South Tahoe Public Utility District

Tahoe Valley South Subbasin (6-5.01) Annual Report

2016 Water Year

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CERTIFICATION

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EXECUTIVE SUMMARY

The TVS Basin is a discrete, highly productive sedimentary geologic basin located in the City of South Lake Tahoe and portions of El Dorado County, California. The 2016 Annual report presents a management level summary of groundwater conditions and supplies within the TVS Basin using data collected from the Basin Monitoring Program and results from numerical hydrologic models.

The 2016 Annual Report provides monitoring data for the 2016 Water Year (2016 WY), which is the 12-month period starting October 1, 2015 through September 30, 2016. In terms of precipitation, 2016 was an above normal water year, which followed a three year drier than normal period (2012-2015 Drought). During the 2016 WY, groundwater recharge to the TVS Basin was estimated at 50,030 acre-feet (AF). Groundwater elevations were above normal, compared to the 10-year base period for groundwater levels (2001-2010) and increased, on average about 2.2 feet compared to 2015 WY groundwater levels. The TVS groundwater model calculated change in groundwater storage is -2,007 acre-feet (AF); however, the incremental change in groundwater storage was positive, gaining about 1,000 AF compared to change in groundwater storage calculated for the 2015 WY. Groundwater production from Public Water System (PWS) wells, which accounts for more than 90% of groundwater extractions in the TVS Basin, totaled 6,665 AF; which is about 15% below the median value (7,770 AF) over the period of record (2005 – 2016).

Tetrachloroethylene (PCE) groundwater contamination continued to have an impact on groundwater supplies in the South Y Area. The South "Y" Plume covers an area of approximately 400 acres, impairing three PWS wells and threatening three other PWS wells within the South Lake Tahoe sub-area. In a continuing effort to address this groundwater concern, the District in collaboration with the Stakeholders Advisory Group (SAG) conducted investigations and pursued grant funding.

Groundwater management activities implemented during the 2016 WY included items required for on-going compliance with the Sustainable Groundwater Management Act (SGMA) and varying efforts to address actions under the 2014 GWMP Implementation Plan. Significant achievements during the 2016 WY included;

1. Formation of a Groundwater Sustainability Agency (GSA) with the El Dorado County Water Agency (EDCWA) to manage groundwater in areas within the TVS Basin, outside District boundaries;
2. An extraction well suitability investigation for the removal of PCE in groundwater within the South "Y" Plume;
3. A review of site investigation, water quality and well production data to assess the spatial and temporal extent of PCE contamination in the South "Y" area;
4. Completion of Phase 1 Modeling updating numeric groundwater models and developing a water budget for the TVS groundwater system; and
5. Submittal of Pre- and Final Applications for State funding to conduct a planning study of remedial alternatives to address groundwater contamination from the South "Y" Plume.

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1 Introduction

The South Tahoe Public Utility District (District) has prepared the following report for the Tahoe Valley South Subbasin of the Tahoe Valley Groundwater Basin, designated by the California Department of Water Resources (DWR) as Groundwater Basin 6-5.01 (TVS Basin). This report was prepared in compliance with both the annual reporting requirements of the 2014 Groundwater Management Plan (Kennedy-Jenks, 2014) and the requirement to submit an annual report pursuant to Section 356 of the Emergency Groundwater Sustainability Plan (GSP) Regulations (California Code of Regulations, Title 23, Division 2, Chapter 1.5, Subchapter 2). The 2016 Annual Report presents a management level summary to assess groundwater conditions and supplies within the TVS Basin, using data collected from the District's Basin Monitoring Program. Progress on implementation of Basin Management Objectives (BMOs) defined in the GWMP are also reported.

The 2016 Annual Report is the second annual report issued since adoption of the 2014 Groundwater Management Plan (GWMP). Additions to this report used to satisfy new reporting requirements in the GSP Regulations include classification of water year type (Section 1.2); presentation of groundwater elevation contour maps (Section 2.4.2); illustration of groundwater extractions (Section 2.6); description of water use within the TVS Basin (Section 2.6.1); and water year 2016 costs (Section 3.8.2).

1.1 TVS Basin

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 sub-basins: Tahoe Valley South, Tahoe Valley West, and Tahoe Valley North (Figure 1-1). Of these three sub-basins, the TVS Basin is the largest and most productive.

Elevations within the TVS Basin range from 6,225 feet at lake level, rising to above 6,500 feet within the groundwater basin. Elevations extend above 10,000 feet within the surrounding watersheds along the Carson Range and Sierra Nevada. 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 Upper Truckee River is joined by Grass Lake and Big Meadow Creeks along the southern extent of its course, Angora Creek centrally, and Trout Creek near Lake Tahoe.

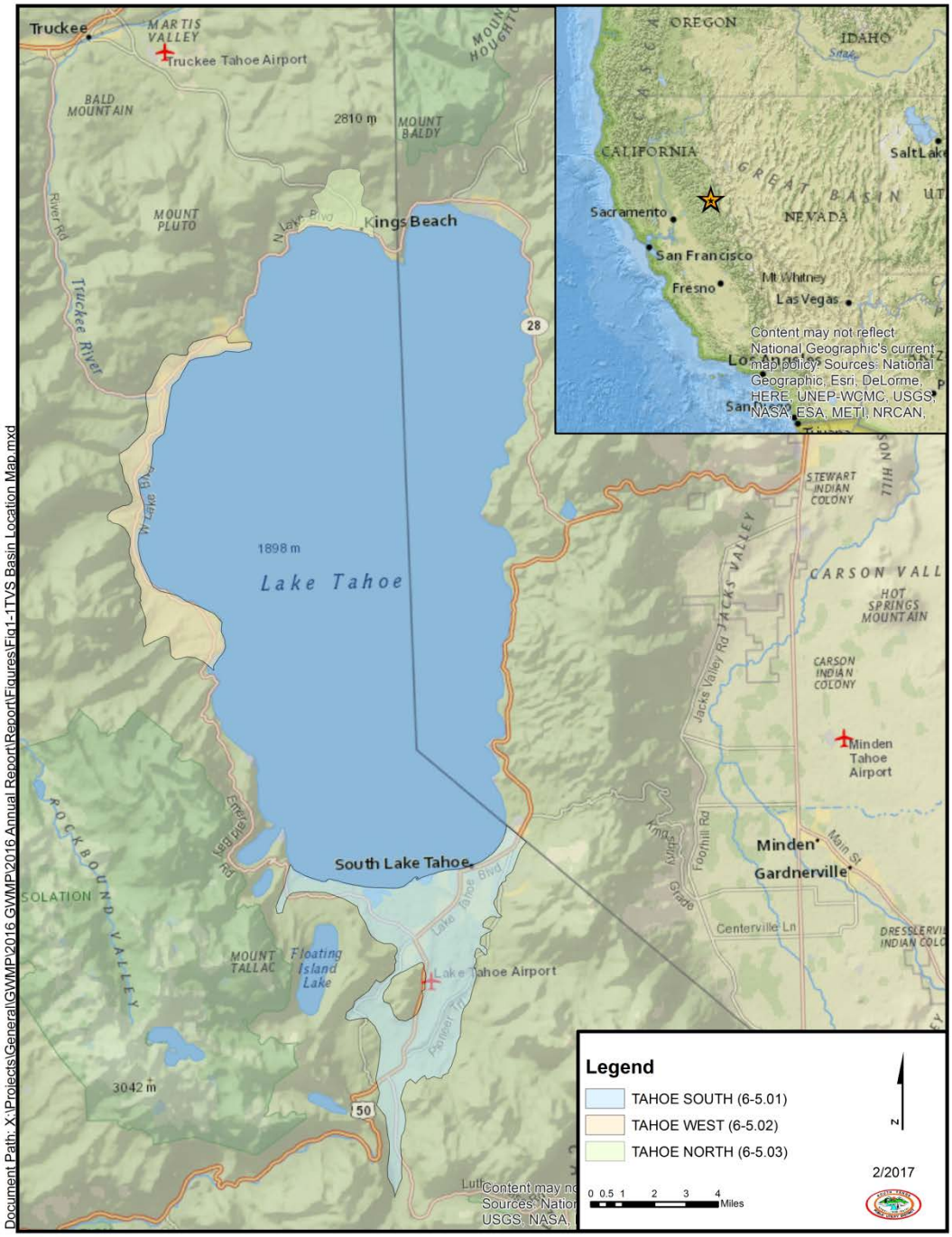

Figure 1-1. Lake Tahoe area regional map with California Department of Water Resources (DWR) designated groundwater basins.

The TVS Basin has an area of approximately 23 square miles (14,814 acres) in El Dorado County, California (Figure 1-2). The TVS Basin is roughly triangular in aerial extent and 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 sub-basin. The City of South Lake Tahoe (CSLT) 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.

The TVS Basin underlies several different jurisdictions which include; CSLT, the unincorporated communities of Meyers, Angora Highlands and Christmas Valley, and portions of unincorporated eastern El Dorado County. 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 areas. 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.

Groundwater is the primary source of drinking water for the communities overlying the TVS Basin. 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. Numerous water-bearing zones (WBZs) have been identified using lithologic and geophysical logs, and interpreted correlations to divide the basin-fill into multiple 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.

Figures 1-3 is a conceptual hydrogeological cross section across the northern portion of the TVS Basin used to illustrate the WBZs. Up to five of these zones have been identified as being practical for groundwater management. The different WBZ designations are informal and are based on the 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 (WBZ1) 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 (WBZ2 and WBZ3) represent the interval at depths between 200 to 600 feet and the shallowest two zones (WBZ4 and WBZ5 on Figure 3-9) represent depths to 200 feet (Bergsohn, 2011)

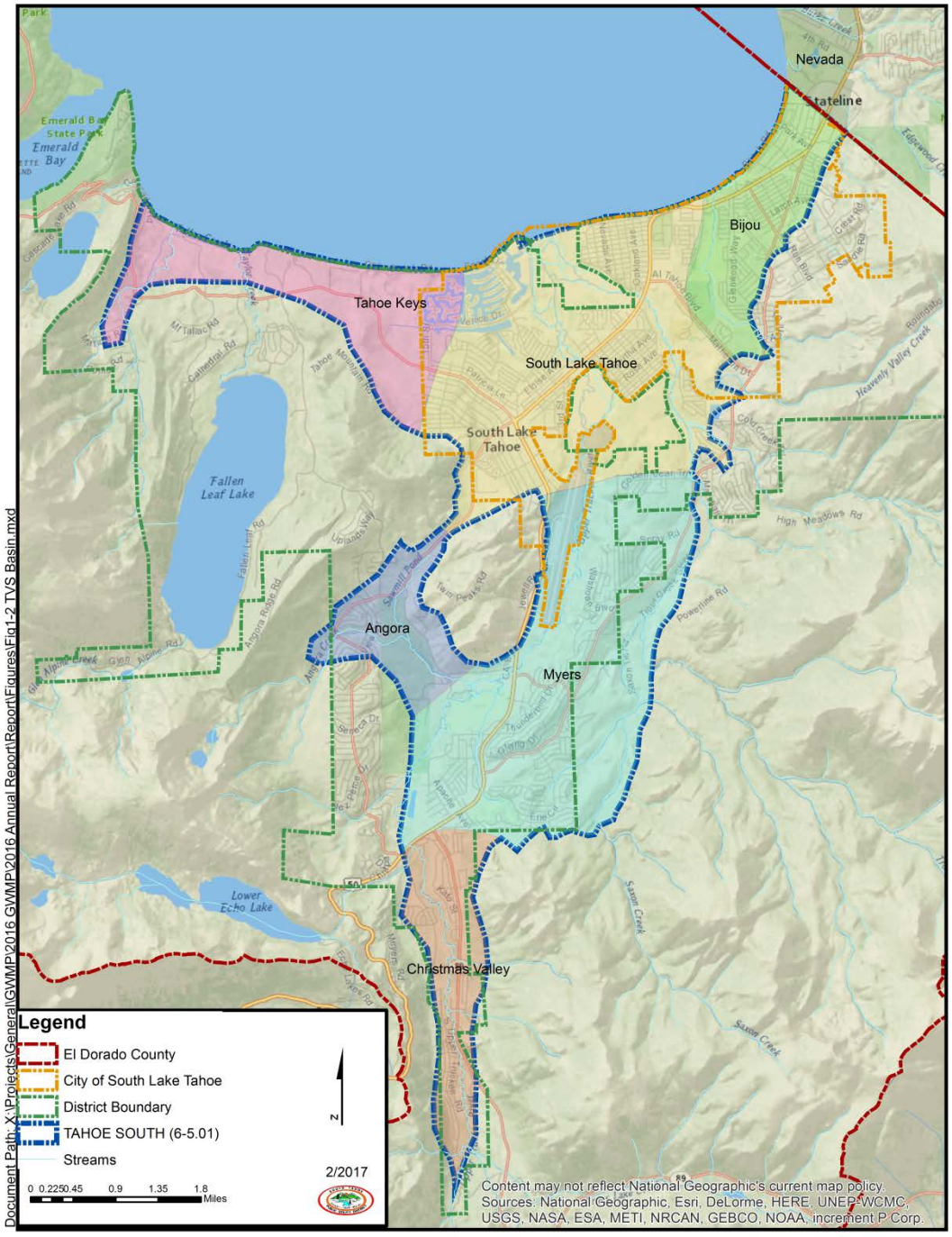

Figure 1-2. TVS Basin showing jurisdictional boundaries and geographically-based sub-area designations used in this report.

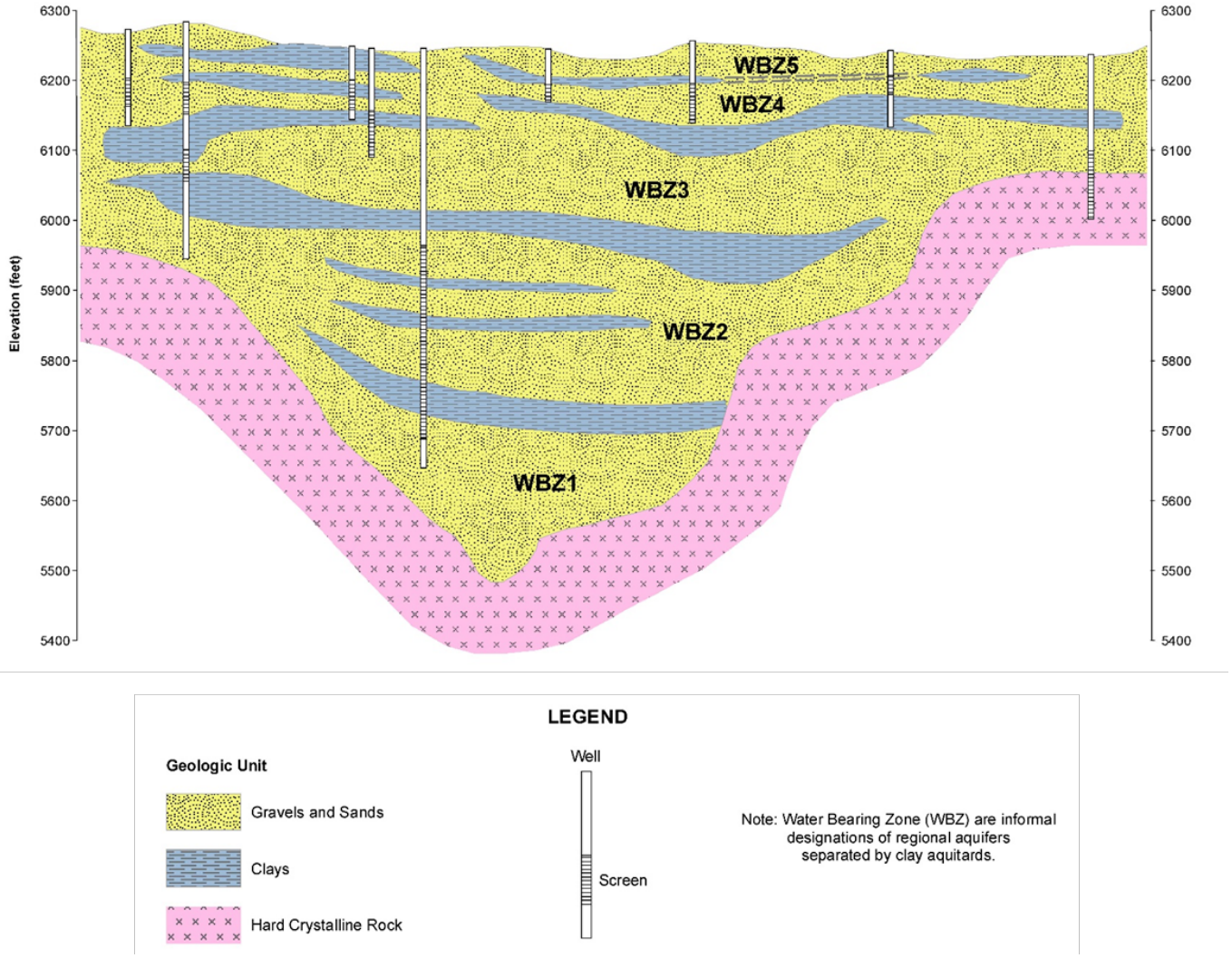

Figure 1-3. Conceptual geologic cross-section oriented east-west showing typical water bearing zones within the TVS Basin (Adapted from Kennedy-Jenks (2014)).

For ease of description the TVS Basin is subdivided into six geographically based sub-areas, herein referred to as the Tahoe Keys, South Lake Tahoe, Bijou, Angora, Meyers and Christmas Valley sub-areas. The location and extent of these sub-areas are shown on Figure 1-2.

1.2 Water Year Classification

Under the GSP Regulations, annual precipitation in a basin is required to be described in terms of water year type. DWR generally assigns water year type based on river flow indices or precipitation amounts and has developed water year classification systems for several hydrologic basins in California. For example, for the Sacramento Valley hydrologic basin, the State Water Resources Control Board (SWRCB) developed five categories based on runoff forecasts and previous water year's index: 1) wet, 2) above normal, 3) below normal, 4) dry, and 5) critical (SWRCB, 1978).

DWR has not developed a water year classification for the Lake Tahoe hydrologic basin. As such, the District requested that the Desert Research Institute (DRI) explore development of a water year classification for the TVS Basin. The water year classification was created following development of the TVS Basin water budget. During development of the water budget, a strong linear correlation was identified between simulated precipitation from the regional Groundwater Surface Water Flow Model for the Truckee River Basin (GSFRM) and groundwater recharge to the TVS Basin. Linear correlation was also found between groundwater recharge to model calculated change in groundwater storage. Using these relationships from the modeling analysis, total accumulated precipitation measured at the four National Resource Conservation Service (NRCS) snow telemetry (SNOTEL) stations within the model area were further evaluated to find the SNOTEL station with the best correlation to the simulated precipitation from the GSFRM. SNOTEL 508: Hagan's Meadow, CA was found to have the best correlation with model simulated groundwater recharge and change in groundwater storage. As such NRCS precipitation records for this station were used to classify water year type for the TVS Basin (Carroll et al, 2016b).

For the TVS Basin, water years 1979 – 2016 were categorically defined by assuming a normal distribution in precipitation and establishing ranges based on the z-statistics in Table 1-1. To allow more flexibility in water year type, seven categories were established: 1) very wet, 2) wet, 3) above normal, 4), normal, 5) below normal, 6) dry, and 7) critical. Choice of z-statistics to define water years was selected to allow at least one critical water year over the 37-year analysis. The very wet periods are indicated by a z-statistic > 1.5 and occur in WY 1980, WY 1982, WY 1995 and WY 2011. The critical water year is indicated by a z-statistic – 1.5 and occurs in WY 1987. Figure 1-4 shows the water year type for each water year during the period of record (1979 – 2016) for SNOTEL 508: Hagan's Meadow, CA. For WY 2016, total accumulated precipitation at SNOTEL 508 measured 36.80 inches; which is regarded as an above normal water year for the TVS Basin.

WY Type	z (upper)	Precipitation (in)		Count
		>	≤	
Very Wet	> 1.5	45	-	4
Wet	1.5	40	45	4
Above	1	35	40	5
Normal	0.5	25	35	10
Below	-0.5	21	25	8
Dry	-1.0	16	21	6
Critical	-1.5	0	16	1

Table 1-1. Classification system for Water Year (WY) Type based on observed WY accumulated precipitation at SNOTEL 508: Hagan's Meadows, CA. Upper bound of z-statistic and ranges in precipitation (inches) (Adapted from Carroll et al, 2016b).

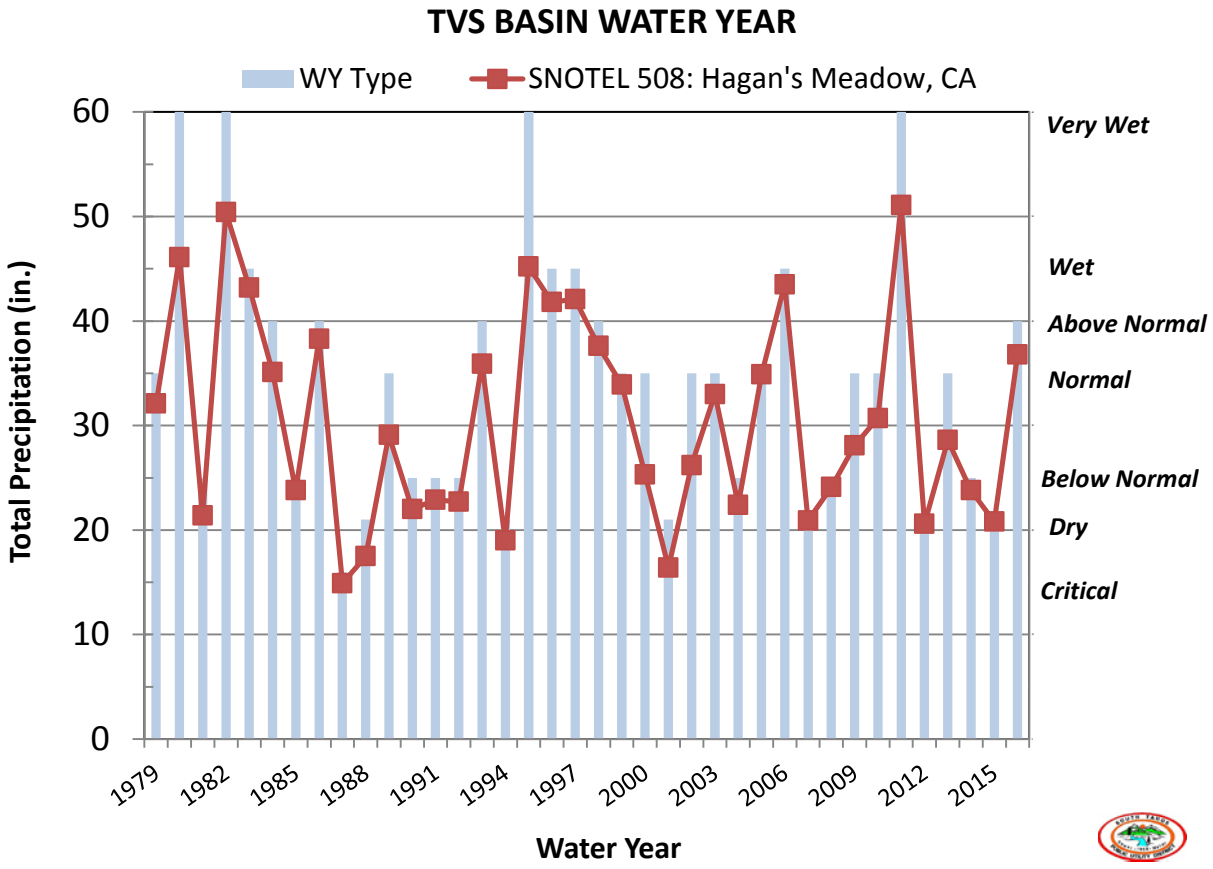

Figure 1-4.The annual accumulated precipitation measured at SNOTEL 508: Hagan's Meadow, CA and water year type indicated on the vertical axis along the right-side of the graph. Precipitation ranges for each water year type are listed in Table 1-1.

2 Groundwater Conditions

The following section presents data collected by the District and derived from numeric groundwater models to show the current state of the TVS Basin. Hydrographs showing groundwater elevation trends across the TVS Basin are provided in Appendix A.

2.1 Groundwater Model

A groundwater flow model was developed by DRI for the TVS Basin and its surrounding watersheds to perform complex hydrologic analysis, develop a water budget and address actions to attain Basin Management Objectives (BMOs) described in the 2014 GWMP, referred to as the TVS groundwater model (Carroll, *et al.*, 2016a). The TVS groundwater model quantifies basin conditions and is based on the U.S. Geological Survey (USGS) MODFLOW-NWT (Niswonger *et al.,* 2011) software. MODFLOW-NWT is the latest installment of the USGS modular program and relies on the Newton solution method and an unstructured, asymmetric matrix solver to calculate groundwater head. MODFLOW-NWT is specifically designed to work with the upstream weighted (UPW) package to solve complex, unconfined groundwater flow simulations to maintain numerical stability during the wetting and drying of model cells.

The model grid is oriented north-south and contains 342 rows and 251 columns. Horizontal cell size is 100 meters (328 feet) and is based on the need to capture steep topography, narrow canyons and potentially steep hydrologic gradients, which are present in the TVS Basin. The model is subdivided into four subsurface layers to maintain reasonable computation time. Layers are determined based on production well screen intervals. Land surface elevations are based on 30 meter (98 feet) Digital Elevation Model (DEM) aggregated to a 100 meter (328 feet) resolution. Layer thicknesses are 40 meters (131 ft) for layer 1 and layer 2, and 100 meters (328 feet) for layer 3. The layer 4 bottom elevation is set to a constant 1,600 meters (5,248 feet) to produce variable thickness ranging from approximately 114 meters (274 feet) along the northern boundary with Lake Tahoe to 1,300 meters (4,264 feet) at watershed divides.

The groundwater model simulates two distinct time periods. The first represents steady-state conditions prior to any significant groundwater production in the basin. Hydraulic conductivity was calibrated using the steady-state model configuration. The transient model simulates the period 1983-2016 to calculate changes in groundwater levels and flux due to variations in climate and groundwater extractions.

2.2 Groundwater Recharge

Recharge for the TVS Basin was extracted from a regional model developed by DRI to assess historical and future water supply in the Truckee River Basin, referred to as the GSFLOW Regional Model (GSFRM). The GSFRM uses the numeric code Groundwater and Surface water flow (GSFLOW, Markstrom et al,

2008) which combines the USGS Precipitation-Runoff-Modeling System with the USGS MODFLOW-2005. Recharge is defined as the model computed excess water leaving the unsaturated root or soil zone and entering the saturated zone after accounting for abstractions of interception, sublimation, surface runoff and evapotranspiration. GSFLOW simulated recharge for the TVS hydrologic basin varies from year to year based on annual cycles of precipitation. Most of the recharge occurs in the mountains of the Sierra Nevada and Carson Range. Annual recharge ranges from 9 inches in the valley to upwards of 34 inches in the higher elevations. This result is consistent with observations of stable isotope levels in stream baseflow and of groundwater from numerous shallow and deep-screened wells which indicate that a significant fraction of groundwater present within the TVS Basin is sourced from precipitation in high elevation areas that recharges at the mountain front and/or in the mountain block (Fogg, et al., 2007).

Groundwater recharge is largely dependent on annual precipitation. DRI developed a regression equation between annual precipitation at SNOTEL 508: Hagan's Meadow, CA to groundwater recharge within the TVS Basin and surrounding watersheds with an R2 of 0.92 (Figure 2-1). Hagan's Meadow was chosen because it resulted in the best correlation between precipitations at one station versus groundwater recharge derived from the TVS groundwater model (Pohll et al, 2016).

Figure 2-2 shows groundwater recharge, as estimated using the relationship to annual precipitation at Hagan's Meadow for its period of record (1979 – 2016) as 39,500 AFY. Average annual recharge over the last decade (2007 – 2016) is 35,640 AFY. The total groundwater recharge within the TVS Basin and surrounding watersheds during the 2016 WY is estimated at 50,030 AF.

The ratio of recharge computed by the GSFLOW model to annual precipitation, which is termed as "recharge efficiency," can be used to describe the fraction (or percentage) of precipitation that is converted to recharge. Mean estimated precipitation by GSFLOW for the TVS domain is approximately 344,000 AFY over the hydrologic analysis area. Computed recharge efficiency for the TVS hydrologic basin varies annually but on average (1983 – 2015) is approximately 11 percent (Pohll et al, 2016).

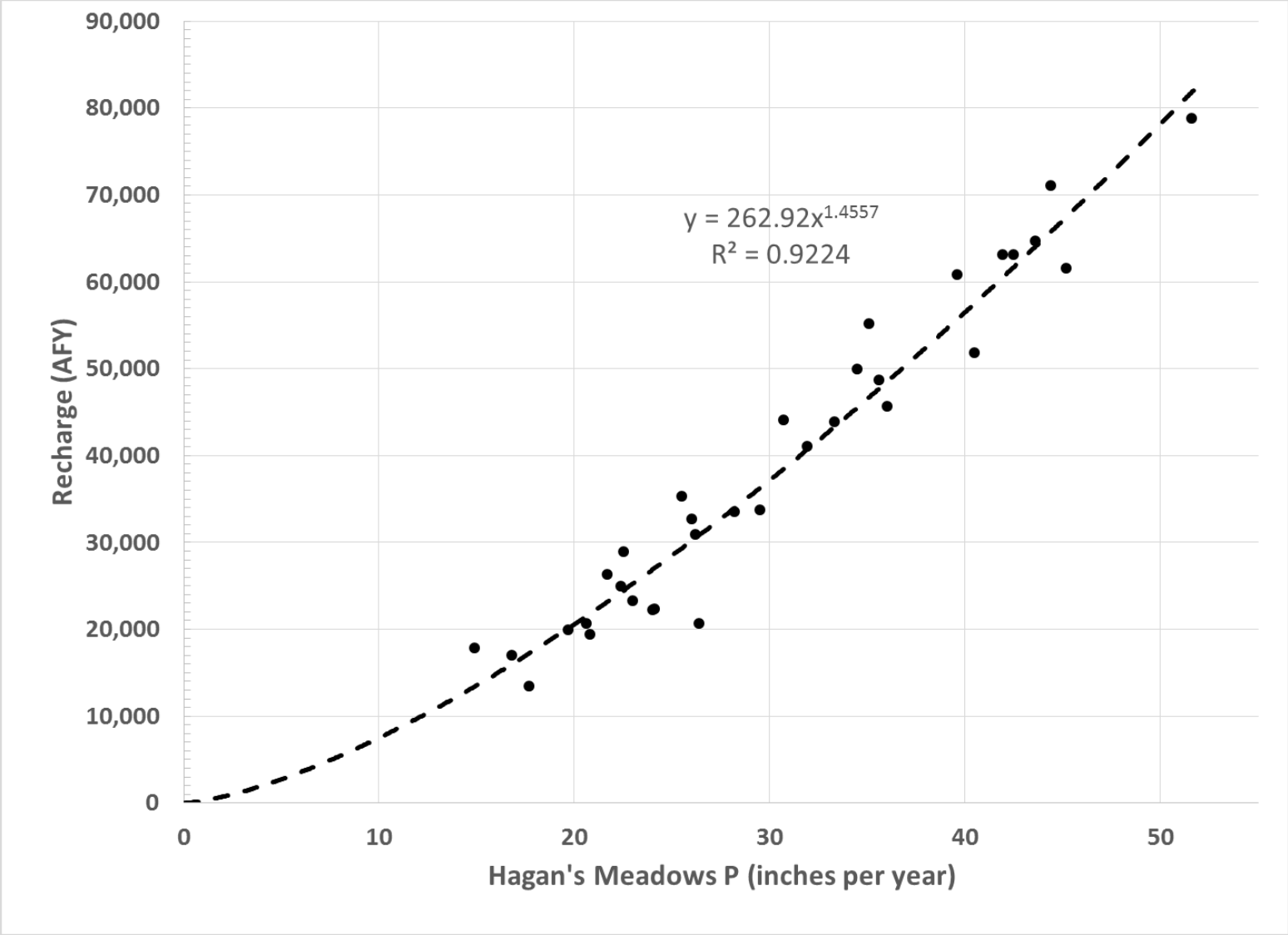

Figure 2-1. SNOTEL 508: Hagan's Meadow, CA annual precipitation versus modeled groundwater recharge within the TVS domain (G.Pohll et al, 2016)

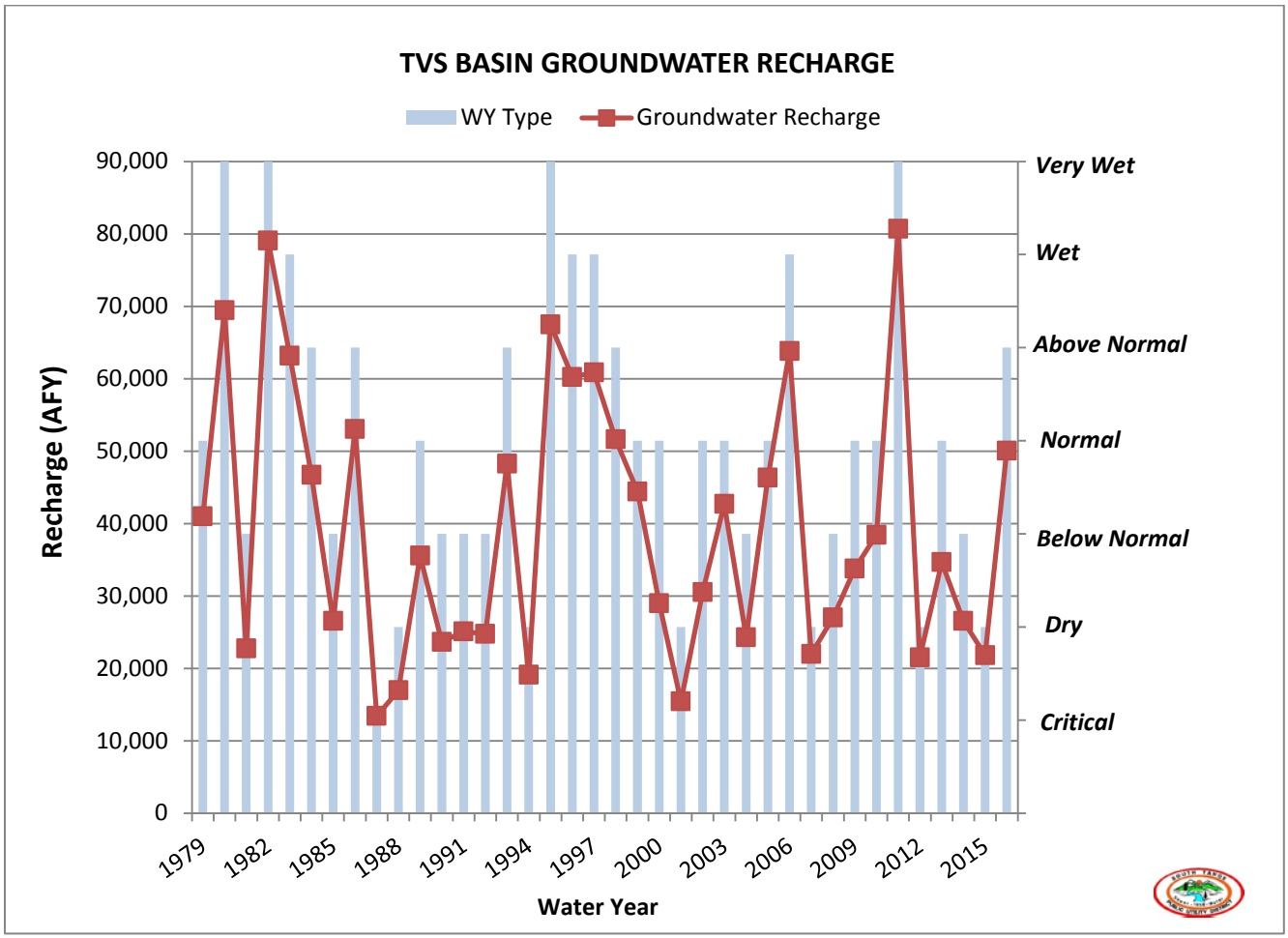

Figure 2-2. Annual groundwater recharge (AFY) from water year 1979 – 2016, estimated using the relationship to accumulated precipitation at Hagan's Meadow (G. Pohl et al, 2016). Water year type using the TVS Basin classification is indicated on the vertical axis along the right-side of the graph.

2.3 Groundwater Monitoring

The District regularly measures groundwater levels in forty-seven (47) wells located in the TVS Basin. The District well network includes thirty (30) observation wells and seventeen (17) PWS wells (Figure 2-3). All of the PWS wells are actively used for 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 used in the California State Groundwater Elevation Monitoring (CASGEM) program.

Construction details for selected wells in which hydrographs are provided (Appendix A) are set forth in Table 2-1. The groundwater zones, shown in Table 2-1, are informal designations using the geographically-based sub-area designations (Christmas Valley, Meyers, Angora, South Lake Tahoe,

Tahoe Keys and Bijou). Christmas Valley Zone is in the southernmost portion of the TVS Basin, south of Lake Valley and Highway 50. The Meyers Zone is located in the southern portion of Lake Valley from Highway 50 north to Twin Peaks. The Angora Zone is located in the northern portion of Lake Valley west of Twin Peaks. The South Lake Tahoe Zone is located north of Lake Valley. The Tahoe Keys Zone is located at the north end of the TVS Basin, west of the South Lake Tahoe sub-area; while the Bijou Zone is located east of the South Lake Tahoe sub-area.

The Basin Monitoring Program uses both hand and continuous readings to monitor groundwater elevation trends across the TVS Basin. Hand readings are collected from each of the TVS Basin groundwater elevation monitoring wells (GWE MW)in November and May of each water year. Hand readings from active PWS wells are collected a minimum of 12-hours after well pumps are turned off for static water level measurements. A smaller number of observation wells (13) are fitted with dedicated water-level monitoring equipment. The data loggers are programmed to collect pressure head and temperature readings at 6:00 AM and 6:00 PM on a daily basis to provide a continuous record of groundwater levels in the TVS Basin.

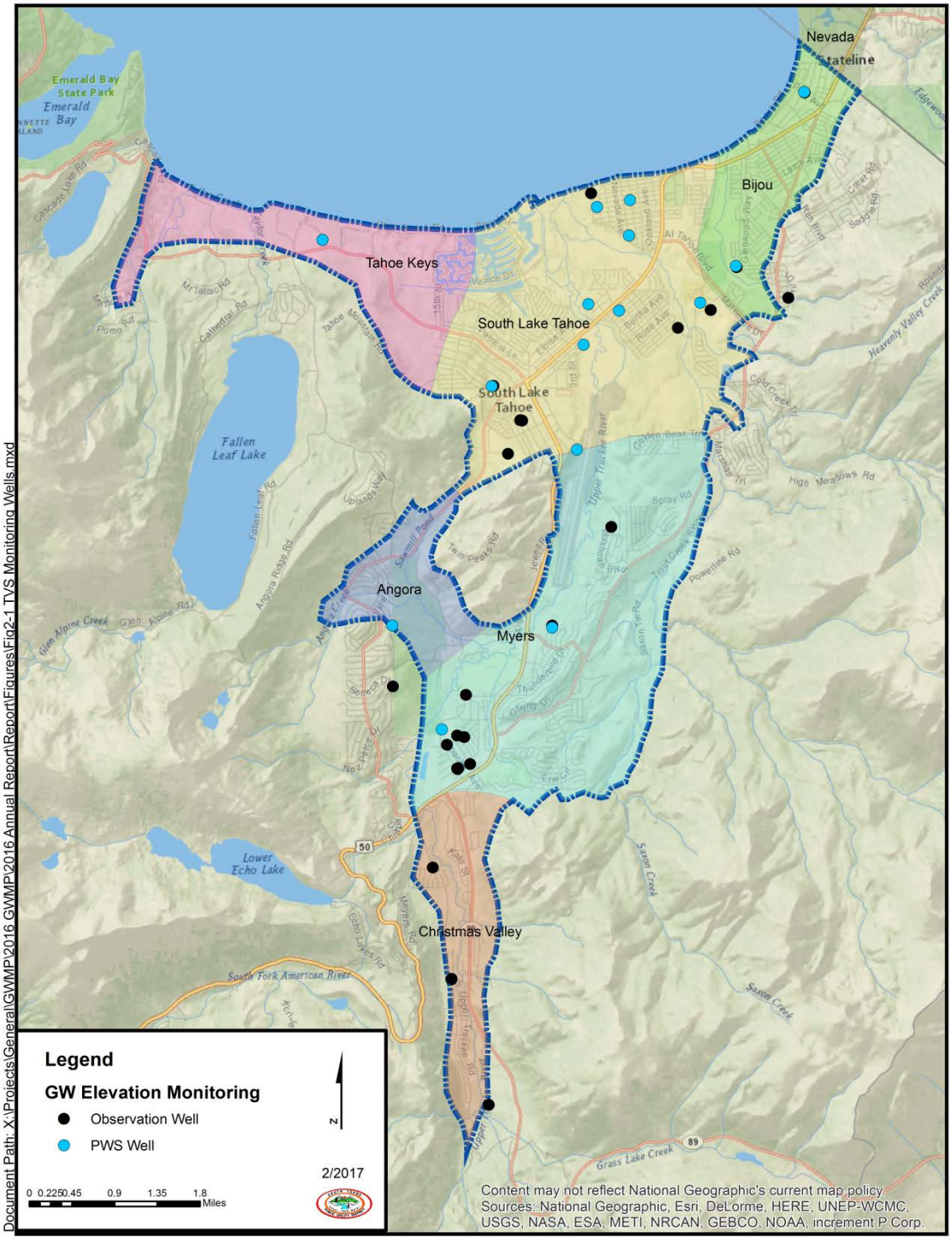

Figure 2-3. Locations of wells used for monitoring changes in groundwater elevation within the TVS Basin.

Well	Groundwater Zone	Reference Point Elevation (ft msl)	Top of Screen Depth (ft bgs)	Bottom of Screen Depth (ft bgs)
Mountain View	Angora	6313.14	95	164
			210	245
Blackrock Well #1	Bijou	6242.72	168	180
Henderson OW	Christmas Valley	6369.78	79	100
			142	205
Bakersfield	Meyers	6310.50	130	170
			180	240
Elks Club Well #1	Meyers	6284.63	110	142
Washoan OW	Meyers	6307.84	102	144
			165	186
			207	228
			249	270
CL-1	South Lake Tahoe	6278.37	104	114
CL-3	South Lake Tahoe	6278.49	39	49
Glenwood Well #3	Bijou	6261.68	112	192
Paloma	South Lake Tahoe	6267.10	188	248
			268	408
Sunset	South Lake Tahoe	6249.00	275	430
Martin OW	South Lake Tahoe	6262.42	95	115
			125	145
			160	180
			200	240
USGS TCF-1-1	South Lake Tahoe	6296.48	325	340
USGS TCF-1-2	South Lake Tahoe	6296.47	245	260
USGS TCF-1-3	South Lake Tahoe	6296.65	158	163
USGS TCF-1-4	South Lake Tahoe	6296.63	130	140
USGS TCF-1-5	South Lake Tahoe	6296.63	88	98
Lily OW	South Lake Tahoe	6236.08	35	37.5
Valhalla	Tahoe Keys	6256.50	110	170

NOTES:
feet msl: Elevation in feet above mean sea level (NAVD88).
ft bgs: Depth in feet below ground surface.

Table 2-1. Well screen intervals for selected groundwater elevation wells within the Tahoe Valley South Basin. Hydrographs for selected wells to show groundwater level trends within each groundwater zone are provided in Appendix A.

2.4 Groundwater Levels

Hydrographs of continuous groundwater elevation readings collected from four observation wells across the TVS Basin are provided below in Figure 2-4. The Henderson Observation Well (OW) is located near the south end of the TVS Basin at the north end of the Christmas Valley sub-area. The Washoan OW is located near the center of the TVS Basin, within the north half of the Meyers sub-area. The Martin OW and Lily OW are both located at the north end of the TVS Basin, within the South Lake Tahoe sub-area. The Martin OW is located near the east margin of the basin within the south half of the sub-area; and the Lily OW is located near the south shore of Lake Tahoe within the north half of the sub-area.

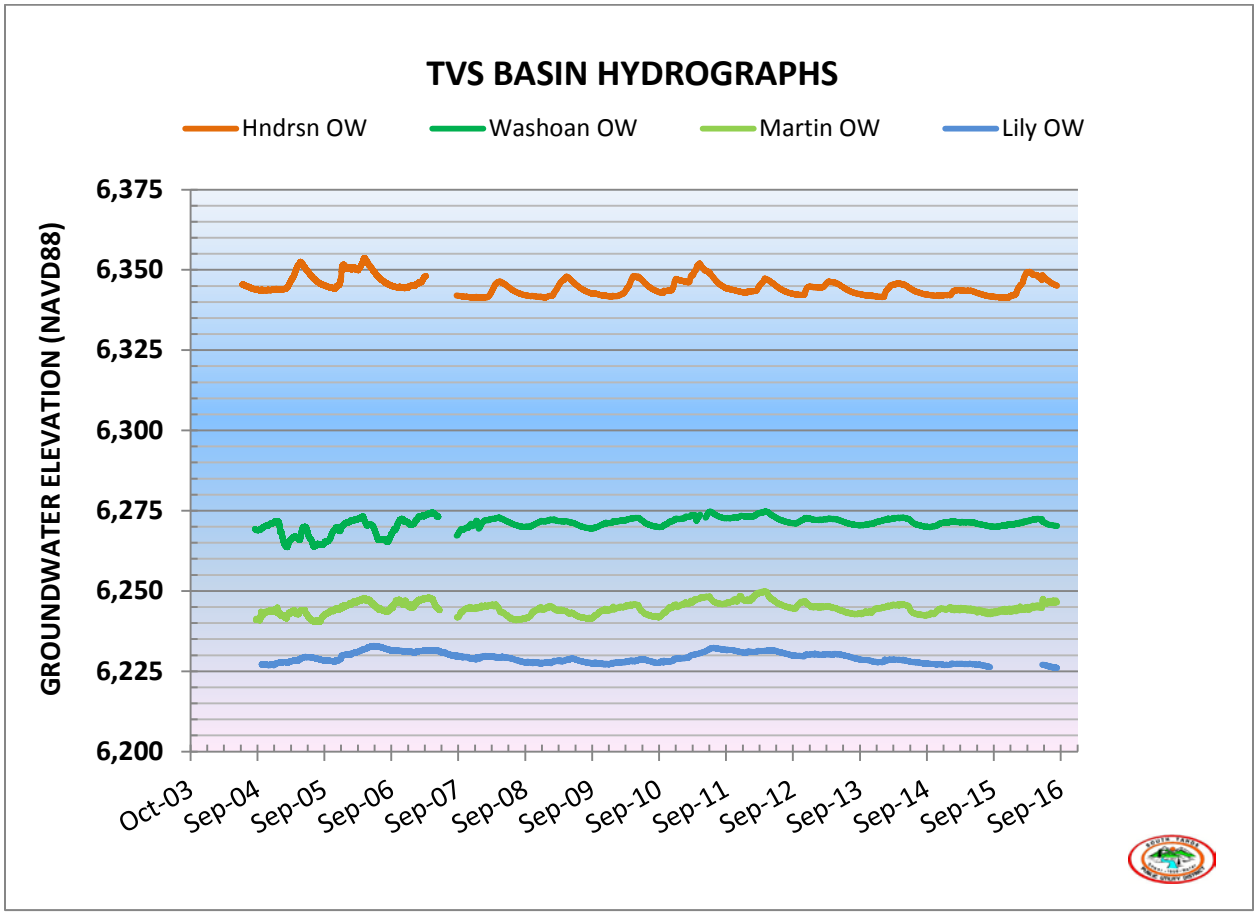

Figure 2-4. Continuous groundwater level readings collected from selected wells distributed across the TVS Basin.

Over the period of record, the continuous readings show that groundwater elevations have been relatively stable. During this period, there were three dry water years; three below normal water years; five normal water years; one above normal water year; and one very wet year (see Figure 1-4). Regular fluctuations representing seasonal changes in groundwater elevations are most pronounced in the

Henderson OW. Groundwater elevations tend to rise during the winter storm season when precipitation exceeds evaporation and plant transpiration (evapotranspiration); and groundwater production is at or near seasonal low water demands. Seasonal high groundwater level typically occurs between early-April through mid-June and tends to decline during the summer and into the fall, when evapotranspiration exceeds precipitation and groundwater production is at or near seasonal high water demands. Seasonal low groundwater elevations typically occur at the end of this seasonal cycle from between mid-July through mid-November.

Groundwater elevations within the TVS Basin marginally declined after the 2011 very wet year through the 2012 – 2015 Drought and recovered during the 2016 above normal water year. The magnitude of these changes is ascertained by comparing interannual changes in seasonal high groundwater levels (May readings) measured from all of the GWE MWs. Between May 2011 and May 2015, the difference in groundwater elevations averaged -3.98 feet. Between May 2015 and May 2016, the difference in groundwater elevations averaged 2.21 feet. Using these averages, groundwater levels across the TVS Basin during the 2016 water year, recovered 55% of the total decline in groundwater levels that occurred during the 2012-2015 Drought.

2.4.1 Basin Condition (Groundwater Levels)

Hand readings collected from the GWE MWs in May of each water year are compared to hand readings collected during a 10- year period (2001- 2010) prior to the 2012-2015 Drought. The purpose of this analysis is to gage the current condition of groundwater levels compared to a base period for groundwater levels selected for the TVS Basin. This period was selected as the base period because groundwater level data for the GWE MWs is readily available and accumulated precipitation measured at SNOTEL 508: Hagan's Meadow, CA averaged 29.3 inches, which is within the normal range of precipitation for the TVS Basin. During the base period for groundwater levels there were: two dry water years; two below normal water years; five normal water years; and one wet water year (see Figure 1-4).

Hand readings collected during the May 2016 water year were used to define current basin conditions as being either normal, above normal, or below normal with respect to the record of groundwater levels collected during the base period (2001 – 2010). The percentile rank of the groundwater elevation measured during the May 2016 monitoring event at each well was determined for more than thirty (30) of the GWE MWs using the record of hand readings collected for that well during the base period. The percentile rank of the May 2016 groundwater elevation for each well was then plotted on a cumulative frequency diagram to show the current state of the TVS Basin in terms of groundwater levels (Figure 2-5).

Figure 2-5 shows the distribution of groundwater elevations measured during the May 2015 and May 2016 monitoring events using their respective percentile ranks within the record of groundwater levels measured for the same wells during the base period. As discussed in Section 1.2, 2015 was a dry water year which occurred at the end of the 2012-2015 Drought. During 2015, the median for the May 2015 groundwater elevations was in the middle of the Normal range (52%) of the base period elevations and

seven wells were found to have Below Normal groundwater elevations. During 2016, the median for the May 2016 groundwater elevations was at the lower end of the Above Normal range (86%) of the base period elevations and only one well was found to have Below Normal groundwater elevations. This well (Seneca Observation Well) is located outside the west boundary of the TVS Basin (Figure 2-3).

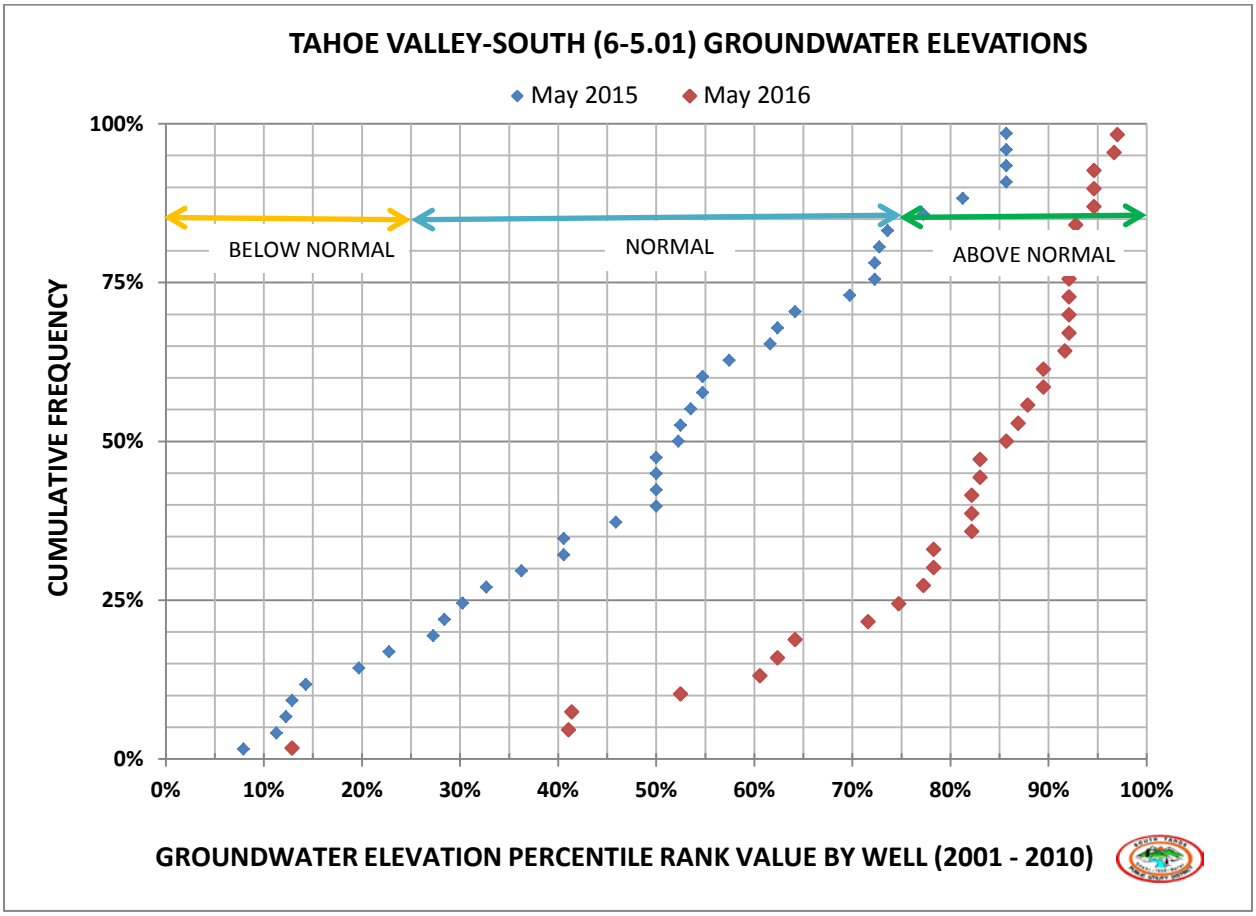

Figure 2-5. Hand readings collected during the May groundwater elevation monitoring event during the 2015 and 2016 water years compared to the record of hand readings for the same wells collected during the 2001-2010 base period for groundwater levels.

2.4.2 Groundwater Elevation Contours

Groundwater elevation contour maps for May 2016 and November 2016 are presented in Figure 2-6 and represent a high and low 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.

Groundwater levels were contoured based on groundwater level measurements for all monitoring wells located in the TVS Basin. The basin-fill deposits of the TVS Basin include a multitude of water-bearing zones (WBZs) with inter-fingered clay lenses. To make maximum use of the available data, all wells are contoured together regardless of the WBZ where they are located. This is considered appropriate to illustrate the general pattern of groundwater flow in the TVS Basin.

Comparison of contours from the two measurement periods shows that the generalized pattern of groundwater flow remains similar between May 2016 and November 2016. This is consistent with the hydrograph data (Appendix A) that shows the typical variation in groundwater levels is on the order of a few feet. In most of the TVS Basin, the November 2016 water level contours progress southward indicating a general lowering of water levels following the summer peak pumping months (Pohll et al, 2016).

2.5 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. Over the past ten years, arsenic, iron, and radionuclides (uranium) have been found in both PWS wells and private wells at concentrations exceeding primary or secondary maximum contaminant levels (MCLs)(Pohll et al, 2016). Well head treatment is presently used to remove arsenic from groundwater produced at one active PWS well (Arrowhead Well No. 3). Two other PWS are currently on stand-by status due to arsenic (Airport Well) and uranium (College Well) concentrations above MCLs in these wells.

Man-made contaminants which have occurred in the TVS Basin include petroleum hydrocarbon and chlorinated hydrocarbon compounds. Of these, the two most prominent constituents of concern are Methyl-tertiary Butyl Ether (MtBE) and PCE.

During the 2016 WY, trace levels of MtBE were detected in two PWS wells (Clement and Paloma Wells) at concentrations below primary or secondary MCLs. The presence of MtBE in these wells is believed to be from remaining areas of degraded water quality following the cessation of clean-up activities at closed Leaking Underground Storage Tank (LUST) sites in the South Lake Tahoe subarea.

PCE in groundwater has impaired water quality in wells situated in the South “Y” area, within the north central portion of the TVS Basin (Figure 2-7). Using water quality data collected over the past 5 years the extent of the contaminant plume has generally been defined and is believed to cover an area of about 400 acres, extending from the South “Y” in a northerly direction toward Lake Tahoe (GEI Consultants, 2016a).

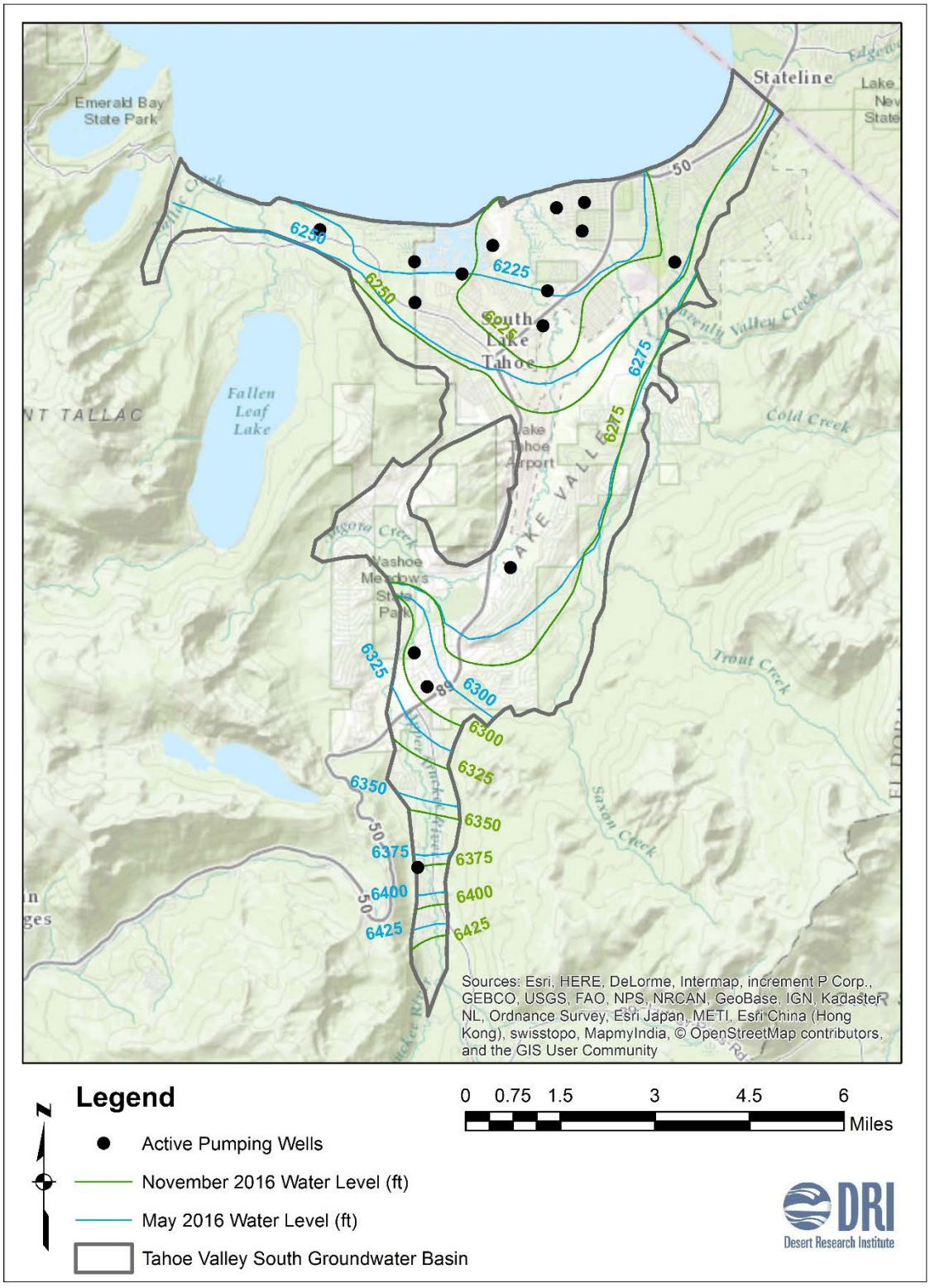

Figure 2-6. Ground water levels (upper 300 ft) as measured in May 2016 and November 2016. Contour interval is 25 ft (Pohll et al., 2016).

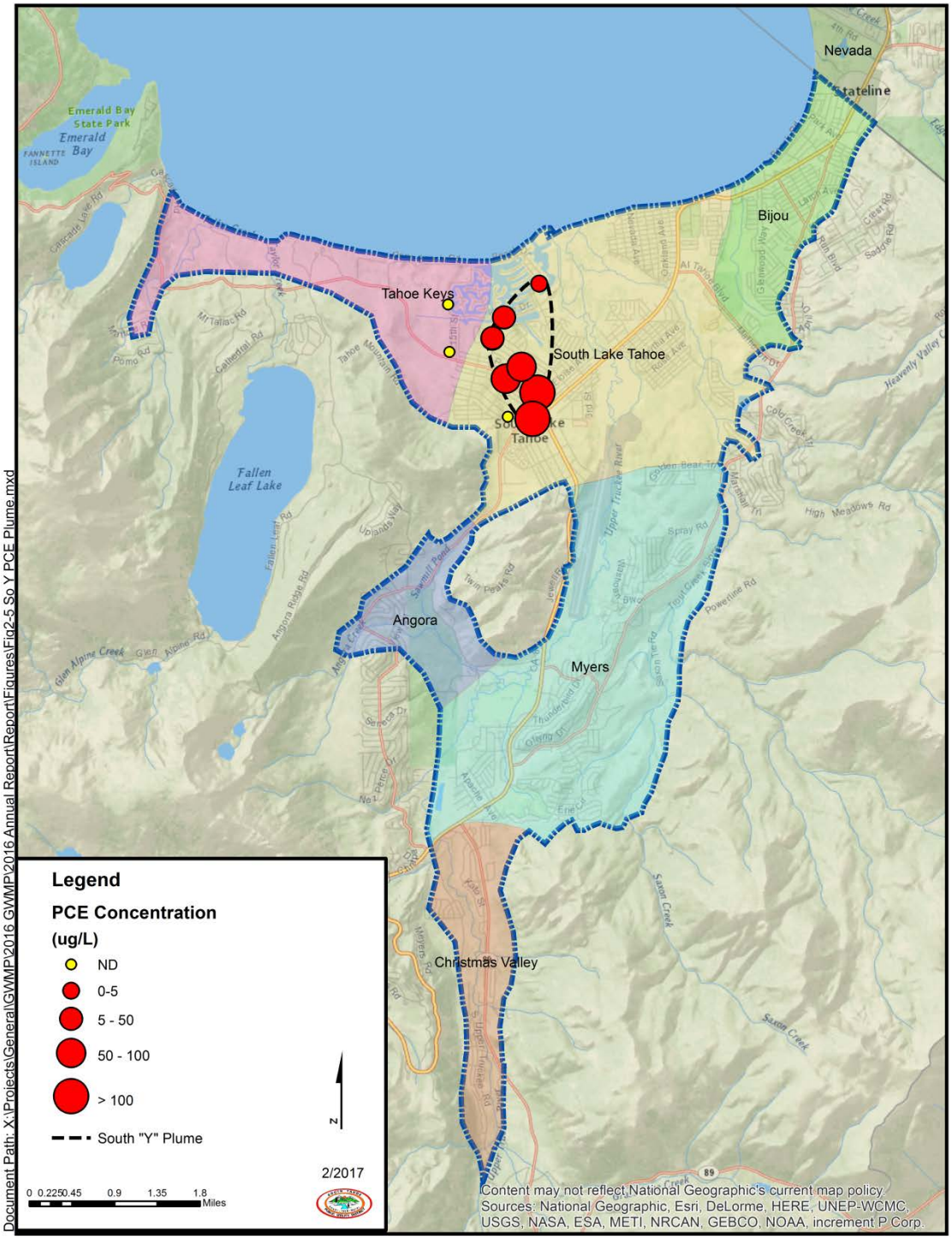

Figure 2-7. Location of the South "Y" Plume within the TVS Basin, as defined by wells with PCE concentrations above 5 micrograms per liter during 2011 - 2016 (Adapted from GEI Consultants, 2016).

The South "Y" Plume has impaired three PWS wells (LBWC #2, LBWC #5 and TKWC #2) with a combined source capacity of 3.25 million gallons per day (MGD). Trace levels of PCE below MCLs is presently detected in one PWS well (TKWC #1); however, PCE concentrations have been steadily increasing in this well during the 2016 WY. Potential impairment of TKWC #1 would further reduce the total production capacity of area drinking water sources by an additional 1.44 MGD. Two other PWS wells (LBWC #1 and TKWC #3) west of the South "Y" plume are presently non-detect (ND) for PCE; however, the combined source capacity of these two neighboring wells is 3.82 MGD and is believed to be at risk for groundwater contamination in the future. The District has mutual aid and assistance agreements for the emergency provision of drinking water using inter-tie connections from its water distribution system to both the Lukins Brothers Water Company (LBWC) and Tahoe Keys Water Company (TKWC) water systems. During the 2016 WY, the District provided 8.73 million gallons through its inter-tie connection to LBWC, which is about 10% of LBWCs total water production for the 2016 WY (see Table 2-2).

Groundwater is the primary source of drinking water for the communities overlying the TVS Basin. The high reliance on groundwater requires that PWS wells must have sufficient source capacity to meet water system demands within the TVS Basin. Because of this reliance on groundwater and susceptibility of groundwater sources to contamination, the total source capacity of active PWS wells is used as an indicator to describe current basin conditions with respect to groundwater quality (Pohll et al, 2016). During the 2016 WY, the total source capacity of PWS wells operating within the TVS Basin is estimated at 28.12 MGD. The minimum threshold for groundwater quality within the TVS Basin is the total maximum day demand (MMD) requirement for all beneficial users of groundwater within the TVS Basin, estimated at 22.775 MGD (Pohll et al, 2016). As the total source capacity of PWS wells exceeds the MDD requirement for all beneficial users, the impact of the South "Y" Plume has not reached the level of an undesirable result. However, the total source capacity of PWS wells has declined by more than 10 % compared to 2011 levels (32.4 MGD). The majority of this decline is attributed to degraded water quality impacts from the South Y Plume (see Figure 3-1).

In September 2015, the Lahontan Regional Water Quality Control Board (LRWQCB) issued a proposed Clean Up and Abatement Order (CAO No. R6T-2015-PROP) to clean up and abate the discharge and threatened discharge of chlorinated hydrocarbons at 1024 Lake Tahoe Blvd, South Lake Tahoe, CA. In July 2016, a revised draft of the proposed CAO (CAO No. R6T-2016-PROP) was issued (LRWQCB, 2016a). The revised CAO includes revised findings based on more recent data collected by the District, LRWQCB and the results of an air sparge test conducted at the subject site (LRWQCB, 2016b). The LRWQCB is currently considering public comments received on the revised draft CAO.

The District, in collaboration with the SAG, has conducted investigations and pursued funding to address the PCE contamination in the South Y Area. Detailed discussions of these activities are provided in Sections 3.7 BMO #7 – Technical Studies and Section 3.8 BMO#8 - Funding of this report.

2.6 Groundwater Production

Groundwater is the primary source of drinking water throughout the TVS Basin and is supplied for residential and commercial water use. More than 90 percent of groundwater extractions from within the TVS Basin are from PWS wells operated by the District, the TKWC and LBWC. Groundwater extractions from these wells are metered using propeller or turbine type flowmeters with a register for total flow and a flow rate indicator. Totalizer readings are recorded on a daily basis by the District and on a monthly basis by TKWC and LBWC. Accuracy of measurement for these flow meters is typically on the order of +/- 2%.

Table 2-2 shows the monthly and total pumping volumes of groundwater extracted by PWS wells during the 2016 water year. During the 2016 WY, a total of seventeen (17) PWS wells were active, of which two were on stand-by status (restricted for emergency use only).

PUBLIC WATER SYSTEM	UNITS	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEPT	2016 WY
South Tahoe Public Utility District (STPUD)	AF	400	313	379	318	284	301	280	385	641	810	788	632	5,534
Tahoe Keys Water Company (TKWC)	AF	80	17	20	20	19	15	20	64	134	161	167	148	865
Lukins Brothers Water Company (LBWC)	AF	23	10	10	14	10	13	10	20	37	41	44	33	266
TVS BASIN PWS TOTALS		503	340	409	353	313	330	311	469	813	1,012	999	814	6,665

Table 2-2. Monthly pumping volumes for community water system wells in the TVS Basin during the 2016 water year, reported in acre-feet (AF).

Groundwater production from each of the TVS Basin public water systems listed above is shown below in Figure 2-8. Since the 2005 WY, the annual groundwater extractions from the pumping of these PWS wells has ranged from about 6,298 AF in 2015 to about 9,652 AF in 2007, with a median value of about 7,770 AF. During the 2016 WY, the total groundwater production from these wells (6,665 AF) was about 15% below the median value. Figure 2-9 shows the locations of the active PWS wells and accompanying pumping volumes for the 2016 WY.

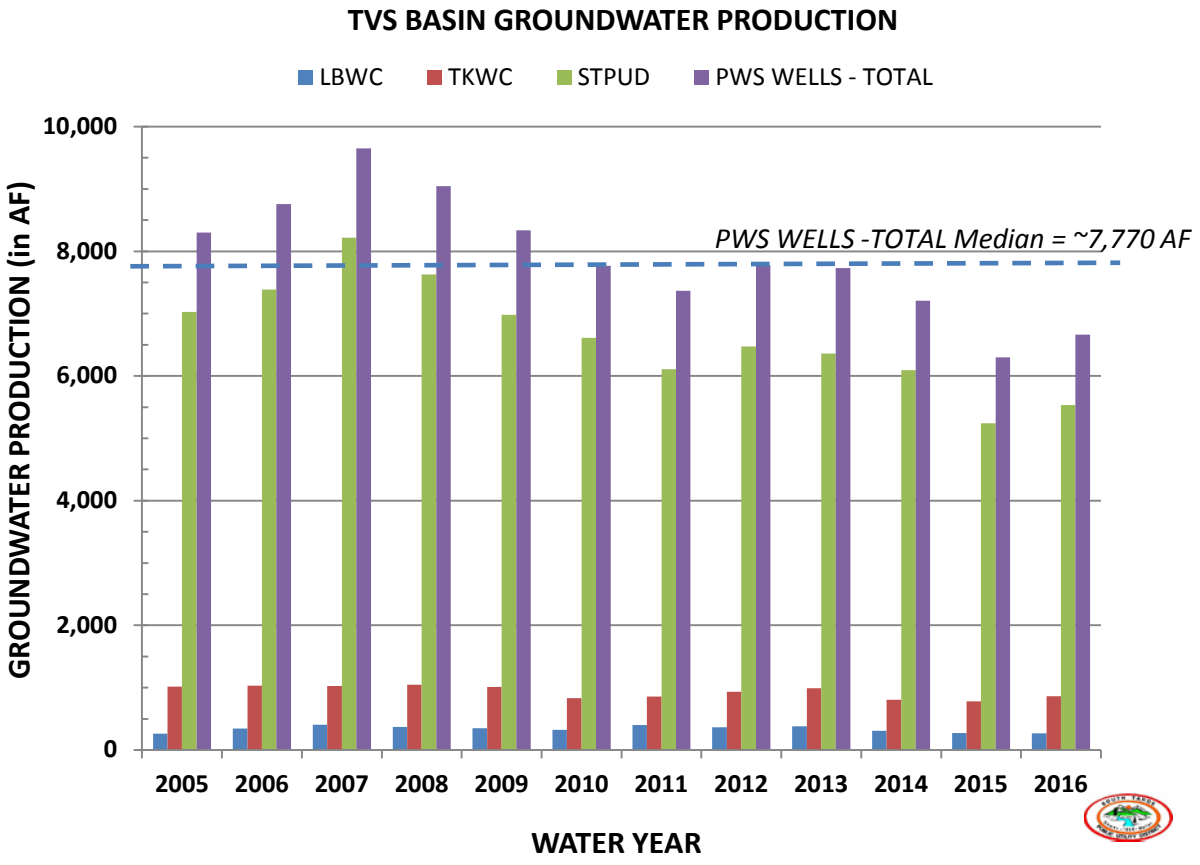

Figure 2-8. Groundwater production trends for public water system wells in the TVS Basin since the 2005 WY, in AF.

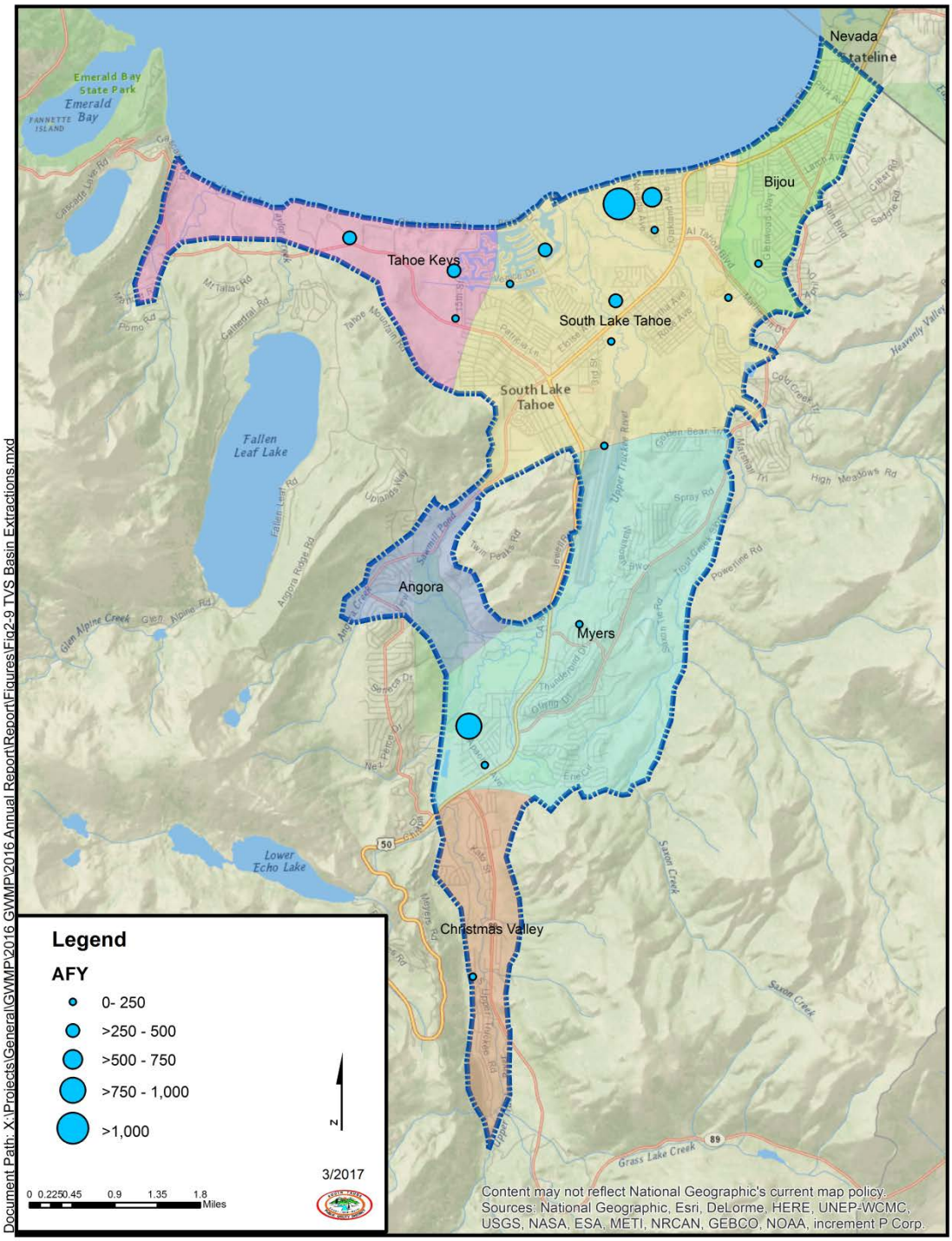

Figure 2-9. Groundwater extraction from public water system wells during the 2016 WY, in AF. These extractions account for more than 90% of the groundwater pumped from the TVS Basin.

2.6.1 Water Use

Total water use information provided in this section is from the South Tahoe Public Utility District 2015 Urban Water Management Plan (UWMP) (J. Crowley Group, 2016). As indicated in the preceding Table 2-2 , the District produces the majority of drinking water used within the TVS Basin (5,534 AF or 83% of TVS Basin PWS Totals). Although not complete, information from this UWMP is believed to be representative of water demand trends within the TVS Basin, calculated on a calendar year basis.

Actual water demands for the 2016 WY have not been categorized, therefore, 2015 water demands from the UWMP are presented in Table 2-3. All non-residential customers are metered, but there are still 41 percent residential customers unmetered. The District is installing meters on all connections and should be fully metered by 2025. The majority of the District's customers are residential. The District commercial category includes office and retail, as well as the resort accounts including hotels, restaurants, and snowmaking. "Losses" account for non-metered water use such as firefighting, flushing, leaks, water theft, or meter inaccuracies.

Use Type *(Add additional rows as needed)*	2015 Actual		
	Additional Description *(as needed)*	Level of Treatment When Delivered	Volume, AFY
Single Family		Drinking Water	1,853
Multi-Family		Drinking Water	915
Commercial	includes institutional	Drinking Water	1,950
Landscape		Drinking Water	6
Losses	non-revenue water	Drinking Water	517
		TOTAL	**5,241**

Table 2-3. South Tahoe Public Utility District 2015 water system demands for potable and raw water (J. Crowley Group, 2016).

Projected customer water demands through 2035 are summarized in Table 2-4. As use of recycled water within the Lake Tahoe basin is prohibited with few exceptions by the Porter-Cologne Act and water supplies are adequate, there are no recycled water demands. Water losses during 2015 are calculated per the DWR/AWWA water audit methodology. 2015 water losses as a percent of total water use are used to project future water losses through 2035. The District does not project any transfers, exchanges, or other potable water uses at this time (J. Crowley Group, 2016).

Use Type *(Add additional rows as needed)*	Additional Description *(as needed)*	Projected Water Use, AFY *Report To the Extent that Records are Available*				
		2020	2025	2030	2035	2040 *(opt)*
Single Family		2,375	2,422	2,468	2,515	
Multi-Family		1,061	1,082	1,103	1,124	
Commercial	includes institutional	2,035	2,075	2,115	2,155	
Landscape		6	6	6	6	
Losses	non-revenue water	542	552	563	574	
TOTAL		**6,019**	**6,136**	**6,255**	**6,373**	**0**

Table 2-4. South Tahoe Public Utility District projected water demands for Potable and Raw Water (J. Crowley Group, 2016).

2.7 Groundwater Storage

Figure 2-10 shows the annual trends of groundwater extractions from PWS wells and the changes in groundwater storage, as derived from the annual water budget calculated by the TVS groundwater model. The main components of the water budget include groundwater recharge; groundwater discharge to streams (baseflow); groundwater flux to Lake Tahoe; and groundwater pumping. Changes in groundwater storage are calculated from the differences in total inflow (recharge) and total outflows (baseflow, flux to Lake Tahoe and groundwater pumping) to the modeled region over a specified period, in this case, water years (Carroll, *et al.*, 2016a).

Long-term reductions in groundwater storage are not occurring within the TVS Basin as evidenced by stable groundwater levels and average annual groundwater storage changes as calculated by the TVS groundwater model that are near zero. Minor groundwater storage changes do occur in response to climate variability and changes in groundwater extraction rates. Through the 12-year period of record (2005 - 2016), changes in groundwater storage have ranged from -3,274 AF (meaning groundwater levels are falling) during the 2008 below normal water year to 8,156 AF (meaning water levels are rising) during the 2011 very wet year. During the 2016 above normal WY the modeled change in groundwater storage is -2,007 AF. The change in groundwater storage trend shows that during the 2016 WY, the TVS Basin recovered about a 1,000 AF of the more than 11,000 AF of groundwater storage lost during the 2012-2015 Drought. This shows the magnitude of groundwater storage changes that may occur within the TVS Basin due to climate variability.

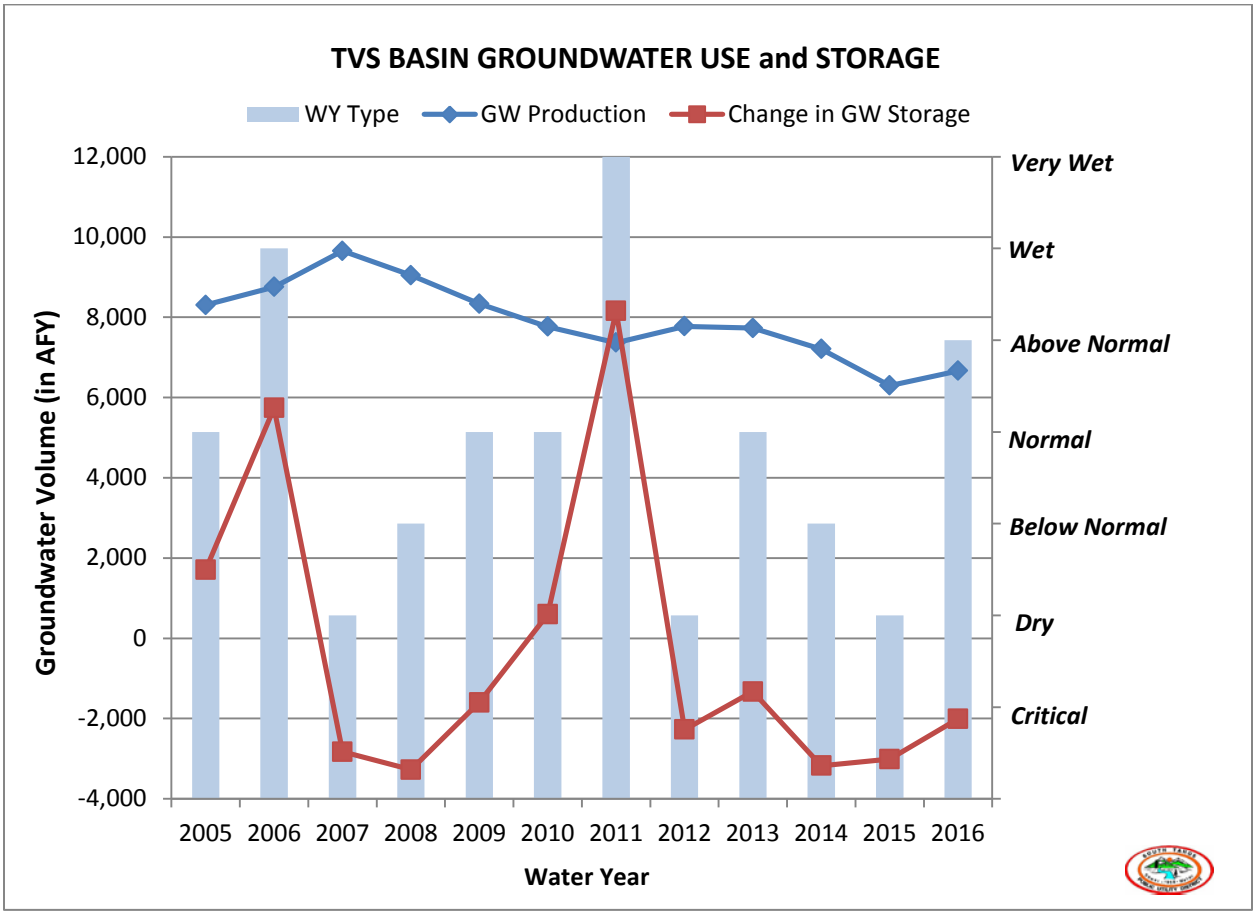

Figure 2-10. Annual groundwater production from public water supply wells and modeled change in groundwater storage, in acre-feet per year, for the TVS Basin from WY 2005 through WY 2016. Water year type using the TVS Basin classification is indicated on the vertical axis along the right-side of the graph. Note that positive changes in groundwater storage indicate that water levels are rising.

3 Basin Management Objectives

Basin Management Objectives (BMOs) are flexible guidelines for the management of groundwater resources that describe specific actions to be taken by the District to meet locally developed objectives at the basin or sub-area scale. Under the 2014 GWMP, eight BMOs have been defined for groundwater management of the TVS Basin.

- 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 the implementation of projects and management actions taken during the 2016 WY.

3.1 BMO #1- Maintain a Sustainable 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 normal range of groundwater levels during the base period (2001 – 2010) for groundwater levels (Section 2.2.1). If long-term groundwater levels show a consistent declining trend that falls below the normal range, 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.

During the 2016 WY, the median for the May 2016 groundwater elevations was at the lower end of the Above Normal range (86%) of the historical data. Groundwater levels will continue to be monitored in accordance with the Basin Monitoring Program.

3.2 BMO #2 – Maintain and Protect Groundwater Quality

Groundwater in the TVS Basin is typically of excellent quality; however, there is historical groundwater contamination from regulated industrial and commercial chemicals, which is impairing water supplies. The nature of the aquifer makes it highly vulnerable to groundwater contamination as evidenced by these past contaminant releases.

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 State Water Resources Control Board Division of Drinking Water (SWRCB-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 public 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 and the development of future groundwater supplies.

The objective of setting quantitative goals for BMO #2 is to provide a means for assessing the 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 levels that threaten the beneficial use of groundwater sources within the TVS Basin.

3.2.1 Source Capacity

The measurable goal for BMO #2 is that degraded water quality concerns within the TVS Basin should not rise to a level that threatens the ability of groundwater sources (PWS wells) to meet water system demands. Demand requirements for public water systems are calculated in accordance with methods described under Section 64554 of the California Waterworks Standards. Under these standards, a public water system's sources shall have the capacity to meet the system's maximum day demand (MDD) calculated using water system's daily, monthly or annual water use data, as available. These standards also include a water system's requirements for peak hourly demand (PHD); however, these requirements are directed toward the adequacy of the water system's distribution system to provide sufficient flows. Therefore, only the MDD for the PWS wells are used to establish a minimum threshold for degraded water quality in the TVS Basin.

Approximately 93 percent of the total water demand is satisfied by the public water system wells operated by the District, TKWC and LBWC water systems. To account for the beneficial users of groundwater not connected to these water systems, a 10 percent safety factor is added to the MDD derived for these water systems to determine the minimum threshold for the TVS Basin. Results of these calculations provide a minimum threshold of 22.775 MGD needed to meet water demands of all beneficial users in the TVS Basin.

The current state of the TVS Basin with regard to groundwater quality is indicated below in Figure 3-1. The total production capacity for all active public water supply wells operating within the TVS Basin is 28.12 MGD, which exceeds the MDD minimum threshold for water quality by 5.3 MGD. However, total

source capacities have declined since 2011 and continue to be of concern. Groundwater management actions taken to mitigate this groundwater concern are described below in Sections 3.7 and 3.8.

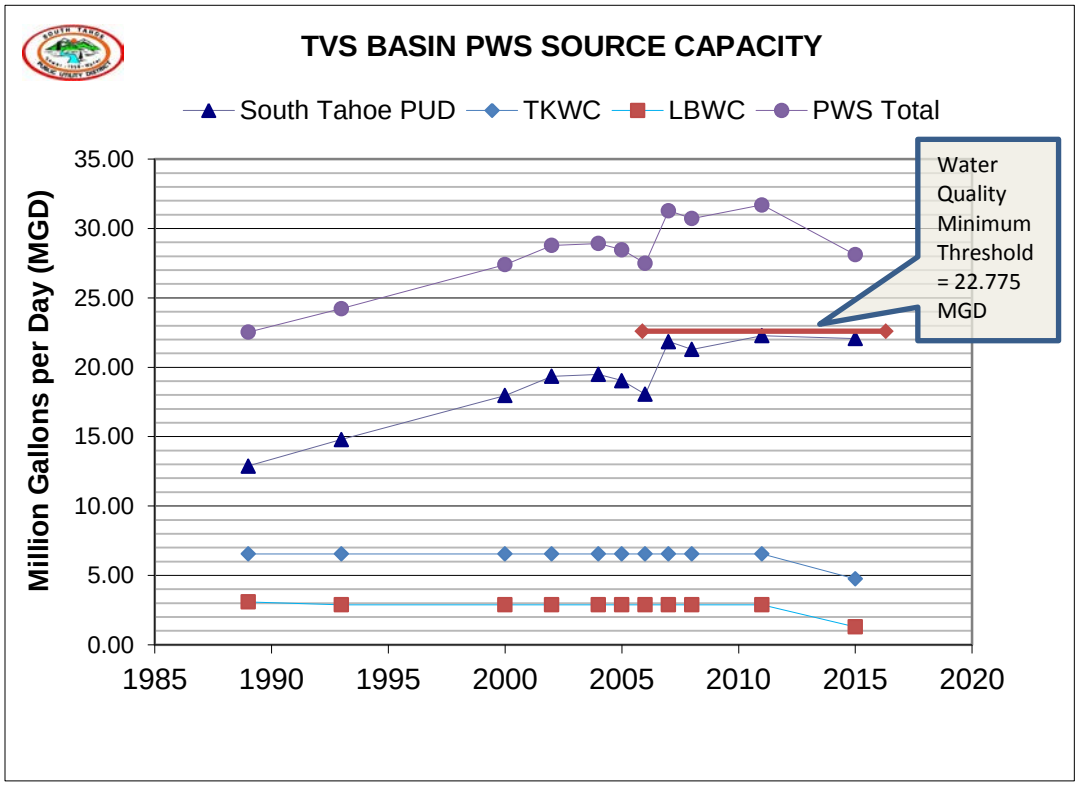

Figure 3-1. Source capacity, in million gallons per day, for active public water system wells operating within the TVS Basin from 1989 through 2015 (adapted from Pohll et al., 2016).

3.3 BMO #3 – Building Collaborative Relationships

The TVS Basin includes a wide range of stakeholders in addition to the District, smaller water companies and domestic well owners. Government agencies, local business interests, environmental groups and private citizens all have interests in local groundwater management. Collaboration and coordination with other local agencies and stakeholders for implementation of the 2014 GWMP is achieved through the Stakeholders Advisory Group (SAG). SAG members during the 2016 WY are listed below in Table 3-1.

Member	Title	Affiliation
Jason Burke	Storm Water Coordinator	City of South Lake Tahoe
Ken Payne, P.E.	Interim General Manager	El Dorado County Water Agency

Robert Lauritzen, P.G.	Geologist	El Dorado County Environmental Management Division
Brian Grey	Engineering Geologist	Lahontan Regional Water Quality Control Board
Joey Keely	Ecosystem Staff Officer	USFS-Lake Tahoe Basin Management Unit
Jennifer Lukins	Water Purveyor	Lukins Brothers Water Company
John Larson	Water Purveyor	Tahoe Keys Water Company
Bob Loding	Water Purveyor	Lakeside Mutual Water Company
Scott Carroll	Environmental Planner	California Tahoe Conservancy/Real Property Owner
Rebecca Cremeen	Associate Planner	Tahoe Regional Planning Agency
Harold Singer	Retired	Non-Business Community Rate Payer

Table 3-1. 2016 WY Stakeholder Advisory Group members.

3.3.1 GSA Formation

The District has been recognized as the exclusive GSA for the portions of the TVS Basin within its service area since November 2015. On September 15, 2016, the District's Board of Directors held a public hearing to consider its decision to serve as a GSA for the portion of the TVS Basin outside of its service area (Figure 3-2). The District caused notice of this public hearing as provided by Water Code Section 10723(b) and Government Code Section 6066. A courtesy copy of the notice was also emailed to the Board of Supervisors of El Dorado County ("County") and the Board of the EDCWA. A copy of the notice was also provided to the SAG. All feedback and comments received prior to the public hearing were supportive of the District's election to act as the GSA for the portion of the TVS Basin outside of its service area. No comments were received at the public hearing.

Immediately following the public hearing, the District's Board of Directors adopted Resolution No. 3040-16, electing the District as the GSA for the portion of the TVS Basin outside of its service area. The District did not adopt any other bylaws, regulations, or ordinances in its role as the GSA at this time, though the need for the same may be revisited during development, adoption and/or implementation of a Groundwater Sustainability Plan (GSP) or alternative GSP (Alternative Plan).

The completed GSA Formation notification was submitted to DWR on September 16, 2016. Upon receipt of this notification, DWR posted the District's notification on its website for public comment. During the 90-day public comment period (September 30 – December 29, 2016), no other agencies submitted a

competing GSA formation notification and no letters of protest were received. As no other competing notice was received, the District is presumed to be the exclusive GSA within the area of the basin it manages.

With completion of this second GSA Formation notification, the TVS Basin is in full compliance with GSA Formation requirements, allowing implementation of SGMA across the full extent of the groundwater basin in cooperation with the EDCWA.

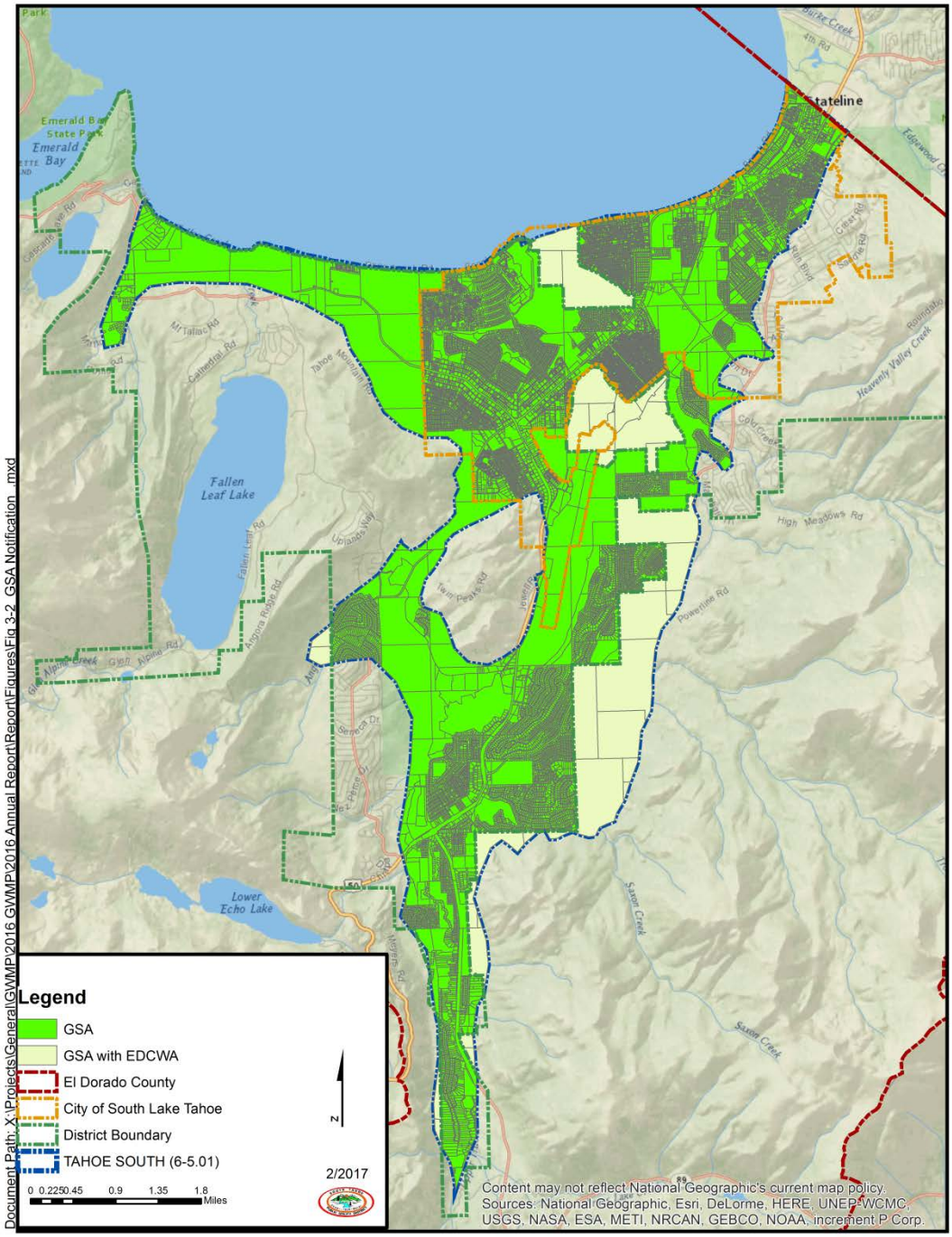

Figure 3-2. Groundwater Sustainability Agency (GSA) boundaries for the TVS Basin. The District is regarded as the exclusive GSA for portions of the basin within its service area and the exclusive GSA with the EDCWA for portions of the basin outside its service area.

3.3.2 GWMP Outreach

Over the past year, the District convened the following public hearings and/or workshops to inform the interested public and agencies of groundwater management activities being performed in the TVS Basin.

1. March 17, 2016: South Tahoe Public Utility District Board Meeting; Groundwater Management Plan 2015 Water Year Annual Report;
2. May 27, 2016: Stakeholders Advisory Group Workshop No. 1
3. August 10, 2016: El Dorado County Water Agency Board of Directors: Tahoe Valley South Subbasin (6-5.01) Groundwater Management;
4. September 15, 2016: South Tahoe Public Utility District Board Meeting; Formation of Groundwater Sustainability Agency for Remaining Portion of the Tahoe Valley South Groundwater Basin (6-5.01);
5. October 20, 2016: South Tahoe Public Utility District Board Meeting; Board Agenda Item 6.a. South Y Fate and Transport Model;
6. October 25, 2016: Stakeholders Advisory Group Workshop No. 2; and
7. December 15, 2016: South Tahoe Public Utility District Board Meeting; Board Agenda Item 8.d. Submittal of Alternative Plans for the TVS Basin.

GWMP documents, Workshop Agendas, Meeting Materials and Meeting notes are posted on the District's website and available for download at: http://stpud.us/news/groundwater-management-process/

3.4 BMO #4 – Integrating Groundwater Quality Protection and Land Use Planning

A key element of the 2014 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) collect groundwater data on a regular schedule to improve the understanding of groundwater conditions in the TVS Basin.

During the 2016 WY the District continued to make improvements to its Drinking Water Source Assessment and Protection (DWSAP) Map through;

- Data clean-up of conflicting well locations;
- Use of heat map to show densities (number per acre) of active potential contaminating activity (PCA) sites; and
- Use of 2016 WY groundwater production volumes to delineate source water protection zones surrounding PWS wells.

Figure 3-3.shows the updated DWSAP Map for the 2016 WY.

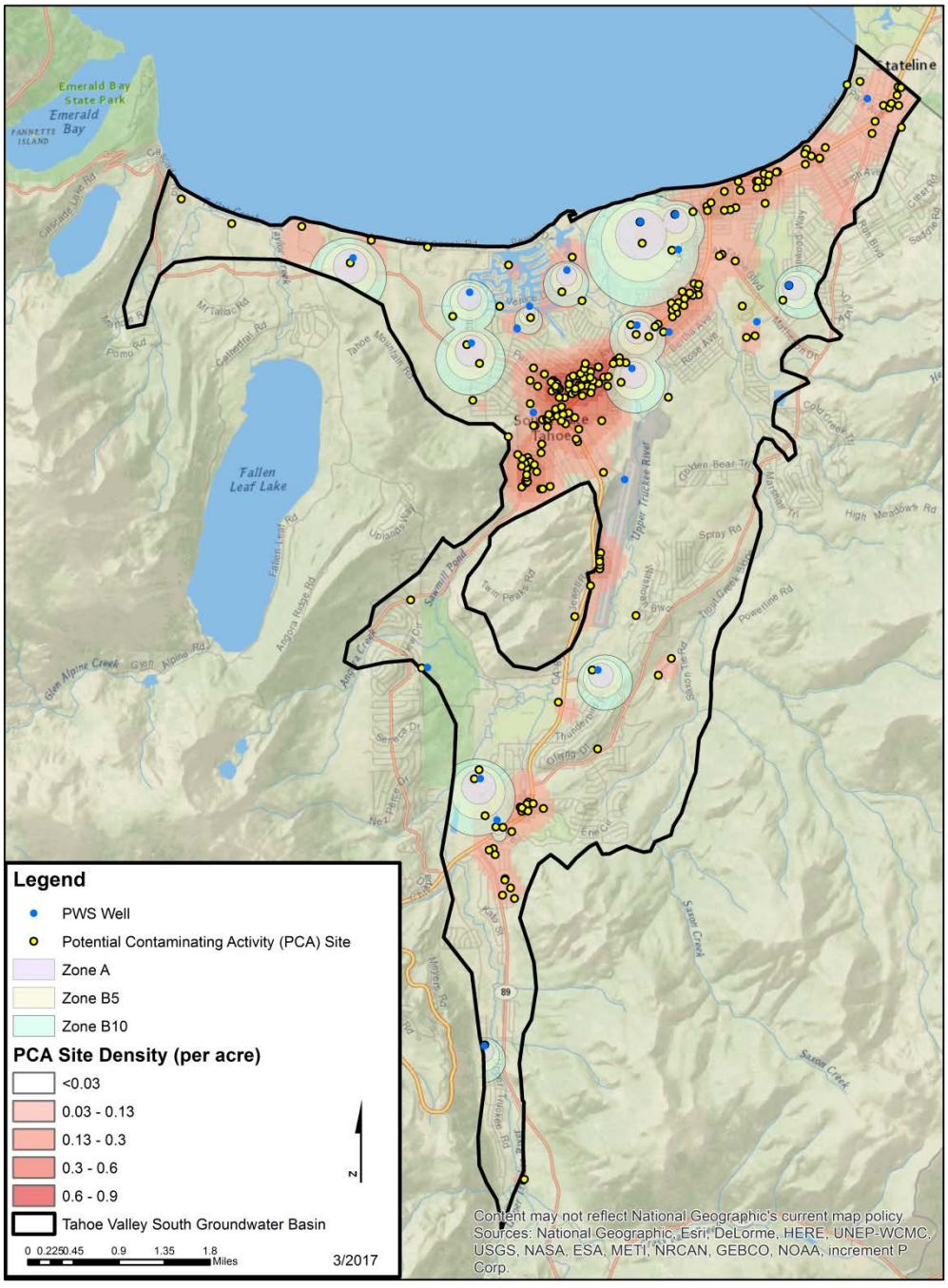

Figure 3-3. Drinking Water Source Assessment and Protection (DWSAP) areas for active public water supply wells in the TVS Basin. Drinking water protection areas surrounding active wells are generated using the modified calculated fixed radius method (CDHS- DDW, 1999) and the total groundwater production for each well during the 2016 WY.

3.5 BMO #5 – Interaction of Water Supply Extractions on 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.

Pumping effects on Surface Water (BMO#5, Action 1) is planned to be evaluated as part of the Phase 2 modeling work being performed by DRI (Section 3.7.1). Modeling analysis will be used to ascertain whether groundwater withdrawals from public water system wells, small community water system wells, and domestic wells have a substantial effect on the surface water bodies including lakes, streams, and wetlands. This modeling analysis currently planned to be conducted during the 2017 WY.

3.6 BMO #6 – Stakeholders Advisory Group (SAG)

The purpose of BMO #6 is to provide guidance regarding the role of the SAG in plan implementation. This includes hosting regular SAG workshops in order to provide a forum for groundwater management issues in the TVS Basin and receiving a regional perspective from different members of the community (see Table 3-1). Other important functions of the SAG include;

1. Facilitation for interagency collaboration;
2. Assessing groundwater supply issues;
3. Assessing groundwater protection issues;
4. Data sharing; and
5. Developing regional support for groundwater projects.

During the 2016 WY, SAG workshops were convened in May and October. Major topics discussed during these workshops are listed in Table 3-2. Minutes from these workshops are provided in Appendix B.

WORKSHOP 1 (May 27, 2016)	**TOPICS**
	2016 Groundwater Management Activities
	South Y Extraction Well Study
	Proposition 1 GCP Funding
	TRPA Regulations
WORKSHOP 2 (October 25, 2016)	**TOPICS**
	2016 Groundwater Management Activities
	2016 DSWPA Mapping Update
	South Y PCE Investigation
	TVS Basin Groundwater Modeling Evaluation Update

Table 3-2. Major discussion topics for SAG Workshops convened during the 2016 WY.

3.7 BMO #7 – Technical Studies

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 is 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 projects reported under BMO #7 outline some of the studies being conducted by the District to further the understanding of the groundwater basin to help support groundwater management.

3.7.1 TVS Basin Groundwater Model

During the 2016 WY, DRI completed the initial phase (Phase 1) of development of groundwater models and hydrologic modeling tools for implementation of the GWMP. Phase 1 generally involved: acquiring the data to update the District's existing groundwater flow model and DRI's existing integrated GSFLOW hydrologic model for the South Tahoe watersheds; constructing and calibrating a steady-state groundwater flow model for the TVS Basin; constructing and calibrating a transient integrated hydrologic model for the South Tahoe watersheds; and calculating a water budget for the TVS groundwater system (Carroll et al., 2016a).

During Phase 2; DRI modeling work will generally involve;

1. Updating the MODFLOW and GSFLOW models through WY 2015;
2. Constructing calibrated transient GSLOW predictive models (2015 – 2100) to evaluate hydrologic effects resulting from climate change;
3. Constructing calibrated transient MODFLOW predictive models (2015 – 2065) for groundwater sustainability planning;
4. Completing hydrologic modeling tools to address specific BMO Actions identified under the GWMP;
5. Training District staff to maintain and use the calibrated models; and
6. Completing regular project management status reports and a final technical report documenting model development and model simulation results.

DRI started work on Phase 2, following completion of Phase 1 work in February 2016. Phase 2 work completed by DRI extended all boundary stresses through WY 2015 for Phase 2 modeling analysis and provided detailed analysis concerning the spatial and temporal distribution of recharge across the TVS model domain. During initial work on Phase 2, DRI also defined a threshold between recharge and groundwater storage at approximately 43,200 AFY (Carroll et al., 2016b). Recharge below this threshold results in negative changes in groundwater storage - groundwater levels fall; while recharge above this threshold results in positive changes in groundwater storage -groundwater levels rise (Pohl et al, 2016). Phase 2 modeling work is on-going and anticipated to be completed during the 2017 WY.

3.7.2 South Y Investigations

During the 2016 WY, the District and TKPOA retained consultants to conduct separate investigations to provide data that could be used to address the PCE groundwater contamination problem in the South "Y" Area. These investigations are briefly summarized in the following section.

3.7.2.1 South Y Extraction Well Suitability Investigation

The South Y Extraction Well Suitability Investigation project originated from concerns expressed by the SAG during the 2014 update of the GWMP. PCE contamination has historical roots in the TVS Basin and was first noted in neighboring PWS wells as far back as 1989. This groundwater concern has persisted to the present day and has impaired drinking water sources used by the District, LBWC and TKWC. During 2014, LBWC removed from service two of its three active PWS wells due to the presence of PCE above MCLs (Section 2.5). Support of renewed investigation and clean-up of groundwater contamination with special emphasis on PCE is an action item in the GWMP Short Term Implementation Plan under BMO #2 (Kennedy-Jenks, 2014).

During the 2016 WY, the District in collaboration with the SAG developed a scope of work to evaluate the suitability of using an inactive water supply well (LBWC #4) for the removal of chlorinated hydrocarbons from groundwater in the South "Y' area. The primary objectives for this investigation were to identify primary flow paths of contaminant migration; estimate aquifer hydraulic properties for extraction well design; and conduct a water treatment pilot test for use in developing a water treatment system predesign (GEI, 2016b).

The South Y Extraction Well Suitability Investigation was conducted from February through May 2016 and consisted of (a) collecting pre-test water quality samples from three discrete depth intervals in LBWC #4 during non-pumping (static) conditions; (b) installing pressure transducers in LBWC #4 and the Rockwater Well to identify potential well interferences from neighboring pumping wells; (c) mechanical cleaning of LBWC #4; (d) conducting a short-term step-drawdown aquifer test; (e) collecting pre-pilot testing baseline water quality samples; (f) conducting a 24-hour constant rate aquifer test, dynamic well profiling (spinner survey) and collecting four depth-specific groundwater samples during pumping conditions; and (g) conducting a water treatment pilot test using a high efficiency ultra violet light (UV) to decompose PCE through direct photolysis, UV advanced oxidation process (AOP) using sodium hypochlorite, and analysis of the spent granular activated carbon (GAC) media used to treat extracted groundwater for discharge compliance.

Results from analysis of field data and analytical laboratory results lead to the following conclusions: (a) in LBWC #4, PCE concentrations (8.6 to 39 µg/L) increased with depth (65 feet, 85 feet, and 107 feet) under static conditions; during pumping, however, PCE concentrations were higher (47 to 55.1 µg/L) but did not vary with depth (68 feet, 72 feet, 82 feet, and 110 feet); (b) in the Rockwater Well, PCE concentrations (69 µg/L) are higher than Well #4 based on a sample collected at 60 feet during static conditions; (c) the Rockwater Well is located hydraulically upgradient of Well #4 and, therefore, suggests

the source of PCE contamination is located further upgradient to the south of these wells; (d) based on the general mineral and inorganic water quality results, only iron and manganese exceed their respective secondary MCLs; (e) Well #4 would be classified by the California Division of Drinking Water (DDW) as an extremely impaired source because PCE concentrations are expected to exceed 10 times the MCL of 5 µg/L; however, DDW will work with the water supplier (utility) to permit the source for drinking water, particularly in situations where a contaminant plume needs to be mitigated through pump and treat methods; (f) PCE was not effectively removed by UV, therefore, UV/AOP is not a recommended treatment technology; (g) dye test results of the spent GAC media indicated the GAC bed life would be decreased by 30 percent, likely due to iron and manganese fouling. Pre-treatment to remove iron and manganese prior to GAC filtration is recommended.

Based on these conclusions and discussions with the District and LBWC, GEI developed five alternatives for pumping and treating PCE at the LBWC #4 location, recommending Alternatives 3 and 5. Additional information collected during a future feasibility study could be used to select between these two alternatives. Alternative 3, consists of drilling a new municipal supply well at the LBWC #4 site that would meet all of the DDW structural well standards, permitting the well with DDW as an extremely impaired source, destroying the original Well #4 in accordance with state and county well standards. Alternative 5 is similar to Alternative 3 but includes the construction of a shallow extraction well to remove PCE contaminated groundwater from the uppermost WBZ (TKZ5). Due to the requirement of a 50-foot sanitary seal, the upper TKZ5 zone may be sealed off if Alternative 3 alone is selected, which would limit removal of PCE from this horizon and may reduce the overall pumping rate. As part of a feasibility study, GEI recommend that a multilevel piezometer be constructed within 100' of LBWC #4 to collect depth-discrete data for final selection between the recommended alternatives (GEI, 2016b).

Findings from this investigation were shared with the SAG and LRWQCB. The Final Report was issued in June 2016 and remains available for download from the Groundwater Management Page of the District's website.

3.7.2.2 PCE Investigation for TKPOA

In concert with the South Y Extraction Well Suitability Investigation, the TKPOA funded an additional study using historical data to assess the spatial and temporal distribution of PCE in soil and groundwater at and down-gradient (north) of the South "Y" Area This study included a review of site investigation reports filed with the LRWQCB and water quality and groundwater production data provided by the District, TKWC and LBWC. Based on review and evaluation of the compiled data, GEI subdivided wells into six different groups based on relative location to the "Y", time of operation and level of PCE concentration detected in the well. Most recent detections (2011 – 2016) were used to estimate the approximate extent of the South "Y" Plume (GEI Consultants, 2016a). Data from this investigation was shared with the SAG and provided to the LRWQCB.

3.8 BMO #8 – Funding

Groundwater projects require funding. In addition to funding from local sources, there are state and federal grants and other funding programs available. These types of opportunities require effort to prepare grant funding applications.

3.8.1 Proposition 1 GSP

During the 2016 WY, the District in collaboration with the SAG identified potential projects for funding to address the PCE groundwater contamination in the South "Y" area. Using the findings of the South Y Investigations (Section 3.7.2), the District in partnership with the LBWC and TKPOA, prepared Pre-Applications and a Full Proposal (FAAST # 36772) requesting funding through the Proposition 1 Groundwater Sustainability Program (GSP) to conduct an engineering feasibility study of remedial alternatives to mitigate PCE groundwater contamination in the South "Y" Area. The total project budget for this request is $588, 540 with a 50% funding match of $294,270 and a grant request of $294,720. Expenditures for supporting studies (e.g., South Y Investigations) and technical planning used to develop the feasibility study are used for the funding match.

3.8.2 GWMP Costs

Costs for implementation of the 2014 GWMP are accounted from the District's Water Enterprise Fund. Development and implementation costs for groundwater management activities have been supported by the El Dorado County Water Agency (EDCWA) under its Cost Share Grant program. Under this program, EDCWA assists projects eligible under Section 96-11 of the El Dorado County Water Agency Act and Board Expenditure Priority Policy (No. B-1003). Grants used for these projects are typically at a 50% matching fund level.

Figure 3-4 shows the GWMP expenditures during the fiscal year (FY) ending June 30, 2016. Costs for groundwater management projects and groundwater management activities totaled $317,900. Over the first 2-years of implementation, the total cost is $454,600.

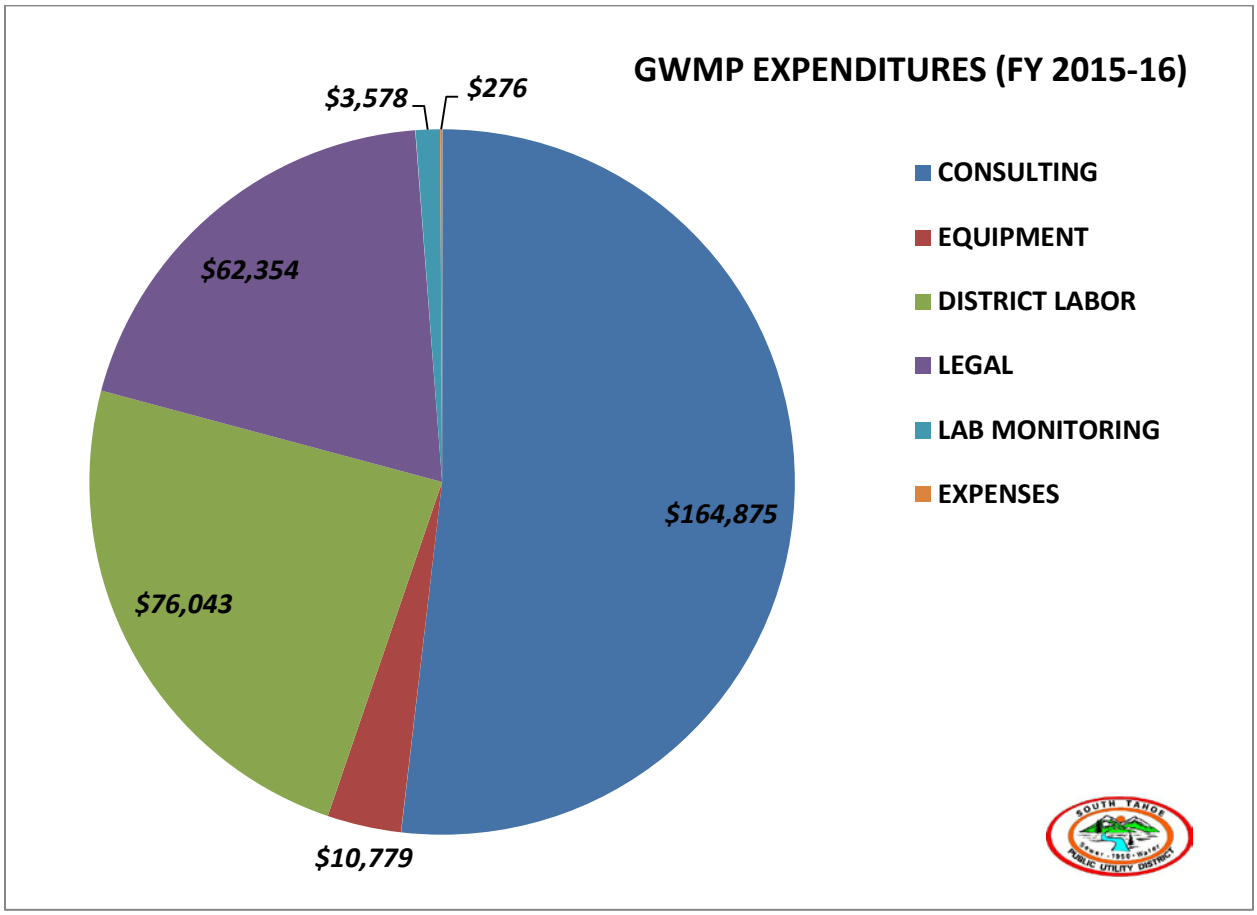

Figure 3-4. Groundwater management plan implementation costs for FY 2015-16.

4 Proposed Actions (2017 WY)

Groundwater management activities for the 2017 WY will generally involve continuing the progress of on-going work initiated during the 2016 WY and the proposed actions listed below;

1. Continue to monitor new regulations and BMP guidance issued by the DWR and SWRCB for implementation of SGMA;
2. Continue to engage with the SWRCB and respond to any questions that may arise during review of the Proposition 1 Full Proposal (Section 3.8.1);
3. Continue to engage with DWR and respond to any questions that may arise during Alternate Plan review (Section 4.1);
4. Complete South "Y" investigation activities initiated at the start of the 2017 WY (Section 4.2);
5. Continue to develop Phase 2 groundwater models, use the numeric models to inform specified BMO actions and advance implementation of the GWMP;

6. Proceed with an engineering feasibility study of remedial alternatives to mitigate PCE contamination in the South "Y" area;
7. Expand public outreach to small community water system and domestic well owners;
8. Continue to monitor basin conditions and groundwater supplies;
9. Continue to update the SAG on the progress of GWMP-related activities, seeking active participation of its members; and
10. Continue to inform the public of groundwater management activities through public hearings, SAG Workshops, notifications through its interested parties list; and the District's web page.

Near the end of the 2016 WY, the District initiated groundwater management projects that are being implemented during the 2017 WY. A brief description of these on-going projects is provided below.

4.1 GSP Alternatives

SGMA was signed into law in September 2014 by Governor Brown to ensure that California's most at-risk groundwater basins are managed sustainably. SGMA defines "sustainable groundwater management" as "the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results" and entails curtailing seawater intrusion, subsidence, and long-term supply depletion by 2042 through local and regional management. (Wat. Code, § 10721(v).) In addition to forming a GSA, SGMA requires groundwater basins to adopt either a groundwater sustainability plan (GSP) or an alternative GSP (Alternative Plan) by January 31, 2022.

SGMA identifies the following three Alternative Plans:

- A GWMP developed pursuant to Part 2.75 of the Water Code (Existing Plan Alternative)
- Management pursuant to an adjudication action
- An analysis of basin conditions that demonstrates that the basin has operated within its sustainable yield for at least a 10-year period (ABC Alternative) (Wat. Code ,§ 10733.6(b).)

To be eligible to submit any of the above Alternative Plans, the local agency must be able to demonstrate that (1) the Alternative Plan applies to the entire basin (23 Cal. Code Regs., § 358.2(a)), and (2) the basin is in compliance with Part 2.11 of the Water Code. The local agency must also demonstrate that its Alternative Plan is "functionally equivalent to the elements of a [GSP] required by Articles 5 and 7... [and is] sufficient to demonstrate the ability of the Alternative [Plan] to achieve the objectives of [SGMA]." (23 Cal. Code Regs., § 358.2(d)).

Groundwater management within the TVS Basin has been practiced by the District since 2000, starting with enactment of its original GWMP as Ordinance No. 477-00 (Groundwater Ordinance). During 2014, this ordinance was updated and replaced by the 2014 GWMP, prepared in accordance with AB3030, also known as the Groundwater Management Act (CWC Section 10750 et. seq.). For the past several years,

the District has been implementing the 2014 GWMP, which has been successful in sustainably managing the TVS Basin's groundwater resources for the region's various beneficial users.

During the 2016 WY, the District conferred with the SAG about submitting an Alternative Plan during both SAG Workshop 1 and Workshop 2 (Appendix B); compared the 2014 GWMP to the requirements of both SGMA and the Emergency Groundwater Sustainability Plan Regulations ("GSP Regulations") to demonstrate that the 2014 GWMP is functionally equivalent to a GSP; prepared an ABC Alternative demonstrating that the TVS has operated within its sustainable yield for at least a 10-year period; and completed DWR's Alternative Elements Guide to demonstrate that the ABC Alternative is functionally equivalent to a GSP.

In December 2016, the District submitted concurrently, the 2014 GWMP as an Existing Plan Alternative to a GSP and the ABC as an Analysis Plan Alternative to a GSP for public comment and DWR review and evaluation. As part of its submittals, the District indicated its preference to DWR that the review be sequenced in such a manner that its Existing Plan Alternative be reviewed first and should DWR agree that the 2014 GWMP is functionally equivalent to a GSP, review of the ABC Alternative was not necessary. Acceptance of the Existing Plan Alternative would allow the District to continue groundwater management activities under the 2014 GWMP and amend this plan as needed, to be fully compliant with new requirements under SGMA. DWR is required to complete its review and assessment of the District's submitted Alternative Plans within two years of its submission (Section 107344.4 (d)).

4.2 South Y Investigation

During the planning and development of the technical proposal for the Proposition 1 GSP Full Proposal (Section 3.8.1), additional work tasks were identified that needed to be performed prior to starting the engineering feasibility study (FS). These tasks generally involved data acquisition and contaminant transport modeling.

Recent PCE concentration data is needed to show the present distribution of PCE groundwater contamination within the South "Y" Plume. In December 2016, the District began collecting groundwater samples for water quality analysis from four inactive water supply wells and one observation well located or near the South "Y" Plume. Groundwater samples from these wells are to be collected in December 2016 and then again during the first quarter of 2017. These data will be used to provide current water quality data for use in the contaminant transport model and FS.

A contaminant fate and transport model is needed that would simulate a variety of remediation activities to aid the engineering alternative analysis and help optimize the design of the remediation system. In October 2016, the District issued a task order to DRI to use the TVS groundwater model to construct a fate and transport model (MT3D-MS) that will be used to simulate the movement and change in concentrations of PCE moving in the South "Y" Plume. Once developed, this fate and transport model will be used to simulate up to fifteen (15) remedial alternatives with varying model elements

(e.g., single vs. multiple sources; location and number of extraction wells; groundwater production from PWS wells, and waste discharge).

5 GWMP Changes

In 2014, the GWMP was last updated to be fully compliant with DWR requirements (AB3030 Plan; California Water Code Section 10750 et seq.) and to better reflect the groundwater concerns of the greater South Lake Tahoe community. As indicated previously in Section 3.0, activities during the 2015 WY focused on items needed to satisfy compliance with new SGMA requirements and initiating projects to address actions identified in the updated GWMP. During the 2016 WY, many projects were conducted to complete projects initiated in 2015.

There were no plan component changes, including addition or modification of BMOs, during the period covered by this report.

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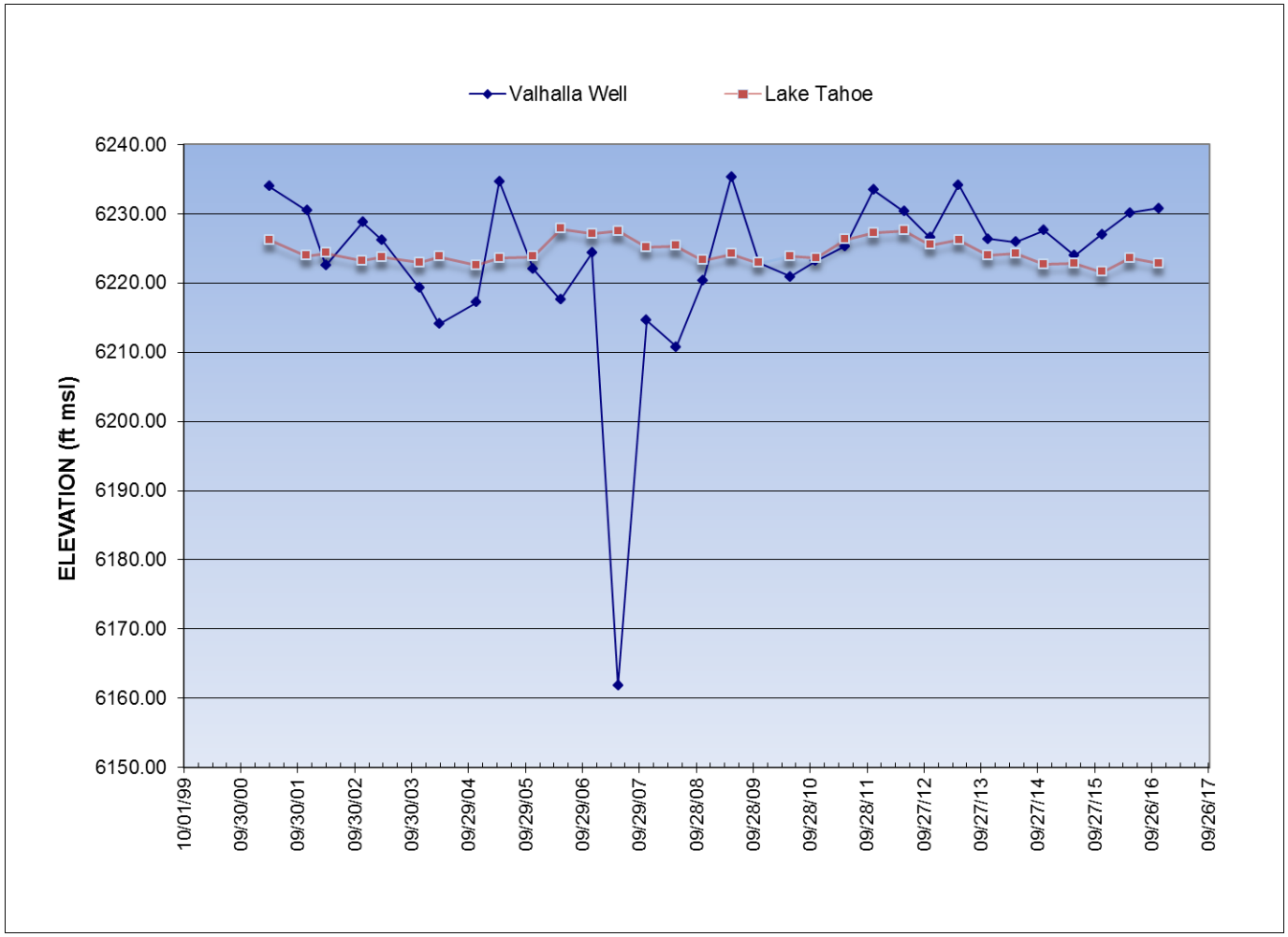
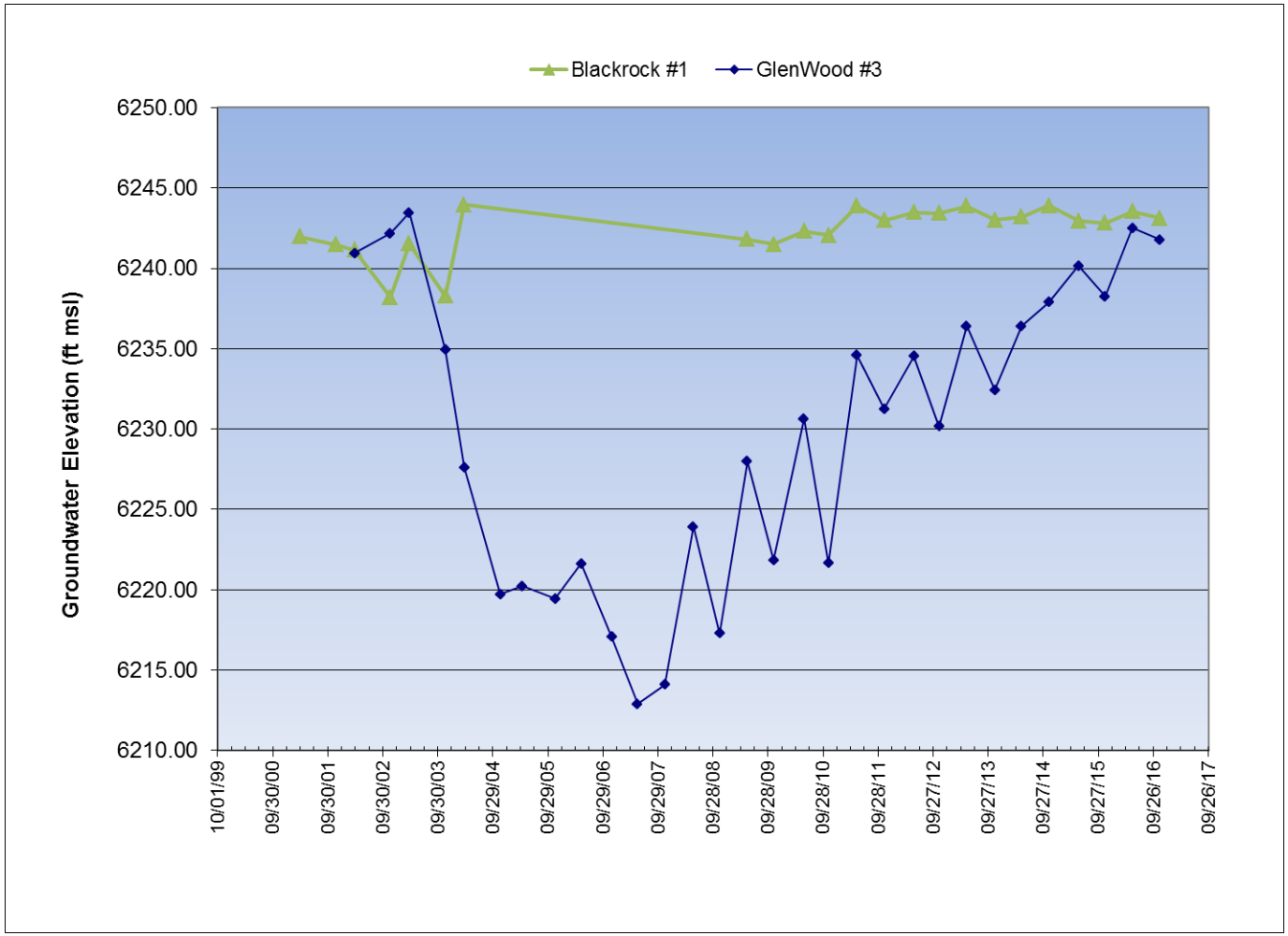
APPENDIX A

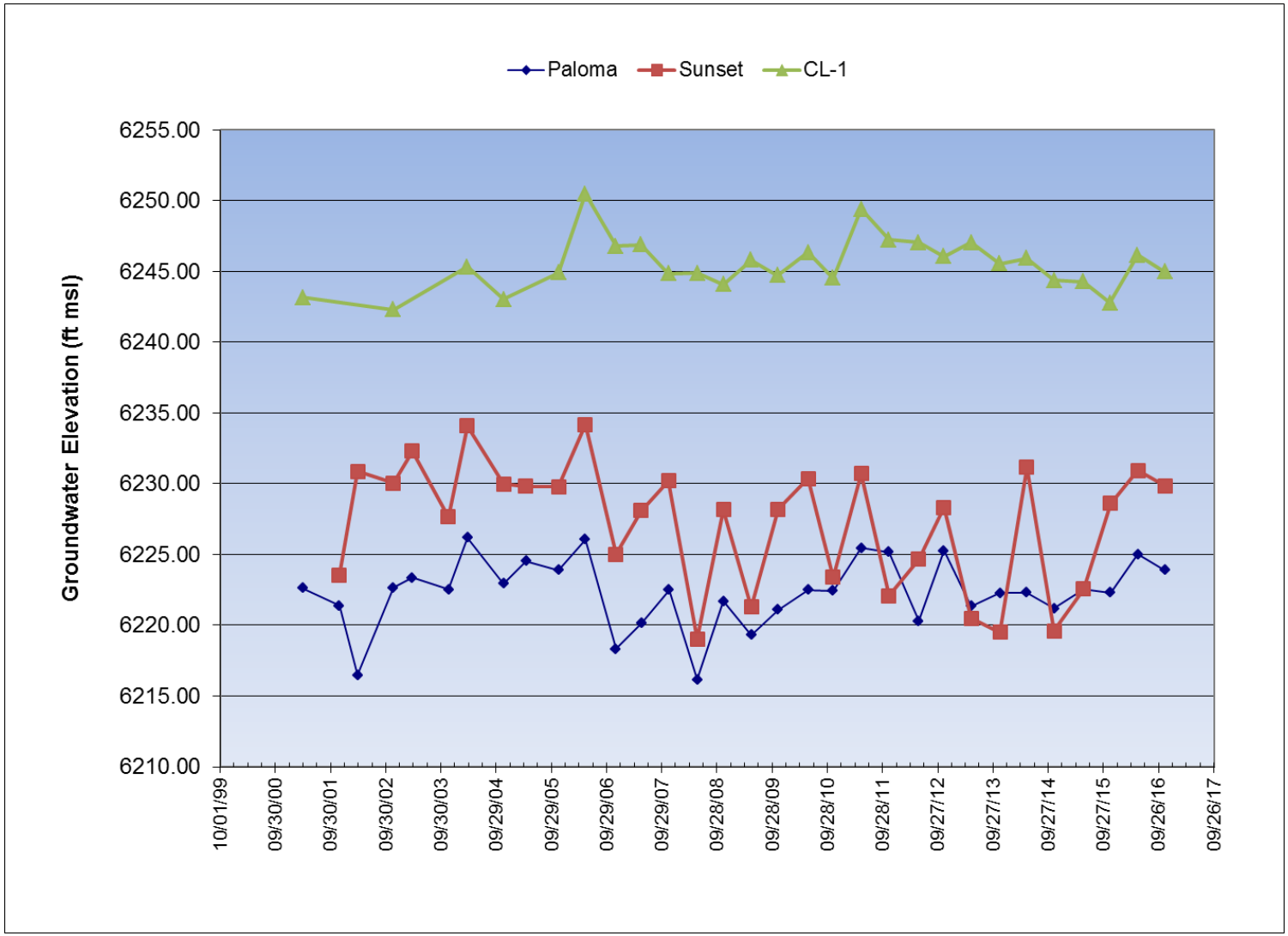
TVS Basin Hydrographs



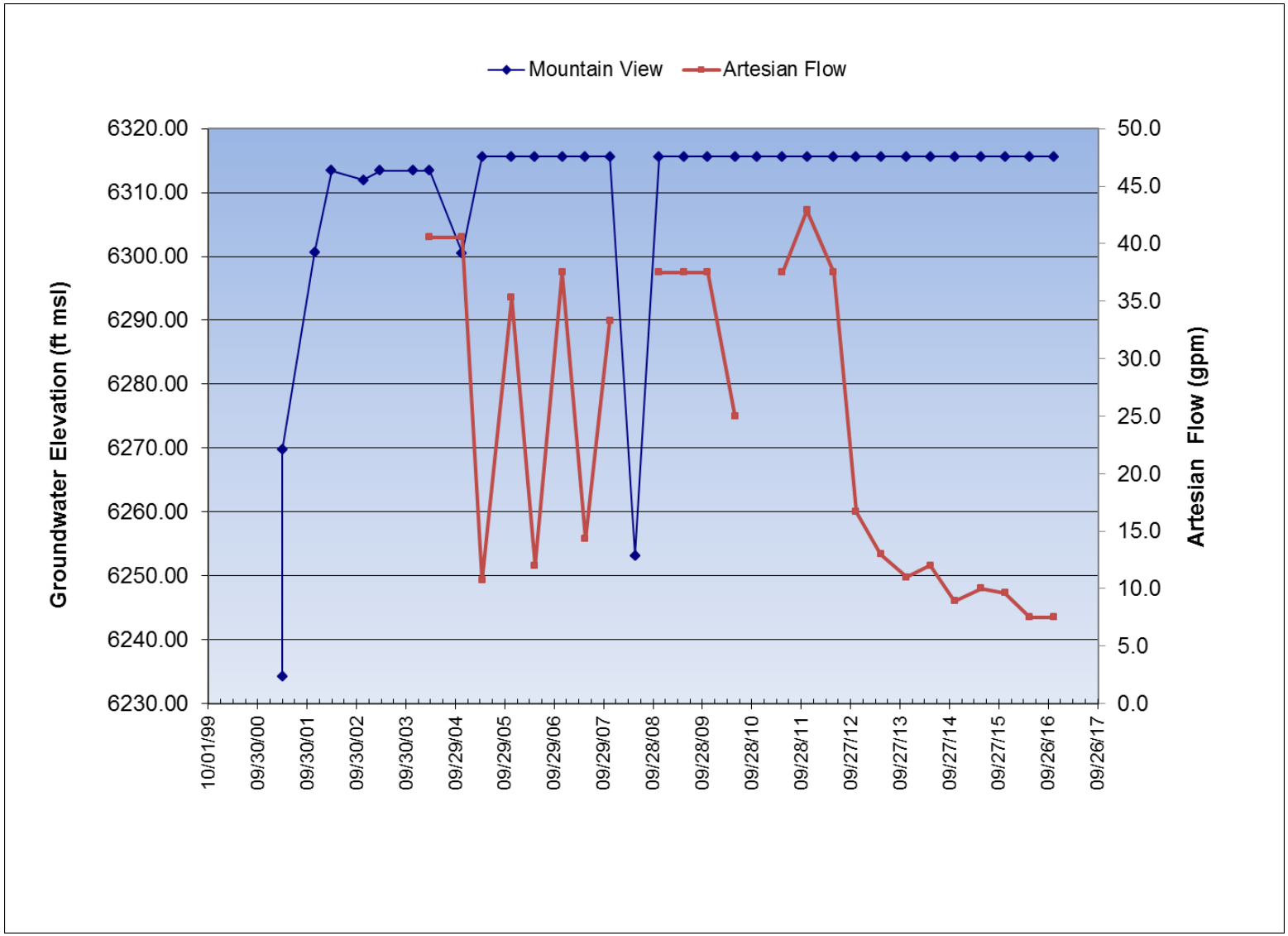
Appendix A – 1. Groundwater hydrograph for the Valhalla (6,257 feet msl) well within the Tahoe Keys Groundwater Zone. Also shown is the water level (stage) of Lake Tahoe measured at USGS 10337000 over the period of record for groundwater levels. All readings are static water levels collected following a minimum 12-hour recovery time, with the exception of the May 2007 reading, which is a pumping water level measured at a well pumping rate of 700 gallons per minute(gpm).



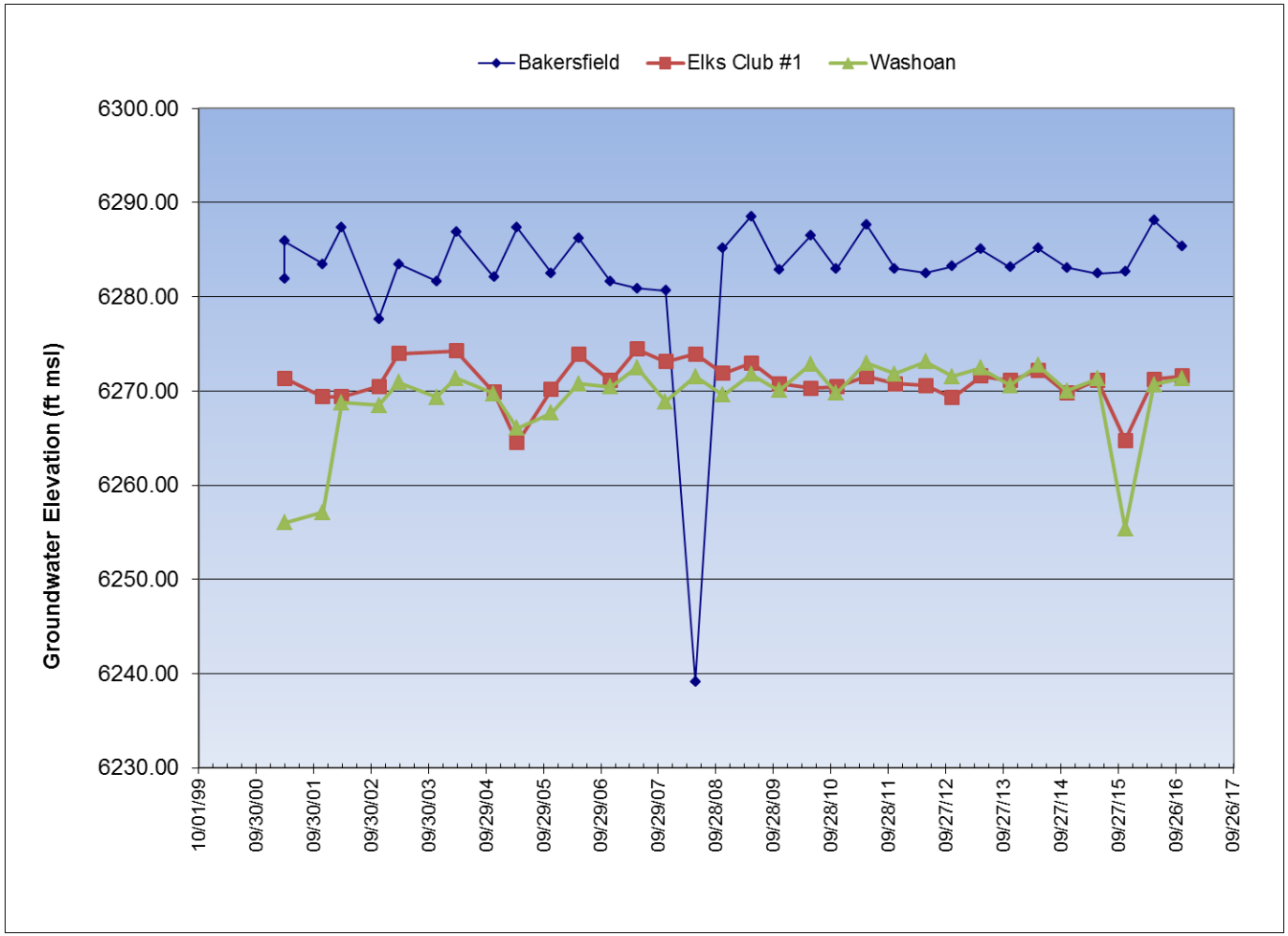
Appendix A – 2. Groundwater hydrograph for the Blackrock #1 (6,241 feet msl) and Glenwood #3 (6,260 feet msl) wells within the Bijou Groundwater Zone. Static water levels in the Blackrock #1 well are stable and slightly rise above ground surface ((6,240 feet msl). The Glenwood #3 well is used to monitor water levels near an active PWS well (Glenwood #5). In 2007, the District restricted water production from Glenwood #5 in order to sustain groundwater production from the Bijou Groundwater Zone. The water level response in Glenwood #3 shows that this change in operation has been successful in allowing groundwater levels to recover to sustainable levels.



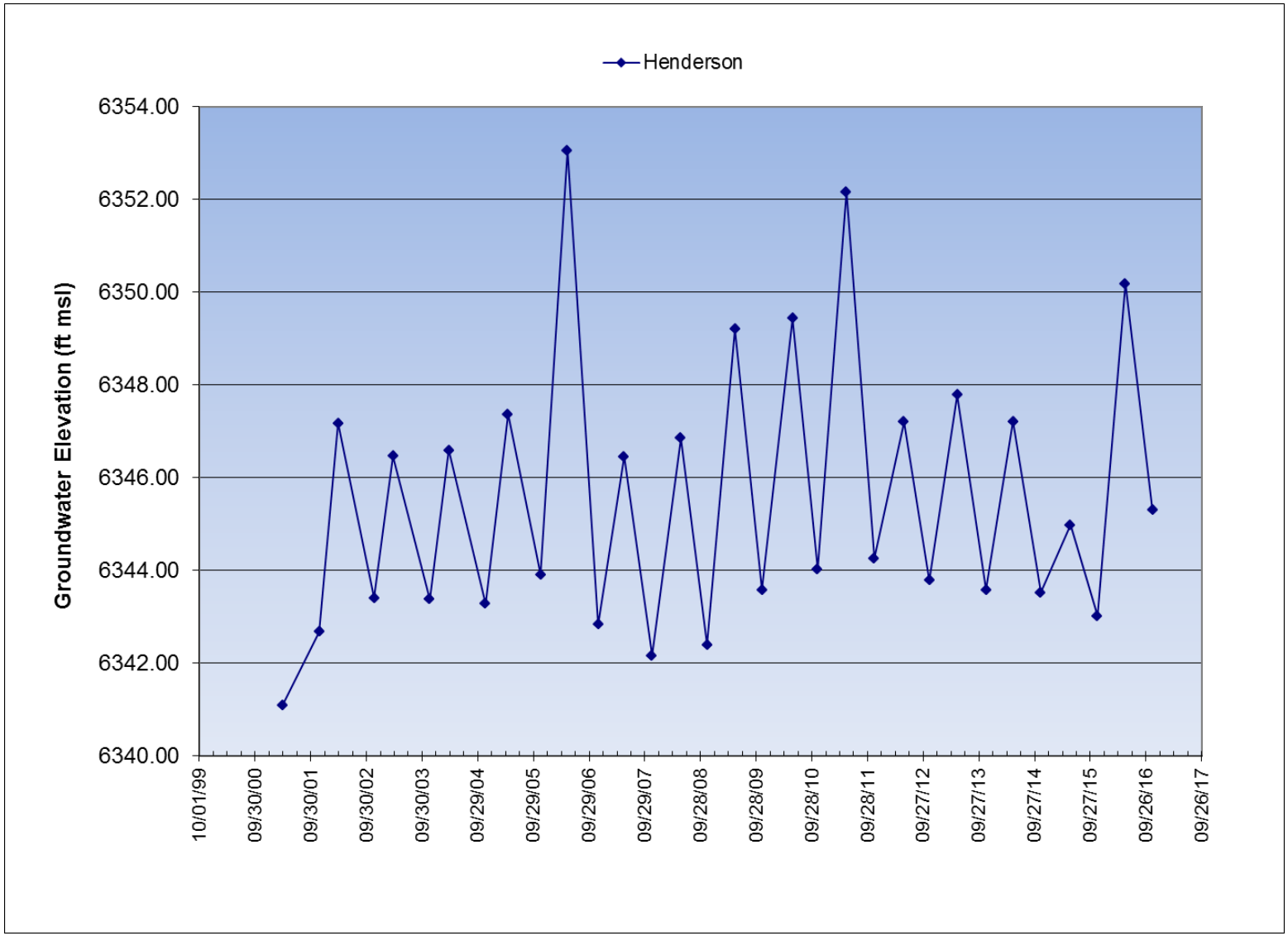
Appendix A – 3. Groundwater hydrograph for the Paloma (6,267 feet msl); Sunset (6,249 feet msl) and CL-1 (6,279 feet msl) wells in the South Lake Tahoe Groundwater Zone. Groundwater levels in these wells are stable and do not exhibit a long-term downward trend.



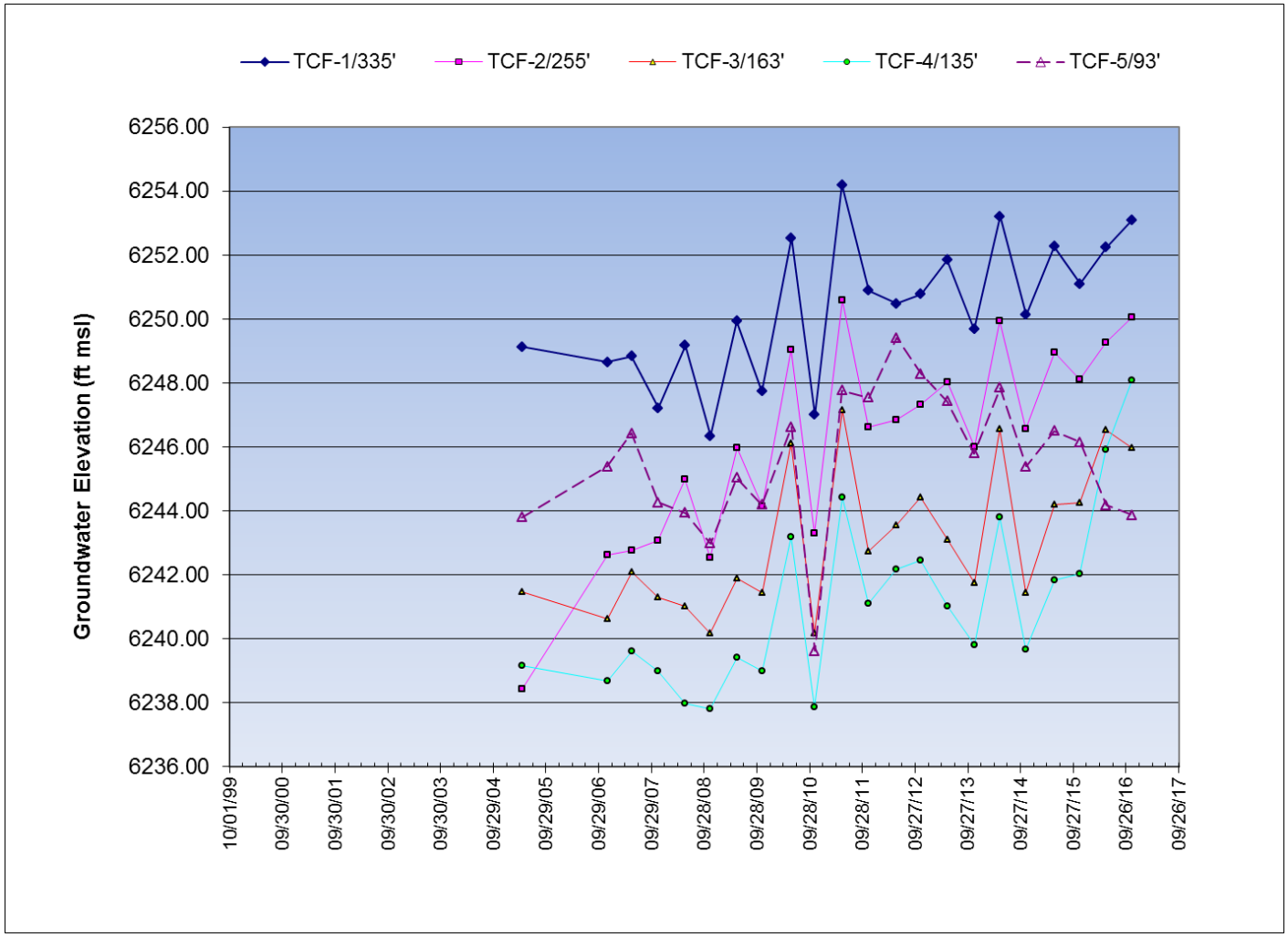
Appendix A – 4. Groundwater hydrograph for the Mountain View (6,313 feet msl) well in the Angora Groundwater Zone. Also shown is the artesian flow rate measured from the same well.



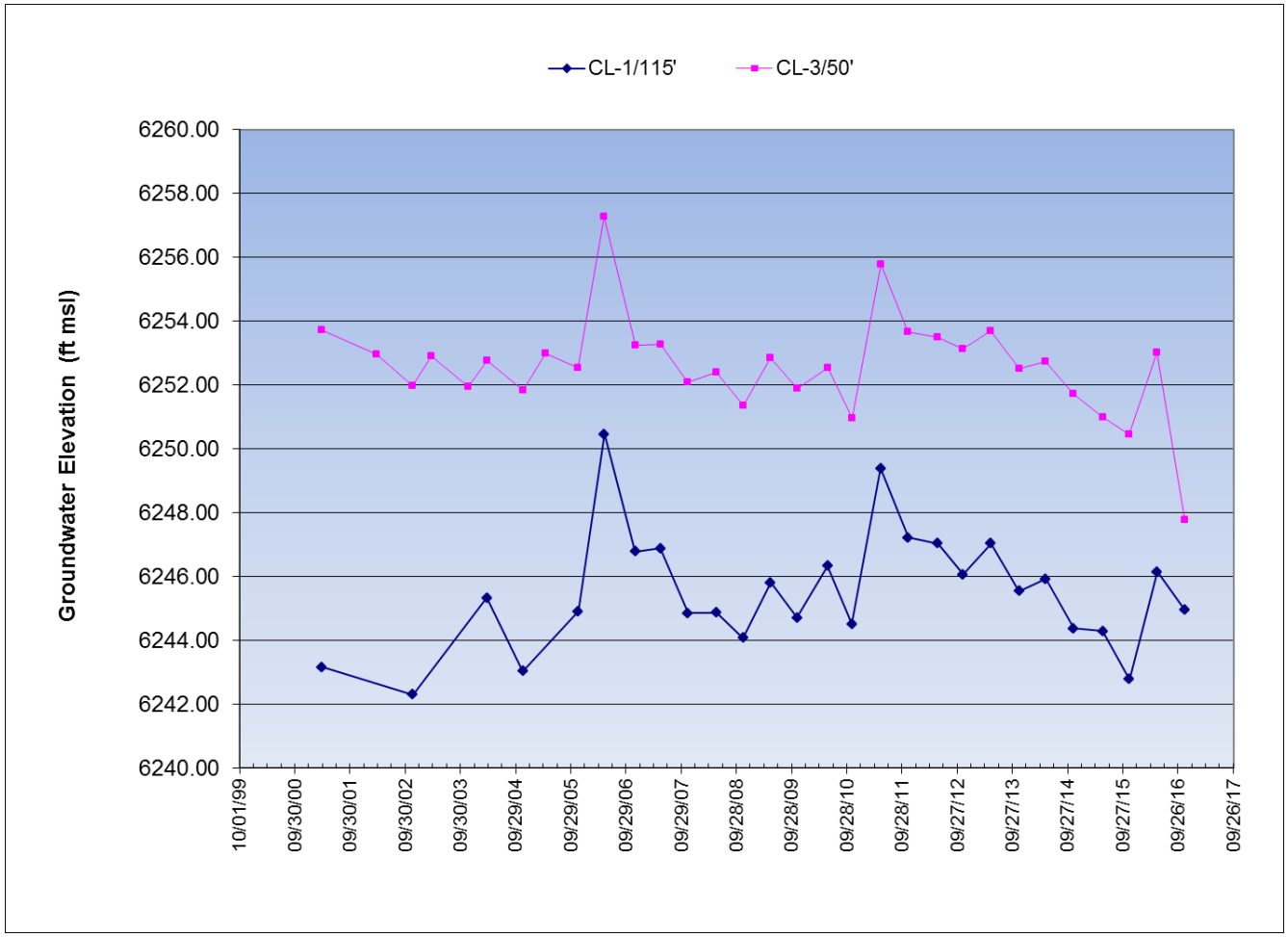
Appendix A - 5. Groundwater hydrograph for the Bakersfield (6,311 feet msl); Elks Club #1 (6,283 feet msl) and Washoan (6,308 feet msl) wells in the Meyers Groundwater Zone. Groundwater levels in the Meyers Groundwater Zone are relatively stable with short periods of declining water levels in response to increased pumping rates. Static water levels collected from the Bakersfield Well are following a minimum 12-hour recovery time, with the exception of the May 2008 reading which is a pumping water level measured at a well pumping rate of 1,500 gallons per minute(gpm).



Appendix-6. Groundwater hydrograph for the Henderson (6,366 feet msl) well within the Christmas Valley Groundwater Zone. Groundwater levels in this well are stable and do not exhibit a long-term downward trend.



Appendix – 7. Groundwater hydrograph for the USGS TCF (6,296 feet msl) nested well within the South Lake Tahoe Groundwater Zone. Total well depths for the observation wells completed within the common borehole are as indicated. The complex vertical flow directions indicated by differences in groundwater levels in this well are believed to result from lowered head in BZ 4 induced by pumping of the Glenwood #5 well.



Appendix - 8. Groundwater hydrograph for the Clement well cluster (6,279 feet msl) within the South Lake Tahoe Groundwater Zone. Total well depths for the observation wells comprising the well cluster are as indicated. Both CL-1 and CL-3 monitor groundwater levels from the uppermost water-bearing zone (TKZ5). Vertical flow is directed downward indicative of recharge adjacent to Tahoe Mountain.

APPENDIX B

SAG Workshop Minutes

Workshop 1 (May 27, 2016)

Workshop 2 (October 25, 2016)

2016 GWMP Stakeholder Advisory Group Minutes
May 27, 2016
South Lake Tahoe, CA

Members Present

Ivo Bergsohn (IB)	Rebecca Cremeen (RC)	John Larson (JL2)
Joey Keely (JK)	Harold Singer (HS)	John Thiel (JT)
Jenn Lukins (JL1)	Brian Grey (BG)	
Robert Lauritzen (RL)	Bob Loding (BL)	
Jason Burke (JB)		

Members Excused

Scott Carroll	Thomas Gavigan

Members Absent

Greg Daum	Doug Dame

Presentations

Lynn Nolan, STPUD	Rebecca Cremeen, TRPA
Eric Ingbar, Gnomon	Ivo Bergsohn, STPUD

Others Present
See Sign-In Sheet (Attached**).**

OPEN FORUM

There was no discussion.

APPROVAL of MINUTES

The SAG approved the meeting minutes from the December 16, 2015 Workshop (Attachment 1). Meeting Minutes will be posted on the District's website.

2016 GW Management Activities (Presentation)

A Power Point presentation was used to discuss GW Management Activities for the 2016 Water Year; 1) Staying current with new State Regulations for implementation of the Sustainable Groundwater Management Act (SGMA); 2 Collaboration with the Stakeholders Advisory Group (SAG) with expanded outreach to small community water systems, private well owners; 3) Issue with fringe areas (discuss later); 4) Complete South Y investigation; 5) Continue development of hydrologic model by DRI; 6) Continue use of water conservation measures; 7) Continue basin monitoring; and 8) Prop.1 funding for Groundwater Cleanup Program (GCP).

DWR Regulations and GSP Alternatives (Attachment 3): The recent Notice issued by the State Water Board (SWB) announcing the final approval to the Emergency Regulation Plans related

to Groundwater Sustainability Plans and Alternatives was discussed. The Emergency Regulations allows Groundwater Sustainability Agencies (GSAs) to submit alternative plans in lieu of a Groundwater Sustainability Plan (GSP). Acceptable alternatives include; 1) an AB3030 Groundwater Management Plan; 2) a comprehensive adjudication; [Basins managed under a court decree] or 3) An Analysis of Basin Conditions (ABC) showing that the basin operated within its sustainable yield over a 10yr period.

Under the Emergency Regulations, GSPs will address a number of undesirable results related to insufficient water supply. As the TVS Basin has adequate recharge, these types of undesirable results are not encountered in the Basin. The most prominent criterion that does apply is degraded water quality, which is identified as the primary groundwater concern within the existing Groundwater Management Plan (GWMP). In order to submit the existing GWMP as an Alternative, the District will need to provide supporting documentation showing the GWMP is functionally equivalent to a GSP. Functional equivalence has to do with plan contents; specifically Section 5 of the SGMA and Section 7 related to annual reporting and periodic evaluation requirements. The deadline for submitting an Alternative to DWR is January 1, 2017. The District believes it is in its best interest to submit an Alternative using the current GWMP along with the new information developed under the GWMP, such as the basin water balance recently completed by the Desert Research Institute (DRI) in February 2016.

SAG Discussion: Planning Horizon- The GWMP is reviewed every 5 years, which is similar to the periodic evaluation requirements required under the Act. The GWMP also includes an annual report that is also required for GSPs. **GSA Powers and Authority** – GSAs primary authority is managing groundwater extractions; this does not supersede LRWQCB authority for regulating water quality. Water quality thresholds in a GSP would be consistent with current Drinking Water Standards. GSAs do have the ability to enact water quality triggers to address groundwater contamination. These triggers could be added to the existing GWMP or included in a GSP, if needed. **Advantages/Disadvantages** – District believes existing GWMP is appropriate for managing identified groundwater concerns in the basin. Completing a GSP may provide more compliance with the Act, but will likely not add further benefit to managing groundwater quantity or quality that would justify its cost. The same groundwater management objectives can be achieved through the existing GWMP as required under a GSP. The resources needed to develop a GSP could also be better used to address existing groundwater concerns identified in the GWMP. BG noted that moving forward under the GWMP would not remove any powers and authorities from the GSA for conducting groundwater investigations. **Funding Concern**- Does managing the basin under a GWMP rather than a GSP make the District less competitive in seeking grant funds for implementation. District could potentially gain an advantage as other areas of the state are facing challenges in forming their GSAs. Having an Alternative GSP in place in by 2017, could benefit the District as Prop 1 implementation funds become available starting in 2017/2018. **Functional Equivalency –** District is in the process of determining the additional items that will need to be added to the GWMP to make it functionally equivalent to a GSP by the next 5-year review period (2019/2020). District is planning to

demonstrate to DWR how it will bring the GWMP into substantial compliance with all of the groundwater management objectives of the Act. JB shared issues City is having with Prop 1 requirement of having Storm Water Resource Plan, which is very redundant with Load Reduction Plan, similar to the GWMP and GSP; just addressing remaining items, but has been uncooperative. City wishes District best of luck with DWR.

Expanded Outreach (Attachments 4 & 5): Lists of different public water systems were introduced for discussion. Attachment 4 - list of groundwater users from District's GSA Formation Notification to DWR. IB expressed desire to better inform small water systems about current groundwater management activities and engaging a representative on the SAG. Potential advantages to joining SAG – greater communication, exchange of information (e.g., water quality concerns, potential mutual well interferences), shared interest in a sustainable resource. Potential outreach ideas- 1) use District mailing list of Private Well Owners; 2) engage Tahoe Meadows Homeowners Association (TMHOA); 3) Fallen Leaf Lake Homeowners Association?

Side Discussion: JB pointed out that GSA Formation Notification (STPUD, August 2015) did not indicate any disadvantaged communities (DAC) within the groundwater basin. That is not an accurate statement. Large portion of the groundwater basin include economically disadvantaged communities. Lukins water service is identified as a disadvantaged community. LN pointed out that definitions for DACs differ between state agencies; as such the definition applied depends on the agency responsible for administrating funding.

Fringe Areas: Fringe Areas are areas within the groundwater basin, which lie outside the District's service area boundaries. Most of the parcels within the fringe areas are public lands. Under the Act, the County is the default GSA for these areas. District needs to show that the GWMP covers the entire extent of the groundwater basin. District is working to develop an agreement with the El Dorado County Water Agency (EDCWA) that would allow these areas to be managed under the GWMP. This agreement needs to be completed before the end of 2016, to support of an Alternative GSP submittal.

Groundwater Modeling: The Phase 1 modeling work was completed in February; primarily focused for the groundwater basin and surrounding water. Report is available on District website. The District approved funding to continue the groundwater modeling program, and Phase 2a will be complete by the end of June. The model evaluation completed in June will also include a recharge analysis which is part of the groundwater vulnerability assessment being completed for the Basin. DRI is updating the MODFLOW and GSFLOW models through the 2015 water year and will start developing the predictive transient models for climate change analysis. These models will be used to simulate conditions from 2015 to 2100 (SGMA requires a 50 year

planning horizon). Dr. Greg Pohll, DRI, will be invited to provide an update on the modeling work at the next SAG workshop.

Urban Water Conservation: On May 18, along with approval of new GSP regulations, SWB also approved modifications to the Urban Water Conservation Regulations. Copies of a Technical Fact Sheet were made available to the SAG. A link at the bottom of the FS is to the State Water Board Information portal on the urban water use conservation regulations.

District and water purveyors will need to provide a Water Supply Reliability Estimate by June 15. The water supply reliability estimate requires an assessment of the current estimated amount of available water supply. For TVS Basin, that would be the amount of groundwater estimated to be in storage. The assessment assumes an additional 3 dry years and water demands similar as for the 2013-14 water years. Given the estimated amount of groundwater in storage, meeting the water reliability requirements should not be an issue. During discussion of this topic it inquired whether the District would continue instituting water conservation measures, regardless of whether there was sufficient groundwater in storage to meet demands over the 3-year horizon. The District has added some items to its existing conservation codes and added staff for educational outreach. It plans to stay with the water conservation program it's had in place since 2007 and may eliminate time-of-day restrictions that were enacted during 2015.

GWMP GIS; Eric Ingbar (EI), Gnomon; Two questions were posed to the SAG; 1) Is a public interface needed for viewing source water protection zones and potential contaminating activity (PCA) sites ?; and 2) Is a secure interface needed for water purveyors/regulators for sharing confidential information. A short questionnaire to identify the types of information that each agency can share was proposed; information types may be categorized as confidential and non-confidential. An open interface was also discussed that would allow all groundwater users to share water quality information with the public, if desired. Confidential information may be protected under the Public Records Act, as these would be working records and not archived (needs follow-up and further thought).

South Y Extraction Well Study (Presentation)

A Power Point presentation was used to provide an update, with preliminary data, on the District's South Y Extraction Well Suitability Investigation. The investigation was conceived following the presentation of contaminant information provided by Lisa Dernbach, LRWQCB

(LD) during the April 2015 SAG Workshop. During this workshop, the SAG suggested that the District consider conducting an investigation using the Lukins Brothers Water Company (LBWC) Well #4 to complement the source area investigation being planned by the LRWQCB. The purposes and objectives of the well investigation are to; 1) Identify Contaminant Pathways; 2) Define aquifer parameters; and 3) Characterize water quality for treatment system design. The LBWC #4 is an inactive well that was drilled in the 1960s. This well was removed from service due to PCE Contamination (in 1994), which was identified in this well, when first sampled for PCE in 1989. The Rockwater Apartments Well was also included in this well study. The PCE contaminant plume extends from the "Y" as far north as the Tahoe Keys Water Company No. 1 and No.2 Wells.

Slides were presented showing the work completed and the findings from the passive sampling, well video-scan, step-test, constant rate pumping /recovery test, vertical flow profiling and capture zone for an extraction well derived from information collected during the investigation. Remaining items to complete the investigation include completing the WQ data evaluation for the Treatment System Pre-design and the project technical report that is expected by the end of June 2016. JL1 and JL2 expressed interest in reviewing the draft report and meeting with the Consultant (GEI Consultants) as the report is finalized.

JL-2 noted that the Consultant is also compiling historical data to show the extent of PCE contamination throughout the South Y Area in conjunction with the Extraction Well Suitability Investigation. This work will also be completed by the end of June.

Prop 1 GCP Funding (Attachment 6 through 11)

LN presented information on the Prop1 Groundwater Cleanup Grant (GCP) funding program. This funding could be used for wellhead treatment or other plans for cleanup of contamination at the Y, among other projects. The GCP is currently accepting pre-applications through June 2016. Prop 1 requires that proposed projects be also identified in Integrated Regional Water Management Program. Tahoe IRWM is currently accepting new projects. LN recommended that SAG complete IRWM Project templates and submit to LN, ASAP to be included in project list. Project descriptions can be fairly broad to be listed, further detail can be provided after listing. LN will provide a copy of the GCP Pre-Application for SAG projects. The SAG expressed interest in applying for this funding.

SAG Discussion: BG identified Lisa as the contact for South Y PCE Cleanup and Abatement. Her report will pursue LT Laundry Works (LTLW), etc. for contaminant delineation and abatement. LD will need funding. BG believes it would be worthwhile to explore companion funding for this

work. Question was raised whether it would make sense to avoid spending public dollars until after the LTLW delineation work is completed. BG believes that a lot of work has already been completed (since 1989), etc. Liability issues are still under discussion. Other data to support other potential side liability is being pursued. There will be opportunity for significant amount of discussion to focus on what the upcoming work could be, and how funding could be used. LN felt partnering with LRWQCB would make the application stronger and increase leverage. LTLW is named in the CAO; however, there is significant variability in the interpretation of the adequacy of the data to assign liability. LD is the appropriate point of contact for discussion of RPs for collaboration on the GCP application.

JL2 discussed potential projects for TKWC. These include additional wellhead treatment for TKWC Well Nos. 1 and 2 in order to provide adequate water supply to meet water demands and fire flows for TKWC service area. JL2 expressed concern with the levels of contamination found in the LBWC #4 Well and the movement of this contamination toward the TKWC wells. A project that would cut-off this groundwater contamination would be welcome.

JL1 discussed potential projects for LBWC, this would include treatment at LBWC #4 as well as a storage tank (allowable in SEZ?). LBWC has applications for wellhead treatment at LBWC #2 and #5. Using inactive private wells as extraction wells (Stanford Camp / Eloise Avenue Wells / Rockwater Well?) may be another project to consider.

IB noted need for plume containment at LTRLW site as a potential project. Uncertain if this is a requirement under CAO. IB suggested that the SAG start a working group to define the project(s) for the GCP funding application. LN will work with JL1 and JL2 on completing IRWM Project Descriptions for Tahoe IRWM Project List.

TRPA Regulations (Attachment 12)

TRPA staff (RC and Shay Navarro) requested input from SAG on TRPA ordinances and policies with a nexus to water and groundwater. Input is being sought on possible code changes and would like to understand the SAG's priorities with regard to ordinances that effect water conservation efforts.

Presented code ordinances related to water, as follows;

- 30.4.60: Artificial turf counted as 25% partial exemption. SAG recommended this be changed to 0% (County, Keys, City, etc.). JL-2 suggested that TRPA also consider new rules encouraging use of native plants.

- 36.5.2 Landscape Screening Requirement. SAG suggested other alternatives (e.g., earth berm, boulders, fencing) should be considered in-lieu of landscaping to conserve water.
- BMP Infiltration Exemption for known contamination areas; TRPA is working to get PCA spatial data from District.
- 60.4.8 No change needed.
- 60.1.3. B. Storm Water Constituents. A lot of the listed constituents are not groundwater concerns. TRPA should consider findings of District Storm Water Hydrocarbon Investigation (completed in mid-2000s); O&G low solubility and not mobile in groundwater environment; may want to consider replacing with other more appropriate constituents of concern (e.g. TPH –extractible or TPH- diesel). IB to send copy of Storm Water report to RC.
- 60.3.3. C.1. Source Water Protection Ordinance – uses a 600 foot fixed radius. Fixed radius is not adequate for large public water system production wells. Would like TRPA to consider using source water production zones that are appropriate for the wells production rate such as used in the District's Source Water Protection Area Map under the GWMP. IB believes there is language in the TRPA ordinance that would allow this change. Source Water Protection Area Map is used primarily as a tool to identify and prioritize potential threats to groundwater wells.
- Sustainability Action Items; District will have an update of its water reuse and recycled water program in the next few years. All viable options will be put on the table and re-evaluated. Currently, a schedule has not been established for this evaluation.
- Rain Barrel Program (RBP) District through Tahoe IRWM (?) received a Prop. 84 grant for TRCD to implement a RBP in the basin.
- Low -Flow Shower Heads – District provides when grant funds are available.
- Turf Buy-Back – District does use when grant funds are available (through Tahoe Sierra IRWM program).
- 4-25 – As District evaluates water demand and sewer capacity on a project-specific basis, is this necessary? Building codes also require low-flow fixtures.
- Climate Change impact on Water Supply– being addressed through groundwater model evaluation.
- 5-19: Groundwater Vulnerabilities – Any TRPA funding available for investigations related to this item?
- 6-15: District standard water restrictions are not limited by time of day.

NEXT STEPS

The following items were identified for further action during the Workshop;

- District will develop a mailer to use and distribute to private well owners (e.g. Tahoe Meadows, FLL and Rainbow Tract areas.
- Eric Ingbar will prepare and send SAG a GIS Sharing Questionnaire.
- LN will head the pre-application process and get that completed by June 15th. The Pre-Application should be reviewed by LD (LRWQCB) and get her input regarding the responsible party piece. Also need to know what they plan to do under the CAO and cleanup and abatement account.
- IB will send Storm Water Report to Rebecca and provide draft South Y Report to SAG.
- IB to schedule a Technical Report Review meeting with the consultants once the draft South Y Extraction Well Suitability Investigation report is distributed and prior to it being finalized (BG noted that LD expressed interest in obtaining a copy of final report).
- JL2 will share PCE Historical Data Compilation Report with SAG.
- LD is requesting a planning meeting with interested parties regarding next steps for source area investigation in South Y Area.

MEETING ADJOURNED (12:00 PM)

SIGN-IN SHEET

South Tahoe Public Utility District

TAHOE VALLEY SOUTH BASIN (6-5.01)
GROUNDWATER MANAGEMENT PLAN

STAKEHOLDERS ADVISORY GROUP
WORKSHOP No.1

May 27, 2016
(9:00 AM – 12:00 PM)

NAME	AFFILIATION	PHONE	EMAIL
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Russ Wigart	El Dorado County	573 7924	

SIGN-IN SHEET

South Tahoe Public Utility District

TAHOE VALLEY SOUTH BASIN (6-5.01)
GROUNDWATER MANAGEMENT PLAN

STAKEHOLDERS ADVISORY GROUP
WORKSHOP No.1

May 27, 2016
(9:00 AM – 12:00 PM)

NAME	AFFILIATION	PHONE	EMAIL
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Bobby Jaeger	LTGC Superintendent	530 318 7127	super@laketahoegc.com
Shannon Cotulla	STPUD	530-208-8939	SCOTULLA@STPUD.US

2016 GWMP Stakeholder Advisory Group Minutes
October 25, 2016
South Lake Tahoe, CA

Members Present

Ivo Bergsohn (IB)	John Larson (JL2)	
Brian Grey (BG)	Ken Payne (KP)	
Scott Carroll (SC)		

Members Excused

John Thiel (JT)	Jason Burke (JB)	Rebecca Cremeen (RC)

Members Absent

Joey Keely	Jenn Lukins	Bob Loding
Harold Singer	Doug Dame	
Greg Daum	Robert Lauritzen	

Presentations

I. Bergsohn, STPUD	J. Larson, TKPOA
E. Ingbar, Gnomon (Via Phone)	G. Pohll, UNR-DRI
	L. Dernbach, LRWQCB

Others Present
Michelle Sweeney, Allegra Communications
Richard Solbrig, STPUD
Brad Herrema, Brownstein Hyatt Farber Schreck (Via Phone)
Heidi Baugh, STPUD

OPEN FORUM
KP: Extended kudos to all involved in the Tahoe Valley South Basin Groundwater Management Plan group. Very impressed with the group staying on top of the grants and the outstanding example we are providing for others to model.

APPROVAL of MINUTES
- No one presented any changes or corrections to meeting minutes from May 27, 2016 Workshop 1. (Attachment 1).
- Meeting Minutes will be posted on the District's website.

South Y Groundwater Sampling (Lisa Dernbach, LRWQCB) - *note this item was added after the Agenda was final.*
Two issues on PCE contamination at the Y:
- Cleanup and abatement order for the former Lake Tahoe Laundry Works (LTLW) site. Potentially Responsible Parties (PRPs) have been operating under interim remediation plan. There is still off site PCE that needs to be investigated. RWQCB included in the Cleanup and Abatement Order lots of comments that were received during the comment period. The Order is currently under review. Lisa thanked everyone who sent comments. We are waiting

for the Order to be issued. There might also be a public meeting held to discuss opening some of the more contentious aspects.

- RWQCB strongly believes there is a second source of PCE in the area that is responsible for the contamination and shutdown of Lukins #2 and #5 public water system (PWS) wells and Rockwater Apartments well (small community water system well) on Emerald Bay Road. LRWQCB released findings in January and are currently waiting to do a supplemental study after the District's extraction well suitability investigation for Lukins Well #4 is completed. LRWQCB is also hoping for results of Tahoe Keys Water Company PCE survey. L. Dernbach (LD) is seeking to solicit SWRCB for additional funds for this supplemental PCE investigation that will be more focused along Emerald Bay Road, west of the "Y" to narrowing down the second inferred PCE source. LD anticipates LRWQCB to investigate deeper into the aquifer to find where it's migrating. The supplemental PCE investigation is envisioned to be performed during Spring 2017. Lisa indicated she could not release any information regarding the second source of PCE right now. Lisa will provide a snapshot map of the area to DRI.

2016 GW Management Activities (Presentation, I. Bergsohn, STPUD)

South Y Extraction Well Study

- Final report on this work was completed in June and has been posted on the District's Website. All Groundwater Management documents, activities, etc. to be migrated to the District's webpage, and building on this in the upcoming year.
- Ivo recommended that the group take a look at the Final Report Conclusions and Recommendations in Chapter 6, and also the Table of Extraction Well Alternatives (Table 6-1).

Prop 1 Funding/South Y Remedial Alternatives Evaluation

- A number of ideas for Prop 1 Funding were received from the SAG following the May Workshop. From these ideas it was proposed that the District move forward and conduct a Feasibility Study (FS) to identify the most cost effective means to remove PCE contaminant mass from the South Y Area; Lynn Nolan (LN) submitted a Pre-app for the FS on behalf of District, in partnership with LBWC and TKPOA in July. A copy of the Pre-App is provided as Attachment 2 of the Meeting Materials
- Two items we would like to obtain through the SAG:
    - 1) Statement of Disadvantaged Community Support (City of South Lake Tahoe and El Dorado County). Statement says, we recognize and support disadvantaged communities in our area. (General letter of support.) Please provide them to Ivo by mid-November so we can include all support letters with the final application which is due by November 28, 2016. Ivo has provided a sample letter with today's material. Draft final application is to be completed by Veteran's Day. Ivo will distribute the draft full proposal.
    - District is planning to do pre-sampling to compliment the sampling that LRWQCB is performing. There have been eight wells (public water supply wells in South "Y" area affected) identified from which to collect samples. (District's Clement Well site; Lukins Bros (LB) 4, LB 2, LTUSD Tahoe Valley Elementary School

well). We will combine these results and with the TKWC well monitoring to complete the current picture of contamination for the South Y area.
  - Along with sampling and prior to the feasibility study, DRI provided a cost proposal for a fate and transport (F&T) model to work with District's existing model. This F&T model will simulate up to15 remedial alternatives, provided by LB, TKWC, and STPUD.
  - The new F&T model will be a key component to assist in our feasibility study for determining the most cost effective alternative. We are looking to identify 3-5 most favorable alternatives. Criteria will be capability to contain plume, efficiency of mass removal, and clean up times.

GSA Formation Notification II (Attachment 3 – NOI)

- In September, the District held a Public Hearing to receive public comment regarding its election to serve as the GSA for areas within TVS Basin, outside its service area. Following the hearing the District submitted a second GSA Formation Notification to DWR. If there are no other GSA notifications submitted within the next 90 days, on December 28th, the District in cooperation with the El Dorado County Water Agency (EDCWA) will be the GSA for the areas that lie within the boundaries of the groundwater basin, but outside the District's service area. Submittal of the second GSA Formation notification and MOU with EDCWA will enable the District to manage groundwater across the full extent of the TVS Basin. This will also allow the District to implement its existing GWMP across the full extent of the TVS Basin, thus satisfying one of the primary requirements for Alternatives to GSPs. Should DWR accept the District's existing plan as a suitable alternative, an enormous amount of time and money could be saved, as the existing GWMP could be amended and used as an Alternative GSP. The MOU between the District and EDCWA is attached as Exhibit D, of Attachment 3 of the Meeting Materials.

GSP Alternative/ Analysis of Basin Conditions (Attachment 4 – GSP Emergency Regulations)

- The new GSP regulations allow for the submittal of an existing AB3030 GWMP or an Analysis of Basin Conditions as a potential Alternative to a GSP. The District is planning on submitting both the 2014 GWMP and an ABC for DWR review and evaluation. The ABC will be completed by DRI, using the updated TVS GW Model. The ABC must demonstrate that the Basin has operated within its sustainable yield over the past 10 years (2007 – 2016); without any undesirable results. These are defined in the GSP Regulations as;
  - Chronic Lowering of Water Levels
  - Reduction in Groundwater Storage;
  - Seawater Intrusion;
  - Degraded Water Quality;
  - Land Subsidence; and
  - Depletions of Interconnected Surface Waters

- With regards to Degraded Water Quality, the District is considering an analysis to show that operating together; the District, LBWC and TKPOA have sufficient water production capacity

to satisfy all drinking water demands with the current levels of groundwater contamination within TVS Basin. As degraded water quality is the primary groundwater concern within our basin, the District requested feedback from the SAG on this approach, defining what is significant and unreasonable, and how to define a minimum threshold for this undesireable result.

- From The GSP Regulations, the definition of the minimum threshold for degraded water quality was presented to the SAG. IB explained that under the proposed approach, should the current level of groundwater contamination result in the total source capacity of PWS wells to fall below a minimum threshold, the groundwater contamination is at a level which threatens the ability of water purveyors to produce sufficient quantities of groundwater to meet all drinking water demands, and actions are needed to correct this result. SAG Discussion:
    - JL: Keys has spent about $1mil to date, over the next 5 years will have to spend significantly more. What level of PCE do we need to get below to make this reasonable? No funding coming to TKPOA. Our property values are reduced, water supply affected.
    - BG: initial off the cuff, seems like municipal wells are held to as cost of operation. Threshold seems to be that Tahoe Keys is threatened but not impaired. Meets the threshold of degraded water quality. Curious of potential funding in the future and whether they will help. More curious about individual well purveyors.
    - JL: Well 2 designed to operate for 2-3 years. With that well off line, won't be enough water in the Tahoe Keys because that will happen during high demand period. What do we do then? 35 micrograms per liter on a medium basis. Landscaping would have to die; Tahoe Keys Marina would need to go off line. Pretty ugly future.
    - Ivo: Is there a benefit to using concentration contours to defining minimum thresholds? Such as is the plume situated within a capture zone or source water protection area for a drinking water supply? What actions could Lahontan take to cause more effective containment and cleanup or mass removal of that? Would there be any assistance? How do you see Lahontan responding.
    - BG: Information would have to be evaluated and investigations would be necessary. It would give them information but no i_____?.
    - JL: I have worked for 12 years as an independent consultant on PCE contamination cases, this is the first one where no one has defined the plume.
    - BG: information shown as within a capture zone. Level of information, level of previous investigations, make decisions and assign liability. We will always be left with unknown in these situations. In terms of added support and value, not giving us anything to point definitively to a party that we would need to define to finance the cleanup. Legacy situation of issues more than 20+ years after the damage has been done.

- KP: Sounds like the program needs to be defined and developed in order to be enforced. Currently there is no program and no definition and therefore no way to enforce.
- IB: How do you recognize the difference between the threat to a 200 gpm or 1400 gpm well? Both are threats, but at different levels. How do we roll that into a minimum threshold? This is something that is being thought about. In the current situation, we could make a case that the water companies within the basin have adequate production to meet the current demands. There is degraded water quality, but it has not reached a level where it is significant and reasonable. if a community identifies it as a real problem, how does the local RWQCB recognize that? Does it cause the prioritization of "important" and qualify it with a need to go after, or we need to continue with our hands tied until a responsible party is found.
- RS:. … is an issue of boundaries and not ability to provide demand.
- IB: Minimum threshold needs to be a number. GSP is supposed to provide metrics. Could use one minimum threshold with numerous milestones. For example, added risk of water company solvency could possibly be a milestone; but not the threshold showing ability to provide adequate drinking water?

<u>Expanded Outreach (Attachment 5 – IB Notes)</u>

- SAG discussed considerations for expanding outreach to small community water systems and private well owners. Some of these include motels and lodges. Idea to possibly recruit someone from the tourist industry for the SAG in an effort to help increase public awareness for drinking water needs and develop materials to increase awareness in the community about its drinking water supply. KP "…may not want to engage the tourist industry too soon; First we need to have a management plan for the South "Y Area, after which would be a better time to bring them on board. Michelle S: Asked about the school board member position being left blank on the SAG member list. Another meeting attendee advised they have hired the former member's replacement, Steve Brennan. Ivo will follow-up.

2016 DSWPA Mapping Update (Presentation, E. Ingbar, Gnomon)

- E. Ingbar provided presentation by telephone. Goal for Drinking Source Water Protection Map is so that everyone (general public as well as water purveyors) can see big picture. Maps are a great way to interest the public. Gnomon is currently working on map improvements—accuracy, i.e. verification, removing duplicate information. Part of the goal is for others to be able to maintain this map/information in the future relatively easily. To do so, there needs to be a data store that is easily maintainable and will include well locations, data, contamination information, spills, cleanups, new locations, etc. For this we need to define how we share information, what is okay for public to see and what purveyors want to see. Issues/Challenges include;
  - Staying current
  - Data Sharing and

  - Types of Sharing Results
- Ivo to send out the single page questionnaires by email to all SAG members; Summarize responses, return to SAG by email Once reviewed we hope to get results out to member agencies by December. DSWP map files to SAG member agencies (internal use). Will send arch project file to whoever would like to have it in order that you can interact and get an idea how it works and what the needs are. Give people in your agency a better idea so we can form the data sharing.

South Y PCE Investigation (Presentation, J. Larson, TKPOA)

- JL provided a brief update of PCE investigation and an overview of work underway and to be completed shortly. During work being done by District on LB Well 4, Tahoe Keys wanted to contribute to effort and compiled data for this area. A draft report has been generated. Conference call set for November 2. GEI Consultants compiled a data set – for which the Regional Board was a great help. Out of about 1000 total data points, only 249 were useful and also used soil samples from 5 sites. They also used PCE data from all three water purveyors. JL presented a map of the South Y Wells - Allows us to see a spatial review of data from south end (up gradient) to north end (down-gradient) going back to 1980's. Key issue: No sampling for up gradient wells (data gap there). Data gap in down gradient wells in the earlier sampling. Water purveyors' data is fairly complete. Maximum groundwater PCE concentrations follow groundwater flow direction.
- Most recent groundwater PCE concentration slide show approximate plume boundary that has probably changed over time as other wells in vicinity have stopped pumping. It was recommended we go down gradient and install multi-layer monitoring wells.
- Slide of vertical distribution--variant of PCE results. Tells us that PCE is heading to Tahoe Keys; it is at least in Well 2 and we have 2.7 micrograms in Well 1. We are discussing the possibility of operating Well 2 on a year-round basis in hopes of intercepting the plume and saving other wells.
- Findings are that due to other wells being taken off line, the PCE plume is heading toward the Keys and the Lake.
- In the opinion of GEI, LTLW is the source.
- Well 2 graphs show increase from 1989 to current use
- Well 1 (almost half of our capacity) graph shows increase of PCE from 1989 to current
- Need to fill in data gaps where possible; implement quarterly sampling; install new multi-level monitoring well. TKPOA is doing bi-weekly sampling and more.
  - IB suggested that multi-level monitoring well be moved up gradient of TKPOA wells for use as a sentinel well. GP asked about any other wells in the area.
- Ivo: would like to get the electronic files from GEI. JL indicated that Ivo should contact Ryan and request the information. Ivo will send those files to Greg at DRI.
- Ivo saving a copy of JL's PowerPoint.

GW Modeling Evaluation Update (Presentation, G. Pohll, UNR-DRI)

- Provide update on hydrologic analysis. Groundwater recharge analysis; working hard on analysis of basin conditions (ABC).

- Using this model with other data to support that effort.
- Creating GIS tools to assist in reporting to DWR
- The Analysis area is larger than TVS GWB. Because most of the groundwater recharge flows from the upper regions surrounding the basin.
    - Precipitation – drives groundwater recharge in the area. We are basing our findings off data from four climate stations (FLL, Echo peak, Heavenly, Hagans Meadows—most important in terms of describing what is accurately happening in the basin). We are trying to develop more simplified methods. Most precipitation occurs on the west side of the analysis area (75"+/yr); on the eastern side (Heavenly Valley) it's 35"/yr. Get 334,000 acre feet per year, which includes both wet and frozen. 11-12% actually goes into the ground and becomes recharge.
- Average over the area, includes wet and frozen precipitation.
- Hagan's Meadow site from 1979 showed an average 31" at that station. Lots of variability.
- We will use this information to create a water year classification for use in reporting to determine type of year, i.e., wet year, dry year, etc. The other collection areas are not representative of the Tahoe area.
- Used Hagan's Meadow to develop estimates of groundwater recharge based on daily precipitation at all stations.
- Graph shows a much greater recharge than amount removed by groundwater pumping.
- Average recharge is 40,000 acre feet per year; pumping is about 8,000 acre feet per year. Most of the precipitation is falling on the west side of the basin. Less recharge is in the central area. 2016 pumping was 6,000 (down from 8,000) due to conservation.
- Presented 2010 recharge by season. Fall and winter minimal recharge. Most recharge occurs in spring. Some localized recharge during summer thunder storms.
- Updated groundwater model to include 2015.
- Analysis of basin conditions. Alternatives to a Groundwater Sustainability plan. Key point demonstrates operation within its sustainable yield over a period of at least 10 years. This will be fairly easy to prove.
- Describing a general outline of Basin condition report. Basin setting, then sustainable yield, then thresholds for components (levels, storage etc.) We need to define the minimum thresholds that define groundwater levels.
- By monitoring Hagans meadows, if precipitation is above 10" we know there is nothing to worry about, but if it's less that's when we would need to monitor water levels at key locations to see if water levels are declining rapidly. Groundwater storage needs: –precip is 31-32"; if the precip decreases then groundwater storage use goes up and groundwater levels go down. Greg did not believe using 31-32" as the threshold was a good idea. We have to think about where on this curve we would settle. Change in groundwater levels is same as change in groundwater storage. We can discuss this further.
- JL asked about a projected curve for use. With TRPA growth restrictions Ivo feels it's very manageable. RS: our production has gone down over last years. We are investing in increased storage to deal with fire flow. JL indicated there should be an explanation rather than a flat line indicating use. Issues have to deal with tourism use rather than build-out issues.

- Water Quality: PCE issues. Is the extraction contributing to the quality issue? Groundwater pumping in Keys and Lukins has accelerated or changed the flow of PCE contamination to some extent. From a total perspective if there were no boundaries the water supply in the basin can support the need.
- JL - The issue is a localized one, between Y and the Lake, to meet needs in that specific area due to this legacy groundwater contamination. Lukins pursued emergency funding and was denied because they had access to STPUD water. It will be the same with Tahoe Keys.
- IB - One of the funding options we are pursuing requires that we pursue cleaning up the aquifer and tying into another water source will not satisfy the funding condition. We need to get our heads around dealing with the problem--maybe a hybrid approach toward the bigger picture. I don't want us to have passed this threshold and we can't handle it, however there are significant impacts. For the grant, we saw the first step is how to best manage this problem. This exercise at hand will help up determine this.
    - Ken said there are two different groups that would address these issues
        - Grants group would review a feasibility
        - Compliance group would (cannot hear)
- IB - We are currently looking for best alternatives for the PCE issue
    - Very costly and long term effort. Important to inform responsible party regarding the road we are going down, and get their engagement.
    - District has not signed on for operation and maintenance for remediation, not sure who that would be, maybe the Water Board, or RP(s)?
    - GSAs were not envisioned to fill that role. Helping the process along is something we, as a GSA can do. But when it comes to actually putting it in the ground, operating and maintaining, we are not in a position to fill that role.
    - JL asked what the water quality objective is for Lake Tahoe with respect to PCE.
- GP - Subsidence is not an issue for our basin.
- GP- Interconnection with surface waters
    - Precipitation is over 300,000 AFY; average runoff is 124,000 acre feet per year. Used model to calculate for increased pumping and influence on streams. 1983 to 2015
- GP -Reporting tools
    - Quantify change to groundwater storage over time (change in groundwater elevation). We have the tool to do this, we just need to refine it. Would probably just apply one number to the entire basin.

Next Steps

For Greg to update 2016 water model, we need updated production numbers by November so it can go through October. Ivo will get that from Jjohn Larson and Jennifer, and lakeside. He will work to compile this info. Will write report in Jan/Feb and release in March. Must be completed and issued prior to April 1.

MEETING ADJOURNED (12:00 PM)

SIGN-IN SHEET

South Tahoe Public Utility District

TAHOE VALLEY SOUTH BASIN (6-5.01)
GROUNDWATER MANAGEMENT PLAN

STAKEHOLDERS ADVISORY GROUP
WORKSHOP No.2

October 25, 2016
(9:00 AM – 12:00 PM)

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