdivided into three subbasins: Tahoe South, Tahoe West, and Tahoe North (Figure 2-1). Of these three subbasins, the TVS Basin is the largest and most productive.

The TVS Basin underlies an area of approximately 23 square miles in El Dorado County, California (Figure 2-2). The TVS Basin is a roughly triangular area that is bounded on the southwest by the Sierra Nevada, on the southeast by the Carson Range, and on the north by the southern shore of Lake Tahoe. The Basin generally conforms to the valleys of the Upper Truckee River and Trout Creek. The TVS Basin does not share a boundary with any other DWR basin or subbasin. The City of South Lake Tahoe overlies the northern portion of the TVS Basin. The southern boundary extends about 3 miles south of the town of Meyers. The northeast boundary of the TVS Basin is defined by the California-Nevada state line; however, a small portion of the physical groundwater basin extends beyond the state line into Nevada as shown on Figure 2-2.

Elevations range from 6,225 feet at lake level rising to above 6,500 feet to the south along the mountain front (DWR, 2003). Portions of seven watersheds overlie the TVS Basin, the largest of which include the Upper Truckee River. The Upper Truckee River flows north across the entire length of the basin and drains into Lake Tahoe through the Upper Truckee Marsh. The River is joined by Grass Lake and Big Meadow Creeks along the southern extent of its course, Angora Creek centrally, and Trout Creek near to Lake Tahoe.

2.2 Geology

Groundwater management requires a sound understanding of the underlying geology of the groundwater basin. The following provides a summary of key references on the local geology.

2.2.1 Regional Geology

The regional geology for the Lake Tahoe area can be generalized as mountains composed mainly of granitic rocks and the valleys filled with basin-fill sedimentary deposits. These basin-fill deposits in the valleys are the primary sources of groundwater in the Lake Tahoe area. Figure 2-3 shows the distribution of these deposits in the southern Lake Tahoe area (Jennings, 1977; Ludington *et al*, 2005). The surrounding mountains are primarily composed of granitic rock, but localized areas of volcanic and metavolcanic rocks occur near Fallen Leaf Lake and in the extreme headwaters of the Upper Truckee River watershed just off the map (Figure 2-3) to the south. A small area of Jurassic marine sedimentary rocks occurs just outside the TVS Basin near the Fallen Leaf Lake.

Lake Tahoe rests within a fault-bounded structural basin, or graben, bordered on the west by the Sierra Nevada and on the east by the Carson Range (USACE, 2003). The structural basin was dropped down along bounding faults during the rise of the Sierra Nevada 2 to 3 million years ago, leading to the large elevation difference between the Lake and the surrounding mountains (USACE, 2003). The Tahoe-Sierra Frontal Fault Zone defines the west side of the graben and is believed to be an east-dipping normal fault, with east-side-down displacements. This western bounding fault zone occurs along a northwest to southeast alignment along the mountain front of the Crystal Range from Emerald Bay toward Meyers, CA. The East Tahoe Fault forms the eastern side of the graben, and is also believed to be an east-dipping normal fault, with northwest-side-down displacement (Schweickert *et al*, 1999). This bounding fault zone occurs along a northeast-southwest direction along the mountain front of the Carson Range, from Stateline toward Meyers. The Tahoe Valley Fault Zone is a series of faults that cross the area. These faults cause minor offsets within the valley sediments which can affect groundwater conditions.

The depth and composition of the sediment-filled valleys was strongly affected by glaciation. Four periods of major glaciation and one minor glacial advance took place during the Pleistocene Epoch (about 2 million to about 10,000 years before present) that greatly modified the landscape in the Lake Tahoe Basin. Large valley glaciers formed in most of the canyons around the lake, except along the eastern shore where glaciation was limited to the northern sides of the highest peaks (Burnett, 1971). One effect of glaciation was to move large masses of rock and sediments to form deposits of outwash, till, and moraine, and to discharge considerable quantities of sediment into the lake. The sediment deposits in Lake Tahoe and adjoining valleys can be greater than 1,000 feet thick in places (Hyne and others, 1972). Much of the glacial rock and sediment was derived from decomposed granite that had been scoured away and reworked from the granitic slopes of the western and southern mountains.

The current outlet from Lake Tahoe and the present day Truckee River system were formed between 75,000 to 10,000 years ago. Earlier, the elevation of the outlet was affected by the formation of ice dams. The lake level during these events is believed to have risen as high as an elevation of 6,800 feet (Birkeland, 1962) as a result of the formation of an ice dam at the natural outlet. The ice dam is believed to have been breached several times, resulting in periodic, catastrophic flooding down valley and periodic lowering of the lake level. During the interglacial periods, the lake level would have been similar to today's level. Lava flows at the outlet of Lake Tahoe provide a minimum threshold for lake elevation at about 6,220 feet.

2.2.2 TVS Basin Geology

Within the TVS Basin, the geology consists of glacial, fluvial, and lacustrine basin fill deposits overlying the bedrock units. The distribution of these units at the surface is shown on the geologic map in Figure 2-3. Basin-fill deposit range in thickness from less than 100 feet along the basin margins to over 1,000 feet thick in the deeper portions of the basin. Gravity survey and well drilling information suggests that at least three areas of thick sediments occur within the TVS Basin. The largest of these underlies the City of South Lake Tahoe between Tahoe Keys and Bijou Creek. A second is located near the south shore of Lake Tahoe, north of Fallen Leaf Lake, underlying the present drainages of Baldwin and Taylor Creeks. A third underlies the Meyers area south of Twin Peaks. The areas where the basin-fill deposits are on the order of 600 feet to 1,000 feet thick generally correlate with the areas of the highest groundwater production.

Most of the basin-fill deposits consist of glacial outwash material that is typically composed of rock ranging from fine silt to large boulders that have been sorted and stratified by the action of water flowing from the glacier). Permeability of these deposits can be moderate to high and these sediments are the primary groundwater producing zones.

During the periods of high lake levels during the formation of an ice dam at the Lake Tahoe outlet, lake levels rose up to several hundred feet. This resulted in extensive deposits of fine-grained lacustrine deposits at the bottom of Lake Tahoe. These lacustrine deposits contain significant amounts of silts and clays having lower permeability. Changes in the elevation of the surface of Lake Tahoe over the geologic history of the lake have left lacustrine deposits as high as 600 feet above the current lake level (about 6,225 feet amsl). The more continuous layers of these fine-grained deposits form confining layers that affect groundwater flow through the basin.

Near the surface, alluvial sediments are present around the creeks and rivers (Figure 2-3). The alluvial deposits primarily are floodplain sediments composed of silt and sand, and stream channel sediments composed of sand and gravel with locally interbedded lacustrine silt and clay (Harrill, 1977). The alluvium ranges from 10 to 20-foot thick near the basin margin and more than 500 feet thick near the south shore of Lake Tahoe. Alluvial deposits consisting of decomposed granite and glacial sediments that have been reworked by stream water typically are restricted to stream margins and floodplains. These sediments generally are very permeable.

Within the alluvial sediments are layers of dark gray (nearly black) organic-rich soil containing decomposing plant material and dark gray organic silt with stringers of coarse sand and are found in the near-surface sediments underlying meadows along stream channels. These deposits are generally in the range from 5 to 8 feet thick, but may have local influence on the movement of shallow groundwater and interaction with surface water (Rowe and Allander, 2000).

Other deposits found in the basin include glacial till, which has a similar range of rock-fragment sizes but has not been sorted or stratified because it was simply deposited from the underside of a glacier. Terminal and lateral moraine deposits form many of the ridges and other topographic features and are composed of unsorted and unstratified masses of rock ranging from fine silt to large boulders. Because these deposits are unsorted and because the fine-grained sediments produced by the grinding glacial action are retained in the deposit, they typically have only moderate permeability. The Angora Ridge, located along the western side of the TVS Basin near Angora Creek, is a lateral moraine.

Two representative cross sections (Figures 2-4 and 2-5) depict the interbedded nature and variability in thickness of the coarse, glacial outwash and fine-grained lacustrine basin fill deposits within the basin. Figure 2-4 shows a north-south cross section from north of Meyers north across the area of thick sediments near the south shore of Lake Tahoe. Figure 2-5 shows an east-west cross section along the south shore of Lake Tahoe from near Camp Richardson to near Bijou Creek.

2.3 Climate

At 6,200 feet elevation, the residents in South Lake Tahoe area enjoy distinct seasons. The four sharply defined seasons bring a continual round of variety and at the same time greatly affect water use. The station in the Lake Tahoe Basin with the longest period of record is the Tahoe City station, which has more than 100 years of records. Table 2-1 presents average climatic conditions for the Lake Tahoe area based on the 110 year record (1903 – 2013) for the Tahoe City Station (NWS COOP 048758). This station is located along the west shore of Lake Tahoe at Tahoe City, approximately 18 miles northwest of South Lake Tahoe. The South Lake Tahoe station has intermittent records of precipitation over the past 14 years, although it had 40 years of temperature records.

TABLE 2-1
LOCAL CLIMATE SUMMARY FOR THE LAKE TAHOE BASIN

	January	February	March	April	May	June
Average Total Precipitation (in.)	5.97	5.29	4.12	2.14	1.20	0.65
Average Total Snowfall (in.)	45.9	36.5	35.2	15.9	3.7	0.2
Average Max Temperature (deg F)	38.6	40.3	44.0	50.4	59.6	68.7
Average Min Temperature (deg F)	19.1	19.9	22.8	26.9	32.8	38.6
Average ETo (in.)	0.6	0.3	1.3	3.8	5.4	5.9

	July	August	September	October	November	December
Average Total Precipitation (in.)	0.26	0.30	0.59	1.82	3.57	5.55
Average Total Snowfall (in.)	0.0	0.0	0.3	2.4	15.5	35.2
Average Max Temperature (deg F)	77.9	77.2	69.8	58.8	46.9	40.3
Average Min Temperature (deg F)	44.4	43.7	39.9	32.3	25.8	20.8
Average ETo (in.)	6.5	4.3	2.2	0.7	0.2	0.0

ETo – Reference evapotranspiration
Source: Western Regional Climate Center for Tahoe, California

At valley elevation, mean annual precipitation ranges from a high of 44 inches per year in the southwest to 22 inches per year in the northeast portion near the Nevada state line. Frontal systems from November through May account for over 85% of Tahoe Basin precipitation. In some years, summertime monsoon storms from the Great Basin bring intense rainfall, especially to high elevations, primarily affecting areas to the northeast of South Lake Tahoe.

In general, precipitation falls as a result of moisture that moves into the area as systems coming east from the Pacific Ocean (Crippen and Pavelka, 1970; Thodal, 1997). These masses are forced upward when they encounter the Sierra Nevada; as a result, precipitation is higher in the Lake Tahoe Basin than it is either in the Central Valley to the west, which lies at a low elevation, or the Carson City area to the east, which is in the rain shadow of the Sierra Nevada.

Most annual precipitation is in the form of snow. In the Sierra Nevada, snow falls in great quantities from late November to early April. The mean annual precipitation at high elevation areas near the western boundaries of the Upper Truckee and Taylor Creek averages over 60 inches per year. The average cumulative winter snow pack in the mountains is 216 inches or nearly 20 feet. Figure 2-6 shows the locations of the snow water equivalent readings for the Heavenly Valley (Station 518), Hagan Meadows (Station 508) and Echo Peak 5 SNOTEL stations, located in the mountains surrounding the TVS Basin. Snow levels are greatest on the western side (Echo Peak 5) than in the eastern (Heavenly Valley and Hagans Meadow). Figure 2-7 showing the snow water equivalent measurements for these stations since 2004 illustrates this relationship. Over that period, the snow water equivalent data from the Echo Peak 5 station ranges from over 60 inch in 2005, 2006 and 2011 to less than 30 inches in 2007, 2002, 2013 and 2014. Elsewhere, Heavenly Valley station generally receives about 50 to

75 percent and Hagan Meadow station about 25 to 50 percent of the snowfall that occurs at Echo Peak 5 station during a given year.

The South Lake Tahoe area has been experiencing a recent drought period with five of the past seven years receiving below average precipitation. The extreme drought conditions in 2013 and 2014 throughout California caused Governor Jerry Brown to issue a Drought Emergency Proclamation on January 17, 2014. Total precipitation for 2013 at Tahoe City was 9.0 inches which is about 22 inches below the annual average. Groundwater level monitoring data will be important for assessing the long-term effects of the drought on the TVS Basin groundwater supply.

2.4 Surface Features

Groundwater and surface water are closely linked. The following provides a summary of key references on the surface water hydrology in the Lake Tahoe area.

2.4.1 Lake Tahoe

Lake Tahoe is the principal hydrologic feature in the area. Lake Tahoe covers approximately 192 square miles in total area. The surface elevation of Lake Tahoe ranges between 6,223 and 6,229.1 feet amsl, and is controlled by the Lake Tahoe Dam at the discharge to the Truckee River near Tahoe City. In addition to Lake Tahoe, there are numerous other lakes and tributary streams in the South Lake Tahoe area. Figure 2-8 provides a hydrograph for Lake Tahoe from 2000 to 2014. During this period, the Lake elevation has varied about 6 feet from a low of about 6222.5 to a high of 6229.0 feet.

Lake Tahoe is classified by limnologists as an oligotrophic lake, which means the lake has very low concentrations of nutrients that can support algal growth, leading to clear water and high levels of dissolved oxygen. The exceptional transparency of Lake Tahoe results from naturally low inputs of nutrients and sediment from the surrounding watershed. Lake Tahoe’s famed transparency has declined by roughly 27 feet since monitoring began in the 1960s (TERC 2013). The transparency decline has been attributed to land disturbance, air pollution, soil erosion, storm water runoff, and the loss of natural landscapes capable of detaining and infiltrating runoff. Scientific research developed in support of the Lake Tahoe total maximum daily load (TMDL) points to inorganic fine sediment particles less than 16 micrometers in diameter as the primary pollutant of concern impairing Lake Tahoe’s transparency (Swift *et al*, 2006). Additional pollutants of concern include phosphorus and nitrogen, as these nutrients can stimulate algal growth in Lake Tahoe.

2.4.2 Watersheds

Portions of seven watersheds overlie the TVS Basin. (Figure 2-6). The majority of stream flows within these watersheds are derived from snow melt in the surrounding mountains. The two largest watersheds within the Lake Tahoe Hydrologic Basin are the Upper Truckee River and Trout Creek watersheds. The Upper Truckee River watershed overlies the central portion of the TVS Basin (Figure 2-6). Main tributary drainages within this watershed are to the Upper Truckee River and include Grass Lake Creek; Big Meadow Creek and Angora Creek. The Upper Truckee River is the main tributary to Lake Tahoe. It drains an area of approximately 57 square miles on the south side of Lake Tahoe (Lahontan Regional Board 2010) and supplies approximately 40 percent of the total stream flow entering Lake Tahoe (TERC 2013b). Major wetland areas occur along the Upper Truckee River and its feeding tributaries.

The Trout Creek watershed is the second largest in the Lake Tahoe Hydrologic Basin and lies immediately east of the Upper Truckee River Watershed (Figure 2-6). This watershed occupies 41 square miles, which is 13 percent of the total land area tributary to Lake Tahoe. Trout Creek has a length of about 12 miles. The land surface altitudes range from lake level to 10,881 feet amsl at Freel Peak. Main tributary drainages within this watershed are to Trout Creek and include Cold Creek, Saxon Creek, Heavenly Valley Creek and Hidden Valley Creek. Major wetland areas include the Upper Truckee Marsh, High Meadows, and Hell Hole (Rowe and Allander, 2000).

USGS stream gage measurements (Figure 2-9) for the Upper Truckee River (USGS 10336610) and Trout Creek (USGS 10336780) show that the Upper Truckee River carries significantly higher flows than Trout Creek during late spring and early summer snowmelt periods, but have similar base flows during the summer. The difference in the peak flows represents the larger area of the Upper Truckee River watershed compared to the Trout Creek watershed. Also, the Upper Truckee River watershed receives significant runoff from mountains to the west side of the TVS Basin, which has higher snow pack volumes relative to the mountains to the east side (Figure 2-7).

2.4.3 Potential Climate Change

The potential for climate change in the Sierra Nevada has been a subject of much recent research. Rising snow level elevations in response to climate change may reduce snow pack volumes and snowmelt throughout the Sierra Nevada Range, which are projected to decline by the end of the century (Cal-adapt 2014a). Studies by the United States Geological Survey (USGS) have also shown changes in stream flow timing trending toward earlier snowmelt and peak stream flow discharges in the Western United States (USGS, 2005b). Should the observed shifts in stream flow timing continue the likelihood of severe summer-drought conditions occurring throughout these watersheds will increase.

2.5 Ecological Resources

Groundwater also plays a role in sustaining ecological resources. The following provides a summary of key references on the ecological resources and restoration efforts in the Lake Tahoe area.

2.5.1 Ecosystems

Terrestrial vegetation overlying the TVS Basin is dominated by coniferous forest. The predominant plant communities include Jeffrey pine, lodgepole pine, white fir and aspen. Significant areas of wet meadows and riparian areas, dry meadows, and brush fields also occur (TRPA 2013). Surface waters provide habitat for common and sensitive fish, amphibian, and invertebrate species, while adjoining meadow and wetland areas support numerous bird, mammal, and plant species. Shallow groundwater plays an essential role in maintaining meadow and wetland areas and sustaining their ecological communities.

Wildfires are a significant factor in ecosystems and their effect has changed and will change over time with changing climate conditions, land cover, land use, and policies. Maintaining water supplies for firefighting can require significant volumes of groundwater that is normally used for potable supply. For many decades fire management policy on federal and state lands focused on fire suppression, which allowed increased densities of trees and underbrush to grow. More recently fire management policy has focused on maintaining defensible spaces and on fuel reduction to reduce fuel severity (USDA 2014) and help reduce the need for water for firefighting. Studies by the Sierra Nevada Research Institute indicate that increased timber harvesting could increase base flows and improve groundwater storage. Reducing tree densities directly reduces the amount of evapotranspiration from vegetation. In addition to these potential reductions in discharge, thinning the forest canopy would allow for a higher proportion of snowpack to accumulate on the forest floor and enhance snowpack retention (Bales *et al*, November 2011).

2.5.2 Stream Environment Zone

Stream Environment Zone (SEZ) is a unique term developed by TRPA to denote perennial, intermittent and ephemeral streams and drainages, as well as marshes and meadows in the Lake Tahoe area. Development, primarily in the 1960’s and 1970’s, reduced the land area covered by marshes, meadows and riparian areas within the Lake Tahoe area.

SEZs generally possess the characteristics of riparian or hydric (wet site) vegetation, alluvial, hydric soils, and/or the presence of surface water or near-surface groundwater at least part of the year. As shown on Figure 2-10, the SEZs in the Lake Tahoe Basin include areas with seasonally high groundwater levels. The SEZs protect water quality because as the surface water flows slow in these areas, natural processes of infiltration, nutrient uptake, denitrification, and sediment capture help to reduce sediment and nutrients in the surface water. Protection of these areas is considered vital to the health of the lakes and rivers receiving the runoff.

2.5.3 Stream and Wetland Restoration

The California Tahoe Conservancy (CTC) was established in 1984 in order to address resource needs in the Lake Tahoe Basin, including the protection and restoration of the natural environment and management of acquired public land at Lake Tahoe. Since 1997, the CTC’s programmatic efforts have been focused California’s commitment to the implementation of the Environmental Improvement Program (EIP) for the Tahoe Basin under various agreements between the State of California, the State of Nevada, the Federal Government, and the TRPA.

The SEZ protection program was developed in response to this reduction to help preserve wildlife habitat and reduce sediment and nutrient loading to Lake Tahoe. The CTC’s SEZ program was established to restore and enhance important SEZ and watershed areas by working to generate projects that include multiple resource benefits like water quality improvement, soil erosion control, wildlife and fisheries habitat, vegetation enhancement, scenic resource enhancement, public access, and interpretive opportunities. Project activities include removing fill, restoring natural, historical stream channels, stabilizing and revegetating stream channels, and reconnecting floodplains. The SEZs may also provide a similar beneficial function for groundwater as well. Therefore, these efforts are considered to have a mutual beneficial function for groundwater management and water quality.

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Section 3: Groundwater Management Area

This section describes the human activity in the TVS Basin including current and projected water demands to provide context for assessing the issues and needs for groundwater management.

3.1 GWMP Area

The TVS Basin lies in the vicinity of South Lake Tahoe, California. The following provides a description of this area.

3.1.1 Local Jurisdictions and Land Use

The TVS Basin underlies several different jurisdictions as shown on Figure 3-1. These include the City of South Lake Tahoe (CSLT), the unincorporated communities of Meyers, Angora Highlands and Christmas Valley, and portions of unincorporated eastern El Dorado County. The Nevada portion of the TVS Basin underlies a portion of the Cities of Stateline, Kingsbury and Zephyr Cove-Round Hill Village. The Nevada jurisdictions are not included in this GWMP.

According to the TRPA Regional Plan, land use throughout the Lake Tahoe Basin is assigned to one of five classifications as follows: Conservation; Recreation; Residential; Commercial and Public Service; and Tourist (TRPA, 2012b). Within the greater South Lake Tahoe area, the majority of the land use is classified as Conservation area, followed by Residential, Recreation, Commercial and Public Service and Tourist area. Conservation areas are non-urban areas with value as primitive or natural areas, with strong environmental limitations on use and with a potential for dispersed recreation or low-intensity resource management. SEZs are included within this land use classification. Residential areas are urban areas that have a potential to provide housing. Recreation areas are non-urban areas with a high potential for developed outdoor recreation, park use, or concentrated recreation. Commercial and Public Service areas are urban areas that have been designated to provide commercial and public services or have the potential to provide future commercial and public services. Tourist areas are urban areas that have the potential to provide intensive tourist accommodations and services or intensive recreation.

The majority of the Conservation areas are federal lands managed by the United States Forest Service - Lake Tahoe Basin Management Unit (USFS-LTBMU). Most of the USFS-LTBMU managed land is located outside of the TVS Basin, but does include large areas around the Camp Richardson/Fallen Leaf Lake area within the northwest portion of the TVS Basin and along the basin margins on the eastern side of the TVS Basin. Urban areas, including residential, commercial and public service and tourist areas occur within the CSLT and the unincorporated communities of El Dorado County, including Angora Highlands, Meyers and Christmas Valley. Recreation areas occur within USFS-LTBMU managed lands and within the CSLT. Tourist areas are found solely within the CSLT along the Highway 50 corridor near Stateline, within the northeast corner of the TVS Basin.

The TRPA tightly regulates land use and development within the Lake Tahoe Basin and has the authority, under a bi-state compact, to adopt environmental quality standards (i.e., thresholds) and to enforce ordinances designed to achieve these standards. Implementation of these ordinances severely limits further urban development throughout the Lake Tahoe Basin.

3.1.2 Population and Economy

The majority of the population within the greater South Lake Tahoe area lives within the residential areas of CSLT and the adjoining unincorporated communities of El Dorado County. Because of land use and development restrictions, projected population growth in the greater South Lake Tahoe area is low, generally less than one percent.

During the first half of the 20th century, development around Lake Tahoe consisted of a few vacation homes. Between 1955 and 1970, the population of the CSLT increased from less than 2,000 to 12,921 full-time residents. The population of the CSLT in 2013 is estimated at approximate 21,387, which is down slightly from 21,403 in the 2010 Census data, but has decreased by about ten percent from the 2000 Census population high of 23,609 (USCB, 2014).

The 2009 estimated population within the STPUD Service Area is 33,124. It is estimated that two-thirds of the District's served population lives within the CSLT and one-third lives within the unincorporated communities of El Dorado County.

The economy of South Lake Tahoe is largely dependent upon tourism. As a destination resort, the South Lake Tahoe area experiences large fluctuations in population on a regular basis. Because of this, water purveyors experience fluctuations in the water demand corresponding to the summer tourist season and must meet maximum water demands on long weekends and holidays.

3.2 Water Purveyors

This section gives a brief description of the public and private water purveyors that serve customers in the greater South Lake Tahoe area. Groundwater is the primary source of drinking water and accounts for more than 95 percent of the potable water used throughout the area. Surface water as a drinking water source is relatively minor and is provided through a surface water intake to Lake Tahoe. Figure 3-2 shows the current service area boundaries for the water systems serving the greater South Lake Tahoe area.

3.2.1 South Tahoe PUD

The District is the largest water purveyor in the South Lake Tahoe area and utilizes only groundwater as its water source. Groundwater production from the Districts wells is believed to account for more than 80% of the total volume of groundwater extracted from the TVS Basin on an annual basis.

Because of the topography and relief across its service area, the water system includes fifteen pressure zones, which are inter-connected using either booster pump stations or pressure-reducing valves (PRVs). As of the date of this report, the STPUD water system presently includes thirteen active supply wells, two emergency standby wells, sixteen booster pump stations, twenty-six PRVs, twenty-three water storage reservoirs, 320 miles of waterline pipe and four well-head treatment systems. There are five interconnections with three neighboring water systems: Tahoe Keys Water Company (TKWC), Lukins Brothers Water Company (LBWC), Lakeside Mutual Water Company (LMWC).

The District is a California Special District established in 1950. In 1987, the District acquired the Tahoe Paradise Water System which served the Meyers and Tahoe Paradise areas. The District's 27,000-acre service area covers the south shore of Lake Tahoe from Emerald Bay on the west, Christmas Valley on the south, the California-Nevada state line to the east, and Lake Tahoe to the north. The service area is largely residential with a relatively small number of connections to commercial businesses. Groundwater pumping is generally controlled by changing water storage reservoir levels in response to water system demands within the pressure zone served by the reservoir within which it is located. The booster stations and PRVs are used to distribute water between pressure zones.

The California-Nevada Interstate Compact Concerning Water of Lake Tahoe, Truckee River, Carson River, and Walker River Basins (Compact) approved in 1971 allocates a total annual surface water and groundwater diversion of 23,000 AFY within the California side of the Lake Tahoe Basin. In 1972 the California State Water Resources Control Board (SWRCB) adopted a Policy for the Administration of Water Rights in the Lake Tahoe Basin establishing that all surface water and groundwater diversions shall not exceed the allocations defined in the Compact. In 1984 the SWRCB prepared a Draft Report titled, Policy for Water Allocation in the Lake Tahoe Basin (Policy). This Policy was termed Draft since both the States of California and Nevada were using the Compact for water allocations within the Lake Tahoe Basin (Baer, 1994; Kennedy/Jenks, 2007). The Policy has not been finalized. The Compact allocated a maximum of 23,000 acre feet for use on the California side of the Lake Tahoe Hydrologic Basin, however the Policy recommended that the allocation be split between public (State and Federal) and private lands. The Policy allocated a maximum of 12,493 AFY for use in the Southern Lake Tahoe area (SWRCB, 1979). The District has a right to a total maximum allocation of 9,528 AF, and this number has been used as a planning level assessment for the District’s Urban Water Management Plan (UWMP) in order to represent the total available annual groundwater supply (Kennedy/Jenks, 2007, Winzler and Kelley, 2011).

Table 3-1 summarizes the annual water use from groundwater pumping of public water supply wells within the TVS Basin from 1989 to 2013. Water use ranged from 6,026 AFY in 2011 to 8,161 AF in 2007. Since 2007, groundwater pumping has generally declined, and total pumping in 2013 was 6,336 AFY.

TABLE 3-1
STPUD HISTORICAL WATER DEMAND (AFY)

	1989	1992	1995	1998	2001	2004	2007	2010	2011	2012	2013
Total Use	6,861	6,533	6,996	6,792	8,079	7,506	8,161	6,546	6,026	6,517	6,336

Source: Based on STPUD pumping records in acre-feet per year (AFY).

Future demand projections for the years 2015 to 2035 from the 2010 UWMP (Winzler and Kelley, 2011) are presented in Table 3-2, based on the population and employment forecasts, plumbing code and planned water conservation measures. Total water use is the sum of water use by customer categories and additional water losses. Future annual water demand is projected to be mainly for residential and commercial sectors. Total water demand is projected to decrease from 6,336 AF in 2013 to 4,484 AF in 2025, and then rise to 4,701 AFY in 2035.

The District holds a permit to divert up to 2,718 AFY from Cold Creek; however, it discontinued this diversion in 1991 due to water quality constraints. The District also has diversion rights to the Upper Truckee River and tributaries for up to 4,424 AFY. These rights have not been utilized in the past and are not planned for use in the future due to supply reliability concerns. One issue of concern for the utilization of surface waters is the availability of a consistent and adequate in-stream flow at diversion points during peak summer months. The District has filed for rights to divert surface water from Lake Tahoe under the Truckee River Operating Agreement for a total of 12,100 AFY. These permit applications are under review by the SWRCB and are therefore not currently a supply source and not included as part of the future supply projections (Winzler and Kelley, 2011).

TABLE 3-2
STPUD PROJECTED WATER SUPPLY AND DEMAND COMPARISON (AFY)

Supply and Demand	2015	2020	2025	2030	2035
Total Supply	9,528	9,528	9,528	9,528	9,528
Total Demand	5,353	4,824	4,484	4,587	4,701
Difference (Supply – Demand)	4,175	4,704	5,044	4,941	4,827

Source: STPUD Final 2010 UWMP Table 5.6 (Winzler and Kelley, 2011)
Units in acre-feet per year

3.2.2 Private Water Systems

The water supply for the greater South Lake Tahoe area is provided by numerous water purveyors including the District, private water companies and private wells. The three largest of these private water companies are shown on Figure 3-2. A brief description of these private water companies is provided below:

- LBWC is a private water company established in 1942 which is governed by the California Public Utility Commission. They have 952 service connections that include businesses, single-family and multi-family dwellings within a 320 acre area in the northwestern portion of the CSLT. LBWC relies solely on groundwater from three active water supply wells. Groundwater pumping by LBWC has ranged from 320 to 370 AFY from 2005 to 2013, which is consistent with the 334 AFY reported for pumping in the 1970s by the SWRCB (SWRCB, 1979). Groundwater production from the LBWC wells is believed to account for about 5% of the total volume of groundwater extracted from the TVS Basin on an annual basis.
- The TKWC is a private water company that serves 1,563 water connections in the 700-acre Tahoe Keys neighborhood of the CSLT. TKWC relies solely on groundwater from three active water supply wells to meet its water demands. TKWC water production information from 1980 through 2008 shows groundwater pumping from TKWC wells ranging from 399 to 1,132 AFY with an average annual production of 784 AFY. TKWC averaged 556 AFY in the 1970s (SWRCB, 1979). Groundwater production from the TKWC wells is believed to account for about 10% of the total volume of groundwater extracted from the TVS Basin on an annual basis.
- The LMWC is a private water company serving about 150 largely non-residential connections in a roughly 70-acre area in the northeast corner of the CSLT, north of Highway 50 adjacent to Stateline. LMWCs annual production in 2007 was approximately 280 AF of surface water. LMWC relies on surface water, drawing water from Lake Tahoe using a 14-inch diameter water intake pipe (CSLT, 2011). LMWC maintains a drinking

water well as a supplemental supply to meet peak summer water demands. Information from a water well rehabilitation report provided by LMWC indicates that this well has a nominal capacity of about 250 gallons per minute (gpm). No other water production information for this well was found.

In addition, there are several public water systems that have wells which supply drinking water to schools, resorts, hotels, apartments and recreational areas located within the TVS Basin. There are additional water systems that are located outside of the TVS Basin that rely on surface water or use small wells for their supply. Table 3-3 provides summary information for 38 of these water systems that lie within the TVS Basin. The general location of these systems is shown on Figure 3-2. The DDW classifies these water systems based on the number of connections and whether the users are full time residents or short-term users.

Information derived from the District’s customer service database suggests that there are as many as 624 active private wells situated within the TVS Basin. Many of these private wells are clustered through many of the older neighborhoods with the northeastern portion of the CSLT; near the south and east flanks of Tahoe Mountain; and at the south end of Christmas Valley. Groundwater production from small community water system and private wells is believed to account for a little more than 5% of the total volume of groundwater extracted from the TVS Basin on an annual basis.

TABLE 3-3
LIST OF PUBLIC WATER SYSTEMS IN TAHOE VALLEY SOUTH BASIN

Map Label	System Name	Est. Population	Service Connections	DDW Class
area	South Tahoe PUD - Main	29,500	13,926	C
area	Tahoe Keys Water Company	1,200	1,563	C
area	Lukins Brothers Water Company	250	952	C
area	Lakeside Mutual Water Company	1,000	128	C
1	Rockwater Apartments.	50	24	C
2	Al Tahoe Elementary	1,300	4	NTNC
3	South Shore Recreation Area	3,300	123	NTNC
4	Station House Inn	30	100	NTNC
5	Tahoe Valley Elementary School	700	1	NTNC
6	A & A Lake Tahoe Inn	25	32	NC
7	Alder Creek Tract	40	20	NC
8	Alder Inn	25	24	NC
9	Alpenrose Inn	40	19	NC
10	Alpine Inn & Spa	25	38	NC
11	Angora Lakes Resort	1,000	11	NC
12	Baldwin Beach	200	1	NC
13	Beverly Lodge	25	30	NC
14	Deerfield Lodge at Heavenly	40	14	NC
15	Echo Peak Water Association	32	26	NC
16	Econo Lodge	120	62	NC

Map Label	System Name	Est. Population	Service Connections	DDW Class
17	Emerald Pines Resort Cabins	100	1	NC
18	Heather Lake Road Tract	25	13	NC
19	King's IV Condominiums	60	40	NC
20	Mark Twain Motel	25	21	NC
21	Matterhorn Motel	50	25	NC
22	Midway Motel Annex	32	16	NC
23	Mt Ralston Properties Association, Inc.	100	80	NC
24	National 9	60	32	NC
25	Pinewood Inn	70	21	NC
26	Pistante S Coyote Den	32	16	NC
27	Rainbow Tract Water Association	25	23	NC
28	Ski Run Management Company	25	2	NC
29	Sky Lake Lodge	25	22	NC
30	Spring Creek Tract Association	280	140	NC
31	Summit Pines Apartments	25	15	NC
32	Tahoe Chalet Inn	100	48	NC
33	Tahoe Valley Lodge	42	21	NC
34	Travel Inn	100	36	NC
35	Vagabond Inn	30	36	NC
36	Villa Tahoe Condominiums	44	22	NC
37	Della Cella Cottages	0	7	NP
38	Truckee Creek Cottages	60	11	NP

Source: Tahoe-Sierra IRWMP (Kennedy/Jenks, 2014).

Notes: **C - Community Water Systems** have 15 or more service connections or regularly serves 25 or more year-round residents used by year-round residents.
NTNC - Non-Transient Non-Community Water System is a public water system that regularly serves at least 25 of the same persons over 6 months per year.
NC - Transient Non-Community Water System is a public water system that serves a transient population of 25 or more persons.
NP - Non-Public or "State Regulated Water System" is a water system that serves 4 to 14 service connections or 10 to 24 people.

3.2.3 Nevada Water Purveyors

The GWMP follows California regulations and DWR has defined the TVS Basin as ending at the Nevada state line. However, the physical groundwater basin does extend into Nevada in the areas of Stateline and Zephyr Cove (Figure 3-1). In the Nevada portion of the TVS Basin, water is provided by the Edgewood Water Company, Kingsbury General Improvement District, Round Hill General Improvement District and the Zephyr Water Utility District. These water purveyors rely on surface water intakes from Lake Tahoe and do not rely on groundwater supplies in the TVS Basin. The actions of these Districts are not considered to have a significant affect groundwater conditions on the California side of the Basin; therefore, these districts are not included in this GWMP.

3.2.4 Historical Groundwater Pumping

All of the water purveyors in the TVS Basin, with the exception of LMWC, derive their entire water supply from groundwater. The District has records available from 1987 through 2013 as shown on Figure 3-3. However, historical data is limited for the private water purveyors. The majority of the reported water demand in the South Lake Tahoe area is for residential and commercial use.

The District's annual groundwater production from 1985 through 2013 has ranged from a low of approximately 6,026 AFY (1,964 million gallons [MG]) in 2011 to a high of 8,161 AFY (2,660 MG) in 2007 with an average annual pumping rate of 7,060 AFY (2,300 MG). Pumping has varied over that period and does not show a definitive trend. However, groundwater pumping has declined from 2009 through 2013 consistent with the relatively low growth in the South Lake Tahoe area. The recent declines in groundwater pumping may also be influenced by the relative increase in second home owners in the South Lake Tahoe area and the high rate of home foreclosures during the recession starting in 2008. The number of active production wells has decreased from a high 34 in 1993 to a low of 12 in 2013. This reflects that several wells were abandoned due to impacts from contaminant plumes which were replaced by new high-capacity wells. As a point of reference for historical pumping, the SWRCB (1979) report listed the average combined pumping for STPUD and the other private well companies that have since merged with STPUD at 5,718 AFY.

Groundwater pumping by LBWC has ranged from 320 to 390 AFY from 2005 to 2013. This is consistent with the 334 AFY reported in the SWRCB (1979) report for pumping in the 1970s. From 1980 through 2008, annual groundwater production from TKWC wells ranged from 399 AFY to 1,131 AFY, with an average production of 784 AFY. TKWC averaged 556 AFY in the 1970s (SWRCB, 1979). The current combined pumping for STPUD, LBWC and TKWC is estimated at about 8,170 AFY. Pumping from small community water system wells and private wells is currently estimated to be on the order of about 225 AFY. Figure 3-4 shows the monthly variability in pumping for STPUD. This shows a strong seasonal pattern where the highest pumping occurs in the summer and the lowest pumping is in the winter months. Minimum, maximum, and average monthly drinking water use peaks in the summer months (June, July, and August) and declines in the winter and spring months (December through April). The maximum water demand in any one month was 381 MG which occurred in July and August. The lowest water demand was 99 MG which occurred in November, February, March, and April. This represents increased outdoor water usage and the tourist population in the summer months which affects groundwater pumping.

Groundwater management is typically focused on long-term trends, but short term peak pumping also presents challenges. The maximum single day demand for the STPUD water system occurred on June 25, 2007 during the Angora Fire at 17.264 million gallons per day (MGD). The maximum single day demand for STPUD without fire flows occurred on August 2, 2007 at 14.831 MGD. Having sufficient capacity to meet this high peak demands is primarily an infrastructure issue; however, localized high pumping, especially in response to a large forest fire could have local impacts, such as on groundwater quality, that may need to be considered.

3.3 Wastewater Management

Under the Porter-Cologne Water Quality Control Act all sewerage from within the Lake Tahoe Basin must be collected, treated and exported outside of the Lake Tahoe Basin. The District is the largest wastewater utility provider for the greater South Lake Tahoe area.

The District's sewer collection system services an area of approximately 42 square miles and includes the CSLT; USFS-LTBMU managed lands west of the CSLT; and unincorporated area of El Dorado County, south of the CSLT (Figure 3-2). The collection system includes 41 pumping station facilities, approximately 314 miles of gravity sewers that range in size from 4 inches to 24 inches in diameter, and approximately 22 miles of force mains that range in size from 2.5 inches to 18 inches in diameter. All sewerage from the collection system is conveyed to the Districts Wastewater Treatment Plant (WWTP) in South Lake Tahoe. The collected wastewater is treated to a secondary treatment standard and then disinfected with chlorine prior to being pumped out of the Lake Tahoe Basin. The WWTP has a treatment capacity of 7.7 million gallons per day (MGD) for dry-weather (sanitary) wastewater flows. It currently receives and treats approximately 4 MGD during the winter and about 5 MGD during the summer. The WWTP is also equipped to handle wet-weather flows in excess of 18 MGD that occur during rainfall events and snowmelt as a result of inflow and infiltration to the collection system. The recycled water system originates at the WWTP and consists of about 27-miles of export pipeline that conveys the disinfected secondary-23 treated wastewater to neighboring Alpine County, where it is temporally stored in a recycled water reservoir from where it is distributed for irrigation use.

The District's sewer collection system includes 1,700 sewer laterals (the portion of the sewer system connecting the building to the main). Twenty-two percent of these are over 40 years old, 39 percent are 30 to 40 years old, 24 percent are 20 to 30 years old, and only eight percent are less than 10 years old. While a lateral can last 50 to 100 years, its life expectancy is determined by its material, original installation, root intrusion or external pressure, soil stability and chemical makeup, high water tables, corrosion (sometimes from the hydrogen sulfide gas present in the sewer system), and forces leading to structural failure (CSLT, 2014). Because of the potential for leaks, sewer lines are considered a potential source of contamination. The District follows the California State Water Well standards (DWR 1981, 1991) that includes mandatory setbacks of 50 feet from any sewer line. The Drinking Water Source Assessment and Protection (DWSAP) Program (CDPH, 2000) also identifies wastewater treatment facilities and conveyance as a potentially contaminating activity.

Section 4: Overview of Local Governmental Agencies

A key goal of the GWMP update is to further expand collaboration with local land use and regulatory agencies for groundwater management and water quality protection in the TVS Basin. The following section outlines the existing regulatory agencies and authorities to provide the context in which increased support for groundwater quality protection can be built.

4.1 History of Collaboration

This GWMP is updated within the context of an existing, on-going coordination and collaboration with water issues in the South Lake Tahoe area primarily focused on Lake Tahoe clarity issues. Because of this, many long-established relationships already exists that form the foundation of coordination and collaboration which will be honored and expanded to include consideration of groundwater management issues with an emphasis on water quality. A key objective of this GWMP update is to continue to build off of these existing relationships to further enhance groundwater management and protection in the TVS Basin.

Table 4-1 provides a summary of the many different agencies with jurisdictions and regulatory oversight related to groundwater quality, hazardous materials management and land use management in the TVS Basin. Additional, more detailed information on the agency responsibilities is presented in Appendix B. The following discussion provides a summary of the roles and responsibilities for the various agencies that are relevant for managing and protecting groundwater in the TVS Basin.

4.2 Groundwater Regulatory Authorities

Groundwater quality regulation is largely from the perspective of drinking water and hazardous materials management. The following provides a summary of actions and programs for groundwater protection in the TVS Basin.

4.2.1 State Water Resources Control Board and Lahontan Regional Water Quality Control Board

The primary responsibility for the protection of groundwater quality in California rests with the State Water Resources Control Board (SWRCB) and nine Regional Water Quality Control Boards (Regional Boards). The SWRCB sets statewide policy for the implementation of federal and state laws and regulations. The Regional Boards adopt and implement Water Quality Control Plans (Basin Plans) which recognize regional differences in natural water quality, actual and potential beneficial uses, and water quality problems associated with human activities. The Water Quality Control Plan (Basin Plan) for the Lahontan Region (LWRCB, 1995) is the primary regional water quality planning document in the California portion of Lake Tahoe and is also the basis for regulation by the Lahontan Regional Water Quality Control Board (LRWQCB).

The Basin Plan establishes beneficial uses and water quality objectives of both surface water bodies and groundwater basins. It also outlines implementation programs such as control and enforcement actions, and describes current monitoring activities. Programs used to implement Basin Plan objectives include waste discharge prohibitions; spills, leaks, investigations, and cleanups; storm water, erosion, and sedimentation control measures; wastewater treatment, disposal, and reclamation measures; oversight of land disposal of solid and liquid waste; groundwater protection and management; TMDLs; and other measures related to specific resource uses and development activities.

As described in the LRWQCB Basin Plan, the beneficial uses of groundwater in the TVS Basin are designated as municipal, industrial and agricultural. Ground waters designated as municipal shall not contain concentrations of chemical constituents in excess of the maximum contaminant level (MCL) or secondary maximum contaminant level (SMCL) based upon drinking water standards specified in the Title 22 of the California Code of Regulations.

The enforcement of groundwater cleanup is primarily conducted through two LRWQCB programs in the TVS Basin, the Underground Storage Tank (UST) Program and the Site Cleanup Program. The Underground Storage Tank Program addresses the potential for, and cleanup of, groundwater contamination from leaking tanks (primarily at gasoline stations. The UST Program includes these four program elements:

- Leak Prevention - The Leak Prevention Program element includes requirements for tank installation, construction, testing, leak detection, spill containment, and overfill protection (State Water Board responsibility; also see El Dorado County responsibility under CUPA in Section 4.2.2).
- Cleanup - Cleanup of leaking tanks often involves a soil and groundwater investigation and remediation, under the direction of a regulatory agency (Joint LRWQCB/ El Dorado County responsibility).
- Enforcement - The SWRCB UST Enforcement Unit provides assistance to local agencies enforcing UST requirements.
- Tank Tester Licensing - Tank integrity testing is required by law, must meet the requirements of the State Water Resources Control Board, and must be conducted by State licensed tank testers (SWRCB responsibility).

Special programs also reside within the SWRCB's UST Cleanup Fund for a variety of situations involving underground storage tanks. These include the Comingled Plume Account; Emergency, Abandoned, and Recalcitrant Account; Removing, Replacing, or Upgrading Underground Storage Tanks; and the Orphan Site Cleanup Fund.

The Site Cleanup Program regulates and oversees the investigation and cleanup of "non-federally owned" sites where recent or historical unauthorized releases of pollutants to the environment have occurred. The types of pollutants are varied and include solvents, pesticides, heavy metals, fuel constituents, etc. The Regional Board oversees the investigation and remediation of pollution to ensure the dischargers cleanup and abate the effects of discharges to promote attainment of either background water quality, or the best water quality which is reasonable if background levels of water quality cannot be restored.Important SWRCB and LRWQCB policies used to protect groundwater resources include:

- SWRCB Resolution No. 68-16: Statement with Respect to Maintaining High Quality Water.
- SWRCB Resolution No. 92-49: Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304.
- SWRCB Resolution No. 2012-0016: Low Threat Underground Storage Tank Case Closure Policy (LTCP), which the SWRCB adopted in November 2012.

4.2.2 El Dorado County

The El Dorado County Department of Environmental Management (EDCEMD), Hazardous Waste Division is typically the lead agency for responding to hazardous waste issues. Through permit and inspection processes, as well as public education programs, the objective of the Hazardous Materials Program is to protect human health and the environment by ensuring that hazardous materials and hazardous waste are properly managed. EDCEMD programs are summarized in the sections that follow and detailed in Appendix B.

The Hazardous Materials Program is approved by Cal-EPA as the local Certified Unified Program Agency (CUPA) for El Dorado County. The Unified Program is intended to provide relief to businesses complying with the overlapping and sometimes conflicting requirements of formerly independently managed programs. The CUPA Program includes the following:

- California Accidental Release Prevention (CalARP) Program
- Underground Storage Tank Program
- Above ground Petroleum Storage Act Requirements for Spill Prevention, Control and Countermeasure (SPCC) Plans
- Hazardous Waste Generator and Onsite Hazardous Waste Treatment Programs which has five tiers of permitting and includes submittal of Hazardous Materials Business Plan which includes Hazardous Materials Release Response Plans and Hazardous Waste Contingency Plan with associated inspections
- California Uniform Fire Code: Hazardous Material Management Plans and Hazardous Material Inventory Statements
- The El Dorado County Hazardous Materials Emergency Response Program (HMERP) works in close cooperation with law enforcement, fire and allied health agency officers and staff. Special attention is given to the hazardous materials used and transported frequently in the county by local businesses.

4.2.3 STPUD

In December 2000, the District enacted Ordinance No. 477-00 adding Division 7 to the Administrative Code. The ordinance was developed for the purposes of regulating, managing, conserving and protecting local groundwater resources. A primary focus of Ordinance No. 477-00 was to establish a Basin Monitoring Program to provide a means for the early detection and immediate response to the release of petroleum products into groundwater, and development of management plans to prevent or minimize the impact of contamination from possible contaminating activities.

Ordinance No. 477-00 is being updated concurrently with this GWMP update. The objective of the updated Ordinance is to provide the District with an enforcement mechanism to protect the District's beneficial use of the aquifer and the water supply infrastructure. However, the District would first look to the regulatory authority of LWQCB and County CUPA. Another key modification to the updated Ordinance will be to reduce the prescriptive monitoring requirements included in the original Ordinance. A copy of the updated Groundwater Management Ordinance No. 558-14 is included in Appendix G.

In 1999, the District adopted a policy to not supply drinking water containing detectable concentrations of Methyl Tertiary Butyl Ether (MtBE) to its customers (STPUD, 2004). MtBE has a primary and secondary MCL of 13 and 5 micrograms per liter (µg/L), respectively. The Districts MtBE policy is not a regulatory drinking water standard, and the policy applies only to the District. This policy requires that any District well producing groundwater at a level of 0.5 µg/L of MtBE be placed on increased observation and testing to determine if the initial measurement is an anomaly. If the concentration of MtBE in the well continues to increase or average greater than 0.5 µg/L the District's Board is notified and actions will be determined. These actions have included suspending production from the public water supply wells or adding wellhead treatment in order to remove MtBE below detectable levels. Therefore, areas of degraded groundwater quality at levels below MCLs, have also affected groundwater supplies in the TVS Basin.

4.2.4 Potential Collaboration on Groundwater Protection

STPUD and other water purveyors in the TVS Basin have a vested interest in preserving groundwater quality in the TVS Basin. The key objectives for the water purveyors are the following:

- Protecting existing water supply infrastructure from groundwater contamination to avoid loss of production capacity and incurring costs of replacing impacted infrastructure,
- Maintaining the water quality of the available groundwater supply in the TVS Basin for providing drinking water to the community, and
- Preserving potential future production well sites from being impacted by groundwater contamination.

Historical issues have demonstrated the vulnerability of the aquifer in TVS Basin. In the 1990s and early 2000s, releases of fuel hydrocarbons and MtBE from leaking underground tanks at gasoline stations resulted in several of the District's groundwater supply wells having to be taken offline when contamination levels exceeded drinking water standards. This resulted in a loss of the beneficial use of portions of the aquifer and caused the District to incur additional costs to replace the impacted wells.

The LRWQCB and County are the primary agencies for implementing the groundwater regulations in the TVS Basin and providing regulatory oversight for groundwater remediation. An objective of this GWMP update is for STPUD and other water purveyors to continue to work with LRWQCB and the County to better achieve the above objectives.

There are several areas for increased collaboration between the LRWQCB, County, District and other water purveyors to insure information about identification, site investigations, remediation, site inspections and case closures at groundwater cleanup sites is communicated to the potentially affected water purveyors, and that issues and concerns of the water purveyors is communicated to LRWQCB and County staff. It is anticipated that additional protocols would need to be established to identify who should be contacted in such an event.

4.3 Land Use Planning Agencies and Programs

A number of agencies have jurisdiction and programs for land use and resource management responsibilities. State law requires that every county and municipality adopt a long-term General Plan that includes seven required elements. Water-related issues are generally addressed directly in the Conservation element. Currently in California, general planning by counties and municipalities, and groundwater and urban water management planning by large water suppliers are the primary means of collaboration between water management and land use planning entities. The following provides a brief summary of the land use planning agencies for the South Lake Tahoe area.

4.3.1 Tahoe Regional Planning Agency (TRPA)

All land surrounding Lake Tahoe, including the City of South Lake Tahoe and the District's service area, falls under the jurisdiction of the TRPA as defined in the Tahoe Regional Planning Compact (Compact) created in 1969. The Compact requires that all local jurisdiction planning be consistent with a series of Environmental Thresholds. TRPA was granted the authority to adopt and implement environmental threshold carrying capacities for the entire Lake Tahoe Basin through the development and enforcement of a regional plan and ordinances. It is generally acknowledged that the TRPA Environmental Thresholds effectively provide a growth control mechanism for Lake Tahoe area.

Within the Lake Tahoe Basin, local land use planning has taken into account regional water issues for decades under the jurisdiction of the TRPA. The basic framework for review and approval of activities in the Lake Tahoe area is established by the following TRPA documents (additional information on these key documents is provided in Appendix B):

- The Tahoe Regional Planning Agency Bi-State Compact
- The Lake Tahoe Water Quality Management Plan (208 Plan),
- The TRPA Regional Plan Goals and Policies which includes
    - Environmental Threshold Carrying Capacities for nine resource areas including Water Quality
    - Best Management Practices (BMP) Handbook for storm water infiltration and hazardous material management
    - Environmental Improvement Plan (EIP)
- Other Regional-Scale Plans and Reference Documents
- Plans for Specific Geographic Areas within the Region
- TRPA Code of Ordinances
- TRPA Programs
- TRPA Administrative Manuals.

The 208 Plan was updated by the TRPA in 2012, is mandated by the CWA, and describes the framework for water quality management in the entire Lake Tahoe Basin, the desired water quality outcomes, and the methods to achieve those outcomes. The 208 Plan incorporates, by reference, many documents by local, state, and federal agencies including the TRPA Regional Plan and Regional Plan Environmental Impact Statement, LRWQCB Basin Plan, USFS-LTBMU Land and Resource Management Plan, and General Plans for the City of South Lake Tahoe and El Dorado County.

The 208 Plan includes regulatory protections and restoration of SEZs that provide significant filtering of nutrients and sediment. The BMP Handbook of the Regional Plan describes methods to help developed properties function more like natural, undisturbed forest and meadowland. By implementing BMPs, property owners can help slow the loss of lake clarity. Owners of developed properties must ensure BMPs remain functional and effective to retain their BMP Certificate and comply with the TRPA Code of Ordinances. If BMPs are not functioning effectively due to property owner's failure to inspect, maintain, and monitor them, a BMP Certificate may be revoked by TRPA.

4.3.2 El Dorado County

The land area within the TVS Basin that is located outside of the City of South Lake Tahoe is contained within El Dorado County. As a result land use regulation outside of the City of South Lake Tahoe is shared by the County and TRPA. The County's General Plan regarding land area in the South Lake Tahoe area emphasizes coordination with TRPA and other state and federal agencies with land use jurisdiction in the Lake Tahoe Basin (Policies 2.10.1.1 through 5, Measure LU-O). The General Plan also requires buffers to be established around future water supplies (Policy 2.2.5.14).

4.3.3 City of South Lake Tahoe

Land use regulation is shared by the City and TRPA because the City of South Lake Tahoe is located within the Lake Tahoe Basin. The City's General Plan (adopted 2011) contains many mutually-adopted policies of the two bodies. In addition to coordination with TRPA, coordination with South Tahoe PUD and other water providers is highlighted in the General Plan (Goal PQP-2 and Policies PQP-2.2, 2.5, and 2.7).

Other CSLT land use policies in the General Plan related to protection of water quality include protection of the groundwater basin from overdraft and contamination (Policy PQP-2.9), protection of Lake Tahoe and other surface water streams from storm water pollution through storm water management (Goals PQP-4 and NCR-2, and Policies PQP-4.1 through 4.3, NCR-2.1 through 2.5, NCR-2.13 and NCR-2.14), considerations of snow removal practices (Policy PQP-11.8), and protection and restoration of SEZs and floodplains (Goal HS-4, Policies HS-4.1, 4.2, and 4.4, NCR-2.9 and NCR-2.12). The CSLT is also a co-permittee to the Municipal NPDES Permit to reduce pollutants in storm water.

4.3.4 US Forest Service

The portions of national forest lands that overlie the TVS Basin are in the US Forest Service Lake Tahoe Basin Management Unit (LTBMU). The LTBMU established the Draft Revised Land and Resource Management Plan (LRMP) in 2013 to bring consistency in planning within the portions of the National Forests that lie within the Lake Tahoe Basin. The management of the LTBMU is focused on forest ecosystem and watershed restoration, with an emphasis on erosion control and water quality improvement.

The LTBMU and TRPA share the same planning area, and by law the LTBMU must cooperate with TRPA. Among the relevant goals of the LTBMU Draft Revised LRMP are to preserve clarity in Lake Tahoe by maintaining or improving water quality, soil function, riparian areas, stream process to reduce erosion, and sustained aquatic habitats including for Lahontan cutthroat trout.

In 2014, the Forest Service proposed to amend its internal Agency directives for Watershed and Air Management to establish direction for management of groundwater resources on USFS lands as an integral component of watershed management (USFS 2014). Specifically, the proposed Groundwater Directive FSM 2560 would provide direction on the consideration of groundwater resources in agency activities, approvals, and authorizations; encourage source water protection and water conservation; establish procedures for reviewing new proposals for groundwater withdrawals on USFS lands that include requirements to evaluate the potential impacts on USFS resources; and provide for measurement and reporting for some larger groundwater withdrawals.

4.3.5 Potential Collaboration on Land Use Planning

Land use decisions can have significant effects on groundwater resources, yet land use groundwater management planning is commonly not done in a collaborative and coordinated fashion. However, the Lake Tahoe Region has a rich and complex history of managing land use to protect Lake Tahoe water quality. While source water protection has been an integrated theme in multi-decade, bi-state negotiations, it has had minor emphasis relative to groundwater quality subjects. There is opportunity to increase understanding of source water issues and to raise the profile of the subject in this Region where water quality is the focus of much attention.

Coordination with TRPA on the update of the Regional Plan is a means to better address the needs and issues of water purveyors for groundwater management and protection in the TVS Basin. There are other administrative activities that can also be done. For example, STPUD will provide TRPA with an updated map of water supply source area protection zones and the newly DWR-required recharge area map that can be incorporated into the current TRPA planning, permitting and inspection process. In addition, the USFS is another key agency active in the TVS Basin with land use planning and water resources protection. Addition of the USFS to the SAG may provide mutual benefits in the areas of land use planning and management, groundwater protection, and data and information sharing.

4.4 Oversight of Drinking Water Supply and Wells

Several agencies have responsibilities for regulatory oversight of public water supply systems and water wells to provide a safe water supply to the community and protect groundwater from potential contamination sources.

4.4.1 SWRCB Division of Drinking Water

The DDW classifies these water systems based on the number of connections and whether the users are full time residents or short-term users. The Drinking Water Program is responsible for enforcing the federal and state Safe Drinking Water Acts. The main responsibilities are to: (1) issue permits to drinking water systems, (2) inspect water systems, (3) monitor drinking water quality, (4) set and enforce drinking water standards and requirements, and (5) award infrastructure loans and grants.

DDW Field Operation Branches are responsible for the enforcement of the federal and California Safe Drinking Water Acts and the regulatory oversight of public water supply systems. Water purveyors are required to submit regular water quality analysis data to DDW as part of the Consumer Confidence Reporting Requirements.

4.4.2 County Small Water System Program

The El Dorado County Department of Environmental Health (EDC-DEH) Small Water System Program permits, inspects, and monitors the small public water systems in the County including within the TVS Basin. The County is the Local Primacy Agency, under contract with the DDW (formerly CDPH), to perform the program requirements that are specified in State and Federal Regulations. The purpose of the program is to ensure that small water systems deliver safe, adequate, and dependable potable water. EDC-DEH reviews new applications and changes of ownership to verify that the system will be able to meet technical, managerial, and financial capabilities.

4.4.3 Well Construction and Abandonment Policies

The EDC-DEH is responsible for issuing permits for the construction, destruction, deepening, and repair of water wells. The County Water Well Program is conducted to help prevent potential contamination reaching groundwater via vertical conduits formed by poorly constructed or abandoned wells.

Drillers are required to follow the California Water Well Standards, Bulletin 74-81 and supplements, developed by the DWR for the construction, destruction, deepening, and repair of a water well (DWR, 1981, 1991). EDC-DEH reviews permits submitted by Licensed Well Drillers for setback and development issues; and conducts inspections as required on specific parcels prior to permit approval, during the placement of the annular seal, and at any other time deemed necessary. Well completion reports are required to be submitted within 60 days of well completion and are reviewed prior to final of the well permit.

The District and other public water supply systems will continue to comply with all County permit requirements regarding well construction and abandonment. However, there is no required reporting on the condition or operation of the estimated 600 private wells within the TVS Basin. Information on the condition and use of these wells would be beneficial for supporting groundwater management and water quality protection. This is a potential area for interagency collaboration to document private wells on properties that require BMP or other site inspections as part of their permitting process.

4.4.4 US Forest Service

A special use authorization is required for all individuals or entities other than the USFS to develop water wells or construct water pipelines on USFS lands. The proposed Groundwater Directive FSM 2560 includes provisions for applicants to evaluate other reasonable alternatives before the USFS would authorize new or increased groundwater pumping on USFS lands. This requirement may be waived if the applicant is a public water supplier and the proposed water source is located in a designated municipal watershed (USFS 2014). The USFS may deny proposals to construct wells on or pipelines across USFS lands which can reasonably be accommodated on non-USFS lands and which the proponent is proposing to construct on USFS lands because they afford a lower cost and less restrictive location than non-USFS lands (USFS 2014).

The District currently has one well located on USFS land in the TVS Basin. The District is concerned that the provisions of the proposed Directive may add unnecessary costs to public works projects and make meeting future drinking water demands more difficult to achieve.

The District is the authorized groundwater management agency by the State of California, and has concerns how this Directive on Public Water Systems will affect the efficient management of the shared groundwater resources within the TVS Basin. The District has provided questions and comments to the USFS regarding the Draft Groundwater Directive and will work with the USFS on implementing the proposed Directive and invite the USFS to join the SAG.

4.5 Lake Tahoe Water Quality Management and TMDL

The USEPA has designated Lake Tahoe an Outstanding National Resource Water, which provides for the highest level of protection under USEPA's Antidegradation Policy. There is a rich and complex history of managing land use to protect Lake Tahoe water quality.

4.5.1 Lake Tahoe TMDL

A large portion of water quality regulation in the Lake Tahoe Region is targeted at improving the clarity of Lake Tahoe which has impaired status under CWC Section 303 (d). LRWQCB leads Lake Tahoe TMDL implementation efforts by coordinating local government storm water treatment and erosion control projects, facilitating stream channel restoration work, and overseeing forest management practices. The LRWQCB is working closely with the TRPA to implement its Regional Plan and associated Environmental Improvement Program. In partnership with the Nevada Division of Environmental Protection, the LRWQCB is developing a detailed TMDL accounting, tracking, and reporting program that will provide for regular TMDL progress assessment and adaptive management.

The LRWQCB Basin Plan (LRWQCB, 1995) and TRPA Code of Ordinances (TRPA, 1987) provide a number of water quality standards and control measures to protect the beneficial uses of surface and groundwater. Previously, LRWQCB set maximum concentration limits for runoff discharged to infiltration systems. Amendments to the Basin Plan, including Basin Plan Section 5.6 describes the differing storm water treatment requirements for municipal and public roadways and new development, redevelopment and existing development projects.

Other efforts to reduce potential contamination sources for Lake Tahoe clarity in many cases also reduce potential sources for groundwater contamination as well. For example, wastewater (particularly in septic systems) which constitutes the largest potential source of nutrients has been treated and exported out of the Lake Tahoe watershed since the 1960s. However, there are other potential man-made chemical contaminants from uncontrolled releases from storage, and accidents that are important to manage for groundwater quality. Further integration of groundwater protection into the existing programs to protect surface waters can provide improved groundwater protection in the TVS Basin.

4.5.2 Storm water Management and Monitoring

The LRWQCB has the obligation to implement and enforce the Lake Tahoe TMDL through NPDES storm water discharge permits issued to the California governmental entities (City of South Lake Tahoe, El Dorado County, and the California Department of Transportation). Efforts to improve Lake clarity have included implementation of nonpoint source pollution BMPs for storm water management that is focused on reducing potential contamination sources.

Storm water management includes on-site infiltration. Infiltration to groundwater can be beneficial by providing additional recharge, but may also provide a conduit for contaminants to reach groundwater. The benefit from storm water management BMPs is to limit pollutants to storm water as well as to groundwater through source control, inspections, and other measures.

Both the LRWQCB and the TRPA include vertical separation requirements for constructing infiltration basins to protect groundwater beneficial uses. The Basin Plan states five feet separation between the highest anticipated groundwater level and the bottom of an infiltration system. The TRPA recommends a distance of 12 inches between the bottom of dry wells and seasonal high groundwater. This requirement is set given the potentially higher risk of groundwater contamination in areas with high groundwater underlying infiltration basins.

The LRWQCB adopted the revised storm water municipal NPDES Permit (Board Order No. R6T-2010-1010) (Municipal Permit) for co-permittees that include El Dorado County and the City of South Lake Tahoe. The Municipal Permit, which is consistent with the TRPA Regional Plan, includes particle number and mass-based load reduction requirements in accordance with the Lake Tahoe TMDL Implementation Schedule. The Municipal Permit required the submittal of a Storm Water Management Plan (SWMP) which describes a clear process to expand existing storm water related activities into a program that incorporates a minimum of twelve components.

Storm water for the California Department of Transportation (Caltrans) is regulated under statewide storm water permit Order No. 2012-0011-DWQ issued by the SWRCB. Caltrans is responsible for reducing sediments and nutrients by managing erosion and storm water runoff along US 50 and SR 89 under the TMDL. Caltrans has several erosion/sediment control projects underway to meet the TMDL as well as ongoing operations and maintenance work including street sweeping and abrasive management.

Storm water monitoring to evaluate the effectives of sediment and load reduction is conducted regionally in both California and Nevada by the Tahoe Resource Conservation District (TRCD) under two grants. The TRCD Regional Storm water Monitoring Program represents 8 agencies to fulfill NPDES permit requirements. and involves collecting and analyzing samples of storm water at eleven sites around the perimeter of Lake Tahoe for total nitrogen, total phosphorus, total suspend solids, turbidity and fine sediment particles. (TRCD, 2013)

The Underground Injection Control (UIC) regulations under the USEPA address the subsurface disposal of fluids through drains, pipes, and other constructed conveyances that are intended to permanently infiltrate water below ground surface. Drywells, unlined sumps, seepage pits, and infiltration galleries are some of the terms used to describe the subcategory of injection wells known as shallow Class V injection for non-hazardous fluids. USEPA acknowledges that storm water wells can be a community asset or liability (USEPA, 2002).

4.6 Integrated Regional Water Management Planning

Another activity with potential relevance to the GWMP is the Tahoe-Sierra Integrated Regional Water Management (IRWM) Plan which defines a vision for the management of water resources in the Tahoe-Sierra IRWM Region. The IRWM Region is an area that extends from the Carson River watershed to the south to the Truckee River watershed to the north including the Lake Tahoe Basin. The IRWM Plan highlights important actions needed to accomplish a broad vision through the year 2035 planning horizon and are intended to be a planning tool that provides a framework to address the major water-related challenges facing the IRWM Region.

The updated Tahoe-Sierra IRWM Plan was completed in summer 2014 and the information contained within this IRWM Plan was developed through the time and contributions of more than 30 water supply, wastewater treatment, land use management, public interest, and ecosystem-focused organizations with interests in the water resources of the Tahoe-Sierra IRWM Region. Six local agencies submitted projects in the IRWM Plan that directly or indirectly influence groundwater management which are detailed in Appendix B.

The IRWM Plan process provides another venue for collaboration with other local water districts, land use planning and regulatory agencies in the area, and provides an opportunity developing and funding projects to support groundwater management.

TABLE 4-1
LIST OF GROUNDWATER RELATED GOVERNMENTAL AGENCIES IN LAKE TAHOE AREA

		Regulatory Authority/Programs That Relate to Groundwater				
Agency	**Geographic Jurisdiction**	**Surface Water Quality**	**Ground Water Quality**	**Drinking Water**	**Land Use**	**Hazardous Materials**
USEPA	Nationwide and some programs in California (CA)	Clean Water Act (CWA)	Underground Injection Control (UIC)	Safe Drinking Water Act (SDWA)	--	TSCA, CERCLA
Tahoe Regional Planning Agency (TRPA)	CA and Nevada (NV) within the Lake Tahoe Basin	Lake Tahoe Water Quality Management Plan under Section 208 of CWA and TRPA Regional Plan		--	TRPA Regional Plan and associated Storm water BMP Handbook	
State Water Resources Control Board (SWRCB)	CA Statewide	With RWQCBs regulates discharges to surface water and groundwater statewide under CWA[1] and Porter Cologne Water Quality Control Act (WQCA)		DDW[2] - SDWA for large water systems	--	Brownfields and Land Disposal Program
Lahontan Regional Water Quality Control Board (LRWQCB)	Lahontan Region including CA portion of Lake Tahoe Basin	Basin Plan[3]/TMDL and Lake Tahoe Municipal Storm water Permit	Basin Plan, Underground Storage Tank (UST), Site cleanup Program,	--	--	
El Dorado County Environmental Health (EDC-DEH)	El Dorado County portion of Lake Tahoe Basin	--	Water Well Program	SDWA for small water systems Water Well Program	County General Plan outside of City limits	Certified Unified Program Agency (CUPA), Hazardous waste/material generator permits
City of South Lake Tahoe (CSLT)	Within City Limits	Complies with Lake Tahoe Municipal Storm water Permit	--	--	City General Plan	--
US Forest Service – LTBMU	National Forest Lands in CA and NV within the Lake Tahoe Basin	Land and Resource Management Plan	Proposed Groundwater Directive FSM 2560	--	Land and Resource Manage-ment Plan	--

Notes:

(1) SWRCB/RWQCB has primacy to implement much of CWA regulatory activity

(2) SWRCB –Division of Drinking Water (DDW, formerly CDPH), El Dorado County is a Local Primacy Agency under contract to SWRCB-DDW for regulating small public water systems;

(3) Basin Plan implements, for the Lahontan Region, state and federal laws including CWA, Porter Cologne WQCA, SDWA, and other hazardous material laws by setting water quality standards

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Section 5: State of the Groundwater Basin

This section describes the recent groundwater level data to assess the overall quantity of groundwater available in the TVS Basin.

5.1 Description of the Aquifers

Most water wells drilled in the TVS Basin are completed in basin-fill deposits that generally consist of unconsolidated glacial, lake and stream sediments. These sedimentary deposits fill the lower reaches of the canyons that drain toward Lake Tahoe and underlie the relatively flat lying valley floors. These deposits can be over 1,000 feet thick in the deeper portions of the basin, but thin toward the basin margins where they cover shallow bedrock areas.

Permeability of these sediments differs considerably, both spatially within each unit and between the different units. In general, high permeabilities are found in glacial outwash and fluvial deposits, while glacial moraine and lacustrine deposits tend to have low permeability (Thodal, 1997; Fogg *et al*, 2007).

Fogg et al. (2007) used lithologic and geophysical logs to construct a series of 10 regional cross-sections through the TVS Basin. They identified at least 26 water-bearing zones within the basin-fill aquifer using the logs, and interpreted correlations to divide the basin-fill into 11 layers, representing regionally correlated units of high and low permeability. Units of relatively high permeability typically correspond to coarse-grained glacial outwash, fluvial and deltaic deposits forming the basin-fill aquifer. The laterally continuous fine-grained lacustrine (lake-bed) deposits form local confining layers or aquitards that affect groundwater flow between these higher permeability deposits.

The glacial deposits were formed as valley glaciers advanced north toward Lake Tahoe through the Upper Truckee River Valley during at least three episodes of glaciation between 3 million and 12,000 years ago. As these glaciers advanced and receded, they formed lateral moraines along the edges of the glaciers path and terminal moraines at the ends of the glaciers advance. These moraine deposits are typically jumbled deposits of clay to boulder size material with moderate permeability. Sediment-laden melt-waters from the receding glaciers flowed in streams, in front of the terminal moraines, north toward Lake Tahoe. These streams dropped their sediment loads along their stream channels and in broad coalescing flood fans and outwash plains. These outwash fan and fluvial channel deposits are composed of layered beds of well sorted gravel, sand and silt size material, with moderate to high permeability. Where these glacial streams deposited sediment directly into Lake Tahoe, thick deltas were formed of inter-layered sand and fine-grained silt and clay. These delta sequences grade laterally with:

- lakeshore deposits consisting of moderately well sorted sand and gravel deposits with relatively high permeability;
- inter-fan and marsh deposits consisting of fine-grained sand, silt and clay; and
- lake deposits, consisting of silt and clay.

The relatively high permeability glacial outwash and delta deposits form excellent groundwater aquifers. The best of these aquifers have been found in the north, primarily beneath the present day Truckee Marsh. Both the inter-fan, marsh and lake deposits are fine-grained and have relatively low permeability. These fine-grained deposits form at least four locally extensive aquitards that separate the reservoirs into a minimum of at least five distinct regional aquifers. Where the sediment types are layered, aquifer can be characterized as different water-bearing zones (WBZ). Where the fine-grained confining layers are more discontinuous, the water-bearing zones act as leaky or semi-confined aquifers. The shallowest intervals occur in the upper 200 feet. These water-bearing zones are unconfined to semi-confined depending on the continuity and relative permeability of the overlying fine-grained layers. These shallow water-bearing zones are the zones that interact most with surface waters.

Figure 5-1 shows a conceptual hydrogeological cross section across the northern portion of the TVS Basin to illustrate these water-bearing zones. Up to five of these zones have been identified as being practical for groundwater management (Bergsohn, 2011). The different water-bearing zone (WBZ) designations are informal and are based on local geographic area and the stratigraphic order is shown as a subscript showing the order in which they occur from deep to shallow depth (1 = lowermost zone; 5 = uppermost zone). The deepest zone (WBZ_1 on Figure 5-1) occurs in the deepest portions of the basin, generally at depths below 600 feet, and may act as a confined aquifer and may locally show artesian conditions. The middle two zones (WBZ_2 and WBZ_3 on Figure 5-1) represent the interval at depths between 200 to 600 feet.

Ten additional hydrogeological cross sections are provided in Appendix C. These draft cross sections were developed by the District in September 2005 to show the geologic characteristics and WBZs throughout the basin. Although not finalized, these cross sections have been utilized by the District for groundwater management since 2005, so are included in this GWMP.

5.2 Groundwater Conditions

A key component of the GWMP is to assess the current groundwater level conditions in the aquifer to provide the technical basis for an assessment of long-term trends.

5.2.1 Groundwater Level Data

Groundwater level data are measured by the District in several wells that are completed in the TVS Basin. Construction details for these wells are provided in Table 5-1 and generalized locations are shown on Figure 5-2. The water-bearing zones are informal designations using geographically-based groundwater areas (Christmas Valley, Meyers, Angora, South Lake Tahoe, Tahoe Keys and Bijou) as shown on Figure 5-2. A description of each of these areas is provided in Appendix D. The District collects semi-annual measurements timed to coincide with seasonal low (November) and high (May) groundwater elevations and continuous readings on a daily basis from selected wells using dedicated water-level monitoring equipment.

The hydrographs for wells within each of these areas presented on Figures 5-3 to 5-11 using the semi-annual hand readings and are for the period from 2000 to 2013. These readings are collected over a two-day period to coordinate with water operations and allow production wells to be turned-off for a minimum 12-hour recovery period prior to measurement. Brief interpretations on groundwater conditions from these water level trends are provided below. In general groundwater levels show relatively stable trends that do not indicate any long-term declines suggesting overdraft. Figure 5-2 shows well locations discussed through this section.

Vertical gradients indicate whether groundwater is moving upward or downward through the alluvial aquifer. This is determined using sets of wells that are located near each other but are screened at different depths. The hydrographs include plots for several sets of wells that are approximately co-located; these sets can be used to investigate vertical gradients.

TABLE 5-1
STPUD WELL CONSTRUCTION SUMMARY

Well Name	Well Type	Well Yield (gpm)	Well Screen (WBZ)	Annular Seal Length
Al Tahoe	Active Production	2,500	110 to 140 ft bgs ($SLTZ_5$) 180 to 240 ft bgs ($SLTZ_4$) 280 to 290 ft bgs (BZ_2) 300 to 400 ft bgs ($SLTZ_3$)	105-ft
Apache Street	Observation	n/a	113 to 134 ft bgs (CVZ_4)	109-ft
Arrowhead	Active Production	1,000	250 to 280 ft bgs (MZ_{34})	235-ft
Arrowhead Cluster				
SW-1	Observation	n/a	10 to 40 ft bgs (CVZ_4)	5-ft
IW-1	Observation	n/a	121 to 151 ft bgs (CVZ_4)	102-ft
DW-1	Observation	n/a	225 to 265 ft bgs (MZ_{34})	213-ft
Bakersfield	Active Production	1,500	130 to 170 ft bgs (MZ_4) 180 to 240 ft bgs (MZ_3)	125-ft
Bayview	Active Production	3,600	180 to 300 ft bgs ($SLTZ_4$) 340 to 370 ft bgs ($SLTZ_3$) 410 to 430 ft bgs ($SLTZ_3$) 510 to 540 ft bgs ($SLTZ_2$)	170-ft
Chris	Limited Operation Production	115	86 to 95 ft bgs ($SLTZ_4$) 100 to 156 ft bgs ($SLTZ_4$)	50-ft
Clement	Inactive Production	180	40 to 120 ft bgs (TKZ_5)	40-ft
Clement Cluster				
CL-1	Observation	n/a	104 to 114 ft bgs (TKZ_5)	100-ft
CL-3	Observation	n/a	39 to 49 ft bgs (TKZ_5)	36-ft
College	Standby Production	1,200	240 to 340 ft bgs (BZ_3)	50-ft
Country Club	Inactive Production	160	114 to 184 ft bgs (MKZ_4)	65-ft
Elks Club #1	Converted to Observation	n/a	87 to 90 ft bgs ($SLTZ_3$) 110 to 142 ft bgs ($SLTZ_3$)	none
Elks Club #2	Active Production	300	110 to 160 ft bgs ($SLTZ_3$) 213 to 223 ft bgs ($SLTZ_1$)	96-ft
ESB-2	Observation	n/a	218 to 228 ft bgs (MZ_4)	210-ft
Glenwood #3	Converted to Observation	n/a	112 to 192 ft bgs (BZ_4)	54-ft
Glenwood #5	Active Production	1,100	150 to 180 ft bgs (BZ_4) 210 to 220 ft bgs (BZ_3)	140-ft
Helen #2	Active Production	260	90 to 150 ft bgs ($SLTZ_4$)	52-ft

Well Name	Well Type	Well Yield (gpm)	Well Screen (WBZ)	Annular Seal Length
Henderson	Observation	n/a	79 to 100 ft bgs (CVZ_4) 142 to 205 ft bgs (CVZ_3, CVZ_2)	65-ft
Industrial No. 2	Converted to Observation	110	40 to 92 ft bgs (TKZ_5) 97 to 107 ft bgs (TKZ_4) 110 to 190 ft bgs (Und.[1])	n/a
Lily Lane	Observation	n/a	37.5 ft bgs ($SLTZ_5$) 64 ft bgs ($SLTZ_5$)	n/a
Mountain View	Inactive Production	160	95 to 164 ft bgs (AZ_1) 210 to 245 ft bgs (AZ_1)	24-ft
Paloma	Active Production	2,500	188 to 248 ft bgs ($SLTZ_4$) 268 to 408 ft bgs ($SLTZ_3$)	172-ft
South Upper Truckee #1	Converted to Observation	n/a	136 to 262 ft bgs (CVZ_3, CVZ_2, CVZ_1)	19-ft
South Upper Truckee #3	Active Production	1,200	70 to 90 ft bgs (CVZ_4) 160 to 180 ft bgs (CVZ_3) 220 to 240 ft bgs (CVZ_2) 260 to 270 ft bgs (CVZ_1) 280 to 310 ft bgs (CVZ_1)	50-ft
Sunset	Active Production	600	275 to 430 ft bgs $SLTZ_3$ and $SLTZ_2$)	255-ft
Tata Well #2	Observation	n/a	73 to 193 ft bgs TKZ_5 and $SLTZ_3$	54–ft
Tata Well #3	Observation	n/a	55 to 75 ft bgs (TKZ_5) 200 to 220 ft bgs ($SLTZ_3$)	none
USGS TCF-1	Observation	n/a	335 ft bgs (BZ_1)	n/a
USGS TCF-2	Observation	n/a	255 ft bgs (BZ_3)	n/a
USGS TCF-3	Observation	n/a	163 ft bgs (BZ_4)	n/a
USGS TCF-4	Observation	n/a	135 ft bgs (BZ_4)	n/a
Valhalla	Active Production	675	110 to 170 ft bgs (TKZ_4)	100-ft
Washoan	Multi-level Observation	n/a	102 to 144 ft bgs ($SLTZ_4$) 165 to 186 ft bgs ($SLTZ_3$) 207 to 228 ft bgs ($SLTZ_2$) 249 to 270 ft bgs ($SLTZ_1$)	74-ft

Notes: n/a – not available
gpm – gallons per minute
wbz – water bearing zone
[1] – Undefined or uncorrelated water-bearing zone

5.2.2 Groundwater Level History

Figure 5-3 shows groundwater elevations from four well sites located near the north margin of the TVS Basin (near the south shore of Lake Tahoe), within the South Lake Tahoe groundwater (GW) area (Figure 5-2). The Bayview, Al Tahoe and Paloma Wells are large-capacity drinking water production wells that pump from the intermediate and deeper portions of the aquifer from 110 to 540 ft bgs (Table 5-1). This is the GW area of greatest groundwater production from the TVS Basin, and each the well yields of these wells range from 2,500 to 3,600 gpm (Table 5-1). The groundwater levels in these three wells generally track each other and the long-term trend is relatively stable.

The Lily Lane Wells is a nested observation well, consisting of a paired deep and shallow well that monitors groundwater elevations near the active production wells (Table 5-1). There is little difference in groundwater elevations between these two wells, indicating horizontal flow toward Lake Tahoe at this location. Comparing the Lily Lane Wells to the Lake Tahoe lake level (USGS 10337000) indicates that groundwater levels closely track Lake Tahoe stage elevation. Comparing the hydrographs between the Lily Lane Wells and the production wells does not show any significant effect from the pumping on shallow groundwater levels.

Figure 5-4 shows groundwater elevations from five well sites located within the South Lake Tahoe GW area (Sunset, Helen Well #2, Chris Wells, College and USGS TCF 1). The Chris and Helen #2 Wells are relatively shallow wells, whereas the Sunset Well is completed in the intermediate and deeper portions of the aquifer. The well yields for these wells differ with the well yield for the shallower Chris Well of about 115 gpm whereas the well yield for the Sunset Well is about 600 gpm. The Chris Well is a limited operation due to the presence of a nearby MtBE plume. Inspection of the hydrographs shows that the Chris and Helen Wells track each other and follow a stable trend. The groundwater levels in the College Well also follow a stable trend consistent with the other wells. A slight declining trend is noted in the hydrograph for the Sunset Well. Comparison of the hydrographs for Chris, Helen and Sunset Wells may suggest a local pumping effect from the Sunset Well on $SLTZ_4$.

The USGS TCF well is a nested well consisting of five observation wells completed in a single borehole (Table 5-1) that monitors groundwater levels at varying depths near Trout Creek (Figure 5-2). Each of the water bearing zones monitored by this nested well are considered to be confined or semi-confined by the intervening clay and peat layers. Comparing the vertical difference in groundwater levels indicates upward flow from BZ_1 and BZ_3 toward BZ_4 and downward vertical flow from BZ_5 toward BZ_4. The complex vertical flow directions observed in the nested well may result from the lowered potentiometric head in BZ_4 induced by pumping of the Glenwood Well #5.

Figure 5-5 shows groundwater elevations from four well sites located in the southwest part of the South Lake Tahoe GW area, near the “Y” track each other and follow a stable trend (Figure 5-5). There are currently no active drinking water wells through this GW area. The Clement, Industrial Well No. 2, Tata #2 and Tata #3 are all inactive drinking water production well that were removed from service. The well screen intervals for both of the Tata wells cross an aquitard which separate water-bearing zones TKZ_5 and $SLTZ_3$.

CL-1 and CL-3 are observation wells which were constructed as a well cluster at the Clement Well site. Both CL-1 and CL-3 monitor groundwater levels from the uppermost water-bearing zone (TKZ_5). Comparison of the vertical difference in groundwater levels (Figure 5-5) shows higher elevations in the shallow well indicating that vertical flow is directed downward through

TKZ_5 in this GW area. Downward directed vertical flow through a water-bearing zone is often a characteristic of recharge areas; however it may also be induced by pumping. As there are currently no active drinking water wells through this GW area, the downward vertical flow observed in CL-1 and CL-3 wells suggest that these wells are located within a recharge area.

Figure 5-6 shows groundwater elevations from one well site located within the northeast portion of the TVS Basin in the Bijou GW area. The Glenwood Well #3 is a former drinking water well that was removed from service and converted to an observation well in 2002. The Glenwood Well #5 is an active drinking water production well with a well yield of 1,100 gpm. Inspection of the hydrographs shows that the Glenwood Wells track each other and follow a declining trend from 2002 through 2007 and a rising trend since 2007. In 2007, the District started restricting production from the Glenwood Well #5 to late May through November to help sustain the aquifer. This well is temporarily off, with the exception of flushing flows and sampling from November through May. The hydrograph shows that this change in operation is helping to maintain groundwater levels.

Figure 5-7 shows groundwater elevations from the Valhalla Well, an active drinking water production well, located within the northwest portion of the TVS Basin, near Camp Richardson (on USFS-LTBMU managed lands) west of the Tahoe Keys GW area. Inspection of the hydrograph shows water levels in the Valhalla Well following a declining trend from 2000 through 2008 and a rising trend since 2008. In 2008, the District started restricting production from the Valhalla Well and reduced its well yield from 1,000 to 675 gpm to help sustain the aquifer. The hydrograph shows that this change in operation is helping to maintain groundwater levels.

Figure 5-8 shows groundwater elevations the Elks Club #1, Elks Club #2 and Washoan Wells located within the central portion of the TVS Basin, near the north end of the Meyers GW area. The Elks Club #1 and Washoan Wells are observation wells, and the Elks Club Well #2 is an active drinking water production well. Inspection of the hydrographs shows that the Elks Club Well #1 and Washoan wells track each other and follow a stable trend. The Elks Club Well #2 shows a slight declining trend since 2007.

Figure 5-9 shows groundwater elevations from four well sites located within the central portion of the TVS Basin, near the southwest part of the Meyers GW area. The Arrowhead Well #3 and Bakersfield Well are active drinking water production wells. The Apache Street Well is a sentinel well, located east of the Arrowhead well site. SW-1, IW-1 and DW-1 are observation wells which were constructed as a well cluster at the Arrowhead Well site. Inspection of the hydrographs shows that the relatively shallow wells (SW-1, IW-1 and Apache Street Well track each other and follow a stable trend. The deep wells (DW-1, ESB-2, Arrowhead Well #3 and Bakersfield Well) also track each other and follow a stable trend. Comparison of the hydrographs between the shallow wells and the deep production wells (Arrowhead Well #3 and Bakersfield Well) have not shown a significant pumping effect from these wells on groundwater level elevations measured from CVZ_4.

Comparison of the vertical difference in groundwater levels in the Arrowhead Cluster (SW-1, IW-1 and DW-1) show higher elevations in the shallow and intermediate wells compared to the deep well indicating that vertical flow is directed downward through CVZ_4 and further from CVZ_4 toward MZ_{34}. These downward directed vertical gradients may result from lowered potentiometric head in MZ_{34} induced by pumping and/or may be indicative of a recharge area.

Figure 5-10 shows groundwater elevations from two well sites located within the central portion and near the west margin of the TVS Basin, in the Meyers and Angora GW areas. The Country Club Well is an inactive drinking water production well. The Mountain View Well was removed from service in 2014, due to declining well yield and inadequate well construction. Well yields declined from an original 160 gpm to about 11 to 43 gpm. The hydrographs for both of these wells are stable (Figure 5-10).

Figure 5-11 shows groundwater elevations from Henderson, South Upper Truckee #1 and South Upper Truckee #2 well located near south end of the TVS Basin within the Christmas Valley GW area. Inspection of the hydrographs shows that the wells track each other and follow a stable trend.

5.2.3 Groundwater Flow

Groundwater elevation contour maps for the November 2013 and May 2011 are presented in Figure 5-12 and 5-13 to represent a low and high groundwater level condition, respectively. The typical pattern is for the highest groundwater conditions to occur in the spring following the spring snowmelt and runoff. The lowest groundwater conditions typically occur in the late summer and early fall due to low recharge following the relatively dry summer months and increased groundwater pumping to meet seasonal demand. In addition, the November 2013 represents a period of historic drought, and May of 2011 follows an unusually wet winter and spring. Therefore, these two periods are representative of the maximum range in groundwater levels and how that would affect groundwater flow. The November 2013 groundwater elevations were measured in November, whereas the May 2011 elevations were measured in May.

Groundwater levels were contoured based on groundwater level measurements for all monitoring wells located in the TVS Basin. As indicated in Table 1 of the Monitoring Plan (Appendix D), the basin-fill deposits include a multitude of confined, semi-confined and unconfined water-bearing zones. To make maximum of the available data, all wells are contoured together regardless of the water-bearing zone. This is considered appropriate to illustrate the general pattern of groundwater flow in the TVS Basin. Since the distribution of data is uneven, the contouring also factored topography, especially in the vicinity of the major streams with the assumption that stream levels are generally below the groundwater surface. In the vicinity of the major streams, this allowed for a cursory assessment of groundwater surface-water interactions discussed in Section 5.3.

Groundwater flows are generally directed from areas of high to low groundwater elevations. The relative rate of groundwater flow (i.e., velocity) is proportional to the hydraulic gradient and the hydraulic conductivity of the water-bearing zone. On the generalized groundwater contour maps, assuming that the hydraulic conductivity is constant, closely spaced contours indicate steeper hydraulic gradient and higher anticipated groundwater velocity. Conversely, more widely spaced contours indicate a shallow hydraulic gradient and lower anticipated groundwater velocity.

The general groundwater level pattern observed in the TVS Basin is for higher groundwater levels to occur along the basin margins where runoff from the surrounding mountains recharges the groundwater basin. Figures 5-12 and 5-13 shows some convergence of groundwater contours towards the major streams (Upper Truckee River and Trout Creek), suggesting an overall net loss of groundwater to these stream channels in these areas. Highest groundwater levels occur in the Christmas Valley GW area which are also forms the topographically highest portion of the valley floor. Lowest groundwater elevations occur along the south shore of Lake Tahoe which is the primary discharge area for groundwater to surface water.

Inspection of Figures 5-12 and 5-13 show a localized cone of depression surrounding the largest municipal drinking water production wells currently active in the TVS Basin (Bayview, Al Tahoe #2 and Paloma Well). This cone of depression may be an artifact resulting from the contouring of groundwater elevations collected from disparate water-bearing zones. Mapping groundwater elevations in individual water-bearing zones would be needed to better define the boundaries of this inferred depression. Lower groundwater elevations are also inferred to occur around the Tahoe Keys GW area and extend southward towards the Sunset Well. Groundwater flow patterns are likely more complex than indicated on the generalized contour maps due to vertical gradients, aquifer heterogeneity, distribution of surface water features, and pumping effects from drinking water production wells.

Inspection of Figures 5-12 and 5-13 indicates that hydraulic gradients vary across the TVS Basin. The spacing of groundwater elevation contours suggests that hydraulic gradients are steepest near the highlands along the basin margins and tend to decline across the valley floor and toward the south shore of Lake Tahoe. Twin Peaks, located near the center of the TVS Basin is a granitic outcrop that also appears to influence groundwater contours and neighboring groundwater flow patterns. Groundwater flow patterns also appear to be influenced by glacial till deposits located along the east (Skyline Ridge) and west (Angora Ridge) margins of the TVS Basin.

Comparison of Figures 5-12 and 5-13 shows that the generalized pattern of groundwater flow remains similar between the November 2013 and May 2011. This is consistent with the hydrograph data (presented in Section 5.2) that shows the typical variation in groundwater levels is on the order of a few feet.

5.3 Groundwater-Surface Water Interactions

Groundwater and surface water systems are connected. As indicated in the previous section (Section 5.2.3), groundwater discharges to the stream channels along much of the Upper Truckee River and Trout Creek. These groundwater discharges (i.e., base flow) provide a component of the total streamflow that accounts for a substantial proportion of total stream flow during the late summer and fall when runoff from the surrounding mountains has diminished. During the winter and spring, the majority of total stream flows is provided by seasonal storm or melts waters and the proportion of the total flow attributed to base flow is relatively low.

A potential consequence of the connection between groundwater and surface water systems is that pumping from drinking water production wells has the potential of reducing base flow to streams, which could affect SEZs and the aquatic and biologic resources dependent on these habitats. The potential impact of groundwater withdrawals on surface water systems depends on a multitude of variables including, but not limited to: the aquifer properties of the groundwater system; the arrangement of aquitards and confining layers between the water-bearing zone(s) and the surface water system; the distribution and construction of neighboring drinking water production wells; and the timing and magnitude of groundwater withdrawals from those wells.

Municipal water supply wells that are located near major streams include seven wells located near the Upper Truckee River (SUT#3, Arrowhead #3, Bakersfield Well, Elks Club #2, Helen #2, Sunset Well and TKWC Well #1) and two wells located near Trout Creek (Paloma and Bayview Wells) The Glenwood Well #3 is located near Bijou Creek, which is a minor tributary to Lake

Tahoe, east of Trout Creek. Evaluation regarding the potential effect of groundwater withdrawals from most of these wells on the surface water system has been performed to various levels of completion. A brief summary of these evaluations is provided below. Further evaluation would be needed to ascertain whether groundwater withdrawals from private company wells, small community water system wells and private wells have a substantial effect on the surface water system.

5.3.1 Estimates of Pumping Effects on the Upper Truckee River

The SUT#3 Well is located approximately 600 west of the main channel of the Upper Truckee River. Aquifer properties derived from data collected during the drilling and testing of this well were used to estimate potential stream depletion from the pumping of this well. From this evaluation, the average rate of stream depletion may represent about ten percent of the base flow through this reach of the Upper Truckee River in the fall (I. Bergsohn, pers comm, 2014).

The Arrowhead #3 Well is located approximately 2,300 east of the main channel of the Upper Truckee River. Based on evaluation of lithological, aquifer test, water chemistry and water level elevation monitoring data, the District believes that this well pumps groundwater from a confined water-bearing zone (MZ_{34}) which is hydraulically separated from the overlying shallow water-bearing zone (CVZ_4). Vertical hydraulic conductivity for the intervening confining layer is estimated at 2 x 10^{-5} centimeters per second (cm/sec) which is relatively low (Bergsohn, 1999). As the surface water of the Upper Truckee River is connected to the shallow water-bearing zone (CVZ_4), pumping of the Arrowhead 3# Well, would not appear to have a substantial effect on the surface water in the Upper Truckee River.

The Bakersfield Well is located approximately 1,000 east of the main channel of the Upper Truckee River. Geophysical logging and aquifer test data indicates that this well also pumps groundwater from a confined water-bearing zone (MZ_3, MZ_4) which is hydraulically separated from the overlying shallow water-bearing zone (MZ_5).. Vertical hydraulic conductivity for the intervening confining layer is estimated at 6 x 10^{-6} cm/sec, which is very low. Findings from this evaluation suggest that there does not appear to be any direct hydraulic connection between the water-bearing zone pumped by the Bakersfield Well and the surface water in the Upper Truckee River (AGRA, 1994).

The Elks Club #2 Well is located approximately 1,000 east of the main channel of the Upper Truckee River. Lithological and aquifer test data indicates that this well pumps groundwater from a confined water-bearing zone (MZ_3, MZ_4) which is hydraulically separated from the overlying shallow water-bearing zone (MZ_5). A more than 50-foot section of clay forms the intervening confining layer (Nimbus Engineers, 2004). As the surface water of the Upper Truckee River is connected to the shallow water-bearing zone (MZ_5), pumping of the Elks Club #2 Well does not appear to have a substantial effect on the surface water in the Upper Truckee River.

The Helen #2 Well is located approximately 1,400 feet west of the main channel of the Upper Truckee River. Pumping test analysis of the Helen #2 Well indicates that this well is hydraulically connected to the lower portion of the uppermost water-bearing zone ($SLTZ_5$). Head differences between shallow and deep well pairs indicate that pumping of the Helen #2 Well increases vertical hydraulic gradients between the upper portion of water table and the lower portion of $SLTZ_5$. The vertical hydraulic conductivity of the confining layer intervening between the upper and lower portion of $SLTZ_5$ is estimated to be on the order of 1 x 10^{-5} cm/s, which is relatively low (Bergsohn, 2000), Review of these data suggest that pumping of the Helen #2

Well does not appear to have a substantial effect on the surface water in the Upper Truckee River.

The Sunset Well is located approximately 500 feet northeast of the main channel of the Upper Truckee River. Lithological, geophysical log, water chemistry and aquifer test data indicates that this well pumps groundwater from a confined water-bearing zone ($SLTZ_2$, $SLTZ_3$) which is hydraulically separated from the overlying shallow water-bearing zone ($SLTZ_5$) Evaluation of projected drawdowns in $SLTZ_5$ from pumping of the Sunset Well are estimated to be on the order of 0.1 foot or less (KSA,1991). As the surface water of the Upper Truckee River is connected to the shallow water-bearing zone ($SLTZ_5$), pumping of the Sunset Well does not appear to have a substantial effect on the surface water in the Upper Truckee River.

5.3.2 Estimates of Pumping Effects on Trout Creek

The Paloma Well is located approximately 600 feet northeast of the main channel of Trout Creek. The Paloma Well pumps groundwater from two differing water-bearing zones. The upper zone ($SLTZ_4$) is semi-confined and is bounded by an overlying confining layer of limited lateral extent. South of the Paloma Well good hydraulic connection occurs between $SLTZ_4$ and the overlying shallow water-bearing zone ($SLTZ_5$) (Bergsohn, 1999). The effect of increased groundwater withdrawals from District wells on the Upper Truckee Marsh were evaluated using a groundwater model. Simulations from this modeling exercise showed that a fifty percent increase in groundwater withdrawals from the Al Tahoe and Paloma Wells could result in an estimated two to three foot decline in shallow groundwater elevation underlying the Upper Truckee Marsh over and above the effect from changes in stage level of Lake Tahoe (AGRA, 1999).

The Bayview Well is located approximately 650 feet east of Trout Creek and approximately 1,250 feet south of the south shore of Lake Tahoe. The Bayview Well pumps groundwater from three differing water-bearing zones. Like the Paloma Well, the upper most water-bearing zone ($SLTZ_4$) pumped by the Bayview Well is semi-confined. Aquifer test data from this well indicates that the water-bearing zones pumped by the Bayview Well appear to be hydraulically connected to Lake Tahoe (Bergsohn, 2004).

5.3.3 Estimates of Pumping Effects on Bijou Creek

The Glenwood #5 Well is located approximately 400 northeast of Bijou Creek. An approximately 60-foot thick clay horizon forms the near surface deposits through this GW area (Nimbus, 2002). Lithological correlations show that this clay horizon is extensive across the Bijou GW area (Fogg *et al*, 2007). This clay horizon would appear to mitigate any pumping effects of the Glenwood #5 Well on surface water in Bijou Creek.

5.4 Preliminary Groundwater Budget

Another method for assessing groundwater conditions is to conduct a groundwater budget analysis that balances the recharge and discharge of groundwater in the TVS Basin. A formal and complete groundwater budget is not available, but previous studies and data are available to assemble a preliminary groundwater budget that helps to provide more insight into assessing and managing groundwater levels in the TVS Basin.

5.4.1 Sustainable Yield

Sustainable yield is the amount of water which can be withdrawn from a groundwater basin without producing an undesirable result. It is often limited to the rate of natural recharge to the groundwater system. Under the SGMA, the safe yield is more explicitly defined as a sustainable yield which is “the maximum quantity of water calculated over a base period that is representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result” (CWC Section 1072 (v)). The allocations defined in the Compact for use in the South Lake Tahoe Area (see Section 3.2.1) exceed the estimated total groundwater recharge to the TVS Basin. Therefore, allocation amounts would not appear to be acceptable objectives for sustainable groundwater management of the TVS Basin.

The DWR is required to publish best management practices to achieve groundwater sustainability by January 1, 2017. Future groundwater budgets for the TVS Basin should consider applying alternate methods for estimating recharge, such as using changes in water levels (i.e., Water-Table Fluctuation Method) to improve the preliminary estimate. Methods used for improving the recharge estimate, should be consistent with the best management practices recommended by DWR.

5.4.2 Groundwater Withdrawals

As discussed in Section 3.2, more than 95% of the potable water used in the TVS Basin is from groundwater withdrawals pumped from the TVS Basin. Groundwater withdrawals from the District’s public water system average about 7,060 AFY. Groundwater withdrawals from the two largest private water companies, TKWC and LBWC average about 784 AFY and 355 AFY, respectively. Using an inferred average daily water use of about 2,000 gallons per day per well for small community water system wells results in an estimated average total groundwater withdrawal of 85 AFY for these wells. Using an inferred average daily water use of about 200 gallons per day per well for private wells results in an estimated average total groundwater withdrawal of 140 AFY for these wells. Using these values the total groundwater withdrawals from wells operating in the TVS Basin is estimated at about 8,394 AFY. Over the total area of the TVS Basin (14,814 acres), this equates to an average groundwater usage of about 0.6 acre-feet per acre.

5.4.3 Groundwater Recharge

Recharge to the groundwater system is derived from two main sources, which include infiltration of precipitation that falls directly on the land surface overlying the TVS Basin and groundwater that flows into the groundwater basin from the surrounding bedrock. Evaluation of stable isotope levels in groundwater collected from deep wells indicate that deep groundwater is sourced from precipitation in high elevation areas. This suggests recharge by surface water or shallow groundwater flowing down the mountain front and recharging at the base of the mountain front; and groundwater recharge at high elevation deep into the mountain block (Fogg *et al*, 2007).

Table 2.1 shows that the total precipitation in the Lake Tahoe Basin averages about 32 inches per year. Over the area of the TVS Basin, this equates to about 39,500 AFY. Water budgets used in groundwater models of the TVS Basin, typically assume that about 25 percent of this precipitation is used as recharge to the groundwater system (AGRA, 1999; ASCOE, 2003; Fogg *et al*, 2007). Assuming that groundwater recharge from the surrounding bedrock is negligible; a preliminary estimate for total groundwater recharge to the TVS Basin is about 9,876 AFY.

Future groundwater budgets for the TVS Basin should consider applying alternate methods for estimating recharge using changes in water levels (i.e., Water-Table Fluctuation Method) to improve the preliminary estimate.

5.4.4 Natural Discharge

Natural discharge of groundwater would include groundwater discharge directly to Lake Tahoe, gaining reaches of local streams, evapotranspiration. Many of these parameters are difficult to estimate, but some previous studies and data are available.

The ASCOE (2003) study evaluated discharge of groundwater directly to Lake Tahoe as part of an assessment of salt and nutrient loading to the Lake via this mechanism. A model was developed to evaluate the discharge of groundwater directly to Lake Tahoe. Those estimates ranged from 1,200 to 2,600 AFY, with an average of 1,980 AFY. A second estimate applying Darcy's Law was of 1,400 AFY used to validate these estimates.

Estimates of groundwater discharge to the streams have not been developed; however, hydrologic studies for streams estimate the baseflow component representing low, summertime flows that are mostly sustained by groundwater discharge to the streams for the Upper Truckee River and Trout Creek to range from 2 to 10 cfs (Jeton, 1999). If the baseflow is assumed to primarily represent streamflows sustained by groundwater, then this would represent a natural discharge on the order of 1,500 to 7,500 AFY.

The vegetation in the meadows and riparian areas along the streams would also represent a natural discharge that would likely represent the difference between the total recharge and the natural and pumping discharges.

5.4.5 Water Balance Summary

The water balance summary indicates that groundwater withdrawal removes about 85 percent of the total groundwater recharge to the TVS Basin. Since groundwater levels are remaining stable, there appears to be no net long-term change in groundwater storage in the TVS Basin. The remaining 15 percent of the recharge moving through the groundwater system would be accounted for by natural discharge directly to Lake Tahoe, gaining reaches of local streams, and evapotranspiration by vegetation in meadows, wetlands and SEZs.

5.5 Assessment of Potential Overdraft Issues

As part of the voluntary components of the GWMP, an assessment of overdraft issues that could affect long-term groundwater management is necessary. These are discussed briefly below.

5.5.1 Assessment of Potential Overdraft

The overall trend of the groundwater elevation data indicates that groundwater pumping is not causing any long-term declines in groundwater levels, or overdraft, in the TVS Basin. The water balance summary supports that the overall groundwater withdrawals are below the level that would result in an overdraft condition. Even with the high density of groundwater use within the

TVS Basin, the regulatory policies restricting growth throughout the Lake Tahoe Basin, will help to ensure that overdraft conditions do not develop in the future.

5.5.2 Assessment of Land Subsidence Potential

Inelastic (i.e., irreversible) land surface subsidence can occur in a groundwater basin made up of compressible sediments if the water table elevation declines substantially. This process can only occur once, so if sediments have been previously compacted due to high lithostatic loads or previous low groundwater levels, then no further subsidence can occur. Much of the basin fill consists of coarse glacial deposits that would not be subject to subsidence. The fine-grained lacustrine layers may have been susceptible to subsidence, but due to the glacial history in the TVS Basin, these layers would have already have been compacted and no further compaction would be anticipated.

Land subsidence can be induced by deep declines in groundwater levels that allow for compaction of fine-grained layers. However, the stable groundwater levels in the TVS Basin, demonstrate that subsidence is not likely to occur. All of these factors indicate that land subsidence is not expected to occur in this Basin.

5.6 Potential Climate Change Impacts

The South Lake Tahoe area is potentially vulnerable to the effects of climate change, especially because of the potential for higher elevation rain/snow line, decreased snow pack, the potential for increased wildfires, and the potential effects on habitats of increasing temperatures. The overall trend is that the climate warms and dries (Coats *et al*, 2013; Dettinger, 2013). These changes may eventually have a significant impact on local groundwater management and solutions may require early planning.

Climate change models project potential changes for the Lake Tahoe area in the coming decades. Over the next century the Lake Tahoe area could see a 2.5 to 5.5 degree increase in both winter low and high temperatures and 3.5 to 9 degree increase in summer high temperatures. Increases in the winter temperatures may affect snowpack, with potential decreases in accumulation of snow (Coats *et al*, 2013; Dettinger, 2013).

Climate models do not show that significant change in total precipitation is likely in the Lake Tahoe area and surrounding areas, but they do project a shift towards more precipitation in the form of rain instead of snow. Precipitation pattern projections are uncertain, but the snowpack in the Sierra Nevada may decrease by 35% to 90% (Snowpack Decadal Averages Tool, Cal-adapt 2014). A shift in the precipitation types would affect snow melt through decreases in the amount of water stored in the snowpack. The potential impacts of climate change to the local groundwater supply may include alteration in the amount and location of recharge to groundwater aquifers, lowering of summer and fall stream baseflows, substantial lowering shallow groundwater levels. In addition, climate change could lead to long-term declines in Lake Tahoe stage that could also further lower groundwater level in the TVS Basin. This could lead to a reduction in aquifer storage reducing the volume of groundwater available for either water supply or sustaining groundwater-surface water interactions. Also, more extreme climate conditions may become more prevalent leading to longer, more severe droughts (Coats *et al*, 2013; Dettinger, 2013). Prolonged drought conditions would be expected to result in increased groundwater withdrawals to meet increased water demands.

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Section 6: Groundwater Quality

Groundwater protection is an important groundwater management goal. This section summarizes the groundwater quality and contaminant concerns for the TVS Basin based on water quality information collected by the District and as reported to the DDW for other water supply wells since 2007.

6.1 Background

A contaminant is any physical, chemical, biological, or radiological substance or matter present in any media at concentrations that may pose a threat to human health or the environment (USEPA, 2009). The USEPA adopts standards for the amount of a contaminant that is allowed in public water systems under the Safe Drinking Water Act. MCLs are enforceable standards established to protect the public against consumption of drinking water contaminants that present a risk to human health. MCLs are established for inorganic chemicals, organic chemicals, disinfection by-products and radioactivity. The USEPA has also established National Secondary Drinking Water Regulations (NSDWRs) that set non-mandatory water quality standards. These secondary maximum contaminant levels (SMCLs) are not enforceable, but are established only as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color and odor. These contaminants are not considered to present a risk to human health at the SMCL. MCLs and SMCLs also serve as water quality objectives for groundwater designated for municipal and domestic supply under the Basin Plan (see Section 4.2.1).

6.2 General Groundwater Quality

Groundwater in the TVS Basin is generally of excellent chemical quality, suitable for the designated beneficial uses of municipal, industrial and agricultural water use and for any other uses to which it might be put. Groundwater from District wells is relatively low in total dissolved solids (TDS) with typical values on the order of 100 milligrams per liter (mg/L) and the concentrations of individual constituents are correspondingly low. The total hardness is extremely low (on average less than 60 mg/L as calcium carbonate) which is characterized as “soft”. Median values for chloride and sulfate are very low at about 4 mg/L and 3 mg/L, respectively. On average, the groundwater is slightly alkaline with a pH of 7.9, although several wells have relatively high alkalinity with measured pH above 9.0 (Airport, Arrowhead Well #3, Bakersfield Well, Blackrock #2 Well, and College Well).

6.2.1 Inorganic Constituents

Inorganic constituents listed in drinking water standards generally include various metals, halogens and nitrogen compounds including cyanide. Of these constituents, arsenic is the only constituent that has been found at concentrations exceeding the primary or secondary MCLs within localized areas of the TVS Basin that has impaired water supplies. Areas of elevated arsenic has been found in samples collected from wells located in the South Lake Tahoe GW area (former Tata Lane Well #1, Airport Well and Washoan Well); in the Angora GW area (Mountain View Well); in the Meyers GW area (Arrowhead Well #3, Bakersfield Well and Flagpole Test Well); and in many private wells located in the Christmas Valley GW area. Locations of the public and private wells are shown on Figure 6-1. High arsenic concentrations in these wells are believed to be contributed from deep confined water-bearing zones ($SLTZ_1$, AZ_1, AZ_2, MZ_1 and MZ_3) penetrated by these wells. The source of arsenic found in private wells within the Christmas Valley GW area is currently unknown. The arsenic found in groundwater is believed to be derived from the weathering of exposed bedrock within and surrounding the groundwater basin and/or the dissolution of arsenic-bearing materials within the basin-fill deposits.

In On January 22, 2001 EPA adopted a new standard for arsenic in drinking water of 10 µg/L, replacing the old standard of 50 µg/L. The rule became effective on February 22, 2002.In order to meet the more stringent standard the District has added a wellhead treatment system (adsorptive media) for the removal of arsenic to the Arrowhead Well #3; and changed the status of the Airport Well from active to standby use, allowing limited operation for emergency purposes only. The former Tata Lane Well #1 is an inactive well that has been disconnected from the water distribution system.

Table 6-1 presents inorganic groundwater quality from the all drinking water wells in the Basin from 2007 to 2014 that were reported to DDW. Other than arsenic, no other inorganic constituents were found that exceeded the primary MCL in the DDW database for 2007 to 2014.

On July 1, 2014, DDW adopted a MCL for hexavalent chromium (or Chromium-6) of 10 µg/L. Chromium is a heavy metal that occurs naturally and is commonly found in low levels in drinking water sources. Trivalent chromium is an essential dietary nutrient, but hexavalent chromium is considered a carcinogen. It enters drinking water supplies as a contaminant from industrial sources such as chrome plating, protective coatings, wood preservatives, heavy-metal based corrosion inhibitors for cooling towers, and leather tanning. Hexavalent chromium has not been detected or is present in trace concentrations of up to 1 µg/L in samples collected from wells located in the TVS Basin (Table 6-1). Because of the recent adoption of this MCL, occurrence data for this constituent is relatively limited. This will change as additional sampling for hexavalent chromium, in response to the adoption of this new drinking water standard, will occur in the future.

Other constituents have secondary MCLs that address constituents that are not toxic, but have aesthetic issues associated with taste, odor or staining. Of these soluble iron and manganese are the two most common. Areas of elevated iron have been found in samples collected from wells located in the South Lake Tahoe GW area [former Tata Lane Wells (#1, #3 and #4), former South Y Well, and former Helen Well #1]. Areas of elevated manganese has also been found in samples collected from wells located in the South Lake Tahoe GW area [former Martin Well, and former Tata Lane Wells (#1and #4)].High iron and manganese concentrations in these wells are believed to be contributed from relatively shallow water-bearing zones (TKZ_4, $SLTZ_5$) penetrated by these wells. Both the former Martin and Tata Lane Well #1 are inactive wells that have been disconnected from the water distribution system. The former Tata Lane Well #4 was also disconnected from the water distribution system and later destroyed in accordance with California Water Well Standards. Iron and manganese concentrations in all of the District's currently active wells are in compliance with secondary MCLs.

The DDW database indicates that since 2007, there are two active water supply wells that have had instances of iron above the secondary MCL; however, both wells have not had manganese above the secondary MCL over that period. Sources of iron and manganese are attributed to natural processes (chemical reactions which occur when waters at varying oxidation states mix in the subsurface) and/or the development of biofilms or corrosion of metal casings within the Wells themselves.

Odor and turbidity above their secondary MCLs were reported to DDW for two wells. These samples are associated with startup of inactive wells and are considered a temporary condition that can be adequately addressed by operation and maintenance procedures.

TABLE 6-1
INORGANIC GROUNDWATER QUALITY
FOR DRINKING WATER WELLS IN THE TAHOE VALLEY SOUTH BASIN

Constituent	MCL	Units	Wells Sampled	Average Conc.	Min. Conc.	Max. Conc.	Wells >MCL
Constituents with Primary MCLs							
Aluminum	1	mg/L	26	0.013	ND	0.33	0
Antimony	0.006	mg/L	26	ND	ND	ND	0
Arsenic	**0.01**	**mg/L**	**31**	**0.004**	**ND**	**0.018**	**4**
Asbestos	7	MFL	4	ND	ND	ND	0
Barium	1	mg/L	26	ND	ND	0.010	0
Beryllium	0.004	mg/L	26	ND	ND	ND	0
Cadmium	0.005	mg/L	26	ND	ND	ND	0
Chromium	0.05	mg/L	26	ND	ND	ND	0
Cyanide	0.15	mg/L	23	ND	ND	ND	0
Fluoride	2	mg/L	29	0.082	ND	0.308	0
Hexavalent chromium	0.01	mg/L	9	ND	ND	0.001	0
Mercury	0.002	mg/L	26	ND	ND	ND	0
Nickel	0.1	mg/L	24	ND	ND	ND	0
Perchlorate	0.006	mg/L	23	ND	ND	ND	0
Selenium	0.05	mg/L	26	ND	ND	ND	0
Thallium	0.002	mg/L	26	ND	ND	ND	0
Constituents with Secondary MCLs							
Color	15	Units	24	1.148	ND	10.0	0
Copper	1	mg/L	25	ND	ND	0.020	0
Iron	**0.3**	**mg/L**	**25**	**0.031**	**ND**	**1.610**	**2**
Manganese	0.05	mg/L	26	ND	ND	0.023	0
Odor—Threshold	**3**	**Units**	**22**	**0.452**	**ND**	**20.00**	**2**
Silver	0.1	mg/L	25	ND	ND	ND	0
Turbidity	**5**	**Units**	**25**	**0.465**	**0.012**	**16.000**	**1**
Zinc	5	mg/L	25	0.003	ND	0.062	0

Note: Bold is for constituents with concentrations above the MCL.
Source: DDW Database for period from 2007 to 2014

6.2.2 Radioactive Constituents

Radioactive constituents are present in groundwater found in the TVS Basin. The source of the radioactivity is the naturally occurring radioactive isotopes found in granite and sediments derived from granite. Radiological substances include total soluble uranium, gross alpha activity and radon. Incidences of radiological substances exceeding the uranium MCL of 20 picocuries per liter (pCi/L) and/or the gross alpha MCL of 15 pCi/L have been found in groundwater samples from, wells located in the South Lake Tahoe GW area (former South Y Well and College Well). High uranium in these wells is believed to be contributed from deep confined water-bearing zones ($SLTZ_3$, and BZ_3) penetrated by these wells. The uranium is believed to be derived from the weathering of exposed bedrock within and surrounding the groundwater basin and/or the dissolution of uranium-bearing materials within the basin-fill deposits.

The former South Y Well was disconnected from the water distribution system and destroyed in accordance with California Water Well Standards. The College Well is a designated standby source that can only be used for short-term emergencies in accordance with state regulations. With the exception of the College Well, uranium concentrations in all of the District's currently active wells are in compliance with MCLs.

Table 6-2 presents natural radioactivity measured from the all drinking water wells in the Basin from 2007 to 2014. Of the wells sampled during this period, 2 had one or more instances of radium activity above the MCL, eleven had elevated gross alpha activity above the MCL and two had uranium activities above the MCL. Activities for radiological substances in water collected from other District Wells are typically less than or equal to 15 pCi/L for total uranium and 10 pCi/L or less for gross alpha.

Radon is a radioactive gas formed by decay of small amounts of uranium and thorium naturally present in rock and soil and is found in groundwater throughout the TVS Basin. Investigation by the California Geological Survey shows that high radon potential is associated with granitic rock (certain granodiorite units), and lake terrace, glacial till and glacial outwash deposits. Moderate radon potential is associated with glacial till, outwash and lake terrace deposits derived from the granodiorite (Churchill, 2009). Radon gas derived from these materials can move into the groundwater system.

Table 6-2 shows radon levels in water samples collected from drinking water wells in the TVS Basin ranges from about 55 pCi/L to greater than 4,000 pCi/L. In 1996, the EPA proposed two options for the maximum level of radon allowable in community water supplies. The proposed MCL is 300 pCi/L and the proposed Alternative MCL (AMCL) is 4,000 pCi/L. The majority of District Wells have average radon levels which are greater than the proposed MCL but less than the proposed AMCL. There has been no recent activity by the EPA or DDW towards adopting a radon MCL, but that may occur in the future. Adoption of an MCL for radon by either EPA or DDW would affect water supplies in the TVS Basin.

TABLE 6-2
NATURAL RADIOACTIVITY
FOR DRINKING WATER WELLS IN THE TAHOE VALLEY SOUTH BASIN

Constituent	MCL	Units	Wells Sampled	Average Conc.	Min. Conc.	Max. Conc.	Wells >MCL
Constituents with Primary MCLs							
Radium-226	**5 (combined Ra-226,228)**	**pCi/L**	**19**	**0.56**	**ND**	**3.99**	**2**
Radium-228		**pCi/L**	**19**	**0.92**	**ND**	**1.99**	
Gross Alpha particle activity	**15**	**pCi/L**	**27**	**8.5**	**ND**	**29.700**	**11**
Radon	n/a	pCi/L	19	1,668	55	33,194	n/a
Uranium	**20**	**pCi/L**	**27**	**5.7**	**ND**	**24.100**	**2**

Note: Bold is for constituents with concentrations above the MCL.
Source: DDW Database for period from 2007 to 2014 for all water supply wells within TVS Basin

6.2.3 Salts and Nutrients

Salts and nutrients are both naturally occurring and anthropogenic. Natural sources of salts are from the dissolution of minerals in the basin-fill deposits. Anthropogenic sources are from disposal of wastewater and infiltration of water containing fertilizers or other sources of salts, nitrates or phosphates. As explained in Section 3.3, all sewerage from within the Lake Tahoe Basin must be collected, treated and exported outside of the Lake Tahoe Basin. However, there are concerns that spills and releases from the District's sewer collection system and the recycled water export system may degrade either surface and/or groundwater quality. The District regularly performs inspections and maintenance on its sewer collection and recycled water export systems in order to prevent sewerage spills and releases.

There are also concerns that deicing salts applied to roadways for snow and ice control operations may also degrade water quality. The Caltrans regularly reports their use of deicing materials within the Lake Tahoe Hydrologic Unit (Deicer Report) to the LRWQCB as a condition of their storm water permit. Typical deicing salt usage within the Hydrologic Unit is reported to be on the order of about 1,000 tons per year (Caltrans, 2012). BMPs are used by Caltrans to minimize the discharge of pollutants during snow and ice removal operations.

Table 6-3 shows TDS levels in water samples collected from drinking water wells in the TVS Basin is relatively low and typically range from 150 to 300 mg/L, which is below the 500 mg/L secondary MCL. Chloride and sulfate levels are also quite low, and below their secondary MCL of 250 mg/L for each constituent.

TABLE 6-3
SALT AND NUTRIENT GROUNDWATER QUALITY
FOR DRINKING WATER WELLS IN THE TAHOE VALLEY SOUTH BASIN

Constituent	MCL	Units	Wells Sampled	Average Conc.	Min. Conc.	Max. Conc.	Wells >MCL
Constituents with Primary MCLs							
Nitrate (as NO_3)	45	mg/L	78	1.1	ND	13.6	0
Nitrate+Nitrite (as N)	10	mg/L	64	0.25	ND	2.02	0
Nitrite (as N)	1	mg/L	73	0.001	ND	0.068	0
Constituents with Secondary MCLs							
Chloride	250	mg/L	26	9.2	ND	64.3	0
Specific Conductance	900	µS/cm	30	215.8	68	549.0	0
Sulfate	250	mg/L	27	3.7	ND	41.0	0
Total Dissolved Solids	500	mg/L	26	141.9	37	302.0	0

Note: Bold is for constituents with concentrations above the MCL.
Source: DDW Database for period from 2007 to 2014

6.2.4 Regulated Industrial and Commercial Chemicals

Man-made contaminants which occur most frequently in the TVS Basin include petroleum hydrocarbon and chlorinated hydrocarbon compounds.

6.2.4.1 Petroleum Hydrocarbons

Petroleum hydrocarbon compounds are from spills and releases associated with the operation of gasoline storage and fueling facilities. Contaminants of concern from these releases often include the most soluble fraction of the gasoline released, including benzene, toluene, ethylbenzene and total xylenes (BTEX) and the gasoline additives used as fuel oxygenates and octane enhancers including MtBE, Tert-Butyl Alcohol (TBA), Tertiary-Amyl Methyl Ether (TAME), and ethanol.

Petroleum hydrocarbon compounds have been found in water samples collected from wells located in the South Lake Tahoe GW area (Chris Avenue Well, Paloma Well, Clement Well, former Tata Lane Well #1 through #4, former Julie Well; former South Y Well,); in the Bijou GW area (Glenwood Well #5); and in the Meyers GW area (Arrowhead Well #3, Bakersfield Well, former Arrowhead Well #2, former Country Club Well); Petroleum contaminants found in these wells (predominantly MtBE) are from areas of degraded water quality found in shallow and intermediate unconfined and semi-confined water-bearing zones ($SLTZ_4$,$SLTZ_5$, TKZ_4, TKZ_5 MZ_5 and CVZ_4) penetrated by these wells. The petroleum hydrocarbon contamination detected in the Glenwood Well #5 shows that areas of degraded water quality has also been found in a relatively deep confined water-bearing zone (BZ_4).

Since 1997, the District has removed from service more than fifteen public water supply wells from its drinking water system due either to the presence of MtBE detected in raw water or the threat of a known MtBE contaminant plume migrating to the well as a result of continued operation. The former Arrowhead Wells #1 and #2 were destroyed in accordance with California Water Well Standards in 1998. The former Helen Well #1, Julie Well, Tata Well #4, and the South Y Well were destroyed in accordance with California Water Well Standards in 2006. The Tata Wells #1 through #3 and Country Club Well were removed from service and are disconnected from the water distribution system The Tata Wells #2 and #3 and the Country Club Well are presently used as observation wells.

Water samples from the Chris Avenue Well, Paloma Well, Clement Well and Glenwood Well #5 contain trace levels of MtBE at or below 0.5 µg/L. In accordance with the District's MtBE policy each of these wells have been placed on an increased observation and testing status and have either been relegated to stand-by status (Paloma and Glenwood Well #5) or temporarily removed from service (Clement Well and Chis Avenue Well) affecting available water supplies.

6.2.4.2 Chlorinated Hydrocarbons

Chlorinated hydrocarbon compounds are most often used as industrial agents used for degreasing metals, cleaning electronic parts and dry cleaning fabrics. They are also contained in many household products such as oil-based paints, drain cleaners, spot removers, engine degreasers and paint removers. Contaminants of concern from these releases often include: Tetrachloroethylene (PCE); Trichloroethylene (TCE), 1,2-Dichloroethane(1,2-DCA); and cis-1,2-Dichloroethene (1,2-DCE). Vinyl Chloride (VC); and 1,4-Dichlorobenzene (1,4-DCB).

Chlorinated hydrocarbon compounds have been found in water samples collected from wells located in the South Lake Tahoe GW area (Clement Well, Blackrock Well #1, former Pine Avenue Well, former Julie Well; former Tata Lane Well #4; former South Y Well, former Industrial Well #2, TKWC Well #2., LBWC Well #2, LBWC Well #3, LBWC Well #4 and LBWC Well #5). Chlorinated hydrocarbon contaminants in these wells (predominantly PCE) are from areas of degraded water quality found in shallow and intermediate unconfined and semi-confined water-bearing zones ($SLTZ_4$,$SLTZ_5$, TKZ_4, and TKZ_5) penetrated by these wells.

In 1991 the District added a centrally located water treatment system (Packed Column Air Stripper) at the Clement Well site in order to remove chlorinated hydrocarbons from groundwater produced from the former Julie Well, former Tata Well #4, the former South Y Well and the Clement Well. As noted above, each of these wells have either been destroyed or removed from service. The Blackrock Well #1 has been disconnected from the water distribution system and is presently used as an observation well. The former Pine Avenue Well was disconnected from the water distribution system and is believed to have been destroyed in the 1990s (last production in 1993). The TKWC Well # 2 is used as a stand-by well in the TKWC water system. The LBWC Well #3 and LBWC Well #4 have been removed from service and are disconnected from the LBWC water system. In July 2014, the LBWC Well #2 and LBWC Well #5 were removed from service due to the presence of PCE above MCLs (LBWC, 2014).The District has been providing emergency water to the LBWC through an intertie in order to replace lost water production from these wells.

Table 6-4 shows that there are two current water supply wells in the TVS Basin have reported concentrations of PCE and 1,2-DCA in excess of MCLs. In the remaining wells, concentrations of these compounds were non-detected using standard analytical methods. Neither of these wells is operated by the District.

TABLE 6-4
GROUNDWATER QUALITY FOR REGULATED INDUSTRIAL AND COMMERCIAL CHEMICALS FOR DRINKING WATER WELLS IN THE TAHOE VALLEY SOUTH BASIN

Constituent	MCL	Units	Wells Sampled	Average Conc.	Min. Conc.	Max. Conc.	Wells >MCL
Constituents with Primary MCLs							
Benzene	0.001	mg/L	34	ND	ND	ND	0
Carbon Tetrachloride	0.0005	mg/L	34	ND	ND	ND	0
1,2-Dichlorobenzene	0.6	mg/L	34	ND	ND	ND	0
1,4-Dichlorobenzene (1,4 DCB)	0.005	mg/L	34	ND	ND	ND	0
1,1-Dichloroethane	0.005	mg/L	34	ND	ND	ND	0
1,2-Dichloroethane (1,2-DCA)	**0.0005**	**mg/L**	**34**	**ND**	**ND**	**0.001**	**1**
1,1-Dichloroethylene	0.006	mg/L	33	ND	ND	ND	0
cis-1,2-Dichloroethylene (1,2-DCE)	0.006	mg/L	33	ND	ND	ND	0
trans-1,2-Dichloroethylene	0.01	mg/L	33	ND	ND	ND	0
Dichloromethane	0.005	mg/L	34	ND	ND	ND	0
1,2-Dichloropropane	0.005	mg/L	34	ND	ND	ND	0
1,3-Dichloropropene	0.0005	mg/L	33	ND	ND	ND	0
Ethylbenzene	0.3	mg/L	34	ND	ND	ND	0
Methyl tert-butyl ether (MTBE)	0.013	mg/L	34	ND	ND	0.001	0
Monochlorobenzene	0.07	mg/L	34	ND	ND	ND	0
Styrene	0.1	mg/L	34	ND	ND	ND	0
1,1,2,2-Tetrachloroethane	0.001	mg/L	34	ND	ND	ND	0
Tetrachloroethylene (PCE)	**0.005**	**mg/L**	**33**	**0.001**	**ND**	**0.019**	**2**
Toluene	0.15	mg/L	34	ND	ND	ND	0
1,2,4-Trichlorobenzene	0.005	mg/L	34	ND	ND	ND	0
1,1,1-Trichloroethane	0.2	mg/L	34	ND	ND	ND	0
1,1,2-Trichloroethane	0.005	mg/L	34	ND	ND	ND	0
Trichloroethylene (TCE)	0.005	mg/L	33	ND	ND	ND	0
Trichlorofluoromethane	0.15	mg/L	34	ND	ND	ND	0
Freon 113	1.2	mg/L	33	ND	ND	ND	0
Vinyl Chloride (VC)	0.0005	mg/L	34	ND	ND	ND	0
Xylenes	1.75	mg/L	34	ND	ND	ND	0

Note: Bold is for constituents with concentrations above the MCL.
Source: CDPH Database for period from 2007 to 2014

6.3 Groundwater Contamination

As indicated in the Section 6.2.4, MtBE and PCE are the two most frequently detected contaminants of concern that have impaired groundwater supplies in the TVS Basin.

MtBE has an extremely high aqueous solubility (48,000 mg/L @ 20-25 degrees centigrade), is very weakly sorbed to soils (K_{oc} =1.15),has a very high mobility in water and density lower than water [0.7404 grams per cubic centimeter (g/cm^3)] .As a result, MtBE is easily leached from soil into groundwater. Once in the subsurface, it is resistant to biodegradation and can therefore, pose a long-term groundwater contamination problem (Fetter, 1999).

PCE has high aqueous solubility (150 mg/L @ 20-25 degrees centigrade), is also very weakly sorbed to soils (K_{oc} =2.42),has moderate mobility in water and density greater than water (1.62 g/cm^3) .As a result, PCE is also easily leached from soil into groundwater. Once in the subsurface PCE typically degrades by progressive dehalogenation. The time required for dehalogenation is variable and dependent on subsurface conditions (e.g., temperature, pH, dissolved oxygen content, presence of nutrients and microorganisms, etc.) Therefore, degradation may or may not occur (Fetter, 1999). Because PCE is denser than water, it can be found in deeper portions of the groundwater system, concentrated along low permeability horizons at the bottom of water-bearing zones.

6.3.1 Groundwater Contamination Sites

The SWRCB maintains an extensive database of information used for managing sites that impact groundwater and requires groundwater cleanup referred to as GeoTracker (http://geotracker.waterboards.ca.gov/). Site information contained in GeoTracker includes clean-up status, potential contaminants of concern, site history, environmental data and technical reports on completed activities. The reader is referred to GeoTracker for this detailed site information.

Figure 6-2 shows the locations of open and closed groundwater cleanup sites by cleanup program type in the TVS Basin (e.g., Leaking Underground Storage Tank (LUST) Cleanup site, Site Cleanup Program (SCP) site). The LUST Cleanup sites are typically gasoline stations but may also include other sites with petroleum hydrocarbon contamination. The SCP sites are typically commercial sites with chlorinated hydrocarbon contamination. Inspection of Figure 6-2 shows that the majority of these sites are located along the main commercial business district from the intersection of Highway 89 and Highway 50 (known as the “Y”) along Highway 50 to Stateline. In order to show areas of groundwater quality concern with respect to water supply, brief descriptions of several of the most significant open sites are provided below.

6.3.1.1 Meyers GW Area Open Sites

The Meyers Landfill site (SL601724846; T10000000216) is located in the Myers GW area between Pioneer Trail and Saxon Creek. This was a municipal landfill operated by private parties from 1946 to 1955 and El Dorado County from approximately 1955 to 1971 under USFS Special Use Permits. Water leaching through the landfill has impacted groundwater beneath the site, resulting in a plume of contaminated groundwater extending approximately 2,000 feet in a north-northeast direction, down-gradient of the site. The contaminants of concern include both petroleum and chlorinated hydrocarbons, including VC, BTEX and naphthalene. VC has also been detected in surface water samples collected from Saxon Creek, down gradient of the former landfill (Weston, 2012). Contamination at the site is being remediated using an impermeable cover to prevent surface water from percolating through the landfill waste. Groundwater monitoring is currently being performed to evaluate the effects of the cover on groundwater flow and water quality underlying the site (USFS, 2013).

6.3.1.2 South Lake Tahoe GW Area Open Sites

The Former USA Gas #7 site (T0601700091) is located in the South Lake Tahoe GW area neighboring the "Y". This site has been under investigation since the discovery of petroleum hydrocarbon contamination during improvements to the underground storage tank (UST) system in 1998. Releases of gasoline from the UST system impacted groundwater beneath the site, resulting in a plume of MtBE contaminated groundwater, which at its maximum, extended more than 1,500 feet in a north-northwest direction, down-gradient of the site, impairing the former Tata Well #4 (see Section 6.1.4.1) and a neighboring private well. Historical maximum MtBE concentrations in this plume have often exceeded 1,000 µg/L in on-site wells. In 1999, on-site remediation activities started by using a soil vapor extraction (SVE)/groundwater pump and treat system. The groundwater pump and treatment system was later expanded to address off-site MtBE groundwater contamination. Remediation activities at the site were discontinued in December 2013. In 2014, the responsible party submitted a site case closure request to the LRWQCB, applying 2012 LTCP criteria. Remaining MtBE groundwater contamination is estimated to extend less than 100 feet beyond the property boundaries. The estimated time needed to naturally degrade the remaining MtBE concentrations to MCLs is estimated at about 8.3 years (Broadbent, 2014). The LRWQCB has indicated that it will issue a No Further Action Required (NFAR) letter to the responsible party, once all monitoring and remediation wells have been properly destroyed in accordance with State and local requirements and all waste piles, drums, debris and other materials from investigation and remediation activities have been removed from the site (LRWQCB, 2014a)

The Terrible Herbst Gas Station site (T0601700090) is located in the South Lake Tahoe GW area along Highway 50 neighboring Trout Creek. This site has been under investigation since a District construction crew encountered petroleum contamination during excavation near the site in 1984. Releases of gasoline from the UST system impacted groundwater beneath the site. In 1997, groundwater samples collected from this site were first analyzed for and then subsequently detected MtBE. Site investigations completed at the site showed a plume of MtBE contaminated groundwater, which at its maximum, extended more than 600 feet in a north-northwest direction, down-gradient of the site. Historical maximum MtBE concentrations within this plume exceeded 500 µg/L (Broadbent, 2003). The District was concerned that the down-gradient margin of this contaminant plume impinged on the capture zone of the Paloma Well (see Section 6.1.4.1). In January 2000, two sentinel wells were installed to monitor groundwater quality near the leading edge of this plume. Remediation activities for petroleum hydrocarbon contamination began in 1995 during replacement of the UST system. At that time, remediation involved the over excavation and removal of contaminated soils and the installation of an air sparge/soil vapor extraction system (AS/SVE). In July 2001, the AS/SVE system was shut-down and later restarted in November 2003. During the interim, direct removal of gasoline "free product" from three monitoring wells was started (in August 2003). In 2005, a dual-phase extraction (DPE) system was installed to improve the groundwater cleanup. The DPE system was operated through August 2008. Free product has not been detected in any site monitoring wells since April 2008. By the end of 2008, contaminant concentrations had declined across most of the historical contaminant plume area, with high residual contaminant concentrations remaining in a "hotspot" centered around one well located within the Highway 50 right-of way.

During the first quarter 2012, MtBE levels had decreased in all site monitoring wells below MCLs (Westmark, 2012). Groundwater cleanup activities at the site currently involve post-remediation monitoring at a reducing sampling frequency.

The South Y PCE site (SL0601794942) is located in the South Lake Tahoe GW area neighboring the “Y”. This site includes the water supply wells that have been impacted by PCE and is currently in the investigation stage. Other sites within the “Y” area in which PCE is the contaminant of concern include Big O Tires (SL0601729739); Lakeside Napa (SL0601756146) and Lake Tahoe Laundry Works (SL0601754315). Both the Big O Tires and Lakeside Napa sites are also in the investigation stage. The Lake Tahoe Laundry Works site is actively being remediated using a soil-vapor extraction/groundwater air sparging (pulsed ozone) system (see Section 6.2.3). Groundwater monitoring is being performed to evaluate the effect of the remediation system on groundwater flow and water quality (E_2C Remediation, 2014).

6.3.1.3 Bijou GW Area Open Sites

The Tahoe Tom’s Gas Station site (T0601700101) is located in the Bijou GW area near Stateline. This site has been under investigation since the discovery of petroleum hydrocarbon contamination at the site in 1999. Releases of gasoline from the UST system impacted groundwater beneath the site, resulting in a plume of MtBE contaminated groundwater, which extends more than 400 feet in a northwest direction, down-gradient of the site. In 2014, this MtBE contaminant plume impaired a neighboring small community water system well. Remediation activities at this site have relied on soil vapor extraction, dewatering and various methods to increase dissolved oxygen levels in the subsurface, including air sparing and in-situ chemical oxidation. On March 4, 2014, the LRWQCB issued an investigative order requiring the responsible party to submit a remediation plan to re-start of the on-site remediation system or operate an alternate treatment system for the removal of soil and groundwater contamination from this site.(LRWQCB b).On August 8, 2014, the LRWQCB issued a new cleanup and abatement order requiring the responsible party to monitor MtBE contaminant levels in the impaired well and/or provide an alternate source of drinking, conduct corrective actions to clean-up groundwater on- and off-site, and implement an expanded monitoring and reporting program (LRWQCB, 2014c).

The Private Residence site (SL0601714201) is located in the Bijou GW area. This site includes the private water supply wells that have been impacted by PCE and MtBE within the Tahoe Meadows subdivision. This site is currently in the investigation stage. Results of recent investigation suggest that the lateral extent of PCE and MtBE contamination is generally delineated, while the vertical extent of delineation is incomplete. The source(s) of MtBE and PCE contamination has not been identified (Fugro, 2014).

6.3.2 Progress of Groundwater Cleanup - MtBE

On March 28, 2000 the El Dorado County Board of Supervisors adopted Ordinance No. 4553 prohibiting the sale of fuel containing MtBE within the El Dorado County portion of the Lake Tahoe Basin (EDC, 2000). This Ordinance 4553 significantly reduced the threat of MtBE contamination resulting from spills and releases of gasoline used in the South Lake Tahoe area. Therefore, nearly all of the closed LUST Cleanup sites involving MtBE employed remediation to address contamination from spills and releases that pre-date March 2000. In order to illustrate the progress of MtBE groundwater cleanup activities in the TVS Basin, brief descriptions of several of the most significant closed sites are provided below.

6.3.2.1 Meyers GW Area Closed Sites

Figure 6-2 shows that all of the LUST Cleanup sites in the Meyers GW area are closed. The most significant of these closed sites are the Beacon Meyers (T0601700137) and Meyers Shell Station (T0601700147) sites.

Releases of gasoline from the Beacon Meyers site impacted groundwater resulting in a plume of MtBE contaminated groundwater extending approximately 1,150 feet in a north-northeast direction, down-gradient of the site (Secor, 1998). Upon the death of the property owner, the LRWQCB took on cleanup of the site using special State funds earmarked for emergency, abandoned, and recalcitrant sites. A contractor hired by the LRWQCB spent six years investigating the extent of groundwater contamination and conducting cleanup actions involving the over excavation and removal of contaminated soils, soil; vapor extraction and pump and treat groundwater remediation. In 2005, the LRWQCB closed the case after post-remediation monitoring showed that MtBE levels had decreased from a maximum concentration of 3,900 µg/L to less than MCLs.

In 1998, a 640 gallon release of gasoline from a product line failure at the Meyers Shell Station (T0601700147) site impacted groundwater resulting in a plume of MtBE contaminated groundwater extending approximately 1,000 feet in a north-northwest direction, down-gradient of the site (Cambria, 1999). Cleanup actions at this site involved the over excavation and removal of contaminated soils, and approximately seven years of pump and treat groundwater remediation. In 2010, the LRWQCB closed the case after post-remediation monitoring showed that the extent of the MtBE contaminant plume had been reduced to 200 feet and MtBE levels had decreased from a maximum concentration of 25,800 µg/L to less than MCLs (LRWQCB, 2010).

6.3.2.2 South Lake Tahoe GW Area Closed Sites

Figure 6-2 shows that several closed LUST Cleanup sites are located near the “Y”. The most significant of these closed sites are the South Y Shell (T0601700150) and Swiss Mart (T0601700148) sites.

Releases of gasoline from the South Y Shell site were first identified during improvements to the underground storage tank system in 1998. Releases from this site impacted groundwater resulting in a plume of MtBE contaminated groundwater extending approximately 600 feet in a north-northeast direction, down-gradient of the site. Cleanup actions at this site involved the over excavation and removal of contaminated soils, and approximately six years of pump and treat groundwater remediation. In 2006, the LRWQCB closed the case after post-remediation monitoring showed that the extent of the MtBE contaminant plume had been reduced to 30 feet and MtBE levels had decreased from a maximum concentration of 99,200 µg/L to less than MCLs (LRWQCB, 2006).

Releases of gasoline from the Swiss Mart site were first identified during improvements to the underground storage tank system in 1998. Releases from this site impacted groundwater resulting in a plume of MtBE contaminated groundwater extending approximately 500 feet in a north-northeast direction, down-gradient of the site, impairing a neighboring private well. Cleanup actions at this site involved the over excavation and removal of contaminated soils; soil vapor extraction and ozone air sparge treatment of contaminated groundwater. In 2010, the LRWQCB closed the case after post-remediation monitoring showed that the extent of the MtBE contaminant plume had been reduced and MtBE levels had decreased from a maximum concentration of 27,000 µg/L to less than MCLs (LRWQCB, 2010).

Section 4.2.1 and Appendix B include general descriptions of the LTCP. Under this policy, the LRWQCB has closed several groundwater cleanup sites in the Basin where site conditions are considered to meet standardized criteria that will generally ensure the protection of human health, safety and the environment. The emphasis of the LRWQCB is to increase corrective action efforts on higher threat cases, such as impacted drinking water wells or sites with human health concerns; and close LUST Cleanup sites that meet LTCP criteria. The District is concerned that sites closed under the LTCP policy allows residual levels of soil contamination and degraded water quality to remain that may affect the development of future water supplies under the District's current MtBE Policy.

6.3.3 Progress of Groundwater Cleanup - PCE

Along with the Meyers Landfill site (see Section 6.2.1.1), the Lake Tahoe Laundry Works site (SL0601754315) is the only other cleanup site that is actively remediating PCE contaminated groundwater in the TVS Basin. There are no closed PCE groundwater cleanup sites.

Remediation activities at the Lake Tahoe Laundry Works site started in April 2010 with operation of a soil-vapor extraction (SVE) combined with groundwater air sparging (GAS) treatment system. In October 2012, the SVE/GASS treatment system was shut-down and replaced using pulsed ozone air sparging. After PCE concentrations in groundwater rebounded at the site (exceeding 50 µg/L), the SVE/GASS treatment system was restarted in November 2013, under a directive from the LRWQCB. Through January 2014, the total mass of volatile organic contaminants (including PCE) removed by the SVE/GASS system has been estimated at approximately 860 pounds (lbs). The PCE mass remaining in shallow soils has been estimated at 0.004 pounds (lbs). While, the PCE mass remaining in shallow groundwater has been estimated at 0.18 lbs. Future activities at this site are planned to involve continued operation of the SVE/GASS treatment system; continued groundwater and shallow soil-vapor monitoring and regular reporting of groundwater monitoring and status of cleanup activities to the LRWQCB (E_2C Remediation, 2014). During the first quarter of 2014, PCE concentrations in groundwater at the site decreased to less than 10 µg/L. Based on these lower concentrations, the LRWQCB accepted the proposed shut-down of the SVE/GASSS treatment system as long as PCE concentrations do not rebound in groundwater or soil vapor by increasing an order of magnitude above concentrations detected in first quarter 2014 (LRWCB, 2014d).

6.4 GWMP Groundwater Aquifer Vulnerability Assessment

This section describes the preliminary groundwater aquifer vulnerability assessment that was done to develop a preliminary risk-based assessment to define the areas with the highest potential threat of groundwater contamination.

6.4.1 Importance of Protecting Groundwater Quality

Maintaining high groundwater quality is not limited to the drinking water wells themselves, but needs to be applied to all of the water-bearing zones used for water supply. Groundwater contamination resulting from leaks or spills has impaired groundwater wells in the TVS Basin (see Section 6.1.4). If the groundwater quality in a portion of the TVS Basin is not usable for water supply due to a contamination problem, it effectively reduces the total water supply, as wells cannot be placed in that area, and concentrating wells in non-impacted areas may lead to other undesirable results that may have to be addressed.

6.4.2 Groundwater Recharge Areas

As of January 1, 2013, DWR requires that the GWMP include a map identifying the recharge areas for the groundwater basins that substantially contribute to their replenishment. The DWR required map of recharge areas in the TVS Basin is provided in Figure 6-3.The purpose of the map defines those areas of the TVS Basin that substantially contribute to the replenishment of the groundwater basin. This map is to be shared with land use planning agencies to help protect groundwater quality, and shall be provided to local planning agencies after the adoption of the GWMP.

The TVS Basin recharge area map (Figure 6-3) is based on the understanding of the local geology and soil characteristics. In general, most areas are underlain by highly permeable soils and sediments, so there is a high potential for recharge over most of the TVS Basin. The areas of highly-permeable soils are considered the most susceptible to groundwater contamination from human activity. Areas of limited recharge are considered to be the areas of low permeability soils are shown on the map based on the currently available soils maps. As discussed in Section 5.4, natural recharge is primarily from direct percolation or infiltration from streams through the permeable soils to the underlying aquifers. Therefore, most of the TVS Basin is considered to have high potential recharge from natural surface sources due to the widespread distribution of highly-permeable sandy soils.

On the TVS Basin recharge area map (Figure 6-3), the stream valleys are mapped separately because of the groundwater-surface water interactions that occur in those areas (see discussion in Section 5.3). Groundwater-surface water interactions are complex and even though there is a net discharge of groundwater, there is still the potential for contaminants to enter the groundwater system in these areas. Since the stream valleys are still considered potential areas of substantial recharge under certain groundwater conditions, they are shown as a separate category on Figure 6-3. .

6.4.3 Definition of Well Source Areas

The source area for a ground water well represents the recharge area with permeable alluvial materials directly overlying an unconfined or semi-confined aquifer, where there is direct percolation of water into the unconfined or semi-confined aquifer. Recharge areas, which may be natural or artificial, are land areas that contribute water to an aquifer. Recharge occurs naturally from lakes, wetlands, direct precipitation, stream inflow, and subsurface inflow from upgradient sources of groundwater.

The delineation of Groundwater Protection Zones was performed using the Modified Calculated Fixed Radius method. The Groundwater Protection Zones are concentric circles that represent the areas of groundwater that may be drawn to the well during two, five and ten years of pumping. The size of each protection zone is determined by: the pumping rate of the well, the effective porosity of the formation that the well is completed in, the interval of pumping (two, five and ten years), and the screened interval of the well.

In the modified approach, the concentric circles are shifted in the upgradient direction in order to better represent the resulting geometry from the intersection of the capture zone of the well and the slope of the hydraulic gradient. The upgradient extent of the zone is determined as one and one-half times the calculated radius). The down-gradient extent of the zone is one-half the calculated radius. Three source area zones are defined. These zones are:

- **Zone A** encompasses the area with less than a two-year travel-time from the source to the well. The purpose of this zone is to protect the drinking water supply from viral, microbial and direct chemical contamination. This area provides only a limited time for responding to serious microbiological contamination or chemical spills.
- **Zone B5** encompasses the area with between a two- and five-year travel-time from the source to the well. This zone provides for more response time for chemical spills than Zone A.
- **Zone B10** encompasses the area with between a five- and ten-year travel-time from the source to the well. The primary purpose of this zone is to encourage decision-makers and planners to recognize long-term aspects of the drinking water source. The ten-year time-of-travel allows for some attenuation or remediation of contaminant sites, or if necessary, time to develop alternate sources of water supply.

The DDW requires a minimum radius for each protection zone: 600 feet for Zone A, 1,000 feet for Zone B5, and 1,500 feet for Zone B10; if the calculated radii of the protection zones are less than the DDW minimums, the minimum values are used instead. Source areas are cropped at the basin margins.

The source zones were calculated for all of the public and private regulated water systems in the TVS Basin listed in Table 3-3. Figure 6-4 shows the extent of the source areas for these wells. The larger source areas are for the high production rate wells located mostly in the north nearer to Lake Tahoe.

6.4.4 Groundwater Vulnerability Map

An accounting of human activities at the ground surface identifies potential sources of contamination that have been used for this part of the groundwater quality threat assessment. The potentially contaminating activities (PCAs) are defined as human activities at the ground surface that are actual or potential sources of microbiological and chemical contaminants to groundwater (CDPH, 1999). The objective of this analysis is to compile the known PCAs and plot them in relation to the source areas for the drinking water wells in the TVS Basin. Data for this study were obtained from various public and private sources.

The business activity PCAs are assigned threat ranks by correlating with rankings used for the DWSAP program guidelines (CDPH, 1999). A general summary of these data include the following groupings:

- Low Threat – includes parks, playgrounds, and schools.
- Moderately Low Threat – includes churches, schools with industrial arts facilities,, general manufacturing, commercial and service industries which would not use chemicals.
- Moderate Threat – includes general manufacturing, commercial and service industries which generally use few chemicals, public areas and office buildings, hospitals, hotels, golf courses.
- Moderately High Threat – includes general manufacturing, commercial and service industries which generally use chemicals, non-retail fuel dispensers.

- High Threat – includes businesses with past histories of contamination including dry cleaners, airports, gasoline stations, automotive repair, chemical manufacturers, machine shops, pest control, and chemical manufacturers.
- Very High Threat – includes businesses with past histories of contamination that handle large volumes of hazardous materials including chemical and waste handling facilities, and bulk fuel storage facilities.

Known contaminated sites (KCS) include environmental regulatory compliance sites in the study area that are under investigation or in remediation for contamination of soil and groundwater. In the GeoTracker database, each site is designated as “open” or “closed”. In addition, the sites are classified as “affecting groundwater used for drinking water”, “other groundwater not used for drinking water supply”, and “soil only sites”. Closed sites include any site with a status that suggests contaminated groundwater is no longer migrating offsite (e.g., case closed, no further action). “Open” indicates that a groundwater contamination issue requires some level of action. A general summary of these data include the following groupings:

- Moderate Threat – includes closed sites that affect groundwater not used for drinking water supply or were soil contamination only.
- High Threat – includes closed sites that were noted to affect groundwater used for drinking water supplies, or open sites that affect groundwater not used for drinking water supply or were soil contamination only.
- Very High Threat – includes open sites that were noted to affect groundwater used for drinking water supplies.

6.4.5 Groundwater Vulnerability Assessment

The results of this analysis are presented on Figure 6-5. Most of the very high threat activities are located along Highways 50 and 89 especially within the City of South Lake Tahoe and Meyers. The well source areas overlap many of these PCA clusters, especially for the high volume wells in the northern portion of the TVS Basin shown by the larger well source areas. This analysis provides a preliminary assessment that indicates that groundwater protection activities should be focused in those areas upgradient of the major groundwater supply wells. This includes Highway 50 in Meyers and Highway 50 from the airport to the state line.

6.5 Storm Water Infiltration and Potential for Groundwater Contamination

Storm water infiltration through detention basins is one of the primary treatment processes utilized in the Tahoe Basin to reduce storm water pollutant loads from urban runoff to the Lake Tahoe Basin and meet the long-term Lake Tahoe TMDL goals. The location of stormwater basins and dry wells relative to the drinking water source areas is shown on Figure 6-6. The following discussion summarizes some of the recent local research into the potential for groundwater contaminants reaching the groundwater through storm water infiltration basins.

6.5.1 Potential for Groundwater Contamination

To assess the effects of these detention basins on potential groundwater contamination, several investigations have been conducted. The storm water investigations are listed below and briefly summarized in the following sections:

- USGS Studies of the Cattlemans Detention Basin (USGS, 2004, 2005, and 2006)
- South Lake Tahoe Hydrocarbon Study (2nd Nature, 2006) and Infiltration BMP Design & Maintenance Study (2nd Nature, 2011).

These studies analyzed a wide range of chemicals of concern related to storm water (e.g., hydrocarbon, trace elements, nutrients, dissolved major ions, and sediment constituents) to evaluate the potential risk of shallow groundwater contamination from these chemicals as a result of storm water infiltration practices. Overall, the study findings showed urban storm water introduced to the detention basins consistently contained heavy petroleum hydrocarbons, but the lack of hydrocarbons and VOCs in shallow groundwater suggested that the soil horizon beneath the detention basins provides adequate treatment to reduce concentrations detected in the infiltrating urban runoff. The studies also indicated that the greatest potential impact is to the shallow groundwater zones underneath infiltration basins rather than deep groundwater used for water supply. The study findings are specific to the chemicals analyzed and are not directly representative of how other chemicals in storm water behave in the subsurface and their potential effect on shallow groundwater. An overview of the findings of these studies is provided below.

6.5.1.1 USGS Studies on the Cattlemans Detention Basin

The USGS conducted comprehensive studies of the Cattlemans detention basin in South Lake Tahoe to evaluate the effectiveness of the detention basin in reducing sediment and nutrient loads from urban runoff and observe whether nutrients in a detention basin are transported by groundwater to nearby Cold Creek (USGS, 2004, 2005, and 2006).

The USGS study began in November 2000 and included analyzing changes in groundwater flow and chemistry (e.g., dissolved major ions, trace elements, nutrients, and organic carbon) for two years after completion of Cattlemans detention basin in October 2001. Data were collected prior to construction of the detention basin as well as during and after construction. A series of 30 monitoring wells were installed. The study showed that the chemical composition and range of concentrations for key constituents (including nitrate) of shallow ground water for a two-year period after completion of the detention basin did not change substantially. Nitrate plus nitrite concentrations were always less than 0.33 mg/L. Data from deeper wells showed similar chemical composition as observed in shallow wells but with generally lower concentrations.

In the 2006 USGS study, a hydrogeochemical and groundwater flow model was developed to determine whether storm water and snowmelt runoff have modified the groundwater flow system beneath the detention basin. Additional geochemical data indicated seasonal variations in groundwater chemical composition, but no trend was observed to indicate that the Cattlemans detention basin had substantially changed the composition of the groundwater.

The 2006 analysis found that high concentrations of ammonia, iron, and dissolved organic carbon, low concentrations of sulfate and nitrate, and large populations of sulfate-reducing microbes imply that the major geochemical process controlling nutrient concentrations occurring beneath the detention basin as sulfate reduction. High concentrations of total nitrogen indicate that oxidation of organic carbon is a second important geochemical process occurring beneath the detention basin. The influx of surface runoff during spring 2002 apparently provided sufficient oxidized organic carbon to produce iron-reducing conditions and an increase in reduced iron, sulfate, and iron-reducing microorganisms. The increase in recharge of oxygenated water to the ground-water system beneath the detention basin in future intervals of increased recharge may eventually redistribute nutrients and speed up transport of dissolved nutrients from the ground-water system to Cold Creek.

6.5.1.2 2nd Nature Inc. Studies

Two detailed studies were conducted by 2nd Nature Inc. in 2006 and 2011 to evaluate the potential risk of several constituents related to storm water pollutants (hydrocarbon, oil and grease, turbidity, iron, nitrogen, phosphorous) to shallow groundwater resources as a result of urban storm water infiltration. The main objective of the 2006 study was to identify whether the hydrocarbon contamination poses a threat to shallow groundwater quality due to infiltration of storm water.

The study focused on storm water infiltration through two dry detention basins (Eloise Basin and Industrial Basin) within the urban limits of the City of South Lake Tahoe and included both storm water sampling and groundwater monitoring over two water years (2004 and 2005). hallow groundwater was monitored from 12 monitoring wells that were installed for this project surrounding the basins to evaluate whether the local water table showed a hydrologic response to infiltration from the detention basin. Data showed urban storm water entering the detention basins consistently contained heavy petroleum hydrocarbons, with less frequent detections of oil and grease. The levels of TPH-diesel detected in the surface water samples exceeded the LRWQCB numerical groundwater quality objectives for petroleum hydrocarbons. Low level detections of VOCs (primarily toluene and xylenes) were observed in approximately 20% of the storm water samples collected. Other key petroleum constituents, including benzene, ethylbenzene, and oxygenates (MtBE, TBA, etc.) were not detected in any of the surface water samples collected. None of the monitoring wells installed for this project contained detectable levels of hydrocarbons, VOCs or oxygenates following the analysis of over 70 shallow groundwater samples collected in locations potentially impacted by detention basin infiltration. The lack of hydrocarbons and VOC detections in all groundwater samples indicates that gasoline surface spills are rapidly depleted in light-end petroleum hydrocarbons before they are entrained in storm water flows and that the soil horizon beneath the detention basins provides adequate treatment to reduce low level concentrations of heavy hydrocarbons, toluene, and xylene compounds that were detected in the infiltrating urban runoff.

The 2011 study further evaluated the vulnerability of groundwater aquifers in South Lake Tahoe from infiltrating urban storm water with a focus on several other constituents related to storm water pollutants (oil and grease, turbidity, iron, nitrogen, phosphorous). The study also reported findings from other storm water infiltration studies from the scientific literature. According to the study findings, the majority of these chemicals are trapped within the upper portions of the soil column where infiltration occurs and extensive migration of pollutants in the subsurface is unlikely. Existing data indicates that constituents such as oil and grease, total iron, total nitrogen, and turbidity are unlikely to degrade groundwater quality as a result of storm water infiltration.

Among the chemicals evaluated, nitrate is considered a moderate risk, given its highly mobile state in the subsurface. Studies of infiltration basins indicated that the storm water infiltration discharge standard of 5 mg/L of total nitrogen was commonly exceeded in urban catchments containing a high proportion of impervious surfaces or recreational land uses. In addition, storm water infiltration studies identified relatively higher average nitrate concentrations measured in shallow monitoring wells located downgradient of infiltration basins relative to nitrate concentrations measured in shallow monitoring wells located upgradient. The mobility of nitrate in groundwater may warrant future monitoring in order to protect the beneficial uses of domestic and municipal water supply wells.

According to the study, the greatest potential risk resulting from storm water infiltration is to the shallow groundwater zones underneath infiltration basins, rather than deep groundwater used for water supply. Other studies of urban storm water infiltration suggest that the shallow groundwater (at a depth of about 3 feet below the water table) consisted almost entirely of storm water and storm water did not penetrate to depths greater than 9.9 feet below the water table. Among several results provided by this study, it is recommended for management purposes that infiltration practices should minimize the contact between inflow storm water and organic sediments retained in infiltration basins. (Datry *et al*, 2004).

Section 7: Stakeholder Involvement

A primary objective of this GWMP has been to provide input in the development of this GWMP update. This section provides a summary of the collaborative, community-building endeavors through stakeholder involvement.

7.1 Stakeholders Advisory Group

Within the Lake Tahoe area, there is an existing, on-going coordination and collaboration with water issues in the TVS Basin. A key objective of this GWMP update is to continue to build off of these existing relationships to further enhance groundwater management and protection in the TVS Basin. To further that objective, a Stakeholder Advisory Group (SAG) was formed to provide input for the development of this GWMP.

7.1.1 Formation of GWMP SAG

The SAG was convened to provide input for the development of this GWMP from various stakeholders that represented the District, local water purveyors, governmental agencies, business interests, and ratepayers representing a broad spectrum of interests to provide input to the update of the GWMP document. The objectives for the SAG are to:

- provide information and insight about key groundwater issues in the TVS Basin,
- develop a framework to expand and improve interagency collaboration particularly in the areas of regulatory oversight, coordinated land use planning, data collection and public education.
- provide review and recommendations to the GWMP document.

Four meetings were held from April through September 2014 to present information on the development of the GWMP, provide a forum to discussion local groundwater issues, and discuss areas of future collaboration among the stakeholders to improve groundwater management and groundwater quality protection. The GWMP is considered a “living document” that the District intends to update periodically to report, in collaboration with other stakeholders in the TVS Basin, on the progress made in managing groundwater resources and to reflect amendments to the CWC. Input from the SAG is considered an important function in the ongoing groundwater management in the TVS Basin.

7.1.2 SAG Members

The 2014 SAG has a roster of twelve members. These members were invited to participate by means of (1) public notice in the *Tahoe Daily Tribune (published March 7, 2014)*, (2) public announcement at the meeting of a local environmental group and (3) personal invitation. The District accepted applications from interested parties and communicated directly with contacts at the agencies whose participation is called out in the existing GWMP. This recruitment process resulted in the SAG consisting of twelve stakeholder members, three District representatives, and two consultants. Table 7-1 lists the SAG members.

The SAG consists of members who reside within the TVS Basin or who represent collaborating businesses or government agencies who have demonstrated a commitment to protecting groundwater resources. Participants on the SAG represent the categories of stakeholder called out in section 7.4 of the existing District GWMP (STPUD, 2000). The purpose of the stakeholder categories is to get a broad spectrum of community, business and agency interests to provide input on the GWMP. The District staff who participated as SAG members included the General Manager, District Hydrogeologist and District Engineer. District staff participated in the SAG proceedings shared information and answered questions directed to them by other members of the SAG. The SAG also included two consultants who participated in the roles of Technical Advisor and Meeting Facilitator.

TABLE 7-1
STAKEHOLDER ADVISORY GROUP MEMBERS

Category	Name	Affiliation	Position
Agency	Jason Burke	City of South Lake Tahoe	Storm Water Program Coordinator
Agency	Robert Lauritzen	El Dorado County	Geologist
Agency	Brian Grey	Lahontan Regional Water Quality Control Board	Engineering Geologist
Agency	Tom Gavigan	Lahontan Regional Water Quality Control Board	Senior Engineering Geologist
Agency	Paul Nielsen	Tahoe Regional Planning Agency	Planning Manager
Business Rate Payer	Rodney Wright	Barton Health	Emergency Management Coordinator
Community Rate Payer	Harold Singer	Resident	Retired
Service Station Operator	Greg Daum	Chevron (Meyers)	Owner/Operator
Real Property Owner	Scott Carroll	Tahoe Conservancy	Associate Environmental Planner
Other	Steve Morales	Lake Tahoe Unified School District	Director of Facilities
Water Purveyor	Jennifer Lukins	Lukins Brothers Water Company	Vice President
Water Purveyor	Greg Trischler	Tahoe Keys Water Company	Supervisor
District	Richard Solbrig	STPUD	General Manager
District	Ivo Bergsohn	STPUD	Hydrogeologist
District	John Thiel	STPUD	Principal Engineer
Consultant	Mike Maley	Kennedy/Jenks Consultants	Hydrogeologist
Consultant	Michelle Sweeney	Allegro Communications	Meeting Facilitator

7.1.3 SAG Meetings and Workshops

STPUD invited the participation of stakeholders in a series of four meetings during the development of the 2014 GWMP Update. Workshops at the District offices in South Lake Tahoe were on April 16, May 14, June 4 and September 24, 2014.

The workshops provided an opportunity for the District to inform the SAG members regarding groundwater conditions in the Basin and for the SAG to identify potential topics for the updated GWMP. This helped the District construct a plan of action around the highest-priority topics. The SAG was also invited to provide edits and suggestions during development of the District's updated GWMP document.

Each workshop had an agenda and review material (sent to the SAG members several days in advance of the meeting). The workshops ran for three hours and included presentations by the District and Consultants on issues, question and answer periods, and designated open discussion periods on a range of topics. A summary of each of the four SAG workshops is provided in Appendix E.

The District has developed the following recommendations based on the discussion during the SAG meetings that have been included in this GWMP update. In summary these recommendations include:

- Maintain the Source Water Protection Map to serve the objectives of the plan document
- Prioritize action according to risk
- Maintain a long-term sustainable water supply
- Maintain and protect groundwater quality
- Coordinate regional monitoring to track groundwater conditions
- Study the interaction of water supply activities with environmental conditions
- Build collaborative capacity with local agencies, private water companies, businesses, private property owners and the public
- Integrate source water protection into local and regional land use planning.

These are not prioritized actions. At present each recommendation holds equivalent and independent importance. However, sequence is implied. That is, by first assessing risk posed by potential threats to groundwater and subsequently assessing the relative likelihood of risk events, the District should be in a position to prioritize actions so that the most damaging threats with the greatest likelihood of occurrence can be the first to receive attention during plan implementation.

7.2 Groundwater Management Collaboration Opportunities

This GWMP is updated within the context of existing, on-going coordination and collaboration in water issues in the TVS Basin. As noted in Section 4, water quality improvement programs, with a focus on Lake Tahoe clarity, have required the coordination and collaboration of many of the organizations and agencies within the Lake Tahoe Basin. Therefore, long-established relationships that form the foundation of coordination and collaboration which will be honored and expanded to include consideration of groundwater management issues with an emphasis on water quality.

The SAG identified numerous groundwater management collaboration opportunities. SAG recommendations on this subject can be summarized in terms of opportunities to (1) protect groundwater (2) coordinate with land use planning (3) share data and (4) enhance collaboration.

7.2.1 Protect Groundwater

Toward the goal of protecting groundwater, the overall goals for groundwater protection discussed by the SAG are summarized as the following:

- Integrate groundwater protection into existing site inspection protocol of the several agencies already conducting site inspections
- Create a private well owner education and cooperation campaign, and
- Maintain an infiltration facility inventory and educate spill responders regarding locations and District/water purveyor notification.

Site inspections of some storm water BMPs and other potentially relevant facilities occur with local agency staff. There are opportunities to leverage these inspections and include a few items such as presence and condition of water supply wells that could provide added groundwater protection.

There are an estimated 600 private wells currently operating within the TVS Basin. Existing private wells do not require permits or operational reporting; therefore, information is lacking on operational status and whether it is being maintained in good condition or allowed to deteriorate. The inspection programs above could be used to gather these data and used as the basis for education and outreach to private well owners regarding vertical migration potential and. These well inventory data could be added to well permitting programs for use in the GWMP. Private well information would be beneficial for supporting groundwater management and water quality protection. These well inventory data could be added to the El Dorado County Water Well Program for use in the GWMP.

Finally, one of the main concerns that have been raised has been the potential for spills to impact groundwater. This concern is highlighted if a spill were to occur near an infiltration facility. Therefore, an effort to locate infiltration facilities as well as education of spill responders regarding:

- the relative urgency of response depending on the spill location and
- the interest of the District and other purveyors to be notified of spills would be helpful for long-term groundwater protection.

7.2.2 Coordination with Land Use Planning

Opportunities exist for improved coordination of groundwater management and land use planning. Potential areas for collaboration include:

- Developing processes to ensure consistency between general plans and the GWMP
- Ensuring that land use plans use current maps, data and analyses from the local water purveyors

- Ensuring that water use projections are developed in coordination and consultation with the GWMP
- Discussing approaches on how to implement land use policies for areas in or approaching groundwater impairment.

Existing law requires a city or county upon adoption of its General Plan to use as a source document any Urban Water Management Plan submitted by a water agency. The SGMA does include language that will broaden the requirement of what is required to be included in future GWMPs.

The SGMA expands the role and responsibility of local water agencies as Groundwater Sustainability Agencies (GSAs) in order to achieve “Sustainable Groundwater Management”. Sustainable Groundwater Management is defined as the management and use of groundwater in a manner that can be maintained over a 50-year planning and implementation horizon without causing undesirable results. Undesirable results include one or more of the following effects:

- Chronic lowering of groundwater levels (Overdraft Condition)
- Significant and unreasonable reduction in groundwater storage
- Significant and unreasonable degradation of water quality, including migration of contaminant plumes that impair water supplies
- Significant and unreasonable land subsidence, and
- Surface water depletions that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

In order to achieve groundwater sustainability goals, the SGMA provides additional authorities to GSAs, which may:

- Impose spacing requirements on new well construction to minimize well interference and excessive drawdown
- Require metering of wells producing more than 2 acre-feet per year (about 1,785 GPD)
- Require regular reporting of water production from metered wells, and
- Assess fees to develop and implement its adopted and state-approved Groundwater Sustainability Plan (GSP).

This may be an area for coordination with TRPA, LRWQCB, EDCEMD, LTBMU and the CSLT.

7.2.3 Sharing Data and Information

A key part of groundwater management is collecting data to monitor groundwater conditions. Multiple governmental agencies and water purveyors collect groundwater-related data in the TVS Basin. A goal of the GWMP is to better coordinate the sharing of this information among the various groups. Data sharing opportunities exist in the following categories: well construction, groundwater level, water quality sampling, volumes of groundwater extracted and surface water conditions. It is not recommended to try and develop a central database at this time because this would require a duplication of existing efforts of each agency maintaining its own database. Rather, the GWMP recommendation is to establish a listing of the available data and contacts on where the data can be obtained. Much of this data is already compiled by state and federal agencies and is readily available online. Listings of the online sources that are relevant to this GWMP are provided in Table 9-1. The mechanism for maintaining this listing is planned to be worked out through the SAG after the adoption of this GWMP update.

In addition, multiple governmental agencies and water purveyors perform regulatory oversight or develop water-resources plans in the TVS Basin and surrounding area. Data sharing between these different groups is recommended to ensure that groundwater management and water quality protection are integrated into the efforts of all the various agencies.

Appendix F includes a preliminary table that was developed during the SAG meetings as an example of how the data sharing could be documented and shared. It is anticipated that this table, or a variation developed subsequently, would be updated by the agencies and purveyors as a mechanism to inform all stakeholders in the area on available data, plans and programs that are related to groundwater management.

7.3 Convene an Ongoing SAG

The 2014 SAG made evident the groundwater protection opportunities made possible by the existence of such a group including:

- Improved information sharing on groundwater contamination sites that may impair water supplies
- Improved information sharing on groundwater cleanup activities
- Improved regulatory inspections with site information relevant to groundwater protection (e.g., dry wells, infiltration features, small community water wells and private wells)
- Enhanced investigation and cleanup of PCE contaminated groundwater impairing water supplies, and
- Enhanced investigation and cleanup of MtBE contaminated groundwater impairing water supplies.

The District will convene a new advisory group to facilitate collaboration in the implementation of this updated GWMP.

7.3.1 Formation of SAG

The current SAG was convened to provide input in the development of this GWMP update. The new SAG will be formed after adoption of the updated GWMP. The new SAG is recommended to be conducted in a similar manner that will meet on a regular, ongoing basis in order to provide a forum to discuss and propose actions for sustainable groundwater management. It is anticipated the procedures for running the SAG will be further developed and will evolve over time.

7.3.2 SAG Formation

The composition of the new SAG is anticipated to be similar to the GWMP SAG. All SAG members for the 2014 GWMP update will be asked to participate. In addition, other groups including the LTBMU will be asked to join the ongoing SAG. The proposed participants on the SAG should represent the key categories of local stakeholder including local water purveyors, agencies and ratepayer representatives. In addition to the District, private water companies including LBWC, Tahoe Keys and LMWC would be invited to join the SAG because of their vested interest in groundwater issues. Local agency representatives from the LTBMU, LRWQCB, TRPA, El Dorado County, and the CSLT would be invited to join to provide their insight on groundwater issues. Efforts would be taken to identify and encourage participation from different types of rate payers including real property owners, business owner, and non-business community members. It is anticipated that the composition of the SAG would change over time, but maintaining participation of the three primary groups (water purveyors, local agencies and rate payers) is considered essential to the long-term success of the SAG.

The SAG meetings would initially be planned to be conducted twice per year, in April and September. The SAG may decide to maintain this schedule or modify it after the first year. The meetings would be open to the public. Meeting times and locations would be announced through the District web page.

Following adoption of the updated GWMP, the District intends to further modify the GWMP as the basis for its Groundwater Sustainability Plan (GSP) and serve as the GSA for the TVS Basin. As such, the District will take the lead on organizing and running the SAG meetings. An agenda would be posted for each meeting. The meeting would initially consist of a brief update by the District and selected members on relevant groundwater issues. Other topics would be listed and presenters would be notified beforehand to allow time to prepare for the meeting. An open discussion period would be provided to let all members to bring up items for discussion not on the agenda. A public comment period would be provided to allow for input from non-member attendees on groundwater related issues. Action items would be recorded. These may include formation of Technical Subcommittees to further assess specific issues that would report back to the SAG in a future meeting. Meetings would conclude with identifying topics of discussion for future meetings and scheduling the date of the next meeting.

7.3.3 Potential Future SAG Topics

The purpose of the SAG is to provide is to provide a forum to facilitate the discussion of groundwater related issues and sharing of information between water districts, land use planning agencies, regulatory agencies, businesses and the public. The 2015 session will begin with an overview of issues and the recommendations of this GWMP.

The SAG will provide a forum for working out this coordination and sharing ideas about how to enhance groundwater protection and achieve groundwater sustainability. The anticipated topics for the 2015 SAG is continued discussion on how to improve interagency collaboration for groundwater management and water quality protection as discussed in Section 7.3.

In the future, the SAG may be called upon to provide input for recommending actions if the measurable goals for BMOs discussed in Section 8, especially regarding groundwater levels and water quality, are not met. The SAG may provide support for an agreed upon course of action to demonstrate regional support, if found to be warranted.

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Section 8: Basin Management Objectives, Strategies, and Actions

BMOs are flexible guidelines for the management of groundwater resources that describe specific actions to be taken by stakeholders to meet locally developed objectives at the basin or sub-area scale. SB 1938 amended the law related to GWMPs to require a public agency seeking State funds administered through DWR to prepare and implement a GWMP that includes BMOs and are required under CWC §10753.7 (a) (1).

An important feature of the BMO method of groundwater management is that it is intended to provide a flexible approach that can be adapted to changing local conditions and increase understanding of the groundwater resource. For this update for the TVS Basin GWMP, a detailed description of the following BMOs is provided:

- BMO #1 – Maintain a sustainable long-term groundwater supply
- BMO #2 – Maintain and protect groundwater quality
- BMO #3 – Strengthen Collaborative Relationships with Local Water Purveyors, Governmental Agencies, Businesses, Private Property Owners and the Public
- BMO #4 – Integrate Groundwater Quality Protection into Local Land Use Planning Activities
- BMO #5 – Assess the interaction of water supply activities with environmental conditions
- BMO #6 – Convene an Ongoing Stakeholder's Advisory Group (SAG) as a forum for future groundwater issues
- BMO #7 – Conduct technical studies to assess future groundwater needs and issues
- BMO #8 - Identify and obtain funding for groundwater projects.

The following section describes each of these BMOs in more detail and provides a list of the anticipated actions to be accomplished for each BMO under this GWMP.

8.1 BMO #1 - Maintain a Sustainable Long-Term Groundwater Supply

The purpose of BMO #1 is to implement measures to manage the groundwater levels for long-term sustainability and reliability of the water supply for all users within the TVS Basin. The measurable goal for tracking groundwater levels is to sustain groundwater levels within the range of historical data. If long-term groundwater levels show a consistent declining trend that falls below the historical range indicating a potential overdraft condition, then an assessment of the cause for the decline would be conducted. If excessive groundwater pumping is found to be the cause, then measures would need to be taken to either redistribute the pumping to other portions of the basin, or reduce pumping at the implicated well(s). No action would be required if the condition described above is not observed.

The District is the primary groundwater pumper from the TVS Basin, but a large number of smaller water companies and independent well owners also pump groundwater from the TVS

Basin for water supply. Currently, the population of the South Lake Tahoe area is relatively small due to changing demographics with more part-time residents. Seasonal variations in demand due to the tourism industry may double or even triple during long winter and summer holiday weekends. Even with a fluctuating population and seasonal demand, overall water demand is less than the average annual recharge. The location of the basin at the head of the watershed, runoff of snow melt from the surrounding mountains and presence of Lake Tahoe combine to naturally maintain groundwater levels. However, groundwater levels are potentially susceptible to drought, climate change and increased future water demand.

Groundwater levels have not shown any indication of a long-term, multi-year declining trend that would be indicative of overdraft. Groundwater levels vary primarily in response to seasonal climatic variations. Areas of concentrated groundwater pumping show evidence of drawdown, but not a long-term declining trend as shown on the hydrographs (Figures 5-3 through 5-11) and Groundwater Contour Maps (Figures 5-12 and 5-13) provided in Section 5. For BMO #1, the following actions are proposed:

1. **Collect and review groundwater levels** – Groundwater level data will continue to be collected from key observation wells listed in the Monitoring Plan (Appendix D). Emphasis will be on maintaining a consistent long-term historical record of groundwater level data at key wells around the basin. It is the long-term record that is most important in assessing the BMO measurable goal.
2. **Collect and track groundwater pumping volumes** – The District will continue to collect groundwater pumping volume data for each District production well. Pumping from other private water purveyors in the TVS Basin will be implemented using a self-reporting process. (This would include all substantial pumpers including the District, small water companies and large private well owners (water supply, industrial, or environmental remediation). The data would be compiled by the District. The data will provide the ability to track trends in pumping.) Historical data should be compiled where available to build up the historical record to improve the ability to assess long-term trends.
3. **Continue water conservation measures** – Water conservation reduces the overall demand for groundwater withdrawals, and thus helps to sustain groundwater levels and long-term groundwater production. The District will continue to implement water conservation policies and practices to encourage water conservation among customers through coordinating public outreach activities, financial incentives and implementing best conservation management practices. It is anticipated that other smaller water companies and independent well owners would implement appropriate water conservation policies and practices. The District will continue public outreach programs to promote water conservation and seek grant funding to help implement water conservation measures.
4. **Continue to participate in California Statewide Groundwater Elevation Monitoring (CASGEM)** – The District will continue to take the lead in reporting groundwater level data to the CASGEM program by reporting appropriate data to the DWR. CASGEM provides a format for sharing groundwater level data. Participation in CASGEM is required by DWR and can be a stipulation for receiving state funding.
5. **Maintain awareness for land subsidence** – The local geology and groundwater level history indicate that land subsidence associated with groundwater extraction is not an

issue in the TVS Basin (Section 5.5.2). The District will monitor groundwater levels as the primary monitoring for potential land subsidence.

6. **Assess the effects of changing MCLs on water supply** - Water quality regulations by the DDW are subject to change that may include lowering an existing MCL or adding a new compound to the list of regulated compounds. This can have a significant impact to the District if these changes in the water quality regulation result in the addition of new water treatment in order to continue serving water from existing wells. If new treatment is required, this may result in significant capital and operational costs to upgrade and maintain the additional water treatment. . Because of the elevated radon in the TVS Basin (Section 6.1.2), an adopted MCL of 300 pCi/L for radon could have a significant effect on water supplies in the TVS Basin.
7. **Assess the effects of the District's MtBE Policy on water supply** – The District maintains an operations policy that restricts groundwater withdrawals from any District well with detectable levels of MtBE contamination (Section 4.2.3). Maintenance of this policy affects the available water supply that may be delivered for drinking water use in the TVS Basin. The District will regularly review the continued need for this policy. Other private water companies and water suppliers may or may not observe this policy.

8.2 BMO #2 - Maintain and Protect Groundwater Quality

Groundwater in the TVS Basin is typically of excellent quality; however, there is a legacy of groundwater contamination from regulated industrial and commercial chemicals (Section 6.1.4), which continues to impair water supplies. The nature of the aquifer makes it highly vulnerable to groundwater contamination as evidenced by these impacts.

The purpose of BMO #2 is to implement measures to maintain and protect groundwater quality in order to sustain the beneficial use of groundwater resources. These measures would address contamination from manmade contaminants and not natural constituents intrinsic to the aquifer. This would include setting measurable goals and continuing proactive measures to protect groundwater quality. The groundwater quality measurable goals are consistent with existing regulations and policies. These would include:

- All groundwater supply wells will meet drinking water standards as defined by the DDW.
- Groundwater quality in the TVS Basin will not be impaired so as to affect its beneficial use of current or potential future use of groundwater for municipal water supply as defined by the LRWQCB Basin Plan.
- Detection of contaminants from regulated industrial and commercial chemicals in any well within the TVS Basin will be evaluated as to its potential as an emerging groundwater quality threat to the water supply.
- Information on areas of degraded water quality will be collected and maintained in order to consider its effect on available water supply under the District's MtBE policy and the development of future groundwater supplies.

The objective of setting quantitative goals for the BMO is to provide a means for assessing relative threat of contamination. The goals are tied to the regulatory requirements, but also make the detection of any manmade contaminant require review and analysis. In this manner, the goals do not add a new level of regulation, but provides a mechanism to be proactive in addressing contamination issues before they reach drinking water standards and potentially affect drinking water wells. For BMO #2, the following actions are proposed:

1. **Monitor and review groundwater quality data** – The District will collect water quality samples from production wells and selected monitoring wells according to the DDW – approved protocols. Appropriate record keeping will be maintained for field records and lab reports. Relevant data will be kept in an electronic database so that the data can be readily used to support District needs. The District and small water companies currently conduct water quality monitoring per DDW requirements for the purpose of monitoring drinking water quality in the groundwater basin.

2. **Take action if a new or uncontrolled groundwater quality issue is found by review of monitoring data** – The collected ground water quality data will be reviewed and evaluated by District, other water purveyors, or local agencies. If a water quality issue is detected through review of the groundwater monitoring data and is not considered an emergency response situation, the District or water purveyor would have the options of how they would handle this situation based on their assessment of the severity of the issue. This may include but is not limited to the following:

    - No further action needed
    - Continue to monitor the situation
    - Install additional monitoring wells to better define the situation
    - Present the findings to the SAG for further discussion and input
    - Request County or LRWQCB action to enhance groundwater cleanup and prevent the migration of contaminant plumes from impairing water supplies; and
    - Implement immediate remediation actions deemed necessary to protect the District's water supply and infrastructure.

3. **Implement emergency action if groundwater quality presents clear and immediate threat to District's water supply and infrastructure** – If an issue presents a clear and immediate threat to the available water supply and infrastructure, then recommendations for immediate action by the affected water purveyor to their Board of Directors may be warranted. This would most likely be in response to a spill or specific event where regulated industrial and commercial chemicals or sewerage are released that may affect groundwater. The specific type of response would be dictated by the chemical characteristics of the contaminants of concern, the proximity of the specific event to existing groundwater source (s), and the potential vulnerability of theses groundwater source (s) to contamination from each specific incident.

4. **Continue to implement County well construction and abandonment standards** – All water supply wells constructed in the TVS Basin by the District or other water purveyors will be done according to applicable County and State Well Standards. Likewise, the District and other well owners will continue to adhere to the requirements for well abandonment and destruction for all District-owned wells. Abandoned or poorly constructed wells provide a conduit for migration of contaminants and poor quality water through the aquifer. The District will work with other water purveyors, local businesses and regulatory agencies to conduct sanitary surveys which identify existing wells that do not meet current Well Standards and which pose the greatest potential threat to groundwater quality. The District will work with the El Dorado County Water Well Program to properly abandon or destroy these wells in a sustained and efficient manner

to protect water quality. The District will also work with private water companies in coordination with the El Dorado County Water Well Program to better inform private well owners on the rationale, methods and regulatory requirements for the destruction of wells.

5. **STPUD will implement the revised Groundwater Ordinance to address groundwater quality issues** – The previous GWMP included an Ordinance that was not fully implemented. Concurrent with the development of this GWMP, the District has developed and approved a revised Groundwater Ordinance. The primary purpose of the updated Ordinance is to provide the District with a better means to implement measures in order to prevent the significant and unreasonable degradation of water quality. Discussion of the Ordinance update were also conducted during the SAG Meetings, and input was received from the SAG that was used to help formulate the revised Ordinance primarily with respect to addressing current groundwater quality concerns. As stated in the Ordinance, the District will rely on and coordinate with the RWQCB and County as the lead agencies to manage groundwater quality in the TVS Basin; however, the District may, at its discretion, take complementary actions to further protect groundwater quality especially as it pertains to protecting the water supply. A copy of the updated Groundwater Management Ordinance No. 558-14 is included in Appendix G.

8.3 BMO #3 - Strengthen Collaborative Relationships among Local Water Purveyors, Governmental Agencies, Businesses, Private Property Owners and the Public

The TVS Basin includes a wide range of stakeholders in addition to the District, smaller water companies and independent well owners. Government agencies, local business interests, environmental groups and private citizens all have interests in local groundwater management. The GWMP process encourages coordination with other local agencies and stakeholders. The SAG will be one of the forums to promote collaboration. Its formation is outlined in BMO #6.

The purpose of BMO #3 is to outline a process for public participation and coordination with local agencies that will continue into the future. The goal of BMO #3 is to develop a process for the regional implementation of measures to maintain and protect groundwater quality for the continued beneficial use of the groundwater resources for the local community. For BMO #3, the following actions are proposed:

1. **Provide regular public outreach opportunities** – The District will provide regular public outreach and participation through one or more public meetings. Potential public outreach includes the following.

    - An annual presentation summarizing the annual report at a public meeting to keep the Board of Directors and public up-to-date on the management of the groundwater basin.
    - Promote water conservation through brochures, new customer information packages, speaking at public events, and providing educational materials at local schools and Earth Day activities.
    - Work with El Dorado County and other local Public Water Systems to prepare a brochure explaining well abandonment and destruction requirements to be distributed as a “bill stuffer” and/or made available at local public meetings.

2. **Maintain a working relationship with local and state regulatory agencies** – Continued communication and coordination with local and state regulatory agencies including El Dorado County, LRWQCB, DDW and the DWR on groundwater issues affecting the TVS Basin. The purpose of this communication is to discuss groundwater issues including water quality to get a better coordinated response with multi-agency support to make these efforts more successful.
3. **Participate in IRWM Plan Process** – The District is leading the Tahoe-Sierra IRWMP process to provide a road map for a long-term water supply in the region. The IRWMP is being developed in collaboration with local stakeholders, such as water and wastewater agencies, and evaluates potential water supply projects and programs that provide regional benefit. The IRWMP also provides a basis for acquiring State and federal funding for local water supply and management projects. The Technical Advisory Committee to the IRWMP Board will be the primary venue through which project ideas will be articulated, evaluated, and prioritized for inclusion in the IRWMP.
4. **Coordinate with regulatory agencies on remediation and closure of contaminated sites** – The District and other water purveyors have a vested interest in the environmental investigation and remediation of contamination sites. The District, or other appropriate water purveyor, as a potentially impacted party, will work with the overseeing regulatory agency (e.g., County, LRWQCB, etc.) by providing timely comments to LRWQCB staff regarding issues and concerns (e.g., remaining levels of contaminants and their potential effects on existing or potential future wells) with candidate sites. The District will coordinate with the regulatory agency and property owner to consider maintaining existing down-gradient monitoring wells to be incorporated into the groundwater monitoring program rather than being destroyed during site closure.
5. **Coordinate data sharing with other public agencies** – Coordination with other agencies that collect data (e.g., USGS, LTBMU, and others) for groundwater levels, hydrology and climatic data. A listing of available data sources will be compiled and a listing of contacts or locations to obtain this data will be maintained and made available. A listing of relevant online data sources is provided in Table 9-1.

8.4 BMO #4 – Integrate Groundwater Quality Protection into Local Land Use Planning Activities

A key element of a GWMP is an ongoing program of monitoring groundwater conditions. The District, small water companies, and large private well owners (water supply, industrial, or environmental remediation) will collect groundwater data on a regular schedule to improve the understanding of groundwater conditions in the TVS Basin. For BMO #4, the following actions are proposed:

1. **Update and maintain map of water supply source area protection zones and share with land-use planning** – California's DWSAP Program was developed by the DDW (formerly CDPH) to protect the State's public water systems and includes both a source water assessment and source area protection program. The District will continue to complete these assessments for new production wells, and also consider updating the source assessments for older wells if there has been a significant change in the operating status of the older wells or significant change in land use in the vicinity of these wells.

2. **Conduct a regional groundwater vulnerability assessment** – A regional groundwater vulnerability assessment would evaluate the entire TVS Basin to determine areas where the aquifer is particular susceptible to contamination from surface activities beyond the preliminary aquifer vulnerability assessment (Section 6.3). The benefits of this analysis are to support local planning and regulatory agencies for assessing the relative threat from commercial activities located within the contributing watersheds surrounding the groundwater basin. As commercial activities within the surrounding watersheds are relatively limited to recreation facilities, the need for a complete vulnerability assessment is desirable but would be subject to the District's ability to obtain outside funding and competing groundwater management needs.
3. **Coordinate with other agencies for monitoring and assessment of storm water management projects on groundwater quality** – Detention basins to control storm water runoff are being implemented as part of the effort to maintain water quality in Lake Tahoe. These basins allow storm water runoff to percolate to the groundwater. Overall, these facilities provide many benefits to both surface water and groundwater; however, by their nature, they provide a possible conduit for contaminants to reach groundwater. Several recent studies have indicated that these facilities do not pose a major risk to groundwater quality (Section 6.4.1). However, as these facilities could pose a groundwater quality concern, future assessments should provide recommendations on the appropriate locations for these recharge features related to groundwater wells source areas and past site activity. Facilities within the drinking water source areas and past site activity. Facilities within these source areas should have additional measures to help insure groundwater quality protection from either spills, long-term degradation of water quality or leaching of residual contamination.
4. **Expand a working relationship with local land-use planning agencies** – The District will continue and expand communication with local planning agencies with the USFS, TRPA, El Dorado County and CSLT. The purpose of this communication is to insure coordination groundwater management issues with local and regional land use planning activities. The District will review and update its policy on assessing the water supply needs of new developments that would request water from the District. This may include adding potential mitigation measures for developers that may include groundwater protection, water conservation or other measures to offset the costs of increasing the water supply.

8.5 BMO #5 - Assess the Interaction of Water Supply Activities with Environmental Conditions

The TVS Basin is located in a unique environmental setting. Water supply operations using groundwater may both affect environmental conditions or be affected by changes in the environment. Groundwater – surface water interactions with Lake Tahoe and the rivers and streams serve as both groundwater discharge and recharge locations depending on their location and the time of year. Understanding the interactions is a necessary part of providing sound groundwater management for the TVS Basin.

The proposed actions for BMO #5 are to outline measures to incorporate environmental stewardship as a part of groundwater management. Potential actions include the following:

1. **Assess the effects of groundwater pumping on habitats in lakes, streams and wetlands** – Continued sensitivity towards environmental issues is a management objective. Operation of water supply systems has the potential to affect environmental conditions primarily through the lowering of groundwater levels affecting environmental habitats in lakes, streams and wetlands. Findings from evaluations on the pumping effects of public water system wells neighboring the Upper Truckee River, Trout Creek and Bijou Creek indicate that the greatest declines in shallow groundwater elevations could potentially result from increased groundwater withdrawals neighboring the Upper Truckee Marsh (Section 5.3). Currently, groundwater withdrawals from the neighboring public water system wells do not appear to have a detrimental effect on shallow groundwater levels underlying this marsh. Further evaluation would be needed to ascertain whether groundwater withdrawals from private company wells, small community water system wells and private wells have a substantial effect on the surface water system. This evaluation should include further identification and evaluation of critical reaches of streams, and wetland areas that may be susceptible to active groundwater pumping. Funding for this evaluation is needed, but would be subject to the District's ability to obtain outside funding and competing groundwater management needs.
2. **Support stream restoration efforts in the Basin** – Work by various agencies have helped to restore a more natural habitat for portions of the Truckee River and Trout Creek. Raising stream levels and groundwater levels in the adjoining meadows can help increase groundwater storage, and habitat restoration can help with protecting water quality. The GWMP recognizes these benefits of stream restoration for groundwater management. Agencies should look for opportunities to work together jointly in support of obtaining funding and implementing these types of projects.
3. **Assess potential effects of climate change on groundwater conditions** – The Basin is susceptible to long-term drought or climate change that would affect the natural recharge. Current understanding of long-term climate change indicates the potential of more extreme shifts of weather with longer periods of prolonged drought. In these cases, snowmelt runoff from the mountains could be significantly diminished for a period of years which could affect groundwater levels and the ability to pump groundwater. Climate change is a complex subject. Therefore, a feasibility study of the potential effects of climate change on groundwater levels and measures to address these effects is needed, but would be subject to the District's ability to obtain outside funding and competing groundwater management needs.

8.6 BMO #6 – Convene an Ongoing Stakeholder's Advisory Group (SAG) as a Forum for Future Groundwater Issues

A key objective of this GWMP update is to continue to build off of these existing relationships to further enhance groundwater management and protection in the TVS Basin. To further that objective, the SAG formed for the 2014 GWMP Update will be asked to continue and supplemented with new members as appropriate. The purpose of the SAG will be to provide a regional forum to discuss groundwater issues that affect all users within the TVS Basin and facilitate collaboration to better resolve these issues. The purpose of BMO #6 is to provide guidance regarding the role of the SAG in plan implementation.

1. **Host SAG meetings starting in 2015** - The District will host regular meetings of the SAG starting in 2015 and continuing annually at least through the next five-year GWMP update. Regular meetings of the SAG are recommended to be convened in April and September of each year. SAG membership will be informed by the priorities of the District and the strategic inroads that can be made by collaboration with agencies and individuals in their areas of expertise.

2. **Facilitate interagency collaboration** – A key objective of the SAG is to provide a forum for ongoing discussion of groundwater management issues in the TVS Basin to get a regional perspective from different members of the community. This will include identifying and facilitating opportunities for more interagency collaboration through the sharing of available data, resources and procedures.

3. **Continue to define the role of the SAG in assessing groundwater supply issues** – If a water supply issue is found through review of the groundwater monitoring data, the District or affected water purveyor may present their findings and recommendations to the SAG for additional review and discussion. If found to be warranted, the SAG may want to provide support to the agreed upon course of action to demonstrate regional support for the action.

4. **Continue to define the role of the SAG in assessing groundwater protection Issues** – If a water quality issue is detected through review of the groundwater monitoring data and is not considered an emergency response situation, the District or affected water purveyor may present their findings and recommendations to the SAG for additional review and discussion. If found to be warranted, the SAG may want to provide support for the agreed upon course of action to demonstrate regional support for the action.

5. **Share Data** – SAG members, including the District, will be asked to contribute data to the collaborative data sharing and monitoring effort. They will also be asked to provide comments in the design of groundwater monitoring and data sharing policy.

6. **Develop regional support for groundwater projects –** SAG members will be asked for their input and to support groundwater initiatives of the District. In the absence of support, stakeholder's suggestions as to improvements or changes to proposed policies or programs will be sought. SAG members will be asked to recruit support of their peers in the South Lake Tahoe area for groundwater protection initiatives.

As the District assesses the key strategic action areas for 2015 and 2020, guidance policy regarding the role of the SAG will be further developed. This policy will be derived from the strategic plan that will be created out of the BMOs and the discussions of the SAG for this document.

Section 7.4 provides an outline the initial process for convening the SAG, and the anticipated procedures for running the SAG; however, these procedures will be further developed and will evolve over time. The 2015 session will begin with an overview of issues and the discussions of the 2014 SAG, identification of emerging issues that have developed and prioritization of potential topics for discussion.

8.7 BMO #7 – Conduct Technical Studies to Assess Future Groundwater Needs and Issues

Understanding the factors that control groundwater conditions in the TVS Basin is important for long-term management. Several studies have been conducted over the years, but additional work will be needed to help address emerging issues. The District and/or other local water purveyors and well owners, will need to conduct various studies to support groundwater management decision makers.

The actions proposed under BMO #7 outline some of the potential studies that could be conducted by the District or others to further the understanding of the groundwater basin to help support groundwater management. However, many of these studies may require obtaining outside funding for them to be completed. The list of potential studies will continue to be updated on an ongoing basis to keep current with emerging issues. For BMO #7, the following actions are proposed:

1. **Assess impact of the SGMA** – in response to the 2014 drought, the California Assembly passed the SGMA in September 2014 that changes how groundwater is actively managed in the state. This GWMP was developed in anticipation of these changes which includes emphasis on monitoring, reporting and interagency collaboration. Under the SGMA, DWR would be required to designate groundwater basins as high, medium, low or very low priority; adopt regulations for the adequacy of groundwater sustainability plans and publish groundwater sustainability best management practices. As DWR has identified the TVS Basin as medium priority, the District intends to further modify the GWMP as the basis for its GSP and serve as the GSA for the TVS Basin. The District will continue to monitor evolving requirements under the SGMA to insure conformance between the adopted regulations and the GSP to be developed for the TVS Basin.
2. **Support future groundwater studies in the Basin** – The District will look to identify and prioritize future groundwater studies that will improve the overall understanding of the TVS Basin and identify actions needed to achieve sustainable groundwater management. Potential subjects for these studies may include improving groundwater cleanup activities to mitigate on-going impairment of water supplies, further evaluation of potential pumping effects on groundwater –surface water interactions, refining the groundwater budget, evaluating groundwater flow conditions in significant water-bearing zones used for drinking water supply, or assessing areas of degraded water quality including areas with natural constituents above MCLs for future water supply. This proposed action is dependent upon obtaining outside funding to be implemented.
3. **Update the existing TVS Basin groundwater model** – The District developed a numerical groundwater model of the TVS Basin in 2007 for the development of groundwater resources in the presence of contaminant plumes. The model provides a quantitative tool for evaluating potential future conditions as well as furthering the overall hydrogeological understanding of groundwater conditions in the TVS Basin. The model could be used, for example, to further assess the impacts of groundwater pumping , evaluating groundwater recharge and using water balances to refine the groundwater budget This model should be updated with new geological and groundwater data, simplified and if possible, integrated into a groundwater-surface water model to provide a tool for use by the District, private water companies and other agencies to evaluate the

potential effects of future groundwater withdrawals within the TVS Basin. This proposed action is dependent upon obtaining outside funding to be implemented.

4. **Expand monitoring well network to evaluate recharge and other key areas** – The District will expand its groundwater monitoring well network to include additional monitoring wells to improve the ability to track the changes in groundwater levels and quality in the TVS Basin. The various purposes of these wells would include defining drawdown effects near active pumping wells, understanding groundwater recharge potential in key recharge areas, and providing better spatial coverage to define groundwater flow. This proposed action is dependent upon obtaining outside funding to be implemented.

5. **Assess potential future need and feasibility of groundwater replenishment facilities** – Currently recharge is considered to be sufficient to support groundwater pumping in the TVS Basin. In the future, it is possible that could change due to increased pumping or climatic conditions such as an extended drought. Therefore, an alternatives assessment of potential groundwater recharge projects should be conducted to identify the preferred methods and capacity of groundwater augmentation that may be required in the future. For example, this could include projects to slow down runoff to increase infiltration rates, divert runoff to percolation ponds or otherwise enhance the natural infiltration process. The District treats an average of 4.0 mgd of wastewater which is exported to outside the Lake Tahoe Hydrologic Basin. This represents a significant water source that could be used to supplement and/or replenish groundwater supplies in the future. Studies to consider added wastewater treatment needed to produce acceptable effluent quality and regulatory changes needed to allow for recycled water use within the TVS Basin or to directly replenish groundwater supplies may also be conducted. These proposed actions are dependent on obtaining outside funding preferably through a grant.

8.8 BMO #8 - Identify and Obtain Funding for Groundwater Projects

Groundwater projects will require funding. In addition to funding from local sources, there are state and federal grants and other funding programs available. These types of opportunities will require effort to prepare application and may require participation in larger programs (e.g., IRWMP) to be eligible.

BMO #8 recommends an evaluation to identify potential funding sources for future groundwater projects. For BMO #8, the following actions are proposed:

1. **Identify Potential Projects** – Some funding opportunities require that the project be “shovel ready” or have short windows when the funds can be used, which would require existing designs, CEQA and other work already be prepared. The District will evaluate the priority of projects that could be designed and put on a shelf until funding is available. This evaluation will be an ongoing task to keep the priority of projects current with changing needs and issues. Several potential projects have been identified as potential actions under the BMOs.

2. **Develop background and supporting materials** – Many grants have a short turnaround time. The District will develop background and supporting materials so that the District can respond quickly and successfully to grant funding opportunities.

3. **Identify potential funding sources** – The District will develop a list of potential funding sources. The District will work through the IRWMP process and also keep track of funding opportunities through State agencies. The District should also evaluate federal and state funding opportunities associated with efforts to maintain water clarity in Lake Tahoe as several related groundwater issues to those efforts.

Section 9: Basin Monitoring Program

This section describes the routine monitoring and reporting activities undertaken by STPUD regarding groundwater and surface water.

9.1 Groundwater Management Monitoring

STPUD currently has in place various programs to fulfill the DWR requirements. This section briefly describes the types of data collected and how and where they are acquired. A summary of the GWMP Monitoring Plan components are provided in Table 9-1.

As part of the GWMP Basin Monitoring Plan, the District will reach out to other water purveyors and other governmental agencies about sharing data. The District will work with other agencies to identify data that will help support the Basin Monitoring Program for all stakeholders.

9.1.1 Groundwater Levels

STPUD collects groundwater head elevation data semiannually from a suite of representative wells in order to facilitate analysis of seasonal and long-term trends in groundwater elevation. STPUD monitors groundwater head elevation in 30 observation wells located throughout the TVS Basin. Semi-annual measurements are collected in May and November of each year in all 30 observation wells; additionally, 13 of the observation wells are equipped with data loggers that measure and record groundwater head elevation twice daily. A more detailed description of the STPUD Groundwater Elevation Monitoring Plan for the TVS Basin, including procedures and protocols, is included in Appendix D.

Supplemental groundwater level data from GeoTracker (see Section 9.2.1), and from the Water Information Center and Water Data Library (see Section 9.3.1) are available online to be included in the GWMP or other groundwater assessments, if needed. The GeoTracker data is primarily collected from shallow monitoring wells screened across the water table, within the uppermost water-bearing zones of the TVS Basin.

9.1.2 Groundwater Quality

To ensure that water quality of drinking water is maintained, the Water Code includes a requirement that water purveyors regularly monitor groundwater quality at each drinking water source (i.e., well). The suite of required constituents includes various inorganic chemicals, radioactivity, and organic chemicals. This section describes the monitoring performed by STPUD and by other entities extracting water from the TVS Basin.

STPUD collects samples of groundwater from 15 active production and monitoring wells on at least an annual basis (from June to August), and submits those samples for analysis of the full suite of Title 22 analytes. Sampling procedures and protocols met all the requirements for Title 22.

The regulated groundwater purveyors listed in Table 3-3 are required to electronically submit laboratory reports for water quality samples to the DDW (see Section 9.2.3). These reported data will be incorporated into the data for the GWMP. These data can be obtained for use by public agencies from DDW rather than contacting each individual agency for the data.

9.1.3 Pumping Volumes

Tracking the volumes of groundwater extracted from the TVS Basin is a key data set for groundwater management, and is an additional authority provided to GSAs under the SGMA.

The largest groundwater pumper is STPUD who currently meters pumping volumes in each well continuously. These data are compiled by the District into monthly and annual pumping volumes. LBWC and TKWC are the next two largest pumpers. Pumping volumes for each of these three water purveyors accounts for more than 95 percent of the groundwater withdrawals from the TVS Basin and should be tracked on a monthly basis for the GWMP. The small private groundwater pumpers listed in Table 3-3 are currently permitted through the County, and have not been required to report groundwater pumping. As part of the GWMP, outreach to these small community water systems will be conducted to get a better understanding of their groundwater usage and encourage metering and reporting for the larger volume production wells.

9.1.4 Land Surface Subsidence

Because of the geologic composition and history of the TVS Basin, inelastic land surface subsidence is not anticipated to occur. The geology of the TVS Basin is discussed in Section 5 and summarized with respect for the potential for land subsidence in Section 5.5.2. The District will monitor groundwater levels, as required under BMO #1, as the primary tool for identifying potential land subsidence. If significant, sustained regional decreases in groundwater levels occur, the District will make an assessment on a case-by-case basis of whether the local geology at that location is susceptible to potential land subsidence, and, if necessary, take appropriate measures.

9.1.5 Surface Flow and Water Quality

The USGS collects and stores large amounts of data on streamflow and surface water quality. that is readily available for use in the GWMP through the National Water Information System (NWIS; http://waterdata.usgs.gov/nwis/). Within the District service area there are twenty streamflow gauges with historical data, with the period of record stretching from 1923 to the present. Of these, four are currently operational as shown on Figure 2-6. The service area also contains numerous sites where surface water quality samples have been collected. These data can be used to estimate recharge from streams for use in the groundwater budget, assess potential groundwater-surface water interactions and monitor surface water quality trends.

9.2 Additional Groundwater Quality Monitoring

In addition to the data sources described above, other data types are available from various agencies via the internet, as described in the following sections.

9.2.1 Groundwater Remediation Monitoring Data

The SWRCB GeoTracker website (http://geotracker.waterboards.ca.gov) acts as a clearinghouse for groundwater data from environmental sites, such as underground storage tanks, landfills, and contaminated sites. Figure 6-2 shows the locations of sites currently listed on GeoTracker. Many of these sites have current and historical data for groundwater levels and water quality associated with their investigation and remediation activities. These data can also be used to supplement the GWMP data.

9.2.2 El Dorado County CUPA Monitoring

The El Dorado County Environmental Management Division, Hazardous Waste Department (EDCEMD-HWD), has been defined as the Certified Unified Program Agency (CUPA) for El Dorado County. As of January 1, 2013 all existing businesses that store threshold quantities of hazardous materials or hazardous waste are required to annually update their hazardous materials information on California Environmental Reporting System (CERS). This is a statewide web-based system to support CUPAs and Participating Agencies (PAs) in electronically collecting and reporting various hazardous materials-related data as mandated by the California Health and Safety Code and new 2008 legislation (AB 2286). This includes all hazardous materials business plans, chemical inventories, site maps, underground and aboveground tank data, and hazardous waste related data for these businesses. These data can be available from EDCEMD-HWD for use in the GWMP.

9.2.3 El Dorado County Small Water System Monitoring

The El Dorado County Environmental Management Division, Environmental Health Department (EDCEMD-EHD) is responsible for managing the Small Water Systems Program for El Dorado County. The Small Water Systems Program is involved with the permitting, inspection, and monitoring of 175 small public water systems. The County is the Local Primacy Agency, under contract with the DDW, to perform the program requirements that are specified in State and Federal Regulations. The purpose of the program is to ensure that small water systems deliver safe, adequate, and dependable potable water. Environmental Health reviews new applications and changes of ownership to verify that the system will be able to meet technical, managerial, and financial capabilities.

A small water system is a private system for the provision of piped water to the public for human consumption that serves at least five, but not more than 14, service connections and does not regularly serve drinking water to more than an average of 25 individuals daily for more than 60 days out of the year. There are several private water systems that have wells which supply drinking water to schools, resorts, hotels, apartments and recreational areas located within the TVS Basin (Section 3.2.2).

Laboratory reports for water quality samples collected from small water systems wells are electronically submitted to the EDCEMD-EHD and DDW. EDCEMD-EHD maintains a database which includes both bacteriological and chemical water quality data for the small water systems wells, along with system number, address, number of service connections, population served and water quality violations. These data can be available from EDCEMD-EHD for use in the GWMP.

9.2.4 TRCD Storm Water and Watershed Monitoring

The Tahoe Resource Conservation District (TRCD) implements a storm water monitoring program. The TRCD monitors six locations around Lake Tahoe. One of the sites is located at Pasadena Avenue and the shore of Lake Tahoe, where the inflow to a storm water treatment device and the outfall to the Lake are both monitored. Samples are collected on an event basis; for the period from October 2013 to March 2014, samples were collected at the Pasadena station in the City of South Lake Tahoe during events starting on January 29 and February 8. Water quality results are available on the RSWMP website (http://tahoercd.org/tahoe-stormwater-monitoring/).

A monitoring plan has been developed to provide monitoring procedures and protocols (TRCD, 2013). Several parameters are measured including flow volume, total suspended solids, turbidity, particle size, and nitrate and phosphorus concentrations. These data are provided an annual report that is submitted to the LRWQCB and the Nevada Division of Environmental Protection (TRCD, 2014).

9.3 Compilation of Data from Other Sources

In addition to those sources described above, various additional types of data are available from different agencies and are typically available via the internet.

9.3.1 Supplemental Water Level Data

The DWR maintains databases and interactive maps available on the internet that provide data reported to DWR for public use. These sites can be accessed to retrieve supplemental data in addition to the data collected as part of this GWMP. These internet sites include:

- The Groundwater Information Center (GIC) is DWR's portal for groundwater information, groundwater management plans, water well basics, and statewide and regional reports, maps and figures. The web link for the GIC is http://water.ca.gov/groundwater/.
- The Water Data Library (WDL) is another portal that allows quick access to groundwater level and some water quality, surface water and climate data for many locations in California. Included in the WDL are data from the USGS NWIS also includes groundwater level and quality information. The web link for the WDL is http://www.water.ca.gov/waterdatalibrary/index.cfm.

9.3.2 CASGEM

STPUD undertakes to collect data to satisfy its responsibilities under the CASGEM Program. The CASGEM Program was created by SB-X7-6, enacted in November 2009. Under this program, local entities (such as STPUD) are required to collect groundwater head elevation data semiannually from a suite of representative wells in order to facilitate analysis of seasonal and long-term trends in groundwater head elevation. The CASGEM data is available via the internet through the DWR WDL discussed above.

The Groundwater Elevation Monitoring Plan attached as Appendix D details the activities STPUD undertakes to collect data to satisfy its responsibilities under the CASGEM Program. STPUD monitors groundwater head elevation in 30 observation wells located throughout the TVS Basin. Semi-annual measurements are collected in May and November of each year in all 30 observation wells; additionally, 13 of the observation wells are equipped with data loggers that measure and record groundwater head elevation twice daily.

9.3.3 Climate Data

Climate data for the South Lake Tahoe area is available from a variety of sources that are listed in Table 9-1. Climate data from the National Oceanic and Atmospheric Administration National Climate Data Center , USDA National Resources Conservation Service National, the DWR California Data Exchange Center, and the Western Regional Data Center, and the Tahoe Climate Information Management System.

Precipitation is the primary component of the climate data that will be compiled regularly to evaluate potential recharge and runoff in the TVS Basin. Tahoe City is the station with the longest period of record with more than 100 years of records. The South Lake Tahoe station has only 14 years of historic precipitation records, but more than 40 years of temperature records. The Tahoe Climate Information Management System has precipitation record back to 1968. Snowmelt runoff from the surrounding mountains is a key recharge component. Snow water equivalent measurements are available through the USDA Natural Resources Conservation Service from three stations in the South Lake Tahoe area (Figure 2-6).

TABLE 9-1
GWMP MONITORING PLAN DATA SOURCES

Organization	Contact	Data
STPUD	Ivo Bergsohn 1275 Meadow Crest Drive South Lake Tahoe, CA 530-544-6474	Groundwater levels Groundwater quality Pumping volumes
Lukins Brothers Water Company	Jennifer Lukins 2013 West Way South Lake Tahoe, CA 530-541-2606	Pumping volumes Groundwater levels
Tahoe Keys Water Company	Greg Trischler 356 Ala Wai Blvd. South Lake Tahoe, CA 530-542-6451	Pumping volumes Groundwater levels
USGS	National Water Information System http://waterdata.usgs.gov/nwis/	Groundwater levels Surface water flow and quality
DWR	Groundwater Information Center http://water.ca.gov/groundwater/ Water Data Library http://www.water.ca.gov/waterdatalibrary/index.cfm CASGEM http://www.water.ca.gov/groundwater/casgem/	Groundwater and climate data
SWRCB	GeoTracker http://geotracker.waterboards.ca.gov Groundwater Ambient Monitoring & Assessment Program (GAMA) http://geotracker.waterboards.ca.gov/gama/	Groundwater levels Groundwater quality Pumping data
TRCD	Regional Storm Water Monitoring Program http://tahoercd.org/tahoe-stormwater-monitoring/	Storm water quality
Desert Research Institute	Tahoe Climate Information Management System http://www.tahoeclim.dri.edu/ California Data Exchange Center http://www.wrcc.dri.edu/summary/Climsmcca.html Western Regional Climate Center http://www.wrcc.dri.edu/summary/Climsmcca.html	Climate data
NOAA	National Climate Data Center Global Historical Climate Network http://www.ncdc.noaa.gov/oa/climate/ghcn-daily/	Climate data
USDA	Natural Resources Conservation Service http://www.wcc.nrcs.usda.gov/ SNOTEL http://www.wcc.nrcs.usda.gov/snow/	Snow water equivalent

Section 10: Implementation Plan

This section outlines a schedule to assist with the implementation and assessment of this GWMP. An important aspect of this section is the identification of the BMOs and actions that will be implemented by the District over time. The schedule for the implementation plan for the BMOs, plan components, and actions is presented in Table 10-1.

10.1 Approach for Implementation

Standing procedures and ongoing practices consist of groundwater management related activities that the District is already implementing and will continue to implement. As presented in Table 10-1, this includes several proposed actions as part of the BMOs. The District intends to continue these activities on an ongoing basis. The actions under these BMOs will focus on managing, maintaining, and monitoring groundwater quantity and quality, coordinate with other local agencies, convene ongoing SAG meetings, and addressing planned or potential future water supply options.

- **Standing procedures and ongoing practices** lists that the District is already performing and will continue to perform in the future.
- **The short-term implementation plan** lists those actions that the District will plan to implement over the next five years. As presented in Table 10-1, this includes several proposed actions under the BMOs #1, #2, #3, #4, #5, #6 and #8. These BMOs and actions will focus on activities related to managing and maintaining groundwater quantity and quality.
- **Facilitate Stakeholder collaboration** lists those actions principally related to building stakeholder collaboration on groundwater issues. These actions are anticipated to be implemented in the short-term and continue through the long-term. Stakeholder collaboration is a key goal of the GWMP update and is therefore called out specifically in the implementation plan.
- **The long-term implementation plan** lists those actions that the District will plan to initiate within the next five years, but full implementation is anticipated to extend beyond the next five years. As presented in Table 10-1, the long-term implementation plan includes several proposed actions as part of the BMOs #1, #2, #6, and #7. These actions will focus on maintaining and protecting groundwater quality, coordinating with other local agencies, and seeking funding opportunities for groundwater projects.
- **Projects dependent upon obtaining outside funding** envision that implementation of the GWMP, as well as many other groundwater management related activities, will be funded from a variety of sources, including State and Federal grant programs. This is a list of actions the District has identified that would be best accomplished through an outside funding source. As presented in Table 10-1, this includes several proposed actions as part of the BMOs #4, #5 and #7.

The GWMP is intended to be a living document, and it will be important to evaluate actions and objectives over time to determine how well they are meeting the overall goal of the GWMP. The District intends to evaluate and update the GWMP on a regular basis.

10.2 Annual Report

The District will produce a concise annual report of groundwater conditions based on the monitoring data. The format of the annual report will be a brief management-level summary that contains up-to-date monitoring data, a brief analysis of the data, and description of groundwater conditions in order to track progress on the groundwater management process.

The basic components that should be addressed by the Annual Report are a summary of the groundwater management activities that occurred during the year being reported. The reports should contain the following information:

- Summary of monitoring results, including a discussion of historical trends;
- Summary of management actions during the period covered by the report;
- Discussion, supported by monitoring results, of whether management actions are achieving progress in meeting BMOs;
- Summary of proposed management actions for the future;
- Summary of any plan component changes, including addition or modification of BMOs, during the period covered by the report; and
- Summary of actions taken to coordinate with other water management and land use agencies, and other government agencies.

The format of the Annual Report is not specifically prescribed to give flexibility for the report to be responsive to current needs which may change over time. The Annual Report is intended to be a brief management level summary for circulation to stakeholders and other interested parties rather than a technical report. There may be times when a more technical discussion is necessary to describe potential groundwater issues or concerns that are relevant to the reporting period.

At this time, the Annual Report will be developed by the District. The results will be presented at a public meeting to the District's Board of Directors and, members of the SAG and other interested parties to keep them up-to-date on groundwater conditions and issues.

10.3 Compliance with the SGMA

Pursuant to the recently enacted SGMA, local agencies may not adopt, renew or amend a GWMP, adopted pursuant to AB 3030 and SB 1938, after January 1, 2015. GWMPs adopted prior to this date will remain in effect until a GSP is adopted. The SGMA requires that GSAs within basins designated by DWR as medium and high-priority adopt a GSP by January 1, 2020 or January 1, 2022, depending on whether the basin is subject to critical conditions of overdraft. The TVS Basin has been designated by the DWR as a medium-priority basin in preliminary rankings and has until January 31, 2015 to complete its final prioritization ranking. Therefore, this GWMP cannot be amended or renewed after January 1, 2015, and, if the GWMP will serve as a basis for compliance with the SGMA, it would need to be augmented to comply with the requirements for a GSP over the next five to seven years.

The SGMA requires that GSPs include prescribed components to achieve sustainable groundwater management to avoid undesirable results, such as chronic depletion of groundwater, water quality degradation, or subsidence. Each GSP must include requisite monitoring and establish measurable objectives, as well as incremental milestones every five years in order to achieve the sustainability goals identified in the plan within roughly 20 years.

Similar to the preparation of the current GWMP, the planning process leading up to the adoption of a GSP involves numerous opportunities for public participation and involvement.

TABLE 10-1
GWMP IMPLEMENTATION PLAN SUMMARY

Standing Procedures and Ongoing Practices	
BMO #1 – Maintain a Sustainable Long-Term Groundwater Supply	Collect and review groundwater levels
	Continue water conservation measures
	Continue to participate in California Statewide Groundwater Elevation Monitoring (CASGEM)
BMO #2 – Maintain and Protect Groundwater Quality	Monitor and review of groundwater quality data
	Continue to implement the County's well construction and abandonment standards
	The District will maintain its MtBE Policy
BMO #3 – Strengthen Collaborative Relationships among Local Water Purveyors, Governmental Agencies, Businesses, Private Property Owners and the Public	Provide for regular public outreach opportunities
	Maintain a working relationship with local and state regulatory agencies
	Participate in IRWMP Process
Short-Term Implementation Plan	
BMO #1 – Maintain a Sustainable Long-Term Groundwater Supply	Collect and track groundwater pumping volumes
BMO #2 – Maintain and Protect Groundwater Quality	STPUD will implement the revised Groundwater Ordinance to address groundwater quality issues SAG will support renewed investigation and clean-up of groundwater contamination with special emphasis on PCE and MtBE contaminant plumes that currently impair water supplies in the South Lake Tahoe and Bijou Areas.
BMO #4 – Integrate Groundwater Quality Protection into Local Land Use Planning Activities	Update and maintain map of water supply source area protection zones and share with land use planning
Facilitate Stakeholder Collaboration	
BMO #3 – Strengthen Collaborative Relationships among Local Water Purveyors, Governmental Agencies, Businesses, Private Property Owners and the Public	Coordinate with regulatory agencies on remediation and closure of contaminated sites
	Coordinate data sharing with other public agencies
BMO #4 – Integrate Groundwater Quality Protection into Local Land Use Planning Activities	Coordinate with other agencies for monitoring and assessment of storm water management projects on groundwater quality
	Expand a working relationship with local land-use planning agencies
BMO #5 – Assess the Interaction of Water Supply Activities with Environmental Conditions	Support stream restoration efforts in the Basin
BMO #6 – Convene an Ongoing Stakeholder's Advisory Group (SAG) as a Forum for Future Groundwater Issues	Host SAG meetings starting in 2015
	Facilitate interagency collaboration and data sharing
	Define role of the SAG in assessing groundwater supply and groundwater protection issues
	Develop regional support for groundwater projects

Long-Term Implementation Plan	
BMO #1 – Maintain a Sustainable Long-Term Groundwater Supply	Maintain awareness for land subsidence Assess the effects of changes to drinking water standards on groundwater supply
BMO #2 – Maintain and Protect Groundwater Quality	Take action if a new or uncontrolled groundwater quality issue is found by review of monitoring data
	Implement emergency action if groundwater quality presents clear and immediate threat to District's water supply and infrastructure
	Assess the effects of changes to drinking water standards on groundwater supply
BMO #3 – Strengthen Collaborative Relationships among Local Water Purveyors, Governmental Agencies, Businesses, Private Property Owners and the Public	Coordinate with regulatory agencies on remediation and closure of contaminated sites
BMO #7 – Address Planned or Potential Future Water Supply Needs and Issues	Assess impact of Changes to California Groundwater Law
BMO #8 – Identify and Obtain Funding Sources for Groundwater Projects	Define projects that could be eligible for outside funding
	Develop background and supporting materials
	Identify potential funding sources
Projects Dependent Upon Obtaining Outside Funding	
BMO #4 – Integrate Groundwater Quality Protection into Local Land Use Planning Activities	Conduct a regional groundwater vulnerability assessment of the Basin
BMO #5 – Assess the Interaction of Water Supply Activities with Environmental Conditions	Assess the effects of groundwater pumping on habitats in lakes, streams and wetlands
	Assess potential effects of climate change on groundwater conditions
BMO #7 – Address Planned or Potential Future Water Supply Needs and Issues	Support future groundwater studies in the Basin
	Update the existing TVS Basin groundwater model
	Expand monitoring well network to evaluate recharge and other key areas
	Assess potential future need and feasibility of groundwater replenishment facilities

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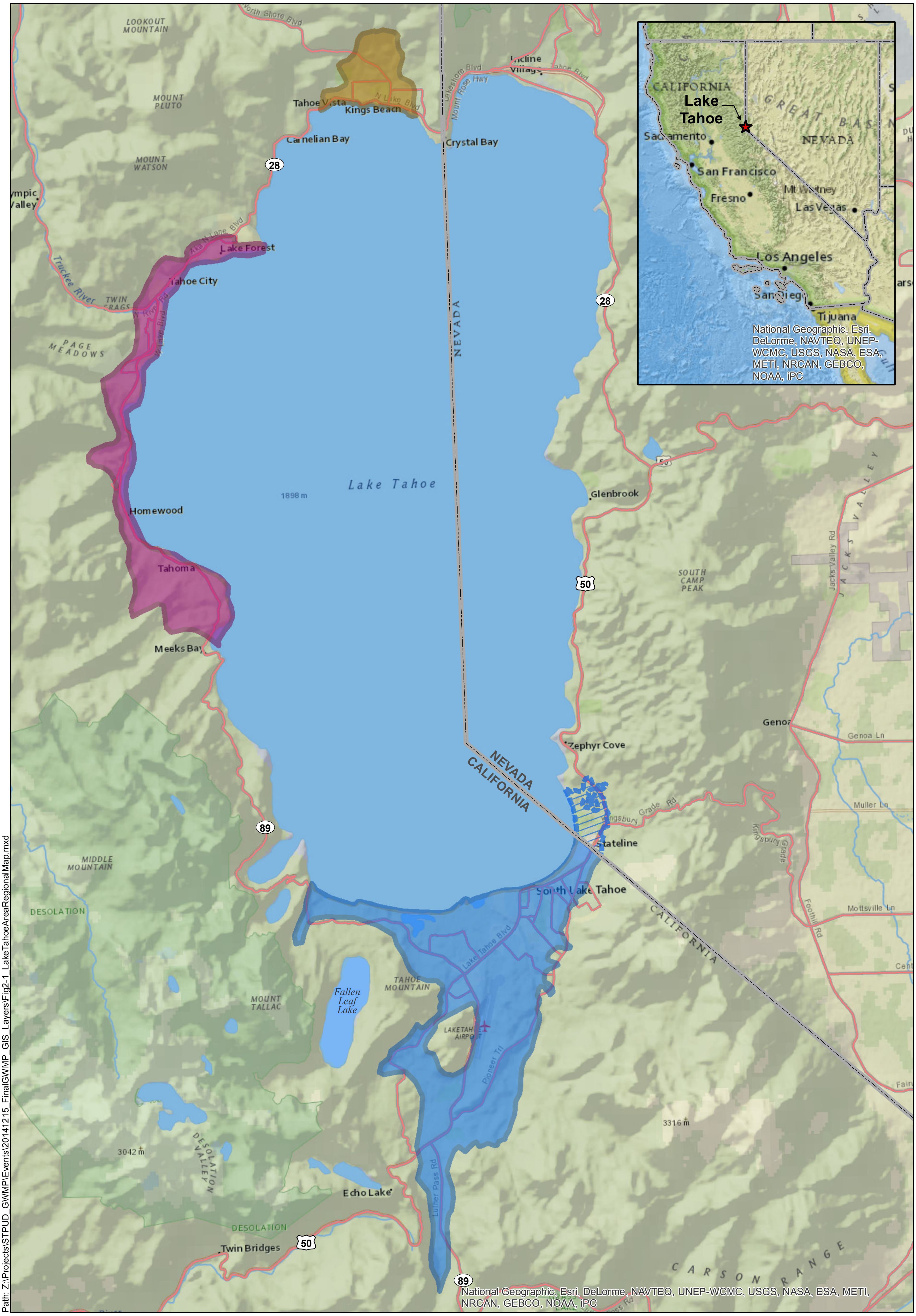
Figures



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LEGEND

- Tahoe Valley North Groundwater Basin (DWR Basin 6-5.03)
- Tahoe Valley West Groundwater Basin (DWR Basin 6-5.02)
- Tahoe Valley South Groundwater Basin (DWR Basin 6-5.01)
- Nevada Extension of Tahoe Valley South Groundwater Basin
- Major Highway
- State Line

N

0 1 2

Scale: Miles

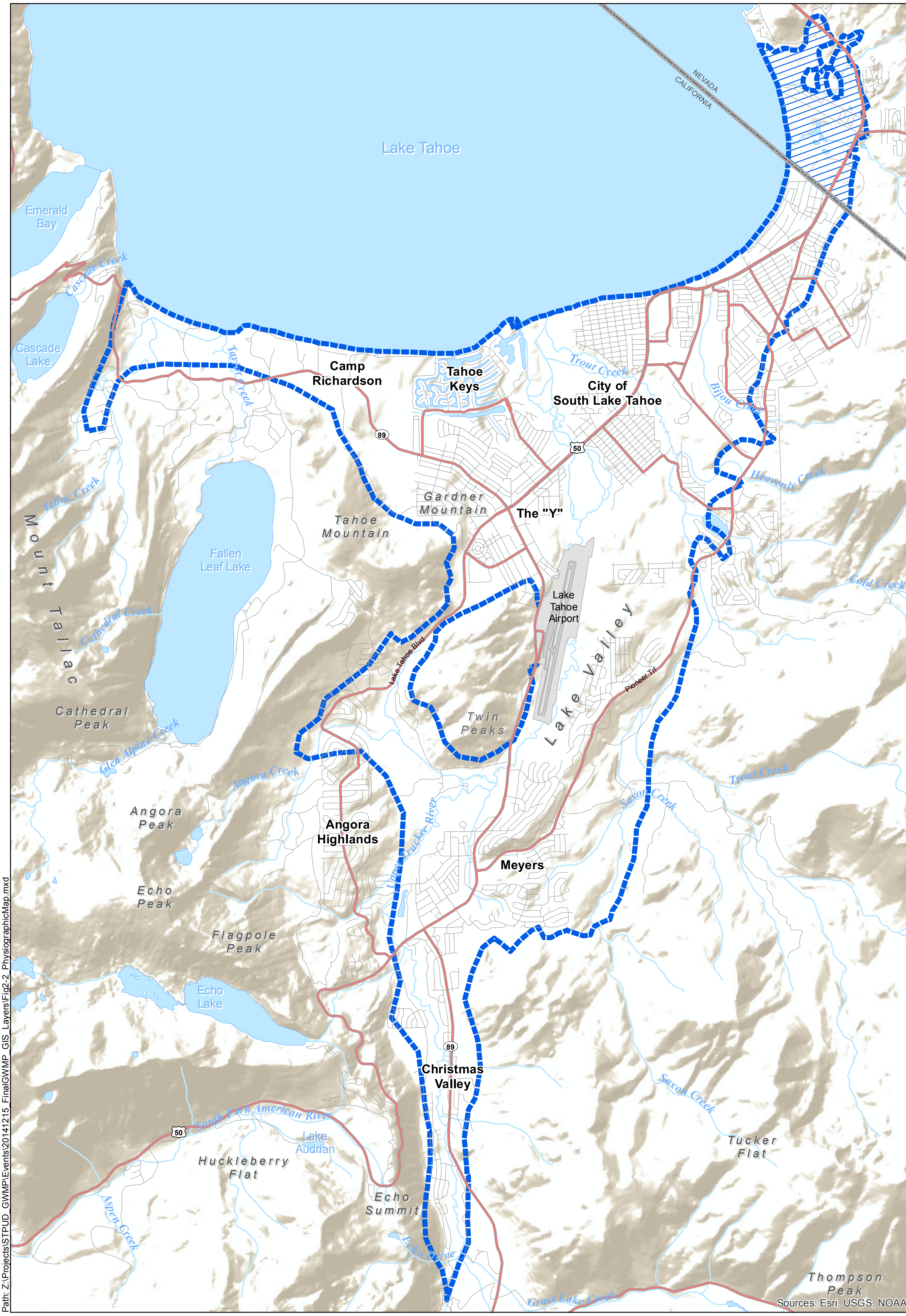
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Lake Tahoe Area Regional Map with DWR Groundwater Basins

K/J 1470005*00
December 2014

Figure 2-1



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LEGEND

- Tahoe Valley South Groundwater Basin
- Nevada Extension of Groundwater Basin
- Lake
- River
- Major Highway
- Road
- State Line

N

0 0.5 1

Scale: Miles

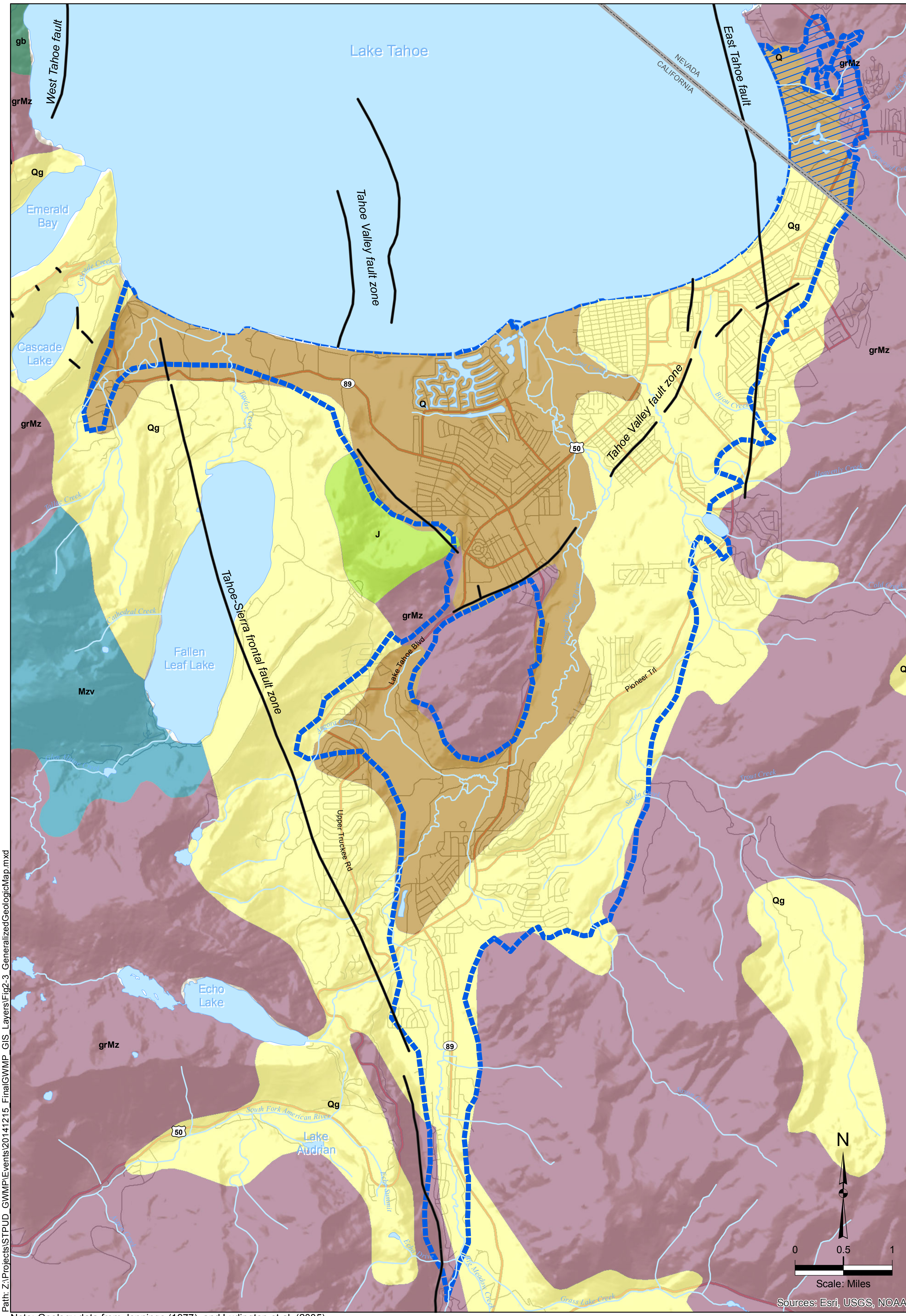
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Tahoe Valley South Groundwater Basin (DWR Basin 6-5.01)

K/J 1470005*00
December 2014

Figure 2-2



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Note: Geology data from Jennings (1977) and Ludington et al. (2005).

LEGEND

Tahoe Valley South Groundwater Basin

Nevada Extension of Groundwater Basin

Lake

River

Fault

Major Highway

Road

State Line

Geologic Unit

Q Alluvium

Qg Glacial Deposits

J Jurassic Marine

Mzv Mesozoic Volcanic and Metavolcanic Rocks

gb Mesozoic Gabbroic Rocks

grMz Mesozoic Granitic Rocks

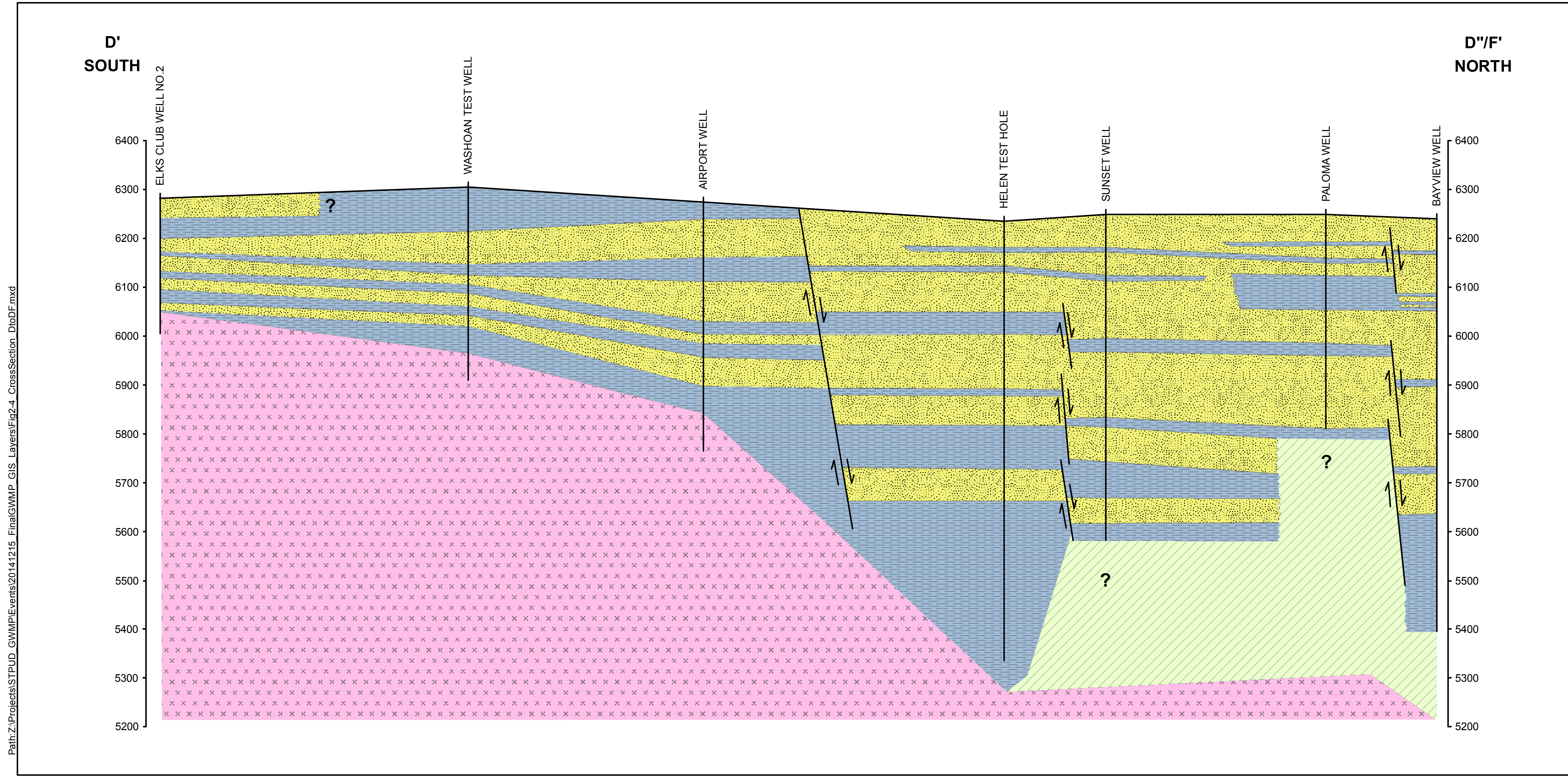
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Generalized Geologic Map for South Lake Tahoe Area

K/J 1470005*00
December 2014

Figure 2-3



EXPLANATION

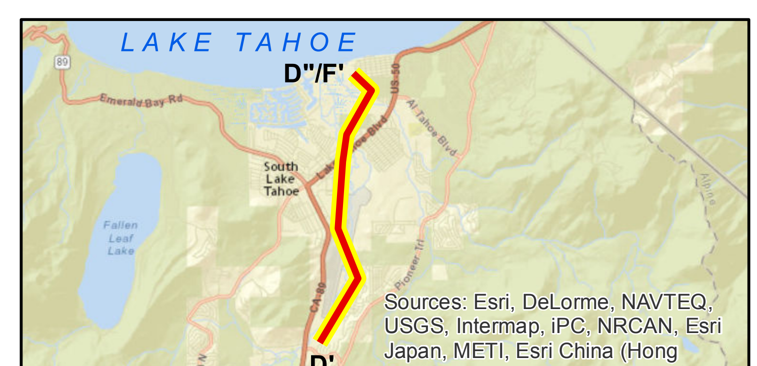
Geologic Unit

- Gravel and Sand (medium to coarse)
- Silt, Clay, with some Fine Sand
- Undifferentiated Basin Fill
- Crystalline Rock (Granite, Metasediments)
- ? Unknown or Uncertain

Growth Fault, Inferred (arrows indicate relative directions of movement)

WELL 1 — Well and Identifier

Feet
200
100
Vertical Scale
0 1000 2000 Feet
Horizontal Scale
Exaggeration: 10x



Index Map

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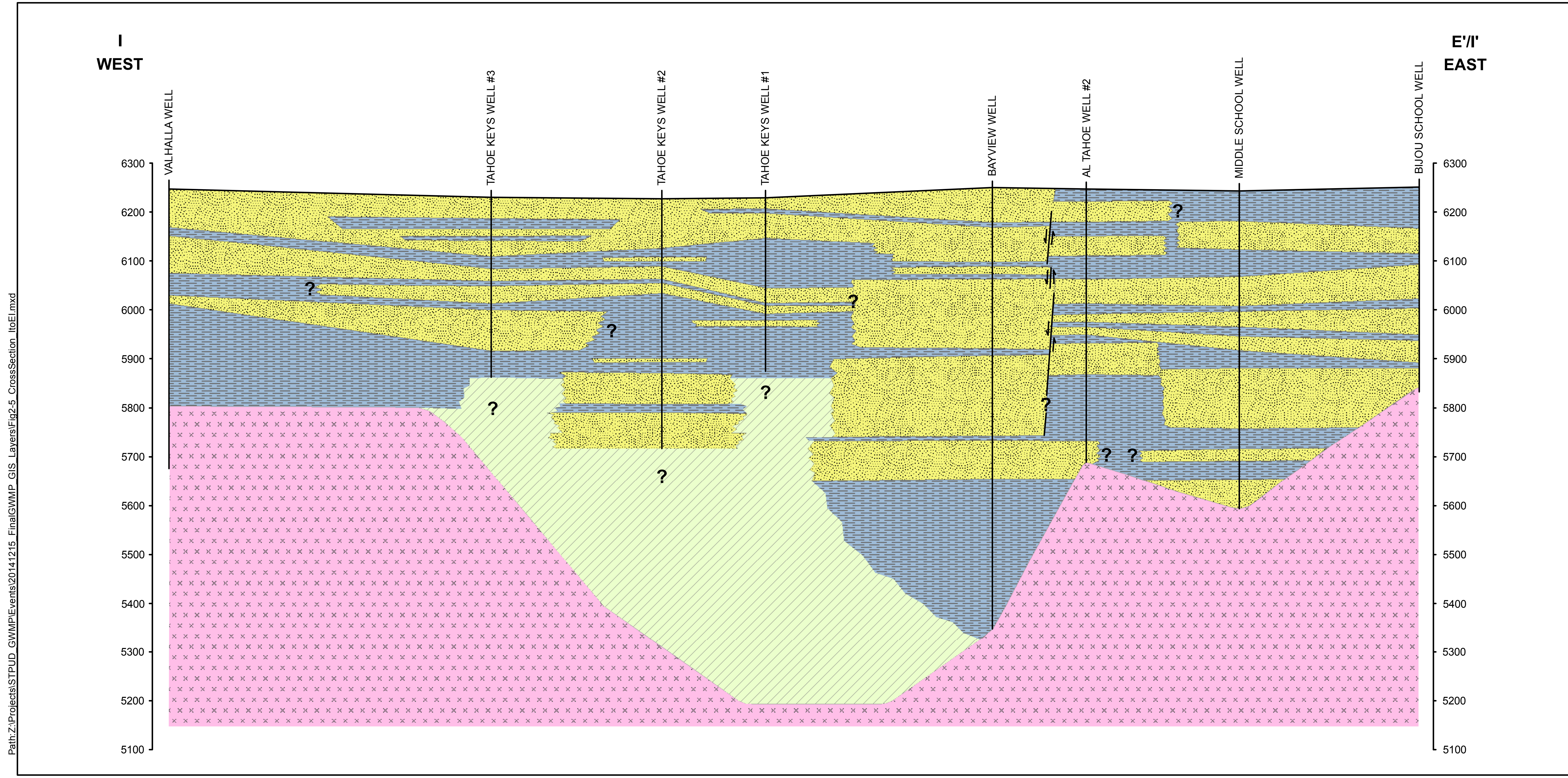
Final Groundwater Management Plan
South Tahoe Public Utility District

North - South Geologic Cross Section Across Tahoe Valley South Basin

K/J 1470005*00
December 2014

Figure 2-4



EXPLANATION

Geologic Unit

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- Undifferentiated Basin Fill
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- ? Unknown or Uncertain

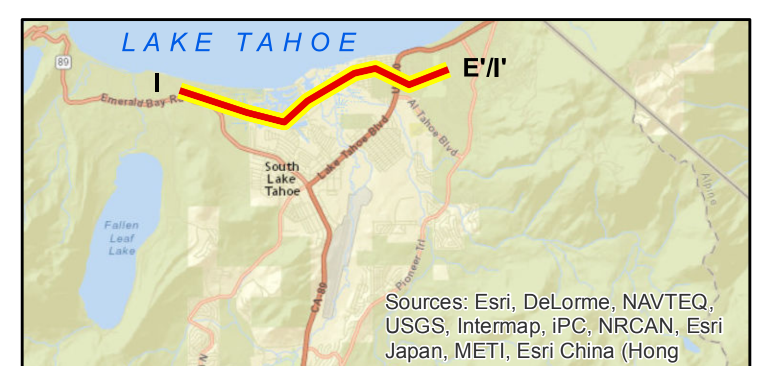
Growth Fault, Inferred (arrows indicate relative directions of movement)

WELL 1 — Well and Identifier

Vertical Scale: 0, 100, 200 Feet

Horizontal Scale: 0, 1000, 2000 Feet

Exaggeration: 10x



Index Map

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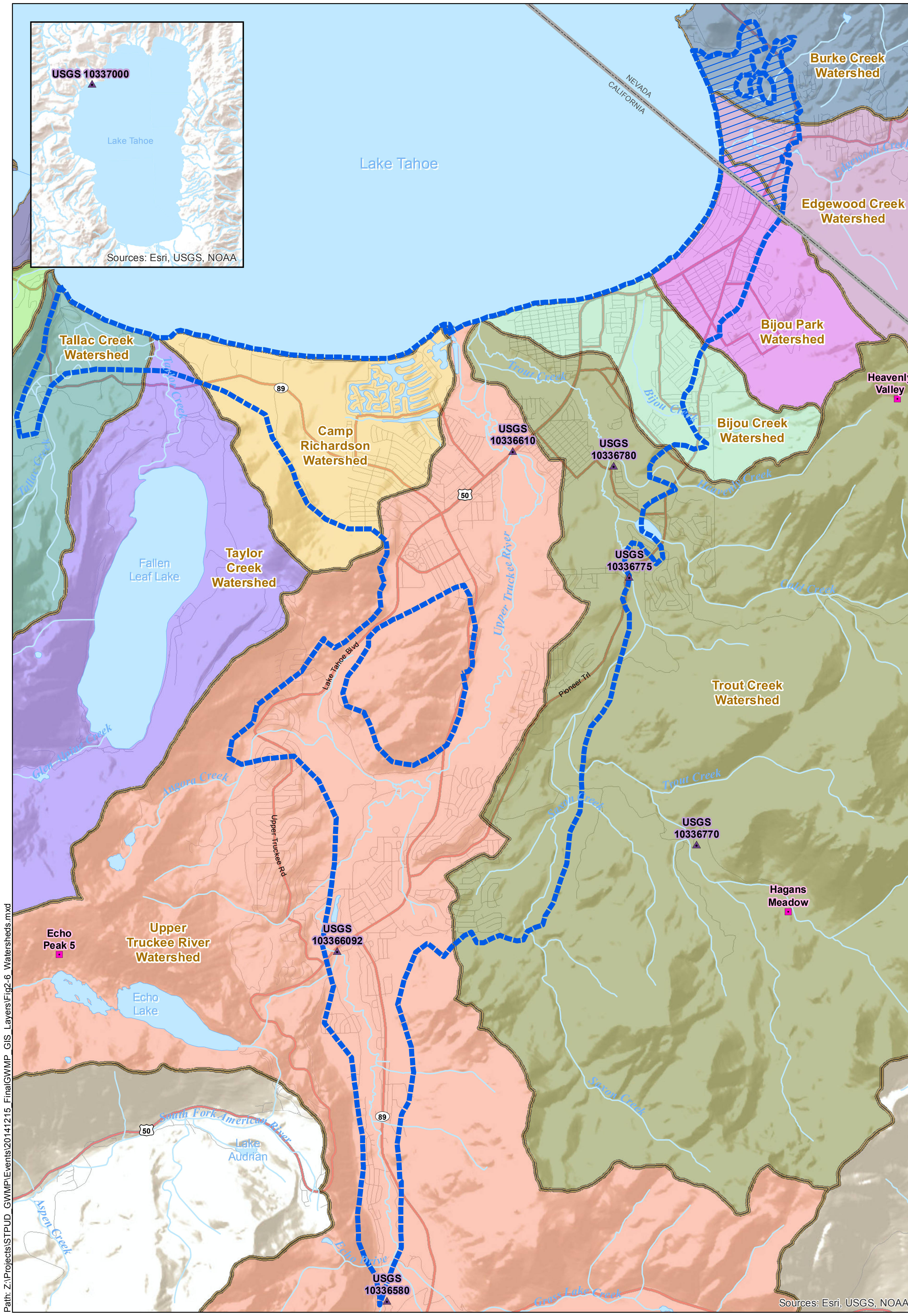
Final Groundwater Management Plan
South Tahoe Public Utility District

East - West Geologic Cross Section Across Tahoe Valley South Basin

K/J 1470005*00
December 2014

Figure 2-5



LEGEND

- USGS Stream Gauges
- DWR Snow Station
- Watershed Boundary
- Tahoe Valley South Groundwater Basin
- Nevada Extension of Groundwater Basin
- Lakes *Lake*
- River
- Major Highway
- Road
- State Line

N

0 0.5 1

Scale: Miles

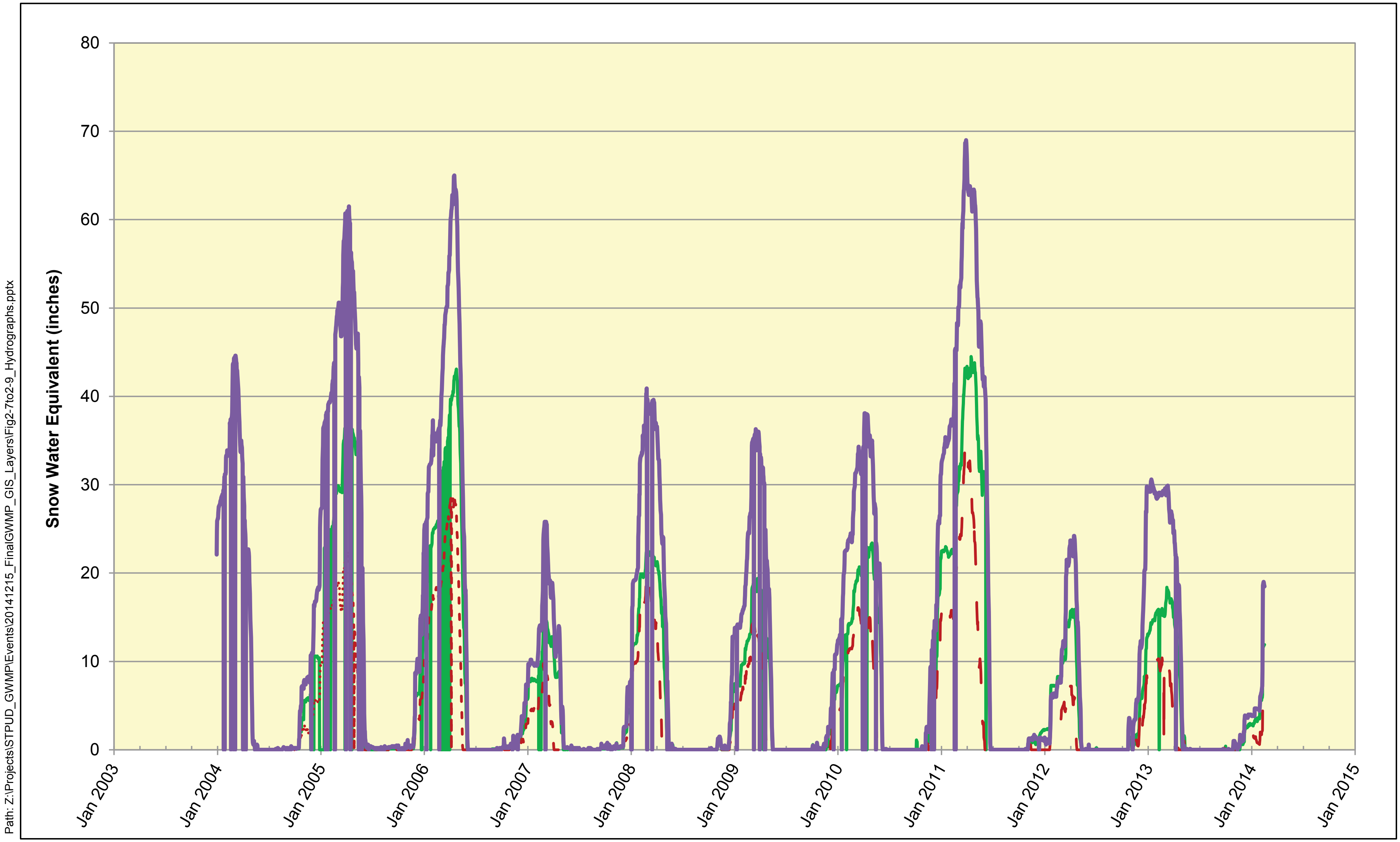
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Watersheds and Hydrologic Features

K/J 1470005*00
December 2014

Figure 2-6



LEGEND

- Heavenly Valley (8,582 ft AMSL)
- Hagans Meadow (7,776 ft AMSL)
- Echo Peak 5 (7,800 ft AMSL)

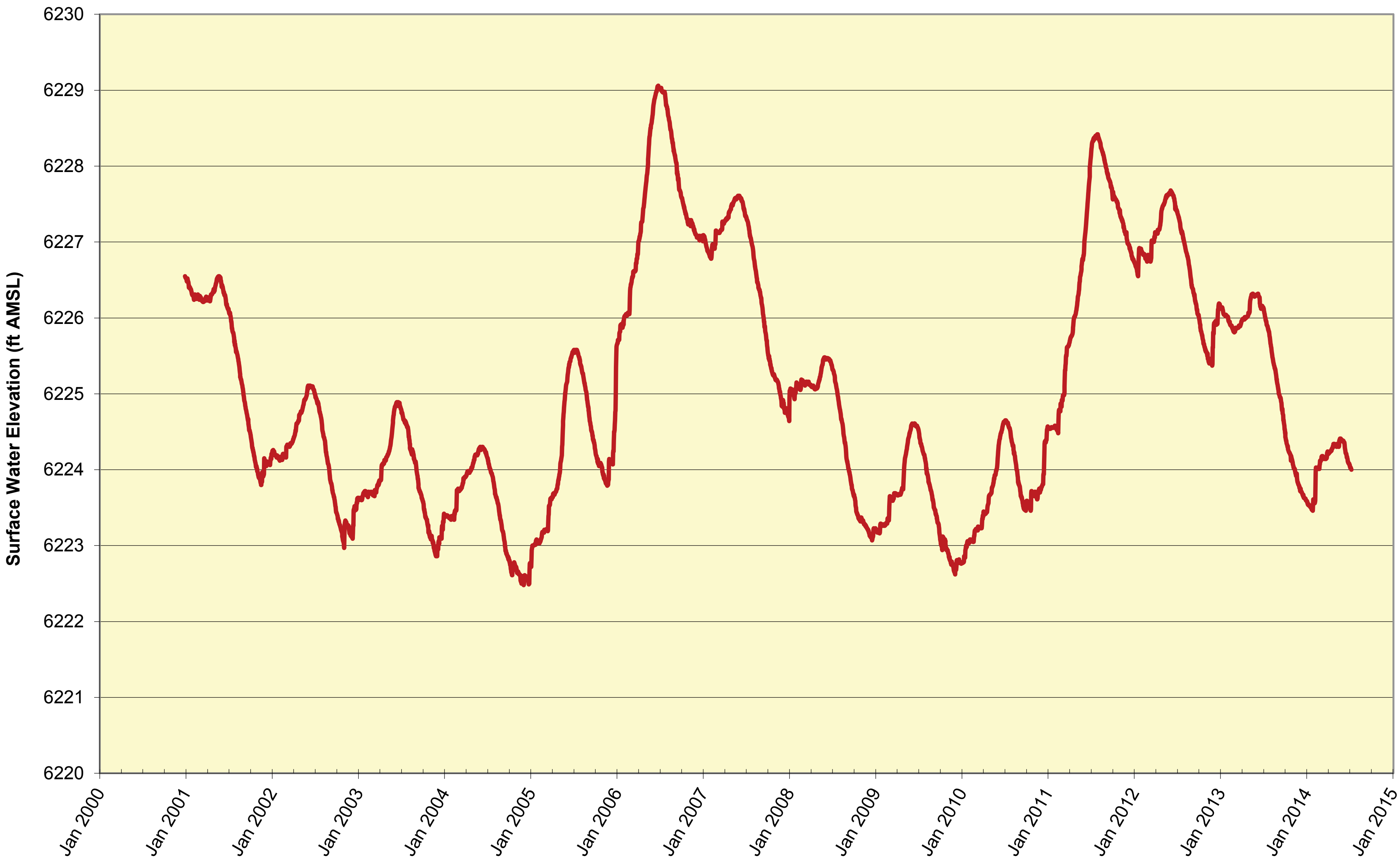
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Snow Water Equivalent Measurements at DWR Snow Stations

K/J 1470005*00
December 2014

Figure 2-7



LEGEND

USGS 10337000 (Elev. = 6220)

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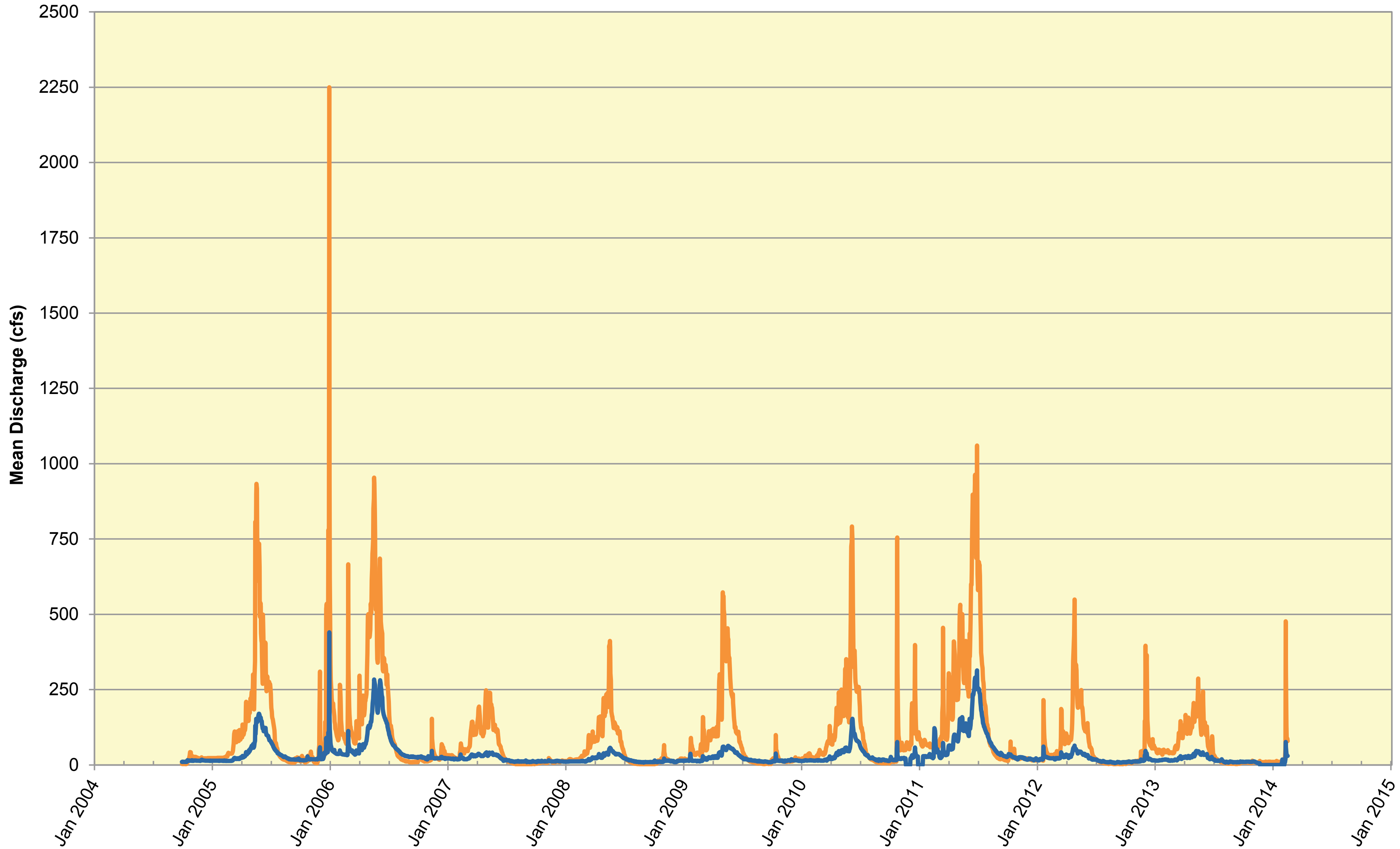
Final Groundwater Management Plan
South Tahoe Public Utility District

Hydrograph of Surface Water Elevation at Lake Tahoe for 2000 to 2014

K/J 1470005*00
December 2014

Figure 2-8



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LEGEND

USGS 10336610 (Elev. = 6229) - Upper Truckee River

USGS 10336780 (Elev. = 6242) - Trout Creek

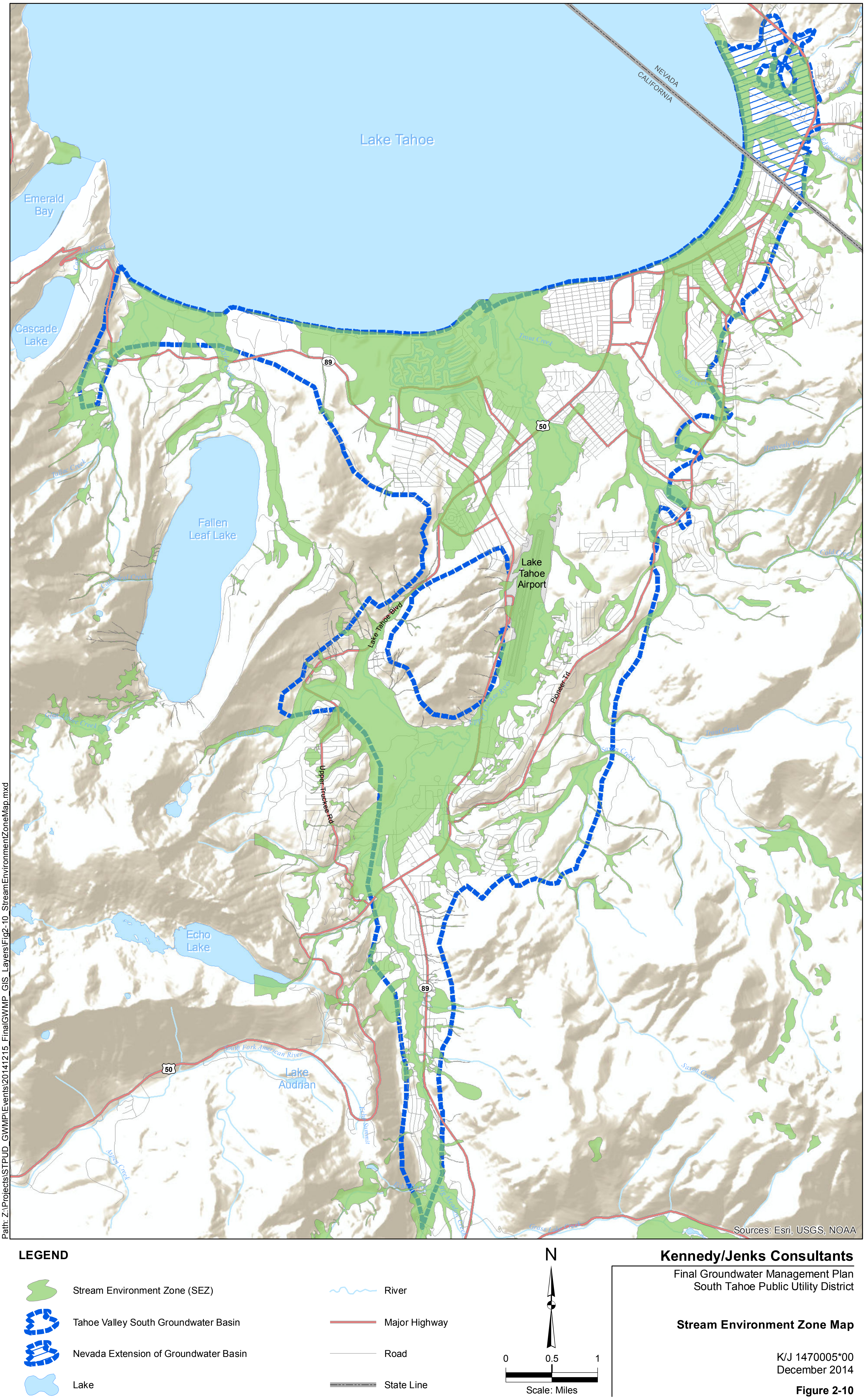
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Hydrograph of Mean Discharge at USGS Stream Gages for 2004 to 2014

K/J 1470005*00
December 2014

Figure 2-9



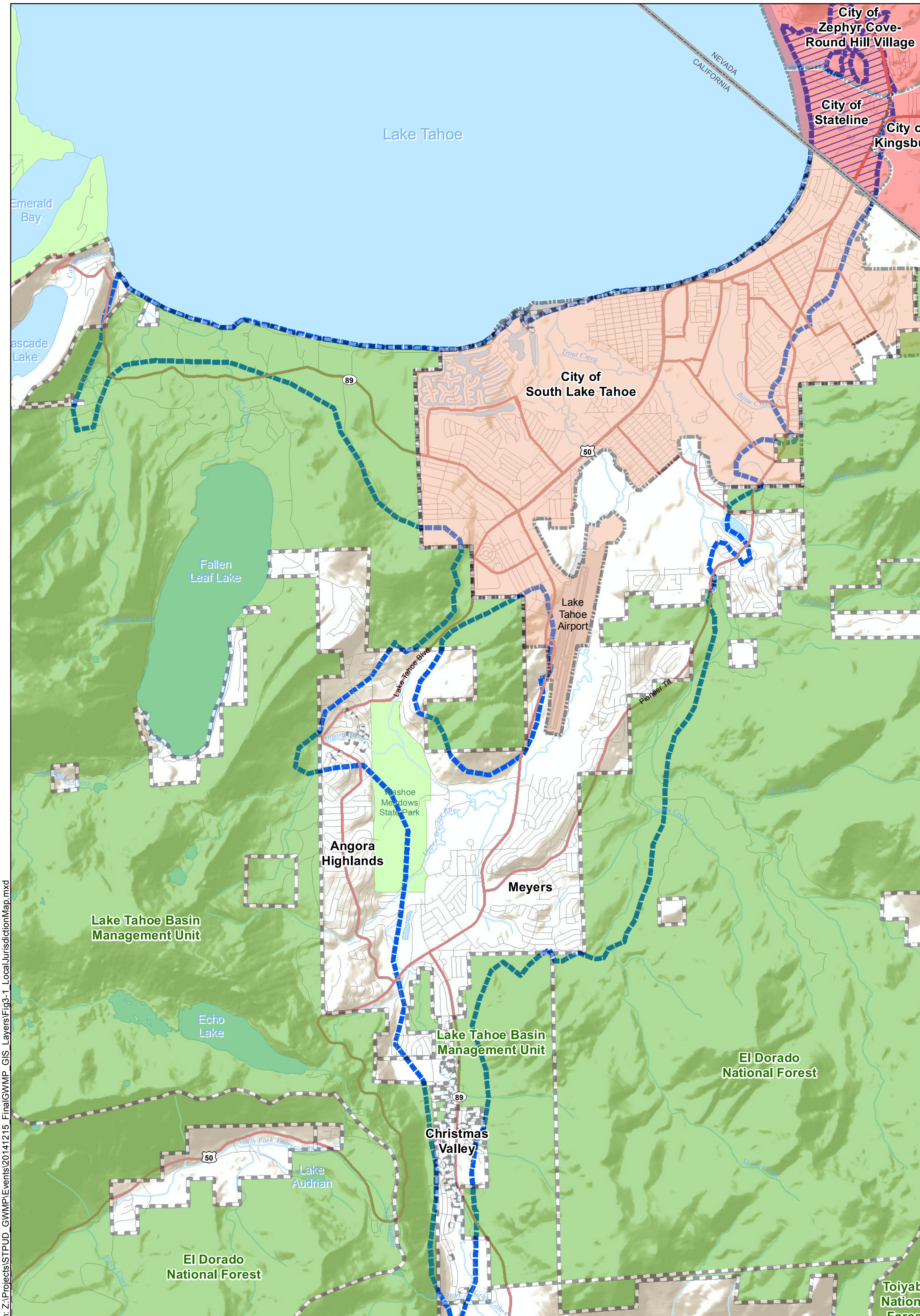
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Stream Environment Zone Map

K/J 1470005*00
December 2014

Figure 2-10



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LEGEND

- City Boundary
- U.S. Forest Service Land
- Privately Owned Land
- State Park
- Tahoe Valley South Groundwater Basin
- Nevada Extension of Groundwater Basin
- Lake
- River
- Major Highway
- Road
- State Line

N

0 0.5 1
Scale: Miles

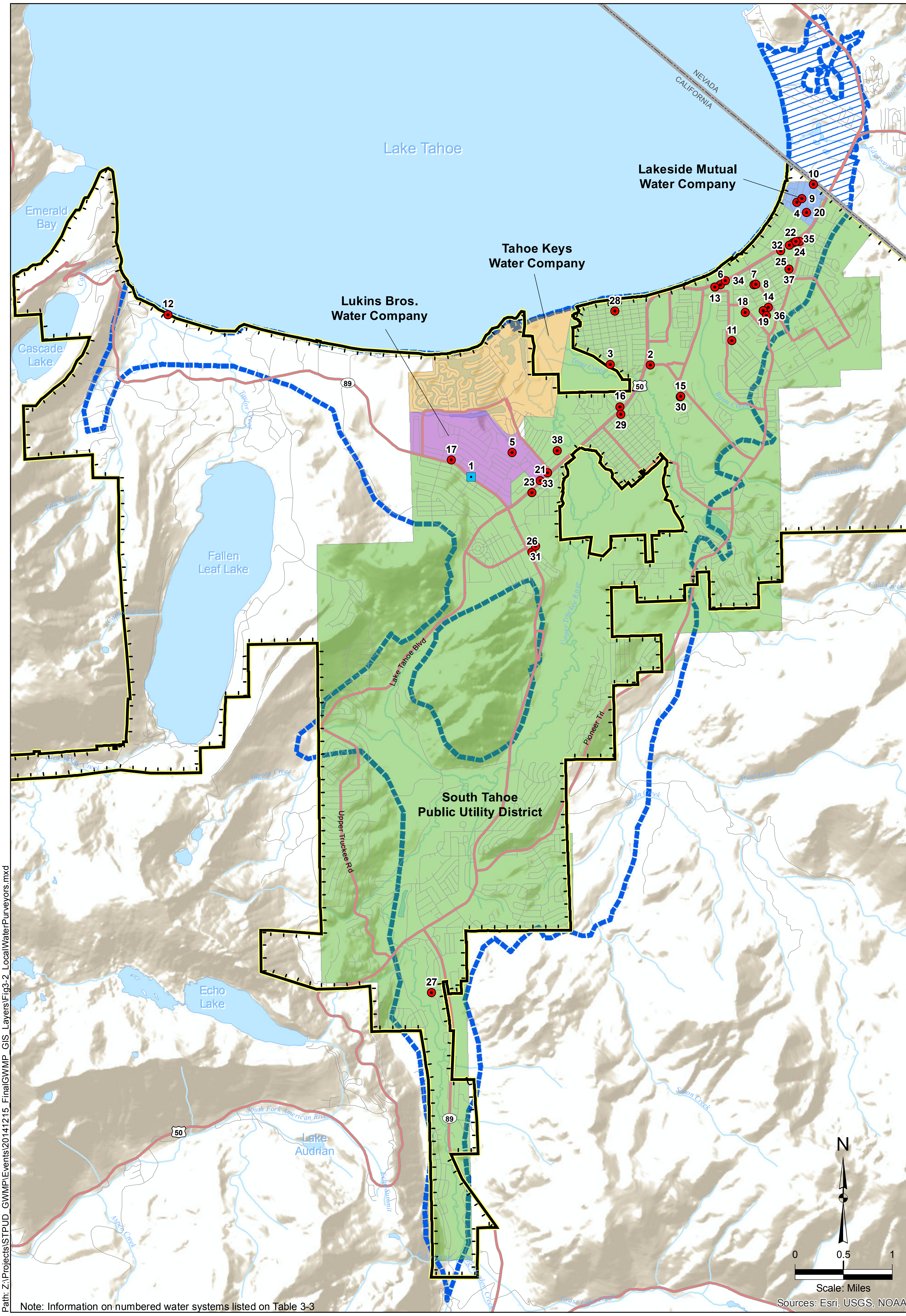
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Local Jurisdiction Map

K/J 1470005*00
December 2014

Figure 3-1



Path: Z:\Projects\STPUD_GWMP\Events\20141215_FinalGWMP_GIS_Layers\Fig3-2_LocalWaterPurveyors.mxd

LEGEND

Water District

- STPUD Water Service Area
- Lukins Bros. Water Company
- Tahoe Keys Water Company
- Lakeside Mutual Water Company
- Community CDPH Water System
- Non-Community CDPH Water System
- STPUD Wastewater Service Area
- Tahoe Valley South Groundwater Basin
- Nevada Extension of Groundwater Basin
- River
- Major Highway
- Road
- State Line

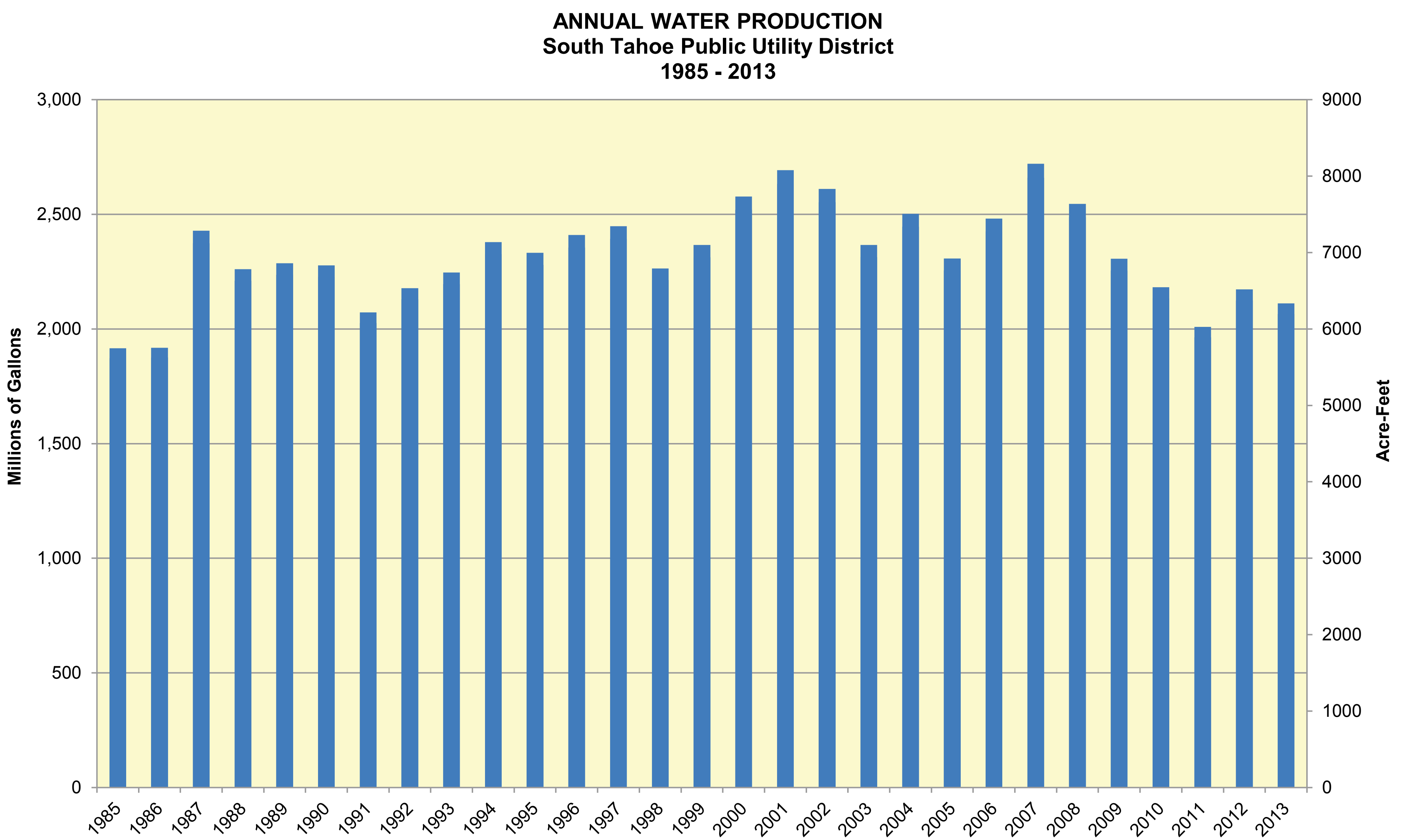
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Local Water Purveyors and Utilities

K/J 1470005*00
December 2014

Figure 3-2



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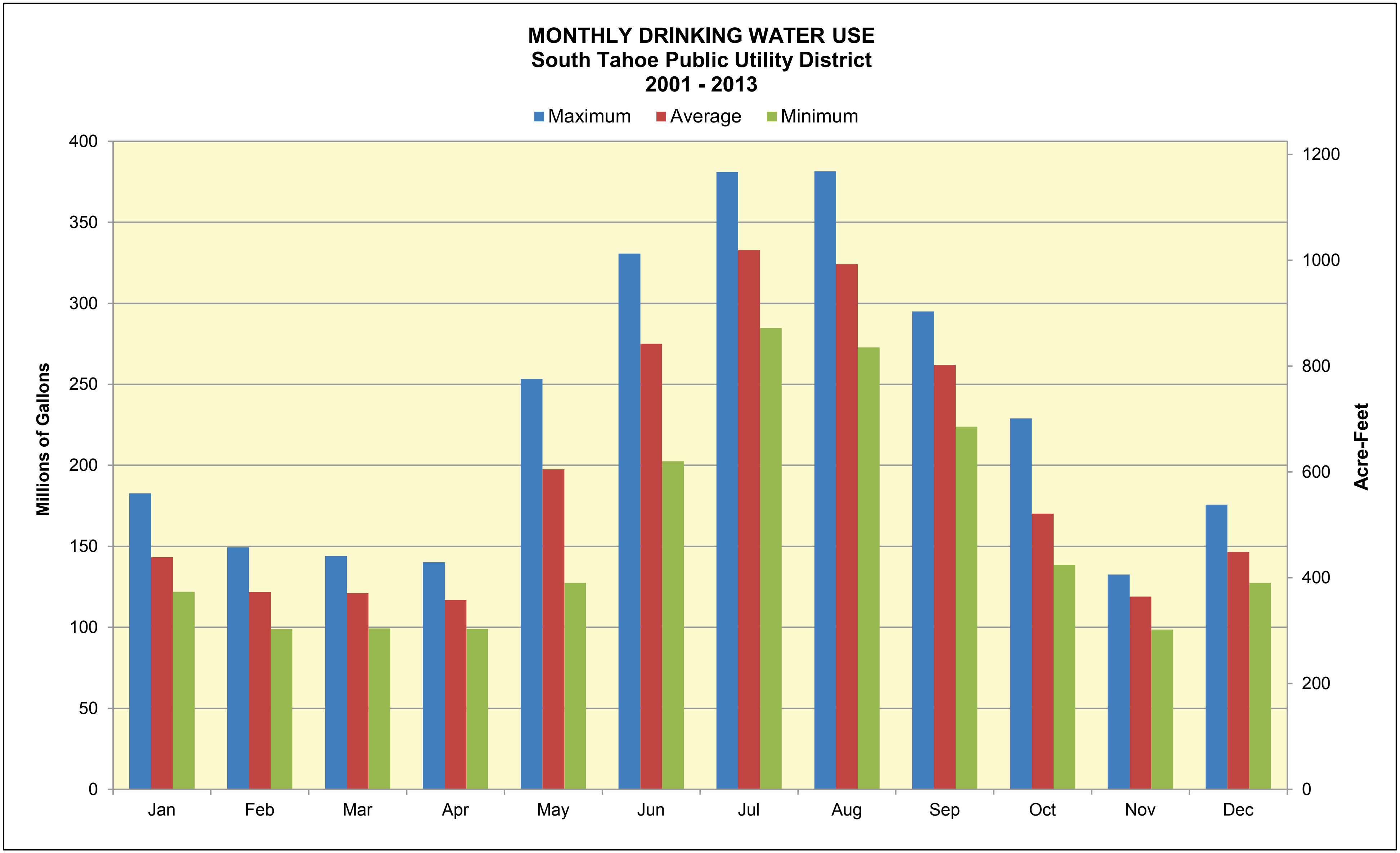
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Historical Groundwater Pumping Trends for STPUD

K/J 1470005*00
December 2014

Figure 3-3



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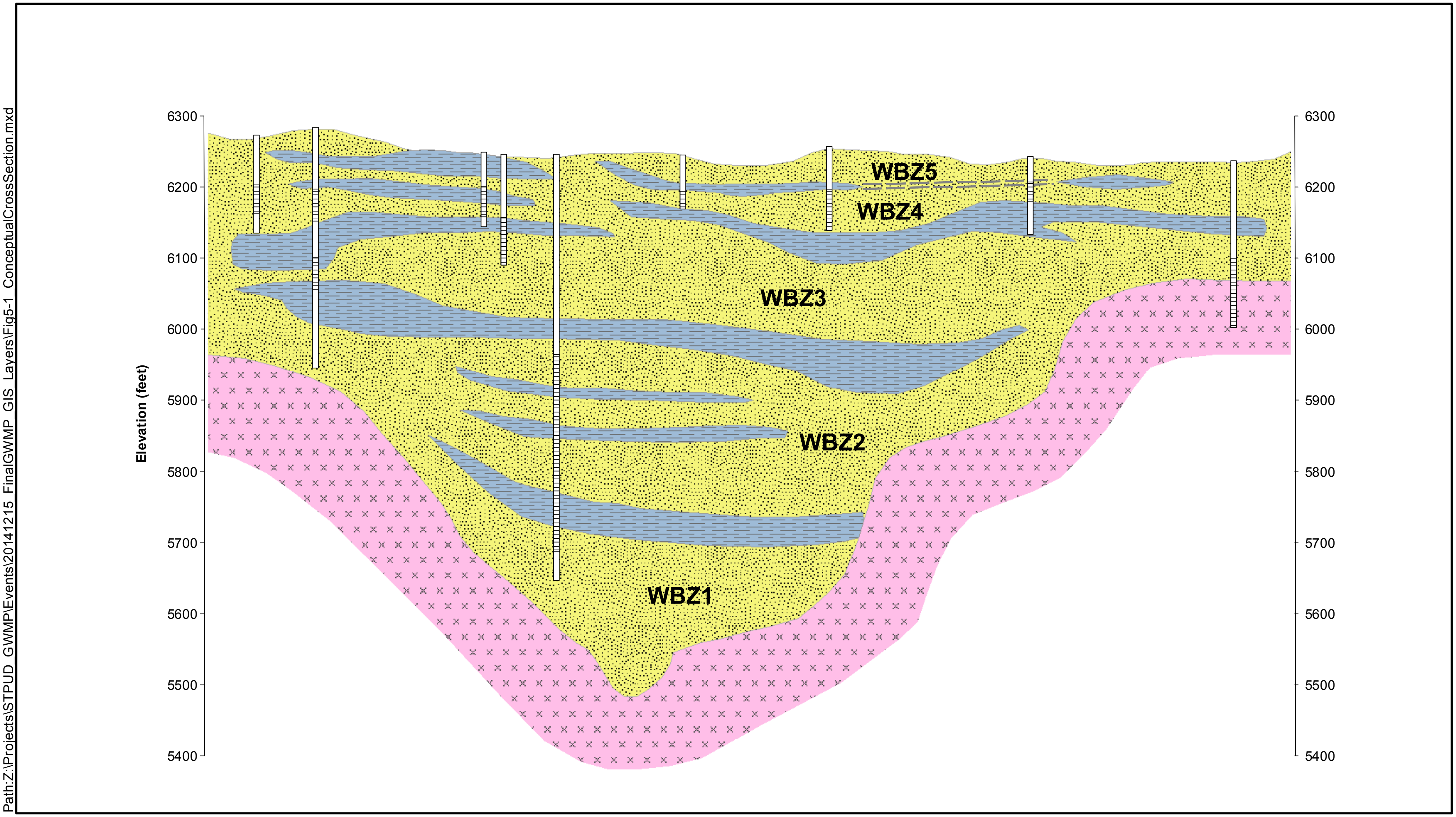
Final Groundwater Management Plan
South Tahoe Public Utility District

Seasonal Groundwater Pumping Trends for STPUD

K/J 1470005*00
December 2014

Figure 3-4



LEGEND

Geologic Unit

Gravels and Sands

Clays

Hard Crystalline Rock

Well

Screen

Note: Water Bearing Zone (WBZ) are informal designations of regional aquifers separated by clay aquitards.

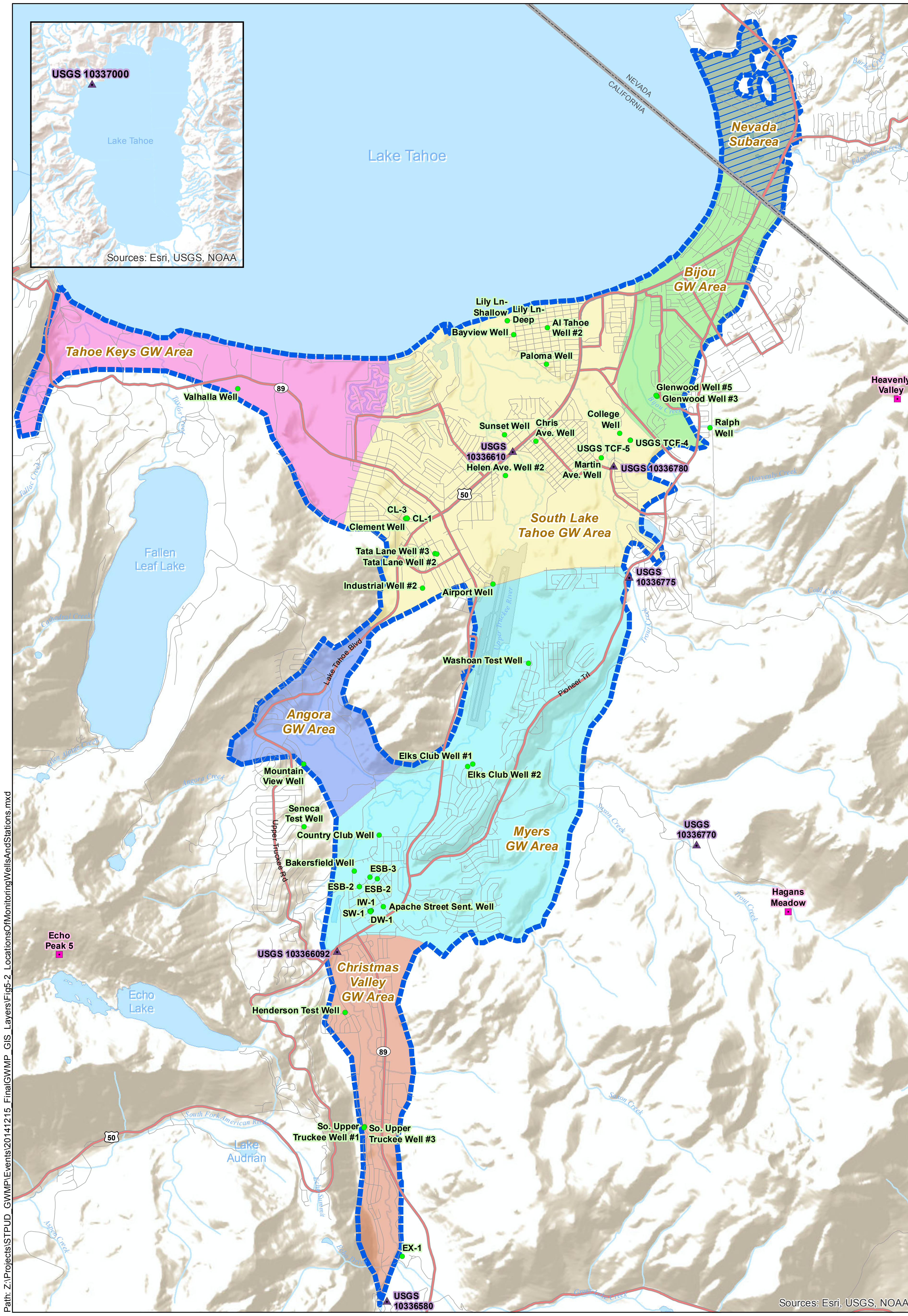
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Conceptual Geologic Cross Section Showing Typical Water Bearing Zones

K/J 1470005*00
December 2014

Figure 5-1



LEGEND

- USGS Stream Gauges
- DWR Snow Station
- MonitoringWell
- Tahoe Valley South Groundwater Basin
- Nevada Extension of Groundwater Basin

Groundwater Areas of TVS Basin

- Angora
- Bijou
- Christmas Valley
- Myers
- Nevada
- South Lake Tahoe
- Tahoe Keys

- Lake
- River
- Major Highway
- Road
- State Line

N

0 0.5 1

Scale: Miles

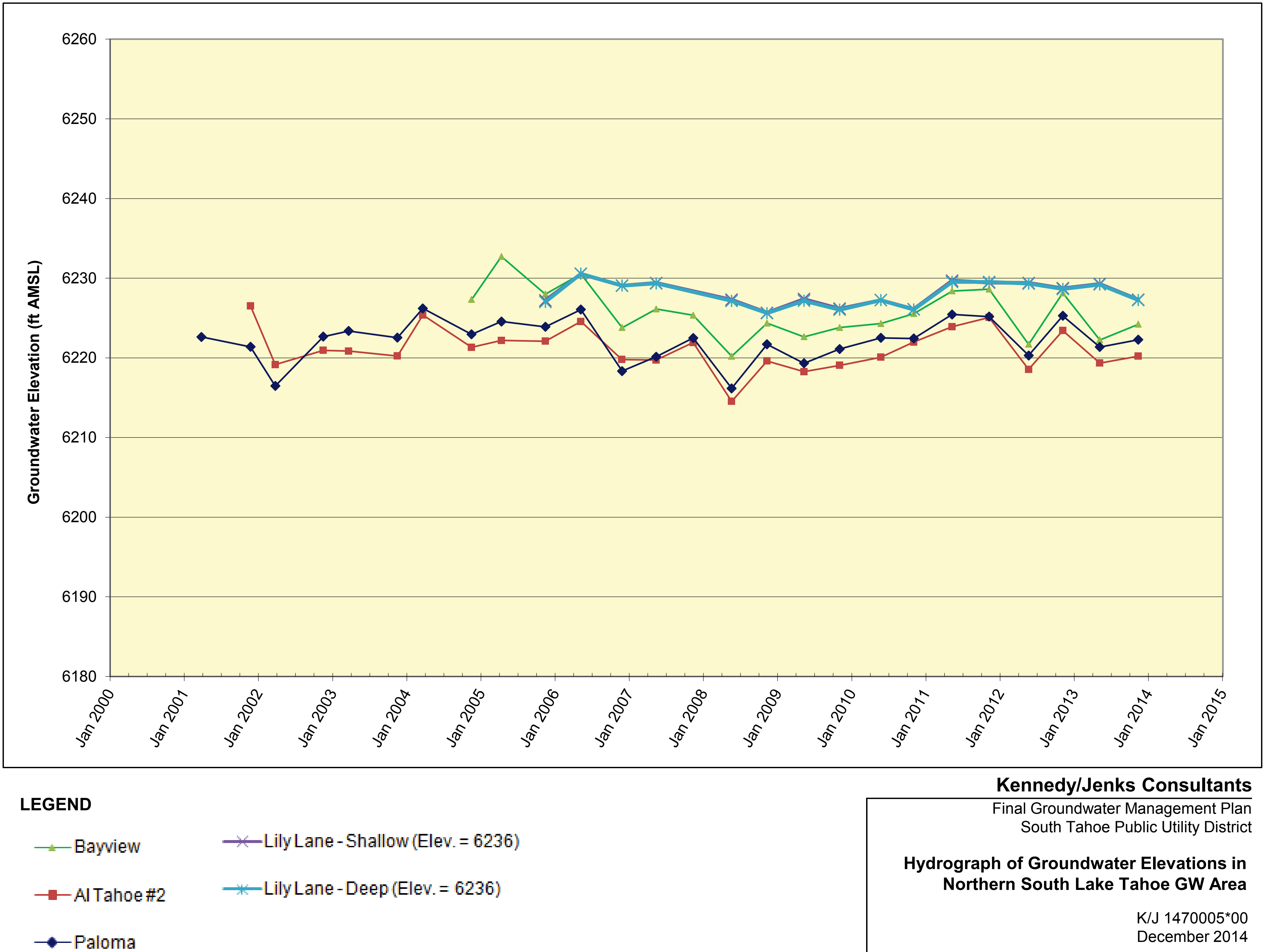
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Locations of Monitoring Wells, Stations and Groundwater Areas

K/J 1470005*00
December 2014

Figure 5-2



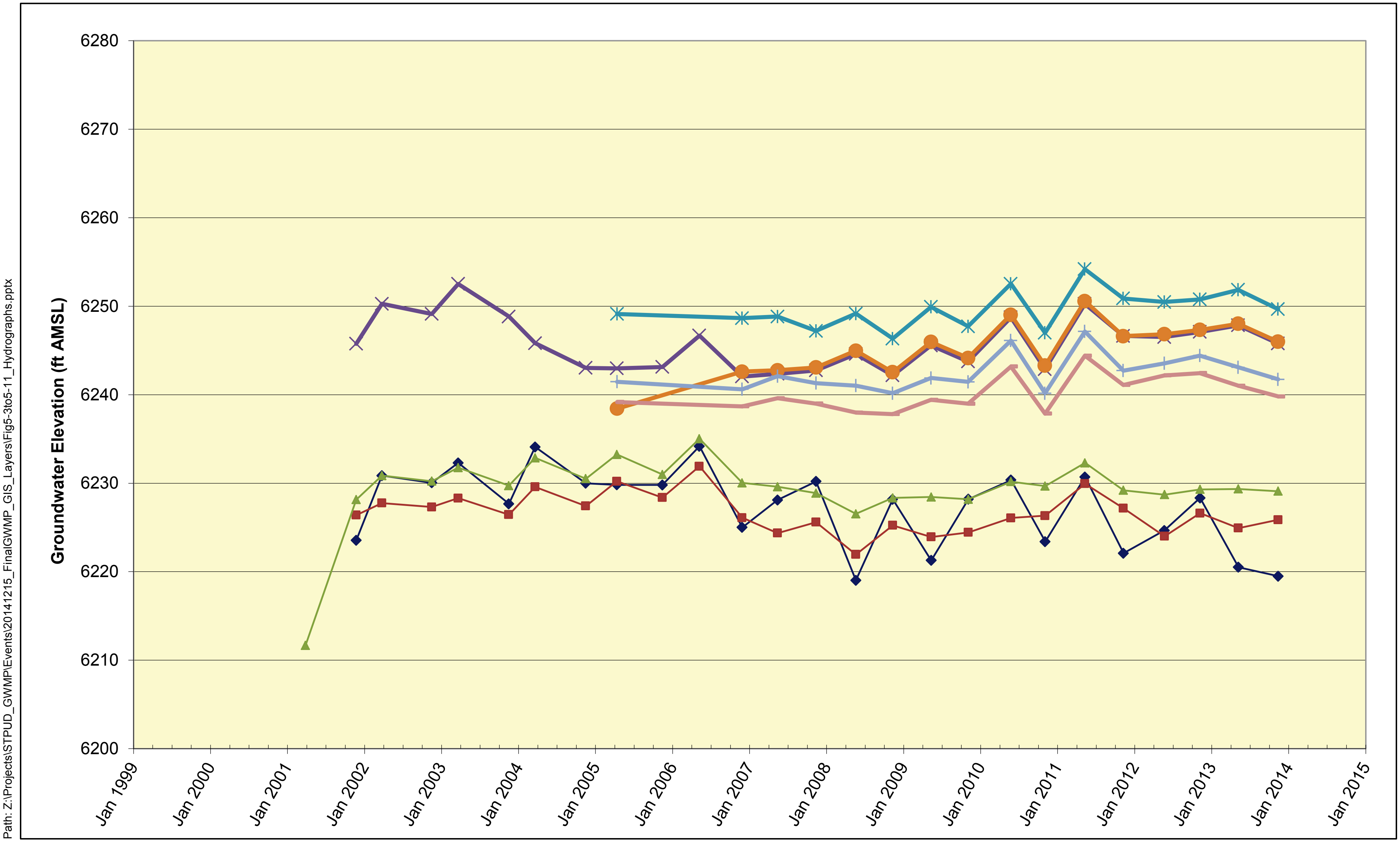
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Hydrograph of Groundwater Elevations in Northern South Lake Tahoe GW Area

K/J 1470005*00
December 2014

Figure 5-3



LEGEND

- College Well (Elev. 6284)
- Sunset Well (Elev. = 6249)
- Chris Well (Elev. = 6250)
- Helen Well #2 (Elev. = 6250)
- USGS TCF-1 (Elev. = 6296)
- USGS TCF-2 (Elev. = 6296)
- USGS TCF-3 (Elev. = 6296)
- USGS TCF-4 (Elev. = 6296)

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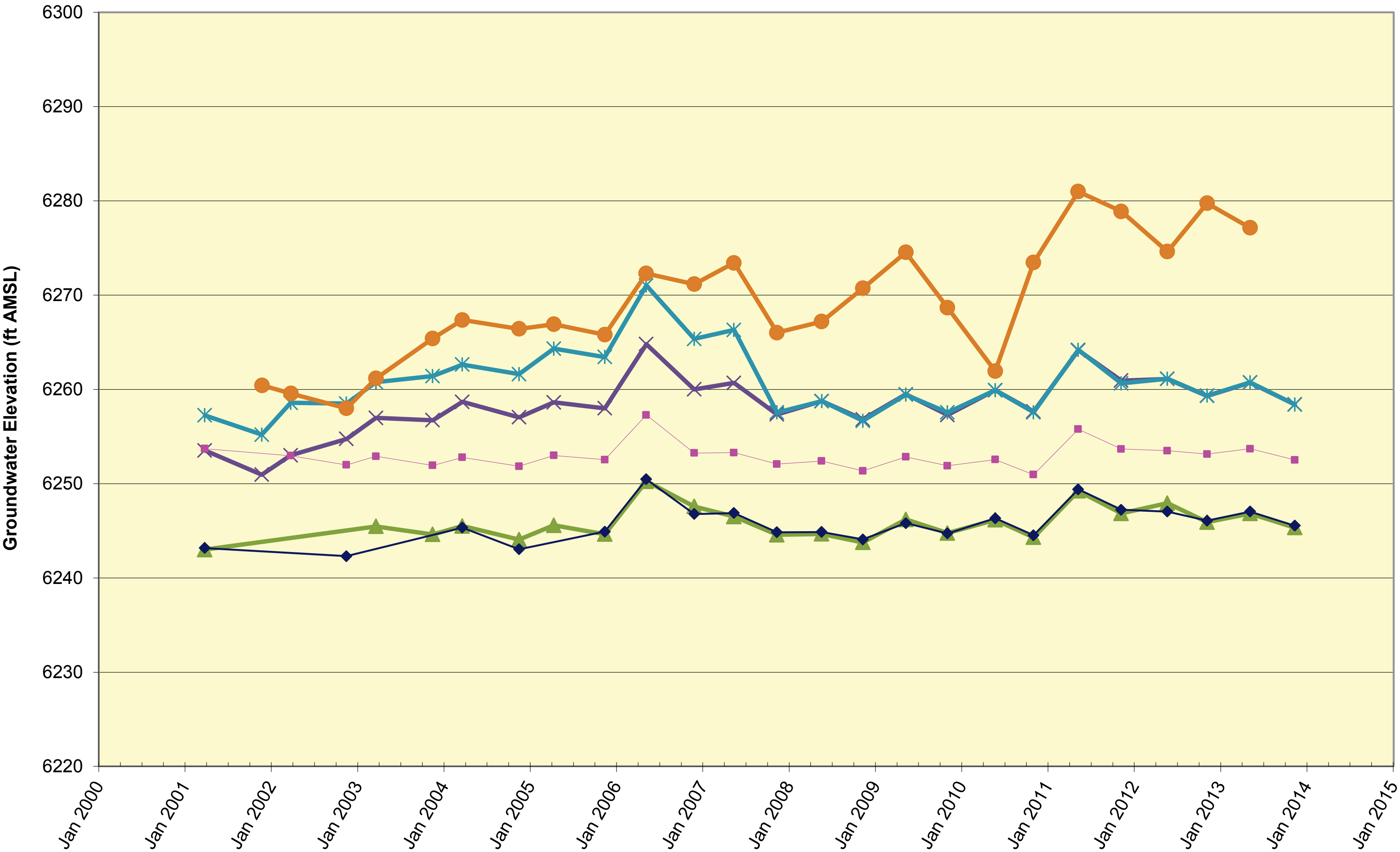
Final Groundwater Management Plan
South Tahoe Public Utility District

Hydrograph of Groundwater Elevations in Central South Lake Tahoe GW Area

K/J 1470005*00
December 2014

Figure 5-4



LEGEND

- Clement Well (Elev. = 6283)
- CL-1 (Elev. = 6278)
- Tata Well #2 (Elev. = 6286)
- CL-3 (Elev. = 6278)
- Tata Well #3 (Elev. = 6286)
- Industrial Well #2 (Elev. = 6306)

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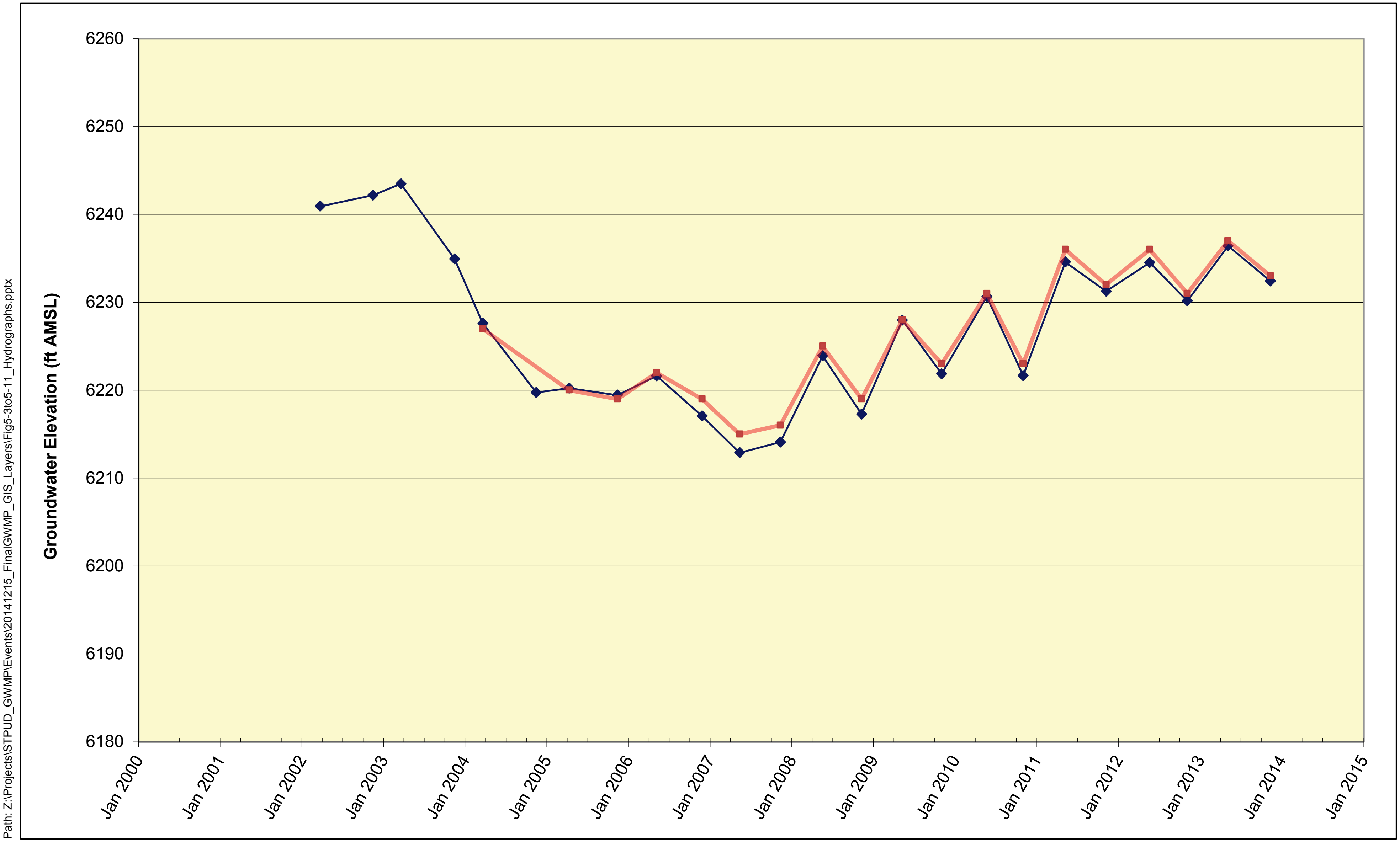
Final Groundwater Management Plan
South Tahoe Public Utility District

Hydrograph of Groundwater Elevations in Northwestern South Lake Tahoe GW Area

K/J 1470005*00
December 2014

Figure 5-5



LEGEND

Glenwood Well #3 (Elev. = 6262)

Glenwood Well #5 (Elev. = 6262)

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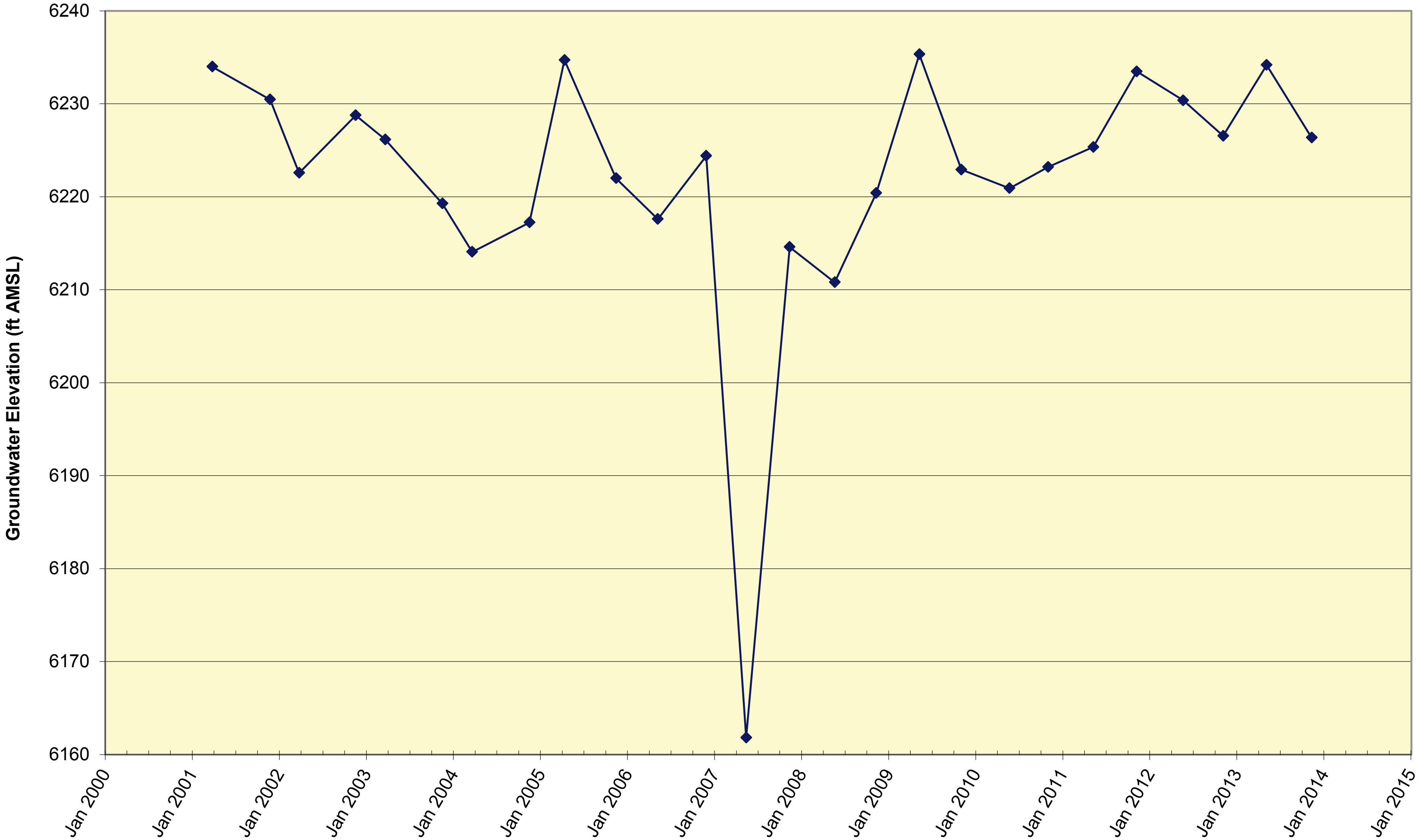
Final Groundwater Management Plan
South Tahoe Public Utility District

Hydrograph of Groundwater Elevations in Bijou GW Area

K/J 1470005*00
December 2014

Figure 5-6



Path: Z:\Projects\STPUD_GWMP\Events\20141215_FinalGWMP_GIS_Layers\Fig5-3to5-11_Hydrographs.pptx

LEGEND

Valhalla Well (Elev. = 6257)

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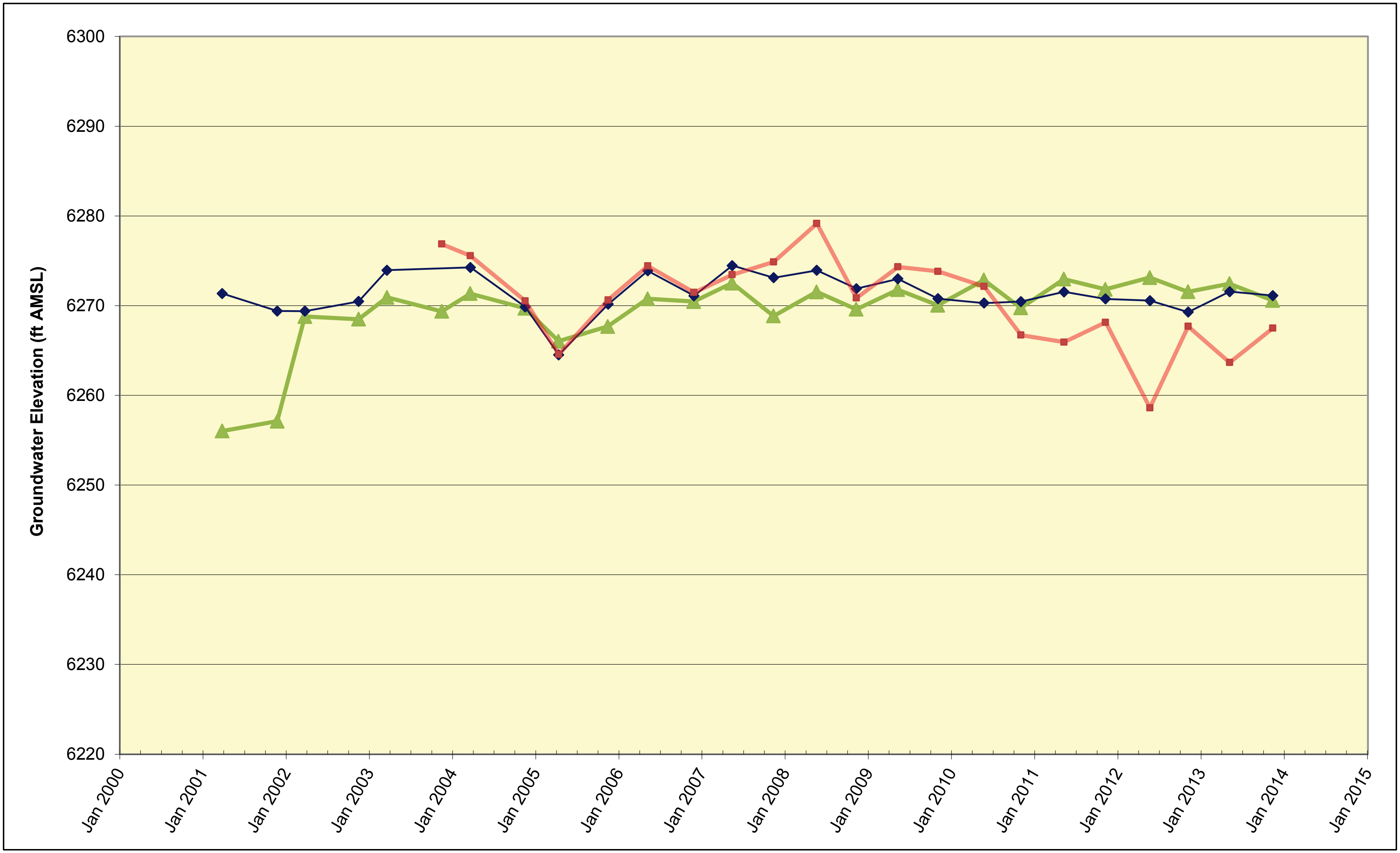
Final Groundwater Management Plan
South Tahoe Public Utility District

Hydrograph of Groundwater Elevations in Tahoe Keys GW Area

K/J 1470005*00
December 2014

Figure 5-7



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LEGEND

- Washoan Well (Elev. = 6308)
- Elks Club Well #1 (Elev. 6287)
- Elks Club Well #2 (Elev. = 6287)

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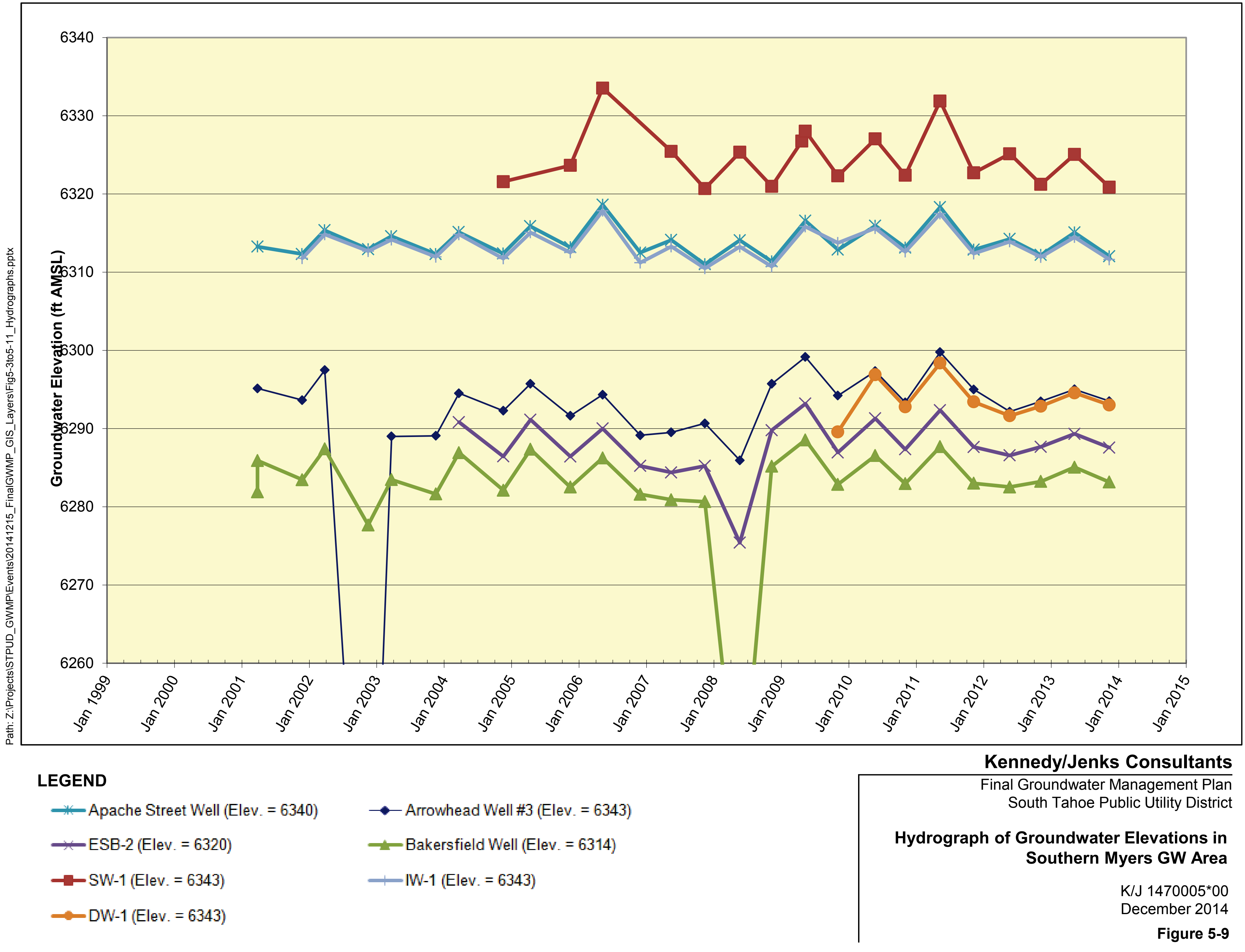
Final Groundwater Management Plan
South Tahoe Public Utility District

Hydrograph of Groundwater Elevations in Northern Myers GW Area

K/J 1470005*00
December 2014

Figure 5-8



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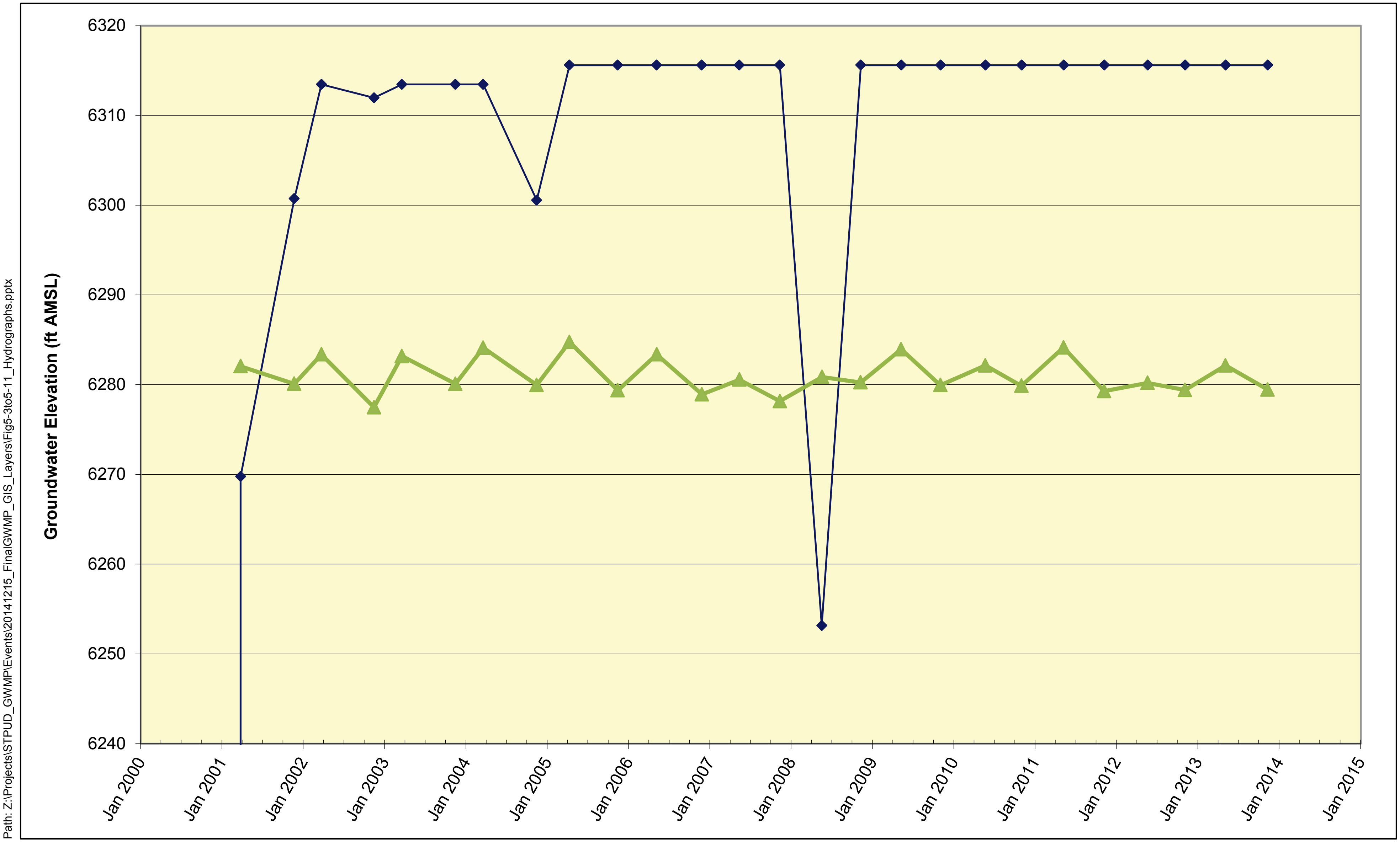
Final Groundwater Management Plan
South Tahoe Public Utility District

Hydrograph of Groundwater Elevations in Southern Myers GW Area

K/J 1470005*00
December 2014

Figure 5-9



LEGEND

Mountain View Well (Elev. = 6316)

Country Club Well (Elev. = 6286)

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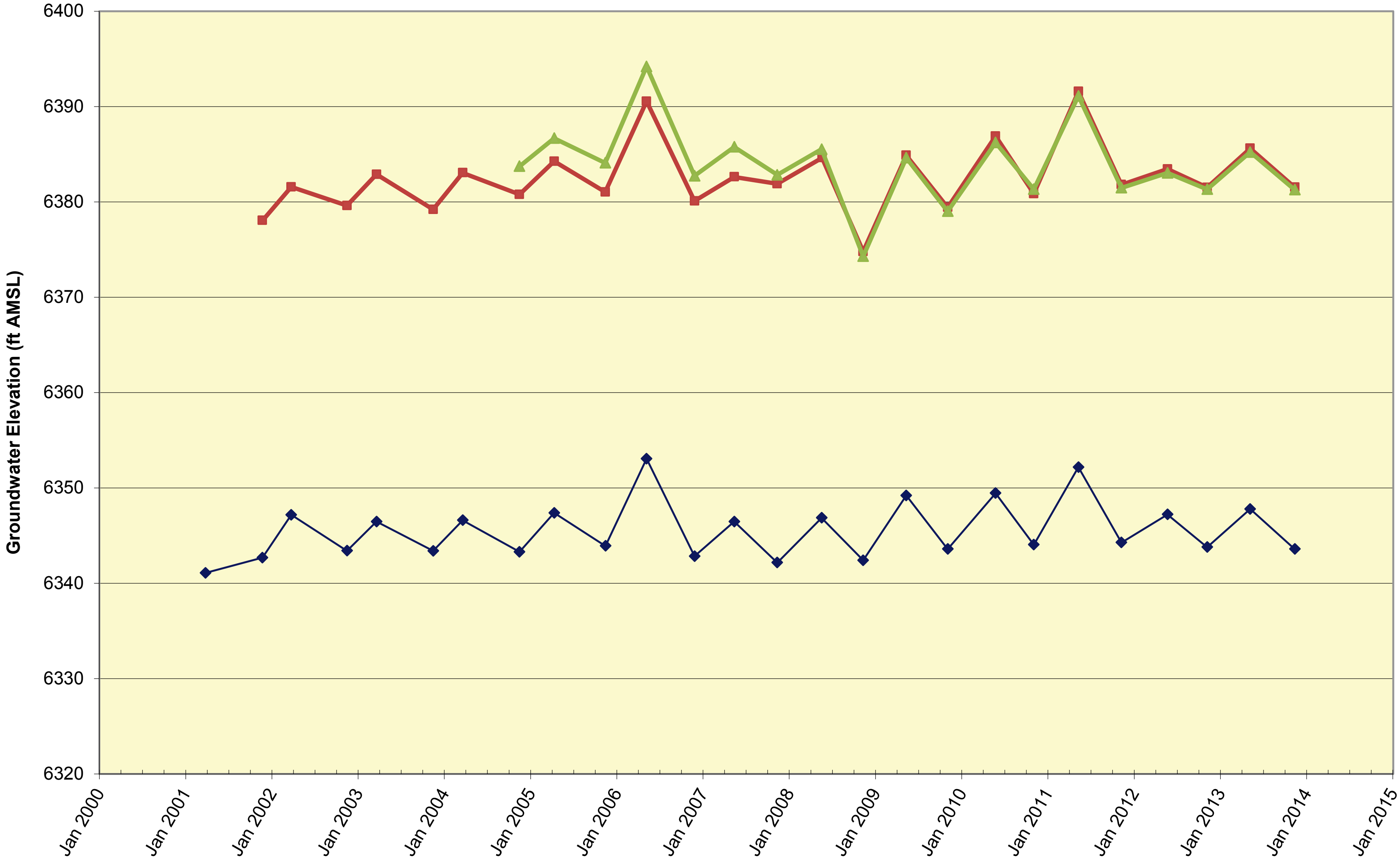
Final Groundwater Management Plan
South Tahoe Public Utility District

Hydrograph of Groundwater Elevations in Angora GW Area

K/J 1470005*00
December 2014

Figure 5-10



Path: Z:\Projects\STPUD_GWMP\Events\20141215_FinalGWMP_GIS_Layers\Fig5-3to5-11_Hydrographs.pptx

LEGEND

- Henderson Well (Elev. = 6370)
- South Upper Truckee Well 1 (Elev. = 6420)
- South Upper Truckee Well 3 (Elev. = 6420)

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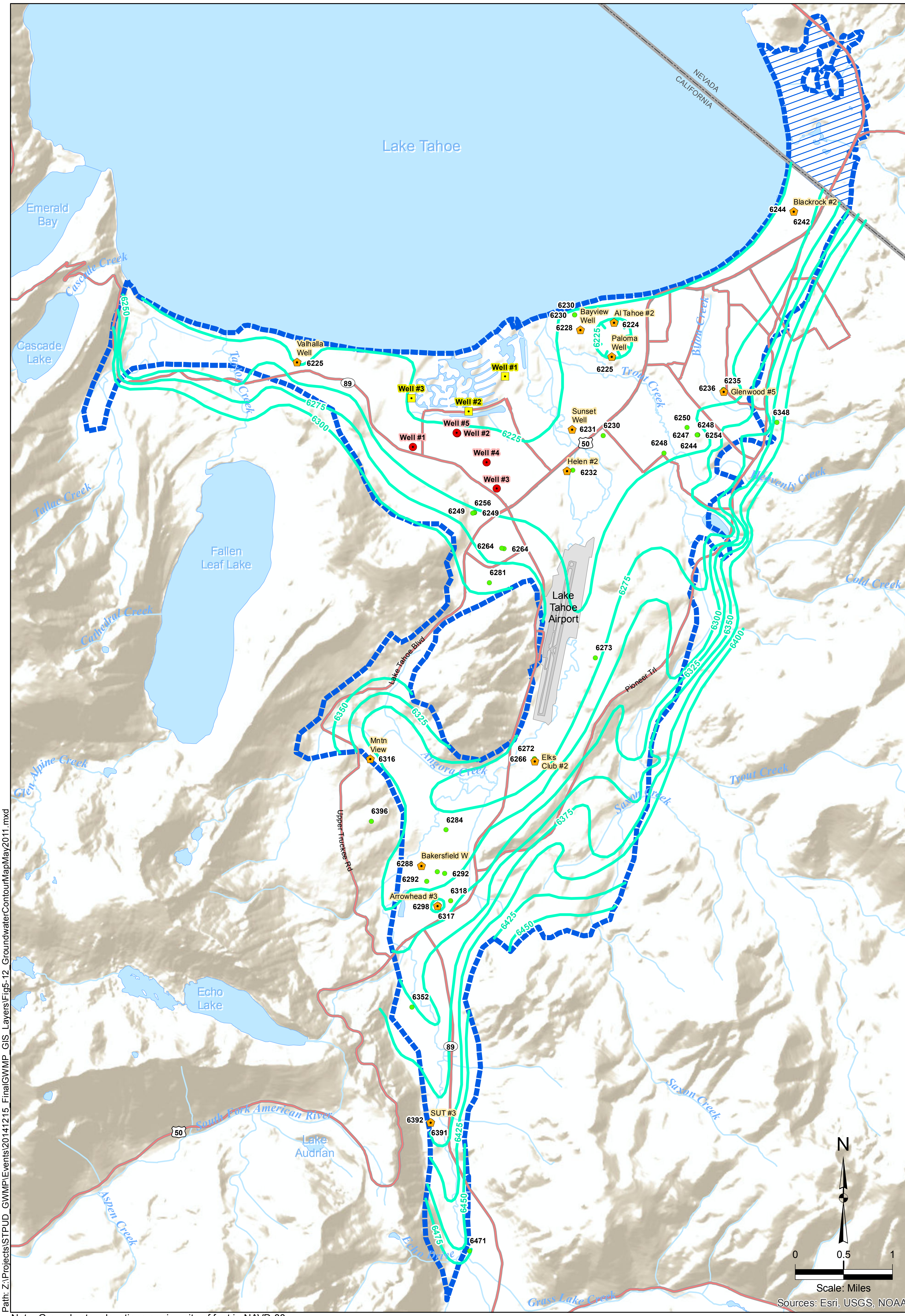
Final Groundwater Management Plan
South Tahoe Public Utility District

Hydrograph of Groundwater Elevations in Christmas Valley GW Area

K/J 1470005*00
December 2014

Figure 5-11



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Note: Groundwater elevations are in units of feet in NAVD 88.

LEGEND

- PWS Active Well
- LBWC Well
- TKWC Well
- Well with Recorded Groundwater Elevation
- Contour of Groundwater Elevation
- Tahoe Valley South Groundwater Basin
- Nevada Extension of Groundwater Basin
- Lake
- River
- Major Highway
- State Line

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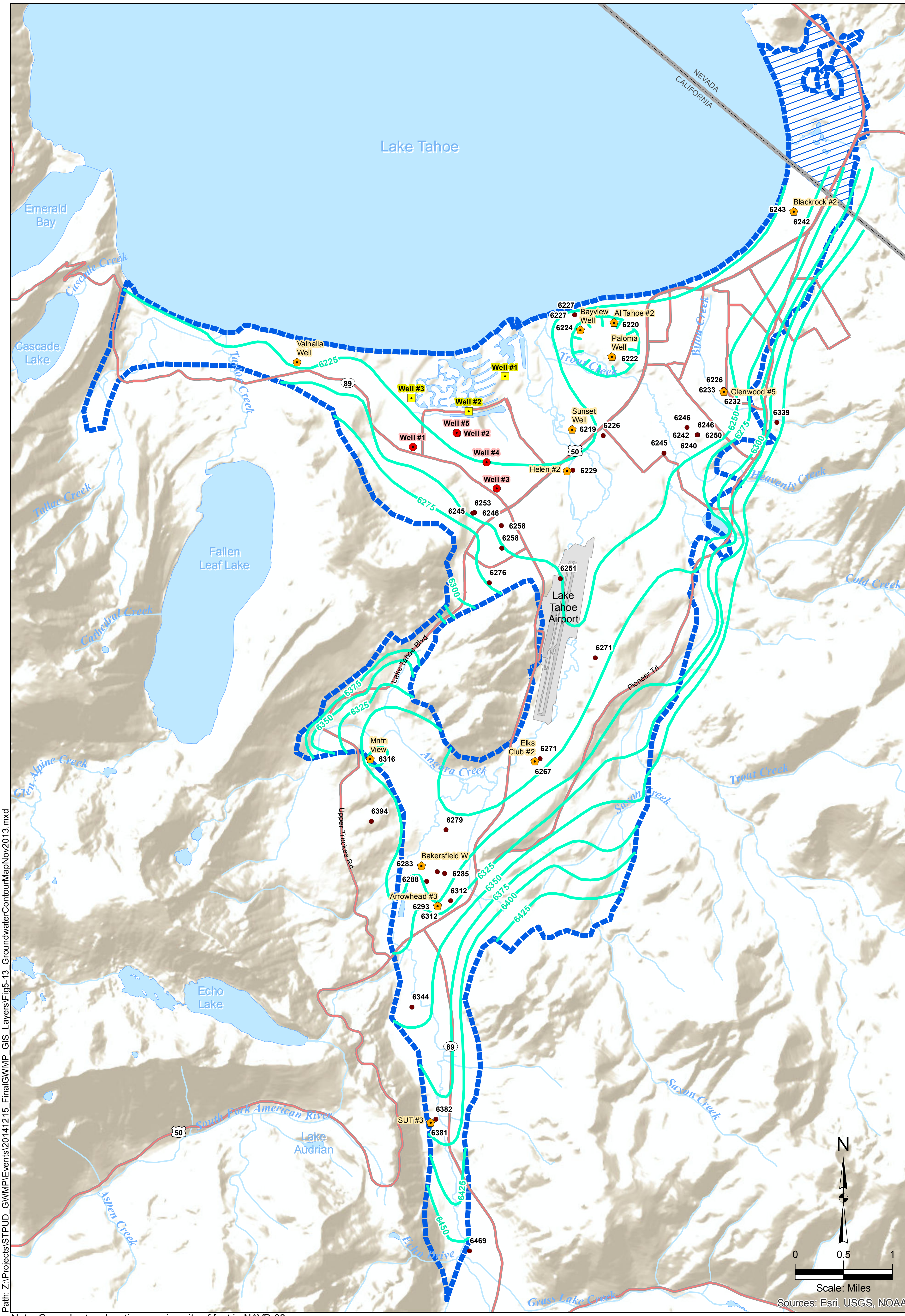
Final Groundwater Management Plan
South Tahoe Public Utility District

Groundwater Contour Map
May 2011

K/J 1470005*00
December 2014

Figure 5-12



Note: Groundwater elevations are in units of feet in NAVD 88.

LEGEND

- PWS Active Well
- LBWC Well
- TKWC Well
- Well with Recorded Groundwater Elevation
- Contour of Groundwater Elevation
- Tahoe Valley South Groundwater Basin
- Nevada Extension of Groundwater Basin
- Lake
- River
- Major Highway
- State Line

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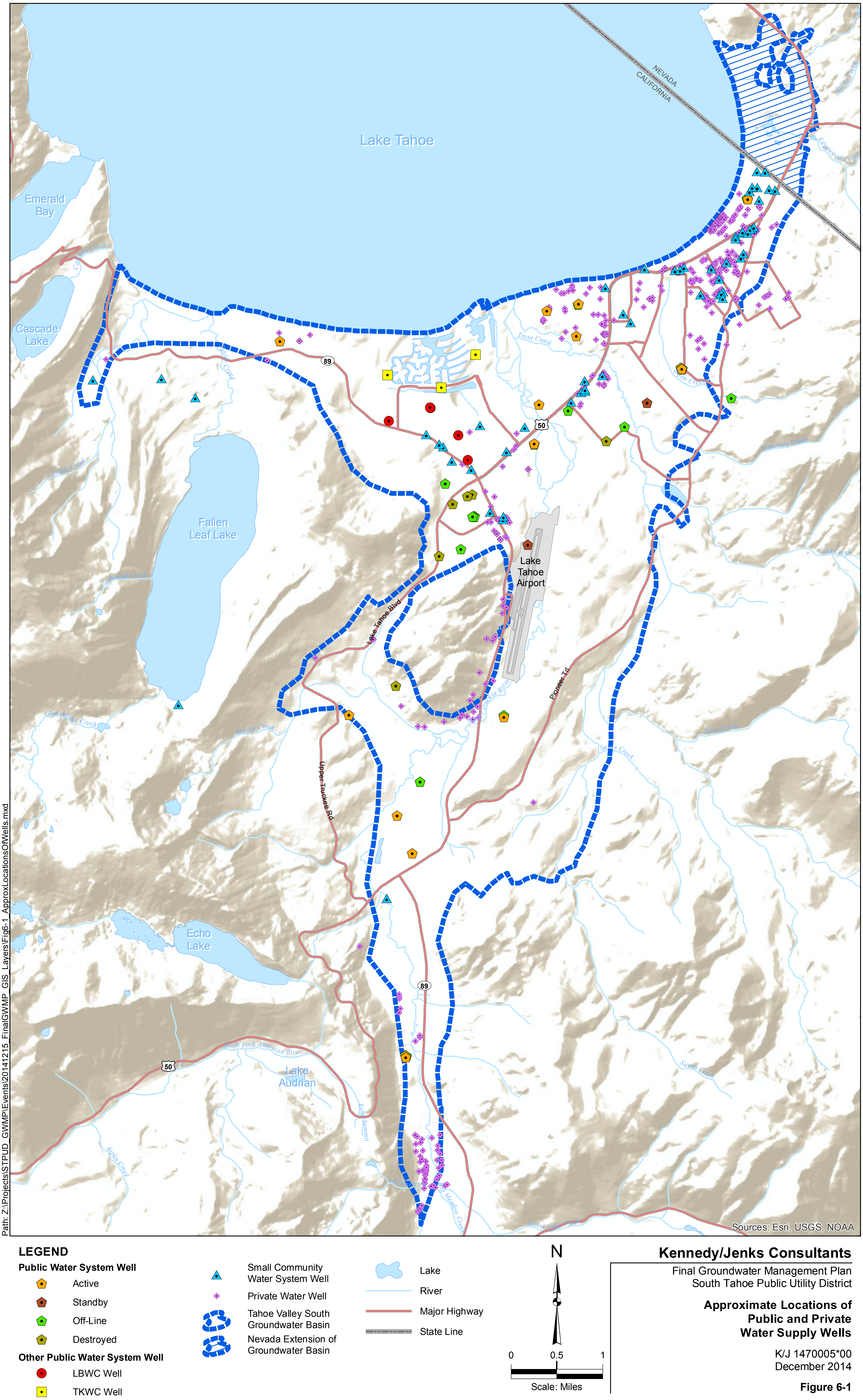
Final Groundwater Management Plan
South Tahoe Public Utility District

Groundwater Contour Map
November 2013

K/J 1470005*00
December 2014

Figure 5-13



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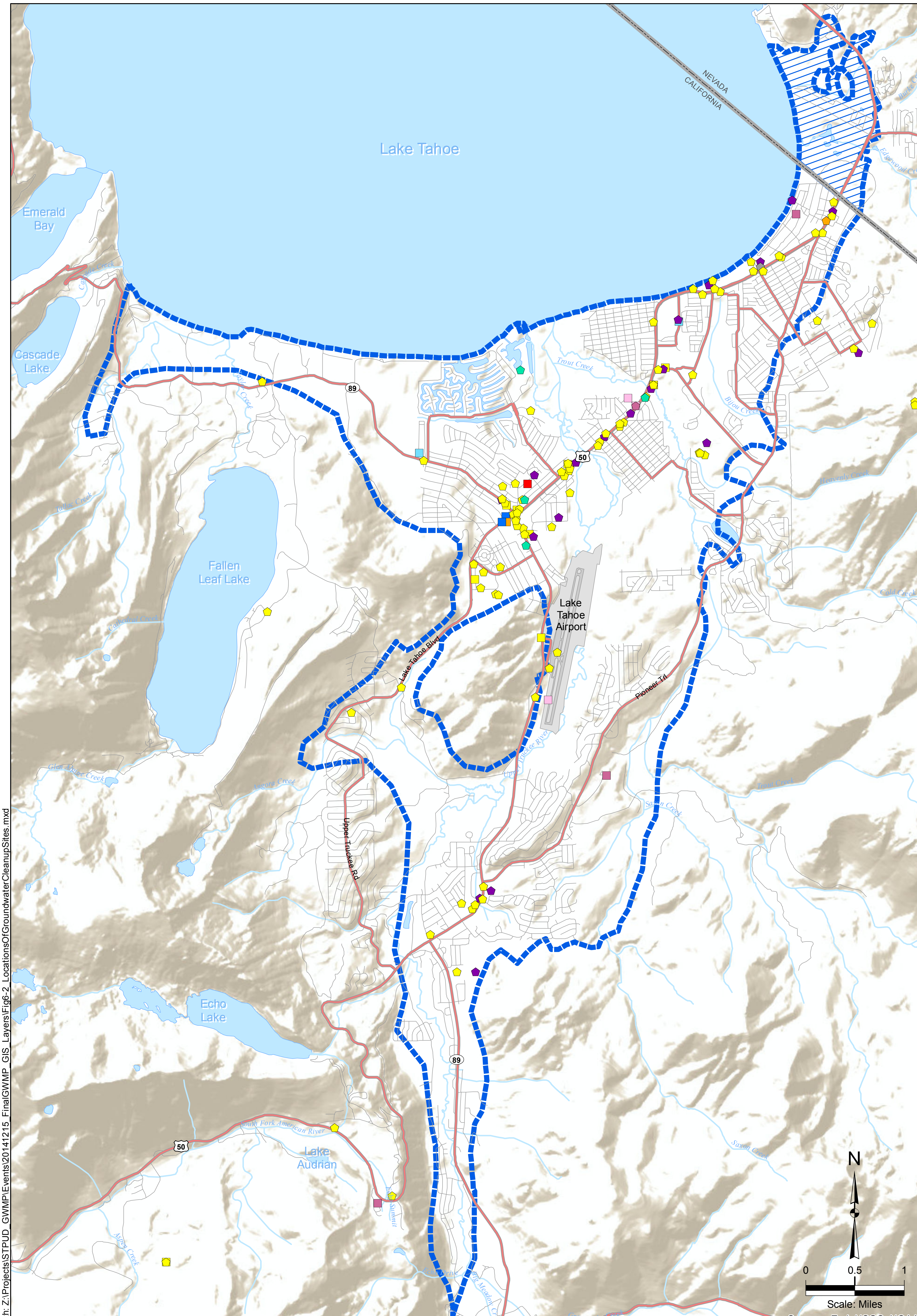
Final Groundwater Management Plan
South Tahoe Public Utility District

Approximate Locations of Public and Private Water Supply Wells

K/J 1470005*00
December 2014

Figure 6-1



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LEGEND

Fuel Hydrocarbon Sites Cleanup Status
- Open - Eligible for Closure
- Open - Remediation
- Open - Site Assessment
- Open - Verification Monitoring
- Completed - Case Closed
- N/A

Other Sites Cleanup Status
- Open
- Open - Inactive
- Open - Remediation
- Open - Site Assessment
- Completed - Case Closed
- Refer: RWQCB
- Refer: Other Agency

- Tahoe Valley South Groundwater Basin
- Nevada Extension of Groundwater Basin
- Lake
- River
- Major Highway
- Road
- State Line

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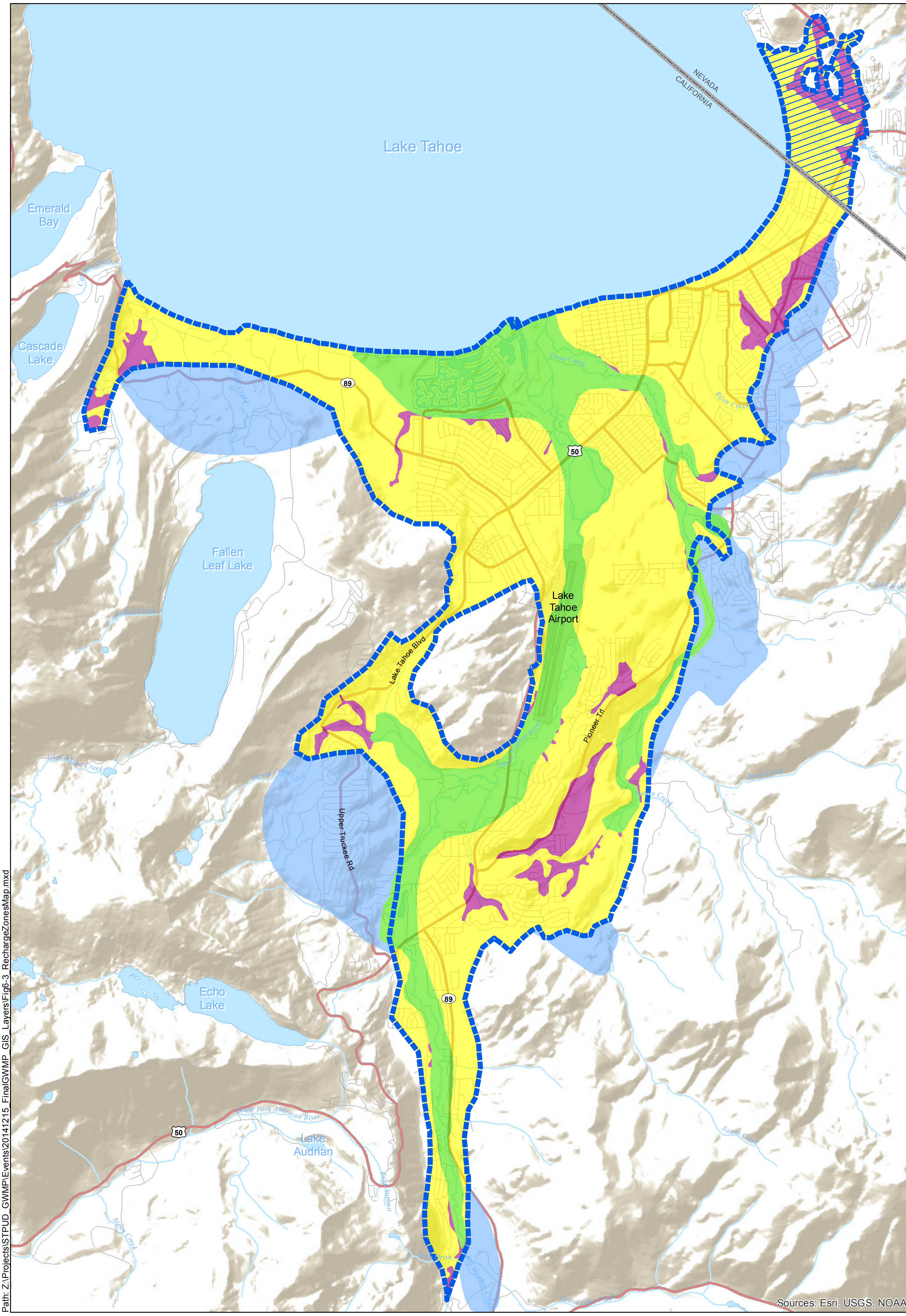
Final Groundwater Management Plan
South Tahoe Public Utility District

Locations of Groundwater Cleanup Sites

K/J 1470005*00
December 2014

Figure 6-2



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LEGEND

Recharge Zone

- Groundwater/Surface Water Interaction
- Alluvium - High Recharge
- Alluvium - Reduced Recharge
- Alluvium - Outside Groundwater Basin

- Tahoe Valley South Groundwater Basin
- Nevada Extension of Groundwater Basin
- Lakes
- River

- Major Highway
- Road
- State Line

N

0 0.5 1

Scale: Miles

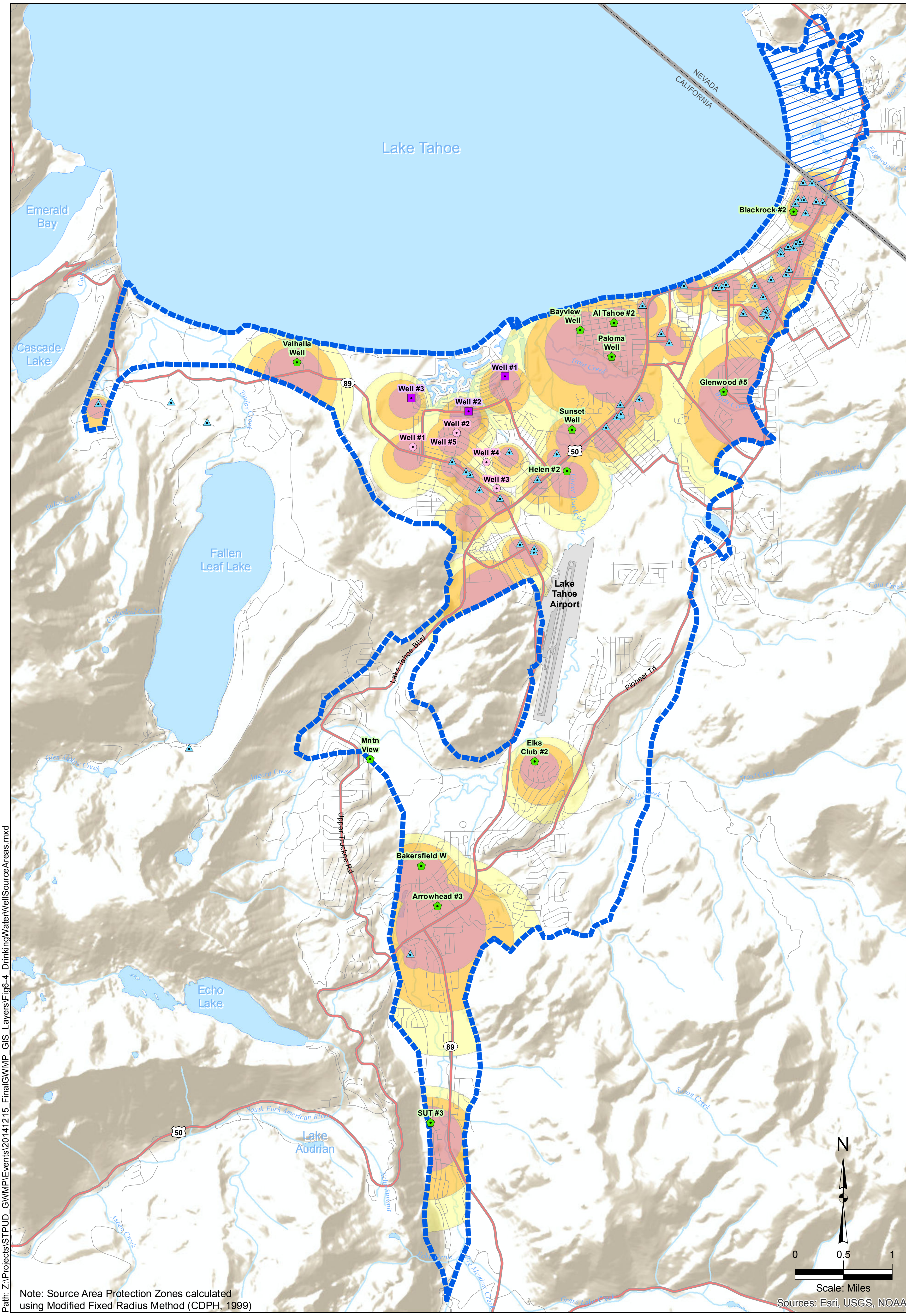
Kennedy/Jenks Consultants

Final Groundwater Management Plan
South Tahoe Public Utility District

Recharge Zones Map

K/J 1470005*00
December 2014

Figure 6-3



LEGEND

Small Community Water System Well

PWS Active Well

LBWC Well

TKWC Well

Source Area Protection Zones

Zone A (2-year Time of Travel)

Zone B5 (5-year Time of Travel)

Zone B10 (10-year Time of Travel)

Tahoe Valley South Groundwater Basin

Nevada Extension of Groundwater Basin

Lake

River

Major Highway

Road

State Line

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Final Groundwater Management Plan
South Tahoe Public Utility District

Drinking Water Well Source Water Protection Areas

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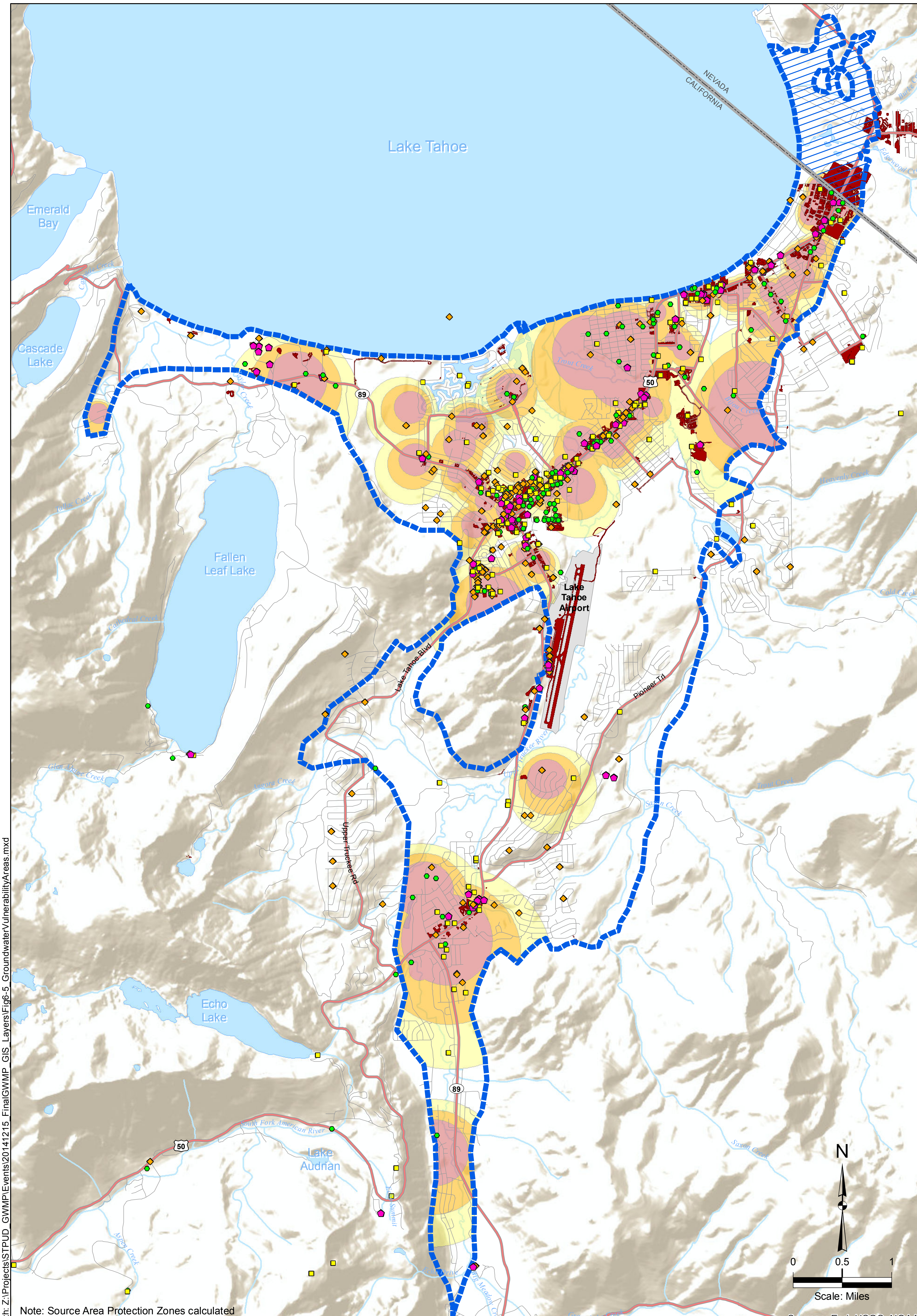
December 2014

Figure 6-4



LEGEND

Hazardous Materials Facility Contamination Threat Level

- Very High
- High
- Moderate
- Low

Source Area Protection Zones

- Zone A (2-year Time of Travel)
- Zone B5 (5-year Time of Travel)
- Zone B10 (10-year Time of Travel)
- Land Use

- Tahoe Valley South Groundwater Basin
- Nevada Extension of Groundwater Basin
- River
- Major Highway
- Road
- State Line

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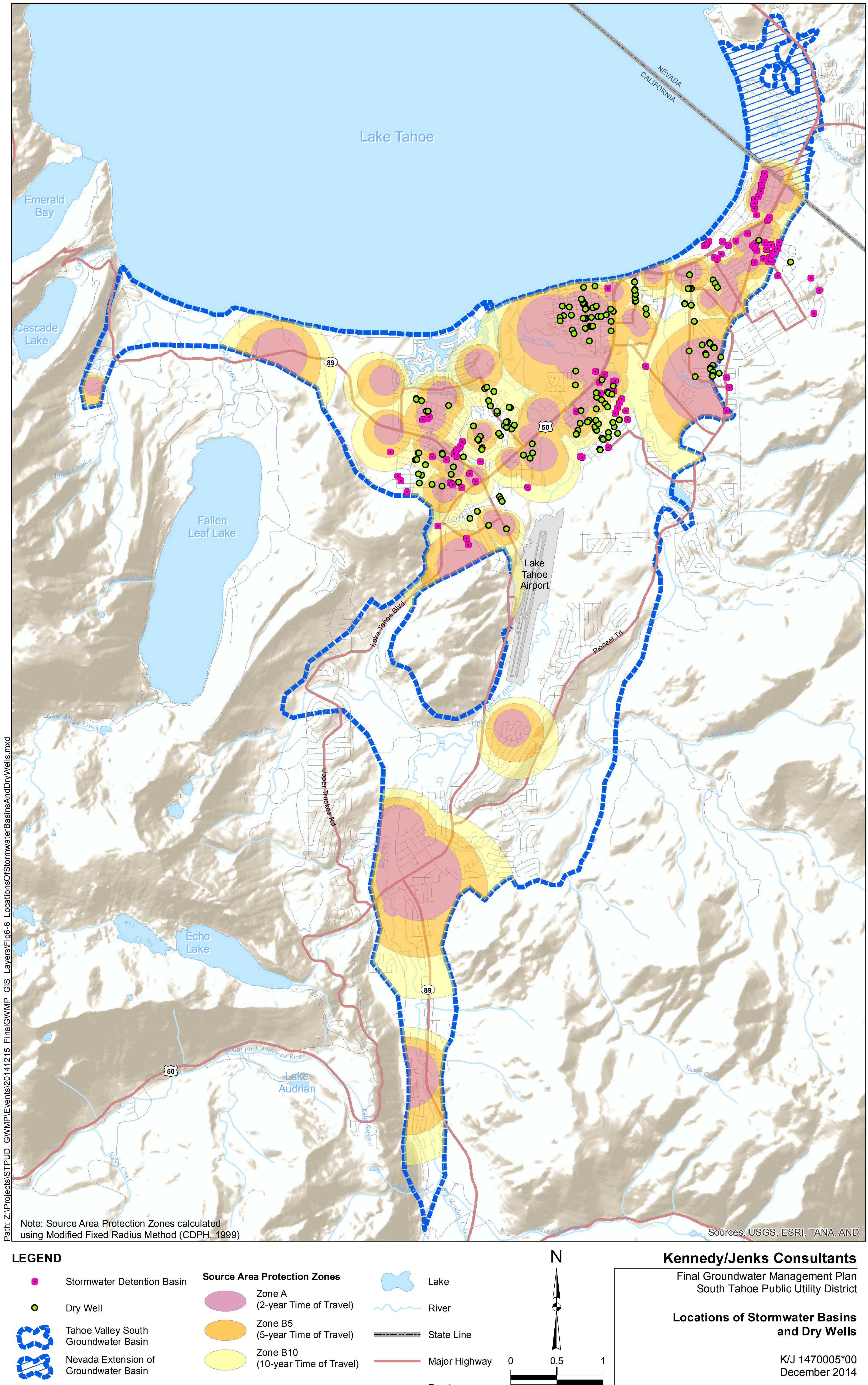
Final Groundwater Management Plan
South Tahoe Public Utility District

Groundwater Vulnerability Areas

K/J 1470005*00
December 2014

Figure 6-5



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Final Groundwater Management Plan
South Tahoe Public Utility District

Locations of Stormwater Basins and Dry Wells

K/J 1470005*00
December 2014

Figure 6-6

Appendix A

GWMP Preparation and Adoption Resolutions

South Tahoe
Public Utility District

1275 Meadow Crest Drive • South Lake Tahoe • CA 96150
Ph: 530.544.6474 • Fx: 530.541.0614 • www.stpud.us

NOTICE OF AVAILABILITY AND PUBLIC HEARING
2014 Groundwater Management Plan Update

The South Tahoe Public Utility District (District) has prepared an updated Groundwater Management Plan (GWMP) pursuant to California Water Code (CWC) Section 10750 *et. seq.* and consistent with the guidelines from the Department of Water Resources. Members of the public are invited to provide comments on the GWMP.

Project Description: The District has developed a GWMP for the Tahoe Valley South (TVS) Basin. The Plan Area includes portions of El Dorado County, the City of South Lake Tahoe, the Community of Meyers and Christmas Valley. The District and its customers, including the business community and economic vitality of South Lake Tahoe, are almost entirely dependent on groundwater for its drinking water supply.

The District recognizes the importance of maintaining a sustainable, reliable, high-quality groundwater supply for the long-term benefit of its citizens. The purpose of the Plan is to implement Basin Management Objectives (BMOs) to manage Groundwater supplies, protect Groundwater quality, and foster Stakeholder involvement with the public and other local agencies. Preparation and adoption of a GWMP will support this goal and help the District meet requirements in the CWC.

Public Review: The Draft GWMP is available for a 30-day public review period from October 30, 2014, to December 1, 2014. All comments must be received at the District office by 5:00 p.m. on Monday, December 1, 2014. Comments may be provided to the District through several different methods. These include:

- If you wish to hand deliver written comments, they must be delivered to the District office.
- If you wish to mail written comments, they must be postmarked by December 1, 2014.
- If you wish to email written comments, they must be emailed to the address shown below.
- If you wish to deliver verbal comments, they must be provided to Ivo Bergsohn at the District office or by phone at the contact information shown below.

Contact information for providing comments to the District on the GWMP is:

South Tahoe Public Utility District
Attn: Ivo Bergsohn
1275 Meadow Crest Drive
South Lake Tahoe, CA 96150
(530) 543-6204
Ibergsohn@stpud.dst.ca.us

To Obtain a Copy of the Draft GWMP: The Draft GWMP is available for public review at the following locations:

South Tahoe Public Utility District
1275 Meadow Crest Drive
South Lake Tahoe, CA 96150
(530) 544-6474

South Lake Tahoe Library
1000 Rufus Allen Blvd.
South Lake Tahoe, CA 96150
(530) 573-3185

The complete GWMP will also be available for viewing online on the plan documents page of the District's website (www.stpud.us).

Public Hearings: The District's Board of Directors will take comments on the GWMP at their regularly scheduled Board Meeting on Thursday, November 20, 2014 (2:30 p.m.) and will consider adopting the GWMP at the following scheduled Board Meeting on Thursday, December 4, 2014 (2:30 p.m.) to which the public and all interested parties to this matter are invited. The meetings will be held in the Main Boardroom of the District's administrative offices at the address provided below:

South Tahoe Public Utility District
Main Boardroom
1275 Meadow Crest Drive
South Lake Tahoe, CA 96150

Your views on the merits of this GWMP will be welcomed by the District. After comments are received from the public and reviewing agencies, the District will consider those comments in taking action regarding the GWMP.

Thank you.

TAHOE DAILY Tribune

P.O. Box 1888 Carson City, NV 89702
(775) 881-1201 FAX: (775) 887-2408

Customer Account: # 1067078

Legal Account
South Tahoe Public Utility District
1275 Meadow Crest Dr
SOUTH LAKE TAHOE, CA 96150
Attn: Heidi Baugh

Cora Jeffreys says:
That (s)he is a legal clerk of the **TAHOE DAILY TRIBUNE**, a newspaper published Wednesday, Friday, Saturday at South Lake Tahoe, in the State of California.

Copy Line
GWMP NOA final

PO#:

Ad #: 10685004D
of which a copy is hereto attached, was published in said newspaper for the full required period of **1** time(s) commencing on **11/1/2014**, and ending on **11/1/2014**, all days inclusive.

Signed: Cora Jeffreys

Date: 11/03/2014 State of Nevada, Carson City

Price: $ 263.35

Subscribed and sworn to before me this ____ day of ______

____
Notary Public

Proof and Statement of Publication

Ad #: 10685004D

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Ibergsohn@stpud.dst.ca.us

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1275 Meadow Crest Drive
South Lake Tahoe, CA 96150
(530) 544-6474

South Lake Tahoe Library
1000 Rufus Allen Blvd.
South Lake Tahoe, CA 96150
(530) 573-3185

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South Tahoe Public Utility District
Main Boardroom
1275 Meadow Crest Drive
South Lake Tahoe, CA 96150

Your views on the merits of this GWMP will be welcomed by the District. After comments are received from the public and reviewing agencies, the District will consider those comments in taking action regarding the GWMP.

Pub: November 1, 2014 **Ad#10685004**

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General Manager
Richard H. Solbrig

Directors
Chris Cefalu
James R. Jones
Randy Vogelgesang
Kelly Sheehan
Eric Schafer

South Tahoe Public Utility District

1275 Meadow Crest Drive • South Lake Tahoe • CA 96150-7401
Phone 530 544-6474 • Fax 530 541-0614 • www.stpud.us

BOARD AGENDA ITEM 6b

TO: Board of Directors

FROM: Ivo Bergsohn, Hydrogeologist

MEETING DATE: November 20, 2014

ITEM – PROJECT NAME: Groundwater Management Plan Update

REQUESTED BOARD ACTION: **2:30 p.m. PUBLIC HEARING**

DISCUSSION: At 2:30 p.m. hold a Public Hearing to receive public comments regarding the Public Review DRAFT Tahoe Valley South Basin (6-5.01) 2014 Groundwater Management Plan (GWMP).

SCHEDULE:

COSTS: N/A

ACCOUNT NO: 1029-####/GWMPUP

BUDGETED AMOUNT REMAINING:

ATTACHMENTS: GWMP Executive Summary- due to its length the complete Public Draft GWMP document is available on the District's website (http://www.stpud.us/plan_documents.html) and can be viewed at the Board Clerk's office upon request.

CONCURRENCE WITH REQUESTED ACTION: **CATEGORY:** Water

GENERAL MANAGER: YES RHS NO

CHIEF FINANCIAL OFFICER: YES [initials] NO

Executive Summary

The District has developed this updated Groundwater Management Plan (GWMP) for the Tahoe South Subbasin of the Tahoe Valley Groundwater Basin listed as California Department of Water Resources (DWR) Groundwater Basin 6-5.01, or more conveniently referred to as the Tahoe Valley South (TVS) Basin. This GWMP is in accordance with Assembly Bill 3030 (AB 3030), also called the Groundwater Management Act under California Water Code (CWC) Section 10750 *et. seq*. The Plan Area will include portions of El Dorado County, the City of South Lake Tahoe, the Community of Meyers and Christmas Valley situated within the TVS Basin to the extent that they lie within the El Dorado County portion of the District's service area.

The District and its customers, including the business community and economic vitality of South Lake Tahoe, are almost entirely dependent on groundwater. The purpose of the GWMP is to implement the goals and objectives to manage groundwater supplies, protect groundwater quality, and foster stakeholder involvement.

Stakeholder Involvement

This GWMP is updated within the context of an existing, on-going coordination and collaboration with water issues in the TVS Basin. A key objective of this GWMP update is to continue to build on these existing relationships to further enhance groundwater management and protection.

A Stakeholder Advisory Group (SAG) was formed to provide input for the development of this GWMP that represented the District, local water purveyors, governmental agencies, business interests, and ratepayers. Four workshops were held from April through September 2014 to present information on the development of the GWMP, provide a forum to discuss local groundwater issues, and discuss areas of future collaboration among the stakeholders to improve groundwater management and groundwater quality protection.

The GWMP is considered a "living document" that the District intends to update periodically as progress is made in managing groundwater resources and to reflect legislative amendments to the CWC regarding groundwater management in California. Input from the SAG is considered an important function in the ongoing groundwater management in the TVS Basin; therefore, the District plans to host regular SAG meetings starting in 2015 to continue to build off of the collaborative efforts of the current SAG.

State of the Groundwater Basin

The TVS Basin is a sedimentary geologic basin within the South Lake Tahoe area that occupies a structural valley or graben located between the main range of the Sierra Nevada on the west and the Carson Range on the east. The basin-fill deposits consist of sequences of sand and gravels which are inter-layered with silts and clays. The sand and gravel deposits form the principal water-bearing reservoirs (aquifers), while the silt and clay deposits form confining layers (aquitards) which retard the movement of Groundwater. Where these confining layers separate adjoining aquifers, the aquifer is composed of multiple water bearing zones (WBZs) with differing groundwater levels.

Snowmelt is the primary source of groundwater recharge for the TVS Basin. Other sources of groundwater recharge include stream-flow seepage and groundwater inflow from surrounding bedrock. Rising snow level elevations in response to climate change are expected to reduce snow pack volumes and snowmelt. Additionally, changes in stream flow timing are trending toward earlier snowmelt and peak stream flow discharges. Alternate hydrologic methods for estimating groundwater recharge should be considered to improve estimates used in the preliminary groundwater budget and to monitor climate change effects.

Evaluation of water level data indicates that groundwater flow patterns appear to be relatively complex influenced by vertical gradients, aquifer heterogeneity, distribution of surface water features, and pumping effects from drinking water wells. In general, groundwater movement is south to north from the basin margins toward Lake Tahoe. Areas of groundwater discharge occur along the upper reaches of the Upper Truckee River and Trout Creek, in wetland areas situated near the south shore of Lake Tahoe and directly into Lake Tahoe, where basin-fill deposits intersect the shoreline.

More than 95 percent of the drinking water supply in the greater South Lake Tahoe area is derived from groundwater. Currently, the combined pumping by public water system wells, private water company wells, small water systems wells and private wells is estimated to be about 8,559 AFY. Assuming that groundwater recharge from the surrounding bedrock is negligible; a preliminary estimate for total groundwater recharge to the TVS Basin is about 9,875 AFY. Allocations defined in the California-Nevada Interstate Compact for use in the South Lake Tahoe Area (see Section 3.2.1) exceed the estimated total groundwater recharge to the TVS Basin. Therefore, allocation amounts would not appear to be an appropriate objective to use for sustainable groundwater management of the TVS Basin.

Inspection of groundwater elevation hydrographs indicates that groundwater levels are relatively stable. Groundwater withdrawals do not appear to be causing any long-term declines in groundwater levels, or overdraft, in the TVS Basin. The water balance summary indicates that groundwater withdrawals are inferred to remove about 85 percent of the total groundwater recharge. As groundwater levels are remaining stable, there appears to be no net long-term change in groundwater storage. Even with the high density of groundwater use within the TVS Basin, the regulatory policies restricting growth throughout the Lake Tahoe Basin will help to ensure that future overdraft conditions do not develop.

Review of the pumping effects of public water system wells on neighboring surface waters appear to indicate that the greatest declines in shallow groundwater elevations could potentially result from increased groundwater withdrawals neighboring the Upper Truckee Marsh. Currently, groundwater withdrawals from neighboring public water system wells do not appear to have a detrimental effect on shallow groundwater elevations through this area.

Groundwater in the TVS Basin is generally of excellent chemical quality, suitable for the designated beneficial uses of municipal, industrial and agricultural water use and for any other uses to which it might be put. For most constituents, Groundwater quality meets all current drinking water quality standards. Arsenic is the most common inorganic constituent that has been found at concentrations exceeding the primary or secondary maximum contaminant levels (MCLs) within localized areas of the TVS Basin. High arsenic concentrations in public water system wells are believed to be contributed from deep confined water-bearing zones, which have impaired water supplies in the South Lake Tahoe Area, Angora Area, Meyers Area and Christmas Valley Area. Future adoption of the proposed MCL for radon could potentially have a significant effect on water supplies throughout the TVS Basin.

Groundwater quality in the TVS Basin has been adversely affected by past releases of man-made contaminants and resultant degradation of groundwater quality beneath sites located along the main commercial business district from the intersection of Highway 89 and Highway 50 (i.e. the "Y") along Highway 50 to Stateline. Man-made contaminants which occur most frequently include petroleum hydrocarbon and chlorinated hydrocarbon compounds. Although there has been notable progress towards the cleanup of PCE and MtBE contaminant plumes that have impacted public water system wells, significant areas of degraded water quality remains and continues to impair water supplies in the South Lake Tahoe area (South Y PCE Site) and in the Bijou area (Tahoe Tom's Gas Station and Private Residences Sites). In addition, contamination sites closed under the Limited Threat Closure Policy allows residual levels of soil contamination and degraded water quality to remain that may affect the operation of current public water system wells and development of future water supplies under the District's MtBE Policy.

Basin Management Objectives

Basin Management Objectives (BMOs) are required in the GWMP under the CWC§ 10753.7(a)(1). The BMOs included in the GWMP include the following:

- Maintain a sustainable long-term groundwater supply
- Maintain and protect groundwater quality
- Build Collaborative Capacity with Local Agencies, Businesses, Private Property Owners and the Public
- Integrate Groundwater Quality Protection into Local Land Use Planning Activities
- Assess the interaction of water supply activities with environmental conditions
- Convene an Ongoing SAG as a forum for future groundwater issues
- Conduct studies to assess future groundwater needs and issues
- Identify and obtain funding for groundwater projects

Maintaining and protecting groundwater quality is the primary BMO for the TVS Basin. Implementation includes, but is not limited to: the regular monitoring and review of groundwater quality data; the continued implementation of Well Standards for well construction, abandonment and destruction; and update of the District's Groundwater Ordinance to address current groundwater quality concerns. Other actions being proposed include taking action(s) to prevent the significant and unreasonable degradation of water quality. Under this action, immediate support is needed to renew investigation and clean-up of groundwater contamination, with special emphasis on PCE and MtBE contaminant plumes that currently impair water supplies in the South Lake Tahoe and Bijou areas. Another goal of this BMO is to improve integration of groundwater management into existing regulatory and land use planning programs.

Building collaborative capacity with Local Agencies, Businesses, Private Property Owners and the Public is another key BMO for the TVS Basin. The District will continue to provide educational services to the public through public presentations, public informational items on relevant groundwater issues affecting the community. Continued stakeholder involvement with regional groundwater management is a key aspect for implementing the updated GWMP. The District will continue to support an ongoing Stakeholder Advisory Group that may advise the District on groundwater issues and to continue to foster an overall spirit of collaboration.

Conducting technical studies to assess future groundwater needs and issues is another key BMO for the TVS Basin. Actions proposed under this BMO include: monitor evolving requirements under the Sustainable Groundwater Management Act to insure conformance between the adopted regulations and the groundwater sustainability plan needed to be developed for the TVS Basin; support of future groundwater studies that may include improving groundwater cleanup activities to mitigate on-going impairment of water supplies, further evaluation of potential pumping effects on groundwater –surface water interactions, refining the groundwater budget, further evaluating groundwater flow conditions in significant water-bearing zones used for drinking water supply; assessing areas of degraded water quality including areas with natural constituents above MCLs for future water supply; updating the District's current groundwater flow model; expanding the District's monitoring well network; and assessing the potential future need and feasibility of groundwater replenishment facilities for the TVS Basin.

Monitoring and Reporting

The District's Basin Monitoring Program collects data on a regular basis to assess groundwater conditions within the Basin. Groundwater level measurements are collected by the District at designated groundwater supply and monitoring wells as designated by the GWMP using protocols identified in the GWMP and other supporting documents. Samples for groundwater quality are collected by the District at all public water system wells in accordance with the requirements of DDW. Groundwater quality samples may be collected at monitoring wells as designated by the GWMP, and collected consistent with protocols provided in the GWMP and the District's Laboratory QA/QC Plan. Additional groundwater level and quality data may be compiled from other agencies that collect data in the Basin. This District will coordinate the collection of groundwater pumping volumes in the TVS Basin by the District other public water systems.

The District will review the collected data with respect to historical data for each sampling location to assess changes in trends. Groundwater quality data will be compared to drinking water quality standards as defined by the DDW, and the water quality objectives for groundwater in the TVS Basin provided in the LRWQCB Basin Plan. The Basin Monitoring Program may be modified by adding/removing wells over time based on the ongoing assessment of basin conditions and modifications will be addressed in the Annual Reports and GWMP updates.

The District will prepare an Annual Report on the implementation of the GMWP to assess the groundwater supplies and conditions in the Plan Area, including progress on implementation of Basin Management Objectives. The results Basin Monitoring Program and data review will be included in the Annual Report. The report will identify and prioritize any groundwater quality problems in the Plan Area, propose specific actions or inter-governmental agency coordination. The report may include such other information as the District determines applicable to Groundwater supplies in the Plan Area. The District shall hold a public hearing at a regularly scheduled Board of Directors meeting regarding the annual report on groundwater supplies and conditions.

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SOUTH TAHOE PUBLIC UTILITY DISTRICT

Richard Solbrig, General Manager

Eric W. Schafer, President	**BOARD MEMBERS**	Randy Vogelgesang, Vice President
Chris Cefalu, Director	James R. Jones, Director	Kelly Sheehan, Director

REGULAR MEETING OF THE BOARD OF DIRECTORS
SOUTH TAHOE PUBLIC UTILITY DISTRICT
November 20, 2014
<u>MINUTES</u>

The South Tahoe Public Utility District Board of Directors met in a regular session, 2:00 p.m., at the District Office, located at 1275 Meadow Crest Drive, South Lake Tahoe, California.

<u>ROLL CALL</u>:

Board of Directors: President Schafer, Directors Cefalu, Jones, Vogelgesang

Staff: Ivo Bergsohn, Tim Bledsoe, Dennis Cocking, Shannon Cotulla, Melonie Guttry, Lynn Nolan, Julie Ryan, Chris Skelly, Richard Solbrig, John Thiel, Paul Hughes, Gary Kvistad

Guests: Jim Hilton, Mike Maley, Kennedy Jenks, Eric Saperstein, Michelle Sweeney, Tim Williams, Kennedy Jenks

<u>CONSENT CALENDAR</u>:

<u>Moved Vogelgesang/ Second Cefalu / Schafer Yes / Cefalu Yes / Jones Yes / Vogelgesang Yes / Sheehan Absent</u> to approve the Consent Calendar as presented.

a. Truckee Marsh Sewer Facilities Protection Project – (1) Approved Change Order No. 2 to V&C Construction, Inc. in the amount of $<7,663.75>; (2) Approved the Partial Closeout Agreement and Release of Claims for V&C Construction, Inc.; and (3) Authorized staff to file a Notice of Partial Completion with the El Dorado County Clerk for Year 1 improvement.

b. Luther Pass Power and Control Project – Approved proposal from the consultants, GHD, for engineering services in the amount of $40,277.

c. Resolution for the Department of Water Resources Water-Energy Grant Program 2014 – Adopted Resolution No. 2966-14 approving grant funding for the Commercial/Industrial Water Efficiency Program.

d. Resolution for the Bureau of Reclamation WaterSMART: Water and Energy Efficiency Grant, 2014 – Adopted Resolution No. 2967-14 approving grant funding for the Bureau of Reclamation WaterSMART Water and Energy Efficiency Grant, 2014.

e. Regular Board Meeting Minutes: November 6, 2014 - Approved November 6, 2014 Minutes.

Director Sheehan arrived at 2:04 p.m. after approval of the Consent Calendar.

ITEMS FOR BOARD ACTION:

a. Truckee Marsh Sewer Facilities Protection Project – Staff gave an overview of the project and further recommended accepting the proposal from Lumos & Associates in the amount of $6,200.

Moved Cefalu / Second Vogelgesang / Schafer Yes / Cefalu Yes / Jones Yes / Vogelgesang Yes / Sheehan Yes to accept the cost proposal from Lumos & Associates to provide professional land survey services for the Upper Truckee Marsh Sewer Facilities Protection Project.

Groundwater Management Plan Update – President Schafer opened the public hearing at 2:31 to receive public comments on the Groundwater Management Plan Update. Staff reported on the 11 months of work that has been complete on the plan. Staff introduced Mike Maley of Kennedy Jenks, who provided a PowerPoint Presentation.

No public comments were received and the public hearing was closed at 3:08 p.m.

b. Management Memorandum of Understanding – Richard Solbrig gave a summary of the MOU Redline version.

Moved Schafer / Second Jones / Schafer Yes / Cefalu Yes / Jones Yes / Vogelgesang Yes / Sheehan Yes to approve the Management Memorandum of Understanding extending the contract to June 28, 2017.

c. Payment of Claims

Moved Vogelgesang / Second Cefalu / Schafer Yes / Cefalu Yes / Jones Yes / Vogelgesang Yes / Sheehan Yes to approve Payment of Claims in the amount of $817,960.18.

STANDING AND AD-HOC COMMITTEE REPORTS:
Nothing to report.

BOARD MEMBER REPORTS:
Director Vogelgesang reported on the November 14, 2014, City of South Lake Tahoe Oversight Committee meeting.

President Schafer suggested staff may want to review the list of property owned by STPUD for continued necessity. He further mentioned the audit report is now available from Grant-Thornton and he recognized Paul Hughes and the finance staff for another successful audit with zero adjustments.

EL DORADO COUNTY WATER AGENCY PURVEYOR REPORT:
Director Jones provided a report regarding the November 12, 2014, El Dorado County Water Agency meeting.

GENERAL MANAGER REPORT:
Richard Solbrig reported there has been four straight days of interviews, tests are currently being reviewed and candidates will be notified the first week of December at the latest.

STAFF/ATTORNEY REPORTS:
Staff introduced Eric Saperstein from ENS Resources, the District's legislative advocate. Eric Saperstein recognized President Schafer for his involvement in CASA, where he provided a voice of knowledge, representing the perspective of small districts on a whole, while doing an excellent job of representing STPUD throughout.

Saperstein further provided the following legislative update:

1) Fire prevention efforts for regional suppression needs are continuing. The District is included in the Forest Service's budget for FY 2015.

2) Corps of Engineers – The District has been able to resolve lack of progress with permitting by working with McClintock's office to push the Corps of Engineers along and move approval of the permitting process. This is a credit to the District to convey its needs through appropriate offices.

3) Tahoe Restoration Act may be reintroduced next year – The District will continue to push the availability of facility relocation costs under the Tahoe Restoration Act to support 66% cost share for local agencies costs associated with any Tahoe Restoration activities.

4) WaterSMART – The US Bureau of Reclamation funding assistance for technologies and activities for efficient usage of water will be funded at a higher level than in the past so there is an opportunity for the District to secure funding in this area.

5) Bureau of Land Management – Saperstein is working with the District on the issue of increased potential for rental fees on BLM properties in Alpine County. Everyone has encountered this issue with BLM, who has imposed new rate structures and he is working to reduce these for the District.

   Outlook: Tomorrow the President is planning to provide some kind of limited protection to over five million illegal aliens to stay in this Country and receive work permits. This may create a backlash with the incoming Republican majority to fight the President on whether or not he is abusing his executive authority. That could theoretically jeopardize the finalization of an omnibus spending bill for FY 2015 and put us in a scenario of a continued resolution until February or March. We may see some kind of omnibus bill for non-controversial pieces of legislation like energy and water development appropriations bills, which funds a number of the programs of interest to the District including WaterSMART. Congress has until December 11th to do something on the budget or face the prospect of shutting down the government.

   Drought Relief Bill – Sen. Feinstein announced this morning that she is pulling the drought relief bill and will not pursue it. She will come back in January to seek putting through regular order on a water bill.

Staff reported the District has received confirmation that PERS rates will drop on salaries from 17.3% to 14.2%. This establishes a new benchmark.

Director Jones expressed appreciation for Director Schafer serving on the Board, bringing great experience as a CPA and auditor, with involvement on the budget and his involvement with CASA.

BREAK AND ADJOURNMENT TO CLOSED SESSION: 3:30 p.m.

RECONVENED TO OPEN SESSION: 4:18 p.m.

a. Pursuant to Government Code Section 54956.9(a)/Conference with Legal Counsel Existing Litigation re: El Dorado County Superior Court Case SC20120227 GRCLT Condominium vs. South Tahoe Public Utility District (Filed 10/22/12).

No reportable Board action.

b. Pursuant to Section 54957.9(a) of the California Government Code, Closed Session may be held for conference with legal counsel regarding existing litigation: STPUD vs. Lakeside Park Association, et al., County of El Dorado, Superior Court Case No. SC20010165.

No reportable Board action.

c. Pursuant to Government code Section 54957(a)/Conference with Labor Negotiators re: Memorandum of Understanding with the Management Unit. Present at this Closed Session will be Agency Negotiators: Richard Solbrig/General Manager, Nancy Hussmann/Human Resources Director, and Paul Hughes/Chief Financial Officer.

No reportable Board action.

ADJOURNMENT: 4:18 p.m.

Eric Schafer, Board President
South Tahoe Public Utility District

Melonie Guttry, Clerk of the Board
South Tahoe Public Utility District

South Tahoe
Public Utility District

Richard Solbrig, General Manager

Memorandum

Date: December 4, 2014

To: Board Members

From: Ivo Bergsohn IB

Re: Comments on the Public Review Draft Tahoe Valley South (6-5.01) 2014 Groundwater Management Plan

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On October 30th 2014 the District issued a Notice of Availability and Public Hearing inviting the public to submit comments on the updated Groundwater Management Plan (GWMP) prepared for the Tahoe Valley South Basin (6-5.01). The 30-day comment period for the Public Review Draft GWMP document ended on December 1st, 2014. As of the date of this memorandum, the District has received comments from two public agencies. The first is a letter received from Joanne Marchetta, Executive Director of the Tahoe Regional Planning Agency. The second is a comment email from Joey Keely, Ecosystem Conservation Staff Officer & Research Coordinator for the USDA Forest Service Lake Tahoe Basin Management Unit. Copies of these comments are attached to this memorandum. No verbal comments were received during the Public Hearing held during the November 20th, 2014 Board Meeting.

District staff believes that the comments received support adoption of the GWMP by the Board.

Attachments

Cc: B. Herrema, BFHS
S. Cottulla
R. Solbrig
File

TAHOE REGIONAL PLANNING AGENCY

Mail
PO Box 5310
Stateline, NV 89449-5310

Location
128 Market Street
Stateline, NV 89449

Contact
Phone: 775-588-4547
Fax: 775-588-4527
www.trpa.org

November 17, 2014

Mr. Ivo Bergsohn
South Tahoe Public Utilities District
1275 Meadow Crest Drive
South Lake Tahoe, CA 96150

Dear Mr. Bergsohn,

Thank you for inviting the Tahoe Regional Planning Agency (TRPA) to participate in the development of the updated Groundwater Management Plan (GWMP) for the Tahoe Valley South Groundwater Basin. We appreciate the opportunity to serve on the Stakeholder Advisory Group and support adoption of the GWMP which will help to protect the community's groundwater resources.

As a result of collaboration among stakeholders, TRPA supports the overall goals and objectives described in the updated GWMP to help sustain a long-term, high-quality groundwater supply for our community. There was a strong spirit of cooperation during the stakeholder meetings and open discussion of ideas of how to continue to improve groundwater management. As a result, several areas for future collaboration were identified among the stakeholders that would further improve groundwater management both now and into the future.

TRPA understands the GWMP is a dynamic document that will be updated and improved over time. TRPA encourages implementation of the updated GWMP and looks forward to its continued involvement in the stakeholder process described in the GWMP.

Sincerely,

JSMarchetta

Joanne S. Marchetta
Executive Director

From:	Keely, Joey -FS
To:	Ivo Bergsohn
Cc:	Gibson, Nancy J -FS; Johnson, Melraine M -FS
Subject:	LTBMU comments -- RE: Notice of Availability and Public Hearing 2014 Groundwater Management Plan Update (29 October 2014)
Date:	Monday, December 01, 2014 4:44:22 PM
Attachments:	image001.png image002.png image003.png

Hello Ivo,

Thank you for the great discussion this afternoon, regarding STPUD's 2014 Groundwater Management Plan Update. I've boiled down LTBMU's input to two supportive comments and one requesting additional clarity/explanation:

1. The Forest Service appreciates the offer to join the Stakeholders Advisory Group and agrees that there are mutual benefits to be gained in the areas of land use planning and management, ground water protection, and data and information sharing.

2. The District is leading the Tahoe-Sierra IRWMP process to provide a road map for water supply in STPUD's service area and LTBMU looks forward to participating in that effort and playing a role in coordinating with other such efforts in the Basin (e.g., the Bureau of Reclamation's Working Groups studying the Truckee River Water supply in both CA and NV).

3. The document would benefit from additional explanation/clarification of how the Plan's regulatory structure is overlaid on and interacts with Lahontan's existing regulatory program for investigation and remediation of groundwater contamination occurrences.

We look forward to working with STPUD and the Stakeholders Advisory Group in the new year!

USDA USFS

Joey Keely, PhD
Ecosystem Conservation Staff Officer
& Research Coordinator

USDA Forest Service
Lake Tahoe Basin Management Unit

office: (530) 543-2661
cell: (530) 721-1608
fax: (530) 543-2693

jkeely@fs.fed.us

35 College Drive
South Lake Tahoe, California 96150
www.fs.fed.us

Caring for the land and serving people.

From: Ivo Bergsohn [mailto:Ibergsohn@stpud.dst.ca.us]
Sent: Wednesday, October 29, 2014 4:34 PM
To: Ivo Bergsohn
Subject: Notice of Availability and Public Hearing 2014 Groundwater Management Plan Update (29 October 2014)

The South Tahoe Public Utility District (District) is updating its Groundwater Management Plan (GWMP) applied to the Tahoe Valley South Basin (DWR Groundwater Basin 6-5.01). As an individual or agency that is concerned with the management of water resources within the greater South Lake Tahoe area, you are being notified of this plan in order to receive information about the update, attend meetings and provide public comment. Should you wish to unsubscribe from this list, please send a message to ibergsohn@stpud.dst.ca.us

The Notice of Availability and Public Hearing for the 2014 Groundwater Management Plan Update (NOA) are being posted on the District's website along with the Public Review Draft document. Information describing the Public Review, Public Hearings schedule and document availability are provided in the attached NOA.

Thank you for your interest in this effort.

This email message has been delivered safely and archived online by Mimecast.

General Manager
Richard H. Solbrig

Directors
Chris Cefalu
James R. Jones
Randy Vogelgesang
Kelly Sheehan
Eric Schafer

South Tahoe
Public Utility District

1275 Meadow Crest Drive • South Lake Tahoe • CA 96150-7401
Phone 530 544-6474 • Fax 530 541-0614 • www.stpud.us

BOARD AGENDA ITEM 8a

TO: Board of Directors

FROM: Ivo Bergsohn, Hydrogeologist

MEETING DATE: December 4, 2014

ITEM – PROJECT NAME: Groundwater Management Plan Update

REQUESTED BOARD ACTION: **2:15 p.m. PUBLIC HEARING**

DISCUSSION: At 2:15 p.m. hold a Public Hearing to receive public comments regarding (1) Adoption of Resolution No. 2969-14, the Tahoe Valley South (6-5.01) 2014 Groundwater Management Plan; and, (2) Enacting Ordinance No. 558-14 amending Division 7 of the Administrative Code.

SCHEDULE:

COSTS: N/A

ACCOUNT NO:

BUDGETED AMOUNT REMAINING:

ATTACHMENTS: Groundwater Management Plan Update is available on the District's website (http://www.stpud.us/plan_documents.html) and can be viewed at the Board Clerk's office upon request.

CONCURRENCE WITH REQUESTED ACTION: **CATEGORY:** Water

GENERAL MANAGER: **YES** RHS **NO**

CHIEF FINANCIAL OFFICER: **YES** PS **NO**

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General Manager
Richard H. Solbrig

Directors
Chris Cefalu
James R. Jones
Randy Vogelgesang
Kelly Sheehan
Eric Schafer

Sewer • 1950 • Water

South Tahoe Public Utility District

1275 Meadow Crest Drive • South Lake Tahoe • CA 96150-7401
Phone 530 544-6474 • Fax 530 541-0614 • www.stpud.us

BOARD AGENDA ITEM 8b

TO: Board of Directors

FROM: Ivo Bergsohn, Hydrogeologist

MEETING DATE: December 4, 2014

ITEM – PROJECT NAME: Groundwater Management Plan

REQUESTED BOARD ACTION: Adopt Resolution No. 2969-14 Adopting the Tahoe Valley South (6-5.01) 2014 Groundwater Management Plan (GWMP); and (2) Enacting Ordinance No. 558-14 amending Division 7 of the Administrative Code.

DISCUSSION: The District has updated its GWMP to ensure compliance with current requirements in accordance with California Water Code (CWC) Section 10750 et. seq. Review and amendment of Ordinance No. 477-00 has also been completed concurrent with this update.

The previous version of the GWMP was developed in 2000 by the District in the form of a groundwater Ordinance. In December, 2000, the District enacted Ordinance No. 477-00 adding Division 7 to the Administrative Code, authorizing the Administration of a GWMP as sanctioned under CWC Section 10750, et seq. The GWMP was developed for the purposes of regulating, managing, conserving and protecting local groundwater resources. The 2000 Plan focused attention on the impacts of man-made contamination on the District and its customers and included an Ordinance for implementing rules, regulations and procedures to identify potential contamination before it impacted the District's wells.

The GWMP is considered a "living document"— a document that the District intends to update periodically to report on the progress made in managing groundwater resources. Importantly, this Plan will need to be replaced with a Groundwater Sustainability Plan by 2020 or 2022 (depending on the TVS Basin's DWR prioritization) in order to comply with the recently passed Sustainable Groundwater Management Act (SGMA). Tracking the SGMA's requirements, this GWMP update was prepared to ensure compliance with current requirements and to plan for expansion of the District's role in the management of the local groundwater resources and water quality. The GWMP update was prepared by the District and its consultants in collaboration with a Stakeholders Advisory Group (SAG) consisting of twelve members who reside within the boundaries of the District or who represent collaborating businesses or government agencies who have demonstrated a commitment to protecting groundwater resources.

Concurrent with this GWMP update, Ordinance No. 477-00 has been reviewed and revised. Since 2000, considerable progress has been made with the remediation of petroleum sites (the primary focus of the 2000 Ordinance). A key element of the updated Ordinance is to revise the Ordinance to address broader groundwater protection concerns, especially the requirements of Section 7.9.2 Basin Monitoring Program. The goal for this Ordinance revision is to provide the District with a mechanism for enforcing groundwater protection—protection created in collaboration with other local agencies that minimizes duplicative regulatory oversight or monitoring requirements.

SCHEDULE:

COSTS: N/A

ACCOUNT NO: 1029- /GWMPUP

BUDGETED AMOUNT REMAINING:

ATTACHMENTS: Resolution No. 2969-14 and Ordinance No. 558-14: A copy of the updated GWMP and Groundwater Management Ordinance are available under the 2014 Groundwater Management Plan Update portion of the Plan Documents page of the District's website (http://www.stpud.us/plan_documents.html) and is also available upon request to the Clerk of the Board.

CONCURRENCE WITH REQUESTED ACTION: **CATEGORY:** Water

GENERAL MANAGER: **YES** RHS **NO**

CHIEF FINANCIAL OFFICER: **YES** PAS **NO**

RESOLUTION 2969-14

RESOLUTION OF THE BOARD OF DIRECTORS OF THE SOUTH TAHOE PUBLIC UTILITY DISTRICT ADOPTING A GROUNDWATER MANAGEMENT PLAN PURSUANT TO WATER CODE SECTION 10750, ET SEQ.

WHEREAS, California Water Code Section 10750 contains a legislative finding and declaration that groundwater is a valuable natural resource that should be managed to insure its safe production and quality, and that local agencies should work cooperatively to manage groundwater resources within their jurisdiction; and

WHEREAS, California Water Code Section 10753 authorizes a local agency to adopt a groundwater management plan pursuant to California Water Code Sections 10750 et seq., for basins or portions of basins within the jurisdiction of the agency that are not already subject to a Groundwater Management Plan; and

WHEREAS, the Tahoe South Subbasin of the Tahoe Valley Groundwater Basin (6-5.01) is located within the South Tahoe Public Utility District's ("District") boundaries; and

WHEREAS, in December 2000, the District enacted Ordinance No. 477-00 adding Division 7 to the Administrative Code authorizing the administration of the Tahoe Valley South (6-5.01) Groundwater Management Plan ("2000 TVS Basin GWMP") pursuant to California Water Code section 10750, et seq.; and

WHEREAS, the District desired to update the 2000 TVS Basin GWMP in order to ensure compliance with current requirements in California Water Code section 10750 et. seq., AB 3030 and SB 1938; and

WHEREAS, a twelve-member Stakeholder Advisory Group (SAG) was convened and met four times in 2014 (April 16, May 14, June 4 and September 24) to provide input from the public, local agencies and business owners as to updating the 2000 TVS Basin GWMP ("2014 TVS Basin GWMP"); and

WHEREAS, the District provided a draft of the 2014 TVS Basin GWMP for public review from October 30 to December 1, 2014 and held a public hearing on November 20, 2014 to present the draft to the public and to solicit comments; and

WHEREAS, the District has made copies of the 2014 TVS Basin GWMP to the public and notice of the public hearing on whether to adopt the 2014 TVS Basin GWMP was given in the manner prescribed by law; and

WHEREAS, the District desires to formally adopt the 2014 TVS Basin GWMP; and

WHEREAS, the District held an additional public hearing on December 4, 2014 to determine whether to adopt the 2014 TVS Basin GWMP; and

WHEREAS, the District's Board of Directors has also adopted revisions to its Groundwater Management Ordinance, added as Division 7, Sections 7.1 through 7.10 of the Administrative Code.

NOW, THEREFORE, BE IT RESOLVED, AS FOLLOWS:

1. The foregoing recitals are true and are incorporated by reference.
2. The 2014 TVS Basin GWMP is hereby adopted to be effective as of December 4, 2014.
3. That the adoption of the 2014 TVS Basin GWMP is statutorily exempt from the California Environmental Quality Act ("CEQA").
4. This Resolution shall take effect immediately.

WE, THE UNDERSIGNED, do hereby certify that the above and foregoing Resolution was duly adopted and passed by the Board of Directors of the South Tahoe Public Utility District as a regularly scheduled meeting held on the 4th day of December, 2014, by the following vote:

AYES:

NOES:

ABSENT:

Eric Schafer, Board President
South Tahoe Public Utility District

ATTEST:

Melonie Guttry, Clerk of the Board

SOUTH TAHOE PUBLIC UTILITY DISTRICT

Richard Solbrig, General Manager

Eric W. Schafer, President	**BOARD MEMBERS**	Randy Vogelgesang, Vice President
Chris Cefalu, Director	James R. Jones, Director	Kelly Sheehan, Director

REGULAR MEETING OF THE BOARD OF DIRECTORS
SOUTH TAHOE PUBLIC UTILITY DISTRICT
December 4, 2014
MINUTES

The South Tahoe Public Utility District Board of Directors met in a regular session, 2:00 p.m., at the District Office, located at 1275 Meadow Crest Drive, South Lake Tahoe, California.

ROLL CALL:

Board of Directors: President Schafer, Directors Cefalu, Vogelgesang, Sheehan
Excused: Director Jones

Staff: Brian Bartlett, Tim Bledsoe, Randy Curtis, Shannon Cotulla, Melonie Guttry, Ross Johnson, Gary Kvistad, Julie Ryan, Richard Solbrig, Chris Stanley, John Thiel

Guests: Melanie Greene, Jim Hilton, Nancy Schafer, Michelle Sweeney, Duane Wallace

ADMINISTERING OATHS OF OFFICE:
The Board Clerk administered Oaths to Director Chris Cefalu for Seat #1, and Director Duane Wallace for Seat #5.

Nancy Schafer acknowledged President Schafer's dedication to the Board, thanking everyone for supporting him and expressed how much he has enjoyed his time as a Board Member.

CONSENT CALENDAR:

Moved Vogelgesang / Second Cefalu / Schafer Yes / Cefalu Yes / Jones Excused / Vogelgesang Yes / Sheehan Yes to approve the Consent Calendar as presented.

a. 2014 Asphalt Patching Services
Approved the Project Closeout Agreement and Release of Claims for Thomas Haen Company, Inc.; and (2) Authorized staff to file a Notice of Completion with the El Dorado County Clerk.

b. Self-Insured Dental Plan Renewal
(1) Approved renewal of the Self-Insured Dental Plan with a funding level of $130.69 per employee per month; and (2) Approved 2015 Dental COBRA rates at $49.29 Single, $98.57 Employee +1, and $167.57 Family.

c. Self-Insured Dental Plan Document Update
Approved updated Plan Document for the Self-Insured Dental Plan.

d. Regular Board Meeting Minutes: November 20, 2014 - Approved November 20, 2014 Minutes.

PRESENTATION

President Schafer was acknowledged for his past year as President leading the District through many difficult decisions. He has provided the Board and staff with the ability to look at the broad picture of a situation, weigh the costs and benefits and provide a very succinct analysis and reasoning behind his decision making process, which helps the rest of the Board and staff to reach theirs. President Schafer was recognized for striking a balance between serving District customers, providing for the long term infrastructure of the District and for always considering staff, with a clear thought process in every situation.

ITEMS FOR BOARD ACTION:

a. Groundwater Management Plan Update – The Public Hearing was opened at 2:15 p.m. to receive public comments regarding (1) Adoption of Resolution No. 2969-14, the Tahoe Valley South (6-5.01) 2014 Groundwater Management Plan; and, (2) Enacting Ordinance No. 558-14 amending Division 7 of the Administrative Code.

No public comments were received and the Public Hearing was closed at 2:15 p.m.

b. Groundwater Management Plan - Staff reviewed a memo distributed to the Board prior to the meeting and gave an overview of the public comments that have been received via mail, email, public hearing and/or telephone by the deadline of December 1, 2014. Comments include a letter of support for adopting the Groundwater Management Plan from Joanne Marchetta, Executive Director of TRPA, two additional supportive comments and a third comment suggesting additional explanation concerning the Groundwater Management Plan from Joe Keely of the US Forrest Service Lake Tahoe Management Unit. Staff added there will be some minor language cleanup to the plan that is still being received from counsel.

Moved Vogelgesang / Second Sheehan / Schafer Yes / Cefalu Yes / Jones Excused / Vogelgesang Yes / Sheehan Yes to Adopt Resolution No. 2969-14 adopting the Tahoe Valley South (6-5.01) 2014 Groundwater Management Plan subject to staffs' subsequent, non-substantial modifications.

Moved Vogelgesang / Second Sheehan / Schafer Yes / Cefalu Yes / Jones Excused / Vogelgesang Yes / Sheehan Yes Enacting Ordinance No. 558-14 amending Division 7 of the Administrative Code.

c. Resolution No. 2968-14 – **Richard Solbrig** presented Resolution No. 2968-14 to Director Schafer in appreciate of his years of service on the Board. **President Schafer** stated it has been a privilege to serve with such a talented group of people here at the District, which is a testament to the community having outstanding water and wastewater operations. He encouraged public outreach efforts to continue so that the community has a better understanding of the District through conservation and environmental efforts.

Moved Cefalu / Second Sheehan / Schafer Yes / Cefalu Yes / Jones Excused / Vogelgesang Yes / Sheehan Yes to Adopt Resolution No. 2968-14 in appreciation of Director Schafer.

d. Payment of Claims

Moved Sheehan / Second Cefalu / Schafer Yes / Cefalu Yes / Jones Excused / Vogelgesang Yes / Sheehan Yes to approve Payment of Claims in the amount of $1,011,665.78.

STANDING AND AD-HOC COMMITTEE REPORTS:

BOARD MEMBER REPORTS:
Directors Cefalu, Vogelgesang and **Sheehan** expressed their appreciation for Director Schafer's leadership, knowledge and experience.

EL DORADO COUNTY WATER AGENCY PURVEYOR REPORT:
There is a meeting scheduled for December 10, 2014.

GENERAL MANAGER REPORT:
Richard Solbrig reported on several items:

1. He is attending a meeting at TRPA on December 5, 2014, regarding the Lake Tahoe Partnership.

2. The City has initiated a lawsuit against Sierra Tahoe Ready Mix and Solbrig recently received a phone call from Mike Wallace, owner of Sierra Tahoe Ready Mix, requesting a written letter of Solbrig's recently published comments in the *Tahoe Daily Tribune*. Solbrig is planning to have a conversation with City officials before writing the letter to be sure he is clear on the issues brought about by the lawsuit. Thomas Haen Construction who purchased the concrete for the District projects has already written a letter for Sierra Tahoe Ready Mix. The Board provided feedback on the letter and if there is a need for additional review after speaking with City officials, it will be brought forward to the Operations Committee. The hearing date for Sierra Tahoe Ready Mix is December 15, 2014.

3. The new District Assistant General Manager is Shannon Cotulla. The two in-house candidates fared well through the interview process and as a result John Thiel has been promoted to the Engineering Department Manager position and Julie Ryan has been promoted to the Principal Engineer position. Solbrig is expecting to receive justification soon to fill the vacant senior engineer position in the Department.

4. The Water Reuse Manager position has been offered to an outside candidate, but until the individual completes the pre-employment process, no names will be announced.

STAFF/ATTORNEY REPORTS:
Attorney Kvistad expressed his appreciation for President Schafer, including his leadership and commitment to the District.

President Schafer acknowledged staff for receiving no violations from Cal OSHA's visit. This is a huge accomplishment and congratulations goes out to all staff for making this happen. He further announced the California Association of Sanitation Agencies Conference is January 21, 2015 through January 23 and Director Vogelgesang is planning to attend.

BREAK AND ADJOURNMENT TO CLOSED SESSION: 2:57 p.m.

RECONVENED TO OPEN SESSION: 4:15 p.m.

a. Pursuant to Government Code Section 54956.9(a)/Conference with Legal Counsel Existing Litigation re: El Dorado County Superior Court Case SC20120227 GRCLT Condominium vs. South Tahoe Public Utility District (Filed 10/22/12).

No reportable Board action.

b. Pursuant to Section 54957.9(a) of the California Government Code, Closed Session may be held for conference with legal counsel regarding existing litigation: STPUD vs. Lakeside Park Association, et al., County of El Dorado, Superior Court Case No. SC20010165.

No reportable Board action.

ADJOURNMENT: 4:15 p.m.

Randy Vogelgesang, Board Vice President
South Tahoe Public Utility District

Melonie Guttry, Clerk of the Board
South Tahoe Public Utility District

Appendix B

Additional Information Regarding Water Quality and Land Use Planning Agencies

Appendix B: Additional Information Regarding Water Quality and Land Use Planning Agencies

This appendix supports Section 4 and contains more detailed regulatory information about the various agencies and programs.

B.1 Lahontan Regional Water Quality Control Board

The SWRCB and LRWQCB implement many of the elements of the CWA for the regulation of groundwater quality under primacy from US Environmental Protection Agency (US EPA).

B.1.1 Groundwater Quality Regulation

There have been several historical releases in the TVS Basin that has required the authority of several regulatory agencies to enforce and oversee groundwater remediation activities. The Basin Plan Beneficial Uses of groundwater in the TVS Basin are designated as municipal, industrial and agricultural. The water quality of groundwaters designated as municipal shall not contain concentrations of chemical constituents in excess of the maximum contaminant level (MCL) or secondary maximum contaminant level (SMCL) based upon drinking water standards specified in the Title 22 of the California Code of Regulations.

The enforcement of groundwater cleanup is primarily conducted through several state and local programs in the TVS Basin.

- The SWRCB Underground Storage Tank Program addresses groundwater contamination from leaking tanks primarily at gasoline stations. The purpose of the UST Program is to protect public health and safety and the environment from releases of petroleum and other hazardous substances from tanks. There are four program elements:
    - Leak Prevention - The Leak Prevention Program element includes requirements for tank installation, construction, testing, leak detection, spill containment, and overfill protection. (El Dorado County responsibility under CUPA)
    - Cleanup - Cleanup of leaking tanks often involves a soil and groundwater investigation and remediation, under the direction of a regulatory agency. (joint SWRCB/LRWQCB/El Dorado County responsibility.
    - Enforcement - The SWRCB provides assistance to local agencies enforcing UST requirements.
    - Tank Tester Licensing - Tank integrity testing is required by law, must meet the requirements of the SWRCB, and must be conducted by State licensed tank testers. (SWRCB responsibility)
- Low Threat Underground Storage Tank Case Closure Policy (LTCP), which the SWRCB adopted on May 1, 2012 under Resolution 2012-0016 and became effective on August 17, 2012. The LTCP allows for the closure of a UST site if site conditions and characteristics meet standardized criteria that will generally ensure the protection of human health, safety and the environment (i.e., low threat case closure). The UST Cleanup Fund has been extended to January 1, 2026 under SB 445.

- The Plan for Implementation of Low threat Underground Storage Tank Case Closure Policy and Additional Program Improvements was approved by Resolution No. 2012-0062 on November 6, 2012 and directs RWQCB staff and other local oversight agencies to aggressively implement the Plan. (SWRCB 2012a, 2012b).The major elements related to UST Program improvement are to provide: (1) focus on high-priority cases (such as impacted drinking water wells, other human health impacts, and sources of free product still remaining in place), and (2) for development of Path to Case Closure Plans for each open case, including specific milestones and timelines.
- SWRCB Underground Storage Tank Cleanup fund provides a means for petroleum UST owners and operators to meet federal state requirements of maintaining financial responsibility to pay for damages arising from their tank operations. The Fund assists a large number of small businesses and individuals by providing reimbursement for expenses associated with cleanup of leaking UST. The Fund also provides money to the RWQCBs and local regulatory agencies to abate emergency situations or to clean up abandoned sites that pose a threat to human health, safety, and the environment aa a result of a UST petroleum release. The Fund also has several special programs including the comingled plume account (CPA), emergency, abandoned, and recalcitrant account (EAR); replacing, removing or upgrading underground storage tanks (RUST), and Orphan Site Cleanup Fund (OSCF)
- The Site Cleanup Program (SCP) regulates and oversees the investigation and cleanup of ‘non-federally owned’ sites where recent or historical unauthorized releases of pollutants to the environment, including soil, groundwater, surface water, and sediment, have occurred.
- The Emergency, Abandoned, and Recalcitrant Account Program and the Orphan Site Cleanup Fund addresses groundwater pollution cases where the responsible party is insolvent or cannot be identified or located. Using Cleanup and Abatement Account (CAA) funds, the LRWQCB conducted a groundwater investigation at Tahoe Meadows where there is PCE contamination. LRWQCB will evaluate remaining orphan cases and prioritize cases with the greatest impact to public health for additional requests to the SWRCB for CAA or other funds for investigations and cleanup.

B.1.2 Lake Tahoe TMDL

Water bodies that are impaired require development of TMDL water quality restoration plans to address the impairments. California’s Lake Tahoe TMDL (dated November 2010 and approved by the EPA) requires attainment of the transparency standard for Lake Tahoe over a 65-year implementation period.

LRWQCB leads Lake Tahoe TMDL implementation efforts in California by coordinating local government storm water treatment and erosion control projects, facilitating stream channel restoration work, and overseeing forest management practices in an effort to reduce sediment and nutrient loads. The TMDL sets the framework for managing urban storm water on a particle number and mass basis. The LRWQCB is working closely with the TRPA to implement its Regional Plan and associated Environmental Improvement Program.

Lake Tahoe TMDL research (LRWQCB 2010) included an analysis of pollutant sources to identify the magnitude of pollutant loads to Lake Tahoe from source categories defined as: surface runoff from developed lands; atmospheric deposition; forested runoff; stream channel erosion; groundwater; and shoreline erosion. The research identified surface runoff from developed lands as the most significant source of pollutant loading for fine sediment particles (the primary pollutant of concern) and phosphorus. Surface runoff from developed lands is estimated to deliver over 70% of the average annual fine sediment particle load and roughly 40% of the average annual phosphorus load to Lake Tahoe. For nitrogen, atmospheric deposition is identified as the most significant source of loading to Lake Tahoe, contributing 55% of the average annual load.

Three TMDLs have been approved as of 2013. A sediment TMDL was approved for Heavenly Valley Creek in 2002, a sediment TMDL was approved for Blackwood Creek in 2008, and a sediment and nutrient (nitrogen and phosphorus) TMDL was approved for Lake Tahoe in 2011. Total nitrogen loading in Cold Creek are being addressed by a NFS restoration project with an expected attainment date of 2028. Elimination of grazing in some parts of the Upper Truckee River watershed have allowed the Upper Truckee River to be delisted for some of these pollutants (USEPA 2010).

B.2 El Dorado County

The El Dorado County Department of Environmental Management (EDCEMD), Hazardous Waste Division is typically the lead agency for responding to hazardous waste issues in the Basin. Through permit and inspection processes, as well as public educational programs, the Hazardous Materials Program objective is to protect human health and the environment by ensuring that hazardous materials and hazardous waste are properly managed.

B.2.1 Hazardous Waste Management

The Hazardous Materials Program is approved by Cal-EPA as the local Certified Unified Program Agency (CUPA) for El Dorado County. The Unified Program is intended to provide relief to businesses complying with the overlapping and sometimes conflicting requirements of formerly independently managed programs. The Unified Program is implemented at the local government level by Certified Unified Program Agencies (CUPAs). The Unified Program (UP) was created by Senate Bill 1082 (1993) to consolidate, coordinate, and make consistent the administrative requirements, permits, inspections, and enforcement activities for the following environmental and emergency management programs under the Certified Unified Program Agency (CUPA) Program include the following:

- California Accidental Release Prevention (CalARP) Program
- Underground Storage Tank Program
- Aboveground Petroleum Storage Act Requirements for Spill Prevention, Control and Countermeasure (SPCC) Plans
- Hazardous Waste Generator and Onsite Hazardous Waste Treatment Programs which has five tiers of permitting (described below) and includes submittal of Hazardous Materials Business Plan which includes Hazardous Materials Release Response Plans and Inventories and Hazardous Waste Contingency Plan with associated inspections
- California Uniform Fire Code: Hazardous Material Management Plans and Hazardous Material Inventory Statements

B.2.2 Hazardous Waste Permitting

EDCEMD uses a tiered permitting is the standard five-level hazardous waste treatment, storage and disposal (TSD) authorization program developed by the DTSC. The first three tiers are designed to regulate on-site treatment of hazardous waste. On-site treatment under these tiers is limited to relatively small amounts of waste with proven, low risk technologies. The onsite tiered permitting program is presently run by the Certified Unified Program Agencies (CUPAs). The fourth tier or "Standardized Permit" is for off-site treatment or storage of wastes that would not require a federal permit, such as waste oil storage or precious metal recovery services. The final tier is that of a full treatment, storage or disposal (TSD). All hazardous waste permitting can be handled by the EDCEMD as the local CUPA or through California Department of Toxic Substances Control (DTSC).

An owner or operator of a facility must complete and submit a Hazardous Materials Business Plan (HMBP) if the facility handles a hazardous material or mixture containing a hazardous material that has a quantity equal to or greater than 55 gallons or any amount of hazardous waste generated.

All hazardous waste generators must also complete and submit a Hazardous Waste Contingency Plan, pay an annual fee and undergo periodic inspections. The required plan components include the Business Owner/Operator Identification and the Emergency Response Procedures/Training Plan/Chemical Locations Map (in the EDC Business Plan).

B.2.3 Emergency Response

The El Dorado County Hazardous Materials Emergency Response Program (HMERP) works in close cooperation with law enforcement, fire and allied health agency officers and staff. Special attention is given to the hazardous materials used and transported frequently in the county by local businesses.

State and Federal laws require that the agencies listed below must be notified immediately whenever a hazardous materials spill or release occurs which presents an immediate threat to the health and safety of employees, the public or the environment.

- Local Fire, Law, and Medical
- EDCEMD:
- State Warning Center

In a typical year, the HMERP will respond incidents throughout El Dorado County including routine spills of vehicle fuels, unknown white powders in the mail, the release of toxic Chlorine gas, as well as, a variety of other hazardous conditions. EDCEMD maintains a list of the spills reported to the County.

For those spills with the potential to affect groundwater quality, there is currently no required notification of water districts concerning these spills. This is a potential area of collaboration to insure that information about potential threats to groundwater quality is communicated to the potentially affected water purveyors. It is anticipated that additional protocols would need to be established to identify who should be contacted in such an event.

B.3 Tahoe Regional Planning Agency

All land in the Lake Tahoe region, including the City and the District's service area, falls under the jurisdiction of the TRPA as defined in the Tahoe Regional Planning Compact (Compact). Within the Lake Tahoe Basin, local land use planning has taken into account regional water issues for decades under the jurisdiction of the TRPA. The basic framework for review and approval of activities in the region is established by the following TRPA documents which are linked below:

- The Tahoe Regional Planning Agency Bi-State Compact - http://www.trpa.org/bi-state-compact/
- The Lake Tahoe Water Quality Management Plan (208 Plan), http://www.trpa.org/regional-plan/208-plan/
- The TRPA Regional Plan Goals and Policies which includes http://www.trpa.org/regional-plan/
  - Environmental Threshold Carrying Capacities for nine resource areas including Water Quality
  - BMP Handbook for stormwater infiltration and hazardous material management http://tahoebmp.org/BMPHandbook.aspx
  - Environmental Improvement Plan (EIP) - http://www.trpa.org/about-trpa/how-we-operate/environmental-improvement-program/
- Other Regional-Scale Plans and Reference Documents: http://www.trpa.org/regional-plan/regional-transportation-plan-2/
- Plans for Specific Geographic Areas in the Region: http://www.trpa.org/regional-plan/plan-area-statements/
- TRPA Code of Ordinances: http://www.trpa.org/regional-plan/code-of-ordinances/
- TRPA Programs including EIP, Science and Monitoring, Invasive Species, Tahoe Keepers, Forest Management, Water Quality and Stormwater Management, Air Quality and Transportation, Sustainable Communities Program, Watercraft, Shorezone, Watershed Signs can be found at http://www.trpa.org/programs/
- TRPA Administrative Manuals

B.3.1 Lake Tahoe Water Quality Management Plan (208 Plan)

The 208 Plan summarizes the TMDLs for Lake Tahoe established by both the LRWQCB and the Nevada Department of Environmental Protection, lists the general and specific National Pollutant Discharge Elimination System (NPDES) permits that have been issued in the Basin, lists the wastewater and solid waste collection agencies in the Basin, describes the programs and BMPs that are used in the Basin to protect water quality, and summarizes existing programs to protect groundwater.

In the 208 Plan, TRPA established environmental thresholds, goals and policies, and ordinances directed at protecting and improving water quality in Lake Tahoe and the Tahoe Basin. TRPA has established water quality threshold standards for six indicator categories including: 1) Lake Tahoe pelagic (deep) waters; 2) Lake Tahoe littoral (nearshore) waters; 3) tributaries; 4) direct surface runoff and storm water discharge to surface waters; 5) storm water discharge to groundwater; and 6) other lakes. Water quality threshold standards adopted by TRPA set a target to return the Lake to the transparency observed in the late 1960s, which is similar to the LRWQCB's Lake Tahoe transparency standard of roughly 98 feet (TRPA 2012a). Chapter 9 of the 208 Plan identifies programs that control groundwater pollution in accordance with Section 208 and refers to US EPA Land Disposal Restrictions as well as the other Agencies and regulations identified in Table 4-1.

208 Plan policies for water quality protect and enhance lake clarity and beneficial uses within the following regulatory framework (TRPA 2012a):

- Concentration-based discharge standards and infiltration requirements for storm water treatment that control water quality impacts associated with new development.
- Regulations requiring the retrofitting of developed properties with BMPs that reduce erosion and eliminate storm water runoff.
- Regulatory protections and restoration of Stream Environment Zones (SEZs) to protect and enhance their water quality values. In the Lake Tahoe Basin, SEZs are meadows, marshes, and permanent, intermittent, and ephemeral streams that provide significant filtering of nutrients and sediment.
- Prohibiting the discharge of wastewater, toxic waste, and solid waste into Lake Tahoe, its tributaries and groundwater resources.

Roles and responsibilities for water quality management in the Lake Tahoe Basin are laid out in the 208 Plan with different federal, state (California and Nevada), county, city, and private entities responsible for establishment of standards and policies, monitoring, enforcement, completion of projects, and operations and maintenance activities. The 208 Plan also summarizes the TMDLs for Lake Tahoe established by both the LRWQCB and the Nevada Department of Environmental Protection, lists the general and specific NPDES permits that have been issued in the Basin, lists the wastewater and solid waste collection agencies in the Basin, describes the programs and best management practices (BMPs) that are used in the Basin to protect water quality, and summarizes existing programs to protect groundwater.

The 208 Plan addresses a range of issues including snow removal, wastewater spill prevention, underground storage tanks, dredging, and reduction of impacts from motorized watercraft.

B.3.2 Regional Plan

The TRPA Regional Plan is required by the Bi-State Compact and established detailed water quality goals and policies to enhance lake clarity and beneficial uses and supports CA and NV authorities to establish and regulate under the TMDL. The Regional Plan complements and supports TMDL implementation described in the 208 Plan. The TRPA Advisory Planning Commission and other participants in the update of the Regional Plan (adopted 2012) include representatives of water management agencies with authority in the Lake Tahoe Basin. Coordination with local, state, and federal agencies is considered important in order to achieve the goals of the Bi-State Compact. The Regional Plan also addresses specific measures related to water quality protection and improvement as well as ensuring sufficient water supply.

The Regional Plan documents environmental threshold carrying capacities for nine resources areas including water quality through the BMP Handbook which includes design guidance for infiltration of stormwater and hazardous material management. The primary purpose of environmental threshold carrying capacities was to provide for growth and development while maintaining the environmental and ecological conditions of the Lake Tahoe Basin. Therefore, development in the Lake Tahoe Basin is strictly regulated to protect water quality primarily in the SEZs.

TRPA has established a number of goals and policies related to water quality. Goals include the reduction of sediment and nutrients to Lake Tahoe and the elimination or reduction of other pollutants. Policies address a range of issues including snow removal, wastewater spill prevention, underground storage tanks, dredging, and reduction of impacts from motorized watercraft. The existing goals and polices for water quality protect and enhance lake clarity and beneficial uses within the following regulatory framework (TRPA 2012a):

- Concentration-based discharge standards and infiltration requirements for storm water treatment that control water quality impacts associated with new development.
- Regulations requiring the retrofitting of developed properties with BMPs that reduce erosion and eliminate storm water runoff.
- Regulatory protections and restoration of SEZs to protect and enhance their water quality values. In the Lake Tahoe Basin, SEZs are meadows, marshes, and permanent, intermittent, and ephemeral streams that provide significant filtering of nutrients and sediment.
- Prohibiting the discharge of wastewater, toxic waste, and solid waste into Lake Tahoe, its tributaries and groundwater resources.

The TRPA Advisory Planning Commission and other participants in the update of the Regional Plan (adopted 2012) include representatives of water management agencies with authority in the Lake Tahoe Basin. As noted in specific planning documents earlier, coordination with local, state, and federal agencies is considered important in order to achieve the goals of the Bi-State Compact. The Regional Plan also addresses specific measures related to water quality protection and improvement as well as ensuring sufficient water supply.

B.3.3 BMP Handbook

The BMP Handbook of the Regional Plan describes methods to help developed properties function more like natural, undisturbed forest and meadowland. Water that is conveyed to a lake by an undisturbed watershed is usually quite pure, because the watershed’s soils and plants act as a natural water purification system. BMPs help developed properties mimic natural conditions, preventing sediment and nutrients from entering our surface waters and filtering runoff water through the soil. By implementing BMPs, property owners can help slow the loss of lake clarity.

Every property within the TVS Basin is subject to the requirements of Chapter 60 of the TRPA. The Code of Ordinances provides direction for applying BMPs for drainage treatment, paved parking and drives, slope stabilization, revegetation, and providing snow storage areas. The Code also requires property owners to infiltrate the volume of a 20-year/1 hour storm on their property or meet alternative standards in instances where special circumstances limit infiltration. All projects permitted by the City under the Memorandum of Understanding (MOU) with TRPA are reviewed for compliance with Chapter 60. TRPA is responsible for BMP enforcing and permitting retrofits on existing development

BMPs for residential properties usually fall into the following categories: vegetating and mulching bare, disturbed soils; infiltrating storm water runoff from impervious surfaces; paving dirt driveways and roads; and stabilizing or retaining steep slopes and loose soils. Mulching and vegetating soils helps them to absorb rain and snowmelt like a sponge, mimicking natural conditions. TRPA regulations require that native and/or adaptive vegetation is planted, reducing the amount of irrigation and fertilization needed, thereby reducing nutrient loading and runoff even further. Runoff from impervious surfaces is stored and infiltrated in specially designed systems, which allows the storm water to filter through the soil instead of letting it collect and run off the property. These infiltration facilities are where the nexus between BMPs and groundwater occur.

B.3.4 BMP Inspection

Without regular maintenance, BMPs lose their effectiveness, resulting in increased runoff and discharge of pollutants to Lake Tahoe. BMPs must remain functional and effective through regular inspections, maintenance, and monitoring for property owners and land managers to comply with the TRPA Code of Ordinances and for local jurisdictions to meet Lake Tahoe TMDL pollutant load reduction targets.

BMP inspections, particularly for larger scale BMPS, assess conditions to determine if BMPs need maintenance action to keep them functioning and effective. Inspection protocols include frequency of inspection intervals, conditions to look for which trigger BMP maintenance, and suggested equipment needed to complete the work. Maintenance actions upkeep BMP function and performance, while monitoring evaluates BMP effectiveness and ensures Lake Tahoe's water quality standards are met. Documenting inspection, maintenance, and monitoring activities provides a record of compliance and can serve as a reminder for future maintenance issues.

Owners of developed properties must ensure BMPs remain functional and effective to retain their BMP Certificate and comply with the TRPA Code of Ordinances. Routine maintenance preserves the lifespan of BMPs and minimizes the potential for discharges of storm water runoff and pollutants to Lake Tahoe. If BMPs are not functioning effectively due to property owner's failure to inspect, maintain, and monitor them, a BMP Certificate may be revoked by TRPA.

BMP inspections assess conditions to determine if BMPs need maintenance action to keep them functioning and effective. Maintenance actions upkeep BMP function and performance, while monitoring evaluates BMP effectiveness and ensures Lake Tahoe's water quality standards are met. Documenting inspection, maintenance, and monitoring activities provides a record of compliance and can serve as a reminder for future maintenance issues. The inspection and monitoring of BMPs, if coordinated with groundwater monitoring, could be part of an early warning system for contaminants that could impact groundwater.

B.4 Integrated Regional Water Management Planning

The Tahoe-Sierra Integrated Regional Water Management Plan (IRWMP) defines a vision for the management of water resources in the Tahoe-Sierra Region (Tahoe-Sierra Region, Region) and highlights important actions needed to accomplish that vision through the year 2035 planning horizon. The updated Tahoe-Sierra IRWMP is planned to be completed in 2014 pending review and approval by DWR. It is intended to be a planning tool that provides a framework to address the major water-related challenges facing the Region through the planning period.

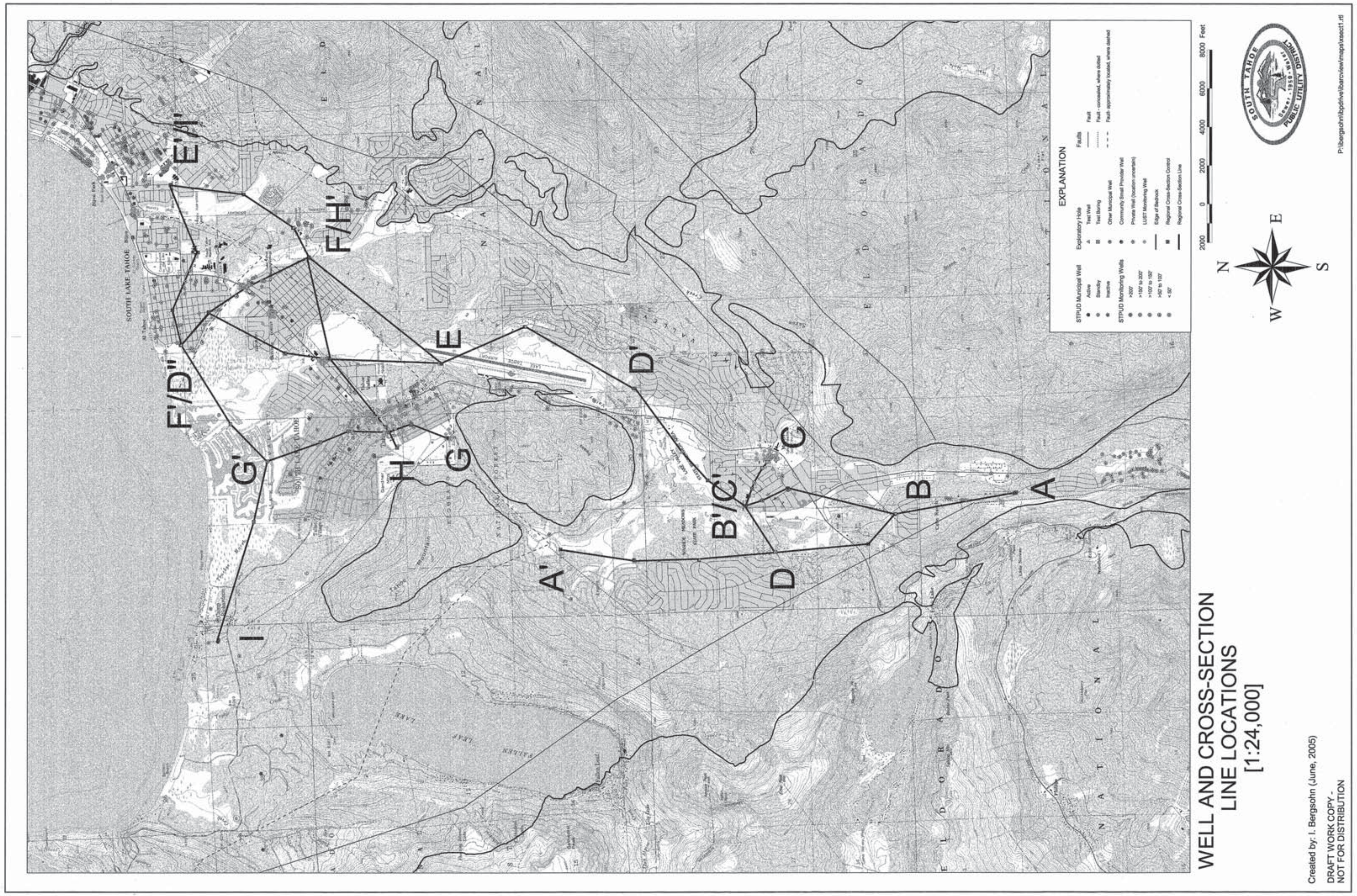
The focus and direction described in the IRWMP provides an opportunity for these organizations to accomplish more to benefit the needs of the Region than they could otherwise accomplish individually. Six local agencies submitted projects in the IRWMP including monitoring, water supply infrastructure, storm water management and stream restoration that directly or indirectly influence groundwater management. In summary, the types of projects listed in the IRWMP for the TVS Basin include:

- STPUD has five projects listed in the IRWMP including three water supply/wastewater projects including water conservation, groundwater protection and a sewer line bypass, and two storm water projects for BMPs on District properties and SEZ restoration of Iroquois Pond.
- The City of South Lake Tahoe has five projects listed that all relate to storm water. These are for storm drain and road improvements that include constructing a series of linear storm drain detention basins that will allow infiltration of storm water to groundwater.
- El Dorado County has one restoration project in the Meyers area to reconnect this Meyers Creek with its historic floodplain allowing for natural filtration of storm water runoff for reducing both downstream pollutants.
- Lukins Brothers Water Company has three water supply projects listed for pipeline replacement to reduce leaks and converting customers to water meters. These both have potential to reduce the overall water demand for the company.
- TRCD has one restoration to monitor the rate of groundwater discharge and nutrient content to help inform related planning activities. TRCD also has two storm water projects for testing of micro storm water infiltration systems and the Regional Storm Water Monitoring Program for the entire Lake Tahoe area.
- CTC has one restoration project for the Upper Truckee River and Marsh to restore natural geomorphic and ecological processes along the most downstream reach of the Upper Truckee River (UTRM), at the mouth of Lake Tahoe.

The IRWMP process provides another venue for collaboration with other local water districts, land use planning and regulatory agencies in the area, and provides an opportunity developing and funding projects to support groundwater management.

Appendix C

Draft Hydrogeological Cross Sections for the Tahoe Valley South Basin



SECTION	NAME	ELEVATION (NGVD 29)	TOTAL DEPTH (feet)	BOTTOM ELEVATION (ft msl)	APPROXIMATE DISTANCE (feet)	TOTAL DISTANCE (feet)
A - A'	South Upper Truckee No. 3	6,398	358	6,040	0	0
A - A'	Henderson Test Well	6,362	510	5,852	6200	6,200
A - A'	Echo Creek Ranch No. 2	6,434	182	6,252	2100	8,300
A - A'	Flagpole Test Hole	6,322	509	5,813	4800	13,100
A - A'	Seneca Test Well	6,472	480	5,992	3900	17,000
A - A'	Mountain View Well	6,315	250	6,065	3350	20,350
A - A'	Mtn. View Sub Well #1	6,320	230	6,090	3800	24,150
B - B'/C'	Henderson Test Well	6,362	510	5,852	0	0
B - B'/C'	Arrowhead Well #3	6,334	310	6,024	5700	5,700
B - B'/C'	ESB-2	6,316	240	6,076	1450	7,150
B - B'/C'	Bakersfield Well	6,306	603	5,703	850	8,000
C - B'/C'	S-24	6,332	175	6,157	0	0
C - B'/C'	S-19	6,336	206	6,130	395	395
C - B'/C'	S-33	6,332	192	6,140	430	825
C - B'/C'	Sioux St. Sentinel Well	6,323	198	6,125	850	1,675
C - B'/C'	ESB-3	6,312	216	6,096	350	2,025
C - B'/C'	Bakersfield Well	6,306	603	5,703	950	2,975
D - D'	Flagpole Test Hole	6,322	509	5,813	0	0
D - D'	Bakersfield Well	6,306	603	5,703	2850	2,850
D - D'	Country Club Well	6,287	330	5,957	2350	5,200
D - D'	Lake Tahoe Golf Course Test Hole	6,290	400	5,890	2000	7,200
D - D'	Elks Club Well No. 2	6,285	266	6,019	4200	11,400
D' - F'/D"	Elks Club Well No. 2	6,285	266	6,019	0	0
D' - F'/D"	Washoan Test Well	6,305	338	5,967	6350	6,350
D' - F'/D"	Airport Well	6,277	415	5,862	4700	11,050
D' - F'/D"	Helen Test Hole	6,245	853	5,392	6100	17,150
D' - F'/D"	Sunset Well	6,247	600	5,647	2100	19,250
D' - F'/D"	Paloma Well	6,263	402	5,861	4450	23,700
D' - F'/D"	Bayview Test Well	6,249	789	5,460	2200	25,900
E - E'/I'	Airport Well	6,277	415	5,862	0	0
E - E'/I'	Martin Ave. Well	6,257	435	5,822	8800	8,800
E - E'/I'	USGS TCF-1	6,289	340	5,949	2000	10,800
E - E'/I'	Glenwood Well #5	6,257	247	6,010	3000	13,800
E - E'/I'	Bijou School Well	6,260	789	5,471	3750	17,550
F/H' - F'/D"	Martin Ave. Well	6,257	435	5,822	0	0
F/H' - F'/D"	MW-33	6,247	170	6,077	3600	3,600
F/H' - F'/D"	Paloma Well	6,263	402	5,861	2300	5,900
F/H' - F'/D"	Bayview Test Well	6,249	789	5,460	2200	8,100
G - G'	Industrial Well #2	6,303	310	5,993	0	0
G - G'	Tata Lane Well #3	6,284	240	6,044	1950	1,950
G - G'	Tata Lane Well #4	6,278	335	5,943	1200	3,150
G - G'	Lukins Brothers Well No.3	6,266	80	6,186	2050	5,200
G - G'	Lukins Brothers Well No.4	6,240	174	6,066	1500	6,700
H - F/H'	Julie Well	6,276	296	5,980	0	0
H - F/H'	Tata Lane Well #4	6,278	335	5,943	950	950
H - F/H'	Helen Test Hole	6,245	853	5,392	4900	5,850
H - F/H'	Martin Ave. Well	6,257	435	5,822	5350	11,200
I - E'/I'	Valhalla Well	6,253	503	5,750	0	0
I - E'/I'	Tahoe Keys Well #3	6,230	364	5,866	6500	6,500
I - E'/I'	Tahoe Keys Well #2	6,230	495	5,735	3200	9,700
I - E'/I'	Tahoe Keys Well #1	6,230	341	5,889	2250	11,950
I - E'/I'	Bayview Test Well	6,249	789	5,460	4800	16,750
I - E'/I'	Al Tahoe Well #2	6,251	409	5,842	1950	18,700
I - E'/I'	Middle School Well	6,250	597	5,653	3150	21,850
I - E'/I'	Bijou School Well	6,260	400	5,860	3900	25,750

DRINKING WATER AQUIFERS
OF THE SOUTH TAHOE PUBLIC UTILITY DISTRICT
WATER-BEARING ZONE DESIGNATIONS

WATER-BEARING ZONE	IDENTIFIER	POTABLE	MUNICIPAL USE
Christmas Valley Zone 1	CVZ1	Y	P
Christmas Valley Zone 2	CVZ2	Y	Y
Christmas Valley Zone 3	CVZ3	Y	Y
Christmas Valley Zone 4	CVZ4	Y	P
Meyers Zone 1	MZ1	N	N
Meyers Zone 2	MZ2	N	N
Meyers Zone 3	MZ3	Y	Y
Meyers Zone 4	MZ4	Y	Y
Meyers Zone 5	MZ5	Y	N
Angora Zone 1	AZ1	Y	Y
Angora Zone 2	AZ2	Y	Y
South Lake Tahoe Zone 1	SLTZ1	N	N
South Lake Tahoe Zone 2	SLTZ2	Y	Y
South Lake Tahoe Zone 3	SLTZ3	Y	Y
South Lake Tahoe Zone 4	SLTZ4	Y	Y
South Lake Tahoe Zone 5	SLTZ5	Y	Y
Tahoe Keys Zone 1	TKZ1	Y	Y
Tahoe Keys Zone 2	TKZ2	Y	Y
Tahoe Keys Zone 3	TKZ3	Y	Y
Tahoe Keys Zone 4	TKZ4	Y	Y
Tahoe Keys Zone 5	TKZ5	Y	Y
Bijou Zone 1	BZ1	Y	Y
Bijou Zone 2	BZ2	?	N
Bijou Zone 3	BZ3	Y	Y
Bijou Zone 4	BZ4	Y	Y
Bijou Zone 5	BZ5	?	N

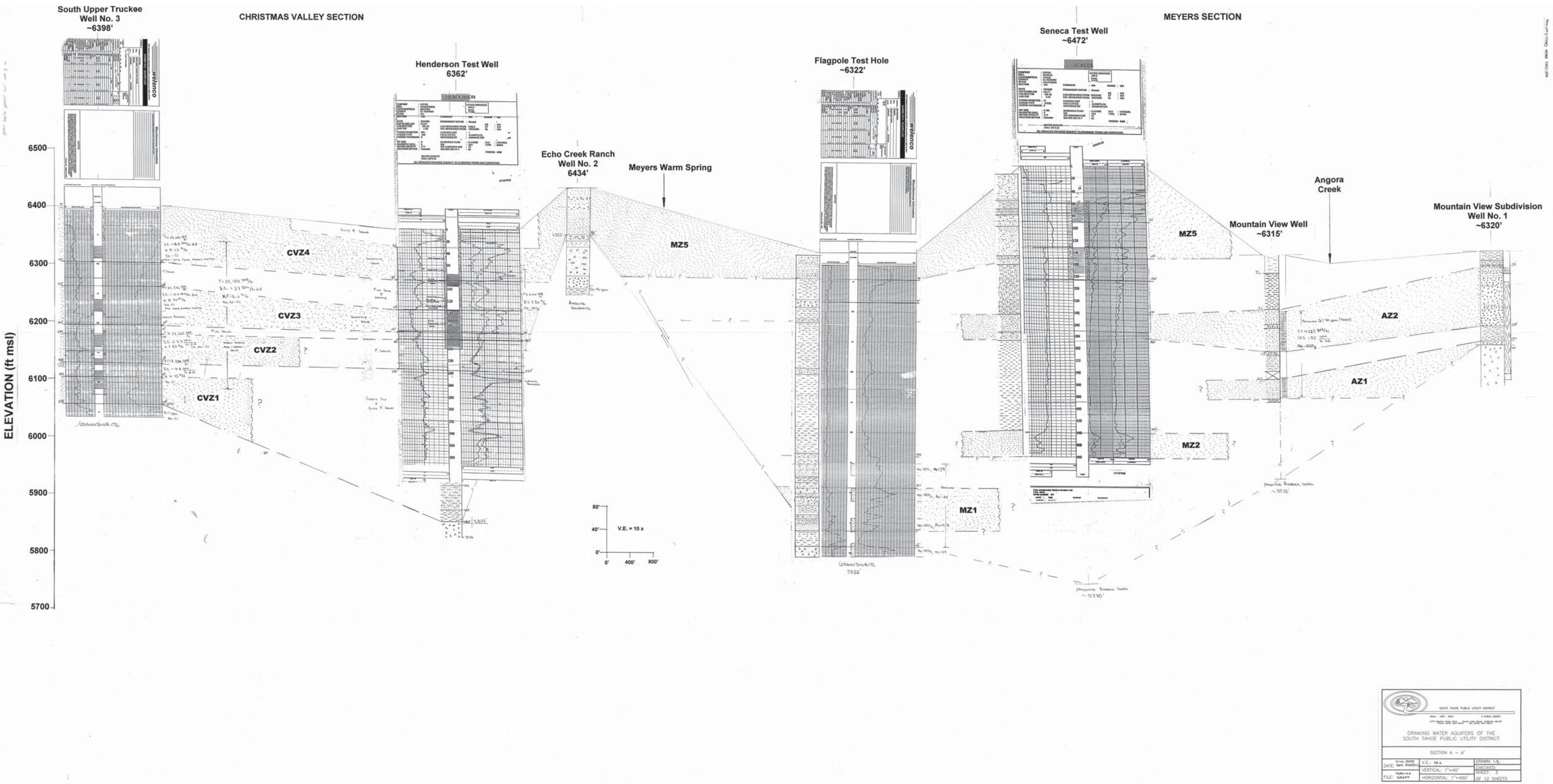
NOTES:
P- Potential
Y- Yes
N- No
? - Unknown

SOUTH TAHOE PUBLIC UTILITY DISTRICT
Sewer . 1950 . Water
A PUBLIC AGENCY

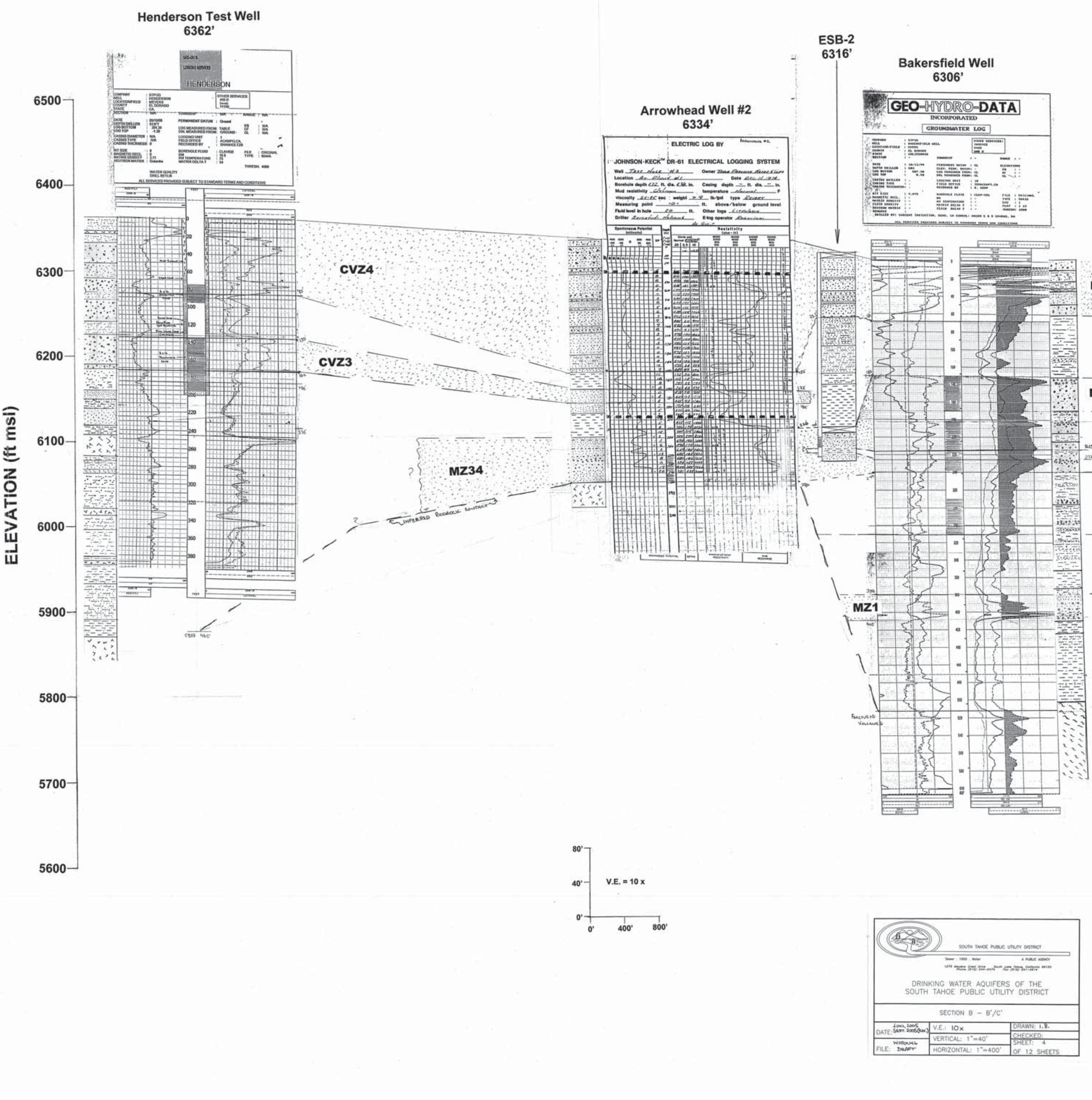
DRINKING WATER AQUIFERS OF THE SOUTH TAHOE PUBLIC UTILITY DISTRICT

WELL AND CROSS-SECTION LINE LOCATIONS

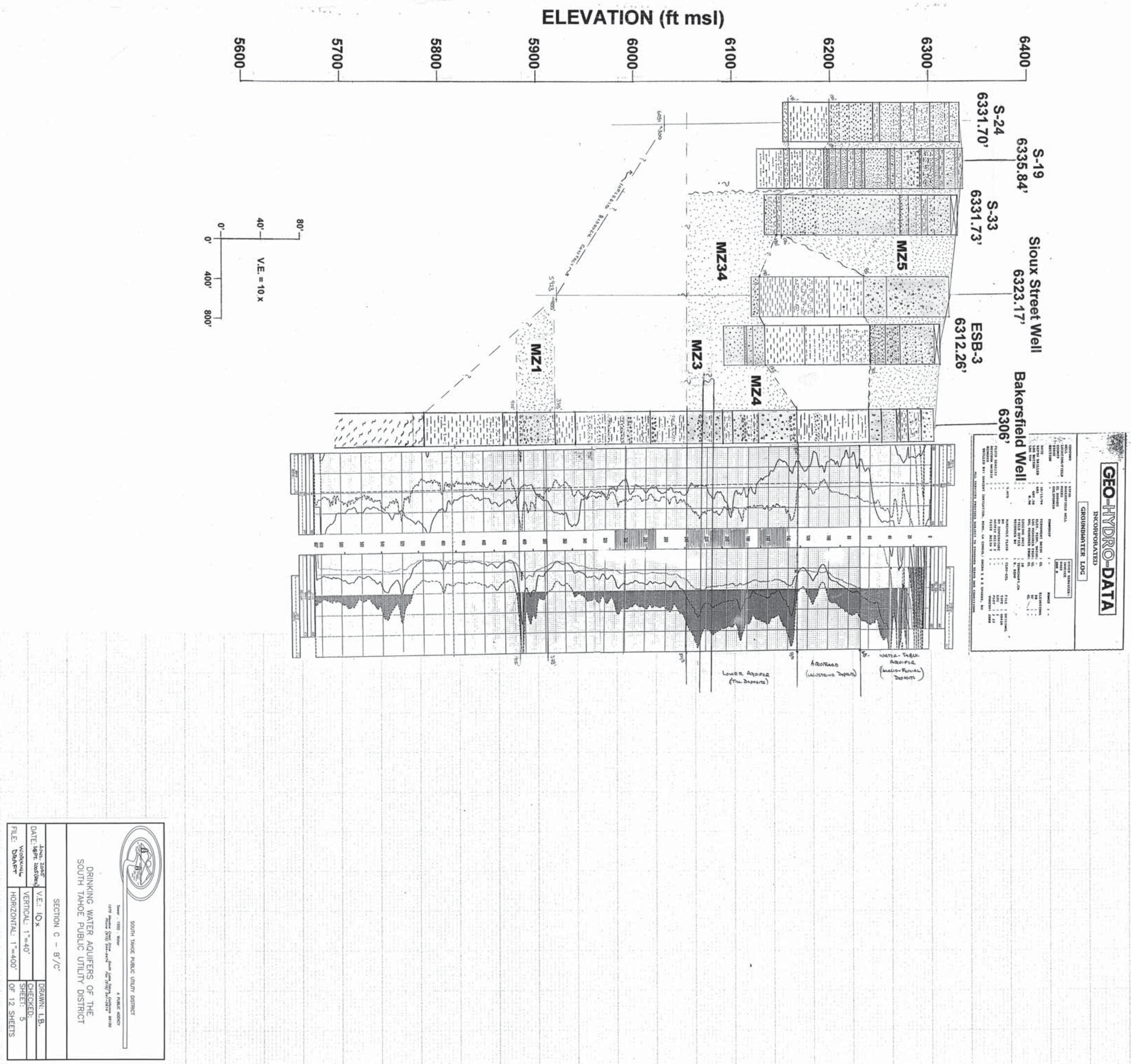
DATE: June, 2005 Sept., 2005 (Rev.)	V.E.: NA	DRAWN: I.B.
	VERTICAL: NS	CHECKED:
FILE: WORKING DRAFT	HORIZONTAL: NS	SHEET: 2 OF 12 SHEETS



South Upper Truckee Well No. 3 ~6398'
CHRISTMAS VALLEY SECTION
Henderson Test Well 6362'
Echo Creek Ranch Well No. 2 6434'
Meyers Warm Spring
Flagpole Test Hole ~6322'
Seneca Test Well ~6472'
MEYERS SECTION
Angora Creek
Mountain View Well ~6315'
Mountain View Subdivision Well No. 1 ~6320'
ELEVATION (ft msl)
6500
6400
6300
6200
6100
6000
5900
5800
5700
CVZ4
CVZ3
CVZ2
CVZ1
MZ5
MZ2
MZ1
AZ2
AZ1
V.E. = 10 x
80'
40'
0'
400'
800'
SOUTH TAHOE PUBLIC UTILITY DISTRICT
DRINKING WATER AQUIFERS OF THE SOUTH TAHOE PUBLIC UTILITY DISTRICT
SECTION A – A'
V.E.: 10 x
VERTICAL: 1"=40'
HORIZONTAL: 1"=400'

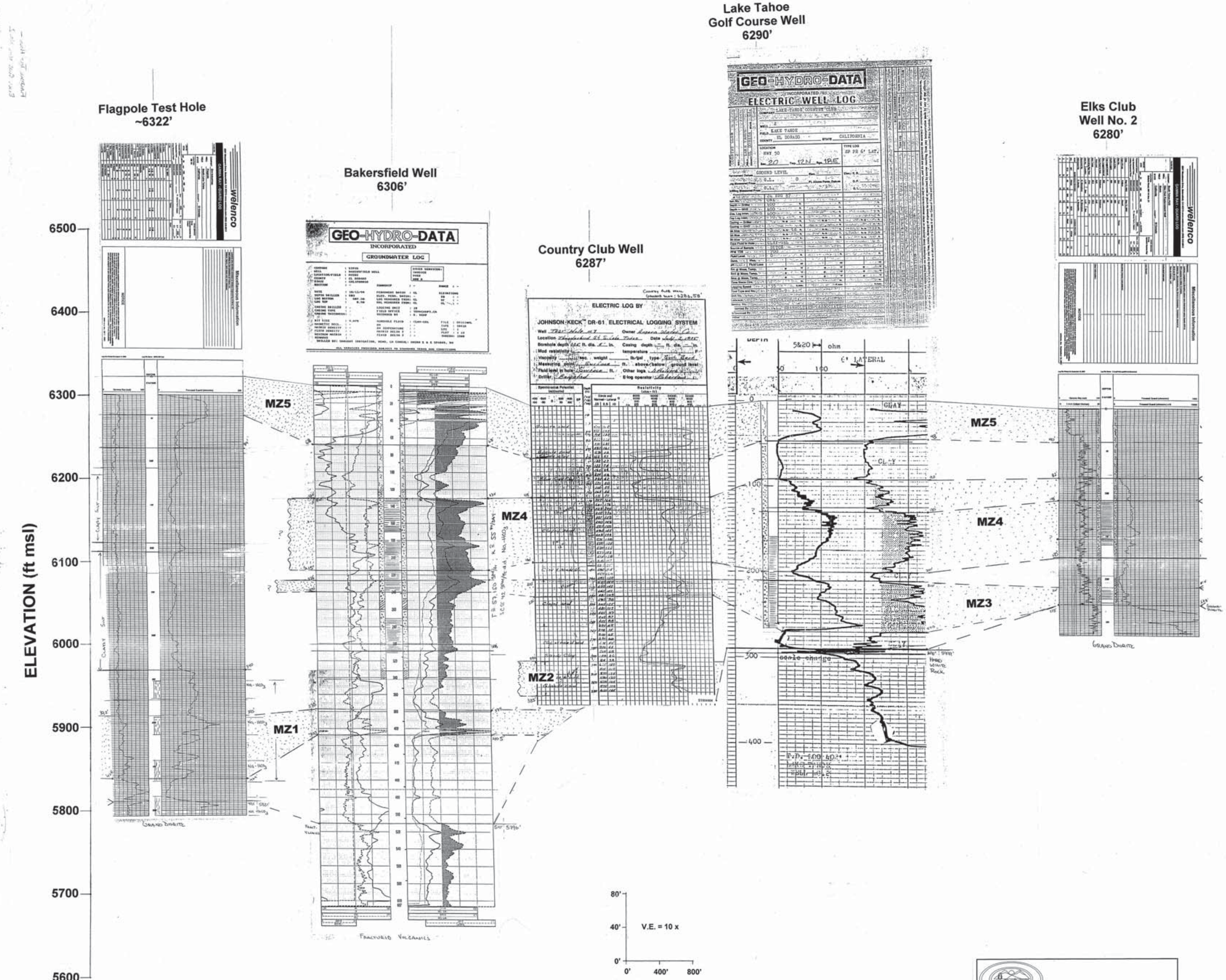


Henderson Test Well
6362'
Arrowhead Well #2
6334'
ESB-2
6316'
Bakersfield Well
6306'
ELEVATION (ft msl)
6500
6400
6300
6200
6100
6000
5900
5800
5700
5600
CVZ4
CVZ3
MZ34
MZ5
MZ4
MZ3
MZ1
HENDERSON
ELECTRIC LOG BY
JOHNSON-KECK DR-61 ELECTRICAL LOGGING SYSTEM
GEO-HYDRO-DATA
INCORPORATED
GROUNDWATER LOG
V.E. = 10 x
80'
40'
0'
0'
400'
800'
SOUTH TAHOE PUBLIC UTILITY DISTRICT
A PUBLIC AGENCY
DRINKING WATER AQUIFERS OF THE
SOUTH TAHOE PUBLIC UTILITY DISTRICT
SECTION B – B'/C'
V.E.: 10x
DRAWN:
VERTICAL: 1"=40'
CHECKED:
HORIZONTAL: 1"=400'
SHEET: 4
OF 12 SHEETS
DATE:
FILE:



ELEVATION (ft msl)
5600
5700
5800
5900
6000
6100
6200
6300
6400
S-24
6331.70'
S-19
6335.84'
S-33
6331.73'
Sioux Street Well
6323.17'
ESB-3
6312.26'
Bakersfield Well
6306'
MZ5
MZ34
MZ4
MZ3
MZ1
V.E. = 10 x
0'
400'
800'
40'
80'
GEO-HYDRO-DATA
INCORPORATED
GROUNDWATER LOG
Lower Aquifer (Till Deposits)
Aquitard (Lacustrine Deposits)
Water-Table Aquifer (Glacio-Fluvial Deposits)
SOUTH TAHOE PUBLIC UTILITY DISTRICT
DRINKING WATER AQUIFERS OF THE SOUTH TAHOE PUBLIC UTILITY DISTRICT
SECTION C – B'/C'
V.E.: 10x
VERTICAL: 1"=40'
HORIZONTAL: 1"=400'
DRAWN: I.B.
CHECKED:
SHEET: 5
OF 12 SHEETS
FILE: Working Draft

MEYERS SECTION

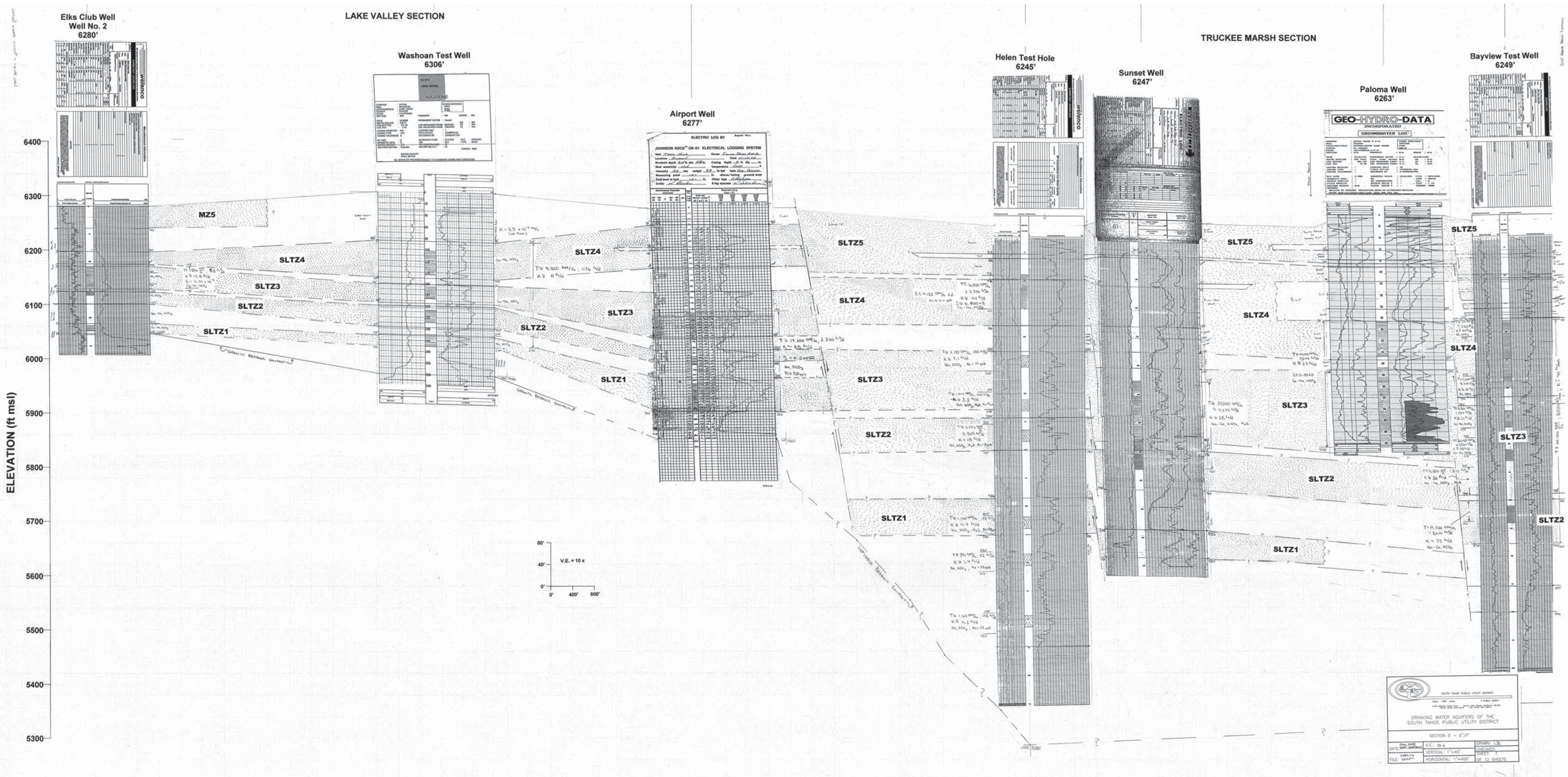


SOUTH TAHOE PUBLIC UTILITY DISTRICT

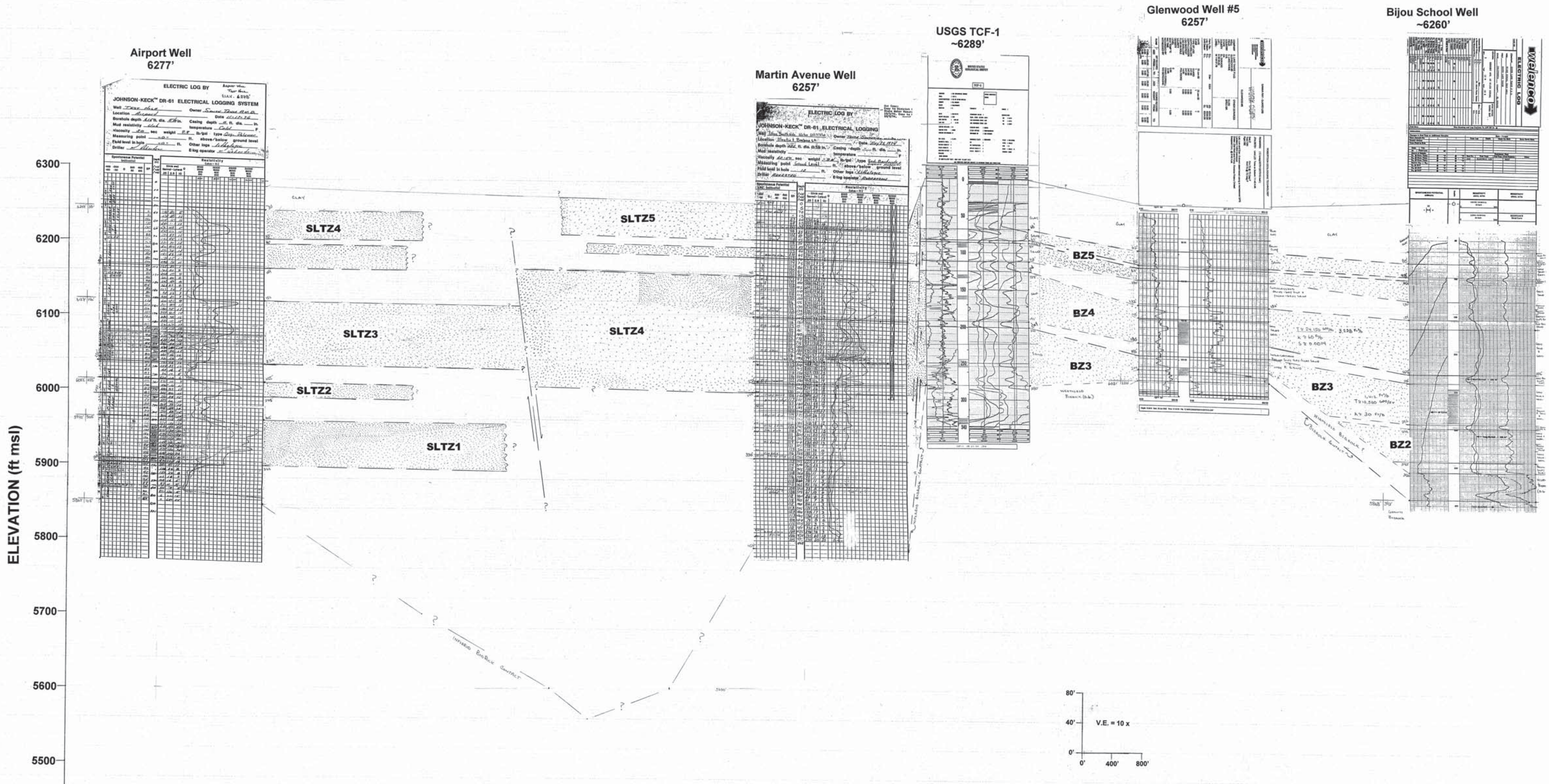
DRINKING WATER AQUIFERS OF THE SOUTH TAHOE PUBLIC UTILITY DISTRICT

SECTION D – D'

DATE:	V.E.: 10 x	DRAWN: L.B.
	VERTICAL: 1"=40'	CHECKED:
FILE:	HORIZONTAL: 1"=400'	SHEET: 6 OF 12 SHEETS



LAKE VALLEY SECTION
TRUCKEE MARSH SECTION
Elks Club Well
Well No. 2
6280'
Washoan Test Well
6306'
Airport Well
6277'
Helen Test Hole
6245'
Sunset Well
6247'
Paloma Well
6263'
Bayview Test Well
6249'
ELEVATION (ft msl)
6400
6300
6200
6100
6000
5900
5800
5700
5600
5500
5400
5300
MZ5
SLTZ5
SLTZ4
SLTZ3
SLTZ2
SLTZ1
V.E. = 10 x
80'
40'
0'
400'
800'
GEO-HYDRO-DATA
ELECTRIC LOG BY
JOHNSON-KECK DR-61 ELECTRICAL LOGGING SYSTEM
SOUTH TAHOE PUBLIC UTILITY DISTRICT
DRINKING WATER AQUIFERS OF THE SOUTH TAHOE PUBLIC UTILITY DISTRICT
VERTICAL: 1"=40'
HORIZONTAL: 1"=400'



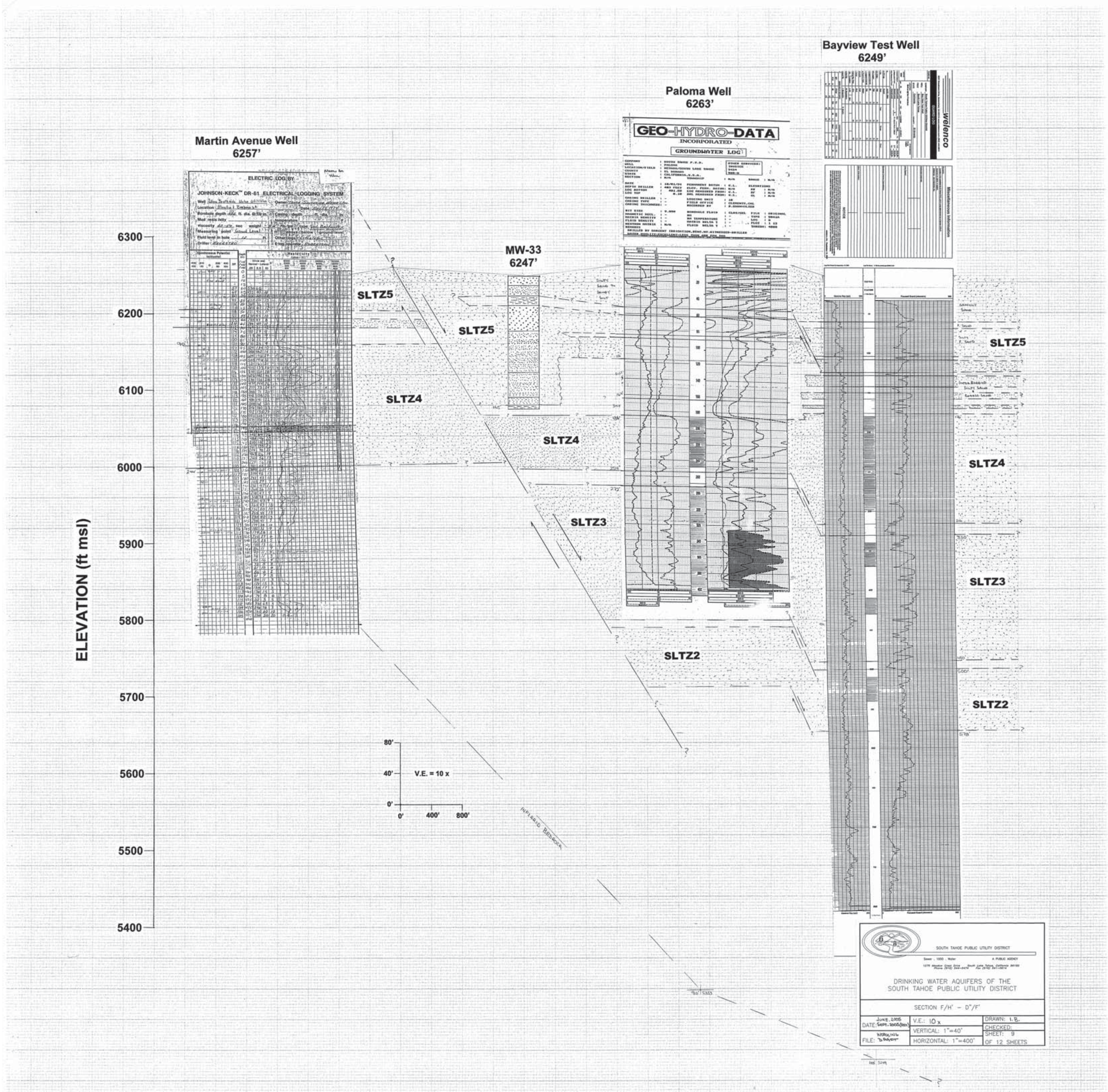
SOUTH TAHOE PUBLIC UTILITY DISTRICT

Sewer . 1950 . Water — A PUBLIC AGENCY

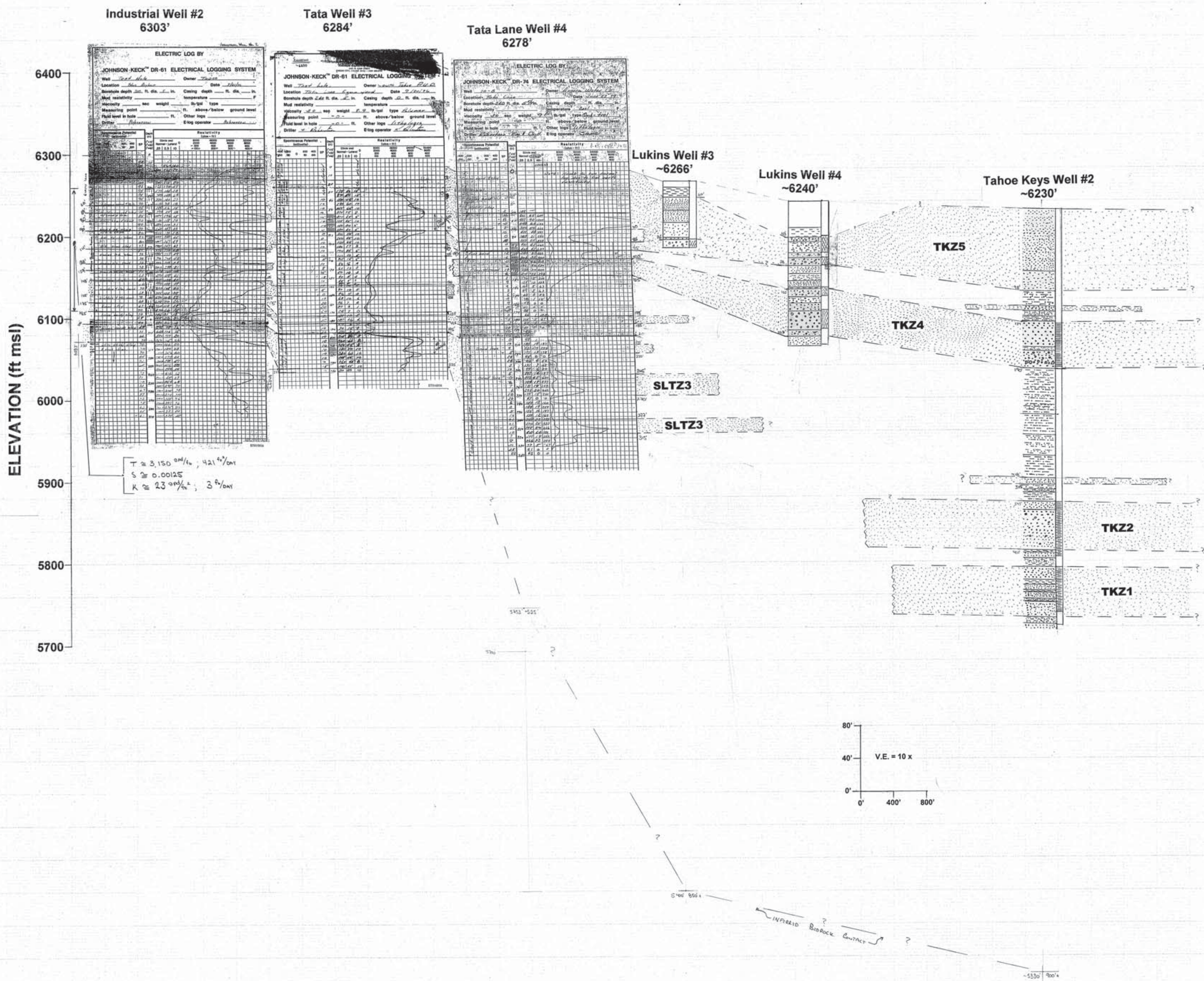
DRINKING WATER AQUIFERS OF THE SOUTH TAHOE PUBLIC UTILITY DISTRICT

SECTION E – E'/I'

DATE: June, 2005 Sept. 2005(Rev.)	V.E.: 10x	DRAWN: J.B.
	VERTICAL: 1"=40'	CHECKED:
FILE: WORKING DRAFT	HORIZONTAL: 1"=400'	SHEET: 8 OF 12 SHEETS



Martin Avenue Well
6257'
MW-33
6247'
Paloma Well
6263'
Bayview Test Well
6249'
ELEVATION (ft msl)
6300
6200
6100
6000
5900
5800
5700
5600
5500
5400
ELECTRIC LOG BY
JOHNSON-KECK DR-61 ELECTRICAL LOGGING SYSTEM
GEO-HYDRO-DATA
INCORPORATED
GROUNDWATER LOG
welenco
SLTZ5
SLTZ4
SLTZ3
SLTZ2
80'
40'
0'
0'
400'
800'
V.E. = 10 x
SOUTH TAHOE PUBLIC UTILITY DISTRICT
A PUBLIC AGENCY
DRINKING WATER AQUIFERS OF THE
SOUTH TAHOE PUBLIC UTILITY DISTRICT
SECTION F/H' - D''/F'
V.E.: 10 x
VERTICAL: 1"=40'
HORIZONTAL: 1"=400'
DRAWN: L.B.
CHECKED:
SHEET: 9
OF 12 SHEETS
DATE:
FILE:



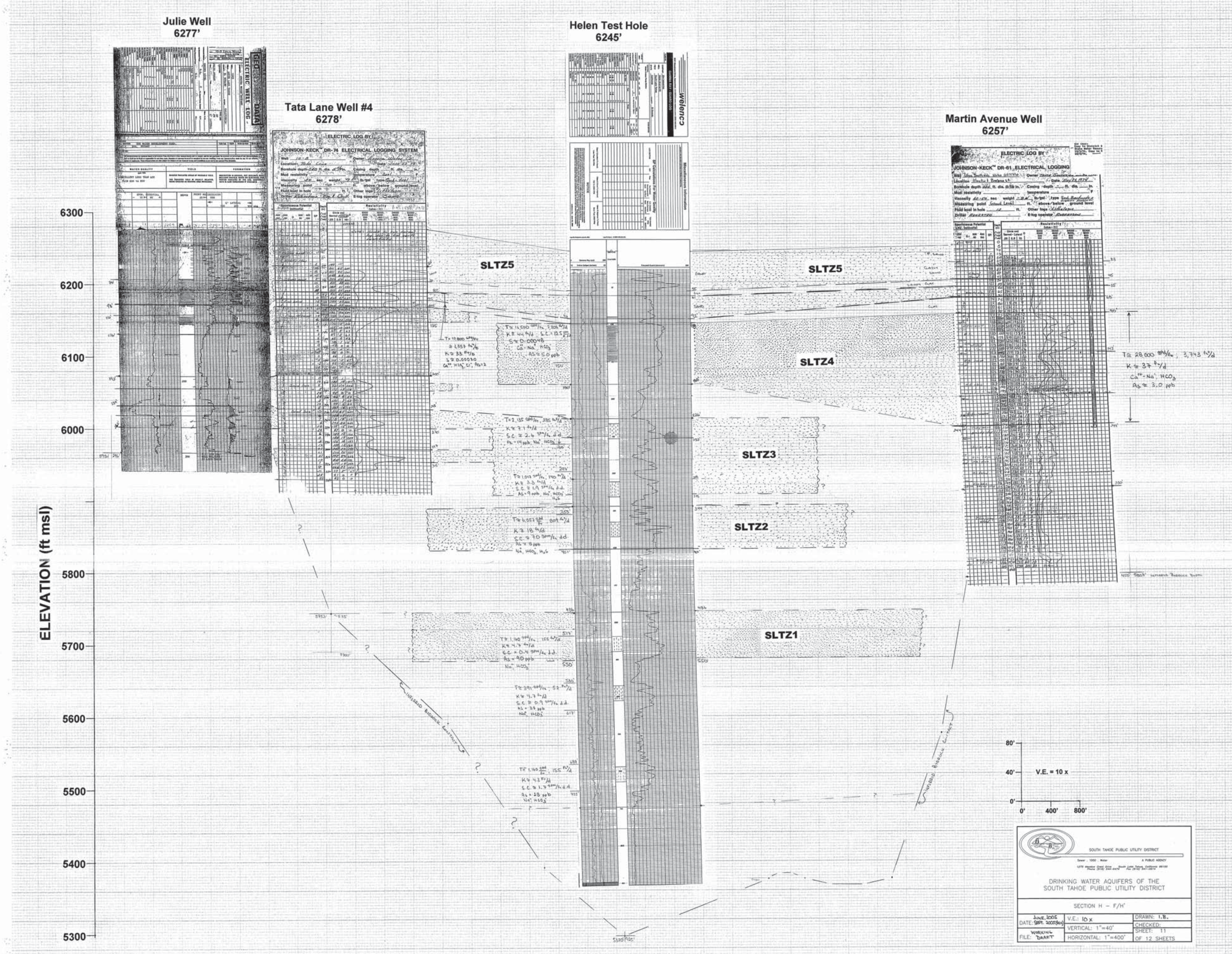
SOUTH TAHOE PUBLIC UTILITY DISTRICT

Sewer . 1950 . Water — A PUBLIC AGENCY

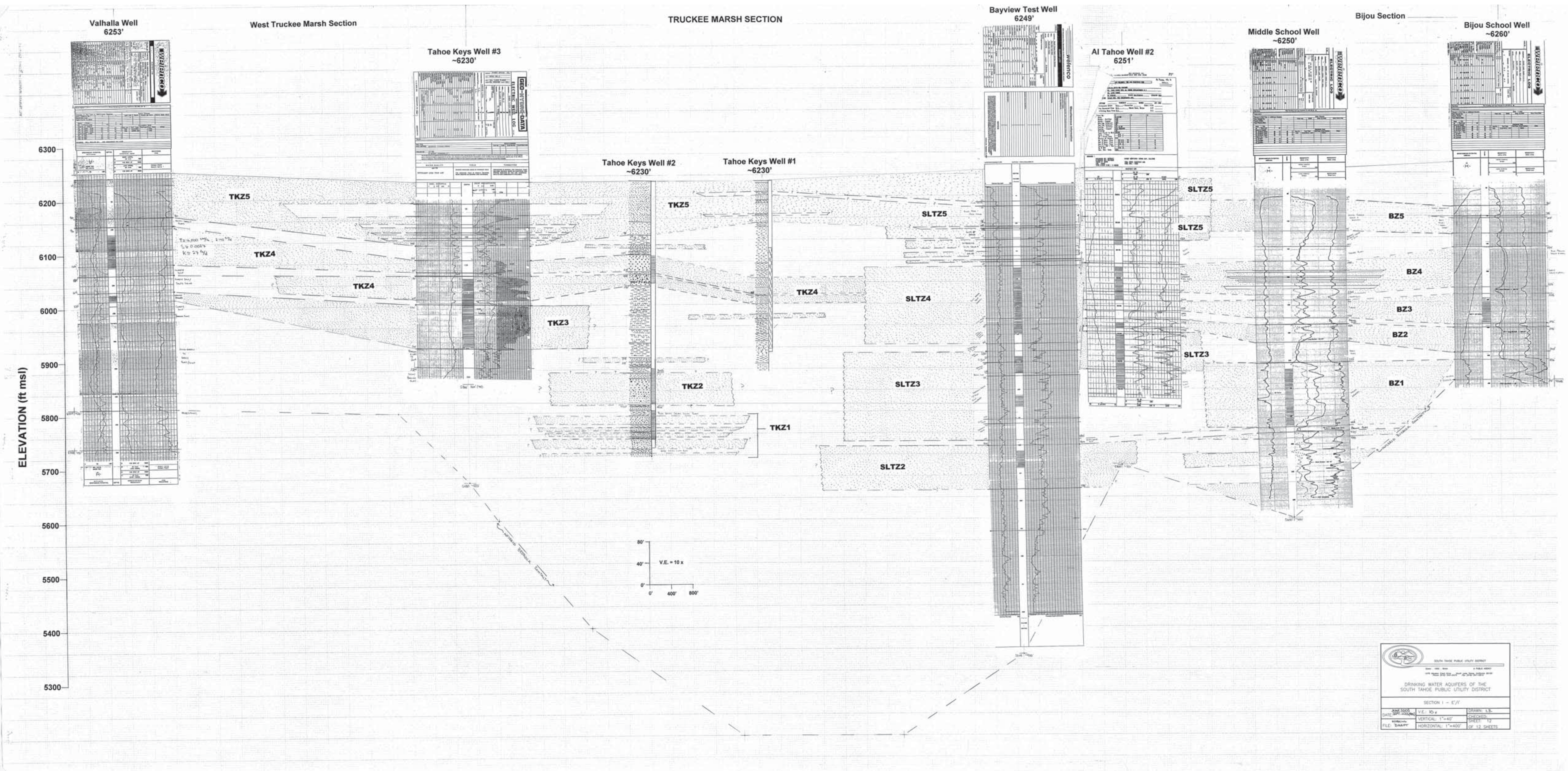
DRINKING WATER AQUIFERS OF THE
SOUTH TAHOE PUBLIC UTILITY DISTRICT

SECTION G – G"

DATE: JUNE, 2005 SEPT. 2005 (REV)	V.E.: 10 x	DRAWN: LB.
	VERTICAL: 1"=40'	CHECKED:
FILE: WORKING DRAFT	HORIZONTAL: 1"=400'	SHEET: 10 OF 12 SHEETS



Julie Well
6277'
Tata Lane Well #4
6278'
Helen Test Hole
6245'
Martin Avenue Well
6257'
ELEVATION (ft msl)
6300
6200
6100
6000
5800
5700
5600
5500
5400
5300
SLTZ5
SLTZ5
SLTZ4
SLTZ3
SLTZ2
SLTZ1
ELECTRIC LOG BY
JOHNSON-KECK DR-74 ELECTRICAL LOGGING SYSTEM
JOHNSON-KECK DR-61 ELECTRICAL LOGGING
ELECTRIC WELL LOG
welenco
80'
40'
0'
0'
400'
800'
V.E. = 10 x
SOUTH TAHOE PUBLIC UTILITY DISTRICT
DRINKING WATER AQUIFERS OF THE
SOUTH TAHOE PUBLIC UTILITY DISTRICT
SECTION H – F/H'
DATE: JUNE 2005 SEPT. 2005(REV)
FILE: WORKING DRAFT
V.E.: 10 x
VERTICAL: 1"=40'
HORIZONTAL: 1"=400'
DRAWN: I.B.
CHECKED:
SHEET: 11
OF 12 SHEETS



TRUCKEE MARSH SECTION
West Truckee Marsh Section
Bijou Section
Valhalla Well
6253'
Tahoe Keys Well #3
~6230'
Tahoe Keys Well #2
~6230'
Tahoe Keys Well #1
~6230'
Bayview Test Well
6249'
Al Tahoe Well #2
6251'
Middle School Well
~6250'
Bijou School Well
~6260'
ELEVATION (ft msl)
6300
6200
6100
6000
5900
5800
5700
5600
5500
5400
5300
TKZ5
TKZ4
TKZ3
TKZ2
TKZ1
SLTZ5
SLTZ4
SLTZ3
SLTZ2
BZ5
BZ4
BZ3
BZ2
BZ1
80'
40'
0'
0'
400'
800'
V.E. = 10 x
SOUTH TAHOE PUBLIC UTILITY DISTRICT
DRINKING WATER AQUIFERS OF THE SOUTH TAHOE PUBLIC UTILITY DISTRICT

Appendix D

Tahoe Valley South Basin Groundwater Monitoring Plan and Protocols

South Tahoe Public Utility District

Groundwater Elevation Monitoring Plan – Tahoe Valley South (Basin No. 6-5.01)

Version 1.0

Ivo Bergsohn, P.G., C.Hg.
12/1/2011

1 Introduction

In December 2010, the South Tahoe Public Utility District (District) submitted a notice of intent to serve as a monitoring entity in the California Statewide Groundwater Elevation Monitoring (CASGEM) Program. The District is the largest drinking water provider in the Lake Tahoe Basin and is an authorized groundwater management agency within the meaning of California Water Code Section 10753(a). Groundwater serves as the principal source of drinking water within the District's service area. As part of its efforts to manage this resource, the District has been actively monitoring groundwater elevations since March 2001. The following document has been prepared by the District to satisfy the CASGEM monitoring plan requirement.

1.1 Purpose

The purpose of this plan is to describe the well network and methods used by the District to monitor groundwater elevations within the Tahoe Valley-South Groundwater Basin (TV-South Basin).

1.2 Objectives

The District collects groundwater elevation readings from both observation wells and municipal water supply wells. The objective of the CASGEM monitoring program is to provide elevation data capable of demonstrating seasonal and long-term groundwater elevation trends. To satisfy this objective, the District shall only report groundwater elevation data collected from observation wells to the California Department of Water Resources (DWR) for CASGEM use.

1.3 Plan Organization

This plan has been prepared in general accordance with the monitoring plan requirements as presented in the Procedures for Monitoring Entity Reporting (DWR, 2010). The information presented in Section 2.0 serves as the rationale for the groundwater elevation monitoring plan and includes a description of the general hydrology, geologic setting and recharge conditions in the TV-South Basin. The other key components required of CASGEM monitoring plans are presented in Sections 3.0.and include: a description of the well network (Section 3.1); a monitoring schedule (Section 3.2); and a description of field methods used for data collection (Section 3.3). Section 4.0 describes the reporting procedures used by the District to record and archive the collected water level data.

2 Tahoe Valley-South Groundwater Basin (TV-South Basin)

2.1 Location and Geographic Scope

The TV-South Basin is regarded by DWR as a sub-basin of the Tahoe Valley Groundwater Basin, located at the south end of the Lake Tahoe Basin Hydrographic Area, about 150 miles east of the San Francisco Bay area and about 90 miles east of the Sacramento Valley(Figure 2.1).

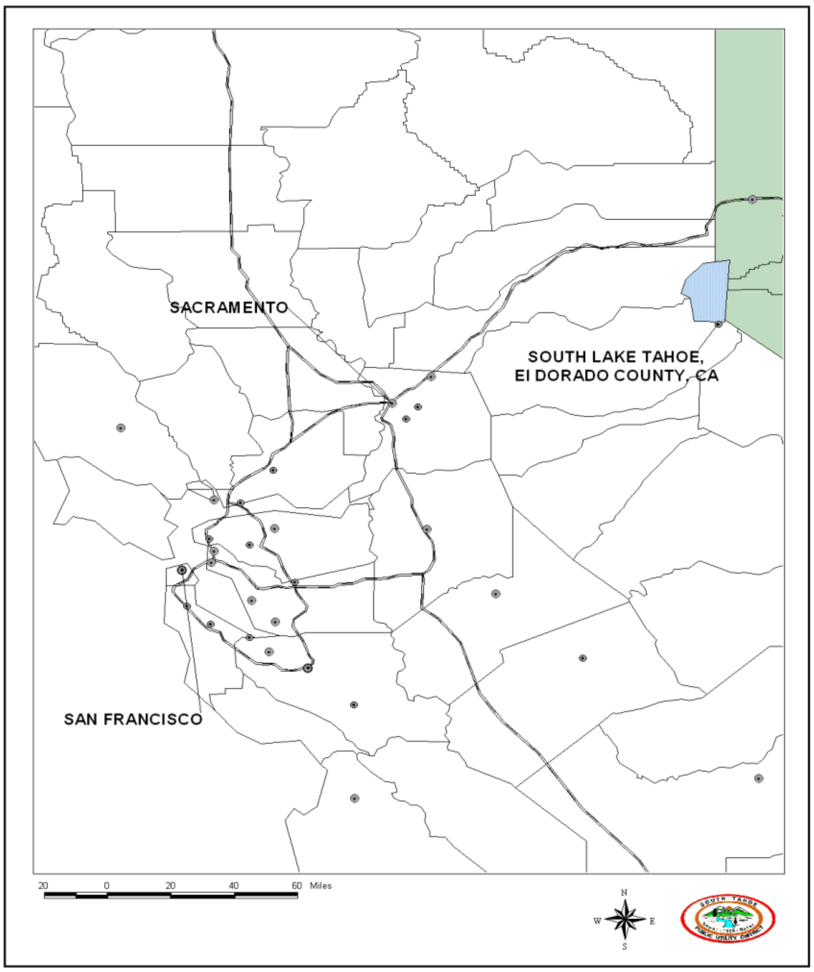


Figure 2.1 Regional Location

The TV-South Basin occupies a roughly triangular area, bounded on the southwest and southeast by mountain blocks of the Sierra Nevada; on the north by the south shore of Lake Tahoe; and to the northeast by the California-Nevada State line. The Basin's southern boundary extends about 3 miles south of the town of Meyers, and forms the triangular apex. Elevations within the Basin range from 6,225 feet at lake level rising to above 6,500 feet to the south, approaching the mountain front. The Upper Truckee River is the largest stream within the Lake Tahoe Hydrographic Area and flows near the center of the TV-South Basin, ultimately discharging into Lake Tahoe through the Upper Truckee Marsh at the north end of the Basin. The District service area covers approximately 27,000 acres (42 square miles) overlying the Basin, and includes portions of El Dorado County, the City of South Lake Tahoe, the Community of Meyers and Christmas Valley (Figure 2.2).

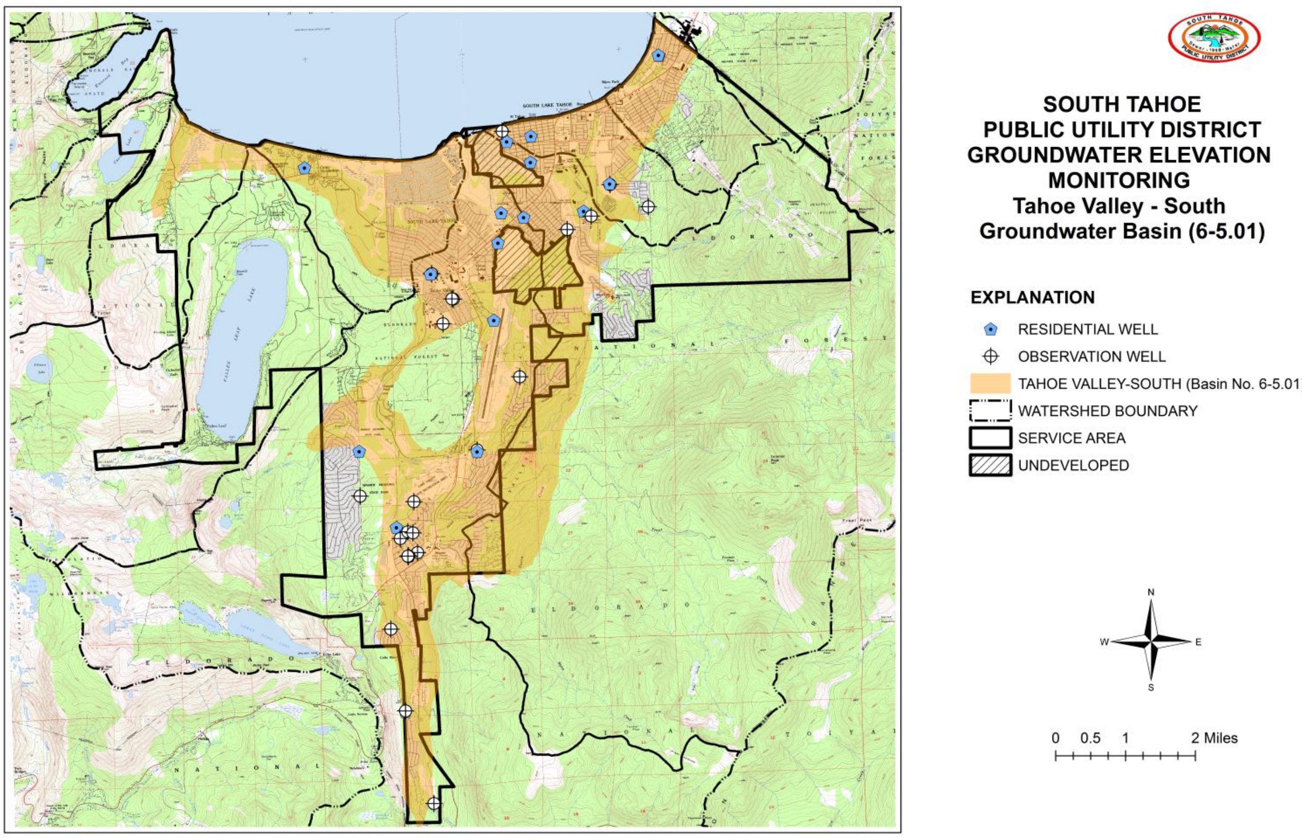


Figure 2.2 Tahoe Valley-South Basin and South Tahoe Public Utility District Service Area. Areas marked by diagonal lines represent undeveloped private lands not included within the service area as defined by the El Dorado Local Agency Formation Commission.

2.2 General Hydrology

2.2.1 Watersheds

Seven watersheds occur across the District's service area. The two largest watersheds are the Upper Truckee River and Trout Creek watersheds. The Upper Truckee River watershed is centrally located within the service area and is the largest in the Lake Tahoe Hydrographic Area comprising an estimated 18% of the total land area tributary to Lake Tahoe. Main tributary drainages to the Upper Truckee River include Grass Lake Creek; Big Meadow Creek and Angora Creek. The Trout Creek Watershed is located immediately east of the Upper Truckee River and is the second largest in the Hydrographic Area comprising an estimated 13% of the total land area tributary to Lake Tahoe. The main tributaries to Trout Creek include Cold Creek, Saxon Creek, Heavenly Valley Creek and Hidden Creek (USGS WRIR 00-4001).

2.2.2 Precipitation

Isohyetal maps for the Lake Tahoe Hydrographic Area show that for South Tahoe watersheds, mean annual precipitation ranges from over 60 inch/year at high elevation areas near the western boundaries of the Upper Truckee and Taylor Ck. watersheds to less than 25 inch/year near Lake Tahoe and the eastern boundary of the Trout Ck. watershed. At valley elevation <6500 ftmsl, mean annual precipitation ranges two-fold from a high of ~44 inch/year in the southwest to ~22 inch/year in the northeast portion of the Basin. Frontal systems from November through May account for over 85% of Tahoe Basin precipitation. Most annual precipitation is in the form of snow. Snowmelt is believed to generate more than 80% of the annual runoff within the Hydrographic Area (USGS WRIR 99-4110).

Snow water equivalent readings for the Heavenly Valley (Station 518) and Hagan Meadows (Station 508) SNOTEL stations, located along the east mountain block of the TV-South Basin, are plotted along with the stream discharge readings for Trout Creek near Tahoe Valley gage (USGS 10336780) to show the intimate relationship between snow melt and stream discharge within the TV-South Basin (Figure 2.3) Inspection of Figure 2.3 shows maximum stream flows typically occurs as the accumulated winter snow pack melts, starting in May and June (spring discharge), when high mountain temperatures rise above 32 degrees Fahrenheit. A second peak in stream discharge may also occur in response to warm pacific-frontal storms and rain-on-snow events at any time prior to spring discharge. In January 1997, a rain-on snow event produced the largest recorded flood peak within the Basin (USGS FS-035-02).

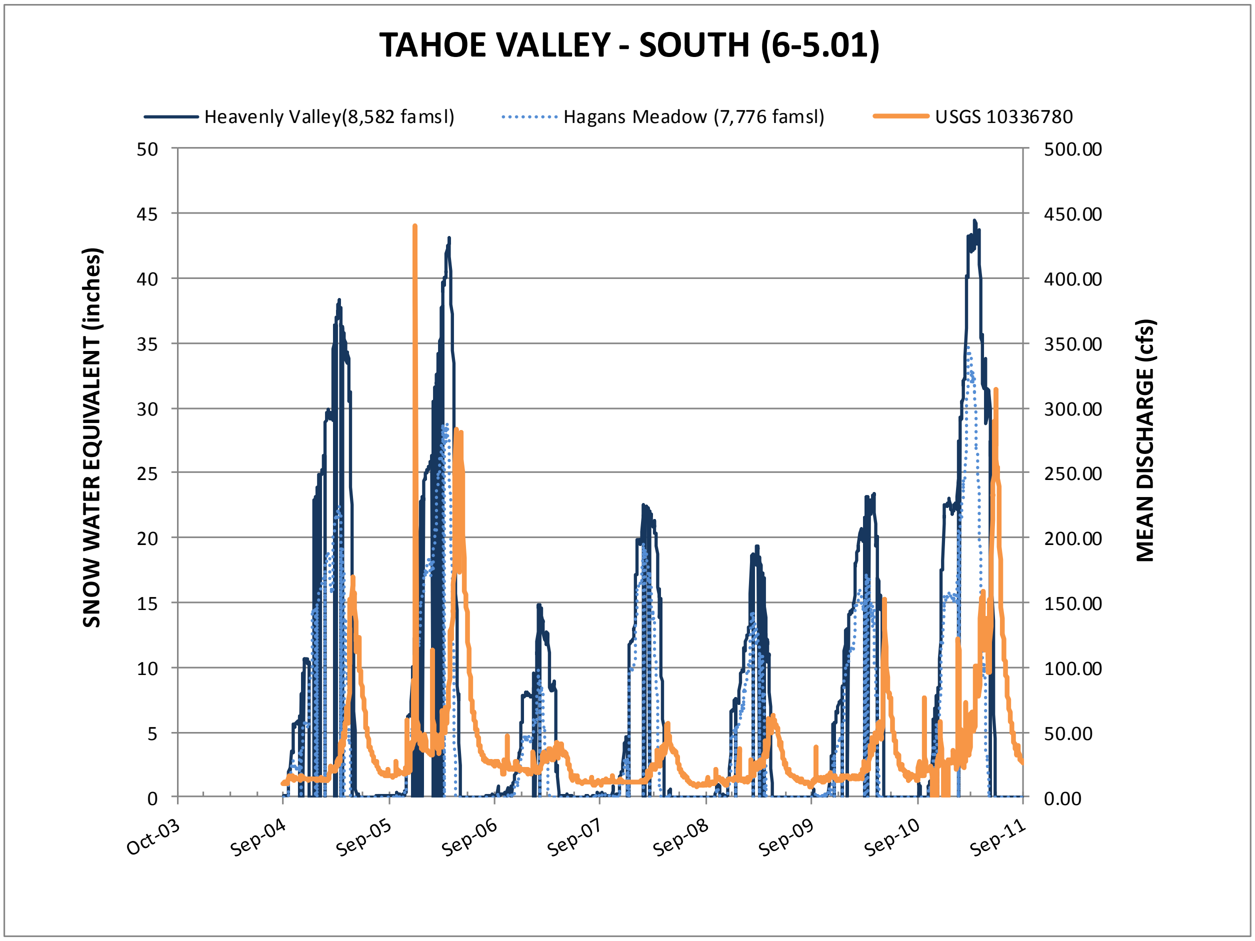


Figure 2.3 Basin precipitation and stream discharge relationships

2.3 Geologic Setting

Figure 2.4 shows the general geology of the TV-South Basin including major mapped units, faults and the bedrock contact with the basin-fill deposits.

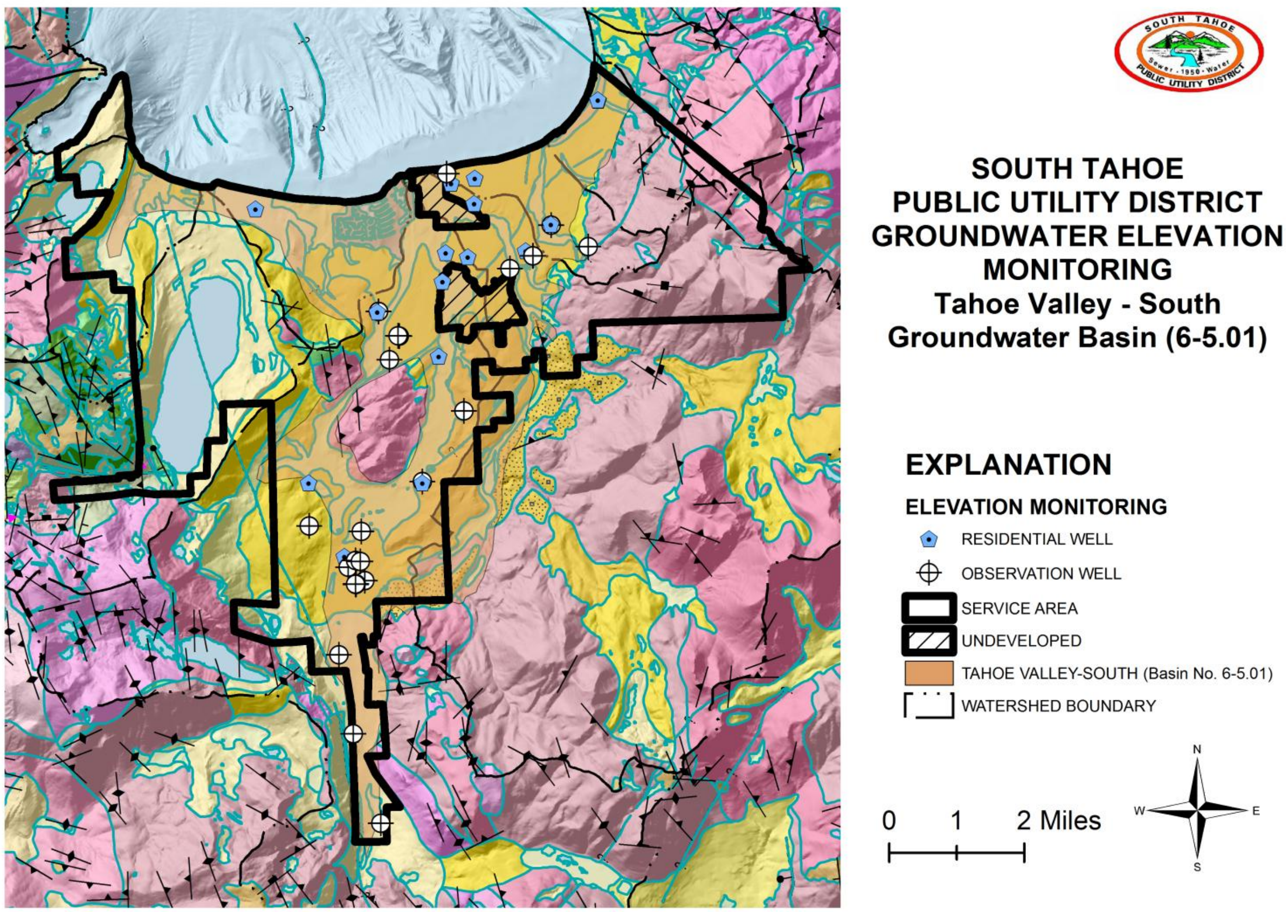


Figure 2.4 Generalized geology of the Tahoe Valley- South Basin (GIS Geologic Data; CGS CD 2008-01)

Structurally, the TV-South Basin lies within a west-tilted asymmetric half-graben. The West Tahoe Fault Zone defines the west side of the graben and is believed to be an east-dipping normal fault, with east-side-down normal displacements. This northwest-southeast trending fault zone extends, from Eagle Point toward the Celio Ranch, near the south end of the Basin. A second zone of faulting occurs near the east side of the graben. This east side fault zone trends in a northeast-southwest direction along the mountain front of the Carson Range, from Stateline toward Meyers. This east side fault zone is also believed to be an east-dipping normal fault, with northwest-side-down normal displacements.

Geologic materials contained within the Basin are broadly subdivided into bedrock and basin-fill deposits. Bedrock consists of metamorphic, granitic and volcanic rocks. These rocks occur along the upper portions of the steep mountain slopes and peaks that form the mountain blocks surrounding the margins of the Basin and floors the structural valley into which the basin-fill deposits lie. A smaller region of bedrock, composed of meta-sedimentary and granitic rocks, is exposed within the north-central portion of the Basin at Twin Peaks and through an adjoining area of low lying hills northwest of Twin Peaks at Tahoe Mountain. Bedrock is not a source of municipal drinking water supply within the Basin.

Basin-fill deposits, in general, consist of unconsolidated glacial, lake and stream sediments. These sedimentary deposits fill the lower reaches of the canyons that drain toward Lake Tahoe and underlie the relatively flat lying valley floors. Across the Basin, the thickness of these deposits is variable. In general, the basin-fill deposits are relatively thin toward the margins of the Basin and where they cover shallow bedrock areas exposed within the Basin. The basin-fill deposits typically thicken away from these bedrock areas to fill the deepest portions of the Basin, referred to as depocenters. Gravity survey and well drilling information suggests that at least three depocenters occur within the Basin. The largest of these depocenters underlies the City of South Lake Tahoe. A second depocenter is located north of Fallen Leaf Lake, underlying the present drainages of Baldwin and Taylor Creeks. A third depocenter underlies the Meyers area, between the Crystal range and Twin Peaks. Within these depocenters, basin-fill deposits may be on the order of 600 feet to more than 1,000 feet thick.

The principal source of groundwater in the Basin is the basin-fill deposits. Glacial deposits form the majority of the aquifers in the Basin. Valley glaciers advanced north toward Lake Tahoe through the Upper Truckee River Valley during at least three episodes of glaciation between 3 million and 12,000 years ago. As these glaciers advanced and receded they formed lateral moraines along the edges of the glaciers path and terminal moraines at the ends of the glaciers advance. These moraine deposits are typically jumbled deposits of clay to boulder size material, with moderate permeability. Sediment-laden melt-waters from the receding glaciers flowed in streams, in front of the terminal moraines, north toward Lake Tahoe. These streams dropped their sediment loads along their stream channels and in broad coalescing flood fans, referred to as outwash plains. These outwash fan and fluvial channel deposits are composed of layered beds of well sorted gravel, sand and silt size material, with moderate to high permeability. Where these glacial streams deposited sediment directly into Lake Tahoe, thick deltas were formed of inter-layered sand and fine-grained silt and clay. These delta sequences grade laterally with: 1) lakeshore deposits, consisting of moderately well sorted sand and gravel deposits with relatively high permeability; 2) inter-fan and marsh deposits, consisting of fine-grained sand, silt and clay; and 3) lake deposits, consisting of silt and clay. Both the inter-fan, marsh and lake deposits have relatively low permeability. The relatively high permeability glacial outwash and delta deposits form excellent groundwater reservoirs. The best of these reservoirs have been found in the north half of the Basin, beneath the present day Truckee Marsh. The relatively low permeable inter-fan, marsh and lake deposits form at least four locally extensive aquitards that separate the reservoirs into a minimum of at least five distinct regional aquifers, which can be further sub-divided into 26 water-bearing zones, of which 18 are actively used for drinking water supply. The water-bearing zone designations are informal and are based on local geographic area and the stratigraphic order in which they occur (1 = lowermost zone; 5 = uppermost zone). Local water-bearing zone designations are provided in Table 1.

AREA	ZONE	IDENTIFIER	SOURCE WATER
CHRISTMAS VALLEY- southern-most portion of Basin, south of Lake Valley and Highway 50.	4	CVZ4	Yes
	3	CVZ3	Yes
	2	CVZ2	Yes
	1	CVZ1	Potential
MEYERS- south Lake Valley portion of Basin, from Highway 50 north to Twin Peaks.	5	MZ5	No
	4	MZ4	Yes
	3	MZ3	Yes
	2	MZ2	No
	1	MZ1	No
ANGORA –south Lake Valley portion of Basin, west of Twin Peaks.	2	AZ2	Yes
	1	AZ1	Yes
SOUTH LAKE TAHOE – north Lake Valley from Lake Tahoe Airport north to the south shore of Lake Tahoe, west of the Tahoe Keys to Johnson Boulevard.	5	SLTZ5	Yes
	4	SLTZ4	Yes
	3	SLTZ3	Yes
	2	SLTZ2	Yes
	1	SLTZ1	No
TAHOE KEYS –north Lake Valley, from Camp Richardson east to the Tahoe Keys.	5	TKZ5	Yes
	4	TKZ4	Yes
	3	TKZ3	Yes
	2	TKZ2	Yes
	1	TKZ1	Yes
BIJOU – northwest portion of the Basin from Johnson Boulevard east to Bijou Park.	5	BZ5	No
	4	BZ4	Yes
	3	BZ3	Yes
	2	BZ2	No
	1	BZ1	Yes

Table 1 Local water-bearing zone designations and current District use.

2.4 Recharge

Sources of recharge to the TV-South Basin are believed to be predominantly direct infiltration of precipitation and/or downward percolation of surface water with a lesser unknown proportion attributed to mountain front recharge. On average, the total groundwater recharge into the Basin (1990 – 2004) is estimated at about 28,846 acre-feet per year (AFY). A breakdown of the average monthly recharge into the Basin between 1990 through 2004 is provided in the following table (Table 2).

	MONTHLY AVERAGE RECHARGE	
MONTH	**(Galls)**	**Acre-Feet (AF)**
Jan	509,459,396	1,563
Feb	686,686,748	2,107
Mar	1,816,443,624	5,574
Apr	2,543,561,418	7,805
May	2,242,410,232	6,881
Jun	993,021,440	3,047
Jul	103,088,371	316
Aug	11,369,118	35
Sept	23,130,706	71
Oct	27,112,284	83
Nov	176,886,543	543
Dec	267,785,851	822
ANNUAL AVERAGE (1990 – 2004)	9,400,955,731	28,846

Table 2 Average monthly groundwater recharge in the Tahoe Valley-South Basin.

2.4.1 Groundwater Levels

Groundwater elevations in the TV-South appear to fluctuate in response to seasonal changes in precipitation and stream runoff. Figure 2.5 shows the groundwater elevations measured in five groundwater basin observation wells along with the snow water equivalent readings for the Heavenly Valley SNOTEL site (Station 518). Figure 2.6 shows the same groundwater elevation hydrographs along with the stream discharge readings for the Upper Truckee River at the South Lake Tahoe gage (USGS 10336610).

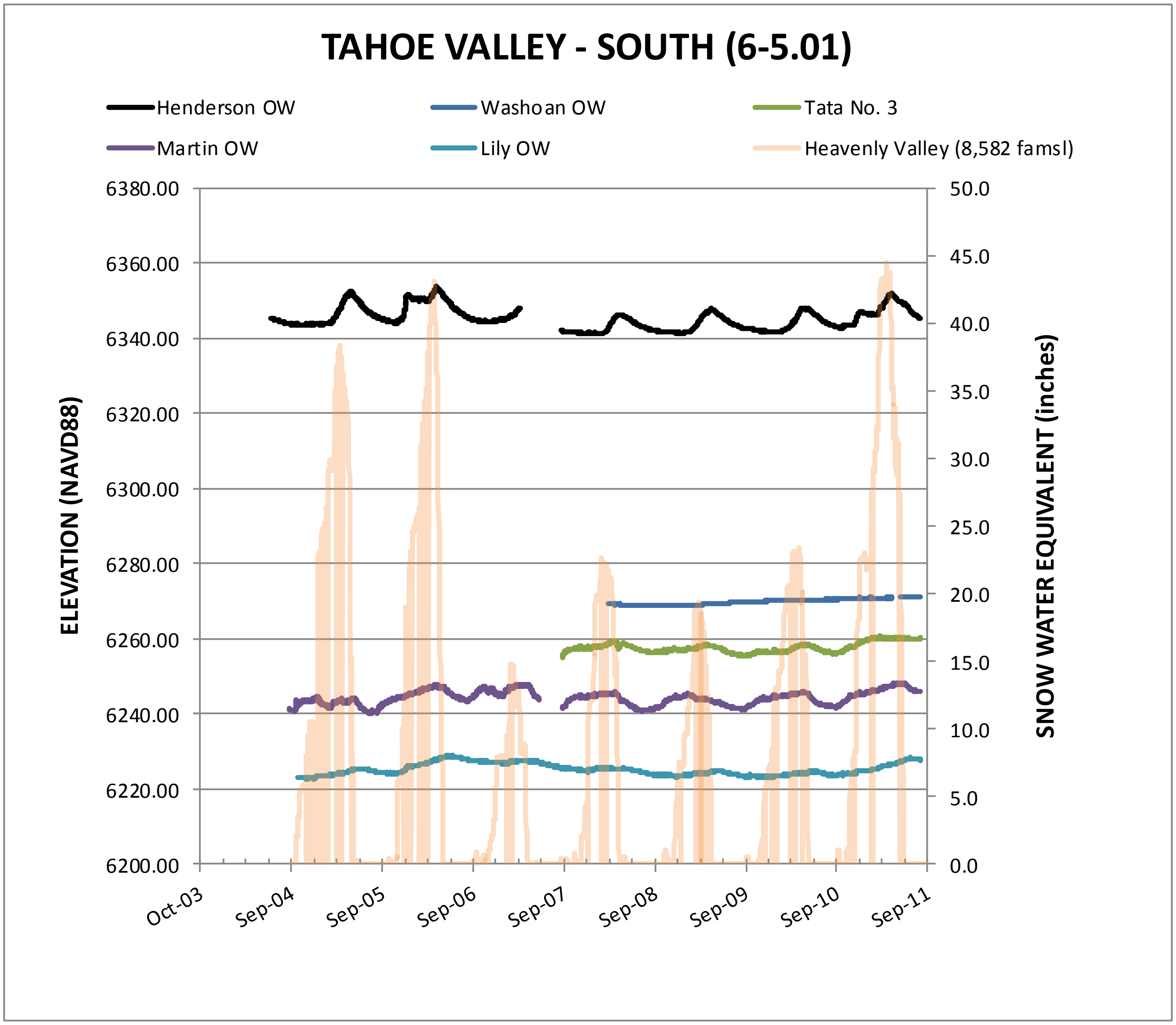


Figure 2.5 Groundwater elevation hydrographs and basin precipitation as measured by snow water equivalent.

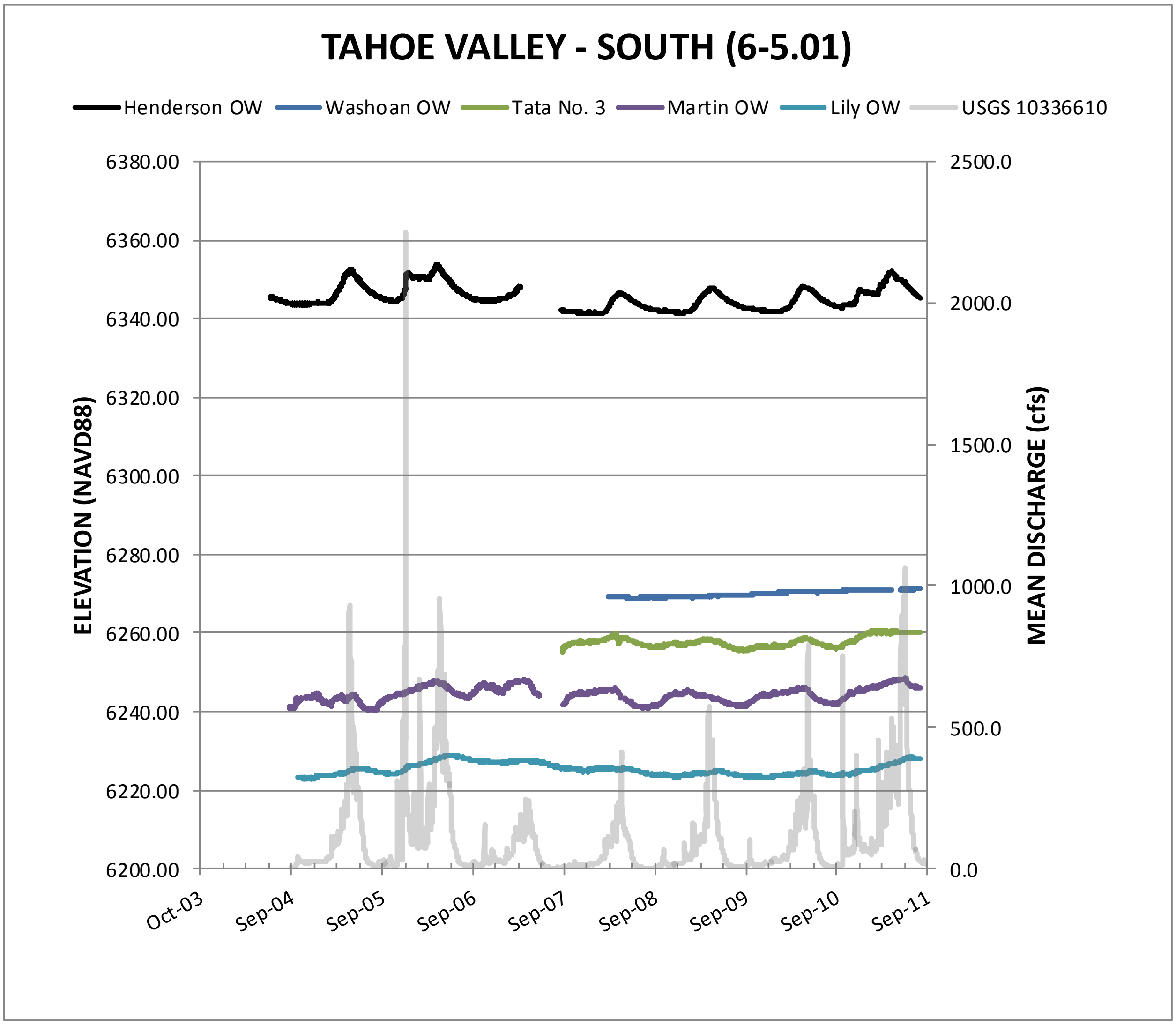


Figure 2.6 Groundwater elevation hydrographs and surface water runoff as measured by mean discharge.

Comparison of Figures 2.5 and 2.6 shows that groundwater elevations fluctuate in response to both seasonal changes in precipitation and surface water runoff. Groundwater elevations tend to rise during the winter storm season with seasonal high groundwater occurring between early-April through mid-June (Figure 2.5) and tend to decline during the summer and into the fall, as stream flows recede and approach baseflow, resulting in seasonal low groundwater elevations occurring between mid-July through mid-November (Figure 2.6). The Washoan Observation Well (OW) and Lily OW do not show this trend. The Washoan OW is screened through a confined portion of the aquifer below the uppermost water-bearing zone (SLTZ5) and does not appear to be strongly influenced by seasonal recharge events. The Lily OW is screened through the uppermost water-bearing zone (SLTZ5) and is located along the north margin of the groundwater basin, fringing Lake Tahoe. Comparison of the Lily OW hydrograph and elevation readings from the Tahoe City gage (USGS 10337000) suggest that groundwater elevations in this portion of the TV-South Basin are strongly influenced by lake level.

3 Groundwater Elevation Monitoring

3.1 Well Network

The District well network includes thirty (30) observation wells and seventeen (17) residential wells. All of the residential wells are active and are used for municipal drinking water supply. Two of these wells are on stand-by status, used only for emergency purposes. The observation wells include: monitoring wells, sentinel wells and test wells; as well as former drinking water supply wells that have been removed from service and are no longer connected to the District's water distribution system. Only the observation wells are proposed for use in the CASGEM program. The location and distribution of these observation wells are shown below (Figure 3.1).

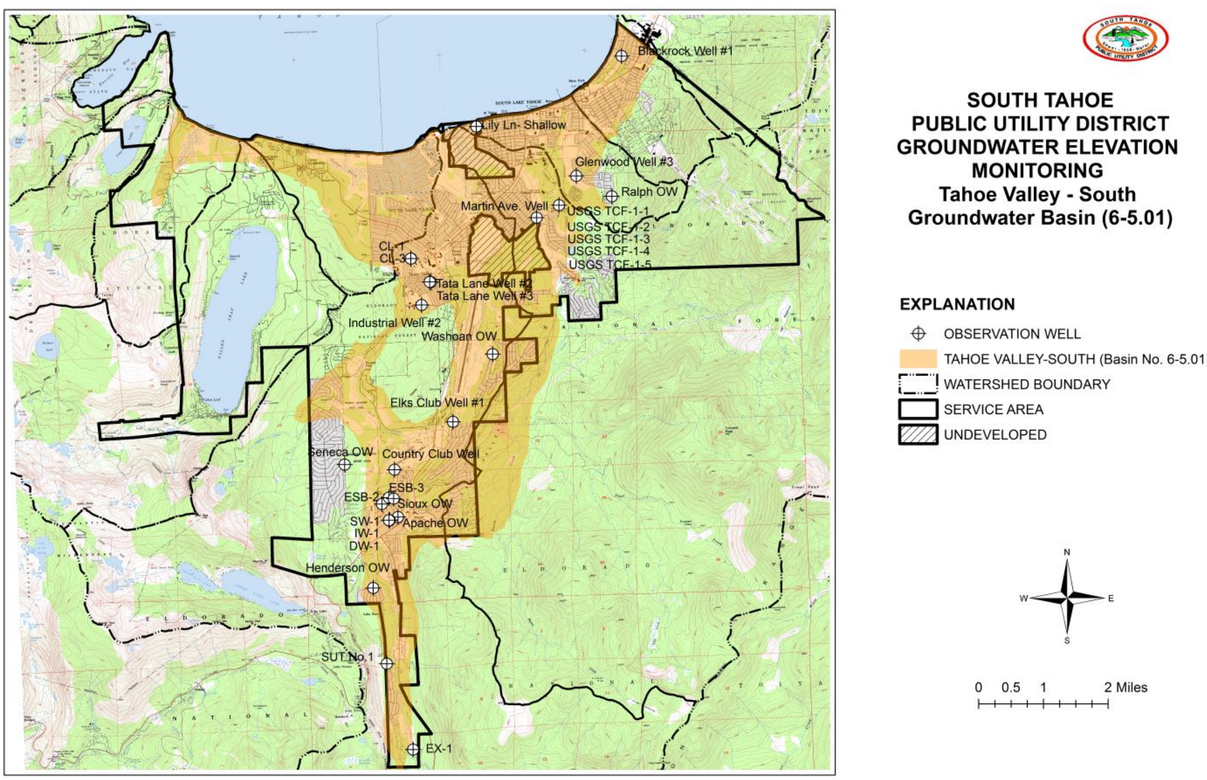


Figure 3.1 District observation wells available for use in the CASGEM program.

As mentioned previously, the observation wells include wells that were constructed for varying purposes. As such, the perforation intervals are also variable, as a consequence of the original intended use of that particular observation well. Figure 3.2 shows the approximate screened intervals, using the top of screen and total depth elevations for each of the observation wells, arranged from the head of the basin (at the south), north toward Lake Tahoe. The water-bearing zones through which these observation wells are screened are identified in Table 3. CASGEM required information for these wells is provided in Attachment A.

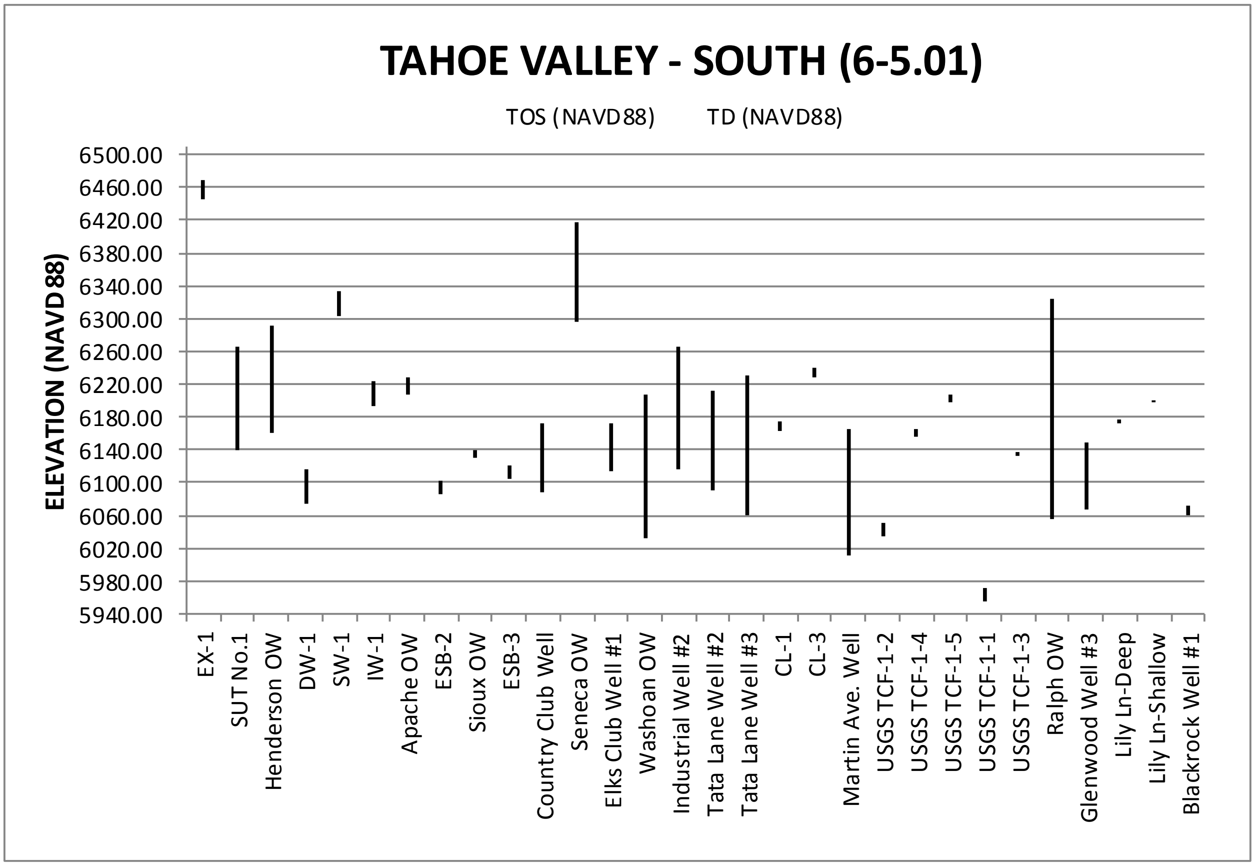


Figure 3.2 Approximate elevation ranges of the observation well screened intervals. The observation wells are arranged in order of geographic location (south to north) across the basin.

3.1.1 Data Gaps

DWR suggests a recommended density of from 2 to 10 observation wells per 100 square miles (DWR, 2010). The District observation well network satisfies this general criterion for the TV-South Basin. The well network is fairly well distributed geographically through most areas with the exception of the Taylor Creek and Tallac Creek watersheds in the northwest corner of the TV-South Basin. Groundwater through these areas is typically used by private wells serving seasonal summer-time residences, and transient and non-transient noncommunity water systems.

There are currently no plans or funding to install dedicated monitoring wells within watersheds situated within the District's service area where there are no wells monitored or where data gaps exist. The District would be interested in discussing the installation of dedicated monitoring wells in portions of the TV-South Basin where data gaps exist should outside funding become available. In the event future monitoring wells are installed by other agencies, the District would consider the possibility of adding such wells to the current monitoring network to reduce data gaps.

3.2 Monitoring Schedule

The District uses two methods for collecting static water level readings from the well network;

1) Hand measurements using an electric well sounder; and
2) Automated readings using a submersible pressure transducer/data logger.

Hand readings are collected from all wells in May and November of each year. May and November are optimal for static water level readings because these months generally coincide with seasonal high and low groundwater elevations and District water demands are low, allowing production wells to be strategically shut-off to attain static water conditions during measurements.

Due to the number, geographic distribution and coordination of temporary shut-offs of active wells, hand readings are completed over a two-day period. Almost half of the observation wells are fitted with dedicated water-level monitoring equipment. The data loggers are programmed to collect daily pressure head and temperature readings at 6:00 AM and 6:00 PM. Table 3 lists the local water-bearing zones screened and the frequency and type of measurements collected from each of the observation wells.

OBSERVATION WELL	WATER-BEARING ZONE	SEMI-ANNUAL HAND READINGS (May and November)	AUTOMATED READINGS (12 Hour Frequency)
Apache OW	CVZ4	X	
Blackrock Well #1	BZ4	X	
CL-1	SLTZ5	X	
CL-3	SLTZ5	X	
Country Club Well	MZ4	X	
DW-1	MZ4	X	
Elks Club Well #1	MZ4	X	
ESB-2	MZ4	X	X
ESB-3	MZ4	X	

EX-1	CVZ4	X	X
Glenwood Well #3	BZ4	X	X
Henderson OW	CVZ3, CVZ4	X	X
Industrial Well #2	SLTZ3, TKZ5	X	
IW-1	CVZ4	X	X
Lily Ln-Deep	SLTZ5	X	
Lily Ln-Shallow	SLTZ5	X	X
Martin Ave. Well	SLTZ4	X	X
Ralph OW	BEDROCK	X	X
Seneca OW	MZ5	X	X
Sioux OW	MZ4	X	
SUT No.1	CVZ2, CVZ3	X	X
SW-1	CVZ4	X	
Tata Lane Well #2	SLT3, TKZ5	X	
Tata Lane Well #3	SLT3, TKZ5	X	X
USGS TCF-1-1	BZ2	X	
USGS TCF-1-2	BZ3	X	
USGS TCF-1-3	BZ4	X	X
USGS TCF-1-4	BZ4	X	
USGS TCF-1-5	BZ5	X	
Washoan OW	SLTZ1, SLTZ2, SLTZ3, SLTZ4	X	X

Table 3 Proposed schedule for TV-South groundwater elevation monitoring.

3.3 Field Methods

3.3.1 Reference Point Elevations

In 2003, Tri-State Surveying, Ltd. established a geo-referencing survey control network across the District's service area. The control survey includes five monuments set by Tri-State State surveying and eleven control monuments from the National Geodetic Survey, Caltrans and El Dorado County DOT. The control network is referenced to NAD' 83, California State Plane Coordinate System, Zone 2 and NAVD88 vertical datum. All coordinate and elevation data for each of the wells in the well network are tied by a Professional Land Surveyor to the control survey. Survey information collected for each well is as follows:

1) Point Identifier;
2) Physical description of identifier;
3) Date of measurement;
4) SP CA 2 Northing coordinate (feet);

5) SP CA 2 Easting coordinate (feet);
6) Latitude (WGS84), in decimal degrees;
7) Longitude (WGS84), in decimal degrees;
8) NAVD88 vertical elevation - ground (feet);
9) NAVD 88 vertical elevation – top of casing measuring point(feet);
10) NGVD 29 vertical elevation - ground (feet);
11) NGVD 29 vertical elevation – top of casing measuring point (feet);
12) Horizontal accuracy (feet); and
13) Vertical accuracy (feet)

Reference points for any new observation well added to the well network will be surveyed by a Professional Land Surveyor in accordance with District surveying requirements.

3.3.2 Groundwater Elevation Readings

3.3.2.1 Semi-Annual Readings

As indicated in Section 3.2 static water level readings are collected over a 2-day period in May and November of each year. Collection over a 2-day period is required to allow production wells to be turned-off for next day static water-level readings. Production wells are allowed a minimum 12 hours recovery time prior to measurement. For most District production wells, minimum 12 hour recovery time has been adequate to attain static water conditions. The shut-off date and time for each production well is recorded on the District's field sheet. An example copy of this field sheet is provided in Attachment B.

Static water level readings are collected using an electric portable water level sounder. The well sounder uses a battery and an electrode attached to the end of a sounding cable. The sounding cable is a 2 conductor PVC, 20 AWG size cable marked in 1-foot increments. A milli-ampere analog meter is used to show contact of the electrode with the water level. The water level is determined by using an engineer's tape to measure the static level to the nearest 0.01 foot from the nearest 1-foot increment on the sounding cable. Methods employed for static-level readings are as follows:

Prior to Use

- Check the connection between the electrode and the sounding cable to insure that it is in good condition
- Check that the sounding cable is clean and free of kinks
- Check the charge on the battery

Measurement

- Inspect and note the general condition of the well cover
- Open the well cover and remove the well cap. Allow the well several minutes to equilibrate with atmospheric pressure. Note the general condition of the well cap and if not vented, any excess pressure or vacuum on the well cap during removal.
- Decontaminate the well sounder electrode and cable using a spray bottle filled with fresh potable water
- Check previous year readings to estimate anticipated water level range
- Lower the sounding cable into the well and measure static water level relative to the established reference point. Take at least three soundings to insure the electrode is in true contact with static level. If the reference point has changed from the previous year's measurement; measure the new reference point elevation in relation to ground surface and note the distance in the field book.
- Hold the cable at the reference point and measure the depth to water to the nearest 0.01 foot from the nearest 1-foot increment on the sounding cable.
- Record the following information in a bound field book;
    - Date and time of measurement
    - Well Name
    - Depth to water reading
    - Notes/Observations
- Reel in the sounding cable and wipe clean with a clean towel
- Replace the well cap and lock the well cover.

3.3.2.2 Automated Readings

Submersible pressure transducers with internal data loggers have been installed in 13 observation wells to collect pressure head readings on a daily (12-hour frequency) basis (Refer to table 3). The majority of these are absolute pressure transducers. In order to compensate pressure head readings for atmospheric pressure, a set of barometric pressure transducers have been deployed in seven of the 13 observation wells. Barometric pressure readings are collected at the same time and frequency as the pressure head readings to provide the most accurate compensated reading. Both the submersible and barometric transducers are typically suspended on a stainless steel wire line attached to the bottom of the well cap. Several wells are fitted with direct read cables that allow retrieval of submersible transducer readings without removal from the well. Pressure and barometric head readings from the well transducers are routinely downloaded at least once per year during the summer or early fall. These files are then used to update long-term head monitoring records and convert the compensated head readings to water-level elevations.

4 Data Reporting

Static water level readings are recorded in bound field books and on the field sheets. Following each measuring event, the collected depth to water field readings are reviewed, checked for errors and entered into a standard MS-excel worksheet. The worksheet is used to convert the field readings to NAVD88 elevations and update water-level hydrographs for each well. The field readings are also used to check the accuracy of the automated readings. Information contained in the water level worksheet for each measuring event is as follows:

- Location ID
- Well Name
- Latitude
- Longitude
- Reference Point Elevation (NAVD88)
- Water Level Date
- Depth to Water Reading (feet)
- Water Level Elevation (NAVD88)
- Data Quality Assurance Code (1 = low to 4 = high)
- Quality Assurance Reviewer (initial)
- Quality Assurance Date
- Quality Assurance Source
- Notes/Comments regarding the measurement

5 References

California Department of Water Resources (DWR). 2010. California Statewide Groundwater Elevation Monitoring (CASGEM) Program, Procedures for Monitoring Entity Reporting, December 2010.

California Geological Society (CGS). 2008. GIS Data for the Geologic Map of the Lake Tahoe Basin, California and Nevada; CGS CD 2008-01.

United States Geological Survey (USGS). 1999. Precipitation-Runoff Simulations for the Lake Tahoe Basin, California and Nevada; Water-Resources Instigations Report 99-4110.

United States Geological Survey (USGS). 2000. Surface- and Ground-Water Characteristics in the Upper Truckee and Trout Creek Watersheds, South Lake Tahoe, California and Nevada, July- December 1996; Water-Resources Instigations Report 00-4001.

United States Geological Survey (USGS). 2002. Estimated Flood Flows in the Lake Tahoe Basin, California and Nevada; Fact Sheet 035-02.

ATTACHMENT A

South Tahoe Public Utility District

Observation Well Network Information

Local Well Designation	State Well Number	RP Elevation	RP Description	GS Elevation
Apache OW		6340.12	Top Well Casing - N'ly Edge	6340.32
Blackrock Well #1	0910002-005	6242.72	Top of sounding tube	6240.73
CL-1		6278.37	Top Well Casing - N'ly Edge	6278.76
CL-3		6278.49	Top Well Casing - N'ly Edge	6278.64
Country Club Well	0910002-011	6286.19	N Bolt on Well Case	6285.49
DW-1		6342.07	Top Well Casing - N'ly Edge	6342.38
Elks Club Well #1	0910002-013	6284.63	Top of sounding tube	6282.95
ESB-2		6319.57	Top Well Casing - N'ly Edge	6319.87
ESB-3		6316.07	Top Well Casing - N'ly Edge	6316.37
EX-1		6475.09	Top Well Casing - N'ly Edge	6475.50
Glenwood Well #3	0910002-020	6261.68	Top Well Casing - N'ly Edge	6259.83
Henderson OW		6369.78	Top Well Casing - N'ly Edge	6366.18
Industrial Well #2	0910002-025	6305.95	1-1/2" Well casing penetration	6305.64
IW-1		6342.88	Top Well Casing - N'ly Edge	6343.22
Lily Ln-Deep		6236.03	Top Well Casing - N'ly Edge	6236.35
Lily Ln-Shallow		6236.08	Top Well Casing - N'ly Edge	6236.35
Martin Ave. Well	0910002-027	6262.42	Top of sounding tube	6260.93
Ralph OW	0910002-031	6351.97	Top of sounding tube	6351.41
Seneca OW		6476.12	Top Well Casing - N'ly Edge	6476.38
Sioux OW		6326.84	Top Well Casing - N'ly Edge	6327.36
SUT No.1	0910002-032	6401.22	Top Well Casing - N'ly Edge	6401.75
SW-1		6342.65	Top Well Casing - N'ly Edge	6343.00
Tata Lane Well #2	0910002-038	6286.11	Top of sounding tube	6284.11
Tata Lane Well #3	0910002-039	6288.34	Center Well Casing	6286.10
USGS TCF-1-1		6296.48	Top Well Casing - N'ly Edge	6295.70
USGS TCF-1-2		6296.47	Top Well Casing - N'ly Edge	6295.70
USGS TCF-1-3		6296.65	Top Well Casing - N'ly Edge	6295.70
USGS TCF-1-4		6296.63	Top Well Casing - N'ly Edge	6295.70
USGS TCF-1-5		6296.63	Top Well Casing - N'ly Edge	6295.70
Washoan OW		6307.84	Top Well Casing - N'ly Edge	6308.02

Local Well Designation	Measurement Method	Measurement Accuracy	Well Use	Well Status
Apache OW	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Blackrock Well #1	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
CL-1	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
CL-3	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Country Club Well	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
DW-1	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Elks Club Well #1	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
ESB-2	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
ESB-3	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
EX-1	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Glenwood Well #3	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Henderson OW	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Industrial Well #2	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
IW-1	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Lily Ln-Deep	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Lily Ln-Shallow	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Martin Ave. Well	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Ralph OW	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Seneca OW	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Sioux OW	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
SUT No.1	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
SW-1	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Tata Lane Well #2	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Tata Lane Well #3	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
USGS TCF-1-1	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
USGS TCF-1-2	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
USGS TCF-1-3	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
USGS TCF-1-4	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
USGS TCF-1-5	Surveyed to a benchmark	0.1 ft.	Observation	Inactive
Washoan OW	Surveyed to a benchmark	0.1 ft.	Observation	Inactive

Local Well Designation	Latitude (N)	Longitude (W)	Coordinates Method	Coordinates Accuracy
Apache OW	38.85517110	120.01712996	Surveyed	1 ft.
Blackrock Well #1	38.95668558	119.94877095	Surveyed	1 ft.
CL-1	38.91288586	120.01097127	Surveyed	1 ft.
CL-3	38.91290350	120.01100542	Surveyed	1 ft.
Country Club Well	38.86577423	120.01766464	Surveyed	1 ft.
DW-1	38.85443311	120.01962396	Surveyed	1 ft.
Elks Club Well #1	38.87606433	120.00050420	Surveyed	1 ft.
ESB-2	38.85819517	120.02160914	Surveyed	1 ft.
ESB-3	38.85956555	120.01955093	Surveyed	1 ft.
EX-1	38.80300347	120.01496678	Surveyed	1 ft.
Glenwood Well #3	38.93021083	119.96286318	Surveyed	1 ft.
Henderson OW	38.83947140	120.02488426	Surveyed	1 ft.
Industrial Well #2	38.90244944	120.00839594	Surveyed	1 ft.
IW-1	38.85454253	120.01955268	Surveyed	1 ft.
Lily Ln-Deep	38.94199789	119.99102375	Surveyed	1 ft.
Lily Ln-Shallow	38.94199808	119.99102512	Surveyed	1 ft.
Martin Ave. Well	38.92113864	119.97461360	Surveyed	1 ft.
Ralph OW	38.92535292	119.95288053	Surveyed	1 ft.
Seneca OW	38.86729305	120.03190638	Surveyed	1 ft.
Sioux OW	38.85929897	120.01817452	Surveyed	1 ft.
SUT No.1	38.82239164	120.02168130	Surveyed	1 ft.
SW-1	38.85451434	120.01971651	Surveyed	1 ft.
Tata Lane Well #2	38.90748125	120.00549011	Surveyed	1 ft.
Tata Lane Well #3	38.90754721	120.00585776	Surveyed	1 ft.
USGS TCF-1-1	38.92376702	119.96812692	Surveyed	1 ft.
USGS TCF-1-2	38.92376598	119.96812789	Surveyed	1 ft.
USGS TCF-1-3	38.92376704	119.96812770	Surveyed	1 ft.
USGS TCF-1-4	38.92376616	119.96812719	Surveyed	1 ft.
USGS TCF-1-5	38.92376655	119.96812806	Surveyed	1 ft.
Washoan OW	38.89093162	119.98850802	Surveyed	1 ft.

Local Well Designation	Well Completion Type	Total Well Depth (feet)
Apache OW	Single Well	134
Blackrock Well #1	Single Well	180
CL-1	Single Well	115
CL-3	Single Well	50
Country Club Well	Single Well	197
DW-1	Single Well	268
Elks Club Well #1	Single Well	168
ESB-2	Single Well	233
ESB-3	Single Well	211
EX-1	Single Well	31
Glenwood Well #3	Single Well	192
Henderson OW	Single Well	210
Industrial Well #2	Single Well	190
IW-1	Single Well	151
Lily Ln-Deep	Part of a nested/multi-completion well	64
Lily Ln-Shallow	Part of a nested/multi-completion well	38
Martin Ave. Well	Single Well	250
Ralph OW	Single Well	295
Seneca OW	Single Well	180
Sioux OW	Single Well	198
SUT No.1	Single Well	262
SW-1	Single Well	40
Tata Lane Well #2	Single Well	193
Tata Lane Well #3	Single Well	225
USGS TCF-1-1	Part of a nested/multi-completion well	340
USGS TCF-1-2	Part of a nested/multi-completion well	260
USGS TCF-1-3	Part of a nested/multi-completion well	163
USGS TCF-1-4	Part of a nested/multi-completion well	140
USGS TCF-1-5	Part of a nested/multi-completion well	98
Washoan OW	Single Well	275

Local Well Designation	Well Completion Report #	Associated Basin	Associated Basin Portion	Well Location Description
Apache OW		6-5.01-Tahoe Valley South	south-central	12N/18E-29
Blackrock Well #1	33505	6-5.01-Tahoe Valley South	north-east	13N/18E-27
CL-1	535956	6-5.01-Tahoe Valley South	central	12N/18E-05
CL-3	535958	6-5.01-Tahoe Valley South	central	12N/18E-05
Country Club Well		6-5.01-Tahoe Valley South	south central	12N/18E-20P01
DW-1		6-5.01-Tahoe Valley South	south central	12N/18E-29
Elks Club Well #1	56760	6-5.01-Tahoe Valley South	central	12N/18E-21
ESB-2		6-5.01-Tahoe Valley South	south central	12N/18E-29
ESB-3		6-5.01-Tahoe Valley South	south central	12N/18E-29
EX-1		6-5.01-Tahoe Valley South	south	11N/18E-08
Glenwood Well #3	6492	6-5.01-Tahoe Valley South	east	12N/18E-02D3
Henderson OW		6-5.01-Tahoe Valley South	south	12N/18E-31
Industrial Well #2		6-5.01-Tahoe Valley South	central	12N/18E-08G02M
IW-1		6-5.01-Tahoe Valley South	south central	12N/18E-29
Lily Ln-Deep		6-5.01-Tahoe Valley South	north-central	13N/18E-32
Lily Ln-Shallow		6-5.01-Tahoe Valley South	north-central	13N/18E-32
Martin Ave. Well	115601	6-5.01-Tahoe Valley South	east	12N/18E-03B01M
Ralph OW		6-5.01-Tahoe Valley South	east	12N/18E-02B6
Seneca OW		6-5.01-Tahoe Valley South	west-south	12N-18E-19
Sioux OW		6-5.01-Tahoe Valley South	south central	12N/18E-29
SUT No.1	91552	6-5.01-Tahoe Valley South	south	11N/18E-05N1
SW-1		6-5.01-Tahoe Valley South	south central	12N/18E-29
Tata Lane Well #2		6-5.01-Tahoe Valley South	central	12N/18EA03M
Tata Lane Well #3		6-5.01-Tahoe Valley South	central	12N/18E-08A04M
USGS TCF-1-1		6-5.01-Tahoe Valley South	east	12N/18E-03
USGS TCF-1-2		6-5.01-Tahoe Valley South	east	12N/18E-03
USGS TCF-1-3		6-5.01-Tahoe Valley South	east	12N/18E-03
USGS TCF-1-4		6-5.01-Tahoe Valley South	east	12N/18E-03
USGS TCF-1-5		6-5.01-Tahoe Valley South	east	12N/18E-03
Washoan OW		6-5.01-Tahoe Valley South	central-south	12N/18E-16

Local Well Designation	Additional Comments	Is Voluntary Well	County
Apache OW		No	El Dorado
Blackrock Well #1	Artesian well	No	El Dorado
CL-1		No	El Dorado
CL-3		No	El Dorado
Country Club Well	Well screen liner; plugged at 197'	No	El Dorado
DW-1		No	El Dorado
Elks Club Well #1	Well screen liner; plugged at 143'	No	El Dorado
ESB-2		No	El Dorado
ESB-3		No	El Dorado
EX-1		No	El Dorado
Glenwood Well #3		No	El Dorado
Henderson OW		No	El Dorado
Industrial Well #2	Screen intervals inferred from well videoscan	No	El Dorado
IW-1		No	El Dorado
Lily Ln-Deep		No	El Dorado
Lily Ln-Shallow		No	El Dorado
Martin Ave. Well		No	El Dorado
Ralph OW	Screen interval inferred from well videoscan	No	El Dorado
Seneca OW		No	El Dorado
Sioux OW		No	El Dorado
SUT No.1		No	El Dorado
SW-1		No	El Dorado
Tata Lane Well #2		No	El Dorado
Tata Lane Well #3		No	El Dorado
USGS TCF-1-1		No	El Dorado
USGS TCF-1-2		No	El Dorado
USGS TCF-1-3		No	El Dorado
USGS TCF-1-4		No	El Dorado
USGS TCF-1-5		No	El Dorado
Washoan OW		No	El Dorado

Local Well Designation	Screen Interval 1 Top	Screen Interval 1 Bottom	Screen Interval 2 Top	Screen Interval 2 Bottom
Apache OW	112.500	134.000		
Blackrock Well #1	168.000	180.000		
CL-1	104.000	114.000		
CL-3	39.000	49.000		
Country Club Well	114.000	184.000		
DW-1	225.000	265.000		
Elks Club Well #1	110.000	142.000		
ESB-2	218.000	228.000		
ESB-3	196.000	206.000		
EX-1	6.000	21.000		
Glenwood Well #3	112.000	192.000		
Henderson OW	79.000	100.000	142.000	205.000
Industrial Well #2	40.000	92.000	97.000	107.000
IW-1	120.000	150.000		
Lily Ln-Deep	59.000	64.000		
Lily Ln-Shallow	35.000	37.500		
Martin Ave. Well	95.000	115.000	125.000	145.000
Ralph OW	28.000	237.000		
Seneca OW	60.000	91.000	133.000	175.000
Sioux OW	188.000	198.000		
SUT No.1	136.000	262.000		
SW-1	10.000	40.000		
Tata Lane Well #2	73.000	193.000		
Tata Lane Well #3	55.000	75.000	200.000	220.000
USGS TCF-1-1	325.000	335.000		
USGS TCF-1-2	245.000	255.000		
USGS TCF-1-3	158.000	163.000		
USGS TCF-1-4	130.000	135.000		
USGS TCF-1-5	88.000	93.000		
Washoan OW	102.000	144.000	165.000	186.000

Local Well Designation	Screen Interval 3 Top	Screen Interval 3 Bottom	Screen Interval 4 Top	Screen Interval 4 Bottom
Apache OW				
Blackrock Well #1				
CL-1				
CL-3				
Country Club Well				
DW-1				
Elks Club Well #1				
ESB-2				
ESB-3				
EX-1				
Glenwood Well #3				
Henderson OW				
Industrial Well #2	110.000	190.000		
IW-1				
Lily Ln-Deep				
Lily Ln-Shallow				
Martin Ave. Well	160.000	180.000	200.000	240.000
Ralph OW				
Seneca OW				
Sioux OW				
SUT No.1				
SW-1				
Tata Lane Well #2				
Tata Lane Well #3				
USGS TCF-1-1				
USGS TCF-1-2				
USGS TCF-1-3				
USGS TCF-1-4				
USGS TCF-1-5				
Washoan OW	207.000	228.000	249.000	270.000

ATTACHMENT B

South Tahoe Public Utility District

Static Water-Level Measurements for District Wells

Standard Operating Procedure (Example)

South Tahoe

Public Utility District

1275 Meadow Crest Drive
South Lake Tahoe, CA 96150
Telephone: (530)544-6474
Fax: (530)541-0614

STATIC WATER-LEVEL MEASUREMENTS FOR DISTRICT WELLS
STANDARD OPERATING PROCEDURE
(November 8th – November 10th, 2011)

REQUIRED TOOLS LIST

- Sockets/Ratchet
    - ½-inch
    - 9/16-inch
    - ¾-inch
    - 15/16-inch
    - 1 1/8-inch
- Pipe Wrench
- Slot-Head Screwdriver
- Water-level Sounder
- Pick
- Snow Shovel
- Wire Brush
- Hand-Broom
- Gloves
- Spray Bottle
- Towels
- Rags

DAY 1 (Tuesday, November 8th, 2011)

1. If operating, turn-off the following wells for next-day static water-level measurements.

WELL	SHUT-OFF DATE/TIME
Bakersfield Well	
Arrowhead Well	
Airport Well	Stand-By Well – *Out of Service*
Valhalla Well	
Glenwood Well No. 5	
Industrial Well No. 2	Removed from Service - OW
Country Club Well	Removed from Service - OW
Martin Ave. Well	Removed from Service - OW
Blackrock Well No. 1	Removed from Service - OW
Blackrock Well No. 2	

DAY 2 (Wednesday, November 9th, 2011)

2.) Collect static water-level measurements from the following wells (minimum 12-hour recovery time)

WELL	DATE/ TIME	Depth to Water (feet)	Measuring Point	Turn-on Well Post Static DTW	NOTES
Apache Street Sentinel Well			Top of 2-inch PVC casing		
SW-1 (Arrowhead Monitoring Well)			Top of 4-inch PVC well casing		Arrwhd FF = 6343.00
IW-1 (Arrowhead Monitoring Well)			Top of 4-inch PVC well casing		PXD Station
DW-1 (Arrowhead Monitoring Well)			Top of 4-inch PVC well casing		Orig. = 6338.93
Arrowhead Well No. 3			Top of 1" sounding tube		
Sioux Street Sentinel Well			Top of 4-inch well casing		
ESB-3 Sentinel Well			Top of PVC well casing		Accessible (?)
ESB-2 Sentinel Well			Top of PVC well casing		PXD Station
Bakersfield Well			Top of PVC sounding tube		
Country Club Well (in-active)			Top of well casing		
Washoan Test Well			Top of 4-inch well casing		
Airport Well			Well house XD reading (PXD @ 200.47')		
Industrial Well No. 2			Well casing access port		
Tata Well No. 3 (OW)			Top of well casing		PXD Station
Tata Well No. 2 (in-active)			Top of sounding tube		
Clement Well (in-active)			Top of pitless unit flange.		

WELL	**DATE/ TIME**	**Depth to Water (feet)**	**Measuring Point**	**Turn-on Well Post Static DTW**	**NOTES**
CL-1 (Clement monitoring well)			Top of 2-inch PVC well casing		
CL-3 (Clement Monitoring well)			Top of 2-inch PVC well casing		
Martin Well (OW)			Top of PVC ST		
Glenwood Well No. 3 (OW)			Top of 4-inch casing.		PXD Station
Glenwood Well No. 5			Well house XD reading (PXD @ 161’)		
Ralph Well			Top of casing flange (0.4’ above ff elev.)		PXD Station
College Well			Top of 3-inch sounding tube		
USGS TCF-1			Top of PVC casing		
USGS TCF-2			Top of PVC casing		
USGS TCF-3			Top of PVC casing		PXD Station
USGS TCF-4			Top of PVC casing		
USGS TCF-5			Top of PVC well casing		
Blackrock Well No. 2 (in-active)			Top of PVC ST		
Blackrock Well No. 1 (OW)			Top of PVC ST		
Seneca Test Well			Top of 4-inch well casing		PXD Station
Valhalla Well			Well House XD Reading (PXD @ 65.71’)		*TTA Combo. = 3185*

3.) Following the days static water level measurement collection, if operating, turn-off the following wells for next day static water-level measurements.

WELL	SHUT-OFF DATE/TIME
South Upper Truckee No. 3	
Mountain View Well	
Elks Club Well No. 2	
Helen Well No. 2	
Chris Well	
Paloma Well	
Bayview Well	
Al Tahoe Well No. 2	
Sunset Well	

DAY 3 (Thursday, November 10th, 2011)

4.) Collect static water-level measurements from the following wells (minimum 12-hour recovery time)

WELL	DATE/ TIME	Depth to Water (feet)	Measuring Point	Turn-on Well Post Static DTW	NOTES
Sunset Well			Top of ST		
Helen Well No.2			Top of PVC ST		
Chris Ave. Well			Top of ST		
Paloma Well			Top of ST		PXD Station
Al Tahoe Well No. 1 (OW)			Top of ST		Accessible (?)
Al Tahoe Well No. 2			Top of ST		
Bayview Well			Top of ST; PXD @ 169.65’		
Lilly - Deep			Top of 1” PVC Casing		
Lilly - Shallow			Top of 2” PVC Casing		PXD Station
South Upper Truckee Well No. 3			Top of 1 ½” ST; PXD @ 124’ below FF		FF=6401.75’
South Upper Truckee No. 1 - OW			Top of casing		FF=6401.75’
LPPS/ EX-1			Top of Well Casing		
Henderson Test Well			Top of Well Casing		PXD Station
Mtn. View Well			Top of 1-inch PVC ST		PXD= Q =
Elks Club Well No. 1			Top of ST		
Elks Club Well No. 2			Top of ST; PXD = 147’		

Appendix E

Stakeholder Advisory Group Meeting Documentation

TAHOE DAILY
Tribune
P.O. Box 1888 Carson City, NV 89702
(775) 881-1201 FAX: (775) 887-2408

Customer Account: # 1067078
Legal Account
South Tahoe Public Utility District
1275 Meadow Crest Dr
SOUTH LAKE TAHOE, CA 96150
Attn: Heidi Baugh

Jody Mudgett says:
That (s)he is a legal clerk of the **TAHOE DAILY TRIBUNE**, a newspaper published Wednesday, Friday, Saturday at South Lake Tahoe, in the State of California.

Copy Line
Groundwater Management Plan

PO#:

Ad #: 10003587D
of which a copy is hereto attached, was published in said newspaper for the full required period of **1** time(s) commencing on **3/7/2014**, and ending on **3/7/2014**, all days inclusive.

Signed: Jody Mudgett
Date: 03/07/2014 State of Nevada, Carson City

Price: $ 140.02

Subscribed and sworn to before me this ____ day of ______

____
Notary Public

Proof and Statement of Publication

Ad #: 10003587D

NOTICE OF INVITATION TO APPLY

South Tahoe Public Utility District
2014 Groundwater Management Plan Update
Stakeholder Advisory Group

The South Tahoe Public Utility District (District) invites participation in the Stakeholder Advisory Group (SAG) for the amendment of its Groundwater Management Plan (GWMP) in accordance with California Water Code. Landowners in the District's service area and other interested parties are invited to apply for membership on the SAG using the application form on the South Tahoe Public Utility District Website.
Visit www.stpud.us for the application.
Applications will be accepted through 5:00pm Monday, March 17, 2014.
Interested parties may also submit a written letter or contact:
South Tahoe Public Utility District
Attention: Groundwater Management Plan Update Committee, Ivo Bergsohn
1275 Meadow Crest Drive
South Lake Tahoe, CA 96150
Phone: 530-544-6474
Email: ibergsohn@stpud.dst.ca.us

The Stakeholder Advisory Group will review the existing Groundwater Management Plan (GWMP) and upon that review will discuss topics such as:

- Groundwater levels;
- Groundwater quality;
- Groundwater monitoring;
- Source water protection;
- Storm water management;
- Adequacy of current monitoring programs;
- Improved groundwater protection needs; and
- Potential impact of the GWMP on business activities.

The update will be conducted from April 1 through July 30, 2014.

Parties requesting to receive digital correspondence regarding the groundwater management plan update are also invited to complete an application--indicating a request to be placed on the list of interested persons.

Pub: March 7, 2014 **Ad#10003587**

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MEETING SUMMARY

DATE	Wednesday, April 16, 2014, 9:00-12
LOCATION	South Tahoe Public Utility District Offices, Board Room, 1275 Meadow Crest Drive
STRATEGIC ADVISORY GROUP CORRESPONDENCE LIST	Karen Bender (El Dorado County), Jason Burke (City of South Lake Tahoe), Scott Carroll (CA Tahoe Conservancy), Greg Daum (Meyers Chevron), Brian Grey and Tom Gavigan (Lahontan Regional Water Quality Control Board), Brian Judge and Paul Nielsen (TRPA), Jennifer Lukins (Lukins Water Co), Steve Morales (LT Unified School District), Harold Singer (Community Rate Payer), Rodney Wright (Barton Health), Greg Trischler (Tahoe Keys Water), John Thiel and Ivo Bergsohn (STPUD), Mike Maley (Kennedy/Jenks), Michelle Sweeney (Allegro Communications)
MEETING HOSTS	Ivo Bergsohn, John Thiel (STPUD), Mike Maley (Kennedy/Jenks)
FACILITATOR	Michelle Sweney (Allegro Communications)

GROUNDWATER MANAGEMENT PLAN UPDATE GOALS

1. Update the Groundwater Management Plan to meet CA legislative requirements and DWR guidelines
2. Update the District ordinance for protecting and monitoring groundwater quality
3. Develop Groundwater Basin Management Objectives (BMOs) to provide a framework for maintaining a sustainable and reliable groundwater supply
4. Create a plan for collecting, compiling and reporting regional groundwater management data
5. Establish a stakeholder forum to host discussion about groundwater topics and facilitate collaborative action toward resolution of groundwater issues

APRIL 16 MEETING GOAL & OBJECTIVES

GOAL

Identify topics and their relative emphasis in the Groundwater Management Plan update

OBJECTIVES

1. Gain understanding of the current status of the South Tahoe groundwater resource
2. Identify topics central to the Groundwater Management Plan update
3. Discuss factors that will inform the District's prioritization of Plan update elements
4. Identify collaboration opportunities within and outside of the Groundwater Strategic Advisory Group

THE GROUNDWATER MANAGEMENT PLAN DOCUMENTS

TWO DOCUMENTS ARE BEING CREATED IN THIS 2014 PLAN UPDATE

- Groundwater Management Plan
- State of the Groundwater resource Report

These will be completed during the summer of 2014, with review by the SAG in July 2014.

GROUNDWATER MANAGEMENT PLAN UPDATE SEQUENCE

1. Articulate source water goals

2. Integrate CA legislative and DWR requirements
3. Update ordinances
4. Articulate basin management objectives
5. Lay the framework for a plan to collect, share and integrate data
6. Convene a forum to advise in planning and implementation

PROPOSED SOUTH TAHOE BASIN SOURCE WATER MANAGEMENT PLAN DOCUMENT PARAMETERS

- 5-year update cycle
- Annual summary reports
- Semi-annual Advisory Group meetings

SOUTH TAHOE BASIN GROUNDWATER RESOURCE

PRESENTATION I OVERVIEW OF THE SOUTH TAHOE GROUNDWATER BASIN

Ivo Bergsohn is the South Tahoe Public Utility District Hydro-Geologist in charge of the Groundwater Management Plan. His presentation, the elements of which follow, can be found on the District website http://www.stpud.us/plan_documents.html

District service area = approx 32 square miles extending from Stateline to Emerald Bay and then from the South Shore all the way just upstream of the confluence and Grass Lake Creek and the Upper Truckee River

Presentation Elements

1. Gravity map
2. Aquifer cross section
3. Transmissivity
4. Simplified water cycle, South Tahoe Basin
5. Distribution of recharge
6. Snowmelt and Groundwater Elevation
7. Water Distribution
8. Drinking Water
    - Groundwater users
    - Well vulnerability
    - Permeability
    - Pumping rate
9. Aquifer properties
    - What MtBE illustrates about well vulnerability
10. Surface and Groundwater Connectivity

TOPICS CENTRAL TO THE GROUNDWATER MANAGEMENT PLAN UPDATE

California Department of Water Resources oversees groundwater management plans. There is flexibility in the groundwater management plan guidance in order to empower the local jurisdiction to prioritize actions according to local priorities. Richard Solbrig, District Manager emphasized the importance of keeping management of the groundwater resource in the hands of the local district(s).

CALIFORNIA DEPARTMENT OF WATER RESOURCES

Senate Bill 1938 l http://www.water.ca.gov/groundwater/gwmanagement/sb_1938.cfm

SB 1938, signed into law in 2002, requires any public agency seeking State funds administered through DWR for the construction of groundwater projects or groundwater quality projects to prepare and implement a groundwater management plan with certain specified components. Requirements include establishing basin management objectives, preparing a plan to involve other local agencies in a cooperative planning effort, and adopting monitoring protocols that promote efficient and effective groundwater management. The requirements applies to both agencies that have already adopted groundwater management plans as well as agencies that do not overlie groundwater basins identified in Bulletin 118 and its updates.

REQUIRED AND RECOMMENDED COMPONENTS OF A GROUNDWATER MANAGEMENT PLAN

1. Invite interested parties and the public to participate
2. Include a plan by the managing entity to “involve other agencies that enables the local agency to work cooperatively with other public entities whose service area or boundary overlies the groundwater basin.
3. Provide a map showing the area of the groundwater basin
4. Establish an advisory committee of stakeholders
5. Describe the area to be managed under the plan
6. Establish Basin Management Objectives (BMOs)
7. Include components relating to the monitoring and management of groundwater levels – adopt monitoring protocols
8. Describe any current of planned actions by the District to coordinate with other land use, zoning or water management planning agencies
9. Provide for periodic reports and periodic re-evaluation of the entire plan

Source: Required and Recommended Components of Local Groundwater Management Plans
http://www.water.ca.gov/groundwater/docs/Bulletin118update2003-appxC.pdf

FACTORS THAT WILL INFORM PRIORITIZATION OF PLAN UPDATE ELEMENTS

PRELIMINARY BASIN MANAGEMENT OBJECTIVES

Basin Management Objectives (BMOs) are required under the California Water Code (CWC) § 10753.7 (a) (1). BMOs are flexible guidelines for the management of groundwater resources that describe specific actions to be taken by stakeholders to meet locally developed objectives at the basin or sub-area scale. Senate Bill (SB) 1938 amended existing law related to groundwater management plans (GWMP) requiring a public agency seeking State funds administered through California Department of Water Resources (DWR) to prepare and implement a GWMP that includes BMOs.

An important feature of the BMO method of groundwater management is that it is intended to provide a flexible approach that can be adapted to changing local conditions and increased understanding of the groundwater resource. The more traditional way of managing groundwater basins typically focused on often difficult to define concepts such as safe yield, replenishment and overdraft.

This GWMP update for the Tahoe Valley Groundwater Basin – Tahoe South Subbasin is a regional effort being facilitated by the South Tahoe Public Utilities District (STPUD or District). The following preliminary draft BMOs are proposed:

- BMO #1 – Maintain a sustainable long-term water supply
- BMO #2 – Maintain and protect groundwater quality
- BMO #3 – Promote public participation and coordination with local agencies
- BMO #4 – Coordinate a regional monitoring program to track groundwater conditions in the basin.
- BMO #5 – Assess and manage the interaction of water supply activities with environmental conditions
- BMO #6 – Increase the hydrogeologic understanding of the groundwater basin
- BMO #7 – Assess planned or potential future water supply needs and issues
- BMO #8 - Identify and obtain funding for groundwater projects

COLLABORATION OPPORTUNITIES

Collaboration opportunities discussed fell broadly in the categories of interagency agreements, data and resource sharing, land use planning, stormwater and education

INTERAGENCY AGREEMENTS

How do participants in this Advisory Group get involved in using the plan that's being developed by the District? Is there a mechanism for that? Can they individually take the plan and adopt it themselves? 1) other water purveyors 2) agencies and local jurisdictions

DATA AND RESOURCE SHARING

DWR places a strong emphasis on monitoring protocols for groundwater levels, pumping and water quality. What is the opportunity for participants in this Advisory Group Forum to identify potential data and resource sharing (capacity building) mechanisms for the future?

Subject areas identified in which data and resource sharing could mutually benefit purveyors and agencies

1. Groundwater levels
2. Pumping volumes
3. Water quality
4. Climate – future water supply
5. Stormwater

LAND USE PLANNING

Do well construction and abandonment policies apply to private wells? DISCUSSION: It is a matter of estimated risk. Perhaps this is a trigger for partner agencies that have land use authority, if the risk is significant enough could partner up and help create more protections that are mandatory—notvolunteer – if the risk is significant enough.

STORMWATER – GROUNDWATER CONNECTIVITIY

While there has been research into this topic, in light of the emphasis on infiltration of stormwater from the Tahoe Basin road system it seems there is ample opportunity to increase understanding of the relationship between storm and ground water.

EDUCATION

In the context of hosting of this Advisory Group the District could facilitate the identification of public and contractor education opportunities regarding groundwater vulnerability and protection. Especially – supply side intrusions, toxic dumping into stormwater system…

CLIMATE CHANGE

The Lake Tahoe Basin Management Unit is undertaking climate change study in cooperation with regional and national USDA and Forest initiatives.

CAPACITY BUILDING

- GRANT WRITING: As water supply is an important sociopolitical topic there is potential mutual benefit for the agencies and parties on this Advisory Group to think about the interdisciplinary nature of groundwater protection and creatively approach the grantwriting task.

- EMERGENCY RESPONSE: It would behoove the drinking water protection interests to participate in existing forae for emergency response planning

- ECOSYSTEM SERVICES: It is worth the District considering whether applying an ecosystem service lens to grant proposals and collaboration with other agencies might yield new funding opportunities.

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MEETING NOTES

DATE	Wednesday, May 14, 2014, 9:00-12 with informal lunch 12:00-1:00
LOCATION	South Tahoe Public Utility District Offices, Board Room, 1275 Meadow Crest Drive
STRATEGIC ADVISORY GROUP CORRESPONDENCE LIST	Robert Lauritzen (El Dorado County), Jason Burke (City of South Lake Tahoe), Scott Carroll (CA Tahoe Conservancy), Brian Grey (Lahontan Regional Water Quality Control Board), Paul Nielsen (TRPA), Jennifer Lukins (Lukins Water Co), Steve Morales (LT Unified School District), Harold Singer (Community Rate Payer), John Thiel and Ivo Bergsohn (STPUD), Mike Maley (Kennedy/Jenks), Michelle Sweeney (Allegro Communications)
MEETING HOSTS	Ivo Bergsohn, John Thiel (STPUD), Mike Maley (Kennedy/Jenks)
FACILITATOR	Michelle Sweeney (Allegro Communications)

GROUNDWATER MANAGEMENT PLAN UPDATE GOALS

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3. Develop Groundwater Basin Management Objectives (BMOs) to provide a framework for maintaining a sustainable and reliable groundwater supply
4. Create a plan for collecting, compiling and reporting regional groundwater management data
5. Establish a stakeholder forum to host discussion about groundwater topics and facilitate collaborative action toward resolution of groundwater issues

MAY 14 MEETING GOAL & OBJECTIVES

GOAL

Generate potential draft content for the Groundwater Management Plan on the subjects of land use planning, education and monitoring and initiate discussion about stormwater management and the groundwater resource.

OBJECTIVES

1. Increase shared understanding of the current status of groundwater monitoring
2. Discuss potential approach to
   - Land use planning
   - Education
   - Monitoring

   implementation actions in the plan document
3. Identify collaboration opportunities in strategic topic areas within and outside of the Groundwater Strategic Advisory Group
4. Summarize findings of existing reports on stormwater-groundwater relationship

ACTION ITEMS AND CONSIDERATIONS IN ADVANCE OF JUNE 4 MEETING

1) ASSESS RISK 2) PRIORITIZE ACTION ACCORDING TO RISK

It has been brought forward by Strategic Advisory Group members in the course of workshops 1 (April 16) and 2 (May 14) that any work not already being performed in the service of providing ample and safe drinking water should be rooted in risk management—the identification, assessment and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities.[1] The SAG and District staff have identified the following pertaining to risk:

QUANTITY

Near-term risk to water supply (quantity) is deemed low relative to other California systems given that the South Tahoe groundwater basin is a headwater system with a record of ample recharge. In this context the SAG recommends actions such as

1. Continuously strive to enhance understanding of the groundwater recharge system and dynamics at play in groundwater recharge
2. In context of the above, conduct a long-range, comprehensive groundwater supply risk assessment. Include in such assessment attention to
   - Climate change (models and management implications)
   - Coordination with the USFS Lake Tahoe Basin Management Unit to derive source water pertinent information from regional climate change and forest resource management studies
   - Investigation of the potential opportunity represented by District surface water rights under changing climate conditions
   - Attention to risk and opportunity implied by regional, state and national climate information and policy related to water supply

QUALITY

Near-term risk to water quality is deemed low relative to other California systems given that the South Tahoe groundwater basin is in a watershed where allowable land uses are tightly controlled and agricultural and industrial uses are at a minimum. Residential and commercial land uses are not expanding out of the current development "footprint" as these are tightly controlled by the Tahoe Regional Planning Agency and its congressional mandate to protect the Basin and its natural resources. In this context the SAG recommends actions including

1. Conduct a comprehensive groundwater quality risk assessment evaluating uncertainty related to threats in any of the following areas: infrastructure failure (of any kind, from any source), natural causes and disasters, deliberate attack, accidents, legal liabilities and financial and political systems.
2. Once a comprehensive risk assessment has identified all possible risk associated with source water quality then define where each risk lies on a spectrum from high-to-low risk based on a standard set of criteria.
3. Separately, define where each risk lies on a spectrum related to the District and partner agencies' ability to mitigate risk based on a standard set of criteria.
4. Integrate the risk and feasibility spectrums (#2 and 3 immediately following) to derive a spectrum of prioritized risk management actions—actions that will result in cost-effective risk reduction.
5. Identify opportunities to better-protect groundwater

In this context Strategic Advisory Group members, District staff and consultants have identified the following

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[1] Risk Management, source: Wikipedia, May 27, 2014

Potential risks associated with groundwater

Gasoline – and additives current and future
MTBE currently in the ground and select wells
Private wells
Sewer system
Stormwater system – roads and stormwater collection system
Monitoring wells?

Opportunities to better-protect groundwater

Interagency collaboration (data and information exchange and capacity-building agreements)
Land use – groundwater recharge management
Education

SOURCE WATER EDUCATION

The Strategic Advisory Group in the April 16, 2014 meeting identified education as a priority action area to be addressed in the Groundwater Management Plan document. In this, May 14, meeting, the group reconvened discussion on the subject of education as it might be integrated into the Plan.

GROUNDWATER STRATEGIC ADVISORY GROUP | A ROLE IN THE FUTURE?

Members identified several opportunities to kickstart collaboration among the groups represented on the SAG. Bergsohn said, "I'm very hopeful that this [Advisory Group] will continue and as far as education I think that is going to be a very important goal of this group. Lukins added, "I think that after the plan is created we should continue to meet on an annual basis or something to meet and confer and see what the TRPA has been doing, to see what the CTC has been doing, see what the utilities have been doing in order to promote the groundwater protection and see if there are new ideas and programs that we could come up with and ways to educate and promote. I think also educating each other as to what each other is doing is a big part as well. Just maintaining the relationships after the plan is created is a critical part."

Collaboration – Leverage existing programs

Singer underscored the opportunities inherent in leveraging existing programs both at the District and via collaboration with other agencies. He emphasized the opportunity inherent in using existing education vehicles to reach a variety of audiences. Singer pointed out too, the value of official collaboration between agencies with the suggestion, "get an MOU with another entity that does more frequent work [on individual properties]—where that entity can look out for things that are pertinent to your need for protecting the groundwater." In this statement Nielsen provided an example of such opportunity, "As Harold points out, regulators show up on private property for a variety of business—whether to address an illicit discharge or NPDES inspection or BMP inspection or coverage verification—to leverage those interactions I agree is a great opportunity."

John Thiel and Paul Nielsen identified two apparent opportunities to leverage existing programs and field visits as follows:

City and County Building Permits

Thiel: "When City and County inspectors go out and do building inspections for new construction and remodels [source water protection] could be a component— they could remind the contractor or the homeowner about [source water protection] opportunities."

TRPA Standard Conditions Approval

Nielsen: "At TRPA we have Standard Conditions of Approval that are attached to different types of projects and we could amend those standard conditions of approval easily at staff level to include, 'please don't do this…', 'please be aware…'. We do it for idling restrictions, fugitive dust… We would be happy to amend those to talk about source water protection."

TABLE A | POTENTIAL COLLABORATION AND LEVERAGING OPPORTUNITIES, EDUCATION

Table A summarizes other potential education collaboration and "leveraging" opportunities identified in the May 14 group discussion.

Resource type	Home Agency
STPUD	educators
County	household hazardous waste collection program
County	historic water education program
CTC	public outreach specialist
TRPA	contractors workshop
TRCD, NTCD	inspectors & garden advisors

Source Water Protection "Motto" and Materials

Sweeney offered this suggestion to the group—streamline your source water protection message: "I think part of what can come out of this discussion and can be integrated into the plan is your thinking in response to the question; What's the groundwater or source water story in 2-4 words? What is the story that we want all of our educators across disciplines to carry with them into the field?"

A LAKE TAHOE BASIN-WIDE SOURCE WATER PROTECTION MAP

Bergsohn introduced the Source Water Protection Map as a tool for making risk-to-source-water evident, "I know in the GWMP we are going to have a source water protection map. If you could show that map and say your site is here, and this proximity to a drinking water source and you're in a "red zone" (very close) or a "yellow zone", or "blue zone", it makes a difference as far as your heightened awareness. [Such a map could give an indication as to] the potential effect of various activities on our drinking water." (p. 14 of 50)

In the course of the May 14 discussion the Source Water Protection Map became a frequent point of reference. Further discussion on this topic can be found in the Land Use Planning and Stormwater sections of these notes.

TABLE B | POTENTIAL EDUCATION APPROACHES AND TOPICS

Table B lists approaches and topics the Advisory Group offered for consideration in the Education element of the Groundwater Management Plan document

Concise motto and message for translation across platforms
The Why of Water Conservation
Water Conservation in a Sustainability context
Water Conservation as Ecosystem Service
Personal Responsibility and drinking water

LAND USE PLANNING

OPPORTUNITIES TO UPDATE EXISTING SOURCE WATER PROTECTIONS I LAND USE

The Tahoe Regional Planning Agency (TRPA) has an existing source water protection ordinance and associated map. The agency is willing to undertake an update of both, incorporating a new map that may come from the efforts being discussed by this SAG.

Nielsen - The (current TRPA) ordinance says that if you have a land use, redevelopment new use that meets certain criteria (in the ordinance) industrial, commercial, then that's a trigger to contact the local water purveyor and get comments on proposed development and see if there are source water protection measures that need to be incorporated like spill plans or special containment facilities, and then incorporate that into our approvals. So our ordinance is really a trigger.

Singer - Now that's TRPA…does that relate back to the City then too that they have the same obligation?

Nielsen - For those projects that they permit on our behalf through the delegation MOU, the answer is yes. So we would like to update those.

PRIVATE WELLS AND SOURCE WATER SYSTEM VULNERABILITY

The following bullet points summarize discussion on the topic of private wells as a source water risk

- While the District has a private well inventory it is incomplete
- The "inventory effort" would significantly benefit from interagency collaboration (example – TRPA site assessments might integrate private well evaluation; private well locations from Lukins' jurisdiction; County data on private well applications and closures)
- A private well GIS layer combined with other source water maps would facilitate a risk evaluation associated with private wells
- Tailored risk-reducing actions could then be designed and implemented across the "private well landscape" correspondent to the level of risk posed by private wells
- A long-term, collaborative program to reduce risk from private wells could ensue

A LAKE TAHOE BASIN-WIDE SOURCE WATER PROTECTION MAP

The concept of a Lake Tahoe Basin-wide source water protection map arose in group discussion at several points during this workshop. At this interval it was discussed 1) as a tool in the context of mapping private well and associated water system vulnerability and 2) as a tool for triggering project review by water purveyors where re/development projects may have connectivity to source waters.

Private Wells Map Layer

Bergsohn - I think putting together a private well inventory is a great idea and I think we already have it. There are probably holes in it…it could be improved, that is definitely something for the future. I love the idea of TRPA including that in their property surveys. That would be great just to know that you have if there are other wells out there that we don't have to worry.

TRPA Source Water Protection Ordinance

Bergsohn to Nielsen - So do you think TRPA then would be open to incorporating or using our map as a basis for triggering your ordinance?

Nielsen - Yes. After the last meeting, I spoke to Joanne our Executive Director and told her what was happening. I said, best available information is what we need to use. Right now the maps are at I think the 500' radius around the well. (Whether that at the time was the best available information or model ordinances – I don't know what it was). I have to think that from a geologic standpoint there is a better way to do it now. Maybe it's polygons based on geology or soils or something.

NB: TRPA, having Lake Tahoe Basin-wide jurisdiction, would seek to have the full Tahoe Basin source water protection map updated.

SHARING INFORMATION, BUILDING COLLABORATION | GROUNDWATER MONITORING

The District requested that Strategic Advisory Group members provide an overview of who is doing what, where in terms of monitoring that may potentially be relevant to the source water resource. Bergsohn described that with this workshop segment "we would like to accomplish" two things 1) get to know what information everyone is collecting in order that 2) we can at a later time ascertain what can be done with that information in relation to the Plan document's Basin Management Objectives

MONITORING CURRENTLY PERFORMED IN THE BASIN WITH POTENTIAL RELEVANCE TO SOURCE WATER

This table summarizes Strategic Advisory Group response to the request for information

TRCD	Basinwide constituent runoff concentration
CalTrans	Road contribution to stormwater flow
CalTrans	Shallow groundwater levels
CTC	Shallow groundwater levels
TRPA	Project-specific data pertaining to SEZs
LTIMP	Stream flow data
LTUSD	Pumping volumes and water use data

County	Meyers landfill monitoring data
Lukins	pumping volumes and ...

The SAG discussed how funding for LTIMP stream monitoring is diminishing. There was some inquiry into how valuable this data might be in a source water context. In closing on this topic, it was suggested that if stream monitoring data is of value to understanding the source water resource it would be worthwhile to incorporate "advocacy for LTIMP stream monitoring" in the Groundwater Management Plan document.

GROUNDWATER QUALITY AND STORMWATER MANAGEMENT

The Lake Tahoe TMDL has led to a high degree of organization in the Tahoe Basin toward the objective of maintaining a high degree of integrity in the stormwater system. The TMDL indicated that integrity of the stormwater system and road surfaces was one of the highest priority actions that could be taken toward improving Lake Tahoe clarity. A key function of the TMDL is collecting and tracking nutrient and fine sediment data, particularly in those segments of the watershed with direct connectivity to the lake. This data feeds into the Lake Tahoe Crediting Program.

While source water constituents of concern differ from the constituents of concern in the TMDL Crediting Program there are important elements of the TMDL-initiated stormwater program that might be leveraged to benefit source water over the long term. Among these elements are: an existing regional approach to stormwater management, collaboration (between CalTrans, County, the City of South Lake Tahoe, Lahontan WQCB, TRPA, the Conservation Districts and environmental conservation entities) in the form of the long-standing SQWIC, data sharing protocols, interagency agreements, maps and monitoring and data collection organizational capacity.

The TMDL looks at water quality in receiving waters as well as constituent runoff concentrations (CRC). The CRC data may be of interest to the District (Tahoe Resource Conservation District, TRCD, collects the CRC data). TRCD also collects data that contributes to understanding BMP effectiveness.

A LAKE TAHOE BASIN-WIDE SOURCE WATER PROTECTION MAP

As discussed both in the education and land use segments of the meeting (referenced above in these notes) a Lake Tahoe Basin-wide source water protection map is viewed as an instrumental tool in kicking off discussion and focused thinking about coordinated source water protection.

NB: Bob Larsen at Lahontan WQCB is the point person with the state of CA for Tahoe's stormwater program under the TMDL.

Burke - Note that there is in Tahoe, the Environmental Improvement Program (EIP) and in this context there has been a decade of investment in large scale water quality improvement projects which are distinct from the residential Best Management Practice program.

In considering potential risk from the interaction of surface stormwater infrastructure and groundwater here are some things to consider.

Stormwater BMPs have 1) a primary, pretreatment system and 2) a treatment infiltration system

Features of stormwater BMPs with source water risk reduction potential

Stormwater BMPs have been installed in the Basin over the course of several decades. Given that the design of BMP components has been continually improved over this time, BMP components and design are different throughout the Tahoe Basin. (The TMDL emphasizes BMP maintenance irregardless of this structural disparity.)

Certain features of the stormwater BMPs have implications for source water protection. For example, drop inlets with concrete bottoms facilitate removal of sewage and diesel spills before these contaminants get into the infiltration system. Some BMPs have concrete bottoms. Not all do.

Other features of stormwater BMPs that can have implications for source water protection include: sand oil separators, weirs, underground chambers, etc.

The City's stormwater infrastructure has many of these protective features throughout. However, in rural areas (such as the unincorporated County sections of the Tahoe Basin) CalTrans may have older infrastructure that does not necessarily have these risk-reducing features.

Maley - A variety of land uses will have a variety of associated risks. Stormwater from a residential area may pose less risk than that from a commercial/industrial area.

Source Water Protection Map overlaying land uses and stormwater infrastructure and maintenance

So an inventory of the stormwater system would be helpful to the source water protection cause. The source water protection map might feature the following:

- Well information
- Groundwater recharge and aquifer features
- Land use (commercial, industrial, residential, etc.)
- Stormwater infrastructure (location, components, maintenance, etc.)

Much of this information already exists. The source water protection initiative would be to bring the data and information from diverse agencies into focus on a source water protection map. From this could be derived source water best practices. The next step would involve integrating these best practices into MOUs and formal practice by the entities installing and maintaining stormwater infrastructure and creating a monitoring system to provide feedback on the effectiveness of these practices in reducing risk.

COLLABORATIVE PROBLEM-SOLVING OPPORTUNITIES PROJECTED TO EMERGE FROM BASIN-WIDE SOURCE WATER PROTECTION MAP

<u>City/County and State Service Station Inspections</u>

Bergsohn - "I know there are sites in town that have drywells for storm water collection that are right down slope from service stations. [A standard inspection visit] might be an opportunity right there to make the station operators aware of the potential problem/issue. That may go a long way to stop from contamination/gasoline running into a storm drain if there is some awareness that there is a potential problem. [When inspecting a site does Lahontan] make the operators aware of those types of potential environmental liabilities?" (p.12 of 50)

Singer – "It seems that the County has more interactions with those types of operations on a routine basis more than anybody else does because they are the regulative authority."

Lauritzen: "Our UST inspectors wouldn't recognize a drywell, probably, if they saw it. But if the County was aware of a drywell at a service station and it was a potential issue and somebody brought that to light to us I think we could bring some pressure to bear on the property owner."

SOUTH TAHOE PUBLIC UTILITY DISTRICT EARLY DETECTION ORDINANCE

The District is inviting the Strategic Advisory Group (SAG) to comment on the existing Groundwater Management Plan, in particular the Early Detection and Response sections. This will be an agenda topic in Workshop 3 on June 4. In order to familiarize the SAG with the topic and discussion questions Ivo Bergsohn provided an introduction and clarifying questions and discussion were exchanged. The following notes provide an overview of this preliminary exchange.

South Tahoe Public Utility District Groundwater Management Plan, EDIR sections

7.6.5	Findings Regarding Zones of Contribution Surrounding District Wells
7.9	Groundwater Monitoring
7.9.3-7.9.11	EDIR Monitoring Wells
7.10	Response to Contamination
7.11	Enforcement

The existing Groundwater Management Plan is the first such plan created by the District. The Plan was written during a time when the gasoline addtive MTBE posed a significant threat to groundwater. The plan emphasized reducing future risk from MTBE or similar components of gasoline. At present, the threat of MTBE to groundwater supply is diminishing as the additive was outlawed more than a decade ago. Gasoline and additives to it are considered a persistent threat to groundwater though. And while significant barriers have been put in place to protect groundwater from exposure to contaminants from service stations, the bottom line is, there is no such thing as zero risk. In this context, the District is seeking expert opinion from SAG members regarding the level of protection provided by county and state programs from potential service station contaminant sources.

HIGHLIGHTS FROM MAY 16 STRATEGIC ADVISORY GROUP EDIR DISCUSSION

Bergsohn - The District has a groundwater monitoring program in the ordinance that says th District "may install wells in close proximity to active underground storage tanks". The intent of the program was to allow the District to install early detection wells. In the event of a contaminant release coming out of the Underground storage tank the well would provide an early indication. Another component of the ordinance is an emergency response plan. This provision requires the service station to have a plan pre-negotiated with the County and Lahontan.

In the late 1990's there was a long lag time between the identification of release, and… cleanup. The intent of the ordinance was to enable a service station operator to immediately initiate interim remediation measures.

Singer - I understand that the ordinance is intended to give the District a means to initiate protective action before there is a major problem. [Today you are asking us to consider] Is it a good use of District resources to implement the ordinance given the other protections in place?

The District has not implemented the program in the decade the ordinance has existed. Bergsohn cited cost-benefit considerations as the primary factor in the decision not to implement. However, he noted that should these elements of the ordinance not be removed in this plan update, then it would be because the benefit of having such provisions was deemed cost-effective and therefore implementation would begin.

ARE NON-DISTRICT PROTECTIVE MEASURES ADEQUATELY REDUCING RISK?

The SAG transitioned to discussion about existing protective measures outside of the EDIR elements of the District ordinance. The risk being discussed here is specifically the risk to groundwater from gasoline and gasoline-related potential contaminants.

Are non-district early detection and response programs adequate?

Lauritzen observed that double-walled storage tanks are highly-desirable for reducing risk. The County does not require that double-walled storage tanks replace single-wall tanks but does require that single wall tanks be lined and any new tanks installed be double-walled.

Thiel noted that the District has information on tank location but not construction. The District doesn't know which tanks are single vs double walled.

Grey offered that the state UST program includes a leak prevention component. Lauritzen added the County has an ongoing monitoring program.

Lauritzen noted that in the event of catastrophic failure to an underground tank the existing protection framework offers inadequate protection.

Is the District having its own early detection mechanism an irreplaceable asset? Is it as viable a protection mechanism as it was believed to be?

Are there changes to service station protocols and county and state programs that would provide adequate protection if the District were to eliminate the monitoring and emergency response plan requirements of the ordinance?

Singer – 1) …Are the new systems and everything in place (not only the physical system but the monitoring systems, etc.…) are they protective enough to negate the need for the sentry wells and even the response plan? 2) From a rate payer perspective, I guess the question really is, is that a good use of District resources to actually implement that ordinance given the other things that are in place?

Carroll - I can see the benefit of a mechanism that allows the District to trigger immediate response to a problem.

In closing the SAG left off with the above questions and the following considerations: 1) Are District early detection wells a unique (and therefore irreplaceable) asset in risk management 2) Is a District-required early response plan from the service stations a unique asset in risk management and one that the District can reasonably "enforce"?

LAHONTAN REGIONAL WATER QUALITY CONTROAL BOARD MAY 27 CONTRIBUTION TO EDIR DISCUSSION

In response to an email from Ivo Bergsohn requesting Lahontan RWQCB comment on the existing District Early Detection ordinance Brian Grey sent this response:

May 27, 2014 Email from Brian Grey, SAG #2 Workshop Follow up
Engineering Geologist
Lahontan Water Board- Region 6
Direct: 530 542-5421
email: BGrey@waterboards.ca.gov

As a member of the SAG, Water Board staff welcome the opportunity to participate in this discussion. The questions you raise and the clarification of issues requested are important topics.

Below is some information regarding leaking underground storage tank and site cleanup program cases to provide context for clarifying the issues.

Leaking Underground Storage Tank Cases

- Seven UST cleanup cases remain open in the groundwater basin, two of which are identified as eligible for closure.
- 76 UST cases have been closed within the groundwater basin.
- Five new UST cleanup cases have been opened in the last 10 years, all of these cases have been closed with the exception of one case opened in 2012 (Midas Muffler).
- The remaining open UST cases have not identified significant remaining source areas or are undergoing some form of investigation or remediation.
- MTBE was completely phased out of gasoline in CA by 2006.
- The Low Threat Underground Storage Tank Case Closure Policy (LTCCP) has a 60-day public participation component which allows for stakeholder concerns to be submitted.

Site Cleanup Program Cases

- Lahontan Water Board currently has 7 open Site Cleanup Program (SCP) cases in the groundwater basin; five of the seven open SCP cases are associated with PCE contamination around the “Y” and Stateline areas.
- The remaining two SCP cases are the Meyers Landfill and the Berry Hinckley Bulk Fueling Facility on James. The latter is a petroleum site eligible for closure under the LTCCP.
- Timely investigation and remediation are largely dependent on responsible party cooperation as there is no insurance fund like the UST cleanup fund for these types of releases.

While Water Board Staff welcomes additional data and acknowledges the benefit from detecting releases as soon as possible, Water Board Staff believe the decision to implement the EDIR is a discussion topic for the SAG, and not a decision for any individual entity. The SAG should collectively discuss the issue and offer a consensus opinion to the District. To facilitate this discussion, please consider a few questions below that could be discussed at the next SAG meeting to help guide the decision-making process.

Questions:

1. Why hasn’t EDIR been implemented before? Are there instances in the last 10 years where EDIR would have been useful?

2. Should EDIR be focused solely on gas stations and petroleum products? Should EDIR consider other constituents of concern and/or types of activities?

3. What is District’s primary concern with respect to gasoline stations and groundwater? Is it the contamination that has been left in place or new releases? Would EDIR be focused on sites with historical contamination left in place or at active stations within sensitive areas?

4. Are there plans to add previously removed wells to service?

5. Is MTBE the primary constituent of concern for the District? What other gasoline or man-made constituents of concern have been detected in District wells historically? What are current concentrations?

6. Would District water quality information be available to public/stakeholders, such as by uploading data to the State Water Board’s Geotracker database?

7. Are sections 7.4 and 7.6 of the GWMP going to be updated to reflect current conditions?

8. Is the confirmation sampling schedule reasonable? Should a clear method to distinguish natural variation of residual contamination from a new release be added? Or would wells be installed in only areas known to be free of chemicals of concern?

9. What happens if the District doesn't adhere to the Plan?

Since I didn't have all the SAG member contact info readily available, could you please distribute to the rest of the SAG? I look forward to participating in the discussion on the need for an EDIR system at the next workshop. In the meantime, please let me know if you have any questions.

MEETING NOTES

DATE	Wednesday, June 4, 2014, 9:00-12:00
LOCATION	South Tahoe Public Utility District Offices, Board Room, 1275 Meadow Crest Drive
STRATEGIC ADVISORY GROUP CORRESPONDENCE LIST	Robert Lauritzen (El Dorado County), Jason Burke (City of South Lake Tahoe), Scott Carroll (CA Tahoe Conservancy), Brian Gray and Tom Gavigan (Lahontan Regional Water Quality Control Board), Paul Nielsen (TRPA), Jennifer Lukins (Lukins Water Co), Steve Morales (LT Unified School District), Harold Singer (Community Rate Payer), Richard Solbrig, Ivo Bergsohn (STPUD), Mike Maley (Kennedy/Jenks), Michelle Sweeney (Allegro Communications)
MEETING HOSTS	Ivo Bergsohn (STPUD), Mike Maley (Kennedy/Jenks)
FACILITATOR	Michelle Sweeney (Allegro Communications)

GROUNDWATER MANAGEMENT PLAN UPDATE GOALS

1. Update the Groundwater Management Plan to meet CA legislative requirements and DWR guidelines
2. Update the District ordinance for protecting and monitoring groundwater quality
3. Develop Groundwater Basin Management Objectives (BMOs) to provide a framework for maintaining a sustainable and reliable groundwater supply
4. Create a plan for collecting, compiling and reporting regional groundwater management data
5. Establish a stakeholder forum to host discussion about groundwater topics and facilitate collaborative action toward resolution of groundwater issues

JUNE 4 MEETING GOAL & OBJECTIVES

GOAL

Clarify through discussion, a plan of action for building collaborative capacity that can reduce risk to groundwater while expanding opportunities to protect groundwater.

OBJECTIVES

1. Discuss opportunities to better protect water supply
2. Describe and discuss a course of action regarding the District's Early Detection and Response Ordinance
3. Further refine discussion on the topic of coordinated land use planning and permitting
4. Consider potential projects that would realize SAG-recommended actions and Basin Management Objectives
5. Summarize findings of existing reports on stormwater-groundwater relationship

OPPORTUNITIES TO BETTER-PROTECT GROUNDWATER

Source Water Protection Map

The concept of a Lake Tahoe Basin-wide source water protection map arose in group discussion at several points during workshop #2. Such a map was referred to 1) as a tool in the context of mapping private well and associated water system vulnerability and 2) as a tool for triggering project review by water purveyors where re/development projects may have connectivity to source waters 3) as a mechanism for expanding source water protections vis-à-vis land use, development, redevelopment and Tahoe Regional

Planning Agency policy and project certifications and 4) as a means of working with the city, county and Lahontan to identify instances where source waters are at risk due to exposure to contaminants via stormwater infrastructure.

In this, workshop #3, Bergsohn shared the recently-updated District Groundwater map and Maley presented several individual layers of maps that will be incorporated into the plan document. The group looked at the map and asked some questions. The group observed that the best source water resources correspond geographically to where there is the densest development. Bergsohn cited hydrogeology, cost and potential contaminant avoidance as the primary drivers of well placement.

The map presented is a map of only the District wells. Lukins has indicated they would like to collaborate on a map reflecting their wells also and Trischler has indicated the Keys is willing to consider it.

Existing Programs with a Nexus in the GWMP

The group reviewed the table “GWMPUP Agency Programs”. The following adjustments to page 2 were provided:

AGENCY	PROGRAM	SUB-PROGRAM
TRPA	Add Environmental Improvement Program	
	Add Chapter 60 – Source Water Protection	
LRWQCB	Characterize the Basin Plan as a key document – not as a program	
	Underground Storage Tank Program has 3 Components	
		Leak Prevention
		Leak Detection
		Site Cleanup
	Watershed Management Initiative has become part of the Integrated Regional Water Management Plans	
	Site Cleanup Program - PCE	
		Waste Discharge Requirement
	Land Disposal	

Education

Members of the SAG emphasized (as in workshops 1 and 2) that the District could gain a lot of ground in raising awareness about groundwater and educating a variety of user groups about stewardship by collaborating and leveraging existing programs – education programs, permitting programs, and others. Singer suggested, “The District should strategically put itself out there. And say, ‘we want to work with other entities’, maybe not even the ones that are in this room, but others, and ‘we are willing to do some training that might be appropriate to help t hem be our eyes and ears’. Not from a regulatory perspective, but education. I think that again sets that signal from the District that they want to work together with people and we are all in this together. You know the saying, "it takes a community to raise a kid". Well, it takes a community to protect your groundwater.

EARLY DETECTION IMMEDIATE RESPONSE ORDINANCE

The District requested input from the Strategic Advisory Group regarding the fate of the District's Early Detection Immediate Response Ordinance.

IN THE POST-MTBE TAHOE BASIN, "IT'S PRETTY MUCH A BULLETPROOF SYSTEM UNDERGROUND"

Present and future risk to groundwater from fuel underground storage tanks in operation – qualitative group consensus - LOW

Ivo Bergsohn asked Greg Daum, "Is there a real need for the extensive and detailed groundwater monitoring in the ordinance?" to which Daum replied, "After the MTBE issue, it is pretty much a bulletproof system underground." Daum and Lauritzen in particular, and others generally, described how all underground fuel storage tanks are double walled and alarmed. The alarmed systems are automatic—not under human control. Service station staff are notified regarding procedures in the event the alarm sounds. The County requires monthly spill and emergency response training at the service stations. The general consensus of the group is that adequate protections are in place to prevent underground fuel leaks and to respond to them in the event of an occurrence.

Present and future risk to groundwater from trace fuel remaining underground after closure of cleanup sites – LOW but the District should retain the right to place sentinel wells where there is concern

Continuing the focus on risk associated with fuel to groundwater the discussion shifted to scenarios other than underground storage tank leaks that might pose a threat. The State of CA and the District do not have the same numeric standard for MTBE detection. This means that the state fund supporting site cleanup requires closure of the cleanup site at a point that may in some cases be in advance of when the District would close the cleanup proceedings. Because the District has a no detect policy for MTBE in groundwater the District has concern that some closed cleanup sites could pose a future risk to water supply. The SAG generally indicated that for specific instances where this is the case the District should retain the right to place sentinel wells that would signal whether these sites were in the present or future able to impact source water.

It was noted that there are a few instances where service stations that are closed and have not been in operation for some time have not cleaned up or closed the sites according state protocol. These could be future potential contaminant sources. The state is actively litigating these cases. These are another example of a scenario that merits the District maintaining the right to place sentinel wells.

Maintain provision enabling District observation/sentinel wells near potential contamination sources

There are potential contaminant sources in the Basin other than fuel. The SAG advised the District to modify the current ordinance language to allow the District to use sentinel wells in *any* scenario where there is concern about potential contamination from *any* potential contaminant.

Create a mechanism enabling the District to create and implement Emergency Response Plans at the time of an incident of release of any potential contamination in any scenario

Underground fuel storage tank emergency response procedures are in place, quite robust and have the confidence of those who know them (Daum, Lauritzen).

However, there are other emergency scenarios—where fuel could be a potential contaminant—that deserve the District's attention.

The group indicated there is substantial risk that fuel-in-transport poses a risk to source water. The group suggests a District review of existing emergency response protocols for fuel transport emergencies.

The group also suggests a the District prioritize a long-term coordination effort between the District, County, City and Lahontan to prepare for targeted source water protection response to fuel transport emergencies: create a GIS layer on the SWP map indicating what kind of stormwater BMPs are located where, creating generic emergency response plans that can be tailored quickly to the specific site of an incident, creating a list of qualified and ready emergency response contractors, etc.

While fuel transport was identified as a high risk scenario that should be prioritized, the SAG recommended that a similar emergency response mechanism be created by the District to anticipate emergency response in the event of contamination by non-fuel contaminant sources.

It was noted that the District should collaborate with emergency first responders to determine in advance what the right interface should be between the District and these agencies during emergencies.

Risk scenarios are of a wide variety. Create a mechanism that will be relevant given this variability. The SAG indicated that the District maintaining an emergency response policy and creating the mechanisms to tailor response to a wide array of scenarios should be a high priority of the groundwater management plan. The SAG deferred to the District to determine whether such a policy ought to be in an ordinance.

MEETING NOTES

DATE	Wednesday, September 24, 2014, 9:00-12:00
LOCATION	South Tahoe Public Utility District Offices, Board Room, 1275 Meadow Crest Drive
STRATEGIC ADVISORY GROUP CORRESPONDENCE LIST	Robert Lauritzen (El Dorado County), Jason Burke (City of South Lake Tahoe), Scott Carroll (CA Tahoe Conservancy), Greg Daum (Meyers Chevron), Doug Smith, Brian Gray and Tom Gavigan (Lahontan Regional Water Quality Control Board), Paul Nielsen (TRPA), Steve Morales (LT Unified School District), Harold Singer (Community Rate Payer), Richard Solbrig, John Thiel, Terry Powers, Ivo Bergsohn (STPUD), Mike Maley (Kennedy/Jenks), Michelle Sweeney (Allegro Communications), Brad Herrema (STPUD Attorney, via telephone)
MEETING HOSTS	Ivo Bergsohn (STPUD), Mike Maley (Kennedy/Jenks)
FACILITATOR	Michelle Sweeney (Allegro Communications)

GROUNDWATER MANAGEMENT PLAN UPDATE GOALS

1. Update the Groundwater Management Plan to meet CA legislative requirements and DWR guidelines
2. Update the District ordinance for protecting and monitoring groundwater quality
3. Develop Groundwater Basin Management Objectives (BMOs) to provide a framework for maintaining a sustainable and reliable groundwater supply
4. Create a plan for collecting, compiling and reporting regional groundwater management data
5. Establish a stakeholder forum to host discussion about groundwater topics and facilitate collaborative action toward resolution of groundwater issues

SEPTEMBER 24 MEETING GOAL & OBJECTIVES

GOAL

Receive comment and suggested edits to the Draft Groundwater Management Plan. Discuss.

OBJECTIVES

1. Share comment received prior to meeting
2. Gather additional SAG member comment on the document
3. Discuss key topics that will benefit from group discussion
4. Share steps to document completion
5. Request endorsement of the Groundwater Management Plan document by SAG

AVAILABILITY OF TRANSCRIPTS OF ALL 2014 GWMP SAG WORKSHOPS

All four GWMP Strategic Advisory Group workshops in 2014 were audio recorded. The audio record, transcripts, a “notes navigator” (an excel table summarizing the transcripts) and the meeting notes documents are available through South Tahoe Public Utility District. The meeting notes (such as this document) are derived from notes taken real-time during the workshops by the facilitator and from the transcripts.

OVERVIEW OF COMMENT RECEIVED ON GROUNDWATER MANAGEMENT PLAN

Comment Received Prior to September 24 Workshop, by Reference

Extensive comments from Lahontan Regional Water Quality Control Board were submitted in an all-Strategic Advisory Group email on September 16t, titled, RE: TVS GMP SAG Review Draft - Text. Harold Singer, ratepayer submitted comments orally to Mike Maley and Ivo Bergsohn on September 18. The written record of this comment exists only in the margins of Mike Maley and Ivo Bergsohn's draft GWMP documents. The third and final comment submitted prior to the September 24 workshop was from Jason Burke, City of South Lake Tahoe, in a September 17 email also titled, RE: TVS GMP SAG Review Draft – Text.

Comment Received During September 24 Workshop

Strategic Advisory Group members who had not already submitted comment on the draft Groundwater Management Plan document were invited by Ivo to open the comment period at the workshop. These comments were fairly minimal and can be summarized as follows:

- The Tahoe Regional Planning Agency submitted no comment.
- El Dorado County would like to see updates to small water system oversight assignments in the plan (at the county and state level) to be up-to-date with recent changes in these responsibilities. (ie, Some systems have previously shifted from the purview of the county to the purview of the state.)
- The City is in agreement with the language that says stormwater managers "should consider" source water protection in building and managing facilities.

Comment Opportunities After September 24 Workshop

Strategic Advisory Group members are invited to submit comment throughout the open review period of the Groundwater Management Plan document (anticipated to be throughout much of the month of November, 2014).

KEY TOPICS

Timing of Groundwater Management Plan Finalization

Groundwater (and source water generally) in the Lake Tahoe Basin at-large and in this Tahoe Valley South Basin is protected through the collaborative effort of many agencies striving to work in coordination. The efficacy of groundwater protection correlates in part to the thoroughness of the participating agencies in implementing a comprehensive plan. Efficacy also correlates to the quality and integrity of the plan itself. The plan should, as Doug Smith of Lahontan put it, "be a living document"—meaning that the plan should identify current challenges to protecting groundwater and promote creation of the organizational and informational context for solving such problems.

Doug Smith underscored that absent a thorough explanation of this collaboration, and the groundwater protections afforded by it, that the Groundwater Management Plan document is (in his and the Lahontan Board's estimation) incomplete and flawed to the extent it shouldn't be published.

Smith asked three questions: 1) To what degree are we collaborating right now? 2) Is this GWMP document to submit to DWR this year but for all of us at the table (in reality) more like a working draft? 3) Or is the GWMP actually complete (in the District's estimation) and not going to be looked at or utilized in the interval before the next required update (5 years)?

The Problem Remains: Sites that the State has closed investigation of and remediation on are currently contaminating water supply

Ivo Bergsohn's criticism of the draft Groundwater Management Plan is that it fails to identify a path to solution of existing PCE contamination problems within the basin. It also fails to make clear the "impact of well contamination on drinking water sources". "That's an issue that is going to get even more difficult to address in the not-too-distant future because of the phase out of the Underground Storage Tank program (the funding for cleanups)," says Bergsohn. He goes on to say that the District's MtBe policy provides protection for the consumer but that there needs to be more than this District policy to protect groundwater (and public health).

Bergsohn's September 24 questions to the SAG on this subject are: 1) Whose responsibility is it to stop contamination and remediate? 2) Absent the state performing these tasks is it incumbent upon the District to do so (including coming up with funding to do so)?

The life of the Groundwater Management Plan is Synonymous with the existence of a Strategic Advisory Group

Richard Solbrig highlighted three areas he would like the GWMP to address in concrete terms saying…

The District needs a collaborative forum (of agencies protecting groundwater) in which to address: 1) Sustainability Agency designation 2) Historical PCE contamination impacts on present day water supply and 3) USFS groundwater management policy.

The facilitator asked, "Does the District intend to commit the resources to host an ongoing strategic advisory group in the interval between now and the next update over the next five years?"

Bergsohn responded, "I think the District's existing ordinance is supposed to meet at least two times a year. Do you think that's adequate?" (asked of Richard Solbrig)

Solbrig clarified, "I think with just those three topics highlighted (above) we are going to certainly need more than two meetings a year in terms of the group that is going to move forward and start working on some of the goals identified in this document."

What is Lahontan asking the District to commit to doing right now? | What is Lahontan willing to commit to doing right now?

Doug Smith indicated that Lahontan is ready to commit the time and resources to work toward collaborative solutions regarding PCE contamination investigation and abatement saying, "We need to create synergy on this issue and that synergy needs to be reflected in the GWMP document".

Smith iterated several times during the workshop that Lahontan wants the District to acknowledge that ground water is protected in this basin through collaborative work. Smith asked that this be a central theme woven throughout the GWMP document itself. He committed

Lahontan staff to work collaboratively with the District both in the near term (to bring the document to an acceptable state of completion) and in the long term.

What is the District asking Lahontan and other affected parties to commit to doing right now? | What is the District willing to commit to doing right now?

The District is asking all parties present to approve (once requested revisions are made) a GWMP document that can be adopted by the District Board in the 2014 calendar year.

Richard Solbrig proposed, "Why don't we identify a sequence of steps for working to resolution on the current PCE problem in the GWMP document and commit to it?" and proposed the following steps: 1) gain commitment of stakeholders to working to resolution of existing PCE problem with sub-steps a) identify the source of the problem and b) assess the impact of the existing PCE problem. Solbrig added that this is not a new problem. It has been over a decade since the problem was identified and in that time much has been done to address it. He envisions the committee convened to address this issue in 2015 as a proactive mechanism to synthesize the extensive information that has been researched on this subject.

An approved Groundwater Management Plan before the close of 2014 is vital to groundwater protection.

The attorney for the District, Brad Herrema, clarified that the rationale behind a GWMP document approval before the end of 2014 has to do with a number of factors. The bottom line is that the District's assessment of the basin's best option for proactively protecting the groundwater resource lies in having an approved GWMP before the close of 2014. (The rationale was persuasive and changed the tenor of Lahontan's request. Before this clarification Smith was asking whether the adoption of the plan might not be undertaken after the first of the year in order to allow for more drastic revision of the GWMP. After this clarification Smith agreed that adoption before the end of 2014 would be for the greater benefit of groundwater protection.)

The BMO "Maintain and Protect Groundwater Quality" will have a sub-element committing to the convening of a group/committee to resolve current PCE contamination

Discussion resulted in the group recommendation that the BMO "Maintain and Protect Groundwater Quality" have a sub-element committing to the District's convening a group/committee to resolve the current PCE contamination issue and its ramifications. (For clarification. No PCE is currently getting into water supply or being used in the basin. PCE is present in the water supply due to historic uses of it.)

Other highlights of discussion on this topic were:

- Creating such a committee would be helpful not only in terms of addressing the PCE issue, but also in terms of serving as an example or "pilot" for the District working more collaboratively to resolve issues.
- By creating this committee we are creating an opportunity to assemble more than a decade of information on the PCE issue.
- Doug Smith said, "Hearing Richard say that he wants this to be a living document gives me confidence that what is going to be said in this document will work for everybody".

Smith indicated that Lahontan would be in support of GWMP document approval. before the end of 2014 (assuming collaborative work toward this end would take place).

- It was suggested that the PCE committee might be the group that evolves (with shifting membership) into a committee whose membership morphs with the subject at hand (ie this committee might be the SAG at least initially).

The District is committed to taking steps in 2015 toward bringing groundwater protection to a higher level of sophistication in the context of land use planning

Paul Nielsen, in dialogue with the group, came to these general conclusions based on discussion in the previous three SAG workshops. The path forward starts by the District and Nielsen meeting in early January 2015 to touch base on the subject of coordinating agency process in order to:

- Incorporate the updated source water / groundwater protection map into appropriate TRPA planning documents
- Create a collaborative, interagency program of action
- Initiate a stand-alone committee that would focus on the subject of upgrading ground water protections in land use planning (not the same committee as the PCE committee)

Alternative to a group endorsement of the Plan document group members are invited to submit a letter of support for ongoing collaboration for groundwater protection

Alternative to a group letter of endorsement of the GWMP the group arrived at the notion of having individual agency/person letters verifying their active participation in the process and enthusiasm for/commitment to? A long-term groundwater protection agenda.

There will be ongoing communication between the District and Lahontan as sections are revised to integrate Lahontan comment

The full Strategic Advisory Group adjourned and a subset of the group met for 30 minutes to coordinate specific actions regarding integration of Lahontan's edits into the draft final Groundwater Management Plan document. In this time participants committed to ongoing communication between the District and Lahontan as sections of the document undergo revision to incorporate Lahontan comment.

Solbrig and Bergsohn committed to design a path that would result in a GWMP 2015 Implementation Plan to be integrated into District overall work plans. Aspects of this plan pertinent to other agencies' work planning (TRPA, Lahontan, the City, water purveyors) will then be brought to the attention of these agencies in the first quarter of 2015.

ACTION ITEMS

The following table summarizes action items discussed by the Strategic Advisory Group in the course of the September 24 workshop.

ACTION	IMPLEMENTER	TIMEFRAME

Update oversight assignment for small water systems	Maley	For final GWMP
Draft sample content of letter of support	District staff	For final GWMP
Draft executive summary of GWMP	Maley/Bergsohn	For final GWMP
In the context of the BMO "Maintain and Protect Groundwater Quality" create a sub-element articulating the District's commitment to convene a group to resolve current PCE contamination issues	Maley	For final GWMP
Meet with Paul Nielsen in January to integrate program of ground water protection upgrades into TRPA annual and long-range planning	Bergsohn (or assigned District staff)	By January 2015
Send admin draft of revised GWMP to all SAG members for review	Bergsohn	October/November 2014
GWMP Executive summary, a paragraph in Section 4 and mentions throughout the GWMP as appropriate will underscore the vital role of collaboration to accomplishing groundwater management goals	Maley	For final GWMP
Design Groundwater Management Implementation 2015 Work Plan document	Bergsohn (or assigned District staff)	January 2015

Appendix F

Preliminary Groundwater-Related Agency Programs Table

AGENCY	PROGRAM	SUB-PROGRAM Level I	SUB-PROGRAM Level II	PLANS	KEY DOCUMENTS	ADDRESS	MONITORING	KEY DOCUMENTS	ADDRESS
EDCEMD									
	Environmental Health	Small Water Systems		X	Bacteriological Sample Siting Plan Requirements	http://www.edcgov.us/Government/EMD/EnvironmentalHealth/Bacteriological_Sample_Siting_Plan_Requirements.aspx	X	Community Water Systems using a Groundwater Source	http://www.edcgov.us/Government/EMD/EnvironmentalHealth/Sampling_Requirements_for_Community_Water_Systems_using_a_Groundwaster_Source.aspx
				X	Water Quality Emergency Notification Plan	http://www.edcgov.us/Government/EMD/Forms/Water_Quality_Emergency_Notification_Plan.aspx	X	Non-Transient/Non-Community Water Systems using a Groundwater Source	http://www.edcgov.us/Government/EMD/EnvironmentalHealth/Sampling_Requirements_for_Non-Transient_Water_System_using_Groundwater_Source.aspx
				X	Annual Water Quality Report	http://www.edcgov.us/Government/EMD/EnvironmentalHealth/Annual_Water_Quality_Report.aspx	X	Non-Community Water Systems using a Groundwater Source	http://www.edcgov.us/Government/EMD/EnvironmentalHealth/Sampling_Requirements_for_Non-Community_Water_Systems_using_a_Groundwater_Source.aspx
		Water Well		X	Policy 800-02: Adequate Water Supply	http://www.edcgov.us/Government/EMD/EnvironmentalHealth/Policy_800-02_water_supplies.aspx	X	Report of Well Production	http://www.edcgov.us/Government/EMD/Forms/WELL_PRODUCTION_REPORTS.aspx
				X	Well Standards Ordinance Chapter 8.39	http://www.edcgov.us/Government/EMD/EnvironmentalHealth/Well_Standards_Ordinance.aspx			
				X	Monitoring Well/Soil Boring Permit Conditions	http://www.edcgov.us/Government/EMD/SolidWaste/Monitoring_Well_Soil_Borning_Permit_Conditions.aspx			
	Hazardous Materials	Certified Unified Program Agency (CUPA)		X	California Environmental Reporting System (CERS)	http://www.calepa.ca.gov/CUPA/EReporting/default.htm			
			Above Ground Storage Tanks (ASTs)	X	Spill Prevention Control and Countermeasure (SPCC) Plan Requirements	http://www.calepa.ca.gov/Cupa/Aboveground/FactSheetSPCC.pdf	X	AST Inspection Logs and Schedules	http://www.edcgov.us/Government/EMD/HazardousMaterials/Above_Ground_Storage_Inspection_Logs.aspx
			Underground Storage Tanks (USTs)	X	UST Ordinance No. 4332	http://www.edcgov.us/Government/EMD/HazardousMaterials/Underground_Storage_Tank_Ordinance_No__4332.aspx	X	UST Ordinance No. 4332- Attachment “C” Sampling Protocol	http://www.edcgov.us/Government/EMD/HazardousMaterials/UST_Ordinance_No__4332_-_Attachment_C.aspx

AGENCY	PROGRAM	SUB-PROGRAM Level I	SUB-PROGRAM Level II	PLANS	KEY DOCUMENTS	ADDRESS	MONITORING	KEY DOCUMENTS	ADDRESS
EDCEMD	Hazardous Materials	Certified Unified Program Agency (CUPA)		X	UST Closure Guidelines	http://www.edcgov.us/Government/EMD/HazardousMaterials/Underground_Storage_Tank_System_Closure_Guidelines.aspx	X	UST Ordinance No. 4332- Attachment "D" Sampling Protocol	http://www.edcgov.us/Government/EMD/HazardousMaterials/UST_Ordinance_No__4332_-_Attachment_D.aspx
			California Accidental Release Program (CalARP)	X	CCR Title 19, Division 2, Chapter 4.5- CalARP Regulations	http://www.calarp.com/CalARP%20Regs.pdf			
			Hazardous Materials	X	Hazardous Materials Ordinance, Chapter 8.38	http://www.edcgov.us/Government/EMD/HazardousMaterials/Hazardous_Materials_Ordinance,_Chapter_8_38.aspx			
				X	Hazardous Materials Inventory	http://www.calepa.ca.gov/Publications/Title27/Hwf2731.pdf			
				X	Site Investigation, Site Remediation, Monitoring Well and Soil Boring Program Requirements	http://www.edcgov.us/Government/EMD/HazardousMaterials/Site_Remediation.aspx			
			Hazardous Waste Generator	X	Hazardous Waste Management Plan (HWMP)	http://www.edcgov.us/Government/EMD/HazardousMaterials/hwmp_v1.aspx			
						http://www.edcgov.us/Government/EMD/HazardousMaterials/hwmp_v2.aspx			
						http://www.edcgov.us/Government/EMD/HazardousMaterials/hwmp_v3.aspx			

AGENCY	PROGRAM	SUB-PROGRAM Level I	SUB-PROGRAM Level II	PLANS	KEY DOCUMENTS	ADDRESS	MONITORING	KEY DOCUMENTS	ADDRESS
EDCEMD	Hazardous Materials	Certified Unified Program Agency (CUPA)	Storm Water Pollution Program	X	Lake Tahoe Basin Storm Water Management Plan	http://www.edcgov.us/Government/EMD/HazardousMaterials/Lake_Tahoe_Basin_Storm_Water_Manangement_Plan.aspx			
					Minimum Construction Site Storm Water Management Practices	http://www.edcgov.us/Government/EMD/HazardousMaterials/Storm_Water_Minimum_Construction_Site_Practices.aspx			
TRPA									
	Water Quality/StormWater Management			X	Lake Tahoe Water Quality Management Plan – Chapter 9 Groundwater Programs	http://www.trpa.org/wp-content/uploads/Final-U.S.-EPA-Adopted-Lake-Tahoe-208-WQMP_2013.06.19.pdf			
LRWQCB									
	Basin Plan			X	Lahontan Basin Plan- Chapter 5 Lake Tahoe Basin	http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/2014bpa/ch5.pdf			
	Non-Point Source Program			X	Nonpoint Source Pollution (NPS) Control Program	http://www.waterboards.ca.gov/water_issues/programs/nps/plans_policies.shtml			
	Storm Water			X	Board Order R6T-2011-0101NPDES Permit for the City of South Lake Tahoe, El Dorado County, and Placer County Storm Water/Urban Runoff Discharge	http://www.waterboards.ca.gov/lahontan/water_issues/programs/tmdl/lake_tahoe/npdes.shtml	X	Storm Water Multiple Application and Reporting Tracking System (SMARTS)	https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.jsp
	Underground Storage Tanks (USTs)			X	GW Cleanup and CZ Policy – SB Resolution 92-49	http://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1992/rs1992_0049.shtml			
				X	Low Threat UST Case Closure Policy	http://www.waterboards.ca.gov/water_issues/programs/ust/lt_cls_plcy.shtml#policy081712			
				X	Low Threat Case Closure Implementation Plan	http://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2012/110612_6_final_ltcp%20imp%20plan.pdf			
	Water Management Initiative (WMI)			X	Upper Truckee River Watershed (2.2)	http://www.waterboards.ca.gov/lahontan/water_issues/programs/watershed_management/docs/final_02_ut22.pdf			
				X	Groundwater Program Activities	http://www.waterboards.ca.gov/lahontan/water_issues/programs/watershed_management/docs/final_02_grounwater_sec311.pdf			
CSLT									
	Stormwater Program			X	CSLT Storm Water Ordinance	http://www.cityofslt.us/DocumentCenter/View/2719			

SOUTH TAHOE PUBLIC UTILITY DISTRICT
2014 GROUNDWATER MANAGEMENT PLAN UPDATE
GROUNDWATER-RELATED AGENCY PROGRAM

AGENCY	Key Documents	Address	Comments
LRWQCB	LAKE TAHOE TMDL		
	TMDL Technical Report	http://www.waterboards.ca.gov/lahontan/water_issues/programs/tmdl/lake_tahoe/docs/techrpt.pdf	Page 4-19 addresses concerns regarding infiltration basins and urban infiltration potential impacts to groundwater
	Synthesis of Information for Infiltration BMP Design and Maintenance	http://www.2ndnaturellc.com/wp-content/uploads/2011/09/BMPSynthesisFinal_reduced.pdf	Study of existing information regarding risks of stormwater treatment and infiltration to groundwater
	Detention Basin Treatment of Hydrocarbons	http://www.2ndnaturellc.com/wp-content/uploads/2011/09/SLT_hydro_Final1.pdf	Study of existing detention basins and effects on groundwater quality
	Lake Tahoe BMP Monitoring Evaluation Process	http://www.2ndnaturellc.com/wp-content/uploads/2011/09/FinalReport_BMPSynthesis.pdf	Synthesis of existing research, includes multiple studies covering the migration from surface water to groundwater in various treatment systems
	Water Quality Performance Evaluation of Park Avenue Detention Basins, City of South Lake Tahoe	http://www.2ndnaturellc.com/wp-content/uploads/2011/09/Park-Ave-WQ-Study.pdf	Study of Park Avenue Basins, including surface water infiltration to shallow groundwater
	Lake Clarity Crediting Program (LCCP)	http://www.waterboards.ca.gov/lahontan/water_issues/programs/tmdl/lake_tahoe/#imp	Establishes TMDL crediting process, requires verification of basin maintenance (BMP RAM) in order to maintain TMDL credits
	Road RAM - Methodology Tech. Document	http://www.2ndnaturellc.com//wp-content/uploads/2011/09/Road_RAM_Technical_Document_FINAL.pdf	
	Road RAM - User Manual	http://www.2ndnaturellc.com/wp-content/uploads/2011/09/Road_RAM_User_Manual_FINAL.pdf	
	BMP RAM - Tech. Document	http://www.2ndnaturellc.com/wp-content/uploads/2012/08/BMP-RAM-Technical-Document1.pdf	BMP RAM is how the City must verify basin maintenance in order to keep the LCCP credits per the TMDL
	BMP RAM - User Manual	http://www.2ndnaturellc.com/wp-content/uploads/2012/08/BMP-RAM-Users-Manual-V.1.pdf	
TSC	Tahoe Basin Regional Stormwater Monitoring Program (RSW	http://www.tahoescience.org/wp-content/uploads/2011/10/RSWMP-Phase-I-document-3_26_08.pdf	
TRCD	Tahoe Basin Stormwater Monitoring	http://tahoercd.org/stormwater-watershed-monitoring-reports/	Links to Implementers' Monitoring Program (Component of RSWMP) reports
	(Stormwater) Monitoring Plan	http://tahoercd.org/wp-content/uploads/2013/08/Implementers-MP-130812.final_.pdf	
	2014 Monitoring Report	http://tahoercd.org/wp-content/uploads/2014/03/Interim-IMP-Monitoring-Report-WY2014-140310.pdf	
	Tahoe Basin RSWMP Phase I	http://tahoercd.org/wp-content/uploads/2013/03/RSWMP-Phase-I-Document.pdf	
	Tahoe Basin RSWMP QAPP	http://tahoercd.org/wp-content/uploads/2013/03/RSWMP-QAPP-110510.pdf	
	Tahoe Basin RSWMP SAP	http://tahoercd.org/wp-content/uploads/2013/03/RSWMP-SAP-110510.pdf	
CSLT	Pollutant Load Reduction Plan	http://www.waterboards.ca.gov/lahontan/water_issues/programs/tmdl/lake_tahoe/docs/cslt_plrp.pdf	
	Stormwater Management Plan	http://www.waterboards.ca.gov/lahontan/water_issues/programs/tmdl/lake_tahoe/docs/csltswpm.pdf	
TRPA	2000 Lake Tahoe Source Water Protection Program (Includes a 1999 Source Water Assessment map inset for the CSLT)	http://www.trpa.org/wp-content/uploads/entire-swapp.pdf	An updated Source Water Assessment Map for CSLT inset is an information need in the GW Management Plan that would benefit stormwater treatment system planning
	TRPA Code - Chapter 60: Water Quality	http://www.trpa.org/wp-content/uploads/Chapter-60.pdf	60.3 - Source Water Protection
STPUD	Detention Basin Treatment of Hydrocarbon Compounds in Urban Stormwater	http://www.2ndnaturellc.com/wp-content/uploads/2011/09/SLT_hydro_Final1.pdf	Evaluation of the risk to shallow groundwater from urban stormwater infiltration

Appendix G

STPUD Groundwater Ordinance No. 558-14

SOUTH TAHOE PUBLIC UTILITY DISTRICT

<u>GROUNDWATER MANAGEMENT ORDINANCE</u>

ADDED AS
DIVISION 7, SECTIONS 7.1 THROUGH 7.10
TO THE ADMINISTRATIVE CODE PURSUANT
TO ORDINANCE NO. 558-14

DIVISION 7
OF THE
ADMINISTRATIVE CODE

Section 7.1 Plan Authorization.

7.1.1 Groundwater Management Plan. The District has developed and adopted a Groundwater Management Plan (Plan) for the Tahoe South Subbasin of the Tahoe Valley Groundwater Basin listed as DWR Groundwater Basin 6-5.01, or more conveniently referred to as the Tahoe Valley South Basin (TVS Basin). The Plan is in accordance with Assembly Bill 3030 (AB 3030), also called the Groundwater Management Act (Section 10750 et. seq. of the California Water Code) and Senate Bill 1938 (SB 1938). The purpose of the Plan is to implement Basin Management Objectives (BMOs) to manage Groundwater supplies, protect Groundwater quality, and foster Stakeholder involvement.

7.1.2 Plan Area. For the purposes of carrying out the goals and objectives established in this Plan, the boundaries of the Plan Area will include portions of El Dorado County, the City of South Lake Tahoe, the Community of Meyers and Christmas Valley situated within the TVS Basin to the extent that they lie within the El Dorado County portion of the District's service area.

7.1.3 Groundwater Management Authorization. The District is an authorized groundwater management agency within the meaning of California Water Code Section 10753(a) and assumes responsibility for managing the quantity and quality of the Groundwater resources within the Plan Area pursuant to this Ordinance.

7.1.4 Water Quality Authority. Pursuant to California Water Code section 10754, the District may exercise the authority of a water replenishment district pursuant to Part 4 (commencing with section 60220) of Division 18 for the protection and preservation of the District's Groundwater resources.

7.1.5 Administration. The District, acting by and through its Board of Directors, shall have jurisdiction over Groundwater within the Plan Area and shall have the powers provided by this Division or any other provision of law. The District shall adopt rules, regulations and procedures to implement and enforce this Plan pursuant to California Water Code Section 10753.9.

Section 7.2 Purpose and Intent.

7.2.1 Purpose. The purpose of this Ordinance is to provide the District a mechanism to regulate and protect the Groundwater resources available to the District so that Groundwater will remain a viable potable water resource and be available to be put to the most efficient and beneficial use by the District and its customers. The Plan is a separate report that provides the technical and planning information supporting this Ordinance.

7.2.2 Emphasis on Groundwater Quality Protection. The District has been significantly and adversely affected by past releases of man-made contaminants that have impaired water supplies. The District has expended significant resources to address the loss of production capacity and/or added treatment requirements resulting from groundwater contamination in order to provide its customers with continued high quality drinking water of sufficient quantity to meet their needs. Groundwater quality in the TVS Basin is highly vulnerable to degradation from man-made contaminants and therefore additional protective measures are necessary.

7.2.3 Intent. Because groundwater is the predominant source of drinking water supply within the Plan Area, the District finds it advisable and in the best interests of all water users to develop and implement this Ordinance for comprehensive groundwater management with an emphasis on protecting Groundwater quality within the TVS Basin.

7.2.4 Coordination with Other Authorities. The District will rely on and coordinate with the existing governmental agencies and authorities, including the El Dorado County Environmental Management Department, the Tahoe Regional Planning Agency and the California Regional Water Quality Control Board, Lahontan Region, in order to manage Groundwater quality within the TVS Basin without unnecessary duplication of effort and utilizing consistent standards, to the extent reasonably possible. The District understands and acknowledges that the El Dorado County Environmental Management Department and the California Region Water Quality Control Board, Lahontan Region have other regulatory authority to address groundwater contamination and clean up. The District may, in its discretion, request that other governmental agencies take actions complementary to the actions taken by the District pursuant to this Ordinance, although such governmental agencies exercise their independent discretion with respect to taking action within their jurisdiction.

Section 7.3 Definitions.

7.3.1 Aquifer(s). Aquifer(s) shall mean a geologic formation or group of formations that transmits or stores water in sufficient quantities to supply the Extraction of water by Wells or springs.

7.3.2 Basin. Basin shall mean the TVS Basin (Basin No. 6-5.01) as originally established in California Division of Water Resources (DWR) Bulletins 118 and 118-80.

7.3.3 Contaminants. Contaminants are any physical, chemical, biological, or radiological substance or matter present in any media at concentrations that may pose a threat to human health or the environment.

7.3.4 Contamination. Contamination shall mean the presence of naturally occurring or man-made substances in surface water, Groundwater, soil, sediment or upon the land in quantities that may result in an impairment of Groundwater quality within the Plan Area.

7.3.5 District. District shall mean the South Tahoe Public Utility District, acting by and through the District's Board of Directors or its duly authorized representatives.

7.3.6 Domestic Use. Domestic Use shall have the same meaning ascribed to it by California Code of Regulations, Title 23, Section 660.

7.3.7 Drinking Water Source Protection Area. Drinking water source protection area is comprised of the Aquifer and Recharge area and is delineated using the modified calculated fixed radius method or other methods approved by State Water Resources Control Board – Division of Drinking Water (formerly California Department of Public Health or CDPH), in accordance with the CDPH Drinking Water Source Assessment Protection (DWSAP) Program. The protection areas and zones shall be shown on the DWSAP map.

7.3.8 Extraction. Extraction shall mean the act of obtaining Groundwater by pumping or other controlled means.

7.3.9 Extraction Facility. Extraction Facility shall mean any device or method for the Extraction of Groundwater, including a Well.

7.3.10 fasl. Feet above mean sea level.

7.3.11 Groundwater. Groundwater shall mean the water beneath the surface of the earth within the zone below the water table in which the soil is completely saturated with water, whether or not flowing through known and defined channels.

7.3.12 Groundwater Basin. Groundwater Basin shall mean an Aquifer or system of Aquifers that has reasonably well defined boundaries and more or less definite areas of Recharge and discharge.

7.3.13 Man-Made Contaminants. Man-made Contaminants shall mean regulated industrial and commercial chemicals which degrade Groundwater quality. Man-made Contaminants which occur most frequently in the TVS Basin include petroleum hydrocarbon and chlorinated hydrocarbon compounds.

7.3.14 Monitoring Well(s). Monitoring Well(s) shall mean a Well constructed with a surface seal and a sand filter pack in accordance with accepted design practices in order to provide for the collection of representative Groundwater samples for laboratory analysis. Such Wells may also be used to detect the presence of Contamination, to investigate the extent and monitor the movement of Groundwater Contamination, to monitor water quality or to collect water-level elevation data to aid in determining the direction and rate of Groundwater flow.

7.3.15 Natural Contaminants. Natural Contaminants shall mean undesirable naturally-occurring substances found in water or soil which may result in a degradation of Groundwater quality for those substances. Natural Contaminants which occur in the Basin include radiological substances (uranium, gross alpha activity and radon), arsenic, soluble iron and manganese.

7.3.16 Overdraft. Overdraft shall mean the condition of a groundwater basin where the average annual amount of water extracted for a long-term period, generally 10 years or more, exceeds the long-term average annual supply of water to the basin plus any temporary surplus.

7.3.17 Person. Person shall mean any individual, firm, partnership, limited liability company, partnership, corporation, association or governmental agency. Governmental agency, as used in this Division, shall not include any local agency exempt from the application of this Division pursuant to state law.

7.3.18 Plan. Plan shall mean the District's Groundwater Management Plan and its modifications, and/or supplements.

7.3.19 Real Property. Real Property shall mean the land and everything permanently fixed as a part of it.

7.3.20 Real Property Owner. Real Property Owner shall mean the Person that is vested with ownership, dominion or legal or rightful title to the Real Property.

7.3.21 Recharge. Recharge shall mean the natural or artificial Replenishment of Groundwater storage by percolation or injection of one or more sources of water.

7.3.22 Remediation. Remediation shall mean the clean-up or removal of Contamination from the soil or Groundwater, and any action taken to prevent or minimize the release and/or migration of Contamination into or within the Groundwater Basin.

7.3.23 Replenishment. Replenishment shall mean the spreading or injection of water for the purpose of enhancing Recharge to the Basin, or otherwise adding to the storage of Groundwater within the Basin.

7.3.24 Responsible Party. Responsible Party shall mean the Real Property Owner, the Operator and/or the discharger of man-made contaminants.

7.3.25 Stakeholder Advisory Group (SAG). Stakeholder Advisory Group shall mean the *ad hoc* groundwater management advisory committee appointed pursuant to Section 7.6 of this Ordinance.

7.3.26 Well(s) or Water Well(s). Well(s) or Water Well(s) shall mean any artificial excavation constructed by any method for the purpose of extracting Groundwater. Well or Water Well shall not include:

(1) Oil and gas wells, or geothermal wells constructed under the jurisdiction of the California State Department of Conservation, except those wells converted to use as Water Wells; or

(2) Wells used for the purpose of:

(a) Dewatering excavation during construction, or

(b) Stabilizing hillsides or earth embankments.

Section 7.4 <u>Findings of the Plan</u>

7.4.1 Groundwater Basin. The Basin is a sedimentary geologic basin within the southern portion of the Lake Tahoe Hydrographic Area that occupies approximately 14,800 acres within a structural valley or graben located between the main range of the Sierra Nevada on the west and the Carson Range on the east. Land surface elevations across the Basin range from approximately 6,230 feet above sea level (fasl), along the south shore of Lake Tahoe to more than 7,000 fasl, where glacial moraine deposits contact bedrock on the mid-slopes of the Sierra Nevada, along the west margins of the Basin. Principle surface water drainages overlying the Basin include the Upper Truckee River and Trout Creek.

7.4.2 Business/Economic Dependence on Groundwater Basin. The District and its customers, including the business community and economic vitality of South Lake Tahoe, are almost entirely dependent on Groundwater. Only a small section of the community, Lakeside Park, is supplied water from a surface water source. Visitors to the south shore of Lake Tahoe often compliment on the drinking water of the south shore of Lake Tahoe for its quality and taste. Drinking water, coupled with the pristine quality and image of Lake Tahoe, is a major asset of the community.

7.4.3 Groundwater Recharge. Groundwater recharge is derived from two main sources, which include infiltration of precipitation that falls directly on the land surface overlying the TVS Basin and groundwater that flows into the groundwater basin from the surrounding bedrock. Using the long-term average annual precipitation in the Lake Tahoe Basin and assuming that about 25 percent of this precipitation infiltrated as groundwater recharge, it is estimated that the total groundwater recharge to the Basin is about 9,875 acre-feet per year (AFY).

7.4.4 Groundwater Flow. In general, the movement of Groundwater through the Basin is south to north, toward Lake Tahoe. Areas of Groundwater discharge within the Basin occur along the upper reaches of the Upper Truckee River and Trout Creek, in wetland areas situated near the south shore of Lake Tahoe and directly into Lake Tahoe, where basin-fill deposits intersect the shoreline. Additional sources of Groundwater discharge include Groundwater pumping, evapotranspiration and seepage to springs.

7.4.5 Groundwater Levels. The basin-fill deposits consist of sequences of sand and gravels which are inter-layered with silts and clays. The sand and gravel deposits form the principal water-bearing reservoirs (Aquifers), while the silt and clay deposits form confining layers (aquitards) which retard the movement of Groundwater. Where these confining layers separate adjoining Aquifers, the water level elevations measured in these Aquifers may differ. As a result, Groundwater levels within the Basin may vary with respect to location and construction of the Wells in which the water level is measured. Local fluctuations in Groundwater levels occur within the Basin in response to seasonal changes in groundwater recharge, evapotranspiration and the hydraulic influences of pumping Wells.

7.4.6 Overdraft Potential. The overall trend of the groundwater elevation data indicates that extractions are not causing any chronic lowering of groundwater levels. As groundwater levels have been relatively stable over a long-term period, changes in groundwater storage are not apparent. Existing regulatory policies limiting growth within the Plan Area further minimize the potential for the development of overdraft conditions within the Basin.

7.4.7 Potential for Land Subsidence. Inelastic (i.e. irreversible) land surface subsidence can occur in a groundwater basin that contains compressible sediments if groundwater levels decline substantially below the historically lowest groundwater level. This process can only occur once; therefore, if sediments have been previously compacted due to high lithostatic loads or previous low groundwater levels, then no further subsidence can occur. The sediments in the Basin have experienced loading due to its glacial history. Therefore, any potentially compressible layers have already been compacted so that no further compaction can occur. Because of the geologic history and minimal overdraft potential, land subsidence is not considered an issue of concern.

7.4.8 General Water Quality. Groundwater within the Basin has excellent chemical quality and is suitable for Domestic Use and public water supply. For most constituents, Groundwater within the Basin meets all drinking water quality standards, including California Drinking Water Primary and Secondary Maximum Contaminant Levels (MCLs). However, there have been few instances where, either because of the presence of natural or man-made Contaminants, MCLs have been exceeded.

7.4.9 Natural Contaminants. The presence of these natural contaminants may limit areas of the Basin from providing water supply or require expensive treatment and thereby reduce the volume of groundwater available for water supply to the community.

7.4.10 Vulnerability to Man-Made Contaminants. Groundwater has been adversely affected by releases of man-made contaminants and resultant degradation of groundwater quality. Areas of degraded groundwater quality persist and continue to impair water supplies located near or within commercial areas of the Basin.

Section 7.5 Basin Management Objectives

7.5.1 Overview of Basin Management Objectives. Basin Management Objectives (BMOs) are required in the Plan under the California Water Code (CWC) § 10753.7 (a) (1). BMOs are described in Section 8 of the Plan. Actions to be undertaken when there is failure to meet BMOs goals for Groundwater Quality are presented in Section 7.7 of this Ordinance.

7.5.1 BMO Goals for Groundwater Quality in the Basin. The Plan shall establish quantitative Basin Management Objectives that Maintain and Protect Groundwater Quality consistent with AB 3030, SB 1938 and other regulations and policy.

(1) All groundwater supply wells in the Basin will meet drinking water standards as defined by the State Water Resources Control Board Division of Drinking Water (DDW) [formerly the California Department of Public Health (CDPH)].

(2) Groundwater quality in the Basin will not be impaired so as to affect its beneficial use of current or potential future use of groundwater for municipal water supply as defined by the LRWQCB Basin Plan.

(3) Detection of contaminants from regulated industrial and commercial chemicals in any well in the Plan Area will be evaluated as to its potential as an emerging groundwater quality threat to the water supply.

(4) Information on areas of degraded water quality will be collected and maintained in order to consider its effect on available water supply under the District's Methyl Tertiary Butyl Ether (MtBE) policy and the development of future groundwater supplies.

7.5.3 Basin Monitoring Program. The purpose of the Basin Monitoring Program is to protect and/or enhance the quality and quantity of water within the Basin. The Basin Monitoring Program shall consist of the specific measures identified in the Plan and can include data from both existing monitoring wells and new monitoring wells. The Basin Monitoring Program may be modified by adding/removing wells over time based on the ongoing assessment of groundwater conditions and modifications will be addressed in the Annual Reports and Plan updates.

(1) *Groundwater Level Monitoring.* Groundwater level measurements will be collected by the District at designated groundwater supply and monitoring wells as designated by the Plan. Data will be collected consistent with protocols provided in the Plan and other supporting documents. Additional groundwater level data will be compiled from other agencies that collect data in the Basin.

(2) *Groundwater Quality Monitoring.* Samples for groundwater quality will be collected by the District at all public water system supply wells in accordance with the requirements of DDW. Groundwater quality samples will be collected at monitoring wells as designated by the Plan, and collected consistent with protocols provided in the Plan and other supporting documents. Additional groundwater quality data will be compiled from other agencies that collect data in the Basin. Groundwater samples shall be sent to an accredited analytical laboratory for chemical analysis within the appropriate holding times for specific analytes.

7.5.4 Data Review. Data shall be reviewed with respect to historical data for each sampling location to assess changes in trends. Groundwater quality data will be compared to drinking water quality standards as defined by the DDW, and the water quality objectives provided in the LRWQCB Basin Plan. All data from the Basin Monitoring Program shall be reviewed by, or under the supervision of, licensed engineers, geologist, or hydrogeologists or other Persons qualified in hydrology or hydrogeology.

7.5.5 Potential Actions. If Basin BMO Goals are not being achieved, the District shall present its findings to the Stakeholder Advisory Group to gather additional input for developing a course of action and determining whether making recommendations of actions to the Board or regulatory agencies is necessary.

Section 7.6 Groundwater Management Program

7.6.1 Establishment of Stakeholder Advisory Group. The District shall appoint a Stakeholder Advisory Group consisting of individual Persons who reside within the boundaries of the District or who represent a governmental agency, and who have demonstrated their commitment to protecting Groundwater resources. The Stakeholder Advisory Group shall: 1) provide information and insight on key groundwater issues affecting groundwater management of the Basin; 2) provide a framework to expand and improve interagency collaboration particularly in the areas of regulatory oversight, coordinated land use planning, data collection and public education; and 3) provide review and input during updates to the Plan. The purpose of the group is also to enable citizens in the District and representatives of governmental agencies to provide a forum for the presentation of findings from groundwater quality monitoring and the evaluation of potential threats to groundwater supplies. The group will operate on principles of collaboration and consensus. Representation shall be balanced among the general interest categories as follows: California Regional Water Quality Control Board, Lahontan Region, El Dorado County, Tahoe Regional Planning Agency, City of South Lake Tahoe, National Forest Service, a Real Property Owner, an Operator, a water purveyor, a business community rate payer, a non-business community rate payer and such other persons as the District deems desirable or advisable. The Stakeholder Advisory Group may advise the District on all matters included within the purposes and provisions of this Division and may comment on rules, regulations and procedures which may be considered for adoption by the Board pursuant to this Division.

7.6.2 Public Education and Community Relations. It is essential to involve the public and the commercial and industrial communities in the development and implementation of the Plan. Public education, public participation and community relations are an integral element to Groundwater management. The District shall continue to provide Groundwater protection educational services to the public through public presentations, public informational items and references to Groundwater protection data available through other governmental agencies.

7.6.3 Technical Investigations. The District may collect data and carry on technical and other investigations necessary to carry out this Division. All hydrogeological investigations and studies carried out by, or on behalf of, the District shall be conducted by, or under the supervision of, licensed engineers, hydrogeologists or other Persons qualified in hydrology or hydrogeology. The District and its authorized agents shall have the right to enter upon any property at any reasonable time within the District to the extent permitted by law.

7.6.4 Establishment of Wellhead Protection Areas. The District shall establish wellhead protection areas in a manner which conforms to the methods contained in the DWSAP Program. The District shall delineate zones for the protection areas using the modified calculated fixed radius method or other methods approved in accordance with the DWSAP Program. The District shall also identify potentially contaminating activities in accordance with the DWSAP Program. New monitoring wells may be located in areas to provide adequate warning time of potential contaminant plumes reaching water supply wells based on the DWSAP B5 and B10 source areas zones delineations. These maps will be provided to land use planning and regulatory agencies to help in their planning and oversight activities.

7.6.5 Vulnerability Analysis. The District shall develop a vulnerability analysis of different areas of the Basin in accordance with the DWSAP Program. Based on the priorities identified in the vulnerability analysis, the District shall develop and implement a management plan to prevent or minimize the potential impact of Contamination from the high priority areas containing potentially contaminating activities.

7.6.6 Annual Report on Groundwater Conditions. The District shall annually prepare a report on Groundwater supplies and conditions in the Plan Area, including progress on implementation of Groundwater management goals and objectives. The report shall identify and prioritize Groundwater quality problems in the Plan Area, propose specific actions and inter-governmental agency coordination. The report may include such other information as the

District determines applicable to Groundwater supplies, the Basin and the Plan Area. The report shall be presented to the Board as part of a public hearing regarding the Groundwater supplies and conditions within the Basin.

Section 7.7 District Actions in Response to Contamination

7.7.1 Aquifer Vulnerability. The District considers that releases of man-made contaminants present a material risk of Contamination. The hydrogeology shows the Basin to be highly vulnerable to the release of man-made contaminants as evidenced by the impairment of groundwater supplies. The District finds it advisable and in the best interest of the District in protecting the quality and quantity of Groundwater in the Plan Area, to establish and implement a Basin monitoring program.

7.7.2 Potential Effects of Contamination on Water Supply. If contamination is not remediated, this may result in the loss of portions of the Basin or increase costs to the District for providing suitable water supply to the community. Areas of contaminated groundwater may result in the long-term loss of usable Groundwater in storage in the Basin from beneficial use, which is the same net effect as chronic overdraft.

7.7.3 Potential Actions. If new or increasing water quality issues are detected, the District shall present its findings to the Stakeholder Advisory Group to gather additional input for developing a course of action and determining whether making recommendations of actions to the Board or regulatory agencies is necessary. If the water quality issue poses a clear and immediate threat to the District's water supply and infrastructure, the District may provide recommendations for immediate actions by the Board and inform the Stakeholder Advisory Group. The District will take appropriate actions based on the recommendations of the Board, District Staff and Stakeholder Advisory Group. Actions may include, but are not limited to, the following:

(1) No further action needed

(2) Continue to monitor the situation

(3) Conduct additional monitoring and/or install new monitoring wells to better define the extent and concentrations of the potential contamination.

(4) Make a request to El Dorado County Environmental Management Department and the California Region Water Quality Control Board, Lahontan Region to take action to enforce groundwater cleanup.

(5) Implement immediate remediation and/or repair actions deemed necessary to protect the public water supply and infrastructure and recover the costs from Responsible Parties for the remediation and/or repair.

7.7.4 Documentation for Potential Cost Recovery. To document costs to address a contamination issue, an implementation schedule along with an estimated budget including engineering, consultant and legal fees and expenses, and District overhead, and a summary of District enforcement actions, if any, shall be prepared.

Section 7.8 Enforcement.

7.8.1 Violation. Violation shall mean any act or omission, or an attempt that contravenes any of the provisions of this Division or other provisions of law.

7.8.2 Cease and Desist Order. The District may issue an administrative order requiring any Responsible Party to cease and desist from the activity which is causing or contributing to Groundwater contamination.

7.8.3 Court Ordered Restraining Order. The District may apply for a restraining order against any Person who violates any section of this Division. The application for restraining order shall comply with Code of Civil Procedure sections 513.010 and 525, *et seq.*, California Rules of Court Rule 359 and other laws, as applicable.

7.8.4 Administrative Hearing.

7.8.4.1 Administrative Hearing Request. Any Person who receives a cease and desist order or a notice that administrative fines and penalties are due may contest that there was a violation or that he or she is the Responsible Party, by completing a request for administrative hearing form and returning it to the District within twenty (20) days after the District gives notice of the cease and desist order or of the administrative fines and penalties. In the case of a request for an administrative hearing to review administrative fines and penalties, the requesting party shall make an advance deposit of the fine or penalty at the time of submitting the request for administrative hearing form.

7.8.4.2 Administrative Hearing Procedures. Upon receipt of a request for administrative hearing form and deposit, if applicable, the District shall hold an administrative hearing at the next regularly scheduled board meeting to determine whether the recipient of the notice of violation is responsible for a violation of this Division. The hearing shall be conducted pursuant to the United States Constitution and California Government Code section 11400, *et seq.*

7.8.5 Administrative Fines and Penalties. Any Person who violates any section of this Division shall be subject to administrative fines and penalties pursuant to Government Code section 53069.4. Each day's continuance of a violation of an ordinance shall constitute a separate and additional violation.

(1) Amount. The District may impose a fine or penalty not to exceed $100 for a first violation, $200 for a second violation of the same section of this Division within one year, and $500 for each additional violation of the same section of this Division within one year.

(2) Notice. The District shall notify the Responsible Party responsible for a violation of this Division that administrative fines and penalties are due. Such notice shall be in writing, and shall be delivered by first-class mail addressed to the Responsible Party at the Responsible Party's last known address, and posted on the property where the violation occurred. Notice of an administrative fine or penalty shall contain the following information:

(a) The date of the violation;

(b) The address or a definite description of the location where the violation occurred;

(c) The section of this Division violated and a description of the violation;

(d) The amount of the fine for the violation;

(e) A description of the fine or penalty payment process, including a description of the time within which and the place to which the fine or penalty shall be paid;

(f) An order prohibiting the continuation or repeated occurrence of the ordinance violation described in the notice; and

(g) A description of the administrative review process, including the time within which the administrative fine or penalty may be contested and the place from which a request for hearing form to contest the administrative fine or penalty may be obtained.

(3) Payment. The fine or penalty shall be paid to the District within thirty (30) days after posting of the notice of violation. Any fine or penalty paid shall be refunded if it is determined, after a hearing, that the Person charged was not responsible for the violation or that there was no violation as charged.

(4) Collection. Remedies for collecting and enforcing fines and penalties for violation of this Division are cumulative and any and all may be used alternatively, and none of the remedies are exclusive. At its discretion, the District may employ the following mechanisms for the collection of fines and penalties:

(a) Fines and penalties imposed for violation of this Division may be added to and become part of the charges fixed by the District for commodities and services furnished to the Real Property where the violation occurred if the Real Property is owned, controlled, or in the possession of the same Person who owned, controlled, or was in possession of it during the time the violation occurred, pursuant to California Water Code § 10754.

(b) Fines and penalties imposed for violation of this Division may be added to and become part of the annual assessment levied upon the land where the violation occurred if the Real Property is owned, controlled, or in the possession of the same Person who owned, controlled, or was in possession of it during the time the violation occurred, pursuant to California Water Code § 10754, and in accordance with Public Utilities Code § 16469. Fines and penalties added to an assessment are a lien on the land, in accordance with Public Utilities Code § 16470.

(c) Fines and penalties imposed for violation of this Division may become a lien on the land where the violation occurred if the District records a certificate of the amount of fines and penalties due, pursuant to California Water Code § 10754 and Public Utilities Code § 16472.1.

(d) Fines and penalties may be collected in the same manner, by the same Persons, and at the same time together with the general taxes levied for the District, pursuant to California Water Code § 10754 and Public Utilities Code §§ 16641 *et seq.*.

(e) Fines and penalties may be collected by an action in any court of competent jurisdiction against a Person or Persons who owned the Real Property where the violation occurred for the collection of all fines and penalties, pursuant to the provisions of the Public Utilities Code § 16647.

7.8.6 Judicial Review. Any Person aggrieved by the District's final administrative decision to impose fines and penalties for violation of this Division may obtain review of the administrative decision by filing an appeal to be heard by the appropriate court in El Dorado County in accordance with the timelines and provisions stated in California Government Code section 53069.4. Any Person aggrieved by the District's final administrative decision to issue fines and penalties may obtain review of the administrative decision by filing a petition for writ of mandate in the court in accordance with Government Code section 11523 and Code of Civil Procedure section 1094.5, *et seq.*

7.8.7 Liability. The Real Property Owner and the Operator shall be jointly and severally liable for compliance with the provisions of this Division. The Real Property Owner and Operator may allocate liability between themselves by contract or otherwise but any such allocation shall not effect compliance with this Division nor be binding upon the District. The District in pursuing its remedies may proceed against Real Property Owner, the Operator, or both, as determined by the District in its sole discretion.

7.8.8 Rules and Regulations. The District shall have the authority to promulgate rules, regulations and procedures to implement and carry out the intent and purpose of this Plan, provided such rules, regulations and procedures are consistent with this Plan and reasonably related to the intent and purpose of this Plan.

Section 7.9 Costs of Implementing Plan.

7.9.1 Findings. The District finds and declares that the Plan is necessary for the protection of Groundwater resources within the District, and that it is in the public interest and will benefit all Persons residing within the Plan Area. The District further finds and declares that specific categories of activities pose greater threats to Groundwater quality than others, and that Persons engaged in those activities should be responsible for a proportionate share of the costs of implementing this Plan based on the proportionate risk posed by their activities.

7.9.2 Charges. The District may include the costs associated with the Plan in the District's charges for commodities and services in accordance with Public Utilities Code section 16467 and the ordinances, rules and regulations of the District. The District may include the costs of the Plan in (1) general charges for commodities and services, and charge the costs uniformly to all District customers; (2) special charges for commodities and services, and charge the costs to a special class of customers engaged in activities which increase the potential for Groundwater Contamination; or (3) a combination of general and special charges.

7.9.3 Special Taxes. The District may assess special taxes to raise funds for carrying on its operations and paying its obligations, in accordance with Public Utilities Code section

16641, *et seq*. All special taxes assessed by the District must be applied uniformly to all taxpayers.

7.9.4 Replenishment Assessments. The District may impose Replenishment assessments for the collection of costs associated with the removal of Contaminants from the Groundwater supplies of the District, in accordance with California Water Code section 60300, *et seq.*

7.9.5 Groundwater Management Account. All monies collected by the District pursuant to this Division shall be placed in the District's Water Enterprise Fund.

Section 7.10 Amendment/Termination.

7.10.1 Amendment/Termination. This Ordinance may be amended by the District from time to time after its adoption, or may be terminated at any time by the District. Amendments or termination will be considered and approved, or disapproved, only at a noticed public hearing by the District.