Appendix C

Hydrogeological Studies

- **Richard C. Slade & Associates LLC.** Hydrogeologic Evaluation for Proposed Crystal Geyser Water Bottling Facility Project, Mount Shasta City, Siskiyou County, California. October 2016.

- **CH2M Hill Engineers, Inc.** Technical Memorandum: Analysis of Groundwater Level Data, Crystal Geyser Water Company. June 6, 2017.

- **Geosyntec Consultants and CH2M.** Response to Public Comments on the CGWD Draft EIR. June 7, 2017.

- **Richard C. Slade & Associates LLC.** Review of Geosyntec Consultants and CH2M Replies to Public Comments; Attachments 1 and 3 to Churchill White LLP Letter dated June 8, 2017, for the Proposed Mt. Shasta Crystal Geyser Facility, Mt. Shasta City, Siskiyou County, CA. July 7, 2017.

RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS

HYDROGEOLOGIC EVALUATION FOR PROPOSED CRYSTAL GEYSER WATER BOTTLING FACILITY PROJECT MT. SHASTA CITY SISKIYOU COUNTY, CALIFORNIA

PREPARED FOR:
ANALYTICAL ENVIRONMENTAL SERVICES
SACRAMENTO, CALIFORNIA

PREPARED BY:
RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS
SHERMAN OAKS, CALIFORNIA

JOB NO. 309-SIS01

OCTOBER 2016

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LIST OF ABBREVIATIONS/ACRONYMS USED IN REPORT

The following provides a list of abbreviations that may be used more than once throughout this report and is provided for the convenience of the reader.

Abbreviation	Full Description
Text Abbreviations	
Ca	calcium
Cl	chloride
CG	Crystal Geyser
DRI	Desert Research Institute
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
E-Log	electric log
HCO_3	bicarbonate
MCL	Maximum Contaminant Level
Mg	magnesium
Na	sodium
NO_3	nitrate
O&M	Operation and Maintenance
PWL	pumping water level
S	storativity
SCADA	Supervisory Control & Data Acquisition
SO_4	sulfate
SWL	static water level
T	transmissivity
USGS	U.S. Geological Survey
WRCC	Western Regional Climate Center
Units of Measure Abbreviations	
AF	acre-feet
AF/d	acre-feet per day
AF/mo	acre-feet per month
AF/yr	acre-feet per year
bgs	below ground surface
cfs	cubic feet per second
gpd	gallons per day
gpd/ft	gallons per day per foot of saturated aquifer thickness (for T values)
gpd/ft^2	gallons per day per square foot (for K values)
gpm	gallons per minute
gpm/ft ddn	gpm per foot of water level drawdown (for specific capacity)
mg/L	milligrams per Liter
NA	not available
ND	not detected
ft^2	square feet
µg/L	micrograms per Liter

INTRODUCTION

BACKGROUND

Based on the County of Siskiyou Notice of Preparation (NOP) of an Environmental Impact Report (EIR), Crystal Geyser (CG) acquired an existing water bottling plant in 2013 that is located within an unincorporated part of Siskiyou County, adjacent to the northern limits of the City of Mt. Shasta. This facility was formerly owned and operated by Coca-Cola Dannon (CCDA), with operations as a bottling plant commencing in 2001 and ceasing in 2010; the equipment at the plant was removed thereafter. Currently, the plant is not in operation and is being revamped by CG for future production of its beverage products (County of Siskiyou, 2016).

The plant itself encompasses 10 acres in a total of 118 acres of land that contain several parcels. In general, the plant facilities consist of the following:

- An approximately 148,000 square-foot (ft^2) building.
- A Domestic Well and pump house.
- A 228,000-gallon fire suppression tank.
- A groundwater production well (DEX-6).
- Stormwater detention basin.
- A leach field that was previously used to dispose of industrial rinse water.
- An entrance from Mt. Shasta Blvd for parking facilities and truck delivery.

Two water-supply wells are to be used at the facility: DEX-6 and the Domestic Well. The main production well, which will be used, as before, for production of bottled beverage products, is currently known as DEX-6. The Domestic Well supplies the plant's internal domestic use, the fire suppression tank, and other operational uses.

Formerly, the plant reportedly used approximately 160 gallons per minute (gpm) on a monthly average basis. This amounts to approximately 230,400 gallons per day (gpd), or 0.71 acre-feet per day (AF/day). Thus, on an average annual basis, the amount of water formerly used was approximately 259 acre-feet per year (AF/yr).

The new plant is proposed to have two separate production lines. When operable, one production line is anticipated to use an average of approximately 80 gpm on a monthly basis, or

approximately 115,000 gpd on an average annualized basis. With two production lines operating, the plant would use an average of approximately 151 gpm on a monthly basis, with an annualized average of 217,000 gpd. Thus, the total maximum volume of groundwater that would need to be produced each year (365 days a year) from both lines in the future, assuming a 100% operational capacity for both onsite wells, would be approximately 243 AF/yr.

Proximal to the site are residential/commercial areas. On the north, south, and west, these residential areas are served via the City of Mt. Shasta water supply and sanitary sewer systems. However, on the east, each residence has its own water well and is on its own subsurface septic/leach field system.

The purposes of this current hydrogeologic evaluation are to review previous work performed by others for the proposed bottling facility and to provide an independent evaluation of the hydrogeologic conditions of the area surrounding the proposed facility. Consequently, this report contains the following key elements:

- A summary of the previous work performed by other consultants.
- A discussion of the basic hydrologic and hydrogeologic conditions in and around the proposed bottling facility.
- An assessment of possible impacts of pumping of the onsite wells on the local aquifer systems (storage and underflow), on water quality, and on the amount of flow from the existing Big Springs.
- Our preliminary conclusions and recommendations with regard to these issues.

GEOGRAPHIC LOCATION

Figure 1, "Site Location Map," in Appendix 1, which shows the general geographic location of proposed GC bottling facility. This facility is located north of the northern end of the Sacramento Valley, and adjacent to the City of Mt. Shasta. The plant specifically lies within Section 19 of Township 40 North, Range 4 West of the Mt. Diablo Baseline and Meridian (MDB&M). The approximate GPS coordinates of the approximate center of the plant are: Latitude 41.326206^{o} N, Longitude 122.317480^{o} W. Ground surface elevation at the plant is approximately 3,680 ft above mean sea level (msl).

Topographically, the site is located on the southwestern terminal flank of Mt. Shasta, a volcanic mountain known as a stratovolcano. The elevation of Mt. Shasta is benchmarked at 14,162 ft

above msl. Thus total relief between the plant and this mountain is approximately 10,480 ft. Mt. Shasta provides the local watershed and recharge area for the plant and its environs.

The climate of the area is generally semi-arid with relatively high average annual rainfall (40 inches) and snowfall (103 inches). However, at the higher mountainous elevations and along the watershed, precipitation and snowfall occur in significantly greater amounts, with most of the precipitation falling at and near the summit as snowfall (especially during the winter months).

LOCATION OF WATER-SUPPLY WELLS, MONITORING WELLS AND SPRINGS

Figure 2, "Well Location Map (Topographic)," shows the locations of existing and historically-known water-supply wells, groundwater monitoring wells and springs relative to topographic conditions, and Figure 3, "Well Location Map (Aerial)," illustrates the location of those wells and springs relative to current cultural features in the vicinity of the proposed bottling facility. Table 1, "Summary of Water-Supply Well Construction Data" (in Appendix 1), provides the well construction data that are available for the local water-supply wells and groundwater monitoring wells. The two figures and the table summarize the basic information and data that were used by others to construct a conceptual geologic model of the area. Because such data are integral to an analysis of site-specific conditions, the summarization and review of these data by RCS provides the necessary input to form the basis of our independent evaluation of groundwater conditions in the area.

REGIONAL & LOCAL GEOLOGIC AND GROUNDWATER CONDITIONS

Basic Regional Geologic Conditions

The proposed facility lies south of and adjacent to the Shasta Valley Groundwater Basin (Basin No 1-4) in the North Coast Hydrologic Region, as defined by the California Department of Water Resources (DWR Bulletin 118 Online Update 2004). As such, the project site is not located within a DWR-defined groundwater basin or subbasin but rather within volcanic rocks emplaced by the recent volcanism of Mt. Shasta (i.e., within the last 10,000 years, within the Holocene geologic epoch).

Mt. Shasta is a stratovolcano that is located within the Cascade Range Geomorphic Province of California and such volcanoes generally build up their volcanic cone(s) over time through one or more vents by overlapping lava (eventually congealing to form the volcanic rocks of obsidian,

basalt, andesite, and dacite); these cones also yield various pyroclastic flows consisting of tuff and ash, and even volcanic debris (e.g., mudflows or lahars). Mt. Shasta was reportedly formed during four separate volcanic events, which gave rise to the Shastina and Hotlum cones (which make up Mt. Shasta), and a group of smaller volcanic cones at Black Butte (USGS, 2016).

Basic geologic conditions in the area have been discussed in numerous published and unpublished reports. Thus, this section of the report will present only a summary of the local geologic conditions, as adapted from our review of these existing reports. The emphasis of this report will be more on the site-specific nature of the hydrogeologic conditions in the vicinity of the proposed bottling facility.

Figure 4A, "Geologic Map," and its accompanying Figure 4B, "Geology Map Legend," in Appendix 1, show and describe the locations and areal (lateral) extent of the various geologic materials that have been mapped by others to occur at ground surface in the region. Also provided on Figure 4A are the property boundaries of the proposed bottling facility, so that the reader may relate the proposed bottling facility to the mapped geologic conditions in the area. The geologic contacts between the various earth materials shown on Figure 4A have been adapted directly from a map prepared by Wagner and Saucedo (1987) for the U.S. Geological Survey (USGS). Many of the geologic units listed on Figure 4B do not occur at ground surface in the area shown on Figure 4A, because they pertain to geologic materials that lie beyond the boundaries of the area mapped on Figure 4A herein.

Basic Local Groundwater Conditions

Generally, the availability and movement of groundwater in the volcanic rocks surrounding the proposed bottling facility are based on the ability of the local earth materials at and beneath the site to store, transmit, and yield groundwater to wells for beneficial use. In the area of the facility, such groundwater can be controlled by the presence of pores in shallow alluvial sediments or by fractures in the much more widespread volcanic rocks. These earth materials and the local hydrogeologic conditions in the area of the proposed bottling facility have been defined in previous studies, and are discussed in greater detail below.

Alluvial Deposits

Alluvial deposits have been mapped on a regional basis (Wagner & Saucedo, 1987) and are shown to occur in Shasta Valley Groundwater Basin which lies northwest of the proposed

bottling facility. These shallow deposits are denoted on Figure 4A by the map symbols "Q" (for Quaternary alluvium). Generally, these alluvial-type units represent those sediments deposited during the Holocene geologic age (i.e., those less than 10,000 years old). Alluvial sediments generally consist of unconsolidated deposits of clay, silt, and fine- to coarse-grained sand and gravel that were eroded by streams and creeks emanating from the surrounding highlands.

In the area of the project site, no such alluvial deposits have been mapped on the small scale geologic map prepared by Wagner and Saucedo (1987). However, review of a previous study of the site (SECOR, 1998a) revealed that local geologic conditions were determined through the drilling of exploratory borings (DEX-1 through DEX-7) proximal to the proposed bottling facility. These borings yielded evidence of deposits of clay, sand, gravel and cobbles that extended to maximum depths of 170 ft below ground surface (bgs) in the vicinity of the proposed bottling facility. These deposits were identified as glacial/fluvial in origin by SECOR (1998a), due to the presence of "numerous gravel layers and clean sorted sands" in the drill cuttings.

Such local deposits, though not extensive, can be considered to be analogous to the alluvial units mapped to a greater extent in Shasta Valley, with regard to groundwater flow through these unconsolidated materials. In this type of sedimentary material groundwater flow and permeability is usually controlled by the interstices (void spaces) between the grains/particles of silt, sand and gravel (i.e., the pore spaces) and by the hydraulic gradient (movement of groundwater from higher to lower elevations). The pore spaces provide what is considered to be primary porosity in these sediments. In general, the greater the degree of openness and interconnection of these pore spaces, the greater would be the permeability (hydraulic conductivity); high permeability would tend to allow these sediments to yield groundwater more freely to wells (assuming they are relatively thick and have a large areal extent).

In the region of the proposed bottling facility, the alluvium is reportedly referred to as the "Upper Aquifer System" by Cal-Trout, local drilling companies and residents (Mr. Jeff Zukin, September 9, 2016, personal communication). However, this system has not been designated as such in the available scientific reports and/or literature. Groundwater recharge to this aquifer system is generally from infiltration of direct precipitation on the land surface and from infiltration of surface water runoff along local streams and creeks. Another basic source of groundwater to the area is from precipitation and/or the melting of the snowfields at the higher elevations of Mt.

Shasta, to the east/northeast. A small amount of recharge would also occur from subsurface sewage disposal systems, assuming such systems were in direct contact with the alluvium.

Volcanic Rocks

Underlying the above "alluvial deposits" in the vicinity of the site, are rocks generally consisting of volcanic tuff and gray, fractured andesite; these volcanic rocks tend to crop out on Spring Hill, north of the proposed bottling facility, where it is denoted on Figure 4A as the "Spring Hill Andesite"). Generally, the chemical properties of the andesite are incidental to this discussion, because the interactions between these rocks and groundwater are minimal due to the relatively short contact time (residence time) of the groundwater in these fractured rocks. Indeed, SECOR (1998a) noted, through tritium sampling of the groundwater emanating at Big Springs, that the local groundwater was "greater than 33 years old, and that the water from sample locations further upgradient was much younger." Thus, the quality of the groundwater has only likely been slightly affected, if at all, by the volcanic rock aquifer systems.

The volcanic rocks in the area of the proposed bottling facility, which are known to be capable of yielding groundwater to wells that contain perforations in these rocks, are known locally as the "Lower Aquifer System" (from the discussion above, the alluvial-type deposits constitute the "Upper Aquifer System"). These volcanic rocks do not have the primary porosity and permeability that are common to the alluvial, fluvial and glacially-derived sediments in the area. Instead, these volcanic rocks have secondary porosity created by fractures and joints imparted to the rocks through their original cooling and subsequent mountain building processes. Generally, these fractures in the andesitic rocks are what provides the storage reservoir for groundwater. With increasing depth, however, the fractures may become less frequent, and the size (or opening) within the fractures may become smaller. SECOR (1998a) also noted that the fracture density of the andesite decreased with depth, citing a boring drilled by others (OB-2) where it was reported by the original geologic logger (not SECOR) between 90 and 119 ft bgs that there was "gradually decreasing fracture spacing until very hard at 118 ft."

PREVIOUS SITE-SPECIFIC GROUNDWATER RESOURCE STUDIES

There have been several prior studies by others in the vicinity of the proposed bottling facility in regard to evaluations of the local groundwater resources. A list of the available hydrogeologic

studies that were reviewed for this current hydrogeologic evaluation is provided in the "References Reviewed" section of this report.

The following provides a brief summary of the key issues discussed in each report in regard to the hydrogeologic conditions specifically within and around the proposed Crystal Geyser bottling facility.

SECOR International Inc., March 18, 1998, Initial Report

In 1998, SECOR International Inc. (SECOR) performed a detailed hydrogeologic study of the facility for Danone International Brands, Inc., the original owners of the former facility. To accomplish this, several wells were drilled between October 11, 1997 and January 30, 1998, as follows:

- Groundwater Monitoring Wells

  DEX-1 through DEX-5

- Water Supply Wells for the Plant

  DEX-6 (active) and DEX-7 (inactive)

Notably, water supply wells DEX-6 & DEX-7 consist of 8-inch diameter open boreholes, in which blank and screened casing were placed only to specific depths that did not extend along the entire borehole (see Table 1 for details regarding construction of these two wells), whereas groundwater monitoring wells DEX-1 through -4 were provided completely with blank and screened well casing (see Table 1). DEX-5 was destroyed shortly following its construction. In addition, there were three pre-existing wells that were previously constructed by others, namely OB-1, OB-2 and OB-3. The geologic logs for these latter three wells were provided in the SECOR report, but no other data (such as the State Well Completion Reports or construction reports) were available on these wells for review. Figures 2 and 3 shows the locations of these wells, whereas Table 1 provides available details on the construction of all wells at the facility. Also provided on the figures and Table 1 are data for other nearby but offsite water-supply wells (for which driller's logs were available) that are owned by others.

Purpose and Objectives of the Study

The stated purpose and objectives of the 1998 study by SECOR were as follows:

- Development of a conceptual hydrogeologic model for the site and surrounding area.
- To determine if the water production boreholes would meet Federal and State permitting requirements for spring water production boreholes. As such, groundwater from these boreholes would need to produce from the same geologic "stratum" from which the nearby natural spring (i.e., the Big Springs) and must be of the same quality and composition from that springs.
- The work was to culminate in the permitting of DEX-6, DEX-7 and OB-1 as spring water production boreholes, as an alternative to extracting water directly from the Big Springs. (However, only DEX-6 was actually permitted to operate at a later date)

Thus, the basic purposes of the work were to verify that: the production wells were hydraulically connected to the Big Springs; the water pumped from the wells was of the same chemical composition as that from the springs; the wells could produce at relatively high rates; and these wells would be secure and provide increased sanitary protection.

In order to meet their stated objectives, SECOR (1998) investigated the following elements in their analysis:

1. Physiography, geomorphology, climatology and hydrology.
2. Local and regional geology.
3. Hydrogeology, which encompassed groundwater flow directions, aquifer properties and water quality.

The focus on the 1998 SECOR study was on field investigations with specific regard to element No. 3.

Summary of the Big Springs

According to SECOR (1998a), the area of Big Springs is a line of multiple springs that issue from the base of a talus slope at the base of the south-facing slope of Spring Hill (see Figures 2 and 3). These springs originate from fractured andesite and, at that time, had an estimated combined flow rate of approximately 10,000 gpm. It was noted that the overall water quality consisted of a sodium-calcium bicarbonate (Na-Ca-HCO_3) character.

Further, stable isotopes (carbon, oxygen and hydrogen), tritium and the noble gas concentrations of helium and neon were used by SECOR (1998a) to determine the age of groundwater collected from five springs, including one from Big Springs, in August 1996 and

from OB-1. The results of this testing revealed that the age of the water from Big Springs and OB-1 was greater than 33 years old. Consequently, it was concluded by SECOR that the groundwater at OB-1 at that time was the same in general composition and age as water issuing from the Big Springs.

Summary of the Conceptual Model and Hydrogeologic Conditions

SECOR (1998a) devoted a significant portion of its report to the results of its field investigations, specifically in regard to the construction and/or testing of groundwater monitoring wells and production wells. However, for the purposes of our summary, we present only the key conclusions derived by SECOR (1998a) from that field investigation with regard to hydrogeologic conditions within and proximal to the proposed bottling facility, including nearby Spring Hill. These key conclusions are as follows:

1. There are two aquifer systems in the vicinity of the proposed site, a glacial-fluvial sedimentary aquifer system and a fractured andesitic bedrock aquifer system. However, it was noted in the report that groundwater occurs only within the fractured andesite on the west and southwest sides of the proposed facility whereas in the central and east sides of the site, it occurs in the fractured andesite, tuff, and glacial-fluvial deposits (SECOR, 1998a, pg. 4-2).
2. Geologic cross sections by SECOR show that Spring Hill consists of an andesite volcanic plug that is rimmed by a tuff (actually this tuff could be a chilled margin of rock around the volcanic plug). The plug appears to have ascended up through the glacial-fluvial deposits. Depth to groundwater in wells DEX-2, DEX-4, DEX-6, DEX-7 and OB-1 & OB-2 (which are shown to be perforated within the plug), are shown to be much deeper in comparison to water levels in other wells (e.g. DEX-3A & DEX-3B) that are located external to the plug and are screened only within the glacial-fluvial deposits.
3. Structurally, there are no faults in the vicinity of the proposed bottling facility, although SECOR did note the presence of a "structural geologic feature" that has a planar geometry on the northeast side of the Spring Hill cone. The possibility of this feature to be a fault or a preferred joint set in the andesite was mentioned, although SECOR stated that this feature did not have an effect on groundwater flow directions.
4. The "catchment" (recharge area) for the Big Springs and the wells was estimated by SECOR (1998a) to extend from those springs up to the summit of Mt. Shasta.
5. Based on groundwater level data collected from the groundwater monitoring wells and boreholes and from other nearby water-supply wells, groundwater flow directions (as illustrated in Figure 9 of the SECOR report) were shown to be to the south, along Spring Hill and to the west, bending to the west-southwest, west of and south of

Spring Hill. (It was noted by RCS that the static water level elevations were above the top of the fractured andesite.)

6. A few pumping tests were conducted on the three target production wells at that time, namely DEX-6, DEX-7 and OB-1. The results of those tests yielded specific capacities for those wells ranging from 14.2 gpm per foot of drawdown (gpm/ft ddn) in DEX-7, to as great as 434 gpm/ft ddn in DEX-6, based on pumping rates ranging from 125 gpm to 490 gpm, respectively. A short, 4.5-hour test in open borehole OB-1 revealed a specific capacity of 135 gpm/ft ddn at a pumping rate of 500 gpm. This value was essentially corroborated by the results of a second test in OB-1 well (a value of 134 gpm/ft ddn).

7. Curve-fitting analyses of the data from the observation wells, using Theis (confined), Cooper-Jacob (confined) and Moench (fractured) solutions, yielded aquifer transmissivity values ranging from 72,167 to 885,177 gallons per day per foot of saturated aquifer (gpd/ft) and storativity values (a dimensionless value) in the range of 0.0033 to 0.0355; these storativity values tend to indicate unconfined groundwater conditions. However, the transmissivity values derived from testing of OB-1 ranged from 247,738 to 885,177 gpd/ft, but these were not considered to be representative for the volcanic aquifer system, due to the short duration of the tests.

8. Specifically, for DEX-6, SECOR noted that transmissivity values ranged from 232,000 gpd/ft to 463,000 gpd/ft, whereas storativity values ranged from 0.005 to 0.035. Based on these values, SECOR cited that such values are indicative of unconfined groundwater conditions; such conditions can exist in fractured rock aquifer systems.

9. Static water levels measured in DEX-1, a well located approximately 850 ft from the Big Springs, showed observed water level drawdown impacts ranging from 0.088 ft to 0.47 ft during the three individual pumping tests of production wells DEX-6, DEX-7 & OB-1. Based on these test data and using a transmissivity of 324,000 gpd/ft and a storativity of 0.02, SECOR (1998a) performed a Theis drawdown analysis, which yielded a theoretical drawdown impact value of approximately 0.19 ft at a rate of 500 gpm, at the location of Big Springs in the City park.

10. Static water level elevations for each of the wells were plotted and groundwater contours drawn in order to determine the flow and direction of groundwater through the area of the wells (SECOR 1998a, Figure 9).

11. Based on water quality analyses of groundwater samples collected from the Big Springs and from the groundwater monitoring and production wells, a number of groundwater analytical tools were employed by SECOR to determine the similarities in water quality between the two types of sources. These tools consisted of micro-particulate analyses (MPA) and bacteriologic analyses, trilinear (Piper) plots, statistical analysis of the data using the Wilcoxon Matched Pairs test, and isotopic analyses (the aforementioned tritium dating). The results of these analyses revealed that the water from Big Springs and from the groundwater monitoring wells and production wells were generally similar in composition, and that the groundwater ranged in age from 21 to 81 years old.

12. The water quality data revealed that the character of the water from the wells, at that time, was primarily a mixed cation, sodium-calcium bicarbonate (Na-Ca-HCO_3) type of groundwater, indicating a meteoric (atmospheric) water influenced by sodium. The total dissolved solids (TDS) concentrations ranged from 72 to 122 milligrams per Liter (mg/L). Water samples collected from the Big Springs showed a similar water quality character and displayed TDS concentrations ranging from only 56 to 95 mg/L.

SECOR Conclusions

Based on its study, SECOR concluded the following:

- The geologic "stratum" from which Big Springs originates is present beneath the site.
- The saturated fractured andesite encountered in the boreholes for wells DEX-6, DEX-7 and OB-1 appears to be hydraulically connected to the same fractured andesite from which the Big Springs flows. SECOR concluded this at the time DEX-6, DEX-7 and OB-1 were designated as the production wells from which the pumped groundwater would supply the original plant operations (only DEX-6 was permitted for production at a later time).
- Groundwater obtained from the proposed production borehole DEX-6 is of the same quality and composition as water from the Big Springs.

SECOR International Inc. June 23, 1998 Tracer Report

At the request of Danone, a tracer study was then conducted by SECOR in order to determine if a biodegradable dye (fluorescein) could be detected at the Big Springs, after it had been injected into DEX-1, which is located approximately 850 ft to the east-northeast of Big Springs. The dye was measured using a fluoroscope, which could detect concentrations at 0.1 parts per billion (ppb). Five stations at the Big Springs and along Big Springs Creek were established in the attempt to sample and measure movement of the dye. Separate tracer test events were performed in DEX-1 on June 8 to June 10, 1998, and on June 10 to June 26, 1998.

Laboratory testing of water samples collected from the five stations at the Big Springs, during the first tracer injection event, revealed that the dye was detected at one of the stations approximately 21 hours after injection. However, laboratory testing of water samples at the five stations following the second tracer injection revealed detections of the dye at three of the five stations established by SECOR.

Based on the results of the tracer tests, SECOR (1998b) concluded that the detections constituted measureable evidence of the validity of the groundwater gradient direction, as calculated in the previous SECOR report (1998a). Further, the results showed that a detectable

hydraulic connection exists between the Big Springs and the then-proposed production boreholes, DEX-1 and OB-1.

The Source Group Inc., September 9, 2005 Report

The Source Group Inc. (SGI) prepared a hydrogeologic report on September 9, 2005 based on previous hydrogeologic reports generated by others up to that time, including a review of two reports by SECOR (1998a and 1998b). New to this September 2005 report was a capture zone analysis. As such, the report constituted an update (or "re-packaging") of the hydrogeologic conditions of the region and provided a brief summary of the available data and information up to that time. This report was conducted for CCDA Waters LLC (CCDA), a subsidiary of Coca-Cola.

Review of that SGI report by RCS revealed that the choice of the production well for the facility had been narrowed down to only DEX-6 The capture zone analysis (actually a calculation) for DEX-6 used previously established values for aquifer transmissivity of 232,000 gpd/ft, an hydraulic gradient of 0.02, and a continuous pumping rate of 500 gpm. This capture zone was shown to have very limited extent and only affected water levels adjacent to DEX-6.

Geosyntec October 17, 2012 Report

This is the earliest dated report by Geosyntec, and was titled "Interpreted Recharge Area Assessment;" it essentially consisted of a watershed assessment. For this report, Geosyntec contracted with EDR to obtain database records of properties within the watershed area. In addition, it was reported that areas that were listed as industrial use in the area were identified and visually observed in the field. This was done to determine the then-current property use and to obtain information on former remediation projects and waste generation records, using GeoTracker (through the RWQCB), Envirostor and the Hazardous Waste Tracker System Database (the latter two through the Department of Toxic Substances Control - DTSC). No discussion of groundwater was provided in the report and, thus, this report will not be further discussed herein.

Geosyntec March 7, 2014 Hydrogeologic Review and Well Testing Report

In this report, Geosyntec discussed the most recent hydrogeologic work for the former Coca-Cola Mt. Shasta Bottling Facility. The stated purposes of this Geosyntec hydrogeologic investigation were to:

- Review previous hydrogeological investigations conducted at the property.
- Complete a watershed assessment to interpret the boundary of the primary groundwater recharge area for the site.
- Evaluate current land use and zoning within that discharge area.
- Identify properties that may have the potential to significantly impact groundwater quality within the area.
- Conduct well testing of the onsite production well and Domestic Well.
- Compare previous testing results with their more recent test results.

Groundwater Recharge Area

Geosyntec conducted a re-evaluation of the groundwater recharge area for the site and for the Big Springs that was previously described by SECOR (1998a) in its October 17, 2012 "Interpreted Recharge Area Assessment Report," as noted above. The original recharge area delineated by SECOR (1998) amounted to 6 square miles (mi^2). However, based on its "...topographic map interpretation and use of Geographical Information System (GIS) software..." Geosyntec (October 2012) defined an additional 1.2 mi^2 of recharge area to bring the total recharge area up to 7.2 mi^2. This new, larger recharge area is illustrated on Figure 5, "Groundwater Recharge Area" (Geosyntec, 2012). The increase in recharge area was based not only on the area in which surface water could percolate to groundwater, but also considered groundwater underflow that could influence the site and the Big Springs. Based on our review of the enlarged recharge area, RCS considers the current depiction of this recharge area to be reasonable.

Geosyntec Testing of DEX-6 and the Domestic Well

Geosyntec conducted additional testing of these two wells in August 2012. The two tests included 4 hours of pumping for DEX-6 and 6 hours of pumping for the onsite Domestic Well. The flow rates were measured manually while pumping into a 55-gallon drum, whereas static and pumping water levels appear to have been measured and recorded by a downwell pressure transducer in each well. The objectives of each test were to help verify the specific capacities of the wells, and to compare the new data to previous results (in the case of DEX-6). The groundwater pumped from each test was discharged to ground surface near each well, and the water eventually drained to a man-made onsite stormwater retention basin on the plant site. The following provides a summary of the results of the two pumping tests:

DEX-6:

Average pumping test rate:	410 gpm
Static water level:	202 ft below reference point (brp, top of casing)
Pumping water level:	202.66 ft brp
Drawdown:	0.66 ft
Specific Capacity:	621.2 gpm/ft ddn

Geosyntec noted that the specific capacity of the most recent test was higher than that originally determined by SECOR (1998) for this well (434 gpm/ft ddn). However, Geosyntec did qualify the difference between these two numbers as likely due to the SECOR test being significantly longer in duration (63 hours) than the 4 hour short-term test.

Domestic Well:

Average pumping test rate:	538 gpm
Static water level:	85.6 ft brp, top of casing
Pumping water level:	87.57 ft brp
Drawdown:	1.96 ft
Specific Capacity:	274.5 gpm/ft ddn

DEX-6 Historic Water Levels

Geosyntec provided a water level hydrograph of available static water levels in DEX-6 between 1998 and 2013. Their hydrograph has been adapted to create our Figure 6, "DEX-6 Water Level Hydrograph." From their hydrograph, Geosyntec noted the following with regard to the water levels in DEX-6:

- Static water levels during the 15-year period of January 1998 to July 2013 "dropped" by 1.3 ft (based on two separate measurements). This decline was attributed either to pumping or to seasonal fluctuations because the measurement was collected in a "summer month in a year of low precipitation." However, Geosyntec did note that the static water levels have been relatively stable over that 15-year period.
- The highest recorded static water level elevation was in April 2006, which was attributed to higher than normal precipitation that occurred during the 2006 water year (October 2005 through September 2006).
- Seasonal fluctuations of the static water levels appear to be on the order of 0.5 to 1 foot.
- Rapid fluctuations in the static water levels between December 2007 and October 2010 were on the order of 0.5 to 0.75 ft, and were reportedly due to water level drawdowns caused by the daily pumping of this well.

Based on our review of these data, RCS generally concurs with these conclusions. An updated version of this hydrograph is presented and discussed in a later section of our report under the section entitled "Static Water Level Data and Hydrographs".

Water Quality Data

Geosyntec collected groundwater samples from both the DEX-6 and the Domestic Well in October 2012 at the end of each respective pumping test. The samples were labeled as "Spring Source #BH-1" (which is DEX-6) and "Spring Source #BH-2" (which is the Domestic Well). As shown in the following table, both samples had the same approximate water quality with regard to key general mineral water quality constituents:

Constituent	Concentrations (mg/L)	
	DEX-6	Domestic Well
Total Dissolved Solids	110	110
pH	7.3	7.2
Calcium (Ca)	6.2	5.6
Magnesium (Mg)	3.7	2.6
Sodium (Na)	11	8.1
Bicarbonate (HCO_3)	57	47
Sulfate (SO_4)	0.61	0.51
Chloride (Cl)	1.5	Not Detected
Fluoride (F)	0.18	0.15

The above tabulated results reveal that the groundwater has a mixed cation Na-Ca-HCO_3) character, similar to that shown by SECOR (1998a). This again indicates that meteoric water is the ultimate recharge source, but the recharge water has been influenced by Na as it percolates through the fractured volcanic rocks. In addition, the groundwater from the two sources (i.e., the wells) appears to be similar in character.

HYDROGEOLOGIC ANALYSIS

FIELD RECONNAISSANCE

A field reconnaissance of the proposed bottling facility and the surrounding region was performed on July 21, 2016 by an RCS groundwater geologist (Mr. Earl LaPensee), in conjunction with AES Staff (Ms. Ryan Lee Sawyer), Geosyntec Staff (Mr. Jeff Zukin) and CG Staff (Mr. Zack Snure). The basic purpose of this field reconnaissance was to observe the locations of groundwater monitoring wells and water-supply wells at and proximal to the proposed bottling facility. In addition to this, RCS obtained additional basic information on the plant operations and water usage during the field visit. During this field reconnaissance and joint meeting, the following data and information were obtained:

1. The water use at the proposed bottling facility will be implemented on a phased approach. The first phase, which will consist of one operating production line, will reportedly use 130 AF/yr initially (0.356 AF/day or 116,003 gpd). The second phase, where a second production line will be put into operation, will use an additional 113 AF/yr (0.309 AF/day or 100,800 gpd). It was reported that this second phase would likely be implemented within 5 to 7 years, after the plant commences production. The total combined production with two lines operating will be 243 AF/yr (0.67 AF/day or 216,788 gpd).
2. Each of the pumping wells (DEX-6 and the onsite Domestic Well) have been equipped with totalizing and instantaneous flow meters and the pumped volumes from these wells are being recorded by plant personnel. In addition, these two wells and the groundwater monitoring wells have also been equipped with pressure transducers to continuously record water level changes over time.
3. DEX-6 supplies the facility through two 30,000-gallon onsite tanks, and the pipeline from the well is routed through those tanks and into the facility.
4. Under the Proposed Project, Well DEX-6 will pump at an operational rate of approximately 200 to 300 gpm (monthly average of 150 gpm) and be operated intermittently throughout the day to refill the 30,000-gallon tanks but only between the 20,000- and 30,000-gallon mark on each tank. As such, calculation of the time to fill this 10,000-gallon volume yields a pumping duration of 33 to 50 minutes, depending on the pumping rate. Thus, the pump in this well would be cycling on and off throughout each day to refill this volume, and the actual period between each off-on cycle would depend on the actual volume of water used during production runs.
5. At the above pumping rate, the maximum amount of water that would need to be produced from well DEX-6 would be 432,000 gpd. However, the daily demand with one production line in operation would only need to be 116,003 gpd 130 AF/yr). Thus, well DEX 6 would need to be pumping only 27% of the time, or approximately 6½ hours per day, maximum, every day. When production commences for the

second production line, the total demand will increase to 216,788 gpd (243 AF/yr). To meet this demand, well DEX-6 would need to pump 50% of the time, every day.

6. Each of the DEX wells and groundwater monitoring wells were visited and photographed by RCS; copies of these photographs are included in Appendix 3. It was observed that the wellhead at each of these wells was secured with locked monument casings/covers and that those wells selected for long-term monitoring purposes appeared to be equipped with transducers.
7. A visit to one of the Big Springs, which is located in Big Springs Park and is owned by the City of Mt. Shasta, was also conducted. This one spring has been developed and is accessible to patrons of the park; a photograph of this spring is provided in Appendix 3. Due to the configuration of the spring, its flow could not be measured. As reported by SECOR (1998a), this spring is one of a few locations where groundwater issues from fractured andesite. The combined flow from these springs was reported to be at a rate of approximately 10,000 gpm; such a flow rate would create a flow volume of approximately 16,000 AF/yr, assuming the flow is constant and continuous throughout the year. A visit to one of the other locations was also performed separately by the RCS groundwater geologist and that spring was observed to also be flowing at a high rate (this rate could not be measured).
8. A visit was also performed to a stream gage/stream stilling well located at the intersection of Interstate Highway 5 and Big Springs Creek. This stream gage is located at a culvert that runs beneath that highway; a photo of this gage is provided in Appendix 3. The flow of the spring was measured and provided in a draft report by CH2M Hill (August 2014). Review of that report revealed the creek to have a flow rate ranging from 19.2 and 19.9 cubic ft per second (cfs) at two separate upstream measuring locations; in other units, these flow rates would represent approximately 8,640 and 8,955 gpm, respectively. These measurements are relatively close to the reported SECOR (1998a) flow rate of 10,000 gpm.

The Domestic Well will also be used in production at the plant, as well as for other purposes such as cleaning the machines and domestic supply, and the water is to be pumped into the adjacent, above-ground 228,000-gallon fire-suppression storage tank. According to estimates obtained from GC Staff, for projected water use from the Domestic Well, the following apply:

A single production line operating:	a total of 2,811,000 gpy, or 8.6 AF/yr.
Two production lines operating:	a total of 5,516,000 gpy, or 16.9 AF/yr.

However, the Domestic Well will be pumping a total of 300 days per year, or 82% of the time. Thus, to supply the demand based on these number of days, the Domestic Well, even though it is known to be capable of pumping at very high rates, will need to be pumped on a daily basis as follows: at only 9,370 gpd (i.e., at 8 gpm, assuming the well is pumping 80% of the time each

day) for one production line operating; and at only 18,367 gpd (or 16 gpm, assuming again that the well is pumping 80% of the time) for the operation of both future production lines.

Actual pumping rates of this well will differ from these estimated above. Based on information obtained from GC (Mr. Richard Weklych, personal communication, August 20, 2016), pumping from the Domestic Well can be varied from rates ranging from 20 to 500 gpm (or greater) because the pump is equipped with a Variable Frequency Drive (VFD) motor, which allows pumping rates to be adjusted. Further, during short (minutes long) fire flow tests at up to 1,500 gpm (fire flow testing up to 1,500 gpm is obtained directly from the 228,000-gallon storage tank), the Domestic Well will be used to replenish the volume obtained from the tank during such fire flow testing. Thus, at such variable rates, pumping durations will vary and the pump would only need to pump on the order of minutes to perhaps one hour at most each day, depending on the amount needed to be pumped. However, on average, the rates from the well, based on 300 days of continuous pumping, are as listed above.

GEOLOGIC/HYDROGEOLOGIC CONDITIONS

RCS reviewed the available State Water Well Completion Reports (i.e., driller's logs) and/or geologic logs to help assess geologic/hydrogeologic conditions in the vicinity of the facility. These driller's logs/geologic logs were obtained from the SECOR (1998a) and the Geosyntec (2014) reports. The wells and test holes discussed herein all lie within the recharge area of Figure 5. The following provides a summary/analysis of those conditions, as recorded on the driller's logs:

Wells OB-2, OB-3 & TH-1 and TH-2

Review of the geologic logs of two of three wells, OB-2 and OB-3, and two test holes TH-1 & TH-2 (all drilled in 1987) as obtained from the SECOR (1998a) report were reviewed by RCS. Figures 2 and 3 show the locations of Wells OB-1, OB-2 and test holes OB-3, TH-1 and TH-2 and Table 1 provides the construction information on the three wells. Those logs revealed the following:

- OB-2 and OB-3 were drilled to depths of 200 ft and 171 ft bgs, respectively. The lithology that was encountered generally consisted of interbedded silt, sand, gravel, cobbles and boulders of gray andesite. In OB-2 this type of material extended to a depth of 80 ft bgs whereas in OB-3, it extended to a depth of 171 ft bgs.

- In OB-2, "fractured tuff" was reported at a depth of 80 ft, until at a depth of 90 ft, fractured andesite was reported. It was noted that the fracture spacing was gradually decreasing until it was very hard at 118 ft bgs. Between 118 and 200 ft bgs, gray to brown, very hard to hard, to fractured andesite was reported. In OB-3, andesite was reported between 94 and 101 ft bgs. This description appears an anomalous description, because the rest of the encountered gravel throughout the hole is reported to be sand, gravel, cobbles and boulders.
- In OB-2 and OB-3, "first water" was reportedly encountered by the driller to be at a depth of 160 ft and 145 ft bgs, respectively. However, final SWLs of 154.4 and 120.6 ft bgs, respectively, were also reported. Thus, in OB-2 it appears that the SWL is within the fractured andesite, whereas in OB-3 the SWL appears to be within the alluvial-type sediments.
- TH-1 was drilled to a depth of 40 ft bgs; clayey silt was encountered to a depth of 15 ft bgs followed by a red tuff "boulder to 17 ft bgs. Beneath 17 ft bgs, red brown tuff with clay-filled fractures was reported to 23 to 24 ft bgs, followed by hard tuff to 40 ft bgs. No water was reportedly encountered in this test hole.

9. TH-2 was reported to have been drilled to a depth of 80 ft bgs. Various earth materials consisting of sand, silt, gravel and cobbles were reported to be present to a depth of 40 ft bgs. Highly fractured tuff was reported from 40 ft to a depth of 50 ft bgs, followed by hard, massive gray-brown andesite to a depth of 80 ft bgs. No groundwater was reportedly encountered in this test hole DEX-6 supplies the facility through a 30,000-gallon onsite tank, and the pipeline from the well is routed through the facility and then into that tank.

Wells DEX-1 through DEX-7 & the Domestic Well

These boreholes/wells were drilled and logged directly by SECOR (1998b) in late-1997. Table 1 lists the pertinent drilling depths and construction information on these wells. Reportedly electric logging of the pilot boreholes for DEX-1 through DEX-7 was performed, along with acoustic televiewer and video logging to aid in the determination of the geometry of the fracture systems. These boreholes were all drilled by Aquarius Well Drilling of Mt. Shasta. The following provides a summary of key geologic/hydrogeologic conditions in these boreholes/wells.

DEX-1

The borehole for this well was drilled to a depth of 82 ft bgs. Reportedly, a brown, yellowish volcanic tuff with boulders and cobbles was encountered from ground surface to a depth of 33 ft bgs, followed by reddish brown andesite, containing "numerous large fractures" to the total depth of the borehole. Groundwater was first encountered at a depth of 55 ft bgs, and the original SWL in late-1997 was reported at 54 ft bgs, entirely within the fractured andesite. It was reported the borehole "grades with increasing fractures" at 60 ft bgs. The borehole was converted to a groundwater monitoring well

(see Table 1). Notable also is the presence of what is termed "seep water" at depths of approximately 100 ft and 140 ft bgs, possibly indicating the lack of the alluvial sediments to support high-capacity water production wells.

DEX-2

This borehole was drilled to a depth of 300 ft bgs. From ground surface to 20 ft bgs a brown sandy silt was reported, followed by brown tuff and silty clay to 33 ft bgs. This was followed by a slightly red to dark gray andesite, which reportedly contained numerous large fractures to a depth of 120 ft bgs. Below this, the andesite was reported as being massive with only minor fractures at 136 ft bgs and moderate fractures at 288 to 290 ft; the latter (deeper) zones were cited on the geologic log as the main water source. It was reported that groundwater was first encountered at a depth of 210 ft bgs and the SWL was reported at 205 ft bgs; the groundwater likely originated from the fractures in the andesite. This borehole was converted to a groundwater monitoring well (see Table 1).

DEX-3A & 3B

The boreholes for these two wells were drilled to depths of 148 and 403 ft bgs, respectively, and revealed a different type of lithology, compared to that in the previous two wells discussed above. These two wells are located only 10 ft apart and, thus, a single lithologic column was depicted by SECOR for both wells. The earth materials were generally reported as consisting of dark grayish to reddish brown to dark gray gravelly sand to sand/gravel with cobbles and boulders occasionally interbedded with silty sand. Groundwater was initially encountered at a depth of 132 ft bgs in both boreholes, with a final SWL at 127 ft bgs in DEX-3A and 140 ft bgs in DEX-3B. Both boreholes were converted to groundwater monitoring wells (see Table 1).

DEX-4

The borehole for this well was drilled to a depth of 292 ft bgs. "Talus" consisting of sand and silt from the base of Spring Hill, was reported from ground surface to a depth of 14 ft bgs, followed by brown tuff (gravel, sand, silt and clay) to a depth of 33 ft bgs. Beneath this, andesite was encountered to the total depth of the borehole. Numerous large fractures between 40 ft and 182 ft were reported. Below 184 ft bgs, no large fractures were present, until a depth of 239 ft to 242 ft bgs, where a moderate number of small fractures were noted by the logger. At 268 ft bgs, small fractures were again noted on the log. It was reported that groundwater was first encountered at a depth of 230 ft bgs and the SWL was reported at 233 ft bgs, entirely within the andesite. This borehole was converted to a groundwater monitoring well (see Table 1).

DEX-5

A total depth of 235 ft bgs was achieved during the drilling of this borehole. Generally, brown silty sand, to 17 ft bgs, followed by grayish brown gravelly sand, consisting largely of andesitic gravel, was present to 90.5 ft bgs (reportedly a thin water-bearing zone was observed at this depth via a video). Between this depth and 152 ft bgs, a mixture of pyroclastic debris and silt to sandy gravel was reported. Below 152 ft bgs, reddish-brown andesite with large fractures, partially filled with tuff, was noted. Groundwater was

reportedly first encountered at a depth of 134 ft bgs and the SWL was reported at 131 ft bgs, within a silty, sandy gravel and pebble mix. This borehole was reportedly destroyed (see Table 1), because "logging of this borehole indicated it was not in a desirable location."

DEX-6

Drilling of the borehole for this well was conducted to a depth of 294 ft bgs. The first 8 ft of drilling encountered dark brown silty sand and gravel, followed by dark grayish brown cobbles and boulders to 94 ft bgs, at which depth finer grained material was reported, consisting of sand and gravel and angular fragments of andesite. These earth materials were present to a depth of 116 ft bgs, at which depth a yellowish brown silty, sandy gravel was present. A rubble zone with seep water was reported at a depth of 144 ft bgs, as observed via a video survey. At a depth of 159 ft bgs, the Spring Hill andesite was reported, and it displayed minor fractures. Groundwater was encountered at a depth of 198 ft bgs, where a prominent zone of fractures, approximately 96 ft in vertical extent occurred; this appears to be the major source of water in the borehole. This borehole was converted into one of the onsite production wells at that time (see Table 1).

DEX-7

In the first 80 ft of drilling, the borehole for this 274-foot deep well encountered clayey to silty to gravelly sand and gravel. Below 80 ft bgs, reddish-brown fractured andesite was encountered to the total drill depth. A minor water seep was observed (via video by the logger) at 136 to 138 ft bgs. At a depth of 158 ft bgs, an increase in the groundwater flow was noted, where the lithology was reported to consist of sand, silt, coarse sand to small pebble gravel; volcanic lapilli was noted in the description by the logger as well. Groundwater was encountered at 192 ft bgs with a subsequent stable SWL reportedly at 181 ft bgs. This borehole was also converted into a production well (see Table 1 for details).

ONSITE DOMESTIC WELL

Only the driller's log, and not a geologic log, was available for this well; as such, a driller's log does not provide the requisite detail on lithologic conditions that a geologic log would render. Nonetheless, this driller's log did provide some useful information with regard to subsurface geologic/hydrogeologic conditions. As recorded on the available driller's log, boulders, brown clay with boulders, and sand and gravel with boulders were reportedly encountered to a depth of 205 ft. Below this, "Brown Spring Rock" and "Harder Brown Rock" were present from 205 ft to 250 ft bgs. "First water" was encountered at a depth of 100 ft bgs, and an apparent SWL was recorded at 80 ft bgs. The driller's log does not indicate what quantities at which this "first water" was encountered, but it could possible correlate to the "seep water" observed in DEX-6. Note also that because the SWL was higher than that first encountered, it is possible that the groundwater emanates from a deeper zone. However, the higher SWL could also be an artifact of the drilling method used (air-rotary which may have a tendency to give an incorrect initial depth).

It could be interpreted that the upper ±200 ft of earth materials in this well may be alluvial/fluvial in nature, but these materials could also be a lahar (volcanic debris flow deposits). The borehole was converted to a well to supply the proposed bottling facility domestic needs; see Table 1 for its construction details.

The available log data tend to indicate two basic aquifer systems occur in the area: a shallow alluvial aquifer system; and an underlying, fractured andesite aquifer system. However, the data are conflicting in that a few wells seem to indicate groundwater in the shallower "alluvial" aquifer system while most of the logs show groundwater originating in the fractured andesite, which would thereby constitute the second aquifer system. The actual geometry of the hydrogeologic system in the vicinity of the plant is complex, because depositional systems in volcanic terrane are composed of great lateral and vertical variability, due to the different rock types typically involved, such as: hard, fractured volcanic rocks, lahars, ash fall tuffs, and ejecta. Thus, for DEX-1, DEX-2, DEX-4, DEX-6, and DEX-7 it can be inferred that these wells can extract groundwater from the same fractured andesite system. Further, the SWL depths in these wells appear to indicate that groundwater is likely governed by unconfined conditions in the fractured rock system. However, DEX-3A, -3B and DEX-5 appear to have groundwater contained in different depositional systems that are discontinuous from these fractured andesite aquifer system.

PRECIPITATION (RAINFALL/SNOWFALL) DATA

The climate in the Mt. Shasta region tends to be dry during the hot summer months but cool, wet and/or snowy during the winter months. In order to evaluate the effect of rainfall on groundwater levels in local wells, rainfall trends based on raingage data are needed because these water levels are influenced by percolation of direct precipitation on the land surface and by the recharge from streams and creeks (e.g., Big Springs Creek, although this stream may not actually be recharging the aquifer systems but rather it may be a site of groundwater discharge from the local aquifer system). In addition to rainfall, snow accumulation is another component to recharge to the local aquifer systems, especially at the higher altitudes (e.g., the summit area of Mt. Shasta).

In order to assess the impact of precipitation (rainfall and snowfall) patterns to water level changes in the local fractured rock aquifer system, available historic rainfall/snowfall data were obtained from the Mt. Shasta rainfall/snow gage (Gage No. 045983). This gage, which is the closest available measuring instrument to the proposed bottling facility, is located in Shastice Park,

approximately 4,200 ft southeast of the plant. These data were obtained on a calendar year basis from the Western Regional Climate Center (WRCC) of the Desert Research Institute (DRI) in Reno, Nevada for an available period of record of 1988 through June 2016. The available data for rainfall and snowfall were graphed separately and are provided as Figures A1 through A4, in Appendix 4.

However, in evaluating the effect of snowfall on water level changes, total snowfall needs to be converted to snowmelt, and then that total needs to be added to the rainfall to get the total precipitation value. There are three basic weather conditions governing the amount of snowfall that can become snowmelt (Haby, 2016). These conditions, as stated by Haby, 2016, are as follows:

- **Wet Snow Above Freezing Ground:** Wet snow is snow that has a high liquid content as it reaches the surface. It needs to be at least 50% made of ice or it will have more characteristics of being a raindrop instead of a snowflake. It gets this liquid content by partially melting before it hits the ground. The wetness of the snowflakes makes it easier for snowflakes to stick together as they fall, thus a wet snow will often have large snowflakes and a lower number of snowflakes. If the ground temperature is above freezing the snowflakes will continue melting. In these situations a snow event can occur but with no snow accumulates on the ground.
- **Wet Snow at/or below Freezing Ground:** In this situation, the snow will accumulate on the ground. This is the best situation for producing snow where the making of snowballs is the easiest. The snow is sticky due to its high partial liquid content. The ratio for wet snow will be less than 10:1. For example, a 5:1 ratio may occur in which it takes 5 inches of snow to produce 1 inch of liquid equivalent.
- **Dry Snow:** A dry snow has little to no liquid water content thus, this snow will be less dense than average. Less dense meaning there will be a lot of air pockets between the snow crystals. Dry snow is not sticky and thus it is difficult to make snowballs with it and the wind blows it around substantially, even after reaching the surface. The ratio for dry snow will be greater than 10:1. In extreme cases it can be 30:1 or greater. Dry snow occurs when the temperatures throughout the troposphere are well below freezing and the surface temperature is below freezing. Since dry snowflakes are less sticky they are less inclined to stick together as they fall, thus a dry snow will often be composed of a large number of small snowflakes.

However, it is not readily possible to determine what the ground conditions were like at the time of each snow event recorded by the subject Mt. Shasta gage. Under these circumstances, it is preferable to convert rainfall to snowmelt under "average" snow conditions. These calculations were performed by RCS using an online calculator, which used a 10:1 snowfall to snowmelt ratio. This online calculator is available at:

http://www.csgnetwork.com/snowraincvt.html

Figure 7A, "Annual Average Precipitation Totals", and Figure 7B, "Accumulated Departure of Precipitation Total", graphically provide the annual combined rainfall and snowmelt total as a bar chart and a graph of accumulated departure for annual rainfall/snowmelt from the long-term average annual rainfall, respectively, for the period of available record. The purposes of these graphs are to define the long-term average annual precipitation at the gage, to illustrate long-term water level trends (changes) in precipitation in the region, and to provide a relative means of comparing the trend in precipitation to other parameters that are affected by these patterns, such as the static water levels in the onsite wells. Note that the year 2015 has a very low amount of precipitation at 2.4 inches. That year, only one measurement of the gage was taken in December. Consequently, the resultant accumulated departure curve for precipitation is skewed towards indicating a drier year than would normally have occurred. Nonetheless, 2015 was a drought year and it is likely that the curve would have still indicated the same basic trend direction, even if the data were available.

The figures provide the following information:

- Annual totals on Figure 7A have ranged from a low of 12 inches in 2014 (the year of no measurements is not included for the low period) to a high of 86.1 inches in 1998. The long-term average annual precipitation for the period of record (1988 through June 2016) is 46.2 inches. (This average does not include the year of no measurements in 2015).
- The highest precipitation totals, that are equal to or greater than the sample standard deviation (denoted by the symbol $+\sigma$ on the graph) of 17.9 inches added to the average annual precipitation total for the period of record (65.7 inches, which does not include the year of no measurements), occurred during the years 1995, 1996 and 1998 (the historic high). These years represent relatively "wet" years, for the period of record.
- The lowest precipitation totals, lower than one standard deviation ($-\sigma$) at or under the average, or a value of 26.7 inches occurred during the years 2013, 2014 and 2016 (these are the historic low years and it is possible that 2015 would have also been below this value, but there are no records to confirm this). These years represent relatively "dry" years in the area.
- The accumulated departure values as depicted on Figure 7B are plotted relative to the long-term average annual precipitation (combined rainfall and snowmelt) for the 1988 through June 2016 period of available data. The zero line on the accumulated departure graph represents the long-term average annual precipitation (this includes the year of no recorded measurements as noted above). The purpose of the accumulated departure curve is to illustrate temporal trends in the precipitation data.

Points plotted above that zero line represent years of excess precipitation, whereas points plotted below that line represent years of deficient precipitation, relative to the long-term mean value. For example, the slopes of the curves declining to the right-hand side of the graph (negative slopes) indicate those years where accumulative precipitation totals are declining, relative to the long-term average; these declining trends represent general periods of deficient precipitation or a "typical dry period." Conversely, those portions of the curve ascending towards the right-hand side of the graph (positive slopes) indicate years where accumulative precipitation totals are increasing, relative to the long-term mean value; in essence, these rising trends represent general periods of increased precipitation, or a "typical wet period." Typical "wet" and "dry" periods are specially denoted on Figure 7B.

- Some of the accumulated departure totals, calculated for those time periods showing deficient precipitation, may represent a year or two of precipitation that has been well above the mean value, but the curve does not ascend above the zero line. For example, the year of 1992 had a high precipitation total (60.7 inches), even though the accumulated departure point for this year was still below the zero line. Thus, the high amount of precipitation during that one year was not enough to raise the accumulated departure curve to a point above the zero line, since accumulated departure totals prior to that year were all showing deficient values relative to the long-term average value. Precipitation totals from 1993 through 1995 were still not adequate to raise the totals above the zero line.
- Figure 7B shows a series of years when precipitation was declining (a hydrologically dry period or drought) relative to the long-term mean value. There was a period of decline (or drought) between 1988 and 1991 (it is likely that trend was a continuation of below normal precipitation years, had data been available to show this). However, starting in 1991 and continuing through to 2006 precipitation was generally increasing (hydrologically, a "wet" period), with a few intervening dry periods that did not last long, as noted by the curve ascending to the right on the figure. Between 2006 and 2011 the precipitation was alternating between "dry" and "wet" periods.
- Starting in 2012 and continuing into June 2016, another hydrologically "dry" period can be discerned. Based on the data, it appears that this trend is likely to continue, but it is unknown when there will be higher than normal precipitation events that will cause the curve to again ascend to the right.

Figure 7B appears to illustrate that for many years following 1995 and generally continuing through to 2011, precipitation has generally been increasing (with some minor intervening "dry" periods), relative to the long-term average annual rainfall of 47.8 inches. This could indicate the precipitation was sufficient to provide increasing amounts of recharge to the fractured bedrock aquifer systems. Further, although the graph shows the precipitation patterns based on the local rain gage measurements, it is likely that precipitation is greater on Mt. Shasta and that over the year, as the accumulated snowfall melts, the recharge to the fractured bedrock aquifer system continues, thus

affording a continuing supply even during the summer months. This increase in precipitation with elevation is evident in a comparison of total snowfall data from 2009 to 2016 between the Shasta Ski Park and the Mt. Shasta City gages:

YEAR	Mt. SHASTA SKI PARK GAGE	MT. SHASTA CITY GAGE
2009	229"	91"
2010	317"	138"
2011	84"	2"
2012	308"	69"
2013	31"	32"
2014	55"	4"
2015	109"	0"
2016	200"	8"

Numbers for the Mt. Shasta City Gage rounded to nearest whole number. The gage is located at an elevation of 3,590 ft above msl.

Data from Mt. Shasta Board and Ski Park (September 2016) located on South Side of Mt. Shasta. The elevation of this Ski Park ranges from 6,200 to 6,600 ft above msl.

STATIC WATER LEVEL DATA AND HYDROGRAPHS

Available historic SWL data was analyzed in order to discern possible long-term changes in those levels over time and to determine groundwater flow directions (when available SWL data are used in conjunction with wellhead elevations). Long-term accumulations of water level data for individual wells are particularly useful records because these data can be used to determine the historically highest and lowest SWLs over time, and to help define possible trends in water levels both seasonally and from year to year over time. Furthermore, current SWLs can then be compared to those that have been recorded over time in specific wells, and, also, SWL comparisons can be made to different wells and to wells in different parts of a geographic area (such as in the vicinity of the proposed bottling plant).

RCS obtained available SWL data (as recorded from transducer measurements) from CG Staff for those wells that are currently being monitored, namely DEX-1, DEX-3A, DEX-3B, DEX-6, DEX-7 and the Domestic Well. Using these SWL data, RCS created hydrographs of the SWLs versus time and compared those data to the accumulated departure of precipitation for the period of record (1998 through June 2016) for two selected key wells, namely DEX-1 and DEX-6. These wells had the longest period of record for SWLs for the fractured aquifer system. The remaining

monitoring wells had much shorter periods of record and/or were constructed in the alluvial aquifer and, thus, were not considered as useful for our current analysis. The resulting water level hydrographs for these wells are provided in Appendix 5, as Figures 5-1 and 5-2.

Superimposed on each of these water level hydrographs is a plot of the monthly accumulated departure of precipitation for the 1997 through 2016 time period that coincides with the period of available SWL measurements. The accumulated departure on the monthly basis is similar to that in Figure 7B, except that the Figure 7B curve provides the seasonal variations in precipitation over each year and for the period of record. The purpose of this superimposed plot on Figures 5-1 and 5-2 is to permit analysis of possible trends in the SWLs to trends in monthly precipitation patterns.

The two figures illustrate the depths to and changes in SWLs over time in each of the monitoring wells for which data were available. The water levels on these graphs are plotted versus the accumulated departure of precipitation on a monthly basis for the Shastice Park rain gage. The seasonal variations in precipitation can readily be seen where at the beginning of each year precipitation values, relative to the average, tend to be higher, declining by the end of each year to a lower value.

Also notable in the graphs is that the accumulated departure of monthly precipitation appears to be increasing over time (curve generally ascends to the right) until about 2012 or 2013, when it reaches a maximum point, after which the accumulated departure of precipitation declines rather steeply until mid-2016. This decline represents the current period of drought that is occurring in the region.

With regard to each well, the seasonal and long-term changes in precipitation have a significant effect on SWLs in each well and other local changes could also affect these levels, as noted below for each well.

DEX-1 Static Water Levels vs. Accumulated Departure of Precipitation

Review of Figure 5-1, "Water Level Hydrograph vs. Accumulated Departure of Monthly Precipitation, DEX-1" illustrates the seasonal and long-term changes in SWLs in this well, in comparison to the trends in the accumulated monthly departure of total precipitation (rainfall and snowmelt combined). Note that in early-2015, a new pressure transducer was installed in this well to replace the earlier version. This graph illustrates the following:

1. The SWLs in DEX-1 have ranged from an elevation of 3,575.6 ft above mean sea level (msl), the shallowest measurement in early-2001, to a slightly lower SWL in late-2015 at 3,573.1 ft above msl. The total SWL fluctuation (a decline) of SWLs has only been 2.5 ft over this 14-year time period. This amounts to an average decline during that period of 0.18 ft per year (ft/yr). Note that there is a period between 2009 and mid-2014 for which there are no recorded water level data. It is likely that SWLs were still declining during that period.
2. Between 1998 and 2009, precipitation was increasing. Similarly between 1997 and early-2000, SWLs were also rising, indicating that for that period recharge was occurring in accordance with the precipitation patterns; the SWLs show a response to increasing precipitation. However, starting in late-2000, SWLs in this well began to decline, even though precipitation was still increasing. This start of water level decline began prior to commencement of operations at the plant (in January 2001). Plant operations ceased in late-2010, but unfortunately, no SWL data are available for DEX-1 either two years before or three years after that date.

DEX-6 Static Water Levels vs. Accumulated Departure of Precipitation

Review of Figure 5-2, "Water Level Hydrograph vs. Accumulated Departure of Monthly Precipitation, DEX-6" illustrates the seasonal and long-term changes in SWLs in this well, in comparison to the accumulated departure of monthly precipitation. It should be noted that the data between 2004 and late-2010 are combined pumping water levels (PWLs) and SWLs, after which only SWLs have been recorded, because of the closure of the plant in late-2010. This figure illustrates the following, with regard to water level changes in Well DEX-6:

1. SWLs have ranged from an elevation of 3,578.3 ft above msl, the shallowest measurement in early-2004, to the deepest SWL point in mid-2016 at 3,576.2 ft above msl. The total decline of SWLs in this well has only been 2.1 ft over this 12-year time period. This amounts to an average water level decline during that period of 0.18 ft/yr, which is the same as that calculated above for DEX-1 for a 14-year period of record.
2. Between 2004 and late-2010, the response of SWLs and PWLs to the seasonal and yearly changes in precipitation has essentially been the same. That is, as precipitation changed seasonally and yearly, SWLs and PWLs rose or declined, and followed the precipitation trends accordingly.
3. Between 2006 and late-2011, SWLs declined. When plant operations ceased at that latter time, there was a slight increase in SWLs, which seems to coincide with increased precipitation. However, subsequent SWLs show a slight decline, while precipitation remained relatively stable between 2011 and 2013. After 2013, SWLs have continued to decline, which correlates with the decline in precipitation (and recharge).

CALCULATION OF GROUNDWATER UNDERFLOW

Introduction

A preliminary calculation of the groundwater underflow within the fractured rock aquifer system in the area of the proposed CG bottling plant was performed for this project. Such an underflow calculation involves determining the cross sectional area of saturated flow along a vertical plane that is perpendicular to groundwater elevation contours; this is because groundwater is known to flow in a direction that is perpendicular to such elevation contours (i.e., from high head to low head).

The vertical plane used herein is oriented generally east-west through Well DEX-6 and extends along a horizontal distance along this plane for at least 800 ft. This distance was conservatively estimated to represent the fractured rock aquifer radiating out from Spring Hill.

The calculation of groundwater underflow was performed using the relation: $Q = KiA$, where:

- Q = the amount of groundwater underflow in the fractured andesite, in gallons per day (gpd).
- K = the hydraulic conductivity of the fractured andesite, in gallons per day per square foot (gpd/ft^2) through which the flow occurs; the magnitude of this parameter was estimated based on aquifer test results performed by SECOR (1998a).
- i = the hydraulic gradient in feet per foot (ft/ft), which is the slope of the water table in this vertical plane and is based on available water level data from selected wells in the area of the proposed project. Two different i values were calculated using June 2016 water level data.
- A = the cross sectional area through a saturated section of the fractured rock aquifer system, in square feet (ft^2). In this case, the saturated thickness of this system (b) for a traverse through the fractured rock aquifer system that is perpendicular to the direction of the groundwater flow (i).

Derivation of the Individual Parameters

Evaluation of most of the parameters listed above was based on available data obtained from the testing conducted by Geosyntec in October 2010 for their report dated February 2011. The following summarizes our evaluation of each of the above-listed parameters:

Transmissivity Value (T): the T valued used herein is based on that obtained from SECOR (1998b) in their model. This T value was deemed to be representative by RCS of the fractured rock aquifer system. Thus, a T value of 324,000 gpd/ft was used in our calculation. However, in calculating the amount of underflow, the T value needs to be converted to K, by dividing T by b [the saturated aquifer thickness (in this case, 100 ft)];

when this is done, a K value of 3,240 gpd/ft^2 is calculated for the fractured rock aquifer system.

Groundwater Gradient (i): this value was calculated using groundwater elevation data collected by Geosyntec in June 2016 from three wells, namely wells DEX-1, DEX-6 and DEX-7. For this date, the groundwater elevation at each of the three selected wells were plotted on a basemap, and the direction and gradient of groundwater flow were determined through the use of the classical three-point solution, typically used by hydrogeologists for a sloping water surface. Based on this solution, the water table in the area of the three wells had a groundwater gradient of approximately 0.003 ft/ft with a groundwater flow direction in the fractured rock aquifer to the south, from DEX-6.

It should be noted that when the Domestic Well was included as an additional point, a different groundwater flow direction to the northwest resulted. Thus, it appears possible that there is an additional component to groundwater flow entering the fractured rock aquifer system from the southeast and at a gradient of 0.002 ft/ft is because this well is perforated within both the shallower alluvial aquifer and the underlying fractured rock aquifer system. However, for the purposes of this analysis only DEX-6 was used, as this is the main production well for the plant.

The Domestic Well is also capable of producing at high rates of flow, on the order of 500 gpm, maximum, and at such a pumping rate, its actual pumping periods would likely be very short in future operational usage. It is very unlikely there would be a significant water level drawdown impact on the fractured rock aquifer, while pumping this well at high rates, but for short time periods. However, for the purposes of this evaluation, this well was included in the calculation of water level drawdown interference over a period of 300 days, and at relatively low pumping rates (see below).

Cross Sectional Area (A): the value for this area was based on an 800-foot distance through DEX-6 that was oriented in an approximate east-west direction. This line was set as perpendicular to the groundwater flow direction and represents the length of the cross sectional area. The saturated thickness (designated by letter "b") of the fractured rock aquifer along this line changes only slightly in both summer and spring. The saturated thickness (b) is based on the depth to the static water level in DEX-6 and the depth of the well; b was set at 100 ft. For the calculation, the saturated thickness was held constant and the cross-sectional area A was calculated to be 80,000 ft^2 (100 ft thick times 800 ft in length).

Thus, for our calculation of groundwater underflow (Q, in gpd), the following values were used, and these were also used in our subsequent calculations regarding the potential impact of pumping of the subject well on groundwater underflow:

$Q = KiA$, where:

$K = 3{,}240$ gpd/ft^2
$i = 0.003$
$A = 80{,}000$ ft^2

Thus, $Q = KiA = (3{,}240 \text{ gpd/ft}^2)(0.003)(80{,}000 \text{ ft}^2)$ gpd

Hence, the cross sectional underflow (Q) at DEX-6 is calculated to be about 777,600 gpd, or about 2.39 AF/day, or ±873 AF/yr.

Calculation of Underflow and Comparison to Total Proposed Production

The groundwater underflow through the area of the proposed bottling facility, as calculated above, converts to a total yearly volume of underflow through the upper portion of the fractured rock aquifer system on the order of 873 AF/yr. As noted above, with one production line operating, a combined total of 130 AF/yr of groundwater will be pumped from both DEX-6 and the Domestic Well, whereas at full capacity in the future (with two production lines in operation), both wells will need to pump a combined total of 243 AF/yr (the original onsite facility had used a total of 259 AF/yr). Thus, with one production line operating, the usage amounts to approximately 15% of the total annual amount of groundwater underflow in the vicinity of the two wells. At the full production capacity, then the total annual groundwater production from both wells would represent approximately 28% of the total annual amount of groundwater underflow through the plant area.

It should be noted that in the vicinity of the plant, there are no other large-scale production wells that pump from the fractured aquifer system. Instead, only a few small-capacity residential wells exist, and these are: located east of the proposed bottling facility; screened to similar depths; and assumed to extract their groundwater supply from this aquifer system. There are approximately 82 residences located northeast, east and southeast of the proposed bottling facility. Assuming a usage of 60 gallons per capita per day (gal/c/d) then for a household of four persons, the daily use would be about 240 gpd per dwelling. This amounts to 87,600 gallons per year (gal/y). Multiplied by the approximate number of residences (82), then the total local residential groundwater demand could be on the order of 7,183,200 gal/y or approximately 22 AF/yr; this volume is only a small fraction (2½%) of the total underflow in the area.

Comparison of Groundwater Underflow to Big Springs Flow

The calculated groundwater underflow above may constitute only a fraction of groundwater that exits at the Big Springs. As noted above, the measured flow from the Big Springs at a downstream gage was reported by CH2M Hill to range from 8,640 to 8,955 gpm, or approximately 13,936 to 14,444 AF/yr. The underflow calculated above in the vicinity of the plant was determined to be 873 AF/yr. This groundwater underflow is only about 6.0% to 6.3%,

respectively, of the flow yielded at the springs. Thus, because of such a small fraction of the ratio of groundwater underflow to spring flow, the actual area from which Big Springs obtains its water supply has to be much larger (both vertically and laterally). Assuming a similar gradient of 0.003 ft/ft and a hydraulic conductivity of 3,240 gpd/ft^2, then the requisite equivalent area that needs to supply a combined flow rate of 12,312,000 gpd from the combined springs would be roughly 1,266,700 ft^2. This is about 15.8 times greater than the area of 80,000 ft^2 that was used in the underflow calculation above. Thus, the actual area of groundwater supplying the underflow to the springs is much greater than the cross sectional area through which DEX-6 and the Domestic Well are obtaining their groundwater supply.

THEORETICAL IMPACT OF PROPOSED PUMPING ON WATER LEVELS

Parameter Estimation

A preliminary evaluation of the theoretical impact of simultaneously pumping DEX-6 and the Domestic Well at full plant capacity on water levels in the groundwater monitoring wells, on the Big Springs, and on other nearby residential wells located east of the proposed bottling facility, was performed using the basic analytical program PUMPIT. These nearby residential wells include: the Pelletier and Russo wells (that have perforations only in the shallow aquifer system, but included here); and the Caskey and Eddy wells (that are perforated in the same fractured andesite system as DEX-6). This program uses the Theis equation to calculate the amount of this impact in terms of the theoretical amount of water level drawdown that might be induced in nearby wells by pumping from the two wells. For this water level drawdown calculation, two scenarios were used: one with one production line in operation (at 130 AF/yr or approximately 116,003 gpd); and a second at full plant capacity (243 AF/yr or approximately 216,788 gpd) from two production lines. In calculating the theoretical water level drawdown impact, the following basic assumptions were used:

- The modeling assumes only one layer and does not delineate the "shallower" alluvial aquifer system and the "deeper" fractured rock aquifer system. Thus, the results obtained by the model are directly applicable to impacts on either the "shallower" or "deeper" aquifer system.
- The aquifer is homogeneous, isotropic, and of infinite areal extent.
- All wells being evaluated are considered to fully penetrate the unconfined fractured rock aquifer system (to as deep as 300 ft bgs); this is the only aquifer system being

pumped by DEX-6. However, the Domestic Well appears to extract its supply from two aquifer systems, but it is assumed for these calculations to be pumping its total demand from the fractured aquifer system only.

- Average values for groundwater flow direction and gradient were utilized in the fractured rock aquifer system, as determined from our analysis of groundwater underflow above, and the values are: the groundwater flow is 30 degrees south of east, and has an average gradient of 0.003 ft/ft.
- Simulation of the theoretical amount of water level drawdown in the aquifer system was conducted under transient conditions (flow to the wells is in a continuous dynamic state) using the previously estimated T value of 324,000 gpd/ft, and an estimated storativity (S) value of 0.038 ft/ft (dimensionless). It should be noted here that there are no T or S values available for the "shallower" aquifer system. However, it is anticipated, based on the geologic conditions encountered in the "shallower" aquifer system, such T and S values are likely to differ significantly from the "deeper" fractured rock aquifer system.
- The well would be pumping at an operational pumping rate of 200 to 300 gpm. However, at these rates the flow would be intermittent because the pump would be cycling on and off throughout each day of production. Assuming the well is pumped at its highest pumping rate, the total amount produced would be 432,000 gpd. However, as noted above, the daily demand with one production line in operation is only 116,003 gpd. Thus, the well would only need to be pumping only 27% of the time, or approximately 6½ hours per day, maximum. This is equivalent to a well pumping at a rate of 81 gpm on a 24-hour per day basis. When the second line is placed into production, the well would need to supply 216,788 gpd. To achieve this at a 300 gpm pumping rate, the well would need to pump 50% of the time. This is equivalent to a well pumping at a rate of 150 gpm, 24 hours per day to meet that demand. Thus, the two simulations were run at 81 gpm and 150 gpm and for an assumed continuous pumping period. However, with the Domestic Well in operation at an average rate of 5 gpm and 11 gpm, then the pumping rate of DEX-6 will be slightly lower, because the Domestic Well will be supplying a portion of the total flow.
- A continuous time period of 365 days, and at the two constant pumping rates of 76 gpm and 139 gpm were utilized for DEX-6, whereas for the Domestic Well, the rates were 5 gpm and 11 gpm for 365 days, as noted above. These rates are equivalent to pumping the well rates of 8 and 16 gpm over a 300 day time period. Thus, the cumulative effect of pumping of each well on the Big Springs is considered herein.

Calculated Drawdown Values

Table 2, "Model-Calculated Values of Theoretical Water Level Drawdown," shows the theoretical drawdown values that were derived from the above-listed parameters for the pumping of the new wells at the proposed bottling facility under the above-listed conditions. Table 2 shows that the water level drawdown interference that might theoretically be induced in

the groundwater monitoring wells, at Big Springs, and at the other proximal, residential water-supply wells that are perforated solely within the fractured rock aquifer system.

Table 2 reveals the following with regard to theoretical water level drawdowns due to the pumping of DEX-6 and the Domestic Well for a continuous 365-day period at the two assigned pumping rates:

- During Phase 1 pumping to supply a total demand of 130 AF/yr (76 and 5 gpm pumping rates, 100% operational pumping duration for DEX-6 and the Domestic Well, respectively), theoretical water level drawdowns could range from 0.09 ft in the Pelletier Well to 0.30 ft in DEX-2. DEX-1 showed a theoretical water level drawdown of 0.24 ft, whereas the Big Springs exhibited a theoretical drawdown of 0.22 ft.
- During Phase 2 pumping, to supply the total demand of 243 AF/yr (139 gpm and 11 gpm pumping rate, 100% operational pumping duration, for the two wells respectively), theoretical drawdowns range from 0.16 ft at the Pelletier Well to 0.56 ft at DEX-2. DEX-1 exhibited a water level drawdown of 0.45 ft whereas the nearby Big Springs showed a theoretical drawdown of 0.40 ft.

However, it is important to note that the calculations for the theoretical drawdown interference using PUMPIT presented herein represent a maximum, but theoretical, water level drawdown-case scenario. Based on our long-term field experience in water level monitoring during actual pumping tests, drawdown impacts in nearby wells induced by pumping of wells under real-world conditions tend to be significantly less than those which have been theoretically-calculated using the same model software that has been used herein. This may be due to the following conditions that cannot be addressed by this model:

- The aquifer represented is an ideal system, whereas any actual aquifer system is not an ideal case, because the real system could have changing directions of groundwater flow and different gradients.
- Heterogeneity of the geometry of the fractures. The direction, interconnectedness and size of the fractures in the aquifer system likely change laterally and vertically and, consequently, the T and S values could also change. Thus, the actual observed drawdown in wells in the region, during future pumping of DEX-6 and the Domestic Well, could also differ from the ideal. Thus some wells would likely exhibit theoretical water well drawdown values that differ significantly from actual observed values.
- The impact of recharge to the groundwater system. This is subject to change and, indeed, may increase into the area, especially during high precipitation years and even with the local lowering of the water table. That is, as pumping from DEX-6 and the Domestic Well continues, and the local groundwater gradient is artificially increased, and as groundwater levels are temporarily lowered, then recharge into the system has the potential to increase. At some point in time, this recharge will result in

the drawdown cone of the pumping wells to become stable (i.e. achieve steady-state conditions), at which time no additional or further drawdown would be induced in offsite proximal wells.

- Pumping durations. The model assumes that pumping from DEX-6 and the Domestic Well will be continuous. However, in actuality, pumping is likely to be sporadic from each well and there will be periods when little or no pumping is occurring, thereby allowing water levels to recover to their pre-pumping levels. The exact scheduling of any non-pumping periods is not known at this time. It should be noted that when pumping is occurring, pumping rates from each well may be higher but for shorter pumping periods, in order to meet the 130 AF/yr and 243 AF/yr demands during Phase 1 and Phase 2 pumping scenarios, respectively. Nonetheless, the assumed pumping rates above still represent a maximum drawdown-case scenario.
- Also of particular note is the specific capacity of DEX-6, obtained by SECOR (1998b) at the end of the original 63-hour pumping test in this well. At a pumping rate of 490 gpm, a drawdown of only 1.13 ft was reported in this well. This calculates to a particularly high specific capacity value of 434 gpm/ft ddn. Thus, with such a high specific capacity, the transmissivity will be high; and high transmissivities tend to yield a broad but relatively "thin" drawdown cone during pumping.

THEORETICAL IMPACT OF PROPOSED PUMPING ON THE BIG SPRINGS

Model Derived Impacts

Pumping of groundwater from both DEX-6 and the Domestic Well may exert some effect on the Big Springs because it appears that these wells extract their supply from the same fractured rock system that supports those springs, and because of their proximity to the springs. Indeed, SECOR (1998a) alluded to such a possibility when they encountered water level drawdown in DEX-1 (located near the springs) when test pumping of DEX-6 was performed. Such drawdown, if it were to occur, would be temporary and would occur only when the wells are actually pumping.

Comparison of the flow of the Big Springs to the total groundwater demand needed for Phases 1 and 2 of the proposed bottling plant provides a different perspective on potential spring impact. As calculated above, the total flow of the springs was estimated from available stream gage data to be 13,791 AF/yr. Comparing this to the total demand of the plant, through pumping of DEX-6 and the Domestic Well, it can readily be seen that extracting 130 AF/yr to 243 AF/yr (for one or two bottling lines, respectively) would only represent approximately 0.9% and 1.8% of the total spring flow, respectively. Thus, it appears that the future water use at the

proposed bottling plant would be considered to be insignificant with regard to the total flow at the Big Springs.

With regard to the PUMPIT modeling efforts, although it resulted in a theoretical water level impact on water levels at the spring (assuming such water levels could even be measured), it does serve to illustrate the relative degree of impact that the pumping of DEX-6 and the Domestic Well could have on the springs. Based on the calculations above, it appears that such an impact is likely to be very minimal, amounting to only a few tenths of a foot (0.22 to 0.40 ft) of water level change at the springs. With regard to nearby residential wells, the predicted drawdown impact is also minimal, ranging from only 0.09 ft in the Pelletier Well to 0.45 ft in the Russo Well. Again, it is cautioned that these calculations are only approximate and actual drawdown could be either greater or less, depending upon pumping conditions (see Table 2 and above discussion).

Stream Gage Data

To check if pumping of the two wells did have some impact on stream levels, an review and analysis of available stream data were obtained from Geosyntec (2016); these data were included in the 2nd Quarter Monitoring Report by Geosyntec. Figure 8, "Stream Gage Measurements," shows the measured water levels in what is known as a "Stilling Well". The location of this "well" is shown on Figures 2 and 3.

The measurements are reported in terms of depth (in ft) to the top of the water surface in the well. The depth of this water surface varies with the amount of stream flow over time. The greater the stream flow, the higher the water surface in the stream and also in the "Stilling Well." Superimposed on the stream flow figure is the Accumulated Departure of Precipitation plot, as was done in figures 5-1 and 5-2 in Appendix 5, to compare seasonal variations to variations in flow of the spring. Also superimposed on Figure 8 is the operational period of the former bottling plant, while under the former ownership of Coca-Cola.

Readily apparent in Figure 8 is the complete lack of correlation between the seasonal variations in precipitation and the stream flows. Apparently, the Big Springs have generally been flowing at a steady, constant rate with very little response to local precipitation events. The reason for

this is that the Big Springs may actually obtain its water supply from the larger catchment area (see Figure 5), which is recharged by precipitation on or near the summit of Mt. Shasta.

Further, with regard to the former operations at the bottling plant, while under Coca-Cola's ownership, there appears to have been no reported or observable effect on the flows from the Big Springs. However, any effect of pumping of the wells on the springs, as shown above, would only be a few tenths of a foot, at most, and would tend to be muted by other inputs or within measurement errors, by the time flows in Big Springs Creek reached the downstream measuring point.

GROUNDWATER QUALITY

Available historic groundwater quality data for OB-1 through OB-3, DEX-1 through DEX-7, and the Big Springs were reviewed and tabulated. Table 3, "Summary of Available Water Quality Data," provides a listing of the water quality data for these sources. The respective Maximum Contaminant Level (MCL) for each analyte, as applicable, has also been listed for comparative purposes. The available data show that all of the historic constituent concentrations have been less than their respective MCLs and, thus, the local groundwater is considered to be of potable quality. The water quality character of groundwater is typically identified by analysis of the concentrations of selected general minerals, as expressed in milliequivalents per Liter (meq/L) which consists of: the key cations, which are calcium (Ca), magnesium (Mg) and sodium (Na); and the key anions, which are bicarbonate (HCO_3), sulfate (SO_4) and chloride (Cl).

Trilinear (Piper) Diagram Analysis

A typical method of graphical analysis of general water quality is through the use of trilinear diagrams, also known as Piper diagrams; this method of graphical analysis was originally devised by A.M. Piper (1944). For this method, the key cations (Ca, Mg and Na) and key anions (HCO_3, SO_4 and Cl), in units of meq/L, are plotted on their respective separate triangles and represent their respective percentage of reactance. The intersection of these points within the cations and anion triangles is marked within the diamond-shaped area, located above those triangles. This diamond-shaped area is composed of four sectors (or fields), with each sector representing the following:

(a) Ca-Mg-HCO_3 type "native" groundwater which typically represents "oxidizing" conditions (i.e., that influenced by meteoric waters).

(b) Ca-Mg-SO_4 type "degraded" groundwater.

(c) Na-Cl-SO_4 type ""connate" groundwater or groundwater "degraded" with chloride, and sulfate.

(d) Na-HCO_3 type "native" groundwater under "reducing" conditions.

Figure 9, "Trilinear (Piper) Diagram for Selected Wells," shows the result of plotting of the various water quality data from Table 3 for each of the sources, onto the four above-named sectors. Also shown on the Piper diagram is the date of each analysis for each source and their respective TDS concentrations in mg/L, with the exception of four samples.

Review of Figure 9 reveals that, with the exception of two samples, the majority of the plotted groundwater sample analyses from the separate sources are similar in overall chemical character, and generally fall within the lower portion of the Ca-Mg-HCO_3 sector of water quality character. The two exceptions, namely OB-1 (7/10/1986) and Big Springs (2/8/1979), fall within the Na-HCO_3 water character sector.

Stiff Diagram Analysis

Another graphical analytical method that is typically used to view water quality data is a method originally developed for the petroleum industry by H.A. Stiff in 1951 (Stiff, 1951); the resulting graphs are generally known as Stiff pattern diagrams, or Stiff patterns. Stiff patterns are useful for identifying the character of the groundwater in a well (or the character of spring water, or of surface water). Generally, the Stiff water quality pattern of a well is a reflection of the blend of groundwater pumped from all of the aquifers available to and perforated by a particular well. Thus, the Stiff pattern diagrams for different wells in a groundwater basin can be influenced by such factors as:

- Localized groundwater quality conditions of the individual aquifer systems in an area. For example, shallower aquifer systems could possess "degraded" groundwater quality, relative to that from deeper aquifer systems, and the resulting Stiff diagram would tend to display relatively large concentrations of the key cations and anions.
- Differences in well depths wherein deeper wells tend to be perforated in deeper aquifer systems that can have differing water quality issues.
- Differences in pumping rates and/or pumping levels from well to well.
- Intrusion of sea water and/or deep percolation of irrigation water, which can increase the salinity of the groundwater.

Even though these conditions may not all apply to the current situation, Stiff pattern diagrams based on the water quality data for the subject wells and the Big Springs, nonetheless, provide a tool whereby overall groundwater quality patterns can be discerned on both a spatial and temporal basis. As such, differences in groundwater quality character noted in a single well over time could have implications towards changes in the physical condition of an individual well or a group of wells. Consequently, some impacts of such groundwater quality changes on an individual well could include:

- Portions of the casing perforations becoming plugged over time, such as by either scale and/or biological growths (biofilm), ultimately resulting in a decrease in pumping rates and/or specific capacities over time. Further, such plugging could also result in a gradual change in water quality over time in a well.
- Corrosion of the well casing, producing holes in the casing, and possibly resulting in water quality changes or in the production of sand and, ultimately, failure of the well.
- Operational shutdown of a well or wells, due to trends toward increasing concentrations of potential contaminants to levels beyond current regulatory standards.

Stiff Water Quality Patterns for Local Groundwater

Figures 6-1 through 6-4 in Appendix 6 provide a temporal view of the Stiff patterns prepared for wells OB-1, OB-2, OB-3, DEX-6 and the Big Springs based on available data. Each Stiff pattern diagram presented on those figures also lists sample collection date, the detected concentrations of total dissolved solids (TDS), total hardness (TH, if available), electrical conductivity (EC), pH, and nitrate (as NO_3).

The Stiff patterns shown on those figures generally reveal that the overall groundwater quality character of the groundwater produced by the wells is a predominantly mixed cation sodium-calcium-bicarbonate (Na-Ca-HCO_3) character. The wells exhibiting these water quality characteristics tend to indicate a mixing of meteoric waters (through recharge of rainfall, which would provide the input of Ca and HCO_3 ions), with water quality that is considered to represent slightly degraded conditions (resulting in the input of Na ions). Furthermore, the Stiff patterns for OB-1, OB-2 OB-3, DEX-6 and the Big Springs show the same basic shape, indicating that the character of the groundwater between the Big Springs and the wells is similar and likely from the same volcanic rock source.

Generally, as pumping of a well continues, water quality conditions can change. That is, specific cations and anions may change over time during pumping of a well, and these changes could be reflected in a change in the shape (and size/width) of the Stiff patterns. However, when the plant was in operation, between early-2001 and late-2010, no data were available to help validate such changes over time, if indeed they did occur. Thus, the impact of future pumping on water quality conditions cannot readily be evaluated at this time. However, given the low degree (i.e., percentage) of groundwater extracted versus the total groundwater underflow through the area of the wells, any such impact would be expected to be minimal. Further, the recharge source for the local aquifers has been and will continue to be from precipitation (rainfall and snowmelt).

PRELIMINARY CONCLUSIONS & RECOMMENDATIONS

PRELIMINARY SUMMARY/CONCLUSIONS

Based upon our review of basic hydrogeologic information and data available for the proposed CG Mt. Shasta City bottling facility, the following preliminary conclusions are provided:

Geologic/Hydrogeologic Conditions

Based on our review of the available data and driller's logs and geologic logs, it is concluded that one basic aquifer system that is defined by fractured volcanic andesite rocks of the Mt. Shasta volcanics supplies groundwater to the plant. It should be noted that there is what is locally known as a "shallower" aquifer system, but extraction of groundwater from this system for plant operations is considered to be negligible (the Domestic Well may obtain a small but unknown portion of its supply from this shallower system). Also of note is the existence of several residential wells located northeast, east and southeast of the plant, which obtain their supply from either the shallow or the fractured rock aquifer systems, or both. This fractured rock aquifer system appears to be under unconfined (water-table) conditions and Well DEX-6 extracts groundwater from this system, whereas the Domestic Well appears to obtain its supply from both the shallower and fractured rock aquifer systems. However, as noted above, it is likely that the shallower aquifer system supplies only a small fraction of the total supply to that well.

Precipitation and Accumulated Departure

Precipitation (combined rainfall and snowmelt) has averaged approximately 47.8 inches in the area based on data from a local rain gage located in Shastice Park, approximately 4,200 ft southeast of the bottling facility. This rain gage has an available precipitation record dating from 1988 through June 2016. These data serve to quantify the amount of direct precipitation to the land surface in the vicinity of proposed bottling facility.

Using the accumulated departure of precipitation curve for the historic period of record (1988 through June 2016), it can be seen that there was an overall period of deficient precipitation (i.e., a drought) from 1987 to 1989 and from 2012 to the present. In between these years, there was an intervening, hydrologically "wet" period from 1987 through 2011 where annual rainfall totals were generally higher than the long-term average annual value.

Static Water Levels, Precipitation and Impact of Extractions on Springs

Based on comparison of water level hydrographs to the graph of accumulated departure of precipitation, wells DEX-1 (located near the Big Springs) and DEX-6, the main production well for the proposed bottling facility, exhibit water levels that tend to follow local, seasonal changes in precipitation. That is, these water levels appear to naturally rise and decline in response to seasonal rainfall patterns. This provides evidence that precipitation is the current, major influence that impacts water levels in the wells. Importantly, the hydrographs also show evidence of a continuous decline trend in water levels over time in wells DEX-1 and DEX-6, since 2012, indicating the ongoing drought is having some effect. However, the declines in water levels in those two wells have been small, averaging only 0.18 ft per year. It should be noted that the declines are similar in the two wells, and that water levels have still been declining and ongoing since the proposed bottling facility was closed in 2010. Nonetheless, there appears to be some correlation of water level decline in DEX-1 starting in 2001, when the proposed bottling facility commenced operations. However, water level data between 2009 and mid-2014 are not available to allow a comparison of changes in water level to the shutdown of the former facility in late-2010. Thus, it appears that pumping of DEX-6 when the former bottling plant was in operation did, in part, cause a decline in water levels in DEX-1, although this possible cause and effect relationship cannot be firmly established.

Water Demand for Proposed Production Facility

The proposed bottling facility is scheduled to use water in two phases: Phase 1 will consist of extracting a total of 130 AF/yr for bottling operations; and Phase 2 will consist of using a total of 243 AF/yr. This volume is less than that previously utilized by the original (former) onsite plant (259 AF/yr). Phase 2 is scheduled to commence between 5 to 7 years following startup of the plant. Nearly all of the supply for bottling operations will be obtained from DEX-6. This well is entirely capable of meeting this demand at pumping rates ranging from 76 gpm on a continuous operational basis for one bottling line, to 139 gpm on a continuous operational basis for both bottling lines. However, the well is also capable of pumping up to 400 gpm for shorter periods. It is understood that the operational rate of the well will actually be on the order of 200 to 300 gpm. Daily potable uses by plant personnel can and will be supplied by the onsite Domestic Well, but its pumping will be only for shorter durations and at lower pumping rates.

Groundwater Recharge/Discharge

Groundwater recharge in the region is via infiltration of both direct precipitation and surface water runoff resulting from rainfall and snowmelt. Indeed, correlation of changes in water levels to seasonal precipitation cycles provides the key evidence for this. In addition, and as defined by others (SECOR, 1998a, Geosyntec, 2014), recharge to the area is through fractured volcanics and the watershed recharge area extends at least from the springs to the summit of Mt. Shasta. The area of the watershed was estimated by Geosyntec to be 7.2 mi^2. RCS generally agrees with this estimate.

Discharge of a portion of the water recharged into the fractured rock aquifer system occurs at the Big Springs. The amount of discharge from the springs was estimated to range from 8,640 to 8,955 gpm by others. RCS generally concurs with this estimate.

Groundwater Underflow and Impact of Pumping

Calculation of groundwater underflow was performed for a cross sectional area within the fractured aquifer system, perpendicular to the groundwater flow direction. The parameters for these calculations were based on the calculation of groundwater gradient and on an estimated value of T. For this calculation, a T value of 324,000 gpd/ft was used, along with a groundwater gradient value of 0.003, and a groundwater flow direction to the southwest.

For a cross sectional area along an 800-foot traverse through the plant area, the groundwater underflow was determined by RCS to be on the order of 873 AF/yr. Based on a total anticipated production at plant capacity of 130 AF/yr during Phase 1, and 243 AF/yr during Phase 2, then for future operations the proposed pumpage ranges from 15% to 28%, respectively, of the total groundwater underflow through the fractured aquifer system in the area of the plant.

The groundwater underflow calculated above was compared to the recorded flow at Big Springs, which was reported by others (CH2M Hill) in 2014 to range from 8,640 to 8,955 gpm; this amounts to 13,936 to 14,444 AF/yr. Thus, the calculated underflow in the region of the proposed bottling facility of 873 AF/yr is very small in comparison, only accounting for 6.0% to 6.3% of the total spring flows. Thus, it is apparent that the calculated underflow likely does not take other potential factors into consideration. Specifically, the depth and width of the fractured aquifer system is likely much greater than that used in calculating underflow. Further, in comparing the proposed amounts of water to be utilized by future bottling operations at the

plant, then that potential impact would correspondingly be lessened. That is, at plant operational demands of 130 AF/yr and 243 AF/yr for Phase 1 and Phase 2 operations, respectively, then the total percentage of underflow to the springs would be 0.9% and 1.8%; such an impact is considered to be insignificant.

Water Level Drawdown Impacts

A calculation (simulation) of the theoretical impact (induced water level drawdown) of pumping of DEX-1 on water levels in DEX-1 and other nearby groundwater monitoring wells, water-supply wells, and the Big Springs, was performed based on the above values of T, S and groundwater flow direction and gradient, and on continuous pumping rates of 76 and 5 gpm, for DEX-6 and the Domestic Well, respectively, for Phase 1 and Phase 2 operational scenarios. Those operational scenarios for DEX-6 and the Domestic Well are at pumping rates of 139 and 11 gpm, respectively, and for a maximum pumping period of 365 days. These calculations were performed using a simple analytical model called PUMPIT, which is based on gross assumptions for an ideal aquifer system.

Calculations of water level drawdown in nearby monitoring wells, water-supply wells and the Big Springs revealed that at the Big Springs, the maximum theoretical drawdowns would be 0.19 ft and 0.40 ft. This assumes continuous pumping rates of 76 gpm and 139 gpm for DEX-6, and 5 gpm and 11 gpm for the Domestic Well, while the two wells are pumping simultaneously for the pumping period. Such theoretical drawdowns do not represent a significant impact on the Big Springs. Further, such theoretical drawdown would occur on a temporary basis, and only when the wells are actively pumping.

Importantly, and based on our long-term field monitoring of water levels during actual pumping tests (on other projects), such theoretically-calculated water level drawdown values are invariably greater and sometimes much greater than actual drawdown values recorded in the field during pumping tests. However, it should be noted that seasonal variations in water levels (amounting to as much as 0.8 ft in DEX-1) would likely impose their imprint on such pumping-induced changes. In addition, changes in direction of groundwater flow and gradient can impose an additional imprint and, thus, also tend to make pumping-induced changes. With regard to data obtained on flows in Big Springs Creek at the "Stilling Well," no effect of the

pumping for the former operations at the plant, when it was owned by Coca-Cola, could be detected.

Based on the foregoing analysis, with regard to the spring and to nearby residential wells, the predicted drawdown impact(s) are expected minimal, ranging from only 0.09 ft in the Pelletier Well to 0.45 ft in the Russo Well. Such drawdowns are unlikely to greatly impact the production capacities of those wells for the following reasons:

- These wells pump at very low flow rates and thus, individual drawdowns in the wells by virtue of their own pumping capacities will also below.
- The wells pump only intermittently and not continuously for long time periods (e.g., weeks, months years).
- Recharge to the well is likely to be not affected, because the wells are generally located upgradient of the production wells at the proposed water bottling facility.

Groundwater Quality Affects from Pumping

Historic water quality data from the onsite wells was reviewed and graphically analyzed through the use of Piper and Stiff Pattern diagrams. These methods revealed that the water has: a predominately Ca-Mg-HCO_3 to a Na-HCO_3 character, as defined by the Piper diagram; and a mixed cation, Na-Ca-HCO_3 water quality character, using the Stiff patterns. These diagrams indicate that meteoric (atmospheric) water is the likely source of recharge water to the local aquifer systems.

Pumping of groundwater over time can induce changes in groundwater quality, especially if there are inputs from various sources and/or if some of these sources tend to have degraded water quality. However, given the similar character of the water quality in the area, and the low degree (i.e., percentage) of groundwater extracted versus the total groundwater underflow through the area of the well, potential impacts of pumping of DEX-6 and the Domestic Well on the water quality of Big Springs are anticipated to be minimal.

PRELIMINARY RECOMMENDATIONS

Based on our review and evaluation of site hydrogeologic conditions at proposed bottling facility and CG work, we provide the following recommendations:

Phasing of Development and Well Operations

The planned sequential activation of the two separate production lines, at the anticipated demand of 130 AF/yr for the first line, and 243 AF/yr total for both lines, and the use of DEX-6 as the main supply, appears to be appropriate for the proposed bottling facility. However, it may be useful for GC to have a standby well, should for any reason DEX-6 become inoperable on a temporary basis. If need arises, it may also be possible to increase the pumping rate from the Domestic Well for short periods of time.

Data Collection

A regular program of data collection and database maintenance is essential to providing a long-term accumulation of data that can be reviewed for possible changes in groundwater conditions over time. Examples of such data collection efforts are as follows:

1. Continue the monitoring and recording of flow rates and water levels in the production wells and groundwater monitoring wells at the proposed bottling. Such monitoring is necessary to check trends in the data on both a seasonal and long-term basis.
2. There are a few groundwater monitoring wells in which the water levels are currently not being monitored. These wells should be permanently destroyed, if GC has no future plans to use these as monitoring points in the future.
3. Spring flows from the Big Springs should continue to be monitored and evaluated on a regular basis in the future.
4. Continue the collection and laboratory analysis of water samples from the production wells and the groundwater monitoring wells for, at least, the common cations and anions.

Data Review and Evaluation

After the data have been collected for each phase of development, RCS also recommends that there should be an ongoing process of review, evaluation and interpretation of those data by qualified groundwater professionals. This is useful because as pumping is conducted on a regular basis and as groundwater conditions change, due to external factors (such as changes in precipitation), then the current and/or future proposed pumping program could be modified to adjust to such changes in conditions, prior to expanding the groundwater production to the next

higher pumping capacity. Examples of such data review and interpretation could consist of the following:

1. Plot the production volumes from each well, along with precipitation, static water levels and pumping water levels, in order to assess the impact of pumping on SWLs in all monitored sites.
2. Conduct a longer-term aquifer test on the Domestic Well only, in order to determine T and S values, if possible, of the "shallow" aquifer system and impact on other offsite wells. Preferably, this could be performed by packing off the "deeper" fractured rock aquifer system and pumping from only the shallower alluvial sediments. (These alluvial sediments may not be able to yield significant quantities of water to a well, based on their fine-grained nature, although some sand and gravel layers could greater amounts, comparatively. Such testing could provide a final determination of this). — contain
3. Changes in spring flow over time should be plotted against total pumping of the plant wells and changes in precipitation over time.
4. Plot temporal changes in key water quality constituents in groundwater samples from the wells. Typical key water quality constituents would be TDS, EC and selected cations and anions, such as Ca, Mg, Na and HCO_3, SO_4 and Cl. Tracking changes in these constituents would provide indication of any possible gross changes in the water quality that may by introduced by pumping of the well.

CLOSURE

DISCLAIMER

This Hydrogeologic Evaluation has been prepared for Analytical Environmental Services (AES) and applies strictly to evaluating only the hydrogeologic and groundwater conditions in support of an Environmental Impact Report (EIR, currently being prepared by Analytical Environmental Services) for the proposed Crystal Geyser Bottling Facility in the vicinity of the Spring Hill, within the City of Mt. Shasta, Siskiyou County, California. No other work such as the drilling, testing or sampling of existing wells at these sites was performed by RCS, nor was any field mapping or investigations performed to help determine the characteristics of the aquifer systems beneath the site. Rather, this report has relied heavily on work performed by others on characterizing the aquifer systems, and on our evaluations of existing data and information. This hydrogeologic evaluation and report has been prepared in accordance with the care and skill generally exercised by reputable professionals, under similar circumstances and in this or similar localities. No other warranty, either express or implied, is made to the professional advice presented herein.

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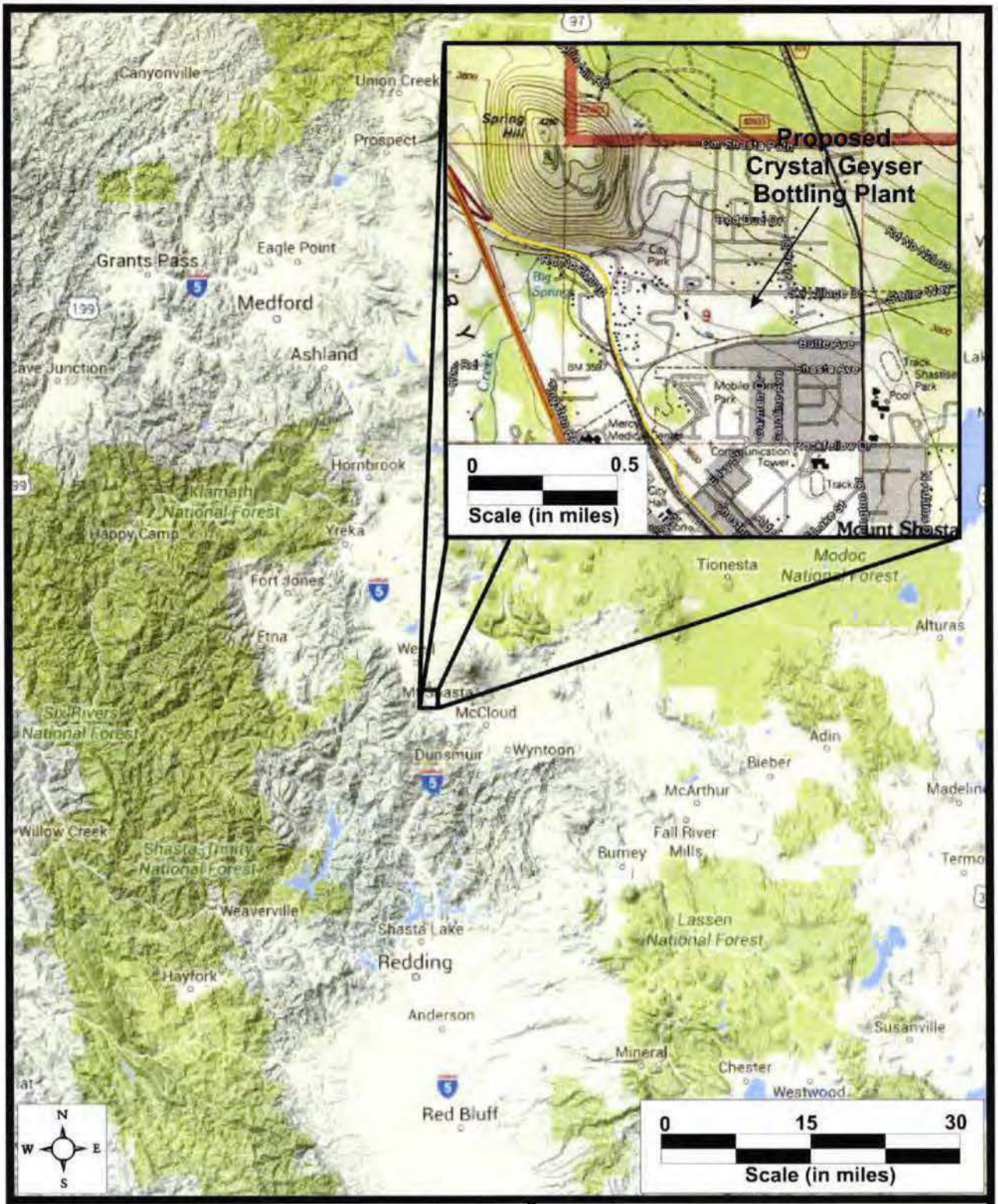
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APPENDICES

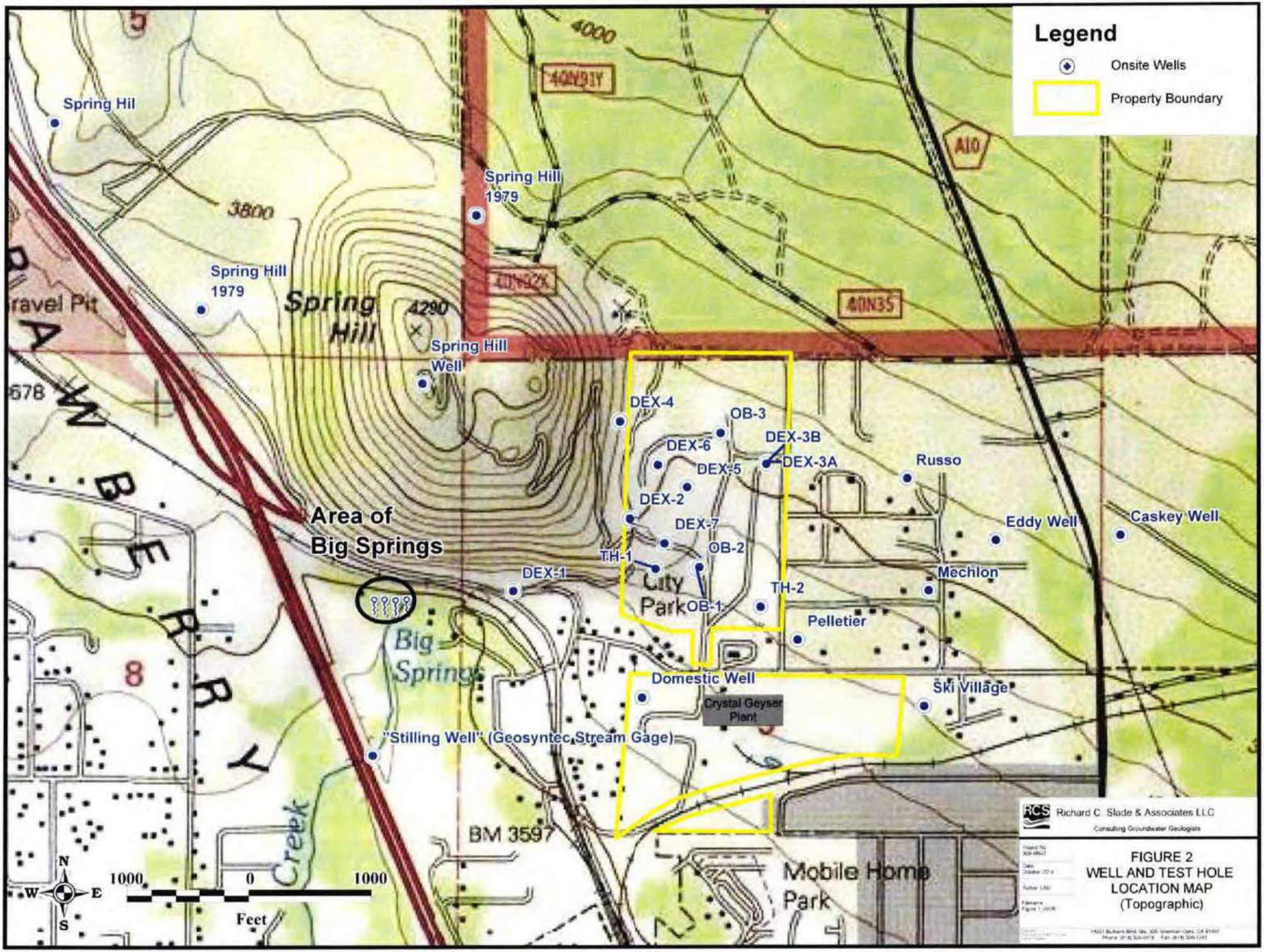
APPENDIX 1
FIGURES

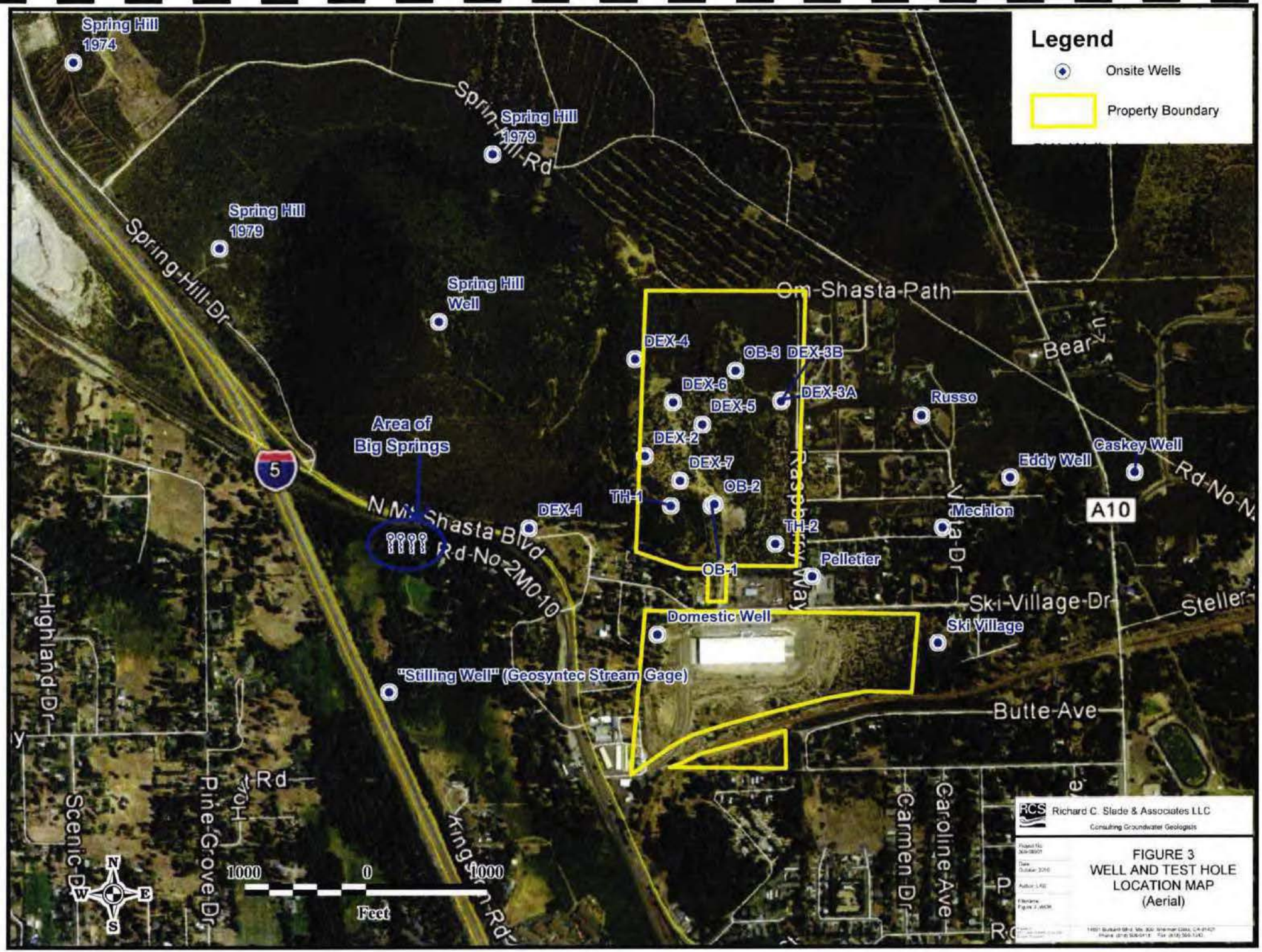


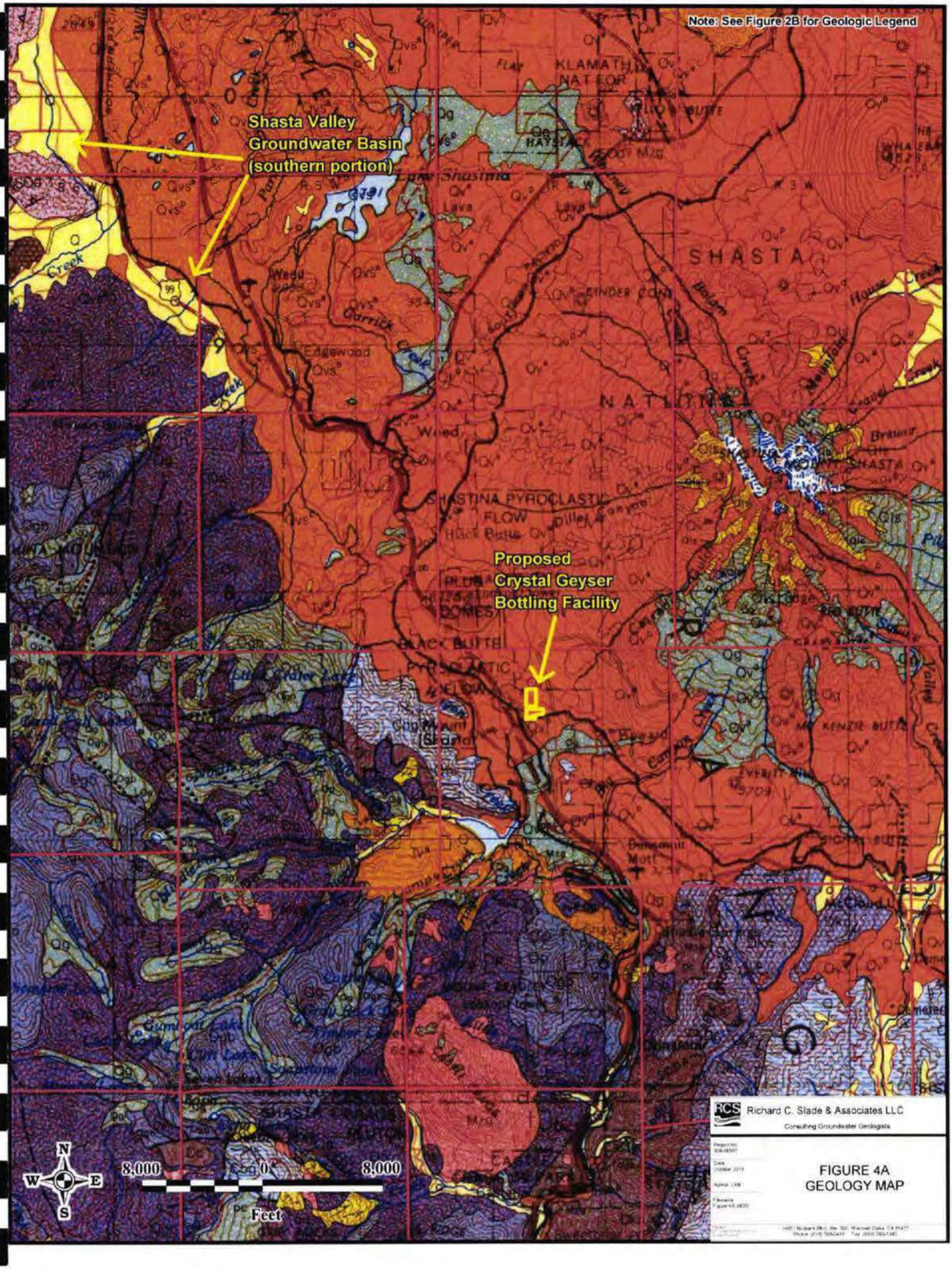
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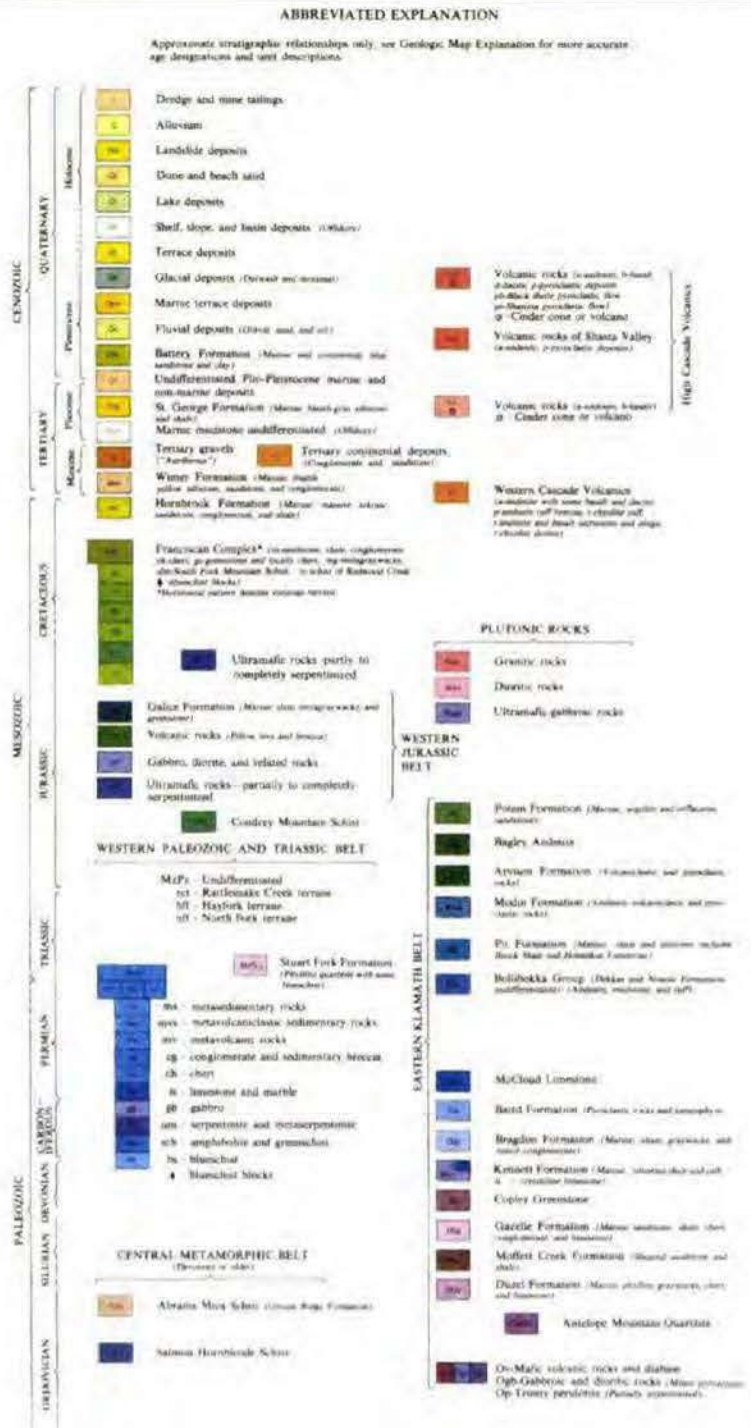
FIGURE 1
SITE LOCATION MAP
MT SHASTA AREA

Job No. 309-SIS01 **October 2016**


Legend
Onsite Wells
Property Boundary
Spring Hil
Spring Hill 1979
Spring Hill 1979
Spring Hill
4290
Spring Hill Well
Area of Big Springs
Big Springs
"Stilling Well" (Geosyntec Stream Gage)
DEX-4
OB-3
DEX-3B
DEX-6
DEX-3A
DEX-5
DEX-2
DEX-7
OB-2
TH-1
DEX-1
City Park
OB-1
TH-2
Russo
Eddy Well
Caskey Well
Mechlon
Pelletier
Domestic Well
Crystal Geyser Plant
Ski Village
Mobile Home Park
BM 3597
Creek
4000
3800
40N31Y
40N32X
40N35
A10
1000
0
1000
Feet
N
S
E
W
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Consulting Groundwater Geologists
FIGURE 2
WELL AND TEST HOLE
LOCATION MAP
(Topographic)


Legend
Onsite Wells
Property Boundary
Spring Hill 1974
Spring Hill 1979
Spring Hill 1979
Spring Hill Well
Spring-Hill-Rd
Spring-Hill-Dr
Om-Shasta-Path
Bear-Cr
DEX-4
OB-3
DEX-3B
DEX-6
DEX-3A
DEX-5
Russo
DEX-2
DEX-7
OB-2
TH-1
DEX-1
TH-2
Area of Big Springs
5
N Mt Shasta Blvd
Rd-No-2M0-10
Rd-No-2M0-10
Eddy Well
Caskey Well
Rd-No-N
A10
Mechlon
Pelletier
OB-1
Domestic Well
Ski Village
Ski-Village-Dr
Steller
"Stilling Well" (Geosyntec Stream Gage)
Butte-Ave
Highland-Dr
Scenic-Dr
Pine-Grove-Dr
Rd
Carmen-Dr
Caroline-Ave
1000
0
1000
Feet
N
W
E
S
RCS
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FIGURE 3
WELL AND TEST HOLE
LOCATION MAP
(Aerial)


Note: See Figure 2B for Geologic Legend
Shasta Valley
Groundwater Basin
(southern portion)
Proposed
Crystal Geyser
Bottling Facility
SHASTA
SHASTINA PYROCLASTIC
FLOW
BLACK BUTTE
DOMES
N
W
E
S
8,000
0
8,000
Feet
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FIGURE 4A
GEOLOGY MAP

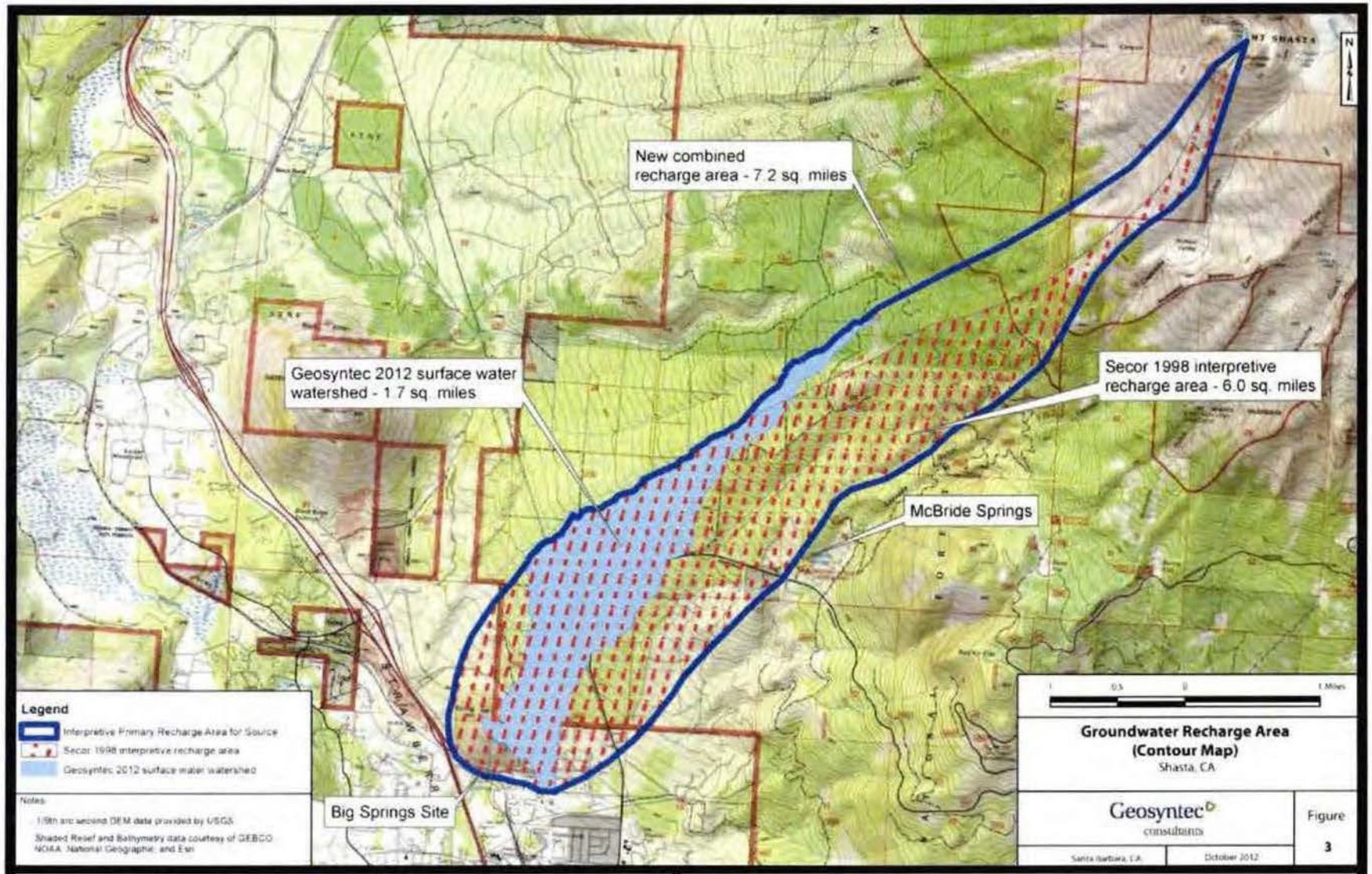


Note: This geologic legend is a composite legend created from the four base maps used to create the Figure 2A Geology Map. For base map reference information please refer to the text of the report.

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FIGURE 4B
GEOLOGIC MAP LEGEND

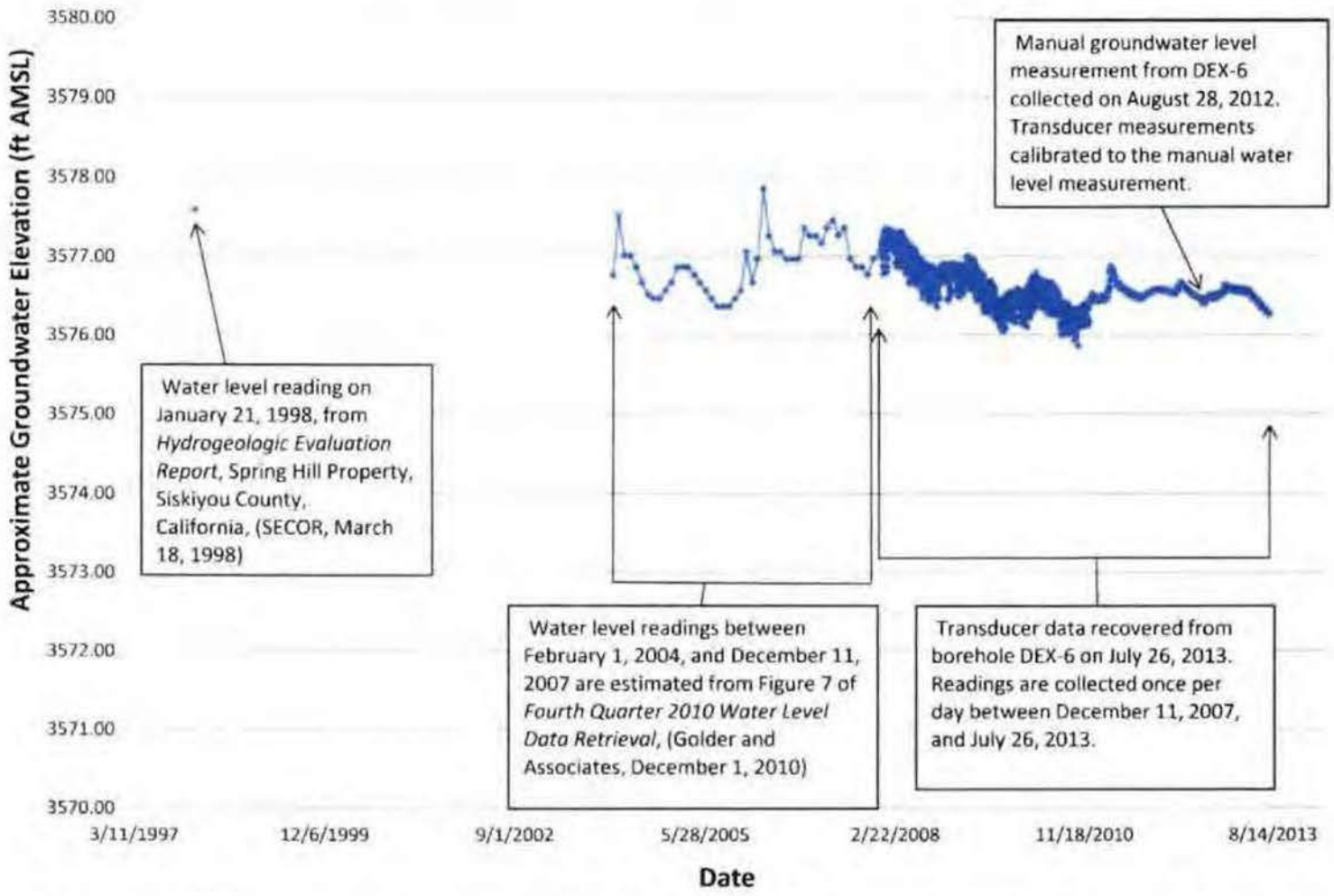
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FIGURE 5
GROUNDWATER RECHARGE AREA
(GEOSYNTEC, 2012)

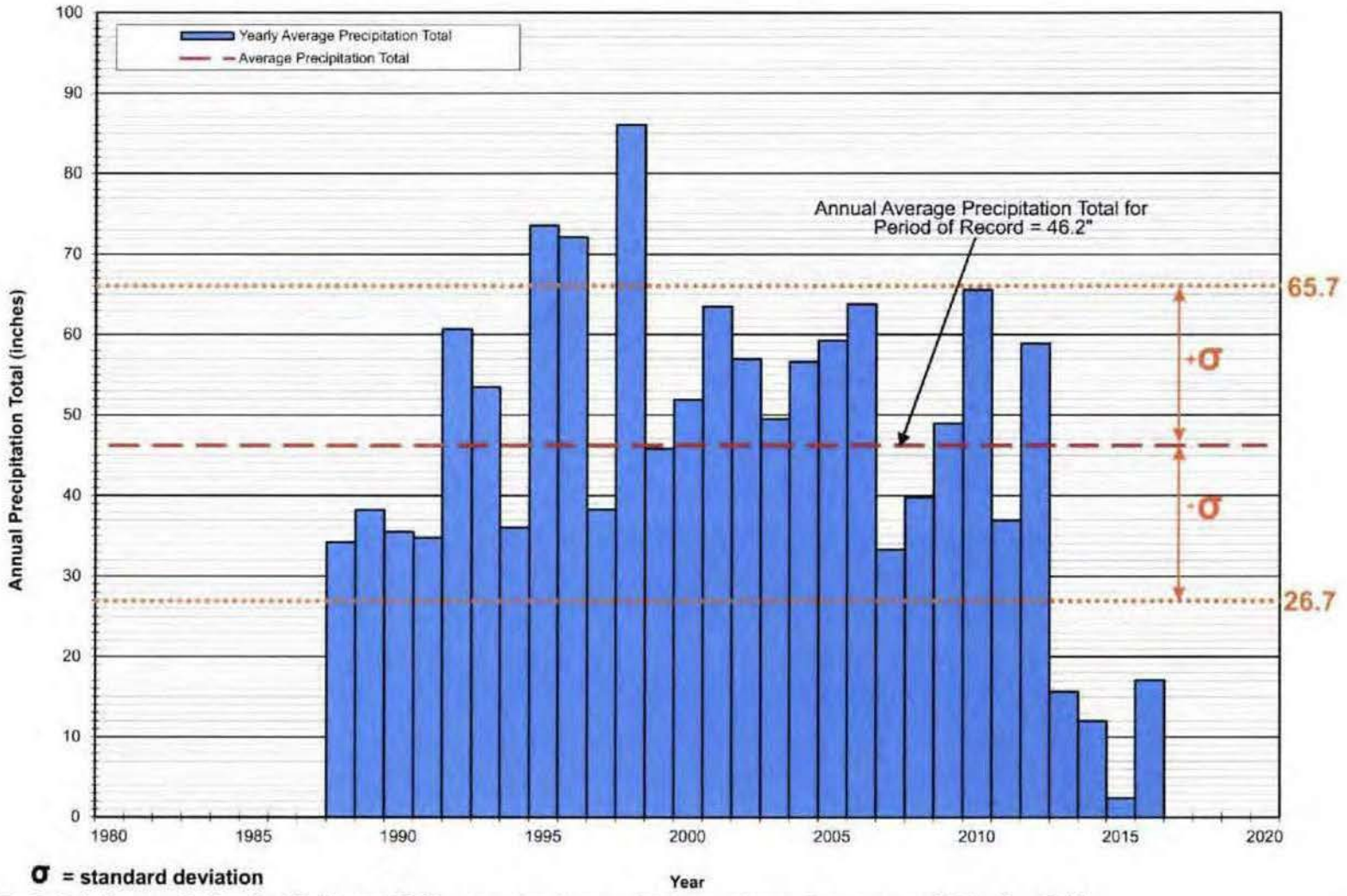
Job No. 309-SIS01 **October 2016**



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FIGURE 6
DEX-6 STATIC WATER LEVEL HYDROGRAPH
(GEOSYNTEC, 2014)

Job No. 309-SIS01 **October 2016**



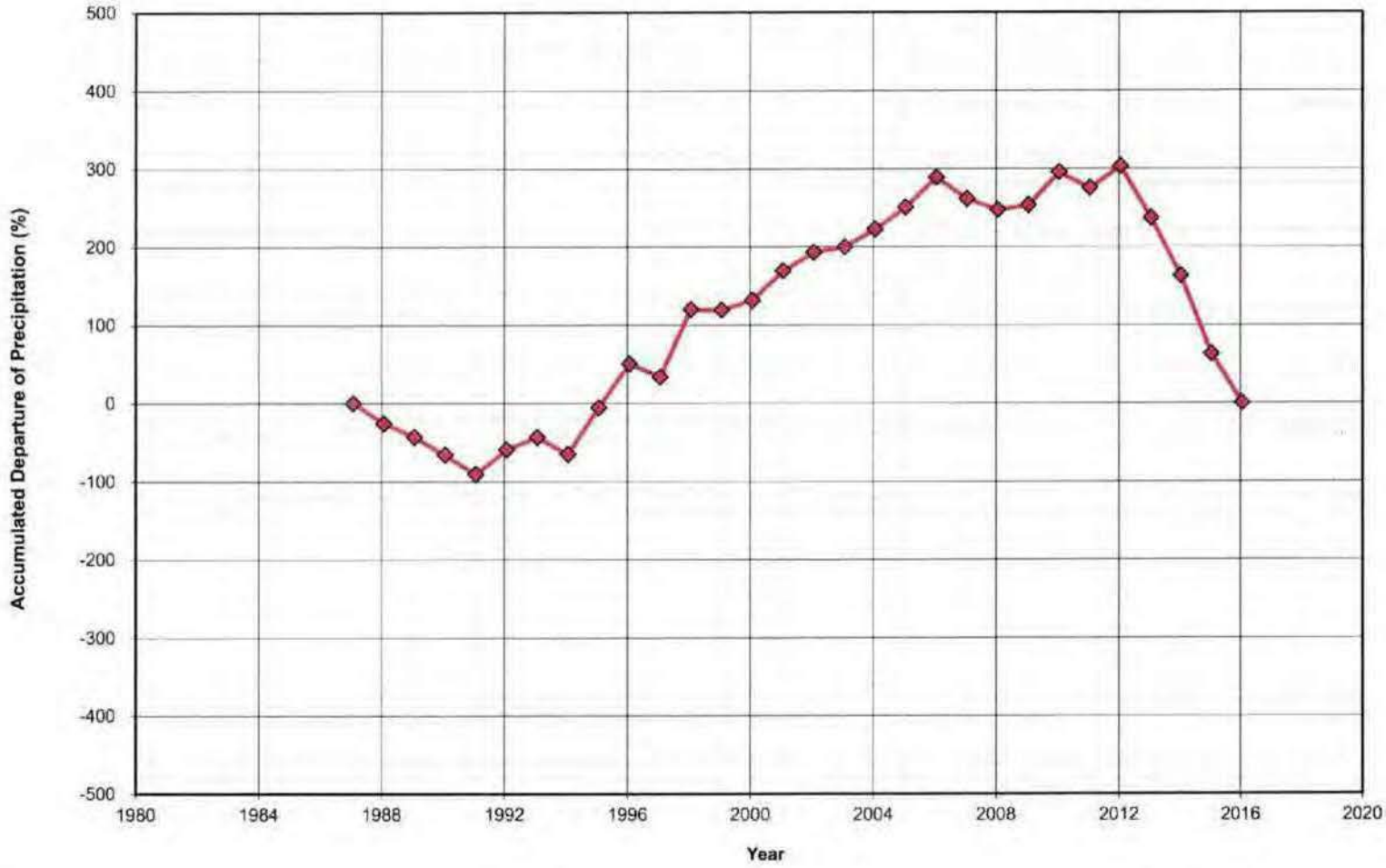
σ = standard deviation

NOTE: Rainfall records for the 2014 and 2016 years are incomplete; nearly no data are available for 2015.

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FIGURE 7A
ANNUAL AVERAGE PRECIPITATION TOTALS
MT SHASTA, CALIFORNIA (GAGE NO. 045983)

Job No. 309-SIS01 **October 2016**

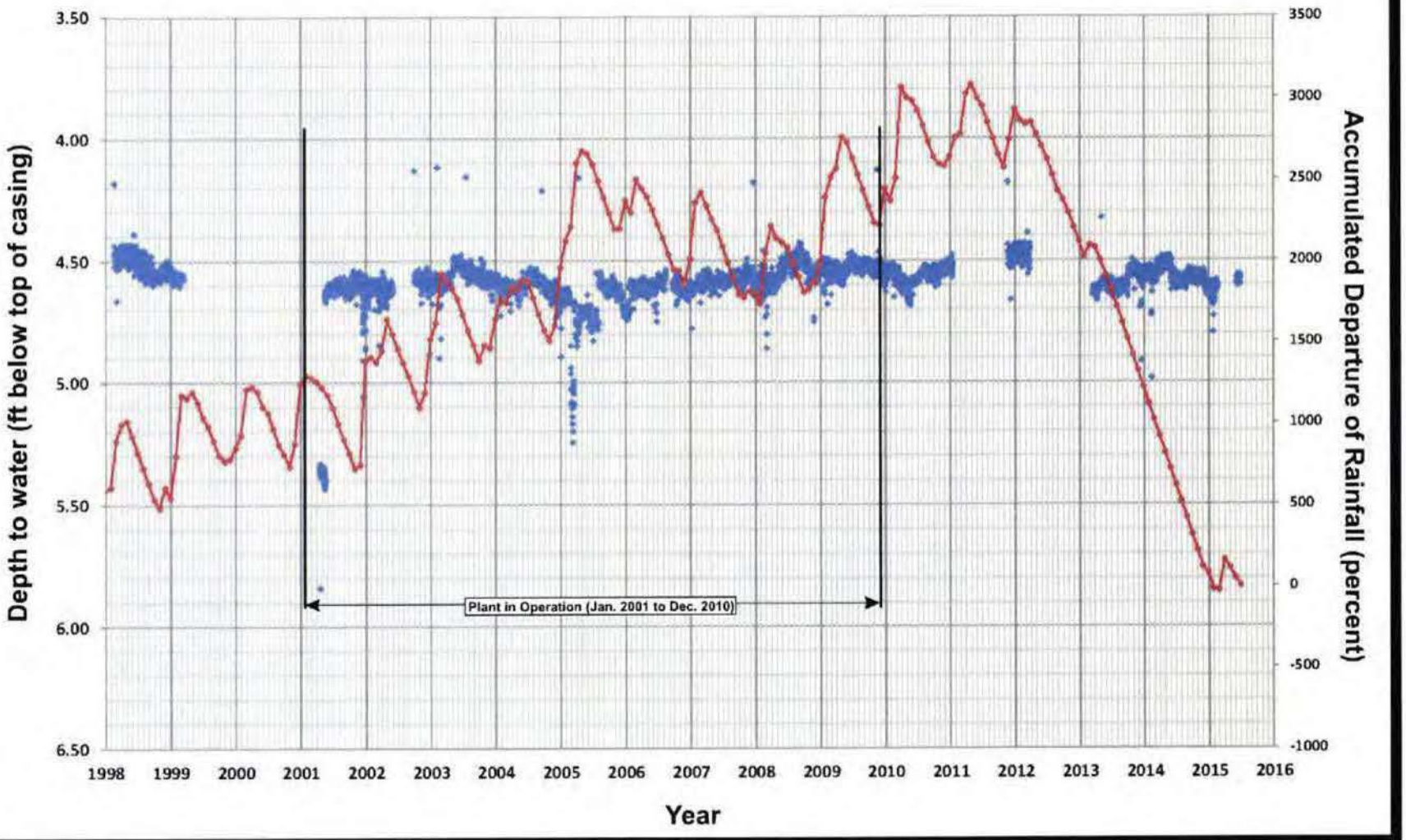


NOTE: Rainfall records for the 2014 and 2016 years are incomplete; nearly no data are available for 2015.

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FIGURE 7B
ACCUMULATED DEPARTURE OF PRECIPITATION
MT SHASTA, CALIFORNIA (GAGE NO. 045983)

Job No. 309-SIS01 **October 2016**



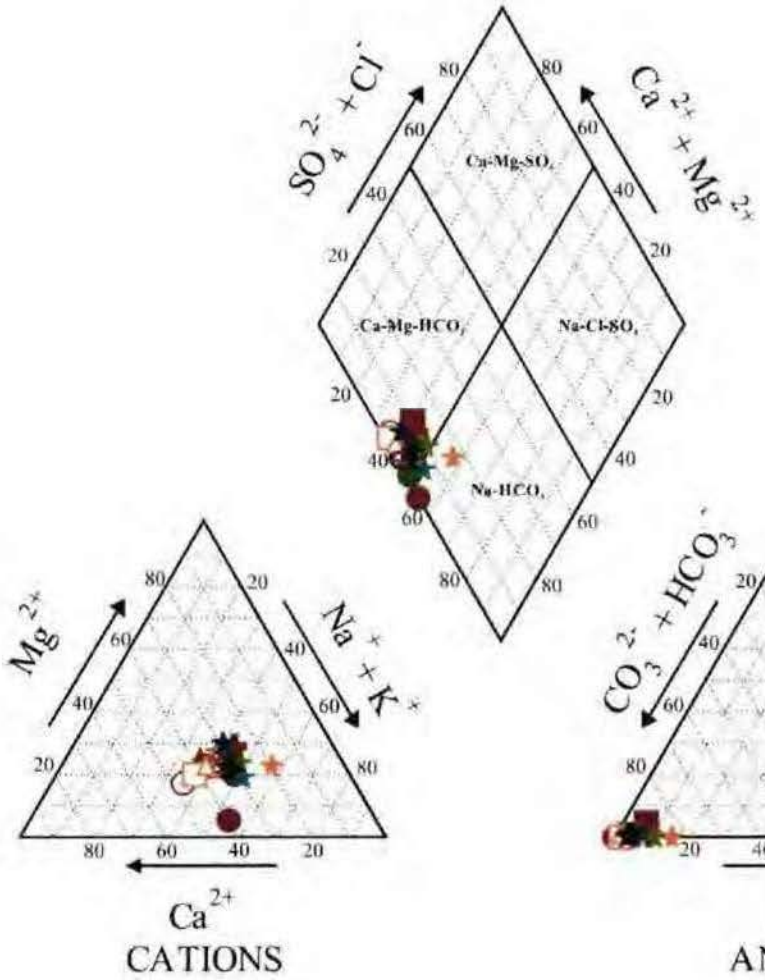
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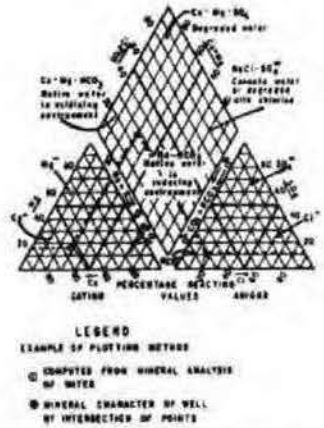
FIGURE 8
STREAM GAGE MEASUREMENTS
"STILLING WELL" AT CULVERT

Job No. 309-SIS01 **October 2016**

LEGEND

- OB-1 7/10/1986
- OB-1 9/1/1987
- OB-1 6/6/1996
- OB-1 8/13/1996
- OB-1 8/13/1997
- OB-1 9/29/1997
- OB-1 10/29/1997
- OB-2 1/9/1987
- OB-2 10/31/1997
- OB-3 1/16/1998
- DEX-1 1/16/1998
- DEX-2 10/28/1997
- DEX-2 11/14/1997
- DEX-2 1/15/1998
- DEX-3A 10/29/1997
- DEX-3A 1/15/1998
- DEX-3B 10/30/1997
- DEX-3B 1/16/1998
- DEX-6 1/22/1998
- DEX-6 6/3/2014
- DEX-6 4/18/2015
- DEX-6 3/24/2016
- DEX-7 2/18/1998
- Big Springs 9/15/1965
- Big Springs 2/1/1979
- Big Springs 9/16/1981
- Big Springs 6/6/1996
- Big Springs 8/13/1996
- Big Springs 5/23/1997
- Big Springs 8/13/1997
- Big Springs 5/11/1997





OB-1	7/10/1986	100
OB-1	9/1/1987	94
OB-1	6/6/1996	89
OB-1	8/13/1996	88
OB-1	8/13/1997	90
OB-1	9/29/1997	79
OB-1	10/29/1997	108
OB-2	1/9/1987	110
OB-2	10/31/1997	84
OB-3	1/16/1998	78
DEX-1	1/16/1998	90
DEX-2	10/28/1997	116
DEX-2	11/14/1997	80
DEX-2	1/15/1998	98
DEX-3A	10/29/1997	118
DEX-3A	1/15/1998	92
DEX-3B	10/30/1997	110
DEX-3B	1/16/1998	72
DEX-6	1/22/1998	102
DEX-6	6/3/2014	90
DEX-6	4/18/2015	92
DEX-6	3/24/2016	110
DEX-7	2/18/1998	122
Big Springs	9/15/1965	98
Big Springs	2/1/1979	95
Big Springs	9/16/1981	98
Big Springs	6/6/1996	96
Big Springs	8/13/1996	96
Big Springs	5/23/1997	56
Big Springs	8/13/1997	85
Big Springs	5/11/1997	70

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FIGURE 9
TRILINEAR (PIPER) DIAGRAM FOR SELECTED WELLS

Job No. 309-SIS01 **October 2016**

APPENDIX 2
TABLES

TABLE 1
SUMMARY OF WELL CONSTRUCTION DATA
PROPOSED CRYSTAL GEYSER MT SHASTA CITY BOTTLING FACILITY
SISKIYOU COUNTY, CALIFORNIA

Well No.	StateWell Completion Report No.	Date Drilled	Method of Drilling	Pilot Hole Depth (ft)	Borehole Diameter (in)	Casing Type & Depth (ft)	Casing Diameter (in)	Screened/ Perforation Intervals (ft)	Type of Perforations*	Slot Opening of Perforations (in)	Type of Gravel Pack
DEX-1	ND	10/24/1997	Air Rotary	82	6	PVC 82	4	42 to 82	wire-wrapped well screen	0.020	#8 Sand
DEX-2	ND	10/11/1997	Air Rotary	300	6	PVC 300	4	260 to 300	wire-wrapped well screen	0.020	ND
DEX-3A	ND	10/25/1997	Air Rotary	148	6	PVC 148	4	115 to 148	wire-wrapped well screen	0.020	#8 Sand
DEX-3B	ND	10/25/1997	Air Rotary	403	8	Steel 378	6 ⅝	375 to 403	Open Borehole	–	–
DEX-4	ND	10/15/1997	Air Rotary	292	6	PVC 292	4	230 to 270	wire-wrapped well screen	0.020	#8 Sand
DEX-5 (destroyed)	ND	10/28/1997	Air Rotary	235	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DEX-6	512905	3/11/1998	Air Rotary	294	14 to 8	Steel 294	10	200 to 242 Open borehole to 294	wire-wrapped well screen	ND	N/A
DEX-7	ND	1/20/1998	Air Rotary	274	8	N/A	N/A	8 to 274	Open Borehole	ND	N/A
OB-1	ND	08/05/1987	Air Hammer Method	238	ND	ND	ND	17 to 238	well screen	ND	ND
OB-2	ND	08/19/1987	Reverse Circulation	200	5¼	PVC 200	4	180 to 200	well screen	0.020 (?)	None
OB-3	ND	09/03/1987	Air Hammer Method	171	10¼	PVC 170	5	150 to 170	well screen	0.040	1/4-gravel
Domestic Plant Well	783964	09/21/2000	Air Rotary	250	14 to 8	Steel 228	8	86 to 229 / Open borehole to 231	wire-wrapped well screen	0.020	ND
Spring Hill Well 1979 (east)	115464	03/13/1979	Air Rotary	390	ND	Steel 180	8	ND	ND	ND	None
Spring Hill Well 1979 (west)	115476	04/13/1979	Air Rotary	246	12	Steel 246	6	140 to 246	wire-wrapped well screen	3 X 1/8	ND
Spring Hill 1974 (1994?)	573056	03/21/1994	Air Rotary	300	12 to 8	Steel 300	8	145 to 160 200 to 300	ND	3 X 1/8	ND
Caskey Well	450246	02/18/1997	Air Rotary	330	8 to 6	Steel 330	6	325 to 330	ND	3 X 1/8	ND
Pelletier Well	555795	02/02/1996	Air Rotary	165	8	Steel 165	ND	130 to 165	ND	3 X 1/8	ND
Eddy Well	450185	01/28/1997	Air Rotary	275	6	Steel 275	6	270 to 275	ND	3 X 1/8	ND
Mechlon Well	393636	08/20/1992	Air Rotary	185	ND	Steel 168	6	164 to 168	ND	3 X 1/8	ND

NOTES: 1. ND = no data; NA = not available
Data on wells obtained primarily from geologic logs and driller's logs and may not reflect the actual "as-built" construction
Data on DEX-6 and domestic well from driller's log and Geosyntec video (March 7, 2014 report)

TABLE 2
MODEL CALCULATED VALUES OF
THEORETICAL WATER LEVEL DRAWDOWN DUE TO PUMPING OF
DEX-6 AND THE DOMESTIC WELL
PROPOSED CRYSTAL GEYSER BOTTLING PLANT
MT. SHASTA CITY

WELL NAME/NO.	THEORETICAL WATER LEVEL DRAWDOWN 365 DAYS CONTINUOUS AND SIMULTANEOUS PUMPING OF DEX-6 & DOMESTIC WELL (ft)	
	Phase 1 at 81 gpm (combined)	Phase 2 at 150 gpm (combined)
DEX-1	0.24	0.45
BIG SPRING	0.22	0.40
DEX-2	0.30	0.56
DEX-3A	0.27	0.50
DEX-3B	0.27	0.50
DEX-4	0.29	0.54
DEX-7	0.29	0.54
OB-1	0.27	0.51
OB-2	0.27	0.50
CASKEY WELL	0.18	0.34
EDDY WELL	0.20	0.37
PELLETIER WELL	0.09	0.16
RUSSO WELL	0.24	0.45

Notes: Based on a T value of 324,000 gpd, and an S value of 0.038.

Well DEX-6 and the onsite Domestic Well are pumping simultaneously.

TABLE 3
SUMMARY OF AVAILABLE WATER QUALITY DATA
PROPOSED CRYSTAL GEYSER MT SHASTA BOTTLING FACILITY
SISKIYOU COUNTY, CALIFORNIA

CONSTITUENT	UNITS	MAXIMUM CONTAMINANT LEVEL (MCL) (1)	WELL NUMBER/NAME																																			
			OB-1							OB-2		OB-3	DEX-1	DEX-2				DEX-3A		DEX-3B		DEX-4	DEX-6				DEX-7	BIG SPRINGS										
Dates of Reported Sample Results:			7/18/1985	6/1/1987	6/6/1996	8/13/1996	8/13/1997	9/29/1997	10/29/1997	1/8/1987	10/31/1997	1/16/1998	1/16/1998	10/28/1997	11/14/1997	1/15/1998	10/29/1997	1/15/1998	10/30/1997	1/16/1998	1/16/1998	1/22/1998	6/3/2014	4/18/2015	3/24/2016	2/18/1998	9/16/1965	2/1/1979	9/16/1981	6/6/21996	8/13/1996	5/23/1997	8/13/1997	11/5/1997
General Physical Constituents																																						
Color	CU	15 (S)	--	--	--	--	--	--	ND-5	--	ND-5	--	--	ND-5	ND-5	--	ND-5	--	25	--	--	--	ND-3	ND-3	ND-3	ND-5	--	--	--	--	--	--	--	--	ND-5
Electrical Conductance	uS/cm	900; 1,600; 2,200[1]	80	81	77	75	85	74	82	--	87	95	99	93	90	91	86	84	78	74	115	94	100	100	100	102	82	--	91	86	85	88	90	85
Odor	units	3 (S)	--	--	--	--	--	--	ND-10	--	ND-2	--	--	ND-2	ND-2	--	ND-2	--	ND-2	--	--	--	ND-1	ND-1	ND-1	ND-2	--	--	--	--	--	--	--	--	ND-2
pH	units	6.5 to 8.5 (S)	--	7.15	6.98	6.9	7.06	7.24	6.92	6.57	6.76	6.48	7.54	6.9	6.84	6.94	6.45	6.65	7.09	7.21	6.78	6.85	7.5	7.4	7.3	6.87	7.3	--	6.4	6.94	6.7	6.33	7	6.99
Turbidity	NTU	0.5 to 1.0 (S)	--	--	--	--	--	0.56	1.1	--	18	15	0.8	1.5	0.32	0.3	28	3.5	40	5.1	0.8	0.86	0.19	0.17	0.35	0.41	--	--	--	--	--	--	--	--	0.24
General Mineral Constituents																																						
Alkalinity as $CaCO_3$	mg/L	None	--	--	--	--	--	--	39	--	41	48	50	44	45	45	41	41	39	40	57	47	48	48	43	52	--	--	--	--	--	--	--	--	41
Barium		1,000 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0047	0.0043	0.0041	--	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)		None	45	49	41	48	49	49	48	51	50	59	61	54	55	55	50	50	48	49	70	57	58	60	52	63	46	46	36	36	49	44	52	50
Boron		1.0 (NL)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.05	ND-0.05	ND-0.05	--	--	--	--	--	--	--	--	--	--
Calcium		None	5.1	5	5.4	5	5	5	5	7	5	8	9	6	6	6	7	7	5	6	7	6	5.8	6.0	6.4	6	5.4	3	5.5	5.7	5	5	5	5
Chloride		250; 500; 600[1]	ND-0.20	2	0.6	0.53	0.58	0.56	0.92	2	0.87	0.73	0.88	0.97	1.19	0.91	0.52	0.53	0.44	0.42	0.61	1.99	1.6	1.6	1.5	3.67	0.9	3	2.5	1.3	1.31	1.07	1.07	1.24
Fluoride		2	--	--	--	--	--	--	ND-0.20	--	ND-0.20	--	--	0.21	0.27	--	ND-0.20	--	0.47	--	--	--	0.19	0.18	0.19	0.34	--	--	--	--	--	--	--	--	0.2
Hardness		None	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	28	29	31	--	--	--	--	--	--	--	--	--	--
Foaming Agents (MBAS)		0.5 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.1	ND-0.1	ND-0.1	--	--	--	--	--	--	--	--	--	--
Magnesium		None	0.4	0.4	0.6	2	2	2	2	2.6	2	3	2	3	3	3	2	2	2	2	2	3	3.4	3.4	3.6	4	2.2	2.1	2.8	2.8	2	3	2	2
Nitrate as NO_3		45 (P)	0.03	0.11	0.09	ND-0.05	0.08	0.03	ND-0.05	0.9	0.11	0.53	0.14	ND-0.05	ND-0.05	ND-0.05	0.16	0.19	ND-0.05	ND-0.05	ND-0.05	ND-0.05	ND-0.1	ND-0.1	ND-0.1	0.15	0.8	--	--	0.12	ND-0.05	0.09	0.11	0.13
Potassium		None	1.4	1.5	1.8	2	1	1	1	1.5	1	3	2	1	1	1	2	2	2	2	2	1	1.0	1.2	1.3	1	1.4	2.2	1.7	1.8	2	1	1	2
Sodium		None	7.2	7.7	8	8	7	7	7	8.1	7	7	7	6	5	6	6	6	6	6	14	9	9.5	10	11	11	7.7	6.6	10	8.6	9	7	8	7
Sulfate		250; 500; 600[1]	ND-0.40	1	0.4	ND-0.40	ND-0.40	ND-0.40	0.4	2	0.43	ND-0.40	0.52	0.45	0.03	0.52	ND-0.40	ND-0.40	ND-0.40	ND-0.40	3.76	3.52	0.65	0.64	0.62	0.63	ND-0.40	ND-0.40	--	0.3	0.56	0.45	0.54	0.46
Total Dissolved Solids		500; 1,000; 1,500[1]	100	94	86	98	90	76	106	110	84	78	90	116	90	98	118	92	110	72	88	102	90	92	110	122	98	95	98	96	98	90	95	70
Detected Inorganics (trace elements and other inorganic compounds)																																						
Aluminum		1,000 (P), 200 (S)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-20	ND-20	ND-20	--	--	--	--	--	--	--	--	--	--
Arsenic		10 (P)	--	--	ND-2	ND-2	ND-2	--	ND-2	--	ND-2	--	--	ND-2	ND-2	--	ND-2	--	ND-2	--	--	--	ND-2	ND-2	ND-2	ND-2	--	--	--	--	ND-2	ND-2	ND-2	ND-2
Chromium VI		10 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-5	ND-5	ND-5	--	--	--	--	--	--	--	--	--	--
Mercury		2 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.2	ND-0.2	ND-0.2	--	--	--	--	--	--	--	--	--	--
Nickel	ug/L	100 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-5	ND-5	ND-5	--	--	--	--	--	--	--	--	--	--
Perchlorate (ClO_4)		6 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.5	ND-0.5	ND-0.5	--	--	--	--	--	--	--	--	--	--
Silver (Ag)		1,000 (S)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.5	ND-0.5	ND-0.5	--	--	--	--	--	--	--	--	--	--
Zinc (Zn)		5,000 (S)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-20	ND-20	ND-20	--	--	--	--	--	--	--	--	--	--
Detected Volatile Organic Compounds (VOCs)																																						
1,1,1 - trichloroethane		200 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.5	ND-0.5	ND-0.5	--	--	--	--	--	--	--	--	--	--
1,1 - dichloroethylene		6 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.5	ND-0.5	ND-0.5	--	--	--	--	--	--	--	--	--	--
1,2-dichloroethane		5 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.5	ND-0.5	ND-0.5	--	--	--	--	--	--	--	--	--	--
1,4-dioxane		1 (NL)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
benzene		1 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.5	ND-0.5	ND-0.5	--	--	--	--	--	--	--	--	--	--
carbon tetrachloride	ug/L	0.5 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.5	ND-0.5	ND-0.5	--	--	--	--	--	--	--	--	--	--
Chloroform (a trihalomethane)		80 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.5	ND-0.5	ND-0.5	--	--	--	--	--	--	--	--	--	--
dichloromethane		5 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.5	ND-0.5	ND-0.5	--	--	--	--	--	--	--	--	--	--
tetrachloroethylene		5 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.5	ND-0.5	ND-0.5	--	--	--	--	--	--	--	--	--	--
toluene		150 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.5	ND-0.5	ND-0.5	--	--	--	--	--	--	--	--	--	--
trichloroethylene		5 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.5	ND-0.5	ND-0.5	--	--	--	--	--	--	--	--	--	--
Radiological Constituents																																						
Gross Alpha		15 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-3	ND-3	ND-3	--	--	--	--	--	--	--	--	--	--
Radium 226 + 228	pCi/L	5 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-1	ND-1	ND-1	--	--	--	--	--	--	--	--	--	--
Uranium		20 (P)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND-0.001	ND-0.001	ND-0.001	--	--	--	--	--	--	--	--	--	--

NOTES: (1) The three listed numbers represent the recommended, upper and short-term State Maximum Contaminant Levels for the constituent.
ND = Not Detected (detection limits vary)
-- = Data not available/not reported for this parameter
*The number in parentheses following the concentration is the number of times the constituent was reported as being detected.
P = Primary MCL, S = Secondary MCL, NL = Notification Level, AL=Action Level (for copper & lead under lead-copper rule).
mg/L = milligrams per Liter, µg/L = micrograms per Liter, pCi/L = picocuries per Liter, µS/cm = microSiemens per centimeter

APPENDIX 3
FIELD RECONNAISANCE PHOTOGRAPHS



Photo 3-1: 228,000 Gallon Tank at Domestic Well Site. View to the West



Photo 3-2: Domestic Well
Exterior Housing



Photo 3-3: Domestic Well Head
Note Transducer Wires into PVC Tube



Photo 3-3: Observation Well DEX-1



Photo 3-4: DEX-2 Wellhead



Photo 3-5: DEX-3A7 3B Wellheads



Photo 3-6: DEX-6 Exterior Shot of Building, View to the North



Photo 3-7: DEX-6 Wellhead



Photo 3-8: DEX-6 Flow Meter



Photo 3-9: DEX-7 Wellhead, View to the West

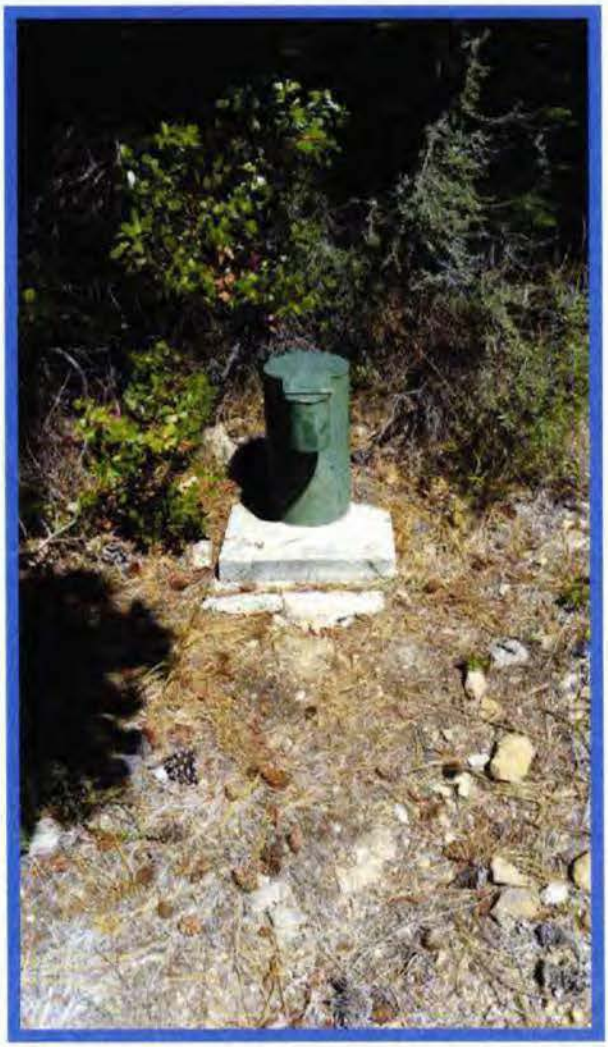


Photo 3-10: Observation Well DEX-4
View to the North



Photo 3-11: Former Production Well OB-1 Building.

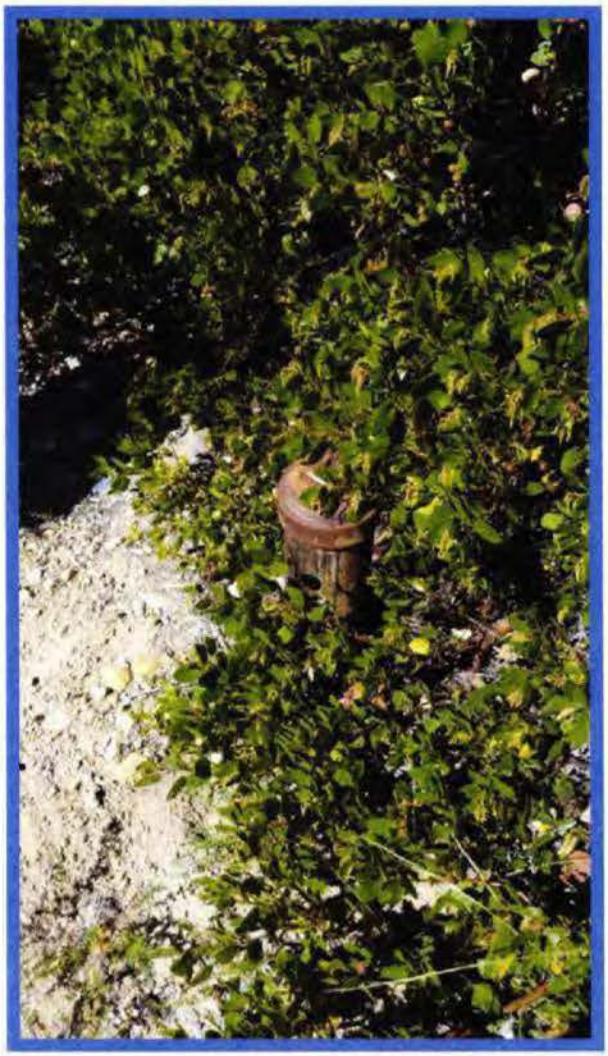


Photo 3-12: Observation Well OB-2

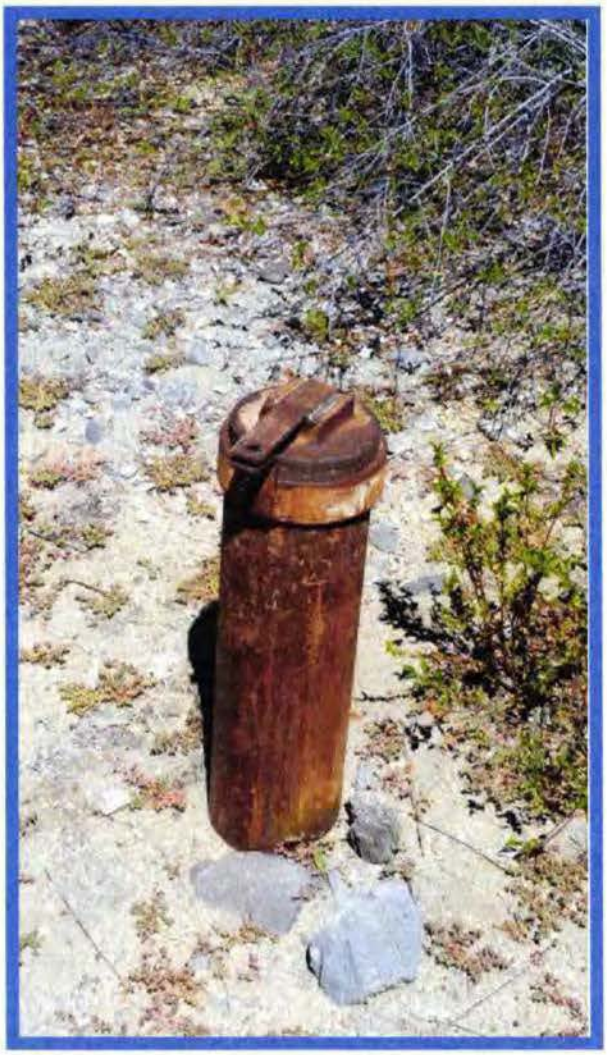


Photo 3-13: Observation Well OB-3

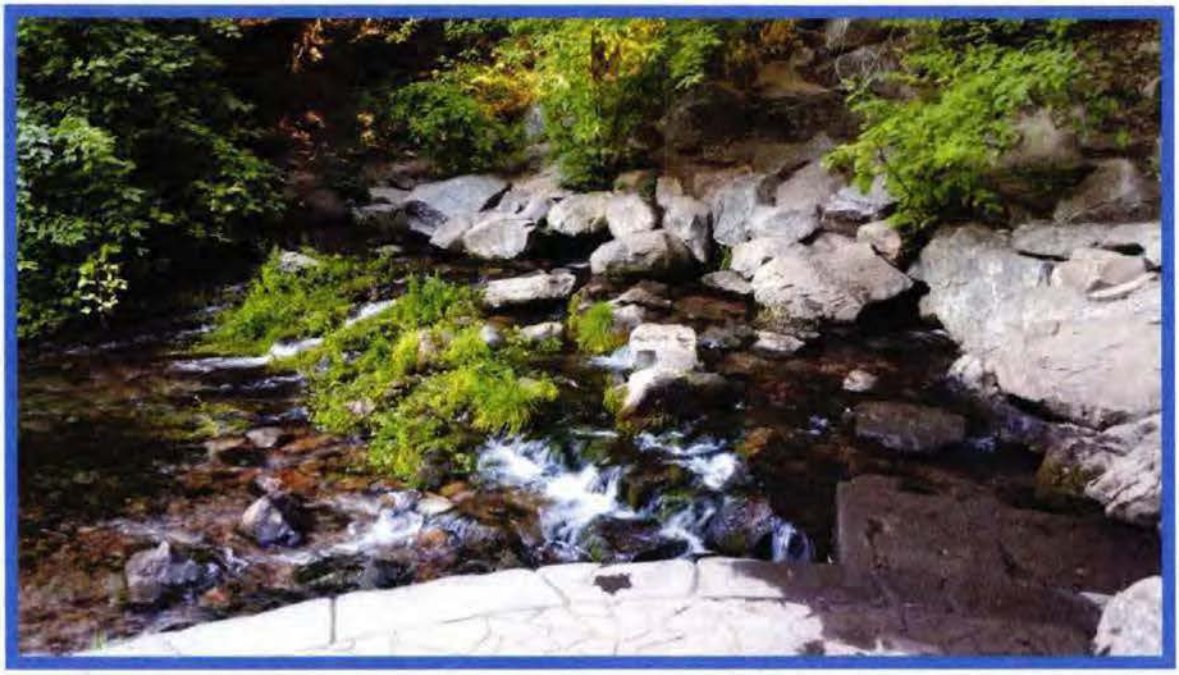
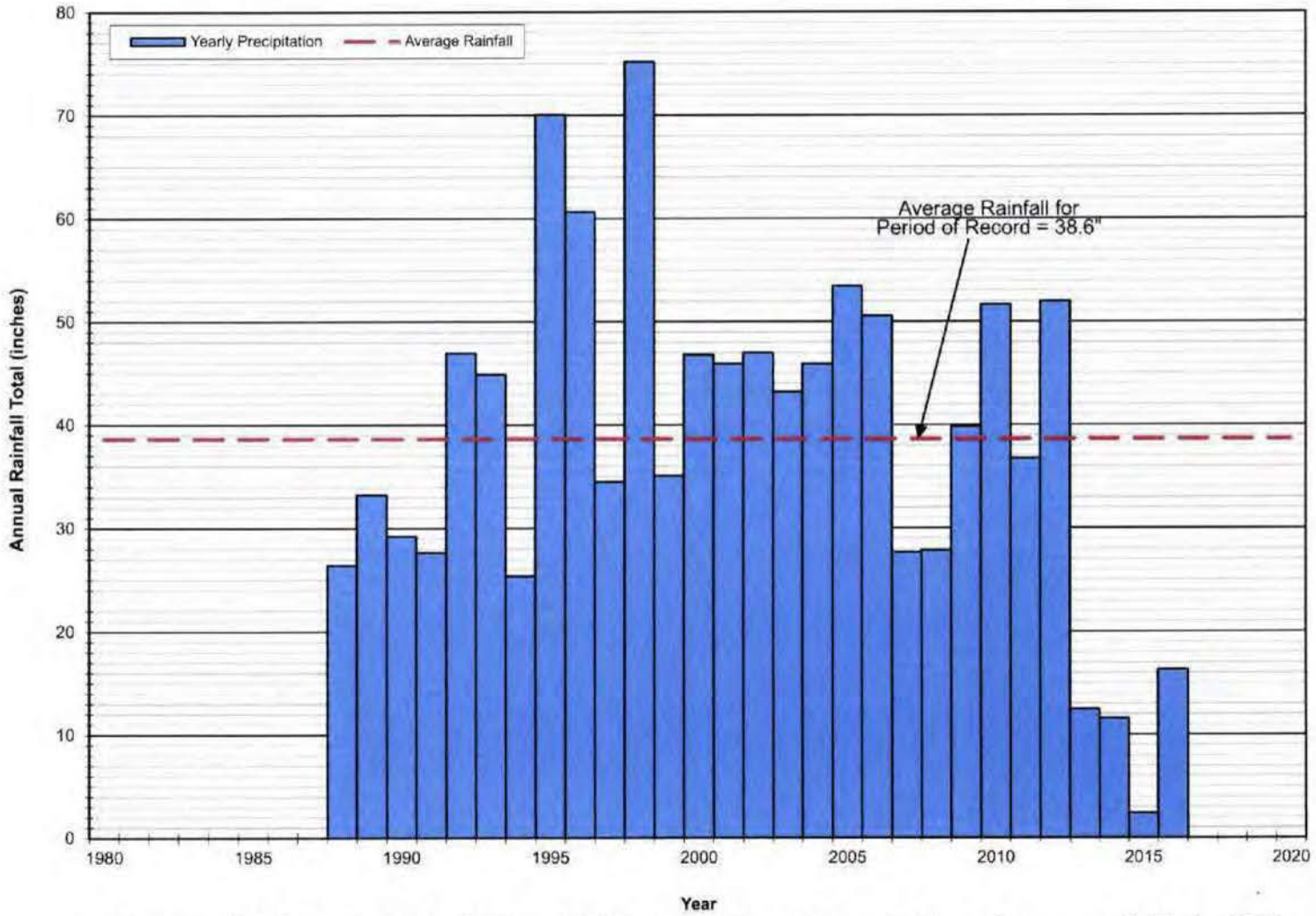


Photo 3-14: The Big Springs in Big Springs Park, View to the North



Photo 3-15: Stream Gage at Big Springs Creek & Interstate Highway 5 Culvert

APPENDIX 4
RAINFALL & SNOWFALL
YEARLY TOTALS
&
ACCUMULATED DEPARTURE CURVE

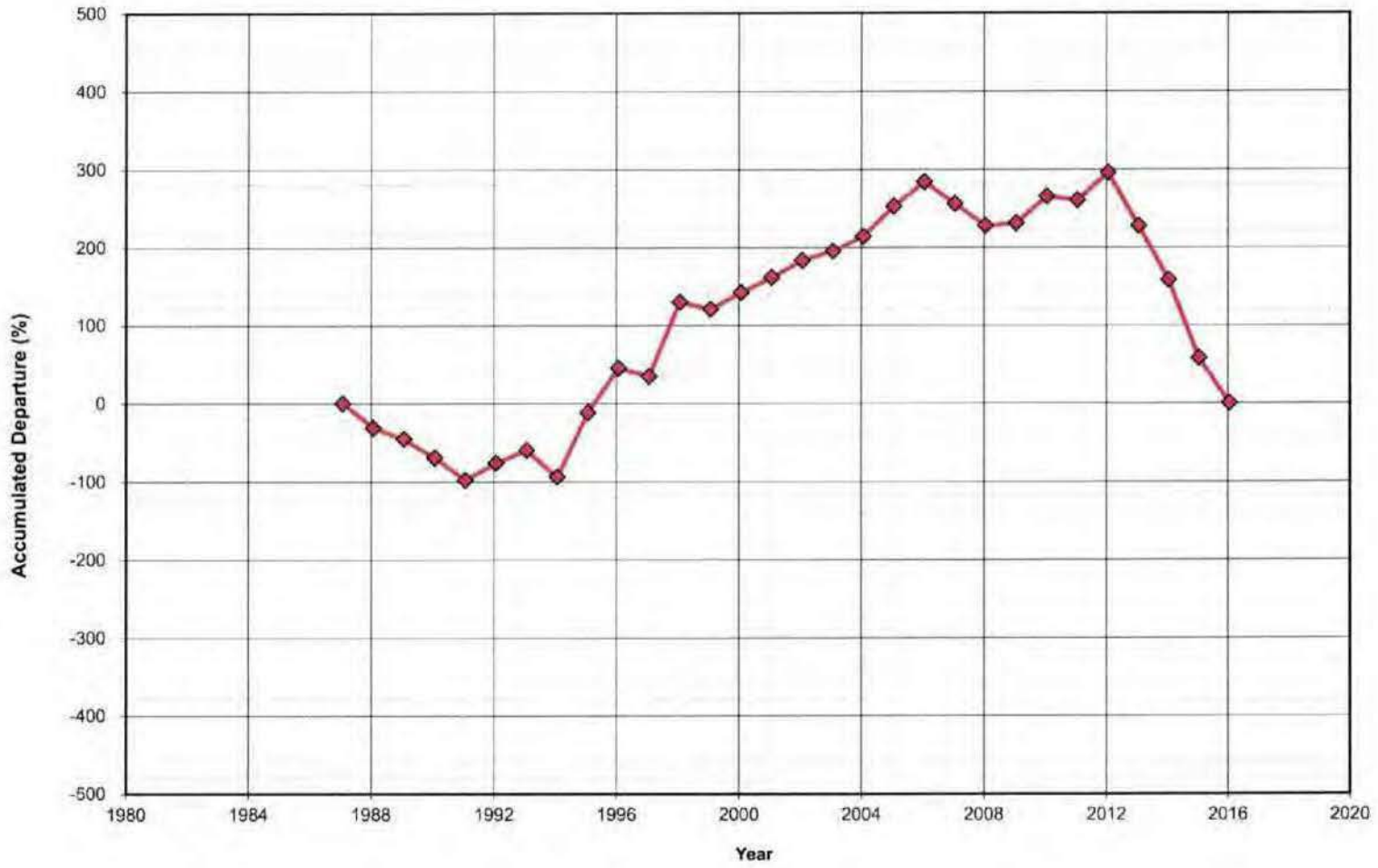


NOTE: Rainfall records for the 2014 and 2016 years are incomplete; nearly no data are available for 2015.

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FIGURE 4-1
ANNUAL RAINFALL TOTALS
MT SHASTA, CALIFORNIA (GAGE NO. 045983)

Job No. 309-SIS01 **October 2016**

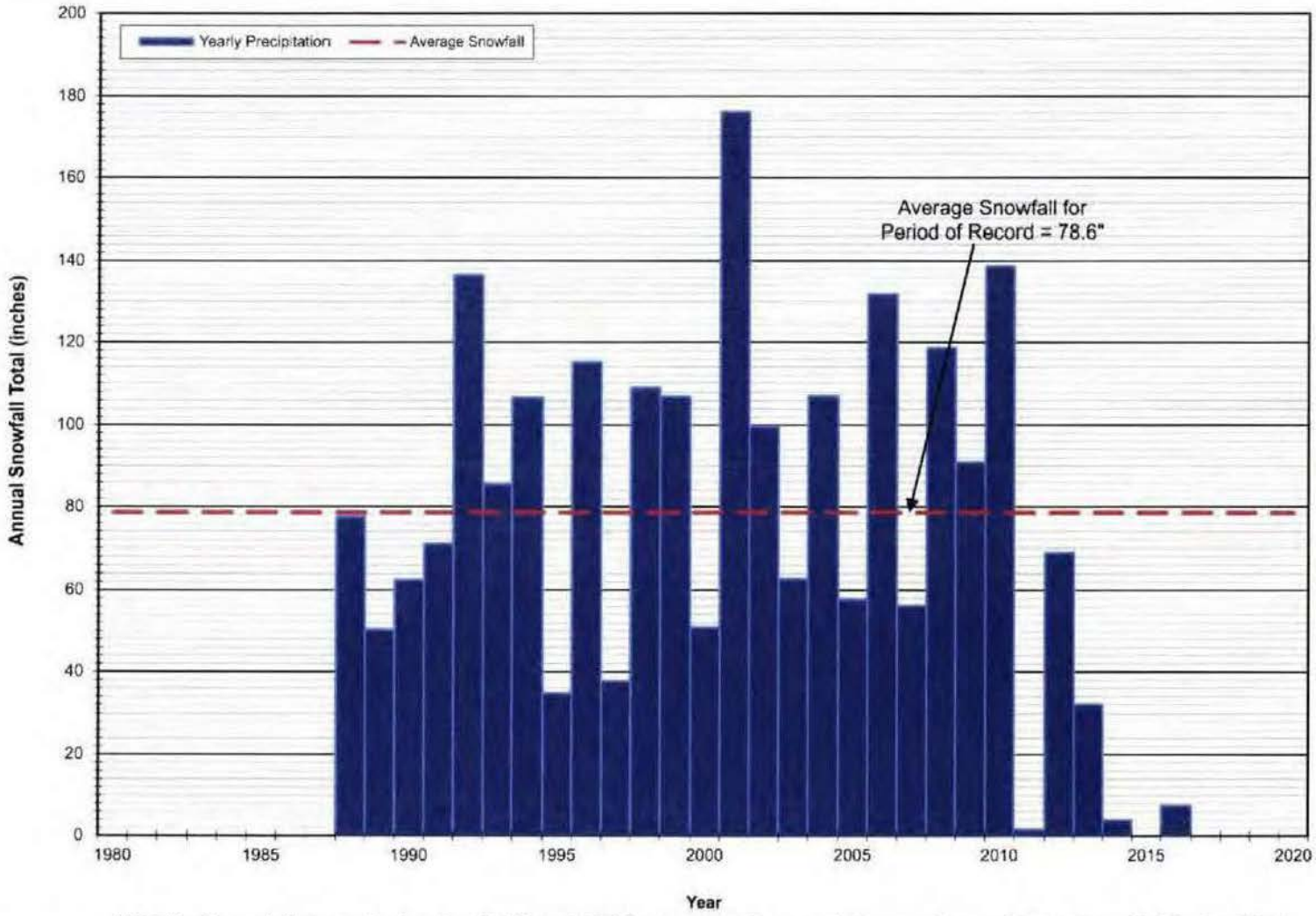


NOTE: Accumulated departure of rainfall value plotted on 12/31 of year the rainfall occurred

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FIGURE 4-2
ACCUMULATED DEPARTURE OF RAINFALL
MT SHASTA, CALIFORNIA (GAGE NO. 045983)

Job No. 309-SIS01 **October 2016**

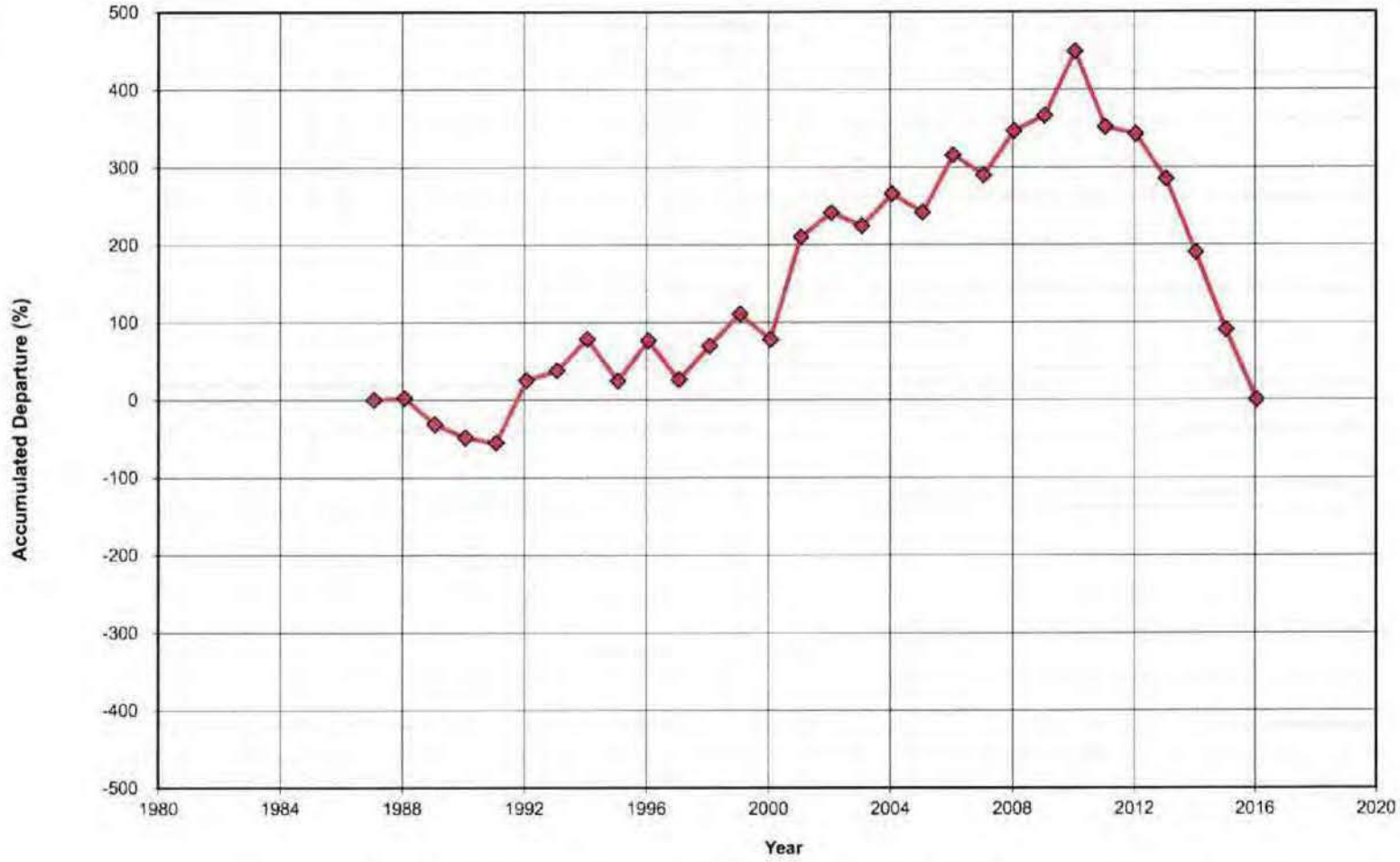


NOTE: Snowfall records for the 2014 and 2016 years are incomplete; nearly no data are available for 2015.

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FIGURE 4-3
ANNUAL SNOWFALL TOTALS
MT SHASTA, CALIFORNIA (GAGE NO. 045983)

Job No. 309-SIS01 **October 2016**



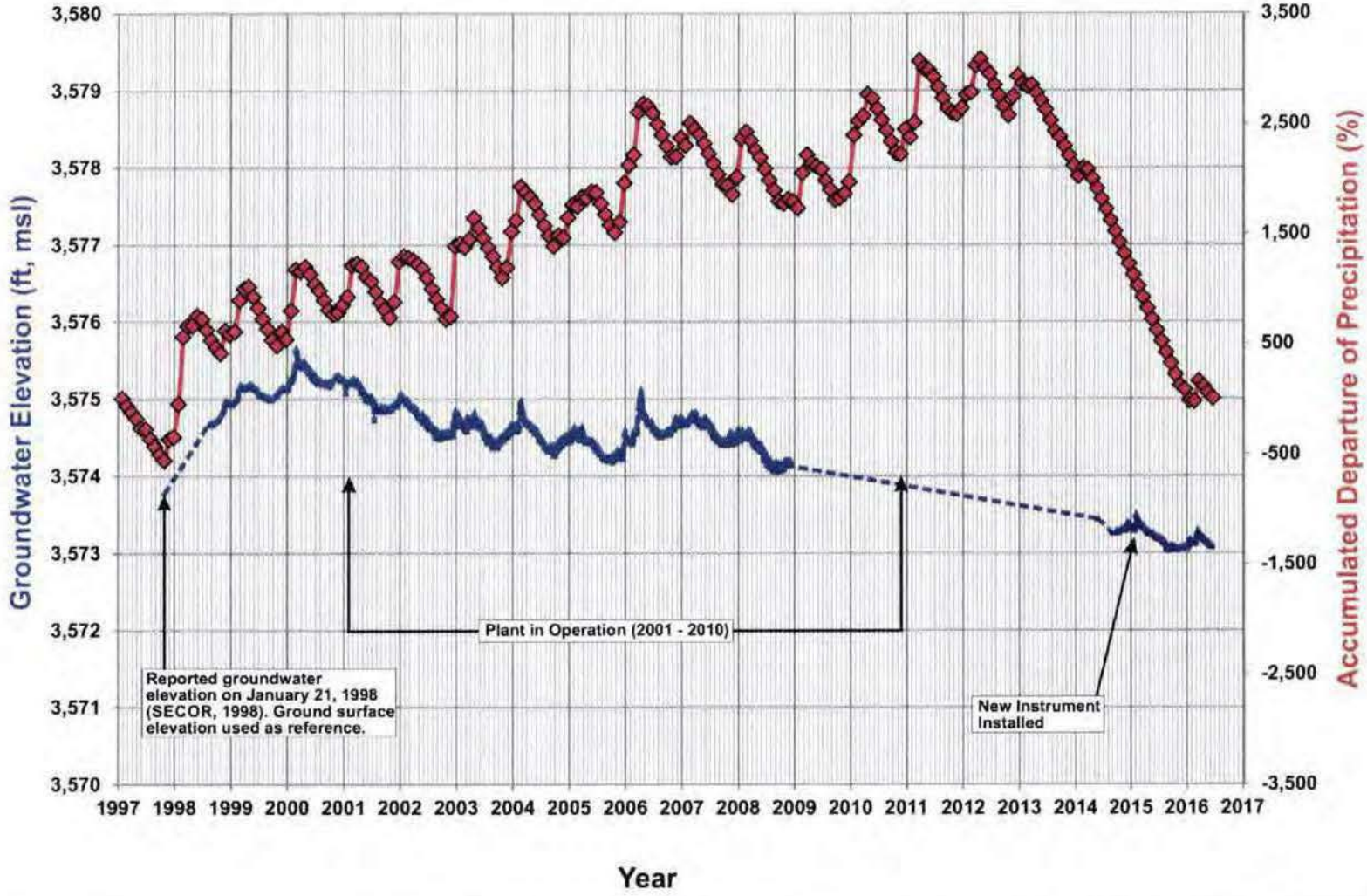
NOTE: Accumulated snowfall departure value plotted on 12/31 of year the rainfall occurred

RCS
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FIGURE 4-4
ACCUMULATED DEPARTURE OF SNOWFALL
MT SHASTA, CALIFORNIA (GAGE NO. 045983)

Job No. 309-SIS01 **October 2016**

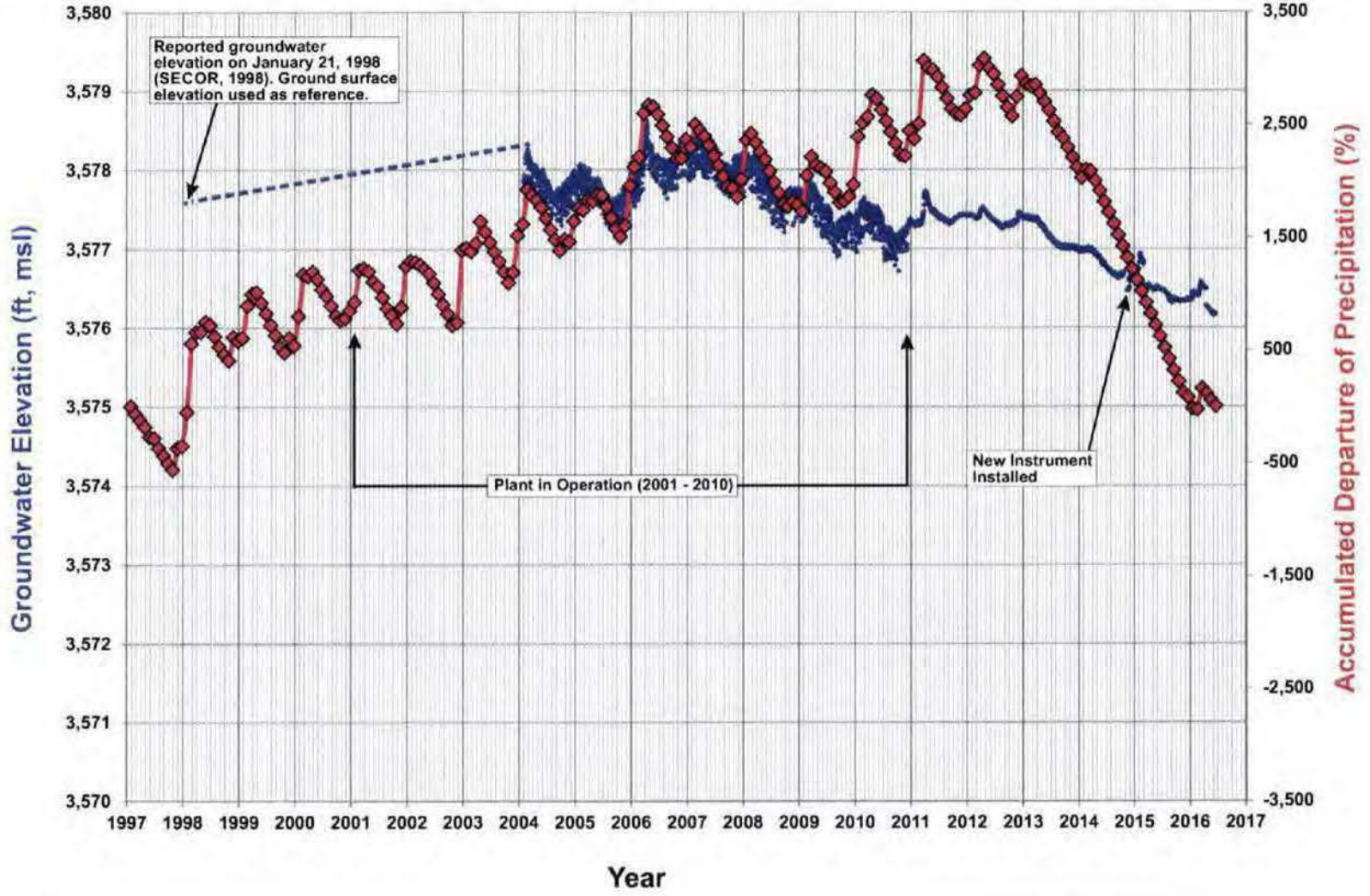
APPENDIX 5
WATER LEVEL HYDROGRAPHS



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FIGURE 5-1
WATER LEVEL HYDROGRAPH FOR DEX-1
vs
ACCUMULATED DEPARTURE OF MONTHLY PRECIPITATION

Job No. 309-SIS01 **October 2016**

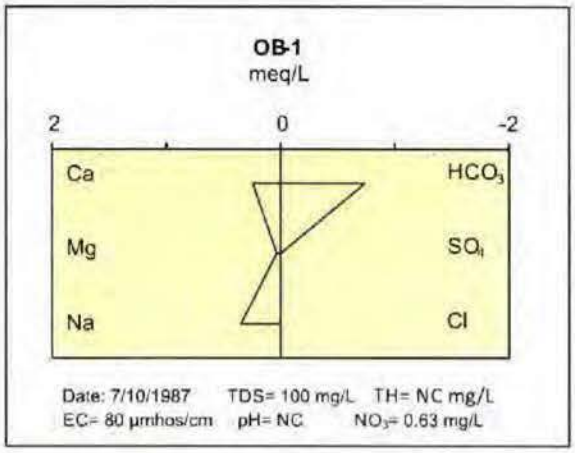


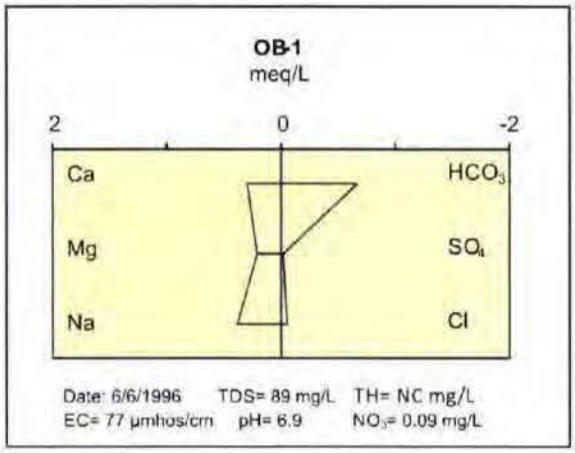
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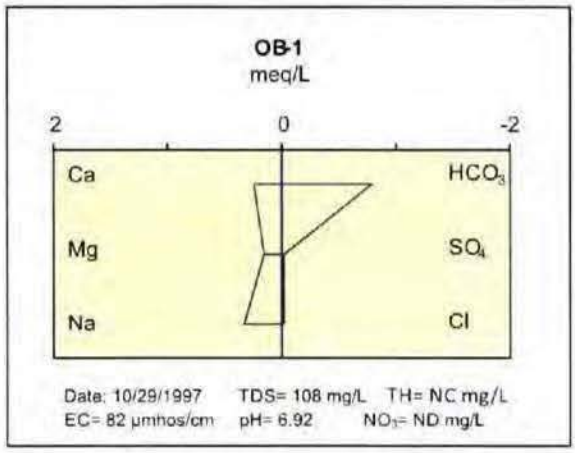
FIGURE 5-2
WATER LEVEL HYDROGRAPH FOR DEX-6
vs
ACCUMULATED DEPARTURE OF MONTHLY PRECIPITATION

Job No. 309-SIS01 October 2016

APPENDIX 6
STIFF DIAGRAM PATTERNS



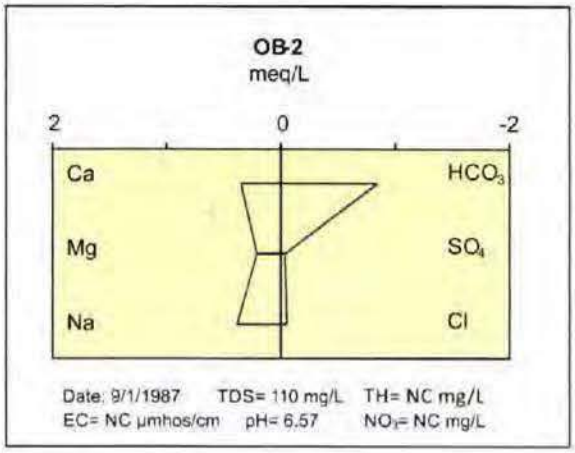


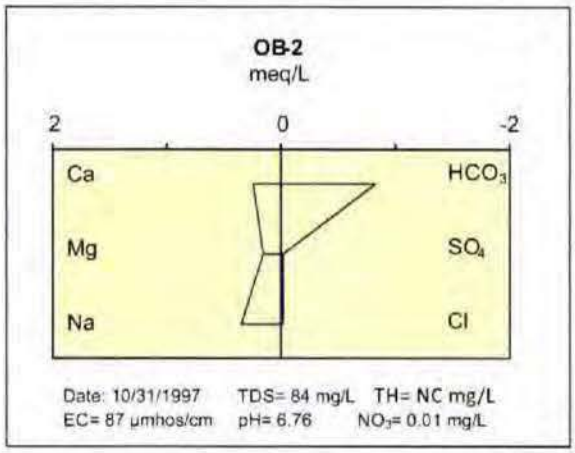


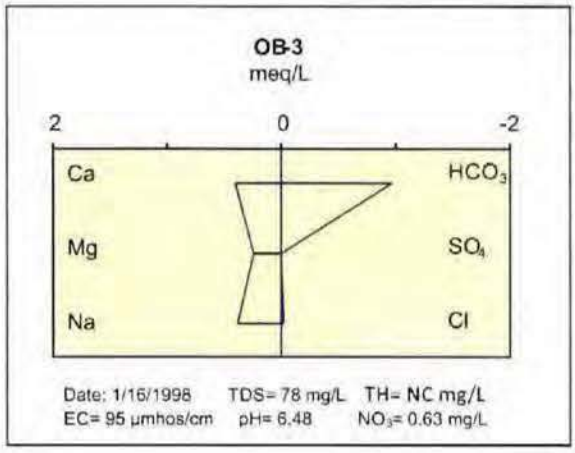
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FIGURE 6-1
OB-1 STIFF DIAGRAMS

Job No. 309-SIS01 **October 2016**



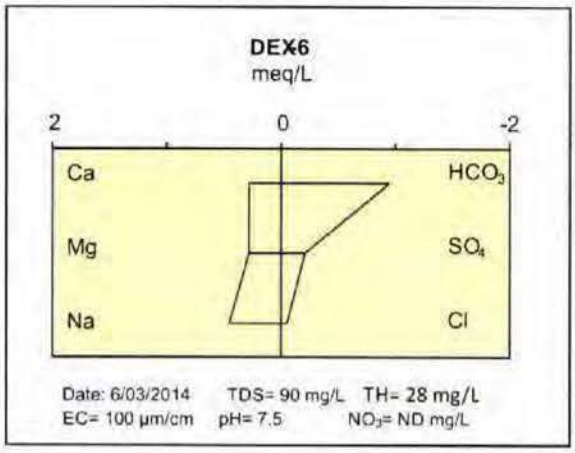


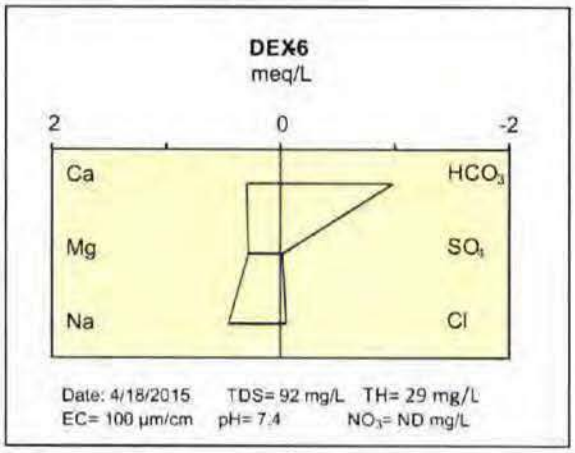


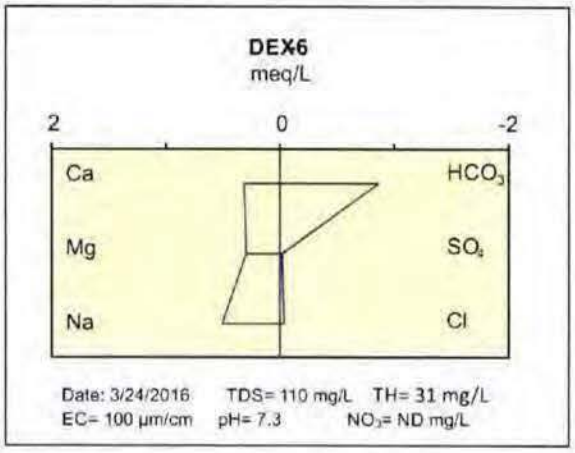
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FIGURE 6-2
OB-2/OB-3 STIFF DIAGRAMS

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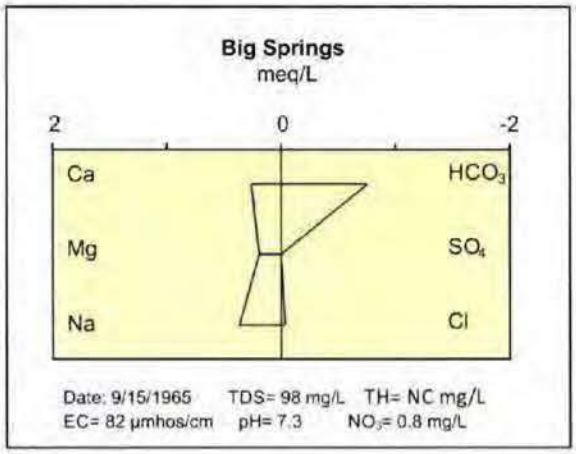


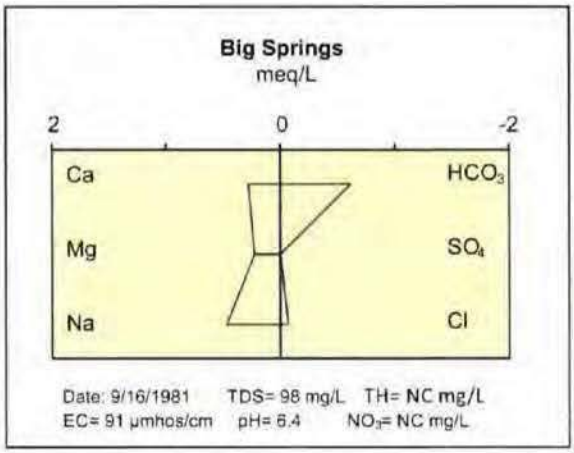


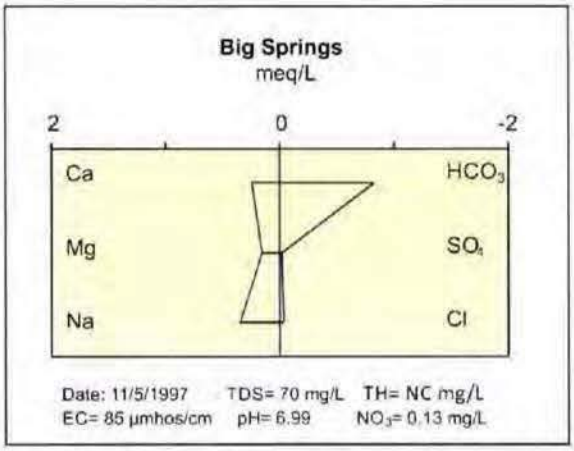
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FIGURE 6-3
DEX-6 STIFF DIAGRAMS

Job No. 309-SIS01 **October 2016**







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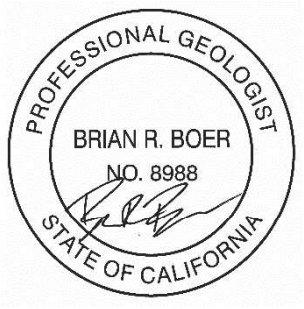
FIGURE 6-4
BIG SPRINGS STIFF DIAGRAMS

Job No. 309-SIS01 **October 2016**

TECHNICAL MEMORANDUM

Analysis of Groundwater Level Data

PREPARED FOR:	Crystal Geyser Water Company
COPY TO:	Alan Calder, Siskiyou County Community Development Department Ryan Sawyer, Analytic Environmental Services
PREPARED BY:	Martin Barackman, CH2M HILL Engineers, Inc. (CH2M) Brian Boer, CH2M
DATE:	June 6, 2017



Introduction

Part I of this analysis summarizes available groundwater data, historical pumping estimates, and local precipitation records in connection with the bottling facility that Crystal Geyser Water Company (CGWC) acquired in 2013. The facility was originally constructed by Dannon Waters of North American (Dannon) between 1998 and 2001, and subsequently operated by Dannon and Coca-Cola Dannon (CCDA Waters) approximately between 2001 and 2010.

Part II of this analysis illustrates the correlation between groundwater levels and precipitation at the CGWC bottling facility. Part III presents conclusions summarizing the potential impact of long-term pumping at the CGWC bottling facility, which are based on the operation of up to two bottling lines at sustained, maximum production as explained in more detail in the *Draft Environmental Impact Report Crystal Geyser Bottling Plant Project* (Siskiyou County, 2017).[1]

Part I: Overview of Available Data

Groundwater Levels

A large amount of groundwater level data and hydrographs related to the bottling facility are available. Hydrographs and groundwater data are available for wells DEX-1, DEX-3a, DEX-6, and DOM-1, which are on CGWC's property. In addition, hydrographs and stilling well data are available for irrigation ditches and streams near the bottling facility. These data were collected by Golder and Associates, Inc., who were conducting water level monitoring on behalf of CCDA Waters. Generally, the groundwater levels were measured using electronic pressure transducers and data loggers on a daily or twice-daily basis. The data cover much of the time when the bottling facility was previously in operation. For purposes of this analysis, however, well data from DEX-3a and DEX-6 are analyzed in more detail, in combination with historical precipitation data and previous pumping rates from DEX-6, to accurately evaluate the effects of both precipitation and pumping from DEX-6 on the groundwater levels in the area.

DEX-6 is the proposed CGWC production well and is screened in the lower aquifer that consists of fractured volcanics. The groundwater level data set for DEX-6 includes daily level measurements during most of the 10-year period from 2001 through 2010, when DEX-6 was being pumped during previous operation of the bottling plant by CCDA Waters.

[1] Siskiyou County. 2017. *Draft Environmental Impact Report Crystal Geyser Bottling Plant Project.* Prepared by Analytical Environmental Services, Sacramento, California. January.

The available electronic groundwater level data set for DEX-3a extends back to August 1998, but there is a gap between late December 2008 and September 2014, where levels were not being monitored or electronic data are not available. Thus, the available DEX-3a data set covers the first 8 years of CCDA Waters pumping, from 2001 through 2008. DEX-3a is screened in the shallow aquifer and located between DEX-6 and many of the private wells to the east. It provides a good location for monitoring effects of DEX-6 pumping on the shallow aquifer, from which the private wells are believed to be drawing. DEX-3a has never been regularly pumped, so the groundwater levels in this well reflect the conditions in the surrounding aquifer.

Pumping

Direct measurements of the pumping rate from DEX-6 when CCDA Waters was in operation are not available. However, DEX-6 is located on a separate parcel from the bottling facility and had a separate electrical meter. With knowledge of the pump type and the depth to water, it is possible to make an accurate estimate of the pumping rate from the electric usage. Records for the monthly electric use at this meter were obtained from Pacific Power, with permission from CCDA Waters. Such records were available dating back to early 2006. Using the data for the electrical use, along with engineering specifications of the pump in DEX-6 (Grundfos 385S-400),[2] the depth to water (200 feet), and an estimate of the working pressure in the pipeline (15 pounds per square inch), a reasonably accurate estimate of the amount of water pumped by CCDA Waters can be developed for each month, for the period between 2006 and the end of CCDA Waters' operations in late 2010. Figure 1 shows the estimated pumping rate from DEX-6 during CCDA Waters operations and the pumping rate proposed by CGWC.



Figure 1. Previous CCDA Waters Pumping from DEX-6 Compared with Proposed CGWC Pumping

[2] Pump flow and power use calculator available online at http://product-selection.grundfos.com/product-detail.product-detail.html?custid=GMA&productnumber=16B73905&qcid=216616141.

Throughout most of 2006 and 2007, DEX-6 was pumped at rates higher than is being proposed by CGWC during the operation of both bottling lines (illustrated on the Figure 1 graph as Phase 2). CCDA Waters pumping exceeded CGWC's calculated rate for operating one bottling line (Phase 1) throughout most of the period between 2005 and 2010. The CCDA Waters pumping was from the same well and at similar average rates to those proposed by CGWC during Phase 2. Therefore, it is reasonable to assume that the effects of Phase 2 CGWC pumping on water levels will be similar to the effects of CCDA Waters pumping. Phase 1 CGWC pumping will have lesser effects than CCDA Waters pumping.

Precipitation Records

Groundwater levels in an aquifer typically respond to changes in precipitation in the recharge area for that aquifer. The response of the groundwater system may be delayed in time from the change in precipitation. Some of this delay is caused by the time it takes for rainfall to infiltrate through the soil and reach groundwater. In colder climates, much of the precipitation falls as snow, which does not begin to infiltrate until it melts, so there may be a longer delay between precipitation and groundwater level changes. The recharge area for the aquifer that feeds Mt. Shasta Big Springs and DEX-6 includes higher areas on Mt. Shasta, where snow is present much of the year. A weather station at the old ski bowl (identifier MSSKI) at elevation 7,600 feet would be a good location for assessing precipitation in the recharge area; however, the data from station MSSKI has major gaps. Another station at Sand Flat (identifier SDFC1) at elevation 6,750 feet has a usable record of monthly precipitation during the 2001 through 2010 timeframe.[3]

The best record in terms of completeness and data quality is from the Forest Service weather station in Mt. Shasta (identifier 045983), approximately 0.75 mile south of the bottling facility. Data from the Mt. Shasta station have been uploaded to the U.S. Historical Climatology Network and have undergone quality assurance review as part of that process.[4] Although the Mt. Shasta station is not in the recharge area of Big Springs and DEX-6, it is reasonably close, and the better quality of data from this station makes it the most usable data set for comparison to water levels. The Mt. Shasta station has monthly precipitation data going back to at least 1950, with some data extending back to before 1900. For the purposes of evaluating the groundwater level data from DEX-6 and DEX-3a, precipitation data are only needed back to the late 1990s, when groundwater levels were first measured in wells at the site.

Part II: Analysis of Available Data

This set of groundwater level, pumping, and precipitation data is valuable for evaluating the effects of the proposed pumping by CGWC. It effectively provides a 10-year-long aquifer test with pumping from the same well (DEX-6) at rates comparable to those currently being proposed during Phase 2. With these historical data it is possible to make confident and accurate estimates of the effects of the proposed pumping on groundwater levels. These estimates are based on actual data collected over many years. Typically, analyses of pumping impacts would require use of groundwater model simulations to make projections of how the aquifer would likely respond to pumping. Groundwater models require detailed estimates of the aquifer extent, hydraulic properties, recharge and discharge rates, and many other parameters that are difficult to measure and, therefore, rarely known with the degree of precision desired. There is typically a significant degree of uncertainty in groundwater model projections. In contrast, at this site, the aquifer response to the proposed pumping is known because that response has already been observed during prior operations.

[3] Available online at http://mesowest.utah.edu/cgi-bin/droman/download_api2.cgi?stn=SDFC1&year1=2017&day1=14&month1=4&hour1=18&timetype=GMT&unit=0.

[4] Available online at http://cdiac.ornl.gov/cgi-bin/broker?_PROGRAM=prog.climsite_monthly.sas&_SERVICE=default&id=045983&_DEBUG=0#write_somevars_clim_mon.

Effect of Pumping on Groundwater Levels

Historically, pumping at DEX-6 was intermittent throughout the day. The well pumped until a tank at the bottling plant was full, then the pump shut down. When the tank was drained below a threshold level, the pump started again and ran until the tank was full. This cycle might have been repeated multiple times per day. Water levels were only measured once or twice per day, and the measurements were not synchronized to the pump cycles; thus, it would be random chance whether the water level was measured when the pump was running or off. When the pump is running, the water level in DEX-6 is depressed, and when the pump shuts off, the water level rapidly returns to normal. The pump cycles result in some random scatter in the DEX-6 groundwater level data set during the years when the well was being pumped. Figure 2 shows the daily groundwater level in DEX-6 along with the pumping rate. The random scatter caused by the pump cycles is apparent in the data prior to 2011. The pumping stopped in early 2011, and the scatter in the data set is greatly diminished after that time. As shown on Figure 2, groundwater levels decreased even as pumping rates began to decrease after 2007. This is the opposite of what would be expected if the pumping was causing drawdown in the aquifer.

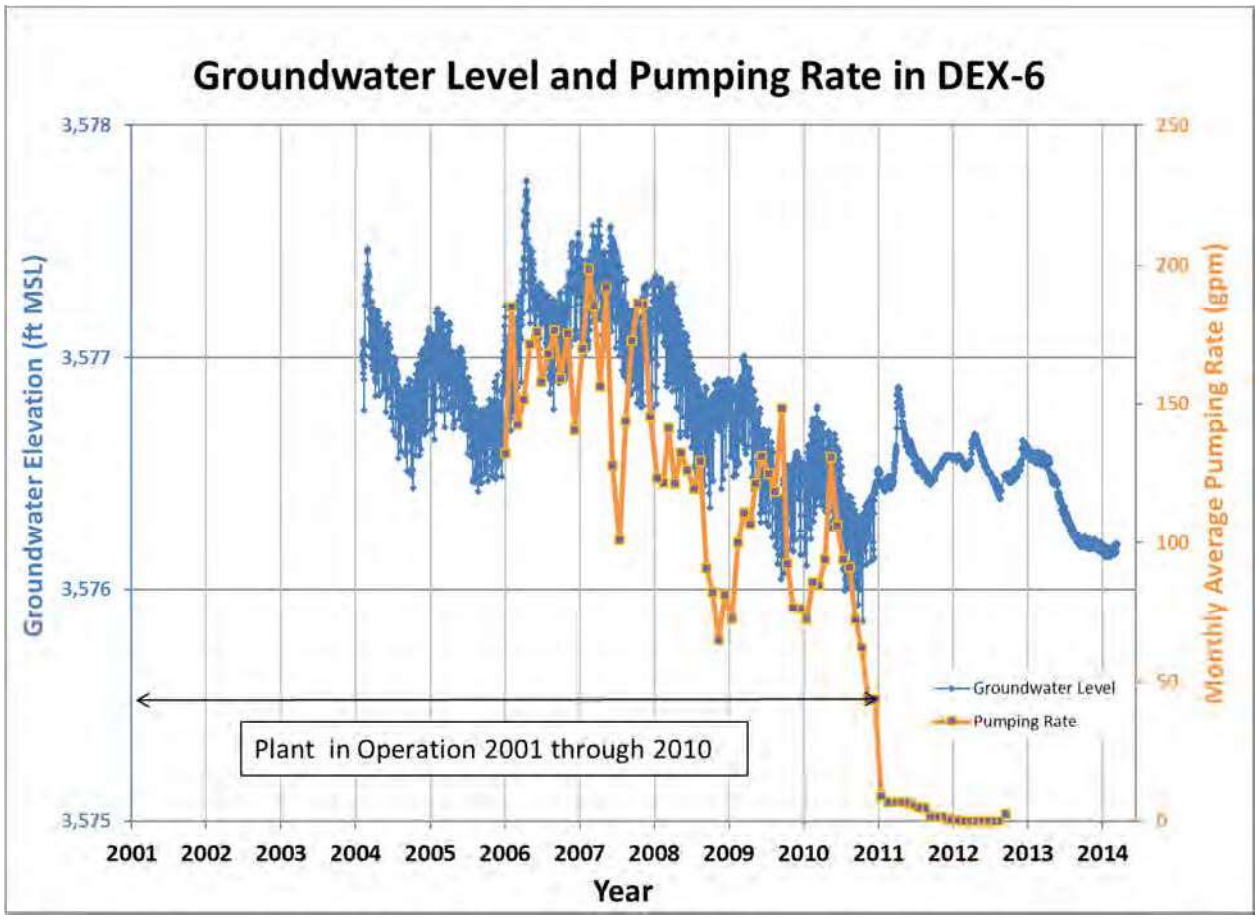


Figure 2. Groundwater Level and Pumping Rate in DEX-6 during CCDA Waters Operations

Figure 3 shows the water level in DEX-3a along with pumping in DEX-6. DEX-3a is screened in the shallow aquifer. It is immediately apparent that the groundwater level changes in the shallow aquifer are much greater than in the deep aquifer. As noted above, however, the groundwater levels in DEX-3a are not correlated with pumping rate. As in the deep aquifer, the higher pumping rates are correlated with higher water levels, which is opposite of what would be expected if the pumping was causing drawdown in the aquifer. It is also apparent that the daily fluctuations in DEX-3a are much less than in DEX-6. It is difficult to tell at the scale of the graph, but the daily fluctuations in DEX-3a are typically less than 0.2 foot. The degree of "noise" in the DEX-3a data in 2016, when no pumping is occurring, is similar to that in 2007, when pumping was high.

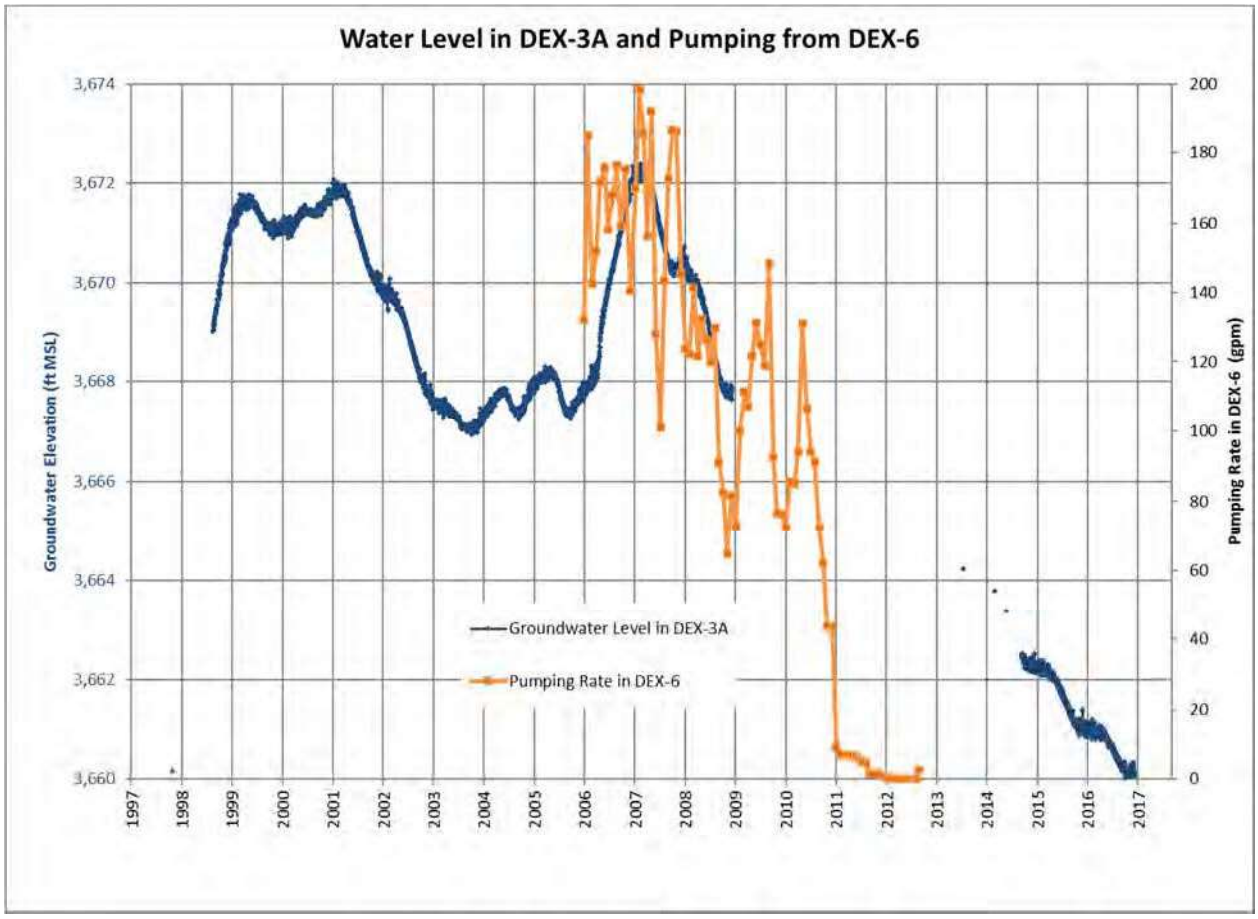


Figure 3. Groundwater Level in Shallow Well DEX-3a and Pumping Rate in DEX-6

Daily, the pumping causes drawdown on the order of about 0.5 foot (the width of the random scatter of the DEX-6 data points prior to 2011), and the water level in the well recovers fully within a few days or hours after pumping stops. High pumping rates cause more drawdown than low pumping rates, so pumping and water level should be negatively correlated, with high water levels at times of low pumping and vice versa. However, as Figures 2 and 3 show, the highest pumping rates correlated with the period of highest water levels; and as pumping rates declined, water levels did not rebound, but rather continued to decline, even after the pumping stopped. There is no correlation between the DEX-6 pumping rate and long-term water level trends in either DEX-6 or DEX-3a.

To evaluate the drawdown associated with pumping in DEX-6, it would be desirable to compare groundwater levels during a period when the well was being pumped regularly with levels when it was not being pumped. No records are available to determine days the pump was running and when it was not; however, it is reasonable to assume that the plant was likely not operating or at least not operating at full capacity during the Christmas holiday period, because of the holidays and generally lower demand

for bottled water during non-summer months. Thus, examining the change in water levels during the holiday period, which is generally the last week of December and first week of January could provide an indication of the amount of drawdown associated with pumping.

Figure 4 shows the measured groundwater levels in DEX-6 during the holiday period over all the years that groundwater levels were collected in DEX-6 when the plant was in operation. The gray area shows a typical holiday break period. During most years, there is some increase in water levels during this period and a decrease in the random scatter of the data, consistent with the pumping rate being reduced or pumping being stopped. During 2007, when the average pumping rate was greater than 150 gpm, the average rebound in groundwater level during the holiday break period is less than 0.75 foot. During 2009 and 2010, when pumping rates were lower, this difference is less than 0.5 foot. These data, collected over a period of nearly 10 years, provide sound basis for the conclusion that when CGWC is pumping DEX-6 at 139 gpm, the average drawdown in the well will be no more than 0.75 foot. This observation is supported by the high specific capacity (that is, pumping rate [gpm]/feet of drawdown) reported in DEX-6 by both SECOR[5] and Geosyntec.[6]

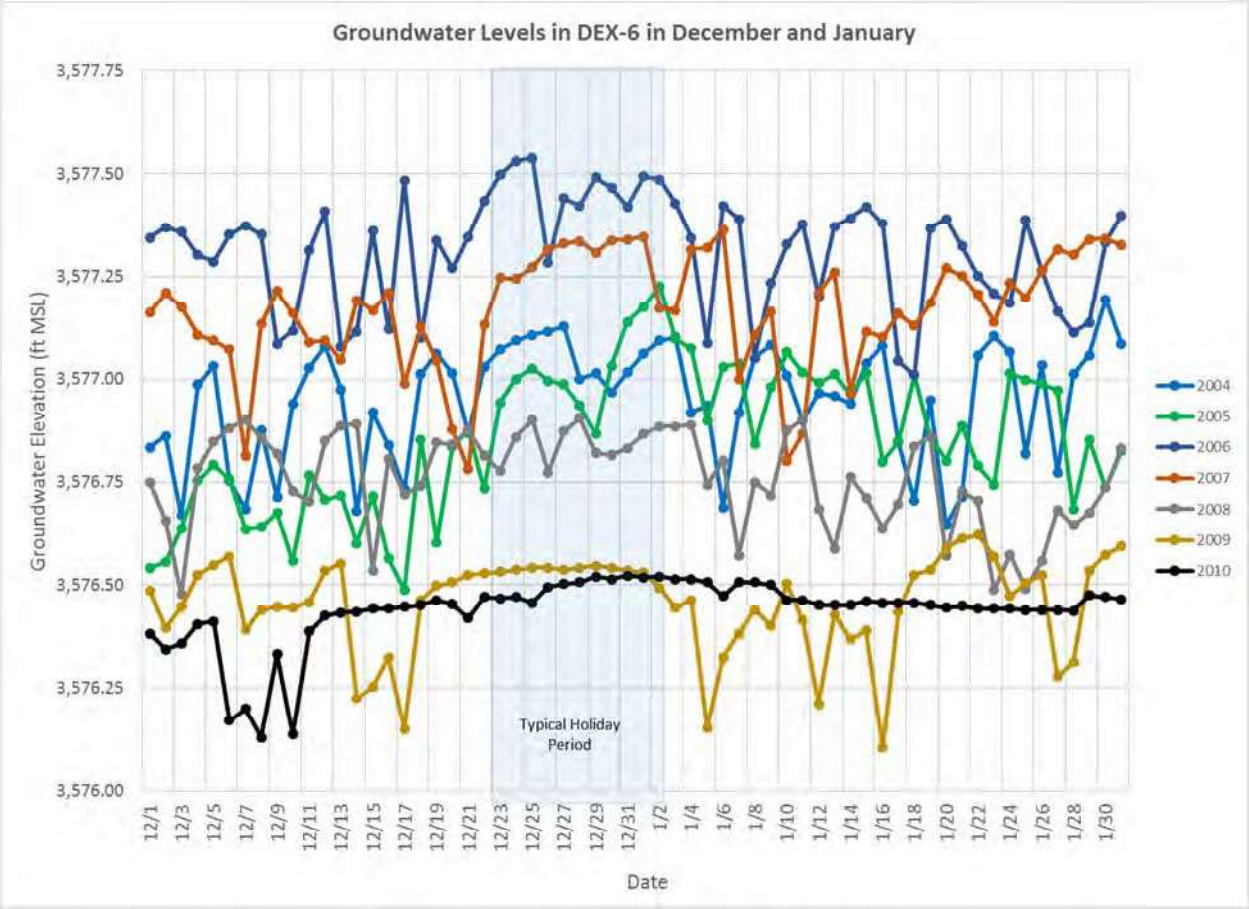


Figure 4. Groundwater Levels in DEX-6 during December and January

[5] SECOR International, Inc. 1998. *Confidential Hydrogeologic Evaluation Report, Springs Hill Property, Siskiyou County, California*. March 18.

[6] Geosyntec. 2014. *Report: Hydrogeologic Review and Well Testing*. Prepared for Coca Cola Mt. Shasta Bottling Facility. March 7.

Figure 5 shows the available groundwater levels in DEX-3a during December and January for the years when DEX-6 was pumping. Groundwater levels in DEX-3a do not show any apparent effect from decreased pumping over the holiday period. Therefore, it is doubtful that DEX-6 pumping had a measurable effect on water levels in DEX-3a. This is not surprising, considering how small the drawdown is in DEX-6, the fact that DEX-3a is located over 850 feet from DEX-6, and DEX-3a and DEX-6 are in two different aquifers.

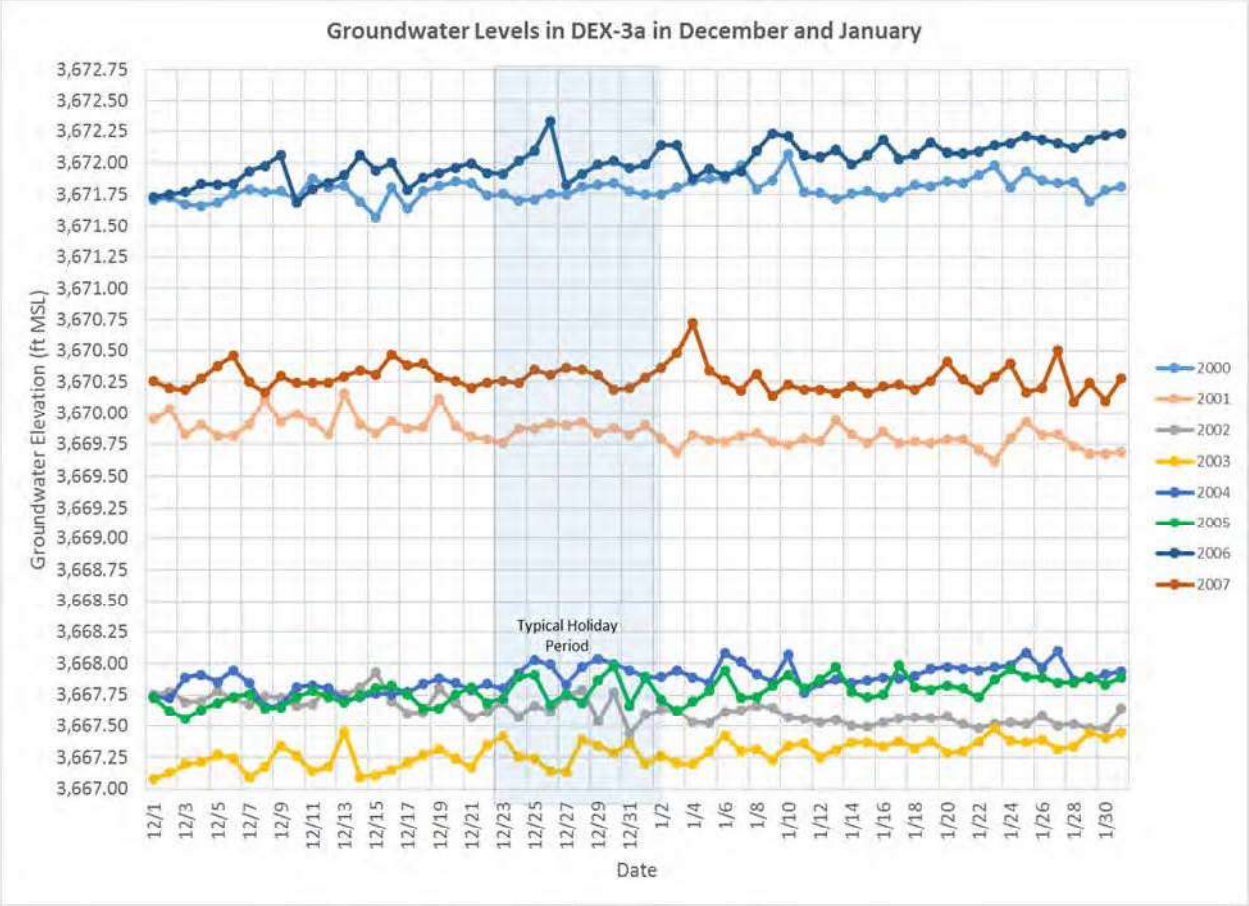


Figure 5. Groundwater Level in DEX-3a during December and January

Estimating Effect of Pumping in DEX-6 on Neighboring Wells

A pumping well produces a “dimple” in the groundwater table that is known as a “cone of depression.” The cone of depression forms as the pumping well removes groundwater from the aquifer and the surrounding groundwater runs “downhill” (or “downgradient” in the terminology of hydrogeologists) to fill in the depression in the water table. The area in the aquifer immediately adjacent to the well is the lowest point in the cone of depression. In addition, the water level inside the well casing is depressed farther than the water level in the aquifer immediately outside the well bore, because of the resistance of water passing through the well screen. Thus, the drawdown in the pumping well is greater than would occur anywhere else in the aquifer. This is true irrespective of aquifer thickness, extent, hydraulic properties, source of recharge, amount of water in storage, degree of connection between different aquifers, direction of groundwater flow, or any other possible hydrogeologic variables. Nowhere in the aquifer is the drawdown associated with pumping greater than in the pumping well itself. Drawdown decreases with distance away from a pumping well, so it is possible to state with confidence, on the basis of many years of past water level measurements, that drawdown caused by pumping at DEX-6, at an average rate of 139 gpm, will be no more than 0.75 foot in neighboring wells, no matter where they are located or in which aquifer they are screened.

In fact, most, if not all, of the neighboring wells are screened in the upper aquifer. The upper aquifer is poorly connected to the lower aquifer, as evident by groundwater level data collected in DEX-3a. The effects of pumping DEX-6 on water levels in the neighboring wells will therefore be strongly muted because of distance and the indirect hydraulic connection, if any. The effect of DEX-6 pumping on neighboring wells will likely not be measurable and will certainly not be significant. As discussed below, the upper aquifer is subject to fluctuations in groundwater level because of changes in precipitation, but not because of pumping from DEX-6 at the rates proposed by CGWC.

Effect of Precipitation on Groundwater Levels

Long-term trends in groundwater levels are apparent in both DEX-6 and DEX-3a. As noted above, there is no correlation between the changes in pumping rate in DEX-6 and these long-term trends in groundwater levels. Comparison of groundwater levels to the precipitation record at the Mt. Shasta weather station provides insight into the cause of the long-term trends in groundwater level. Figures 6 and 7 show the groundwater levels in DEX-6 and DEX-3a, compared to a 2-year running average of annual precipitation at the Mt. Shasta and Sand Flat weather stations. The 2-year running average is calculated as the sum of the previous 24 months of precipitation, divided by 2. Because aquifers contain large volumes of water and respond relatively slowly to changes in rainfall, a long-term average of precipitation is often used to correlate with groundwater level changes. For this analysis, 1-year, 2-year, and 3-year averages were evaluated. The 2-year and 3-year averages produced a much better correlation than the 1-year average. The 2-year average produced a marginally better correlation between precipitation and groundwater levels than the 3-year average.

As noted previously, it takes some time for water that falls as rain or snow to infiltrate into the ground, reach the depth of the aquifer, and cause an increase in the groundwater level. The length of this delay is longer in cold climates, where snowfall does not infiltrate until spring. The plots below (see Figures 6 and 7) incorporate an 8-month lag, meaning that, for example, the precipitation value posted in September 2007 is the average of the precipitation that fell in the 24 months prior to January 2007. Eight months is not an unreasonable lag time, considering that the recharge area for this aquifer includes higher elevations where most of the precipitation falls as snow and may take more time to melt, infiltrate, and travel several miles through the aquifer to the site.

Figures 6 and 7 show a positive correlation between groundwater levels in both DEX-6 and DEX-3a and precipitation at two nearby weather stations. The trends in groundwater levels in both DEX-6 and DEX-3a are clearly related to changes in precipitation and not related to pumping from DEX-6.

It should also be pointed out that between 2007 and 2017 there is an observed 12-foot drop in groundwater levels in DEX-3a; whereas, there is only a 2-foot drop in DEX-6. In addition, groundwater elevations in DEX-3a are 80 to 90 feet higher than groundwater elevations in DEX-6. These data further suggest there is a limited hydraulic connection between the two wells (or between the upper and lower aquifers) and that groundwater levels in DEX-3a are more affected by changes in precipitation than groundwater levels in DEX-6.

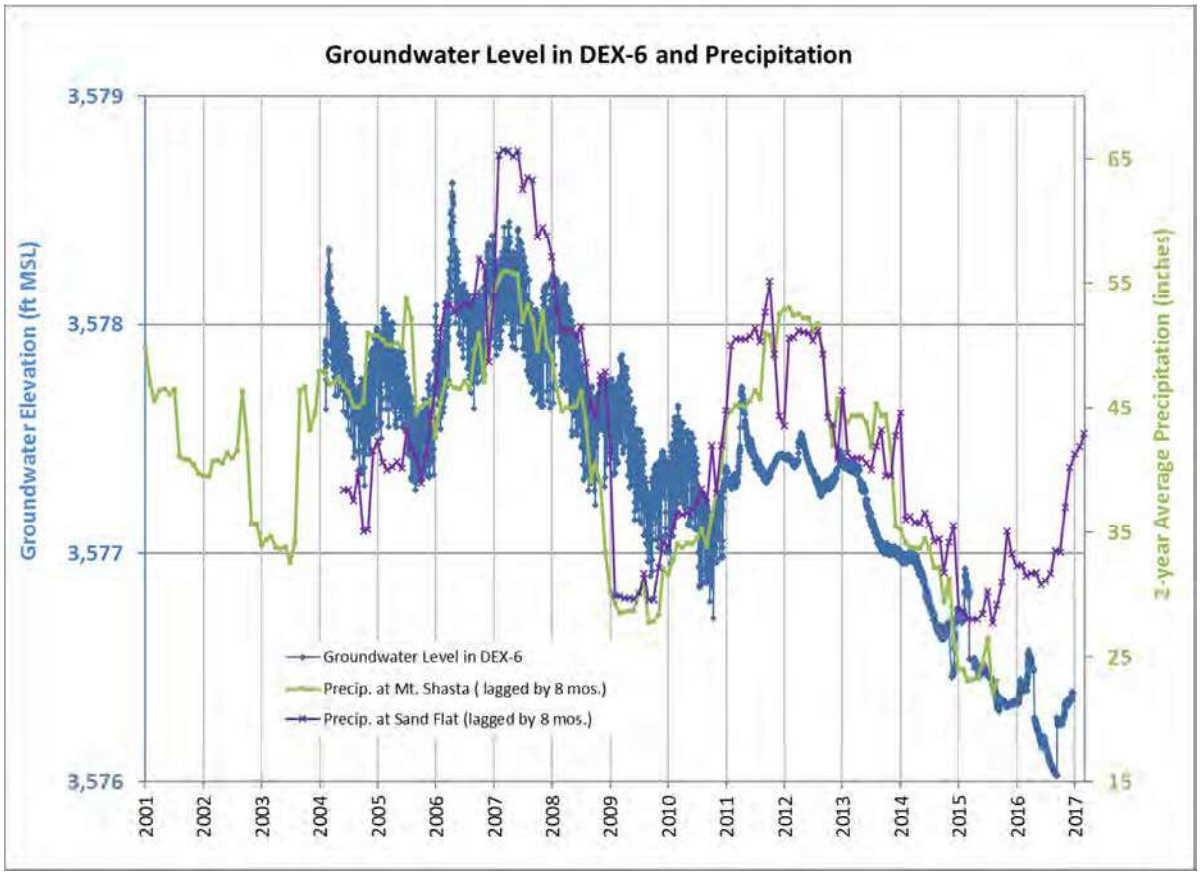


Figure 6. Groundwater Level in DEX-6 and Precipitation

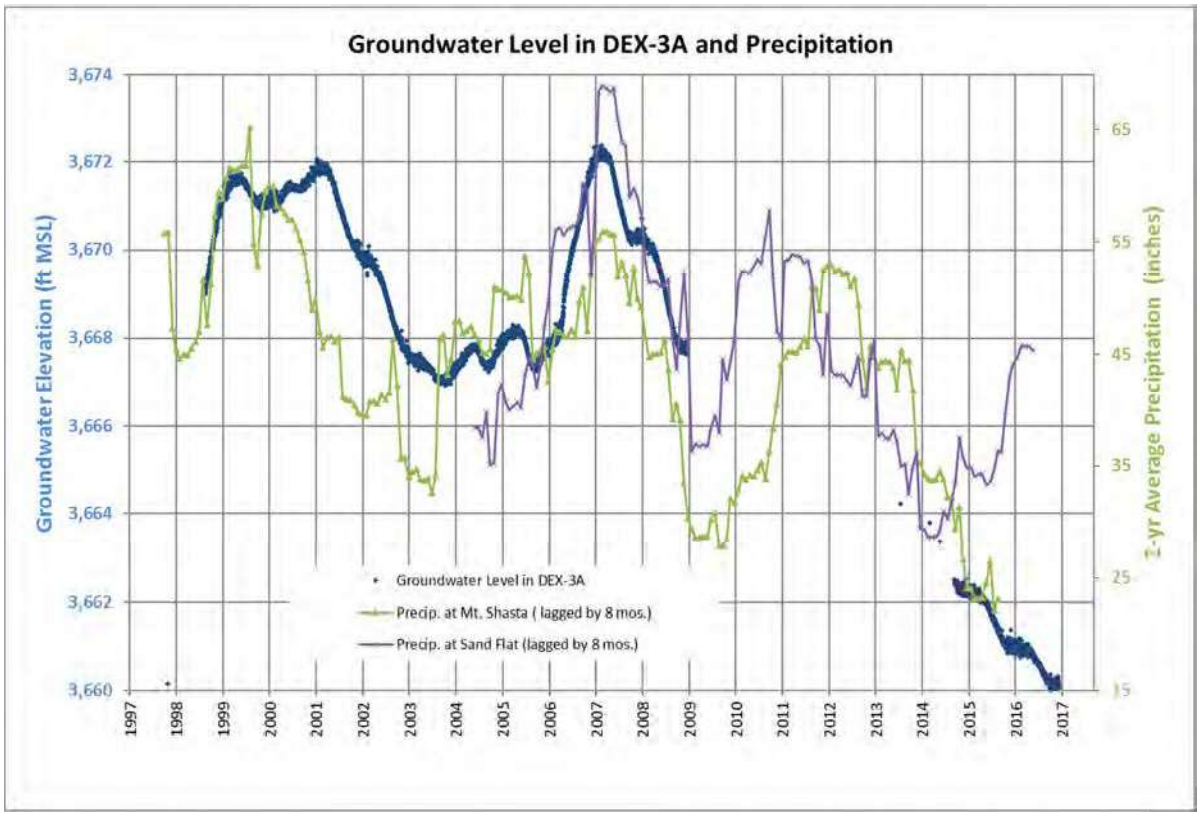


Figure 7. Groundwater Level in DEX-3a and Precipitation

Part III: Conclusions

The correlation between previous pumping of DEX-6, at rates similar to those proposed by CGWC, along with the extensive sets of local precipitation data and historical groundwater level data from DEX-6 and DEX-3a, provides a sound basis for conclusions regarding the effects of the proposed pumping on groundwater levels and neighboring wells. Analysis of the existing groundwater level, pumping, and precipitation data supports the following conclusions:

- There is no correlation between CCDA Waters pumping rates and long-term trends in groundwater levels in DEX-6 or DEX-3a.
- The average daily drawdown caused by pumping in DEX-6 at the rates proposed (139 gpm) will be no more than 0.75 foot anywhere in the aquifer.
- Drawdown in neighboring wells caused by pumping DEX-6 will be much less than 0.75 foot and likely not measurable.
- The long-term water level trends in both the deep and shallow aquifers are correlated with changes in precipitation.
- The shallow aquifer is more affected by changes in precipitation than the deep aquifer, and changes in groundwater levels observed in DEX-3a are not the result of pumping in DEX-6.

This evaluation uses the large amount of existing water level and pumping data to evaluate the long-term effects of pumping from DEX-6 at rates similar to those being proposed by CGWC. The existing pumping and water level data alone provide a sound basis for evaluating the effects of pumping DEX-6 without the need for further characterization of the aquifer.

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Technical Memorandum

Date:	June 7, 2017
To:	Crystal Geyser Water Company
Copy to:	Alan Calder, Siskiyou County Community Development Department Ryan Sawyer, Analytical Environmental Services
From:	Mark Grivetti and Jeffrey Zukin (Geosyntec Consultants, Inc.) Peter Rude (CH2M)
Subject:	**Response to Public Comments on the CGWC Draft EIR Geosyntec Consultants and CH2M**

INTRODUCTION

This Technical Memorandum provides selected responses to public comments on the Draft Environmental Impact Report dated January 2017 (Draft EIR) regarding hydrogeology, groundwater, and wastewater at the Crystal Geyser Water Company (CGWC) bottling facility in Mount Shasta California. Geosyntec Consultants, Inc. and CH2M in consultation with CGWC, have reviewed the Draft EIR and selected public comments. The authors of this memorandum have also reviewed underlying reports, logs and other data cited in Appendix P of the Draft EIR (Richard C. Slade & Associates LLC Hydrogeologic Evaluation Report) as well as other available data pertaining to hydrogeology and wastewater discharge. The authors have been directly involved in site-specific investigations at the bottling facility since 2012. The authors of this Technical Memorandum include:

Mr. Mark Grivetti is a Principal Hydrogeologist with Geosyntec Consultants based in Santa Barbara, California. He is a Professional Geologist, Certified Hydrogeologist, and Certified Engineering Geologist in the State of California. In his nearly 35 years of work in the field, Mr. Grivetti has worked on many water resource projects involving development of groundwater for municipalities, industrial sites, agricultural, and domestic uses. He routinely evaluates the impacts associated with water supply development in terms of yield, sustainability, impact on surface water and other relevant issues.

Mr. Jeffrey Zukin is a Senior Geologist with Geosyntec Consultants in Santa Barbara, California. Mr. Zukin is a California Professional Geologist and Certified Engineering Geologist. Mr. Zukin has over 25 years of experience in performing and managing groundwater resources, environmental investigations, and geohazard evaluations around the United States. Mr. Zukin has

managed groundwater resource studies that have involved both regional exploration as well as site-specific development projects. His groundwater resource experience includes evaluation of groundwater basins and bedrock aquifers, aquifer testing, geophysical and geochemical analysis, groundwater modeling, well field design, long-term groundwater yield analyses, development of spring sources, and watershed protection management. Environmental hydrogeology work has included the assessment of potential impacts of contaminants on drinking water aquifers.

Mr. Peter Rude is a Principal Project Manager with CH2M in Redding, California. Mr. Rude is a registered Professional Engineer – Civil Engineer in California, Hawaii, and Colorado. Mr. Rude has over 25 years of experience in managing water conveyance, water reclamation, irrigation, sub-surface drainage, leach field, groundwater water treatment and wastewater treatment projects around the U.S. from feasibility studies to design, permitting, construction, and startup.

This Technical Memorandum includes responses to selected comments in the following Comment Letters:

- Central Valley Regional Water Quality Control Board (RWQCB)
- California Trout (CalTrout)
- Law Office of Donald B. Mooney
- Mr. Peter Martin
- Dr. Kim Mattson
- Ms. Phoenix Lawhon Isler
- Mr. Tim Parker
- Mr. Robert Blankenship
- Dr. Daniel Axelrod
- Ms. Alison Austin
- Mr. Joe Abad & Ms. Karen Shaneyfelt

RESPONSE TO DRAFT EIR PUBLIC COMMENTS

Response to Central Valley Regional Water Quality Control Board (RWQCB)

Wastewater Treatment Option 2

The Central Valley Regional Water Quality Control Board (RWQCB) stated that an updated Report of Waste Discharge (RWD) could be required if Wastewater Treatment Option 2 includes floor wash water. Under Wastewater Treatment Option 2, however, floor wash water will be discharged to the City sewer system. There would be no need for an updated RWD in this case.

Well Identification and Well Data

The RWQCB noted that Figure 3-9 shows the same well names as Waste Discharge Requirement (WDR) Order 5-01-233 and the 2001 Mitigated Negative Declaration adopted by the RWQCB, where MW-1 is located northeast, or upgradient, of the leach field area. Geosyntec reporting from second Quarter 2014 to present shows MW-3 as the upgradient well. In addition, the groundwater mixing model uses general mineral water quality data including Total Dissolved Solids (TDS), sodium, chloride, Chemical Oxygen Demand (COD), boron and sulfate concentrations for the two downgradient wells to estimate background groundwater quality, called out in Appendix H as MW-1 and MW-2. RWQCB staff requests that the Draft EIR include clarification of this confusion in monitoring well names.

The locations of monitoring wells MW-1, MW-2 and MW-3 (shown on Figure 4.8.1) correspond to the locations shown in the most recent Golder Associate Monitoring Report (Golder Associates, April 30, 2013), Well Drillers Reports, and those used by CGWC in the quarterly monitoring reports submitted to the RWQCB (Geosyntec Monitoring Reports, Monitoring and Report Program 5-01-233). The authors propose that these locations and well designations be used in future monitoring reports and other submittals. Figure 3-9 in the Draft EIR should be revised to reflect these well locations and designations.

The RWQCB noted that the Summers mixing model evaluation uses data from the two downgradient monitoring wells (MW-1 and MW-2) and excludes the upgradient well MW-3 data. Monitoring wells MW-1 and MW-2 are located directly adjacent to the leach field and data collected from these monitoring wells is judged to represent background quality of shallow groundwater in the near vicinity of the leach field (see Draft EIR, Appendix H). Groundwater data collected in monitoring well MW-3, which is located upgradient of the leach field area, indicates that TDS and other general minerals appear to be relatively high in this well. Data from MW-3 were therefore excluded from the averages presented in Table 4.8.1 of the Draft EIR because it was judged that data from this well do not represent background concentrations beneath the leach

field. Because MW-3 has poorer groundwater quality than MW-1 and MW-2, the exclusion of MW-3 data leads to a relatively higher estimated shallow background groundwater quality (i.e., better general groundwater quality) beneath the leach field. Furthermore, the exclusion of MW-3 data results in a higher estimated increase of TDS, sodium, chloride, COD, and boron concentrations in the model and thus a more conservative estimate of overall potential impacts.

Leach Field

The RWQCB is concerned the proposed leach field expansion to 108,000 gallons per day (gpd) may not provide sufficient capacity for peak discharges when production expands to two bottling lines, which RWQCB assumes to be 150,000 gallons per production day (gppd). The last sentence of Draft EIR Section 3.5.8.1 states "It should be noted that industrial process and industrial rinse wastewater peak discharge rates would not occur during the same production day." Therefore, the peak wastewater discharge for two bottling lines is 100,000 gppd, not 150,000 gppd, as indicated by the RWQCB.

Mount Shasta Wastewater Treatment Plan (WWTP)

The RWQCB noted that Section 4.12.1 of the Draft EIR claims flow design capacity at the City WWTP to be 0.75 million gallons per day (mgd) average dry-weather flow and 3.56 mgd peak wet-weather flow. The RWQCB concluded that these values are inconsistent with those in WDR Order R5-2012-0086. In response, the author notes that the values in WDR Order R5-2012-0086 are from 2012 and only report average dry-weather flow limit of 0.8 mgd. The numbers that were used in the Draft EIR came from City of Mt. Shasta Public Works Department and the City's engineer, Pace Engineering.

The RWQCB noted that Table 3-1 provides estimated wastewater flows for one and two bottling lines, and the Draft EIR specifies a holding tank size. Given that wastewater generation from the facility will likely often exceed the permitted flow to the City's collection system, the RWQCB requested further clarification describing how the facility will handle the storage of generated wastewater if 1) the City issues a permit restricting the facility wastewater flows to 24,000 gpd at all times, and 2) the City has the discretion to further restrict or prohibit flows to the WWTP whenever the City deems necessary.

Compliance with this mitigation measure will require strict operational controls. By implementing this measure, CGWC can functionally only operate one bottling line, which will discharge wastewater flows to the City up to 20,000 gpd for five days, up to 54,000 gpd on one day, and no discharge on the 7th day since the facility will be closed. Over a seven-day average, with onsite storage of 40,000 gallons, the average flow to the City will be approximately 22,000 gpd. A 10% contingency results in a flow of approximately 24,000 gpd.

Given the WWTP's current challenges with respect to effluent limits for copper and zinc, RWQCB staff is concerned with the potential for additional loading of copper and zinc to the City WWTP due to facility operations (tea and juice), and requests that the Draft EIR, specifically Section 4.12.1.2 and Impact 4.12-1, be revised to provide a brief discussion regarding compliance challenges at the WWTP, and how CGWC's discharge would not cause problems. In response, the authors note that the Draft City Industrial Wastewater Permit lists the limits of copper and zinc and other constituents that CGWC must attain for the City to comply with the RWQCB. To maintain compliance with the City's Industrial Wastewater Permit, CGWC will conduct testing to ascertain the copper and zinc and other constituents in the wastewater and share that information with the City and RWQCB prior to starting full tea and or juice beverage production at the plant. The copper and zinc values presented in the Draft EIR were from CGWC other bottling facilities in Bakersfield and Calistoga which are aging facilities. It is most probable that the copper and zinc is coming from aging copper and galvanized pipes. The Mt. Shasta facility has all new piping, most of which is stainless steel. If for some unforeseen reason that copper or zinc becomes a problem at the Mt. Shasta facility then onsite pretreatment could be implemented. This pretreatment would likely entail coagulation, clarification, and filtration.

Response to California Trout (CalTrout)

Assessment, Monitoring and Evaluation Protocol

CalTrout proposes to require CGWC to provide a conceptual water balance model, accurate water age, aquifer storage capacity, and recharge sources and areas. This proposal is unnecessary as there will be no significant measurable effect on the spring system associated with CGWC's operations. The geology and hydrogeology of the CGWC property has been well evaluated. In addition, long-term spring flow and groundwater level data, including data collected during periods of past plant production and historic drought, show that spring flow will not be significantly impacted. This conclusion was reached independently by several geotechnical/hydrogeologic firms retained to evaluate the hydrogeology of the property, including Slade & Associates, Geosyntec, CH2M, and the Source Group. In addition, CGWC is already subject to monitoring and reporting requirements under WDR Order 5-01-233 for the leach field.

Catchment/Recharge Area

The 7.2 square mile recharge area presented in Appendix P is an estimated primary recharge area for the CGWC site and was developed by Geosyntec to assess potential risks to groundwater quality. Geosyntec considered the recharge area to be highly interpretive. It is common for hydrogeologists to use topographic divides to define recharge areas. It is true that these types of methods do not account for the complexity of the volcanic bedrock geology and the recharge area may even larger. Because of the complexity of volcanic terrain, a very accurate delineation of the

recharge area boundary is not likely possible. CalTrout suggested that the recharge or catchment area for Big Springs, which includes the CGWC property, may be larger. CalTrout's estimates of the Big Springs catchment area are also highly interpretive.

Overall, the precise delineation of the catchment area is outside the scope of the Draft EIR, as the size of the recharge area does not have any direct bearing on the conclusions presented in the Draft EIR that CGWC pumping will be a small fraction of spring flow. These conclusions are supported by independent studies performed by several hydrogeologists (see comment above).

The Lawrence Livermore study (Visser et. al., 2017)[1] provides some insight into the age of the water and the elevation of the recharge areas, but adds little to an understanding of spring flow. The CalTrout data confirms that average spring flow is at least as much as was assumed in the EIR (19 cubic feet per second [cfs]) and that spring flow is relatively high even under severe drought conditions (Cal Trout measured a minimum of 16.2 cfs in 2015). So, even at the lowest reported flow measured under severe drought conditions, Crystal Geyser pumping represents less than 3% of the spring flow. Neither of these data sets provides any data that would change the conclusion that CGWC pumping will be a small fraction of spring flow, as such it will have no adverse effect on the aquifer.

With regard to groundwater flow direction, there is no statement on page 17 of Appendix P that flow from DEX-6 is to the south. Page 9 discusses groundwater flow, based on the SECOR (1998)[2] report, which shows flow to the west and southwest in the near vicinity of DEX 6.

With regard to pumping modeling, the model used by Richard Slade & Associates is based on the Theis equation. The Theis equation and associated assumptions are well established and commonly used to predict aquifer drawdown. In fact, SECOR pump test results show that Theis solutions can be reasonably applied to the fractured volcanic aquifer in the vicinity of DEX-6. In addition, model results are supported by long-term groundwater monitoring results.

Lastly, it has been established that both Big Springs and DEX-6 yield water from the same aquifer based on well logs, cross-sections, and field testing and observations.

Big Springs

CalTrout questions the use of a stilling well to measure flow. The stilling well provides a long-term database for relative water level changes in Big Springs Creek. Although the stilling well has

[1] Visser et. al., 2017, California GAMA Special Study: Tracers of recent recharge to predict drought impacts on groundwater: Mount Shasta Study Area, December 2016 (Revised February 2017).
[2] SECOR International Inc., 1998, Hydrogeologic Evaluation Report, Spring Hill Property, Siskiyou County, California.

not been calibrated to provide measurement of stream flow, the water level in the stilling well does correlate to the flow in the creek, and the data show that water levels and, thus spring flow (the source of water to Big Springs Creek), have been relatively stable since 1999. The database includes periods of drought and wet years. Furthermore, flow data collected by the USGS, CGWC and CalTrout during various years also indicate that creek flow is relatively stable.

CalTrout indicates that "CGWC states that the Big Springs stage could drop about 0.18 feet." This is inaccurate. SECOR (1998) indicated that the pressure head at the spring could decrease by 0.19 feet at Big Springs due to pumping. The Richard Slade & Associates Hydrogeologic Evaluation Report (RCS Report) estimates approximately 0.22 feet and 0.40 feet of drawdown in the aquifer at Big Springs during Phase 1 and Phase 2, respectively. This is the projected change in potential head in the aquifer and cannot be directly equated to a change in stage or creek level.

The Draft EIR impact analysis is based on a spring flow of between 19.2 and 20.0 cfs. The CalTrout data confirm that this is an appropriate range of flow for this analysis. Although the specific flow path between DEX-6 and Big Springs is not known at this time, knowledge of the groundwater flow path is not necessary to support the fact that CGWC pumping represents a small fraction of total spring flow.

Overall, the inclusion of CalTrout data in the Draft EIR would not change the conclusion that there is no significant impact to Big Springs or to the groundwater aquifer due to CGWC's pumping from DEX-6. Big Springs flow has been shown to be generally stable and high flow occurs even under drought conditions, which CalTrout data supports. Relative impacts during extreme drought, average years, and wet years should be similar and, therefore, the Draft EIR reasonably concluded that impacts would not be significant.

Groundwater Geochemistry

We do not agree with the CalTrout letter that a lack of isotope and age dating data at DEX-6 in some way compromises the evaluation of the impact of pumping from DEX-6 on spring flow. It is not necessary to know the elevation of the recharge source and aquifer storage volume to calculate that the proposed pumping from DEX-6 is a small fraction of the measured flow from Big Springs. Whether one of the multiple outlets that make up the Big Springs complex will be affected more than the others really has no bearing on the overall conclusion reached in the Draft EIR (CGWC pumping impact on total Big Springs flow will be less than significant). It should also be pointed out that Cal Trout incorrectly refers to a 12-15 year age of water at Big Springs as measured by Visser et. al., 2017. Visser et, et. al., 2017 indicates that the age of the water at Big Springs was greater than 12 years or greater than 60 years which is in general agreement with past results reported by Cal Trout and SECOR.

Overall, Visser et. al. 2017 provides no insight into spring flow and recent CalTrout data confirm that the spring flow rates used in the Draft EIR are appropriate. No conclusions in the Draft EIR would change if these more recent data were incorporated into a revised draft

Response to Law Office of Donald B. Mooney

Groundwater Characteristics

A review of boring logs and geophysical information presented in SECOR (1998) indicates that groundwater beneath the CGWC property occurs in both alluvial material and fractured andesitic bedrock. The alluvial material is often referred to as the Upper aquifer and the fractured andesite is often referred to as the Lower aquifer. Based on geologic data collected at the CGWC property, groundwater in the alluvial material flows through pore spaces (i.e., porous flow) and groundwater in the andesitic bedrock occurs in a system of fractures (i.e., fracture flow). The proposed production borehole DEX-6 is completed in the andesitic bedrock material (Lower aquifer) and based on the SECOR boring log yields water from a complex network of small fractures. Hydrogeologists would generally not categorize groundwater flowing in porous or fractured lithology as water flowing in a "known or definite channel," nor would this water be considered surface water. Some but not all the groundwater traveling through the aquifer around DEX-6 likely emerges at Big Springs and then becomes surface water.

Furthermore, SECOR (1998) indicates that no lava tubes were identified in the immediate vicinity of the site. A review of the borings logs for DEX-1, DEX-2, DEX-4, DEX-5, DEX-6 and DEX-7 indicates that no lava tubes or relatively large subsurface channel type structures were observed during drilling. Also, geophysical surveys conducted at the site provided no evidence of lava tubes or large subsurface channel type structures. DEX-6 yields groundwater from a dispersed network of fractures in a fractured rock aquifer, not a defined subsurface channel.

Spring water is typically defined as a discharge of groundwater appearing at the surface (Todd, 1980)[3] or a place where a concentrated discharge of ground water flows at the ground surface (USGS).[4] Furthermore, the State of California definition of bottled spring water is as follows:

Spring Water: Water derived from an underground source which flows naturally to the surface of the earth. Spring water must be collected only at the spring or through a borehole tapping the underground source supplying the spring. There must be natural force causing the water to flow to the surface through a natural orifice. Spring water collected with use of external force must:

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[3] Todd, D.K, 1980, Groundwater Hydrology, 2nd Edition
[4] https://water.usgs.gov/water-basics_glossary.html

- be from the same underground stratum as the spring, as shown by a measurable hydraulic connection using a hydrogeologically valid method between the borehole and the natural spring;

- have all the same physical properties and be of the same composition and quality as the water that flows naturally to the surface of the earth through the spring's natural orifice before treatment; and

- not be under the direct influence of surface water.[5]

The State definition of bottled spring water is in accordance with Code of Federal Food and Drug Regulations Title 21 Part 165.110 (2) (vi) federal bottling regulations:

> (vi) The name of water derived from an underground formation from which water flows naturally to the surface of the earth may be "spring water." Spring water shall be collected only at the spring or through a bore hole tapping the underground formation feeding the spring. There shall be a natural force causing the water to flow to the surface through a natural orifice. The location of the spring shall be identified. Spring water collected with the use of an external force shall be from the same underground stratum as the spring, as shown by a measurable hydraulic connection using a hydrogeologically valid method between the bore hole and the natural spring, and shall have all the physical properties, before treatment, and be of the same composition and quality, as the water that flows naturally to the surface of the earth. If spring water is collected with the use of an external force, water must continue to flow naturally to the surface of the earth through the spring's natural orifice. Plants shall demonstrate, on request, to appropriate regulatory officials, using a hydrogeologically valid method, that an appropriate hydraulic connection exists between the natural orifice of the spring and the bore hole.

The water that CGWC is proposing to pump from DEX-6 is groundwater derived from an underground source and, by definition, spring water is a discharge of groundwater at the land surface. The State of California issued a license to Dannon (and now CGWC) that allows groundwater from DEX-6 to be bottled or labeled as spring water. Based on bottling regulations, the State of California would not allow bottled spring water to be under the direct influence of surface water.

[5] https://www.cdph.ca.gov/pubsforms/Pages/fdbBVWfaq.aspx#sprgwtr

Deetz Soils

As provided in Appendix J "A custom soil resource report was downloaded from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) for the planned irrigation area. The soil is Deetz gravelly loamy sand, with 0 to 5 percent slopes. The depth to a restrictive feature is more than 80 inches and the natural drainage class is somewhat excessively drained. The hydraulic capacity of the soil is high to very high and the depth to the water table is more than 80 inches."

A high hydraulic capacity means it has a high infiltration rate. Therefore, the soils are suitable for the leach field and the irrigation area.

Summers Model

The Summers Mixing Model is a standard methodology for screening possible groundwater quality impacts of soil leachate. The Summers model assumes no attenuation of the chemical compounds in the aquifer (other than dispersivity and mixing due to downward movement of water in the leach field area) or in the vadose zone. That is, the model assumes no soil filtering capacity and, therefore, is often considered to be a relatively conservative calculation. The model does assume complete mixing in a calculated mixing zone at a point at the edge of the leach field. The equation used to calculate the mixing zone thickness is presented in Environmental Protection Agency (EPA) documents.[6] The mixing zone and mixing of the effluent would likely increase as groundwater travels further downgradient of the leach field thus further decreasing estimated groundwater quality impacts.

In addition, the authors note that CGWC will conduct monitoring in accordance with WDR Order 5-01-233 and the Supplemental Monitoring and Reporting Program (RWQCB, October 30, 2015) to ensure that groundwater quality will not be significantly impacted. Current WDR monitoring requirements include effluent and shallow groundwater monitoring and the analyses of priority pollutants. Priority pollutant analyses comprises numerous constituents and suites of constituents including Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), pesticides, and metals.

[6] USEPA, 1996, Soil Screening Guidance: Technical Background Document, May 1996, U.S. Environmental Protection Agency, Office of Emergency Response: Washington DC, EPA/540/R-95/128, PB96-963502.

Response to Peter Martin

Wastewater Recycling

Recycling wastewater at the bottling facility is not a viable option. As noted in the above definitions and response to the Law Office of Donald B. Mooney, treated wastewater cannot be bottled and labeled as spring water. With regard to recycling wastewater discharges during production, CGWC is implementing clean-in-place aseptic cleaning, which will greatly reduce wastewater discharge from the plant by tens of thousands of gpd.

Deetz Soils

See above responses to the Law office of Donald B. Mooney. For purposes of the leach field, hydraulic capacity (i.e., infiltration) is of greater concern than filtration. The Summers Model assumes no soil filtrating capacity.

Wastewater Flow

Mr. Martin suggests that wastewater flow from the bottling facility will impact the operation of Mount Shasta's WWTP. Mitigation Measure 4.12-1 of the Draft EIR will significantly restrict daily flows to a maximum of 24,000 gpd, in order to address the capacity issues at the WWTP. The authors note that 24,000 gpd is equivalent to 16.7 gpm over a 24-hour period. This is an extremely small flow for the WWTP. The WWTP has an average dry weather flow capacity of 0.75 mgd (520 gpm), and at that capacity, the bottling facility will only be producing about 3% of the average dry weather flow capacity.

Hazardous Materials

With regard to Mr. Martin's question regarding secondary containment, Appendix G, Sheet 16 of 16 illustrates secondary containment as the equipment is on a concrete slab higher than the concrete floor and concrete stem wall of the building.

Summers Model

The comments presented by Peter Martin regarding the Summers Model are addressed in the above response to the Law Office of Donald B. Mooney.

Response to Dr. Kim Mattson

Big Springs Stream Flow

CalTrout has been measuring stream flow at several locations below Big Springs since 2014. The data from their most downstream gauge (about 50 feet upstream from the I-5 culvert) are shown below:

Table 1. MSSQ gage water year statistics.

WY	Average Stage (feet)	Max Stage (feet)	Min Stage (feet)	Average Flow (cfs)	Max Flow (cfs)	Min Flow (cfs)
2014	1.47	1.50	1.43	21.3	24.8	17.7
2015	1.44	1.51	1.41	18.8	25.4	16.2
2016	1.49	1.59	1.41	23.7	36.6	16.5

[7]

The CalTrout measurements above show average flow of about 21 cfs, in the same range as previously measured by the USGS in the 1980's.

During public comment, Dr. Mattson reported that he has established two staff gauges in the stream below Big Springs and that he has been making streamflow measurements there since 2001. Dr. Mattson reports that his measurements show a 3 cfs decrease in streamflow from year 2001 to 2003 (20 cfs to 17 cfs) and then streamflow remains relatively steady through about 2016. Dr. Mattson suggests that this drop was due to pumping by the previous bottling operations of Danone Waters of North American (Dannon), and subsequently of Coca-Cola Danone (CCDA Waters). Dr. Mattson references a document that indicates that Dannon/CCDA Waters were pumping at 0.3 to 0.7 cfs, but suggests that pumping by Dannon/CCDA Waters may have been more than 0.7 cfs.

As described in more detail in the corresponding Technical Memorandum-Analysis of Groundwater Level Data prepared by CH2M (2017)[8], a review of previous electric power bills related to well DEX-6 was conducted by CH2M engineers, which shows that well DEX-6 was pumped at an average of about 0.3 cfs during 2006 and 2007. Pumping rates then declined, starting in 2008 until the plant closed in 2010. Unfortunately, electric power records are not available prior to 2006. The CH2M analysis illustrates that operation of both bottling lines by CGWC would result in pumping at a similar average rate (0.3 cfs) as Dannon/CCDA Waters' previous operations. There is no plausible scenario where pumping at 0.3 cfs from DEX-6 could directly result in a 3.0 cfs decrease in spring flow at Big Springs, which is almost ½ mile away. As a worst case, the

[7] Source: Annual Summary Report, Investigation and Characterization of the Hydrology, Hydrogeology, and Water Quality of Big Springs, Mount Shasta, California; prepared for: CalTrout; prepared by: Geoscience Services (GeoServ); report date: July 29, 2016.
[8] CH2M, 2017, Technical Memorandum – Analysis of Groundwater Level Data, June 6, 2017.

decrease in spring flow could be no more than the pumping rate, 0.3 cfs, which is a small fraction of the spring flow (less than 2% under normal conditions).

There are other explanations for Dr. Mattson's observations of spring flow decrease between 2001 and 2003. Perhaps the gauge used by Dr. Mattson is in a portion of the stream where the flow is less or stream flow measurements were collected at times of relatively lower seasonal flow. It is also possible that random measurement error contributes to the discrepancy. Even under good conditions with a stable channel profile, the accuracy of direct open channel flow measurement (using a current velocity meter) is about plus or minus 5%. Using a staff gauge, the accuracy decreases to plus or minus 10% under ideal conditions and plus or minus 20% is not unusual (Harmel, R. D., Cooper, R. J., Slade, R. M., Haney, R. L., and Arnold, J. G.: Cumulative uncertainty in measured streamflow and water quality data for small watersheds, Transaction of the American Society of Agricultural and Biological Engineers, 49(3), 689–701, 2006a.) Some of the variability may be due to measurement errors.

Response to Phoenix Lawhon Isler

GAMA Data

There is nothing in the final Lawrence Livermore report (Visser et. al, 2017) that conflicts with the data on which the conclusions in the Draft EIR are based. The Lawrence Livermore study provides some insight into the age of the water and the elevation of the recharge areas, but adds nothing to our understanding of the volume of water flowing from the spring or passing through the aquifer.

It should be noted that age dates provided by Visser et, et. al., 2017 indicated that the age of water at Big Springs was greater than 12 years or greater than 60 years and not 1 to 5 years as reported by the commenter. In addition, the age dates presented by Visser et. al., 2017 are in general agreement with past results reported by CalTrout and SECOR.

The conclusion that CGWC pumping will have less than significant effect on spring flow and water levels in neighboring wells is based largely on water level monitoring data collected at the CGWC site during 10 years of prior bottling facility operations. These conclusions are not dependent on the age of the water or the size of the catchment area or any of the other difficult to measure parameters of the aquifer, but rather on an analysis of actual measurements of water levels in the creek and the wells when the pumping was occurring in the same well and at the similar or greater rates as are currently being proposed by CGWC.

As noted above, an additional groundwater level analysis is also provided concurrently with this report to clearly illustrate with graphs that the changes in water level during previous operations of the facility were related to precipitation, not pumping (CH2M, 2017).

The existing water level and pumping data from prior operations provide sufficient basis to support the conclusions of less than significant effect even without any detailed knowledge of aquifer parameters.

Chemical Interactions

CGWC reports that industrial waste water will be treated in a pH neutralization system before discharge to either the sewer or leach field. Additionally, CGWC reports that their use of chlorine and bleach will be very small relative to the 24,000 gpd of proposed discharge. Therefore, there is no reasonable expectation of potential chemical interactions between the effluent constituents in the wastewater that may be sent to the leach field. The potential production of trihalomethanes from the use of chlorine and bleach is expected to be minimal but will be monitored per WDR Order 5-01-233 and the Supplemental Monitoring and Reporting Program.

Response to Tim Parker

Groundwater

The geology and hydrogeology of the CGWC property has been relatively well evaluated. Previous investigations to the Draft EIR included the completion of approximately fifteen wells and boreholes, preparation of multiple geologic cross-sections, collection and analysis of multiple groundwater samples from numerous wells and springs, aquifer testing in multiple wells, geophysical surveys, tracer studies, and long-term groundwater level monitoring. Long-term groundwater monitoring data include a 10-year period of previous pumping operations that shows no adverse effects from pumping at rates similar to those being proposed. A large amount of hydrogeologic data have been collected at the site and there are sufficient data presented in the Draft EIR to support the conclusion that potential pumping impacts will be less than significant. The fact that the Draft EIR relied on previous investigations to assess potential impacts to neighboring domestic wells and spring flow is both reasonable and judicious.

As shown in monitoring records, the daily water level measurements from DEX-6 from the period when it was pumped at rates comparable to or higher[9] than what is currently proposed show daily drawdown in the pumped well is on the order of 0.5 feet or less. A pumping well is the lowest point in the cone of depression. Drawdown decreases with distance away from a pumping well, so

[9] CH2M Groundwater Analysis

no matter how complex the aquifer conditions, drawdown elsewhere will be less than in the pumping well. Therefore, it is possible to state with confidence that the proposed pumping from DEX-6 will have a minimal, if any, effect on water levels in surrounding wells, because that pumping has a minimal effect on the water levels in DEX-6. In addition, there was no long-term trend of water level decline in the aquifer associated with the 10 years of prior pumping. The changes in water level during this time are associated with changes in precipitation (CH2M, 2017).

Regional Hydrogeology and Modeling

There is agreement that the hydrogeology in the Mt. Shasta area is complex. Regardless, there is sufficient information presented in the Draft EIR to support the conclusion that pumping effects will be less than significant. The available information includes long-term groundwater monitoring data for a 10- year period (years 2001 through 2010) of previous pumping operations that show daily drawdown in the pumping well (DEX-6) is on the order of 0.5 feet or less.

The model used by Slade and Associates is based on the Theis equation. The Theis equation and associated assumptions are commonly used to predict aquifer drawdown. In fact, SECOR's earlier pump test results showed that Theis solutions can be reasonably applied to the fractured volcanic aquifer in the vicinity of DEX-6. In addition, the model conservatively assumes that the Upper aquifer and Lower aquifer are fully connected and model results are supported by long-term groundwater monitoring results for the pumping well. As noted previously, drawdown in the pumping wells will be minimal and drawdown elsewhere will be less than the pumping well, regardless of the complexities of geology and groundwater flow.

Upper and Lower Aquifers

Basic laws of physics dictate that drawdown at any other location, no matter how complex the geology, will be less than in the pumping wells (see above response to Tim Parker under the heading "Groundwater" and response below to Dr. Daniel Axelrod under the heading "Hydrologic Connectivity").

Tracer Test

The hydraulic connection between DEX-6 and Big Springs has been established through aquifer testing and tracer tests. As noted in the response to Dr. Axelrod below, groundwater contour maps clearly show that DEX-6 is upgradient of Big Springs.

The dye tracer test results show that a hydraulic connection exists between wells on CGWC property and Big Springs. The significant dilution of tracer material, as noted by the commenter, is believed to be the result of the high volume of spring flow mixing with the smaller volume of groundwater flowing through the well in which the dye tracer was injected. The fact that the dye

tracer was detected at Big Springs indicates that a hydraulic connection occurs. The consideration of whether the connection is "fairly weak" or "strong" or whether the spring is within the capture zone of the well borehole is not relevant to spring certification rules. Furthermore, these factors are also not relevant to the spring flow impact analyses because the project's proposed pumping volume is a small percentage of Big Springs flow. Because proposed pumping volume is a small percentage of measured Big Springs flow, the Draft EIR reasonably concluded that spring flows would not be significantly impacted.

Groundwater Quality

No significant concentrations of priority pollutants are expected in any groundwater discharge because CGWC uses all food grade products in their bottling process. In addition, the evaluation of impacts provided by the Summers mixing model is generally conservative in nature because the model assumes no attenuation of the chemical compounds in the aquifer (other than dispersivity and mixing due to downward movement of water in the leach field area) or in the vadose zone. The model does not consider dispersion downgradient of the leach field or any retardation or degradation factors. Furthermore, as noted above, CGWC reports that Priority Pollutants along with metals and general minerals, will be monitored in effluent and groundwater in accordance with WDR Order 5-01-233 and the Supplemental Monitoring and Reporting Program.

Also see above responses to the Law Office of Donald B. Mooney under "Summers Model" and Phoenix Lawhon Isler under "Chemical Interactions".

<u>Response to Robert Blankenship</u>

Groundwater – Mounding

Groundwater level data collected in MW-1, MW-2 and MW-3 (monitoring wells adjacent to the leach field) between 2006 and 2017 indicate that very little to no mounding occurred during previous operation of the plant. In addition, based on the estimated permeability of the lithology in the vicinity of the leach field, the relatively large leach field area, and the volume of planned discharge, significant mounding is not expected to occur.

It should also be noted that WDR Order 5-01-233, issued by the RWQCB requires both monitoring of water in the vadose zone and groundwater levels in the Upper aquifer. Thus, potential impacts to groundwater levels due to potential mounding will be monitored during any use of the leach field.

Background Concentrations

Table 4.8.1 lists constituents that were used to model water quality impacts as presented in Appendix H. These constituents are significant "effluent contaminants of concern." For the purposes of the modeling Table 4.8.1 provides reasonable background concentrations for the listed constituents.

Chemical analysis of samples collected from monitoring wells MW-1, MW-2 and MW-3 are presented in quarterly monitoring reports prepared by CGWC's consultant, Geosyntec Consultants. The quarterly reports have been submitted to the RWQCB from 2014 to the present. Samples were analyzed for numerous constituents including general minerals, chemical oxygen demand (COD), coliform, VOCs, SVOCs, pesticides, and metal concentrations. The data will likely be used to establish baseline groundwater quality background in the leach field area for the project.

As presented in Table 4.8.1, the background concentrations of constituents were derived from data collected from monitoring wells MW-1 and MW-2. Monitoring wells MW-1 and MW-2 are located directly adjacent to the leach field and data collected from these monitoring wells were judged to represent the quality of shallow groundwater beneath the leach field or in the close proximity to the leach field (see Draft EIR, Appendix H). Groundwater data collected in monitoring well MW-3, which is located upgradient of the leach field area, indicate that TDS and other general minerals appear to be relatively high in this well compared to concentrations detected in MW-1 and MW-2. Data from MW-3 were excluded from the averages presented in Table 4.8.1 because data from this well were judged not to represent background concentrations directly beneath the leach field. Because MW-3 has poorer groundwater quality than MW-1 and MW-2, the exclusion of MW-3 data leads to a relatively higher estimated background groundwater quality (i.e., better general groundwater quality) beneath the leach field and a more conservative estimate of potential impacts (see above response to RWQCB "Well Identification and Well Data).

For Figure 4.8-1, the locations of monitoring wells MW-1, MW-2 and MW-3 correspond to the locations shown in the April 30, 2013 Golder Associates Monitoring Report, Well Drillers Reports, and those used by CGWC in the quarterly monitoring reports submitted to the RWQCB since early 2014 (Geosyntec Monitoring Reports, Monitoring and Reporting Program 5-01-233).

Piezometer

The commenter is incorrect regarding the statement that the design of the piezometers is a violation of the conditions of WDR Order 5-01-233. For more information, the design of the piezometers is presented in Golder Associates Revised Workplan to Install Leach Field Piezometers, dated August 10, 2006, addressed to the RWQCB. Piezometers P-1 through P-4 were installed to monitor

the occurrence of water in the upper vadose zone. The piezometers were designed to be completed at depth of approximately 5-6 feet bgs. To this date, the piezometers have met the intended purpose of vadose zone monitoring.

To date, the array of groundwater monitoring wells and piezometers installed in the leach field area provide adequate monitoring for shallow groundwater and the vadose zone. CGWC will replace any of these wells and piezometers if required by the RWQCB.

Groundwater Monitoring

CGWC will continue to conduct monitoring in accordance with the current or any future WDR issued by the RWQCB. The requirements of WDR 5-01-233 and the recently issued Supplemental Monitoring and Report Program (RWQCB, October 30, 2015) indicate that quarterly monitoring of groundwater levels in MW-1, MW-2 and MW-3 is required. Consequently, daily measurements or data loggers are not required in these monitoring wells. In the past MW-1, MW-2 and MW-3 have been equipped with data loggers and currently MW-1 and MW-2 are equipped with data loggers. Groundwater level data collected from these three monitoring wells are reported to the RWQCB on a quarterly basis. It should be noted that DEX-6, the Domestic Well, DEX-3A and DEX-1 are also currently equipped with data loggers, and groundwater level data collected from DEX-6, DEX-3A and DEX-1 are currently reported to the RWQCB on a quarterly basis as well.

The commenter is incorrect in stating that WDR Order 5-01-233 requires only annual sampling. The WDR and Supplemental Monitoring and Reporting Program, dated October 30, 2015, requires weekly, monthly and quarterly sampling of effluent. The same Supplemental Monitoring and Reporting Program initially requires quarterly monitoring of groundwater and then possibly annual monitoring of some constituents only if approved by the RWQCB.

Current WDR monitoring requirements include Priority Pollutant monitoring that comprises numerous constituents and suites of constituents including VOCs, SVOCs, pesticides and metals, in wells MW-1, MW-2 and MW-3.

Neither CGWC nor its hydrogeological subconsultants are aware of any groundwater monitoring wells that have been “observed dry over many years,” except for Piezometers P-1 through P-4 which are designed to monitor water occurrence in the upper vadose zone. These piezometers would be expected to be dry by design. Monitoring wells MW-1, MW-2 and MW-3 are designed to monitor the very upper portion of the alluvial aquifer or Upper aquifer. Review of hydrographs and tables presented in the quarterly monitoring reports submitted to the RWQCB by CGWC does not show monitoring wells MW-1, MW-2 and MW-3 going “dry” for long-term, extended periods of time (i.e. “over many years”), if at all. Groundwater levels in MW-1 and MW-3 may have dropped below the bottom of these monitoring wells on a seasonal basis in the past and during the

later portion of the recent historic drought. As of March 2017, there was approximately 8 to 16 feet of water column in the monitoring wells. [10]

Monitoring wells completed on CGWC property were installed by California licensed drillers and currently meet the intended purpose of the monitoring locations.

With regard to well identification, since taking ownership of the facility, CGWC has consistently referred to the wells as MW-1, MW-2 and MW-3 with the associated locations shown on Figure 4.8.1. The locations of monitoring wells, as shown in Figure 4.8.1, correspond to the locations shown in the last Golder Associate monitoring report (Golder Associates, April 30, 2013), the Well Drillers Reports, and those used by CGWC in quarterly monitoring reports submitted to the RWQCB from 2014 to the present (Geosyntec Monitoring Reports, Monitoring and Report Program 5-01-233). CGWC will continue to use the current labels and associated locations unless instructed differently by the RWQCB.

Alleged Violations of WDR Order 5-01-233

CGWC has reported that the RWQCB has not contacted them to report any violations of WDR Order 5-01-233 nor has it issued to CGWC any violations of WDR Order 5-01-233. See above regarding well installation by licensed drillers.

Phthalates

MW-3 is located hydraulically upgradient of the leach field and, consequently, the phthalate detections referred to in this comment are not likely associated with past Dannon or CCDA operations. The phthalate detected in MW-3 is a common laboratory or field equipment contaminant.

CGWC reports that there will be no plastic production occurring at the CGWC facility and, consequently, there is no possibility of solvent or plasticizer contamination associated with the referred to plastic production process.

Response to Dr. Daniel Axelrod

Previous Investigations

The hydrogeologic analysis in the Draft EIR is largely based on information collected from previous investigations, along with operational data collected during previous bottling plant

[10] Geosyntec Consultants, 1st Quarter 2017 Monitoring Report, April 28, 2017.

operations. Such previous investigations involved the completion of approximately 15 wells and boreholes; geologic logging and the preparation of multiple geologic cross-sections; collection and chemical analysis of multiple groundwater samples from numerous wells and springs; aquifer testing in multiple wells; geophysical surveys; tracer studies; and long-term groundwater level monitoring. These investigations were performed by licensed professionals. Long-term groundwater monitoring data include a 10-year period of previous pumping operations that shows no adverse effects from pumping at rates similar to those being proposed (CH2M, 2017). A relatively large amount of geologic and hydrogeologic work have been performed on the CGWC property and the hydrogeology of the CGWC property has been relatively well evaluated. It is reasonable that the Draft EIR, along with the RCS Report, relies on this abundance of previous data to reasonably support the conclusion that potential pumping impacts will be less than significant.

Upper Aquifer

The saturated portion of the shallow alluvium is often referred to as the "Upper aquifer" system and the saturated portion of the underlying volcanic bedrock is referred to as the "Lower aquifer" system by geologists and drillers. These terms are defined in the Draft EIR and appropriate for describing the local hydrogeology of the site.

Previous geologic and hydrogeologic investigations conducted at the site confirm that pumping well DEX-6 is completed in the fractured andesite aquifer, which also is the source of Big Springs. It should also be pointed out that it is not the objective of the Draft EIR to demonstrate hydraulic connection between DEX-6 and Big Springs nor is it especially relevant since the impact analysis on spring flow conservatively assumes total hydraulic connection between DEX-6 and Big Springs.

Geologic Complexity

A relatively large amount of geologic and hydrogeologic work have been performed on the CGWC property. A part of this work was to identify geologic features and structures that could impact groundwater flow. SECOR (1998) does identify a possible fault on the northeast side of Spring Hill and, therefore, likely took this into account in evaluating groundwater flow direction. Overall, the geology beneath the CGWC property has been well evaluated; the hydraulic connection between DEX-6 and Big Springs has been documented; and groundwater flow direction beneath the CGWC property has been well established, based on standard hydrogeological methods. Furthermore, the aquifer response to long-term pumping at rates similar to proposed pumping rates has already been observed during the 10 years when the bottling facility was previously in operation (CH2M, 2017).

Please note the header on Mr. Davisson letter (Supp 1-1) indicates the source of the quote is ML Davisson & Associates, Inc., not UC Lawrence Livermore.

SECOR Report

The commenter summarizes his comments by indicating that SECOR (1998a) was "not designed to check on the effect of industrial pumping on neighboring residential wells." The commenter overlooks the fact that a bottling plant was in operation for approximately 10 years, between 2001 and 2010, and groundwater levels, pumping rates and precipitation data exist for this period of operation (pumping data exists between 2006 and 2010). This set of data is extremely valuable for evaluating the effects of pumping by CGWC. The data effectively provides a 10-year operational aquifer test with pumping from the same well (DEX-6) at rates comparable to those currently being proposed (CH2MHill, 2017). Based on actual data collected over many years, it is possible to make confident and accurate estimates of the effects of the proposed pumping on groundwater levels.

The comment concludes on Page 11 that "an actual field study….is needed before the project is approved". Again, the comment overlooks the fact that the Draft EIR impact analyses for groundwater levels and residential wells relies on a relatively large amount of geologic and hydrogeologic data compiled by several previous investigations, including 10 years of monitoring data collected during actual operations of the plant. As discussed in previous responses, the 10-year monitoring record between 2001 and 2010 shows that the daily water level measurements from DEX-6, when it was pumped at rates comparable to what is currently proposed, indicates that daily drawdown in the pumped well is on the order of 0.5 feet or less. A pumping well is the lowest point in the cone of depression. Drawdown decreases with distance away from a pumping well, so no matter how complex the aquifer conditions, drawdown elsewhere will be less than in the pumping well. Therefore, it is possible to state with confidence that the proposed pumping from DEX-6 will have a minimal, if any, effect on water levels in surrounding wells, because that pumping has a minimal effect on the water levels in DEX-6. In addition, there was no long-term trend of water level decline in the aquifer associated with the 10 years of prior pumping. The changes in water level during this time are associated with changes in precipitation (CH2M, 2017). The impact analysis is further supported by additional analyses (modeling and cross-sectional flow calculations) completed by Slade & Associates in the RCS Report.

Although it is not necessary for purposes of the Draft EIR, our only recommendation for further field studies is for aquifer testing in the domestic well (DOM-1), which Slade & Associates recently completed in conjunction with a subcontractor.

Dacite

The commenter references an unpublished paper prepared by UC Santa Barbara graduate student Ms. Alison Austin regarding the observation of dacite in the Spring Hill area. Dacite and andesite are both extrusive volcanics that are often associated with each other (dacite and andesite mineralogy are slightly different, with dacite containing a slightly higher percentage of silica). Consequently, it is not surprising that Ms. Austin observed dacite material in the Spring Hill area along with fractured andesite. However, licensed professional geologists (SECOR) clearly described rocks encountered in borings completed to the east and south of the Spring Hill Dome, including DEX-6 and DEX-1, as fractured andesite.

Groundwater Flow

The commenter references an unpublished paper prepared by UC Santa Barbara student Ms. Alison Austin, including a groundwater level contour map (Figure 6) that is part of the paper. The paper was attached to Ms. Austin's comment letter. While acknowledging the efforts of Ms. Austin, the interpretation of elevation contours and groundwater flow direction shown in her paper are clearly flawed and, as such, are completely inconsistent with SECOR (1998) and the current interpretation of groundwater flow direction.

First, Figure 6 of Ms. Austin's paper shows groundwater elevations higher in the spring area than in adjacent areas to the north. This would indicate that groundwater is flowing from Big Springs to the north and that the source of Big Springs is from areas south of the spring area. This contradicts all available information and basic hydrogeologic principles. These contours are simply wrong.

To support her contours, Ms. Austin may be referencing a USGS study, also cited by the Law Office of Donald B. Mooney, which lists the Big Springs elevation at 3599 MSL.[11] However, the elevation of Big Springs, as reported by CalTrout in their 2009 Mt. Shasta Springs Summary Report, is 3,567 ft. MSL. The 1998 SECOR report shows Big Springs elevation at 3563.44 ft. MSL. It is unclear how the USGS paper determined the Big Springs elevation, and if the calculation applies to the same location presently analyzed, but in any event the County may reasonably rely on the Big Springs elevations presented by CalTrout and SECOR.

Second, the groundwater flow direction around the lower monitoring wells, shown on Figure 6 as Lower, MW-2, and MW-3, are in direct contradiction to data recently collected by Geosyntec and

[11] Slightly thermal springs and non-thermal springs at Mount Shasta, California; Chemistry and recharge elevations, by M. Nathenson, J.M. Thompson 1, L.D. White, U.S. Geological Survey, Menlo Park, CA 94025, available at: https://pubs.er.usgs.gov/publication/70025915

submitted to the RWQCB which clearly and consistently shows that the groundwater flow direction in this area is westward toward Big Springs (Geosyntec Quarterly Monitoring Reports from 4th Quarter 2015 to present). Ms. Martin's Figure 6 shows a mound or general SE flow in this area, which is not consistent with current data.

Third, Figure 6 apparently shows a deflection along an interpreted fault zone using a queried and dotted arrow located. However, the contours shown do not reflect a deflection, rather a generally consistent SW flow direction. We agree that the elevation contours do suggest the occurrence of a hydraulic boundary, such as a fault or relatively impermeable layer, however, this possible boundary is located east of DEX-6.

The groundwater flow directions and contours shown in Ms. Austin's Figure 6 are incorrect and not consistent with more recent data and interpretations presented in SECOR (1998) nor are they consistent with recent data collected by Geosyntec as part of the WDR monitoring program. Data collected by SECOR and Geosyntec clearly show that the general groundwater flow direction near DEX-6 is generally westward or southwestward toward Big Springs. The commenter's suggestion that groundwater in the DEX-6 area flows towards the east and towards the residential neighbor is not a reasonable possibility based on interpretation of years of measured data.

The author agrees with the comment that "quality and composition" of groundwater is not conclusive proof of a common source. However, similar groundwater quality of two waters provides supporting evidence of a similar source area, and such quality and composition data is used to support certification of spring borehole sources.

Groundwater Drawdown

Dr. Axelrod's comments regarding potential drawdown and impacts on neighboring wells are answered in the above response ("SECOR Report").

By comparing the proposed pumping volumes with spring flow volumes, the Draft EIR conservatively assumes total hydraulic connection. Thus, the impact analysis is considered conservative. If a full connection does not exist between DEX-6 and Big Spring, then even less impact will occur to spring flow. The Draft EIR impact analysis did not and does not need to take in consideration the 1998 SECOR tracer study to analyze potential impacts to groundwater and surface water.

Hydrologic Connectivity

Based on geologic and hydrogeologic data, there appears to be some separation or the occurrence of a semi-permeable hydraulic boundary between the Upper and Lower aquifer systems. Thus, the assumption of 100% connection is conservative. Ms. Austin hypothesized a fault that controls

groundwater flow. SECOR (1998) also suggests that a fault may occur in the Spring Hill area. SECOR (1998) also observed a semi-welded tuff on top of the fracture andesite that could represent a semi-permeable boundary. The evidence for some hydraulic separation or the existence of a semi-permeable boundary between the two aquifer systems are as follows:

First, groundwater elevations in DEX-3a, located east of DEX-6 and completed in the Upper aquifer, are approximately 80 to 90 feet higher than groundwater elevations in Lower aquifer wells to the west (i.e., DEX-2, DEX-4, DEX-6 and DEX-7). The difference in groundwater elevations produces a steep hydraulic gradient from east to west and, thus, the observed tightening of groundwater elevation contours in SECORs groundwater flow map. The unusually steep gradient implies separation.

Second, between 2007 and 2017 there is an observed twelve foot drop in groundwater levels in Upper aquifer well DEX-3A, whereas there is only a two foot drop in DEX-6. This indicates that groundwater potentiometric surface levels behave differently in the two aquifers, which implies at least some hydraulic separation.

Third, pump test data presented in SECOR 1998 suggest relatively smaller drawdown to the east in the Upper aquifer. In addition, during the 10-year period of production in DEX-6, very little daily pumping responses were observed in monitoring well DEX-3A, in the Upper aquifer. The lack of pumping responses observed in the Upper aquifer supports an argument for some hydraulic separation.

Fourth, as noted above, there is geologic evidence of a semi-permeable layer (semi-welded tuff) and a possible fault, both of which could act as semi-permeable boundaries.

Groundwater Modeling

Dr. Axelrod's comments regarding use of the Theis equation are answered in the above response to Tim Parker under "Regional Hydrogeology and Modeling".

With regard to PUMPIT modeling, it should also be noted that the PUMPIT model conservatively assumes that the Upper aquifer and Lower aquifer are fully connected and model results are supported by long-term groundwater monitoring results for DEX-6. As noted above, the assumption of full connectivity is likely conservative. If there are hydraulic boundaries between the production well DEX-6 and neighboring domestic wells, such as a fault or an impermeable lithologic layer, then drawdown predicted by the PUMPIT Model in the nearest wells will be too large and therefore conservative for determining potential impacts to neighboring wells.

As previously discussed in other responses, further testing of DEX-6 is not necessary. The commenter overlooks the fact that the bottling plant was in operation for all most 10 years between

2001 and 2010 and that groundwater levels, pumping data and precipitation exist for this period of operation (pumping data exists between 2006 and 2010). The data effectively provide a 10-year long test with pumping from the same well (DEX-6) at rates comparable to those currently being proposed (CH2M, 2017). With these historic data, along with the results of the past hydrogeologic investigations, it is possible to make confident and very accurate estimates of the effects of the proposed pumping on groundwater levels. The aquifer response to the proposed pumping is known because that response has already been observed during prior operations. The 10 years of pumping equates to a 10-year operational aquifer test and the results of this test indicate that no significant impacts will occur to groundwater levels.

Recharge

Dr. Axelrod's comments regarding groundwater recharge and the specific catchment area relative to DEX-6 and Big Springs is responded to in the above response to CalTrout "Catchment/Recharge Area".

Big Springs

The comment regarding Appendix P, p. 17, Point #8, is not accurate. The Slade & Associates report does not say that "the flow rate in Big Springs has dropped by 17%", rather it compares two measurements of flow conducted in 2014 with an approximate estimate of flow in 1998 and considers these two numbers to be comparable, considering the variability inherent in open-channel stream flow measurement techniques. The spring flow in Big Springs has been relatively stable even through the recent drought years. Based on recent CalTrout information, CGWC's total pumping represents less than 3% of the spring flow, even at the lowest flow measured during the recent drought period. During average or wet years, total proposed pumping represents less than 2% of spring flow. The impact of pumping on spring flow will, therefore, be minimal during drought as well as during average and wet years.

Figure 4.8.4 has been revised. An explanation of the revision is presented monitoring reports submitted to the Regional Board (Geosyntec, 1st Quarter 2017 Monitoring Report, April 28, 2017).

Groundwater in the Lower aquifer and DEX-6 will fluctuate with precipitation as groundwater aquifers are recharged from rainfall and snowmelt that percolate into the subsurface. The seasonal fluctuations observed in DEX-6 are relatively small and chemistry data (bacterial data and Macroscopic Particulate Analysis data) indicate that DEX-6 is not under the direct influence of surface water. The observed groundwater level fluctuations discussed in the comment should not be considered evidence of a direct connection between the Upper aquifer and the Lower aquifer, as suggested. In fact, available data indicates groundwater levels in DEX-6 have fluctuated a total of approximately 2½ feet between 1998 and 2017. This period includes 10 years of pumping

operations (2001 to 2010) and the historic drought period between 2011 and 2015. Therefore, groundwater levels in DEX-6 are without question very stable.

Hydrographs

CGWC has submitted groundwater level data to the RWQCB on a quarterly basis since early 2014. These data are available for public review and include measurements in wells DEX-1, DEX-6 and DEX-3A.

The commenter notes a 6-foot decline in groundwater levels in DEX-3A between February 2007 to December 2008 and implies (but does not state) that this drop may be associated with pumping. The commenter, however, does not present the fact that only a 1-foot drop occurred in DEX-6 over the same period. Furthermore, as discussed in an earlier response between 2007 and 2017, there is an observed 12-foot drop in groundwater levels in Upper aquifer well DEX-3A, whereas there is only a 2- foot drop in DEX-6 completed in the Lower aquifer. Based on basic hydrogeological principles, it is clear that observed groundwater levels changes in DEX-3A are not directly related to groundwater level changes in DEX-6 and associated pumping in DEX-6 (CH2M, 2017).

Water Composition

Overall, DEX-6 and Big Springs water quality data plot in the same location on the Piper Diagram. The commenter has disregarded the fact that only one out of eight Big Springs samples plots in a slightly different location than DEX-6 samples, which can be explained by a variety of reasons including seasonal variations or variations in laboratory and field methodology. Both the Piper and Stiff analyses clearly support the conclusions on water quality and source presented in the RCS Report.

Response to Alison Austin

We have responded to many of Ms. Austin's comments in our responses to Dr. Axelrod above.

Volcanos and Hydraulic Fracturing

The fact that pumping in DEX-6 produces less than a foot of drawdown in the Lower aquifer indicates that stress fields or loading factors in the subsurface will not change significantly and the potential for the proposed pumping operations to generate or induce seismicity is not significant. In addition, the commenter appears to have overlooked the fact that there is currently another major bottling operation in the Mt. Shasta area, that Dannon/CCDA Waters operated a bottling plant for 10 years on the proposed project site, and there are municipal wells in the area which pump at relatively high rates. None of the operations are associated with induced seismicity.

Furthermore, it is inappropriate to compare proposed DEX-6 pumping to hydraulic fracturing (fracking) operations. Fracking is an operation where liquids and sands are injected into production reservoirs at very high pressures whereas proposed pumping operations DEX-6 will extract groundwater from a freshwater aquifer producing relatively small changes in potentiometric head. Fracking is an operation intended to create cracks or fractures in reservoir rock; whereas, pumping in freshwater aquifers has no such purpose or effect.

Response to Joe Abad & Karen Shaneyfelt

Turbidity

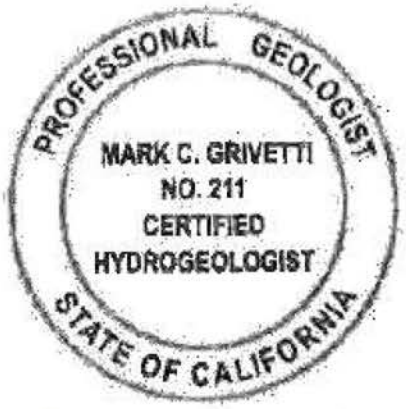
The likelihood that the reported turbidity was associated with DEX-6 pumping is very low for several reasons. First, during Dannon/CCDA Waters production, water levels in DEX-6 fluctuated a total of only 1-2 feet, thus it would not seem reasonable that DEX-6 pumping could significantly impact water levels in a well located over 1,500 feet away. Second DEX-6 and Mr. Abad's well are completed in different aquifers, which should further minimize impacts from DEX-6. Third, if Mr. Abad's problem occurred due to DEX-6 pumping then one might expect other wells in the vicinity to have the same problem. Fourth, turbidity problems in wells are generally associated with well construction problems with the well or over pumping in the well itself. It is more likely that Mr. Abad's turbidity issues are associated with some sort of construction problem in his well such as an improper sanitary seal or a crack in the casing. These types of well construction issues can cause turbidity issues during periods of wet weather, when runoff or shallow groundwater is present and able to seep into the well. During dry weather, when there is no surface or shallow groundwater present, turbidity can return to normal. It is unclear why this pattern reportedly changed when CCDA Waters shut down production in 2010.

* * * * *

The undersigned respectively submit these responses for consideration for preparation of the Final EIR.

Sincerely,

Geosyntec Consultants, Inc.

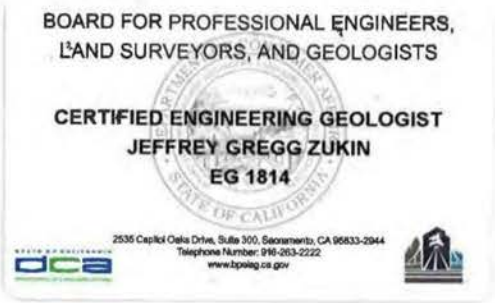


Mark Grivetti, P.G., C.Hg.
Senior Principal Hydrogeologist

CH2M



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Senior Geologist

RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS

MEMORANDUM

July 7, 2017

To: Ms. Ryan Lee Sawyer
Analytical Environmental Services (AES)
Sent via email (rsawyer@analyticalcorp.com)

RCS Job No. 309-SIS01

Re: Review of Geosyntec Consultants and CH2M Replies to Public Comments
Attachments 1 and 3 to Churchill White LLP Letter dated June 8, 2017
For the Proposed Mt. Shasta Crystal Geyser Facility
Mt. Shasta City, Siskiyou County, CA

Dear Ms. Sawyer:

In response to an email request from Bibiana Alvarez of AES on June 12, 2017 in regard to review of the two, above-listed attachments to the Churchill White LLP (CWL) letter of June 8, 2017, RCS herein provides comments to the written reviews of the DEIR by Geosyntec Consultants. Our review, herein, which relates specifically to groundwater resources issues, yielded no significant differences in the findings between our Hydrogeologic Evaluation of the proposed Crystal Geyser bottling facility and the review of the data by the hydrogeological consulting firms of Geosyntec and CH2M. Provided below is our review of the interpretations and methodologies used by those consultants.

ATTACHMENT 1: GEOSYNTEC & CH2M TECHNICAL MEMORANDUM (JUNE 7, 2017).

Responses to CalTrout

Item 1: Well Locations. The reviewers noted that a figure in the DEIR has the shallow monitoring wells mislabeled on one of the DEIR figures (No. 4.8.1). RCS agrees that these wells have been mislabeled on that figure in the DEIR. It should be noted that these wells are not shown in the Hydrogeologic Evaluation by RCS, because that evaluation was focused on the water supply (production) wells and the deeper groundwater monitoring wells both on and near the subject property.

Item 2: Response to CalTrout Comments. Geosyntec/CH2M notes that CalTrout seems to require a conceptual water balance model, an accurate water age, the aquifer storage capacity, and the recharge sources and areas. Geosyntec/CH2M notes that CalTrout's "proposal" is unnecessary as there will be "no significantly and measureable effect on the spring system associated with CGWC's operations." Indeed, RCS generally agrees with that statement because our independent analysis of the data encountered no historical impacts.

Item 3: Catchment/Recharge Area. Geosyntec notes that the catchment area discussed in the RCS hydrogeologic evaluation, which had originally been determined by Geosyntec, is preliminary and interpretive and was developed to determine potential risks to groundwater quality. Indeed, CalTrout reportedly noted that the catchment area

could be larger and that is a possibility. However, the actual size of the catchment area would have minor impact on the ultimate flow of water through the aquifer system, because of the complexities of such systems in volcanic rock areas. RCS agrees essentially with the Geosyntec reply that the CalTrout estimate of the catchment area would also be interpretive.

Item 4: Dating of Springs Water. Visser et al (February 2017) determined the age of the water from various springs under the auspices of the State's Groundwater Ambient Monitoring Program (GAMA) and RCS obtained a copy of and reviewed this relatively recent report (first published in December 2016, followed by a revised version in February 2017) after our hydrogeologic evaluation had been completed. That review set out to address three basic research items:

- Elevation of source area for recharge to the Mt. Shasta groundwater system (of which the Big Springs is a part).
- Characteristics of the flow paths.
- Travel times from recharge areas to discharge locations.

The 2017 Visser study sampled selected wells and springs in the Mt. Shasta area and had the waters tested for the common anions and cations and a suite of geochemical isotope tracers, namely Deuterium (^{2}H)-Oxygen (^{18}O), Helium ($^{3}H/^{4}H$), Carbon ($^{14}C/^{13}C$), Sulfur (^{35}Sr), Sodium (^{22}Na), Tritium (^{3}H), and Krypton (^{85}Kr). As a result of that study, Visser et al (2017) constrained the ages of the water emanating from the Big Springs, in particular, to a general age range of between 15 and 60 years. This is in keeping with previous estimates by SECOR (1998a), which indicated that the water from the Big Springs was greater than 33 years old. Further, the study noted that more than 50% of the water recharging the region area originates at elevations below 6,600 ft whereas the remaining originates at elevations higher than that.

Nonetheless, even though determination of the age and at what elevations the local groundwater resources are emanating may be of some of interest, academically, the Visser 2017 report provided no insight into the dynamics of spring flow and, thus, is of limited use with regard to possible impacts of the proposed bottling facility on that spring; Geosyntec cites as much and we concur.

Item 5: Statement on Page 17 of the Appendix P Hydrogeologic Evaluation. Geosyntec replies to the commenter that it is not stated on that page that groundwater flow direction is to the south. Geosyntec is correct that that comment is not there. Flow has been identified to be to the west and southwest.

Item 6: Pumpit Model used by RCS. Geosyntec supports the use of the model and the Theis solution is applicable. It should be noted that the solution is somewhat conservative in that actually observed water level drawdowns do not approach those predicted by the model.

Item 7: Big Springs. Geosyntec cites the use of the stilling well and other gages showing/indicating flow of the stream and that spring flows have been shown to be relatively stable. RCS agrees.

Item 8: Groundwater Geochemistry. See RCS comment, Item 4, above. RCS concurs that that lack of isotope data has no bearing on the impact of flow on the springs by the pumping of DEX-6 and that the Visser et al (2017) report provided no new insight into the dynamics of flow from the Big Springs.

Responses to Law Office of Donald B. Mooney

An initial response to the law office comments is towards water flowing in a "known and definite channel". RCS has seen no evidence or data to support that claim. Instead, the water pumped by the wells at the proposed bottling is flowing through a fractured rock aquifer systems and would be classified as "percolating groundwater".

The response to those law office comments is focused primarily on the definition of spring water and Geosyntec adequately supports that the water pumped by DEX-6 is, indeed, spring water as defined by Federal Food and Drug regulations. Nonetheless, the definition of whether or not the groundwater pumped from the well is spring water has no bearing on the potential impact of the pumping of the well on the local groundwater resources.

RCS has no comments on Deetz Soils or the Summers Model as these are applicable to discharges from the leachfield. RCS is not an expert in leachfields and thus this item was not evaluated in our 2016 Hydrogeologic Evaluation.

Responses to Peter Martin

RCS has no comments on this set of responses, because those responses address the concerns of Mr. Martin with regard to wastewater and hazardous materials. RCS did not evaluate these aspects of the proposed bottling facility because these items are not within our areas of expertise.

Responses to Dr. Kim Mattison

The replies by Geosyntec are with regard to Dr. Mattison's comment that there is a decrease in streamflow by 3% between from 2001 to 2003 and thereafter streamflow remains constant through 2016. Dr. Mattison suggested that the decrease in streamflow was due to pumping by previous bottling operations. Geosyntec cites that measurement was due to errors possibly associated with the location of the gages that were used, and/ or collection of the data during a period of relatively low flow (such as during the late summer). Open channel flow measurements can reportedly have an error of ±5%. RCS understands that open channel measurements and measurements using different gages and/or at different times of the year can be subject to wide variations.

It should be noted that our review of the stream gage measurements (Figure 8 in the Hydrogeologic Evaluation) actually appears to show a general increase in stream flow measurements during the 2001 to 2003 period at the "Stilling Well", which seems to contradict Dr. Mattison's reported decrease during that same time period.

Responses to Phoenix Lawson Isler

Phoenix Isler reportedly cites the Visser et al (2017) report and age dating of the water. Our comments in Item 4, above, applies here also. Further, Geosyntec notes that the water level and pumping data from prior operations provide sufficient basis to support the conclusions of the DEIR in regard to the potential impacts from the future pumping being less than significant.

A recent aquifer test of the Domestic well also revealed no significant potential water level impacts to nearby wells.

Responses to Tim Parker

RCS generally agrees with the comments provided by the other consultants in regard to the items noted by Tim Parker. These are as follows:

- There are adequate background data geologic and hydrogeologic data with which to evaluate the aquifer systems in the region.
- Daily drawdowns in DEX-6 are 0.5 ft or less and this is observable in the water level data. Further, the pumping well is the center of the cone of depression and as a result all other water level drawdowns at wells located at any distance radially outward from that pumping well will be less than that in the pumping well, even in volcanic rock terrane. This is corroborated by the modeling by RCS using the Theis solution.
- Dye tracer testing did indicate some degree of hydraulic connection between the Big Springs and DEX-1 and aquifer testing illustrated that pumping of DEX-6 affected water levels in DEX-1. If there were no hydraulic connection then no dye would have been detected, regardless of the concentration of dye used. Nonetheless, if the results of tracer and aquifer testing indicated no hydraulic connectivity then the impact of the pumping of the plant would have absolutely no impact. Thus, because a connection has been established, then pumping for the plant will have some effect on spring flows, but only with regard to impact to the water level in a theoretical well at the spring; this impact was shown to be on the order of 0.22 to 0.4 ft for Phases 1 and 2 pumping, respectively, and this was deemed to be insignificant in the RCS evaluation.

Responses to Robert Blankenship

RCS has no comments on this set of responses, because those responses address the concerns of Mr. Blankenship with regard to groundwater mounding, background water quality and groundwater monitoring at the proposed bottling facility's wastewater leachfield. RCS did not evaluate these aspects of the proposed bottling facility, as stated above.

Responses to Dr. Daniel Axlerod

Residential Wells

Geosyntec summarizes that some previous hydrogeological investigations collected and evaluated abundant groundwater data regarding local geology, the upper and lower aquifer systems, the local water wells, and the geological complexity in the area; RCS concurs with their discussions. Geosyntec does also cite a comment by Dr. Axlerod in which the SECOR 1998a report was "not designed to check on the effect of industrial pumping on neighborhood residential wells." It is agreed that the focus of the SECOR 1998a report was not on the residential wells. However, RCS addressed this in its Hydrogeologic Evaluation in the DEIR. Indeed, it is problematic, at best, to measure and rely on residential wells for data collection; potential impacts on such privately-owned wells can and have been evaluated using other methods (e.g., modeling).

Allison Austin Paper

Geosyntec also cites an unpublished paper (a copy of which has been recently received by RCS) prepared by a Ms. Allison Austin (February 2017) on the volcanics of Spring Hill (which RCS. In that paper, Ms. Austin prepared a map showing groundwater elevation contours and groundwater flow directions which Geosyntec stated as being "clearly flawed and, as such, are completely inconsistent with SECOR (1998) and the current interpretation of groundwater flow direction." In particular, Geosyntec notes that Ms. Austin is using an elevation for the spring of 3,599 ft above mean sea level (msl), as obtained by a paper in the Journal of Volcanology and Geothermal Research. However, according to Geosyntec, CalTrout and SECOR both determined the elevation was lower (I.e., 3,567 ft and 3,563 ft above msl, respectively). The latter two elevations are documented as such in the CalTrout (SGSI, 2009) and SECOR (1998a) reports and, consequently, Ms. Austin's contours are in error and Figure 6 requires a revision. Also, our review of Figure 6 revealed an interesting "bullseye" pattern around MW-3, with higher elevations along the outer "rings" and lower elevations along the inner "rings". Such patterns are typical of pumping depressions. However, MW-3 it is a monitoring well and not a pumping well and thus that water level at MW-3 is likely a monitoring or a reporting error. It appears Ms. Austin has based the interpretation on only one water level measurement. Geosyntec notes that water level measurements were collected as a part of the Waste Discharge Requirements (WDRs). RCS looked at the data presented within the 2nd Quarter 2016 Monitoring Report, for the facility; we agree that those water levels in the monitoring wells indicate a flow generally to the west. Thus, RCS concurs with Geosyntec that the map may not accurately depict groundwater flow directions. This is because the plotted water level data are not complete (e.g., missing water levels from MW-1 and MW-2.

Groundwater Drawdown and Hydrologic Connectivity & Separation

Geosyntec correctly points out the RCS has assumed a 100% connection between the Upper and Lower Aquifer systems; RCS did treat the two as one continuous system for the purpose of being conservative. Also, Geosyntec notes evidence for a possible separation between the two aquifer systems such as:

- A difference in water level elevations of approximately 80 to 90 ft between water levels in DEX3a and other DEX wells located to the west.
- A 12-foot drop in water levels in DEX-3A compared to only a 2-foot drop in DEX-6 showing that the water levels may behave differently in the two aquifers.
- Aquifer testing results by SECOR (1998a) showing a smaller degree of drawdown in the upper aquifer system.
- The presence of a semi-welded tuff on top of the fractured volcanic rock aquifer, which could represent a semi-permeable boundary.

RCS generally concurs with this assessment. Indeed the results of recent aquifer testing conducted on the Domestic Well, conducted in May 2017, also indicated a lack of response in both monitoring wells DEX-3A and DEX-3B. This also provides additional evidence for some degree of separation between the deeper fractured rock aquifer system and the upper alluvial aquifer system.

Groundwater Modeling and Recharge

See previous comments above. RCS agrees with these comments.

Big Springs

As noted by Geosyntec, RCS did not state that the flow rate of the Big Springs has "dropped by 17%". RCS also agrees with all subsequent comments presented by Geosyntec in this section.

Hydrographs

Geosyntec notes in its reply to Dr. Axelrod that significantly larger declines in water levels (as shown in the hydrographs) occurred in DEX-3A (6 to 12 ft) in comparison to those in DEX-6 (1 to 2 ft) over the same time periods. RCS essentially agrees with this reply.

Water Composition

RCS did show in its October 2016 Hydrogeologic Evaluation that the overall water quality character between DEX-6 and the Big Springs, as shown on Piper and Stiff diagrams in that report, is essentially the same.

Volcanoes and Hydraulic Fracturing

As indicated by Geosyntec, it is highly unlikely that pumping of any of the wells in the vicinity of the proposed bottling plant will induce seismicity, as suggested by Dr. Axelrod. If not, former pumping operations at the plant (and even by others in the area) would have already induced such seismicity.

Responses to Joe Abad and Karen Shaneyfelt

RCS agrees with the Geosyntec replies with regard to increased turbidity in the cited well. It should also be noted that no other evidence or data, other than anecdotal accounts, have been provided by those commenters (e.g., in regard to actual turbidity measurements).

ATTACHMENT 3: ANALYSIS OF GROUNWATER LEVEL DATA BY CH2M (JUNE 6, 2017).

CH2M provides their comments using an analysis of the available water level data and presenting a number of graphs to illustrate the changes in these levels. In addition, CH2M also provides estimates of pumping rates based on electrical (power) records; those same data on pumping rates were not available for the 2001 through 2005 time period when Coca-Cola Dannon Waters (CCDA Waters) was operating the facility.

Part I – Overview of Available Data

Groundwater Levels

CH2M focused on the use of water level data from DEX-3A and DEX-6, which seems appropriate for their analysis. In essence, RCS notes that the twice per day measurements showed a daily variation in those measurements, which was used later on in their reply.

Estimation of Pumping Rate

In particular, their method of estimating the pumping rate based on the available electric records, depth to water and estimates of working pressures in the pipeline are sound, in the

absence of other, more definitive data. Indeed, this is an accepted alternative method of estimating pumping rates in the industry in the absence of actual flow meter data. However, CH2M did plot those data (their Figure 1) relative to the RCS averaged pumping rates during operational plant phases 1 and 2, for DEX-6 (as calculated in the RCS October 2016 Hydrogeologic Evaluation) for the proposed facility; it should be noted that those averaged rates are over a 365-day time period whereas CH2M plotted monthly variations. Nonetheless, the plots did illustrate that relative to an average pumping rate for the two operational phases for the plant in the future, the 2005 through 2007 pumping rates were generally higher than both phases and after 2006 certainly higher than Phase 1 of the plant operations. Based on this, CH2M concludes that the effects of Phase 1 of the proposed bottling facility will be less than that of CCDA pumping, whereas the effect of Phase 2 will be essentially the same as CCDA pumping.

Precipitation Records

CH2M also used the same precipitation records as did RCS in its October 2016 Hydrogeologic Evaluation, that is from the same rain gage (the Mt. Shasta gage), and also from one additional rain gage (Sand Flat). RCS accepts the use of these data.

Part II – Analysis of Available Data

CH2M generally states that the recorded data during the pumping from DEX-6, between January 2001 and December 2010, effectively constituted a 10-year long aquifer test and that the aquifer response to the proposed pumping is known because that response has already been observed during the prior CCDA operations. In its analysis, CH2M used a number of graphs, as follows:

(1) Water level elevations plotted along with pumping rates in DEX-6 over the 2001 through 2014 time period.

(2) Water level elevations in DEX-3A plotted along with pumping rates in DEX-6 over the 1998 through 2016 time period.

(3) Water level elevations in separate plots on a monthly basis for each year, for the 2004 through 2010 time period. I

(4) Water level elevations in separate plots on a monthly basis for each year, for the 2000 through 2007 time period.

(5) Water level elevations in DEX-6 compared to 2-year average precipitation totals for the 2001 through 2016 time period for the Mt. Shasta and Sand Flat rain gages.

(6) Water level elevations in DEX-3A compared to 2-year average precipitation totals for the 1997 through 2016 time period, for the Mt. Shasta and Sand Flat rain gages.

The use of these graphs is appropriate and they provide another method of reviewing the data from the wells. In essence, our review of the CH2M plots yielded the following:

(1) Water level elevations generally declined throughout the 2006 through 2010 time period. In addition, pumping rates also declined through this time period. However, the RCS Hydrogeologic Evaluation revealed that precipitation was generally decreasing between 2006 and 2008 but then exhibited an increasing trend between

2009 through 2012, followed by another declining period through 2016. It should be noted that in the CH2M figure for DEX-3A, water levels exhibited an increase between 2006 and 2007, when precipitation was decreasing, and this was followed by a water level decline from 2007 through 2017. However, water level data are missing for the well between 2007 and 2013, so it is difficult to determine the response in water levels to rainfall or to pumping. Nonetheless, it may be inferred, based on the data prior to 2007 and after 2013, that there is more a correlation between declining rainfall and water levels than declining pumping and declining water levels. That is, if pumping was providing the greatest impact on water levels, then it is likely that declining pumping will have shown an increase in water levels, which generally appears not to be the case. Thus, we can deduce that rainfall appears to be the predominant agent in the change in water levels in DEX-3A.

(2) Water levels in DEX-3A appeared to have been rising relative to the period of greatest pumping in DEX-6, but declining relative to the period of declining pumping in DEX-6. The converse should have occurred if pumping of DEX-6 had in any way affected water levels in DEX-3A.

(3) This series of plots show the changes in static water levels in DEX-6, with a maximum recovery ranging from 0.5 ft to 0.75 ft (depending upon pumping rates), over a "typical" holiday period (last week in December) when operations at the plant were, essentially, over for the season.

(4) This series of plots show changes in static water levels in DEX-3. The changes in water levels appear to indicate no significant changes over the same holiday period (above), when pumping by DEX-6 was much reduced. Closer comparison of the two graphs in (3) and (4) appear to indicate that for at least one year (2006), pumping in late December of that year appeared to indicate a drop in static water levels in both wells. However, a definite correlation could not be seen regularly over the entire year in that graph nor in a comparison between each of the years.

(5) The water levels in DEX-6, for this plot, do show some degree of correlation between those water levels and the 2-year average precipitation totals. However, CH2M notes an 8-month lag in the data between the precipitation and the change in water levels.

(6) The water level changes in DEX-3A also correlate well with the rainfall data, with the same approximate degree of lag as noted above for DEX-6.

Based on the above series of graphs, CH2M concluded the following:

- No correlation exists between the pumping of CCDA Waters wells and long-term trends in water levels in DEX-6 and DEX-3A.
- The average daily drawdown caused by the pumping of DEX-6 at an average of 139 gpm will be no more than 0.75 ft anywhere in the aquifer system.
- Drawdown in neighboring wells caused by pumping in DEX-6 will be much less than 0.75 ft and likely not measureable.
- The long-term water level trends in both the deep and shallow aquifer systems can be correlated to changes in precipitation.

- The shallower aquifer is more affected by changes in precipitation than is the deeper aquifer system, and changes in water levels observed in DEX-3A are not the result of pumping by DEX-6.

The evidence provided by CH2M seems to support their conclusions. Indeed, RCS's independent evaluation has shown that precipitation is the major factor that influences water levels in wells in the area and that pumping of DEX-6 and the Domestic Well will not cause any significant water level drawdowns in the wells.

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