# COMPLIANCE PROGRAM
## HEXAVALENT CHROMIUM MAXIMUM CONTAMINANT LEVEL
## (Cr6 MCL)

## Water Supply Alternatives Analysis / Feasibility Study Report

*Prepared for:*

**Santa Ynez River Water Conservation District**
**Improvement District No. 1**

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# LIST OF ACRONYMS AND ABBREVIATIONS USED IN DOCUMENT

| | |
|---|---|
| **ADD** | Average Day Demand (Water Consumption) |
| **AF** | Acre Feet (the volume of water to cover one acre one foot deep) |
| **BAT** | Best Available Technology |
| **Cr6** | Hexavalent Chromium |
| **CWG** | Consultant Work Group |
| **CDPH** | California Department of Public Health |
| **CEQA** | California Environmental Quality Act |
| **District** | Santa Ynez River Water Conservation District, Improvement District No. 1 |
| **ESA** | Endangered Species Act |
| **GPM / gpm** | Gallons Per Minute |
| **MCL** | Maximum Contaminant Level |
| **MDD** | Maximum Day Demand (Water Consumption) |
| **MHD** | Maximum Hour Demand (Water Consumption) |
| **POE** | Point of Entry |
| **PPB / ppb** | Parts Per Billion |
| **OEHHA** | Office of Environmental Health Hazard Assessment (California) |
| **RWQCB** | Regional Water Quality Control Board |
| **SWP** | State Water Project |
| **SWRCB** | State Water Resources Control Board (California) |

# 1 EXECUTIVE SUMMARY

The California Department of Public Health (CDPH) adopted a maximum contaminant level (MCL) for hexavalent chromium (Cr6) in drinking water of 10 parts per billion, effective July 1, 2014. In anticipation of this new standard being set, the Santa Ynez River Water Conservation District, Improvement District No. 1 Board authorized formation of a Consultant Work Group (CWG) to evaluate Cr6 presence in the District water supply, and to investigate various alternatives capable of achieving compliance with the new Cr6 MCL.

This report provides the results of effort by the Consultant Work Group, including multiple rounds of water quality sampling and well profiling to characterize the average concentration of Cr6 from each of the District Upland Wells; comparison of available treatment technologies for removal of Cr6 and conceptual design of treatment facilities; comprehensive hydraulic analyses addressing potential water blending between multiple wells and distribution of water among and between the existing District water zones; conceptual engineering design of a dedicated distribution system for irrigation water, separate from the domestic water distribution system; and quantification of water supplies from all sources available to the District, with consideration for augmenting those supplies not containing Cr6.

Water quality sampling and well profiling efforts concluded that naturally occurring Cr6 concentrations vary between the District Upland Wells. Four (4) of the eleven (11) total District Upland Wells were demonstrated to have Cr6 concentrations consistently above the 10 ppb Cr6 limit. Several other wells were demonstrated to have Cr6 concentrations hovering just below the 10 ppb Cr6 limit. Well profiling conducted for several of the Upland Wells identified elevation zones with high Cr6 concentrations, which contributed to the overall Cr6 concentration in produced water being very close to the 10 ppb Cr6 limit. Preventing water from entering the well casing from the higher Cr6 elevations could result in produced water which is well within the Cr6 MCL; this could theoretically be achieved using packers. Another potential approach for wells with total Cr6 concentrations very close to the Cr6 MCL would be to blend this well's water with another well that is producing water containing very low Cr6 concentrations. The water blended from the two well sources would then have Cr6 concentrations well within the MCL.

The CDPH has approved several treatment methods for removal of Cr6 from municipal drinking water, which have been identified as Best Available Technologies (BAT). The approved BATs include Reverse Osmosis (RO), Anion Exchange, and Reduction-Coagulation-Microfiltration (RCMF). Each of these technologies was examined for potential treatment of Upland Well water containing Cr6 concentrations above or near the MCL. RO was found not to be feasible for the circumstances present at potential treatment facility sites, and with the Cr6 concentrations identified. Both strong base anion (SBA) and weak base anion (WBA) exchange treatment could be feasible for removal of identified Cr6 concentrations from Upland Wells, as would RCMF. Conceptual layouts for both types of treatment plants have been developed as part of the alternatives analysis.

The District water storage and distribution system consists of three different pressure zones. Comprehensive hydraulic analysis was conducted as part of the feasibility study, in order to determine the ability to move water from any supply source throughout the distribution system. The hydraulic analysis also evaluated equipment and infrastructure necessary to support blending of water from multiple wells as well as raw water delivery to potential treatment plant locations and distribution of treated water. Additional lines, upsized lines, booster pumps, and additional water storage capabilities could be needed to support blending, treatment, or inter-connection of the existing distribution zones. The hydraulics analysis also evaluated establishment of a separate distribution for irrigation water, which would be supplied from wells with Cr6 concentrations above the MCL, one well with high nitrate (Well 3), and the gallery well. Such a system would involve a high redundancy of distribution lines, over and above the existing distribution system.

The CWG identified a total of six (6) different alternatives that could be employed by the District to achieve compliance with the Cr6 MCL. The identified alternatives are considered the building blocks for a potential integrated and comprehensive solution to be implemented by the District. The six alternatives include:

Alternative 1: Blending of Water from Multiple Wells/Sources

Alternative 2: Separate Piping for Irrigation Water

Alternative 3: Surface Water Treatment for Gallery Well

Alternative 4: Minimize Use of Upland Wells with High Cr6

Alternative 5: Treatment Systems for Selected Upland Wells

Alternative 6: Well Improvements (Modifications)

Each of the above technology alternatives has the capability of addressing, in some manner, elevated Cr6 concentrations in the District domestic water supply. However, use of a single technology in isolation would not necessarily achieve the highest efficiency or greatest ability to meet the water supply objectives of the District. Therefore, the next step was to develop "Solutions Packages" or "Complete Options" that combine various technology alternatives.

Following development and analysis of the six technology alternatives, complete options (implementation solution packages) were developed by combining appropriate alternatives. The CWG created a total of twelve separate "Complete Options" that include the full spectrum of combined alternatives - "Bookend to Bookend" (from "No Action" on the one end all the way to "Treat Everything" at the other end). The Complete Options were each designated with a letter "A" to "H".

The Complete Options were then evaluated to determine relative ranking of each in meeting District objectives. The three criteria used in the ranking determination are: 1) Water Quality Assurance; 2) Water Production Reliability; and 3) Annualized Cost.

The ranking evaluation resulted in the identification of three complete options which achieved the highest scoring; the CWG believes these three top-ranked Complete Options represent the best available solutions out of the total twelve studied, and therefore selection of a Complete Option for implementation should be made from among these three finalists.

Complete Option A achieved the highest ranking according to the applied criteria. Complete Option A represents the "full treatment" solution. Treatment would be provided for any well with produced water containing Cr6 concentrations above or near the MCL, and for the Gallery Well. Complete Option A consists of the following components:

- Five treatment plants (four groundwater and one surface water)
- All Upland wells in full production
- Reactivation of wells 1 and 3 in Santa Ynez
- Activation of the Gallery Well as a potable water source

Complete Option D achieved the second highest scoring in the ranking evaluation. Complete Option D (as well as variants D-P and D-C) can be characterized as a "two treatment plant" solution. The Gallery Well would not be treated, and Upland Wells with production water Cr6 concentrations near or marginally over the MCL would be addressed either with blending or well modification. Complete Option D consists of the following components:

- Two groundwater treatment plants
- Reactivation of Wells 1 and 3 in Santa Ynez
- Blending two marginal wells with compliant water
- Packers on two wells, as an alternative to blending, or combined with blending

Complete Option E achieved the third highest scoring in the ranking evaluation. Complete Option E (as well as variants E-P and E-C) can be characterized as a "one treatment plant" solution. Option E relies more heavily upon blending and well modification to address all but the most severely Cr6 impacted wells. The Gallery Well would not be treated. Complete Option E consists of the following components:

- One groundwater treatment plant
- Reactivation of Wells 1 and 3 in Santa Ynez
- Blending three marginal wells with compliant water
- Packers on one to three marginal wells, as an alternative to blending, or combined with blending

# 2 INTRODUCTION

## 2.1 Purpose

The purpose of this report is to summarize analyses and conclusions of a technical Consultant Work Group (CWG) assembled by the Santa Ynez River Water Conservation District, Improvement District No. 1 (District), whose assignment was to develop and evaluate a wide range of alternative solutions to achieve compliance with the adoption of a new maximum contaminant level (MCL) drinking water standard for hexavalent chromium (Cr6).

The reader is referred to the Appendices to this report for the detailed technical memos or reports from which the summary discussion in this Report is derived.

## 2.2 Background

### 2.2.1 Existing Water Supply

Water supply is best understood with some reference to the water consumption demands of District customers. The metrics used to describe demand include: average day demand (ADD), maximum day demand (MDD), and maximum hour demand (MHD). ADD for this discussion is based on the maximum annual water production during the most recent 10 year period. During the last 10 years (2004 to 2013) the annual water production for the District ranged from 4,850 to 6,274 acre-feet and averaged 5,582 acre-feet. The maximum annual water production occurred in 2007. An ADD based on the 2007 annual water use of 6,274 acre-feet equates to 3,890 gallons per minute (gpm). The maximum day demand (MDD) for the peak summer day occurred on July 12, 2006 with a flow rate of 9,527 gpm (2004 to 2013 period of record). The maximum hour demand (MHD) for the maximum summer day for each year occurred on June 21, 2008 with a flow rate of 14,175 gpm. The maximum day and maximum hour demand for frost protection of 22,701 gpm occurred on April 9, 2011.

Historically, the water supply from upland wells, river wells, Lake Cachuma and State Water Project (SWP) has been needed to satisfy the MDD of 9,527 gpm. For reference, the production capacity of the 11 upland wells has historically been approximately 7,200 gallons per minute, therefore providing the capacity to meet approximately 76% of the MDD. The remaining 24% of MDD has typically been met using river wells and Mesa Verde Pump Station which provides Lake Cachuma water, and to a lesser extent, from SWP deliveries.

On January 17, 2014 the Governor Declared a Drought State of Emergency, which called for conservation State-wide, directed the State to manage water for drought and called upon all Californians to reduce their water usage by 20 percent. Subsequently on January 21, 2014 the Santa Barbara County Board of Supervisors declared a County-wide drought emergency. The Board of Trustees declared a Water Shortage Emergency and adopted a Stage 1 Water Supply

Shortage on June 17, 2014 in response to surface water supply shortages caused by the drought conditions.

Based on the Governor's executive order, the State Water Resources Control Board ("SWRCB") adopted on July 15, 2014, the Emergency Regulations for Statewide Urban Water Conservation to address the prolonged drought in the State. The Office of Administrative Law reviewed and approved the Regulations which were filed with the Secretary of State on July 29, 2014 making it effective until April 25, 2015, unless extended or repealed.

The District's water supplies continue to be constrained from the drought conditions. The water levels in the operating Upland wells generally continue to decline and monitoring has indicated that the levels are now down by 60 feet. With the decline in these levels, water production is impacted resulting in lower gallon per minute flows. As an example, well 25 that produced 975 gpm, is now producing at 930 gpm with a level of decline of 54 feet. Production is expected to continue to ramp back from today's quantity across a continuing sustained drought, as ground water levels decline. The remaining Upland wells are experiencing the same effects.

In addition, extreme dry conditions continue to prevail across the State of California and locally for a successive third year with rainfall amounts in 2014 being the third lowest on record. In the local watershed, which is the source of runoff into Santa Ynez River, the Antecedent Index (AI) or the rain needed to saturate the soil to create runoff, is as dry as the level experienced in the 1988-91 drought. The rainfall in 2014 at Cachuma is only third lowest total since rainfall recording began in 1953. The sustained drought has resulted this year in a 55% reduction in the delivery of water from Lake Cachuma. The conditions described above have changed the water supply balance with Cachuma providing 16% of the total demand, 0% from the SWP, 34% of the water supplies from the Santa Ynez Upland Groundwater Basin, and approximately 50% from the Santa Ynez River wells.

In order to meet regional demand, water from the Cachuma Project that was being stored for the new water year beginning October 1, is now being used. Should the drought conditions prevail into next year, the District's sources will be greatly depleted in relation to this supply. For water year 2014/15, the District will only receive 45% or 1,193 AF of its 2,651 AF entitlement. Since SWP water availability is questionable next year (this year, project participants received only a 5% allocation) and a certain amount of 2014 Cachuma water is planned to be "banked" in the event of the dry conditions prevailing through the next rainfall season for 2015, the importance of the District's Upland and River Wells is paramount.

### 2.2.2 Occurrence of Chromium in Groundwater

The presence of chromium in groundwater can be derived from either or both natural and anthropogenic (i.e., man-made) sources. Locally, chromium is only found in chromium-rich rock formations and as natural deposits weathered from these materials.

As a naturally-occurring metal found in certain ore deposits (principally chrome ore or chromite), chromium is present throughout California. In fact, California's official State Rock is Serpentine, a shiny, green and blue rock that contains the State's principal deposits of chromite. Bordering the Santa Ynez Valley to the north are the rising San Rafael Mountains that are the source of the deposits of the Paso Robles Formation of the Santa Ynez Upland Groundwater Basin. The San Rafael Mountains are also part of the contributing watershed that provides recharge to the basin. The Franciscan Formation dominates the geology of these mountains, which locally include a serpentinite matrix known to contain chromite. Active geochemical processes in the environment favor the oxidation (the loss of electrons) of the Cr3 in chromite ($FeCr_2O_4$) to form Cr6, the more soluble form of chromium. The increased solubility of oxidized chromite means that it can more easily be dissolved in groundwater. As a result, groundwater flow through the aquifer results in the presence of Cr6 in the Santa Ynez Upland Groundwater Basin. Unlike an isolated contaminant plume of Cr6 from an industrial source, water will continue to react with chromium-bearing deposits in the Paso Robles Formation, resulting in a continuous source of Cr6 in the local groundwater.

Anthropogenic Cr6 contamination of groundwater has occurred in several industrialized areas of California from the use of chromium in chrome-plating, wood preservatives, paint pigments, manufacturing of stainless steel, and other industrial processes. This is not a contamination source affecting the Santa Ynez Upland Groundwater Basin.

### 2.2.3 Regulatory Framework

In 2001, the California state legislature mandated under SB351 that a state regulation be established to limit the concentration of hexavalent chromium (Cr6) in drinking water. This launched several years of study into the appropriate maximum contaminant level (MCL) to protect public health, sampling to measure the occurrence of Cr6 and Total Cr in drinking water systems, and testing of treatment technologies for Cr6 removal. A substantial factor in the timing of the release of the final Cr6 MCL was the litigation promulgated by the Natural Resources Defense Council, Environmental Working Group and Clean Water Action. These groups commented on the Draft MCL (10 ppb) stating that it failed to meet the CPDH statutory obligations to set the level as close as possible to OEHHA's PHG, and to place primary emphasis on public health. CDPH accelerated the release of the MCL in response to the litigation, but retained the draft MCL level of 10 ppb.

California Department of Public Health (CDPH) finalized the MCL of 10 parts per billion (ppb) for hexavalent chromium (Cr6) effective July 1, 2014. The total chromium (total Cr) MCL remains at 50 ppb.

### 2.2.4 Health Effects

Chromium has two preferred oxidation states, trivalent and hexavalent (Cr3 and Cr6). Trivalent chromium is an essential element in diet and has a very low toxicity level. Hexavalent chromium, on the other hand, has been identified in recent studies as carcinogenic by the oral route of exposure. Specifically, high concentrations of Cr6 in water given to mice and rats over a two-year period resulted in the formation of tumors affecting the tongue, mouth, and intestines (National Toxicology Program [NTP] 2007).

Chromium derived from both natural and anthropogenic sources is present in municipal drinking water throughout California. In 2011, the State of California Office of Environmental Health Hazard Assessment (OEHHA) set a new public health goal (PHG) for concentrations of hexavalent chromium in drinking water of 0.02 parts per billion (ppb). At this level, OEHHA estimated that there would be no discernable risk associated with inhalation, ingestion, or other contact; detailed studies of low concentration (low dose) Cr6 exposure were not available at the time OEHHA established the PHG, and therefore an extremely conservative and unsubstantiated value was employed. In contrast, the application of U.S. EPA risk assessment methodologies using data developed in more recent mode of action (MOA) studies supports a safe drinking water level higher than the current federal MCL for total chromium of 100 ppb.

Following circulation and review of the Draft MCL with a proposed limit of 10 ppb for Cr6, CDPH eventually adopted the Final Cr6 MCL incorporating the 10 ppb limit. While there are still differing opinions as to whether a 10 ppb MCL is unnecessarily low for the protection of public health, which is a concern due to the high costs associated with compliance, the newly adopted California MCL of 10 ppb for Cr6 appears to provide a wide margin of safety with respect to the protection of human health. The Federal Environmental Protection Agency is also scheduled to do a mode of action study on Cr6, but results are still several years away.

### 2.2.5 Compliance with Cr6 MCL is Mandatory

California Department of Public Health (CDPH) finalized the MCL of 10 parts per billion (ppb) for hexavalent chromium effective July 1, 2014. Initial compliance sampling results must be submitted to CDPH before January 1, 2015. If the running annual average of any four consecutive quarterly reports indicates Cr6 concentrations exceeding the MCL, a public water system will be deemed to be out of compliance. Notification of violation must be given to customers at that point, and a compliance performance schedule must be negotiated between the district and CDPH. Also, at any point where quarterly sampling results indicate a concentration so excessive that the annual average Cr6 MCL will be exceeded, notification must be provided to customers and a compliance performance schedule negotiated with CDPH.

The regulations do not allow a waiver or exemption for small public water systems, nor are there provisions providing relief in cases of financial hardship relative to the cost of necessary system improvements to address elevated Cr6 concentrations in public water supplies. The final version of the regulations does not establish a grace period or phasing schedule within which to achieve compliance with the new MCL standard.

Worth noting and a substantial factor in the timing of the release of the final Cr6 MCL was the lawsuit filed against DPH by the Natural Resources Defense Council and the Environmental Working Group, requesting a court ordered mandate to "ensure a speedy performance of the statutory duty" to establish a primary drinking water standard for hexavalent chromium. Additionally, these groups commented on the Draft MCL (10 ppb) stating that it failed to meet the CPDH statutory obligations to set the level as close as possible to OEHHA's PHG, and to place primary emphasis on public health. CDPH accelerated the release of the MCL in response to the litigation, but retained the draft MCL level of 10 ppb.

### 2.2.6 District Pro-active Stance on Cr6

CDPH released the Draft Cr6 MCL on August 22, 2013. The conceptual timeline for adoption of a final MCL was identified as June 2014. While it was not known at the time of release whether 10 ppb would be adopted as the final Cr6 MCL, District management staff recognized the potential for some Upland Wells to produce water with Cr6 concentrations above the pending MCL. As a result, the District Board of Trustees initiated and allocated funding for this alternatives study in January 2014, well ahead of the anticipated adoption date for the Final Cr6 MCL. For the development and analysis of project alternatives, the Cr6 consultant working group (CWG) assumed the Final MCL would specify a concentration of 10 ppb, and that the effective date of the regulation would be July 1, 2014.

### 2.2.7 Legislative and Regulatory Efforts by the District

The District became aware of potential regulatory changes when CDPH requested that all groundwater users in the State conduct analyses for Chromium 6, as part of a statewide occurrence study. The District complied with the request, beginning in 2002, and discovered that while it easily complied with the current standard, it may not be able to comply with new stricter regulations that could be demanded by the legislature.

Initial consultations with CDPH were encouraging in that it did not, at the time, believe that the new regulations would cause serious problems for the District. Even when the California OEHHA set a public health goal for Chromium 6 at 0.02 parts per billion in 2012, CDPH assured water districts that an enforceable regulation would be much more reasonable and achievable.

It was not until the Natural Resources Defense Council sued CDPH to finalize an enforceable Chromium 6 regulation in August of 2012, that both districts and regulatory agencies became concerned that compliance with a new regulation would be likely difficult, expensive and time consuming. At that time, the District immediately contacted the Association of California Water Agencies (ACWA) to request support in helping to craft a regulation that was, first of all, fully protective to the public, but was also reasonable in its implementation and would provide financial support to districts when expensive treatment technologies were required.

The District joined the ACWA chromium work group and aligned itself with several other water agencies in the State facing similar issues. Through this group, the District was able to lobby legislators, government officials and regulatory agencies to include necessary provisions in the rule making process. The District also contacted the staffs of local legislators including the offices of Hannah-Beth Jackson and Das Williams on several occasions and in conference calls with regulatory officials.

The draft regulation for Chromium 6 was made public in August 2013. With assistance from its consulting engineering firm, the District provided substantial comments to the draft. It also worked closely with ACWA to ensure that its comments would reflect the needs of affected water districts. Additionally, the District submitted a detailed cost information report to ACWA (as did several other water agencies) for use in its education and lobbying efforts with legislators and regulators.

By January 2014, the District had also joined a Chromium 6 advocacy group that was being coordinated by ACWA. Together, the agencies in this group met with the Governor's office, legislators and high-ranking officials in CDPH and the State Water Resources Control Board. The purpose of these meetings was to educate staffs and demonstrate the costs and difficulties associated with anything other than the most thoughtful implementation of this new regulation. This group was able to show CDPH that the data it used for Chromium 6 occurrence throughout the State and the costs associated with treating water to the levels proposed, was deeply flawed.

The District continues to maintain its relationships with ACWA and the Chromium 6 groups to influence a pending bill that would provide compliance time for districts that need to make changes. It is also on the Water Bond Coalition team to ensure that funds are made available for agencies compelled to build expensive Chromium 6 treatment facilities. The District also continues to inform and request assistance from its local legislators.

## 2.3 Cr6 Consultant Work Group

In January 2014, the District Board authorized the formation of a Consultant Work Group (CWG) tasked with the identification and evaluation of possible approaches to achieve the District's compliance with the Cr6 MCL (pending at that time). Consultants for the work group were carefully selected to achieve necessary expertise in each critical area of the effort. The credentials and experience of each consulting firm, as well as their assignment for the study, are presented below.

### 2.3.1 Credentials / Experience / Assignment

#### *2.3.1.1 Hazen & Sawyer*

Since 1951, Hazen and Sawyer has provided public works engineering to help clients provide safe drinking water to their customers, and control water pollution and its effects on the environment. It is the largest design firm in the nation focused entirely on water and wastewater (2010–2014, Engineering News-Record), employing nearly 800 engineering professionals. Hazen and Sawyer's reputation is founded on the superior technical work of many of the world's most knowledgeable and experienced water treatment experts, and it maintains the largest active research portfolio of any firm in the water industry. Dr. Nicole Blute, P.E. has been leading the 12-year Cr6 treatment technology research program at the City of Glendale funded by the State of California, and the Water Research Foundation, which provides the foundation for drinking water treatment knowledge on Cr6 treatment effectiveness and cost. In this project, Vice President Lynn Grijalva, P.E., and Project Manager Nicole Blute, PhD, P.E. led the District's treatment evaluation of options for wells above the Cr6 regulatory limit, including technologies, layouts, and costs. They also collaborated with the consultant group to develop an overall compliance strategy, and identify and assemble "complete options" consisting of combinations of alternatives (e.g., treatment and non-treatment) that effectively use District resources and allow for prioritization of considerations in option selection. Last, they spearheaded the effort to create and perform the ranking evaluation of identified complete options, based upon the criteria developed on a collaborative basis by the CWG.

#### *2.3.1.2 Stetson Engineers*

Established in 1957, Stetson Engineers, Inc. has a distinguished history in the civil engineering, environmental engineering and water resources fields, balancing environmental protection and enhancement efforts with development. Project Manager and Supervising Engineer, Joe DeMaggio, P.E. led the Stetson Team for the engineering feasibility study for the use of wells with high Cr6. Mr. DeMaggio has over three decades of project management and engineering experience focused on water system hydraulics, water system design and cost estimation, agricultural engineering, flood studies, and hydraulic structure design. The Stetson Team includes professional civil engineers, hydrologists and groundwater experts. The Stetson Team has an established reputation for producing water system solutions in mixed urban and agricultural watersheds that provide citizen and property protection in conjunction with water supply needs. Nationally, Stetson Engineers are recognized experts in hydrology, hydraulics, agricultural engineering, water system modeling, water rights and water resources management.

#### *2.3.1.3 Dudek Hydrogeology*

For more than 30 years, Dudek has helped California's water and wastewater agencies develop and implement cost-effective programs to improve the function and efficiency of their facilities, achieve regulatory compliance and maintain excellent customer service. Project Manager and Senior Hydrogeologist, Trey Driscoll, PG, CHG led the Dudek Hydrogeology team for Cr6 well profiling work performed on the District's Upland Wells. Other Dudek team members included Stephen K. Dickey, PG, CHG, CEG, Peter T. Quinlan, RG, Lydia Roach Dorrance, PhD, Steve Stuart, PE and Jeff Kubran. The Dudek team has extensive experience with Cr6 groundwater characterization and remediation having worked for over two decades on the cleanup of anthropogenic sources of Cr6. Dudek's water resource team specializes in forensic support, including water rights, groundwater supply, sustainable yield and watershed studies, groundwater modeling, groundwater recharge and groundwater treatment technologies.

#### *2.3.1.4 Dudek Environmental*

The Santa Barbara office of Dudek began preparing environmental review documents to satisfy requirements under the California Environmental Quality Act (CEQA) in 1978. Since that time, Dudek has functioned as environmental staff for many of the special services districts in the region, including water districts and sanitary districts. Dudek environmental staff routinely prepares environmental review documentation for water-related improvement projects and for water master plans, and also orchestrates the regulatory permitting process associated with these projects. Project Manager Jonathan Leech provided environmental constraints input, meeting coordination, schedule administration, and synthesis of technical reports into the Alternatives Analysis & Feasibility Study Report. Kenneth Marshall, Regional Office Director, contributed to the direction of work effort by the work group, consideration of alternatives technologies, evaluation of complete options, and report preparation.

#### *2.3.1.5 William J. Brennan Water Systems Consulting*

Bill Brennan has spent over 35 years as an industry leader in the fields of water quality, engineering, production and management, working for both the City of San Diego and the Central Coast Water Authority (CCWA). Additionally, he served as a Director for the State Water Project Contractors Authority and the State and Federal Water Contractors Agency. He represented CCWA on the State Water Contractors Inc. Engineering, Operations and Maintenance, Energy, Risk Oversight and Water Transfers Committees and has authored and co-authored several papers in the water quality field.

Since retiring in 2013, Bill formed a consulting firm, William J. Brennan Water Systems Consulting, and has been active in assisting water districts with water quality, reliability and public relations issues.

#### *2.3.1.6 Fiona Hutton Associates*

Fiona Hutton & Associates (FH&A) specializes in developing and implementing communications, public education and outreach programs for water agencies, local governments, trade associations, non-profit organizations and more. The firm has extensive experience in regional and statewide water supply and quality issues and understands California's ever-changing regulatory environment, supply and demand needs and the short and long-term challenges the state is facing. FH&A's in-depth knowledge of the state's complex water supply landscape has helped water agencies throughout the state navigate and communicate these challenges with stakeholders and the public.

More specifically, FH&A has assisted water districts and organizations in crafting communications pertaining to the Cr6 MCL. As a member of the CWG, FH&A is responsible for press releases, information packages for District customers, and public information materials.

# 3 ALTERNATIVES DEVELOPMENT

## 3.1 Primary Considerations

In developing alternatives that could address the ability of the District to comply with the new Cr6 MCL, the CWG focused on the three primary considerations discussed below: water supply quantity; water quality reliability; and, cost-effectiveness of water supply solution.

### 3.1.1 Water Supply Quantity

Prior to the new MCL effective date of July 1, 2014, the District water supply and distribution system was able to meet customer demands under nearly all circumstances. However, full use of reservoir storage and operation of all active Upland Wells was required to meet maximum day and maximum hour demand conditions. Historically, the District developed a portfolio of water resources including Cachuma Project Water, State Water Project (SWP) water and Santa Ynez River alluvial well water to serve the lower pressure zones (Zones 1 and 2) and Upland Well water to serve the higher pressure zones (Zone 3 and a portion of Zone 2) in the distribution system. Both the Cachuma Project and SWP water deliveries are dependent upon annual precipitation in the watersheds serving as the water source of supply. The Cachuma Project water allocation has been consistent with 100 percent deliveries occurring annually despite Endangered Species Act (ESA) constraints. However, drought conditions and future ESA requirements will cause shortages and reductions in deliveries. The quantity of water available from the SWP is highly variable and cannot be assured from year to year. Extractions from the alluvial wells located within the Santa Ynez River are subject to quantity limits designated in State Water Resources Control Board licenses, and are also physically affected by the downstream alluvial conditions and the account-based water rights water held in storage behind Bradbury Dam. Additionally, these "river" wells and associated infrastructure are vulnerable to flood events resulting from significant rainfall in the watershed, at times leaving them damaged and unusable for extended periods. Given the variability and uncertainty of these water supplies, it has been the practice of the District to rely on the Upland Wells to provide the supplemental water necessary to meet system water demands. It is therefore absolutely critical the District maintain water production capacity related to the Upland Wells in order to address variability in the quantity of water available from other sources.

According to Stetson Engineers (Stetson) (refer to Appendix C), the production capacity of the 11 operational Upland Wells is approximately 7,200 gallons per minute (gpm). This production capacity can be compared to the water system average day demand (ADD), maximum day demand (MDD), and maximum hour demand (MHD). For the alternatives development, ADD was based on the average demand during the maximum annual water production during the last 10 years which occurred in 2007, with water use of 6,274 acre-feet or 3,890 gpm. The maximum day demand (MDD) for the peak summer day occurred on July 12, 2006 with a flow rate of 9,527 gpm. The maximum hour demand (MHD) for the maximum summer day occurred on June 21, 2008 with a flow rate of 14,175 gpm. The peak MHD associated with frost protection demand occurred on April 9, 2011 with a flow rate of 22,701 gpm. Based upon these demand figures, the Upland Well production capacity has historically been adequate to meet ADD. To meet MHD, the District must utilize all water stored in its three reservoirs in addition to full production of all Upland Wells.

In that reservoir storage is already required in order to satisfy the highest MDD and MHD recorded for the most recent 10-year period, any reduction in Upland Well production capacity places additional reliance on the water reservoir components, which may not be adequate. Reduction of Upland Well production capacity, due to the implementation of the new Cr6 MCL, results in the District not having the ability to meet MHD for maximum summer day water consumption events. Consequently, maximum water supply (production capacity) associated with the Upland Wells was a primary consideration in developing alternatives.

### 3.1.2 Water Quality Reliability

Santa Ynez River Water Conservation District, Improvement District No. 1 is a public water district with an obligation to provide assured water delivery to all domestic water connections. Water supply upon which the District relies in order to meet domestic demands must therefore be unquestionably reliable with respect to water quality (i.e., potable water that meets or exceeds all regulatory drinking water standards). Solutions which theoretically render sufficient water quantity without assuring water quality compliance would be of little value to the District. Some options offer more risk to water quality non-compliance than others. Consequently, water quality reliability was a primary consideration in developing alternatives.

### 3.1.3 Cost-effectiveness of Water Supply Solution

Based upon preliminary evaluation of the potential extent of Cr6 impacts to Upland Wells, the CWG concluded that solutions for compliance with the Cr6 MCL would most likely exceed present cash reserves of the District. Cost-effectiveness should always be addressed in consideration of alternatives for large scale infrastructure proposals, but especially so when strong justification is anticipated to be necessary in relation to public funding mechanisms to implement the selected alternative.

Stetson and Hazen and Sawyer included initial capital costs and annual operations and maintenance costs as part of developing alternatives. Total costs were then divided by the water production associated with each alternative, to render cost per acre-foot of water produced by the alternative. Refer to Appendix C for the Stetson report, which includes the detailed cost analysis for each alternative.

## 3.2 Potential Alternatives

The CWG identified a total of six (6) different alternatives that could be employed by the District to achieve compliance with the Cr6 MCL. The identified alternatives are considered the building blocks for a potential integrated and comprehensive solution to be implemented by the District (identified as "complete options" later in this report). A description of each of the alternatives is provided in the following sub-sections.

### 3.2.1 Alternative 1: Blending of Water from Multiple Wells/Sources

Several Upland Wells produce water with concentrations of Cr6 approaching or slightly greater than the 10 ppb MCL. One method to achieve acceptable Cr6 concentrations in water delivered to customers involves blending of water from multiple District wells prior to delivery to customers. Alternative 1 therefore involves blending (mixing) of two wells or blending water from the distribution system with a well. This alternative is not anticipated to impact the overall water production. However, pipeline installation between wells will be required to enable this feature at locations where blending will be implemented. An examination of Cr6 concentrations from Upland Wells, derived from monthly sampling results in the period December 2013 through June 2014, identified four wells with produced water Cr6 concentrations near the MCL that would be excellent candidate wells to address with a potential blending solution. The following sub-alternatives were each examined for Alternative 1.

- Alt 1-1 – Blend Well 7 with Well 24 in the existing 0.5 MG Zone 3 tank.
- Alt 1-2 – Blend Well 7 with Well 24 at the Well 7 site.
- Alt 1-3 – Blend Well 27 with Zone 2 water then pump into Zone 3.
- Alt 1-4 – Blend Well 28 with Zone 2 water then pump into Zone 3.
- Alt 1-5 – Blend Well 5 with Well 25 at the Well 25 site.
- Alt 1-6 – Blend Well 24 with Well 25 at the Well 25 site.

### 3.2.2 Alternative 2: Separate Piping for Irrigation Water

The Cr6 MCL is a drinking water standard not applicable to water used for irrigation or other non-potable purposes. Alternative 2 considers the possibility of using Cr6 impacted wells for irrigation only, which would require installation of a separate dedicated irrigation water distribution system. Under this alternative, wells producing water with Cr6 concentrations greater than the MCL would be used for non-potable supply only; wells producing water with low or non-detectable Cr6 concentrations would supply the domestic (drinking water) distribution system.

### 3.2.3 Alternative 3: Surface Water Treatment for Gallery Well

The District Gallery Well extends approximately 300 feet into and 45 feet below the Santa Ynez River. Due to its construction within and beneath the active channel of river, the water collected by the Gallery Well is considered "surface water." The Gallery Well is currently not used because it does not meet the requirements of the Surface Water Treatment Rule, which mandates a more stringent treatment method than for typical groundwater wells.

Alternative 3 involves treatment of Gallery Well water to meet the Surface Water Treatment Rule. Reactivating this well would provide an additional source of water for the District, or be used to offset a reduction in water supply associated with adoption of *Alternative 4* or *Alternative 6*. Surface water treatment requires treatment for pathogens and other regulated constituents. While the Gallery Well has not been specifically sampled for Cr6, all historical sampling and analysis of the Gallery Well has shown non-detectable levels of total chromium (total Cr).

### 3.2.4 Alternative 4: Minimize Use of Upland Wells with High Cr6

Alternative 4 involves minimizing use of the Upland Wells in the overall District water supply management approach, excluding from the water supply inventory those wells producing water with Cr6 concentrations near or above the MCL. Thus, under Alternative 4, only Upland Wells producing water with Cr6 concentrations compliant with the MCL would continue to be employed; those wells with high Cr6 concentrations (above or near the MCL) in water would be shut-off.

Infrastructure improvements for Alternative 4 would be less extensive than for any of the other technology alternatives; however, the water supply would not provide the current level of water production used by the District. Stetson evaluated the system modifications needed in order to render the water system capable of meeting required system pressures and flow demands utilizing a combination of the Upland Wells with low Cr6 concentrations, water deliveries via the Mesa Verde Pump Station, and the 6-cfs and 4-cfs well fields (refer to Appendix C for detailed evaluation).

### 3.2.5 Alternative 5: Treatment Systems for Selected Upland Wells

Adoption of a primary drinking water standard requires the CDPH to also adopt best available technologies (BAT) for water systems to utilize in achieving compliance with the new standard. In determining BAT for a given contaminant, consideration is given to the costs and benefits of technologies that have been proven effective under full-scale field applications. Three BATs are included as part of the new regulation for Cr6: 1) reduction/coagulation/filtration; 2) ion exchange; and, 3) reverse osmosis. As the State-adopted BATs, these technologies were the only methods considered as part of this alternatives study. However, the establishment of the new Cr6 MCL has prompted engineering consultants and other specialists in water treatment to focus on new and innovative ways to reduce Cr6 concentrations for drinking water applications. Any new, alternative technologies will require pilot testing to prove feasibility and applicability specific to the water source to be treated in order to achieve CDPH approval. District staff and engineering consultants will continue to monitor these new developments and treatment methods to assure that the most cost effective groundwater treatment solutions available are considered in achieving compliance with the new Cr6 regulation.

An examination of Cr6 concentrations from Upland Wells, derived from monthly sampling results in the period December 2013 through June 2014, identified several wells with Cr6 concentrations near or above the MCL. These wells cannot be reliably used for domestic water supply unless the elevated Cr6 concentrations are addressed. Alternative 5 involves installing treatment for Cr6 removal at the impacted wells, either individually or for combinations of wells. This alternative maintains the same water production volume of each well, and allows wells with non-compliant Cr6 concentrations to be brought back into production (the short-term or interim approach to compliance with the Cr6 MCL is anticipated to involve taking all non-compliant wells offline). The following sub-alternatives were each examined for Alternative 5.

- Alt 5-1 – Treat Wells 1, 2 and 15 at existing ID1 shop site. Add Well 3 as a redundant source, which is currently offline due to elevated nitrate concentrations.
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site
- Alt 5-3 – Treat Well 7 at Well 7 site
- Alt 5-4 – Treat Well 25 at Well 25 site

### 3.2.6 Alternative 6: Well Improvements (Modifications)

Based upon review of water sampling results from all Upland Wells and examination of regional geologic formations in the Santa Ynez Valley, Dudek identified a potential for Cr6 concentrations to vary with depth below the ground surface. To evaluate whether Cr6 concentrations in groundwater correlate to discrete depths below the ground surface, Dudek performed profiling of selected Upland Wells. The profiling included collection of water samples at prescribed depth intervals with the well pump in operation (dynamic sampling). The results of the well profiling indicate a general decline in Cr6 concentration in groundwater with increasing depth; the deepest producing zone for each of the profiled wells demonstrated Cr6 concentrations in groundwater which are less than the 10 ppb MCL. Refer to Appendix D for the complete well profile evaluation results.

The well profile evaluation and examination of regional geologic formations in the Santa Ynez Valley concluded that it should be feasible to modify or improve some of the wells that have composite water concentrations above the Cr6 MCL, in order to extract water preferentially from depths with acceptable Cr6 concentration in groundwater. Refer to Appendix D for well profiling and geologic/hydrologic evaluations.

Alternative 6 is the installation of packers in wells to prevent the ingress of water from zones in the aquifer with high Cr6 concentrations. When a well is drilled, the bore hole is generally a larger diameter than the casing of the well; the extra space around the casing is normally filled with gravel to allow movement of water from the surrounding ground layers toward the casing and to filter finer materials. Certain portions of the solid casing consist of fine perforations or screen to allow water to pass from the ground, into the casing, for extraction by the well pump. A packer is a water proof barrier inflated inside the casing, to prevent vertical movement of water and preferentially pump from discrete zones. One or multiple packers can be installed to isolate production zones. Installation of packers is relatively straightforward, but is expected to result in lower overall production rates from each target well, compared to existing production rates without the packers. There is also a risk of some water from higher Cr6 zones being pulled into the well, that results in potential water quality uncertainty. The following sub-alternatives were each examined for Alternative 6.

- Alt 6-1 – Well 7 – block inflow from high Cr6 zone (install packer).
- Alt 6-2 – Well 25 – block inflow from high Cr6 zone (install packer).
- Alt 6-3 – Well 28 – block inflow from high Cr6 zone (install packer).
- Alt 6-4 – Well 27 – block inflow from high Cr6 zone (install packer).

# 4 SOLUTIONS DEVELOPMENT

Each of the identified technology alternatives has the capability of addressing, in some manner, elevated Cr6 concentrations in the District domestic water supply. However, use of a single technology in isolation would not necessarily achieve the highest efficiency or greatest ability to meet the water supply objectives of the District. Therefore, the next step was to develop "Solutions Packages" or "Complete Options" that combine various technology alternatives.

## 4.1 "Screening" Criteria

In developing solutions packages involving various combinations of the technology alternatives and designed to achieve compliance with the new Cr6 MCL, the CWG first applied a set of screening criteria, as described in the sub-sections below. Potential solutions that fared poorly under application of the screening criteria were dismissed from further consideration.

### 4.1.1 Engineering Feasibility

The first screening criteria applied during development of solutions packages was engineering feasibility. For dedicated treatment plants, the ability of various treatment methods or technologies were reviewed with respect to their proven ability to remove Cr6 from water. For wells considered to be candidates for blending to achieve acceptable Cr6 concentrations, the highest recorded Cr6 concentrations in water samples were identified for the target well across the six-month sampling period. Wells within reasonable proximity to the target well were then reviewed to determine highest recorded Cr6 concentrations, and whether it would be feasible to mix or blend the water from the two well sources to a composite concentration below the MCL.

Modeling of the existing water distribution system was conducted for each of the alternatives to evaluate system capacity and to determine needed improvements for the transmission of water between wells and proposed new system components, as well as between pressure zones. The most extensive distribution system modifications were modeled for a separate irrigation (i.e. non-potable) system; a separate irrigation water distribution system would require parallel piping throughout a large portion of the existing distribution system, but would be feasible from an engineering perspective.

### 4.1.2 Risk

Risk can generally be considered as the opposite of reliability with regard to infrastructure systems. In a public water district, delivery of water supply meeting all water quality standards must be assured. Substantial risks associated with water quantity or quality generally cannot be tolerated.

Completely avoiding risk often comes with a substantial expense, and therefore while solutions with minimum risk were a goal, solutions which balanced some risk with lower costs were also included for consideration. Solutions with one or more components thought to possess little or no risk were given additional attention to determine possible enhancement of water quantity with addition of one or two components possessing potentially moderate risk. The combination of very low risk components with moderate risk components was seen as a possible means to achieve acceptable system risks, with lower overall expenditures.

### 4.1.3 Water Quality

With the exception of a separate water distribution system (Alternative 2), solutions must be capable of providing water meeting the Cr6 MCL at each point of entry (POE). The MCL requires the concentration limit to be met at the point where water enters the distribution system, which means that water at any well-head which is not compliant with MCL must be addressed in some manner before introduction to the water system. Non-compliant wells must be shut-off until a method is developed to bring produced water from such wells into compliance with the MCL, or the District would have to issue Notices of Violation to customers.

### 4.1.4 Water Production

A primary goal for the solutions was set at achieving the same water production capability that existed before the new Cr6 MCL takes effect. It was recognized that some wells would need to be shut-off due to recorded water samples with Cr6 concentrations above the MCL, reducing overall water production capability. In order to "not lose ground" in terms of water production to achieve compliance with the MCL, solutions should be capable of restoring water production capacity.

Water deliveries by the District through agricultural meters is subject to interruption based upon lack of water availability; consequently there is some flexibility to respond to lower water production capability in the short-term, or permanently. On the other hand, solutions which deliver the exact water production as existed prior to the Cr6 MCL adoption would provide for no future expansion of domestic service connections in the future.

### 4.1.5 Permitting/Planning Issues

Improvements that include structural development would be subject to building permits from the County of Santa Barbara. Treatment plants would involve permits from the Regional Water Quality Control Board. All proposed physical development and contemplated actions by a public agency fall under the purview of the California Environmental Quality Act (CEQA). Solutions packages were therefore vetted at a cursory level for potential fatal flaws from the standpoint of land use policy, regulatory permitting, and CEQA environmental review.

# 5 IMPLEMENTATION SOLUTION PACKAGES – "COMPLETE OPTIONS"

Following development and analysis of the six technology alternatives, and using the screening criteria discussed above, complete options (implementation solution packages) were developed by combining appropriate alternatives. The CWG created a total of twelve separate "Complete Options" that include the full spectrum of combined alternatives - "Bookend to Bookend" (from "No Action" on the one end all the way to "Treat Everything" at the other end). Below is a description of the twelve complete options (A to H) that were evaluated to address the high Cr6 in the Upland Wells.

## 5.1 Description of Complete Options

### 5.1.1 Complete Option A

Complete Option A represents the "full treatment" solution. Treatment would be provided for any well with produced water containing Cr6 concentrations near or above the MCL, and for the Gallery Well. This option would result in five (5) separate water treatment plants. No blending or well modification would be included, and no Upland Wells would be excluded from long-term production. Complete Option A consists of the following Alternatives:

- Alt 3-1 – Surface water treatment of Gallery Well
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing District shop site
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site
- Alt 5-3 – Treat Well 7 at Well 7 site
- Alt 5-4 – Treat Well 25 at Well 25 site

### 5.1.2 Complete Option B

Complete Option B represents the "Upland Wells full treatment" solution. Treatment would be provided for any well with produced water containing Cr6 concentrations near or above the MCL; unlike Option A, no treatment would be provided for the Gallery Well (and therefore this well would remain off line). This option would result in four (4) separate water treatment plants. Again, no blending or well modification would be included, and no Upland Wells would be excluded from long-term production. Complete Option B consists of the following Alternatives:

- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID#1 shop site
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site
- Alt 5-3 – Treat Well 7 at Well 7 site
- Alt 5-4 – Treat Well 25 at Well 25 site

### 5.1.3 Complete Option C

Complete Option C can be characterized as the "three treatment plant" solution. The fourth treatment plant for Upland Wells (included in Options A & B) would be eliminated in favor of blending (Well 28) and well modification (Well 27) to address elevated Cr6 concentrations. No treatment would be provided for the Gallery Well under Option C; this well would therefore remain off line. Complete Option C consists of the following Alternatives:

- Alt 1-4 – Blend Well 28 with Zone 2 water then pumped into Zone 3
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID#1 shop site
- Alt 5-3 – Treat Well 7 at Well 7 site
- Alt 5-4 – Treat Well 25 at Well 25 site
- Alt 6-4 – Well 27 – install packer

### 5.1.4 Complete Option D

Complete Option D (as well as variants D-P and D-C) can be characterized as a "two treatment plant" solution. The Gallery Well would not be treated, and Upland Wells with production water Cr6 concentrations near or marginally over the MCL would be addressed either with blending or well modification. Complete Option D consists of the following Alternatives:

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site

### 5.1.5 Complete Option D-P

The "P" in Complete Option D-P designates "packer"; this Option is a two treatment plant solution, where Upland Wells with production water Cr6 concentrations near or marginally over the MCL would be addressed solely with packers (well modification). The Gallery Well would not be treated, and no blending of wells would be included. Complete Option D-P consists of the following Alternatives:

- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site
- Alt 5-2 – Treat Wells 27 and Well 28 at Well 27 site
- Alt 6-1 – Well 7 – install packer
- Alt 6-2 – Well 25 – install packer

### 5.1.6 Complete Option D-C

The "C" in Complete Option D-C designates "combined"; this Option is a two treatment plant solution, where Upland Wells with production water Cr6 concentrations near or marginally over the MCL would be addressed with a combination of both packers (well modification) and blending. This approach could allow for immediate installation of packers as a means of reducing well-specific concentrations of Cr6 in produced water, with blending as a longer term solution and/or in response to any gradual increases in Cr6 concentrations over time. The Gallery Well would not be treated, and would therefore remain off line. Complete Option D-C consists of the following Alternatives:

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site
- Alt 6-1 – Well 7 – install packer
- Alt 6-2 – Well 25 – install packer

### 5.1.7 Complete Option E

Complete Option E (as well as variants E-P and E-C) can be characterized as a "one treatment plant" solution. Option E relies more heavily upon blending and well modification with treatment providing Cr6 removal from the three most highly impacted wells. Non-treatment improvements would be used for three marginal wells: either blending with compliant Upland well water or installing packers to select water from low Cr6 strata in the aquifer. The Gallery Well would not be treated. Complete Option E consists of the following Alternatives:

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site
- Alt 1-4 – Blend Well 28 with Zone 2 water then pumped into Zone 3
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site
- Alt 6-4 – Well 27 – install packer

### 5.1.8 Complete Option E-P

The "P" in Complete Option E-P designates "packer". This Option is a one treatment plant solution, where the groundwater treatment plant would provide Cr6 removal from the three most highly impacted wells. Non-treatment improvements would be used for four marginal wells: one well via blending with compliant Upland well water, and three wells via installation of packers to select water from low Cr6 strata in the aquifer. The Gallery Well would not be treated, and would remain off line. Complete Option E-P consists of the following Alternatives:

- Alt 1-4 – Blend Well 28 with Zone 2 water then pumped into Zone 3
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID#1 shop site
- Alt 6-1 – Well 7 – install packer
- Alt 6-2 – Well 25 – install packer
- Alt 6-4 – Well 27 – install packer

### 5.1.9 Complete Option E-C

The "C" in Complete Option E-C designates "combined"; this Option is a one treatment plant solution to address the most highly impacted wells, while Upland Wells with produced water Cr6 concentrations near or marginally over the MCL would be addressed with a combination of both packers (well modification) and blending. This approach could allow for immediate installation of packers as a means of reducing well-specific concentration of Cr6 in produced water, with blending as a longer term solution and/or in response to any gradual increases in Cr6 concentration levels over time. The Gallery Well would not be treated, and would therefore remain off line. Complete Option E-C consists of the following Alternatives:

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site
- Alt 1-4 – Blend Well 28 with Zone 2 water then pumped into Zone 3
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site
- Alt 6-1 – Well 7 – install packer
- Alt 6-2 – Well 25 – install packer
- Alt 6-4 – Well 27 – install packer

### 5.1.10 Complete Option F

Complete Option F does not consider treatment or non-treatment approaches, and instead relies on limiting the use of wells that have been impacted by the Cr6 MCL, requiring them to be shut down when Cr6 levels surpass the MCL. Under Option F, the distribution system will be supplied with water from Wells 5, 6, and 24 which contain relatively low Cr6 levels ranging from 0.7 to 4.1 ppb. Upland Wells that have produced water near or exceeding the Cr6 MCL of 10 ppb (based upon sampling results from December 2013 through June 2014) would be taken off line. Existing water supplies from the river wells and State Project Water would be pumped further into Zones 2 and 3. Additional booster pumps and some new distribution pipelines would be necessary to increase surface water deliveries to Zones 2 and 3. Complete Option F includes the following Alternative:

- Alt 4-1 – Minimize Use of Upland Wells with High Cr6 use Wells with Cr6 concentrations below 10 ppb

### 5.1.11 Complete Option G

Complete Option G would establish a new, completely separate distribution system dedicated to irrigation water supply. The existing water distribution system would be maintained for delivery of domestic water meeting the Cr6 MCL. The irrigation water distribution system would be supplied by wells with produced water containing Cr6 concentrations currently exceeding the MCL. The domestic water system would use the existing reservoirs, the river wells and Wells 5, 7, 24, 25, and 27. No treatment plants would be installed. Complete Option G includes the following Alternatives:

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site
- Alt 2 – Separate Irrigation System
- Alt 6-4 – Well 27 – install packer

### 5.1.12 Complete Option H

Complete Option H would avoid the high costs of either a dedicated irrigation water distribution system or any treatment plants. This option employs only blending and well modification technologies, targeting the Upland Wells with Cr6 concentrations that are near or marginally exceed the MCL. This Option would increase available water supply over Option F (turning off every well with Cr6 concentrations approaching the MCL), but would result in lower water production capability than any of the other Complete Options. Compliance reliability of Complete Option H is also the lowest of any Complete Option, in that fluctuations in Cr6 concentrations could cause the target wells to fail compliance even with blending or well modification (no treatment plants are included in the Option, which provide the highest reliability). Because of the compliance risks, this Option was not further evaluated. Complete Option H includes the following Alternatives:

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site
- Alt 6-3 – Well 28 – install packer
- Alt 6-4 – Well 27 – install packer

# 6 RANKING PROCESS FOR COMPLETE OPTIONS

## 6.1 Ranking Analysis

Hazen and Sawyer employed a commercially available software program, Criterium DecisionPlus (CDP), to assist in the evaluation of the complete options. The software requires input from the user to determine:

- The end goal of the decision process,
- Decision criteria and weighting factors, and
- Complete options with scores by criteria.

**Goal:** The goal of the evaluation was to develop a ranking of the complete options.

**Decision Criteria:** The set of first order criteria and assigned weighting factors were determined through collaboration with the District staff and CWG. The three primary factors most critical to the District are the ability of the system to meet Cr6 compliance (i.e., the risk of non-compliance), water production reliability, and cost. For the first order ranking, an equal weighting factor was placed on water quality (50%), and on water production (50%). While very important, cost was considered separately and in parallel with the scoring, so that the District's decision-making can be based primarily on water quality and production.

**Complete Options and Scoring:** Scores were assigned with input from the District and CWG for decision criteria based on the distribution system modeling results that were completed for each complete option. The scores were assigned on a scale from 0 to 10, with a score of 0 representing the least and 10 representing the most favorable water quality assurance and production reliability. The key factors taken into consideration for each criteria include:

- Water Quality Assurance – Water quality was considered from the perspective that water from the State Water Project and the Santa Ynez River supplies could be interrupted by prolonged drought, flood damage, environmental constraints, or seismic damage to water resource delivery systems. In those situations, local Upland Well groundwater that meets water quality regulations would provide the greatest assurance of compliance. Each option was evaluated with respect to risk of Cr6 concentration increase because of linked wells due to blending, likelihood of compliance, redundancy in the system, addition and contribution of low concentration sources, and accommodations for future demands. A full score of 10 was given to options in which the groundwater had historically low Cr6 levels, below 4 ppb, and treatment plants would be installed to treat wells with high or marginal Cr6 concentrations to a target of 6 ppb. The maximum Cr6 levels entering the distribution system at each well, treatment plant or blending station were considered in evaluating every complete option. The resilience to changing water quality (i.e., fluctuating Cr6 concentrations) in the wells was also considered.

- Water Production Reliability – Production reliability was considered from the perspective of using all water resources at their full production and from the perspective of the District relying on Upland wells when the river wells and surface water supplies are interrupted. Each option was evaluated based on the number of resources kept in use, comparison to current production, ability to meet MDD and ADD requirements, redundancy, and possible reductions to supply. The distribution system modeling conducted by Stetson provided information on the production of each water supply, the routing of supplies through the distribution system to meet customer demands, and the cost of necessary piping and pumping improvements to meet demands in each Complete Option.
- Annualized Cost – The cost evaluation was based on the twenty-year life cycle costs, including annualized capital cost and anticipated annual operation, energy and maintenance costs.

## 6.2 Ranking of Complete Options – Conclusion

Details of the ranking all of Complete Options (A through G) are provided in Appendix A. The result of the ranking exercise was the identification of the three Complete Options with the highest ranking scores. Complete Option A ranked the highest in Water Quality and Water Production Reliability, but also carries the highest price tag. Complete Options D has the second highest scoring in the rankings, and Complete Option E has the third highest scoring. Complete Options D and E each have marginally lower Water Production Reliability (greater risk) than the top ranked Complete Option A. Each of these top three Complete Options are described below in more detail.

# 7 HIGHEST RANKED COMPLETE OPTION

## 7.1 Option A

### 7.1.1 Detailed Description of Option Components

Complete Option A represents the "full treatment" solution. Treatment would be provided for any well with produced water containing Cr6 concentrations above or near the MCL, and for the Gallery Well. Complete Option A consists of the following components:

- Five treatment plants (four groundwater and one surface water)
- All Upland wells in full production
- Reactivation of wells 1 and 3 in Santa Ynez
- Activation of the Gallery Well as a potable water source

The four groundwater treatment plants would provide Cr6 removal from all Upland wells impacted by the Cr6 MCL, without reducing any well pumping rates, or relying on blending to meet a water quality goal. The plants provide the opportunity to reactivate wells that were temporarily taken off line due to non-compliant Cr6 concentration levels, and bring them back into production through treatment and/or blending. The surface water treatment plant would allow the Gallery Well to become a potable water source, contributing 776 gpm to the District supply portfolio.

Upland wells producing water at or near the Cr6 MCL include Wells 1, 2, 7, 15, 25, 27, and 28, all of which are in Zone 2 or Zone 3. Wells 1, 2, and 15 would be combined and treated in one plant located at the District office and shop site; Wells 27 and 28 would be treated in a plant at the Well 27 site; and Well 7 and Well 25 would each have a dedicated treatment plant. Well 3 would serve as a redundant source in case of higher peak flows or when wells need to be maintained, that could blend with the treatment plant at 1, 2, and 15. All wells with Cr6 levels near or above the 10 ppb MCL would be treated in this option. Analysis of possible Cr6 treatment approaches is included in the Hazen and Sawyer Treatment Process Evaluation technical memorandum (Appendix B).

Withdrawing water from a depth of about 45 feet beneath the Santa Ynez River, the Gallery Well is classified as groundwater under the influence of surface water. In order to activate the Gallery Well as a potable water source, treatment, including filtration and disinfection, would be required to bring the supply into compliance with the Surface Water Treatment Rule.

The top ranked option, Complete Option A, provides the most diversified water portfolio, using surface water, river wells and Upland wells at multiple points of entry into the system, which gives the District the greatest flexibility to manage its resources to meet demands under any circumstances.

## 7.2 Discussion of Selection Criteria with respect to Option A

### 7.2.1 Water Quality

All well water above or near the Cr6 MCL would be treated to achieve a target goal of no more than 6 ppb entering the distribution system. Agencies often operate with a margin of safety, in case well concentrations, treated water concentrations, or laboratory analytical data fluctuate, and therefore a target concentration of no greater than 6 ppb Cr6 was used in the treatment design evaluation. The addition of the Gallery Well provides a low Cr6 source in addition to existing river wells and imported water. Inactive Wells 1 and 3 that are out of compliance for Cr6 and nitrate, respectively, can be reactivated and brought into compliance through treatment and blending. The plants can accommodate potentially worsening raw water quality in the future, and still produce finished water that meets the Cr6 MCL. This option received a score of ten (10) for water quality assurance because overall risks associated with water quality have been alleviated and are well controlled. This is the highest score possible for water quality assurance of the Complete Options considered (i.e., lowest water quality risk).

### 7.2.2 Water Production

In Option A, all wells would remain in full production in Zones 2 and 3. Currently inactive, Wells 1 and 3 would be reactivated to support the production and pressure in the Santa Ynez Pressure Zone 2. The Gallery Well would provide a new potable water source of 776 gpm (maximum volume of 515 acre-feet per year), entering the system in Zone 1 to use the District's full allocation. In years when surface water supplies are available, this option increases total system water production to 16,011 gpm, thus meeting peak existing demands and providing capacity to serve future customers. In times when surface water supplies are interrupted by prolonged drought, environmental constraints, flooding or seismic damage or system maintenance, the Upland wells would produce 6,600 gpm, which is sufficient to meet existing average day demand (3,890 gpm) with 70% surplus. Water quality objectives would be met via dedicated water treatment plants, and average day demand could be met without any external water supplies. A score of 10 would reflect full production at current levels. Because of the additional flow from Gallery well, this Option was given a score of 11 in the water production reliability rating. This is the highest ranking of all the Complete Options.

### 7.2.3 Annualized Cost

Implementation of Option A in the District's water delivery system would require construction of five treatment plants, additional pipelines, and booster pumps. The twenty-year annualized life cycle cost for capital and operation and maintenance is $5.1 million. This is based on a total capital cost of $25,773,000 and equates to a cost of $914 per acre-foot of produced water.

### 7.2.4 Water Supply Delivered

The five proposed treatment plants would make available for unrestricted use the total water supplied by all 11 District Upland Wells and the Gallery Well. The total production from the Upland Wells, Gallery Well, and surface water deliveries would be 16,011 gpm, accounting for 168% of the maximum day demand (MDD) of 9,527 gpm. To assure supply reliability, agencies typically operate with a buffer with respect to MDD. With respect to volume of water supply delivered, Complete Option A ranks the highest of all the Complete Options.

### 7.2.5 System Redundancy

The five treatment plants provide redundancy in the event that any well or treatment unit is taken out of service in an emergency or for planned maintenance. Option A provides the best systems redundancy of all the Complete Options evaluated.

### 7.2.6 Ability to Meet Existing / Future Customer Water Demand

The total flow in the system provides up to 68% of contingency to supply the system during increased water demands. The contingency addresses short-term peaks from abnormally hot or dry climatic conditions, or sustained demand increases that could be associated with growth of customer connections in the District.

### 7.2.7 Feasibility of Permitting with Regulatory Agencies

The five treatment plants under this complete option would involve the most arduous permitting process of any of the complete options. Structural development would occur at five separate locations, each potentially requiring a building permit from Santa Barbara County. An individual permit from the RWQCB would potentially be necessary for each individual treatment plant. Due to Cr6 contained in the waste-stream, a small quantity waste generator permit for the District would likely be necessary from California Environmental Protection Agency. However, employing one or more of the BAT treatment methods approved by CDPH would streamline the permit review process and increase the feasibility of obtaining necessary permits from appropriate regulatory agencies.

Due to the number of facilities involved, and the potential need for resource agencies to rely upon environmental review conducted by the District in order to issue permits, a program level environmental impact report under CEQA would be recommended for this complete option. Field surveys for occurrence of natural resources can be completed concurrently for all proposed sites, project impacts quantified, and programmatic mitigation measures identified and assessed from a cost perspective.

Given probable treatment plant technology has been proven and permitted at other locations in California, even in Santa Barbara County, it should not prove infeasible to obtain necessary regulatory agency permits for Complete Option A. The treatment plant proposed at the existing District Office/Shop property would be considered in-fill development. Adequate area appears to exist in proximity to the gallery wells for a treatment plant siting. The placement of the other treatment plants may take refinement in order to minimize environmental impacts or land use conflicts.

### 7.2.8 Response to Changing External Water Supply Conditions

The five proposed treatment plants would make available for unrestricted use the total water supplied by all 11 District Upland Wells and the Gallery Well. This results in the greatest volume of water within the control of the District, and the best resiliency with respect to future restrictions in external water supplies from the SWP. In wet years, natural flows in the Santa Ynez River would contribute extra volume to the District supply via the new treatment plant for the Gallery Well; over a sustained period of drought and associated reductions in releases from Cachuma, the water supply from the Gallery Wells could be very limited.

# 8 SECOND HIGHEST RANKED COMPLETE OPTION

## 8.1 Option D

### 8.1.1 Detailed description of Option Components

Complete Option D (as well as variants D-P and D-C) can be characterized as a "two treatment plant" solution. The Gallery Well would not be treated, and Upland Wells with production water Cr6 concentrations near or marginally over the MCL would be addressed either with blending or well modification. Complete Option D consists of the following components:

- Two groundwater treatment plants
- Reactivation of Wells 1 and 3 in Santa Ynez
- Blending two marginal wells with compliant water
- Packers on two wells, as an alternative to blending, or combined with blending

The two groundwater treatment plants would provide Cr6 removal from the three most highly impacted wells and two of the marginally impacted wells. The plants provide the opportunity to reactivate wells that were temporarily taken out of service due to non-compliant Cr6 concentrations and bring them back into production through treatment and/or blending. Non-treatment improvements would be used for two marginal wells: either blending with nearby compliant wells or installing packers to select water only from low Cr6 strata in the aquifer.

High Cr6 Wells 1, 2, and 15 with concentrations above 24 ppb would be combined and treated in one plant located at the District office and shop site. Wells 27 and 28, which are marginally above the Cr6 MCL, would be treated at a second plant at the Well 27 site. Well 3 would serve as a redundant water source at times of high peak demand or when other wells are undergoing maintenance.

In sub-option D, Wells 7 and 24 would be blended together at the Well 7 site, and Wells 5 and 25 would be blended at the Well 25 site to produce an overall Cr6 concentration below the 10 ppb MCL.

In addition, there are opportunities for improving this option through future add-ons. These improvements include packers on wells 7 and 25 to reduce Cr6 level and installation of gallery well treatment to provide additional supply.

In sub-option D-P, packers would be installed on Wells 7 and 25 to achieve a Cr6 concentration below the 10 ppb MCL, rather than the blending.

Sub-option D-C combines all packer and blending alternatives: packers in Wells 7 and 25, blending Well 7 with Well 24, and blending Well 5 with Well 25.

## 8.2 Discussion of Selection Criteria with respect to Option D

### 8.2.1 Water Quality

Five of the Upland wells would be treated to achieve a target goal of 6 ppb in plants that could accommodate worsening raw water quality in the future and still produce finished water that meets the Cr6 MCL. The two marginal wells relying on blending are expected to achieve 7 to 8.5 ppb Cr6 entering the distribution system, but are at risk of non-compliance if the raw Cr6 concentration increases in either the compliant or non-compliant wells. Wells addressed with packers are expected to achieve Cr6 below 10 ppb if strata can be reliably separated, but are at risk of non-compliance if short-circuiting occurs (i.e., if water with Cr6 is able to migrate between groundwater elevation zones, despite the presence of a packer). Three Upland wells have consistently low Cr6 concentrations and are expected to remain in compliance. Option D received a water quality score of 7 because approximately 70% of the Upland water is assured of compliance, and 30% is vulnerable to groundwater quality conditions. This places Complete Option D tied for third place in the overall rankings for water quality (behind the options with 5, 4, and 3 treatment plants).

### 8.2.2 Water Production

In Option D, all wells in Zones 2 and 3 would remain in production. Inactive Wells 1 and 3 would be reactivated to support the production and pressure in Zone 2. In years when the alluvium wells and State Project Water are available, the Option D combination of surface water and groundwater would meet current production. In times when surface water supplies are interrupted by prolonged drought, environmental constraints, flooding, seismic damage or system maintenance, the Option D Upland wells would produce 6,600 gpm, which exceeds existing average day demands of 3,890 gpm by 70%. Options D-P and D-C would produce a lower flow rate, estimated at 6,100 gpm because of the packers are anticipated to reduce well production by 25%. The production rate of the blended wells may have to be reduced if the Cr6 concentration increases in either the compliant or non-compliant well, but less than a third of the groundwater production would be vulnerable. Option D is preferred over D-P and D-C, with a score of 9 for production reliability. This places Complete Option D fourth in the rankings for reliability (behind the options with 5, 4, and 3 treatment plants).

### 8.2.3 Annualized Cost

Implementation of Option D includes two treatment plants, additional pipelines, booster pumps and blending facilities. Sub-option D-P has a lower cost because packers are substituted for blending. Sub-option D-C is higher in cost because it combines blending and packers. The use of non-treatment alternatives makes the total cost to implement and operate Option D less than an Option that solely relies on treatment plants. The twenty-year annualized life cycle cost is $3.4 million. This is based on a total capital cost of $17,507,000 and equates to a cost of $609 per acre-foot of produced water (approximately the midpoint between Complete Option A at $914 per acre-foot and Complete Option E (see below) at $412 per acre-foot). Adding future projects such as packers on wells 7 and 25 for water quality improvements and the gallery well treatment for additional supply would increase the life cycle cost to $4.2 million.

### 8.2.4 Water Supply Delivered

For Option D, the total flow of the system produces up to 15,235 gpm, accounting for 160% of the maximum day demand (MDD) of 9,527 gpm. The total flow in the system provides up to 60% of added contingency to supply the system during increased water demands. If packers are installed at Well 7 and Well 25 for Options D-P and D-C, the total production in the system would be reduced to 14,735 gpm, which accounts for 155% of the MDD. This option is ranked second with regard to water supply delivered.

### 8.2.5 System Redundancy

The treatment plants have internal redundancy in the event that any well or treatment unit is taken out of service in an emergency or for maintenance. There are also two treatment plants proposed, allowing for temporary unavailability of either due to emergency or planned maintenance. Water from three compliant wells and three wells addressed with packers and/or blending would be available to supply the water distribution system in the event that both treatment plants are simultaneously taken out of commission due to an emergency or disaster event.

### 8.2.6 Ability to Meet Existing / Future Customer Water Demand

The total flow in the system provides up to 55% of contingency to supply the system during increased water demands (assuming packers are installed in Wells 7 and 25, lowering well production rates for these wells). The contingency addresses short-term peaks from abnormally hot or dry climatic conditions, or sustained demand increases that could be associated with growth of customer connections in the District.

### 8.2.7 Feasibility of Permitting with Regulatory Agencies

The two treatment plants under this complete option would involve a less arduous permitting process overall than Complete Option A. Structural development would occur at only two separate locations, both potentially requiring a building permit from Santa Barbara County. An individual permit from the RWQCB would potentially be necessary for each individual treatment plant, but this would involve only two permits total; it is not likely that a permit from the RWQCB would be required for either of the blending systems. Due to Cr6 contained in the waste-stream, a small quantity waste generator permit for the District would still likely be necessary from California Environmental Protection Agency. But again, employing one or more of the BAT treatment methods approved by CDPH would streamline the permit review process and increase the feasibility of obtaining necessary permits from appropriate regulatory agencies.

Due to the number of individual facilities involved, and the potential need for resource agencies to rely upon environmental review conducted by the District in order to issue permits, a program level environmental impact report under CEQA would be also recommended for this complete option. Field surveys for occurrence of natural resources can be completed concurrently for all proposed sites, project impacts quantified, and programmatic mitigation measures identified and assessed from a cost perspective.

Given probable treatment plant technology has been proven and permitted at other locations in in Santa Barbara County, it should not prove infeasible to obtain necessary regulatory agency permits for Complete Option D. The treatment plant proposed at the existing District Office/Shop property would be considered in-fill development. Hazen & Sawyer provided a conceptual layout for the treatment plant at Well 27 which appears to potentially fit within available space.

### 8.2.8 Response to Changing External Water Supply Conditions

Considering water supply associated with alluvium wells and State Project Water, the Option D combination of surface water and groundwater would meet current production. If surface water supplies are interrupted by prolonged drought, environmental constraints, flooding, seismic damage or system maintenance, the Option D Upland wells would produce 6,600 gpm, which exceeds existing average day demands of 3,890 gpm, but which would not accommodate maximum day demand. Permanent reduction of water available from SWP or alluvium wells (as would occur with restrictions to Cachuma releases) could force the District to develop additional water storage facilities to accommodate peak demands, or could necessitate the addition of future treatment plants.

# 9 THIRD HIGHEST RANKED COMPLETE OPTION

## 9.1 Option E

### 9.1.1 Detailed description of Option Components

Complete Option E (as well as variants E-P and E-C) can be characterized as a "one treatment plant" solution. Option E relies more heavily upon blending and well modification to address all but the most severely Cr6 impacted wells. The Gallery Well would not be treated. Complete Option E consists of the following components:

- One groundwater treatment plant
- Reactivation of Wells 1 and 3 in Santa Ynez
- Blending three marginal wells with compliant water
- Packers on one to three marginal wells, as an alternative to blending, or combined with blending

The groundwater treatment plant would provide Cr6 removal from the three most highly impacted wells. The plant provides the opportunity to reactivate wells that were taken out of service due to non-compliant Cr6 concentration and bring them back into production through treatment and/or blending. Non-treatment improvements would be used for three marginal wells: either blending with compliant Upland waters or installing packers to select water from low Cr6 strata in the aquifer. Packers are assumed to reduce well flow rates by 25%.

High Cr6 Wells 1, 2, and 15 with concentrations above 24 ppb would be treated at a plant located at the District office and shop site. Well 3 would serve as a redundant source that could blend at the treatment plant in case of higher peak demand or when other wells are undergoing maintenance.

In addition, there are opportunities for improving this option through future add-ons. These improvements include packers on wells 7 and 25 to reduce Cr6 level and installation of surface gallery well treatment to provide additional supply.

Sub-option E-P would blend Well 28 with water in Zone 2, and install packers in Wells 7, 25, and 27. Sub-option E-C would install packers in Wells 7 and 25, and then blend them with Wells 24 and 5, respectively; Well 28 would be blended with water in Zone 2; a packer would be installed in Well 27.

## 9.2 Discussion of Selection Criteria with respect to Option E

### 9.2.1 Water Quality

Three wells with Cr6 concentrations above the MCL would be treated to achieve a target goal of no more than 6 ppb entering the distribution system. The plant would have redundancy for emergencies or maintenance and can accommodate potentially worsening raw water quality. These treated wells and the existing compliant wells have a high degree of water quality assurance, but they represent less than half of the Upland groundwater resource. Three marginal wells would rely on blending that is expected to achieve 7 to 8.5 ppb Cr6 entering the distribution system. Two to four wells will rely on packers and are expected to achieve Cr6 below 10 ppb if aquifer strata are reliably separated. The untreated marginal wells provide more than half of the Upland groundwater and are vulnerable to several possible risks: Cr6 concentrations could rise in the marginal wells, Cr6 concentrations could rise in the compliant wells that provide blending water, a compliant well could go out of service, and short-circuiting could occur in wells addressed with packers. The Water Quality Assurance score is 4, tied for 3rd place in the overall rankings for water quality of all Complete Options.

### 9.2.2 Water Production

In Option E, all wells in Zones 2 and 3 would remain in operation, and inactive Wells 1 and 3 would be reactivated to support the production and pressure in Zone 2, but reliance on packers would reduce the overall groundwater production. In years when surface water supplies are available through the river wells and State Project Water, this option produces 14,685 gpm which is less than current production. In times when surface water supplies are interrupted by prolonged drought, environmental constraints, flooding, seismic damage or system maintenance, Option E would produce 6,050 gpm from the Upland wells and is preferred over Options E-P and E-C that would produce 5,550 gpm. All three sub-options would be able to meet the existing ADD of 3,890 gpm during times that external water sources are not available. The production rate is at risk of being reduced by half if the Cr6 concentration increases in untreated wells. Option E is given a score of 7 for production reliability, giving it an overall ranking of 7th place for production reliability.

### 9.2.3 Annualized Cost

Implementation of Option E would require construction of one treatment plant, pipelines and improvements for blending and packers. The twenty-year annualized life cycle cost is $2.3 million. This is based on a total capital cost of $13,388,000 and equates to $412 per acre-foot of produced water. Adding future projects such as packers on wells 7 and 25 for improved water quality and gallery well treatment for increased water production would increase the life cycle cost to $3.1 million.

### 9.2.4 Water Supply Delivered

Option E was modeled for the ability to meet customer demands in the District's distribution system, using supplies from the Upland wells with only two packers, river wells and State Project Water. The total production would be 14,685 gpm, accounting for 154% of the maximum day demand (MDD) of 9,527 gpm. The total flow in the system provides up to 54% of contingency to supply the system during increased water demands. System production would decrease to 14,185 gpm with the installation of two more packers in Sub-Options E-P and E-C.

### 9.2.5 System Redundancy

The one treatment plant option will have internal redundancy in the event that any well or treatment unit is taken out of service in an emergency or for maintenance. However, there would not be a second treatment plant at another site in the event an emergency or natural disaster impacted the treatment plant site. Water from three compliant wells and three wells addressed with packers and/or blending would be available to supply the water distribution system in the event that the treatment plant is taken out of commission due to an emergency or disaster event, but production volume capability would be limited. Option E has less system redundancy than either Complete Option A or D.

### 9.2.6 Ability to Meet Existing / Future Customer Water Demand

The total flow in the system provides up to 49% of contingency to supply the system during increased water demands (assuming packers are installed in a total of four wells, lowering well production rates for these wells). The contingency addresses short-term peaks from abnormally hot or dry climatic conditions, or sustained demand increases that could be associated with growth of customer connections in the District. Surplus water delivery capacity in Option E to accommodate future growth would be 19% less than in Option A and up to 6% less than in Option D.

### 9.2.7 Feasibility of Permitting with Regulatory Agencies

The one treatment plant under this complete option would result in substantially less permitting for this complete option, compared to Complete Option A or D. Structural development would occur at a single location, as an expansion to the existing District office and shop development, but still requiring a building permit from Santa Barbara County. One permit from the RWQCB would potentially be necessary the treatment plant, compared to five for Option A and two for Option D. Due to Cr6 contained in the waste-stream, a small quantity waste generator permit for the District would likely be necessary from California Environmental Protection Agency. However, employing one of the BAT treatment methods approved by CDPH would streamline the permit review process and increase the feasibility of obtaining necessary permits from appropriate regulatory agencies.

Pipe construction, booster pumps, and other minor equipment for the blending facilities could likely qualify for categorical exemptions under CEQA. The one treatment plant at the District office/shop property could potentially be addressed with a mitigated negative declaration (MND).

Given probable treatment plant technology has been proven at other locations in Santa Barbara County, it should not prove infeasible to obtain necessary regulatory agency permits for Complete Option E. The treatment plant proposed at the existing District Office/Shop property would be considered in-fill development. Infrastructure improvements for blending would be located within alignments already dedicated to water extraction, distribution, and storage.

### 9.2.8 Response to Changing External Water Supply Conditions

With surface water supplies through the river wells and State Project Water, this option produces 14,685 gpm which is less than current production. In times when surface water supplies are interrupted by prolonged drought, environmental constraints, flooding, seismic damage or system maintenance, Option E would produce 6,050 gpm from the Upland wells, easily meeting the existing ADD of 3,890 gpm. Permanent reduction of water available from SWP or alluvium wells (as would occur with restrictions to Cachuma releases) could force the District to develop even greater additional water storage facilities than Complete Option D in order to accommodate peak demands, or could necessitate the addition of future treatment plants.

## 10 SUMMARY OF TOP THREE COMPLETE OPTIONS

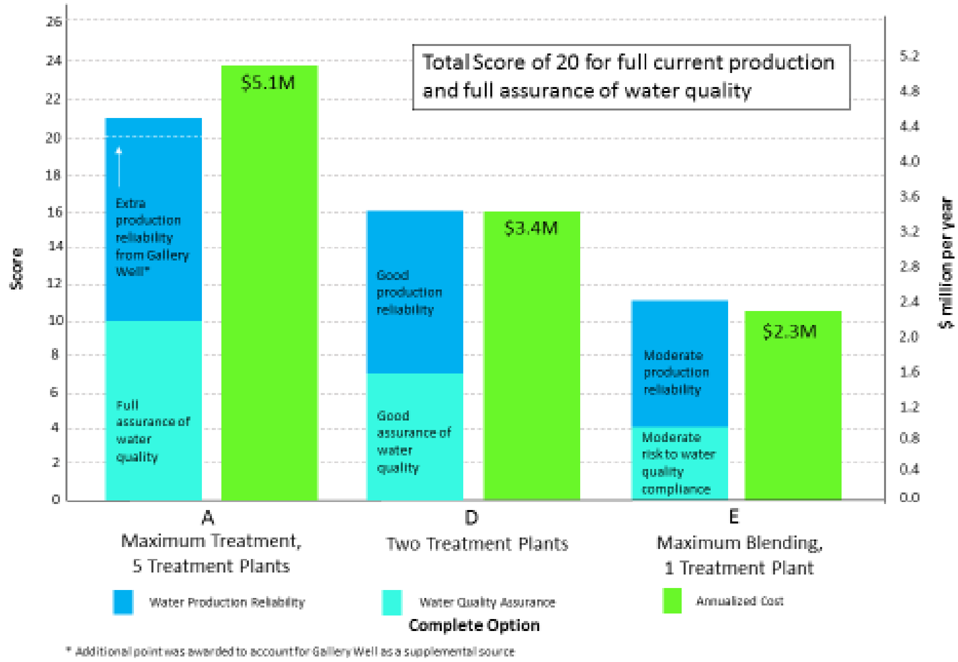
Figure 1 presents the ranking described in Sections 7, 8, and 9 for Complete Options A, D, and E and an overview of cost estimates. The figure shows that Complete Option A offers the maximum (more than current) water production and assurance of achieving water quality goals, albeit at highest cost.

Complete Option D provides full production reliability and good assurance of water quality, for slightly lower cost.

Complete Option E is lowest cost of these three options but carries lower than current production reliability and more risk in terms of water quality compliance.

There is potential for future add-on projects for Complete Options D and E to improve water quality or gain additional production capacity, if desired, for additional cost. Adding packers on wells 7 and 25 and installing the gallery well treatment would increase the annualized cost of Option D to $4.2 million and Option E to $3.1 million.

**Figure 1. Summary of Scoring and Cost Estimation for Complete Options A, D, and E**




# 11 CONCEPTUAL IMPLEMENTATION APPROACH

## Short-term

In order to comply with the newly adopted Cr6 MCL, and avoid delivering water to customers with Cr6 above the MCL, the first short term step is to immediately shut down Wells #2 and #15. These wells might be available in an emergency situation, subject to approval or allowance by CDPH and possible Notice of Violation required.

A second short-term step is to potentially modify wells #7 and/or #25 with packers to preferentially extract water from zones with lower Cr6 concentrations in these wells.

## Long-term

The first step in long-term implementation is to prepare a preliminary design report for the entire program, followed by a programmatic CEQA environmental review. Final design of some projects may begin in parallel with the environmental review. Upon completion of the environmental review, obtain regulatory permits for each project in coordination with its final design. The five treatment plants, associated pipelines and pump stations will be constructed in a coordinated schedule with the five year compliance period.

# 12 APPENDICES

A. **Hazen & Sawyer Evaluation of Complete Cr6 Options**

B. **Hazen & Sawyer Treatment Process Evaluation**

C. **Stetson Engineers System Hydraulics Study**

D. **Dudek Well Profile Report**

# APPENDIX A

## Hazen & Sawyer Evaluation of Complete Cr6 Options

HAZEN AND SAWYER
Environmental Engineers & Scientists

# Technical Memorandum:
## Evaluation of Complete Cr6 Options

To: **Santa Ynez River Water Conservation District, Improvement District No. 1** – Chris Dahlstrom and Eric Tambini

From: **Hazen and Sawyer** – Lynn Grijalva, PE, Nicole Blute, PhD, PE, Ian Mackenzie, PE, and Kenny Chau

cc: **Dudek** – Ken Marshall, Jonathan Leech, and Trey Driscoll
**Stetson Engineers** – Joe DeMaggio

Date: September 16, 2014

Re: Engineering Feasibility Study for Use of Wells with High Chromium 6: Evaluation of Complete Cr6 Options

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# Introduction

In 2001, the California state legislature mandated that a state regulation be established to limit the concentration of hexavalent chromium (Cr6) in drinking water. This launched several years of study into the appropriate maximum contaminant level (MCL) to protect public health, sampling to measure the occurrence of Cr6 and Total Cr in drinking water systems, and testing of treatment technologies for Cr6 removal. California Department of Public Health (CDPH) finalized the MCL of 10 parts per billion (ppb) for hexavalent chromium effective July 1, 2014. The total chromium (total Cr) MCL remains at 50 ppb.

There is naturally occurring chromium in the water bearing geology in the Santa Ynez River District, Improvement District #1 (District). As a result most wells in the District are impacted by the Cr6 MCL Three of the District's upland wells have shown Cr6 concentrations of 13 to 26 ppb and one inactive upland well was measured at 36 ppb when last active. Four upland wells have Cr6 concentrations between 8.4 and 10, which is in compliance, but very near the MCL. Only two active and two inactive upland wells are within a reliable range for Cr6 compliance.

The District's distribution system is comprised of three pressure zones, which rely on the Santa Ynez Upland groundwater basin, Santa Ynez River alluvium groundwater, and the State Water Project water. Zone 1 relies on the use of the River Wells and State Project Water delivered by the Mesa Verde (MV) Pump Station, which are not impacted by Cr6. Zones 2 and 3 rely on groundwater from the Upland Wells and have several wells that are impacted by Cr6 above the MCL. Table 1 presents a summary of Cr6 and Total Cr concentrations in District water supplies and in each zone.

**Table 1. District Sources of Supply and Chromium Concentrations**

| Zone | Supply | Status | Capacity (gpm) | Cr6 (ppb)* | Total Cr (ppb)* |
|---|---|---|---|---|---|
| **Zone 1** | 6.0 CFS Well field | Active | 2260 | ND*** | ND |
| | 4.0 CFS Well field | Active | 1775 | ND | ND |
| | MV | Active | 5200 | ND | ND |
| **Zone 2** | Well 1** | Inactive | 200 | 36 | 59 |
| | Well 2 | Active | 500 | 22 - 24 | 22 |
| | Well 3** | Inactive | 600 | 10 | 12 |
| | Well 4** | Inactive | 300 | 1.9 | 16 |
| | Well 15 | Active | 1200 | 25 - 26 | 26 |
| | Well 27 | Active | 1250 | 6.9 - 13 | 12 |
| | Well 28 | Active | 750 | 8.7 - 9.2 | 9.5 |
| **Zone 3** | Well 5 | Active | 250 | 0.7-1.1 | 1.9 |
| | Well 6** | Inactive | 300 | ND | ND |
| | Well 7 | Active | 900 | 2.1 - 10 | 10 |
| | Well 24 | Active | 300 | 1.3 - 4.1 | 4 |
| | Well 25 | Active | 950 | 8.4 - 9.8 | 8.4 |

* Samples collected from 1/29/14 to 5/28/14.

** Currently inactive, flow rate recorded when last active

***ND = non-detect. Non-detect value is 0.02 ppb for Cr6 and 0.2 ppb for Total Cr

Alternatives for complying with the new Cr6 regulation were developed by the District in consultation with the team of engineers, hydrologists, and modelers. Six primary alternatives, and variations to those basic alternatives, are shown in the next section. The alternatives were then assembled into "complete options" reflecting the combination of alternatives necessary for the whole District. The purpose of this technical memorandum is to support the District's compliance planning and implementation by presenting a comparison of the options available to comply with the new Cr6 regulation. The options were developed and evaluated in terms of achieving three goals:

1. Comply with the water quality regulations, with high assurance and low risk
2. Meet current water production reliably, and look for opportunities to increase production
3. Minimize the cost impact to District customers

# Alternatives Evaluation

The alternatives include both treatment and non-treatment methods. Four non-treatment alternatives were considered, including blending impacted and non-impacted wells (Alternative 1), using the Cr6 impacted wells only for irrigation (Alternative 2), minimizing the use of the impacted wells (Alternative 4), and installing packers in wells to target aquifer zones with lower Cr6 (Alternative 6). Two treatment alternatives were considered. Alternative 5 is treatment for removing Cr6 from Upland wells exceeding the Cr6 MCL. Alternative 3 is surface water treatment for the Gallery Well to meet the requirements of the Surface Water Treatment Rule and allow this well to be reactivated.

Alternative 1 involves mixing of two wells or mixing water from the distribution system with a well. This alternative uses lower Cr6 water to dilute higher Cr6 concentrations, producing a lower Cr6 level in the overall blend. This alternative is not anticipated to impact the overall water production. However, minor pipe modifications will be required to enable to this feature at locations where blending will be implemented.

Alternative 2 considers the possibility of using Cr6 impacted wells for irrigation only, which would require installation of a separate irrigation distribution system. This alternative would accomplish compliance with the MCL using low Cr6 wells in the existing distribution system.

Alternative 3 is surface water treatment of the Gallery Well. This well is currently not used because it does not meet the requirements of the Surface Water Treatment Rule. Reactivating this well would provide an additional source of water for the District.

Alternative 4 involves minimizing use of the Upland Wells to achieve compliance using only wells in compliance with the Cr6 MCL. This alternative requires little infrastructure but will not provide the current level of water production used by the District.

Alternative 5 involves installing treatment for Cr6 removal at the impacted wells, either individually or for combinations of wells. This alternative maintains the same production of each well, and allows non-compliant inactive wells to be brought back into production.

Alternative 6 is the installation of a packers in wells to prevent the ingress of water from zones in the aquifer with high Cr6 concentrations. Installation of packers is relatively straightforward, but is expected to result in lower production rates. There is also a risk of some water from higher Cr6 zones leaking into the well. The work by Dudek, 2014, provides further information.

# List of Alternatives

1. Alternative 1 – Blending, there are 6 possible locations for blending
    - Alt 1-1 – Blend well 7 with well 24 into existing 0.5 MG Zone 3 tank.
    - Alt 1-2 – Blend well 7 with well 24 at well 7 site.
    - Alt 1-3 – Blend well 27 with Zone 2 water then pump into Zone 3.
    - Alt 1-4 – Blend well 28 with Zone 2 water then pump into Zone 3.
    - Alt 1-5 – Blend well 5 with well 25 at well 25 site.
    - Alt 1-6 – Blend well 24 with well 25 at well 25 site
2. Alternative 2 – Separate Irrigation Water System, *using wells 2,3,15 & gallery well.*
3. Alternative 3 – Surface Water Treatment Gallery Well
4. Alternative 4 – Minimize Use of Upland Wells with High Cr6
    - Alt 4-1 – Maximum hour demand (June), *use wells 5,6 and 24, MVPS, 6.0 cfs and 4.0 cfs River wells, reservoir storage and additional booster pumps.*
    - Alt 4-2 – Frost protection historical demand (April), same system requirements as 4-1
5. Alternative 5 – Well Treatment. Treatment was considered for groups of wells at 4 locations:
    - Alt 5-1 – Treat wells 1, 2 and 15 at existing ID#1 shop site, 1,900 gpm add well 3 (600 gpm) as redundant source.
    - Alt 5-2 – Treat well 27 and well 28 at well 27 site
    - Alt 5-3 – Treat well 7 at well 7 site
    - Alt 5-4 – Treat well 25 at well 25 site
6. Alternative 6 – Well Improvements (packers), there are 4 packer options
    - Alt 6-1 – Well 7 – block inflow from high Cr6 zone, 25% flow reduction
    - Alt 6-2 – Well 25 - block inflow from high Cr6 zone, 25% flow reduction
    - Alt 6-3 – Well 28 - block inflow from high Cr6 zone, 25% flow reduction
    - Alt 6-4 – Wells 27 - block inflow from high Cr6 zone, 25% flow reduction

Each alternative was broken down into sub-alternatives to address either a set of wells or an individual well. Most of the alternatives only consider solutions for one zone and do not provide the District with a complete solution to achieve system wide Cr6 compliance and meet customer demands. Consequently, a list of feasible combinations of alternatives, or "complete options" were analyzed.

# Complete Options

The list of complete options were developed and evaluated according to water production capabilities and water quality compliance assurance. A total of 11 complete options (A through G) were considered for the evaluation as shown in Table 2 as combinations of the previously identified alternatives and sub-alternatives. Distribution system modeling was completed by Stetson Engineers for each of the complete options to assess feasibility of the options and necessary infrastructure. A decision making process was then used to score and rank the options, which is described below.

**Table 2: Matrix of Complete Options Considered**

**Alternatives**

| Complete Options | Blending | | | | | | Separate Irrigation System | Gallery Well Treatment | Minimize Use of High Cr6 Wells | | Well Treatment | | | | Well Improvements (Packers) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-1 | 1-2 | 1-3 | 1-4 | 1-5 | 1-6 | 2-1 | 3-1 | 4-1 | 4-2 | 5-1 | 5-2 | 5-3 | 5-4 | 6-1 | 6-2 | 6-3 | 6-4 |
| A | | | | | | | | ✔ | | | ✔ | ✔ | ✔ | ✔ | | | | |
| B | | | | | | | | | | | ✔ | ✔ | ✔ | ✔ | | | | |
| C | | | | ✔ | | | | | | | ✔ | | ✔ | ✔ | | | | ✔ |
| D | | ✔ | | | ✔ | | | | | | ✔ | ✔ | | | | | | |
| D-P | | | | | | | | | | | ✔ | ✔ | | | ✔ | ✔ | | |
| D-C | | ✔ | | | ✔ | | | | | | ✔ | ✔ | | | ✔ | ✔ | | |
| E | | ✔ | | ✔ | ✔ | | | | | | ✔ | | | | | | | ✔ |
| E-P | | | | ✔ | | | | | | | ✔ | | | | ✔ | ✔ | | ✔ |
| E-C | | ✔ | | ✔ | ✔ | | | | | | ✔ | | | | ✔ | ✔ | | ✔ |
| F | | | | | | | | | ✔ | | | | | | | | | |
| G | | ✔ | | | ✔ | | ✔ | ✔ * | | | | | | | | | | ✔ |

*Gallery well is untreated and used for irrigation only

# Decision Making Process

A commercially available software program, Criterium DecisionPlus (CDP), was used to assist in the evaluation of the complete options. The software requires input from the user to determine:

- The end goal of the decision process,
- Decision criteria and weighting factors, and
- Complete options with scores by criteria.

**Goal:** The goal of the evaluation was to develop a quantitative evaluation of the complete options.

**Decision Criteria:** The set of criteria and assigned weighting factors were determined through a workshop with the District and consulting team (Table 3). The three primary factors most critical to the District were the ability of the system to meet Cr6 compliance (i.e., the risk of non-compliance), water production reliability, and cost. An equal weighting factor was placed on water quality, and on water production. While very important, cost was considered separately and in parallel with the scoring, so that the District's decision making can be based primarily on water quality and production.

### Table 3: Evaluation Criteria and Weighting Factor

| Criteria | Definition | Weighting Factor (%) |
|---|---|---|
| Water Quality Compliance Assurance | The ability to meet the Cr6 MCL at each entry into the distribution system, mitigating the risk that Cr6 levels in the wells may fluctuate over time. | 50 |
| Water Production Reliability | The ability to produce a continuous and reliable supply to meet system demands. | 50 |
| Annualized Cost | Capital and O&M costs of the options, annualized over a 20 year period. | |

**Complete Options and Scoring:** Scores were assigned with input from the District and Consultant team for decision criteria based on the distribution system modeling results that were completed for each complete option. The scores were assigned on a scale from 0 to 10, with a score of 0 representing the least and 10 representing the most favorable water quality assurance and production reliability. The key factors taken into consideration for each criteria include:

- Water Quality Assurance – Water quality was considered from the perspective that the State Project Water and the Santa Ynez River alluvium supplies could be interrupted by prolonged drought, flood damage, environmental constraints, or seismic damage to water resource delivery systems. In those situations, local groundwater that meets water quality regulations would provide the greatest assurance of compliance. Each option was evaluated with respect to risk of concentration increase because of linked wells due to blending, likelihood of compliance, redundancy in the system, addition and contribution of low concentration sources, and accommodations for future demands. A full score of 10 was given to options in which the groundwater had historically low Cr6 levels, below 4 ppb, and treatment plants would be installed to convert high or marginal Cr6 levels to a target of 6 ppb. The maximum Cr6 levels entering the distribution system at each well, treatment plant or blending station were considered in evaluating every complete option. The resilience to changing water quality in the wells was also considered.

- Water Production Reliability - Production reliability was considered from the perspective of using all water resources at their full production, and from the perspective of the District relying on Upland wells when the river wells and surface water supplies are interrupted. Each option was evaluated based on the number of resources kept in use, comparison to current production, ability to meet Maximum Daily Demand (MDD) and Average Daily Demand (ADD) requirements, redundancy, and possible reductions to supply. The distribution modeling conducted by Stetson provided information on the production of each water supply, the routing of supplies through the distribution to meet system demands, and the cost of necessary piping and pumping improvements to meet demands in each Option.
- Annualized Cost – The cost evaluation was based on the twenty-year life cycle costs, including annualized capital cost and anticipated annual operation, energy and maintenance costs.

# Complete Options Evaluation

A summary of the complete options in relation to water quality and production are provided in Table 4. The wells were grouped by Cr6 levels which were determined by the Cr6 results provided by the District. All wells to be treated assumed a target Cr6 concentration of 6 ppb. Each complete option was evaluated to include the participating wells to provide an overall percentage for treated wells and non-treated wells (e.g. blending, etc.). Water quality assurance was determined by the percentage of treated vs non-treated wells.

A more thorough description of each complete option including background information on what each option encompasses, the distribution modeling results, and a summary of the results follows (Options A to G).

**Table 4: Complete Options Upland Well Water Production and Chromium 6 Compliance Assurance**

| Cr6 Conditions | Well | Normal Flow (gpm) | Complete Options | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | D-P | D-C | E | E-P | E-C | F | G** |
| < 4 ppb | 5 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 |
| | 6 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| | 24 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| | **Total Flow (gpm)** | | **850** | **850** | **850** | **850** | **850** | **850** | **850** | **850** | **850** | **850** | **850** |
| | **% of Upland Wells** | | 13% | 13% | 14% | 13% | 14% | 14% | 14% | 15% | 15% | 100% | 23% |
| | **% of Total Supply** | | 5% | 6% | 6% | 6% | 6% | 6% | 6% | 6% | 6% | 9% | 7% |
| 6 ppb after treatment | (treated) 1 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | - | - |
| | (treated) 2 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | - | - |
| | (treated) 3 | 600 | - | - | - | - | - | - | - | - | - | - | - |
| | (treated) 7 | 900 | 900 | 900 | 900 | - | - | - | - | - | - | - | - |
| | (treated) 15 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | - | - |
| | (treated) 25 | 950 | 950 | 950 | 950 | - | - | - | - | - | - | - | - |
| | (treated) 27 | 1250 | 1250 | 1250 | - | 1250 | 1250 | 1250 | - | - | - | - | - |
| | (treated) 28 | 750 | 750 | 750 | - | 750 | 750 | 750 | - | - | - | - | - |
| | **Total Flow (gpm)** | | **5750** | **5750** | **3750** | **3900** | **3900** | **3900** | **1900** | **1900** | **1900** | **0** | **0** |
| | **% of Upland Wells** | | 87% | 87% | 62% | 59% | 64% | 64% | 31% | 34% | 34% | 0% | 0% |
| | **% of Total Supply** | | 36% | 38% | 26% | 26% | 26% | 26% | 13% | 13% | 13% | 0% | 0% |
| 8 - 10 ppb | 7 | 900 | - | - | - | 900 | 650 | 650 | 900 | 650 | 650 | - | 900 |
| | 25 | 950 | - | - | - | 950 | 700 | 700 | 950 | 700 | 700 | - | 950 |
| | 27 | 1250 | - | - | 950 | - | - | - | 950 | 950 | 950 | - | 950 |
| | 28 | 750 | - | - | 500 | - | - | - | 500 | 500 | 500 | - | - |
| | **Total Flow (gpm)** | | **0** | **0** | **1450** | **1850** | **1350** | **1350** | **3300** | **2800** | **2800** | **0** | **2800** |
| | **% of Upland Wells** | | 0% | 0% | 24% | 28% | 22% | 22% | 55% | 50% | 50% | 0% | 77% |
| | **% of Total Supply** | | 0% | 0% | 10% | 12% | 9% | 9% | 22% | 20% | 20% | 0% | 23% |

**Table 4 (Cont'd)**

| Cr6 Conditions | Well | Normal Flow (gpm) | Complete Options | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **A** | **B** | **C** | **D** | **D-P** | **D-C** | **E** | **E-P** | **E-C** | **F** | **G**** |
| | **Summary of Results** | | | | | | | | | | | | |
| **Flow (gpm)** | **Upland Wells** | 7200 | 6600 | 6600 | 6050 | 6600 | 6100 | 6100 | 6050 | 5550 | 5550 | 850 | 3650 |
| | **River Wells (4 cfs)** | 1775 | 1175 | 1175 | 1175 | 1175 | 1175 | 1175 | 1175 | 1175 | 1175 | 1175 | 1175 |
| | **River Wells (6 cfs)** | 2260 | 2260 | 2260 | 2260 | 2260 | 2260 | 2260 | 2260 | 2260 | 2260 | 2260 | 2260 |
| | **Mesa Verde (SWP)** | 5200 | 5200 | 5200 | 5200 | 5200 | 5200 | 5200 | 5200 | 5200 | 5200 | 5200 | 5200 |
| | **Gallery Well** | 776 | 776 | - | - | - | - | - | - | - | - | - | - |
| | **Total (gpm)** | **17211** | **16011** | **15235** | **14685** | **15235** | **14735** | **14735** | **14685** | **14185** | **14185** | **9485** | **12285** |
| **Upland Wells** | **Below 6 ppb** | | 100% | 100% | 76% | 72% | 78% | 78% | 45% | 50% | 50% | 100% | 23% |
| | **Above 8 ppb** | | 0% | 0% | 24% | 28% | 22% | 22% | 55% | 50% | 50% | 0% | 77% |
| **Total Supply** | **Below 6 ppb** | | 100% | 100% | 90% | 88% | 91% | 91% | 78% | 80% | 80% | 100% | 77% |
| | **Above 8 ppb** | | 0% | 0% | 10% | 12% | 9% | 9% | 22% | 20% | 20% | 0% | 23% |
| | **WQ Assurance Score** | | **10** | **10** | **7** | **7** | **7** | **7** | **4** | **4** | **4** | **1** | **1** |
| | **Water Production Reliability Score** | | **11*** | **10** | **8** | **9** | **8** | **8** | **7** | **6** | **6** | **1** | **3** |

*Score assigned from 0 to 10 was determined in the absence of the Gallery Well. An additional point was awarded for any complete option that supports or require supply from the Gallery Well.
** A total production rate of 16,311 gpm is achieved for the separate irrigation system (Option G) with 4,026 gpm, including the Gallery Well, dedicated solely for irrigation use.

## Option A Maximum Treatment – Upland and Gallery Wells

**Description:** Option A is a combination of

- Five treatment plants (four groundwater and one surface water)
- All Upland wells in full production
- Reactivation of wells 1 and 3 in Santa Ynez
- Activation of the Gallery Well as a potable water source.

The four groundwater plants would provide Cr6 removal from all Upland wells impacted by the Cr6 MCL, without reducing any well pumping rates, or relying on blending to meet a water quality goal. The plants provides the opportunity to reactivate wells that were out of compliance, and bring them back into production through treatment and/or blending. The surface water plant would allow the Gallery Well to become a potable water source, contributing 776 gpm to the District supply portfolio.

The Cr6 impacted wells include wells 2, 7, 15, 25, 27, and 28, all of which are in Zone 2 or Zone 3. It is common practice for utilities to target between 50-80% of the MCL in treatment to provide a margin of safety. Wells 1, 2, and 15 would be combined and treated in one plant located at the District office and shop site; wells 27 and 28 would be treated in a plant at the well 27 site; and well 7 and well 25 would each have a dedicated treatment plant. Well 3 would serve as a redundant source in case of higher peak flows or when wells need to be maintained, that could blend with the treatment plant at 1, 2, and 15. All wells with Cr6 levels near or above the 10 ppb MCL would be treated in this option. Analysis of possible Cr6 treatment approaches is included in the Treatment Process Evaluation technical memorandum.

Withdrawing water from a depth of about 20 feet beneath the Santa Ynez River, the Gallery Well is classified as groundwater under the influence of surface water. In order to activate the Gallery Well as a potable water source, multiple treatment barriers of filtration and disinfection would be required to bring the supply into compliance with the Surface Water Treatment Rule.

**Distribution System Analysis**: This option was modeled for the ability to meet customer demands in the District's distribution system, using supplies from the Upland wells, Gallery Well, river wells and the State Water Project (via the Mesa Verde Pump Station). The total production would be 16,011 gpm, accounting for 168% of MDD of 9,527 gpm. The total flow in the system provides up to 68% of contingency to supply the system during increased water demands.

Table 5 summarizes the overall infrastructure and production of the proposed option:

**Table 5. Option A Features and Production Capacity**

| | Quantity | Cr6, ppb | Production Capacity, gpm |
|---|---|---|---|
| Treatment plants | 5 | | |
| Treated upland wells | 7 | 6 | 5750 |
| Untreated compliant wells | 3 | 0.7 – 4.1 | 850 |
| River wells | 10 | ND | 3435 |
| Gallery well | 1 | ND | 776 |
| Mesa Verde Pump Station | 5 | ND | 5,200 |
| Total water production | | | 16,011 |

**Water Quality Compliance Assurance**

All well water above or near the Cr6 MCL would be treated to achieve a target goal of no more than 6 ppb entering the distribution system. The addition of the Gallery Well provides a low Cr6 source in addition to existing river wells and imported water. The five treatment plants provide redundancy in the event that any well or treatment unit is taken out of service in an emergency or for planned maintenance. Inactive wells 1 and 3 that are out of compliance for Cr6 and nitrate, respectively, can be reactivated and brought into compliance through treatment and blending. The plants can accommodate potentially worsening raw water quality in the future, and still produce finished water that meets the Cr6 MCL. Overall risks associated with water quality have been alleviated and are well controlled, which results in the highest score possible for water quality assurance of the options considered (i.e., lowest water quality risk).

**Water Production Reliability**

In Option A, all wells would remain in full production in Zones 2 and 3. Currently inactive wells 1 and 3 would be reactivated to support the production and pressure in the Santa Ynez Zone 2. The Gallery Well would provide a new potable water source of 776 gpm and a maximum volume of 515 acre-ft, entering the system in Zone 1 to use the District's full allocation. In years when surface water supplies are available, this option increases water production to 16,011 gpm, to meet peak demands, redundancy and future customers. In times when surface water supplies are interrupted by prolonged drought, environmental constraints, flooding or seismic damage or system maintenance the Upland wells would produce 6,600 gpm. Option A is able to produce the highest volume of water compared with all the other options. A score of 10 would reflect full production at current levels; because of the "bonus" additional flow from the Gallery Well, this Option was given a score of 11 in the water production reliability rating.

**Annualized Cost**

Implementation of Option A in the District's system would require construction of the treatment plants, additional pipelines, and booster pumps. The twenty-year annualized cost of capital and operation and maintenance is $5.1 million/year.

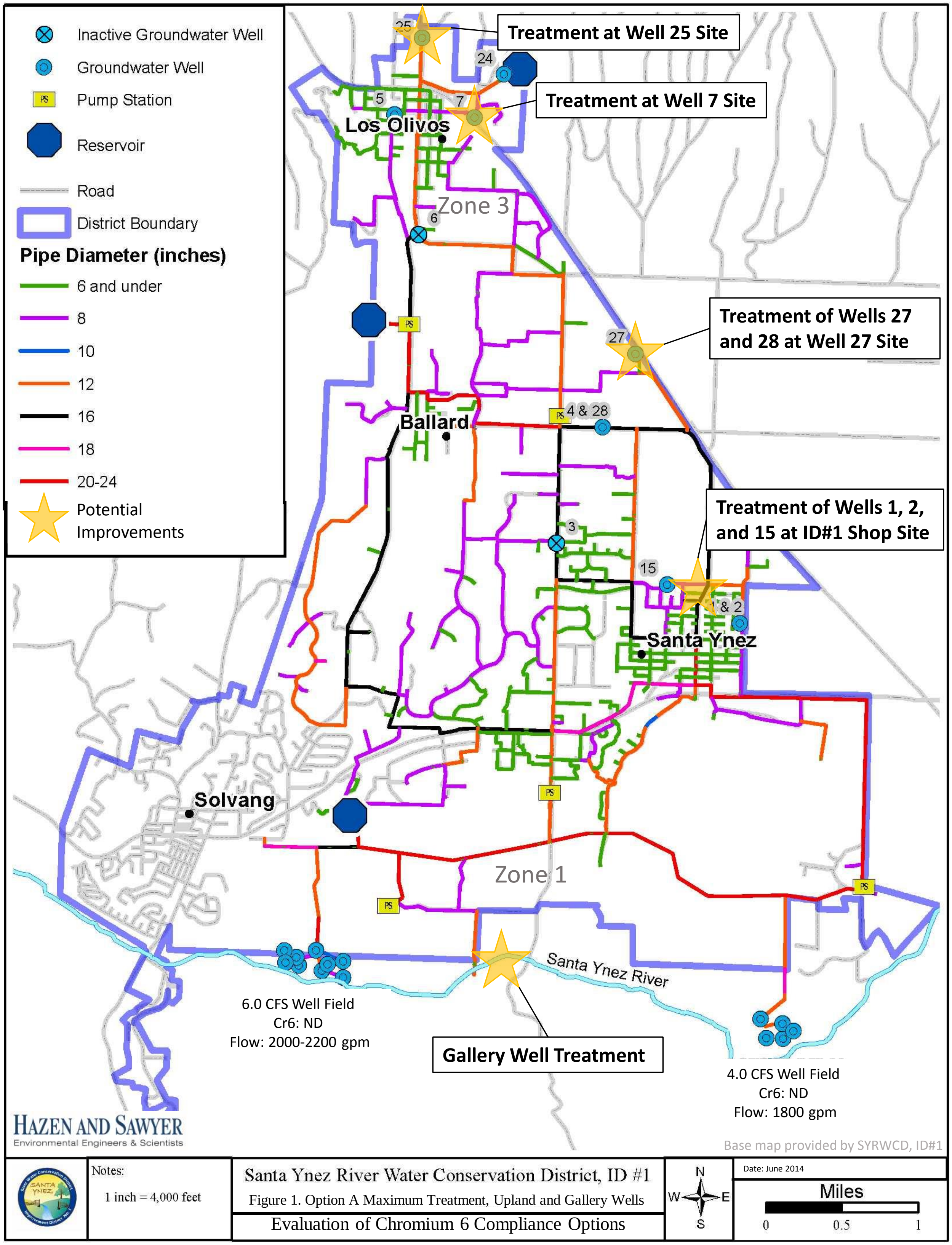
**Evaluation Criteria**

Scores assigned to each criteria for Option A are shown below in Table 6, with a high score reflecting a relatively favorable option.

**Table 6. Option A Summary of Evaluation**

| Criteria | Score (0 to 10) |
|---|---|
| Water Quality Compliance Assurance | 10 |
| Water Production Reliability | 11* |
| Annualized Cost | $5.1M |

*Addition production from Gallery Well


Inactive Groundwater Well
Groundwater Well
Pump Station
Reservoir
Road
District Boundary
Pipe Diameter (inches)
6 and under
8
10
12
16
18
20-24
Potential Improvements
Treatment at Well 25 Site
Treatment at Well 7 Site
Treatment of Wells 27 and 28 at Well 27 Site
Treatment of Wells 1, 2, and 15 at ID#1 Shop Site
Gallery Well Treatment
Los Olivos
Ballard
Santa Ynez
Solvang
Zone 3
Zone 1
Santa Ynez River
6.0 CFS Well Field
Cr6: ND
Flow: 2000-2200 gpm
4.0 CFS Well Field
Cr6: ND
Flow: 1800 gpm
Base map provided by SYRWCD, ID#1
HAZEN AND SAWYER
Environmental Engineers & Scientists
Notes:
1 inch = 4,000 feet
Santa Ynez River Water Conservation District, ID #1
Figure 1. Option A Maximum Treatment, Upland and Gallery Wells
Evaluation of Chromium 6 Compliance Options
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# Option B Maximum Well Treatment, No Gallery Well

**Description:** Option B is a combination of

- Four groundwater treatment plants
- All Upland wells in full production
- Reactivation of wells 1 and 3 in Santa Ynez

The four groundwater plants would provide Cr6 removal from all Upland wells impacted by the Cr6 MCL, without reducing any well pumping rates, or relying on blending to meet a water quality goal. The plants provide the opportunity to reactivate wells that were out of compliance, and bring them back into production through treatment and/or blending.

The Cr6 impacted wells include wells 2, 7, 15, 25, 27, and 28, all of which are in Zone 2 or Zone 3. Wells 1, 2, and 15 would be combined and treated in one plant located at the District office and shop site; wells 27 and 28 would be treated in a plant at the well 27 site; and well 7 and well 25 would each have a dedicated treatment plant. Well 3 would serve as a redundant source in case of higher peak flows or when wells need to be maintained, that could be blended with the treatment plant for wells 1, 2, and 15. All wells with Cr6 levels near or above the 10 ppb MCL would be treated in this option. Analysis of possible Cr6 treatment approaches is included in the Treatment Process Evaluation technical memorandum.

**Distribution System Analysis**: This option was modeled for the ability to meet customer demands in the District's distribution system, using supplies from the Upland wells, Gallery Well, river wells and the State Water Project. The total production would be 15,235 gpm, accounting for 160% of the maximum day demand (MDD) of 9,527 gpm determined by Stetson Engineers in their hydraulic analysis. The total flow in the system provides up to 60% of added contingency to supply the system during periods of increased water demands.

Table 7 summarizes the overall infrastructure and production of the proposed option:

**Table 7. Option B Features and Production Capacity**

| | Quantity | Cr6, ppb | Production Capacity, gpm |
|---|---|---|---|
| Treatment plants | 4 | | - |
| Treated upland wells | 7 | 6 | 5,750 |
| Untreated compliant wells | 3 | 0.7 – 4.1 | 850 |
| River wells | 10 | ND | 3,435 |
| Gallery well | 0 | | 0 |
| Mesa Verde Pump Station | 5 | ND | 5,200 |
| Total well production | | | 15,235 |

**Water Quality Compliance Assurance**

All groundwater above or near the Cr6 MCL would be treated to achieve a target goal of no more than 6 ppb entering the distribution system to provide buffering against fluctuations in treatment plant performance and analytical variation. It is common practice for utilities to target between 50-80% of the MCL in treatment to provide a margin of safety. The four treatment plants provide redundancy in the event that any well or treatment unit is taken out of service in an emergency or for planned maintenance. Inactive wells 1 and 3 that are out of compliance for Cr6 and nitrate, respectively, can be reactivated and brought into compliance through treatment and blending. The plants can accommodate potentially worsening raw water quality in the future, and still produce finished water that meets the Cr6 MCL. Overall risks associated with water quality have been alleviated and are well controlled, which results in the highest score possible for water quality assurance of the options considered (i.e., lowest water quality risk).

**Water Production Reliability**

In Option B, all wells would remain in full production in Zones 2 and 3. Currently inactive wells 1 and 3 would be reactivated to support the production and pressure in the Santa Ynez Zone 2. In years when surface water supplies are available, this option maintains current water production at 15,235 gpm, to meet peak demands, redundancy and future customers. In times when surface water supplies are interrupted by prolonged drought, environmental constraints, flooding or seismic damage or system maintenance the Upland wells would produce 6,600 gpm. Option B is given a score of 10 reflecting full production at current levels.

**Annualized Cost**

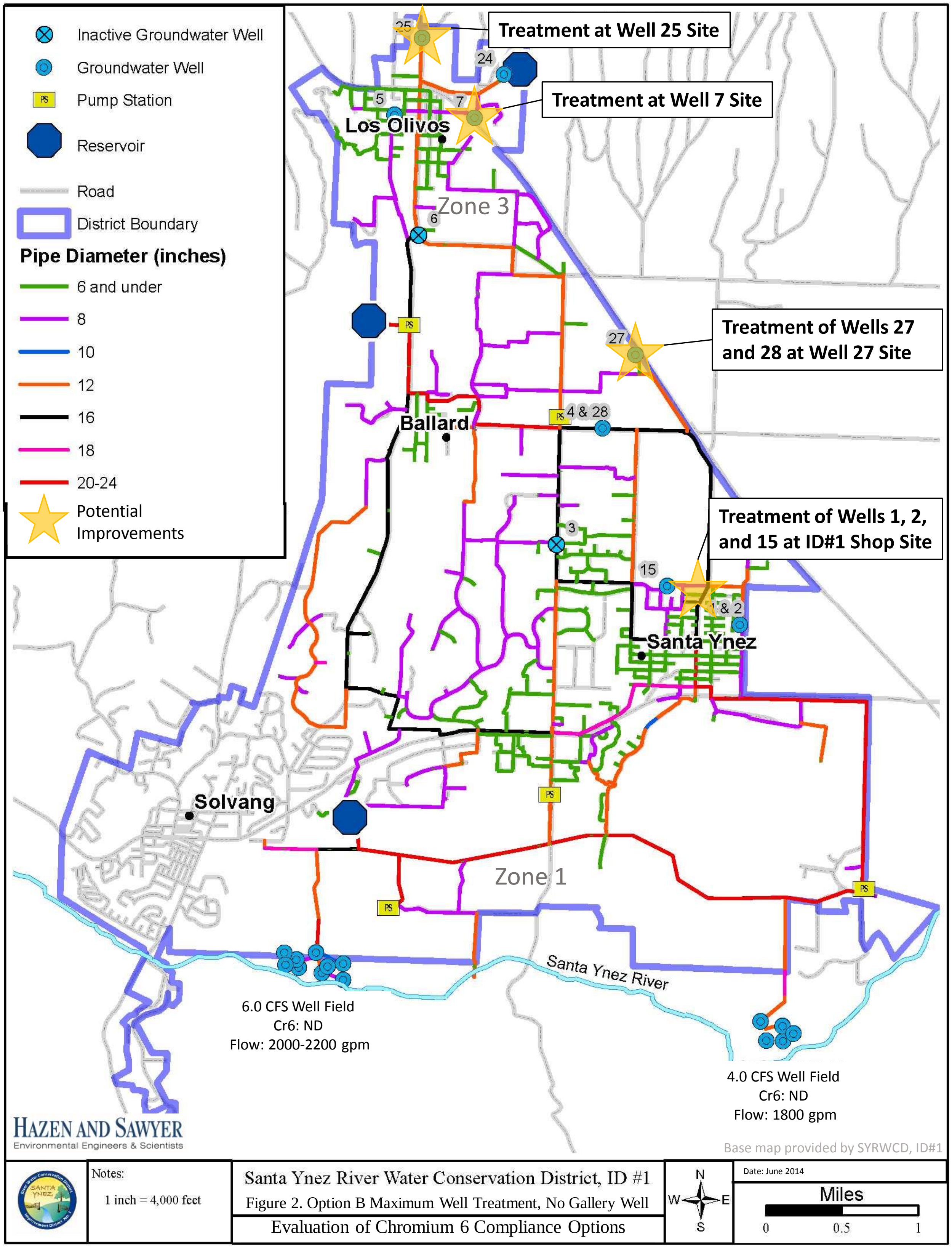
Implementation of Option B in the District's system would require construction of the treatment plants, additional pipelines, and booster pumps. The twenty-year annualized cost of capital and operation and maintenance is $4.8 million/year.

**Evaluation Criteria**

Scores assigned to each criteria for Option B are shown in Table 8, with a high score reflecting a relatively favorable option.

**Table 8. Option B Summary of Evaluation**

| Criteria | Score (0 to 10) |
|---|---|
| Water Quality Compliance Assurance | 10 |
| Water Production Reliability | 10 |
| Annualized Total Cost | $4.8M |


Inactive Groundwater Well
Groundwater Well
Pump Station
Reservoir
Road
District Boundary
Pipe Diameter (inches)
6 and under
8
10
12
16
18
20-24
Potential Improvements
Treatment at Well 25 Site
Treatment at Well 7 Site
Treatment of Wells 27 and 28 at Well 27 Site
Treatment of Wells 1, 2, and 15 at ID#1 Shop Site
Los Olivos
Zone 3
Ballard
Santa Ynez
Solvang
Zone 1
Santa Ynez River
6.0 CFS Well Field
Cr6: ND
Flow: 2000-2200 gpm
4.0 CFS Well Field
Cr6: ND
Flow: 1800 gpm
Base map provided by SYRWCD, ID#1
HAZEN AND SAWYER
Environmental Engineers & Scientists
Notes:
1 inch = 4,000 feet
Santa Ynez River Water Conservation District, ID #1
Figure 2. Option B Maximum Well Treatment, No Gallery Well
Evaluation of Chromium 6 Compliance Options
Date: June 2014
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# Option C Three Treatment Plants

**Description:** Option C is a combination of system upgrades to achieve Cr6 compliance:

- Three groundwater treatment plants
- Reactivation of Wells 1 and 3 in Santa Ynez
- Blending one marginal well with compliant water
- Packers on one well

The groundwater treatment plants would provide Cr6 removal from the three most highly impacted wells and two of the marginally impacted wells. The plants provide the opportunity to reactivate wells that were out of compliance and bring them back into production through treatment and/or blending.

High Cr6 wells 1, 2, and 15 with concentrations above 24 ppb would be combined and treated in one plant located at the District office and shop site. Well 3 would serve as a redundant water source at times of high peak demand or when other wells are undergoing maintenance. Marginal wells 7 and 25 would each have a treatment plant. Non-treatment improvements would be used for two other marginal wells to produce an overall Cr6 concentration below the 10 ppb MCL. Marginal Well 28 would be turned down and blended with Zone 2 distribution system water, and a packer would be installed in Well 27 to select water only from low Cr6 strata in the aquifer.

**Distribution System Analysis**: This option was modeled for the District's distribution system, including the Upland wells and additional volumes coming from the river wells and from the State Water Project to meet the system demand. The total flow of the system produces up to 14,685 gpm, accounting for 154% of the maximum day demand (MDD) of 9,527 gpm. The total flow in the system provides up to 54% of added contingency to supply the system during increased water demands.

Table 9 summarizes the overall infrastructure and production of the proposed option:

**Table 9. Option C Features and Production Capacity**

| | Quantity | Cr6, ppb | Production Capacity, gpm |
|---|---|---|---|
| Treatment plants | 3 | | |
| Treated upland wells | 5 | 6 | 3,750 |
| Blended/packer upland wells | 2 | <10 | 1,450 |
| Untreated compliant wells | 3 | 0.7 – 4.1 | 850 |
| River wells | 10 | ND | 3,435 |
| Gallery well | 0 | | 0 |
| Mesa Verde Pump Station | 5 | ND | 5,200 |
| Total well production | | | 14,685 |

**Water Quality Compliance Assurance**

Five of the Upland wells would be treated to achieve a target goal of 6 ppb in plants that could accommodate worsening raw water quality in the future and still produce finished water that meets the Cr6 MCL. The plants would have internal redundancy in the event that any well or treatment unit is take out of service in an emergency or for maintenance. The marginal well relying on blending is expected to stay below 10 ppb Cr6 entering the distribution system, but is at risk of non-compliance if the raw Cr6 concentration increases in either the compliant or non-compliant wells. The packered well is expected to achieve Cr6 below 10 ppb if strata can be reliably separated, but is at risk of non-compliance if short-circuiting occurs. Three upland wells have consistently low Cr6 concentrations and are expected to remain in compliance. Approximately 75% of the upland water is assured of compliance, and 25% is vulnerable to groundwater quality conditions. Option C received a score of 7 for compliance assurance.

**Water Production Reliability**

In Option C, all wells in Zones 2 and 3 would remain in production. Inactive wells 1 and 3 would be reactivated to support the production and pressure in the Santa Ynez Zone 2. In years when the river wells and State Project Water are available, the Option C combination of surface water and groundwater would meet current production. In times when surface water supplies are interrupted by prolonged drought, environmental constraints, flooding, seismic damage or system maintenance, the Option C Upland wells would produce 6650 gpm. Well 27 is expected to be turned down to blend with water from the distribution system to achieve the MCL at the blended water point of entry. Packers are estimated to reduce well 27 production by 25%. The future production of the blended well may have to be reduced if the Cr6 concentration increases in either the compliant or non-compliant well, but only a quarter of the groundwater production would be vulnerable. Option was given a score of 8 for production reliability.

**Annualized Cost**

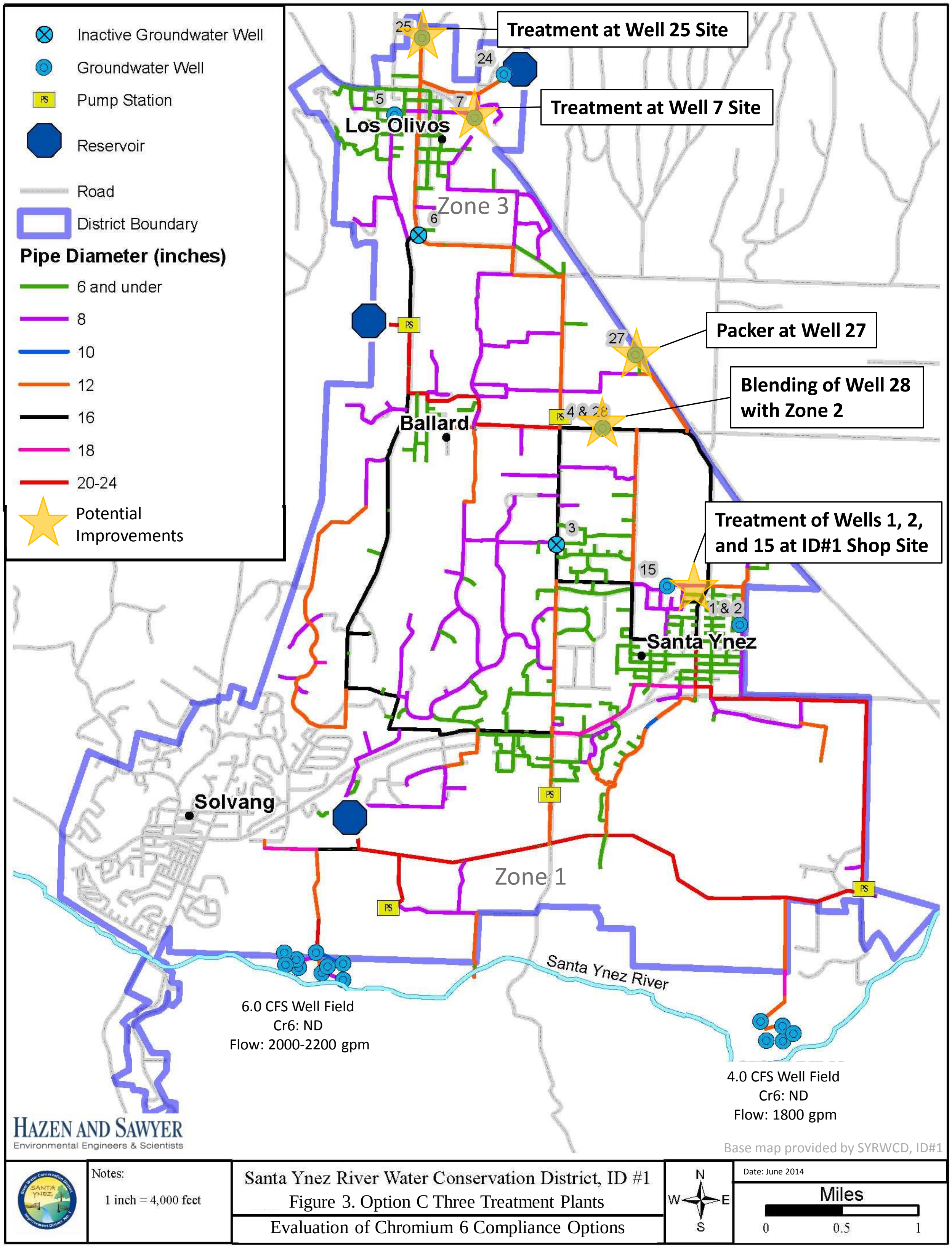
Implementation of multiple treatment plants on the District's system would significantly impact the overall costs. It would require plant construction, additional pipelines, and booster pumps.. As Option C combines both treatment and non-treatment alternatives to achieve compliance, the total cost to implement and operate the system would be less than the options that use only treatment plants. However, because treatment is still used to meet compliance, the overall annualized costs still remain high ($3.7 million/year).

**Evaluation Criteria**

Scores assigned to each criteria for Option C are shown in Table 10, with a high score reflecting a relatively favorable option.

**Table 10. Option C Summary of Evaluation**

| Criteria | Score (0 to 10) |
|---|---|
| Water Quality Compliance Assurance | 7 |
| Water Production Reliability | 8 |
| Annualized Cost | $3.7M |




Santa Ynez River Water Conservation District, ID #1
Figure 3. Option C Three Treatment Plants
Evaluation of Chromium 6 Compliance Options

# Options D, D-P, and D-C Two Treatment Plants

**Description:** Option set D (divided into sub-options D, D-P, and D-C) is a combination of system upgrades to achieve Cr6 compliance:

- Two groundwater treatment plants
- Reactivation of Wells 1 and 3 in Santa Ynez
- Blending two marginal wells with compliant water
- Packers on two wells to isolate the aquifer zone from which water is extracted, as an alternative to blending, or combined with blending

The two groundwater treatment plants would provide Cr6 removal from the three most highly impacted wells and two of the marginally impacted wells. The plants provide the opportunity to reactivate wells that were out of compliance and bring them back into production through treatment and/or blending. Non-treatment improvements would be used for two marginal wells: either blending with nearby compliant wells or installing packers to select water only from low Cr6 strata in the aquifer.

High Cr6 wells 1, 2, and 15 with concentrations above 24 ppb would be combined and treated in one plant located at the District office and shop site. Wells 27 and 28, which are marginally above or near the Cr6 MCL, would be treated at a second plant at the well 27 site. Well 3 would serve as a redundant water source at times of high peak demand or when other wells are undergoing maintenance.

In sub-option D, wells 7 and 24 would be blended together at the well 7 site, and wells 5 and 25 would be blended at the well 25 site to produce an overall Cr6 concentration below the 10 ppb MCL.

In sub-option D-P packers would be installed on wells 7 and 25 to achieve a Cr6 concentration below the 10 ppb MCL, rather than the blending.

Sub-option D-C combines all packer and blending alternatives: packers in wells 7 and 25, blending well 7 with well 24, and blending well 5 with 25.

**Distribution System Analysis**: For Option D, the total flow of the system produces up to 15,235 gpm, accounting for 160% of the maximum day demand (MDD) of 9,527 gpm. The total flow in the system provides up to 60% of added contingency to supply the system during increased water demands. If packers are installed at well 7 and well 25 for Options D-P and D-C, the total production in the system would be reduced to 14,735 gpm, which accounts for 155% of the MDD. Table 11 summarizes the overall infrastructure and production of the proposed option:

**Table 11. Option D Features and Production Capacity**

| | Quantity | Cr6, ppb | Production Capacity, gpm (D, D-P, & D-C) | | |
|---|---|---|---|---|---|
| Treated upland wells | 5 | < 6 | 3,900 | 3,900 | 3,900 |
| Blended/packer upland wells | 2 | 7 – 8.5 | 1850 | 1350 | 1350 |
| Untreated compliant wells | 3 | <6 | 850 | 850 | 850 |
| River wells | 10 | ND | 3,435 | 3,435 | 3,435 |
| Gallery well | 0 | ND | 0 | 0 | 0 |
| Mesa Verde Pump Station | 5 | | 5,200 | 5,200 | 5,200 |
| Total water production | | | 15,235 | 14,735 | 14,735 |

**Water Quality Compliance Assurance**

Five of the Upland wells would be treated to achieve a target goal of 6 ppb in plants that could accommodate worsening raw water quality in the future and still produce finished water that meets the Cr6 MCL. The plants have internal redundancy in the event that any well or treatment unit is take out of service in an emergency or for maintenance. The two marginal wells relying on blending are expected to achieve 7 to 8.5 ppb Cr6 entering the distribution system, but are at risk of non-compliance if the raw Cr6 concentration increases in either the compliant or non-compliant wells. Packered wells are expected to achieve Cr6 below 10 ppb if strata can be reliably separated, but are at risk of non-compliance if short-circuiting occurs. Three upland wells have consistently low Cr6 concentrations and are expected to remain in compliance. Option D received a score of 7 because approximately 70% of the upland water is assured of compliance, and 30% is vulnerable to groundwater quality conditions.

**Water Production Reliability**

In Option D, all wells in Zones 2 and 3 would remain in production. Inactive wells 1 and 3 would be reactivated to support the production and pressure in the Santa Ynez Zone 2. In years when the river wells and State Project Water are available, the Option D combination of surface water and groundwater would meet current production. In times when surface water supplies are interrupted by prolonged drought, environmental constraints, flooding, seismic damage or system maintenance, the Option D Upland wells would produce 6,600 gpm. Options D-P and D-C would produce a lower flow rate, estimated at 6,100 gpm because of the packers are estimated to reduce well production by 25%. The production rate of the blended wells may have to be reduced if the Cr6 concentration increases in either the compliant or non-compliant well, but less than a third of the groundwater production would be vulnerable. Option D is preferred over D-P and D-C, with a score of 9 for production reliability. Packers can be tried for Cr6 reduction, but the production impact should be tested.

**Annualized Cost**

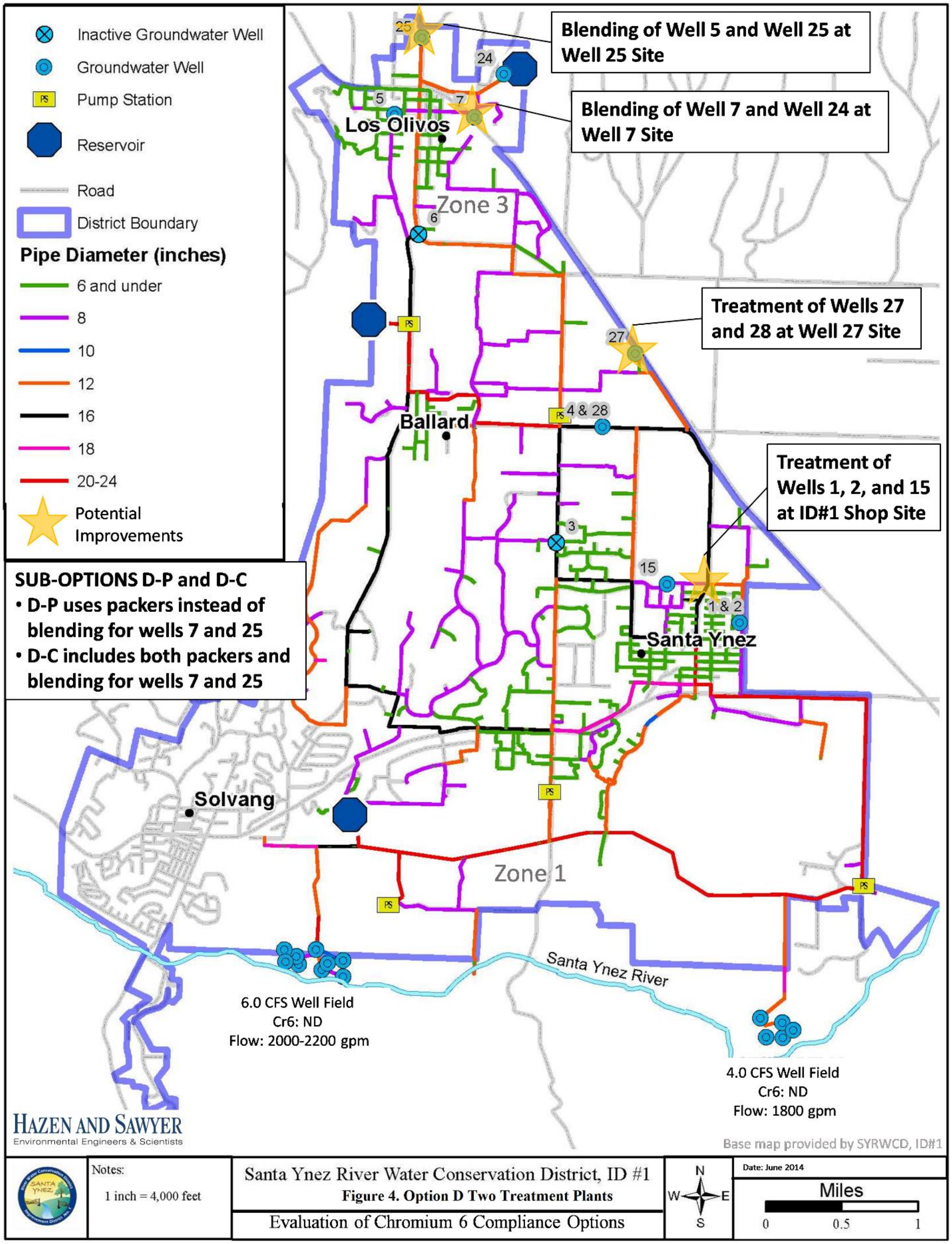
Implementation of Option D includes two treatment plants, additional pipelines, booster pumps and blending facilities. Sub-options D-P has a lower cost because packers are substituted for blending. Sub-option D-C is higher in cost because it combines blending and packers. The use of non-treatment alternatives makes the total cost to implement and operate Option D less than an Option that solely relies on treatment plants. The twenty-year annualized cost of capital and operation and maintenance is $3.4 million/year.

**Evaluation Criteria**

Scores assigned to each criteria for Option D, D-P, and D-C are shown in Table 12, with a high score reflecting a relatively favorable option.

**Table 12. Option D Summary of Evaluation**

| Criteria | Option D | Option D-P | Option D-C |
|---|---|---|---|
| Water Quality Compliance Assurance | 7 | 7 | 7 |
| Water Production Reliability | 9 | 8 | 8 |
| Annualized Total Cost | $3.4M | $3.3M | $3.5M |


Inactive Groundwater Well
Groundwater Well
Pump Station
Reservoir
Road
District Boundary
Pipe Diameter (inches)
6 and under
8
10
12
16
18
20-24
Potential Improvements
SUB-OPTIONS D-P and D-C
• D-P uses packers instead of blending for wells 7 and 25
• D-C includes both packers and blending for wells 7 and 25
Blending of Well 5 and Well 25 at Well 25 Site
Blending of Well 7 and Well 24 at Well 7 Site
Treatment of Wells 27 and 28 at Well 27 Site
Treatment of Wells 1, 2, and 15 at ID#1 Shop Site
Los Olivos
Zone 3
Ballard
Santa Ynez
Solvang
Zone 1
Santa Ynez River
6.0 CFS Well Field
Cr6: ND
Flow: 2000-2200 gpm
4.0 CFS Well Field
Cr6: ND
Flow: 1800 gpm
HAZEN AND SAWYER
Environmental Engineers & Scientists
Base map provided by SYRWCD, ID#1
Notes:
1 inch = 4,000 feet
Santa Ynez River Water Conservation District, ID #1
Figure 4. Option D Two Treatment Plants
Evaluation of Chromium 6 Compliance Options
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# Options E, E-P, and E-C Maximum Blending

**Description:** Option set E (divided into sub-options E, E-P, and E-C) is a combination of well treatment, well blending, and utilization of packers to achieve Cr6 compliance.

- One groundwater treatment plant
- Reactivation of Wells 1 and 3 in Santa Ynez
- Blending three marginal wells with compliant water
- Packers on one to three marginal wells, as an alternative to blending, or combined with blending

The groundwater treatment plant would provide Cr6 removal from the three most highly impacted wells. The plant provides the opportunity to reactivate wells that were out of compliance and bring them back into production through treatment and/or blending. Non-treatment improvements would be used for three marginal wells: either blending with compliant Upland waters or installing packers to select water from low Cr6 strata in the aquifer. Packers are assumed to reduce well flow rates by 25%.

High Cr6 wells 1, 2, and 15 with concentrations above 24 ppb would be treated at a plant located at the District office and shop site. Well 3 would serve as a redundant source that could blend at the treatment plant in case of higher peak demand or when other wells are undergoing maintenance.

For Sub-option E, wells 7 and 24 would be blended at the well 7 site, wells 5 and 25 would be blended at the well 25 site, and well 28 would be blended with Zone 2 distribution system water consisting of water from Zone 1 and wells in Zone 2. A packer will be installed in well 27.

Sub-option E-P would blend well 28 with water in Zone 2, and install packers in wells 7, 25, and 27.

Sub-option E-C would install packers in wells 7 and 25, and then blend them with wells 24 and 5, respectively. Well 28 would be blended with water in Zone 2. A packer would be installed in well 27.

**Distribution System Analysis**: Option E was modeled for the ability to meet customer demands in the District's distribution system, using supplies from the Upland wells with only one packer, river wells and State Project Water. The total production would be 14,685 gpm, accounting for 154% of the maximum day demand (MDD) of 9,527 gpm. The total flow in the system provides up to 54% of contingency to supply the system during increased water demands. System production would decrease to 14,185 gpm with the installation of two more packers in Sub-Options E-P and E-C. Table 13 summarizes the overall infrastructure and production of the proposed option:

**Table 13. Option E Features and Production Capacity**

| | Quantity | Cr6, ppb | Production Capacity, gpm (E, E-P, E-C) | | |
|---|---|---|---|---|---|
| Treatment plants | 1 | | | | |
| Treated upland wells | 3 | <6 | 1,900 | 1,900 | 1,900 |
| Blended/packer upland wells | 4 | 7 - 8.5 | 3,300 | 2,800 | 2,800 |
| Compliant wells | 3 | 1 - 4 | 850 | 850 | 850 |
| River wells | 10 | ND | 3,435 | 3,435 | 3,435 |
| Gallery well | 0 | | 0 | 0 | 0 |
| Mesa Verde Pump Station | 5 | ND | 5,200 | 5,200 | 5,200 |
| Total water production | | | 14,685 | 14,185 | 14,185 |

**Water Quality Compliance Assurance**

Three wells with Cr6 concentrations above the MCL would be treated to achieve a target goal of no more than 6 ppb entering the distribution system. The plant would have redundancy for emergencies or maintenance and can accommodate potentially worsening raw water quality. These treated wells and the existing compliant wells have a high degree of water quality assurance, but they represent less than half of the upland groundwater resource. Three marginal wells would rely on blending that is expected to achieve 7 to 8.5 ppb Cr6 entering the distribution system. Two to four wells will rely on packers and are expected to achieve Cr6 below 10 ppb if aquifer strata are reliably separated. The untreated marginal wells provide more than half of the upland groundwater and are vulnerable to several possible risks: Cr6 concentrations could rise in the marginal wells, Cr6 concentrations could rise in the compliant wells that provide blending water, a compliant well could go out of service, short-circuiting could occur in packered wells. The Water Quality Assurance score is 4.

**Water Production Reliability**

In Option E, all wells in Zones 2 and 3 would remain in operation, and inactive wells 1 and 3 would be reactivated to support the production and pressure in Santa Ynez Zone 2, but reliance on packers would reduce the overall groundwater production. In years when surface water supplies are available through the river wells and State Project Water, this option produces 14,685 gpm which is less than current production. In times when surface water supplies are interrupted by prolonged drought, environmental constraints, flooding, seismic damage or system maintenance, Option E would produce 6,050 gpm from the Upland wells and is preferred over Options E-P and E-C that would produce 5,550 gpm. The production rate is at risk of being reduced by half if the Cr6 concentration increases in untreated wells. Option E is given a score of 7 for production reliability.

**Annualized Cost**

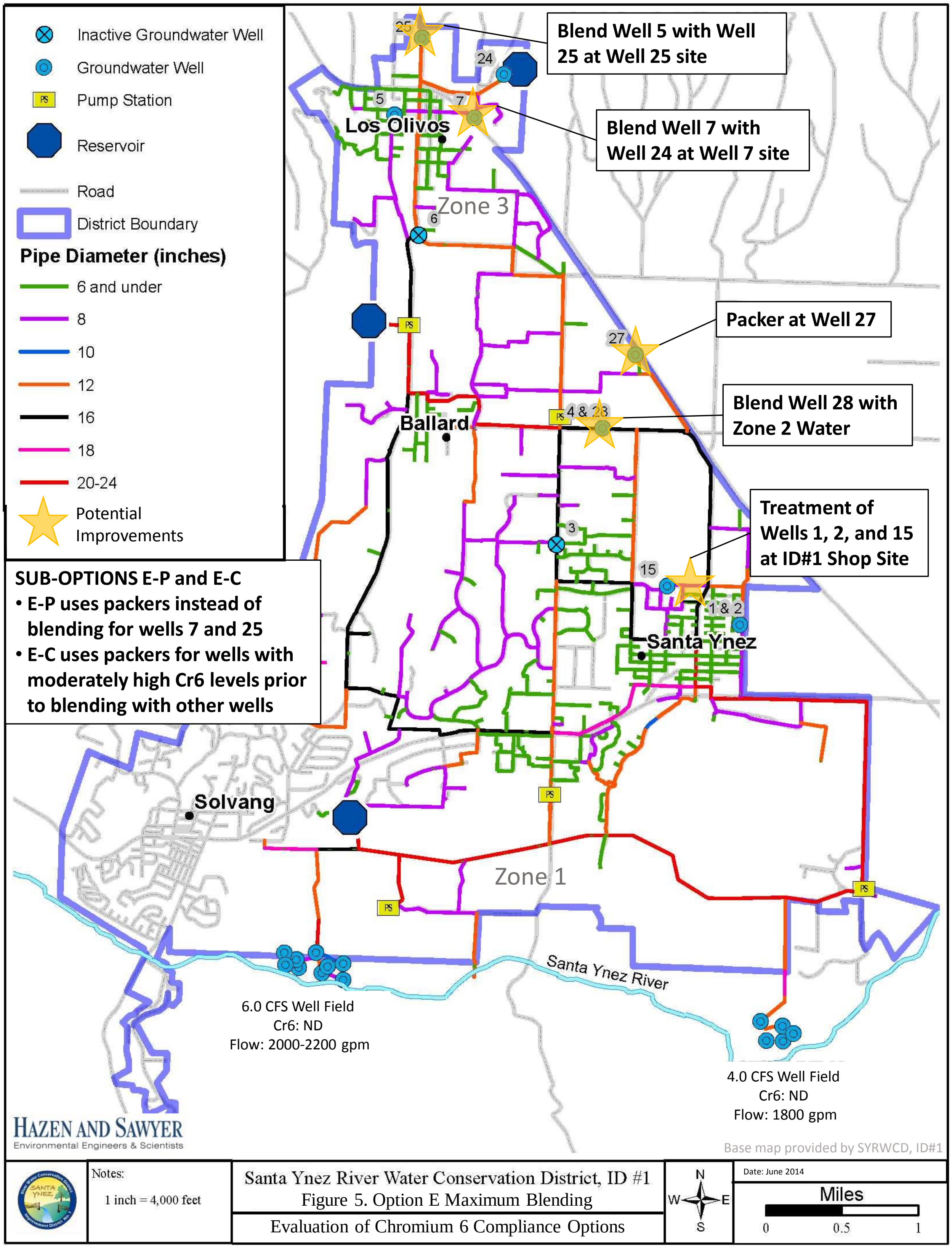
Implementation of Option E would require construction of one treatment plant, pipelines and improvements for blending and packers. The twenty-year annualized cost for capital, operation and maintenance is $2.3 million/year.

**Evaluation Criteria**

Scores assigned to each criteria for Option E, E-P and E-C are shown in Table 14. A score of 10 is most favorable. Option E received moderate scores in water quality compliance assurance and high scores in production reliability.

**Table 14. Option E Summary of Evaluation**

| CRITERIA | Option E | Option E-P | Option E-C |
|---|---|---|---|
| Water Quality Compliance Assurance | 4 | 4 | 4 |
| Water Production Reliability | 7 | 6 | 6 |
| Annualized Total Cost | $2.3M | $2.3M | $2.4M |


Inactive Groundwater Well
Groundwater Well
Pump Station
Reservoir
Road
District Boundary
Pipe Diameter (inches)
6 and under
8
10
12
16
18
20-24
Potential Improvements
SUB-OPTIONS E-P and E-C
• E-P uses packers instead of blending for wells 7 and 25
• E-C uses packers for wells with moderately high Cr6 levels prior to blending with other wells
Blend Well 5 with Well 25 at Well 25 site
Blend Well 7 with Well 24 at Well 7 site
Packer at Well 27
Blend Well 28 with Zone 2 Water
Treatment of Wells 1, 2, and 15 at ID#1 Shop Site
Los Olivos
Zone 3
Ballard
Santa Ynez
Solvang
Zone 1
Santa Ynez River
25
24
5
7
6
27
4 & 28
3
15
1 & 2
6.0 CFS Well Field
Cr6: ND
Flow: 2000-2200 gpm
4.0 CFS Well Field
Cr6: ND
Flow: 1800 gpm
Base map provided by SYRWCD, ID#1
HAZEN AND SAWYER
Environmental Engineers & Scientists
Notes:
1 inch = 4,000 feet
Santa Ynez River Water Conservation District, ID #1
Figure 5. Option E Maximum Blending
Evaluation of Chromium 6 Compliance Options
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# Option F Minimum Well Production

**Description:** Option F considers minimizing the use of the Upland Wells to meet Cr6 compliance. The features of Option F are:

- Three small Upland wells in full production
- Inactivation of eight Upland wells
- Booster pumps and pipelines to increase surface water delivery to Zones 2 and 3

This option does not consider treatment or non-treatment approaches, and instead relies on limiting the use of wells that have been impacted with Cr6, requiring them to be shut down when Cr6 levels surpass the MCL. The system will be supplied with water from Wells 5, 6, and 24 which contain relatively low Cr6 levels ranging from 0.7 to 4.1 ppb. Existing water supplies from the river wells and State Project Water would be pumped further into Zones 2 and 3.

**Distribution System Analysis**: This option was modeled for the District's distribution system assuming that all impacted wells are out of service due to high Cr6 levels. The distribution model included water provided by the river wells and the State Water Project. The total flow of the system would produce up to 9,485 gpm, accounting for nearly 100% of the maximum day demand (MDD) of 9,527 gpm. This option does not provide any added contingency for peaking or increasing water demand.

Table 15 summarizes the overall infrastructure and production of the proposed option:

**Table 15. Option F Features and Production Capacity**

| | Quantity | Cr6, ppb | Production Capacity, gpm |
|---|---|---|---|
| Treatment plants | 0 | | |
| Treated upland wells | 0 | | 0 |
| Compliant upland wells | 3 | 0.7 – 4.1 | 850 |
| Blended/packer wells | 0 | | 0 |
| River wells | 10 | ND | 3,435 |
| Gallery well | 0 | | 0 |
| Mesa Verde Pump Station | 5 | ND | 5,200 |
| Total well production | | | 9,485 |

**Water Quality Compliance Assurance**

By turning off all the wells that are impacted by Cr6 levels above the MCL, the water throughout the distribution system would experience a low Cr6 concentration. There are potentially high risks involved in relying on a few wells to supply the system with water if the Cr6 levels increase in the wells over time. In a scenario in which surface water supplies are interrupted, and marginal wells are out of compliance, the only way for the District to meet the most basic customer demands would be to serve non-compliant water. Option F is given the lowest score of all options for water quality compliance assurance.

### Water Production Reliability

Since most of the wells will not be used as a result of the Cr6 levels, only a limited number of wells will provide water to the system. No additional sources will make up for inactive wells resulting in a much lower overall production. In years when surface water supplies are available, the combination of river wells, State Project Water and the compliant wells is 9,485 gpm, which is far less than current production. In times when surface water supplies are interrupted by prolonged drought, environmental constraints, flooding, seismic damage or system maintenance, Option F would produce a mere 850 gpm. Option F achieves the lowest score of all options in regards to reliable water production.

### Annualized Cost

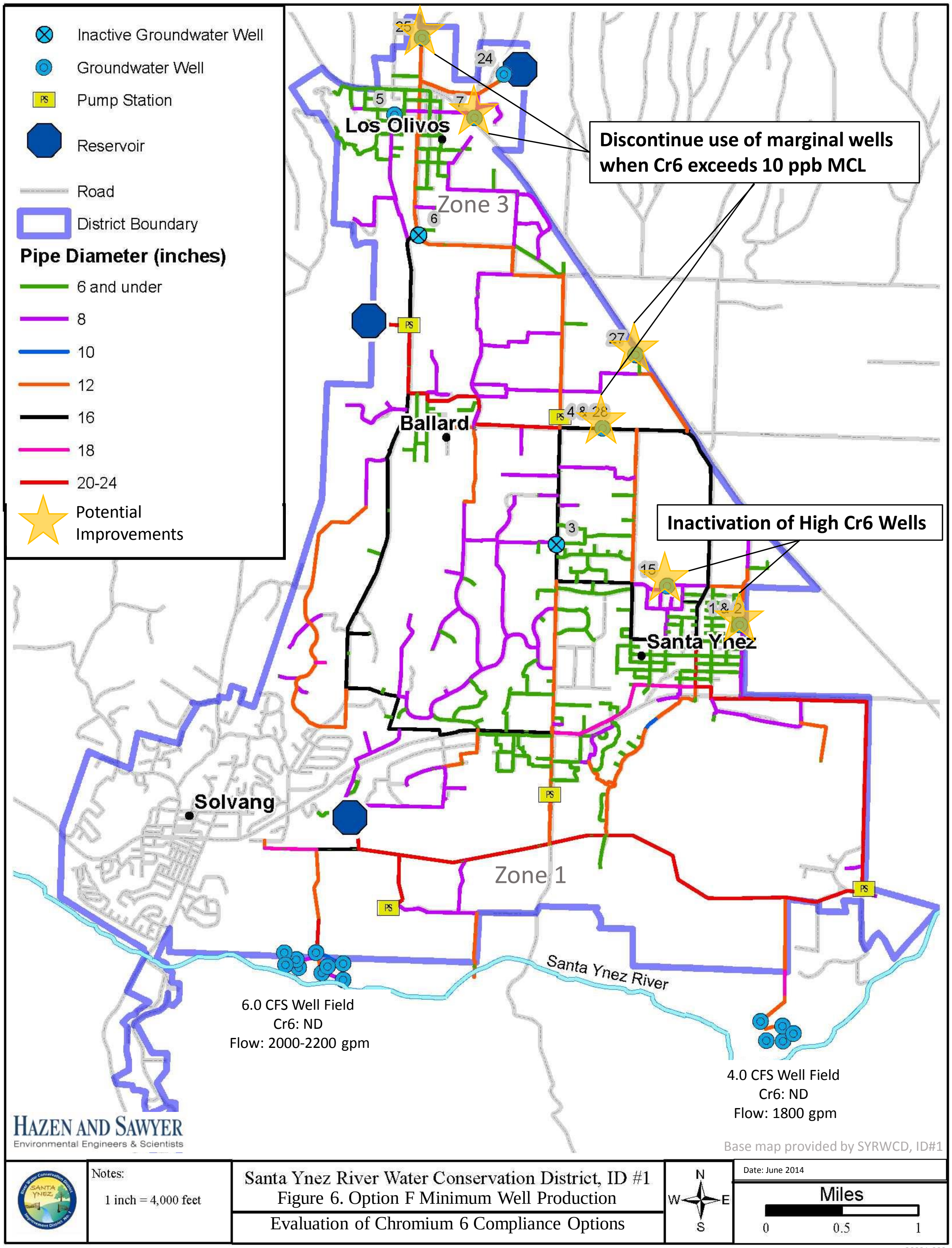
Option F would require construction of booster pumps and pipelines to deliver surface water to Zones 2 and 3. The twenty-year annualized cost of capital, operation and maintenance is $0.4 million/year.

### Evaluation Criteria

Scores assigned to each criteria for Option F are shown in Table 16, with a high score reflecting a relatively favorable option.

**Table 16. Option F Summary of Evaluation**

| Criteria | Score (0 to 10) |
|---|---|
| Water Quality Compliance Assurance | 1 |
| Water Production Reliability | 1 |
| Annualized Cost | $0.4M |


Inactive Groundwater Well
Groundwater Well
Pump Station
Reservoir
Road
District Boundary
Pipe Diameter (inches)
6 and under
8
10
12
16
18
20-24
Potential Improvements
Discontinue use of marginal wells when Cr6 exceeds 10 ppb MCL
Inactivation of High Cr6 Wells
Los Olivos
Ballard
Santa Ynez
Solvang
Zone 3
Zone 1
Santa Ynez River
6.0 CFS Well Field
Cr6: ND
Flow: 2000-2200 gpm
4.0 CFS Well Field
Cr6: ND
Flow: 1800 gpm
Base map provided by SYRWCD, ID#1
HAZEN AND SAWYER
Environmental Engineers & Scientists
Notes:
1 inch = 4,000 feet
Santa Ynez River Water Conservation District, ID #1
Figure 6. Option F Minimum Well Production
Evaluation of Chromium 6 Compliance Options
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# Option G Separate Irrigation System

**Description:** Option G would split the District water distribution system into a domestic water system and a separate irrigation water system, including

- Domestic water system
  - Existing river wells, and six existing Upland wells
  - Packer on one marginally compliant well
  - Blending two marginal wells with compliant wells
- Irrigation water system
  - Existing gallery well and three existing non-compliant wells
  - Reactivation of wells 1 and 3
  - Storage and distribution system

The domestic water system would use the existing reservoirs, the river wells and wells 5, 7, 24, 25, and 27. No treatment plants would be installed. Three small existing wells 5, 6 and 24 with low Cr6 would be used for the domestic system. Non-treatment improvements would be used for three larger marginal wells. Well 7 would be blended with compliant well 24, and well 25 would be blended with compliant well 5. A packer would be installed in well 27.

This requires a completely new irrigation water distribution system to be implemented to accept water from the gallery well and wells 1, 2, 3, 15, and 28 that does not meet drinking water standards. This water would be distributed to larger irrigation customers to be used solely for irrigation purposes. Two inactive wells that are out of compliance for Cr6 or nitrate would be brought back into production. To meet frost control demands, the domestic system would be connected via one-way valves to add production and storage for irrigation, prevent irrigation water from flowing into the domestic system.

**Distribution System Analysis**: Option G was modeled for the ability to meet customer demands in the two separate systems, using supplies from Upland wells, river wells, gallery well and State Project water. Total production would be 16,311 gpm. The domestic system could produce up to 12,285 gpm meeting 171% of the domestic maximum day demand (MDD) of 9,527 gpm, providing 71% of added contingency for increasing water demand and peaking. The irrigation system would supply up to 4,026 gpm. Table 17 summarizes the breakdown of the overall system with the proposed option:

**Table 17. Option G Features and Production Capacity**

| | Quantity | Cr6, ppb | Domestic Capacity, gpm | Irrigation Capacity, gpm |
|---|---|---|---|---|
| Treatment plants | 0 | | | |
| Treated upland wells | 0 | | 0 | 0 |
| Blended/packered wells | 11 | 7 – 8.5 | 2800 | 0 |
| Untreated compliant wells | | 0.7 – 4.1 | 850 | 0 |
| Non-compliant upland wells | | 10 – 36 | 0 | 3,250 |
| Gallery well | 1 | ND | 0 | 776 |
| River wells | 10 | ND | 3,435 | 0 |
| Mesa Verde Pump Station | 5 | ND | 5,200 | 0 |
| Total well production | | | 12,285 | 4,026 |

**Water Quality Compliance Assurance**

The existing compliant wells have a high degree of water quality assurance, but they represent a small fraction of the upland groundwater resource. Two marginal wells would rely on blending that is expected to achieve 7 to 8.5 ppb Cr6 entering the distribution system. One well will rely on a packer and is expected to achieve Cr6 below 10 ppb if aquifer strata are reliably separated. The untreated marginal wells provide most of the upland groundwater and are vulnerable to several possible risks: Cr6 concentrations could rise in the marginal wells, Cr6 concentrations could rise in the compliant wells that provide blending water, a compliant well could go out of service, short-circuiting could occur in packered wells. There are potentially high risks involved in relying on a few untreated wells if the Cr6 levels increase in the wells over time. In a scenario in which surface water supplies are interrupted, and marginal wells are out of compliance, the only way for the District to meet basic customer demands would be to serve non-compliant water. A low score of 1 was assigned for water quality assurance.

**Water Production Reliability**

In Option G, all wells in Zones 2 and 3 would remain in production. Inactive wells 1 and 3 and the Gallery Well would be reactivated to support irrigation. In years when the river wells and State Project Water are available, the combination of surface water and groundwater would meet current production. Although the irrigation system has access to all of the District water resources, the domestic system is at risk of inadequate production if surface water availability or groundwater quality diminish. In times when surface water supplies are interrupted by prolonged drought, environmental constraints, flooding, seismic damage or system maintenance, the domestic Upland wells would produce 3,650 gpm. If the marginal wells must be reduced for Cr6 compliance, the Upland well production could go down as low as 850 gpm in a worst case scenario. A score of 3 was assigned for water production reliability.

**Annualized Cost**

Option G requires construction and maintenance of separate irrigation system pipelines and reservoirs, and a modified domestic system. The twenty-year annualized cost is $2.3 million/year.

**Evaluation Criteria**

Scores assigned to each criteria for Option G are shown in Table 18, with a high score reflecting a relatively favorable option.

**Table 18. Option G Summary of Evaluation**

| Criteria | Score (0 to 10) |
|---|---|
| Water Quality Compliance Assurance | 1 |
| Water Production Reliability | 3 |
| Annualized Cost | $2.3M |

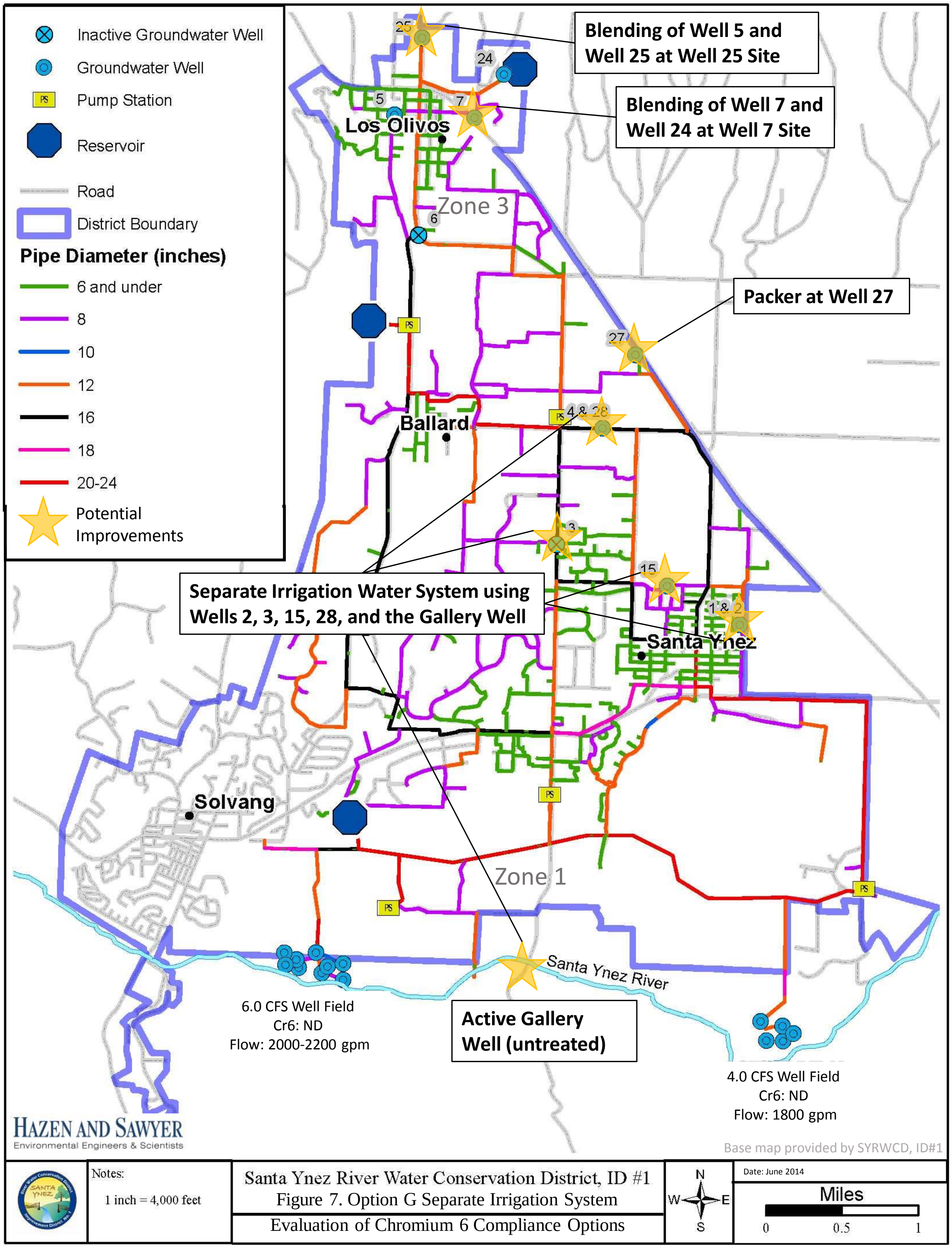
Inactive Groundwater Well
Groundwater Well
Pump Station
Reservoir
Road
District Boundary
Pipe Diameter (inches)
6 and under
8
10
12
16
18
20-24
Potential Improvements
Blending of Well 5 and Well 25 at Well 25 Site
Blending of Well 7 and Well 24 at Well 7 Site
Packer at Well 27
Separate Irrigation Water System using Wells 2, 3, 15, 28, and the Gallery Well
Los Olivos
Zone 3
Ballard
Santa Ynez
Solvang
Zone 1
Santa Ynez River
6.0 CFS Well Field
Cr6: ND
Flow: 2000-2200 gpm
Active Gallery Well (untreated)
4.0 CFS Well Field
Cr6: ND
Flow: 1800 gpm
Base map provided by SYRWCD, ID#1
HAZEN AND SAWYER
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Figure 7. Option G Separate Irrigation System
Evaluation of Chromium 6 Compliance Options
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# Summary of Complete Options Evaluation

In review of the all of the complete options, three emerge as distinctly different options with strong value for the cost. At the high end of the range is an option with full assurance and production, at the low end is moderate assurance and reliability and in the middle is a moderately priced with relatively good assurance and reliability. The scoring is summarized in Table 19, and also in Figure 8.

**Table 19. Scoring of Complete Options**

| Complete Option | Water Quality Compliance Assurance | Water Production Reliability | Total Score | Annualized Cost |
|---|---|---|---|---|
| **A** | 10 | 11 | 21 | $5.1M |
| **B** | 10 | 10 | 20 | $4.8M |
| **C** | 7 | 8 | 15 | $3.7M |
| **D** | 7 | 9 | 16 | $3.4M |
| **D-P** | 7 | 8 | 15 | $3.3M |
| **D-C** | 7 | 8 | 15 | $3.5M |
| **E** | 4 | 7 | 11 | $2.3M |
| **E-P** | 4 | 6 | 10 | $2.3M |
| **E-C** | 4 | 6 | 10 | $2.4M |
| **F** | 1 | 1 | 2 | $0.4M |
| **G** | 1 | 3 | 4 | $2.3M |

### High Level Costs

Complete Option A emerged at the high end of the range. Treatment plants on all non-compliant and marginal wells provide full assurance of Cr6 compliance, and allow inactive wells to be reactivated. The Gallery well treatment plant adds production capacity beyond the current production rate. Changes in water quality, or interruption to surface water supplies do not affect the production capacity of the system in Option A. The cost is highest at $5.1 million.

The other option at this level is Option B, which did not include the Gallery Well plant. The cost savings ($300,000) is relatively small for giving up the opportunity to utilize this water resource.

### Mid Level Costs

Complete Option D is the favored option at the mid range of alternatives. Two groundwater treatment plants would give assurance that 70% of the groundwater would operate in full compliance and full production. The other third would rely on blending and packers, and have some vulnerability to changing Cr6 in the groundwater. The cost is in the midrange of $3.4 million.

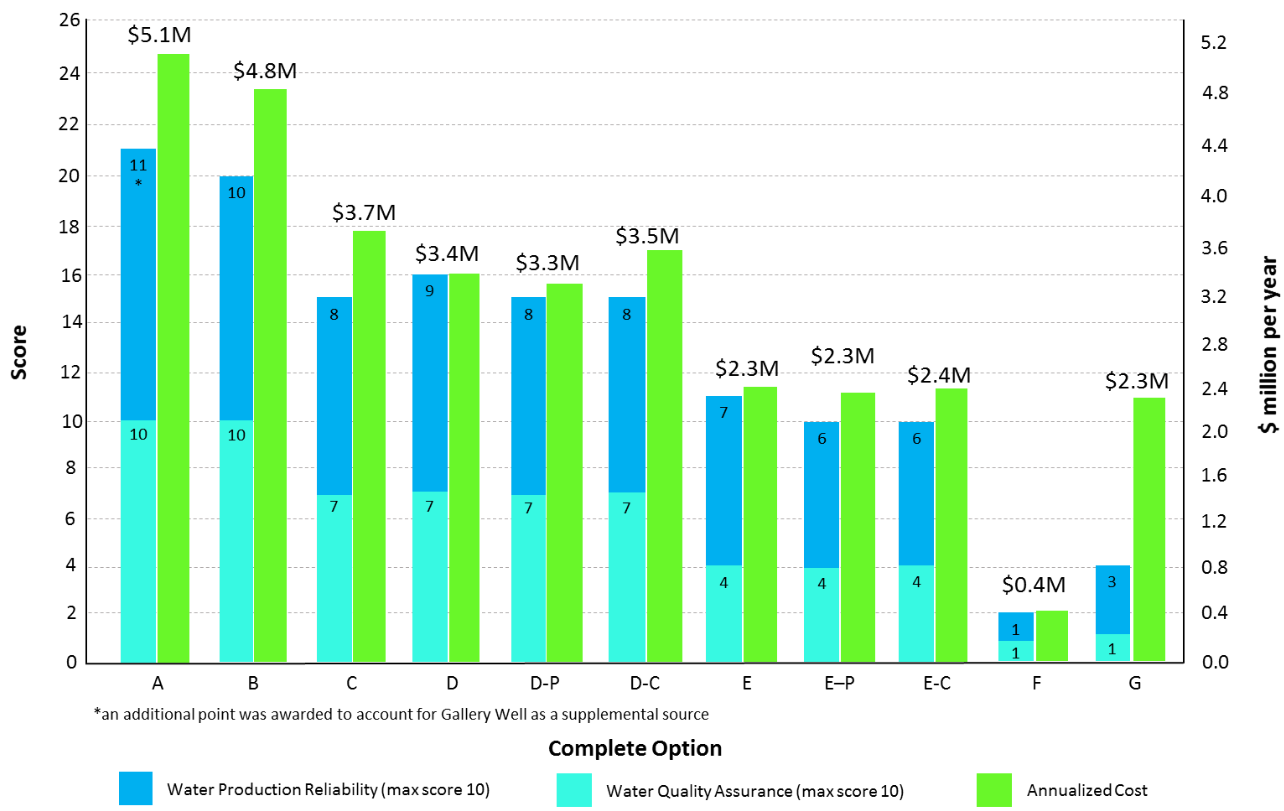
Other options at this level are Option C and variations of Option D. All of the variations provided a similar level of water quality compliance assurance, with approximately three quarters of the Upland groundwater in the range of 6 ppb or lower entering the system. One quarter of the Upland groundwater supplies rely on packers or blending, making them vulnerable to changes in groundwater quality. The differences between these options and Option D are the location of the second groundwater plant and the different combinations of blending and packers. The water production reliability was lower than D in every case due to packers placed on more productive wells in the other options. The cost of other options was higher compared with their compliance and production values.

### Low Level Costs

Complete Option E was clearly the favored option at the low end of the range. A single plant on the high Cr6 wells provide full assurance of Cr6 compliance and water production on approximately half of the Upland groundwater. Blending on most of the marginal wells and packers on one well provide compliance and production on the remainder of the wells, but are vulnerable to non-compliance and lower production if the Cr6 increases in those marginal wells. The cost is lowest at $2.3 million.

The other options at this level are F and G. Option F has unacceptable risks because it inactivates all but three small wells and relies only on river wells and State Project Water which are subject to interruption by prolonged drought, environmental constraints or flooding. Option G creates two separate systems for Irrigation water and domestic water. The domestic water relies on the same river wells and State Water Project, and is vulnerable to supply interruptions. The cost of building separate parallel systems is equal to the cost of building treatment and water quality improvements in Option E, but without the compliance and domestic production capabilities.

**Figure 8. Scoring and Cost Comparison of Complete Options**



# Conclusions

The consultant working group developed three options for consideration by the District.

"Complete Option A - Maximum Treatment" is the option with the greatest benefits in water production and quality. Every non-compliant and marginal well would receive treatment, giving full assurance that the Upland groundwater meets the Cr 6 MCL with redundancy and adaptability for future changes in groundwater quality. Option A increases the current production of water by utilizing the unused allocation for the Gallery Well and putting it into beneficial use as part of the potable water supply. Inactive wells will be put back into production also. This option provides the most diversified water portfolio, using surface water, river wells and Upland wells at multiple points of entry into the system, which gives the District the greatest flexibility to manage its resources to meet demands under any circumstances. This option mitigates all potential risks identified by the consultant working group, so no risks or future upgrade costs are listed for this Option, as shown in Tables 20 and 21.The drawback to this option is that it is also the most costly, with an annualized cost of $5.1M.

**Table 20. Risks Associated with Components of Complete Option A**

| Complete Option A Components | Expected Cr6 Results (ppb) | Potential Risks |
|---|---|---|
| **Alternative 3-1** (Surface water treatment of Gallery Well) | Meets target of 6 ppb | No risks |
| **Alternative 5-1** (Treat Wells 1,2,3 and 15 at existing ID#1 shop site) | Meets target of 6 ppb | No risks |
| **Alternative 5-2** (Treat Wells 27 and 28 at Well 27 site) | Meets target of 6 ppb | No risks |
| **Alternative 5-3** (Treat Well 7 at Well 7 site) | Meets target of 6 ppb | No risks |
| **Alternative 5-4** (Treat Well 25 at Well 25 site) | Meets target of 6 ppb | No risks |

**Table 21. Annualized Costs to Upgrade Complete Option A in the Future**

| | Annualized Cost | | | |
|---|---|---|---|---|
| | **Capital ($)** | **O&M ($)** | **Energy ($)** | **Total ($)** |
| **Option A Package** | 2,069,000 | 2,918,000 | 112,000 | 5,099,000 |
| | | | | |
| *Add-ons:* | | | | |
| No add-ons for this option | - | - | - | - |
| **Option A Package *plus* Add-ons Total:** | No upgrades necessary, cost remains the same | | | |

"Complete Option D" is a feasible option with two treatment plants. All of the Upland Wells would be brought into compliance and the total production would be the same as current production. Seventy percent of the Upland groundwater would be in compliance with a high level of certainty. Thirty percent of the Upland groundwater supply would rely on blending and would be vulnerable to non-compliance if groundwater Cr6 concentrations increase in the future. The manageable risks associated with Complete Option D are listed below in Table 22.

**Table 22. Risks Associated with Components of Complete Option D**

| Complete Option D Components | Expected Cr6 Results (ppb) | Potential Risks |
|---|---|---|
| **Alternative 1-2** (Blend well 7 with well 24) | 8.5 | • Must maintain proper blending ratio to ensure overall Cr6 remains below MCL<br>• Well 7 must be operated only when Well 24 is operated, otherwise Well 7 may exceed the MCL<br>• Potential loss of up 1200 gpm (combined flow) if Well 24 is offline for maintenance<br>• Variable Cr6 levels in wells are dependent on several factors (e.g. flowrate, depth, etc.) |
| **Alternative 1-5** (Blend well 5 with well 25) | 8.0 | • Must maintain proper blending ratio to ensure overall Cr6 remains below MCL<br>• Well 25 must be operated only when Well 5 is operated, otherwise Well 25 will likely exceed the MCL<br>• Potential loss of up 1200 gpm (combined flow) if Well 5 is offline for maintenance<br>• Variable Cr6 levels in wells are dependent on several factors (e.g. flowrate, depth, etc.) |

Complete Option D is an attractive alternative to the District despite the risks presented in Table 20. Two opportunities for improving the attractiveness of this option include packer installation and surface gallery treatment. The addition of other components such as installation of packers on wells used for blending could improve the overall water quality. Implementation of an additional treatment plant to treat the Gallery wells could supply additional capacity to meet future demands. Although there are additional costs affiliated with the upgrades (estimated in Table 23), the District has options to address the risks and future demands that can be added to Option D.

**Table 23. Annualized Costs to Upgrade Complete Option D in the Future**

| | Annualized Cost | | | |
|---|---|---|---|---|
| | **Capital ($)** | **O&M ($)** | **Energy ($)** | **Total ($)** |
| **Option D Package** | 1,406,000 | 1,920,000 | 94,000 | 3,420,000 |
| | | | | |
| *Add-ons:* | | | | |
| **Packer Installation**<br>*May improve water quality for wells 7 and 25 to reduce the overall Cr6 level in blend*<br>*Risks: Packers do not guarantee sustainable, improved water quality and may reduce the production capacity of wells* | 23,000 | 20,000 | 6,000 | 49,000 |
| **Surface Gallery Treatment**<br>*Allows for up to an additional 776 gpm of flow to meet future demands* | 474,000 | 181,000 | 121,000 | 776,000 |
| **Option D Package *plus* Add-ons Total:** | | | | 4,245,000 |

"Complete Option E" has only one treatment plant, and only half of the Upland groundwater would achieve a high level of water quality assurance for Cr6 compliance. Half of the Upland groundwater would rely on blending and packers and would be vulnerable to non-compliance if Cr6 concentrations increase in groundwater. The total production is only slightly less than current production, but would be subject to flow reductions if groundwater quality diminishes in marginal wells or in the water used for blending.

**Table 24. Risks Associated with Components of Complete Option E**

| Complete Option E Components | Expected Cr6 Results (ppb) | Potential Risks |
|---|---|---|
| **Alternative 1-2** (Blend well 7 with well 24) | 8.5 | • Must maintain proper blending ratio to ensure overall Cr6 remains below MCL<br>• Well 7 must be operated only when Well 24 is operated, otherwise Well 7 may exceed the MCL<br>• Potential loss of up 1200 gpm (combined flow) if Well 24 is offline for maintenance<br>• Variable Cr6 levels in wells are dependent on several factors (e.g. flowrate, depth, etc.) |
| **Alternative 1-4** (Blend well 28 with zone 2 water) | 8 or below | • Must maintain proper blending ratio to ensure overall Cr6 remains below MCL<br>• Well 28 must be operated only when Zone 2 has adequate flows, otherwise Well 28 may exceed the MCL<br>• Variable Cr6 levels in wells are dependent on several factors (e.g. flowrate, depth, etc.) |
| **Alternative 1-5** (Blend well 5 with well 25) | 8.0 | • Must maintain proper blending ratio to ensure overall Cr6 remains below MCL<br>• Well 25 must be operated only when Well 5 is operated, otherwise Well 25 will likely exceed the MCL<br>• Potential loss of up 1200 gpm (combined flow) if Well 5 is offline for maintenance<br>• Variable Cr6 levels in wells are dependent on several factors (e.g. flowrate, depth, etc.) |
| **Alternative 6-4** (Packers on well 27) | 10 or below | • Groundwater with high Cr6 may find a short circuit route around the packers<br>• Packers will reduce the production capacity |

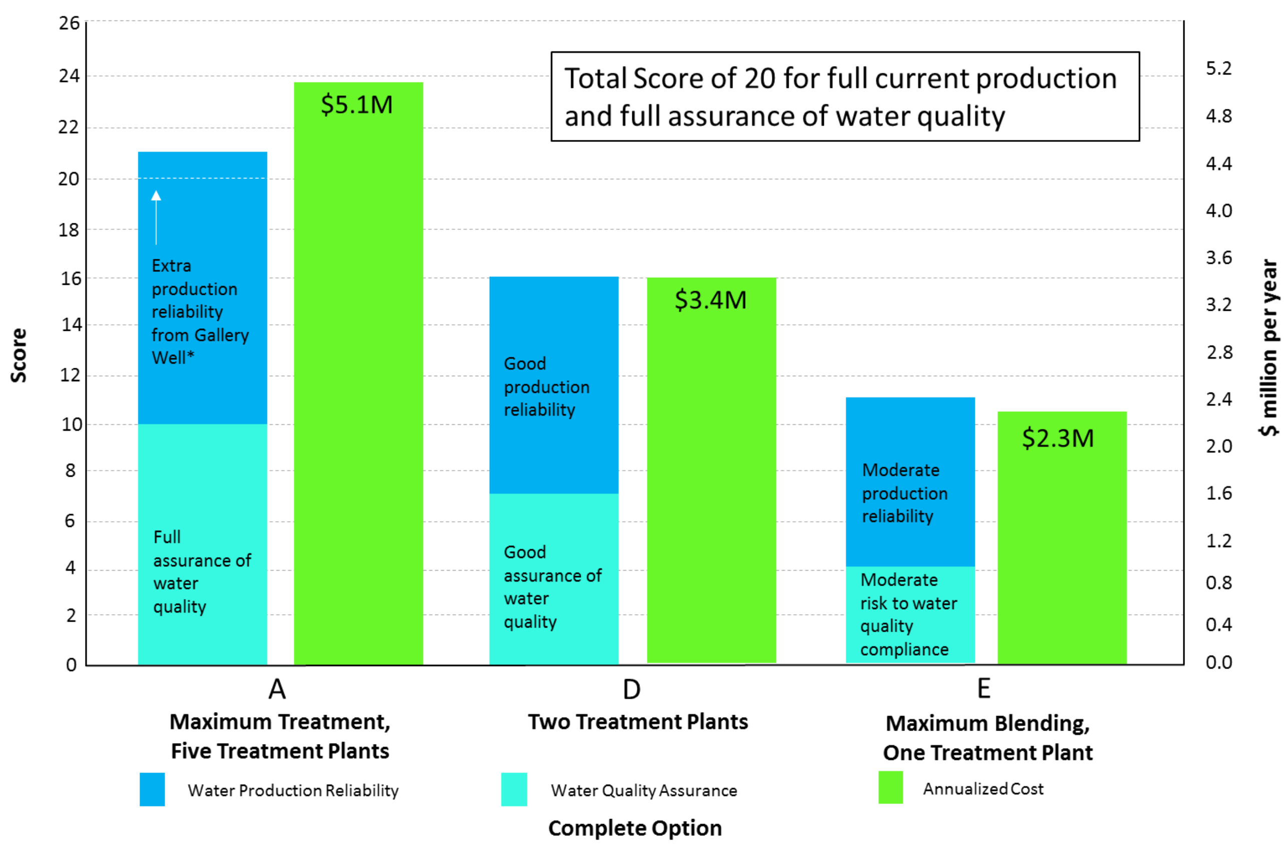
Despite the risks associated for Option E as presented in Table 22, there are opportunities for improving the attractiveness of this option by installing packers on the wells that will be blended to potentially improve the overall quality. Additionally, the gallery wells can be brought online and treated to provide an additional supply of 776 gpm to the District. Although there are additional costs affiliated with the upgrades (estimated in Table 25), the District has options to address the risks and future demands that can be added to Option E if it was considered.

**Table 25. Annualized Costs to Upgrade Complete Option E in the Future**

| | Annualized Cost | | | |
|---|---|---|---|---|
| | **Capital ($)** | **O&M ($)** | **Energy ($)** | **Total ($)** |
| **Option E Package** | 1,075,000 | 1,240,000 | 23,000 | 2,338,000 |
| | | | | |
| *Add-ons:* | | | | |
| **Packer Installation**<br>*May improve water quality for wells 7 and 25 to reduce the overall Cr6 level in blend*<br>*Risks: Packers do not guarantee sustainable, improved water quality and may reduce the production capacity of wells* | 8,000 | 18,000 | 6,000 | 32,000 |
| **Surface Gallery Treatment**<br>*Allows for up to an additional 776 gpm of flow to meet future demands* | 474,000 | 181,000 | 121,000 | 776,000 |
| **Option E Package *plus* Add-ons Total:** | | | | 3,146,000 |

Figure 9 provides a summary comparison for the top three complete options: A, D, and E.

**Figure 9. Summary of Scoring and Cost Comparison of Top Three Complete Options**




* Additional point was awarded to account for Gallery Well as a supplemental source

# APPENDIX B

## Hazen & Sawyer Treatment Process Evaluation

# Technical Memorandum:
## Treatment Process Evaluation

To: **Santa Ynez River Water Conservation District, Improvement District No. 1** – Chris Dahlstrom and Eric Tambini

From: **Hazen and Sawyer** – Nicole Blute, PhD, PE, Lynn Grijalva, PE, Ian Mackenzie, PE, Ying Wu, DEnv, PE, and Kenny Chau

cc: **Dudek** – Ken Marshall, Jonathan Leech, and Trey Driscoll
**Stetson Engineers** – Joe DeMaggio

Date: August 28, 2014

Re: Engineering Feasibility Study for Use of Wells with High Chromium 6

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# Treatment Process Evaluation

Several of the options under consideration by the Santa Ynez River Conservation District ID#1 (District) for achieving chromium 6 (Cr6) MCL compliance include removal of Cr6 from well water (i.e., treatment). The District evaluated applicability of the Best Available Technologies (BATs) listed by the California Department of Public Health (CDPH) for the District, including:

- Ion Exchange
  - Weak-base anion (WBA) exchange
  - Strong-base anion (SBA) exchange, single pass
  - Strong-base anion (SBA) exchange, re-generable
- Reduction Coagulation Filtration (RCF, or with microfiltration, RCMF)
- Reverse Osmosis (RO)

Each of the approaches is described below, then evaluated for the two primary treatment clusters identified in alternatives 5-1 and 5-2 of Appendix C. The treatment mechanisms of the BATs include removal with engineered media, a more conventional method similar to surface water treatment with chemical dosing and filtration, and removal by membranes.

**Weak-Base Anion (WBA)**

WBA treatment is comprised of three unit processes to remove Cr6, including pH adjustment, resin contact, and aeration for pH readjustment as shown in Figure 1.

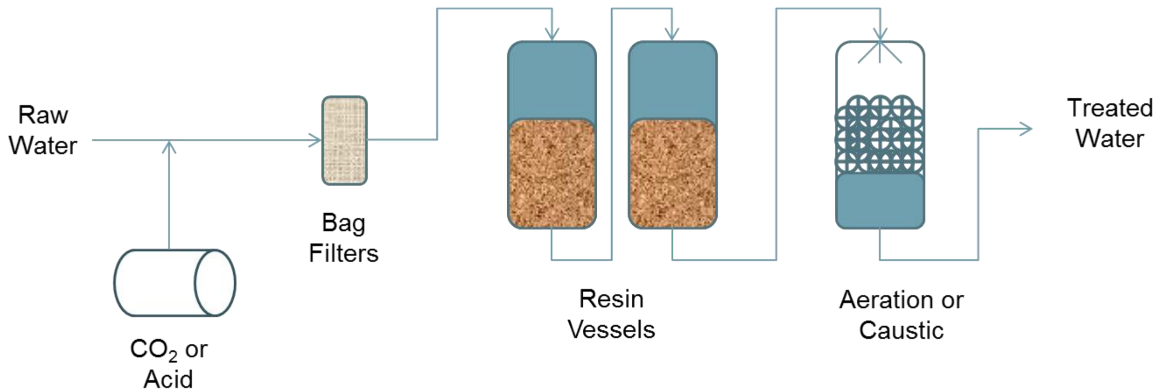


*Figure 1. Cr6 treatment with weak-base anion (WBA) exchange*

Cr6 removal with WBA resin is highly pH dependent, hence raw water is dosed with either carbon dioxide gas ($CO_2$) or acid to drop the pH level down to 6.0. The water then flows through bag filters for particle removal prior to entering the WBA resin vessels, which typically operates in a lead-lag formation to fully utilize the life of the resins. Once the Cr6 is removed, the effluent leaving the vessels will require pH adjustment to increase the pH back to its original state; this is accomplished by either aeration or caustic soda, depending on the method of dropping the pH.

The WBA resin operates in single-pass mode (rather than regeneration), with disposal and replacement of resin when Cr6 in the finished water exceeds the District's treatment target. WBA generally requires lower maintenance and operator attention compared with other technologies. Long bed lives have been observed in other applications and tests of WBA resin.

**Strong-Base Anion (SBA) Exchange**

The SBA treatment process operates similarly to the WBA process with preferential removal of Cr6 from the water onto the resin beads. SBA resins have much lower capacity compared with WBA, and hence must either be replaced more frequently (single-pass) or regenerated with salt solution (regeneration). Figure 2 depicts an SBA process including regeneration. The brine components would not be needed for the single-pass application.

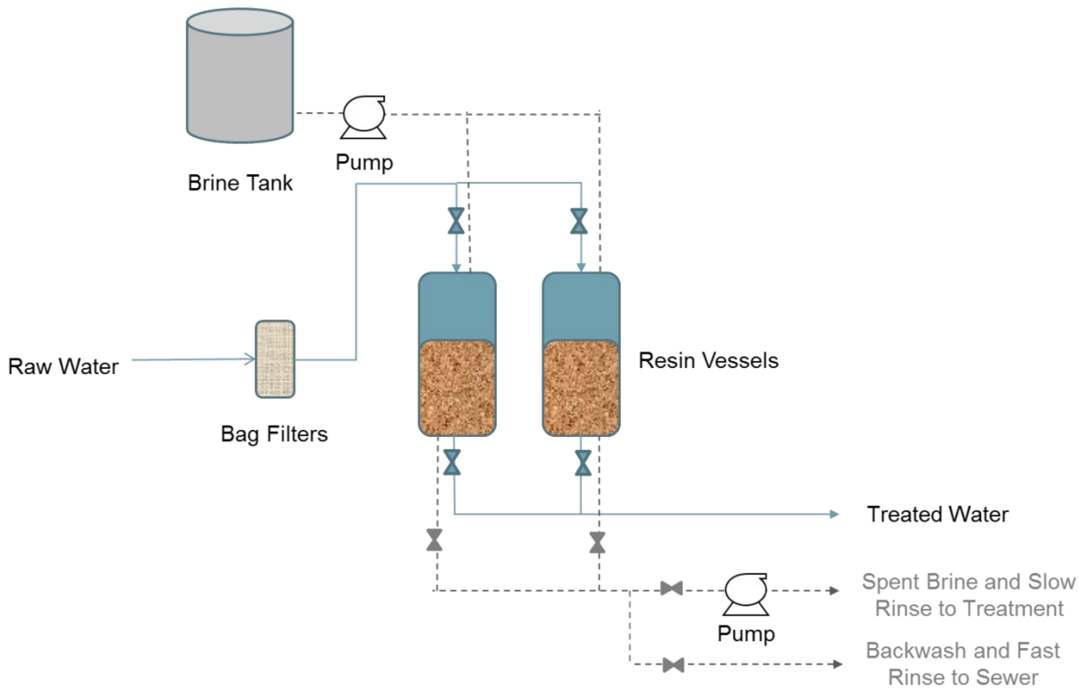


***Figure 2. Cr6 treatment with strong-base anion (SBA) exchange***

Like WBA, SBA also removes Cr6 by passing through the ion exchange vessels, but the removal does not require depression of pH or increasing pH after the treatment process. Particles in the groundwater are filtered out using bag filters prior to entering the SBA vessels. Cr6 is removed until breakthrough is achieved. Sulfate impacts the capacity of SBA resins for Cr6, with higher levels reducing the overall resin use time to replacement or regeneration.

The SBA process can be operated in single-pass or regeneration mode. Single-pass would involve disposal of the resin once breakthrough is achieved. Since the resin life is more variable for SBA resins, and breakthrough is likely to be more frequent, resin disposal may be very costly on an operations and maintenance (O&M) basis.

Regeneration with a salt (i.e., brine) solution decreases O&M costs but increases system complexity and capital expenditures. Regeneration mode would require additional tanks and pumps to store, prepare, and transfer the brine solution to the resins, and storage and possibly treatment for to remove the hazardous Cr6 component of the brine waste. Regeneration at the District would require trucking of brine off site for disposal.

**Reduction Coagulation Filtration Process**

The RCF process is comprised of multiple steps involving chemical dosing, reduction, oxidation, polymer dosing, and filtration as depicted below in Figure 3.

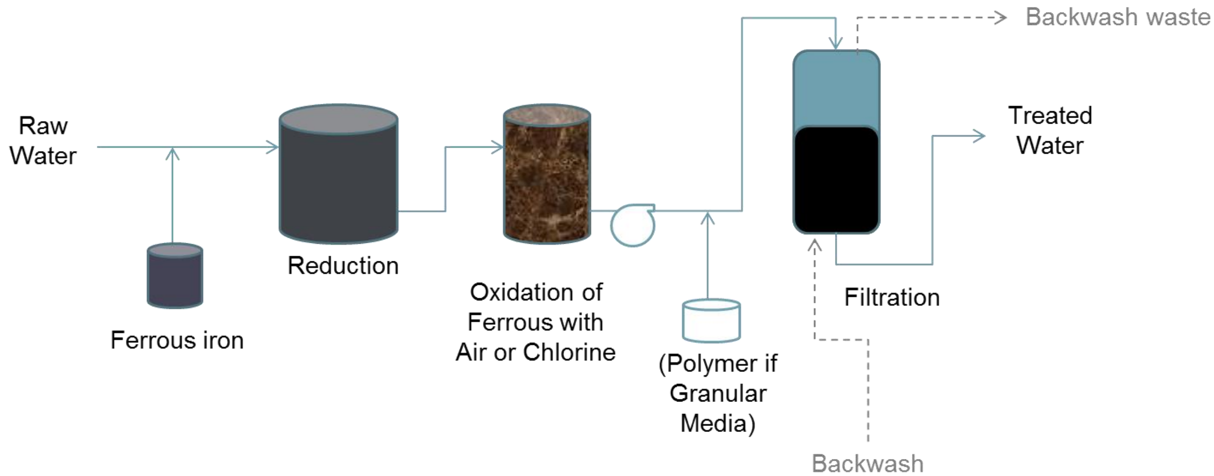


*Figure 3. Cr6 treatment with reduction coagulation filtration (RCF or RCMF)*

Raw water is dosed with ferrous iron to reduce the Cr6 to trivalent chromium (Cr3), which is associated with particles and can be physically removed by filtration. Sufficient reduction time is necessary for reduction of Cr6. Ferrous iron is added in excess of the Cr6, and remaining ferrous must be oxidized and filtered, which can be accomplished using air or a small dose of chlorine. Filtration can be either granular media filtration or microfiltration, with polymer used to build particle size for granular media filtration. Additional tanks and pumps are included in the RCF infrastructure for backwashing filters and handling backwash water.

The RCF process is more complex than the WBA process and the single-pass SBA process, requiring more attention from the operations staff. Regenerable SBA is expected to be of similar operational complexity as RCF. Waste generated in the RCF process includes backwash water (which may be largely recyclable with additional infrastructure) and precipitated solids that must be disposed offsite unless a local sewer allows for disposal of unsettled backwash water solids.

**Reverse Osmosis (RO)**

The RO process relies on the use of high pressure membranes to exclude chromium molecules through size and charge exclusion, and relies on pretreatment and post treatment (Figure 4).

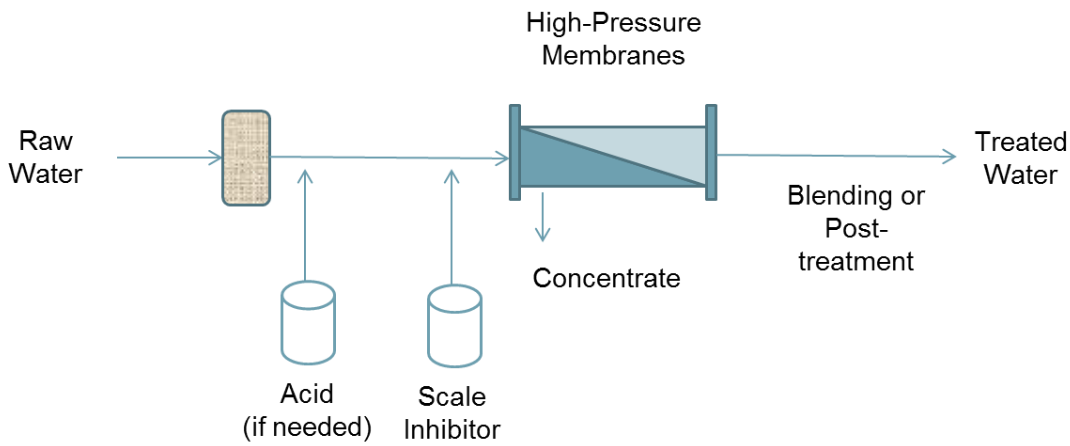


*Figure 4. Cr6 treatment with reverse osmosis (RO)*

As RO membranes are prone to fouling, feed water quality is key to achieving successful performance of the RO units and pretreatment is critical. The pretreatment process varies widely depending on the water quality of the raw water source, however typically contains an antiscalant or scale inhibitor to mitigate scaling. The filtrate from the RO membranes is stripped of all minerals and as a result is considered corrosive. Blending of the filtrate with bypassed (untreated) water and/or post-treatment is necessary to remineralize the water for corrosion protection of the distribution system.

Overall, RO membranes can effectively remove chromium but results in much greater waste volumes compared with the other BATs.

**Proposed Treatment of Wells**

The District's Upland Wells contain Cr6 with levels ranging from 0.7 to 30 ppb, many of which exceed the 10 ppb MCL. Treatment options were considered for the wells near or exceeding the 10 ppb MCL, including wells 1, 2, 7, 15, 25, 27, and 28. The wells were grouped where feasible for cost savings and to decrease operational complexity.  Potential treatment was considered for the following wells and groups:

- Wells 1, 2, and 15 combined and treated at the ID#1 site
- Wells 27 and 28 combined and treated at the Well 27 site
- Well 7 on site treatment
- Well 25 on site treatment

Analysis of the potential alternatives revealed that the first two treatment sites were more likely to be included in a complete option (Appendix C).  Consequently, the first two treatment sites were evaluated to identify the primary factors important in technology selection, including water quality, residuals waste, operability, and cost.  Summaries of the basis for technology selection at each site are provided in the following sections.

## Basis for Technology Selection at the Group of Wells 1, 2, and 15

For the technology comparison, partial stream treatment was evaluated. Partial stream treatment would include bypass of a portion of the raw water around the treatment process, with blending into the treatment plant effluent water. The treatment goal assumed in this analysis was a Cr6 level of 6 ppb in the combined finished water to allow a margin of safety in operations and in analytical variation.

For partial treatment, wells 2 and 15 would be combined and treated to 2 ppb, and then blended with the bypass (well 1) to achieve an overall goal of 6 ppb to achieve compliance and minimize capital cost.

**Treatment of partial flow** (more complex operations but lower capital and O&M costs)
Total flow: 2,000 gpm
Bypass flow: 300 gpm (well 1)
Treated flow: 1,700 gpm (wells 2 and 15)
Treatment system Cr6 goal: 2 ppb
Final water Cr6 goal: 6 ppb

Treatment at full flow would require less attention from the operations staff compared to partial treatment since it would eliminate the additional blending procedure. An analysis of the increased cost for full flow treatment for the WBA system is included in Table 2 to characterize the difference.

**Treatment of full flow** (simpler operations but higher capital and O&M costs)
Total treated flow: 2,000 gpm
Treatment system and final water Cr6 goal: 6 ppb

The anticipated water quality characteristics for the blend was determined below in Table 1 based on the blending of wells 1, 2, and 15.

***Table 1. Water Quality of Wells 1, 2, and 15, and Anticipated Characteristics for the Treatment System Influent***

| Parameter | Well 1 (300 gpm) | Well 2 (500 gpm) | Well 15 (1,200 gpm) | Whole Treatment (2,000 gpm) | Partial Treatment (1,700 gpm) |
|---|---|---|---|---|---|
| Cr6 (ug/L) | 23 | 23 | 25 | 24 | 24 |
| Sulfate (mg/L) | 48 | 50 | 90 | 74 | 78 |
| Alkalinity (mg/L as $CaCO_3$) | 330 | 330 | 320 | 324 | 323 |
| Uranium (ug/L) | Not sampled | Not sampled | Not sampled | N/A | N/A |
| Nitrate (mg/L as $NO_3$) | 26 | 8.5 | 19 | 17 | 16 |
| Calcium (mg/L as Ca) | 48 | 45 | 43 | 44 | 44 |
| pH* | 7.8 | 7.8 | 7.7 | 7.7 | 7.7 |
| Chloride (mg/L) | 110 | 46 | 56 | 62 | 53 |
| TDS (mg/L) | 500 | 470 | 520 | 505 | 505 |
| CCPP | 28 | 28 | 18 | 24 | 31 |

The water quality information provided in Table 1 was used to evaluate the process performance of each treatment technology and to develop cost estimates. Factors evaluated included the impact of water quality on treatment performance, waste generation and disposal methods, impacts on O&M, and capital and O&M costs to implement and operate the technologies.

## *Table 2. Basis for Technology Selection at Wells 1, 2, and 15*

| | Water Quality Aspects and Pre- and Post-Treatment Requirements | Residuals Waste | Operability Considerations | Cost Estimates | | |
|---|---|---|---|---|---|---|
| | | | | Capital | O&M | Annualized* |
| **SBA – Single pass operation** | Sulfate concentrations in the blend are moderate, making single-pass SBA possible. Nitrate concentrations are low (16 mg/L as $NO_3$), so additional vessels to blend down peaking are not needed. | Disposal of two beds of resin (each 341 cf) approximately every 3 days at the design flow rate and 24/7 use. | Single-use approach is much simpler than regeneration. | $2.8 M | $15.8 M | $16.0 M |
| **SBA – Regenerable operation** | Same as above. Approximately 9 tons of salt every week. | Approximately 18,000 gallons of brine every week (roughly two to three tanker trailers per week)#. This may be decreased if proven in piloting that the more brine can be recycled, or more concentrated but smaller brine volumes used. | Regeneration with brine treatment will require automated operations with PLC controls, and handling and/or disposal of a hazardous brine waste. | $5.4M<br><br>($4.0 M if brine is disposed of as hazardous) | $2.6 M#<br><br>($2.2 M if brine is disposed of as hazardous)# | $3.0 M#<br><br>($2.5 M if brine is disposed of as hazardous)# |
| **WBA – Single pass operation** | Alkalinities in the wells are high, requiring large quantities of $CO_2$ to decrease pH for chromium removal. Pre-treatment for this design flow rate and 24/7 use would require approximately 40 tons of $CO_2$ per week (one 20 ton tanker truck every 4 days). | Disposal of two beds of resin (each 341 cf) every 10 months, as a hazardous and TENORM waste.<br><br>Disposal of backwash water with each new resin bed. Requires temporary tankage to capture backwash water. | Simplest operations with frequent $CO_2$ deliveries and infrequent resin replacement. Air stripping for pH correction will generate some noise. | $4.8 M<br><br>($5.4 M if treating the whole flow to 6 ppb) | $1.1 M<br><br>($1.2 M if treating the whole flow to 6 ppb) | $1.5 M<br><br>($1.7 M if treating the whole flow to 6 ppb) |
| **RCMF** | Broadly applicable in District water qualities. Treatment chemicals needed include 600 gallons of ferrous sulfate and 120 gal of hypochlorite per week operating at design flow rate and 24/7 use. Hypochlorite for disinfection is additional. Smaller quantities of hypochlorite and/or citric acid for membrane cleaning and sodium bisulfite and/or caustic for neutralizing cleaning residuals are also required. | Sewer available. Settling, dewatering of solids, and recycling of backwash water would be recommended based on sewer capacity, and requires testing to confirm proof of concept. Waste from periodic membrane cleaning requires neutralization prior to disposal to sewer. Estimated 2.8 tons of dewatered solids per week. | Automated operations will be necessary with PLC controls for the multiple chemical feed systems. This system is more complex than the single-pass ion exchange systems. | $7.2 M | $0.8 M | $1.4 M |
| **RO** | Broadly applicable in District water qualities. Pre-treatment with cartridge filters and chemical addition (acid and antiscalant) would be needed. | Concentrate disposal to the sewer is not feasible due to salt restrictions and quantity (i.e., 15-25% of the flow). | N/A | N/A | N/A | N/A |

*Based on 5% interest rate and a 20-year life cycle. N/A – Not applicable.

# Based on 4 bed volumes of 9.5% brine and 1 bed volume of slow rinse per regeneration. 1.5 bed volumes of spent brine and 0.5 bed volume of slow rinse wastewater are reclaimed. The estimated costs for the approach with brine treatment may be significantly decreased if proven in piloting that brine can be treated more efficiently, thus, less solid waste. The estimated costs for brine disposal as hazardous are based on a preliminary quote from a hazardous disposal service provider, which can change significantly with market conditions due to limited number of providers and capacity.

SBA – Strong base anion exchange; WBA – Weak base anion exchange; RCMF – Reduction coagulation microfiltration; RO – Reverse osmosis.

## Basis for Technology Selection at Wells 27 and 28

Cr6 concentrations in wells 27 and 28 are near or just under the 10 ppb MCL. Partial treatment and blending was evaluated to reduce the overall treatment system capacity and to produce a finished water quality of 6 ppb. The well with a higher Cr6 concentration was considered for treatment (i.e., 80% of the flow from well 27 treated and blended with the remaining 20% from well 28). The treatment plant influent will therefore receive the water quality characterized by well 27, as shown in Table 3.

**Treatment of partial flow**
Total flow: 2,000 gpm
Bypass flow: 1,000 gpm – including 250 gpm from Well 27 and 750 gpm from Well 28
Treated flow: 1,000 gpm –partially treating Well 27 (1,000 gpm of 1,250 gpm)
Treatment system Cr6 goal: 2 ppb
Final water Cr6 goal: 6 ppb

*Table 3. Water Quality of Wells 27 and 28 and Anticipated Characteristics for the Treatment System Influent*

| Parameter | Well 27 | Well 28 | Treatment system influent (Well 27) |
|---|---|---|---|
| Cr6 (ug/L) | 10 | 8.9 | 10 |
| Sulfate (mg/L) | 100 | 150 | 100 |
| Alkalinity (mg/L as $CaCO_3$) | 280 | 270 | 280 |
| Uranium (ug/L) | 4.1 | 4.6 | 4.1 |
| Nitrate (mg/L as $NO_3$) | 7.1 | 8.4 | 7.1 |
| Calcium (mg/L as Ca) | 58 | 77 | 58 |
| pH* | 7.5 | 7.3 | 7.5 |
| Chloride (mg/L) | 35 | 35 | 35 |
| TDS (mg/L) | 480 | 480 | 480 |
| CCPP | 18 | 16 | 18 |

* Field pH needs to be confirmed to assess whether pH adjustment is necessary to avoid scale formation.

An evaluation of each technology for the treatment system at wells 27 and 28 is presented in Table 4. Treatment robustness, waste disposal, O&M, and the costs associated with each of the technologies were considered in this analyses.

### Table 4. Basis for Technology Selection at Wells 27 and 28

| | Water Quality Aspects and Pre- and Post-Treatment Requirements | Residuals Waste | Operability Considerations | Cost Estimates: Capital | Cost Estimates: O&M | Cost Estimates: Annualized* |
|---|---|---|---|---|---|---|
| **SBA – Single pass operation** | Sulfate concentrations in well 27 are high, making replacement of single-pass SBA more frequent. Nitrate concentrations are low (7 mg/L as $NO_3$), so chromatographic peaking (resulting in higher effluent concentrations than influent) is not a major concern. | Disposal of two beds of resin (each 201 cf) approximately every 5 days at the design flow rate and continuous use. | Single-pass approach is much simpler than regeneration. | $1.8 M | $12 M | $12.1 M |
| **SBA – Regenerable operation** | Same impacts of water quality as presented above. Approximately 5 to 6 tons of salt every week. | For regeneration of SBA, approximately 12,000 gallons of brine every week (roughly two tanker trailers per week)#. This may be decreased if proven in piloting that the brine can be recycled, or more concentrated but smaller brine volumes used. | Regeneration with brine treatment will require automated operations with controls, and handling of a hazardous brine waste. | $4.0 M ($3.2 M if brine is disposed of as hazardous rather than being treated on site) | $2.0 M# ($1.7 M if brine is disposed of as hazardous rather than being treated on site)# | $2.3 M# ($1.9 M if brine is disposed of as hazardous rather than being treated on site)# |
| **WBA – Single pass operation** | Alkalinities in the wells are high, requiring large quantities of $CO_2$ to decrease pH for chromium removal. Pre-treatment for this design flow rate and continuous use would require approximately 22 tons of $CO_2$ per week (one 20 ton tanker truck every 7 days). | Disposal of two beds of resin (each 200 cf) approximately every 10 months, as a hazardous and TENORM waste. Disposal of backwash water with each new resin bed. Requires temporary tankage to capture backwash water. | Simplest operations with frequent $CO_2$ deliveries and infrequent resin replacement. Air stripping for pH adjustment will generate some noise. | $3.2 M | $0.7 M | $1.0 M |
| **RCF or RCMF** | Treatment chemicals needed include approximately 350 gallons of ferrous sulfate and 70 gal of hypochlorite per week operating at design flow rate and continuous use. Hypochlorite for disinfection is additional. Clean-in-place chemicals are also additional. | No sewer access at this location. Settling, dewatering of solids, and recycling of backwash water would be necessary due to lack of sewer in this part of the system, and requires testing to confirm proof of concept. Waste from periodic membrane cleaning would need to be hauled off site. Estimated 1.6 tons of dewatered solids per week. | Automated operations will be necessary with controls for the multiple chemical feed systems. This system is more complex than the single-pass ion exchange systems. | $6.0 M | $0.6 M | $1.0 M |
| **RO** | Pre-treatment with cartridge filters and chemical addition (acid and antiscalant) would be needed. | No sewer access. Waste is anticipated to be 15-25% of the flow rate, making this approach infeasible at this site. | N/A | N/A | N/A | N/A |

*Based on 5% interest rate and a 20-year life cycle. N/A – Not applicable.

#Based on 4 bed volumes of 9.5% brine and 1 bed volume of slow rinse per regeneration. 1.5 bed volumes of spent brine and 0.5 bed volume of slow rinse wastewater are reclaimed. The estimated costs for the approach with brine treatment may be significantly decreased if proven in piloting that brine can be treated more efficiently, thus, less solid waste. The estimated costs for brine disposal as hazardous are based on a preliminary quote from a hazardous disposal service provider, which can change significantly with market conditions due to limited number of providers and capacity.

SBA – Strong base anion exchange; WBA – Weak base anion exchange; RCF – Reduction coagulation filtration; RCMF – Reduction coagulation microfiltration; RO – Reverse osmosis.

# Decision Making Process

After performing the technology evaluation, a commercially available software program, Criterion DecisionPlus (CDP), was used to apply weighting and judgment to decision criteria. The software requires input from the user to determine:

- The end goal of the decision process,
- Decision criteria and weighting factors, and
- Complete options with scores by criteria.

The goal of the evaluation was to develop a ranking of the treatment technologies to decide on the best treatment option for the criteria noted below. The set of criteria and assigned weighting factors were determined by the District and the consulting team. Seven factors were selected to evaluate the treatment options, including: treatment robustness of the technology, the complexity on operations and maintenance (O&M), the amount of water loss from the treatment process, waste disposal and handling generated from the treatment process (if applicable), the ability to treat other constituents, footprint requirements, and the annualized cost. Each of the criteria were assigned weights, with a total weight of 100%. Sub-criteria and weights were assigned to support the evaluation of the key criteria. Treatment robustness, residuals handling, annualized costs, and O&M complexity were assigned with higher weights (25%, 25%, 20% and 15%, respectively) than other factors, as they were viewed as the primary factors in the technology evaluation. The definitions that describe what each criteria and sub-criteria entail are described in Table 5.

The Hazen and Sawyer team consisting of three chromium treatment experts served as an expert panel to assign scores for each decision criteria based on the findings in Tables 2 and 4. The scores were assigned on a scale from 0 to 10 (with 10 being the more favorable option) for each of the treatment technologies as shown below in Tables 6 (wells 1, 2, and 15) and 7 (wells 27 and 28) for each of the criteria and sub-criteria. Tables 6 and 7 provide an average of the team's scoring results. The scores were then input into the CDP software to generate results that consider the scoring and applied weights to determine the more favored technology to be recommended for the District's two sites.

*Table 5. Decision Criteria*

| | Criteria/Sub-criteria | Definition | Weight (%) |
|---|---|---|---|
| **1** | **Treatment Robustness** | | **25** |
| | Reliability to Meet Cr(VI) Goal of 6 ppb | Ability to achieve or exceed water quality goals | 40 |
| | System Resilience to Change | Ability to handle fluctuations in water quality or changes in the treatment goal without significant operational changes | 30 |
| | Impact from Competing Constituents | Interfering constituents (i.e. sulfate, silica, iron, manganese) | 20 |
| | Concern of Chromatographic Peaking | Co-occurring constituents exceed half the MCL and have the potential for release at higher than influent concentrations (e.g., nitrate from SBA resins) | 10 |
| **2** | **O&M Complexity** | | **15** |
| | Equipment Complexity | Chemical feed system requirements and the need for constant monitoring. Multiple components requiring frequent maintenance. | 40 |
| | Chemical Deliveries | Frequency of chemical deliveries | 40 |
| | Operations Certification | Level of operations staff required for the system | 10 |
| | Number of Full-time Employees (FTEs) | Number of staff required to maintain operation of process and the need for operator attention. | 10 |
| **3** | **Water Loss** | **Water loss associated from process** | **5** |
| **4** | **Residuals Handling** | | **25** |
| | Disposal of Liquid Waste | Is liquid waste generated? Is there access to a sewer? | 80 |
| | Offsite Disposal of Solid Waste | How frequent are truck trips to dispose of waste offsite? | 20 |
| **5** | **Removal of Other Constituents** | **Technology removal of co-occurring constituents requiring treatment** | **5** |
| **6** | **Footprint** | **Treatment plant footprint and land requirements** | **5** |
| **7** | **Annualized Cost** | **Construction, equipment, engineering, and O&M** | **20** |

*Table 6. Assigned Scores for Technologies to Treat Wells 1, 2, and 15*

| | Criteria/Sub-criteria | SBA (Single-Pass) | SBA (Regenerable) | WBA (Single-Pass) | RCMF | RO |
|---|---|---|---|---|---|---|
| 1 | Treatment Robustness | | | | | |
| | Reliability to Meet Cr(VI) Goal of 6 ppb | 10 | 10 | 10 | 10 | 10 |
| | System Resilience to Change | 6 | 6 | 8 | 10 | 10 |
| | Impact from Competing Constituents | 5 | 5 | 10 | 10 | 10 |
| | Concern of Chromatographic Peaking | 10 | 10 | 10 | 10 | 10 |
| 2 | O&M Complexity | | | | | |
| | Equipment Complexity | 10 | 2 | 7 | 4 | 4 |
| | Chemical Deliveries | 10 | 2 | 2 | 7 | 7 |
| | Operations Certification | 10 | 4 | 7 | 4 | 4 |
| | Number of Full-time Employees (FTEs) | 10 | 5 | 10 | 6 | 6 |
| 3 | Water Loss | 9 | 7 | 10 | 6 | 1 |
| 4 | Residuals Handling | | | | | |
| | Disposal of Liquid Waste | 10 | 3 | 10 | 8 | 1 |
| | Offsite Disposal of Solid Waste | 0 | 3 | 6 | 2 | 10 |
| 5 | Removal of Other Constituents | 10 | 10 | 10 | 10 | 10 |
| 6 | Footprint | 10 | 5 | 5 | 5 | 5 |
| 7 | Annualized Cost | 1 | 5 | 8 | 8 | 0 |

10 = Most favorable compared to other technologies; 0 = Least favorable.

*Table 7. Assigned Scores for Technologies to Treat Wells 27 and 28*

| | Criteria/Sub-criteria | SBA (Single-Pass) | SBA (Regenerable) | WBA (Single-Pass) | RCMF | RO |
|---|---|---|---|---|---|---|
| **1** | **Treatment Robustness** | | | | | |
| | Reliability to Meet Cr(VI) Goal of 6 ppb | 10 | 10 | 10 | 10 | 10 |
| | System Resilience to Change | 6 | 6 | 8 | 10 | 10 |
| | Impact from Competing Constituents | 3 | 3 | 10 | 10 | 10 |
| | Concern of Chromatographic Peaking | 10 | 10 | 10 | 10 | 10 |
| **2** | **O&M Complexity** | | | | | |
| | Equipment Complexity | 10 | 2 | 7 | 4 | 4 |
| | Chemical Deliveries | 10 | 2 | 4 | 7 | 7 |
| | Operations Certification | 10 | 4 | 7 | 4 | 4 |
| | Number of Full-time Employees (FTEs) | 10 | 5 | 10 | 6 | 6 |
| **3** | **Water Loss** | 8 | 6 | 10 | 6 | 1 |
| **4** | **Residuals Handling** | | | | | |
| | Disposal of Liquid Waste | 10 | 3 | 10 | 3 | 1 |
| | Offsite Disposal of Solid Waste | 0 | 1 | 6 | 2 | 10 |
| **5** | **Removal of Other Constituents** | 10 | 10 | 10 | 10 | 10 |
| **6** | **Footprint** | 10 | 5 | 5 | 5 | 5 |
| **7** | **Annualized Cost** | 1 | 6 | 8 | 8 | 0 |

10 = Most favorable compared to other technologies; 0 = Least favorable.

# Decision Software Output

The results of the CDP Software for Wells 1, 2 and 15 and Wells 27 and 28 are summarized in Figures 5 and 6, respectively. For both clustered groups, WBA received the highest ranking among the technologies evaluated (WBA, SBA regenerable and single pass, RCMF, and RO). For Wells 1, 2 and 15, the score for WBA was 8.3 out of 10, followed by 7.6 for RCMF and 7.0 for SBA single pass. For Wells 27 and 28, WBA received a score of 8.5 out of 10, followed by 6.8 for SBA single pass and 6.7 for RCMF. For WBA, the sub-criteria which had relatively low scores include chemical deliveries and footprint, both of which are affected by a large carbon dioxide dose required to reduce pH for effective treatment. The advantages of WBA include robust treatment, simple operations, minimal liquid waste, removal of other constituents and relatively low treatment cost.

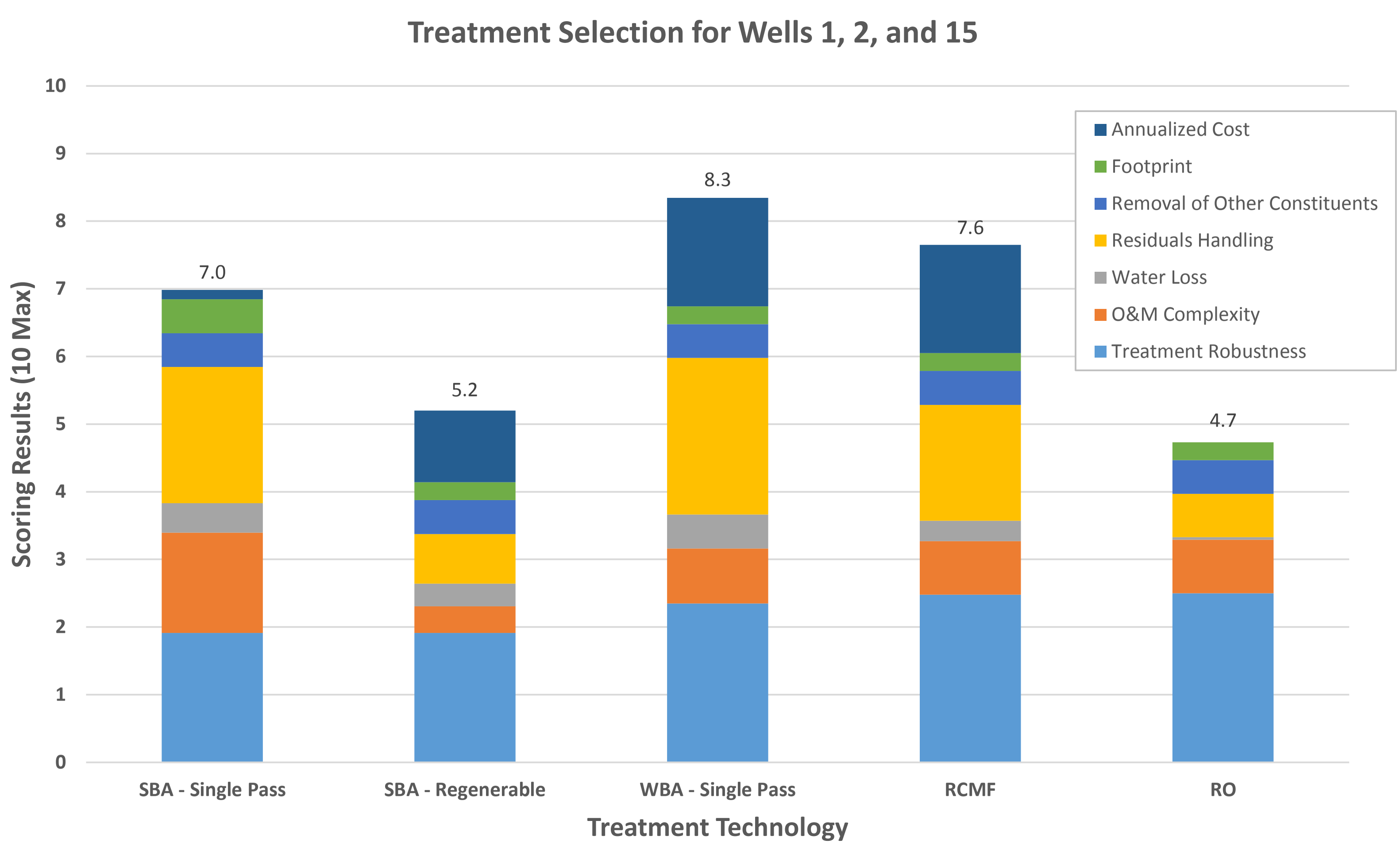


*Figure 5. Treatment Evaluation of Wells 1, 2, and 15*

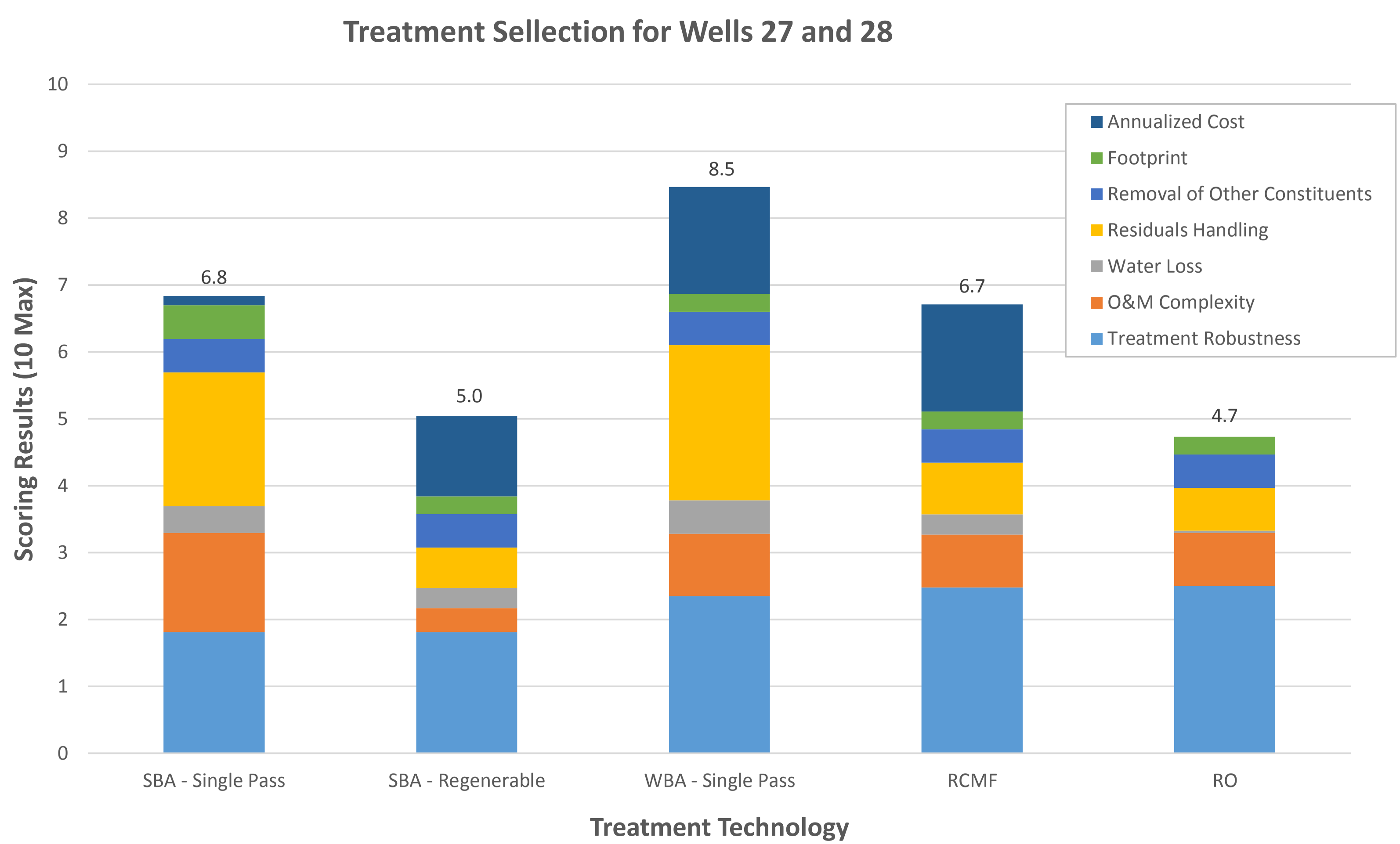


*Figure 6. Treatment Evaluation of Wells 27 and 28*

## Summary

The analyses completed for both treatment plants determined that WBA would be the most preferred option for treating Cr6 in the District's distribution system as depicted in Figures 5 and 6. WBA treatment is the preferred BAT option resulting in relatively high scores in treatment robustness, residuals handling, and the annualized cost.

Advantages of the WBA approach identified included handling fluctuations in the water quality over time without the need for significant operational changes and requiring simple operations. The primary focal point for WBA will be in sustaining the pH adjustment processes ($CO_2$ and aeration). The WBA resin would be replaced once breakthrough occurs (i.e. Cr6 concentration exceeds 6 ppb in the treated water from the lag bed), which is anticipated to be as frequent as two resin changes annually if the system is continuously run. The used resin will be disposed of as a hazardous and TENORM waste. Additional disposal consideration to consider is necessary for storing backwash water with each new resin bed installation, which would require a temporary tankage to capture backwash water.

# APPENDIX C

## Stetson Engineers System Hydraulics Study

**DRAFT**

# ENGINEERING FEASIBILITY STUDY FOR THE USE OF WELLS THAT EXCEED THE NEW MAXIMUM CONTAMINATE LEVEL OF HEXAVALENT CHROMIUM 6

## SANTA YNEZ RIVER WATER CONSERVATION DISTRICT, IMPROVEMENT DISTRICT NUMBER 1

## SEPTEMBER 15, 2014

STETSON ENGINEERS INC.

WATER RESOURCE PROFESSIONALS

SERVING CLIENTS SINCE 1957

◈ NORTHERN AND SOUTHERN CALIFORNIA ◈ ARIZONA ◈ COLORADO

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## Attachments


ATTACHMENT A – COST SUMMARY TABLES FOR EACH ALTERNATIVE
ATTACHMENT B – MAP OF PROPOSED SOLUTIONS FOR EACH ALTERNATIVE
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ATTACHMENT F – FLOW FROM WELLS AND PUMPS FOR EACH COMPLETE OPTION

# 1.0 INTRODUCTION

The purpose of this report is to document Stetson Engineers Inc. (Stetson) engineering feasibility study for use of wells with that exceed the mew maximum contaminant level (MCL) of Cr6. A comprehensive list of project alternatives and options was prepared by the consultant work group (CWG) and Santa Ynez River Water Conservation District, Improvement District No. 1 (ID1). This engineering feasibility study provides descriptions of alternatives and complete options to address the wells that exceed the new MCL for Cr6 (greater than 10 ppb) in the upland wells. The engineering feasibility study estimated the cost for various alternatives including blending, separating agricultural and irrigation water, gallery well with surface water treatment, minimum use of upland wells, well treatment, and installing packers in the well to reduce flow from detectable Cr6 formations. The engineering feasibility study uses the hydraulic model developed by Stetson to determine the water system deficiencies and proposed solutions for each alternative and complete options. Stetson also worked with Hazen & Sawyer to perform hydraulic modeling for water treatment facilities for Wells 1, 2, 3, 7, 15, 25, 27, and 28. After the analysis was performed on each alternative, potential complete options were developed by combining appropriate alternatives. In addition, engineering cost analysis was preformed to compare potential complete options, which combine the alternatives and options. Engineering cost analysis includes project costs, capitalized project cost along with annual costs for energy, operation, and maintenance. Cost summary tables for each alternative and complete options are shown in Attachments A and D, respectively. Maps of proposed solutions for each alternative and complete options are shown in Attachments B and E, respectively. Flow from wells and pumps for each alternative and complete options are shown in Attachment C and F, respectively.

## 1.1 Water Quality

ID1's 11 uplands wells contain concentrations of Cr ranging from zero to 26 parts per billion (ppb) and Cr6 ranging from zero to 26 ppb. Only three of ID1's uplands wells, Wells 5, 6 and 24 contain Cr6 concentration well below the new 10 ppb MCL.

The ID1 system was designed and configured based on the presumed usability of State Water Project (SWP) and Santa Ynez River well water (alluvium) to serve the lower zones, Zones 1 and 2, and uplands well water to serve the higher zones, Zone 3 and a portion of Zone 2. The production capacity of the 11 upland wells is approximately 7,200 gallons per minute (gpm). The three wells below 5 ppb Cr6 are Well 5, which produces approximately 250 gpm, Well 6, which produces approximately 300 gpm, and Well 24, which produces approximately 300 gpm. Table 1 shows a list of the 11 upland wells normal flow rates and Cr6 incidence range along with a summary of normal flow rates for the remaining wells (<5 ppb), along with wells (5 to 10 ppb, which require monitoring) and wells that exceed 10 ppb.

TABLE 1. UPLAND WELL SUMMARY

| Well No. | Cr6 Incidence | Pressure Zone | Normal Flow (gpm) | Cr6 Range (ppb) |
|---|---|---|---|---|
| 1 | Offline Pending Treatment | 2 | 200 | 36 |
| 2 | Offline Pending Treatment | 2 | 500 | 22 – 24 |
| 3 | Offline Pending Treatment | 2 | 600 | 0 |
| 5 | Low (Available for Use) | 3 | 250 | 0.7 – 1.1 |
| 6 | Low (Available for Use) | 3 | 300 | 0 |
| 7 | Monitor | 3 | 900 | 2.1 – 10 |
| 15 | Offline Pending Treatment | 2 | 1,200 | 25 – 26 |
| 24 | Low (Available for Use) | 3 | 300 | 1.3 – 4.1 |
| 25 | Monitor | 3 | 950 | 8.4 - 9.8 |
| 27 | Monitor | 2 | 1,250 | 6.9 – 13 |
| 28 | Monitor | 2 | 750 | 8.8 – 9.2 |
| | | Total | 7,200 | |
| <5 ppb | Low (Available for Use) | | 850 | |
| 5 to 10 ppb | Monitor | | 3,850 | |
| >10 ppb | Offline Pending Treatment | | 2,500 | |
| | | Total | 7,200 | |

ppb = parts per billion
gpm = gallons per minute
Well 3 added to offline pending treatment well flow because of high nitrates

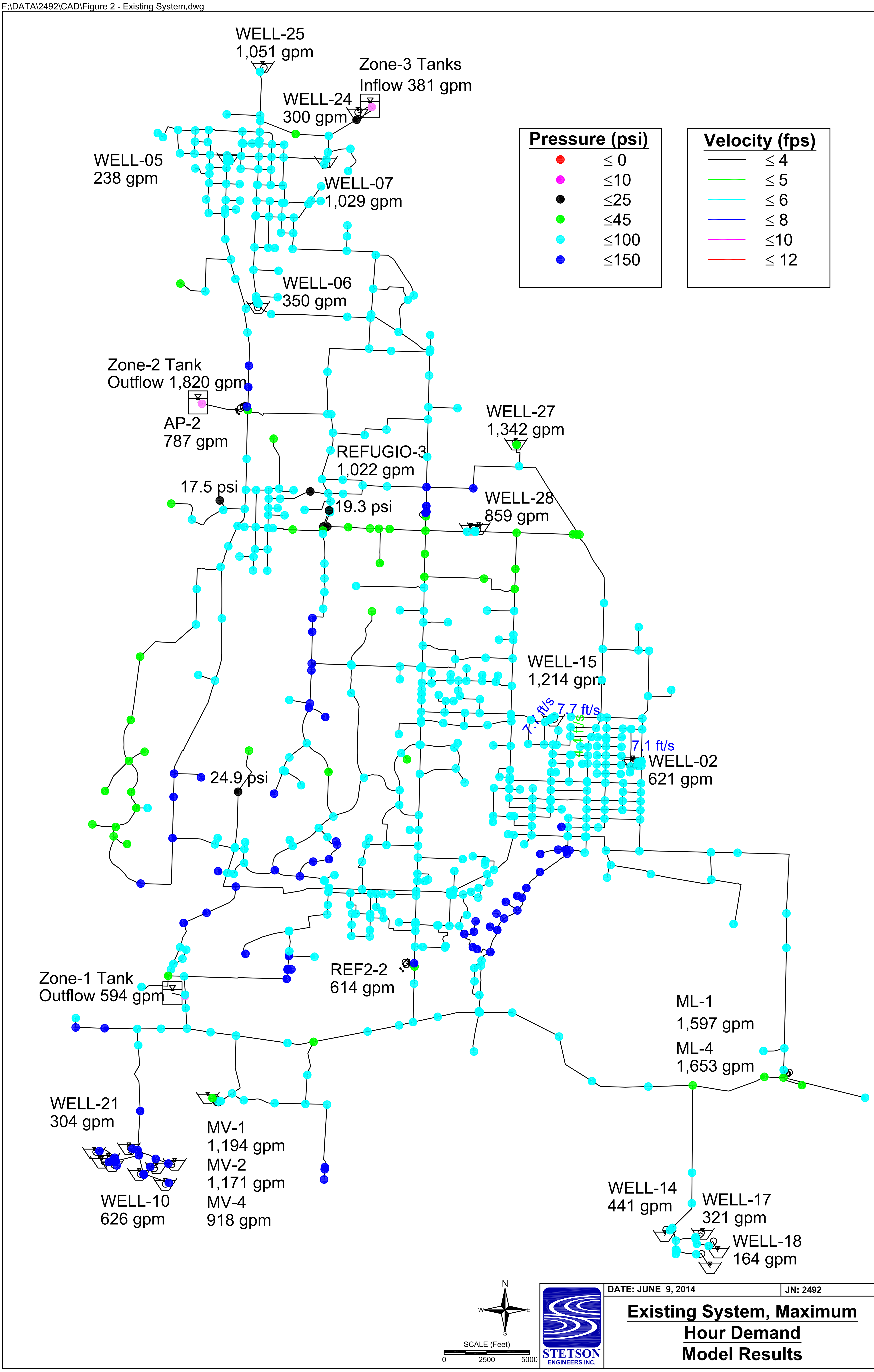
# 2.0 EXISTING SYSTEM

The most recent version of the hydraulic model was used as a baseline to determine the water system improvements needed during the summer time maximum hour demand (14,175 gpm) that are needed to provide minimum required system pressure of 25 psi and maximum pipeline velocity of 4 feet per second. The existing upland wells were operated (except Wells 1 and 3) along with the MVPS and river wells to provide the minimum number of model nodes with pressures less than 25 psi. There are two model nodes located southeast of Zone 2 tank as shown on Figure 1 with pressures of 17.5 and 19.3 psi, respectively. These nodes will be reviewed during the planning process and upgraded as appropriate. An additional low-pressure model node has a pressure of 24.9 psi (Figure 1) but this is close enough to the minimum pressure of 25 psi. The only other discrepancies with the existing system are a few pipelines with velocity greater than 4 feet per second, two are located near Well 15 and the other is located near Well 2 as shown on Figure 1. These pipe velocities will also be reviewed as part of the planning process and upgraded as appropriate.

## 2.1 Water System Demand Distribution for Hydraulic Model

The hydraulic model developed by Stetson was used to determine potential water system issues and to propose solutions for each alternative and complete options. Model input includes an estimation of the water system average day demand (ADD), maximum day demand (MDD), and maximum hour demand (MHD). ADD was based on the maximum annual water production during the last 10 years. During the last 10 years (2004 to 2013) the annual water production ranged from 4,850 to 6,274 acre-feet and averaged 5,582 acre-feet as shown on Table 2. The maximum annual water production occurred in 2007. The ADD was based on the 2007 water use of 6,274 acre-feet or 3,890 gpm. The water demand was distributed throughout the system for the hydraulic model based on 2005 water meter deliveries.

F:\DATA\2492\CAD\Figure 2 - Existing System.dwg




DATE: JUNE 9, 2014

JN: 2492

**Existing System, Maximum Hour Demand Model Results**

FIGURE 1

TABLE 2. HISTORICAL WATER PRODUCTION SUMMARY (ACRE-FEET) 2004-2013

| **Year** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** | **Oct** | **Nov** | **Dec** | **Annual** | **% of Average** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2004 | 165 | 161 | 286 | 576 | 716 | 814 | 907 | 867 | 812 | 427 | 173 | 167 | 6,071 | 109% |
| 2005 | 111 | 125 | 123 | 343 | 442 | 637 | 850 | 859 | 665 | 487 | 312 | 196 | 5,150 | 92% |
| 2006 | 137 | 240 | 156 | 124 | 375 | 681 | 914 | 857 | 684 | 535 | 437 | 211 | 5,351 | 96% |
| 2007 | 213 | 137 | 402 | 506 | 689 | 767 | 885 | 826 | 665 | 522 | 455 | 207 | 6,274 | 112% |
| 2008 | 106 | 100 | 375 | 594 | 678 | 800 | 864 | 836 | 737 | 582 | 376 | 139 | 6,187 | 111% |
| 2009 | 223 | 101 | 216 | 548 | 704 | 653 | 866 | 775 | 714 | 413 | 384 | 157 | 5,754 | 103% |
| 2010 | 117 | 106 | 279 | 285 | 542 | 670 | 787 | 796 | 682 | 354 | 245 | 134 | 4,997 | 90% |
| 2011 | 146 | 129 | 141 | 357 | 517 | 582 | 757 | 714 | 609 | 453 | 255 | 190 | 4,850 | 87% |
| 2012 | 236 | 215 | 297 | 271 | 560 | 672 | 736 | 832 | 640 | 505 | 350 | 115 | 5,429 | 97% |
| 2013 | 119 | 162 | 344 | 560 | 636 | 756 | 778 | 709 | 584 | 477 | 368 | 262 | 5,755 | 103% |
| Minimum | 106 | 100 | 123 | 124 | 375 | 582 | 736 | 709 | 584 | 354 | 173 | 115 | 4,850 | 87% |
| Maximum | 236 | 240 | 402 | 594 | 716 | 814 | 914 | 867 | 812 | 582 | 455 | 262 | 6,274 | 112% |
| Average | 157 | 148 | 262 | 416 | 586 | 703 | 834 | 807 | 679 | 476 | 336 | 178 | 5,582 | 100% |

The ADD is 3,890 gallons per minute (gpm). The maximum day demand (MDD) for the peak summer day occurred on July 12, 2006 with a flow rate of 9,527 gpm (2004 to 2013 period of record). The maximum hour demand (MHD) for the maximum summer day for each year occurred on June 21, 2008 with a flow rate of 14,175 gpm. The summer time average day demand, maximum day demand, and maximum hour demand for each of the three pressure zones are shown on Table 3. Also shown on Table 3 are the maximum hour demand (22,701 gpm) for frost protection that occurred on April 9, 2011.

TABLE 3. WATER DEMAND DISTRIBUTION BY PRESSURE ZONES (SUMMERY)

| Pressure Zone | Average Day Demand (gpm) | Maximum Day Demand (gpm) | Maximum Hour Demand (gpm) | Percent |
|---|---|---|---|---|
| Zone 1 | 513 | 1,258 | 1,871 | 13% |
| Zone 2 | 2,171 | 5,312 | 7,910 | 56% |
| Zone 3 | 1,206 | 2,957 | 4,394 | 31% |
| Total | 3,890 | 9,527 | 14,175 | 100% |

**WATER DEMAND DISTRIBUTION BY PRESSURE ZONES (FROST PROTECTION)**

| Pressure Zone | Maximum Hour Demand (gpm) |
|---|---|
| Zone 1 | 10,995 |
| Zone 2 | 8,177 |
| Zone 3 | 3,529 |
| Total | 22,701 |

## 2.2 Water Demand and Water Supply for Existing System

The water supply from upland wells, river wells, and State Water Project (SWP) delivered through the Mesa Verde Pump Station (MVPS) are needed to satisfy the maximum day demand of 9,527 gpm. The maximum hour demand of 14,175 gpm is typically met by tank storage. The most recent version of the hydraulic model was used as a baseline to determine the water system improvements needed during the summer time maximum hour demand (14,175 gpm) that are needed to provide minimum required system pressure of 25 psi and maximum pipeline velocity of 4 feet per second. All the existing upland wells were operated (except Wells 1 and 3) along with the MVPS and river wells to provide the minimum number of model nodes with pressures less than 25 psi. During the maximum hour demand the flow out of the storage tanks are 594 gpm for Zone 1, 1,820 gpm for Zone 2 and -381 gpm (inflow) for Zone 3 as shown on Figure 1. At a maximum flow rate out of the tank of 1,820 gpm for Zone 2 tank with storage capacity of 6.5 million gallons (MG), there is adequate tank storage to satisfy the maximum hour demand for about 30 hours assuming the tank is depleted to 50% of capacity and starts full.

Some of the 6-cfs and 4-cfs well field wells need to be operating to provide water to meet the maximum day demand. Most of the 6-cfs and 4-cfs well field wells need to be operating to provide water to meet the maximum day demand if the high Cr6 Upland Wells are not in operation. In addition, three of the five Mesa Verde Pumps must operate to meet the maximum day demand. A summary of the flow rates from the wells and Mesa Verde Pump Station are shown in Table 4 for the baseline model run for the existing system. The total water supply flow is 12,143 gpm with the maximum day demand flow requirement of 9,527 gpm leaving a water supply surplus of 2,616 gpm.

Water also must be provided to each pressure zone to meet the MDD of each pressure zone as previously shown in Table 3. Because significant portion of the water supply is located in pressure Zone 1, booster pumps convey the water from Zone 1 to Zones 2 and 3. Zone 3 MDD is 2,957 gpm. Wells 5, 6, 7, 24 and 25 provide 4,803 gpm and Alamo Pintado booster pump provide 787 gpm and Refugio-3 booster pump provide 1,022 gpm for a total inflow to Zone 3 of 6,612 gpm which is 3,655 gpm greater than the MDD and 2,218 greater than the MHD (4,394 gpm). The wells and booster pumps in Zone 3 need to be operated to provide system pressure during the MHD. Stetson considered the operation of all the existing Zone 3 booster pumps and operating one of the small booster pumps at Alamo Pintado and Refugio-3 provided the best hydraulic condition for both Zones 2 and 3 even though the flow is 3,655 gpm greater than what is needed to satisfy the MDD in Zone 3. With the Zone 2 booster pumps operating (3,864 gpm) and the Zone 2 upland wells operating (4,036 gpm) there is a net inflow to Zone 2 of 779 gpm (6,091 – 5,312 gpm) taking into consideration the water pumped to Zone 3 (1,809 gpm). Zone 2 has a MDD of 5,312 gpm and a net inflow of 4,630 resulting in a surplus of approximately 779 gpm to satisfy the MDD in Zone 2. No additional booster pumping capacity from Zone 1 to Zone 2 is needed to satisfy the MDD of Zone 2 when the upland wells are in operation. For some of the following alternatives additional flow must be added to Zone 2 to satisfy the MDD of Zones 2 and 3 when the upland wells are not operating.

TABLE 4. WELL AND PUMP OPERATION SUMMARY FOR MAXIMUM HOUR DEMAND

| Water Source | Location | Well No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|---|
| **Wells** | | | | | |
| | Upland | 1 | 200 | 0 | 2 |
| | Upland | 2 | 500 | 621 | 2 |
| | Upland | 3 | 600 | 0 | 2 |
| | Upland | 5 | 250 | 238 | 3 |
| | Upland | 6 | 300 | 350 | 3 |
| | Upland | 7 | 900 | 1,029 | 3 |
| | Upland | 15 | 1,200 | 1,214 | 2 |
| | Upland | 24 | 300 | 300 | 3 |
| | Upland | 25 | 950 | 1,051 | 3 |
| | Upland | 27 | 1,250 | 1,342 | 2 |
| | Upland | 28 | 750 | 859 | 2 |
| | | ***Upland Wells Subtotal*** | *7,200* | *7,004* | |
| | 6 cfs well field | 8 | 150 | 0 | 1 |
| | 6 cfs well field | 9 | 375 | 0 | 1 |
| | 6 cfs well field | 10 | 600 | 626 | 1 |
| | 6 cfs well field | 19 | 260 | 0 | 1 |
| | 6 cfs well field | 21 | 275 | 304 | 1 |
| | 6 cfs well field | 22 | 200 | 0 | 1 |
| | 6 cfs well field | 23 | 400 | 0 | 1 |
| | | ***6 cfs Well Field Subtotal*** | *2,260* | 930 | |
| | 4 cfs well field | 12 | 600 | 0 | 1 |
| | 4 cfs well field | 14 | 600 | 441 | 1 |
| | 4 cfs well field | 17 | 375 | 321 | 1 |
| | 4 cfs well field | 18 | 200 | 164 | 1 |
| | | ***4 cfs Well Field Subtotal*** | *1,175* | 926 | |
| | Gallery Well | | 776 | 0 | 1 |
| | | **Total Wells** | **12,011** | **8,860** | |
| **State Water Project (SWP)** | | | | | |
| | Mesa Verde Pump Station | | | | |
| | | MV-1 | 1,200 | 1,194 | 1 |
| | | MV-2 | 1,145 | 1,171 | 1 |
| | | MV-3 | 885 | 0 | 1 |
| | | MV-4 | 865 | 918 | 1 |
| | | MV-5 | 1,105 | 0 | 1 |
| | | ***Mesa Verde Total*** | ***5,200*** | **3,283** | 1 |
| | **Total Water Supply (Wells & Mesa Verde )** | | **17,211** | **12,143** | |

# 3.0 ALTERNATIVES WITH OPTIONS

A comprehensive list of project alternatives and options were prepared by the consultant work group (Stetson, Hazen & Sawyer, and Dudek) and ID No.1 and include blending, separate irrigations system, water treatment, well treatment, and minimum use of wells with high Cr6. Below is a list of six (6) alternatives and options that were evaluated to address the Cr6 that exceed and are close to the MCL in the upland wells.

1. Alternative 1 – Blending Options, there are six blending options
   Blending options considered include the following six options:
   - Alt 1-1 – Blend Well 7 with Well 24 into existing 0.5 MG Zone 3 tank.
   - Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.
   - Alt 1-3 – Blend Well 27 with Zone 2 water then pumped into Zone 3.
   - Alt 1-4 – Blend Well 28 with Zone 2 water then pumped into Zone 3.
   - Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
   - Alt 1-6 – Blend Well 24 with Well 25 at Well 25 site
2. Alternative 2 – Separate Irrigation Water System, *use Wells 2,3,15 & Gallery Well*
3. Alternative 3 – Surface Water Treatment Gallery Well
4. Alternative 4 – Minimize Use of Upland Wells affected by High Cr6
   - Alt 4-1 – Maximum hour demand (June), *use Wells 5,6 and 24*
   - Alt 4-2 – Frost protection historical demand (April)
5. Alternative 5 – Well Treatment Location Options, there are four well treatment options.
   Treatment location options considered include the following four options:
   - Alt 5-1 – Treat Wells 1, 2 and 15 at existing ID1 shop site, 1,900 gpm add Well 3 (600 gpm) as redundant source.
   - Alt 5-2 – Treat Wells 27 and 28 at Well 27 site
   - Alt 5-3 – Treat Well 7 at Well 7 site
   - Alt 5-4 – Treat Well 25 at Well 25 site
6. Alternative 6 – Well Improvements (packers), there are four packer options
   - Alt 6-1 – Well 7 – block inflow from zone affected by Cr6 regulations, 25% flow reduction
   - Alt 6-2 – Well 25 - block inflow from zone affected by Cr6 regulations, 25% flow reduction

- Alt 6-3 – Well 28 - block inflow from zone affected by Cr6 regulations, 25% flow reduction
- Alt 6-4 – Well 27 - block inflow from zone affected by Cr6 regulations, 25% flow reduction

Each alternative and option needs to satisfy the maximum day demand and the annual water requirements for each pressure zone in the water system. Existing water use for each pressure zone is shown in Table 5.

- Zone 1 uses 736 acre-feet (AF) per year on average or 13% of the total system water use.
- Zone 2 uses 3,115 AF per year on average or 56% of the total system water use.
- Zone 3 uses 1,731 AF per year on average or 31% of the total system water use.

The total average water use is 5,582 AF per year as previously shown on Table 4. Some of the alternatives transfer some of the water use from Zone 1 into Zone 2 and from Zone 2 into Zone 3. The redistribution of water use by zone for the alternative analysis is also shown on Table 5.

TABLE 5. WATER USE BY PRESSURE ZONE

| **Existing System** | | |
|---|---|---|
| **Water Use by Zone** | **Percent** | **AF** |
| Zone 1 | 13% | 736 |
| Zone 2 | 56% | 3,115 |
| Zone 3 | 31% | 1,731 |
| | **100%** | **5,582** |

| **Proposed System with Some Demands Transferred from Zones 3 and 1 to Zone 2 to Solve Low Pressure Problems** | | |
|---|---|---|
| **Water use by Zone** | **Percent** | **AF** |
| Zone 1 | 13% | 713 |
| Zone 2 | 56% | 3,136 |
| Zone 3 | 31% | 1,733 |
| | **100%** | **5,582** |

A summary of the wells and pumps operating for each alternative is shown on Table 6 along with the percent of maximum day demand (MDD). Following the discussion of each alternative is the description of the engineering cost estimate followed by a discussion of complete options which combine appropriate alternatives.

# Table 6 - Alternatives 1-1 to 6-4 Well and Pump Flow Summary

| Water Source | Name | Well or Pump No. | Normal Flow (gpm) | Alternatives with Normal Flow Rates (gpm) 1-1 | 1-2 | 1-3 | 1-4 | 1-5 | 1-6 | 2 | 3 | 4-1 | 4-2 | 5-1 | 5-2 | 6-1 | 6-2 | 6-3 | 6-4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wells** | | | | | | | | | | | | | | | | | | | |
| | Upland | 1 | 200 | 0 | 0 | 0 | 0 | 0 | 0 | 200 | 0 | 0 | 0 | 200 | 0 | 0 | 0 | 0 | 0 |
| | Upland | 2 | 500 | 0 | 0 | 0 | 0 | 0 | 0 | 500 | 0 | 0 | 0 | 500 | 0 | 0 | 0 | 0 | 0 |
| | Upland | 3 | 600 | 0 | 0 | 0 | 0 | 0 | 0 | 600 | 0 | 0 | 0 | 600 | 0 | 0 | 0 | 0 | 0 |
| | Upland | 5 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 |
| | Upland | 6 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| | Upland | 7 | 900 | 900 | 900 | 0 | 0 | 0 | 0 | 900 | 0 | 0 | 0 | 0 | 0 | 650 | 0 | 0 | 0 |
| | Upland | 15 | 1,200 | 0 | 0 | 0 | 0 | 0 | 0 | 1,200 | 0 | 0 | 0 | 1,200 | 0 | 0 | 0 | 0 | 0 |
| | Upland | 24 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| | Upland | 25 | 950 | 0 | 0 | 0 | 0 | 700 | 700 | 950 | 0 | 0 | 0 | 0 | 0 | 0 | 700 | 0 | 0 |
| | Upland | 27 | 1,250 | 0 | 0 | 1,000 | 0 | 0 | 0 | 1,250 | 0 | 0 | 0 | 0 | 1,250 | 0 | 0 | 0 | 950 |
| | Upland | 28 | 750 | 0 | 0 | 0 | 750 | 0 | 0 | 750 | 0 | 0 | 0 | 0 | 750 | 0 | 0 | 500 | 0 |
| | | ***Subtotal*** | ***7,200*** | ***1,750*** | ***1,750*** | ***1,850*** | ***1,600*** | ***1,550*** | ***1,550*** | ***7,200*** | ***850*** | ***850*** | ***850*** | ***3,350*** | ***2,850*** | ***1,500*** | ***1,550*** | ***1,350*** | ***1,800*** |
| | 6 cfs field | 8 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| | 6 cfs field | 9 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 |
| | 6 cfs field | 10 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 |
| | 6 cfs field | 19 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 |
| | 6 cfs field | 21 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 |
| | 6 cfs field | 22 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| | 6 cfs field | 23 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| | | ***Subtotal*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** |
| | 4 cfs field | 12 | 600 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 cfs field | 14 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 |
| | 4 cfs field | 17 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 |
| | 4 cfs field | 18 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| | | ***Subtotal*** | ***1,775*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** |
| | Gallery well | | ***776*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***776*** | ***776*** | ***0*** | ***776*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** |
| | | ***Wells Total*** | ***12,011*** | ***5,185*** | ***5,185*** | ***5,285*** | ***5,035*** | ***4,985*** | ***4,985*** | ***11,411*** | ***5,061*** | ***4,285*** | ***5,061*** | ***6,785*** | ***6,285*** | ***4,935*** | ***4,985*** | ***4,785*** | ***5,235*** |
| **State Water Project/ Exchange** | | | | | | | | | | | | | | | | | | | |
| | Mesa Verde Pump Station | | | | | | | | | | | | | | | | | | |
| | | MV-1 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 |
| | | MV-2 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 |
| | | MV-3 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 |
| | | MV-4 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 |
| | | MV-5 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 |
| | | ***Subtotal*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** |
| | | ***Total System*** | ***17,211*** | ***10,385*** | ***10,385*** | ***10,485*** | ***10,235*** | ***10,185*** | ***10,185*** | ***16,611*** | ***10,261*** | ***9,485*** | ***10,261*** | ***11,985*** | ***11,485*** | ***10,135*** | ***10,185*** | ***9,985*** | ***10,435*** |
| | | MDD | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 |
| | | % of MDD | 181% | 109% | 109% | 110% | 107% | 107% | 107% | 174% | 108% | 100% | 108% | 126% | 121% | 106% | 107% | 105% | 110% |

Maximum day demand (MDD) based on July 12, 2006 maximum day for 2004 to 2013 period of record

## 3.1 Alternative 1 – Blending Options

Stetson Engineers performed hydraulic modeling analysis to determine system modifications that would be needed in order to render the water system capable of meeting required system pressures and flow demands utilizing each of the upland well water system blending options. Various options addressing the water system blending were evaluated including; 1) Blending monitored wells with nearby complying wells, 2) Blending wells close to the new MCL with water from adjacent pressure zone. Engineers cost estimate for each blending option was prepared. Blending options considered include the following options:

- Alt 1-1 – Blend Well 7 with Well 24 into existing 0.5 MG Zone 3 tank.
- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.
- Alt 1-3 – Blend Well 27 with Zone 2 water then pumped into Zone 3.
- Alt 1-4 – Blend Well 28 with Zone 2 water then pumped into Zone 3.
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
- Alt 1-6 – Blend Well 24 with Well 25 at Well 25 site.

### 3.1.1 Alternative 1-1 – Blend Well 7 and 24 in Existing 0.5 MG Zone 3 Tank

A new 10-inch pipeline approximately 2,400 feet long will be constructed to convey Well 7 water (900 gpm) to an existing 0.5 MG tank. A new 8-inch pipeline approximately 400 feet long will be constructed to convey Well 24 water (300 gpm) to an existing 0.5 MG tank. The existing tank is located adjacent to the existing 3.5 MG tank used to maintain water pressure and provide storage for Zone 3. Well 7 has a flow rate of 900 gpm with a Cr6 level of 10 ppb. Well 24 has a flow rate of 300 gpm with a Cr6 level of 4.1 ppb. The blended flow level is 8.5 ppb for a flow of 1,200 gpm. System improvements needed to meet the maximum hour demand includes a new booster pump station located near Zone 1 tank, a small booster pump to satisfy low pressure at one model node located in Zone 2, control valves, blow offs, air/vacuum valves, relocate a few Zone 1 meters to Zone 2, relocate a few Zone 2 meters to Zone 3, new 8-inch, 10-inch and 12-inch pipelines, electrical controls, SCADA, electric power facilities, and purchase of land and right of ways. The capital cost of the new pipelines, static mixer, control valves, tank modifications, and other system improvements are $3,896,000 with an additional annual O&M cost of $46,000 and an additional energy cost of $35,000 per year. See Chapter 4 for comparison of cost with other alternatives. See Attachment A for an itemized list and details for cost estimate. See Attachment B for a map showing the system improvements needed to meet the maximum hour demand. See Attachment C for the flow from wells and pumps.

### 3.1.2 Alternative 1-2 – Blend Well 7 and 24 at Well 7 Site

A new 8-inch pipeline approximately 2,400 feet long will be constructed to convey Well 24 water (300 gpm) to the Well 7 site. The blended water will be pumped into the Zone 3 system at Well 7. Well 7 has a flow rate of 900 gpm with a Cr6 level of 10 ppb. Well 24 has a flow rate of 300 gpm with a Cr6 level of 4.1 ppb. The blended flow level is 8.5 ppb. System improvements needed to meet the maximum hour demand includes a new booster pump station located near Zone 1 tank, a small booster pump to satisfy low pressure at one model node located in Zone 2, control valves, blow offs, air/vacuum valves, relocate a few Zone 1 meters to Zone 2, relocate a few Zone 2 meter to Zone 3, new 8-inch, 10-inch and 12-inch pipelines, electrical controls, SCADA, electric power facilities, and purchase of land and right of ways. The capital cost of the new pipelines, static mixer, control valves, and other system improvements are $3,817,000 with an additional annual O&M cost of $45,000 and an additional energy cost of $35,000 per year. See Chapter 4 for comparison of cost with other alternatives. See Attachment A for a map showing the system improvements needed to meet the maximum hour demand. See Attachment A for an itemized list and details for cost estimate. See Attachment B for a map showing the system improvements needed to meet the maximum hour demand. See Attachment C for the flow from wells and pumps.

### 3.1.3 Alternative 1-3 – Blend Well 27 with Zone 2 Water then Pumped into Zone 3

A new 75 horsepower booster pump station will be installed at the Well 27 site for pumping blended water from Zone 2 to Zone 3. Well 27 flow rate is 1,250 gpm when pumping into Zone 2 and 1,000 gpm when pumping into Zone 3 and has with a Cr6 level of 13 ppb. Blending with 1,000 gpm of Zone 1 water will reduce the Cr6 level to approximately 6.5 ppb. The existing 8-inch pipeline in Zone 3 would need to be enlarged by installing a new parallel 12-inch pipe approximately 4,100 feet long. System improvements needed to meet the maximum hour demand includes a new booster pump station located near Zone 1 tank, a small booster pump to satisfy low pressure at one model node located in Zone 2, control valves, blow offs, air/vacuum valves, relocate a few Zone 1 meters to Zone 2, relocate a few Zone 2 meter to Zone 3, new 8-inch, 10-inch and 12-inch pipelines, electrical controls, SCADA, electric power facilities, and purchase of land and right of ways. The capital cost of the new pipelines, static mixer, control valves, and other system improvements are $4,505,000 with an additional annual O&M cost of $56,000 and an additional energy cost of $38,000 per year. See Chapter 4 for comparison of cost with other alternatives. See Attachment A for an itemized list and details for cost estimate. See Attachment B for a map showing the system improvements needed to meet the maximum hour demand. See Attachment C for the flow from wells and pumps.

### 3.1.4 Alternative 1-4 – Blend Well 28 with Zone 2 Water then Pumped into Zone 3

A new 150 horsepower booster pump station will be installed at the Well 28 site for pumping blended water from Zone 2 to Zone 3. Well 28 flow rate is 750 gpm with a Cr6 level of 8.9 ppb. Blending with 750 gpm of Zone 1 water will reduce the Cr6 level to approximately 4.5 ppb. An existing 12-inch pipeline downstream of Refugio-3 booster would need to be enlarged by installing a new parallel 8-inch pipe approximately 800 feet long along with a new 16-inch pipeline 1,800 feet long from Well 28 to Zone 3. System improvements needed to meet the maximum hour demand includes a new booster pump station located near Zone 1 tank, a small booster pump to satisfy low pressure at one model node located in Zone 2, control valves, blow offs, air/vacuum valves, relocate a few Zone 1 meters to Zone 2, relocate a few Zone 2 meter to Zone 3, new 8-inch, 10-inch and 12-inch pipelines, electrical controls, SCADA, electric power facilities, and purchase of land and right of ways. The capital cost of the new pipelines, static mixer, control valves, and other system improvements are $4,501,000 with an additional annual O&M cost of $60,000 and an additional energy cost of $38,000 per year. See Chapter 4 for comparison of cost with other alternatives. See Attachment A for an itemized list and details for cost estimate. See Attachment B for a map showing the system improvements needed to meet the maximum hour demand. See Attachment C for the flow from wells and pumps.

### 3.1.5 Alternative 1-5 – Blend Well 5 and 25 at Well 25 Site

A new 8-inch pipeline approximately 3,500 feet long will be constructed to convey Well 5 water (250 gpm) to the Well 25 site. The blended water will be mixed in a static mixer at Well 25 site. Well 25 has a flow rate of 950 gpm with a Cr6 level of 9.8 ppb. Well 5 has a flow rate of 250 gpm with a Cr6 level of 0.9 ppb. The blended flow level is approximately 7.2 ppb. System improvements needed to meet the maximum hour demand includes a new booster pump station located near Zone 1 tank, a small booster pump to satisfy low pressure at one model node located in Zone 2, control valves, blow offs, air/vacuum valves, relocate a few Zone 1 meters to Zone 2, relocate a few Zone 2 meter to Zone 3, new 8-inch, 10-inch and 12-inch pipelines, electrical controls, SCADA, electric power facilities, and purchase of land and right of ways. The capital cost of the new pipelines, static mixer, control valves, and other system improvements are $4,122,000 with an additional annual O&M cost of $48,000 and an additional energy cost of $13,000 per year. See Chapter 4 for comparison of cost with other alternatives. See Attachment A for an itemized list and details for cost estimate. See Attachment B for a map showing the system improvements needed to meet the maximum hour demand. See Attachment C for the flow from wells and pumps.

### 3.1.6 Alternative 1-6 – Blend Well 24 with Well 25 at Well 25 Site

A new 8-inch pipeline approximately 5,100 feet long will be constructed to convey Well 24 water (300 gpm) to Well 25 site. The blended water will be mixed in a static mixer at Well 25 site. Well 25 has a flow rate of 950 gpm with a Cr6 level of 9.8 ppb. Well 24 has a flow rate of 300 gpm with a Cr6 level of 4.1 ppb. The blended flow level is approximately 7.7 ppb. System improvements needed to meet the maximum hour demand includes a new booster pump station located near Zone 1 tank, a small booster pump to satisfy low pressure at one model node located in Zone 2, control valves, blow offs, air/vacuum valves, relocate a few Zone 1 meters to Zone 2, relocate a few Zone 2 meter to Zone 3, new 8-inch, 10-inch and 12-inch pipelines, electrical controls, SCADA, electric power facilities, and purchase of land and right of ways. The capital cost of the new pipelines, static mixer, control valves, and other system improvements are $4,360,000 with an additional annual O&M cost of $51,000 and an additional energy cost of $13,000 per year. See Chapter 4 for comparison of cost with other alternatives. See Attachment A for an itemized list and details for cost estimate. See Attachment B for a map showing the system improvements needed to meet the maximum hour demand. See Attachment C for the flow from wells and pumps.

## 3.2 Alternative 2 – Separate Irrigation Water System

Stetson Engineers performed hydraulic modeling analysis to provide a separate irrigation water system for Zones 1, 2 and 3 that uses the five upland wells with the highest Cr6 levels, Wells 1, 2, 3, 15 and 28 located in Zone 2 and the Gallery Well located in Zone 1. The flow rate from Well 1 is 200 gpm, Well 2 is 500 gpm, Well 3 is 600 gpm (high nitrates) , Well 15 is 1,200 gpm, Well 28 is 750 gpm and the Gallery Well is 776 gpm for a total flow rate of 4,026 gpm or 534 acre-feet per month. The maximum month demand for the irrigated lands was estimated to determine if the five wells and gallery well will provide an adequate supply.

### 3.2.1 Irrigation Demand for Irrigated Lands for Separate Irrigation Water System

Stetson mapped the irrigation water uses in the ID1 service area which includes vineyards, cropland, orchards, pasture, and lawn watering for cemetery, school and parklands. The location of all agricultural service meters were provided by ID1 along with the monthly water use for 2013. A summary of the total monthly irrigation water use for 2013 are shown on Table 7. Not all the lands will be served by the proposed separate irrigated water system. Small water users that are located far from other users were not included because of the high cost to construct a pipeline to these small isolated parcels. A summary of the monthly irrigation water use for 2013 for the lands served by the proposed new irrigation water system are shown on Table 7. Shown on Table 8 is the estimated water use for each pressure zone for the separate irrigation system. Forty-eight percent (48%) of the irrigation water use is in Zone 1 as shown on Table 8.

## Table 7. 2013 Agricultural Water Use

| Month | Water Use (hcf) | (gal) | (gpd) | (gpm) | (Acre-feet) |
|---|---|---|---|---|---|
| January | 5,018 | 3,753,464 | 121,079 | 84.1 | 12 |
| February | 14,246 | 10,656,008 | 380,572 | 264.3 | 33 |
| March | 53,925 | 40,335,900 | 1,301,158 | 903.6 | 124 |
| April | 111,068 | 83,078,864 | 2,769,295 | 1,923.1 | 255 |
| May | 109,706 | 82,060,088 | 2,647,100 | 1,838.3 | 252 |
| June | 116,419 | 87,081,412 | 2,902,714 | 2,015.8 | 267 |
| July | 157,668 | 117,935,664 | 3,804,376 | 2,641.9 | 362 |
| August | 108,206 | 80,938,088 | 2,610,906 | 1,813.1 | 248 |
| September | 95,472 | 71,413,056 | 2,380,435 | 1,653.1 | 219 |
| October | 77,915 | 58,280,420 | 1,880,014 | 1,305.6 | 179 |
| November | 39,577 | 29,603,596 | 986,787 | 685.3 | 91 |
| December | 28,123 | 21,036,004 | 678,581 | 471.2 | 65 |
| **Total** | **917,343** | **686,172,564** | | **1,299.9** | **2,106** |

## Irrigation Water Use for Proposed Separate Irrigation Water System

| Month | Water Use (hcf) | (gal) | (gpd) | (gpm) | (Acre-feet) |
|---|---|---|---|---|---|
| January | 5,015 | 3,751,220 | 121,007 | 84.0 | 12 |
| February | 14,242 | 10,653,016 | 380,465 | 264.2 | 33 |
| March | 53,574 | 40,073,352 | 1,292,689 | 897.7 | 123 |
| April | 107,988 | 80,775,024 | 2,692,501 | 1,869.8 | 248 |
| May | 108,155 | 80,899,940 | 2,609,675 | 1,812.3 | 248 |
| June | 116,368 | 87,043,264 | 2,901,442 | 2,014.9 | 267 |
| July | 155,979 | 116,672,292 | 3,763,622 | 2,613.6 | 358 |
| August | 107,619 | 80,499,012 | 2,596,742 | 1,803.3 | 247 |
| September | 94,443 | 70,643,364 | 2,354,779 | 1,635.3 | 217 |
| October | 77,270 | 57,797,960 | 1,864,450 | 1,294.8 | 177 |
| November | 39,543 | 29,578,164 | 985,939 | 684.7 | 91 |
| December | 28,102 | 21,020,296 | 678,074 | 470.9 | 65 |
| **Total** | **908,298** | **679,406,904** | | **1,287.1** | **2,085** |

TABLE 8. SEPARATE IRRIGATION SYSTEM WATER USE BY PRESSURE ZONE

| Zone | Acre-Feet | Percent |
|---|---|---|
| 1 | 1,001 | 48% |
| 2 | 709 | 34% |
| 3 | 375 | 18% |
| **TOTAL** | **2,085** | **100%** |

### 3.2.2 Pipelines for Separate Irrigation Water System

A proposed new pipeline system was laid out to connect most of the large irrigation water users with Wells 1, 2, 3, 15 and 28 and a regulation reservoir located near the existing Zone 2 tank and the Gallery Well located in Zone 1. The pipes were sized based on a maximum velocity of four feet per second during the maximum month demand and seven feet per second during a frost protection event. The locations of the proposed pipelines are adjacent to existing pipelines to minimize the cost of right-of-way acquisition.

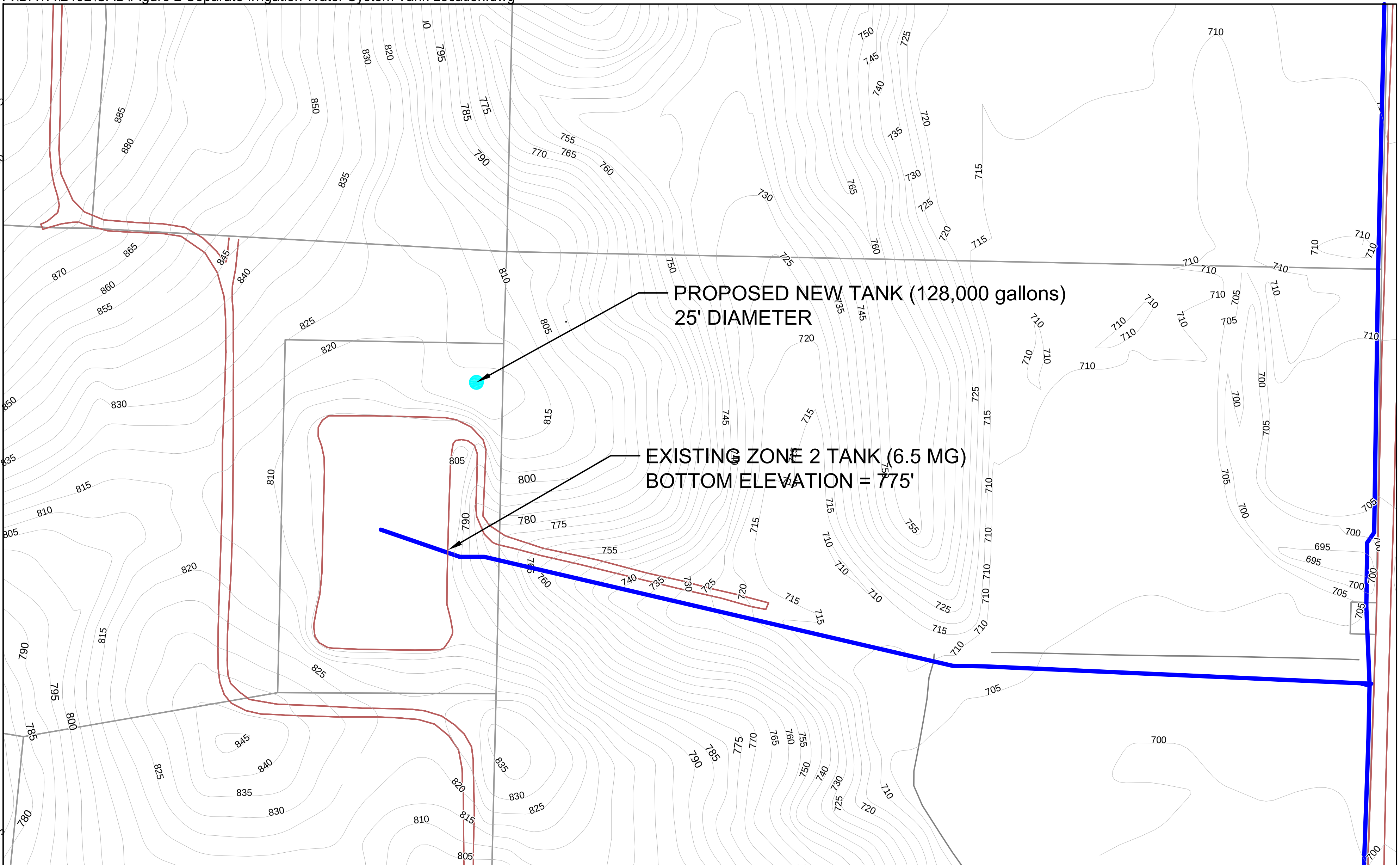
### 3.2.3 Tank for Separate Irrigation Water System

The proposed new Zone 2 tank will have the same bottom and water surface elevation as the existing Zone 2 tank but will have a smaller capacity. The location of the proposed new tank is shown on Figure 2. The proposed new tank will have a capacity of 128,000 gallons. The size of the tank was based on matching the 25-foot water level in the existing Zone 2 tank and reasonable diameter to match the height. A 25-foot high by 35-foot diameter (128,000 gallon) tank was determined to be the most appropriate size of the proposed new tank. The minimum size tank needed for operation based on 20% of average day demand for Zone 2. The minimum storage requirement is 126,600 gallons.

### 3.2.4 Booster Pump for Separate Irrigation Water System

A booster pump is needed to provide flow and pressure to the irrigated lands located in the Zone 3 area. A booster pump with a 15,000 gallon hydropnuematic tank was determined to be the most cost effective to provide pressure compared to installing a new reservoir located near the existing Zone 3 tank because of the cost of the delivery pipelines and the cost of the new reservoir. The flow rate of the proposed new booster pump is 785 gpm with a 50 horsepower motor located at the existing Alamo Pintado booster pump site.

F:\DATA\2492\CAD\Figure 2 Separate Irrigation Water System Tank Location.dwg




LEGEND

WATER MAIN

ROAD

PRACEL BOUNDARY

850 CONTOUR

N S E W

SCALE (FEET)

0 100 200

STETSON ENGINEERS INC.

DATE: JUNE 9, 2014

JN: 2492

# Separate Irrigation Water System Tank Location

FIGURE 2

### 3.2.5 Wells for Separate Irrigation Water System

Wells 1, 2, 3, 15 and 28 were selected to provide water for the irrigated lands because they have the highest Cr6 concentrations. The Gallery Well was also selected to serve the agricultural lands because it is considered a surface water diversion and would need treatment to provide water to the municipal customers but will not need treatment to provide water to the irrigated lands. The flow rate from Well 1 is 200 gpm, Well 2 is 500 gpm, Well 3 is 600 gpm, Well 15 is 1,200 gpm, Well 28 is 750 gpm, and the Gallery Well is 776 gpm for a total flow rate of 4,026 gpm or 534 acre-feet per month. Existing pumps in Wells 1, 2, 15, and 28 will be utilized to provide pressure in the proposed pipeline system and new Zone 2 reservoir along with a new 75 horsepower submersible well pump in Well 3. The existing Gallery Well pump will be used to provide flow and pressure to a new 15,000-gallon hydropneumatic tank located at the gallery Well site in Zone 1.

### 3.2.6 Frost Protection for Separate Irrigation Water System

Stetson prepared a WaterCAD Hydraulic Model for the proposed new pipelines. The model was used to determine if there is adequate pressure and flow at the water meters in Zones 1, 2 and 3 when the 27 vineyard water meters are using water for sprinkler Frost Protection (FP).

FP sprinkler system for vineyards typically requires 45 to 55 gallons per minute (gpm) per acre and a pressure of 45 to 50 psi to provide adequate FP. The vineyards in all three zones have water meters that range from 1-inch to 6-inches. For this analysis, we assumed only vineyards with water meters 4-inches and greater are used for frost protection. There are 27 vineyard water meters that are 4-inches or greater. The vineyard locations for all three zones are shown on Figure 3.

The Sensus Omni $T^2$ 4-inch and 6-inch water meters have a maximum continuous operation design flow rate of 1,000 gpm and 2,000 gpm, respectively. At the maximum continuous flow rate, the pressure loss through a 4-inch and 6-inch water meter is approximately 9 psi. If flow rates greater than the maximum continuous flow rate pass through the meter, the accuracy of measuring the flow may be reduced and the pressure loss through the meter increases significantly.

Estimation of the system water demand for frost protection is based on the maximum hour demand event that occurred during April 9, 2011 of 22,701 gpm, which includes the system demand plus frost protection demand. Estimated flow rates provided by vineyard owners or the number acres with sprinklers and 45 gpm per acre with a pressure of 45 psi. If the water demand for frost protection is greater than the meter capacity then the meter capacity was used. The only water demand limited by the meter capacity is the Kaufman Family Trust vineyard, 4-inch meter with 34 sprinkler irrigated acres and a water demand of 1,530 gpm (34 acres x 45 gpm/ac) so 1,000 gpm was used for the water demand as shown on Table 9. The required total flow rate for the vineyards frost protection and 27 meters is 20,748 gpm as shown on Table 9.

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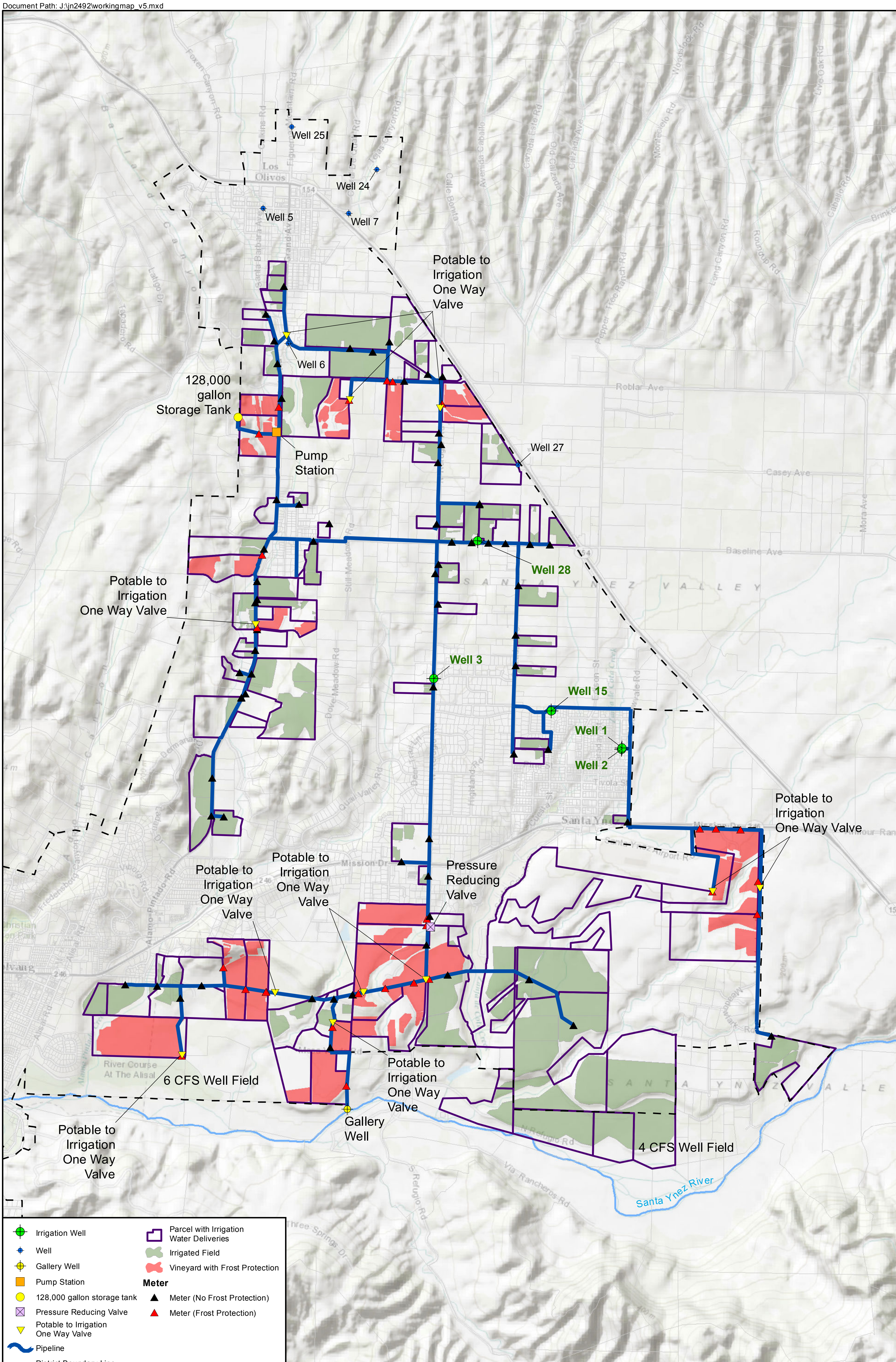



STETSON ENGINEERS INC.

PROPOSED SEPERATE IRRIGATION WATER SYSTEM

DRAFT

FIGURE 3

### TABLE 9. REQUIRED FLOW RATE FOR FROST PROTECTION

| | Vineyard[1] | Acreage | Acreage With sprinklers | No. of Meters for Frost Protection | Meter Size (inches) | Required Flow Per Meter (gpm)[2] | Required Total Flow (gpm) | Estimated Total Flow (gpm)[4] |
|---|---|---|---|---|---|---|---|---|
| Zone 1 | | | | | | | | |
| | Caldwell | 35.1 | 35 | 2 | 6 | 788 | 1,575 | 1,590 |
| | Davidge | 71.5 | 70 | 4 | 6 | 788 | 3,150 | 2,403 |
| | Kaufman Family Trust | 43 | 34 | 1 | 4 | 1,000 | 1,000 | 1,000 |
| | L&L Vineyards, LLC | 33.6 | 33 | 2 | 6 | 743 | 1,485 | 1,500 |
| | Monte Cristo Block II, LLC | 12.3 | 12.3 | 1 | 4 | 554 | 554 | 559 |
| | Old College Ranch, Inc. | 20 | 20 | 2 | 6 | 450 | 900 | 908 |
| | Roseville Properties, LLC[3] | 65.6 | 59 | 2 | 6 | 1,328 | 2,655 | 2,690 |
| | **Total** | **281.1** | **263.3** | **14** | | | **11,319** | **10,650** |
| Zone 2 | | | | | | | | |
| | Honea Vineyards LP | | 5.8 | 1 | 4 | 261 | 261 | 227 |
| | Foley Estates Vineyard & Winery | | 11 | 1 | 6 | 495 | 495 | 500 |
| | Rideau, Iris Family Trust | | 13.3 | 1 | 4 | 599 | 599 | 605 |
| | Gainey Vineyard, LLC | | 47.6 | 2 | 6 | 1,071 | 2,142 | 2,150 |
| | Gainey Vineyard, LLC | | 15.7 | 1 | 6 | 707 | 707 | 714 |
| | Claxton Vineyards Limited | | 17.4 | 1 | 4 | 783 | 783 | 790 |
| | | | 17.4 | 1 | 6 | 783 | 783 | 790 |
| | Gainey Vineyard, LLC | | 21.3 | 1 | 6 | 959 | 959 | 968 |
| | | **Total** | **149.5** | **9** | | | **6,729** | **6,744** |
| Zone 3 | | | | | | | | |
| | Blackjack | 20 | 8 | 1 | 4 | 360 | 360 | 363 |
| | Beckmen | 37 | 18 | 1 | 6 | 810 | 810 | 818 |
| | Young | 24 | 14 | 1 | 4 | 630 | 630 | 636 |
| | Royal Oaks (Roblar) | 36 | 20 | 1 | 4 | 900 | 900 | 908 |
| | **Total** | **117** | **60** | **4** | | **3,300** | **2,700** | **2,725** |
| | **Overall Total** | | | **27** | | | **20,748** | **20,119** |

Notes: [1] See Figure 3 for vineyard locations.
[2] Required flow rate based on 45 gpm per acre and is limited by the maximum allowable flow rate for meters (4" meter: 1000 gpm, 6" meter: 2000 gpm).
[3] One existing 6" meter and one proposed 6" meter.
[4] Estimated flow rates based on model results.

The WaterCAD Hydraulic Model was then used to further estimate the frost protection demand for each vineyard based on the simulated pressures. The frost protection demand for each FP node was decreased or increased linearly based on simulated pressures. The total estimated frost protection is about 20,119 gpm as shown in Table 9.

The model was then run with the irrigation water use served by the proposed separate water system only and Frost Protection Demand (FPD) of 20,119 gpm, which gives a total demand of 21,989 gpm.

Estimation of the system water demand for frost protection is based on the maximum hour demand event that occurred during April 9, 2011 of 22,701 gpm, which includes the system demand plus frost protection demand. Estimated flow rates provided by vineyard owners or the number acres with sprinklers and 45 gpm per acre with a pressure of 45 psi. If the water demand for frost protection is greater than the meter capacity then the meter capacity was used. The only water demand limited by the meter capacity is the Kaufman Family Trust vineyard, 4-inch meter with 34 sprinkler irrigated acres and a water demand of 1,530 gpm (34 acres x 45 gpm/ac) so 1,000 gpm was used for the water demand as shown on Table 7. The required total flow rate for the vineyards frost protection and 27 meters is 20,748 gpm as shown on Table 7.

The WaterCAD Hydraulic Model was then used to further estimate the frost protection demand for each vineyard based on the simulated pressures. The frost protection demand for each FP node was decreased or increased linearly based on simulated pressures. The total estimated frost protection is about 20,119 gpm as shown in Table 7.

The model was then run with the irrigation water use served by the proposed separate water system only and Frost Protection Demand (FPD) of 20,119 gpm, which gives a total demand of 21,989 gpm.

### 3.2.7 System Operation for Separate Irrigation Water System

Water from the existing municipal system will flow into the separate irrigation system at 12 one-way valves located in all three pressure zones during frost protection events. The locations of the 12 one-way valves are shown on Figure 3.

Typical FP events begin at 3:00 am therefore the water levels in Zone 1, 2 and 3 existing tanks and new Zone 2 tank should be near full at 3:00 am. Water will flow out of the existing Zone 1 tank at a rate of 5,906 gpm, the tank's water level will decrease at a rate of 0.35 MG per hour, and the pressure will drop by approximately 3 psi after about 10 hours of operation. Water will flow out of the existing Zone 2 tank and new Zone 2 tank at a rate of 3,332 gpm, the tank's water level will decrease at a rate of 0.20 MG per hour, and the pressure will drop by approximately 3 psi after approximately 16 hours of operation. Water will flow out of the existing Zone 3 tank at a rate of 202 gpm, the tank's water level will decrease at a rate of 0.01 MG per hour, and the pressure will drop by approximately 1 psi after approximately 28 hours of operation.

A summary of the wells and booster pumps operating during the frost protection event are shown in Attachment C.

### 3.2.8 Costs for Separate Irrigation Water System

New pipelines for the separate irrigation system consist of 73,900 feet of 8-inch pipeline, 18,000 feet of 10-inch pipeline, 24,000 feet of 12-inch pipeline and 1,500 feet of 16-inch pipeline. The new system improvements needed to meet the maximum hour demand includes a new booster pump station with hydropneumatic tank located near Alamo Pintado booster pump, control valves, blow offs, air/vacuum valves, new tank near Zone 2 tank, electrical controls, SCADA, electric power facilities, and purchase of land and right of ways. The capital cost of the new pipelines, tanks, control valves, and other system improvements are $23,455,000 with an additional annual O&M cost of $265,000 and an additional energy cost of $57,000, which includes municipal pumping costs per year. See Chapter 4 for comparison of cost with other alternatives. See Attachment A for an itemized list and details for cost estimate. See Attachment B for a map showing the system improvements needed to meet the maximum hour demand. See Attachment C for the flow from wells and pumps.

## 3.3 Alternative 3 – Surface Water Treatment Gallery Well

Stetson Engineers prepared a feasibility design and cost estimate for bringing the Gallery Well into production including surface water treatment. Stetson performed hydraulic modeling analysis to provide system improvements need to deliver the treated surface water up to Zones 2 and 3 to replace a portion of the upland wells water supply. The Gallery Well will be used to replace the upland wells with highest Cr6 levels. The Gallery Well appropriation allows a peak diversion rate of 1.73 cfs (776 gpm) and a maximum annual volume of 515 acre-feet. Since the Gallery Well will only provide enough water to replace a portion of the upland wells yield, water from the 4 cfs and 6 cfs river well fields and Mesa Verde Pump Station (MVPS) will be considered in this alternative along with booster pump station modifications. System modifications that would be needed in order to render the water system capable of meeting required system pressures and flow demands utilizing a combination of the two upland wells (Wells 5, 6 and 24) that have Cr6 values less than 10 ppb, river wells, MVPS and Gallery Well water will be determined. Engineers cost estimate for Gallery Well system improvements were prepared along with additional energy cost to pump water from Zone 1 to Zones 2 and 3.

### 3.3.1 Gallery Well Water Treatment

Use of the existing Gallery Well, which extends approximately 300 feet into and 20 feet below the Santa Ynez River, is being considered for potable water use. Due to the relative shallow depth of the Gallery Well, the water collected by the Gallery Well is to be considered "Surface Water", and requires a more stringent treatment method than typical groundwater wells.

Drinking water standards provided by the California Department of Health Services (DHS) have set Maximum Contaminant Levels (MCLs) which are enforceable under the safe drinking water act. There are primary MCLs that are set for chemical and radioactive contaminants, as well as secondary MCLs that are set for taste, odor, or appearance. In addition to MCLs, there are Action Levels (ALs) that are health based advisory levels established by DHS for chemical in which an MCL has not been established. Surface water treatment requires treatment for turbidity, Total Dissolved Solids (TDS), salts, heavy metals, nitrates, pathogens, and organic compounds. Due the nature of surface water, and its exposure to the elements and human contamination, the water quality can fluctuate greatly. As a result, the surface water can be exposed to pathogens long before sampling shows any indication of a problem with the water supply. A water quality report by the Central Coast Assessment Monitoring Program (CCAMP) was found with the last water quality sampling was done in 2008. The results are shown below:

**Santa Ynez River Water Quality Report for Gallery Well**

| Contaminant | Range | Mean | Median | # Samples |
|---|---|---|---|---|
| Total Dissolved Solids (TDS) (mg/l) | 200 – 900 | 729.5 | 790.0 | 29 |
| Total Suspended Solids (TSS) (mg/l) | 0.510 – 10,000 | 551 | 2,000 | 20 |
| Turbidity (NTU) | 0.0 – 3,000 | 202.6 | 1.4 | 29 |
| Nitrate (mg/l) | 0.002-1.950 | 0.219 | .120 | 29 |
| Salinity (ppt) | 0.16-59.0 | 2.63 | 0.57 | 28 |
| Coliform (MPN/100 mil) | 170-90,000 | 11,794 | 2,400 | 19 |
| Chloride (mg/l) | 11.0 – 68.0 | 47.30 | 57.50 | 20 |

Source: Central Coast Ambient Monitoring (CCAMP) – 314SYI – Santa Ynez River @HWY 101. www.ccamp.info/_2010/view_data.php

In addition to the typical constituents that need to be treated for surface water, there is a "Surface Water Treatment Rule" (SWTR) and the "Enhanced Surface Water Treatment Rule" regulated by the Environmental Protection Agency (EPA). These rules set forth guidelines on the pathogens *Giardia* and *Cryptosporidium*, with the latter known to be chlorine resistant. The removal of these constituents requires effective filtration methods and disinfection, with some cases requiring advanced disinfection methods.

The treatment for the surface water from the existing Gallery Well would need to undergo filtration and disinfection which complies with the EPA's SWTRs. Since the Gallery Well is located 20 feet below the bottom of the riverbed, the turbidity levels of the water to be treated should be relatively low. There are other water treatment plants in the area such as the William B. Carter Water Treatment Plan which treats surface water using a conventional treatment method. In addition to conventional treatment methods, there is granular activated carbon treatment and membrane filtration treatment.

### 3.3.2 Conventional Treatment

The "conventional treatment" method consists of pre-treatment, aeration, flash mix, coagulation/flocculation, sedimentation, filtration, and disinfection. The filtration method is generally either sand or other media filters. This type of methods is generally used for raw water with a higher turbidity, in which the water requires coagulation and flocculation to remove the suspended solids and other contaminants. The advantages of using the conventional method:

- Widely used with proven results
- Low initial cost

The disadvantages of using this method are:

- Large footprint required
- Higher maintenance cost due to replacing of filter media
- Backwash cycle requires disposal due to coagulation chemicals
- Process moves HGL to atmosphere, requires large booster pump to discharge into distribution pipeline
- Susceptible to SWTR violation. May require advanced disinfection methods such as ozonation or ultra-violet.

### 3.3.3 Granular Activated Carbon (GAC) Treatment Method

The GAC method is very similar to the conventional treatment method, but instead of using regular media, the method uses granular activated carbon and the media for filtration. In addition to the regular filtration that the media provides, the GAC is effective in removing organic compounds, disinfection by-products, pesticides, other synthetic organic compounds. Due to the minimal water quality data, it is not known if the use of GAC is required.

### 3.3.4 Membrane Filter Treatment

Membrane Filter treatment consists of using a membrane to separate the water from the contaminants under pressure. Membrane filtration is either Microfiltration (MF), Ultrafiltration (UF), Nanofiltration (NF), or Reverse Osmosis (RO), with the difference being the size of contaminant allowed to pass through the filtration. These types of filtration processes are being used due to the EPA's SWTR requirement to remove *Giardia* and *Cryptosporidium*. Also with the Gallery Well having some filtration due to the location 20 feet below the riverbed, the amount of turbidity would not affect the required backwash cycles of the system. The advantages of using the membrane filtration method:

- Removal of suspended solids with no coagulant
- Very high removal of *Giardia* and *Cryptosporidium*
- Much smaller footprint then conventional method
- Low maintenance costs
- Chemical free backwash which can be discharged to local water bodies
- Long-term compliance with drinking water regulations
- System under pressure, requiring smaller booster pump

The disadvantages of using this method are:

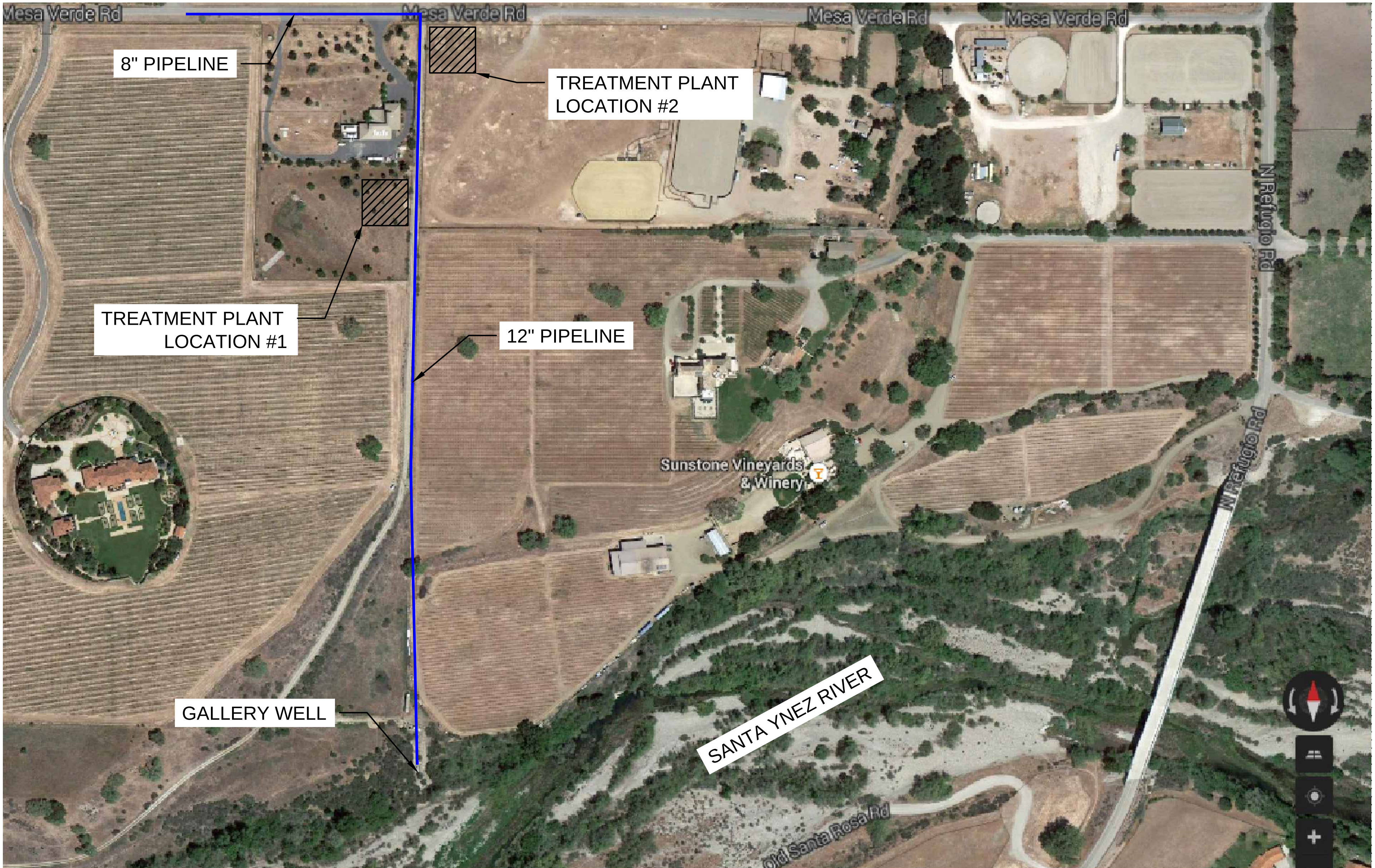
- High initial cost
- Complex controls

For the water treatment for the Santa Ynez River Gallery Well, we have selected a microfiltration treatment method. This type of method requires a smaller footprint and satisfies the EPA's stringent regulations. The following is a cost estimate of the MF water treatment plant for the Gallery Well.

### 3.3.5 Costs for Gallery Well Treatment and System Improvements

New pipelines for the Gallery Well treatment system improvements consist of 2,200 feet of 8-inch pipeline and 25,000 feet of 12-inch pipeline. The new system improvements needed to meet the maximum hour demand includes a new booster pump station located at the treatment plant site (Figure 4), control valves, blow offs, air/vacuum valves, electrical controls, SCADA, electric power facilities, and purchase of land and right of ways. The capital cost of the new pipelines, water treatment facility, control valves, and other system improvements are $5,905,000 with an additional annual O&M cost of $181,000 and an additional energy cost of $121,000 per year. See Chapter 4 for comparison of cost with other alternatives. See Attachment A for an itemized list and details for cost estimate. See Attachment B for a map showing the system improvements needed to meet the maximum hour demand. See Attachment C for the flow from wells and pumps.

F:\DATA\2492\CAD\Treatment Location Map.dwg




SOURCE: AERIAL IMAGE FROM GOOGLE.COM

STETSON ENGINEERS INC.

DATE: JUNE 9, 2014

JN: 2492

# GALLERY WELL TREATMENT PLANT LOCATION

FIGURE 4

## 3.4 Alternative 4 – Minimize use of Upland Wells with High Cr6

Stetson Engineers performed hydraulic modeling analysis to determine system modifications that would be needed in order render the water system capable of meeting required system pressures and flow demands by minimizing the use of upland wells with high Cr6. Two options addressing the water system demand were evaluated including; 1) maximum hour demand, 2) frost protection demand. Engineers cost estimate for each option was prepared. Water demand options considered include the following options:

- Alt 4-1 – Minimize use of upland wells with high Cr 6 during maximum hour demand.
- Alt 4-2 – Minimize use of upland wells with high Cr 6 during frost protection demand.

Stetson performed hydraulic modeling analysis to determine the minimum use of upland wells with high Cr6. System improvements needed to deliver the SWP water from MVPS and the 6 cfs and 4 cfs well fields up to Zones 2 and 3 to replace the upland wells water supply. System modifications that are needed in order to render the water system capable of meeting required system pressures and flow demands utilizing a combination of the upland wells with Cr6 less than 10 ppb (Wells 5, 6 and 24), MVPS, 6-cfs and 4-cfs well fields were determined. Engineers cost estimate for system improvements were prepared along with additional energy cost to pump water from Zone 1 to Zones 2 and 3.

### 3.4.1 Model Demand Distribution

The water system average day demand (ADD) was based on the maximum annual water production during the last 10 years. During the last 10 years (2004 to 2013) the annual water production ranged from 4,850 to 6,274 acre-feet and averaged 5,582 acre-feet as previously shown on Table 2. The maximum annual water production occurred in 2007. The ADD was based on the 2007 water use of 6,274 acre-feet or 3,890 gpm. The water demand was distributed throughout the system for the hydraulic model based on 2005 water meter deliveries.

The ADD is 3,890 gallons per minute (gpm). The maximum day demand for the peak summer day occurred on July 12, 2006 with a flow rate of 9,527 gpm (2004 to 2013 period of record). The maximum hour demand for the maximum summer day occurred on June 21, 2008 with a flow rate of 14,175 gpm. The summer time ADD, maximum day demand and maximum hour demand for each of the three pressure zones are shown on Table 10. Frost protection for each pressure zone for the maximum hour demand (22,701 gpm) that occurred on April 9, 2011 are shown in Table 11.

TABLE 10. WATER DEMAND DISTRIBUTION BY PRESSURE ZONES (SUMMER)

| Pressure Zone | Average Day Demand (gpm) | Maximum Day Demand (gpm) | Maximum Hour Demand (gpm) |
|---|---|---|---|
| Zone 1 | 513 | 1,258 | 1,871 |
| Zone 2 | 2,171 | 5,316 | 7,910 |
| Zone 3 | 1,206 | 2,953 | 4,394 |
| Total | 3,890 | 9,527 | 14,175 |

**Table 11. WATER DEMAND DISTRIBUTION BY PRESSURE ZONES (FROST PROTECTION)**

| Pressure Zone | Maximum Hour Demand (gpm) |
|---|---|
| Zone 1 | 10,995 |
| Zone 2 | 8,177 |
| Zone 3 | 3,529 |
| Total | 22,701 |

### 3.4.2 Water Demand and Water Supply

The water supply from wells and SWP is needed to satisfy the maximum day demand of 9,527 gpm. The maximum hour demand of 14,175 gpm is met by reservoir storage. The flow rate out of the three storage reservoirs are 4,627 gpm during the maximum hour demand based on the hydraulic model.

At a maximum flow rate of 4,627 gpm and total reservoir storage capacity of 16.7 million gallons (mg), there is adequate reservoir storage to satisfy the peak hour demand for about 30 hours assuming the three reservoirs are depleted to 50% of capacity.

Most of the 6-cfs and 4-cfs well field wells affected by Cr6need to be operating to provide water to meet the maximum day demand if the Upland Wells are not in operation. In addition, all five Mesa Verde Pumps (5,200 gpm) must operate to meet the maximum day demand. A summary of the flow rates from the wells and Mesa Verde Pump Station are shown in Attachment C. The total water supply flow is 9,106 gpm with the maximum day demand flow requirement of 9,527 gpm leaving a water supply surplus of 56 gpm.

Water also must be provided to each pressure zone to meet the maximum day demand (MDD) of each pressure zone as previously shown in Table 10. Because most of the water supply is located in pressure Zone 1, booster pumps convey the water from Zone 1 to Zones 2 and 3. Zone 3 MDD is 2,953 gpm. Wells 5, 6 and 24 provide 841 gpm and Alamo Pintado booster pump provide 1,737 gpm and Refugio-3 provides 1,014 gpm for a total inflow to Zone 3 of 3,592 gpm which is 639 gpm greater than the MDD. Stetson considered the operation of all the existing Zone 3 booster pumps and operating the large booster pump at Alamo Pintado along with Refugio-3 provided the best hydraulic condition for both Zones 2 and 3 even though the flow is

639 gpm greater than what is needed to satisfy the MDD. With all the usable Zone 2 booster pumps operating (5,600 gpm) and no upland wells there is net inflow to Zone 2 of 2,849 gpm (5,600 – 1,737 – 1,014 gpm) taking into consideration the water pumped to Zone 3 (1,737 + 1,014 gpm). Zone 2 has a MDD of 5,316 gpm and a net inflow of 2,840 resulting in a shortage of 2,467 gpm (5,316 – 2,849 gpm) to satisfy the MDD in Zone 2. Additional booster pumping capacity from Zone 1 to Zone 2 is needed to satisfy the MDD.

### 3.4.3 System Operational Settings

The number of water supply pumps operated is governed by the maximum day demand. The maximum hour demand is satisfied by a combination of the water supply pumps, booster pumps and water from the tanks. Zone 2 demands are satisfied with booster pumps. The flow rate of Refugio-2 with all three pumps operating is 1,301 gpm (695 + 303 +303). Meadow Lark pump station flow with all four pumps operating is 5,227 gpm (1,397 + 1,131 + 1,331 + 1,368). Zone 3 booster pumps are Alamo Pintado (larger pump flow rate of 1,737 gpm) and Refugio-3 (flow rate of 1,014 gpm). The two small Alamo Pintado booster pumps are not required to satisfy the MDD in Zone 3. To determine the water supply pumps (i.e. groundwater well pumps from the 6-cfs and 4-cfs well fields and Mesa Verde pumps) to be operated in Zone 1 mostly depend on meeting the water demands instead of providing system pressure. Any supply pumps in Zone 1 can be operated as long as the water supply meets with Zone 1 demand and the flow rate of booster pumps delivering water to Zone 2.

Operating the upland groundwater wells is limited to the three wells with the lowest Cr6 values. Wells 5, 6, and 24 can pump into Zone 3 with a flow rate of approximately 250 gpm, 300 gpm, and 350 gpm, respectively depending on the system operating pressure. A summary of the normal flow and hydraulic model flow rate in gallons per minute (gpm) for Alternative 4-1 is shown in Attachment C.

Three options were considered to increase the booster pumping capacity by from Zone 1 to Zone 2 to satisfy the MDD.

1. Add pump to existing Refugio 2 pump station
2. Add pump to existing Meadow Lark pump station
3. Add new pump station at Zone 1 reservoir site.

After evaluating the above three options for increasing the booster pumping capacity, adding a new pump at the Zone 1 reservoir location and replacing Refugio 2-1 with a larger pump appears to be the most appropriate option considering the system hydraulics and cost for pipeline enlargements.

### 3.4.4 Evaluation Criteria and Hydraulic Modeling Results for Alternative 4-1

The Title 22 criteria for service pressure, is to provide a minimum 20 psi at all service connections. Since the Hydraulic Model was calibrated to plus or minus 3 psi, a minimum pressure of 25 psi was used to evaluate the system pressures. In distribution mains, ID1 requires velocities of no more than 4 feet per second (fps) without fire flows during the maximum hour demand.

The simulated hydraulic model results for the maximum hour demand with the booster pumps and well pumps flow rates shown in Attachment C. There are several model nodes that do not meet the minimum pressure of 25 psi. The low pressure critical node is located at Luma Yucca Road just north of Hidden Hills Road with pressure of 15.9 psi prior to the proposed solutions. After new pipe and pumps are installed the pressure increased to 17.1 psi as shown on the map for Alternative 4-1 in Attachment B.

There are 10 pipes that exceed the maximum velocity requirement of 4 fps in Zone 1 as shown in Attachment B. Parallel pipelines were installed to reduce the velocity.

### 3.4.5 Cost Summary and Conclusions for Alternative 4-1

The hydraulic analysis indicate that installing a new pump at the Refugio 2-1 pump station, new pump station at Zone 1 tank and new pipelines. Moving some delivery point from Zone 2 to Zone 3 and some from Zone 1 to Zone 2 and installing a small booster for an individual service solves the pressure and velocity problems.

### 3.4.6 Costs for Alternative 4-1 System Improvements Maximum Hour Demand

New pipelines for Alternative 4-1 system improvements consist of 1,600 feet of 8-inch pipeline, 4,300 feet of 10-inch pipeline, and 5,600 feet of 12-inch pipeline. The new system improvements needed to meet the maximum hour demand includes a new booster pump station located at the Zone 1 tank, new pump at Refugio 2-1, control valves, blow offs, air/vacuum valves, electrical controls, SCADA, electric power facilities, and purchase of land and right of ways. The capital cost of the new pipelines, booster pumps, control valves, and other system improvements are $3,287,000 with an additional annual O&M cost of $41,000 and an additional energy cost of $64,000 per year. See Chapter 4 for comparison of cost with other alternatives. See Attachment A for an itemized list and details for cost estimate. See Attachment B for a map showing the system improvements needed to meet the maximum hour demand. See Attachment C for the flow from wells and pumps.

### 3.4.7 Costs for Alternative 4-2 System Improvements Frost Protection Demand

New pipelines for Alternative 4-2 system improvements consist of 1,600 feet of 8-inch pipeline, 4,300 feet of 10-inch pipeline, and 5,600 feet of 12-inch pipeline. The new system improvements needed to meet the maximum hour demand includes a new booster pump station located at the Zone 1 tank, new pump at Refugio 2-1, control valves, blow offs, air/vacuum valves, electrical controls, SCADA, electric power facilities, and purchase of land and right of ways. The capital cost of the new pipelines, booster pumps, control valves, and other system improvements are $3,287,000 with an additional annual O&M cost of $41,000 and an additional energy cost of $64,000 per year. These costs are the same as Alternative 4-1, no additional system improvements beyond what is proposed for Alternative 4-1 are needed to satisfy the historic frost protection demand. See Chapter 4 for comparison of cost with other alternatives. See Attachment A for an itemized list and details for cost estimate. See Attachment B for a map showing the system improvements needed to meet the maximum hour demand. See Attachment C for the flow from wells and pumps.

## 3.5 Alternative 5 - Well Treatment Options

Stetson performed hydraulic modeling to support Hazen & Sawyer well treatment options for Alternative 5. This element of the hydraulic modeling for Hazen & Sawyer was to develop pipeline locations for connecting central treatment facilities or individual treatment facilities. Hazen & Sawyer well treatment options are as follows: 1) Treat Wells 1, 2, 3 and 15 at a centralized location at ID1's shop site, 2) Treatment of Wells 27 and 28 at Well 27 site, 3) Treat Well 7 at Well 7 site, and 4) Treat Well 25 at well 25 site. Stetson's hydraulic modeling will have an element of analyzing piping, system capacities, system pressure, booster pumps and storage facilities size and location. Engineers cost estimate for system improvements (pipes, pumps, pumps, etc) were prepared. Cost estimates for well treatment alternatives were prepared by Hazen & Sawyer and provided to Stetson for the cost summary tables.

Alternative 5 – Well Treatment Location Options, there are four well treatment options. Treatment location options considered include the following four options:

- Alt 5-1 – Treat Wells 1, 2 and 15 at existing ID1 shop site, 1,900 gpm add Well 3 (600 gpm) as redundant source.
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site
- Alt 5-3 – Treat Well 7 at Well 7 site
- Alt 5-4 – Treat Well 25 at Well 25 site

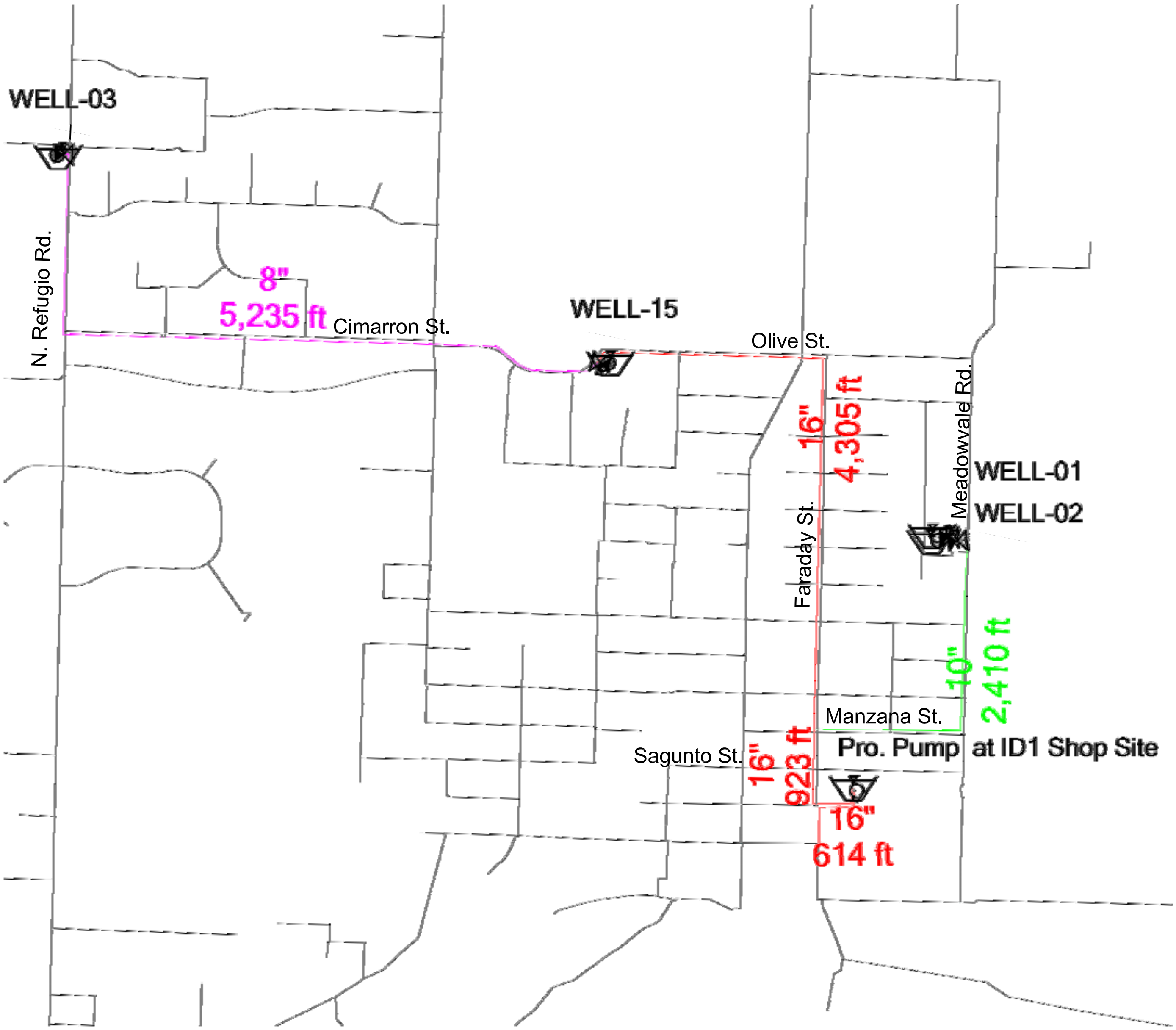
### 3.5.1 Alternative 5-1 Wells 1, 2, 3 and 15 Treatment at ID1 Shop Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at ID1's shop site for treatment and blending of Wells 1, 2, 3 and 15 with Well 3 as a redundant source. Stetson added new dedicated pipelines to the hydraulic model from Well 1, 2, 3 and15 to the proposed treatment plant located at ID1's shop site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 86 psi. The pressure needed at the treatment plant discharge during the average day demand was estimated at 84 psi. The dedicated pipelines includes a 8-inch diameter pipeline 5,400 feet long from Well 3 to Well 15, a 16-inch diameter pipeline 4,400 long from Well 15 to join pipe to treatment plant, a 6-inch pipeline 100 feet long from Well 1 to Well 2, a 10-inch diameter pipeline from Well 2 to join pipe to treatment plant, a 16-inch diameter pipeline 1,000 feet long from the combined Wells 1, 2, 3 and 15 to treatment plant. The discharge pipeline from the treatment plant is 16-inch diameter 700 feet long as shown on Figure 5. The capital cost of the new pipelines, booster pumps, control valves, other system improvements plus treatment plant costs from Hazen & Sawyer are $12,299,000 with an additional annual O&M cost of $1,212,000 and an additional energy cost of $72,000 per year. See Chapter 4 for comparison of cost with other alternatives. See Attachment A for an itemized list and details for cost estimate. See Attachment B for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment C.

### 3.5.2 Alternative 5-2 Wells 27 and 28 Treatment at Well 27 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 27 site for treatment and blending of Wells 27 and 28. Stetson added new dedicated pipelines to the hydraulic model from Well 28 to the proposed treatment plant located at Well 27 site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand for Zone 2 at 36 psi and Zone 3 at 108 psi. The dedicated pipeline is 10-inches in diameter and 4,000 feet long from Well 28 to Well 27. The discharge from the Zone 2 booster pump will connect to an existing 12-inch diameter pipeline and the discharge from the Zone 3 booster pump will connect to an existing 8-inch diameter pipeline as shown on Figure 6. The capital cost of the new pipelines, control valves, other system improvements plus treatment plant costs from Hazen & Sawyer (including booster pumps) are $7,538,000 with an additional annual O&M cost of $737,000 and an additional energy cost of $49,000 per year. See Chapter 4 for comparison of cost with other alternatives. See Attachment A for an itemized list and details for cost estimate. See Attachment B for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment C.

FIGURE 5




LEGEND

- Existing Pipe
- Proposed 8-inch Pipe
- Proposed 10-inch Pipe
- Proposed 16-inch Pipe

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STETSON ENGINEERS INC.

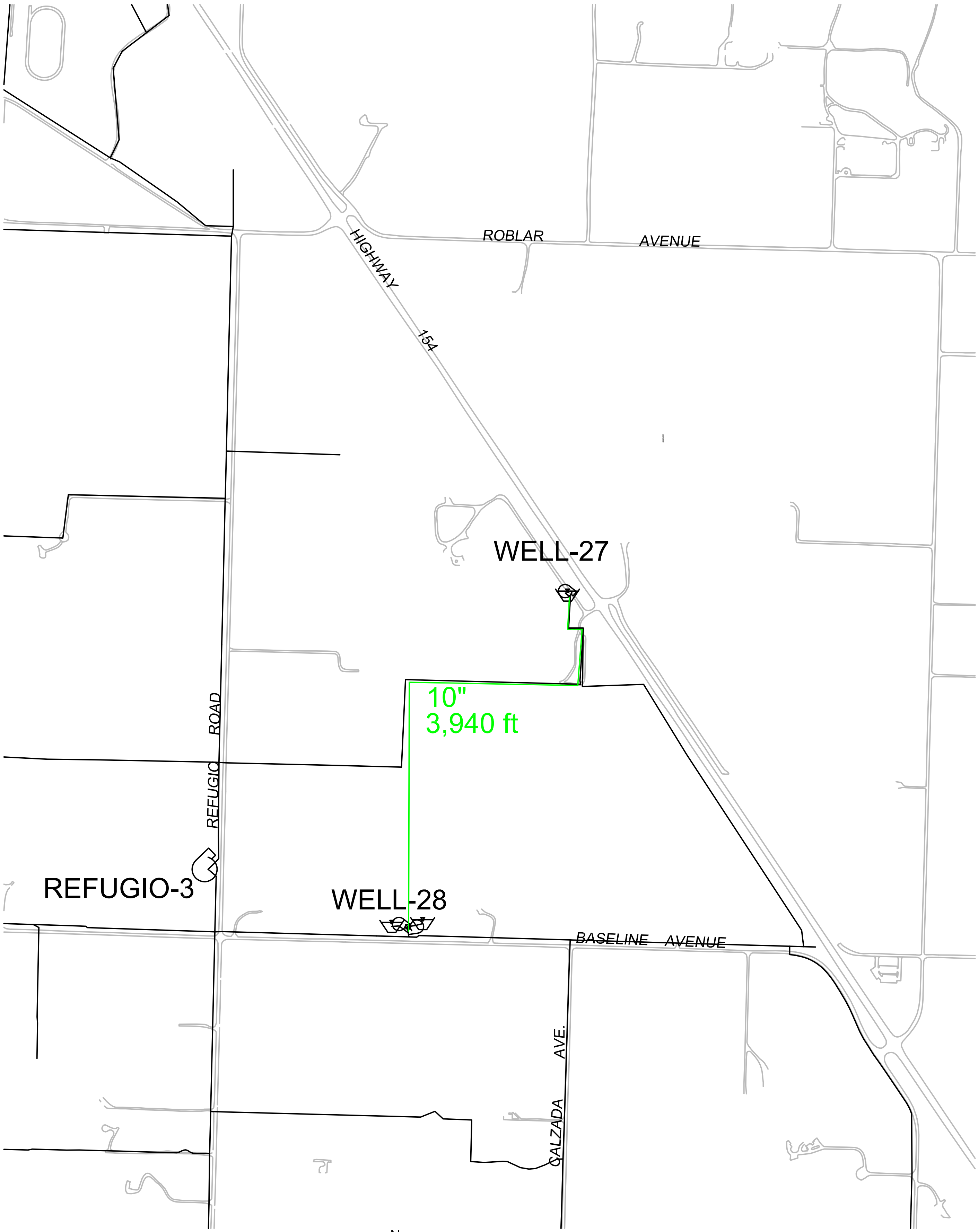
DATE: JUNE 9, 2014

JN: 2492

## Pipelines to Treatment Plant at ID#1 Shop Site

F:\DATA\2492\CAD\Figure 5 Treatement Plant at ID1 Site.dwg

FIGURE 6




LEGEND

- Existing Pipe
- Proposed 10-inch Pipe
- Road

STETSON ENGINEERS INC.

DATE: JUNE 9, 2014

JN: 2492

**Pipelines to Treatment Plant at Well 27**

F:\DATA\2492\CAD\Figure 6 Treatment Plant at Well 27.dwg

### 3.5.3 Alternative 5-3 Well 7 at Well 7 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 7 site for treatment and blending of Well 7. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 66 psi. Cost estimates were not prepared by Stetson for Alternative 5-3. Hazen & Sawyer provided a treatment cost of $3,475,000 with an additional O&M cost of $433,000 and an additional energy cost of $24,000.

### 3.5.4 Alternative 5-4 Well 25 at Well 25 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 25 site for treatment and blending of Well 25. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 49 psi. Cost estimates were not prepared by Stetson for Alternative 5-4. Hazen & Sawyer provided a treatment cost of $3,475,000 with an additional O&M cost of $433,000 with an additional energy cost of $26,000.

## 3.6 Alternative 6 – Install Packers as Well Treatment Options

Stetson performed hydraulic modeling to support Dudek's well treatment to block inflow from high Cr6 formations by installing packers in the wells for Alternative 6. Stetson's hydraulic modeling will have an element of analyzing piping, system capacities, system pressure, booster pumps and storage facilities size and location. Dudek assumed a reduction of 25% in well flow rate. Engineers cost estimate for system improvements (pipes, pumps, pumps, etc) were prepared. Cost estimates for well packer treatment alternatives were prepared by Dudek and provided to Stetson for the cost summary tables.

Alternative 6 – Install Packers as Well Treatment Options, there are four well packer treatment options. Install well packer options considered include the following four options:

- Alt 6-1 – Well 7 – block inflow from Cr6 intrusion zone (install packer).
- Alt 6-2 – Well 25 – block inflow from Cr6 intrusion zone (install packer).
- Alt 6-3 – Well 28 – block inflow from Cr6 intrusion zone (install packer).
- Alt 6-4 – Well 27 – block inflow from Cr6 intrusion zone (install packer).

### 3.6.1 Alternatives 6-1 to 6-4- Install Packers in Wells 7, 25, 28 and 27

New pipelines for Alternatives 6-1 to 6-4 system improvements are the same and consist of 3,400 feet of 8-inch pipeline and 8,300 feet of 12-inch pipeline. The new system improvements needed to meet the maximum hour demand includes a new booster pump station located at the Zone 1 tank, control valves, blow offs, air/vacuum valves, electrical controls, SCADA, electric power facilities, and purchase of land and right of ways. The capital cost of the new pipelines, booster pumps, control valves, and other system improvements are $3,434,000 including $100,000 for installation of the packer, with an additional annual O&M cost of $50,000 and an additional energy cost of $34,000, $6,000, $16,000, $59,000 per year for Alternatives 6-1, 6-2, 6-3 and 6-4, respectively. See Chapter 4 for comparison of cost with other alternatives. See Attachment A for an itemized list and details for cost estimate. See Attachment B for a map showing the system improvements needed to meet the maximum hour demand. See Attachment C for the flow from wells and pumps.

# 4.0 ENGINEERING COST ESTIMATION FOR ALTERNATIVES

Stetson performed engineering cost estimation for Alternatives 1 through 6 based on pipelines, pump and other facilities needed to provide required system pressure and limit the maximum velocity in the pipelines to about 4 feet per second during the maximum hour demand. Hazen and Sawyer provided cost for water treatment of wells (Alternative 5) and Dudek provided cost for well packers (Alternative 6). System improvement capital costs were annualized using an interest rate of 5% and expected life of 20 years for each component as shown on Table 9. Additional costs for operation and maintenance (O&M) for the alternatives were estimated based on percentage of capital cost. O&M cost for water treatment were provided by Hazen & Sawyer. Energy costs were estimated based on the additional cost to pump water from Zone 1 instead of using the Upland wells. See Attachment A for an itemized list and details for cost estimate for each alternative. Table 12 shows a summary of the costs for each alternative. Following the table is a description of each cost component shown in Table 12.

## 4.1 Mobilization and Demobilization Cost

Mobilization cost includes all activities and associated costs for transportation of construction contractor's personnel, equipment, and operating supplies to the project site; establishment of offices, buildings, and other necessary general facilities for the construction contractor's operations at the construction site; premiums paid for performance and payment bonds, including coinsurance and reinsurance agreements as applicable are typically included in mobilization costs. Demobilization cost include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal and site cleanup, of offices, buildings and other facilities assembled on the site specifically for the construction project. Mobilization and demobilization cost was estimated as 5 percent of all capital costs excluding land and right of ways, contingencies, engineering and design, and construction management and bidding.

## 4.2 Pipelines

The pipelines consist of PVC pipelines. The pipeline costs were estimated for materials and installation of PVC pipeline sizes ranging from 6 to 16 inches in diameter. Unit costs of pipes are shown in Table 13.

## Table 12 Capital Cost, Annualized Capital Cost and O&M Cost Summary for Each Alternative

| | | Alternative Number: | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Capital Cost Summary** | | **1-1** | **1-2** | **1-3** | **1-4** | **1-5** | **1-6** | **2** | **3** | **4-1** | **4-2** | **5-1** | **5-2** | **6-1** | **6-2** | **6-3** | **6-4** |
| Notes | Item | Blending Well 7 & 24 at Zone 3 Tank | Blending Well 24 & 7 | Blending Well 27 & Z2 | Blending Well 28 & Z2 | Blending Well 5 & 25 | Blending Well 24 & 25 | Separate Irrigation System | Gallery Well Treatment | Minimum use of Upland Wells | Frost Protection Min. use of Upland Wells | Well Treatment Wells 1, 2, 3 & 15 | Well Treatment Wells 27 & 28 | Well 7 block inflow | Well 25 block inflow | Well 28 block inflow | Well 27 block inflow |
| [1] | Mobilization and demobilization | $122,000 | $119,000 | $142,000 | $142,000 | $129,000 | $137,000 | $768,000 | $181,000 | $102,000 | $102,000 | $409,000 | $250,000 | $107,000 | $107,000 | $107,000 | $107,000 |
| [2] | Pipelines | $1,990,000 | $1,986,000 | $2,249,000 | $2,100,000 | $2,123,000 | $2,283,000 | $13,645,000 | $1,664,000 | $1,590,000 | $1,590,000 | $3,288,000 | $1,597,000 | $1,634,000 | $1,634,000 | $1,634,000 | $1,634,000 |
| [3] | Control Valves | $221,000 | $198,000 | $234,000 | $254,000 | $213,000 | $212,000 | $1,037,000 | $199,000 | $155,000 | $155,000 | $207,000 | $120,000 | $154,000 | $154,000 | $154,000 | $154,000 |
| [4] | Tanks | $0 | $0 | $0 | $0 | $0 | $0 | $420,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| [5] | Pump Stations | $95,000 | $95,000 | $215,000 | $320,000 | $110,000 | $110,000 | $98,000 | $255,000 | $180,000 | $180,000 | $63,000 | $15,000 | $135,000 | $135,000 | $135,000 | $135,000 |
| [6] | Electrical Controls | $55,000 | $55,000 | $95,000 | $115,000 | $60,000 | $60,000 | $45,000 | $95,000 | $55,000 | $55,000 | $15,000 | $5,000 | $55,000 | $55,000 | $55,000 | $55,000 |
| [7] | SCADA System | $50,000 | $25,000 | $25,000 | $25,000 | $25,000 | $25,000 | $75,000 | $50,000 | $25,000 | $25,000 | $25,000 | $25,000 | $25,000 | $25,000 | $25,000 | $25,000 |
| [8] | Water Treatment Plant or well treatment | $0 | $0 | $0 | $0 | $0 | $0 | $20,000 | $1,300,000 | $0 | $0 | $20,000 | $0 | $100,000 | $100,000 | $100,000 | $100,000 |
| [8] | WTP Hazen & Sawyer | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $4,542,000 | $3,223,000 | $0 | $0 | $0 | $0 |
| [9] | Electrical Power Facilities | $30,000 | $30,000 | $30,000 | $30,000 | $40,000 | $40,000 | $15,000 | $50,000 | $30,000 | $30,000 | $10,000 | $10,000 | $30,000 | $30,000 | $30,000 | $30,000 |
| [10] | Land and Right of Ways | $231,000 | $230,000 | $230,000 | $230,000 | $260,000 | $260,000 | $400,000 | $480,000 | $230,000 | $230,000 | $30,000 | $36,000 | $230,000 | $230,000 | $230,000 | $230,000 |
| [11] | Contingencies | $256,000 | $251,000 | $299,000 | $299,000 | $270,000 | $287,000 | $1,612,000 | $379,000 | $214,000 | $214,000 | $858,000 | $525,000 | $224,000 | $224,000 | $224,000 | $224,000 |
| [12] | Engineering and Design | $423,000 | $414,000 | $493,000 | $493,000 | $446,000 | $473,000 | $2,660,000 | $626,000 | $353,000 | $353,000 | $1,416,000 | $866,000 | $370,000 | $370,000 | $370,000 | $370,000 |
| [13] | Construction Management and Bidding | $423,000 | $414,000 | $493,000 | $493,000 | $446,000 | $473,000 | $2,660,000 | $626,000 | $353,000 | $353,000 | $1,416,000 | $866,000 | $370,000 | $370,000 | $370,000 | $370,000 |
| | **Total Capital Cost** | **$3,896,000** | **$3,817,000** | **$4,505,000** | **$4,501,000** | **$4,122,000** | **$4,360,000** | **$23,455,000** | **$5,905,000** | **$3,287,000** | **$3,287,000** | **$12,299,000** | **$7,538,000** | **$3,434,000** | **$3,434,000** | **$3,434,000** | **$3,434,000** |
| | Acre feet (AF) pumped per year | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 |
| | $/AF | 698 | 684 | 807 | 806 | 738 | 781 | 4,202 | 1,058 | 589 | 589 | 2,203 | 1,350 | 615 | 615 | 615 | 615 |
| **Annualized Capital Cost** | | **1-1** | **1-2** | **1-3** | **1-4** | **1-5** | **1-6** | **2** | **3** | **4-1** | **4-2** | **5-1** | **5-2** | **6-1** | **6-2** | **6-3** | **6-4** |
| [20] | Mobilization and demobilization | $9,800 | $9,500 | $11,400 | $11,400 | $10,400 | $11,000 | $61,600 | $14,500 | $8,200 | $8,200 | $32,800 | $20,100 | $8,600 | $8,600 | $8,600 | $8,600 |
| [20] | Pipelines | $159,700 | $159,400 | $180,500 | $168,500 | $170,400 | $183,200 | $1,094,900 | $133,500 | $127,600 | $127,600 | $263,800 | $128,100 | $131,100 | $131,100 | $131,100 | $131,100 |
| [20] | Control Valves | $17,700 | $15,900 | $18,800 | $20,400 | $17,100 | $17,000 | $83,200 | $16,000 | $12,400 | $12,400 | $16,600 | $9,600 | $12,400 | $12,400 | $12,400 | $12,400 |
| [20] | Tanks | $0 | $0 | $0 | $0 | $0 | $0 | $33,700 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| [20] | Pump Stations | $7,600 | $7,600 | $17,300 | $25,700 | $8,800 | $8,800 | $7,900 | $20,500 | $14,400 | $14,400 | $5,100 | $1,200 | $10,800 | $10,800 | $10,800 | $10,800 |
| [20] | Electrical Controls | $4,400 | $4,400 | $7,600 | $9,200 | $4,800 | $4,800 | $3,600 | $7,600 | $4,400 | $4,400 | $1,200 | $400 | $4,400 | $4,400 | $4,400 | $4,400 |
| [20] | SCADA System | $4,000 | $2,000 | $2,000 | $2,000 | $2,000 | $2,000 | $6,000 | $4,000 | $2,000 | $2,000 | $2,000 | $2,000 | $2,000 | $2,000 | $2,000 | $2,000 |
| [20] | Water Treatment Plant or well treatment | $0 | $0 | $0 | $0 | $0 | $0 | $1,600 | $104,300 | $0 | $0 | $1,600 | $0 | $8,000 | $8,000 | $8,000 | $8,000 |
| [20] | WTP Hazen & Sawyer | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $364,500 | $258,600 | $0 | $0 | $0 | $0 |
| [20] | Electrical Power Facilities | $2,400 | $2,400 | $2,400 | $2,400 | $3,200 | $3,200 | $1,200 | $4,000 | $2,400 | $2,400 | $800 | $800 | $2,400 | $2,400 | $2,400 | $2,400 |
| [20] | Land and Right of Ways | $18,500 | $18,500 | $18,500 | $18,500 | $20,900 | $20,900 | $32,100 | $38,500 | $18,500 | $18,500 | $2,400 | $2,900 | $18,500 | $18,500 | $18,500 | $18,500 |
| [20] | Contingencies | $20,500 | $20,100 | $24,000 | $24,000 | $21,700 | $23,000 | $129,400 | $30,400 | $17,200 | $17,200 | $68,800 | $42,100 | $18,000 | $18,000 | $18,000 | $18,000 |
| [20] | Engineering and Design | $33,900 | $33,200 | $39,600 | $39,600 | $35,800 | $38,000 | $213,400 | $50,200 | $28,300 | $28,300 | $113,600 | $69,500 | $29,700 | $29,700 | $29,700 | $29,700 |
| [20] | Construction Management and Bidding | $33,900 | $33,200 | $39,600 | $39,600 | $35,800 | $38,000 | $213,400 | $50,200 | $28,300 | $28,300 | $113,600 | $69,500 | $29,700 | $29,700 | $29,700 | $29,700 |
| | **Total Annualized Capital Cost (rounded)** | **$312,000** | **$306,000** | **$362,000** | **$361,000** | **$331,000** | **$350,000** | **$1,882,000** | **$474,000** | **$264,000** | **$264,000** | **$987,000** | **$605,000** | **$276,000** | **$276,000** | **$276,000** | **$276,000** |
| | Acre feet (AF) pumped per year | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 |
| | $/yr/AF | 56 | 55 | 65 | 65 | 59 | 63 | 337 | 85 | 47 | 47 | 177 | 108 | 49 | 49 | 49 | 49 |
| **Annual O&M Cost Summary** | | **1-1** | **1-2** | **1-3** | **1-4** | **1-5** | **1-6** | **2** | **3** | **4-1** | **4-2** | **5-1** | **5-2** | **6-1** | **6-2** | **6-3** | **6-4** |
| [25] | Mobilization and demobilization | $1,200 | $1,200 | $1,400 | $1,400 | $1,300 | $1,400 | $7,700 | $1,800 | $1,000 | $1,000 | $4,100 | $2,500 | $1,100 | $1,100 | $1,100 | $1,100 |
| [25] | Pipelines | $29,900 | $29,800 | $33,700 | $31,500 | $31,800 | $34,200 | $204,700 | $25,000 | $23,900 | $23,900 | $49,300 | $24,000 | $24,500 | $24,500 | $24,500 | $24,500 |
| [25] | Control Valves | $4,400 | $4,000 | $4,700 | $5,100 | $4,300 | $4,200 | $20,700 | $4,000 | $3,100 | $3,100 | $4,100 | $2,400 | $3,100 | $3,100 | $3,100 | $3,100 |
| [25] | Tanks | $0 | $0 | $0 | $0 | $0 | $0 | $4,200 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| [25] | Pump Stations | $4,800 | $4,800 | $10,800 | $16,000 | $5,500 | $5,500 | $4,900 | $12,800 | $9,000 | $9,000 | $3,200 | $800 | $6,800 | $6,800 | $6,800 | $6,800 |
| [25] | Electrical Controls | $600 | $600 | $1,000 | $1,200 | $600 | $600 | $500 | $1,000 | $600 | $600 | $200 | $100 | $600 | $600 | $600 | $600 |
| [25] | SCADA System | $2,500 | $1,300 | $1,300 | $1,300 | $1,300 | $1,300 | $3,800 | $2,500 | $1,300 | $1,300 | $1,300 | $1,300 | $1,300 | $1,300 | $1,300 | $1,300 |
| [25] | Water Treatment Plant or well treatment | $0 | $0 | $0 | $0 | $0 | $0 | $2,000 | $130,000 | $0 | $0 | $2,000 | $0 | $10,000 | $10,000 | $10,000 | $10,000 |
| [25] | WTP Hazen & Sawyer | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $1,139,000 | $700,000 | $0 | $0 | $0 | $0 |
| [25] | Electrical Power Facilities | $300 | $300 | $300 | $300 | $400 | $400 | $200 | $500 | $300 | $300 | $100 | $100 | $300 | $300 | $300 | $300 |
| [25] | Land and Right of Ways | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| [25] | Contingencies | $2,600 | $2,500 | $3,000 | $3,000 | $2,700 | $2,900 | $16,100 | $3,800 | $2,100 | $2,100 | $8,600 | $5,300 | $2,200 | $2,200 | $2,200 | $2,200 |
| [25] | Engineering and Design | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| [25] | Construction Management and Bidding | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | **Total O&M (rounded)** | **$46,000** | **$45,000** | **$56,000** | **$60,000** | **$48,000** | **$51,000** | **$265,000** | **$181,000** | **$41,000** | **$41,000** | **$1,212,000** | **$737,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** |
| [28] | **Energy Cost (additional)** | **$35,000** | **$35,000** | **$38,000** | **$38,000** | **$13,000** | **$13,000** | **$57,000** | **$121,000** | **$64,000** | **$64,000** | **$72,000** | **$49,000** | **$34,000** | **$6,000** | **$16,000** | **$59,000** |

TABLE 13. UNIT PIPE COSTS

| Pipe Size I.D. (inches) | Material | Design Pressure (psi) | Pipe Class | Total Cost ($/ft) |
|---|---|---|---|---|
| 6 | PVC | 165 | C900 | 100 |
| 8 | PVC | 165 | C900 | 110 |
| 10 | PVC | 165 | C900 | 130 |
| 12 | PVC | 165 | C900 | 150 |
| 16 | PVC | 165 | C905 | 210 |

I.D. = Inside diameter

The pipe material proposed for all new pipelines is PVC. Water pressure, energy losses (head losses), and flow velocity was determined for each pipeline using the hydraulic model. Each pipeline segment was designed to satisfy the flow required by the area to be served and based on the maximum hour demand.

As with any system requiring closed pressurized pipes, typical of municipal and irrigation water delivery systems, the design of pipe networks is based on the maximum allowable velocity while meeting hydraulic requirements. The pipeline system was designed to satisfy the maximum hour demand. Pipeline design involves determining the maximum total dynamic head, which enables the engineer to select the proper pump size.

Pipe diameters were optimized to reduce the combined cost of pumps, energy, pipeline materials, and installation. Smaller diameter pipe is less expensive to purchase and install but increases pumping costs by increasing energy losses due to friction. Pipe diameters are selected to have a velocity of less than four feet per second and a maximum velocity of seven feet per second for frost protection events. The diameter of each new pipeline is calculated based on flow rate and velocity of the flow.

The friction losses each pipe was estimated using the Hazen-Williams equation which is expressed as follows:

$$hf = \frac{10.44 * Q^{1.852} * L}{C^{1.852} * D^{4.87}}$$

Where:

$hf$ = Friction head loss [feet]
$Q$ = Flow [gpm]
$D$ = Pipe diameter [inches]
$L$ = Length of pipe [feet]
$C$ = Hazen-Williams coefficient

A Hazen-Williams coefficient "C" of 150 was used for design of the proposed new pipelines.

## 4.3 Control Valves

Control valves costs were estimated for gate valves, check valves, pressure reducing valves, blow-off valve assembly, air/vac and air release valves for the proposed new pipelines. Costs for control valves were based on two valves per pipeline. Costs for blow-offs and air/vac and air release valves were based on one per pipeline or one every 2,000 feet of pipe for long pipelines. Costs for inline static mixers were included for the blending alternatives. Costs for pressure reducing valves and flow control valves were also included for Alternatives 2 and 5.

## 4.4 Tanks

Hydropneumatic tanks (15,000 gallon) are used to control pressure at proposed new booster pumps for Alternatives 2 and 3. The cost for a proposed new 128,000-gallon storage tank was estimated for Alternative 2 (separate irrigation system) for pressure regulation in Zone 2.

## 4.5 Pump Stations

Pump stations are required to provide sufficient energy to move water from the source to one or more delivery points. Pump stations may be one or more individual pumps and refer to all works including structures, pumps, electrical controls, and accessories. Pump stations are sized based on the peak flow rate and the total dynamic head (TDH) required to deliver water to the model nodes with a minimum system pressure of 25 psi during the maximum hour demand. Total dynamic head is the sum of the change in elevation from the water source to the model node elevation, the pressure requirement and the head loss due to friction along the length of pipe, at bends and valves. The horsepower rating for each of the pumps is based on peak flows in the pipeline, the total dynamic head and the pump efficiency, according to the following equation.

$$Hp = \frac{Q * TDH}{3960 * \eta}$$

Where:

| | | |
|---|---|---|
| Hp | = Pump horsepower |
| $Q$ | = Flow rate, [gallons per minute] |
| TDH | = Total dynamic head, [feet] |
| $\eta$ | = Pump and motor efficiency [75%] |

## 4.6 Electrical Controls

Electrical controls for pump motors includes costs for control panels, control boxes, overload protection, low water shutoff, electrical wires, conduits, pressure sensors, starters, relays, capacitors and reduced voltage starters.

## 4.7 SCADA System

Supervisory control and data acquisition (SCADA) cost includes remote terminal unit panel, telemetry, programmable logic controller, associated conduits, and communication equipment. Cost for SCADA was added to all proposed new pump stations and storage tanks.

## 4.8 Water Treatment Plant or Well Treatment

Stetson estimated the cost for the surface water treatment of the Gallery Well for Alternative 3. Dudek estimated the cost for packers for Alternative 6 at $100,000 for each well.

## 4.9 Water Treatment Plant Design by Hazen & Sawyer

Cost for water treatment of Cr6 were provided by Hazen & Sawyer for Alternatives 5 as shown on Table 14.

TABLE 14. TREATMENT COST BY HAZEN & SAWYER

| Alternative | Capital Cost 1) | O&M | Pumping |
|---|---|---|---|
| 5-1 | 6,820,000 | 1,139,000 | 54,000 |
| 5-2 | 4,839,000 | 700,000 | 54,000 |
| 5-3 | 3,475,000 | 433,000 | 24,000 |
| 5-4 | 3,475,000 | 433,000 | 26,000 |

Note: [1] Capital costs reduced to 66.6% to remove mobilization and demobilization, engineering, and contingencies and construction management.

## 4.10 Electrical Power Facilities

Electrical power facilities includes power line and transformer costs were calculated based on the electrical distribution lines needed to provide electric power to the proposed new booster pump stations from the closest existing power line. It was assumed that the existing power grid in the area has adequate capacity to satisfy the power needs of the water system well pumps and booster pumps.

Electricity to power the pumps is provided by an electrical distribution line leading to the booster pump stations. Construction of the electrical distribution line is estimated to cost $10.00 per foot. This amount corresponds to the approximate cost of a 12.5-volt electrical distribution line. Cost also includes electrical service, meter, and electrical utility box.

## 4.11 Land and Right of Ways

Cost for purchase of land and right of ways for buried pipelines, Gallery Well treatment plant and booster pumps were estimated based on 20-foot wide right of ways for pipelines and a 20 foot by 20 foot lot for small booster pumps and 50 foot by 50 foot lot for large booster pumps and 100 foot by 100 foot lot for the Gallery Well treatment plant. The estimated cost for right of ways was based on $4 per foot from recent right of way purchases by ID1. Buried pipeline right of ways typically cost 10 percent of the land cost. The estimated cost of the land purchase for booster pumps and Gallery Well treatment plant is $30,000, $200,000, and $250,000, respectively.

## 4.12 Contingencies

Costs for contingencies were included in the total capital cost of the water system improvement project to cover differences between actual and estimated quantities of materials, unforeseeable difficulties at the site, minor changes in plans and other uncertainties in design plans. Contingencies cost is based on an assumption of 10% added to all cost components of the water system improvement project except land and right of ways, engineering and design, and construction management and bidding.

## 4.13 Engineering and Design

Engineering and design was estimated at 15% of the construction cost including contingencies but not including land and right of ways and construction management and bidding.

## 4.14 Construction Management and Bidding

Construction management and bidding was estimated at 15% of all the construction cost not including engineering and design and land and right of ways.

## 4.15 Annualized Capital Cost

The total capital cost was annualized using and annual interest rate of five (5) percent and a useful project life of 20 years for all capital costs.

## 4.16 Annual Operation and Maintenance Cost

The annual operation and maintenance (O&M) costs associated with the proposed new facilities include the additional costs to operate and maintain the proposed new pipelines, pumps and other water system facilities. These individual costs are estimated based on a percentage of the capital cost. O&M is estimated at one percent of capital costs for mobilization and demobilization, tanks, electrical controls, electrical power facilities and contingencies. O&M is estimated at 1.5 percent for pipelines and two percent for control valves. O&M is estimated at five percent for pump stations and SCADA systems and ten percent for water treatment plant and well treatment. Hazen & Sawyer estimated the O&M cost for the water treatment plants for Alternative 5.

## 4.17 Energy Cost

The annual energy cost to pump water is based on the additional cost for pumping water compared to the annual cost to pump water during an average year when 5,582 acre-feet of water is pumped. Table 15 shows the calculation of 2013 pumping cost of $643,384 and an average year pumping cost of $622,478. Table 16 shows the cost for pumping an acre-foot of water (325,851 gallons) for each of the wells, pumps, and booster pumps based on 2013 data provided by ID1. The energy cost for each alternative and each complete option are shown in Attachments A and D, respectively.

TABLE 15. PUMPING COST FOR 2013

| Water Supply | 2013 AF | Percent | 2013 $/AF | 2013 $ | Average AF | Average $ |
|---|---|---|---|---|---|---|
| Upland Wells | 2,185 | 37.9% | 123 | $268,755 | 2,116 | $260,268 |
| MVPS, SWP | 2,529 | 43.8% | 37 | $93,573 | 2,444 | $90,428 |
| River Wells | 1,056 | 18.3% | 81 | $85,536 | 1,022 | $82,782 |
| | **5,770** | **100.0%** | | **$447,864** | **5,582** | **$433,478** |
| Zone 1 to Zone 2 | 2,754 | 47.7% | 40 | $110,160 | 2,663 | $106,520 |
| Zone 2 to Zone 3 | 1,067 | 18.5% | 80 | $85,360 | 1,031 | $82,480 |
| | | | **Total** | **$643,384** | **Total** | **$622,478** |
| | | | $/AF | 112 | $/AF | 112 |

TABLE 16. ENERGY COST FOR PUMPING WATER

| Water Source | Location | Well No. | Cost [1)] ($/AF) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| | Upland | 1 | 123 | 2 |
| | Upland | 2 | 123 | 2 |
| | Upland | 3 | 86 | 2 |
| | Upland | 5 | 140 | 3 |
| | Upland | 6 | 225 | 3 |
| | Upland | 7 | 153 | 3 |
| | Upland | 15 | 86 | 2 |
| | Upland | 24 | 210 | 3 |
| | Upland | 25 | 107 | 3 |
| | Upland | 27 | 124 | 2 |
| | Upland | 28 | 90 | 2 |
| | 6 cfs well field | All | 80 | 1 |
| | 4 cfs well field | All | 110 | 1 |
| | Gallery Well | | 80 | 1 |
| **State Water Project (SWP) and Booster Pumps** | | | | |
| | Mesa Verde Pump Station | | 37 | 1 |
| | Zone 1 to Zone 2 | | 40 | 1 |
| | Zone 2 to Zone 3 | | 80 | 2 |

Note: [1] 2013 estimated pumping cost per acre-foot. Weighted average cost for 4 cfs and 6 cfs well field cost was used for river wells based on pumping rates of wells for each alternative.

# 5.0 COMPLETE OPTIONS

After the analysis was performed on each alternative, complete options were developed by the project team by combining appropriate alternatives. In addition, engineering cost analysis was preformed to compare complete options which combine the alternatives and options. Engineering cost analysis includes project costs, capitalized project cost along with annual costs for energy, operation, and maintenance. Cost summary tables for each complete option are shown in Attachment D. Maps of proposed solutions for each complete option are shown in Attachment E. Flow from wells and pumps for each complete option are shown in Attachment F. Below is a list of twelve (12) complete options (A to H) that were evaluated to address the high Cr6 in the upland wells.

**A Complete Option A – includes the following five alternatives:**

- Alt 3-1 – Surface water treatment of Gallery Well.
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site.
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site
- Alt 5-3 – Treat Well 7 at Well 7 site
- Alt 5-4 – Treat Well 25 at Well 25 site

**B Complete Option B – includes the following four alternatives:**

- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site.
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site
- Alt 5-3 – Treat Well 7 at Well 7 site
- Alt 5-4 – Treat Well 25 at Well 25 site

**C Complete Option C – includes the following five alternatives:**

- Alt 1-4 – Blend Well 28 with Zone 2 water then pumped into Zone 3.
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site.
- Alt 5-3 – Treat Well 7 at Well 7 site
- Alt 5-4 – Treat Well 25 at Well 25 site
- Alt 6-4 – Well 27 – install packer

**D Complete Option D – includes the following four alternatives:**

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site.
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site

**D-P Complete Option D-P – includes the following four alternatives:**

- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site.
- Alt 5-2 – Treat Wells 27 and Well 28 at Well 27 site
- Alt 6-1 – Well 7 – install packer
- Alt 6-2 – Well 25 – install packer

**D-C Complete Option D-C – includes the following six alternatives:**

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site.
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site
- Alt 6-1 – Well 7 – install packer
- Alt 6-2 – Well 25 – install packer

**E Complete Option E – includes the following five alternatives:**

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.
- Alt 1-4 – Blend Well 28 with Zone 2 water then pumped into Zone 3.
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site.
- Alt 6-4 – Well 27 – install packer

**E-P Complete Option E-P – includes the following five alternatives:**

- Alt 1-4 – Blend Well 28 with Zone 2 water then pumped into Zone 3.
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID#1 shop site.
- Alt 6-1 – Well 7 – install packer
- Alt 6-2 – Well 25 – install packer
- Alt 6-4 – Well 27 – install packer

**E-C Complete Option E-C – includes the following seven alternatives:**

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.
- Alt 1-4 – Blend Well 28 with Zone 2 water then pumped into Zone 3.
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site.
- Alt 6-1 – Well 7 – install packer
- Alt 6-2 – Well 25 – install packer
- Alt 6-4 – Well 27 – install packer

**F Complete Option F – includes the following alternative:**

- Alt 4-1 – Minimize Use of Upland Wells with High Cr6 Maximum hour demand (June), *use Wells 5, 6 and 24*.

**G Complete Option G – includes the following four alternatives:**

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
- Alt 2 – Separate Irrigation System
- Alt 6-4 – Well 27 – install packer

**H Complete Option H – includes the following four alternatives:**

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
- Alt 6-3 – Well 28 – install packer
- Alt 6-4 – Well 27 – install packer

A summary of the well and pump flows for each complete option is shown on Table 17.

# Table 17 Complete Options Well and Pump Flow Summary

| Water Source | Name | Well or Pump No. | Normal Flow (gpm) | A | B | C | D | D-P | D-C | E | E-P | E-C | F | G | H | Nothing | Existing |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Complete Options | | | | | | | | | | | | | |
| **Wells** | | | | | | | | | | | | | | | | | |
| | Upland | 1 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 0 | 200 | 0 | 0 | 200 |
| | Upland | 2 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 0 | 500 | 0 | 0 | 500 |
| | Upland | 3 | 600 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 600 | 0 | 0 | 0 |
| | Upland | 5 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 |
| | Upland | 6 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| | Upland | 7 | 900 | 900 | 900 | 900 | 900 | 650 | 650 | 900 | 650 | 650 | 0 | 900 | 900 | 0 | 900 |
| | Upland | 15 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 0 | 1,200 | 0 | 0 | 1,200 |
| | Upland | 24 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| | Upland | 25 | 950 | 950 | 950 | 950 | 950 | 700 | 700 | 950 | 700 | 700 | 0 | 950 | 950 | 0 | 950 |
| | Upland | 27 | 1,250 | 1,250 | 1,250 | 950 | 1,250 | 1,250 | 1,250 | 950 | 950 | 950 | 0 | 950 | 950 | 0 | 1,250 |
| | Upland | 28 | 750 | 750 | 750 | 500 | 750 | 750 | 750 | 500 | 500 | 500 | 0 | 750 | 500 | 0 | 750 |
| | | ***Subtotal*** | ***7,200*** | ***6,600*** | ***6,600*** | ***6,050*** | ***6,600*** | ***6,100*** | ***6,100*** | ***6,050*** | ***5,550*** | ***5,550*** | ***850*** | ***6,900*** | ***4,150*** | ***850*** | ***6,600*** |
| | 6 cfs field | 8 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| | 6 cfs field | 9 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 |
| | 6 cfs field | 10 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 |
| | 6 cfs field | 19 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 |
| | 6 cfs field | 21 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 |
| | 6 cfs field | 22 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| | 6 cfs field | 23 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| | | ***Subtotal*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** | ***2,260*** |
| | 4 cfs field | 12 | 600 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 cfs field | 14 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 |
| | 4 cfs field | 17 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 | 375 |
| | 4 cfs field | 18 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| | | ***Subtotal*** | ***1,775*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** | ***1,175*** |
| | Gallery well | | ***776*** | ***776*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***776*** | ***0*** | ***0*** | ***0*** |
| | | ***Wells Total*** | ***12,011*** | ***10,811*** | ***10,035*** | ***9,485*** | ***10,035*** | ***9,535*** | ***9,535*** | ***9,485*** | ***8,985*** | ***8,985*** | ***4,285*** | ***11,111*** | ***7,585*** | ***4,285*** | ***10,035*** |
| **State Water Project/ Exchange** | | | | | | | | | | | | | | | | | |
| | Mesa Verde Pump Station | | | | | | | | | | | | | | | | |
| | | MV-1 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 |
| | | MV-2 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 | 1,145 |
| | | MV-3 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 | 885 |
| | | MV-4 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 | 865 |
| | | MV-5 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 |
| | | ***Subtotal*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** | ***5,200*** |
| | | ***Total System*** | ***17,211*** | ***16,011*** | ***15,235*** | ***14,685*** | ***15,235*** | ***14,735*** | ***14,735*** | ***14,685*** | ***14,185*** | ***14,185*** | ***9,485*** | ***16,311*** | ***12,785*** | ***9,485*** | ***15,235*** |
| | | MDD | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 | 9,527 |
| | | % of MDD | 181% | 168% | 160% | 154% | 160% | 155% | 155% | 154% | 149% | 149% | 100% | 171% | 134% | 100% | 160% |
| | | | | | | | | | | | | | | 4,026 | Irrigation wells | | |

MDD based on July 12, 2006 maximum day for 2004 to 2013 period of record

## 5.1 Complete Option A

Complete Option A – includes the following five alternatives:

- Alt 3-1 – Surface water treatment of Gallery Well.
- Alt 5-1 – Treat Wells 1, 2, 3 and 15 at existing ID1 shop site.
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site
- Alt 5-3 – Treat Well 7 at Well 7 site
- Alt 5-4 – Treat Well 25 at Well 25 site

Stetson performed hydraulic modeling to determine the cost water system improvements when all the alternatives listed in Complete Option A are implemented.

### 5.1.1 Alternative 3-1 Surface Water Treatment of Gallery Well

Stetson Engineers prepared a feasibility design and cost estimate for bringing the Gallery Well into production including surface water treatment. Stetson performed hydraulic modeling analysis to provide system improvements need to deliver the treated surface water up to Zones 2 and 3. The Gallery Well appropriation allows a peak diversion rate of 1.73 cfs (776 gpm) and a maximum annual volume of 515 acre-feet. The system improvements needed to bring the Gallery Well into production includes the cost for the treatment plant and booster pump station located at the treatment plant site as previously shown on Figure 4.

### 5.1.2 Alternative 5-1 Wells 1, 2, 3, and 15 Treatment at ID1 Shop Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at ID1's shop site for treatment and blending of Wells 1, 2, 3 and 15 with Well 3 as a redundant source. Stetson added new dedicated pipelines to the hydraulic model from Well 1, 2, 3 and15 to the proposed treatment plant located at ID1's shop site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 84 psi. The pressure needed at the treatment plant discharge during the average day demand was estimated at 82 psi. The dedicated pipelines includes a 8-inch diameter pipeline 5,400 feet long from Well 3 to Well 15, a 16-inch diameter pipeline 4,400 long from Well 15 to join pipe to treatment plant, a 6-inch pipeline 100 feet long from Well 1 to Well 2, a 10-inch diameter pipeline from Well 2 to join pipe to treatment plant, a 16-inch diameter pipeline 1,000 feet long from the combined Wells 1, 2, 3 and 15 to treatment plant. The discharge pipeline from the treatment plant is 16-inch diameter 700 feet long as previously shown on Figure 5.

### 5.1.3 Alternative 5-2 Wells 27 and 28 Treatment at Well 27 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 27 site for treatment and blending of Wells 27 and 28. Stetson added new dedicated pipelines to the hydraulic model from Well 28 to the proposed treatment plant located at Well 27 site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand for Zone 2 at 38 psi and Zone 3 at 100 psi. The dedicated pipeline is 10-inches in diameter and 4,000 feet long from Well 28 to Well 27. The discharge from the Zone 2 booster pump will connect to an existing 12-inch diameter pipeline and the discharge from the Zone 3 booster pump will connect to an existing 8-inch diameter pipeline as previously shown on Figure 6.

### 5.1.4 Alternative 5-3 Well 7 at Well 7 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 7 site for treatment and blending of Well 7. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 66 psi.

### 5.1.5 Alternative 5-4 Well 25 at Well 25 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 25 site for treatment and blending of Well 25. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 49 psi.

### 5.1.6 Complete Option A Cost Summary

The capital cost of the new pipelines, control valves, other system improvements plus treatment plant costs from Hazen & Sawyer (including booster pumps and inline blending static mixer) are $25,773,000 with an additional annual O&M cost of $2,918,000 and an additional energy cost of $112,000 per year. See Chapter 6 for comparison of cost with other complete options. See Attachment D for an itemized list and details for cost estimate. See Attachment E for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment F.

## 5.2 Complete Option B

Complete Option B – includes the following four alternatives:

- Alt 5-1 – Treat Wells 1, 2, 3, and 15 at existing ID#1 shop site.
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site
- Alt 5-3 – Treat Well 7 at Well 7 site
- Alt 5-4 – Treat Well 25 at Well 25 site

Stetson performed hydraulic modeling to determine the cost water system improvements when all the alternatives listed in Complete Option B are implemented.

### 5.2.1 Alternative 5-1 Wells 1, 2, 3, and 15 Treatment at ID1 Shop Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at ID1's shop site for treatment and blending of Wells 1, 2, 3 and 15 with Well 3 as a redundant source. Stetson added new dedicated pipelines to the hydraulic model from Well 1, 2, 3 and15 to the proposed treatment plant located at ID1's shop site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 84 psi. The pressure needed at the treatment plant discharge during the average day demand was estimated at 82 psi. The dedicated pipelines includes a 8-inch diameter pipeline 5,400 feet long from Well 3 to Well 15, a 16-inch diameter pipeline 4,400 long from Well 15 to join pipe to treatment plant, a 6-inch pipeline 100 feet long from Well 1 to Well 2, a 10-inch diameter pipeline from Well 2 to join pipe to treatment plant, a 16-inch diameter pipeline 1,000 feet long from the combined Wells 1, 2, 3 and 15 to treatment plant. The discharge pipeline from the treatment plant is 16-inch diameter 700 feet long as previously shown on Figure 5.

### 5.2.2 Alternative 5-2 Wells 27 and 28 Treatment at Well 27 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 27 site for treatment and blending of Wells 27 and 28. Stetson added new dedicated pipelines to the hydraulic model from Well 28 to the proposed treatment plant located at Well 27 site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand for Zone 2 at 38 psi and Zone 3 at 100 psi. The dedicated pipeline is 10-inches in diameter and 4,000 feet long from Well 28 to Well 27. The discharge from the Zone 2 booster pump will connect to an existing 12-inch diameter pipeline and the discharge from the Zone 3 booster pump will connect to an existing 8-inch diameter pipeline as previously shown on Figure 6.

### 5.2.3 Alternative 5-3 Well 7 at Well 7 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 7 site for treatment and blending of Well 7. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 66 psi.

### 5.2.4 Alternative 5-4 Well 25 at Well 25 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 25 site for treatment and blending of Well 25. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 49 psi.

### 5.2.5 Complete Option B Cost Summary

The capital cost of the new pipelines, control valves, other system improvements plus treatment plant costs from Hazen & Sawyer (including booster pumps and inline blending static mixer) are $23,182000 with an additional annual O&M cost of $2,779,000 and an additional energy cost of $112,000 per year. See Chapter 6 for comparison of cost with other complete options. See Attachment D for an itemized list and details for cost estimate. See Attachment E for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment F.

## 5.3 Complete Option C

Complete Option C – includes the following five alternatives:

- Alt 1-4 – Blend Well 28 with Zone 2 water then pumped into Zone 3.
- Alt 5-1 – Treat Wells 1, 2, 3, and 15 at existing ID#1 shop site.
- Alt 5-3 – Treat Well 7 at Well 7 site
- Alt 5-4 – Treat Well 25 at Well 25 site
- Alt 6-4 – Well 27 – install packer

Stetson performed hydraulic modeling to determine the cost water system improvements when all the alternatives listed in Complete Option C are implemented.

### 5.3.1 Alternative 1-4 – Blend Well 28 with Zone 2 Water then Pumped into Zone 3

A new 150 horsepower booster pump station will be installed at the Well 28 site for pumping blended water from Zone 2 to Zone 3. Well 28 flow rate is 750 gpm with a Cr6 level of 8.9 ppb. Blending with 750 gpm of Zone 2 water (5 ppb) will reduce the Cr6 level to approximately 7.0 ppb. An existing 12-inch pipeline downstream of Refugio-3 booster would need to be enlarged by installing a new parallel 8-inch pipe approximately 800 feet long along with a new 16-inch pipeline 1,800 feet long from Well 28 to Zone 3.

### 5.3.2 Alternative 5-1 Wells 1, 2, 3, and 15 Treatment at ID1 Shop Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at ID1's shop site for treatment and blending of Wells 1, 2, 3 and 15 with Well 3 as a redundant source. Stetson added new dedicated pipelines to the hydraulic model from Well 1, 2, 3 and15 to the proposed treatment plant located at ID1's shop site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 84 psi. The pressure needed at the treatment plant discharge during the average day demand was estimated at 82 psi. The dedicated pipelines includes a 8-inch diameter pipeline 5,400 feet long from Well 3 to Well 15, a 16-inch diameter pipeline 4,400 long from Well 15 to join pipe to treatment plant, a 6-inch pipeline 100 feet long from Well 1 to Well 2, a 10-inch diameter pipeline from Well 2 to join pipe to treatment plant, a 16-inch diameter pipeline 1,000 feet long from the combined Wells 1, 2, 3 and 15 to treatment plant. The discharge pipeline from the treatment plant is 16-inch diameter 700 feet long as previously shown on Figure 5.

### 5.3.3 Alternative 5-3 Well 7 at Well 7 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 7 site for treatment and blending of Well 7. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 66 psi.

### 5.3.4 Alternative 5-4 Well 25 at Well 25 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 25 site for treatment and blending of Well 25. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 49 psi.

### 5.3.5 Alternative 6-4 Install Packer in Well 27

Stetson performed hydraulic modeling to support Dudek's well treatment to block inflow from high Cr6 formations by installing a packer in the Well 27 located in Zone 2. Stetson's hydraulic modeling will have an element of analyzing piping, system capacities, system pressure, booster pumps and storage facilities size and location. Dudek assumed a reduction of 25% in well flow rate. Cost estimates for well packer treatment alternatives were prepared by Dudek and estimated at $100,000 per well we provided to Stetson for the cost summary tables

### 5.3.6 Complete Option C Cost Summary

The capital cost of the new pipelines, control valves, other system improvements plus packer costs from Dudek plus treatment plant costs from Hazen & Sawyer (including booster pumps and inline blending static mixer) are $19,009,000 with an additional annual O&M cost of $2,098,000 and an additional energy cost of $55,000 per year. See Chapter 6 for comparison of cost with other complete options. See Attachment D for an itemized list and details for cost estimate. See Attachment E for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment F.

## 5.4 Complete Option D

Complete Option D – includes the following four alternatives:

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.

- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
- Alt 5-1 – Treat Wells 1, 2, 3, and 15 at existing ID#1 shop site.
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site

Stetson performed hydraulic modeling to determine the cost water system improvements when all the alternatives listed in Complete Option D are implemented.

### 5.4.1 Alternative 1-2 – Blend Well 7 and 24 at Well 7 Site

A new 8-inch pipeline approximately 2,400 feet long will be constructed to convey Well 24 water (300 gpm) to the Well 7 site. The blended water will be pumped into the Zone 3 system at Well 7. Well 7 has a flow rate of 900 gpm with a Cr6 level of 10 ppb. Well 24 has a flow rate of 300 gpm with a Cr6 level of 4.1 ppb. The blended flow water quality is 8.5 ppb.

### 5.4.2 Alternative 1-5 – Blend Well 5 and 25 at Well 25 Site

A new 8-inch pipeline approximately 3,500 feet long will be constructed to convey Well 5 water (250 gpm) to the Well 25 site. The blended water will be mixed in a static mixer at Well 25 site. Well 25 has a flow rate of 950 gpm with a Cr6 level of 9.8 ppb. Well 5 has a flow rate of 250 gpm with a Cr6 level of 0.9 ppb. The blended flow level is approximately 7.2 ppb.

### 5.4.3 Alternative 5-1 Wells 1, 2, 3, and 15 Treatment at ID1 Shop Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at ID1's shop site for treatment and blending of Wells 1, 2, 3 and 15 with Well 3 as a redundant source. Stetson added new dedicated pipelines to the hydraulic model from Well 1, 2, 3 and15 to the proposed treatment plant located at ID1's shop site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 84 psi. The pressure needed at the treatment plant discharge during the average day demand was estimated at 82 psi. The dedicated pipelines includes a 8-inch diameter pipeline 5,400 feet long from Well 3 to Well 15, a 16-inch diameter pipeline 4,400 long from Well 15 to join pipe to treatment plant, a 6-inch pipeline 100 feet long from Well 1 to Well 2, a 10-inch diameter pipeline from Well 2 to join pipe to treatment plant, a 16-inch diameter pipeline 1,000 feet long from the combined Wells 1, 2, 3 and 15 to treatment plant. The discharge pipeline from the treatment plant is 16-inch diameter 700 feet long as previously shown on Figure 5.

### 5.4.4 Alternative 5-2 Wells 27 and 28 Treatment at Well 27 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 27 site for treatment and blending of Wells 27 and 28. Stetson added new dedicated pipelines to the hydraulic model from Well 28 to the proposed treatment plant located at Well 27 site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand for Zone 2 at 38 psi and Zone 3 at 100 psi. The dedicated pipeline is 10-inches in diameter and 4,000 feet long from Well 28 to Well 27. The discharge from the Zone 2 booster pump will connect to an existing 12-inch diameter pipeline and the discharge from the Zone 3 booster pump will connect to an existing 8-inch diameter pipeline as previously shown on Figure 6.

### 5.4.5 Complete Option D Cost Summary

The capital cost of the new pipelines, control valves, other system improvements plus treatment plant costs from Hazen & Sawyer (including booster pumps and inline blending static mixer) are $17,507,000 with an additional annual O&M cost of $1,920,000 and an additional energy cost of $94,000 per year. See Chapter 6 for comparison of cost with other complete options. See Attachment D for an itemized list and details for cost estimate. See Attachment E for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment F.

## 5.5 Complete Option D-P

Complete Option D-P – includes the following four alternatives:

- Alt 5-1 – Treat Wells 1, 2, 3, and 15 at existing ID#1 shop site.
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site
- Alt 6-1 – Well 7 – install packer
- Alt 6-2 – Well 25 – install packer

Stetson performed hydraulic modeling to determine the cost water system improvements when all the alternatives listed in Complete Option D-P are implemented.

### 5.5.1 Alternative 5-1 Wells 1, 2, 3, and 15 Treatment at ID1 Shop Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at ID1's shop site for treatment and blending of Wells 1, 2, 3 and 15 with Well 3 as a redundant source. Stetson added new dedicated pipelines to the hydraulic model from Well 1, 2, 3 and15 to the proposed treatment plant located at ID1's shop site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 84 psi. The pressure needed at the treatment plant discharge during the average day demand was estimated at 82 psi. The dedicated pipelines includes a 8-inch diameter pipeline 5,400 feet long from Well 3 to Well 15, a 16-inch diameter pipeline 4,400 long from Well 15 to join pipe to treatment plant, a 6-inch pipeline 100 feet long from Well 1 to Well 2, a 10-inch diameter pipeline from Well 2 to join pipe to treatment plant, a 16-inch diameter pipeline 1,000 feet long from the combined Wells 1, 2, 3 and 15 to treatment plant. The discharge pipeline from the treatment plant is 16-inch diameter 700 feet long as previously shown on Figure 5.

### 5.5.2 Alternative 5-2 Wells 27 and 28 Treatment at Well 27 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 27 site for treatment and blending of Wells 27 and 28. Stetson added new dedicated pipelines to the hydraulic model from Well 28 to the proposed treatment plant located at Well 27 site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand for Zone 2 at 38 psi and Zone 3 at 100 psi. The dedicated pipeline is 10-inches in diameter and 4,000 feet long from Well 28 to Well 27. The discharge from the Zone 2 booster pump will connect to an existing 12-inch diameter pipeline and the discharge from the Zone 3 booster pump will connect to an existing 8-inch diameter pipeline as previously shown on Figure 6.

### 5.5.3 Alternative 6-1 and 6-2 Install Packers in Wells 7 and 25

Stetson performed hydraulic modeling to support Dudek's well treatment to block inflow from high Cr6 formations by installing packers in the Wells 7 and 25 located in Zone 3. Stetson's hydraulic modeling will have an element of analyzing piping, system capacities, system pressure, booster pumps and storage facilities size and location. Dudek assumed a reduction of 25% in well flow rate. Cost estimates for well packer treatment alternatives were prepared by Dudek and estimated at $100,000 per well were provided to Stetson for the cost summary tables.

### 5.5.4 Complete Option D-P Cost Summary

The capital cost of the new pipelines, control valves, other system improvements plus treatment plant costs from Hazen & Sawyer (including booster pumps and inline blending static mixer) and packer costs from Dudek are $16,529,000 with an additional annual O&M cost of $1,926,000 and an additional energy cost of $100,000 per year. See Chapter 6 for comparison of cost with other complete options. See Attachment D for an itemized list and details for cost estimate. See Attachment E for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment F.

## 5.6 Complete Option D-C

Complete Option D-C – includes the following six alternatives:

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
- Alt 5-1 – Treat Wells 1, 2, 3, and 15 at existing ID#1 shop site.
- Alt 5-2 – Treat Wells 27 and 28 at Well 27 site
- Alt 6-1 – Well 7 – install packer
- Alt 6-2 – Well 25 – install packer

Stetson performed hydraulic modeling to determine the cost water system improvements when all the alternatives listed in Complete Option D-C are implemented.

### 5.6.1 Alternative 1-2 – Blend Well 7 and 24 at Well 7 Site

A new 8-inch pipeline approximately 2,400 feet long will be constructed to convey Well 24 water (300 gpm) to the Well 7 site. The blended water will be pumped into the Zone 3 system at Well 7. Well 7 has a flow rate of 900 gpm with a Cr6 level of 10 ppb. Well 24 has a flow rate of 300 gpm with a Cr6 level of 4.1 ppb. The blended flow level is 8.5 ppb.

### 5.6.2 Alternative 1-5 – Blend Well 5 and 25 at Well 25 Site

A new 8-inch pipeline approximately 3,500 feet long will be constructed to convey Well 5 water (250 gpm) to the Well 25 site. The blended water will be mixed in a static mixer at Well 25 site. Well 25 has a flow rate of 950 gpm with a Cr6 level of 9.8 ppb. Well 5 has a flow rate of 250 gpm with a Cr6 level of 0.9 ppb. The blended flow level is approximately 7.2 ppb.

### 5.6.3 Alternative 5-1 Wells 1, 2, 3, and 15 Treatment at ID1 Shop Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at ID1's shop site for treatment and blending of Wells 1, 2, 3 and 15 with Well 3 as a redundant source. Stetson added new dedicated pipelines to the hydraulic model from Well 1, 2, 3 and15 to the proposed treatment plant located at ID1's shop site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 84 psi. The pressure needed at the treatment plant discharge during the average day demand was estimated at 82 psi. The dedicated pipelines includes a 8-inch diameter pipeline 5,400 feet long from Well 3 to Well 15, a 16-inch diameter pipeline 4,400 long from Well 15 to join pipe to treatment plant, a 6-inch pipeline 100 feet long from Well 1 to Well 2, a 10-inch diameter pipeline from Well 2 to join pipe to treatment plant, a 16-inch diameter pipeline 1,000 feet long from the combined Wells 1, 2, 3 and 15 to treatment plant. The discharge pipeline from the treatment plant is 16-inch diameter 700 feet long as previously shown on Figure 5.

### 5.6.4 Alternative 5-2 Wells 27 and 28 Treatment at Well 27 Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at Well 27 site for treatment and blending of Wells 27 and 28. Stetson added new dedicated pipelines to the hydraulic model from Well 28 to the proposed treatment plant located at Well 27 site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand for Zone 2 at 38 psi and Zone 3 at 100 psi. The dedicated pipeline is 10-inches in diameter and 4,000 feet long from Well 28 to Well 27. The discharge from the Zone 2 booster pump will connect to an existing 12-inch diameter pipeline and the discharge from the Zone 3 booster pump will connect to an existing 8-inch diameter pipeline as previously shown on Figure 6.

### 5.6.5 Alternative 6-1 and 6-2 Install Packers in Wells 7 and 25

Stetson performed hydraulic modeling to support Dudek's well treatment to block inflow from high Cr6 formations by installing packers in the Wells 7 and 25 located in Zone 3. Stetson's hydraulic modeling will have an element of analyzing piping, system capacities, system pressure, booster pumps and storage facilities size and location. Dudek assumed a reduction of 25% in well flow rate. Cost estimates for well packer treatment alternatives were prepared by Dudek and estimated at $100,000 per well we provided to Stetson for the cost summary tables.

### 5.6.6 Complete Option D-C Cost Summary

The capital cost of the new pipelines, control valves, other system improvements plus treatment plant costs from Hazen & Sawyer (including booster pumps and inline blending static mixer) and packer costs from Dudek are $17,801,000 with an additional annual O&M cost of $1,940,000 and an additional energy cost of $100,000 per year. See Chapter 6 for comparison of cost with other complete options. See Attachment D for an itemized list and details for cost estimate. See Attachment E for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment F.

## 5.7 Complete Option E

Complete Option E – includes the following five alternatives:

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.
- Alt 1-4 – Blend Well 28 with Zone 2 water then pump to Zone 3.
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
- Alt 5-1 – Treat Wells 1, 2, 3, and 15 at existing ID#1 shop site.
- Alt 6-4 – Well 27 – install packer

Stetson performed hydraulic modeling to determine the cost water system improvements when all the alternatives listed in Complete Option E are implemented.

### 5.7.1 Alternative 1-2 – Blend Well 7 and 24 at Well 7 Site

A new 8-inch pipeline approximately 2,400 feet long will be constructed to convey Well 24 water (300 gpm) to the Well 7 site. The blended water will be pumped into the Zone 3 system at Well 7. Well 7 has a flow rate of 900 gpm with a Cr6 level of 10 ppb. Well 24 has a flow rate of 300 gpm with a Cr6 level of 1.3 ppb. The blended flow level is 7.8 ppb.

### 5.7.2 Alternative 1-4 – Blend Well 28 with Zone 2 Water then Pumped into Zone 3

A new 150 horsepower booster pump station will be installed at the Well 28 site for pumping blended water from Zone 2 to Zone 3. Well 28 flow rate is 750 gpm with a Cr6 level of 9.2 ppb. Blending with 750 gpm of Zone 2 water (5 ppb) will reduce the Cr6 level to approximately 7.1 ppb. An existing 12-inch pipeline downstream of Refugio-3 booster would need to be enlarged by installing a new parallel 8-inch pipe approximately 800 feet long along with a new 16-inch pipeline 1,800 feet long from Well 28 to Zone 3.

### 5.7.3 Alternative 1-5 – Blend Well 5 and 25 at Well 25 Site

A new 8-inch pipeline approximately 3,500 feet long will be constructed to convey Well 5 water (250 gpm) to the Well 25 site. The blended water will be mixed in a static mixer at Well 25 site. Well 25 has a flow rate of 950 gpm with a Cr6 level of 9.8 ppb. Well 5 has a flow rate of 250 gpm with a Cr6 level of 0.9 ppb. The blended flow level is approximately 7.2 ppb.

### 5.7.4 Alternative 5-1 Wells 1, 2, 3, and 15 Treatment at ID1 Shop Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at ID1's shop site for treatment and blending of Wells 1, 2, 3 and 15 with Well 3 as a redundant source. Stetson added new dedicated pipelines to the hydraulic model from Well 1, 2, 3 and15 to the proposed treatment plant located at ID1's shop site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 84 psi. The pressure needed at the treatment plant discharge during the average day demand was estimated at 82 psi. The dedicated pipelines includes a 8-inch diameter pipeline 5,400 feet long from Well 3 to Well 15, a 16-inch diameter pipeline 4,400 long from Well 15 to join pipe to treatment plant, a 6-inch pipeline 100 feet long from Well 1 to Well 2, a 10-inch diameter pipeline from Well 2 to join pipe to treatment plant, a 16-inch diameter pipeline 1,000 feet long from the combined Wells 1, 2, 3 and 15 to treatment plant. The discharge pipeline from the treatment plant is 16-inch diameter 700 feet long as previously shown on Figure 5.

### 5.7.5 Alternative 6-4 Install Packer in Well 27

Stetson performed hydraulic modeling to support Dudek's well treatment to block inflow from high Cr6 formations by installing a packer in the Well 27 located in Zone 2. Stetson's hydraulic modeling will have an element of analyzing piping, system capacities, system pressure, booster pumps and storage facilities size and location. Dudek assumed a reduction of 25% in well flow rate. Cost estimates for well packer treatment alternative was prepared by Dudek and estimated at $100,000 per well were provided to Stetson for the cost summary tables.

### 5.7.6 Complete Option E Cost Summary

The capital cost of the new pipelines, control valves, other system improvements plus treatment plant costs from Hazen & Sawyer (including booster pumps and inline blending static mixer) and packer costs from Dudek are $13,388,000 with an additional annual O&M cost of $1,240,000 and an additional energy cost of $23,000 per year. See Chapter 6 for comparison of cost with other complete options. See Attachment D for an itemized list and details for cost estimate. See Attachment E for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment F.

## 5.8 Complete Option E-P

Complete Option E-P – includes the following five alternatives:

- Alt 1-4 – Blend Well 28 with Zone 2 water then pumped into Zone 3.
- Alt 5-1 – Treat Wells 1, 2, 3, and 15 at existing ID#1 shop site.
- Alt 6-1 – Well 7 – install packer
- Alt 6-2 – Well 25 – install packer
- Alt 6-4 – Well 27 – install packer

Stetson performed hydraulic modeling to determine the cost water system improvements when all the alternatives listed in Complete Option E-P are implemented.

### 5.8.1 Alternative 1-4 – Blend Well 28 with Zone 2 Water then Pumped into Zone 3

A new 150 horsepower booster pump station will be installed at the Well 28 site for pumping blended water from Zone 2 to Zone 3. Well 28 flow rate is 750 gpm with a Cr6 level of 8.9 ppb. Blending with 750 gpm of Zone 2 water (5 ppb) will reduce the Cr6 level to approximately 7.0 ppb. An existing 12-inch pipeline downstream of Refugio-3 booster would need to be enlarged by installing a new parallel 8-inch pipe approximately 800 feet long along with a new 16-inch pipeline 1,800 feet long from Well 28 to Zone 3.

### 5.8.2 Alternative 5-1 Wells 1, 2, 3, and 15 Treatment at ID1 Shop Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at ID1's shop site for treatment and blending of Wells 1, 2, 3 and 15 with Well 3 as a redundant source. Stetson added new dedicated pipelines to the hydraulic model from Well 1, 2, 3 and15 to the proposed treatment plant located at ID1's shop site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 84 psi. The pressure needed at the treatment plant discharge during the average day demand was estimated at 82 psi. The dedicated pipelines includes a 8-inch diameter pipeline 5,400 feet long from Well 3 to Well 15, a 16-inch diameter pipeline 4,400 long from Well 15 to join pipe to treatment plant, a 6-inch pipeline 100 feet long from Well 1 to Well 2, a 10-inch diameter pipeline from Well 2 to join pipe to treatment plant, a 16-inch diameter pipeline 1,000 feet long from the combined Wells 1, 2, 3 and 15 to treatment plant. The discharge pipeline from the treatment plant is 16-inch diameter 700 feet long as previously shown on Figure 5.

### 5.8.3 Alternative 6-1, 6-2, 6-4 Install Packers in Wells 7, 25, and 27

Stetson performed hydraulic modeling to support Dudek's well treatment to block inflow from high Cr6 formations by installing packers in the Wells 7, 25 and 27 located in Zones 2 and 3. Stetson's hydraulic modeling will have an element of analyzing piping, system capacities, system pressure, booster pumps and storage facilities size and location. Dudek assumed a reduction of 25% in well flow rate. Cost estimates for well packer treatment alternatives were prepared by Dudek and estimated at $100,000 per well were provided to Stetson for the cost summary tables

### 5.8.4 Complete Option E-P Cost Summary

The capital cost of the new pipelines, control valves, other system improvements plus packer costs from Dudek plus treatment plant costs from Hazen & Sawyer (including booster pumps and inline blending static mixer) are $12,360,000 with an additional annual O&M cost of $1,246,000 and an additional energy cost of $29,000 per year. See Chapter 6 for comparison of cost with other complete options. See Attachment D for an itemized list and details for cost estimate. See Attachment E for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment F.

## 5.9 Complete Option E-C

Complete Option E-C – includes the following seven alternatives:

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.
- Alt 1-4 – Blend Well 28 with Zone 2 water then pump to Zone 3.
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
- Alt 5-1 – Treat Wells 1, 2, 3, and 15 at existing ID#1 shop site.
- Alt 6-1 – Well 7 – install packer
- Alt 6-2 – Well 25 – install packer
- Alt 6-4 – Well 27 – install packer

Stetson performed hydraulic modeling to determine the cost water system improvements when all the alternatives listed in Complete Option E-C are implemented.

### 5.9.1 Alternative 1-2 – Blend Well 7 and 24 at Well 7 Site

A new 8-inch pipeline approximately 2,400 feet long will be constructed to convey Well 24 water (300 gpm) to the Well 7 site. The blended water will be pumped into the Zone 3 system at

Well 7. Well 7 has a flow rate of 900 gpm with a Cr6 level of 10 ppb. Well 24 has a flow rate of 300 gpm with a Cr6 level of 1.3 ppb. The blended flow level is 7.8 ppb.

### 5.9.2 Alternative 1-4 – Blend Well 28 with Zone 2 Water then Pumped into Zone 3

A new 150 horsepower booster pump station will be installed at the Well 28 site for pumping blended water from Zone 2 to Zone 3. Well 28 flow rate is 750 gpm with a Cr6 level of 9.2 ppb. Blending with 750 gpm of Zone 2 water (5 ppb) will reduce the Cr6 level to approximately 7.1 ppb. An existing 12-inch pipeline downstream of Refugio-3 booster would need to be enlarged by installing a new parallel 8-inch pipe approximately 800 feet long along with a new 16-inch pipeline 1,800 feet long from Well 28 to Zone 3.

### 5.9.3 Alternative 1-5 – Blend Well 5 and 25 at Well 25 Site

A new 8-inch pipeline approximately 3,500 feet long will be constructed to convey Well 5 water (250 gpm) to the Well 25 site. The blended water will be mixed in a static mixer at Well 25 site. Well 25 has a flow rate of 950 gpm with a Cr6 level of 9.8 ppb. Well 5 has a flow rate of 250 gpm with a Cr6 level of 0.9 ppb. The blended flow level is approximately 7.2 ppb.

### 5.9.4 Alternative 5-1 Wells 1, 2, 3, and 15 Treatment at ID1 Shop Site

Stetson performed hydraulic modeling to determine pressures at the proposed treatment plant at ID1's shop site for treatment and blending of Wells 1, 2, 3 and 15 with Well 3 as a redundant source. Stetson added new dedicated pipelines to the hydraulic model from Well 1, 2, 3 and15 to the proposed treatment plant located at ID1's shop site. The hydraulic model was also used to determine pressure needed at the treatment plant discharge during the maximum hour demand at 84 psi. The pressure needed at the treatment plant discharge during the average day demand was estimated at 82 psi. The dedicated pipelines includes a 8-inch diameter pipeline 5,400 feet long from Well 3 to Well 15, a 16-inch diameter pipeline 4,400 long from Well 15 to join pipe to treatment plant, a 6-inch pipeline 100 feet long from Well 1 to Well 2, a 10-inch diameter pipeline from Well 2 to join pipe to treatment plant, a 16-inch diameter pipeline 1,000 feet long from the combined Wells 1, 2, 3 and 15 to treatment plant. The discharge pipeline from the treatment plant is 16-inch diameter 700 feet long as previously shown on Figure 5.

### 5.9.5 Alternative 6-1, 6-2, 6-4 Install Packers in Wells 7,25, and 27

Stetson performed hydraulic modeling to support Dudek's well treatment to block inflow from high Cr6 formations by installing packers in the Wells 7, 25 and 27 located in Zones 2 and 3. Stetson's hydraulic modeling will have an element of analyzing piping, system capacities, system pressure, booster pumps and storage facilities size and location. Dudek assumed a reduction of 25% in well flow rate. Cost estimates for well packer treatment alternative was prepared by Dudek and estimated at $100,000 per well were provided to Stetson for the cost summary tables.

### 5.9.6 Complete Option E-C Cost Summary

The capital cost of the new pipelines, control valves, other system improvements plus treatment plant costs from Hazen & Sawyer (including booster pumps and inline blending static mixer) and packer costs from Dudek are $13,495,000 with an additional annual O&M cost of $1,258,000 and an additional energy cost of $29,000 per year. See Chapter 6 for comparison of cost with other complete options. See Attachment D for an itemized list and details for cost estimate. See Attachment E for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment F.

## 5.10 Complete Option F

Complete Option F – includes the following alternative:

- Alt 4-1 – Minimize use of upland wells with Cr6 levels that exceed the new MCL.

New pipelines for Alternative 4-1 system improvements consist of 1,600 feet of 8-inch pipeline, 4,300 feet of 10-inch pipeline, and 5,600 feet of 12-inch pipeline. The new system improvements needed to meet the maximum hour demand includes a new booster pump station located at the Zone 1 tank, new pump at Refugio 2-1, control valves, blow offs, air/vacuum valves, electrical controls, SCADA, electric power facilities, and purchase of land and right of ways. The capital cost of the new pipelines, booster pumps, control valves, and other system improvements are $3,287,000 with an additional annual O&M cost of $41,000 and an additional energy cost of $64,000 per year. See Chapter 6 for comparison of cost with other complete options. See Attachment D for an itemized list and details for cost estimate. See Attachment E for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment F.

## 5.11 Complete Option G

Complete Option G – includes the following four alternatives:

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
- Alt 2-1 – Separate Irrigation Water System
- Alt 6-4 – Well 27 – install packer

Stetson performed hydraulic modeling to determine the cost water system improvements when all the alternatives listed in Complete Option G are implemented.

### 5.11.1 Alternative 1-2 – Blend Well 7 and 24 at Well 7 Site

A new 8-inch pipeline approximately 2,400 feet long will be constructed to convey Well 24 water (300 gpm) to the Well 7 site. The blended water will be pumped into the Zone 3 system at Well 7. Well 7 has a flow rate of 900 gpm with a Cr6 level of 10 ppb. Well 24 has a flow rate of 300 gpm with a Cr6 level of 1.3 ppb. The blended flow level is 7.8 ppb.

### 5.11.2 Alternative 1-5 – Blend Well 5 and 25 at Well 25 Site

A new 8-inch pipeline approximately 3,500 feet long will be constructed to convey Well 5 water (250 gpm) to the Well 25 site. The blended water will be mixed in a static mixer at Well 25 site. Well 25 has a flow rate of 950 gpm with a Cr6 level of 9.8 ppb. Well 5 has a flow rate of 250 gpm with a Cr6 level of 0.9 ppb. The blended flow level is approximately 7.2 ppb.

### 5.11.3 Alternative 2-1 – Separate Irrigation Water System

Stetson Engineers performed hydraulic modeling analysis to provide a separate irrigation water system for Zones 1, 2 and 3 that uses the five upland wells with the highest Cr6 levels, Wells 1, 2, 3, 15 and 28 located in Zone 2 and the Gallery Well located in Zone 1. The flow rate from Well 1 is 200 gpm, Well 2 is 500 gpm, Well 3 is 600 gpm (high nitrates) , Well 15 is 1,200 gpm, Well 28 is 750 gpm and the Gallery Well is 776 gpm for a total flow rate of 4,026 gpm or 534 acre-feet per month. The maximum month demand for the irrigated lands was estimated to determine if the five wells will provide an adequate supply. See Chapter 3.2 for complete description of Alternative 2-1.

### 5.11.4 Alternative 6-4 Install Packer in Well 27

Stetson performed hydraulic modeling to support Dudek's well treatment to block inflow from high Cr6 formations by installing a packer in the Well 27 located in Zone 2. Stetson's hydraulic modeling will have an element of analyzing piping, system capacities, system pressure, booster pumps and storage facilities size and location. Dudek assumed a reduction of 25% in well flow rate. Cost estimates for well packer treatment alternative was prepared by Dudek and estimated at $100,000 per well were provided to Stetson for the cost summary tables.

### 5.11.5 Complete Option G Cost Summary

The capital cost of the new pipelines, control valves, other system improvements, inline blending static mixer, and packer costs from Dudek are $24,652,000 with an additional annual O&M cost of $286,000 and an additional energy cost of $5,000 per year. See Chapter 6 for comparison of cost with other complete options. See Attachment D for an itemized list and details for cost estimate. See Attachment E for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment F.

## 5.12 Complete Option H

Complete Option H – includes the following four alternatives:

- Alt 1-2 – Blend Well 7 with Well 24 at Well 7 site.
- Alt 1-5 – Blend Well 5 with Well 25 at Well 25 site.
- Alt 6-3 – Well 28 – install packer
- Alt 6-4 – Well 27 – install packer

Stetson performed hydraulic modeling to determine the cost water system improvements when all the alternatives listed in Complete Option H are implemented.

### 5.12.1 Alternative 1-2 – Blend Well 7 and 24 at Well 7 Site

A new 8-inch pipeline approximately 2,400 feet long will be constructed to convey Well 24 water (300 gpm) to the Well 7 site. The blended water will be pumped into the Zone 3 system at Well 7. Well 7 has a flow rate of 900 gpm with a Cr6 level of 10 ppb. Well 24 has a flow rate of 300 gpm with a Cr6 level of 1.3 ppb. The blended flow level is 7.8 ppb.

### 5.12.2 Alternative 1-5 – Blend Well 5 and 25 at Well 25 Site

A new 8-inch pipeline approximately 3,500 feet long will be constructed to convey Well 5 water (250 gpm) to the Well 25 site. The blended water will be mixed in a static mixer at Well 25 site. Well 25 has a flow rate of 950 gpm with a Cr6 level of 9.8 ppb. Well 5 has a flow rate of 250 gpm with a Cr6 level of 0.9 ppb. The blended flow level is approximately 7.2 ppb.

### 5.12.3 Alternatives 6-3 and 6-4 Install Packers in Wells 28 and 27

Stetson performed hydraulic modeling to support Dudek's well treatment to block inflow from high Cr6 formations by installing packers in the Wells 28 and 27 located in Zone 2. Stetson's hydraulic modeling will have an element of analyzing piping, system capacities, system pressure, booster pumps and storage facilities size and location. Dudek assumed a reduction of 25% in well flow rate. Cost estimates for well packer treatment alternative was prepared by Dudek and estimated at $100,000 per well were provided to Stetson for the cost summary tables.

### 5.12.4 Complete Option H Cost Summary

The capital cost of the new pipelines, control valves, other system improvements, inline blending static mixer, and packer costs from Dudek are $2,810,000 with an additional annual O&M cost of $49,000 and an additional energy cost of $32,000 per year. See Chapter 6 for comparison of cost with other complete options. See Attachment D for an itemized list and details for cost estimate. See Attachment E for a map showing the system improvements needed to meet the maximum hour demand. Maximum hour demand pumps and flow rates used in the hydraulic model are shown in Attachment F.

# 6.0 ENGINEERING COST ESTIMATION FOR COMPLETE OPTIONS

Stetson performed engineering cost estimation for Complete Options A through H based on pipelines, pump and other facilities needed to provide required system pressure and limit the maximum velocity in the pipelines to about 4 feet per second during the maximum hour demand. Hazen and Sawyer provided cost for water treatment of wells and Dudek provided cost for packers. System improvement capital costs were annualized using an interest rate of 5% and expected life of 20 years for each component as shown on Table 18. Additional costs for operation and maintenance (O&M) for the complete options were estimated based on percentage of capital cost for system improvements plus costs for operating the treatment plans from Hazen Sawyer. O&M cost for water treatment were provided by Hazen & Sawyer. Energy costs were estimated based on the additional cost to pump water from Zone 1 instead of using the upland wells plus the cost to operate the booster pumps from the treatment plants and blending pumps. See Attachment D for an itemized list and details for cost estimate for each complete option. Table 18 shows a summary of the costs for each complete option. Capital costs range from $2.8 million to $24.7 million. The O&M costs range from $49,000 to $2.9 million per year. Additional energy costs range from $5,000 to $112,000 per year.

Table 18 Separate 11x17 excel table

TABLE 18. CAPITAL COST, ANNUALIZED CAPITAL COST AND O&M COST SUMMARY FOR EACH COMPLETE OPTION

## Table 18 Capital Cost, Annualized Capital Cost and O&M Cost Summary for Each Complete Option

**Capital Cost Summary**

| Notes | Item | A | B | C | D | D-P | D-C | E | E-P | E-C | F | G | H |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Alt 3-1,<br>Alt 5-1,2,3,4 | Alt 5-1,2,3,4 | Alt 1-4,<br>Alt 5-1,3,4,<br>Alt 6-4 | Alt 1-2,5<br>Alt 5-1,2 | Alt 5-1,2<br>Alt 6-1,2 | Alt 1-2,5<br>Alt 5-1,2<br>Alt 6-1,2 | Alt 1-2,4,5<br>Alt 5-1<br>Alt 6-4 | Alt 1-4<br>Alt 5-1<br>Alt 6-1,2,4 | Alt 1-2,4,5<br>Alt 5-1<br>Alt 6-1,2,4 | Alt 4-1 | Alt 1-2,5<br>Alt 2-1<br>Alt 6-4 | Alt 1-2,5<br>Alt 6-3,4 |
| [1] | Mobilization and demobilization | $849,000 | $771,000 | $632,000 | $582,000 | $549,000 | $592,000 | $445,000 | $411,000 | $448,000 | $102,000 | $803,000 | $93,000 |
| [2] | Pipelines | 2,765,000 | $2,735,000 | $2,723,000 | $3,476,000 | $2,735,000 | $3,472,000 | $3,460,000 | $2,723,000 | $3,383,000 | $1,590,000 | $14,343,000 | $1,466,000 |
| [3] | Control Valves | 212,000 | $187,000 | $238,000 | $296,000 | $187,000 | $296,000 | $387,000 | $238,000 | $334,000 | $155,000 | $1,000,000 | $155,000 |
| [4] | Tanks | 0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $340,000 | $0 |
| [5] | Pump Stations | 183,000 | $63,000 | $288,000 | $63,000 | $63,000 | $63,000 | $288,000 | $288,000 | $288,000 | $180,000 | $113,000 | $15,000 |
| [6] | Electrical Controls | 45,000 | $5,000 | $65,000 | $5,000 | $5,000 | $5,000 | $65,000 | $65,000 | $65,000 | $55,000 | $50,000 | $5,000 |
| [7] | SCADA System | 25,000 | $0 | $25,000 | $0 | $0 | $0 | $25,000 | $25,000 | $25,000 | $25,000 | $75,000 | $0 |
| [8] | Water Treatment Plant or well treatment | 1,320,000 | $20,000 | $120,000 | $20,000 | $220,000 | $220,000 | $120,000 | $320,000 | $320,000 | $0 | $120,000 | $200,000 |
| [8] | WTP Hazen & Sawyer | $12,394,000 | $12,394,000 | $9,171,000 | $7,765,000 | $7,765,000 | $7,765,000 | $4,542,000 | $4,542,000 | $4,542,000 | $0 | $0 | $0 |
| [9] | Electrical Power Facilities | 30,000 | $10,000 | $10,000 | $10,000 | $10,000 | $10,000 | $10,000 | $10,000 | $10,000 | $30,000 | $25,000 | $10,000 |
| [10] | Land and Right of Ways | 286,000 | $36,000 | $30,000 | $36,000 | $36,000 | $36,000 | $30,000 | $30,000 | $30,000 | $230,000 | $530,000 | $30,000 |
| [11] | Contingencies | $1,782,000 | $1,619,000 | $1,327,000 | $1,222,000 | $1,153,000 | $1,242,000 | $934,000 | $862,000 | $942,000 | $214,000 | $1,687,000 | $194,000 |
| [12] | Engineering and Design | $2,941,000 | $2,671,000 | $2,190,000 | $2,016,000 | $1,903,000 | $2,050,000 | $1,541,000 | $1,423,000 | $1,554,000 | $353,000 | $2,783,000 | $321,000 |
| [13] | Construction Management and Bidding | $2,941,000 | $2,671,000 | $2,190,000 | $2,016,000 | $1,903,000 | $2,050,000 | $1,541,000 | $1,423,000 | $1,554,000 | $353,000 | $2,783,000 | $321,000 |
| | **Total Capital Cost** | **25,773,000** | **23,182,000** | **19,009,000** | **17,507,000** | **16,529,000** | **17,801,000** | **13,388,000** | **12,360,000** | **13,495,000** | **3,287,000** | **24,652,000** | **2,810,000** |
| | Acre feet (AF) pumped per year | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 |
| | $/AF | 4,617 | 4,153 | 3,405 | 3,136 | 2,961 | 3,189 | 2,398 | 2,214 | 2,418 | 589 | 4,416 | 503 |

**Annualized Capital Cost**

| Notes | Item | A | B | C | D | D-P | D-C | E | E-P | E-C | F | G | H |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [20] | Mobilization and demobilization | 68,000 | 62,000 | 51,000 | 47,000 | 44,000 | 48,000 | 36,000 | 33,000 | 36,000 | 8,000 | 64,000 | 7,000 |
| [20] | Pipelines | 222,000 | 219,000 | 219,000 | 279,000 | 219,000 | 279,000 | 278,000 | 219,000 | 271,000 | 128,000 | 1,151,000 | 118,000 |
| [20] | Control Valves | 17,000 | 15,000 | 19,000 | 24,000 | 15,000 | 24,000 | 31,000 | 19,000 | 27,000 | 12,000 | 80,000 | 12,000 |
| [20] | Tanks | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27,000 | 0 |
| [20] | Pump Stations | 15,000 | 5,000 | 23,000 | 5,000 | 5,000 | 5,000 | 23,000 | 23,000 | 23,000 | 14,000 | 9,000 | 1,000 |
| [20] | Electrical Controls | 4,000 | 0 | 5,000 | 0 | 0 | 0 | 5,000 | 5,000 | 5,000 | 4,000 | 4,000 | 0 |
| [20] | SCADA System | 2,000 | 0 | 2,000 | 0 | 0 | 0 | 2,000 | 2,000 | 2,000 | 2,000 | 6,000 | 0 |
| [20] | Water Treatment Plant or well treatment | 106,000 | 2,000 | 10,000 | 2,000 | 18,000 | 18,000 | 10,000 | 26,000 | 26,000 | 0 | 10,000 | 16,000 |
| [20] | WTP Hazen & Sawyer | 995,000 | 995,000 | 736,000 | 623,000 | 623,000 | 623,000 | 364,000 | 364,000 | 364,000 | 0 | 0 | 0 |
| [20] | Electrical Power Facilities | 2,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 2,000 | 2,000 | 1,000 |
| [20] | Land and Right of Ways | 23,000 | 3,000 | 2,000 | 3,000 | 3,000 | 3,000 | 2,000 | 2,000 | 2,000 | 18,000 | 43,000 | 2,000 |
| [20] | Contingencies | 143,000 | 130,000 | 106,000 | 98,000 | 93,000 | 100,000 | 75,000 | 69,000 | 76,000 | 17,000 | 135,000 | 16,000 |
| [20] | Engineering and Design | 236,000 | 214,000 | 176,000 | 162,000 | 153,000 | 164,000 | 124,000 | 114,000 | 125,000 | 28,000 | 223,000 | 26,000 |
| [20] | Construction Management and Bidding | 236,000 | 214,000 | 176,000 | 162,000 | 153,000 | 164,000 | 124,000 | 114,000 | 125,000 | 28,000 | 223,000 | 26,000 |
| | **Total Annualized Capital Cost (rounded)** | **2,069,000** | **1,860,000** | **1,526,000** | **1,406,000** | **1,327,000** | **1,429,000** | **1,075,000** | **991,000** | **1,083,000** | **261,000** | **1,977,000** | **225,000** |
| | Acre feet (AF) pumped per year | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 | 5,582 |
| | $/yr/AF | 371 | 333 | 273 | 252 | 238 | 256 | 193 | 178 | 194 | 47 | 354 | 40 |

**Annual O&M Cost Summary**

| Notes | Item | A | B | C | D | D-P | D-C | E | E-P | E-C | F | G | H |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [25] | Mobilization and demobilization | 8,000 | 8,000 | 6,000 | 6,000 | 5,000 | 6,000 | 4,000 | 4,000 | 4,000 | 1,000 | 8,000 | 1,000 |
| [25] | Pipelines | 41,000 | 41,000 | 41,000 | 52,000 | 41,000 | 52,000 | 52,000 | 41,000 | 51,000 | 24,000 | 215,000 | 22,000 |
| [25] | Control Valves | 4,000 | 4,000 | 5,000 | 6,000 | 4,000 | 6,000 | 8,000 | 5,000 | 7,000 | 3,000 | 20,000 | 3,000 |
| [25] | Tanks | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,000 | 0 |
| [25] | Pump Stations | 9,000 | 3,000 | 14,000 | 3,000 | 3,000 | 3,000 | 14,000 | 14,000 | 14,000 | 9,000 | 6,000 | 1,000 |
| [25] | Electrical Controls | 0 | 0 | 1,000 | 0 | 0 | 0 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 0 |
| [25] | SCADA System | 1,000 | 0 | 1,000 | 0 | 0 | 0 | 1,000 | 1,000 | 1,000 | 1,000 | 4,000 | 0 |
| [25] | Water Treatment Plant or well treatment | 132,000 | 2,000 | 12,000 | 2,000 | 22,000 | 22,000 | 12,000 | 32,000 | 32,000 | 0 | 12,000 | 20,000 |
| [25] | WTP Hazen & Sawyer | 2,705,000 | 2,705,000 | 2,005,000 | 1,839,000 | 1,839,000 | 1,839,000 | 1,139,000 | 1,139,000 | 1,139,000 | 0 | 0 | 0 |
| [25] | Electrical Power Facilities | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| [25] | Land and Right of Ways | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| [25] | Contingencies | 18,000 | 16,000 | 13,000 | 12,000 | 12,000 | 12,000 | 9,000 | 9,000 | 9,000 | 2,000 | 17,000 | 2,000 |
| [25] | Engineering and Design | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| [25] | Construction Management and Bidding | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Total O&M (rounded)** | **2,918,000** | **2,779,000** | **2,098,000** | **1,920,000** | **1,926,000** | **1,940,000** | **1,240,000** | **1,246,000** | **1,258,000** | **41,000** | **286,000** | **49,000** |
| [28] | **Energy Cost (additional)** | **112,000** | **112,000** | **55,000** | **94,000** | **100,000** | **100,000** | **23,000** | **29,000** | **29,000** | **64,000** | **5,000** | **32,000** |

# 7.0 Abbreviations and Acronyms Used in the Report

| | |
|---|---|
| °F | Degrees Fahrenheit |
| ACP | Asbestos Cement Pipe |
| Acre-feet | 325,851 gallons |
| ADD | Average day demand |
| AF | Acre-feet |
| AFY | Acre-feet per Year |
| Alt | Alternative |
| AP | Alamo Pintado Pump Station |
| Avg | Average |
| AWWA | American Water Works Association |
| BG | Below Ground |
| C | Pipe Friction (roughness) Coefficient Value |
| CAD | Computer Aided Design |
| CCP | Concrete Pipe |
| cfs | Cubic feet per second |
| CIMIS | California Irrigation Management Information System |
| CIP | Cast Iron Pipe |
| CMLCSP | Cement Lined and Coated Steel Pipe |
| Cr6 | Hexavalent Chromium |
| DIP | Ductile Iron Pipe |
| DHS | California Department of Health Services |
| EPA | Environmental Protection Agency |
| ft | feet |
| ft/s | Feet per Second |
| fps | Feet per second |
| GAC | Granular Activated Carbon |
| GIP | Galvanized Iron Pipe |
| GIS | Geographic Information Systems |
| gpd | gallons per day |
| gpm | gallons per minute |

| | |
|---|---|
| h | height |
| hcf | Hundred cubic feet |
| HGL | Hydraulic Grade Line |
| Hp | Horsepower |
| ID | Inside Diameter |
| ID1 | Santa Ynez River Water Conservation District Improvement District #1 |
| in | inch(es) |
| ISO | Insurance Service Office |
| LF | Linear feet |
| LS | Lump Sum |
| MCL | Maximum Containment Level |
| MDD | Maximum Day Demand |
| MF | Microfiltration |
| Mg or MG | million gallons |
| Min | Minimum |
| mgd | million gallons per day |
| MHD | Maximum Hour Demand |
| ML | Meadowlark Pump Station |
| MSL | Mean Sea Level |
| MVPS or MV | Mesa Verde Pump Station |
| No. | Number |
| O&M | Operations and Maintenance |
| Obs | Observed |
| pi | pi = 3.14 |
| Ppb | Parts per billion |
| psi | pounds per square inch |
| PVC | Poly Vinyl Chloride Pipe |
| Ref | Refugio Pump Station |
| RO | Reverse Osmosis |
| SCADA | Supervisory Control and Data Acquisition |
| SCP | Somastic Coated Pipe |
| sf | square feet |

| | |
|---|---|
| Sim | Simulated |
| STL | Steel pipe |
| SWP | State Water Project |
| TDH | Total Dynamic Head |
| TDS | Total Disolved Solids |
| WC | WaterCAD |
| WS | Water Surface |
| WTP | Water Treatment Plant |
| yr | Year |
| < | Less than |
| > | Greater than |
| ≤ | Less than or equal to |
| ≥ | Greater than or equal to |

# Attachment A

## Alternative 1-1 Blending Well 7 and Well 24 into existing 0.5 MG Zone 1 Tank Cost Estimate

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | **$ 1,990,000** |
| | 8 inch pipeline from well 24 to tank | 400 | LF | $ 110 | $ 44,000 |
| | 10 pipeline from well 7 to tank | 2,400 | LF | $ 130 | $ 312,000 |
| | 8 Immediately downstream of 6 cfs well field | 500 | LF | $ 110 | $ 55,000 |
| | 8 Immediately downstream of 6 cfs well field | 1,000 | LF | $ 110 | $ 110,000 |
| | 12 Immediately downstream of Mesa Verde | 700 | LF | $ 150 | $ 105,000 |
| | 12 Immediately downstream of Mesa Verde | 1,700 | LF | $ 150 | $ 255,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 800 | LF | $ 150 | $ 120,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,600 | LF | $ 150 | $ 240,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,400 | LF | $ 150 | $ 210,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 2,100 | LF | $ 150 | $ 315,000 |
| | 8 Relocation Zone 1 meters to Zone 2 | 1,200 | LF | $ 110 | $ 132,000 |
| | Relocation Zone 1 meters to Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | 8 Immediately downsteram of new booster at Zone 1 Tank | 700 | LF | $ 110 | $ 77,000 |
| [3] | **Control Valves** | | | | **$ 221,000** |
| | Valves at Well 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 7 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at 0.5 MG Tank | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 7 and 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (1,000 gpm) at Zone 1 Tank | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (12 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 8-inch valves | 10 | Each | $ 1,500 | $ 15,000 |
| | 10-inch valves | 2 | Each | $ 2,000 | $ 4,000 |
| | 12-inch valves | 12 | Each | $ 2,500 | $ 30,000 |
| | Blowoff valve assembly with valve box | 12 | Each | $ 5,000 | $ 60,000 |
| | Air/vacuum and air relaease valve with valve box | 12 | Each | $ 5,000 | $ 60,000 |
| [5] | **Pump Stations** | | | | **$ 95,000** |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 50 | Hp | $ 1,600 | $ 80,000 |
| | Booster Pump (12 gpm) 16.3 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| [6] | **Electrical Controls** | | | | **$ 55,000** |
| | Refugio-2 upgrade to operate all 3 pumps | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (50 hp) at Zone 1 Tank | 1 | LS | $ 40,000 | $ 40,000 |
| | Booster Pump (12 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | **$ 50,000** |
| | SCADA Connection, components, operations for new booster | 1 | LS | $ 25,000 | $ 25,000 |
| | SCADA Connection, components, operations for 0.5 MG tank | 1 | LS | $ 25,000 | $ 25,000 |
| [9] | **Electrical Power Facilities** | | | | **$ 30,000** |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 20,000 | $ 20,000 |
| | Booster Pump (12 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | **$ 231,000** |
| | Acquire 20' right of way for well 7 pipeline | 150 | LF | $ 4 | $ 1,000 |
| | Acquire 50' by 50' of Land and permitting | 1 | LS | $ 200,000 | $ 200,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 2,672,000** |

**Future Energy Cost Alternative 1-1 and 1-2**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 1,577 | 28.3% | | | | |
| Upland Wells in operation for Alternative 1-1 and 1-2 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 7 | 477 | | 153 | 477 | $72,981 | [b] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [c] |
| River Wells | 1,505 | 27.0% | 92 | 1,505 | $138,460 | |
| | 5,582 | 100.0% | | 5,582 | $518,081 | |
| Zone 1 to Zone 2 | | | | | | |
| | 3,292 | 59.0% | 40 | 3,292 | $131,680 | |
| Zone 2 to Zone 3 | | | | | | |
| | 100 | 1.8% | 80 | 100 | $8,000 | |
| | | | | Total | $657,761 | |
| | | | | $/AF | 118 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Extra Pumping Cost | $35,283 | |
| | | | | $/AF | 6 | |

[a] Based on 80% operation per year

[b] Based on 33% operation per year

[c] Based on approximate 2013 water use (rounded)

**Alternative 1-2 Blending Well 7 with Well 24 at Well 7 Site Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 1,986,000 |
| | 8 inch pipeline from well 24 to well 7 | 2,500 | LF | $ 110 | $ 275,000 |
| | 8 inch parallel pipeline from well 7 to system | 700 | LF | $ 110 | $ 77,000 |
| | 8 Immediately downstream of 6 cfs well field | 500 | LF | $ 110 | $ 55,000 |
| | 8 Immediately downstream of 6 cfs well field | 1,000 | LF | $ 110 | $ 110,000 |
| | 12 Immediately downstream of Mesa Verde | 700 | LF | $ 150 | $ 105,000 |
| | 12 Immediately downstream of Mesa Verde | 1,700 | LF | $ 150 | $ 255,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 800 | LF | $ 150 | $ 120,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,600 | LF | $ 150 | $ 240,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,400 | LF | $ 150 | $ 210,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 2,100 | LF | $ 150 | $ 315,000 |
| | 8 Relocation Zone 1 meters to Zone 2 | 1,200 | LF | $ 110 | $ 132,000 |
| | Relocation Zone 1 meters to Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | 8 Immediately downsteram of new booster @ Zone 1 Tank | 700 | LF | $ 110 | $ 77,000 |
| [3] | **Control Valves** | | | | $ 198,000 |
| | Valves at Well 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 7 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 7 and 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 8-inch valves | 12 | Each | $ 1,500 | $ 18,000 |
| | 12-inch valves | 11 | Each | $ 2,500 | $ 28,000 |
| | Blowoff valve assembly with valve box | 11 | Each | $ 5,000 | $ 55,000 |
| | Air/vacuum and air relaease valve with valve box | 11 | Each | $ 5,000 | $ 55,000 |
| [5] | **Pump Stations** | | | | $ 95,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 50 | Hp | $ 1,600 | $ 80,000 |
| | Booster Pump (10 gpm) 16.4 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| [6] | **Electrical Controls** | | | | $ 55,000 |
| | Refugio-2 upgrade to operate all 3 pumps | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 40,000 | $ 40,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ 25,000 |
| | SCADA Connection, components, operations for new booster | 1 | LS | $ 25,000 | $ 25,000 |
| [9] | **Electrical Power Facilities** | | | | $ 30,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 20,000 | $ 20,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 230,000 |
| | Acquire 50' by 50' of Land and permitting | 1 | LS | $ 200,000 | $ 200,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | Total | $ 2,619,000 |

**Future Energy Cost Alternative 1-1 and 1-2**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 1,577 | 28.3% | | | | |
| Upland Wells in operation for Alternative 1-1 and 1-2 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 7 | 477 | | 153 | 477 | $72,981 | [b] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [c] |
| River Wells | 1,505 | 27.0% | 92 | 1,505 | $138,460 | |
| | 5,582 | 100.0% | | 5,582 | $518,081 | |
| Zone 1 to Zone 2 | | | | | | |
| | 3,292 | 59.0% | 40 | 3,292 | $131,680 | |
| Zone 2 to Zone 3 | | | | | | |
| | 100 | 1.8% | 80 | 100 | $8,000 | |
| | | | | Total | $657,761 | |
| | | | | $/AF | 118 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Extra Pumping Cost | $35,283 | |
| | | | | $/AF | 6 | |

[a] Based on 80% operation per year
[b] Based on 33% operation per year
[c] Based on approximate 2013 water use (rounded)

## Alternative 1-3 Blending Well 27 with Zone 2 Water then pumped into Zone 3 Cost Estimate

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 2,249,000 |
| | 12 pipeline from well 27 to zone 3 | 4,100 | LF | $ 150 | $ 615,000 |
| | 8 Immediately downstream of 6 cfs well field | 500 | LF | $ 110 | $ 55,000 |
| | 8 Immediately downstream of 6 cfs well field | 1,000 | LF | $ 110 | $ 110,000 |
| | 12 Immediately downstream of Mesa Verde | 700 | LF | $ 150 | $ 105,000 |
| | 12 Immediately downstream of Mesa Verde | 1,700 | LF | $ 150 | $ 255,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 800 | LF | $ 150 | $ 120,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,600 | LF | $ 150 | $ 240,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,400 | LF | $ 150 | $ 210,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 2,100 | LF | $ 150 | $ 315,000 |
| | 8 Relocation Zone 1 meters to Zone 2 | 1,200 | LF | $ 110 | $ 132,000 |
| | Relocation Zone 1 meters to Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | 8 Immediately downsteram of new booster @ Zone 1 Tank | 700 | LF | $ 110 | $ 77,000 |
| [3] | **Control Valves** | | | | $ 234,000 |
| | Valves at Well 27 | 1 | LS | $ 20,000 | $ 20,000 |
| | Valves at Well 27 new booster pump | 1 | LS | $ 20,000 | $ 20,000 |
| | Flow control valves at well 27 and new booster at well 27 | 2 | Each | $ 5,000 | $ 10,000 |
| | 12-inch inline blending static mixer | 1 | LS | $ 15,000 | $ 15,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 8-inch valves | 8 | Each | $ 1,500 | $ 12,000 |
| | 10-inch valves | 0 | Each | $ 2,000 | $ - |
| | 12-inch valves | 14 | Each | $ 2,500 | $ 35,000 |
| | Blowoff valve assembly with valve box | 11 | Each | $ 5,000 | $ 55,000 |
| | Air/vacuum and air relaease valve with valve box | 11 | Each | $ 5,000 | $ 55,000 |
| [5] | **Pump Stations** | | | | $ 215,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 50 | Hp | $ 1,600 | $ 80,000 |
| | Booster Pump (1,000 gpm, 206 TDH, 75 hp) at Well 27 | 75 | Hp | $ 1,600 | $ 120,000 |
| | Booster Pump (10 gpm) 16.4 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| [6] | **Electrical Controls** | | | | $ 95,000 |
| | Refugio-2 upgrade to operate all 3 pumps | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 40,000 | $ 40,000 |
| | Booster Pump (1,000 gpm, 206 TDH, 75 hp) at Well 27 | 1 | LS | $ 40,000 | $ 40,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ 25,000 |
| | SCADA Connection, components, operations for new booster | 1 | LS | $ 25,000 | $ 25,000 |
| [9] | **Electrical Power Facilities** | | | | $ 30,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 20,000 | $ 20,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 230,000 |
| | Acquire 50' by 50' of Land and permitting | 1 | LS | $ 200,000 | $ 200,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | Total | $ 3,078,000 |

**Future Energy Cost Alternative 1-3**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 1,389 | 24.9% | | | | |
| Upland Wells in operation for Alternative 1-3 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 27 | 289 | | 124 | 289 | $35,836 | [b] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [c] |
| River Wells | 1,693 | 30.3% | 92 | 1,693 | $155,756 | |
| | 5,582 | 100.0% | | 5,582 | $498,232 | |
| Zone 1 to Zone 2 | | | | | | |
| | 3,480 | 62.3% | 40 | 3,480 | $139,200 | |
| Zone 2 to Zone 3 | | | | | | |
| | 289 | 5.2% | 80 | 289 | $23,120 | |
| | | | | Total | $660,552 | |
| | | | | $/AF | 118 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Extra Pumping Cost | $38,074 | |
| | | | | $/AF | 6 | |

[a] Based on 80% operation per year

[b] Based on 14.3% operation per year

[c] Based on approximate 2013 water use (rounded)

## Alternative 1-4 Blending Well 28 with Zone 2 Water then pumped into Zone 3 Cost Estimate

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 2,100,000 |
| | 16 Pipeline from well 28 to zone 3 | 1,800 | LF | $ 210 | $ 378,000 |
| | 8 Pipeline from well 28 to zone 3 | 800 | LF | $ 110 | $ 88,000 |
| | 8 Immediately downstream of 6 cfs well field | 500 | LF | $ 110 | $ 55,000 |
| | 8 Immediately downstream of 6 cfs well field | 1,000 | LF | $ 110 | $ 110,000 |
| | 12 Immediately downstream of Mesa Verde | 700 | LF | $ 150 | $ 105,000 |
| | 12 Immediately downstream of Mesa Verde | 1,700 | LF | $ 150 | $ 255,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 800 | LF | $ 150 | $ 120,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,600 | LF | $ 150 | $ 240,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,400 | LF | $ 150 | $ 210,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 2,100 | LF | $ 150 | $ 315,000 |
| | 8 Relocation Zone 1 meters to Zone 2 | 1,200 | LF | $ 110 | $ 132,000 |
| | Relocation Zone 1 meters to Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | 8 Immediately downsteram of new booster @ Zone 1 Tank | 700 | LF | $ 110 | $ 77,000 |
| [3] | **Control Valves** | | | | $ 254,000 |
| | Valves at Well 28 | 1 | LS | $ 20,000 | $ 20,000 |
| | Valves at Well 28 new booster pump | 1 | LS | $ 20,000 | $ 20,000 |
| | Flow control valves at well 28 and new booster at well 28 | 2 | Each | $ 5,000 | $ 10,000 |
| | 12-inch inline blending static mixer | 1 | LS | $ 15,000 | $ 15,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 8-inch valves | 10 | Each | $ 1,500 | $ 15,000 |
| | 10-inch valves | 0 | Each | $ 2,000 | $ - |
| | 12-inch valves | 14 | Each | $ 2,500 | $ 35,000 |
| | 16-inch valves | 2 | Each | $ 3,500 | $ 7,000 |
| | Blowoff valve assembly with valve box | 12 | Each | $ 5,000 | $ 60,000 |
| | Air/vacuum and air relaease valve with valve box | 12 | Each | $ 5,000 | $ 60,000 |
| [5] | **Pump Stations** | | | | $ 320,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 50 | Hp | $ 1,600 | $ 80,000 |
| | Booster Pump (1,500 gpm, 300 TDH, 150 hp) at Well 28 | 150 | Hp | $ 1,500 | $ 225,000 |
| | Booster Pump (10 gpm) 16.5 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| [6] | **Electrical Controls** | | | | $ 115,000 |
| | Refugio-2 upgrade to operate all 3 pumps | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 40,000 | $ 40,000 |
| | Booster Pump (1,500 gpm, 300 TDH, 150 hp) at Well 28 | 1 | LS | $ 60,000 | $ 60,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ 25,000 |
| | SCADA Connection, components, operations for new booster | 1 | LS | $ 25,000 | $ 25,000 |
| [9] | **Electrical Power Facilities** | | | | $ 30,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 20,000 | $ 20,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 230,000 |
| | Acquire 50' by 50' of Land and permitting | 1 | LS | $ 200,000 | $ 200,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 3,074,000** |

**Future Energy Cost Alternative 1-4**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 1,293 | 23.2% | | | | |
| Upland Wells in operation for Alternative 1-4 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 28 | 193 | | 90 | 193 | $17,370 | [b] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [c] |
| River Wells | 1,789 | 32.0% | 91 | 1,789 | $162,799 | |
| | 5,582 | 100.0% | | 5,582 | $486,809 | |
| Zone 1 to Zone 2 | | | | | | |
| | 3,576 | 64.1% | 40 | 3,576 | $143,040 | |
| Zone 2 to Zone 3 | | | | | | |
| | 386 | 6.9% | 80 | 386 | $30,880 | |
| | | | | Total | $660,729 | |
| | | | | $/AF | 118 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Extra Pumping Cost | $38,251 | |
| | | | | $/AF | 6 | |

[a] Based on 80% operation per year

[b] Based on 14.3% operation per year

[c] Based on approximate 2013 water use (rounded)

**Alternative 1-5 Blending Well 5 with Well 25 at Well 25 Site Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 2,123,000 |
| | 8 pipeline from well 5 to well 25 | 3,500 | LF | $ 110 | $ 385,000 |
| | 10 Immediately downstream of 12" connection W25 & Z3 tank | 800 | LF | $ 130 | $ 104,000 |
| | 8 Immediately downstream of 6 cfs well field | 500 | LF | $ 110 | $ 55,000 |
| | 8 Immediately downstream of 6 cfs well field | 1,000 | LF | $ 110 | $ 110,000 |
| | 12 Immediately downstream of Mesa Verde | 700 | LF | $ 150 | $ 105,000 |
| | 12 Immediately downstream of Mesa Verde | 1,700 | LF | $ 150 | $ 255,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 800 | LF | $ 150 | $ 120,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,600 | LF | $ 150 | $ 240,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,400 | LF | $ 150 | $ 210,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 2,100 | LF | $ 150 | $ 315,000 |
| | 8 Relocation Zone 1 meters to Zone 2 | 1,200 | LF | $ 110 | $ 132,000 |
| | Relocation Zone 1 meters to Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | 8 Immediately downsteram of new booster @ Zone 1 Tank | 700 | LF | $ 110 | $ 77,000 |
| [3] | **Control Valves** | | | | $ 213,000 |
| | Valves at Well 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 5 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 5 and 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) Zone 2 | 1 | LS | $ 2,000 | $ 2,000 |
| | Booster Pump (<25 gpm) 21.7 to 60 psi Zone 3 | 1 | LS | $ 2,000 | $ 2,000 |
| | 8-inch valves | 10 | Each | $ 1,500 | $ 15,000 |
| | 10-inch valves | 2 | Each | $ 2,000 | $ 4,000 |
| | 12-inch valves | 12 | Each | $ 2,500 | $ 30,000 |
| | Blowoff valve assembly with valve box | 12 | Each | $ 5,000 | $ 60,000 |
| | Air/vacuum and air relaease valve with valve box | 12 | Each | $ 5,000 | $ 60,000 |
| [5] | **Pump Stations** | | | | $ 110,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 50 | Hp | $ 1,600 | $ 80,000 |
| | Booster Pump (<25 gpm) 21.7 to 60 psi Zone 3 | 1.0 | Hp | $ 15,000 | $ 15,000 |
| | Booster Pump (10 gpm) 16.6 to 60 psi Zone 2 | 1.0 | Hp | $ 15,000 | $ 15,000 |
| [6] | **Electrical Controls** | | | | $ 60,000 |
| | Refugio-2 upgrade to operate all 3 pumps | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 40,000 | $ 40,000 |
| | Booster Pump (<25 gpm) 21.7 to 60 psi Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ 25,000 |
| | SCADA Connection, components, operations for new booster | 1 | LS | $ 25,000 | $ 25,000 |
| [9] | **Electrical Power Facilities** | | | | $ 40,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 20,000 | $ 20,000 |
| | Booster Pump (<25 gpm) 21.7 to 60 psi Zone 3 | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) 16.6 to 60 psi Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 260,000 |
| | Acquire 50' by 50' of Land and permitting | 1 | LS | $ 200,000 | $ 200,000 |
| | Acquire 20' by 20' of Land and permitting | 2 | LS | $ 30,000 | $ 60,000 |
| | | | | **Total** | **$ 2,831,000** |

**Future Energy Cost Alternative 1-5 and 1-6**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 1,580 | 28.3% | | | | |
| Upland Wells in operation for Alternative 1-5 and 1-6 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 25 | 480 | | 107 | 480 | $51,360 | [b] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [c] |
| River Wells | 1,502 | 26.9% | 92 | 1,502 | $138,184 | |
| | 5,582 | 100.0% | | 5,582 | $496,184 | |
| Zone 1 to Zone 2 | | | | | | |
| | 3,289 | 58.9% | 40 | 3,289 | $131,560 | |
| Zone 2 to Zone 3 | | | | | | |
| | 100 | 1.8% | 80 | 100 | $8,000 | |
| | | | | Total | $635,744 | |
| | | | | $/AF | 114 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Extra Pumping Cost | $13,266 | |
| | | | | $/AF | 2 | |

[a] Based on 80% operation per year
[b] Based on 31% operation per year
[c] Based on approximate 2013 water use (rounded)

**Alternative 1-6 Blending Well 24 with Well 25 at Well 25 Site Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 2,283,000 |
| | 8 inch pipeline from well 24 to well 25 | 5,100 | LF | $ 110 | $ 561,000 |
| | 8 Immediately downstream of 12" connection W25 & Z3 tank | 800 | LF | $ 110 | $ 88,000 |
| | 8 Immediately downstream of 6 cfs well field | 500 | LF | $ 110 | $ 55,000 |
| | 8 Immediately downstream of 6 cfs well field | 1,000 | LF | $ 110 | $ 110,000 |
| | 12 Immediately downstream of Mesa Verde | 700 | LF | $ 150 | $ 105,000 |
| | 12 Immediately downstream of Mesa Verde | 1,700 | LF | $ 150 | $ 255,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 800 | LF | $ 150 | $ 120,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,600 | LF | $ 150 | $ 240,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,400 | LF | $ 150 | $ 210,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 2,100 | LF | $ 150 | $ 315,000 |
| | 8 Relocation Zone 1 meters to Zone 2 | 1,200 | LF | $ 110 | $ 132,000 |
| | Relocation Zone 1 meters to Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | 8 Immediately downsteram of new booster @ Zone 1 Tank | 700 | LF | $ 110 | $ 77,000 |
| [3] | **Control Valves** | | | | $ 212,000 |
| | Valves at Well 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 24 and 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (25 gpm) 23.4 to 60 psi Zone 3 | 1 | LS | $ 2,000 | $ 2,000 |
| | Booster Pump (10 gpm) 16.6 to 60 psi Zone 2 | 1 | LS | $ 2,000 | $ 2,000 |
| | 8-inch valves | 12 | Each | $ 1,500 | $ 18,000 |
| | 12-inch valves | 12 | Each | $ 2,500 | $ 30,000 |
| | Blowoff valve assembly with valve box | 12 | Each | $ 5,000 | $ 60,000 |
| | Air/vacuum and air relaease valve with valve box | 12 | Each | $ 5,000 | $ 60,000 |
| [5] | **Pump Stations** | | | | $ 110,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 50 | Hp | $ 1,600 | $ 80,000 |
| | Booster Pump (25 gpm) 23.4 to 60 psi Zone 3 | 1.0 | Hp | $ 15,000 | $ 15,000 |
| | Booster Pump (10 gpm) 16.6 to 60 psi Zone 2 | 1.0 | Hp | $ 15,000 | $ 15,000 |
| [6] | **Electrical Controls** | | | | $ 60,000 |
| | Refugio-2 upgrade to operate all 3 pumps | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 40,000 | $ 40,000 |
| | Booster Pump (25 gpm) 23.4 to 60 psi Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | Booster Pump (10 gpm) 16.6 to 60 psi Zone 2 | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ 25,000 |
| | SCADA Connection, components, operations for new booster | 1 | LS | $ 25,000 | $ 25,000 |
| [9] | **Electrical Power Facilities** | | | | $ 40,000 |
| | Booster Pump (1,000 gpm, 50 hp) at Zone 1 Tank | 1 | LS | $ 20,000 | $ 20,000 |
| | Booster Pump (25 gpm) 23.4 to 60 psi Zone 3 | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) 16.6 to 60 psi Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 260,000 |
| | Acquire 50' by 50' of Land and permitting | 1 | LS | $ 200,000 | $ 200,000 |
| | Acquire 20' by 20' of Land and permitting | 2 | LS | $ 30,000 | $ 60,000 |
| | | | | Total | $ 2,990,000 |

**Future Energy Cost Alternative 1-5 and 1-6**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 1,580 | 28.3% | | | | |
| Upland Wells in operation for Alternative 1-5 and 1-6 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 25 | 480 | | 107 | 480 | $51,360 | [b] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [c] |
| River Wells | 1,502 | 26.9% | 92 | 1,502 | $138,184 | |
| | 5,582 | 100.0% | | 5,582 | $496,184 | |
| Zone 1 to Zone 2 | | | | | | |
| | 3,289 | 58.9% | 40 | 3,289 | $131,560 | |
| Zone 2 to Zone 3 | | | | | | |
| | 100 | 1.8% | 80 | 100 | $8,000 | |
| | | | | Total | $635,744 | |
| | | | | $/AF | 114 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Extra Pumping Cost | $13,266 | |
| | | | | $/AF | 2 | |

[a] Based on 80% operation per year

[b] Based on 31% operation per year

[c] Based on approximate 2013 water use (rounded)

**Alternative 2 Separate Irrigation Water System Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 13,645,000 |
| | 8- inch pipelines | 73,900 | LF | $ 100 | $ 7,390,000 |
| | 10- inch pipelines | 18,000 | LF | $ 130 | $ 2,340,000 |
| | 12- inch pipelines | 24,000 | LF | $ 150 | $ 3,600,000 |
| | 16- inch pipelines | 1,500 | LF | $ 210 | $ 315,000 |
| [3] | **Control Valves** | | | | $ 1,037,000 |
| | Gallery well hydropneumatic tank valves | 1 | LS | $ 5,000 | $ 5,000 |
| | 128,000 gallon tank valves | 1 | LS | $ 10,000 | $ 10,000 |
| | Zone 2 to Zone 3 Booster Pump @ Alamo Pintado (785 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| | 4-inch pressure reducing valves connection to existing system | 5 | Each | $ 10,000 | $ 50,000 |
| | 6-inch pressure reducing valves connection to existing system | 3 | Each | $ 15,000 | $ 45,000 |
| | 8-inch pressure reducing valves connection to existing system | 2 | Each | $ 20,000 | $ 40,000 |
| | Zone 2 to Zone 1 pressuer reducing valve | 1 | Each | $ 20,000 | $ 20,000 |
| | New water meter connections | 30 | Each | $ 5,000 | $ 150,000 |
| | 8-inch valves | 37 | Each | $ 1,500 | $ 55,500 |
| | 10-inch valves | 9 | Each | $ 2,000 | $ 18,000 |
| | 12-inch valves | 12 | Each | $ 2,500 | $ 30,000 |
| | 16-inch valves | 1 | Each | $ 3,500 | $ 3,500 |
| | Blowoff valve assembly with valve box | 59 | Each | $ 5,000 | $ 295,000 |
| | Air/vacuum and air relaease valve with valve box | 59 | Each | $ 5,000 | $ 295,000 |
| | Well #3 connection to separate irrigation system | 1 | LS | $ 10,000 | $ 10,000 |
| [4] | **Tanks** | | | | $ 420,000 |
| | 15,000 hydropneumatic tank at Gallery Well | 1 | LS | $ 110,000 | $ 110,000 |
| | 15,000 hydropneumatic tank at Alamo Pintado booster pump | 1 | LS | $ 110,000 | $ 110,000 |
| | 128,000 gallon tank at Zone 2 existing tank site | 1 | LS | $ 200,000 | $ 200,000 |
| [5] | **Pump Stations** | | | | $ 98,000 |
| | Zone 2 to Zone 3 Booster Pump @ Alamo Pintado (785 gpm, 50 hp) | 1 | LS | $ 50,000 | $ 50,000 |
| | Well #3 pump and motor (600 gpm, 75 hp) | 1 | LS | $ 48,000 | $ 48,000 |
| [6] | **Electrical Controls** | | | | $ 45,000 |
| | Gallery Well presure tank | 1 | LS | $ 5,000 | $ 5,000 |
| | Zone 2 to Zone 3 Booster Pump @ Alamo Pintado (50 hp) | 1 | LS | $ 40,000 | $ 40,000 |
| [7] | **SCADA System** | | | | $ 75,000 |
| | SCADA Connection, components, operations at new Zone 2 tank | 1 | LS | $ 25,000 | $ 25,000 |
| | SCADA Connection, components, operations at new Zone 3 booster | 1 | LS | $ 25,000 | $ 25,000 |
| | SCADA Connection, components, operations at Gallery well | 1 | LS | $ 25,000 | $ 25,000 |
| [8] | **Water Treatment** | | | | $ 20,000 |
| | Well #3 cleaning and development | 1 | LS | $ 20,000 | $ 20,000 |
| [9] | **Electrical Power Facilities** | | | | $ 15,000 |
| | Zone 2 to Zone 3 Booster Pump @ Alamo Pintado (50 hp) | 1 | LS | $ 15,000 | $ 15,000 |
| [10] | **Land and Right of Ways** | | | | $ 400,000 |
| | Acquire 50' by 50' of and and permitting for Zone 3 booster | 1 | LS | $ 200,000 | $ 200,000 |
| | Acquire 50' by 50' of and and permitting for Gallery well tank | 1 | LS | $ 200,000 | $ 200,000 |
| | | | | **Total** | **$ 15,755,000** |

**Future Energy Cost Alternative 2**

| Water Supply | 2013 AF | Percent | 2013 $/AF | 2013 AF | 2013 $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells in operation for Alternative 2 | | | | | | |
| Well 1 | 59 | 1.1% | 123 | 59 | $7,275 | [a] |
| Well 2 | 146 | 2.6% | 123 | 146 | $17,976 | [a] |
| Well 3 | 177 | 3.2% | 86 | 177 | $15,198 | [a] |
| Well 15 | 968 | 17.3% | 86 | 968 | $83,248 | [b] |
| Well 28 | 220 | 3.9% | 90 | 220 | $19,787 | [a] |
| Well 5 | 324 | 5.8% | 140 | 324 | $45,360 | [c] |
| Well 6 | 388 | 7.0% | 225 | 388 | $87,300 | [c] |
| Well 24 | 388 | 7.0% | 210 | 388 | $81,480 | [c] |
| MVPS, SWP | 1,397 | 25.0% | 37 | 1,397 | $51,689 | [d] |
| River Wells | 1,000 | 17.9% | 95 | 1,000 | $95,000 | [e] |
| Gallery Well | 515 | 9.2% | 80 | 515 | $41,200 | [f] |
| Irrigation | 2,085 | | | 5,582 | $545,514 | |
| Municipal | 3,497 | | | | | |
| Total | 5,582 | 100.0% | | | | |
| Zone 1 to Zone 2 | | | | | | |
| | 2,199 | 38.1% | 40 | 2,127 | $85,080 | |
| Zone 2 to Zone 3 | | | | | | |
| | 633 | 11.0% | 80 | 612 | $48,960 | |
| | | | | Total | $679,554 | |
| | | | | $/AF | 122 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Extra Pumping Cost | $57,076 | |
| | | | | $/AF | 10 | |

[a] Based on 18.2% operation per year
[b] Based on 50% operation per year
[c] Based on 80% operation per year
[d] Based on water needs not supplied by wells
[e] Assumed 2013 water pumping rate
[f] Limited to 515 acre-feet per year by water rights

## Alternative 3 Surface Water Treatment Gallery Well Cost Estimate

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 1,664,000 |
| | 12 inch immediately downstream of treatment plant booster pump | 200 | LF | $ 150 | $ 30,000 |
| | 8 Immediately downstream of 6 cfs well field | 500 | LF | $ 110 | $ 55,000 |
| | 8 Immediately downstream of 6 cfs well field | 1,000 | LF | $ 110 | $ 110,000 |
| | 12 Immediately downstream of Mesa Verde | 700 | LF | $ 150 | $ 105,000 |
| | 12 Immediately downstream of Mesa Verde | 1,700 | LF | $ 150 | $ 255,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 800 | LF | $ 150 | $ 120,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,600 | LF | $ 150 | $ 240,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,400 | LF | $ 150 | $ 210,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 2,100 | LF | $ 150 | $ 315,000 |
| | 8 Relocation Zone 1 meters to Zone 2 | 1,200 | LF | $ 110 | $ 132,000 |
| | Relocation Zone 1 meters to Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | 8 Immediately downsteram of new booster @ Zone 1 Tank | 700 | LF | $ 110 | $ 77,000 |
| [3] | **Control Valves** | | | | $ 199,000 |
| | Booster Pump (1,200 gpm) at Zone 1 Tank | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (776 gpm, 195' TDH, 75 hp) at treatment plant | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) 16.5 to 40 psi | 1 | LS | $ 2,000 | $ 2,000 |
| | 8-inch valves | 8 | Each | $ 1,500 | $ 12,000 |
| | 10-inch valves | 0 | Each | $ 2,000 | $ - |
| | 12-inch valves | 14 | Each | $ 2,500 | $ 35,000 |
| | 12-inch valves at two new booster pumps | 4 | Each | $ 2,500 | $ 10,000 |
| | 12-inch check valves at two new booster pumps | 2 | Each | $ 5,000 | $ 10,000 |
| | Blowoff valve assembly with valve box | 11 | Each | $ 5,000 | $ 55,000 |
| | Air/vacuum and air relaease valve with valve box | 11 | Each | $ 5,000 | $ 55,000 |
| [5] | **Pump Stations** | | | | $ 255,000 |
| | Booster Pump (1,200 gpm) at Zone 1 Tank | 75 | Hp | $ 1,600 | $ 120,000 |
| | Booster Pump (776 gpm, 195' TDH, 75 hp) at treatment plant | 75 | Hp | $ 1,600 | $ 120,000 |
| | Booster Pump (10 gpm) 16.5 to 40 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| [6] | **Electrical Controls** | | | | $ 95,000 |
| | Booster Pump (1,200 gpm) at Zone 1 Tank | 1 | LS | $ 40,000 | $ 40,000 |
| | Booster Pump (776 gpm, 195' TDH, 75 hp) at treatment plant | 1 | LS | $ 40,000 | $ 40,000 |
| | Refugio-2 upgrade to operate 2 pumps | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) 16.5 to 40 psi | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ 50,000 |
| | SCADA Connection, components, operations for new Z1 booster | 1 | LS | $ 25,000 | $ 25,000 |
| | SCADA Connection, components, operations for new treat booster | 1 | LS | $ 25,000 | $ 25,000 |
| [8] | **Water Treatment Plant** | | | | $1,300,000 |
| | Membrane Equipment, Pall System (800 gpm) | 1 | LS | $1,000,000 | $1,000,000 |
| | Backwash Tank System | 1 | LS | $50,000 | $50,000 |
| | Treatment Plant Building and Appurtenances | 1 | LS | $250,000 | $250,000 |
| [9] | **Electrical Power Facilities** | | | | $ 50,000 |
| | Booster Pump (1,200 gpm) at Zone 1 Tank | 1 | LS | $ 20,000 | $ 20,000 |
| | Booster Pump (776 gpm, 195' TDH, 75 hp) at treatment plant | 1 | LS | $ 20,000 | $ 20,000 |
| | Booster Pump (10 gpm) 16.5 to 40 psi | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 480,000 |
| | Acquire 50' by 50' of Land and permitting | 1 | LS | $ 200,000 | $ 200,000 |
| | Acquire 100' by 100' of Land and permitting for treatment plant | 1 | LS | $ 250,000 | $ 250,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | Total | $ 4,093,000 |

**Future Energy Cost Alternative 3**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 1,100 | 19.7% | | | | |
| Upland Wells in operation for Alternative 3 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [b] |
| Gallery Well | 515 | 9.2% | 80 | 515 | $41,200 | [c] |
| River Wells | 1,467 | 26.3% | 90 | 1,467 | $132,030 | |
| | 5,582 | 100.0% | | 5,582 | $479,870 | |
| Gallery Well Booster Pump at Treatment Plant | | | | | | |
| | 515 | | 40 | 515 | $20,600 | |
| Zone 1 to Zone 2 | | | | | | |
| | 3,769 | 67.5% | 40 | 3,769 | $150,760 | |
| Zone 2 to Zone 3 | | | | | | |
| | 633 | 11.3% | 80 | 633 | $50,640 | |
| | | | | Total | $701,870 | |
| | | | | $/AF | 126 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Gallery well booster pump | $41,200 | |
| | | | | Extra Pumping Cost | $120,592 | |
| | | | | $/AF | 14 | |

[a] Based on 80% operation per year
[b] Based on approximate 2013 water use (rounded)
[c] Limited to 515 acre-feet per year by water rights

**Alternative 4-1 Cost Estimate for Minimum Use of Upland Wells**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 1,590,000 |
| | 10 inch immediately downstream of 6 cfs well field | 500 | LF | $ 130 | $ 65,000 |
| | 10 Immediately downstream of 6 cfs well field | 2,000 | LF | $ 130 | $ 260,000 |
| | 12 Immediately downstream of Mesa Verde | 400 | LF | $ 150 | $ 60,000 |
| | 10 Immediately downstream of Mesa Verde | 1,800 | LF | $ 130 | $ 234,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 800 | LF | $ 150 | $ 120,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,600 | LF | $ 150 | $ 240,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,500 | LF | $ 150 | $ 225,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,300 | LF | $ 150 | $ 195,000 |
| | 8 Relocation Zone 1 meters to Zone 2 | 1,000 | LF | $ 110 | $ 110,000 |
| | Relocation Zone 1 meters to Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | 8 Immediately downsteram of new booster @ Zone 1 Tank | 600 | LF | $ 110 | $ 66,000 |
| [3] | **Control Valves** | | | | $ 155,000 |
| | Booster Pump (1,250 gpm, 60 hp) at Zone 1 Tank | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) Luma Yucca Rd | 1 | LS | $ 2,000 | $ 2,000 |
| | 8-inch valves | 4 | Each | $ 1,500 | $ 6,000 |
| | 10-inch valves | 6 | Each | $ 2,000 | $ 12,000 |
| | 12-inch valves | 10 | Each | $ 2,500 | $ 25,000 |
| | Blowoff valve assembly with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| | Air/vacuum and air relaease valve with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| [5] | **Pump Stations** | | | | $ 180,000 |
| | Booster Pump (1,250 gpm, 60 hp) at Zone 1 Tank | 75 | Hp | $ 1,600 | $ 120,000 |
| | Install new pump at Refugio-2 (1,500 gpm, 100 hp) | 75 | Hp | $ 600 | $ 45,000 |
| | Booster Pump (10 gpm) 17.1 to 60 psi | 1 | Hp | $ 15,000 | $ 15,000 |
| [6] | **Electrical Controls** | | | | $ 55,000 |
| | Booster Pump (1,250 gpm, 60 hp) at Zone 1 Tank | 1 | LS | $ 40,000 | $ 40,000 |
| | Refugio-2 upgrade to larger 100 hp pump | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ 25,000 |
| | SCADA Connection, components, operations for new booster, Z1 | 1 | LS | $ 25,000 | $ 25,000 |
| [9] | **Electrical Power Facilities** | | | | $ 30,000 |
| | Booster Pump (1,250 gpm, 60 hp) at Zone 1 Tank | 1 | LS | $ 20,000 | $ 20,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 230,000 |
| | Acquire 50' by 50' of Land and permitting | 1 | LS | $ 200,000 | $ 200,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 2,265,000** |

**Future Energy Cost Alternative 4-1**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 1,100 | 19.7% | | | | |
| Upland Wells in operation for Alternative 4 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [b] |
| River Wells | 1,982 | 35.5% | 90 | 1,982 | $178,380 | |
| | 5,582 | 100.0% | | 5,582 | $485,020 | |
| Zone 1 to Zone 2 | | | | | | |
| | 3,769 | 67.5% | 40 | 3,769 | $150,760 | |
| Zone 2 to Zone 3 | | | | | | |
| | 633 | 11.3% | 80 | 633 | $50,640 | |
| | | | | Total | $686,420 | |
| | | | | $/AF | 123 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Extra Pumping Cost | $63,942 | |
| | | | | $/AF | 11 | |

[a] Based on 80% operation per year

[b] Based on approximate 2013 water use (rounded)

**Alternative 5-1 Treat Wells 1, 2, 3 and Well 15 at Existing ID1 Shop Site Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | **$ 3,288,000** |
| | 8 inch pipe from well 3 to joint pipe to treatment plant | 5,400 | LF | $ 110 | $ 594,000 |
| | 16 Wells 3 and 15 to joint pipe to treatment plant | 4,400 | LF | $ 210 | $ 924,000 |
| | 10 Wells 1 and 2 to joint pipe to treatment plant | 2,500 | LF | $ 130 | $ 325,000 |
| | 6 Well 1 to joint pipe to treatment plant | 100 | LF | $ 110 | $ 11,000 |
| | 16 Joint pipe from wells 1, 2, 3 and 15 to treatment plant | 1,000 | LF | $ 210 | $ 210,000 |
| | 16 Treatment plant discharge pipe | 700 | LF | $ 210 | $ 147,000 |
| | 8 Immediately downstream of 6 cfs well field | 500 | LF | $ 110 | $ 55,000 |
| | 8 Immediately downstream of 6 cfs well field | 1,000 | LF | $ 110 | $ 110,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,600 | LF | $ 150 | $ 240,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,400 | LF | $ 150 | $ 210,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 2,100 | LF | $ 150 | $ 315,000 |
| | 8 Relocation Zone 1 meters to Zone 2 | 1,200 | LF | $ 110 | $ 132,000 |
| | Relocation Zone 1 meters to Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| [3] | **Control Valves** | | | | **$ 207,000** |
| | Well 15 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 3 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 2 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 1 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 6 and 8-inch valves | 10 | Each | $ 1,500 | $ 15,000 |
| | 10-inch valves | 2 | Each | $ 2,000 | $ 4,000 |
| | 12-inch valves | 6 | Each | $ 2,500 | $ 15,000 |
| | 16-inch valves | 6 | Each | $ 3,500 | $ 21,000 |
| | Blowoff valve assembly with valve box | 12 | Each | $ 5,000 | $ 60,000 |
| | Air/vacuum and air relaease valve with valve box | 12 | Each | $ 5,000 | $ 60,000 |
| [5] | **Pump Stations** | | | | **$ 63,000** |
| | Booster Pump (10 gpm) 16.8 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| | Well #3 pump and motor (600 gpm, 75 hp) | 1 | LS | $ 48,000 | $ 48,000 |
| [6] | **Electrical Controls** | | | | **$ 15,000** |
| | Refugio-2 upgrade to operate 2 pumps | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | **$ 25,000** |
| | SCADA Connection, components, operations for treatment plant | 1 | LS | $ 25,000 | $ 25,000 |
| [8] | **Water Treatment** | | | | **$ 20,000** |
| | Well #3 cleaning and development | 1 | LS | $ 20,000 | $ 20,000 |
| [9] | **Electrical Power Facilities** | | | | **$ 10,000** |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | **$ 30,000** |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 3,658,000** |

**Future Energy Cost Alternative 5-1**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 2,631 | 47.1% | | | | Z2 & 3 |
| | 1,100 | | | | | Z3 |
| | 1,531 | | | | | Z2 |
| Upland Wells in operation for Alternative 5-1 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| Well 1 | 163 | | 123 | 163 | $20,049 | [b] |
| Well 2 | 402 | | 123 | 402 | $49,446 | [b] |
| Well 3 | 0 | | 86 | 0 | $0 | [b] |
| Well 15 | 966 | | 86 | 966 | $83,076 | [b] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [c] |
| River Wells | 451 | 8.1% | 91 | 451 | $41,041 | |
| | 5,582 | 100.0% | | 5,582 | $500,252 | |
| Zone 1 to Zone 2 | | | | | | |
| | 2,238 | 40.1% | 40 | 2,238 | $89,520 | |
| Zone 2 to Zone 3 | | | | | | |
| | 633 | 11.3% | 80 | 633 | $50,640 | |
| | | | | Total | $640,412 | |
| | | | | $/AF | 115 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | WTP Booster Pump Cost from Hazen & Sawyer | $54,000 | |
| | | | | $/AF | 10 | |
| | | | | Extra Pumping Cost | $71,934 | |
| | | | | $/AF | 13 | |

[a] Based on 80% operation per year

[b] Based on 50% operation per year

[c] Based on approximate 2013 water use (rounded)

**Alternative 5-2 Treat Well 27 and Well 28 at Well 27 Site Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | **$ 1,597,000** |
| | 10 inch pipe from well 28 to well 27 treatment plant | 4,000 | LF | $ 130 | $ 520,000 |
| | 8 Immediately downstream of 6 cfs well field | 500 | LF | $ 110 | $ 55,000 |
| | 8 Immediately downstream of 6 cfs well field | 1,000 | LF | $ 110 | $ 110,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,600 | LF | $ 150 | $ 240,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,400 | LF | $ 150 | $ 210,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 2,100 | LF | $ 150 | $ 315,000 |
| | 8 Relocation Zone 1 meters to Zone 2 | 1,200 | LF | $ 110 | $ 132,000 |
| | Relocation Zone 1 meters to Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| [3] | **Control Valves** | | | | **$ 120,000** |
| | Well 27 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 28 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) 16.6 to 60 psi | 1 | LS | $ 2,000 | $ 2,000 |
| | 8-inch valves | 6 | Each | $ 1,500 | $ 9,000 |
| | 10-inch valves | 2 | Each | $ 2,000 | $ 4,000 |
| | 12-inch valves | 6 | Each | $ 2,500 | $ 15,000 |
| | 16-inch valves | 0 | Each | $ 3,500 | $ - |
| | Blowoff valve assembly with valve box | 7 | Each | $ 5,000 | $ 35,000 |
| | Air/vacuum and air relaease valve with valve box | 7 | Each | $ 5,000 | $ 35,000 |
| [5] | **Pump Stations** | | | | **$ 15,000** |
| | Booster Pump (10 gpm) 16.6 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| [6] | **Electrical Controls** | | | | **$ 5,000** |
| | Booster Pump (10 gpm) 16.6 to 60 psi | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | **$ 25,000** |
| | SCADA Connection, components, operations for treatment plant | 1 | LS | $ 25,000 | $ 25,000 |
| [9] | **Electrical Power Facilities** | | | | **$ 10,000** |
| | Booster Pump (10 gpm) 16.6 to 60 psi | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | **$ 36,000** |
| | Acquire 20' by 1,500' ROW for pipe from well 28 and permitting | 1,500 | LF | $4 | $ 6,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 1,808,000** |

**Future Energy Cost Alternative 5-2**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 2,713 | 48.6% | | | | Z2 & 3 |
| | 1,583 | | | | | Z3 |
| | 1,130 | | | | | Z2 |
| Upland Wells in operation for Alternative 5-2 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| Well 27 | 1,009 | | 124 | 1,009 | $125,116 | [b] |
| Well 28 | 604 | | 90 | 604 | $54,360 | [b] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [c] |
| River Wells | 369 | 6.6% | 91 | 369 | $33,579 | |
| | 5,582 | 100.0% | | 5,582 | $519,695 | |
| Zone 1 to Zone 2 | | | | | | |
| | 2,156 | 38.6% | 40 | 2,156 | $86,240 | |
| Zone 2 to Zone 3 | | | | | | |
| | 150 | 2.7% | 80 | 150 | $11,984 | |
| | | | | Total | $617,919 | |
| | | | | $/AF | 111 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | WTP Booster Pump Cost from Hazen & Sawyer | $54,000 | |
| | | | | $/AF | 10 | |
| | | | | Extra Pumping Cost | $49,441 | |
| | | | | $/AF | 9 | |

[a] Based on 80% operation per year
[b] Based on 50% operation per year
[c] Based on approximate 2013 water use (rounded)

**Alternative 6 Cost Estimate for Well Treatment (packers) of Wells 7, 25, 27, and 28**
**All costs are the same for each of the alternatives using 25% reduction in well flow**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 1,634,000 |
| | 8 inch pipe immediately downstream of 6 cfs well field | 500 | LF | $ 110 | $ 55,000 |
| | 8 Immediately downstream of 6 cfs well field | 1,000 | LF | $ 110 | $ 110,000 |
| | 12 Immediately downstream of Mesa Verde | 700 | LF | $ 150 | $ 105,000 |
| | 12 Immediately downstream of Mesa Verde | 1,700 | LF | $ 150 | $ 255,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 800 | LF | $ 150 | $ 120,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,600 | LF | $ 150 | $ 240,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,400 | LF | $ 150 | $ 210,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 2,100 | LF | $ 150 | $ 315,000 |
| | 8 Relocation Zone 1 meters to Zone 2 | 1,200 | LF | $ 110 | $ 132,000 |
| | Relocation Zone 1 meters to Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | 8 Immediately downsteram of new booster @ Zone 1 Tank | 700 | LF | $ 110 | $ 77,000 |
| [3] | **Control Valves** | | | | $ 154,000 |
| | Booster Pump (1,200 gpm) at Zone 1 Tank | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 8-inch valves | 8 | Each | $ 1,500 | $ 12,000 |
| | 10-inch valves | 0 | Each | $ 2,000 | $ - |
| | 12-inch valves | 12 | Each | $ 2,500 | $ 30,000 |
| | Blowoff valve assembly with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| | Air/vacuum and air relaease valve with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| [5] | **Pump Stations** | | | | $ 135,000 |
| | Booster Pump (1,200 gpm) at Zone 1 Tank | 75 | Hp | $ 1,600 | $ 120,000 |
| | Booster Pump (10 gpm) 16.5 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| [6] | **Electrical Controls** | | | | $ 55,000 |
| | Booster Pump (1,200 gpm) at Zone 1 Tank | 1 | LS | $ 40,000 | $ 40,000 |
| | Refugio-2 upgrade to operate all 3 pumps | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ 25,000 |
| | SCADA Connection, components, operations for new booster | 1 | LS | $ 25,000 | $ 25,000 |
| [9] | **Electrical Power Facilities** | | | | $ 30,000 |
| | Booster Pump (1,200 gpm) at Zone 1 Tank | 1 | LS | $ 20,000 | $ 20,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 230,000 |
| | Acquire 50' by 50' of Land and permitting | 1 | LS | $ 200,000 | $ 200,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 2,263,000** |

**Future Energy Cost Alternative 6-1 Well 7 Packer**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 1,626 | 29.1% | | | | |
| Upland Wells in operation for Alternative 6-1 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 7 | 526 | | 153 | 526 | $80,478 | [b] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [c] |
| River Wells | 1,456 | 26.1% | 90 | 1,456 | $131,040 | |
| | 5,582 | 100.0% | | 5,582 | $518,158 | |
| Zone 1 to Zone 2 | | | | | | |
| | 3,243 | 58.1% | 40 | 3,243 | $129,720 | |
| Zone 2 to Zone 3 | | | | | | |
| | 107 | 1.9% | 80 | 107 | $8,560 | |
| | | | | Total | $656,438 | |
| | | | | $/AF | 118 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Extra Pumping Cost | $33,960 | |
| | | | | $/AF | 6 | |

[a] Based on 80% operation per year

[b] Based on 50% operation per year and 25% reduction in flow

[c] Based on approximate 2013 water use (rounded)

**Future Energy Cost Alternative 6-2 Well 25 Packer**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 1,664 | 29.8% | | | | |
| Upland Wells in operation for Alternative 6-2 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 25 | 564 | | 107 | 564 | $60,348 | [b] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [c] |
| River Wells | 1,418 | 25.4% | 90 | 1,418 | $127,620 | |
| | 5,582 | 100.0% | | 5,582 | $494,608 | |
| Zone 1 to Zone 2 | | | | | | |
| | 3,205 | 57.4% | 40 | 3,205 | $128,200 | |
| Zone 2 to Zone 3 | | | | | | |
| | 69 | 1.2% | 80 | 69 | $5,520 | |
| | | | | Total | $628,328 | |
| | | | | $/AF | 113 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Extra Pumping Cost | $5,850 | |
| | | | | $/AF | 1 | |

[a] Based on 80% operation per year

[b] Based on 50% operation per year and 25% reduction in flow

[c] Based on approximate 2013 water use (rounded)

**Future Energy Cost Alternative 6-3 Well 28 Packer**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 1,502 | 26.9% | | | | |
| Upland Wells in operation for Alternative 6-3 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 28 | 402 | | 90 | 402 | $36,180 | [b] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [c] |
| River Wells | 1,580 | 28.3% | 90 | 1,580 | $142,200 | |
| | 5,582 | 100.0% | | 5,582 | $485,020 | |
| Zone 1 to Zone 2 | | | | | | |
| | 3,367 | 60.3% | 40 | 3,367 | $134,680 | |
| Zone 2 to Zone 3 | | | | | | |
| | 231 | 4.1% | 80 | 231 | $18,480 | |
| | | | | Total | $638,180 | |
| | | | | $/AF | 114 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Extra Pumping Cost | $15,702 | |
| | | | | $/AF | 2 | |

[a] Based on 80% operation per year

[b] Based on 50% operation per year and 25% reduction in flow

[c] Based on approximate 2013 water use (rounded)

**Future Energy Cost Alternative 6-4 Well 27 Packer**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 1,867 | 33.4% | | | | |
| Upland Wells in operation for Alternative 6-4 | | | | | | |
| Well 5 | 324 | | 140 | 324 | 45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | 87,300 | [a] |
| Well 7 | 0 | | 153 | 0 | 0 | |
| Well 25 | 0 | | 107 | 0 | 0 | |
| Well 27 | 767 | | 124 | 767 | 95,108 | [b] |
| Well 24 | 388 | | 210 | 388 | 81,480 | [a] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | 92,500 | [c] |
| River Wells | 1,215 | 21.8% | 90 | 1,215 | 109,350 | |
| | 5,582 | 100.0% | | 5,582 | 511,098 | |
| Zone 1 to Zone 2 | | | | | | |
| | 3,002 | 53.8% | 40 | 3,002 | 120,080 | |
| Zone 2 to Zone 3 | | | | | | |
| | 633 | 11.3% | 80 | 633 | 50,640 | |
| | | | | Total | 681,818 | |
| | | | | $/AF | 122 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Extra Pumping Cost | $59,340 | |
| | | | | $/AF | 10 | |

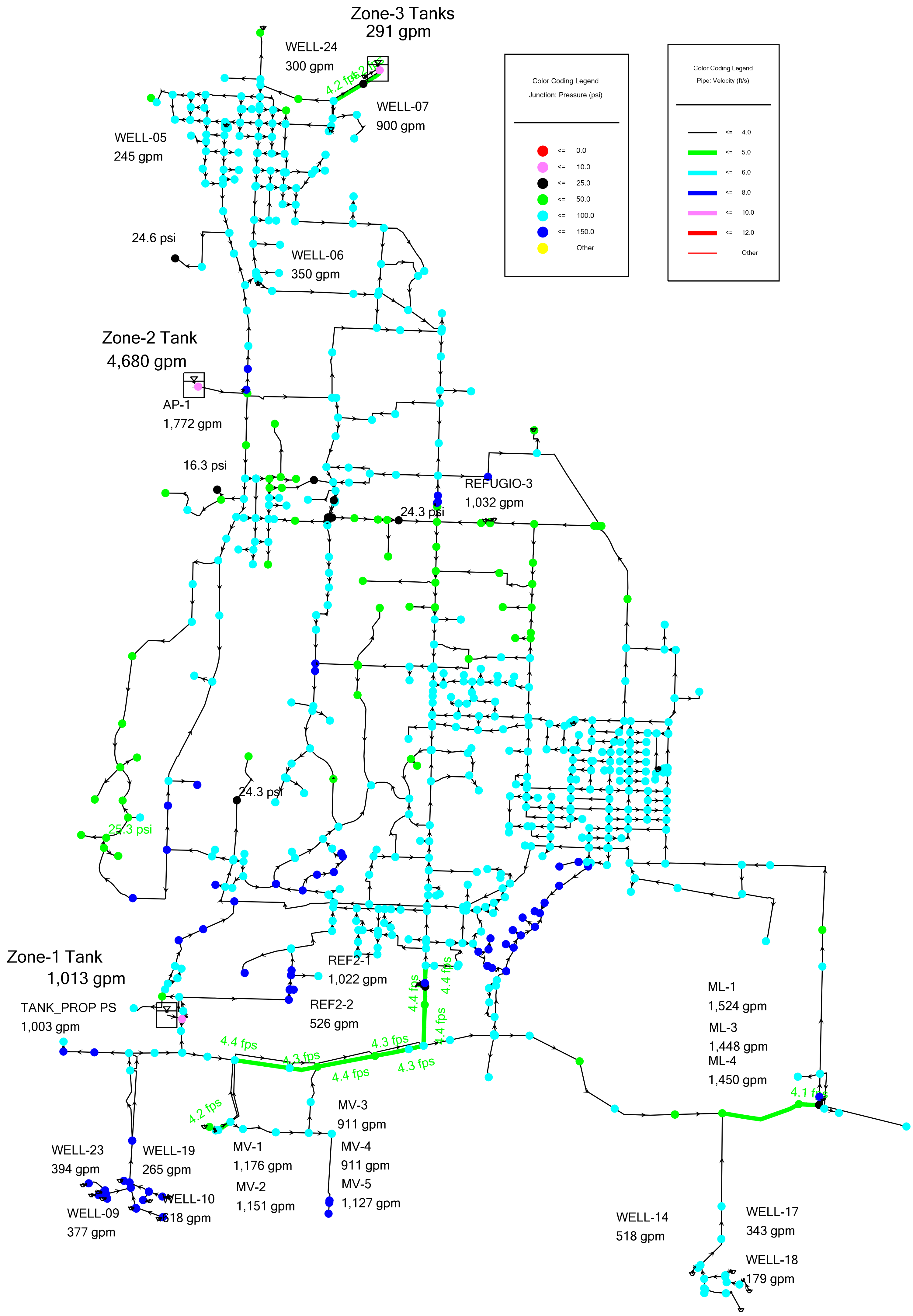
[a] Based on 80% operation per year

[b] Based on 50% operation per year and 25% reduction in flow

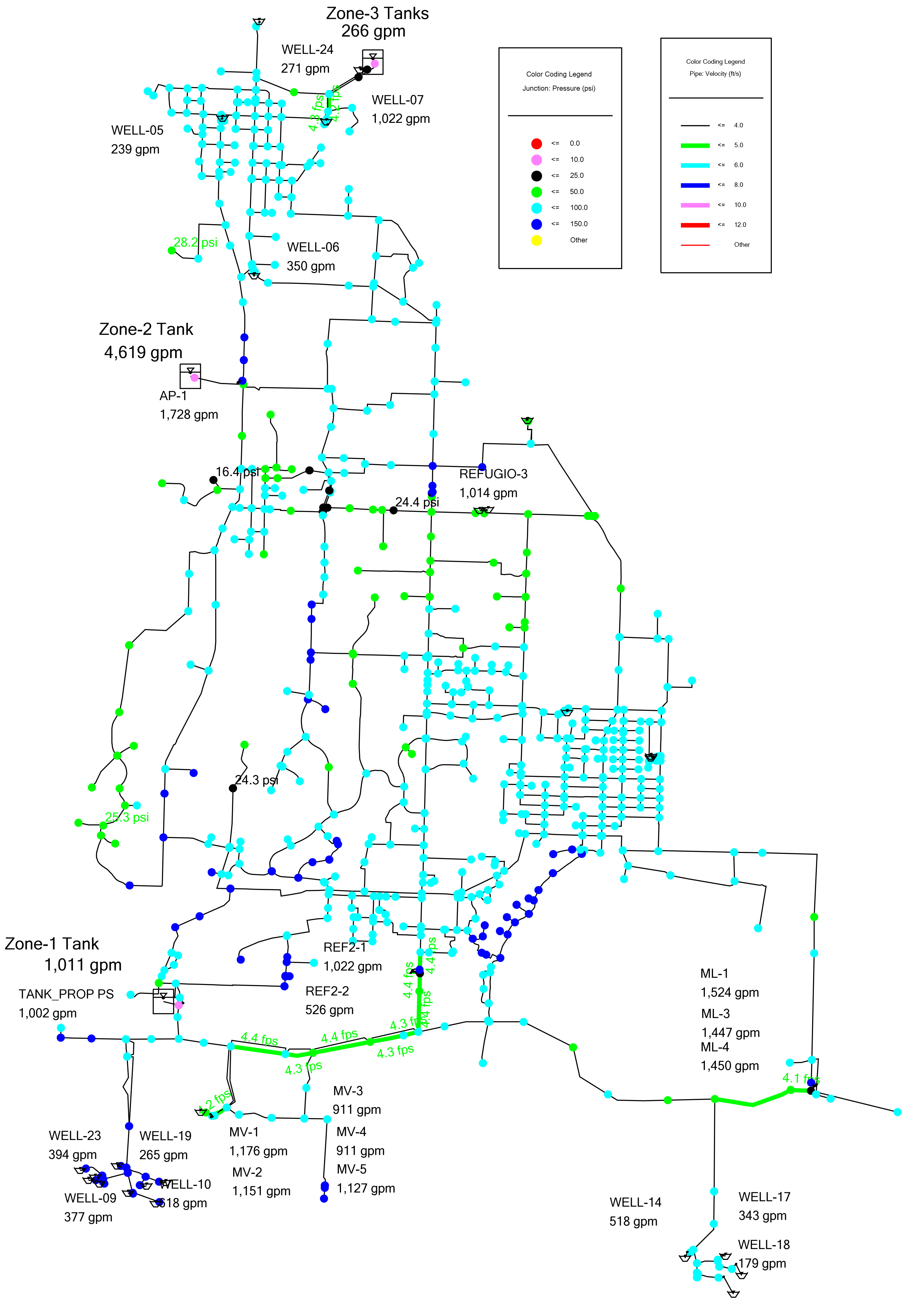
[c] Based on approximate 2013 water use (rounded)

# Attachment B

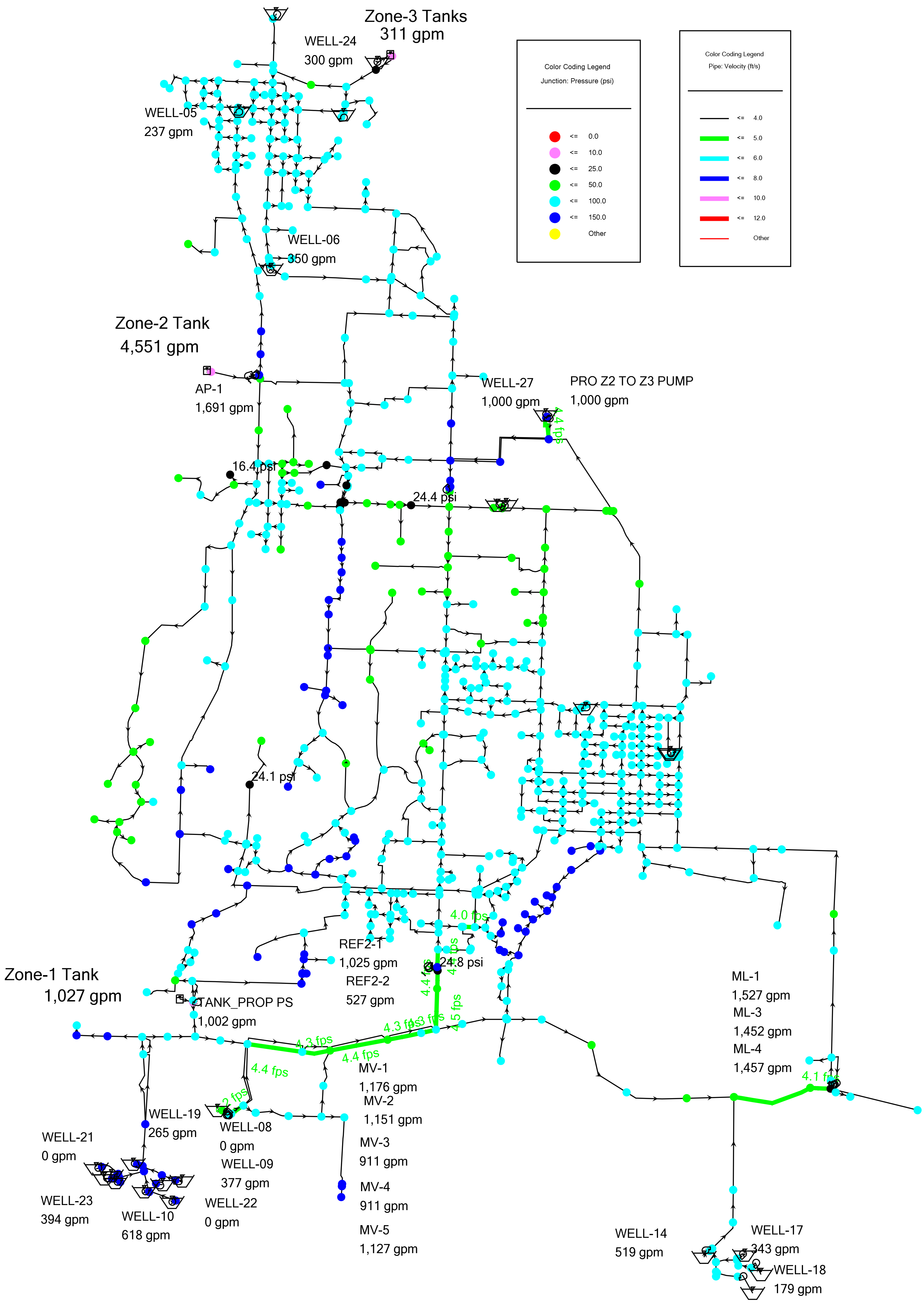
## Alternative 1-1: Blend Well 7 with Well 24 into Existing 0.5 MG Zone 3 Tank
## Proposed Solutions
## Maximum Hour Demand



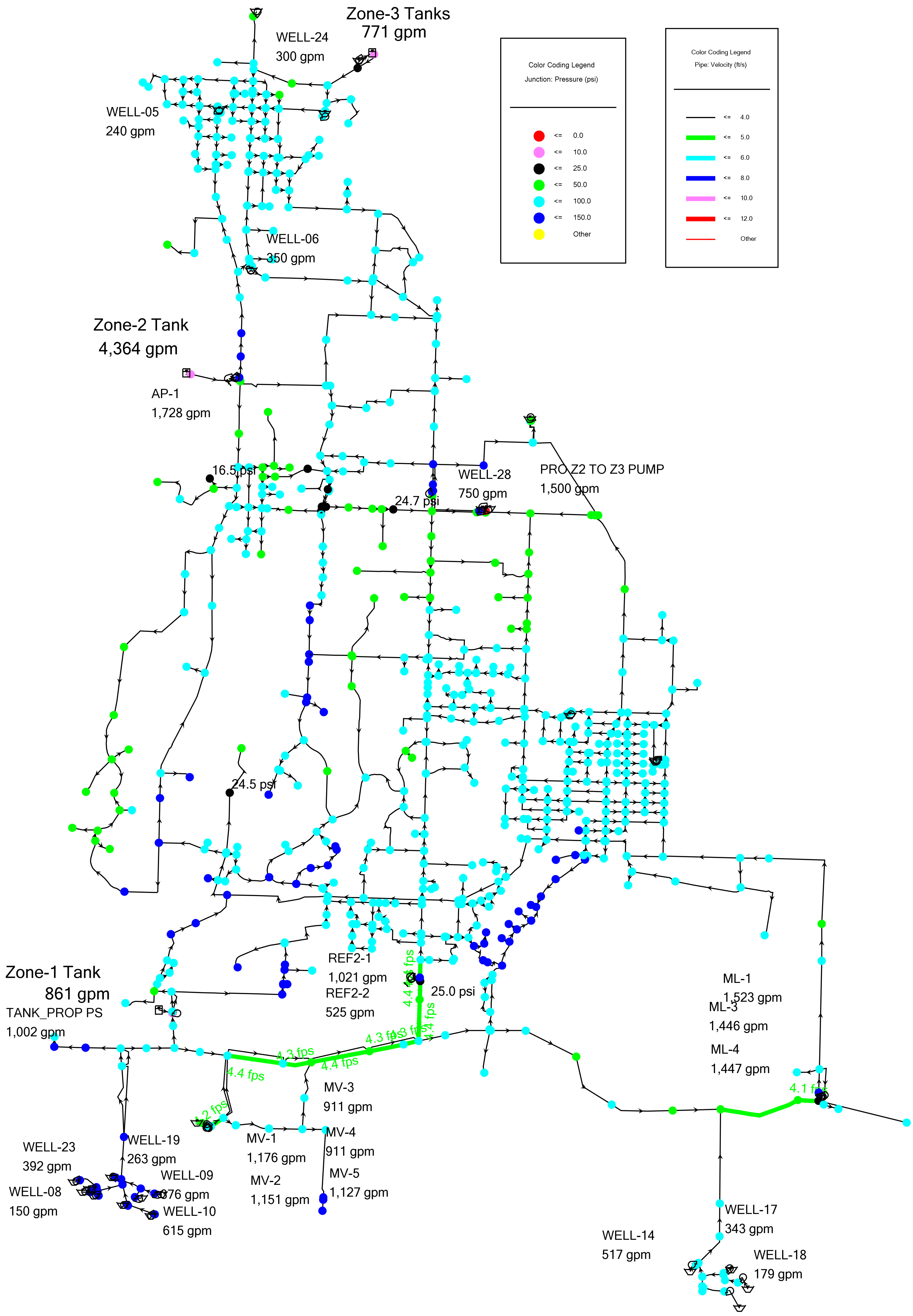
# Alternative 1-2: Blend Well7 with Well 24 at Well 7 Site
## Proposed Solutions
## Maximum Hour Demand



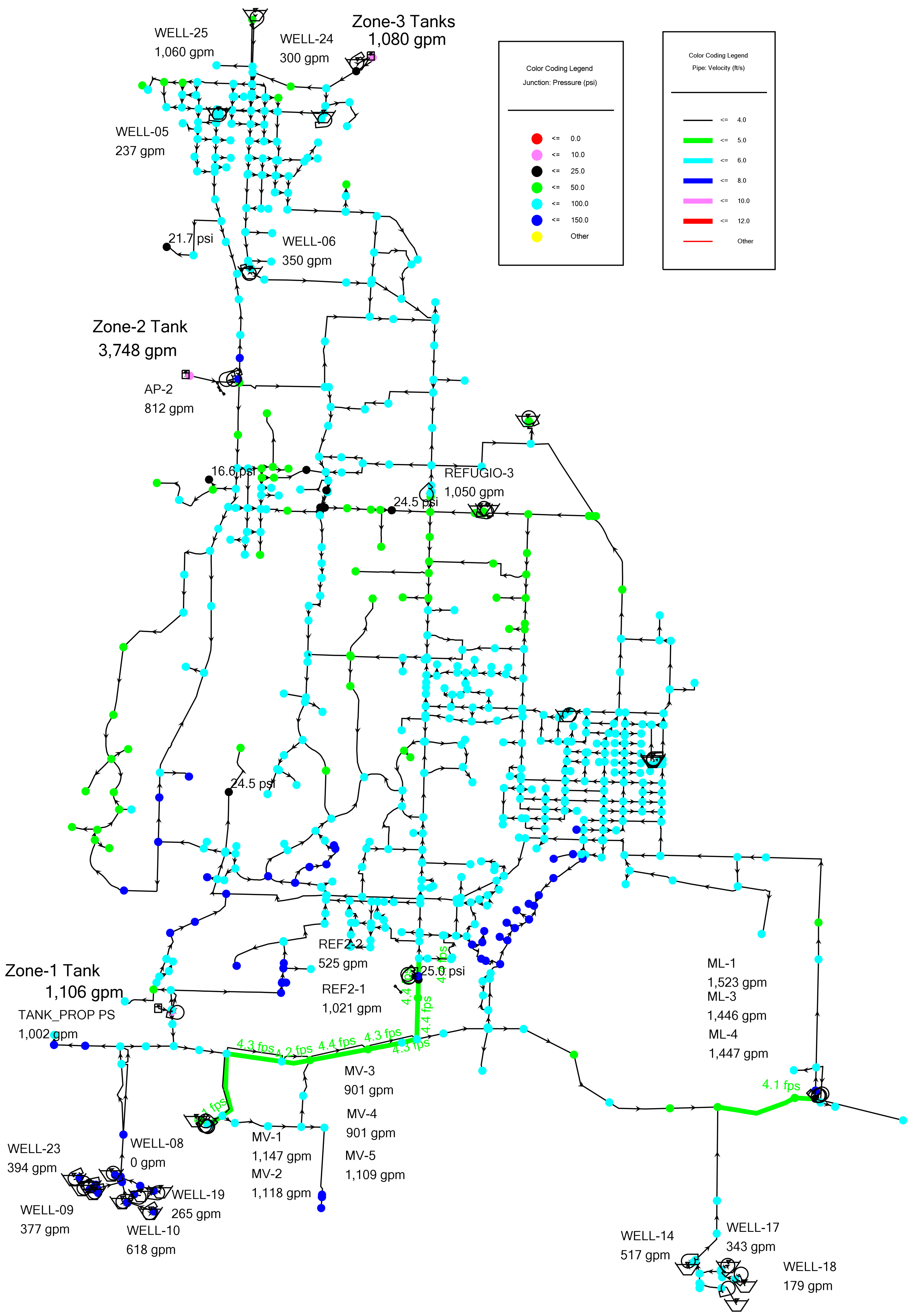
## Alternative 1-3: Blend Well 27 With Zone 2 Water then pumped into Zone-3
## Proposed Solutions
## Maximum Hour Demand



# Alternative 1-4: Blend Well 28 With Zone 2 Water then pumped into Zone-3
## Proposed Solutions
## Maximum Hour Demand



# Alternative 1-5: Blend Well 5 with Well 25 at Well 25 Site
## Proposed Solutions
## Maximum Hour Demand

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27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
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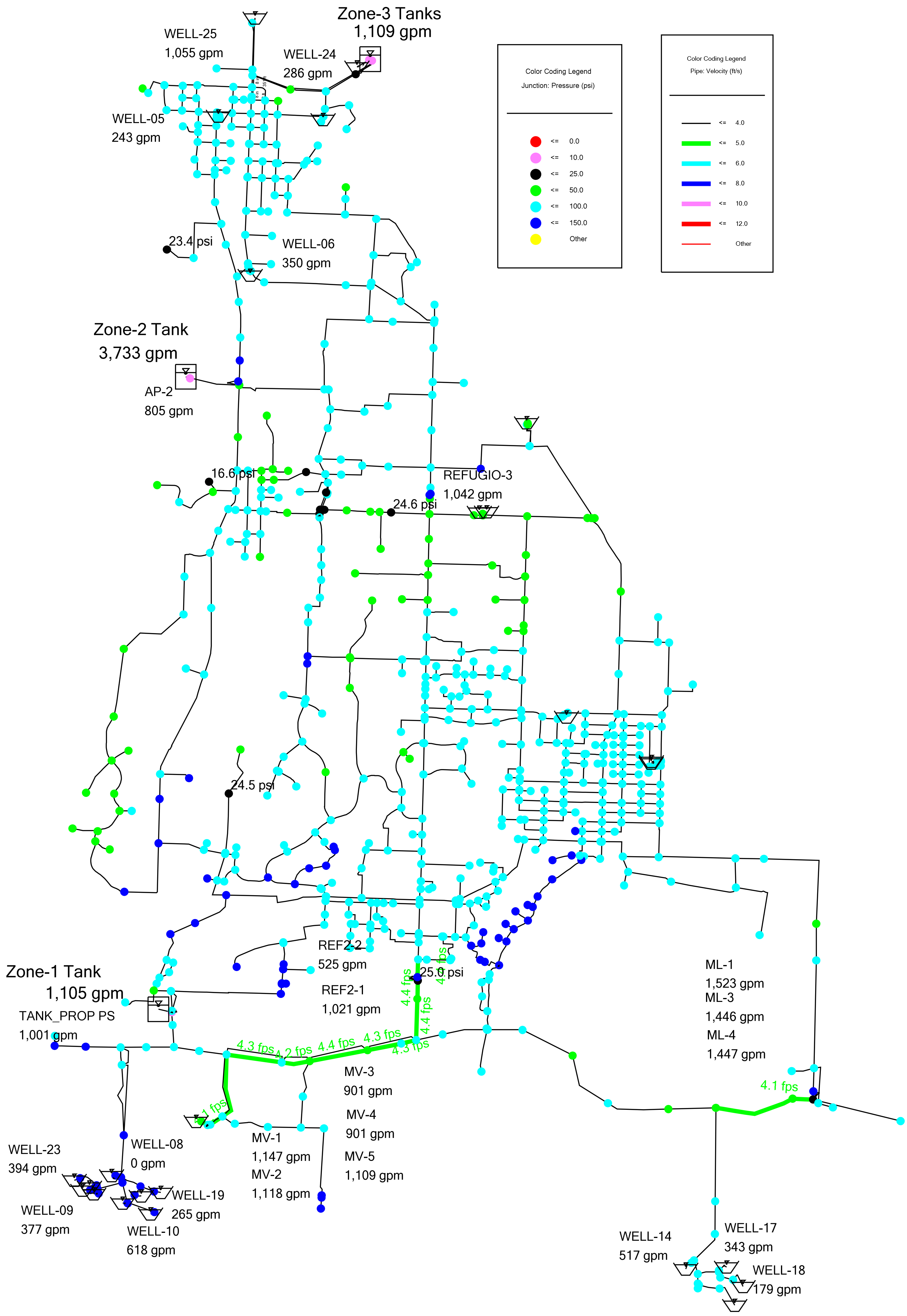
Bentley WaterCAD V8i
[08.11.00.30]

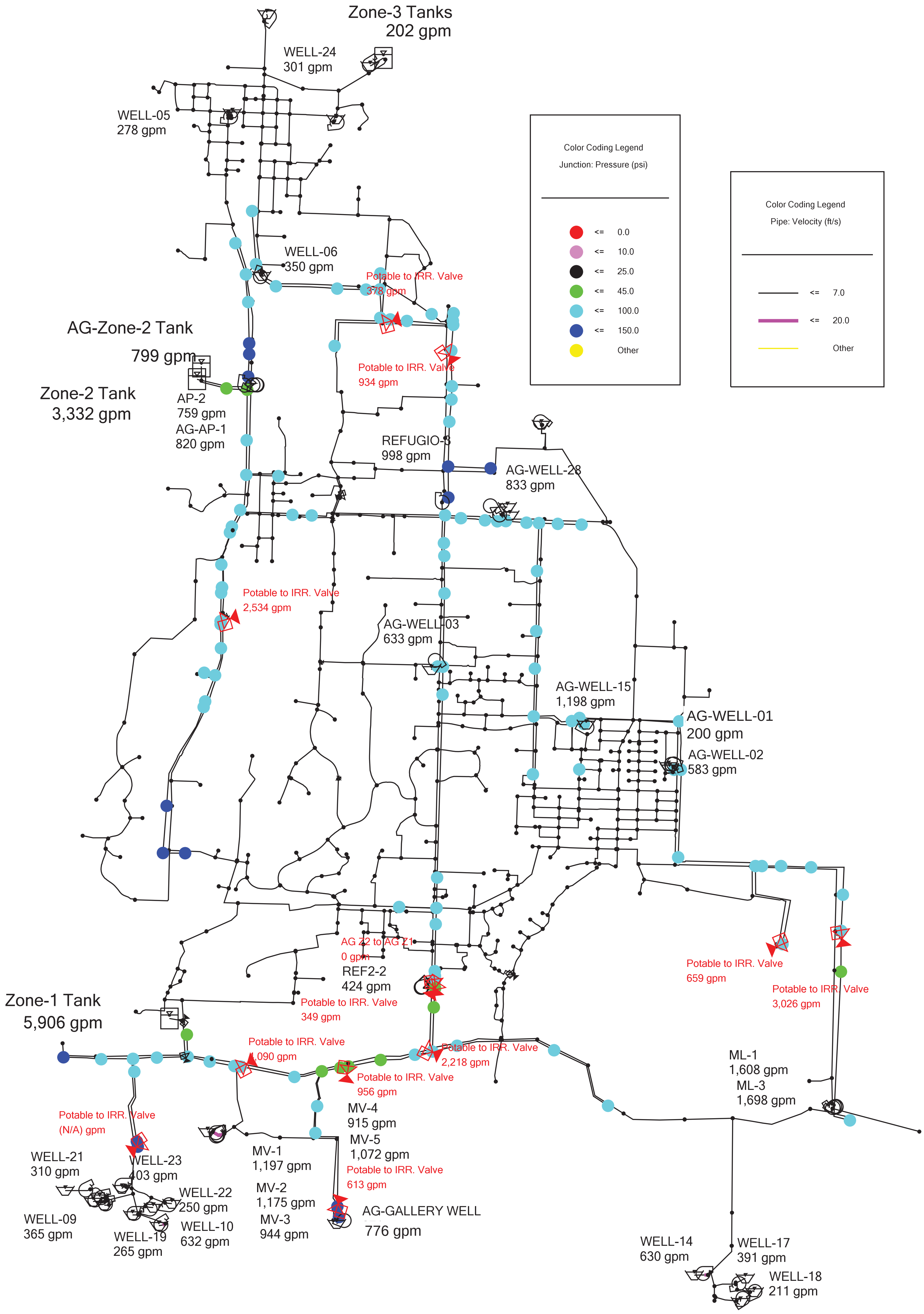
## Alternative 1-6: Blend Well 24 with Well 25 at Well 25 Site

## Proposed Solutions

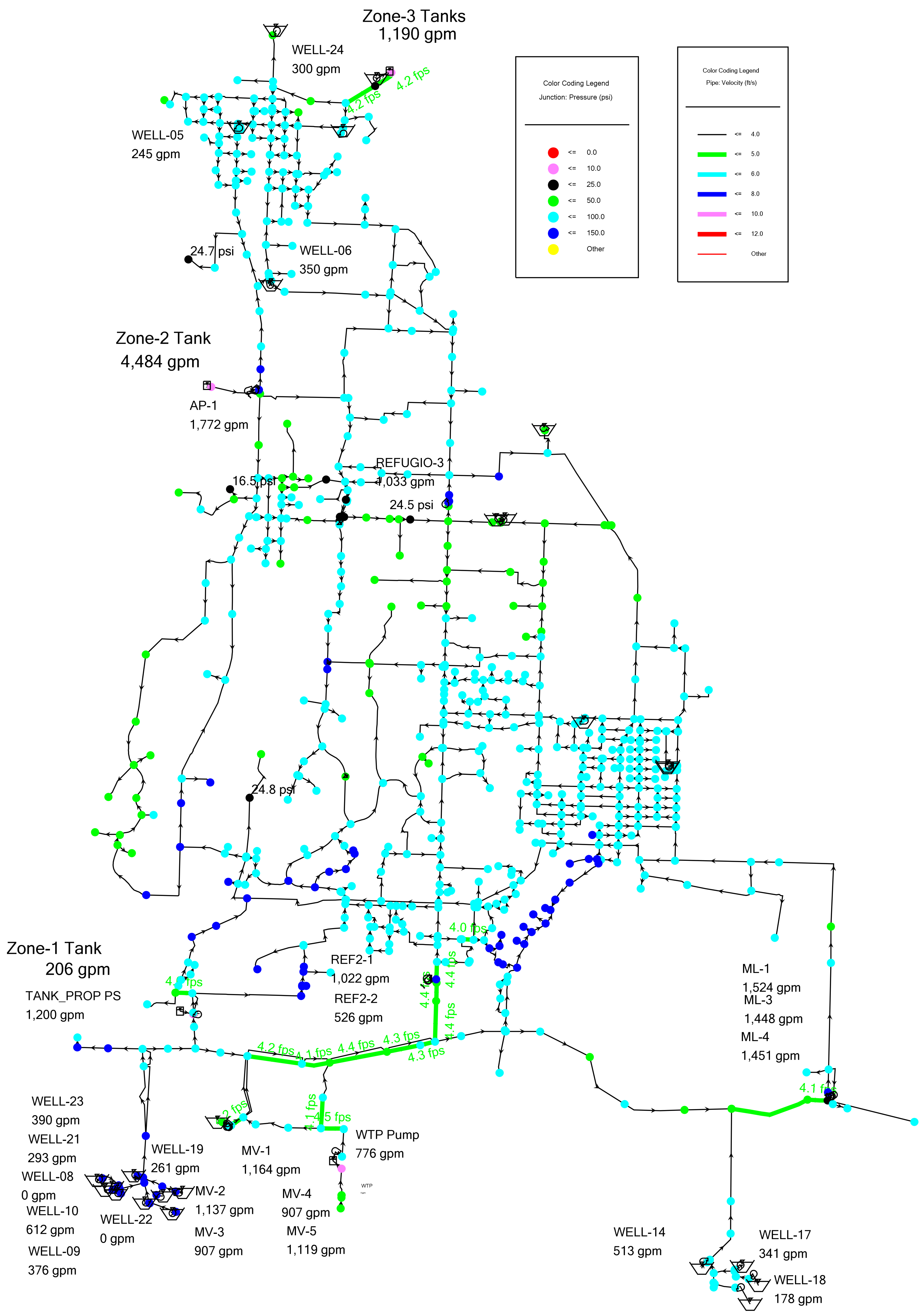
## Maximum Hour Demand



## Alternative 2: Separate Irrigation Water System
## 2013 April Demand (1,870 gpm) with Frost Protection Demand (20,119 gpm)
## Total Irrigation Demand = 21,989 gpm

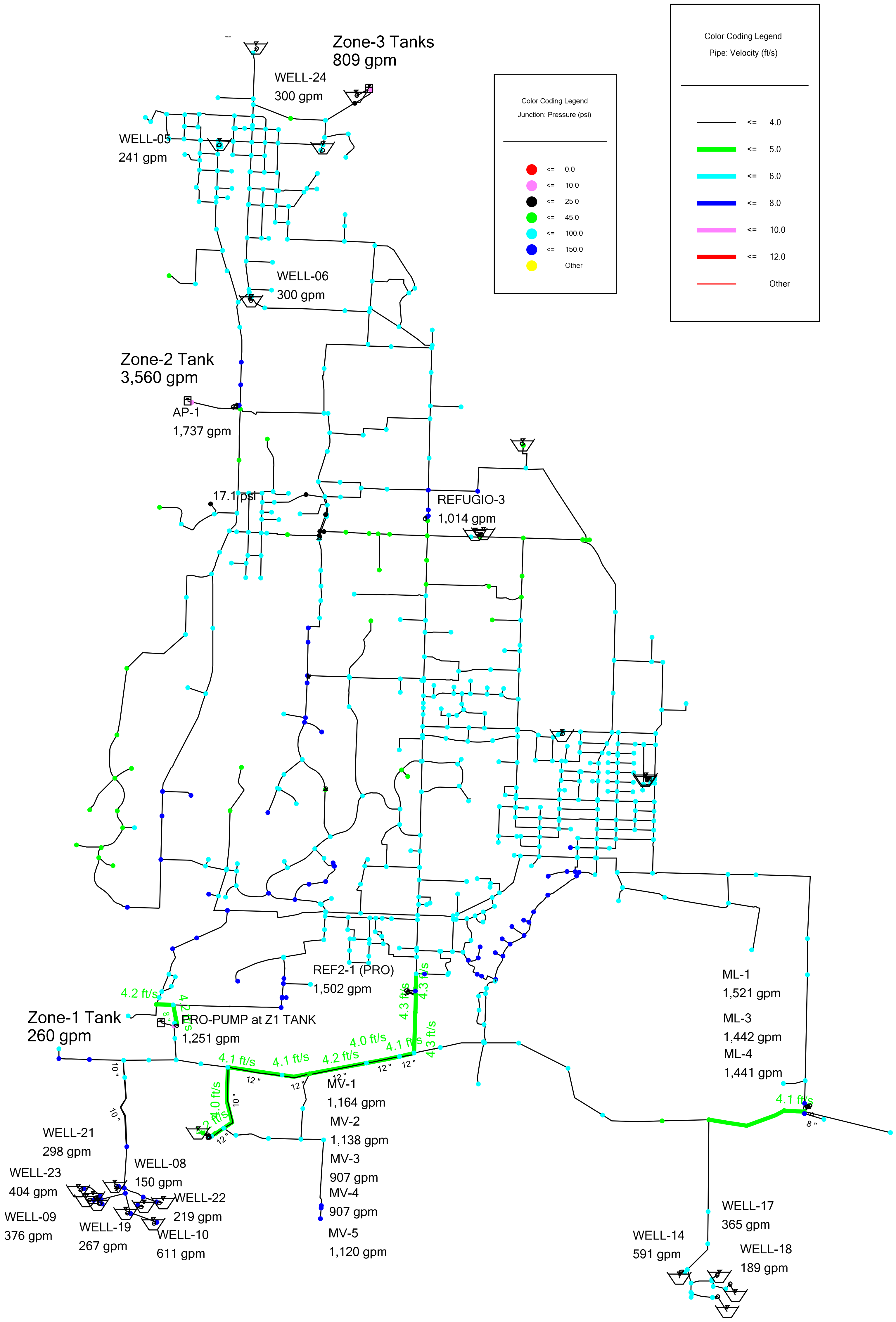


# Alternative 3: Surface Water Treatment Gallery Well
## Proposed Solutions
## Maximum Hour Demand

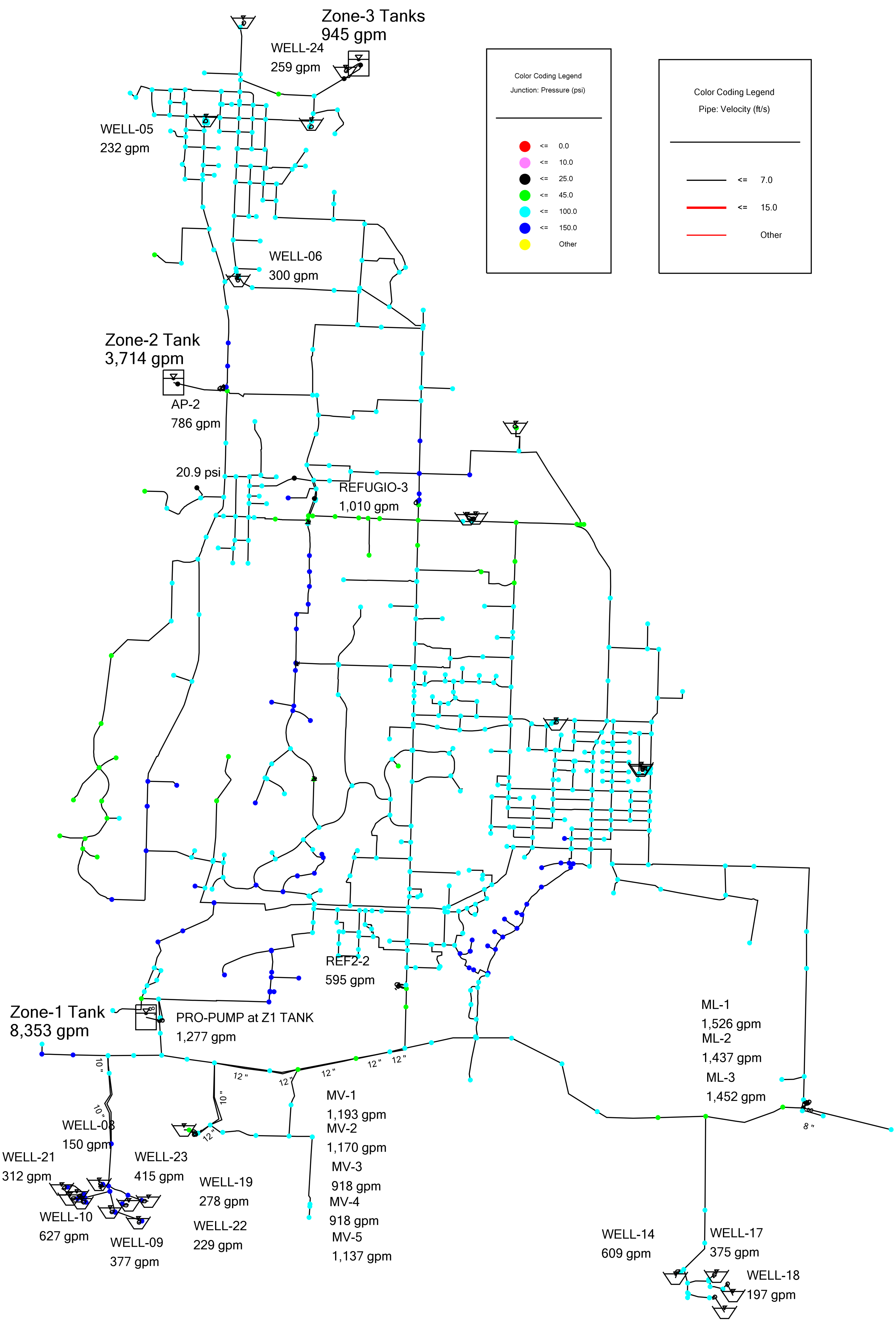


# Alternative 4-1

## Proposed Solutions, Maximum Hour Demand (14,175 gpm)



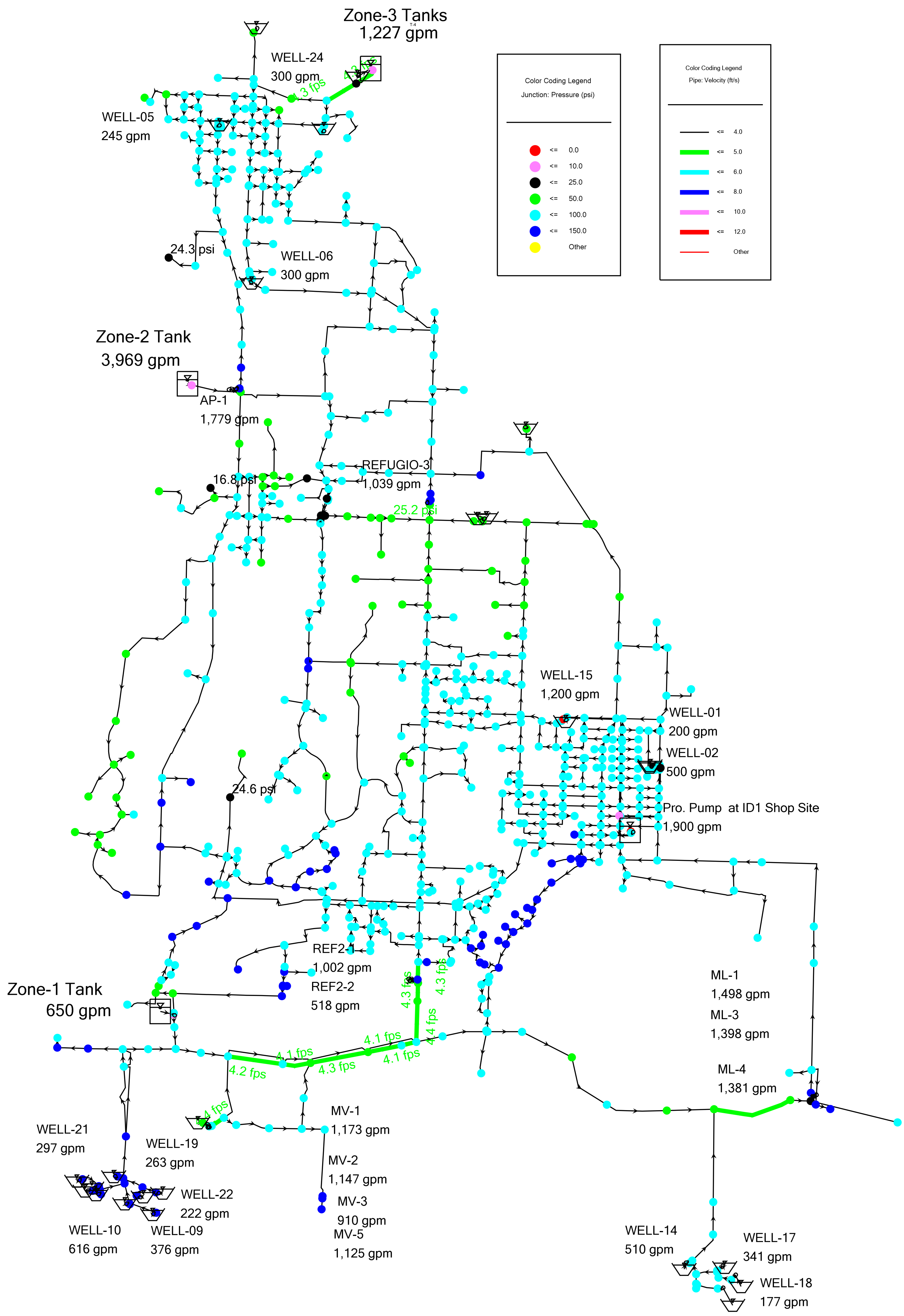
# Alternative 4-2
# Proposed Solutions
# April Demand plus Frost Protection Demand



# Alternative 5-1: Treat Well 2 and Well 15 at Existing ID#1 Shop Site

## Proposed Solutions

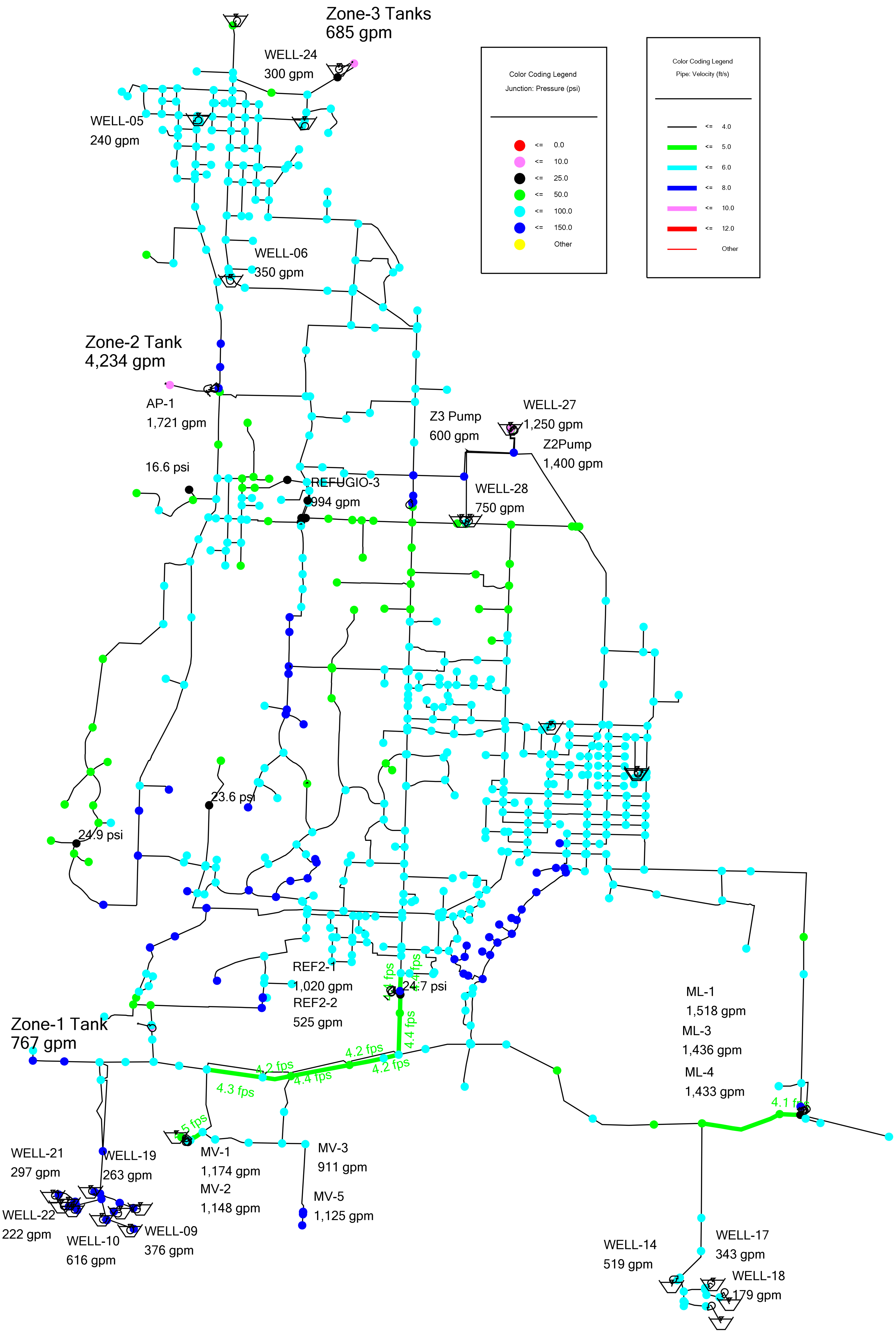
## Maximum Hour Demand



# Alternative 5-2: Treat Well 27 with Well 28 at Well 27 Site

## Proposed Solutions

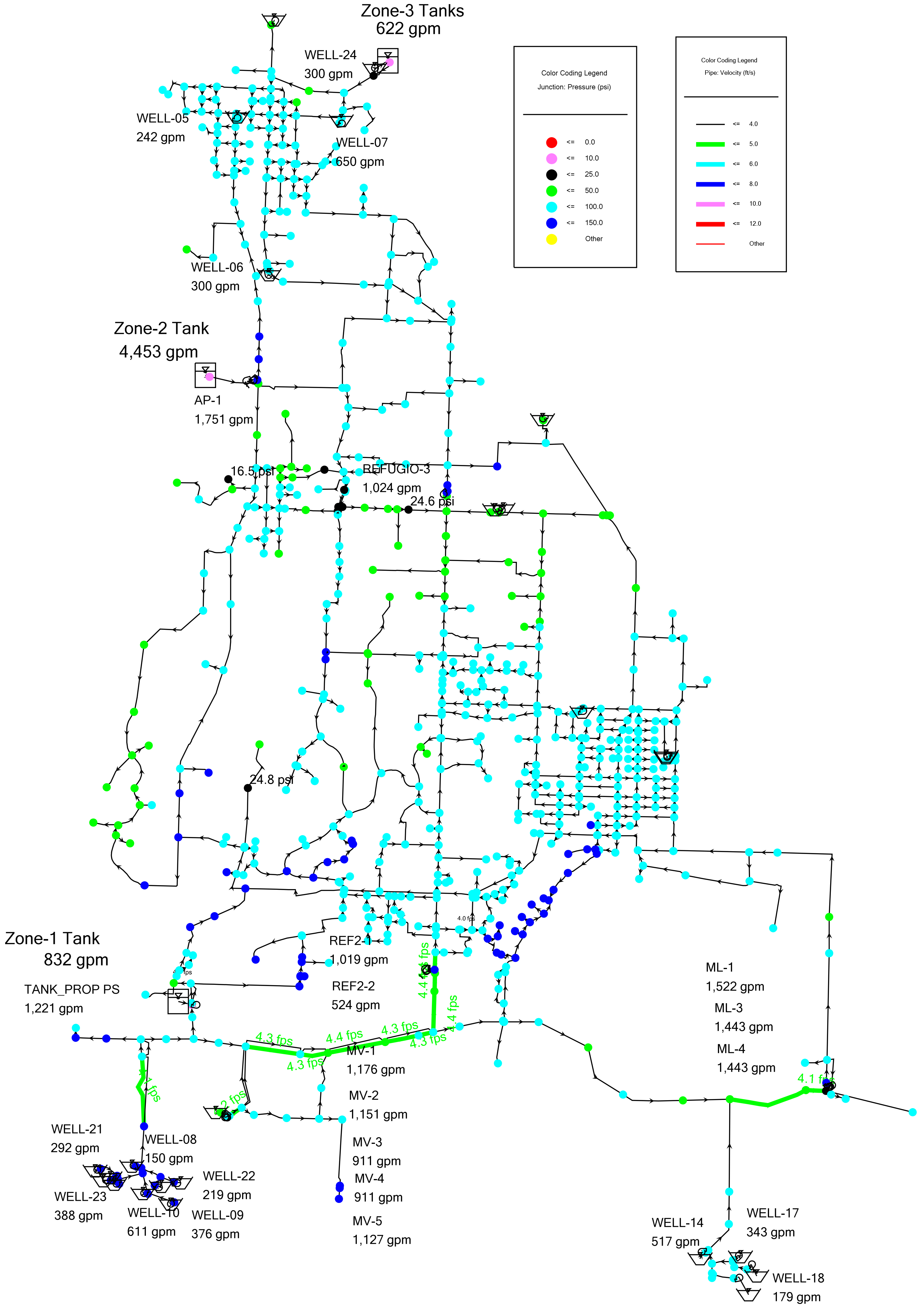
## Maximum Hour Demand



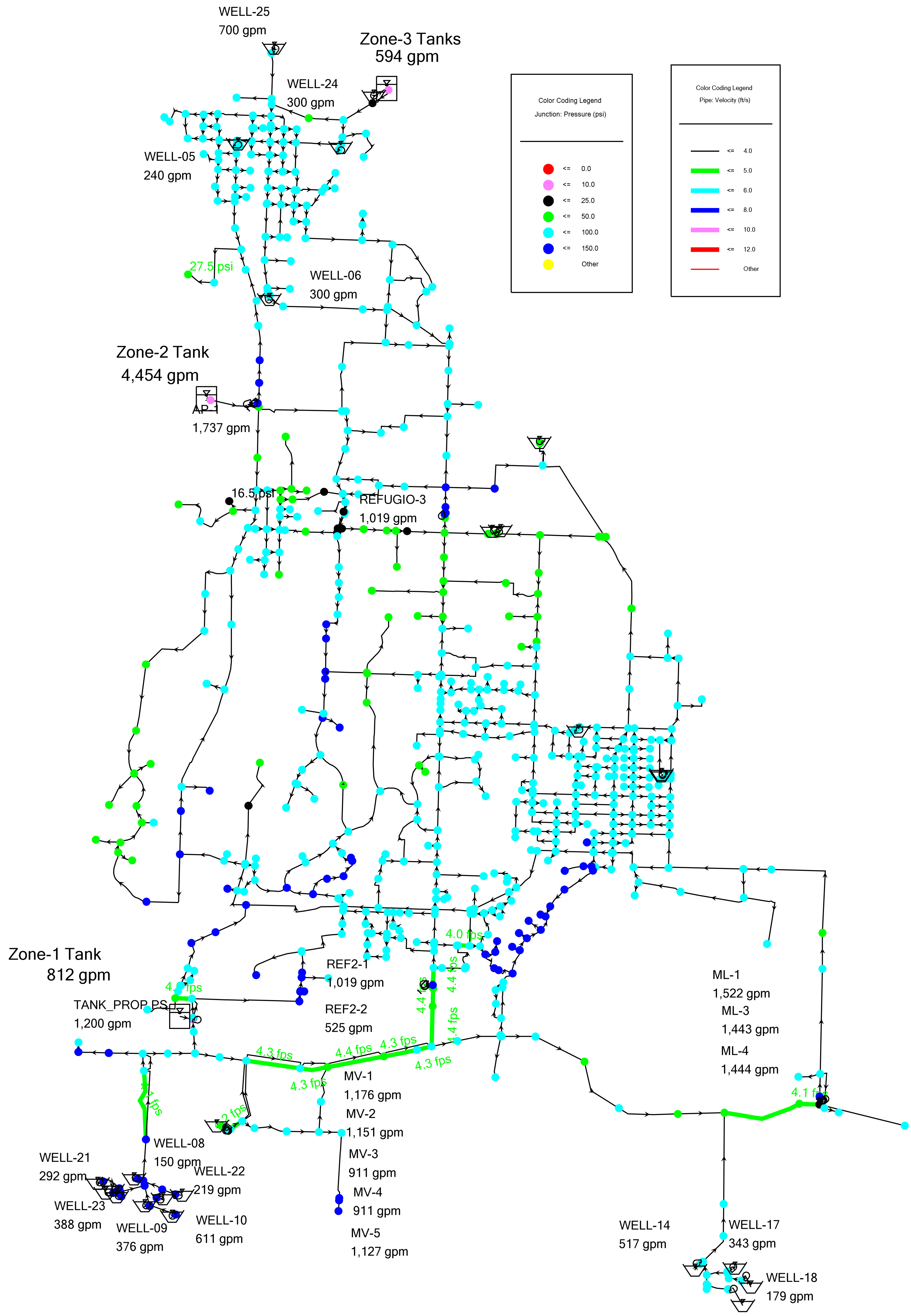
# Alternative 6-1: Well 7- Block Inflow From High Cr6 Zone, 25% Flow Reduction

## Proposed Solutions

## Maximum Hour Demand



# Alternative 6-2: Well 25- Block Inflow From High Cr6 Zone, 25% Flow Reduction
## Proposed Solutions
## Maximum Hour Demand

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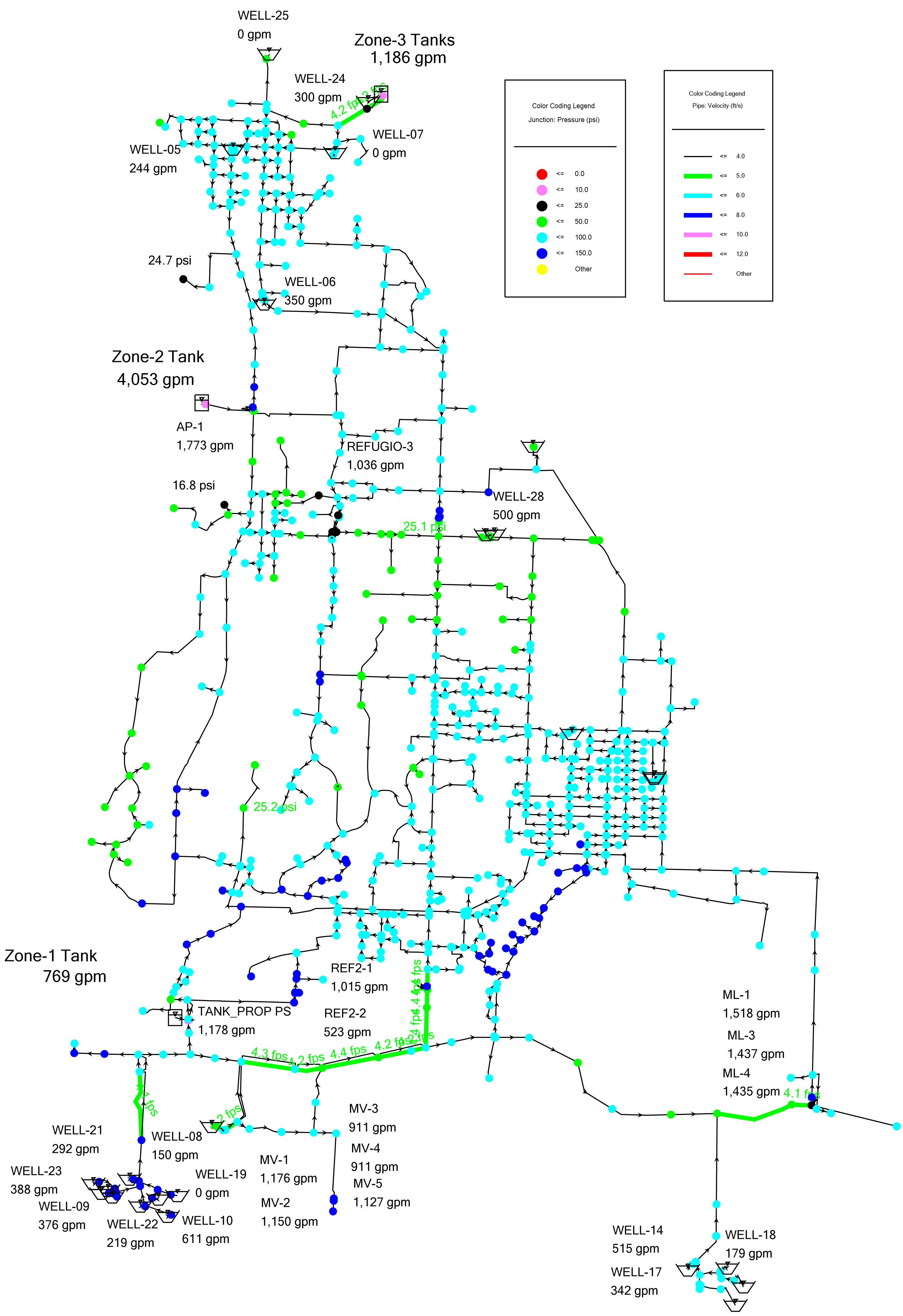
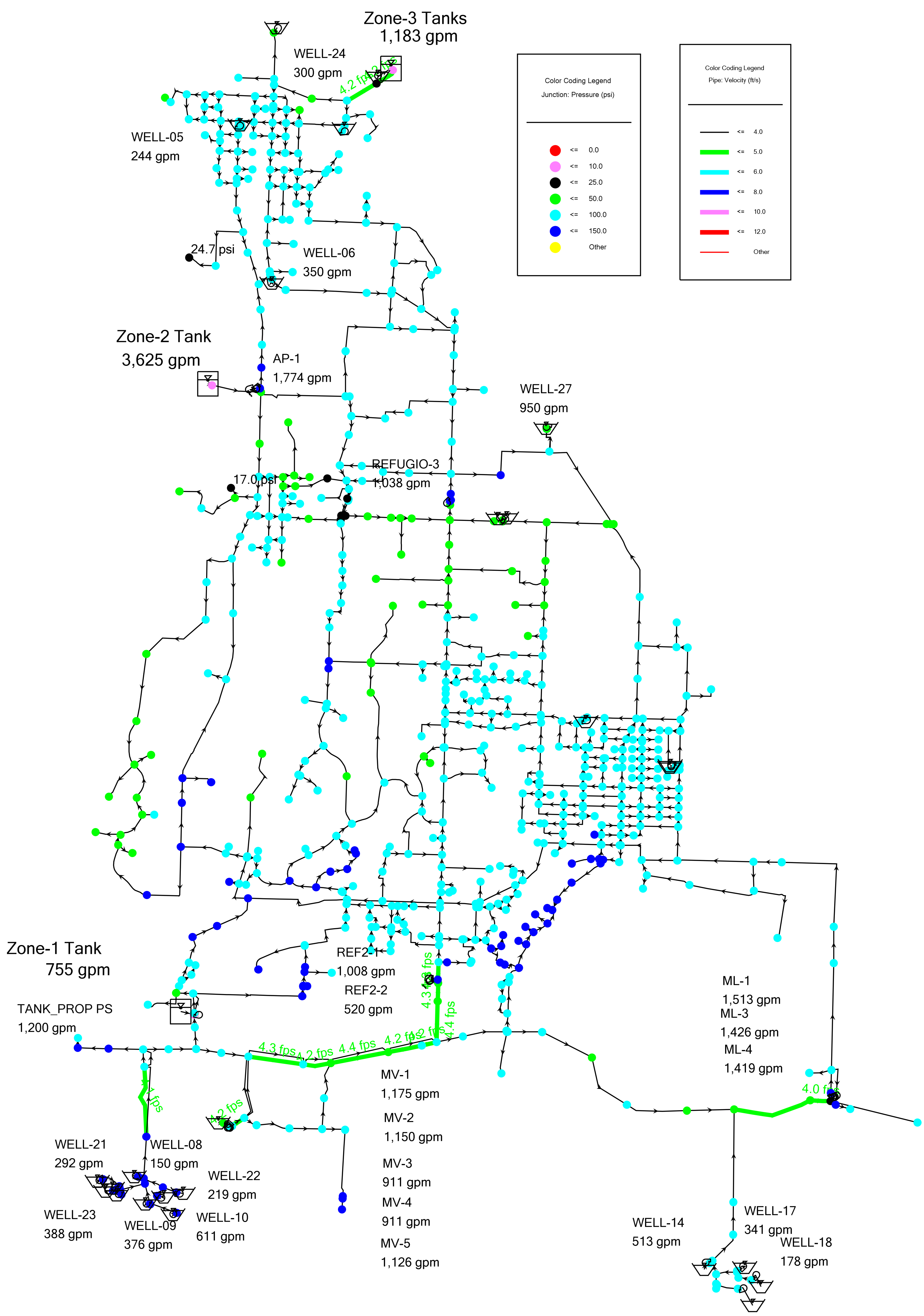
Bentley WaterCAD V8i
[08.11.00.30]

# Alternative 6-3: Well 28- Block Inflow from High Cr6 Zone
## Proposed Solutions
## Maximum Hour Demand



# Alternative 6-4: Well 27- Block Inflow From High Cr6 Zone, 25% Flow Reduction
## Proposed Solutions
## Maximum Hour Demand



# Attachment C

## Alterative 1-1
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 245 | 3 |
| Upland | 6 | 300 | 350 | 3 |
| Upland | 7 | 900 | 900 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 0 | 3 |
| Upland | 27 | 1,250 | 0 | 2 |
| Upland | 28 | 750 | 0 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***1,795*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 377 | 1 |
| 6 cfs well field | 10 | 600 | 618 | 1 |
| 6 cfs well field | 19 | 260 | 265 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 394 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,654*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 518 | 1 |
| 4 cfs well field | 17 | 375 | 343 | 1 |
| 4 cfs well field | 18 | 200 | 179 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,040*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **4,489** | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,176 | 1 |
| | MV-2 | 1,145 | 1,151 | 1 |
| | MV-3 | 885 | 911 | 1 |
| | MV-4 | 865 | 911 | 1 |
| | MV-5 | 1,105 | 1,127 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,276*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,765** | |

## Alterative 1-1
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,772 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,772*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,032 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***2,804*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,022 | 2 |
| | 2 | 500 | 526 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,548*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,524 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,448 | 2 |
| | 4 | 1,500 | 1,450 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,422*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,970** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Zone 1 Tank | NA | 1,000 | 1,000 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,000 | 1,258 | -258 |
| 2 | 4,166 | 5,312 | -1,146 |
| 3 | 4,599 | 2,957 | 1,642 |
| **Total** | **9,765** | **9,527** | **238** |

**Alterative 1-2**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 239 | 3 |
| Upland | 6 | 300 | 350 | 3 |
| Upland | 7 | 900 | 1,022 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 271 | 3 |
| Upland | 25 | 950 | 0 | 3 |
| Upland | 27 | 1,250 | 0 | 2 |
| Upland | 28 | 750 | 0 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***1,882*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 377 | 1 |
| 6 cfs well field | 10 | 600 | 618 | 1 |
| 6 cfs well field | 19 | 260 | 265 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 394 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,654*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 518 | 1 |
| 4 cfs well field | 17 | 375 | 343 | 1 |
| 4 cfs well field | 18 | 200 | 179 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,040*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **4,576** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,176 | 1 |
| | MV-2 | 1,145 | 1,151 | 1 |
| | MV-3 | 885 | 911 | 1 |
| | MV-4 | 865 | 911 | 1 |
| | MV-5 | 1,105 | 1,127 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,276*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,852** | |

## Alterative 1-2
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,728 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,728*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,014 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***2,742*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,022 | 2 |
| | 2 | 500 | 526 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,548*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,524 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,447 | 2 |
| | 4 | 1,500 | 1,450 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,421*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,969** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Zone 1 Tank | NA | 1,000 | 1,002 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 999 | 1,258 | -259 |
| 2 | 4,229 | 5,312 | -1,083 |
| 3 | 4,624 | 2,957 | 1,667 |
| **Total** | **9,852** | **9,527** | **325** |

## Alterative 1-3
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 237 | 3 |
| Upland | 6 | 300 | 350 | 3 |
| Upland | 7 | 900 | 0 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 0 | 3 |
| Upland | 27 | 1,250 | 1,000 | 3 |
| Upland | 28 | 750 | 0 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***1,887*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 377 | 1 |
| 6 cfs well field | 10 | 600 | 618 | 1 |
| 6 cfs well field | 19 | 260 | 265 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 394 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,654*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 519 | 1 |
| 4 cfs well field | 17 | 375 | 343 | 1 |
| 4 cfs well field | 18 | 200 | 179 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,041*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **4,582** | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,176 | 1 |
| | MV-2 | 1,145 | 1,151 | 1 |
| | MV-3 | 885 | 911 | 1 |
| | MV-4 | 865 | 911 | 1 |
| | MV-5 | 1,105 | 1,127 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,276*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,858** | |

## Alterative 1-3
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,697 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,697*** | |
| Refugio-3 (REF-3) | NA | 950 | 0 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***1,697*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,022 | 2 |
| | 2 | 500 | 526 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,548*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,527 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,452 | 2 |
| | 4 | 1,500 | 1,457 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,436*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,984** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Zone 1 Tank | NA | 1,000 | 1,000 | 2 |
| Pump at Well27 (Z2 to Z3) | NA | 1,000 | 1,000 | 3 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 987 | 1,258 | -271 |
| 2 | 4,287 | 5,312 | -1,025 |
| 3 | 4,584 | 2,957 | 1,627 |
| **Total** | **9,858** | **9,527** | **331** |

## Alterative 1-4
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 240 | 3 |
| Upland | 6 | 300 | 350 | 3 |
| Upland | 7 | 900 | 0 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 0 | 3 |
| Upland | 27 | 1,250 | 0 | 2 |
| Upland | 28 | 750 | 750 | 3 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***1,640*** | |
| 6 cfs well field | 8 | 150 | 150 | 1 |
| 6 cfs well field | 9 | 375 | 376 | 1 |
| 6 cfs well field | 10 | 600 | 615 | 1 |
| 6 cfs well field | 19 | 260 | 263 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 392 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,796*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 517 | 1 |
| 4 cfs well field | 17 | 375 | 343 | 1 |
| 4 cfs well field | 18 | 200 | 179 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,039*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **4,475** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,176 | 1 |
| | MV-2 | 1,145 | 1,151 | 1 |
| | MV-3 | 885 | 911 | 1 |
| | MV-4 | 865 | 911 | 1 |
| | MV-5 | 1,105 | 1,127 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,276*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,751** | |

**Alterative 1-4**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,728 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,728*** | |
| Refugio-3 (REF-3) | NA | 950 | 0 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***1,728*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,021 | 2 |
| | 2 | 500 | 525 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,546*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,523 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,446 | 2 |
| | 4 | 1,500 | 1,447 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,416*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,962** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Zone 1 Tank | NA | 1,000 | 1,002 | 2 |
| Pump at Well28 (Z2 to Z3) | NA | 1,500 | 1,500 | 3 |

**Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)**

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,147 | 1,258 | -111 |
| 2 | 4,486 | 5,312 | -826 |
| 3 | 4,118 | 2,957 | 1,161 |
| **Total** | **9,751** | **9,527** | **224** |

**Alterative 1-5**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 237 | 3 |
| Upland | 6 | 300 | 350 | 3 |
| Upland | 7 | 900 | 0 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 1,060 | 3 |
| Upland | 27 | 1,250 | 0 | 2 |
| Upland | 28 | 750 | 0 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***1,947*** | |
| | | | | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 377 | 1 |
| 6 cfs well field | 10 | 600 | 618 | 1 |
| 6 cfs well field | 19 | 260 | 265 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 394 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,654*** | |
| | | | | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 517 | 1 |
| 4 cfs well field | 17 | 375 | 343 | 1 |
| 4 cfs well field | 18 | 200 | 179 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,039*** | |
| | | | | |
| Gallery Well | | *776* | 0 | 1 |
| | | | | |
| | ***Subtotal (Wells)*** | **12,011** | **4,640** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,147 | 1 |
| | MV-2 | 1,145 | 1,118 | 1 |
| | MV-3 | 885 | 901 | 1 |
| | MV-4 | 865 | 901 | 1 |
| | MV-5 | 1,105 | 1,109 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,176*** | |
| | | | | |
| | **Total (Wells + SWP)** | **17,211** | **9,816** | |

**Alterative 1-5**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 0 | 3 |
| | 2 | 750 | 812 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***812*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,050 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***1,862*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,021 | 2 |
| | 2 | 500 | 525 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,546*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,523 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,446 | 2 |
| | 4 | 1,500 | 1,447 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,416*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,962** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Zone 1 Tank | NA | 1,000 | 1,002 | 2 |

**Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)**

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 905 | 1,258 | -353 |
| 2 | 5,102 | 5,312 | -210 |
| 3 | 3,809 | 2,957 | 852 |
| **Total** | **9,816** | **9,527** | **289** |

**Alterative 1-6**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 243 | 3 |
| Upland | 6 | 300 | 350 | 3 |
| Upland | 7 | 900 | 0 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 286 | 3 |
| Upland | 25 | 950 | 1,055 | 3 |
| Upland | 27 | 1,250 | 0 | 2 |
| Upland | 28 | 750 | 0 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***1,934*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 377 | 1 |
| 6 cfs well field | 10 | 600 | 618 | 1 |
| 6 cfs well field | 19 | 260 | 265 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 394 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,654*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 517 | 1 |
| 4 cfs well field | 17 | 375 | 343 | 1 |
| 4 cfs well field | 18 | 200 | 179 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,039*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **4,627** | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,147 | 1 |
| | MV-2 | 1,145 | 1,118 | 1 |
| | MV-3 | 885 | 901 | 1 |
| | MV-4 | 865 | 901 | 1 |
| | MV-5 | 1,105 | 1,109 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,176*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,803** | |

## Alterative 1-6
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 0 | 3 |
| | 2 | 750 | 805 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***805*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,042 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***1,847*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,021 | 2 |
| | 2 | 500 | 525 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,546*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,523 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,446 | 2 |
| | 4 | 1,500 | 1,447 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,416*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,962** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Zone 1 Tank | NA | 1,000 | 1,001 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 906 | 1,258 | -352 |
| 2 | 5,116 | 5,312 | -196 |
| 3 | 3,781 | 2,957 | 824 |
| **Total** | **9,803** | **9,527** | **276** |

**Alterative 2**
**Proposed Solutions, April Water Demand plus Frost Protection Demand (21,989 gpm)**
**Well and Pump Operation Summary (Irrigation Water System Only)**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 200 | 2 |
| Upland | 2 | 500 | 583 | 2 |
| Upland | 3 | 600 | 633 | 2 |
| Upland | 15 | 1,200 | 1,198 | 2 |
| Upland | 28 | 750 | 833 | 2 |
| | ***Subtotal (Upland)*** | ***3,250*** | ***3,447*** | |
| Gallery Well | | *776* | 776 | 1 |
| | ***Subtotal (Wells)*** | **4,026** | **4,223** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at AP Pump Station | NA | 820 | 820 | 3 |

**Comparison of Water Supply Pumping Capacity and 2013 April Water Demand plus Frost Protection Demand**

| Zone | Model Inflow (gpm) | 2013 Irrigation Water Demand | Frost Protection | Total (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|---|---|
| 1 | 776 | 891 | 10,649 | 11,540 | -10,764 |
| 2 | 3,447 | 634 | 6,745 | 7,379 | -3,932 |
| 3 | 0 | 345 | 2,725 | 3,070 | -3,070 |
| **Total** | **4,223** | **1,870** | **20,119** | **21,989** | **-17,766** |

**Alterative 3**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 245 | 3 |
| Upland | 6 | 300 | 350 | 3 |
| Upland | 7 | 900 | 0 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 0 | 3 |
| Upland | 27 | 1,250 | 0 | 2 |
| Upland | 28 | 750 | 0 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***895*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 376 | 1 |
| 6 cfs well field | 10 | 600 | 612 | 1 |
| 6 cfs well field | 19 | 260 | 261 | 1 |
| 6 cfs well field | 21 | 275 | 293 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 390 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,932*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 513 | 1 |
| 4 cfs well field | 17 | 375 | 341 | 1 |
| 4 cfs well field | 18 | 200 | 178 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,032*** | |
| Gallery Well | | *776* | 776 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **4,635** | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,164 | 1 |
| | MV-2 | 1,145 | 1,137 | 1 |
| | MV-3 | 885 | 907 | 1 |
| | MV-4 | 865 | 907 | 1 |
| | MV-5 | 1,105 | 1,119 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,234*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,869** | |

## Alterative 3
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,772 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,772*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,033 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***2,805*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,023 | 2 |
| | 2 | 500 | 526 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,549*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,524 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,448 | 2 |
| | 4 | 1,500 | 1,451 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,423*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,972** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Gallery Well WTP | NA | 1,000 | 776 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 3,002 | 1,258 | 1,744 |
| 2 | 3,167 | 5,312 | -2,145 |
| 3 | 3,700 | 2,957 | 743 |
| **Total** | **9,869** | **9,527** | **342** |

**Alterative 4-1**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 241 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 0 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 0 | 3 |
| Upland | 27 | 1,250 | 0 | 2 |
| Upland | 28 | 750 | 0 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***841*** | |
| 6 cfs well field | 8 | 150 | 150 | 1 |
| 6 cfs well field | 9 | 375 | 376 | 1 |
| 6 cfs well field | 10 | 600 | 611 | 1 |
| 6 cfs well field | 19 | 260 | 267 | 1 |
| 6 cfs well field | 21 | 275 | 298 | 1 |
| 6 cfs well field | 22 | 200 | 219 | 1 |
| 6 cfs well field | 23 | 400 | 404 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***2,325*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 591 | 1 |
| 4 cfs well field | 17 | 375 | 365 | 1 |
| 4 cfs well field | 18 | 200 | 189 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,145*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **4,311** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,164 | 1 |
| | MV-2 | 1,145 | 1,138 | 1 |
| | MV-3 | 885 | 907 | 1 |
| | MV-4 | 865 | 907 | 1 |
| | MV-5 | 1,105 | 1,120 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,236*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,547** | |

**Alterative 4-1**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| | | | | |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,737 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,737*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,014 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***2,751*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 0 | 2 |
| | 2 | 500 | 0 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***0*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,521 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,442 | 2 |
| | 4 | 1,500 | 1,442 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,405*** | |
| | **Zone 2 Subtotal** | **8,150** | **4,405** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at RefigoPump Station | NA | 1,500 | 1,502 | 2 |
| Pump at Zone 1 Tank | NA | 1,250 | 1,251 | 2 |

**Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)**

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,548 | 1,258 | 290 |
| 2 | 4,407 | 5,312 | -905 |
| 3 | 2,751 | 2,957 | -206 |
| **Total** | **8,706** | **9,527** | **-821** |

**Alterative 4-2**
**Proposed Solutions, Peak Hour Demand in April 2011**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 232 | 3 |
| Upland | 6 | 300 | 350 | 3 |
| Upland | 7 | 900 | 0 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 259 | 3 |
| Upland | 25 | 950 | 0 | 3 |
| Upland | 27 | 1,250 | 0 | 2 |
| Upland | 28 | 750 | 0 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***841*** | |
| 6 cfs well field | 8 | 150 | 150 | 1 |
| 6 cfs well field | 9 | 375 | 377 | 1 |
| 6 cfs well field | 10 | 600 | 627 | 1 |
| 6 cfs well field | 19 | 260 | 278 | 1 |
| 6 cfs well field | 21 | 275 | 312 | 1 |
| 6 cfs well field | 22 | 200 | 229 | 1 |
| 6 cfs well field | 23 | 400 | 415 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***2,388*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 609 | 1 |
| 4 cfs well field | 17 | 375 | 375 | 1 |
| 4 cfs well field | 18 | 200 | 197 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,181*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **4,410** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,193 | 1 |
| | MV-2 | 1,145 | 1,170 | 1 |
| | MV-3 | 885 | 918 | 1 |
| | MV-4 | 865 | 918 | 1 |
| | MV-5 | 1,105 | 1,137 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,336*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,746** | |

## Alterative 4-2
## Proposed Solutions, Peak Hour Demand in April 2011
## Well and Pump Operation Summary

| | | | | |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 0 | 3 |
| | 2 | 750 | 786 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***786*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,010 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***1,796*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 0 | 2 |
| | 2 | 500 | 595 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***595*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,526 | 2 |
| | 2 | 1,500 | 1,437 | 2 |
| | 3 | 1,500 | 1,452 | 2 |
| | 4 | 1,500 | 0 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,415*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,010** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at RefigoPump Station | NA | 1,500 | 0 | 2 |
| Pump at Zone 1 Tank | NA | 1,250 | 1,277 | 2 |

## Comparison of Water Supply Pumping Capacity and 2011 April Peak Hour Demand (With Frost Protection)

| Zone | Model Inflow (gpm) | 2011 Peak Hour Demand (gpm) | Frost Protection Demand | Total | Surplus (+) / Deficit (-) |
|---|---|---|---|---|---|
| 1 | 2,618 | 323 | 10,649 | 10,972 | -8,354 |
| 2 | 4,491 | 1,453 | 6,745 | 8,198 | -3,707 |
| 3 | 1,796 | 806 | 2,725 | 3,531 | -1,735 |
| **Total** | **8,905** | **2,582** | **20,119** | **22,701** | **-13,796** |

**Alterative 5-1**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 200 | 2 |
| Upland | 2 | 500 | 500 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 245 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 0 | 3 |
| Upland | 15 | 1,200 | 1,200 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 0 | 3 |
| Upland | 27 | 1,250 | 0 | 2 |
| Upland | 28 | 750 | 0 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***2,745*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 376 | 1 |
| 6 cfs well field | 10 | 600 | 616 | 1 |
| 6 cfs well field | 19 | 260 | 263 | 1 |
| 6 cfs well field | 21 | 275 | 297 | 1 |
| 6 cfs well field | 22 | 200 | 222 | 1 |
| 6 cfs well field | 23 | 400 | 0 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,774*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 510 | 1 |
| 4 cfs well field | 17 | 375 | 341 | 1 |
| 4 cfs well field | 18 | 200 | 177 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,028*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **5,547** | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,173 | 1 |
| | MV-2 | 1,145 | 1,147 | 1 |
| | MV-3 | 885 | 910 | 1 |
| | MV-4 | 865 | 0 | 1 |
| | MV-5 | 1,105 | 1,125 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***4,355*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,902** | |

## Alterative 5-1
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,773 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,773*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,039 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***2,812*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,002 | 2 |
| | 2 | 500 | 518 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,520*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,498 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,398 | 2 |
| | 4 | 1,500 | 1,381 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,277*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,797** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at 1D1 Shop Site WTP | NA | 1,900 | 1,900 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,360 | 1,258 | 102 |
| 2 | 4,885 | 5,312 | -427 |
| 3 | 3,657 | 2,957 | 700 |
| **Total** | **9,902** | **9,527** | **375** |

## Alterative 5-2
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 240 | 3 |
| Upland | 6 | 300 | 350 | 3 |
| Upland | 7 | 900 | 0 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 0 | 3 |
| Upland | 25 | 950 | 0 | 3 |
| Upland | 27 | 1,250 | 1,250 | 2/3 |
| Upland | 28 | 750 | 750 | 2/3 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***2,590*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 376 | 1 |
| 6 cfs well field | 10 | 600 | 616 | 1 |
| 6 cfs well field | 19 | 260 | 263 | 1 |
| 6 cfs well field | 21 | 275 | 297 | 1 |
| 6 cfs well field | 22 | 200 | 222 | 1 |
| 6 cfs well field | 23 | 400 | 0 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,774*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 519 | 1 |
| 4 cfs well field | 17 | 375 | 343 | 1 |
| 4 cfs well field | 18 | 200 | 179 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,041*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **5,405** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,174 | 1 |
| | MV-2 | 1,145 | 1,148 | 1 |
| | MV-3 | 885 | 911 | 1 |
| | MV-4 | 865 | 0 | 1 |
| | MV-5 | 1,105 | 1,125 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***4,358*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,763** | |

## Alterative 5-2
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,721 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,721*** | |
| Refugio-3 (REF-3) | NA | 950 | 994 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***2,715*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,020 | 2 |
| | 2 | 500 | 525 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,545*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,518 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,436 | 2 |
| | 4 | 1,500 | 1,433 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,387*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,932** | |
| **Booster Pumps (Proposed)** | | | | |
| Z2 Pump at Well 27 | NA | 1,400 | 1,400 | 2 |
| Z3 Pump at Well 27 | NA | 600 | 600 | 3 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,241 | 1,258 | -17 |
| 2 | 4,617 | 5,312 | -695 |
| 3 | 3,905 | 2,957 | 948 |
| **Total** | **9,763** | **9,527** | **236** |

**Alterative 6-1**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 242 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 650 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 0 | 3 |
| Upland | 27 | 1,250 | 0 | 2 |
| Upland | 28 | 750 | 0 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***1,492*** | |
| 6 cfs well field | 8 | 150 | 150 | 1 |
| 6 cfs well field | 9 | 375 | 376 | 1 |
| 6 cfs well field | 10 | 600 | 611 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 292 | 1 |
| 6 cfs well field | 22 | 200 | 219 | 1 |
| 6 cfs well field | 23 | 400 | 388 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***2,036*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 517 | 1 |
| 4 cfs well field | 17 | 375 | 343 | 1 |
| 4 cfs well field | 18 | 200 | 178 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,038*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **4,566** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,176 | 1 |
| | MV-2 | 1,145 | 1,151 | 1 |
| | MV-3 | 885 | 911 | 1 |
| | MV-4 | 865 | 911 | 1 |
| | MV-5 | 1,105 | 1,127 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,276*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,842** | |

## Alterative 6-1
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,751 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,751*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,024 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***2,775*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,019 | 2 |
| | 2 | 500 | 524 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,543*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,522 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,443 | 2 |
| | 4 | 1,500 | 1,443 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,408*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,951** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Zone 1 Tank | NA | 1,200 | 1,221 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,178 | 1,258 | -80 |
| 2 | 4,397 | 5,312 | -915 |
| 3 | 4,267 | 2,957 | 1,310 |
| **Total** | **9,842** | **9,527** | **315** |

**Alterative 6-2**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 240 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 0 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 700 | 3 |
| Upland | 27 | 1,250 | 0 | 2 |
| Upland | 28 | 750 | 0 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***1,540*** | |
| 6 cfs well field | 8 | 150 | 150 | 1 |
| 6 cfs well field | 9 | 375 | 376 | 1 |
| 6 cfs well field | 10 | 600 | 611 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 292 | 1 |
| 6 cfs well field | 22 | 200 | 219 | 1 |
| 6 cfs well field | 23 | 400 | 388 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***2,036*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 517 | 1 |
| 4 cfs well field | 17 | 375 | 343 | 1 |
| 4 cfs well field | 18 | 200 | 179 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,039*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **4,615** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,176 | 1 |
| | MV-2 | 1,145 | 1,151 | 1 |
| | MV-3 | 885 | 911 | 1 |
| | MV-4 | 865 | 911 | 1 |
| | MV-5 | 1,105 | 1,127 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,276*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,891** | |

## Alterative 6-2
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,737 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,737*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,019 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***2,756*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,019 | 2 |
| | 2 | 500 | 525 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,544*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,522 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,444 | 2 |
| | 4 | 1,500 | 1,444 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,410*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,954** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Zone 1 Tank | NA | 1,200 | 1,200 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,197 | 1,258 | -61 |
| 2 | 4,398 | 5,312 | -914 |
| 3 | 4,296 | 2,957 | 1,339 |
| **Total** | **9,891** | **9,527** | **364** |

**Alterative 6-3**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 244 | 3 |
| Upland | 6 | 300 | 350 | 3 |
| Upland | 7 | 900 | 0 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 0 | 3 |
| Upland | 27 | 1,250 | 0 | 2 |
| Upland | 28 | 750 | 500 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***1,394*** | |
| 6 cfs well field | 8 | 150 | 150 | 1 |
| 6 cfs well field | 9 | 375 | 376 | 1 |
| 6 cfs well field | 10 | 600 | 611 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 292 | 1 |
| 6 cfs well field | 22 | 200 | 219 | 1 |
| 6 cfs well field | 23 | 400 | 388 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***2,036*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 515 | 1 |
| 4 cfs well field | 17 | 375 | 342 | 1 |
| 4 cfs well field | 18 | 200 | 179 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,036*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **4,466** | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,176 | 1 |
| | MV-2 | 1,145 | 1,150 | 1 |
| | MV-3 | 885 | 911 | 1 |
| | MV-4 | 865 | 911 | 1 |
| | MV-5 | 1,105 | 1,127 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,275*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,741** | |

## Alterative 6-3
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,773 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,773*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,036 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***2,809*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,015 | 2 |
| | 2 | 500 | 523 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,538*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,518 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,437 | 2 |
| | 4 | 1,500 | 1,435 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,390*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,928** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Zone 1 Tank | NA | 1,200 | 1,178 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,241 | 1,258 | -17 |
| 2 | 4,797 | 5,312 | -515 |
| 3 | 3,703 | 2,957 | 746 |
| **Total** | **9,741** | **9,527** | **214** |

**Alterative 6-4**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 245 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 0 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 0 | 3 |
| Upland | 27 | 1,250 | 950 | 2 |
| Upland | 28 | 750 | 0 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***1,795*** | |
| 6 cfs well field | 8 | 150 | 150 | 1 |
| 6 cfs well field | 9 | 375 | 376 | 1 |
| 6 cfs well field | 10 | 600 | 611 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 292 | 1 |
| 6 cfs well field | 22 | 200 | 219 | 1 |
| 6 cfs well field | 23 | 400 | 388 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***2,036*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 513 | 1 |
| 4 cfs well field | 17 | 375 | 341 | 1 |
| 4 cfs well field | 18 | 200 | 178 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,032*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **4,863** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,175 | 1 |
| | MV-2 | 1,145 | 1,150 | 1 |
| | MV-3 | 885 | 911 | 1 |
| | MV-4 | 865 | 911 | 1 |
| | MV-5 | 1,105 | 1,126 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,273*** | |
| | **Total (Wells + SWP)** | **17,211** | **10,136** | |

**Alterative 6-4**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,779 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,779*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,040 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***2,819*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,008 | 2 |
| | 2 | 500 | 520 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,528*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,513 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,426 | 2 |
| | 4 | 1,500 | 1,419 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,358*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,886** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Zone 1 Tank | NA | 1,200 | 1,200 | 2 |

**Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)**

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,255 | 1,258 | -3 |
| 2 | 5,217 | 5,312 | -95 |
| 3 | 3,664 | 2,957 | 707 |
| **Total** | **10,136** | **9,527** | **609** |

# Attachment D

**Complete Option A - Alt 5-1, 5-2, 5-3 and 5-4 and Gallery Well Treatment (Alt 3-1) Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 2,765,000 |
| | 16 Wells 3 and 15 to joint pipe to treatment plant | 4,400 | LF | $ 210 | $ 924,000 |
| | 10 Wells 1 and 2 to joint pipe to treatment plant | 2,500 | LF | $ 130 | $ 325,000 |
| | 6 Well 1 to joint pipe to treatment plant | 100 | LF | $ 100 | $ 10,000 |
| | 8 Well 3 to joint pipe to treatment plant | 5,400 | LF | $ 110 | $ 594,000 |
| | 16 Joint pipe from wells 1,2,3 and 15 to treatment plant | 1,000 | LF | $ 210 | $ 210,000 |
| | 16 Treatment plant discharge pipe | 700 | LF | $ 210 | $ 147,000 |
| | 10 Well 28 to well 27 pipe to treatment plant | 4,000 | LF | $ 130 | $ 520,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | 12 Immediately downstream of GW treatment plant booster pump | 200 | LF | $ 150 | $ 30,000 |
| [3] | **Control Valves** | | | | $ 212,000 |
| | Booster Pump (776 gpm, 195' TDH, 75 hp) at GW treatment plant | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 15 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 2 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 3 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 1 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 27 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 28 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 6 and 8-inch valves | 4 | Each | $ 1,500 | $ 6,000 |
| | 10-inch valves | 4 | Each | $ 2,000 | $ 8,000 |
| | 12-inch valves | 2 | Each | $ 2,500 | $ 5,000 |
| | 16-inch valves | 6 | Each | $ 3,500 | $ 21,000 |
| | Blowoff valve assembly with valve box | 11 | Each | $ 5,000 | $ 55,000 |
| | Air/vacuum and air relaease valve with valve box | 11 | Each | $ 5,000 | $ 55,000 |
| [5] | **Pump Stations** | | | | $ 183,000 |
| | Booster Pump (10 gpm) 17.4 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| | Booster Pump (776 gpm, 195' TDH, 75 hp) at GW treatment plant | 75 | Hp | $ 1,600 | $ 120,000 |
| | Well 3 new pump and motor 600 gpm 75 hp | 1 | LS | $ 48,000 | $ 48,000 |
| [6] | **Electrical Controls** | | | | $ 45,000 |
| | Booster Pump (776 gpm, 195' TDH, 75 hp) at GW treatment plant | 1 | LS | $ 40,000 | $ 40,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ 25,000 |
| | SCADA Connection, components, operations for GW booster | 1 | LS | $ 25,000 | $ 25,000 |
| [8] | **Water Treatment Plant** | | | | $1,320,000 |
| | GW Membrane Equipment, Pall System (800 gpm) | 1 | LS | $1,000,000 | $1,000,000 |
| | GW Backwash Tank System | 1 | LS | $50,000 | $50,000 |
| | GW Treatment Plant Building and Appurtenances | 1 | LS | $250,000 | $250,000 |
| | Well 3 cleaning and development | 1 | LS | $20,000 | $ 20,000 |
| | Treatment for Wells 1,2,3,15 Hazen & Sawyer | Costs prepared | by Hazen & Sawyer | | |
| | Treatment for Wells 27 & 28 Hazen & Sawyer | Costs prepared | by Hazen & Sawyer | | |
| | Treatment for Well 7 Hazen & Sawyer | Costs prepared | by Hazen & Sawyer | | |
| | Treatment for Well 25 Hazen & Sawyer | Costs prepared | by Hazen & Sawyer | | |
| [9] | **Electrical Power Facilities** | | | | $ 30,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (776 gpm, 195' TDH, 75 hp) at GW treatment plant | 1 | LS | $ 20,000 | $ 20,000 |
| [10] | **Land and Right of Ways** | | | | $ 286,000 |
| | Acquire 100' by 100' of Land and permitting for GW treatment plant | 1 | LS | $ 250,000 | $ 250,000 |
| | Acquire 20' by 1,500' ROW for pipe from well 28 and permitting | 1,500 | LF | $4 | $ 6,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | Total | $ 4,866,000 |

GW = Gallery well

**Future Energy Cost Complete Option A (Alt 5-1, 5-2, 5-3, 5-4, 3-1) and Complete Option B (Alt 5-1, 5-2, 5-3, 5-4)**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes | Water Use | |
|---|---|---|---|---|---|---|---|---|
| Upland Wells | 4,639 | 83.1% | | | | Z2 & 3 | | |
| | 943 | | | | | Z1 | 736 | |
| | 2,940 | | | | | Z2 | 3,115 | |
| | 1,906 | | | | | Z3 | 1,731 | |
| Wells and Pumps in operation for Complete Options A and B | | | | | | | 5,582 | |
| Well 5 | 0 | 0.0% | 140 | 0 | $0 | [a] | | |
| Well 6 | 0 | 0.0% | 225 | 0 | $0 | [a] | | |
| Well 7 | 728 | 13.0% | 153 | 728 | $111,384 | [b] | | |
| Well 24 | 0 | 0.0% | 210 | 0 | $0 | [a] | | |
| Well 25 | 767 | 13.7% | 107 | 767 | $82,069 | [b] | | |
| Well 27 | 1,009 | 18.1% | 124 | 1,009 | $125,116 | [b] | 410 To Zone 3 | 1,203 To Zone 2 |
| Well 28 | 604 | 10.8% | 90 | 604 | $54,360 | [b] | | |
| Well 1 | 163 | 2.9% | 123 | 163 | $20,049 | [b] | | |
| Well 2 | 402 | 7.2% | 123 | 402 | $49,446 | [b] | | |
| Well 3 | 0 | 0.0% | 86 | 0 | $0 | [b] | | |
| Well 15 | 966 | 17.3% | 86 | 966 | $83,076 | [b] | | |
| MVPS, SWP | 800 | 14.3% | 37 | 800 | $29,600 | Assumed | | |
| Gallery Well | 0 | 0.0% | 80 | 0 | $0 | Limited by water right of 515 AF | | |
| River Wells | 143 | 2.6% | 91 | 143 | $13,013 | Assumed | | |
| | 5,582 | 100.0% | | 5,582 | $568,113 | | | |
| Zone 1 to Zone 2 | | | | | | | | |
| | 207 | 3.7% | 40 | 207 | $8,280 | | | |
| Zone 2 to Zone 3 | | | | | | | | |
| | 1 | 0.0% | 80 | 1 | $80 | | | |
| | | | | Total | $576,473 | | | |
| | | | | $/AF | 103 | | | |
| | | | | Average Pumping Cost | $622,478 | | | |
| | | | | $/AF | 112 | | | |
| | | | | WTP Booster Pump Cost from Hazen & Sawyer | $158,000 | | | |
| | | | | $/AF | 28 | | | |
| | | | | Extra Pumping Cost | $111,995 | | | |
| | | | | $/AF | 20 | | | |

[a] Based on 0% operation per year

[b] Based on 50% operation per year

**Complete Option B - Alt 5-1, 5-2, 5-3 and 5-4 Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 2,735,000 |
| | 16 Wells 3 and 15 to joint pipe to treatment plant | 4,400 | LF | $ 210 | $ 924,000 |
| | 10 Wells 1 and 2 to joint pipe to treatment plant | 2,500 | LF | $ 130 | $ 325,000 |
| | 6 Well 1 to joint pipe to treatment plant | 100 | LF | $ 100 | $ 10,000 |
| | 8 Well 3 to joint pipe to treatment plant | 5,400 | LF | $ 110 | $ 594,000 |
| | 16 Joint pipe from wells 1,2,3 and 15 to treatment plant | 1,000 | LF | $ 210 | $ 210,000 |
| | 16 Treatment plant discharge pipe | 700 | LF | $ 210 | $ 147,000 |
| | 10 Well 28 to well 27 pipe to treatment plant | 4,000 | LF | $ 130 | $ 520,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| [3] | **Control Valves** | | | | $ 187,000 |
| | Well 15 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 2 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 3 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 1 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 27 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 28 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 6 and 8-inch valves | 4 | Each | $ 1,500 | $ 6,000 |
| | 10-inch valves | 4 | Each | $ 2,000 | $ 8,000 |
| | 12-inch valves | 0 | Each | $ 2,500 | $ - |
| | 16-inch valves | 6 | Each | $ 3,500 | $ 21,000 |
| | Blowoff valve assembly with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| | Air/vacuum and air relaease valve with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| [5] | **Pump Stations** | | | | $ 63,000 |
| | Booster Pump (10 gpm) 17.4 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| | Well 3 new pump and motor 600 gpm 75 hp | 1 | LS | $ 48,000 | $ 48,000 |
| [6] | **Electrical Controls** | | | | $ 5,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ - |
| | | 1 | LS | $ - | $ - |
| [8] | **Water Treatment Plant** | | | | $ 20,000 |
| | Well 3 cleaning and development | 1 | LS | $20,000 | $ 20,000 |
| | Treatment for Wells 1,2,3,15 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| | Treatment for Wells 27 & 28 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| | Treatment for Well 7 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| | Treatment for Well 25 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| [9] | **Electrical Power Facilities** | | | | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 36,000 |
| | Acquire 20' by 1,500' ROW for pipe from well 28 and permitting | 1,500 | LF | $4 | $ 6,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 3,056,000** |

**Future Energy Cost Complete Option A (Alt 5-1, 5-2, 5-3, 5-4, 3-1) and Complete Option B (Alt 5-1, 5-2, 5-3, 5-4)**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes | Water Use | | |
|---|---|---|---|---|---|---|---|---|---|
| Upland Wells | 4,639 | 83.1% | | | | Z2 & 3 | | | |
| | 943 | | | | | Z1 | 736 | | |
| | 2,940 | | | | | Z2 | 3,115 | | |
| | 1,906 | | | | | Z3 | 1,731 | | |
| Wells and Pumps in operation for Complete Options A and B | | | | | | | 5,582 | | |
| Well 5 | 0 | 0.0% | 140 | 0 | $0 | [a] | | | |
| Well 6 | 0 | 0.0% | 225 | 0 | $0 | [a] | | | |
| Well 7 | 728 | 13.0% | 153 | 728 | $111,384 | [b] | | | |
| Well 24 | 0 | 0.0% | 210 | 0 | $0 | [a] | | | |
| Well 25 | 767 | 13.7% | 107 | 767 | $82,069 | [b] | | | |
| Well 27 | 1,009 | 18.1% | 124 | 1,009 | $125,116 | [b] | | 410 To Zone 3 | 1,203 To Zone 2 |
| Well 28 | 604 | 10.8% | 90 | 604 | $54,360 | [b] | | | |
| Well 1 | 163 | 2.9% | 123 | 163 | $20,049 | [b] | | | |
| Well 2 | 402 | 7.2% | 123 | 402 | $49,446 | [b] | | | |
| Well 3 | 0 | 0.0% | 86 | 0 | $0 | [b] | | | |
| Well 15 | 966 | 17.3% | 86 | 966 | $83,076 | [b] | | | |
| MVPS, SWP | 800 | 14.3% | 37 | 800 | $29,600 | Assumed | | | |
| Gallery Well | 0 | 0.0% | 80 | 0 | $0 | Limited by water right of 515 AF | | | |
| River Wells | 143 | 2.6% | 91 | 143 | $13,013 | Assumed | | | |
| | 5,582 | 100.0% | | 5,582 | $568,113 | | | | |
| Zone 1 to Zone 2 | | | | | | | | | |
| | 207 | 3.7% | 40 | 207 | $8,280 | | | | |
| Zone 2 to Zone 3 | | | | | | | | | |
| | 1 | 0.0% | 80 | 1 | $80 | | | | |
| | | | | Total | $576,473 | | | | |
| | | | | $/AF | 103 | | | | |
| | | | | Average Pumping Cost | $622,478 | | | | |
| | | | | $/AF | 112 | | | | |
| | | | | WTP Booster Pump Cost from Hazen & Sawyer | $158,000 | | | | |
| | | | | $/AF | 28 | | | | |
| | | | | Extra Pumping Cost | $111,995 | | | | |
| | | | | $/AF | 20 | | | | |

[a] Based on 0% operation per year
[b] Based on 50% operation per year

**Complete Option C - Alt 5-1, 5-3, 5-4, 1-4 and 6-4 Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 2,723,000 |
| | 16 Pipeline from well 28 to zone 3 | 2,000 | LF | $ 210 | $ 420,000 |
| | 8 Pipeline from well 28 to zone 3 | 800 | LF | $ 110 | $ 88,000 |
| | 16 Wells 3 and 15 to joint pipe to treatment plant | 4,400 | LF | $ 210 | $ 924,000 |
| | 10 Wells 1 and 2 to joint pipe to treatment plant | 2,500 | LF | $ 130 | $ 325,000 |
| | 6 Well 1 to joint pipe to treatment plant | 100 | LF | $ 100 | $ 10,000 |
| | 8 Well 3 to joint pipe to treatment plant | 5,400 | LF | $ 110 | $ 594,000 |
| | 16 Joint pipe from wells 1,2,3 and 15 to treatment plant | 1,000 | LF | $ 210 | $ 210,000 |
| | 16 Treatment plant discharge pipe | 700 | LF | $ 210 | $ 147,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| [3] | **Control Valves** | | | | $ 238,000 |
| | Valves at Well 28 | 1 | LS | $ 20,000 | $ 20,000 |
| | Valves at Well 28 new booster pump | 1 | LS | $ 20,000 | $ 20,000 |
| | Flow control valves at well 28 and new booster at well 28 | 2 | Each | $ 5,000 | $ 10,000 |
| | 12-inch inline blending static mixer | 1 | LS | $ 15,000 | $ 15,000 |
| | Well 15 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 2 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 3 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 1 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 6 and 8-inch valves | 6 | Each | $ 1,500 | $ 9,000 |
| | 10-inch valves | 2 | Each | $ 2,000 | $ 4,000 |
| | 12-inch valves | 0 | Each | $ 2,500 | $ - |
| | 16-inch valves | 8 | Each | $ 3,500 | $ 28,000 |
| | Blowoff valve assembly with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| | Air/vacuum and air relaease valve with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| [5] | **Pump Stations** | | | | $ 288,000 |
| | Booster Pump (10 gpm) 17.3 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| | Booster Pump (1,500 gpm, 300 TDH, 150 hp) at Well 28 | 150 | Hp | $ 1,500 | $ 225,000 |
| | Well 3 new pump and motor 600 gpm 75 hp | 1 | LS | $ 48,000 | $ 48,000 |
| [6] | **Electrical Controls** | | | | $ 65,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| | Booster Pump (1,500 gpm, 300 TDH, 150 hp) at Well 28 | 1 | LS | $ 60,000 | $ 60,000 |
| [7] | **SCADA System** | | | | $ 25,000 |
| | SCADA Connection, components, operations for new booster | 1 | LS | $ 25,000 | $ 25,000 |
| [8] | **Water Treatment Plant** | | | | $ 120,000 |
| | Packer at well 27 | 1 | LS | $ 100,000 | $ 100,000 |
| | Well 3 cleaning and development | 1 | LS | $20,000 | $ 20,000 |
| | Treatment for Wells 1,2,3,15 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| | Treatment for Well 7 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| | Treatment for Well 25 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| [9] | **Electrical Power Facilities** | | | | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 30,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | $ 3,499,000 |

**Future Energy Cost Complete Option C (Alt 5-1, 5-3, 5-4, 1-4, 6-4)**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes | Water Use | |
|---|---|---|---|---|---|---|---|---|
| Upland Wells | 3,503 | 62.8% | | | | Z2 & 3 | | |
| | 2,079 | | | | | Z1 | 736 | |
| | 3,161 | | | | | Z2 | 3,115 | |
| | 1,731 | | | | | Z3 | 1,731 | |
| Wells and Pumps in operation for Complete Option C | | | | | | | 5,582 | |
| Well 5 | 15 | 0.3% | 140 | 15 | $2,155 | [a] | | |
| Well 6 | 18 | 0.3% | 225 | 18 | $4,147 | [a] | | |
| Well 7 | 728 | 13.0% | 153 | 728 | $111,384 | [c] | | |
| Well 24 | 18 | 0.3% | 210 | 18 | $3,870 | [a] | | |
| Well 25 | 767 | 13.7% | 107 | 767 | $82,069 | [c] | | |
| Well 27 | 378 | 6.8% | 124 | 378 | $46,919 | [b] | | |
| Well 28 | 46 | 0.8% | 90 | 46 | $4,131 | [a] | 92 To Zone 3 | 0 To Zone 2 |
| Well 1 | 163 | 2.9% | 123 | 163 | $20,049 | [c] | | |
| Well 2 | 402 | 7.2% | 123 | 402 | $49,446 | [c] | | |
| Well 3 | 0 | 0.0% | 86 | 0 | $0 | | | |
| Well 15 | 966 | 17.3% | 86 | 966 | $83,076 | [c] | | |
| MVPS, SWP | 1,579 | 28.3% | 37 | 1,579 | $58,423 | Assumed | | |
| Gallery Well | 0 | 0.0% | 80 | 0 | $0 | Limited by water right of 515 AF | | |
| River Wells | 500 | 9.0% | 93 | 500 | $46,500 | Assumed | | |
| | 5,582 | 100.0% | | 5,582 | $512,169 | | | |
| Zone 1 to Zone 2 | 1,343 | 24.1% | 40 | 1,343 | $53,720 | | | |
| Zone 2 to Zone 3 | 92 | 1.6% | 80 | 92 | $7,345 | | | |
| | | | | Total | $573,233 | | | |
| | | | | $/AF | 103 | | | |
| | | | | Average Pumping Cost | $622,478 | | | |
| | | | | $/AF | 112 | | | |
| | | | | WTP Booster Pump Cost from Hazen & Sawyer | $104,000 | | | |
| | | | | $/AF | 19 | | | |
| | | | | Extra Pumping Cost | $54,755 | | | |
| | | | | $/AF | 10 | | | |

[a] Based on 3.8% operation per year

[b] Based on 25% operation per year and 25% flow reduction

[c] Based on 50% operation per year

**Complete Option D - Alt 5-1, 5-2, 1-2, and 1-5 Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 3,476,000 |
| | 16 Wells 3 and 15 to joint pipe to treatment plant | 4,400 | LF | $ 210 | $ 924,000 |
| | 10 Wells 1 and 2 to joint pipe to treatment plant | 2,500 | LF | $ 130 | $ 325,000 |
| | 6 Well 1 to joint pipe to treatment plant | 100 | LF | $ 100 | $ 10,000 |
| | 8 Well 3 to joint pipe to treatment plant | 5,400 | LF | $ 110 | $ 594,000 |
| | 16 Joint pipe from wells 1,2,3 and 15 to treatment plant | 1,000 | LF | $ 210 | $ 210,000 |
| | 16 Treatment plant discharge pipe | 700 | LF | $ 210 | $ 147,000 |
| | 10 Well 28 to well 27 pipe to treatment plant | 4,000 | LF | $ 130 | $ 520,000 |
| | 8 pipeline from well 7 to 12" mainline | 700 | LF | $ 110 | $ 77,000 |
| | 8 pipeline from well 24 to well 7 | 2,300 | LF | $ 110 | $ 253,000 |
| | 8 pipeline from well 5 to well 25 | 3,500 | LF | $ 110 | $ 385,000 |
| | 10 Well 7 to pipe intersection | 200 | LF | $ 130 | $ 26,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| [3] | **Control Valves** | | | | $ 296,000 |
| | Well 15 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 2 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 3 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 1 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 27 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 28 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 7 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 7 and 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 5 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 5 and 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 6 and 8-inch valves | 10 | Each | $ 1,500 | $ 15,000 |
| | 10-inch valves | 4 | Each | $ 2,000 | $ 8,000 |
| | 12-inch valves | 0 | Each | $ 2,500 | $ - |
| | 16-inch valves | 6 | Each | $ 3,500 | $ 21,000 |
| | Blowoff valve assembly with valve box | 14 | Each | $ 5,000 | $ 70,000 |
| | Air/vacuum and air relaease valve with valve box | 14 | Each | $ 5,000 | $ 70,000 |
| [5] | **Pump Stations** | | | | $ 63,000 |
| | Booster Pump (10 gpm) 17.4 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| | Well 3 new pump and motor 600 gpm 75 hp | 1 | LS | $ 48,000 | $ 48,000 |
| [6] | **Electrical Controls** | | | | $ 5,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ - |
| | | 1 | LS | $ - | $ - |
| [8] | **Water Treatment Plant** | | | | $ 20,000 |
| | Well 3 cleaning and development | 1 | LS | $20,000 | $ 20,000 |
| | Treatment for Wells 1,2,3,15 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| | Treatment for Wells 27 & 28 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| | Treatment for Well 7 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| | Treatment for Well 25 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| [9] | **Electrical Power Facilities** | | | | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 36,000 |
| | Acquire 20' by 1,500' ROW for pipe from well 28 and permitting | 1,500 | LF | $4 | $ 6,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 3,906,000** |

**Future Energy Cost Complete Option D (Alt 5-1, 5-2, 1-2, 1-5)**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes | Water Use | | |
|---|---|---|---|---|---|---|---|---|---|
| Upland Wells | 4,414 | 79.1% | | | | Z2 & 3 | | | |
| | 1,168 | | | | | Z1 | 736 | | |
| | 2,734 | | | | | Z2 | 3,115 | | |
| | 1,730 | | | | | Z3 | 1,731 | | |
| Wells and Pumps in operation for Complete Option D | | | | | | | 5,582 | | |
| Well 5 | 118 | 2.1% | 140 | 118 | $16,500 | [a] | | | |
| Well 6 | 141 | 2.5% | 225 | 141 | $31,755 | [a] | | | |
| Well 7 | 424 | 7.6% | 153 | 424 | $64,825 | [a] | | | |
| Well 24 | 141 | 2.5% | 210 | 141 | $29,638 | [a] | | | |
| Well 25 | 446 | 8.0% | 107 | 446 | $47,733 | [a] | | | |
| Well 27 | 1,009 | 18.1% | 124 | 1,009 | $125,116 | [b] | | 410 To Zone 3 | 1,203 To Zone 2 |
| Well 28 | 604 | 10.8% | 90 | 604 | $54,360 | [b] | | | |
| Well 1 | 163 | 2.9% | 123 | 163 | $20,049 | [b] | | | |
| Well 2 | 402 | 7.2% | 123 | 402 | $49,446 | [b] | | | |
| Well 3 | 0 | 0.0% | 86 | 0 | $0 | [b] | | | |
| Well 15 | 966 | 17.3% | 86 | 966 | $83,076 | [b] | | | |
| MVPS, SWP | 768 | 13.8% | 37 | 768 | $28,416 | Assumed | | | |
| Gallery Well | 0 | 0.0% | 80 | 0 | $0 | Limited by water right of 515 AF | | | |
| River Wells | 400 | 7.2% | 91 | 400 | $36,400 | Assumed | | | |
| | 5,582 | 100.0% | | 5,582 | $587,315 | | | | |
| Zone 1 to Zone 2 | | | | | | | | | |
| | 432 | 7.7% | 40 | 432 | $17,280 | | | | |
| Zone 2 to Zone 3 | | | | | | | | | |
| | 50 | 0.9% | 80 | 50 | $4,000 | | | | |
| | | | | Total | $608,595 | | | | |
| | | | | $/AF | 109 | | | | |
| | | | | Average Pumping Cost | $622,478 | | | | |
| | | | | $/AF | 112 | | | | |
| | | | | WTP Booster Pump Cost from Hazen & Sawyer | $108,000 | | | | |
| | | | | $/AF | 19 | | | | |
| | | | | Extra Pumping Cost | $94,117 | | | | |
| | | | | $/AF | 17 | | | | |

[a] Based on 29.1% operation per year

[b] Based on 50% operation per year

**Complete Option D-P- Alt 5-1, 5-2, 6-1 and 6-2 Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 2,735,000 |
| | 16 Wells 3 and 15 to joint pipe to treatment plant | 4,400 | LF | $ 210 | $ 924,000 |
| | 10 Wells 1 and 2 to joint pipe to treatment plant | 2,500 | LF | $ 130 | $ 325,000 |
| | 6 Well 1 to joint pipe to treatment plant | 100 | LF | $ 100 | $ 10,000 |
| | 8 Well 3 to joint pipe to treatment plant | 5,400 | LF | $ 110 | $ 594,000 |
| | 16 Joint pipe from wells 1,2,3 and 15 to treatment plant | 1,000 | LF | $ 210 | $ 210,000 |
| | 16 Treatment plant discharge pipe | 700 | LF | $ 210 | $ 147,000 |
| | 10 Well 28 to well 27 pipe to treatment plant | 4,000 | LF | $ 130 | $ 520,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| [3] | **Control Valves** | | | | $ 187,000 |
| | Well 15 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 2 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 3 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 1 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 27 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 28 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 6 and 8-inch valves | 4 | Each | $ 1,500 | $ 6,000 |
| | 10-inch valves | 4 | Each | $ 2,000 | $ 8,000 |
| | 12-inch valves | 0 | Each | $ 2,500 | $ - |
| | 16-inch valves | 6 | Each | $ 3,500 | $ 21,000 |
| | Blowoff valve assembly with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| | Air/vacuum and air relaease valve with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| [5] | **Pump Stations** | | | | $ 63,000 |
| | Booster Pump (10 gpm) 17.4 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| | Well 3 new pump and motor 600 gpm 75 hp | 1 | LS | $ 48,000 | $ 48,000 |
| [6] | **Electrical Controls** | | | | $ 5,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ - |
| | | 1 | LS | $ - | $ - |
| [8] | **Water Treatment Plant** | | | | $ 220,000 |
| | Well 3 cleaning and development | 1 | LS | $20,000 | $ 20,000 |
| | Install packer in well 25 | 1 | LS | $100,000 | $ 100,000 |
| | Install packer in well 7 | 1 | LS | $100,000 | $ 100,000 |
| | Treatment for Wells 1,2,3,15 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| | Treatment for Wells 27 & 28 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| | Treatment for Well 7 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| | Treatment for Well 25 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| [9] | **Electrical Power Facilities** | | | | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 36,000 |
| | Acquire 20' by 1,500' ROW for pipe from well 28 and permitting | 1,500 | LF | $4 | $ 6,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 3,256,000** |

**Future Energy Cost Complete Option D-P (Alt 5-1, 5-2, 6-1, 6-2) and D-C (Alt 1-2, 1-5, 5-1, 5-2, 6-1, 6-2)**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes | Water Use | | |
|---|---|---|---|---|---|---|---|---|---|
| Upland Wells | 4,416 | 79.1% | | | | Z2 & 3 | | | |
| | 1,166 | | | | | Z1 | 736 | | |
| | 2,734 | | | | | Z2 | 3,115 | | |
| | 1,732 | | | | | Z3 | 1,731 | | |
| Wells and Pumps in operation for Complete Option D-P and D-C | | | | | | | 5,582 | | |
| Well 5 | 145 | 2.6% | 140 | 145 | $20,299 | [a] | | | |
| Well 6 | 174 | 3.1% | 225 | 174 | $39,067 | [a] | | | |
| Well 7 | 376 | 6.7% | 153 | 376 | $57,567 | [b] | | | |
| Well 24 | 174 | 3.1% | 210 | 174 | $36,462 | [a] | | | |
| Well 25 | 404 | 7.2% | 107 | 404 | $43,209 | [b] | | | |
| Well 27 | 1,009 | 18.1% | 124 | 1,009 | $125,116 | [c] | | 410 To Zone 3 | 1,203 To Zone 2 |
| Well 28 | 604 | 10.8% | 90 | 604 | $54,360 | [c] | | | |
| Well 1 | 163 | 2.9% | 123 | 163 | $20,049 | [c] | | | |
| Well 2 | 402 | 7.2% | 123 | 402 | $49,446 | [c] | | | |
| Well 3 | 0 | 0.0% | 86 | 0 | $0 | | | | |
| Well 15 | 966 | 17.3% | 86 | 966 | $83,076 | [c] | | | |
| MVPS, SWP | 766 | 13.7% | 37 | 766 | $28,342 | Assumed | | | |
| Gallery Well | 0 | 0.0% | 80 | 0 | $0 | Limited by water right of 515 AF | | | |
| River Wells | 400 | 7.2% | 91 | 400 | $36,400 | Assumed | | | |
| | 5,582 | 100.0% | | 5,582 | $593,393 | | | | |
| Zone 1 to Zone 2 | | | | | | | | | |
| | 430 | 7.7% | 40 | 430 | $17,200 | | | | |
| Zone 2 to Zone 3 | | | | | | | | | |
| | 50 | 0.9% | 80 | 50 | $4,000 | | | | |
| | | | | Total | $614,593 | | | | |
| | | | | $/AF | 110 | | | | |
| | | | | Average Pumping Cost | $622,478 | | | | |
| | | | | $/AF | 112 | | | | |
| | | | | WTP Booster Pump Cost from Hazen & Sawyer | $108,000 | | | | |
| | | | | $/AF | 19 | | | | |
| | | | | Extra Pumping Cost | $100,115 | | | | |
| | | | | $/AF | 18 | | | | |

[a] Based on 35.8% operation per year

[b] Based on 35.8% operation per year and 25% flow reduction

[c] Based on 50% operation per year

**Complete Option D-C - Alt 5-1, 5-2, 1-2, 1-5, 6-1, and 6-2 Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | **$ 3,472,000** |
| | 16 Wells 3 and 15 to joint pipe to treatment plant | 4,400 | LF | $ 210 | $ 924,000 |
| | 10 Wells 1 and 2 to joint pipe to treatment plant | 2,500 | LF | $ 130 | $ 325,000 |
| | 6 Well 1 to joint pipe to treatment plant | 100 | LF | $ 100 | $ 10,000 |
| | 8 Well 3 to joint pipe to treatment plant | 5,400 | LF | $ 110 | $ 594,000 |
| | 16 Joint pipe from wells 1,2,3 and 15 to treatment plant | 1,000 | LF | $ 210 | $ 210,000 |
| | 16 Treatment plant discharge pipe | 700 | LF | $ 210 | $ 147,000 |
| | 10 Well 28 to well 27 pipe to treatment plant | 4,000 | LF | $ 130 | $ 520,000 |
| | 8 pipeline from well 7 to 12" mainline | 700 | LF | $ 110 | $ 77,000 |
| | 8 pipeline from well 24 to well 7 | 2,500 | LF | $ 110 | $ 275,000 |
| | 8 pipeline from well 5 to well 25 | 3,500 | LF | $ 110 | $ 385,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| [3] | **Control Valves** | | | | **$ 296,000** |
| | Well 15 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 2 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 3 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 1 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 27 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 28 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 7 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 7 and 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 5 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 5 and 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 6 and 8-inch valves | 10 | Each | $ 1,500 | $ 15,000 |
| | 10-inch valves | 4 | Each | $ 2,000 | $ 8,000 |
| | 12-inch valves | 0 | Each | $ 2,500 | $ - |
| | 16-inch valves | 6 | Each | $ 3,500 | $ 21,000 |
| | Blowoff valve assembly with valve box | 14 | Each | $ 5,000 | $ 70,000 |
| | Air/vacuum and air relaease valve with valve box | 14 | Each | $ 5,000 | $ 70,000 |
| [5] | **Pump Stations** | | | | **$ 63,000** |
| | Booster Pump (10 gpm) 17.4 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| | Well 3 new pump and motor 600 gpm 75 hp | 1 | LS | $ 48,000 | $ 48,000 |
| [6] | **Electrical Controls** | | | | **$ 5,000** |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | **$ -** |
| | | 1 | LS | $ - | $ - |
| [8] | **Water Treatment Plant** | | | | **$ 220,000** |
| | Well 3 cleaning and development | 1 | LS | $20,000 | $ 20,000 |
| | Install packer in well 25 | 1 | LS | $100,000 | $ 100,000 |
| | Install packer in well 7 | 1 | LS | $100,000 | $ 100,000 |
| | Treatment for Wells 1,2,3,15 Hazen & Sawyer | Costs prepared | by Hazen & Sawyer | | |
| | Treatment for Wells 27 & 28 Hazen & Sawyer | Costs prepared | by Hazen & Sawyer | | |
| | Treatment for Well 7 Hazen & Sawyer | Costs prepared | by Hazen & Sawyer | | |
| | Treatment for Well 25 Hazen & Sawyer | Costs prepared | by Hazen & Sawyer | | |
| [9] | **Electrical Power Facilities** | | | | **$ 10,000** |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | **$ 36,000** |
| | Acquire 20' by 1,500' ROW for pipe from well 28 and permitting | 1,500 | LF | $4 | $ 6,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 4,102,000** |

**Future Energy Cost Complete Option D-P (Alt 5-1, 5-2, 6-1, 6-2) and D-C (Alt 1-2, 1-5, 5-1, 5-2, 6-1, 6-2)**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes | Water Use | |
|---|---|---|---|---|---|---|---|---|
| Upland Wells | 4,416 | 79.1% | | | | Z2 & 3 | | |
| | 1,166 | | | | | Z1 | 736 | |
| | 2,734 | | | | | Z2 | 3,115 | |
| | 1,732 | | | | | Z3 | 1,731 | |
| Wells and Pumps in operation for Complete Option D-P and D-C | | | | | | | 5,582 | |
| Well 5 | 145 | 2.6% | 140 | 145 | $20,299 | [a] | | |
| Well 6 | 174 | 3.1% | 225 | 174 | $39,067 | [a] | | |
| Well 7 | 376 | 6.7% | 153 | 376 | $57,567 | [b] | | |
| Well 24 | 174 | 3.1% | 210 | 174 | $36,462 | [a] | | |
| Well 25 | 404 | 7.2% | 107 | 404 | $43,209 | [b] | | |
| Well 27 | 1,009 | 18.1% | 124 | 1,009 | $125,116 | [c] | 410 To Zone 3 | 1,203 To Zone 2 |
| Well 28 | 604 | 10.8% | 90 | 604 | $54,360 | [c] | | |
| Well 1 | 163 | 2.9% | 123 | 163 | $20,049 | [c] | | |
| Well 2 | 402 | 7.2% | 123 | 402 | $49,446 | [c] | | |
| Well 3 | 0 | 0.0% | 86 | 0 | $0 | | | |
| Well 15 | 966 | 17.3% | 86 | 966 | $83,076 | [c] | | |
| MVPS, SWP | 766 | 13.7% | 37 | 766 | $28,342 | Assumed | | |
| Gallery Well | 0 | 0.0% | 80 | 0 | $0 | Limited by water right of 515 AF | | |
| River Wells | 400 | 7.2% | 91 | 400 | $36,400 | Assumed | | |
| | 5,582 | 100.0% | | 5,582 | $593,393 | | | |
| Zone 1 to Zone 2 | | | | | | | | |
| | 430 | 7.7% | 40 | 430 | $17,200 | | | |
| Zone 2 to Zone 3 | | | | | | | | |
| | 50 | 0.9% | 80 | 50 | $4,000 | | | |
| | | | | Total | $614,593 | | | |
| | | | | $/AF | 110 | | | |
| | | | | Average Pumping Cost | $622,478 | | | |
| | | | | $/AF | 112 | | | |
| | | | | WTP Booster Pump Cost from Hazen & Sawyer | $108,000 | | | |
| | | | | $/AF | 19 | | | |
| | | | | Extra Pumping Cost | $100,115 | | | |
| | | | | $/AF | 18 | | | |

[a] Based on 35.8% operation per year

[b] Based on 35.8% operation per year and 25% flow reduction

[c] Based on 50% operation per year

**Complete Option E - Alt 5-1, 1-2, 1-4, 1-5 and 6-4 Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 3,460,000 |
| | 16 Pipeline from well 28 to zone 3 | 2,000 | LF | $ 210 | $ 420,000 |
| | 8 Pipeline from well 28 to zone 3 | 800 | LF | $ 110 | $ 88,000 |
| | 16 Wells 3 and 15 to joint pipe to treatment plant | 4,400 | LF | $ 210 | $ 924,000 |
| | 10 Wells 1 and 2 to joint pipe to treatment plant | 2,500 | LF | $ 130 | $ 325,000 |
| | 6 Well 1 to joint pipe to treatment plant | 100 | LF | $ 100 | $ 10,000 |
| | 8 Well 3 to joint pipe to treatment plant | 5,400 | LF | $ 110 | $ 594,000 |
| | 16 Joint pipe from wells 1,2,3 and 15 to treatment plant | 1,000 | LF | $ 210 | $ 210,000 |
| | 16 Treatment plant discharge pipe | 700 | LF | $ 210 | $ 147,000 |
| | 8 Pipeline from well 7 to 12" mainline | 700 | LF | $ 110 | $ 77,000 |
| | 8 Pipeline from well 24 to well 7 | 2,500 | LF | $ 110 | $ 275,000 |
| | 8 Pipeline from well 5 to well 25 | 3,500 | LF | $ 110 | $ 385,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| [3] | **Control Valves** | | | | $ 387,000 |
| | Valves at Well 28 | 1 | LS | $ 20,000 | $ 20,000 |
| | Valves at Well 28 new booster pump | 1 | LS | $ 20,000 | $ 20,000 |
| | Flow control valves at well 28 and new booster at well 28 | 2 | Each | $ 5,000 | $ 10,000 |
| | 12-inch inline blending static mixer | 1 | LS | $ 15,000 | $ 15,000 |
| | Valves at Well 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 7 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 7 and 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 5 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 5 and 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 15 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 2 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 3 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 1 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 6 and 8-inch valves | 12 | Each | $ 1,500 | $ 18,000 |
| | 10-inch valves | 2 | Each | $ 2,000 | $ 4,000 |
| | 12-inch valves | 0 | Each | $ 2,500 | $ - |
| | 16-inch valves | 8 | Each | $ 3,500 | $ 28,000 |
| | Blowoff valve assembly with valve box | 18 | Each | $ 5,000 | $ 90,000 |
| | Air/vacuum and air relaease valve with valve box | 18 | Each | $ 5,000 | $ 90,000 |
| [5] | **Pump Stations** | | | | $ 288,000 |
| | Booster Pump (10 gpm) 17.3 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| | Booster Pump (1,500 gpm, 300 TDH, 150 hp) at Well 28 | 150 | Hp | $ 1,500 | $ 225,000 |
| | Well 3 new pump and motor 600 gpm 75 hp | 1 | LS | $ 48,000 | $ 48,000 |
| [6] | **Electrical Controls** | | | | $ 65,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| | Booster Pump (1,500 gpm, 300 TDH, 150 hp) at Well 28 | 1 | LS | $ 60,000 | $ 60,000 |
| [7] | **SCADA System** | | | | $ 25,000 |
| | SCADA Connection, components, operations for new booster | 1 | LS | $ 25,000 | $ 25,000 |
| [8] | **Water Treatment Plant** | | | | $ 120,000 |
| | Packer at well 27 | 1 | LS | $ 100,000 | $ 100,000 |
| | Well 3 cleaning and development | 1 | LS | $20,000 | $ 20,000 |
| | Treatment for Wells 1,2,3,15 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| | Treatment for Well 7 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| | Treatment for Well 25 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| [9] | **Electrical Power Facilities** | | | | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 30,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | Total | | $ 4,385,000 |

**Future Energy Cost Complete Option E (Alt 5-1, 1-2, 1-4, 1-5, 6-4)**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes | Water Use | | |
|---|---|---|---|---|---|---|---|---|---|
| Upland Wells | 2,934 | 52.6% | | | | Z2 & 3 | | | |
| | 2,648 | | | | | Z1 | 736 | | |
| | 1,915 | | | | | Z2 | 3,115 | | |
| | 1,733 | | | | | Z3 | 1,731 | | |
| Wells and Pumps in operation for Complete Option E | | | | | | | 5,582 | | |
| Well 5 | 74 | 1.3% | 140 | 74 | $10,376 | [a] | | | |
| Well 6 | 89 | 1.6% | 225 | 89 | $19,970 | [a] | | | |
| Well 7 | 266 | 4.8% | 153 | 266 | $40,767 | [a] | | | |
| Well 24 | 89 | 1.6% | 210 | 89 | $18,639 | [a] | | | |
| Well 25 | 281 | 5.0% | 107 | 281 | $30,018 | [a] | | | |
| Well 27 | 384 | 6.9% | 124 | 384 | $47,554 | [b] | | | |
| Well 28 | 221 | 4.0% | 90 | 221 | $19,896 | [a] | 442 | To Zone 3 | 0 To Zone 2 |
| Well 1 | 163 | 2.9% | 123 | 163 | $20,049 | [c] | | | |
| Well 2 | 402 | 7.2% | 123 | 402 | $49,446 | [c] | | | |
| Well 3 | 0 | 0.0% | 86 | 0 | $0 | | | | |
| Well 15 | 966 | 17.3% | 86 | 966 | $83,076 | [c] | | | |
| MVPS, SWP | 2,000 | 35.8% | 37 | 2,000 | $74,000 | Assumed | | | |
| Gallery Well | 0 | 0.0% | 80 | 0 | $0 | Limited by water right of 515 AF | | | |
| River Wells | 648 | 11.6% | 95 | 648 | $61,560 | Assumed | | | |
| | 5,582 | 100.0% | | 5,582 | $475,350 | | | | |
| Zone 1 to Zone 2 | | | | | | | | | |
| | 1,912 | 34.3% | 40 | 1,912 | $76,480 | | | | |
| Zone 2 to Zone 3 | | | | | | | | | |
| | 492 | 8.8% | 80 | 492 | $39,370 | | | | |
| | | | | Total | $591,200 | | | | |
| | | | | $/AF | 106 | | | | |
| | | | | Average Pumping Cost | $622,478 | | | | |
| | | | | $/AF | 112 | | | | |
| | | | | WTP Booster Pump Cost from Hazen & Sawyer | $54,000 | | | | |
| | | | | $/AF | 10 | | | | |
| | | | | Extra Pumping Cost | $22,722 | | | | |
| | | | | $/AF | 4 | | | | |

[a] Based on 18.3% operation per year

[b] Based on 18.3% operation per year and 25% flow reduction

[c] Based on 50% operation per year

## Complete Option E-P - Alt 5-1, 1-4 6-1, 6-2 and 6-4 Cost Estimate

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 2,723,000 |
| | 16 Pipeline from well 28 to zone 3 | 2,000 | LF | $ 210 | $ 420,000 |
| | 8 Pipeline from well 28 to zone 3 | 800 | LF | $ 110 | $ 88,000 |
| | 16 Wells 3 and 15 to joint pipe to treatment plant | 4,400 | LF | $ 210 | $ 924,000 |
| | 10 Wells 1 and 2 to joint pipe to treatment plant | 2,500 | LF | $ 130 | $ 325,000 |
| | 6 Well 1 to joint pipe to treatment plant | 100 | LF | $ 100 | $ 10,000 |
| | 8 Well 3 to joint pipe to treatment plant | 5,400 | LF | $ 110 | $ 594,000 |
| | 16 Joint pipe from wells 1,2,3 and 15 to treatment plant | 1,000 | LF | $ 210 | $ 210,000 |
| | 16 Treatment plant discharge pipe | 700 | LF | $ 210 | $ 147,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| [3] | **Control Valves** | | | | $ 238,000 |
| | Valves at Well 28 | 1 | LS | $ 20,000 | $ 20,000 |
| | Valves at Well 28 new booster pump | 1 | LS | $ 20,000 | $ 20,000 |
| | Flow control valves at well 28 and new booster at well 28 | 2 | Each | $ 5,000 | $ 10,000 |
| | 12-inch inline blending static mixer | 1 | LS | $ 15,000 | $ 15,000 |
| | Well 15 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 2 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 3 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 1 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 6 and 8-inch valves | 6 | Each | $ 1,500 | $ 9,000 |
| | 10-inch valves | 2 | Each | $ 2,000 | $ 4,000 |
| | 12-inch valves | 0 | Each | $ 2,500 | $ - |
| | 16-inch valves | 8 | Each | $ 3,500 | $ 28,000 |
| | Blowoff valve assembly with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| | Air/vacuum and air relaease valve with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| [5] | **Pump Stations** | | | | $ 288,000 |
| | Booster Pump (10 gpm) 17.3 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| | Booster Pump (1,500 gpm, 300 TDH, 150 hp) at Well 28 | 150 | Hp | $ 1,500 | $ 225,000 |
| | Well 3 new pump and motor 600 gpm 75 hp | 1 | LS | $ 48,000 | $ 48,000 |
| [6] | **Electrical Controls** | | | | $ 65,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| | Booster Pump (1,500 gpm, 300 TDH, 150 hp) at Well 28 | 1 | LS | $ 60,000 | $ 60,000 |
| [7] | **SCADA System** | | | | $ 25,000 |
| | SCADA Connection, components, operations for new booster | 1 | LS | $ 25,000 | $ 25,000 |
| [8] | **Water Treatment Plant** | | | | $ 320,000 |
| | Packer at well 27 | 1 | LS | $ 100,000 | $ 100,000 |
| | Packer at well 7 | 1 | LS | $ 100,000 | $ 100,000 |
| | Packer at well 25 | 1 | LS | $ 100,000 | $ 100,000 |
| | Well 3 cleaning and development | 1 | LS | $20,000 | $ 20,000 |
| | Treatment for Wells 1,2,3,15 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| [9] | **Electrical Power Facilities** | | | | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 30,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 3,699,000** |

**Future Energy Cost Complete Option E-P (Alt 1-4, 5-1, 6-1, 6-2, 6-4) and E-C (Alt 1-2, 1-4, 1-5, 5-1, 6-1, 6-2, 6-4)**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes | Water Use | | |
|---|---|---|---|---|---|---|---|---|---|
| Upland Wells | 2,867 | 51.4% | | | | Z2 & 3 | | | |
| | 2,715 | | | | | Z1 | 736 | | |
| | 1,915 | | | | | Z2 | 3,115 | | |
| | 1,727 | | | | | Z3 | 1,731 | | |
| Wells and Pumps in operation for Complete Option E-P and E-C | | | | | | | 5,582 | | |
| Well 5 | 81 | 1.5% | 140 | 81 | $11,340 | [a] | | | |
| Well 6 | 97 | 1.7% | 225 | 97 | $21,825 | [a] | | | |
| Well 7 | 210 | 3.8% | 153 | 210 | $32,161 | [b] | | | |
| Well 24 | 97 | 1.7% | 210 | 97 | $20,370 | [a] | | | |
| Well 25 | 226 | 4.0% | 107 | 226 | $24,139 | [b] | | | |
| Well 27 | 384 | 6.9% | 124 | 384 | $47,554 | [b] | | | |
| Well 28 | 242 | 4.3% | 90 | 242 | $21,744 | [a] | | 483 To Zone 3 | 0 To Zone 2 |
| Well 1 | 163 | 2.9% | 123 | 163 | $20,049 | [c] | | | |
| Well 2 | 402 | 7.2% | 123 | 402 | $49,446 | [c] | | | |
| Well 3 | 0 | 0.0% | 86 | 0 | $0 | | | | |
| Well 15 | 966 | 17.3% | 86 | 966 | $83,076 | [c] | | | |
| MVPS, SWP | 2,000 | 35.8% | 37 | 2,000 | $74,000 | Assumed | | | |
| Gallery Well | 0 | 0.0% | 80 | 0 | $0 | Limited by water right of 515 AF | | | |
| River Wells | 715 | 12.8% | 98 | 715 | $70,070 | Assumed | | | |
| | 5,582 | 100.0% | | 5,582 | $475,774 | | | | |
| Zone 1 to Zone 2 | | | | | | | | | |
| | 1,979 | 35.5% | 40 | 1,979 | $79,160 | | | | |
| Zone 2 to Zone 3 | | | | | | | | | |
| | 533 | 9.5% | 80 | 533 | $42,640 | | | | |
| | | | | Total | $597,574 | | | | |
| | | | | $/AF | 107 | | | | |
| | | | | Average Pumping Cost | $622,478 | | | | |
| | | | | $/AF | 112 | | | | |
| | | | | WTP Booster Pump Cost from Hazen & Sawyer | $54,000 | | | | |
| | | | | $/AF | 10 | | | | |
| | | | | Extra Pumping Cost | $29,096 | | | | |
| | | | | $/AF | 5 | | | | |

[a] Based on 20% operation per year

[b] Based on 20% operation per year and 25% flow reduction

[c] Based on 50% operation per year

**Complete Option E-C - Alt 5-1, 1-2, 1-4, 1-5, 6-1, 6-2 and 6-4 Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 3,383,000 |
| | 16 Pipeline from well 28 to zone 3 | 2,000 | LF | $ 210 | $ 420,000 |
| | 8 Pipeline from well 28 to zone 3 | 800 | LF | $ 110 | $ 88,000 |
| | 8 pipeline from well 24 to well 7 | 2,500 | LF | $ 110 | $ 275,000 |
| | 8 pipeline from well 5 to well 25 | 3,500 | LF | $ 110 | $ 385,000 |
| | 16 Wells 3 and 15 to joint pipe to treatment plant | 4,400 | LF | $ 210 | $ 924,000 |
| | 10 Wells 1 and 2 to joint pipe to treatment plant | 2,500 | LF | $ 130 | $ 325,000 |
| | 6 Well 1 to joint pipe to treatment plant | 100 | LF | $ 100 | $ 10,000 |
| | 8 Well 3 to joint pipe to treatment plant | 5,400 | LF | $ 110 | $ 594,000 |
| | 16 Joint pipe from wells 1,2,3 and 15 to treatment plant | 1,000 | LF | $ 210 | $ 210,000 |
| | 16 Treatment plant discharge pipe | 700 | LF | $ 210 | $ 147,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| [3] | **Control Valves** | | | | $ 334,000 |
| | Valves at Well 28 | 1 | LS | $ 20,000 | $ 20,000 |
| | Valves at Well 28 new booster pump | 1 | LS | $ 20,000 | $ 20,000 |
| | Flow control valves at well 28 and new booster at well 28 | 2 | Each | $ 5,000 | $ 10,000 |
| | Valves at Well 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 7 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 7 and 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 5 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 5 and 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for well 28 | 1 | LS | $ 15,000 | $ 15,000 |
| | Well 15 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 2 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Well 3 flow control valve | 1 | LS | $ 10,000 | $ 10,000 |
| | Well 1 flow control valve | 1 | LS | $ 5,000 | $ 5,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | 6 and 8-inch valves | 10 | Each | $ 1,500 | $ 15,000 |
| | 10-inch valves | 2 | Each | $ 2,000 | $ 4,000 |
| | 12-inch valves | 0 | Each | $ 2,500 | $ - |
| | 16-inch valves | 8 | Each | $ 3,500 | $ 28,000 |
| | Blowoff valve assembly with valve box | 13 | Each | $ 5,000 | $ 65,000 |
| | Air/vacuum and air relaease valve with valve box | 13 | Each | $ 5,000 | $ 65,000 |
| [5] | **Pump Stations** | | | | $ 288,000 |
| | Booster Pump (10 gpm) 17.3 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| | Booster Pump (1,500 gpm, 300 TDH, 150 hp) at Well 28 | 150 | Hp | $ 1,500 | $ 225,000 |
| | Well 3 new pump and motor 600 gpm 75 hp | 1 | LS | $ 48,000 | $ 48,000 |
| [6] | **Electrical Controls** | | | | $ 65,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| | Booster Pump (1,500 gpm, 300 TDH, 150 hp) at Well 28 | 1 | LS | $ 60,000 | $ 60,000 |
| [7] | **SCADA System** | | | | $ 25,000 |
| | SCADA Connection, components, operations for new booster | 1 | LS | $ 25,000 | $ 25,000 |
| [8] | **Water Treatment Plant** | | | | $ 320,000 |
| | Packer at well 27 | 1 | LS | $ 100,000 | $ 100,000 |
| | Packer at well 7 | 1 | LS | $ 100,000 | $ 100,000 |
| | Packer at well 25 | 1 | LS | $ 100,000 | $ 100,000 |
| | Well 3 cleaning and development | 1 | LS | $20,000 | $ 20,000 |
| | Treatment for Wells 1,2,3,15 Hazen & Sawyer | Costs prepared by Hazen & Sawyer | | | |
| [9] | **Electrical Power Facilities** | | | | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 30,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 4,455,000** |

**Future Energy Cost Complete Option E-P (Alt 1-4, 5-1, 6-1, 6-2, 6-4) and E-C (Alt 1-2, 1-4, 1-5, 5-1, 6-1, 6-2, 6-4)**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes | Water Use | |
|---|---|---|---|---|---|---|---|---|
| Upland Wells | 2,867 | 51.4% | | | | Z2 & 3 | | |
| | 2,715 | | | | | Z1 | 736 | |
| | 1,915 | | | | | Z2 | 3,115 | |
| | 1,727 | | | | | Z3 | 1,731 | |
| Wells and Pumps in operation for Complete Option E-P and E-C | | | | | | | 5,582 | |
| Well 5 | 81 | 1.5% | 140 | 81 | $11,340 | [a] | | |
| Well 6 | 97 | 1.7% | 225 | 97 | $21,825 | [a] | | |
| Well 7 | 210 | 3.8% | 153 | 210 | $32,161 | [b] | | |
| Well 24 | 97 | 1.7% | 210 | 97 | $20,370 | [a] | | |
| Well 25 | 226 | 4.0% | 107 | 226 | $24,139 | [b] | | |
| Well 27 | 384 | 6.9% | 124 | 384 | $47,554 | [b] | | |
| Well 28 | 242 | 4.3% | 90 | 242 | $21,744 | [a] | 483 To Zone 3 | 0 To Zone 2 |
| Well 1 | 163 | 2.9% | 123 | 163 | $20,049 | [c] | | |
| Well 2 | 402 | 7.2% | 123 | 402 | $49,446 | [c] | | |
| Well 3 | 0 | 0.0% | 86 | 0 | $0 | | | |
| Well 15 | 966 | 17.3% | 86 | 966 | $83,076 | [c] | | |
| MVPS, SWP | 2,000 | 35.8% | 37 | 2,000 | $74,000 | Assumed | | |
| Gallery Well | 0 | 0.0% | 80 | 0 | $0 | Limited by water right of 515 AF | | |
| River Wells | 715 | 12.8% | 98 | 715 | $70,070 | Assumed | | |
| | 5,582 | 100.0% | | 5,582 | $475,774 | | | |
| Zone 1 to Zone 2 | | | | | | | | |
| | 1,979 | 35.5% | 40 | 1,979 | $79,160 | | | |
| Zone 2 to Zone 3 | | | | | | | | |
| | 533 | 9.5% | 80 | 533 | $42,640 | | | |
| | | | | Total | $597,574 | | | |
| | | | | $/AF | 107 | | | |
| | | | | Average Pumping Cost | $622,478 | | | |
| | | | | $/AF | 112 | | | |
| | | | | WTP Booster Pump Cost from Hazen & Sawyer | $54,000 | | | |
| | | | | $/AF | 10 | | | |
| | | | | Extra Pumping Cost | $29,096 | | | |
| | | | | $/AF | 5 | | | |

[a] Based on 20% operation per year

[b] Based on 20% operation per year and 25% flow reduction

[c] Based on 50% operation per year

**Complete Option F - Alt 4-1 Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 1,590,000 |
| | 10 Immediately downstream of 6 cfs well field | 500 | LF | $ 130 | $ 65,000 |
| | 10 Immediately downstream of 6 cfs well field | 2,000 | LF | $ 130 | $ 260,000 |
| | 12 Immediately downstream of Mesa Verde | 400 | LF | $ 150 | $ 60,000 |
| | 10 Immediately downstream of Mesa Verde | 1,800 | LF | $ 130 | $ 234,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 800 | LF | $ 150 | $ 120,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,600 | LF | $ 150 | $ 240,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,500 | LF | $ 150 | $ 225,000 |
| | 12 Zone 1 main line from Mesa Verde to Refugio Booster Pumps | 1,300 | LF | $ 150 | $ 195,000 |
| | 8 Relocation Zone 1 meters to Zone 2 | 1,000 | LF | $ 110 | $ 110,000 |
| | Relocation Zone 1 meters to Zone 2 | 1 | LS | $ 10,000 | $ 10,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | 8 Immediately downsteram of new booster @ Zone 1 Tank | 600 | LF | $ 110 | $ 66,000 |
| [3] | **Control Valves** | | | | $ 155,000 |
| | Booster Pump (1,250 gpm, 60 hp) at Zone 1 Tank | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) Luma Yucca Rd | 1 | LS | $ 2,000 | $ 2,000 |
| | 8-inch valves | 4 | Each | $ 1,500 | $ 6,000 |
| | 10-inch valves | 6 | Each | $ 2,000 | $ 12,000 |
| | 12-inch valves | 10 | Each | $ 2,500 | $ 25,000 |
| | Blowoff valve assembly with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| | Air/vacuum and air relaease valve with valve box | 10 | Each | $ 5,000 | $ 50,000 |
| [5] | **Pump Stations** | | | | $ 180,000 |
| | Booster Pump (1,250 gpm, 60 hp) at Zone 1 Tank | 75 | Hp | $ 1,600 | $ 120,000 |
| | Install new pump at Refugio-2 (1,500 gpm, 100 hp) | 75 | Hp | $ 600 | $ 45,000 |
| | Booster Pump (10 gpm) 17.1 to 60 psi | 1 | Hp | $ 15,000 | $ 15,000 |
| [6] | **Electrical Controls** | | | | $ 55,000 |
| | Booster Pump (1,250 gpm, 60 hp) at Zone 1 Tank | 1 | LS | $ 40,000 | $ 40,000 |
| | Refugio-2 upgrade to larger 100 hp pump | 1 | LS | $ 10,000 | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ 25,000 |
| | SCADA Connection, components, operations for new booster, Z1 | 1 | LS | $ 25,000 | $ 25,000 |
| [9] | **Electrical Power Facilities** | | | | $ 30,000 |
| | Booster Pump (1,250 gpm, 60 hp) at Zone 1 Tank | 1 | LS | $ 20,000 | $ 20,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 230,000 |
| | Acquire 50' by 50' of Land and permitting | 1 | LS | $ 200,000 | $ 200,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 2,265,000** |

**Future Energy Cost Alternative 4-1**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes |
|---|---|---|---|---|---|---|
| Upland Wells | 1,100 | 19.7% | | | | |
| Upland Wells in operation for Alternative 4 | | | | | | |
| Well 5 | 324 | | 140 | 324 | $45,360 | [a] |
| Well 6 | 388 | | 225 | 388 | $87,300 | [a] |
| Well 24 | 388 | | 210 | 388 | $81,480 | [a] |
| MVPS, SWP | 2,500 | 44.8% | 37 | 2,500 | $92,500 | [b] |
| River Wells | 1,982 | 35.5% | 90 | 1,982 | $178,380 | |
| | 5,582 | 100.0% | | 5,582 | $485,020 | |
| Zone 1 to Zone 2 | | | | | | |
| | 3,769 | 67.5% | 40 | 3,769 | $150,760 | |
| Zone 2 to Zone 3 | | | | | | |
| | 633 | 11.3% | 80 | 633 | $50,640 | |
| | | | | Total | $686,420 | |
| | | | | $/AF | 123 | |
| | | | | Average Pumping Cost | $622,478 | |
| | | | | $/AF | 112 | |
| | | | | Extra Pumping Cost | $63,942 | |
| | | | | $/AF | 11 | |

[a] Based on 80% operation per year
[b] Based on approximate 2013 water use (rounded)

Complete Option G - Alt 1-2, 1-5, 2-1, and 6-4 Cost Estimate

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 14,343,000 |
| | 8 -inch pipelines | 73,900 | LF | $ 100 | $ 7,390,000 |
| | 10 - inch pipelines | 18,000 | LF | $ 130 | $ 2,340,000 |
| | 12 - inch pipelines | 24,000 | LF | $ 150 | $ 3,600,000 |
| | 16 - inch pipelines | 1,500 | LF | $ 200 | $ 300,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | 10 pipeline near well 7 in Zone 3 | 200 | LF | $ 130 | $ 26,000 |
| | 8 pipeline parallel in Zone 3 | 400 | LF | $ 110 | $ 44,000 |
| | 8 pipeline from well 24 to well 7 | 2,300 | LF | $ 110 | $ 253,000 |
| | 8 pipeline from well 5 to well 25 | 3,500 | LF | $ 110 | $ 385,000 |
| [3] | **Control Valves** | | | | $ 1,000,000 |
| | Gallery well hydropneumatic tank valves | 1 | LS | $ 5,000 | $ 5,000 |
| | 100,000 gallon tank valves | 1 | LS | $ 10,000 | $ 10,000 |
| | Zone 2 to Zone 3 Booster Pump @ Alamo Pintado (785 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 7 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 7 and 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 5 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 5 and 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | 4-inch pressure reducing valves connection to existing system | 6 | Each | $ 10,000 | $ 60,000 |
| | 6-inch pressure reducing valves connection to existing system | 4 | Each | $ 15,000 | $ 60,000 |
| | 8-inch pressure reducing valves connection to existing system | 2 | Each | $ 20,000 | $ 40,000 |
| | 10-inch pressure reducing valves connection to existing system | 0 | Each | $ 25,000 | $ - |
| | 12-inch pressure reducing valves connection to existing system | 0 | Each | $ 30,000 | $ - |
| | 4-inch pressure reducing valves Zone 2 to Zone 1 | 0 | Each | $ 10,000 | $ - |
| | 8-inch valves | 41 | Each | $ 1,500 | $ 61,500 |
| | 10-inch valves | 9 | Each | $ 2,000 | $ 18,000 |
| | 12-inch valves | 12 | Each | $ 2,500 | $ 30,000 |
| | 16-inch valves | 1 | Each | $ 3,500 | $ 3,500 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | Blowoff valve assembly with valve box | 65 | Each | $ 5,000 | $ 325,000 |
| | Air/vacuum and air relaease valve with valve box | 61 | Each | $ 5,000 | $ 305,000 |
| | Well #3 connection to separate irrigation system | 1 | LS | $ 10,000 | $ 10,000 |
| [4] | **Tanks** | | | | $ 340,000 |
| | 15,000 hydropneumatic tank at Gallery Well | 1 | LS | $ 110,000 | $ 110,000 |
| | 10,000 hydropneumatic tank at Alamo Pintado booster pump | 1 | LS | $ 80,000 | $ 80,000 |
| | 100,000 gallon tank at Zone 2 existing tank site | 1 | LS | $ 150,000 | $ 150,000 |
| [5] | **Pump Stations** | | | | $ 113,000 |
| | Zone 2 to Zone 3 Booster Pump @ Alamo Pintado (785 gpm) 50 hp | 1 | LS | $ 50,000 | $ 50,000 |
| | Booster Pump (10 gpm) 17.6 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| | Well #3 pump and motor 600 gpm 75 hp | 1 | LS | $ 48,000 | $ 48,000 |
| [6] | **Electrical Controls** | | | | $ 50,000 |
| | Gallery Well presure tank | 1 | LS | $ 5,000 | $ 5,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| | Zone 2 to Zone 3 Booster Pump @ Alamo Pintado (25 hp) | 1 | LS | $ 40,000 | $ 40,000 |
| [7] | **SCADA System** | | | | $ 75,000 |
| | SCADA Connection, components, operations at new Zone 2 tank | 1 | LS | $ 25,000 | $ 25,000 |
| | SCADA Connection, components, operations at new Zone 3 booster | 1 | LS | $ 25,000 | $ 25,000 |
| | SCADA Connection, components, operations at Gallery well | 1 | LS | $ 25,000 | $ 25,000 |
| [8] | **Water Treatment** | | | | $ 120,000 |
| | Well #3 cleaning and development | 1 | LS | $ 20,000 | $ 20,000 |
| | Install packer in well 27 | 1 | LS | $100,000 | $ 100,000 |
| [9] | **Electrical Power Facilities** | | | | $ 25,000 |
| | Zone 2 to Zone 3 Booster Pump @ Alamo Pintado (25 hp) | 1 | LS | $ 15,000 | $ 15,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 530,000 |
| | Acquire 50' by 50' of land and permitting for Zone 3 booster | 1 | LS | $ 250,000 | $ 250,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | Acquire 50' by 50' of land and permitting for Gallery well tank | 1 | LS | $ 250,000 | $ 250,000 |
| | | | | **Total** | **$ 16,595,000** |

**Future Energy Cost Complete Option G (Alt 1-2, 1-5, 2-1, 6-4)**

| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes | Water Use | | |
|---|---|---|---|---|---|---|---|---|---|
| Upland Wells | 4,067 | 72.9% | | | | Z2 & 3 | | | |
| | 1,515 | | | | | Z1 | 736 | | |
| | 2,823 | | | | | Z2 | 3,115 | | |
| | 1,731 | | | | | Z3 | 1,731 | | |
| Wells and Pumps in operation for Complete Option G | | | | | | | 5,582 | | |
| Well 5 | 142 | 2.5% | 140 | 142 | $19,845 | [a] | | | |
| Well 6 | 170 | 3.0% | 225 | 170 | $38,194 | [a] | | | |
| Well 7 | 368 | 6.6% | 153 | 368 | $56,281 | [a] | | | |
| Well 24 | 170 | 3.0% | 210 | 170 | $35,648 | [a] | | | |
| Well 25 | 395 | 7.1% | 107 | 395 | $42,244 | [a] | | | |
| Well 27 | 384 | 6.9% | 124 | 384 | $47,554 | [b] | | 0 To Zone 3 | 384 To Zone 2 |
| Well 28 | 423 | 7.6% | 90 | 423 | $38,052 | [a] | | | |
| Well 1 | 163 | 2.9% | 123 | 163 | $20,049 | [c] | | | |
| Well 2 | 402 | 7.2% | 123 | 402 | $49,446 | [c] | | | |
| Well 3 | 486 | 8.7% | 86 | 486 | $41,796 | [c] | | | |
| Well 15 | 966 | 17.3% | 86 | 966 | $83,076 | [c] | | | |
| MVPS, SWP | 915 | 16.4% | 37 | 915 | $33,855 | Assumed | | | |
| Gallery Well | 300 | 5.4% | 80 | 300 | $24,000 | Limited by water right of 515 AF | | | |
| River Wells | 300 | 5.4% | 91 | 300 | $27,300 | Assumed | | | |
| | 5,582 | 100.0% | | 5,582 | $557,339 | | | | |
| Zone 1 to Zone 2 | | | | | | | | | |
| | 779 | 14.0% | 40 | 779 | $31,160 | | | | |
| Zone 2 to Zone 3 | | | | | | | | | |
| | 487 | 8.7% | 80 | 487 | $38,960 | | | | |
| | | | | Total | $627,459 | | | | |
| | | | | $/AF | 112 | | | | |
| | | | | Average Pumping Cost | $622,478 | | | | |
| | | | | $/AF | 112 | | | | |
| | | | | WTP Booster Pump Cost from Hazen & Sawyer | $0 | | | | |
| | | | | $/AF | 0 | | | | |
| | | | | Extra Pumping Cost | $4,981 | | | | |
| | | | | $/AF | 1 | | | | |

[a] Based on 35% operation per year

[b] Based on 25% operation per year and 25% flow reduction

[c] Based on 50% operation per year

**Complete Option H - Alt 1-2, 1-5, 6-3, and 6-4 Cost Estimate**

| | Description | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|---|
| [2] | **Pipelines** | | | | $ 1,466,000 |
| | 8 -inch pipelines in Zone 1 | 1,400 | LF | $ 100 | $ 140,000 |
| | 10 - inch pipelines in Zone 1 | 3,900 | LF | $ 130 | $ 507,000 |
| | Relocation Zone 2 meter to Zone 3 | 1 | LS | $ 5,000 | $ 5,000 |
| | 8 pipeline relocation Zone 1 meter to Zone 2 | 1,200 | LF | $ 110 | $ 132,000 |
| | 8 pipeline parallel in Zone 3 | 200 | LF | $ 110 | $ 22,000 |
| | 8 pipeline from well 24 to well 7 | 2,500 | LF | $ 110 | $ 275,000 |
| | 8 pipeline from well 5 to well 25 | 3,500 | LF | $ 110 | $ 385,000 |
| [3] | **Control Valves** | | | | $ 155,000 |
| | Valves at Well 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 7 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 7 and 24 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | Valves at Well 5 | 1 | LS | $ 10,000 | $ 10,000 |
| | 12-inch inline blending static mixer for wells 5 and 25 | 1 | LS | $ 10,000 | $ 10,000 |
| | 8-inch valves | 6 | Each | $ 1,500 | $ 9,000 |
| | 10-inch valves | 2 | Each | $ 2,000 | $ 4,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 2,000 | $ 2,000 |
| | Blowoff valve assembly with valve box | 8 | Each | $ 5,000 | $ 40,000 |
| | Air/vacuum and air relaease valve with valve box | 8 | Each | $ 5,000 | $ 40,000 |
| [4] | **Tanks** | | | | $ - |
| [5] | **Pump Stations** | | | | $ 15,000 |
| | Booster Pump (10 gpm) 17.1 to 60 psi | 1.0 | Hp | $ 15,000 | $ 15,000 |
| [6] | **Electrical Controls** | | | | $ 5,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 5,000 | $ 5,000 |
| [7] | **SCADA System** | | | | $ - |
| [8] | **Water Treatment** | | | | $ 200,000 |
| | Install packer in well 27 | 1 | LS | $100,000 | $ 100,000 |
| | Install packer in well 28 | 1 | LS | $100,000 | $ 100,000 |
| [9] | **Electrical Power Facilities** | | | | $ 10,000 |
| | Booster Pump (10 gpm) | 1 | LS | $ 10,000 | $ 10,000 |
| [10] | **Land and Right of Ways** | | | | $ 30,000 |
| | Acquire 20' by 20' of Land and permitting | 1 | LS | $ 30,000 | $ 30,000 |
| | | | | **Total** | **$ 1,880,000** |

**Future Energy Cost Complete Option H (Alt 1-2, 1-5, 6-3, 6-4)**

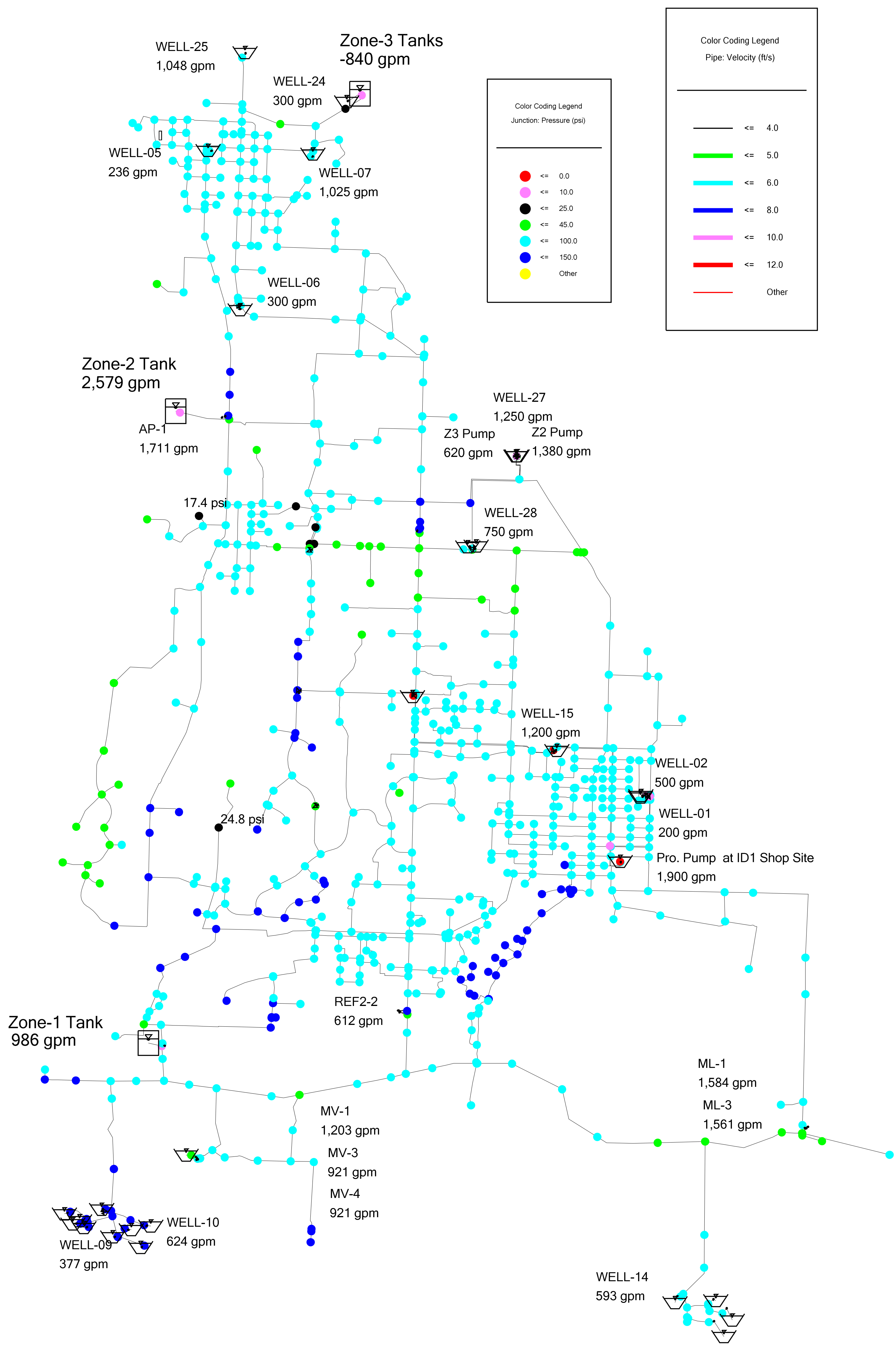
| Water Supply | Average AF | Percent | 2013 $/AF | Average AF | Average $ | Notes | Water Use | | |
|---|---|---|---|---|---|---|---|---|---|
| Upland Wells | 2,235 | 40.0% | | | | Z2 & 3 | | | |
| | 3,347 | | | | | Z1 | 736 | | |
| | 1,169 | | | | | Z2 | 3,115 | | |
| | 1,731 | | | | | Z3 | 1,731 | | |
| Wells and Pumps in operation for Complete Option H | | | | | | | 5,582 | | |
| Well 5 | 122 | 2.2% | 140 | 122 | $17,010 | [a] | | | |
| Well 6 | 146 | 2.6% | 225 | 146 | $32,738 | [a] | | | |
| Well 7 | 315 | 5.6% | 153 | 315 | $48,241 | [a] | | | |
| Well 24 | 146 | 2.6% | 210 | 146 | $30,555 | [a] | | | |
| Well 25 | 338 | 6.1% | 107 | 338 | $36,209 | [a] | | | |
| Well 27 | 767 | 13.7% | 124 | 767 | $95,108 | [b] | | 0 To Zone 3 | 767 To Zone 2 |
| Well 28 | 402 | 7.2% | 90 | 402 | $36,180 | [b] | | | |
| Well 1 | 0 | 0.0% | 123 | 0 | $0 | | | | |
| Well 2 | 0 | 0.0% | 123 | 0 | $0 | | | | |
| Well 3 | 0 | 0.0% | 86 | 0 | $0 | | | | |
| Well 15 | 0 | 0.0% | 86 | 0 | $0 | | | | |
| MVPS, SWP | 2,000 | 35.8% | 37 | 2,000 | $74,000 | Assumed | | | |
| Gallery Well | 0 | 0.0% | 80 | 0 | $0 | Limited by water right of 515 AF | | | |
| River Wells | 1,347 | 24.1% | 94 | 1,347 | $126,618 | Assumed | | | |
| | 5,582 | 100.0% | | 5,582 | $496,658 | | | | |
| Zone 1 to Zone 2 | | | | | | | | | |
| | 2,611 | 46.8% | 40 | 2,611 | $104,440 | | | | |
| Zone 2 to Zone 3 | | | | | | | | | |
| | 665 | 11.9% | 80 | 665 | $53,200 | | | | |
| | | | | Total | $654,298 | | | | |
| | | | | $/AF | 117 | | | | |
| | | | | Average Pumping Cost | $622,478 | | | | |
| | | | | $/AF | 112 | | | | |
| | | | | WTP Booster Pump Cost from Hazen & Sawyer | $0 | | | | |
| | | | | $/AF | 0 | | | | |
| | | | | Extra Pumping Cost | $31,820 | | | | |
| | | | | $/AF | 6 | | | | |

[a] Based on 30% operation per year

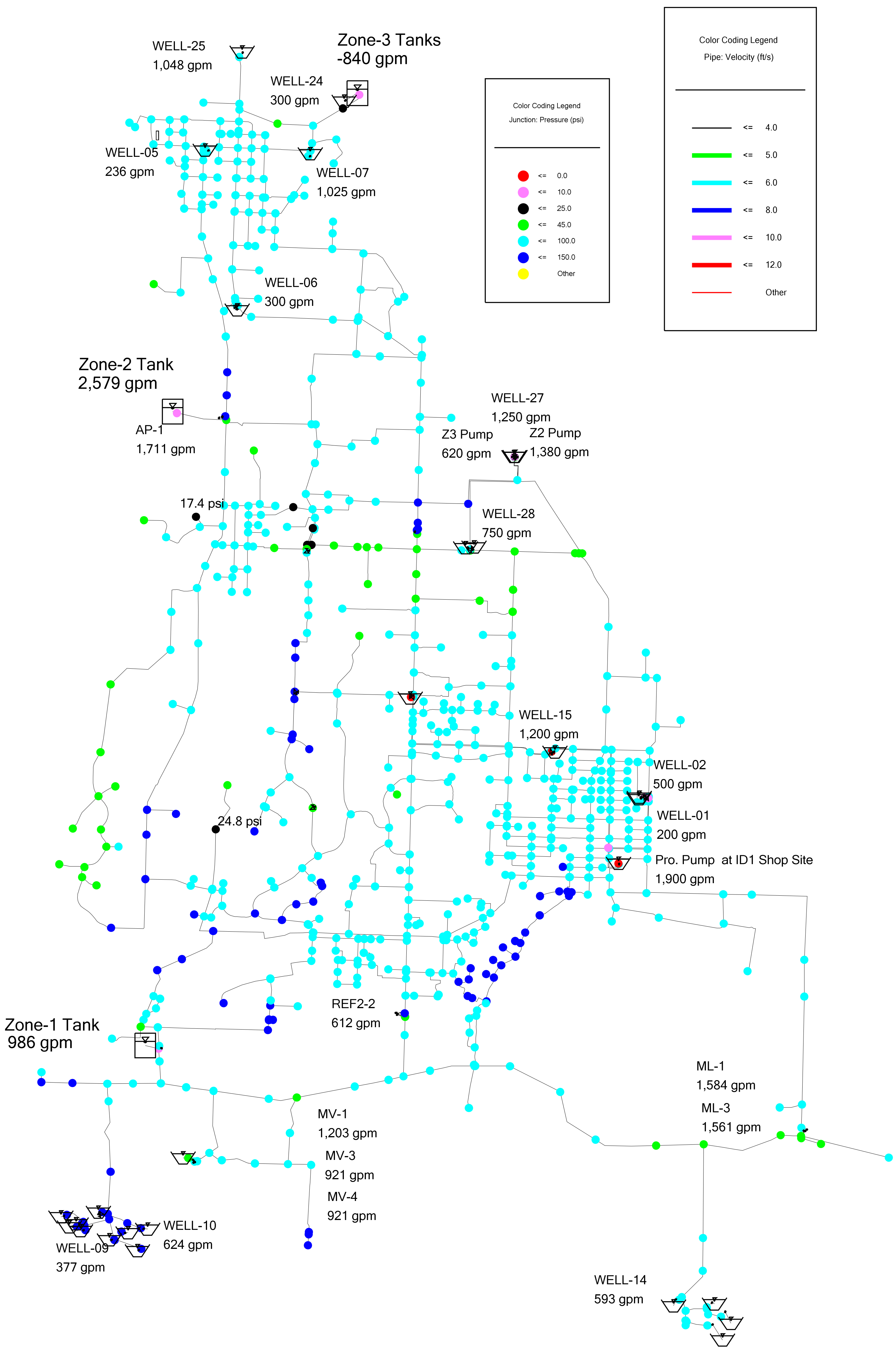
[b] Based on 50% operation per year and 25% flow reduction

# Attachment E

# Complete Option A
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)

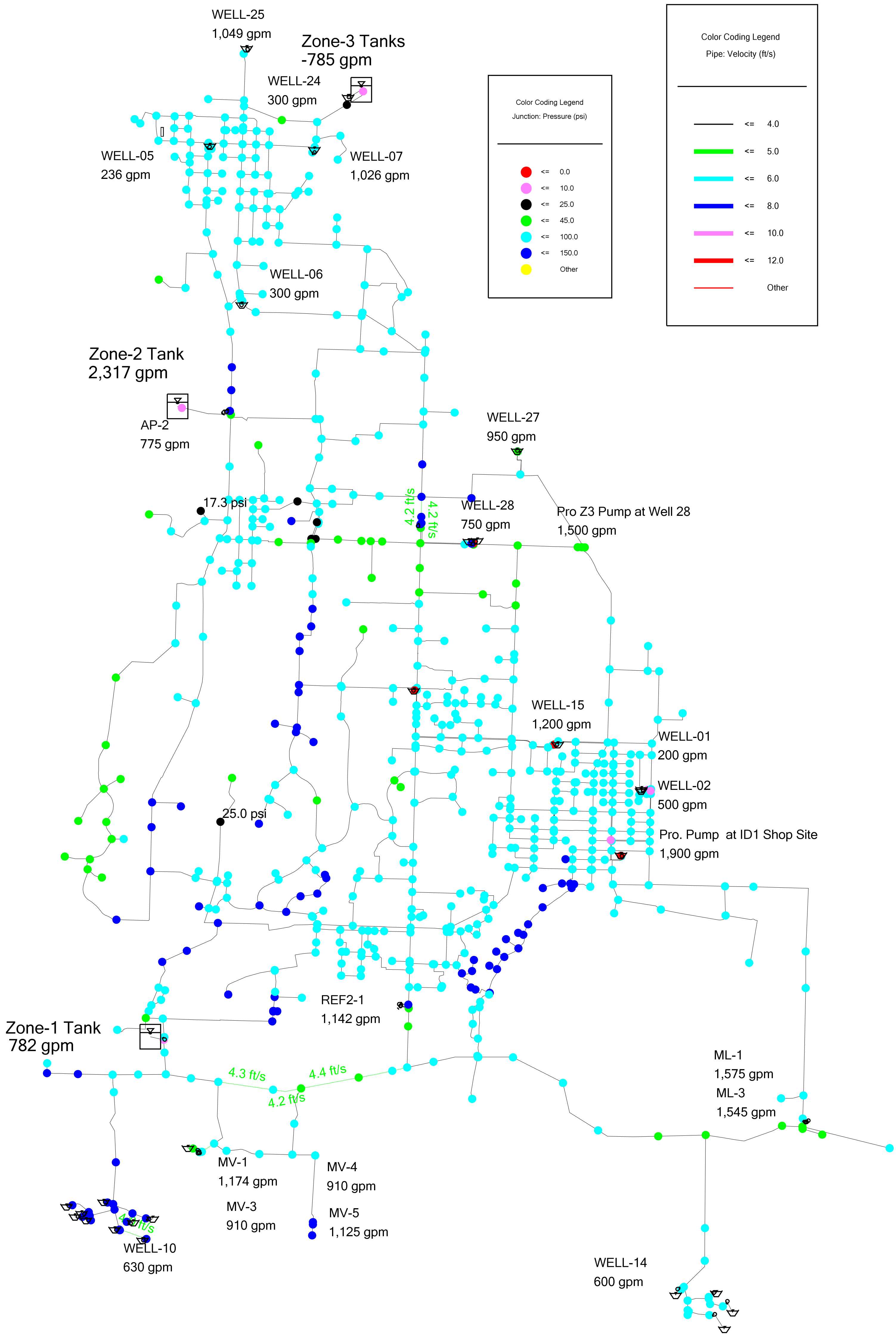


# Complete Option B
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)



## Complete Option C

## Proposed Solutions, Maximum Hour Demand (14,175 gpm)

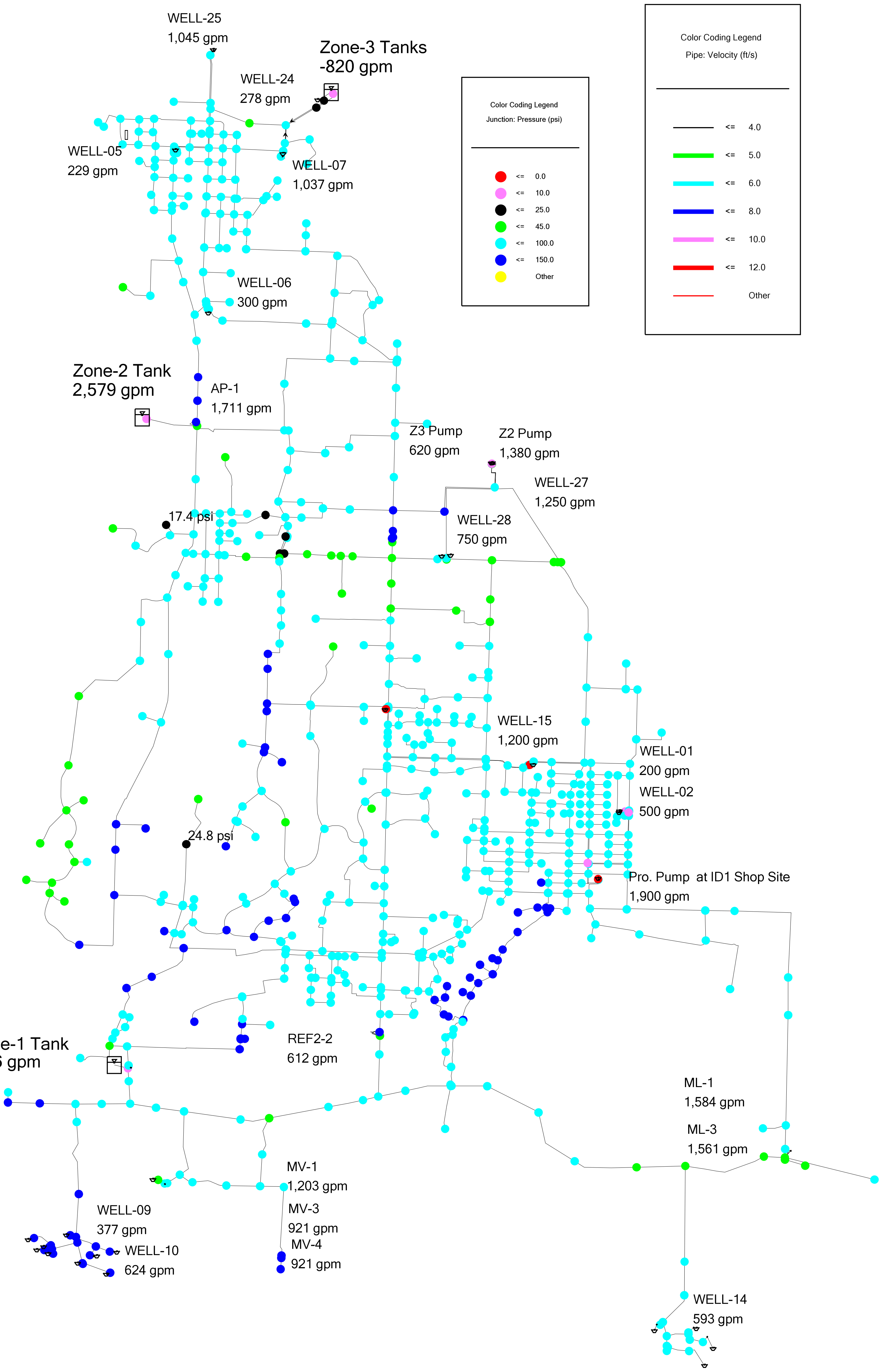



ID1 Hydraulic Model-Opt C.wtg
6/6/2014
I:\DATA\2492\Hydraulic Model\Complete Options



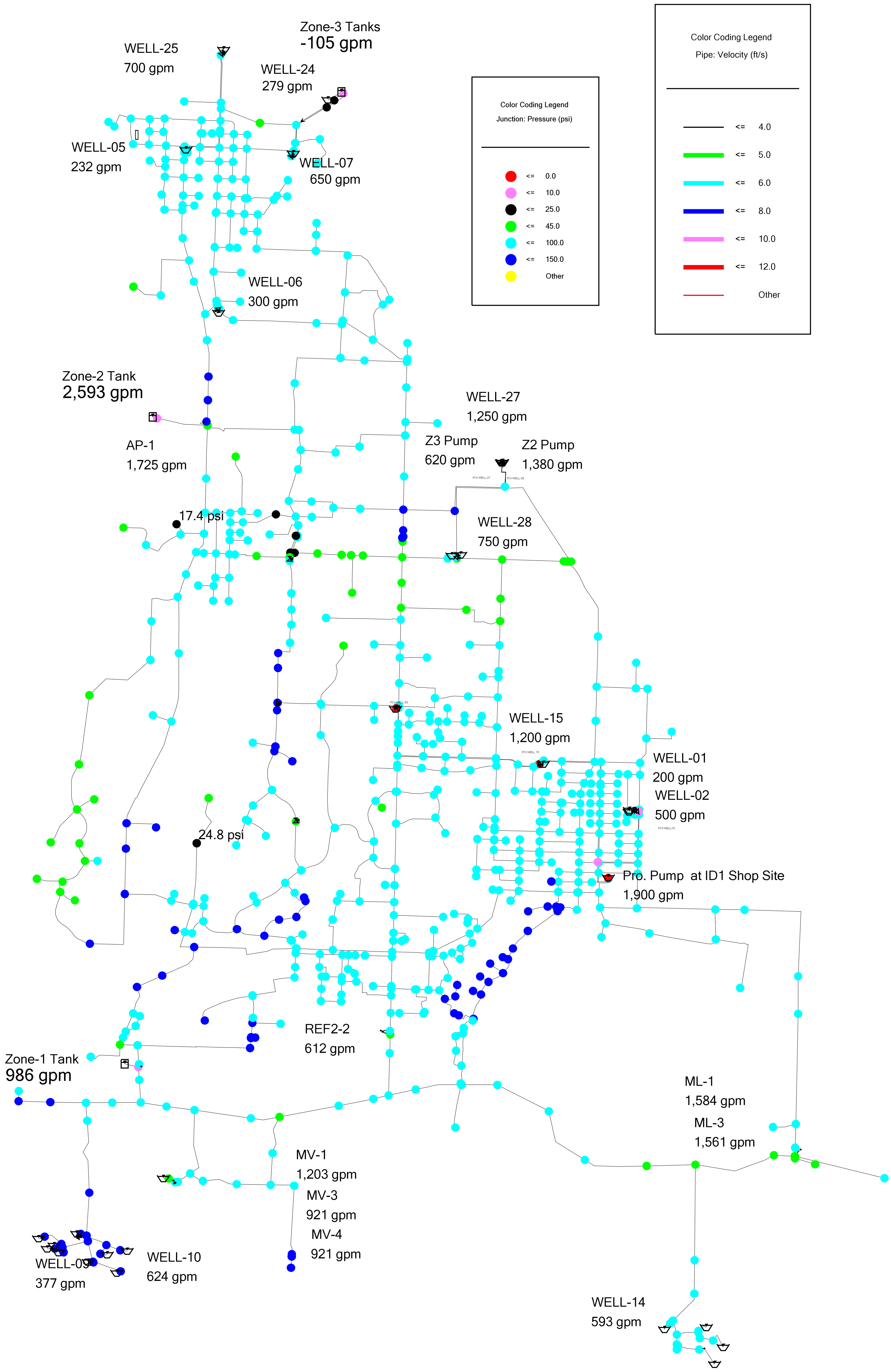
Bentley WaterCAD V8i
[08.11.00.30]

# Complete Option D
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)

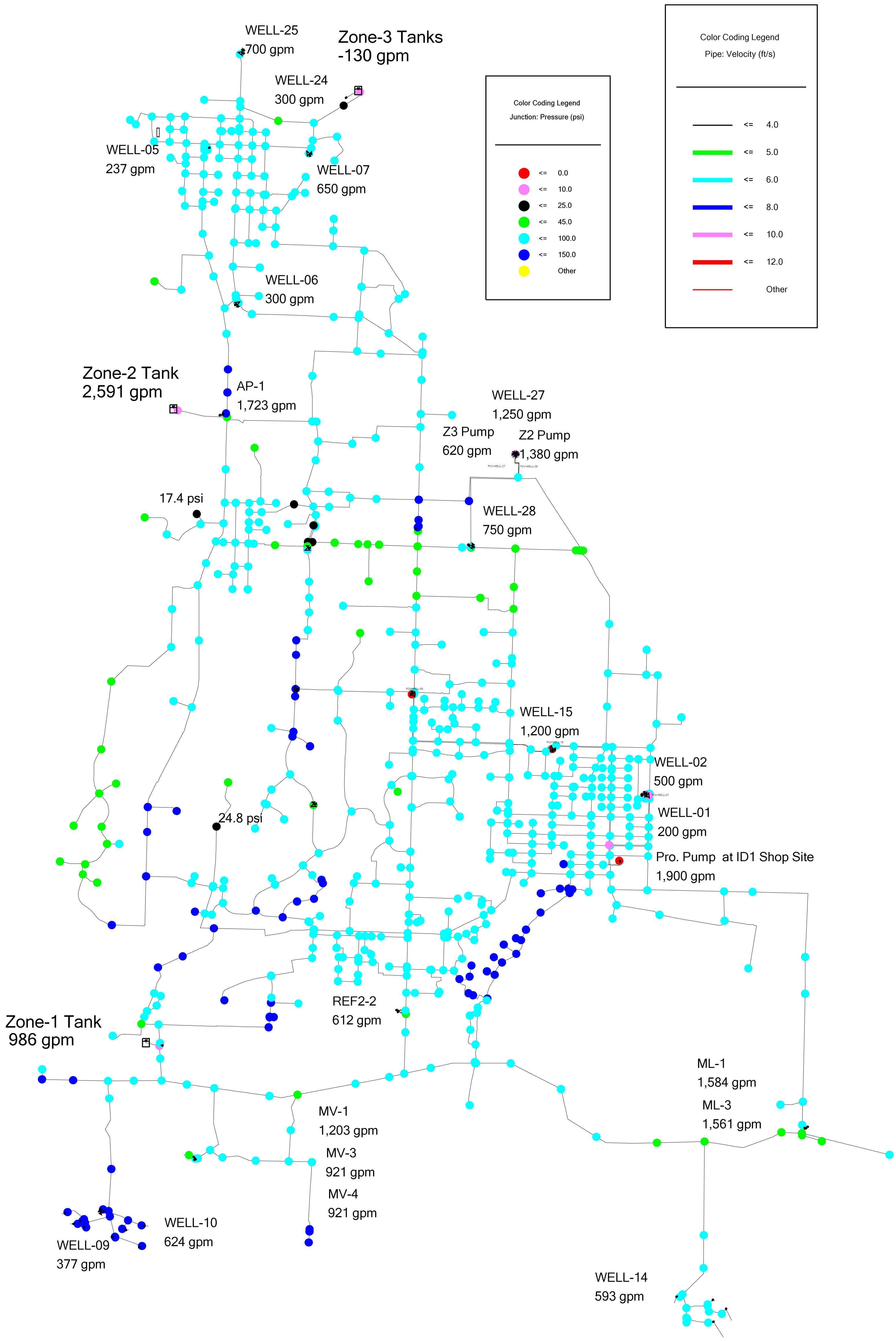


**Complete Option D-C**

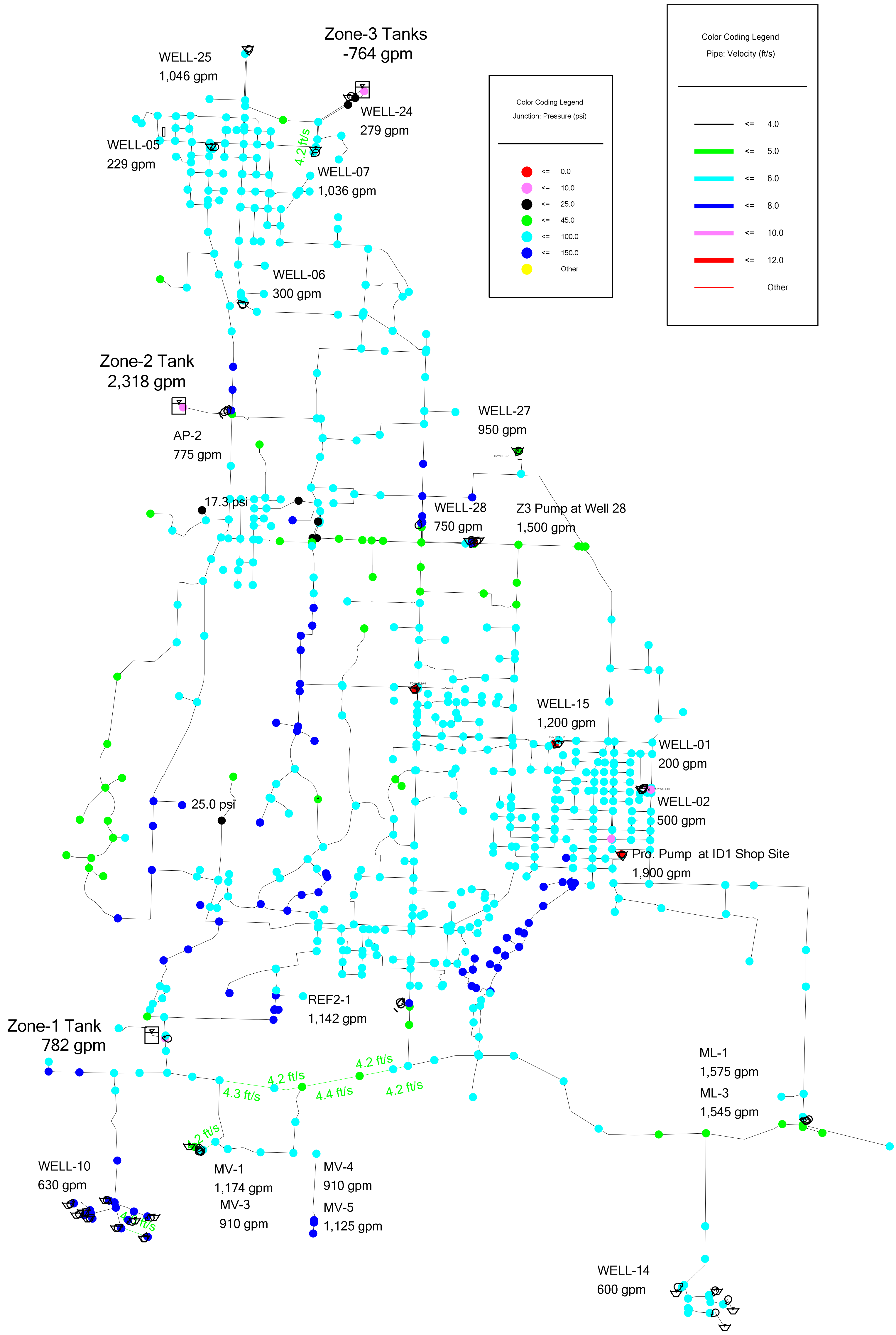
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**



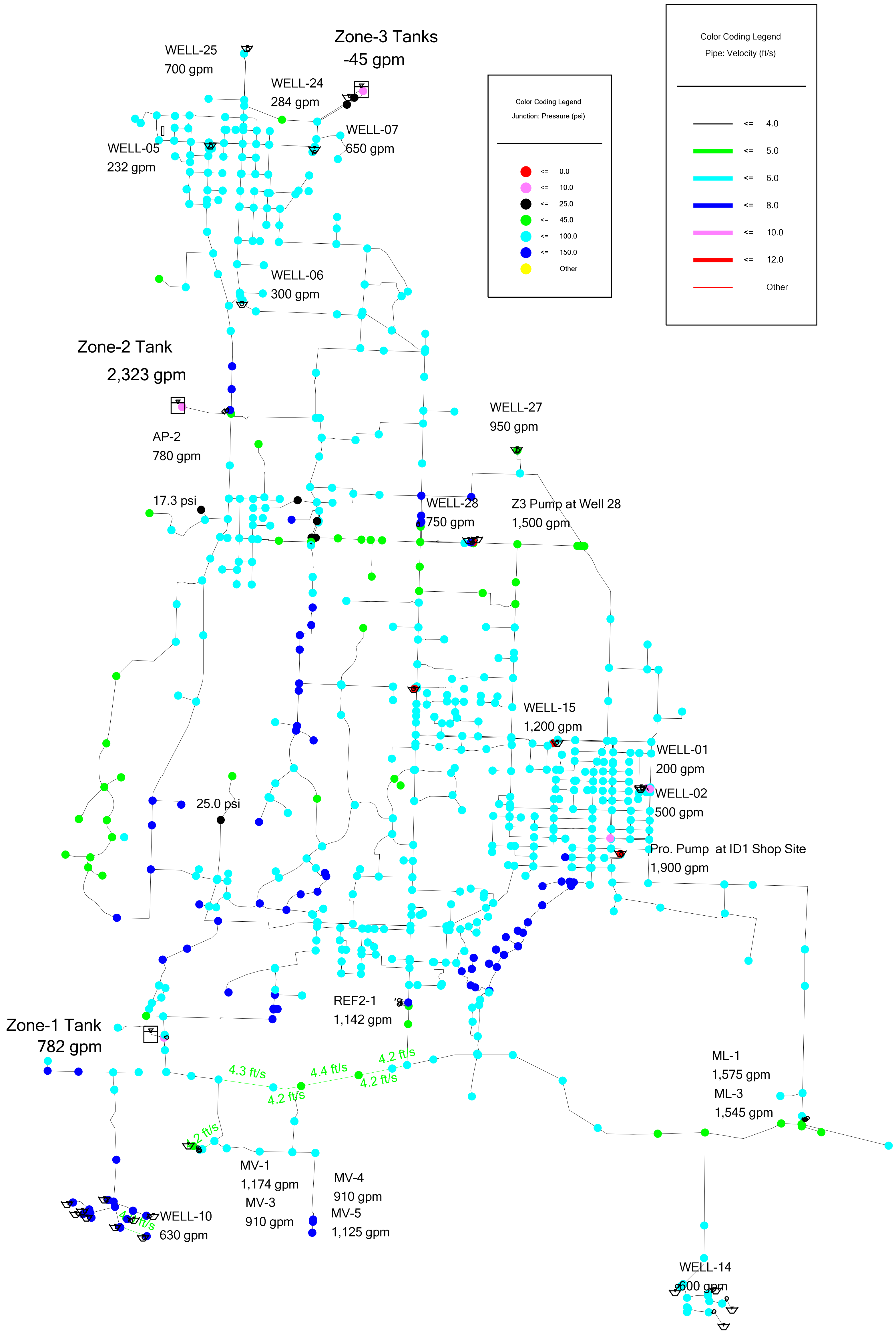
## Complete Option D-P
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)



# Complete Option E
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)

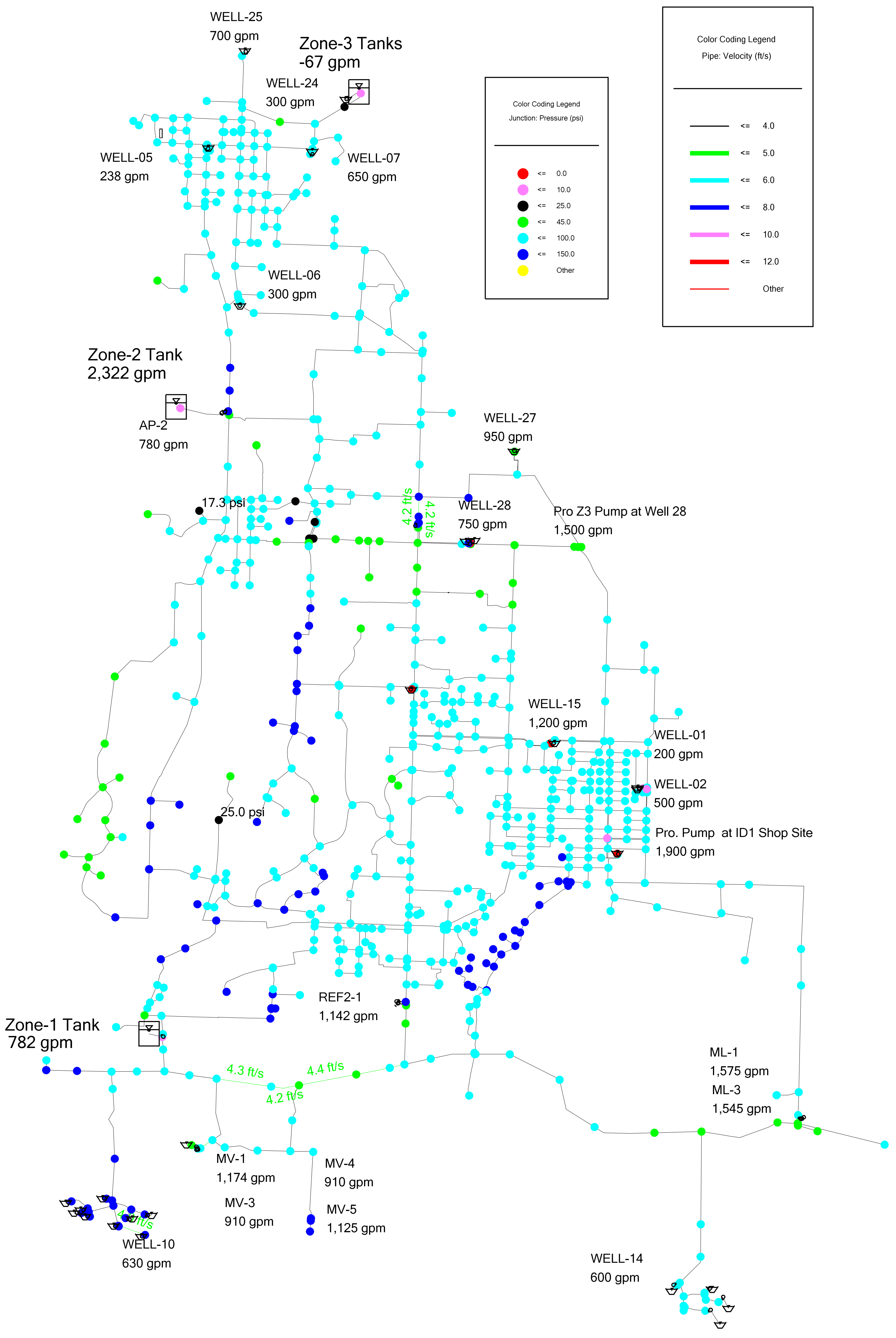


## Complete Option E-C
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)



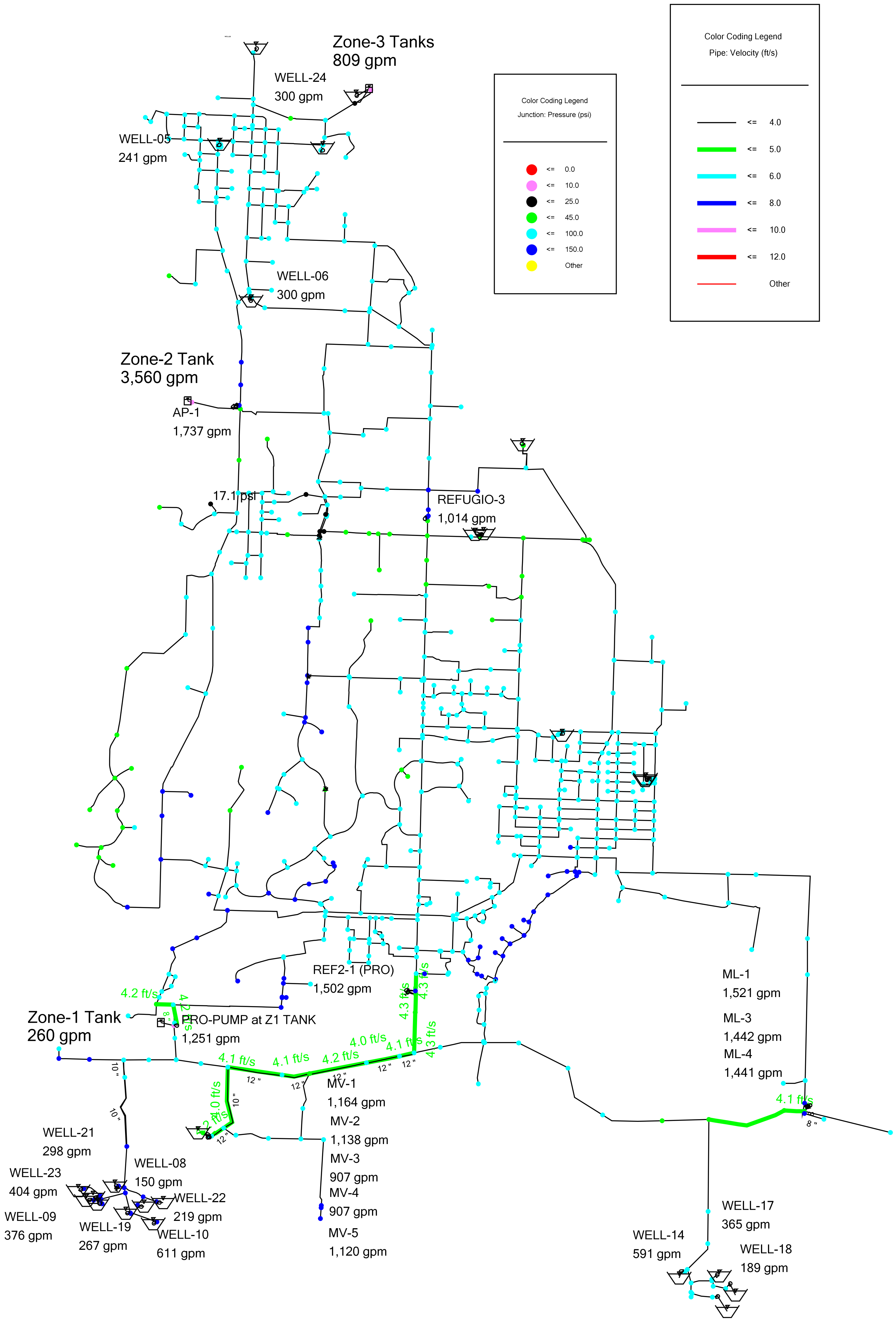
# Complete Option E-P

## Proposed Solutions, Maximum Hour Demand (14,175 gpm)



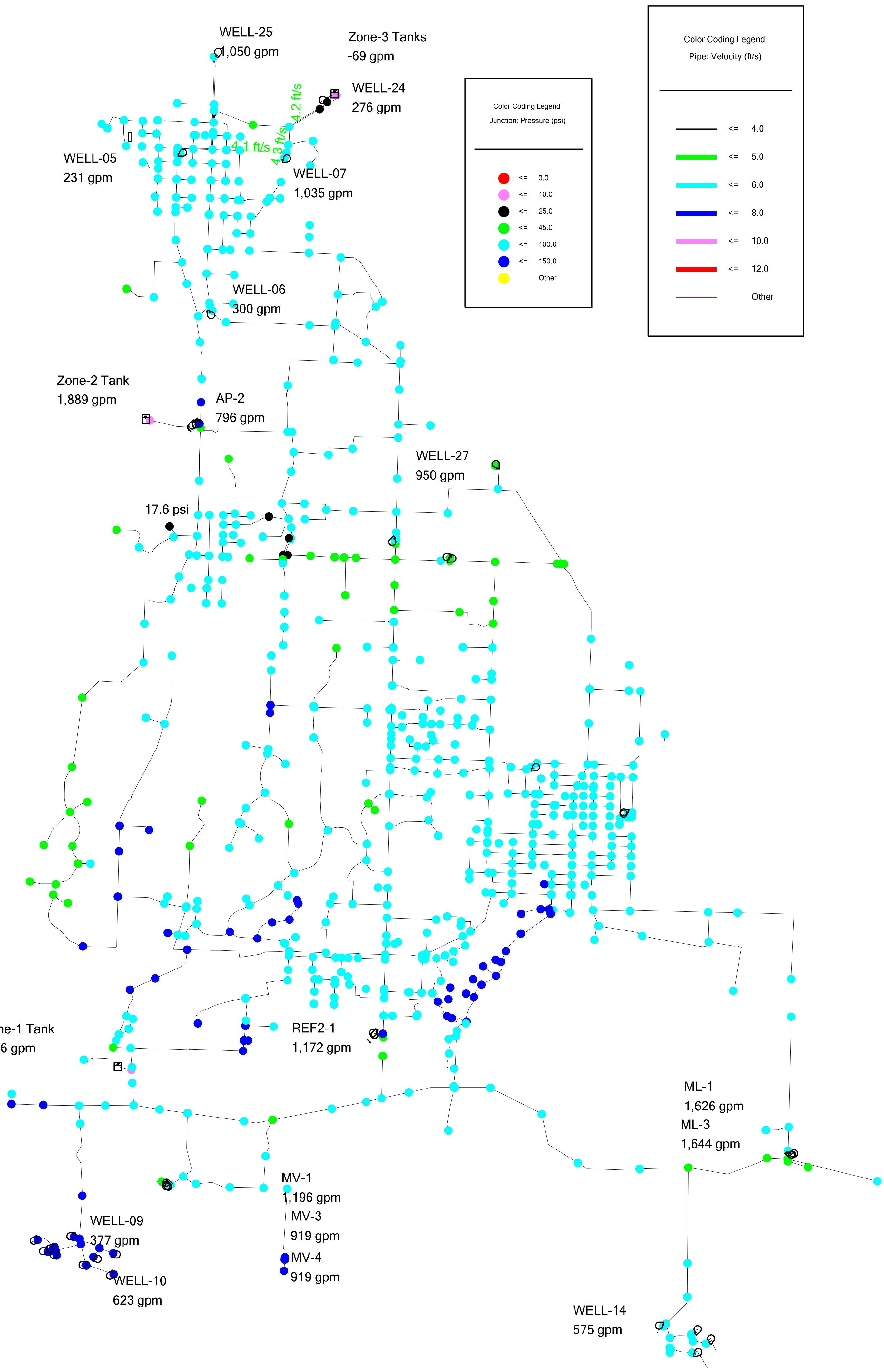
# Complete Option F

## Proposed Solutions, Maximum Hour Demand (14,175 gpm)



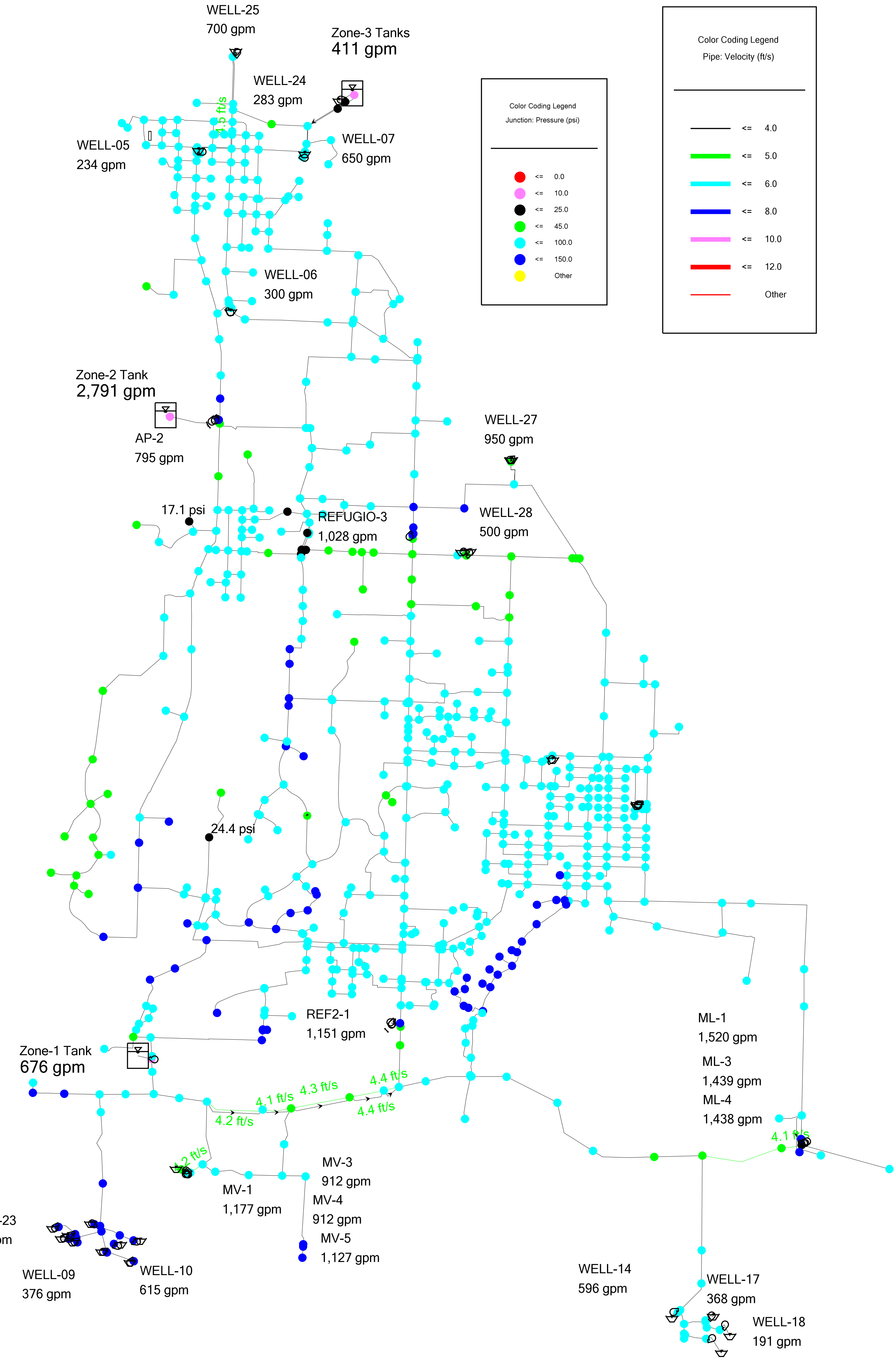
# Complete Option G

## Proposed Solutions, Maximum Hour Demand (10,103gpm)



# Complete Option H

## Proposed Solutions, Maximum Hour Demand (14,175 gpm)



# Attachment F

**Complete Option A**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 200 | 2 |
| Upland | 2 | 500 | 500 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 236 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 1,025 | 3 |
| Upland | 15 | 1,200 | 1,200 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 1,048 | 3 |
| Upland | 27 | 1,250 | 1,250 | 2/3 |
| Upland | 28 | 750 | 750 | 2/3 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***6,809*** | |
| | | | | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 377 | 1 |
| 6 cfs well field | 10 | 600 | 624 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 0 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,001*** | |
| | | | | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 593 | 1 |
| 4 cfs well field | 17 | 375 | 0 | 1 |
| 4 cfs well field | 18 | 200 | 0 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***593*** | |
| | | | | |
| Gallery Well | | *776* | 0 | 1 |
| | | | | |
| | ***Subtotal (Wells)*** | **12,011** | **8,403** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,203 | 1 |
| | MV-2 | 1,145 | 0 | 1 |
| | MV-3 | 885 | 921 | 1 |
| | MV-4 | 865 | 921 | 1 |
| | MV-5 | 1,105 | 0 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***3,045*** | |
| | | | | |
| | **Total (Wells + SWP)** | **17,211** | **11,448** | |

**Complete Option A**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,711 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,711*** | |
| Refugio-3 (REF-3) | NA | 950 | 0 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***1,711*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 0 | 2 |
| | 2 | 500 | 612 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***612*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,584 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,561 | 2 |
| | 4 | 1,500 | 0 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***3,145*** | |
| | **Zone 2 Subtotal** | **8,150** | **3,757** | |
| **Booster Pumps (Proposed)** | | | | |
| Z2 Pump at Well 27 Site WTP | NA | 1,380 | 1,380 | 2 |
| Z3 Pump at Well 27 Site WTP | NA | 620 | 620 | 3 |
| Pump at 1D1 Shop Site WTP | NA | 1,900 | 1,900 | 2 |

**Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)**

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 882 | 1,258 | -376 |
| 2 | 5,326 | 5,312 | 14 |
| 3 | 5,240 | 2,957 | 2,283 |
| **Total** | **11,448** | **9,527** | **1,921** |

**Complete Option B**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 200 | 2 |
| Upland | 2 | 500 | 500 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 236 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 1,025 | 3 |
| Upland | 15 | 1,200 | 1,200 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 1,048 | 3 |
| Upland | 27 | 1,250 | 1,250 | 2/3 |
| Upland | 28 | 750 | 750 | 2/3 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***6,809*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 377 | 1 |
| 6 cfs well field | 10 | 600 | 624 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 0 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,001*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 593 | 1 |
| 4 cfs well field | 17 | 375 | 0 | 1 |
| 4 cfs well field | 18 | 200 | 0 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***593*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **8,403** | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,203 | 1 |
| | MV-2 | 1,145 | 0 | 1 |
| | MV-3 | 885 | 921 | 1 |
| | MV-4 | 865 | 921 | 1 |
| | MV-5 | 1,105 | 0 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***3,045*** | |
| | **Total (Wells + SWP)** | **17,211** | **11,448** | |

**Complete Option B**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,711 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,711*** | |
| Refugio-3 (REF-3) | NA | 950 | 0 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***1,711*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 0 | 2 |
| | 2 | 500 | 612 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***612*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,584 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,561 | 2 |
| | 4 | 1,500 | 0 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***3,145*** | |
| | **Zone 2 Subtotal** | **8,150** | **3,757** | |
| **Booster Pumps (Proposed)** | | | | |
| Z2 Pump at Well 27 Site WTP | NA | 1,380 | 1,380 | 2 |
| Z3 Pump at Well 27 Site WTP | NA | 620 | 620 | 3 |
| Pump at 1D1 Shop Site WTP | NA | 1,900 | 1,900 | 2 |

**Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)**

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 882 | 1,258 | -376 |
| 2 | 5,326 | 5,312 | 14 |
| 3 | 5,240 | 2,957 | 2,283 |
| **Total** | **11,448** | **9,527** | **1,921** |

**Complete Option C**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 200 | 2 |
| Upland | 2 | 500 | 500 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 236 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 1,026 | 3 |
| Upland | 15 | 1,200 | 1,200 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 1,049 | 3 |
| Upland | 27 | 1,250 | 950 | 2 |
| Upland | 28 | 750 | 750 | 3 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***6,511*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 0 | 1 |
| 6 cfs well field | 10 | 600 | 630 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 0 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***630*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 600 | 1 |
| 4 cfs well field | 17 | 375 | 0 | 1 |
| 4 cfs well field | 18 | 200 | 0 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***600*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **7,741** | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,174 | 1 |
| | MV-2 | 1,145 | 0 | 1 |
| | MV-3 | 885 | 910 | 1 |
| | MV-4 | 865 | 910 | 1 |
| | MV-5 | 1,105 | 1,125 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***4,119*** | |
| | **Total (Wells + SWP)** | **17,211** | **11,860** | |

## Complete Option C
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 0 | 3 |
| | 2 | 750 | 775 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***775*** | |
| Refugio-3 (REF-3) | NA | 950 | 0 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***775*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,142 | 2 |
| | 2 | 500 | 0 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,142*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,575 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,545 | 2 |
| | 4 | 1,500 | 0 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***3,120*** | |
| | **Zone 2 Subtotal** | **8,150** | **4,262** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Well 28 Site WTP | NA | 1,500 | 1,500 | 3 |
| Pump at 1D1 Shop Site WTP | NA | 1,900 | 1,900 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,087 | 1,258 | -171 |
| 2 | 5,587 | 5,312 | 275 |
| 3 | 5,186 | 2,957 | 2,229 |
| **Total** | **11,860** | **9,527** | **2,333** |

## Complete Option D
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| **Well or Pump Name** | **Well or Pump No.** | **Normal Flow (gpm)** | **Model Flow (gpm)** | **Pressure Zone** |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 200 | 2 |
| Upland | 2 | 500 | 500 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 229 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 1,037 | 3 |
| Upland | 15 | 1,200 | 1,200 | 2 |
| Upland | 24 | 300 | 278 | 3 |
| Upland | 25 | 950 | 1,045 | 3 |
| Upland | 27 | 1,250 | 1,250 | 2/3 |
| Upland | 28 | 750 | 750 | 2/3 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***6,789*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 377 | 1 |
| 6 cfs well field | 10 | 600 | 624 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 0 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,001*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 593 | 1 |
| 4 cfs well field | 17 | 375 | 0 | 1 |
| 4 cfs well field | 18 | 200 | 0 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***593*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **8,383** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,203 | 1 |
| | MV-2 | 1,145 | 0 | 1 |
| | MV-3 | 885 | 921 | 1 |
| | MV-4 | 865 | 921 | 1 |
| | MV-5 | 1,105 | 0 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***3,045*** | |
| | **Total (Wells + SWP)** | **17,211** | **11,428** | |

**Complete Option D**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,711 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,711*** | |
| Refugio-3 (REF-3) | NA | 950 | 0 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***1,711*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 0 | 2 |
| | 2 | 500 | 612 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***612*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,584 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,561 | 2 |
| | 4 | 1,500 | 0 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***3,145*** | |
| | **Zone 2 Subtotal** | **8,150** | **3,757** | |
| **Booster Pumps (Proposed)** | | | | |
| Z2 Pump at Well 27 Site WTP | NA | 1,380 | 1,380 | 2 |
| Z3 Pump at Well 27 Site WTP | NA | 620 | 620 | 3 |
| Pump at 1D1 Shop Site WTP | NA | 1,900 | 1,900 | 2 |

**Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)**

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 882 | 1,258 | -376 |
| 2 | 5,326 | 5,312 | 14 |
| 3 | 5,220 | 2,957 | 2,263 |
| **Total** | **11,428** | **9,527** | **1,901** |

**Complete Option D-C**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 200 | 2 |
| Upland | 2 | 500 | 500 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 232 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 650 | 3 |
| Upland | 15 | 1,200 | 1,200 | 2 |
| Upland | 24 | 300 | 279 | 3 |
| Upland | 25 | 950 | 700 | 3 |
| Upland | 27 | 1,250 | 1,250 | 2/3 |
| Upland | 28 | 750 | 750 | 2/3 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***6,061*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 377 | 1 |
| 6 cfs well field | 10 | 600 | 624 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 0 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,001*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 593 | 1 |
| 4 cfs well field | 17 | 375 | 0 | 1 |
| 4 cfs well field | 18 | 200 | 0 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***593*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **7,655** | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,203 | 1 |
| | MV-2 | 1,145 | 0 | 1 |
| | MV-3 | 885 | 921 | 1 |
| | MV-4 | 865 | 921 | 1 |
| | MV-5 | 1,105 | 0 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***3,045*** | |
| | **Total (Wells + SWP)** | **17,211** | **10,700** | |

## Complete Option D-C
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,725 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,725*** | |
| Refugio-3 (REF-3) | NA | 950 | 0 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***1,725*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 0 | 2 |
| | 2 | 500 | 612 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***612*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,584 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,561 | 2 |
| | 4 | 1,500 | 0 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***3,145*** | |
| | **Zone 2 Subtotal** | **8,150** | **3,757** | |
| **Booster Pumps (Proposed)** | | | | |
| Z2 Pump at Well 27 Site WTP | NA | 1,380 | 1,380 | 2 |
| Z3 Pump at Well 27 Site WTP | NA | 620 | 620 | 3 |
| Pump at 1D1 Shop Site WTP | NA | 1,900 | 1,900 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 882 | 1,258 | -376 |
| 2 | 5,312 | 5,312 | 0 |
| 3 | 4,506 | 2,957 | 1,549 |
| **Total** | **10,700** | **9,527** | **1,173** |

## Complete Option D-P
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 200 | 2 |
| Upland | 2 | 500 | 500 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 237 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 650 | 3 |
| Upland | 15 | 1,200 | 1,200 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 700 | 3 |
| Upland | 27 | 1,250 | 1,250 | 2/3 |
| Upland | 28 | 750 | 750 | 2/3 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***6,087*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 377 | 1 |
| 6 cfs well field | 10 | 600 | 624 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 0 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,001*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 593 | 1 |
| 4 cfs well field | 17 | 375 | 0 | 1 |
| 4 cfs well field | 18 | 200 | 0 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***593*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **7,681** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,203 | 1 |
| | MV-2 | 1,145 | 0 | 1 |
| | MV-3 | 885 | 921 | 1 |
| | MV-4 | 865 | 921 | 1 |
| | MV-5 | 1,105 | 0 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***3,045*** | |
| | **Total (Wells + SWP)** | **17,211** | **10,726** | |

## Complete Option D-P
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,723 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,723*** | |
| Refugio-3 (REF-3) | NA | 950 | 0 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***1,723*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 0 | 2 |
| | 2 | 500 | 612 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***612*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,584 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,561 | 2 |
| | 4 | 1,500 | 0 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***3,145*** | |
| | **Zone 2 Subtotal** | **8,150** | **3,757** | |
| **Booster Pumps (Proposed)** | | | | |
| Z2 Pump at Well 27 Site WTP | NA | 1,380 | 1,380 | 2 |
| Z3 Pump at Well 27 Site WTP | NA | 620 | 626 | 3 |
| Pump at 1D1 Shop Site WTP | NA | 1,900 | 1,900 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 882 | 1,258 | -376 |
| 2 | 5,314 | 5,312 | 2 |
| 3 | 4,536 | 2,957 | 1,579 |
| **Total** | **10,732** | **9,527** | **1,205** |

**Complete Option E**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 200 | 2 |
| Upland | 2 | 500 | 500 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 229 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 1,036 | 3 |
| Upland | 15 | 1,200 | 1,200 | 2 |
| Upland | 24 | 300 | 279 | 3 |
| Upland | 25 | 950 | 1,046 | 3 |
| Upland | 27 | 1,250 | 950 | 2 |
| Upland | 28 | 750 | 750 | 3 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***6,490*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 0 | 1 |
| 6 cfs well field | 10 | 600 | 630 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 0 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***630*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 600 | 1 |
| 4 cfs well field | 17 | 375 | 0 | 1 |
| 4 cfs well field | 18 | 200 | 0 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***600*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **7,720** | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,174 | 1 |
| | MV-2 | 1,145 | 0 | 1 |
| | MV-3 | 885 | 910 | 1 |
| | MV-4 | 865 | 910 | 1 |
| | MV-5 | 1,105 | 1,125 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***4,119*** | |
| | **Total (Wells + SWP)** | **17,211** | **11,839** | |

## Complete Option E
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 0 | 3 |
| | 2 | 750 | 775 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***775*** | |
| Refugio-3 (REF-3) | NA | 950 | 0 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***775*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,142 | 2 |
| | 2 | 500 | 0 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,142*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,575 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,545 | 2 |
| | 4 | 1,500 | 0 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***3,120*** | |
| | **Zone 2 Subtotal** | **8,150** | **4,262** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Well 28 Site WTP | NA | 1,500 | 1,500 | 3 |
| Pump at 1D1 Shop Site WTP | NA | 1,900 | 1,900 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,087 | 1,258 | -171 |
| 2 | 5,587 | 5,312 | 275 |
| 3 | 5,165 | 2,957 | 2,208 |
| **Total** | **11,839** | **9,527** | **2,312** |

## Complete Option E-C
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 200 | 2 |
| Upland | 2 | 500 | 500 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 232 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 650 | 3 |
| Upland | 15 | 1,200 | 1,200 | 2 |
| Upland | 24 | 300 | 284 | 3 |
| Upland | 25 | 950 | 700 | 3 |
| Upland | 27 | 1,250 | 950 | 2 |
| Upland | 28 | 750 | 750 | 3 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***5,766*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 0 | 1 |
| 6 cfs well field | 10 | 600 | 630 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 0 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***630*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 600 | 1 |
| 4 cfs well field | 17 | 375 | 0 | 1 |
| 4 cfs well field | 18 | 200 | 0 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***600*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **6,996** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,174 | 1 |
| | MV-2 | 1,145 | 0 | 1 |
| | MV-3 | 885 | 910 | 1 |
| | MV-4 | 865 | 910 | 1 |
| | MV-5 | 1,105 | 1,125 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***4,119*** | |
| | **Total (Wells + SWP)** | **17,211** | **11,115** | |

## Complete Option E-C
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 0 | 3 |
| | 2 | 750 | 780 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***780*** | |
| Refugio-3 (REF-3) | NA | 950 | 0 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***780*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,142 | 2 |
| | 2 | 500 | 0 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,142*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,575 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,545 | 2 |
| | 4 | 1,500 | 0 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***3,120*** | |
| | **Zone 2 Subtotal** | **8,150** | **4,262** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Well 28 Site WTP | NA | 1,500 | 1,500 | 3 |
| Pump at 1D1 Shop Site WTP | NA | 1,900 | 1,900 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,087 | 1,258 | -171 |
| 2 | 5,582 | 5,312 | 270 |
| 3 | 4,446 | 2,957 | 1,489 |
| **Total** | **11,115** | **9,527** | **1,588** |

## Complete Option E-P
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 200 | 2 |
| Upland | 2 | 500 | 500 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 238 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 650 | 3 |
| Upland | 15 | 1,200 | 1,200 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 700 | 3 |
| Upland | 27 | 1,250 | 950 | 2 |
| Upland | 28 | 750 | 750 | 3 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***5,788*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 0 | 1 |
| 6 cfs well field | 10 | 600 | 630 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 0 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***630*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 600 | 1 |
| 4 cfs well field | 17 | 375 | 0 | 1 |
| 4 cfs well field | 18 | 200 | 0 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***600*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **7,018** | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,174 | 1 |
| | MV-2 | 1,145 | 0 | 1 |
| | MV-3 | 885 | 910 | 1 |
| | MV-4 | 865 | 910 | 1 |
| | MV-5 | 1,105 | 1,125 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***4,119*** | |
| | **Total (Wells + SWP)** | **17,211** | **11,137** | |

## Complete Option E-P
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 0 | 3 |
| | 2 | 750 | 780 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***780*** | |
| Refugio-3 (REF-3) | NA | 950 | 0 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***780*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 0 | 2 |
| | 2 | 500 | 780 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***780*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,587 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,568 | 2 |
| | 4 | 1,500 | 0 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***3,155*** | |
| | **Zone 2 Subtotal** | **8,150** | **3,935** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at Well 28 Site WTP | NA | 1,500 | 1,500 | 3 |
| Pump at 1D1 Shop Site WTP | NA | 1,900 | 1,900 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,414 | 1,258 | 156 |
| 2 | 5,255 | 5,312 | -57 |
| 3 | 4,468 | 2,957 | 1,511 |
| **Total** | **11,137** | **9,527** | **1,610** |

**Complete Option F**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 241 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 0 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 300 | 3 |
| Upland | 25 | 950 | 0 | 3 |
| Upland | 27 | 1,250 | 0 | 2 |
| Upland | 28 | 750 | 0 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***841*** | |
| 6 cfs well field | 8 | 150 | 150 | 1 |
| 6 cfs well field | 9 | 375 | 376 | 1 |
| 6 cfs well field | 10 | 600 | 611 | 1 |
| 6 cfs well field | 19 | 260 | 267 | 1 |
| 6 cfs well field | 21 | 275 | 298 | 1 |
| 6 cfs well field | 22 | 200 | 219 | 1 |
| 6 cfs well field | 23 | 400 | 404 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***2,325*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 591 | 1 |
| 4 cfs well field | 17 | 375 | 365 | 1 |
| 4 cfs well field | 18 | 200 | 189 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,145*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **4,311** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,164 | 1 |
| | MV-2 | 1,145 | 1,138 | 1 |
| | MV-3 | 885 | 907 | 1 |
| | MV-4 | 865 | 907 | 1 |
| | MV-5 | 1,105 | 1,120 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***5,236*** | |
| | **Total (Wells + SWP)** | **17,211** | **9,547** | |

## Complete Option F
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 1,737 | 3 |
| | 2 | 750 | 0 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***1,737*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,014 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***2,751*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 0 | 2 |
| | 2 | 500 | 0 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***0*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,521 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,442 | 2 |
| | 4 | 1,500 | 1,441 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,404*** | |
| | **Zone 2 Subtotal** | **8,150** | **4,404** | |
| **Booster Pumps (Proposed)** | | | | |
| Pump at RefigoPump Station | NA | 1,500 | 1,502 | 2 |
| Pump at Zone 1 Tank | NA | 1,250 | 1,251 | 2 |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,549 | 1,258 | 291 |
| 2 | 4,406 | 5,312 | -906 |
| 3 | 3,592 | 2,957 | 635 |
| **Total** | **9,547** | **9,527** | **20** |

## Complete Option G
## Proposed Solutions, Maximum Hour Demand (10, 103 gpm Potable Demand Only)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 231 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 1,034 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 275 | 3 |
| Upland | 25 | 950 | 1,050 | 3 |
| Upland | 27 | 1,250 | 950 | 2 |
| Upland | 28 | 750 | 0 | 3 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***3,840*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 377 | 1 |
| 6 cfs well field | 10 | 600 | 623 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 0 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,000*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 575 | 1 |
| 4 cfs well field | 17 | 375 | 0 | 1 |
| 4 cfs well field | 18 | 200 | 0 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***575*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **5,415** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,196 | 1 |
| | MV-2 | 1,145 | 0 | 1 |
| | MV-3 | 885 | 919 | 1 |
| | MV-4 | 865 | 919 | 1 |
| | MV-5 | 1,105 | 0 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***3,034*** | |
| | **Total (Wells + SWP)** | **17,211** | **8,449** | |

**Complete Option G**
**Proposed Solutions, Maximum Hour Demand (10, 103 gpm Potable Demand Only)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 0 | 3 |
| | 2 | 750 | 798 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***798*** | |
| Refugio-3 (REF-3) | NA | 950 | 0 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***798*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,172 | 2 |
| | 2 | 500 | 0 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,172*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,626 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,644 | 2 |
| | 4 | 1,500 | 0 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***3,270*** | |
| | **Zone 2 Subtotal** | **8,150** | **4,442** | |

## Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1* | 167 | 0 | 167 |
| 2 | 4,594 | 4,536 | 58 |
| 3 | 3,688 | 2,581 | 1,107 |
| **Total** | **8,449** | **7,117** | **1,332** |

Note: * Zone 1 demand is mainly for irrigattion use. To be conservative on pipe velocities, potable demand is assumed to be zero in this model run.

## Complete Option H
## Proposed Solutions, Maximum Hour Demand (14,175 gpm)
## Well and Pump Operation Summary

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Wells** | | | | |
| Upland | 1 | 200 | 0 | 2 |
| Upland | 2 | 500 | 0 | 2 |
| Upland | 3 | 600 | 0 | 2 |
| Upland | 5 | 250 | 234 | 3 |
| Upland | 6 | 300 | 300 | 3 |
| Upland | 7 | 900 | 650 | 3 |
| Upland | 15 | 1,200 | 0 | 2 |
| Upland | 24 | 300 | 283 | 3 |
| Upland | 25 | 950 | 700 | 3 |
| Upland | 27 | 1,250 | 950 | 2 |
| Upland | 28 | 750 | 500 | 2 |
| | ***Subtotal (Upland)*** | ***7,200*** | ***3,617*** | |
| 6 cfs well field | 8 | 150 | 0 | 1 |
| 6 cfs well field | 9 | 375 | 376 | 1 |
| 6 cfs well field | 10 | 600 | 615 | 1 |
| 6 cfs well field | 19 | 260 | 0 | 1 |
| 6 cfs well field | 21 | 275 | 0 | 1 |
| 6 cfs well field | 22 | 200 | 0 | 1 |
| 6 cfs well field | 23 | 400 | 407 | 1 |
| | ***Subtotal (6 cfs well field)*** | ***2,260*** | ***1,398*** | |
| 4 cfs well field | 12 | 600 | 0 | 1 |
| 4 cfs well field | 14 | 600 | 596 | 1 |
| 4 cfs well field | 17 | 375 | 368 | 1 |
| 4 cfs well field | 18 | 200 | 191 | 1 |
| | ***Subtotal (4 cfs well field)*** | ***1,775*** | ***1,155*** | |
| Gallery Well | | *776* | 0 | 1 |
| | ***Subtotal (Wells)*** | **12,011** | **6,170** | |
| | | | | |
| Mesa Verde Pump Station | | | | |
| | MV-1 | 1,200 | 1,177 | 1 |
| | MV-2 | 1,145 | 0 | 1 |
| | MV-3 | 885 | 912 | 1 |
| | MV-4 | 865 | 912 | 1 |
| | MV-5 | 1,105 | 1,127 | 1 |
| | ***Subtotal(SWP)*** | ***5,200*** | ***4,128*** | |
| | **Total (Wells + SWP)** | **17,211** | **10,298** | |

**Complete Option H**
**Proposed Solutions, Maximum Hour Demand (14,175 gpm)**
**Well and Pump Operation Summary**

| Well or Pump Name | Well or Pump No. | Normal Flow (gpm) | Model Flow (gpm) | Pressure Zone |
|---|---|---|---|---|
| **Booster Pumps (Existing)** | | | | |
| Alamo Pintado (AP) | 1 | 1,800 | 0 | 3 |
| | 2 | 750 | 795 | 3 |
| | 3 | 900 | 0 | 3 |
| | ***AP Subtotal*** | ***31,061*** | ***795*** | |
| Refugio-3 (REF-3) | NA | 950 | 1,028 | 3 |
| | ***Zone 3 Subtotal*** | ***32,011*** | ***1,823*** | |
| Refugio-2 (REF-2) | 1 | 1,100 | 1,151 | 2 |
| | 2 | 500 | 0 | 2 |
| | 3 | 550 | 0 | 2 |
| | ***REF-2 Subtotal*** | ***2,150*** | ***1,151*** | |
| Meadow Lark (ML) | 1 | 1,500 | 1,520 | 2 |
| | 2 | 1,500 | 0 | 2 |
| | 3 | 1,500 | 1,439 | 2 |
| | 4 | 1,500 | 1,438 | 2 |
| | ***ML Subtotal*** | ***6,000*** | ***4,397*** | |
| | **Zone 2 Subtotal** | **8,150** | **5,548** | |

**Comparison of Water Supply Pumping Capacity and Maximum Day Demand (MDD)**

| Zone | Model Inflow (gpm) | MDD (gpm) | Surplus (+) / Deficit (-) |
|---|---|---|---|
| 1 | 1,133 | 1,258 | -125 |
| 2 | 5,175 | 5,312 | -137 |
| 3 | 3,990 | 2,957 | 1,033 |
| **Total** | **10,298** | **9,527** | **771** |

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# APPENDIX D

## Dudek Well Profile Report

DRAFT

# Santa Ynez River Water Conservation District
# ID No. 1
# Hexavalent Chromium MCL Compliance
# Santa Ynez Upland Groundwater Basin
# Well Profiling

## Technical Memorandum

**Prepared By**

DUDEK

**September 15, 2014**

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**ACRONYMS AND ABBREVIATIONS**

| ACRONYM | MEANING |
|---|---|
| A | interval between i and i+1 |
| BTOC | below top of casing |
| C | concentration of given constituent |
| CDPH | California Department of Public Health |
| BGS | feet below the ground surface |
| GPM | gallons per minute |
| CR(VI) | hexavalent chromium |
| HP | horse power |
| I | first sample collection and flow measurement depth |
| **I+1** | second sample collection and flow measurement depth |
| ID NO.1 | Improvement District No. 1 |
| MCL | maximum contaminant level |

| | |
|---|---|
| µG/L | micrograms per liter |
| PVC | polyvinyl chloride |
| Q | flow of water within the well (either as a volume per unit time, as velocity, or as a percent of total discharge) |
| R | radius |
| ID NO. 1 | Santa Ynez River Water Conservation District Improvement District No. 1 |
| TDS | total dissolved solids |
| USGS | U.S. Geological Survey |
| V | velocity |

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**TECHNICAL MEMORANDUM**

**Date:** **September 15, 2014**

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**Subject:** **Santa Ynez Upland Groundwater Basin Hexavalent Chromium Well Profiling**

## 1 PURPOSE

This technical memorandum summarizes the profiling results of Santa Ynez River Water Conservation District Improvement District No. 1 (ID No.1) water supply wells No.15, No. 25, No. 27 and No. 28. These wells are impacted by naturally occurring hexavalent chromium (Cr(VI)) at concentrations that exceed or have the potential to exceed the newly adopted California Department of Public Health (CDPH) maximum contaminant level (MCL) of 10 micrograms per liter (µg/L). The profiling was conducted to identify specific strata, or zones, that contribute Cr(VI) at concentrations above the MCL under pumping, or dynamic, conditions. Depth discrete samples were collected and analyzed for total chromium and Cr(IV). Additional profiling was conducted to understand the ambient flow conditions within the well casing under static, non-pumping, conditions. The results of the profiling were used to develop recommendations for treatment and/or well modifications that ID No. 1 may consider and implement to bring the water supply wells in compliance with the MCL.

## 2 BACKGROUND

ID No. 1 currently operates 9 groundwater wells, maintains an additional 2 groundwater wells on stand-by status and monitors 1 well in the Santa Ynez Upland Groundwater Basin (Upland Basin), generally located north of Santa Ynez, California, in the Alamo Pintado Creek Watershed (Figure 1). Of these 12 groundwater wells, 4 have historically and consistently exceeded the Cr(VI) MCL of 10 µg/L (Table 1 and Figure 2).

**Table 1**
**Upland Wells Historical Cr(VI) Concentrations**

| Upland Well | Cr(VI) Concentrations (µg/L) | | | Well Status |
|---|---|---|---|---|
| | Low | High | Average | |
| **1** | **21** | | **21** | Stand-by |
| **2** | **22** | **23** | **23** | Operational |
| 3 | <10[a] | 12[a] | 11[a] | Stand-by[b] |
| 4 | 1.9 | | 1.9 | Monitoring[c] |
| 5 | 0.7 | 1.1 | 0.8 | Operational |
| 6 | 0 | 0 | 0 | Operational |
| 7 | 2.1 | **10** | 8.4 | Operational |
| **15** | **25** | **25** | **25** | Operational |
| 24 | 1.3 | 3.1 | 3.1 | Operational |
| 25 | 8.4 | 9.3 | 9.3 | Operational |
| **27** | 6.9 | **11** | **11** | Operational |
| 28 | 8.7 | 8.9 | 8.9 | Operational |

a. Results are for total chromium
b. Well 3 is currently offline due to elevated nitrate concentrations.

c. Well 4 is not viable for production and is only used as a monitoring well.
Boldface type denotes exceedance of the Cr(VI) MCL of 10 µg/L.
Note: All samples were not analyzed using the same analytical method. These data are provided solely for historical context and should not be used for compliance monitoring purposes.

Chromium is a heavy metal and the 21st most abundant element on the planet (Helmenstine 2014). Chromium can be found in two anion forms, trivalent chromium ((Cr(III)) and Cr(VI). Naturally occurring chromium is found in chromium rich iron oxides, which are most abundant in mafic igneous rocks and older volcanic rocks (Ernst 2012). Often these formations are found along tectonically active areas, such as California, which exposes these materials to weathering (Ernst 2012). Weathering of chromium-rich deposits leads to naturally high concentrations of chromium as both Cr(III) and Cr(VI) (Oze 2007).

Cr(VI) occurs naturally in the Upland Basin. This chromium has been weathered from ancient rocks of the San Rafael Mountains. The material has migrated down gradient into the Upland Basin. The source is likely the serpentine associated with the Franciscan complex and Mesozoic plutonic rocks in the San Rafael Mountains (Oze 2007) (Figures 1 and 2). ID No. 1 wells are typically screened across intervals of thinly bedded sands, gravels, and clays associated with the Paso Robles Formation, a poorly consolidated, heterogeneous, non-marine sedimentary deposit, that contains cobbles of the Mesozoic plutonic rocks (LaFreniere 1968). The heterogeneity of the Paso Robles Formation may influence the vertical distribution of Cr(VI) in the SYRCWD wells. If discrete zones of high Cr(VI) concentration exist within a well, it may be possible to re-engineer it to produce more water from intervals with lower Cr(VI) concentrations, thereby reducing the wellhead concentration below the MCL. The well profiling work described below documents the vertical distribution of flow, total chromium, and Cr(VI) within ID No. 1 wells No.15, No. 25, No. 27, and No. 28.

## 3 GEOLOGIC SETTING

The Upland Basin is a triangular-shaped 130-square-mile area that narrows to the east (Figure 3). The basin was created by faulting and uplift of the Transverse Ranges. To the south, the basin is bounded by the Santa Ynez River fault zone. To the north, the basin is bounded by the Little Pine Fault.

The surface of the Upland basin consists of a terraced upland underlain by poorly consolidated sedimentary deposits (Figure 3). The underlying deposits are of Tertiary (1.65 million to 63 million years) and Quaternary age (11,000 years to 1.65 million years). The basal unit of the Upland basin is the Careaga sand, a marine deposit of fine to medium sand, generally coarser in the upper part (LaFreniere 1968). Overlying the Careaga sand is the Paso Robles Formation, a weakly consolidated valley alluvial sediment composed largely of Monterey Shale detritus (Diblee 1993). The Paso Robles formation was deposited by streams that drained the rising San Rafael Mountains. The primary gravels in the Paso Robles Formation are derived from the Monterey Shale; however, the Paso Robles formation also contains cobbles and boulders of serpentine close to outcrops of the Franciscan complex and Mesozoic plutonic rocks (LaFreniere 1968). Overlying the Paso Robles Formation are Quaternary terrace deposits and alluvium that are less deformed than the underlying formations (LaFreniere 1968).

The geology of the San Rafael Mountains on the north eastern side of the Santa Ynez Valley favors Cr(VI) formation in the Upland Basin. The San Rafael Mountains are part of the Transverse Ranges, an east-west oriented mountain range that is part of the Franciscan Complex, which forms the basement rock in the Coast Range ophiolite (Wahl 1995, 1998). The Franciscan is the oldest formation in the area and is made up of a serpentine matrix known to result in oxidation of chromite to Cr(VI) (Whal 1995; Oze 2007). The Franciscan formed as a result of Farallon-North American Plate convergence (Whal 1998).

# 4 HYDROGEOLOGICAL SETTING

Unconsolidated Tertiary and Quaternary sands and gravels comprise the primary water-bearing formations in the Upland Basin. The thickness of these deposits exceeds 4,000 feet (Dibblee 1993). Underlying the unconsolidated marine and non-marine deposits are pre-Tertiary consolidated rocks that form the boundaries of the groundwater basin (LaFreniere 1968).

Almost all water production in the Upland Basin is from the Paso Robles Formation, which is characterized by heterogeneous lenticular deposits that result in highly variable well yields. In some instances, thick beds of clay separate distinct water-producing zones. All of the ID No. 1 Upland Basin wells are screened in and produce water from the Paso Robles Formation.

# 5 METHODS

## 5.1 Dynamic Flow

Depth-discrete flow profiles documenting the flow contributions from the perforated sections of ID No. 1 wells No. 15, No. 25, and No. 28 were created using the U.S. Geological Survey (USGS) Tracer Pulse Dynamic Flow Profile method (USGS 1999). In this method, a high-pressure hose equipped with valves for dye injection is lowered to a known depth in the well, and a pulse (~150 milliliters) of dye is injected into the water column. The travel-time of the tracer to a detector on the surface is measured. The hose is then lowered to the next depth, another pulse of dye is injected into the water column, and the travel-time is measured. The distance between the depths of dye release divided by the difference in the travel-times yields the velocity of the water in the well. Assuming piston flow, the flow rate (Q) is calculated using a known well radius (r) and the velocity (v):

$$Q = (v\pi r2) \text{ where: } v = (d2-d1)/(t2-t1)$$

where:
Q = flow rate (gallons per minute) (multiply cubic feet per minute by 7.48052)
v = velocity (feet per minute)
π = Pi (3.14159)
r = well radius (feet)
d1 = distance one (feet)
d2 = distance two (feet)
t1 = travel time at distance one (minutes)
t2 = travel time at distance two (minutes)

The flow rate profile for each well was constructed from the velocities measured at multiple depths in the well.

The dynamic flow contribution from the perforated sections of ID No. 1 well No. 27 was measured with a Titan spinner/flow meter (spinner) tool. The spinner tool has an impeller that measures counts per second as it is lowered down the well casing at a constant line speed. Multiple passes with the spinner tool were performed to provide in situ calibration and estimate fluid velocity by depth.

## 5.2 Ambient Temperature Surveys

Prior to conducting the dynamic flow survey, ambient temperature surveys were conducted for wells No. 15, No. 25, No. 27, and No. 28 in order to determine the potential vertical flow within the well casing under static, non-pumping conditions.

These profiles were created to assist with evaluation of the depth distribution of Cr(VI) in the wells. Water moving from one depth in the aquifer to a different depth in the aquifer via the well bore can alter the concentration of constituents in the groundwater adjacent to the depth at which water exits the well. Wells No. 15, No. 25, No. 27, and No. 28 were pumped for 24 hours before the depth discrete samples were collected in order to minimize the effects of vertical flow on the sampled concentrations. To accurately assess the long-term effects of vertical flow in the well, a series of depth discrete samples should be collected after the wells have been pumping for longer periods of time to see if there is a trend in concentration with time.

## 5.3 Groundwater Chemistry

Depth-discrete water quality samples were collected using the HydroBooster sampling method for wells No. 15, No. 25, and No. 28. The Hydro Booster sampling method was developed by USGS to collect water at selected depths within production wells that have limited access to fit traditional wire-line tools (Izbicki 1999). A wire-line sampler was used for well No. 27, because a 2-inch Schedule 40 polyvinyl chloride (PVC) access tube was installed to a depth below the test pump. Each well was pumped for approximately 24 hours before the depth-discrete groundwater samples were collected.

The groundwater samples were analyzed for total dissolved solids (TDS), total chromium, and Cr(VI). The measured concentrations at each depth represent the average concentration of the entire water column below the sample point. In order to convert the measured concentrations to depth-discrete concentrations, the measured concentrations were adjusted based on the flow rates determined for each interval from the dynamic flow survey using the following equation:

$$C_a = (C_i Q_i - C_{i+1} Q_{i+1})/Q_a$$

where:
C = concentration of given constituent
Q = flow of water within the well (either as a volume per unit time, as velocity, or as a percent of total discharge)
i = first sample collection and flow measurement depth
i+1 = second sample collection and flow measurement depth
a = interval between i and i+1

The above equation is only valid for changes in concentration between adjacent samples that exceed the laboratory error limits and for changes in flow that exceed the error in velocity derived from travel time measurements in the field. For intervals over which these conditions were not met, the concentration was not adjusted and was assumed to equal the measured concentration.

# 6 RESULTS

## 6.1 Well No. 15

### 6.1.1 Location and Construction

Well 15, drilled in 1986, is located within the town of Santa Ynez (Figure 1). The Well 15 completion consists of dual casing construction that is designed to address cascading water from the upper zone. The well is dual cased from 130 to 240 feet below the ground surface (bgs) with an 18-inch-diameter louvered casing and 14-inch-diameter inside blank casing. Below the dual casing is a 30 foot "window" blank 18-inch-diameter section that connects back to the 14-inch-diameter casing, which is designed to allow flow from 130 to 240 feet to discharge into the 14-inch-diameter casing between 240 and 270 feet. Under static, non-pumping conditions, the depth to water is approximately 95 feet. When pumping, the depth to water increases to approximately 110 feet. The single 14-inch-diameter well casing is screened from 280 to 470 feet bgs and completed to 490 feet bgs with a 20-foot blank section.

Well 15 is fitted with an electric Hitachi 150-horse-power (hp) submersible pump with a capacity of 1,400 gallons per minute (gpm). The suction intake depth is set at 205 feet bgs with an 8 inch column pipe (drop pipe). Currently, the well produces approximately 1,250 gpm.

### 6.1.2 Flow Profiles

Well No. 15 was pumped at an average pumping rate of 1,200 gpm with a pumping water level of approximately 110 feet below top of casing (btoc) during the dynamic flow survey. The dynamic survey indicates that approximately 80% of the flow in well No. 15 comes from the upper screened interval and cascades into the well through the dual casing window (Figure 5).

The results of the temperature survey for well No. 15 are inconclusive, showing little change in the slope of the profile with depth in the well and temperatures consistently above the estimated local geothermal gradient (Figure 5).

### 6.1.3 Groundwater Chemistry

#### *6.1.3.1 Total Chromium*

Measured total chromium concentrations within well No. 15 do not vary with depth (Figure 5). The average concentration between 230 and 330 feet bgs is approximately 23 µg/L, and the average concentration between 330 and 430 feet bgs is approximately 20 µg/L. All of the total chromium concentrations measured are below the MCL for total chromium of 50 µg/L.

#### *6.1.3.2 Hexavalent Chromium*

Measured Cr(VI) concentrations in samples collected from well No. 15 were greater than the MCL of 10 µg/L at all depths (Figure 5). Samples collected between 230 and 330 feet bgs have concentrations between 26 and 27 µg/L, and samples collected between 330 and 430 feet bgs have concentrations between 16 and 22 µg/L. Two wellhead samples were collected prior to and after the depth-discrete water quality sampling. Both samples had a concentration of 25 µg/L.

#### *6.1.3.3 Total Dissolved Solids*

Well 15 TDS ranges from 490 to 660 mg/L (Figure 5). TDS increases slightly with depth between 230 and 660 feet bgs. Below 660 feet bgs, TDS declines slightly with the lowest concentration measured at 490 mg/L in the sample collected at 435 feet bgs.

## 6.2 Well No. 25

### 6.2.1 Location and Construction

Well 25, drilled in 2007, is located on a private property easement approximately 1 mile to the north of the town of Los Olivos (Figure 1). The well is cased to 950 feet bgs with a 14.5-inch outer diameter stainless steel casing. The well casing is screened from 630 to 750 feet bgs, 775 to 820 feet bgs, and 880 to 930 feet bgs. Well 25 is fitted with a 200-hp submersible pump with a suction intake depth of 520 feet bgs and a flow rate of 900 gpm.

### 6.2.2 Flow profile

Well No. 25 was pumped at an average pumping rate of 960 gpm, with a pumping water level of approximately 427 feet btoc during the dynamic flow profile testing. The dynamic survey indicates that approximately 17% of the total flow in the well is produced between 600 and 630 feet bgs, above the top of the upper screen interval (Figure 6). A video survey of the well in 2008 indicated cascading water flowed into the well through leaks in the welds of the blank casing above the screen interval.

From intervals within the well screen, the dynamic survey found approximately 39% of the flow in well No. 25 is produced between 630 and 660 feet bgs, and an additional 37% is produced between 660 and 735 feet bgs (Figure 6). The middle and upper portions of the upper well screen produce the majority of the total flow in the well under dynamic conditions. The lower and middle well screens produce approximately 7% of the total flow under dynamic conditions.

Under static, non-pumping conditions, the temperature survey suggests water enters well No. 25 through the lower and middle well screens, flows upward within the well, and may exit the well within the middle to upper portions of the upper well screen (Figure 6). A temperature survey also indicates that water moves vertically down the well from 330 to 600 feet bgs, agreeing with both the video and dynamic flow surveys of the well. This water, entering the well through leaky welds in the blank casing above the first screen interval may account for up to 17% of the flow in well No. 25 and has the potential to alter the concentrations of the constituents in the formation adjacent to the well, as well as the concentrations of constituents measured at the wellhead under dynamic conditions.

### 6.2.3 Groundwater Chemistry

#### *6.2.3.1 Total Chromium*

Three samples were collected at the wellhead prior to, during, and after the depth-discrete water quality sampling. These samples have total chromium concentrations of 8.9 µg/L, 8.6 µg/L, and 8.5 µg/L, respectively. The average total chromium concentration measured between 500 and 750 feet bgs is approximately 7 µg/L. There is, however, a trend of decreasing chromium concentrations with depth in this interval, and chromium was not detected in any of the samples collected below 750 feet bgs (Figure 6). The highest concentration of total chromium is 14 µg/L, measured in the shallowest sample collected

(500 feet bgs). None of the measured samples have concentrations that exceed 50 µg/L, the MCL for total chromium.

The flow adjusted concentrations indicate that the zone between 500 and 600 feet bgs has the highest concentration of total chromium (Figure 6). The flow adjusted concentration in this zone, which is above the uppermost well screen, is approximately 40 µg/L (Figure 6). Between 600 and 750 feet bgs, the average flow-adjusted chromium concentration is approximately 9 µg/L. None of the flow-adjusted concentrations exceed the MCL for total chromium.

#### *6.2.3.2 Hexavalent Chromium*

The wellhead Cr(VI) samples collected prior to, during and after the depth-discrete water quality sampling have concentrations of 9.7 µg/L, 9.8 µg/L, and 9.8 µg/L, respectively. Measured concentrations of Cr(VI) collected at discrete depths within well No. 25 range from non-detect to 14 µg/L, with the highest concentration of Cr(VI) measured in the shallowest sample. Samples collected below 750 feet bgs, within the middle- and lower-screened intervals, did not have detectable concentrations of Cr(VI). The average concentration of the samples collected between 500 and 750 feet bgs is approximately 8 µg/L.

The flow-adjusted concentrations indicate that the zone between 500 and 600 feet bgs has the highest concentration of Cr(VI) (Figure 6). The flow adjusted concentration in this zone, which is above the uppermost well screen, is approximately 36 µg/L (Figure 6). Between 600 and 750 feet bgs, the average flow-adjusted chromium concentration is approximately 10 µg/L.

#### *6.2.3.3 Total Dissolved Solids*

Well 25 TDS concentrations range from 410 to 540 mg/L. The concentration of TDS between 765 and 890 feet bgs ranges from 410 to 450 mg/L, and the concentration of TDS between 500 and 750 feet bgs ranges from 480 to 540 mg/L.

## 6.3 Well No. 27

### 6.3.1 Location and Construction

Well 27, drilled in 2006, is located on a private property easement approximately 2.25 miles southeast of the town of Los Olivos (Figure 1). The well is cased to 1,205 feet bgs. The well casing is screened from 940 to 1,040 feet bgs and 1,095 and 1,185 feet bgs. Well 27 is fitted with a Goulds 200-hp vertical turbine pump and U.S. Electric Motor with a suction intake depth of 430 feet bgs and a flow rate of 1,343 gpm. During the flow survey of Well No. 27, a test pump was installed with a suction intake depth of 300 feet bgs and a flow rate of 560 gpm, or approximately 42% of the normal operating production rate.

### 6.3.2 Flow Profiles

The spinner log for Well 27 indicates that, at a production rate of 560 gpm, approximately 75% of the total flow is produced between 940 and 1040 feet bgs in the upper screen interval (Figure 7). The temperature profile suggests that, under static conditions, water enters the well at approximately 1,090 feet bgs and flows upward in the well to the top of the lower screen interval, where it exits the well at approximately 970 feet bgs (Figure 7). The zone of vertical flow under static conditions corresponds to the zone from which the majority of the water is produced during pumping. Down-hole pressures were not measured in this well.

6.3.3 Groundwater Chemistry

*6.3.3.1 Total Chromium*

The concentration of total chromium in wellhead samples collected prior to and after the depth-discrete water quality sampling is 13 and 15 µg/L, respectively. Total chromium concentrations in samples collected from well No. 27 range from 12 to 35 µg/L (Figure 7). None of the samples collected have total chromium concentrations above 50 µg/L, the MCL for total chromium.

*6.3.3.2 Hexavalent Chromium*

Cr(VI) concentrations in samples collected from well No. 27 ranged from 2 to 14 µg/L (Figure 7). The concentration of Cr(VI) in both wellhead samples collected prior to and after the depth-discrete water quality sampling is 14 µg/L. Between 940 and 1040 feet bgs, the upper screen interval, the average concentration of Cr(VI) is approximately 12 µg/L, which is above the MCL for Cr(VI). In contrast, between 1080 and 1195 feet bgs, the lower screen interval, the average concentration of Cr(VI) is approximately 3 µg/L.

*6.3.3.3 Total Dissolved Solids*

Well 27 TDS concentrations range from 460 to 530 mg/L.

## 6.4 Well No. 28

6.4.1 Location

Well 28, drilled in 2008, is located on ID No. 1-owned property approximately 2 miles northeast of the town of Santa Ynez and 2.4 miles southeast of the town of Los Olivos (Figure 1). The well is cased to 940 feet bgs with a 14.5-inch outer diameter stainless steel casing. The well casing is screened from 640 to 685 feet bgs, 725 to 800 feet bgs, and 900 to 920 feet bgs. Well 28 is fitted with a Byron Jackson 100-hp submersible pump and CentriPro motor with a suction intake depth of 443.5 feet bgs and a flow rate of 700 gpm.

6.4.2 Flow Profiles

Approximately 26% of the total flow is produced from the upper screen, between 620 and 660 feet bgs (Figure 8). Approximately 60% of the flow is produced from the middle screen, between 725 and 800 feet bgs. The lower screen, from 900 to 9,020 feet bgs, produces approximately 14% of the flow.

Under static conditions; and inflections in the slope of the temperature survey at 600 and 780 feet bgs suggest that water enters the well at 600 feet bgs, flows downward through the well bore, and exits the well at 780 feet bgs (Figure 8).

6.4.3 Groundwater Chemistry

*6.4.3.1 Total Chromium*

The concentrations of total chromium in wellhead samples collected prior to and after the depth-discrete water quality sampling were 8.7 µg/L and 7.9 µg/L, respectively. The average total chromium measured between 620 and 660 feet bgs, the upper screen interval, wss approximately 9 µg/L. The average total chromium measured between 660 and 800 feet bgs, the interval containing the middle screen, was approximately 8 µg/L, and the total chromium concentration measured from the deep screen interval, at 900 feet bgs, was approximately 1 µg/L. There is a downward increase in total chromium between 620 and 750 feet bgs (Figure 8) and an abrupt decrease in total chromium below 770 feet bgs (Figure 8). None of the samples collected have total chromium concentrations above 50 µg/L, the MCL for total chromium.

The flow-adjusted concentrations indicate that the interval between 750 and 770 feet bgs contributes the highest concentrations of chromium to the well. The average flow adjusted chromium concentration in this interval is approximately 25 µg/L, and this interval contributes approximately 30% of the total flow in the well. The average flow-adjusted concentration above 750 feet bgs is approximately 6 µg/L, and the average flow-adjusted concentration below 770 feet bgs is approximately 1 µg/L. None of the flow adjusted chromium concentrations exceed the MCL for total chromium.

#### *6.4.3.2 Hexavalent Chromium*

The concentration of Cr(VI) in wellhead samples collected prior to and after the depth-discrete water quality sampling was 8.9 µg/L and 9.0 µg/L, respectively. Cr(VI) concentrations in samples collected from well No. 28 range from 1 to 13 µg/L. Between 620 and 770 feet bgs within the upper and upper middle screens, concentrations increase from 9 to 13 µg/L (Figure 8). Below 790 feet bgs in the lower middle and lower screens, the measured Cr(VI) concentrations are 1 to 2 µg/L.

As was observed in the flow-adjusted total chromium concentrations, the flow-adjusted Cr(VI) concentrations indicate that the interval between 750 and 770 feet bgs contributes the highest concentrations of Cr(VI) to the well (Figure 8). The average flow-adjusted Cr(VI) concentration in this interval is approximately 32 µg/L. The average flow-adjusted concentration above 750 feet bgs is approximately 7 µg/L, and the average flow adjusted concentration below 770 feet bgs is approximately 1 µg/L.

#### *6.4.3.3 Total Dissolved Solids*

TDS concentrations in well No. 28 range from 500 to 550 mg/L. There are no apparent trends with depth in the TDS concentrations.

# 7 CONCLUSIONS

## 7.1 Well No. 15

The flow profile conducted on well No. 15 demonstrated that 80% of the production is derived from the interval between 240 and 260 feet bgs. The measured concentration of Cr(VI) in this zone is approximately 26 µg/L, well above the newly adopted MCL for Cr(VI) of 10 µg/L. Additionally, concentrations of Cr(VI) between 20 and 27 µg/L were measured in at all but the deepest sample in well No. 15. All of the depth discrete samples have concentrations of Cr(VI) above the MCL.

## 7.2 Well No. 25

Both the measured and flow-adjusted concentrations of Cr(VI) decrease with depth in well No. 25. The highest concentration of Cr(VI), measured in the sample collected from 500 feet bgs, is 14 µg/L. Based on the results of the flow survey, which indicate approximately 17% of the total flow in well No. 25 enters the well above 630 feet bgs, the flow-adjusted concentration at 500 feet bgs could be as high as 36 µg/L. This flow likely derives from leaks in the welds of the blank casing above 630 feet bgs.

Between 630 and 735 feet bgs, the interval that produces approximately 74% of the total flow in the well, both the measured and flow-adjusted concentrations range from 7 to 11 µg/L. Below 735 feet bgs, Cr(VI) was not detected in any of the three samples collected.

Both the measured and flow adjusted concentrations of Cr(VI) suggest that the water leaking through the welds in the blank casing has higher concentrations of Cr(VI) than water entering the well through the well screens. Because this water may have a concentration as high as 36 µg/L, it likely increases the concentration of Cr(VI) measured at the wellhead.

## 7.3 Well No. 27

During the dynamic flow profiling of well No. 27, approximately 75% of the flow was produced from the upper screen. Measured Cr(VI) concentrations of samples collected within the upper screen interval range from 9 to 14 µg/L. In contrast, the concentrations of Cr(VI) measured in samples collected between 1080 and 1170 feet bgs, the interval of the lower screen, range from 2 to 6 µg/L. Therefore, it may be possible to reengineer the existing well to produce more water from the lower screen interval and reduce the blended concentration of Cr(VI) measured at the wellhead.

## 7.4 Well No. 28

Measured concentrations of Cr(VI) at well No. 28 increase with depth from 9 µg/L at 620 feet bgs to 13 µg/L at 760 feet bgs. The measured concentration at 770 feet bgs is 10 µg/L. In contrast, the three samples collected below 770 feet bgs have concentrations of 1 to 2 µg/L.

When adjusted for the depth, discrete flow contributions measured while the well was pumping, the average concentration of Cr(VI) above 760 feet bgs is approximately 7 µg/L, between 760 and 780 feet bgs is approximately 32 µg/L, and below 780 feet bgs is approximately 1 µg/L. The interval between 760 and 780 feet bgs contributes approximately 18% of the total flow for well No. 28. Because there appears to be a discrete zone between 760 and 780 feet bgs where Cr(VI) concentrations exceed the MCL, it may be possible to reengineer the existing well to produce water at the wellhead with a blended concentration of Cr(VI) below the MCL.

# 8 RECOMMENDATIONS

The results for the well profiling project suggest that changes to the existing construction of wells No. 25, 27, and 28 have the potential to reduce wellhead concentrations of Cr(VI). Well No. 15 will likely require wellhead treatment for Cr(VI). Based on the preliminary results of the well profiling, Dudek recommends the following:

- Because the concentration of Cr(VI) is greater than the MCL at all depths in well No. 15, Dudek recommends wellhead treatment for removal of Cr(VI) at this well.
- If wellhead Cr(VI) concentrations are detected above the MCL, Dudek recommends installing an inflatable well packer immediately above the upper screen in well No. 25 to prevent water with high concentrations of Cr(VI) from entering the well via leaks in the welds of the blank casing. After installation of the inflatable packer, Dudek recommends collecting wellhead samples over the course of several days to determine the variability of the Cr(VI) concentrations with time. If wellhead concentrations of Cr(VI) decrease after the packer is installed, Dudek recommends pumping the well to the water system for several months to confirm Cr(VI) concentrations have

stabilized. If wellhead concentrations of Cr(VI) do not decrease after the packer is installed, the packer should be deflated and reinstalled at varying depths in the well and retested to determine wellhead Cr (VI) concentrations.

- Dudek recommends feasibility testing of the lower screen at well No. 27 to see if additional flow can be produced from this screen. The lower-concentration water produced from the lower screen could then be blended with water to potentially reduce the concentration of Cr(VI) at the wellhead. The feasibility testing could be accomplished by installing an inflatable well packer below the upper screen and a test pump in the blank section between the upper and lower screens. After installation of the inflatable packer and test pump, wellhead samples should be collected over several months to determine the concentration of Cr(VI) with time. If the testing of the lower screen shows that the two screen intervals could produce a blended concentration below the MCL, an engineered suction could be constructed and lowered into the well. An engineered suction is a flow control device that has been designed to distribute flow into a well throughout the vertical well screen. The blended water could then be produced from the well without requiring wellhead treatment.

- If wellhead Cr(VI) concentrations in well No. 28 are detected above the MCL, Dudek recommends use of an inflatable packer(s) or engineered suction to address the elevated concentrations of Cr(VI) measured between 760 and 780 feet bgs. Additionally, use of a swedge patch that eliminates flow contribution between 760 and 780 feet bgs should be evaluated.

Modification of wells No. 25 and No. 28 to preferentially pump from the production zones where elevated Cr(VI) concentrations were not detected may be a viable alternative to wellhead treatment. Use of inflatable packers or engineered suctions below the pump intake is likely the best option. After implementation of any well modifications, Dudek recommends initial wellhead sampling followed by monthly monitoring to evaluate variation in Cr(VI) concentration with time.

# 9 REFERENCES


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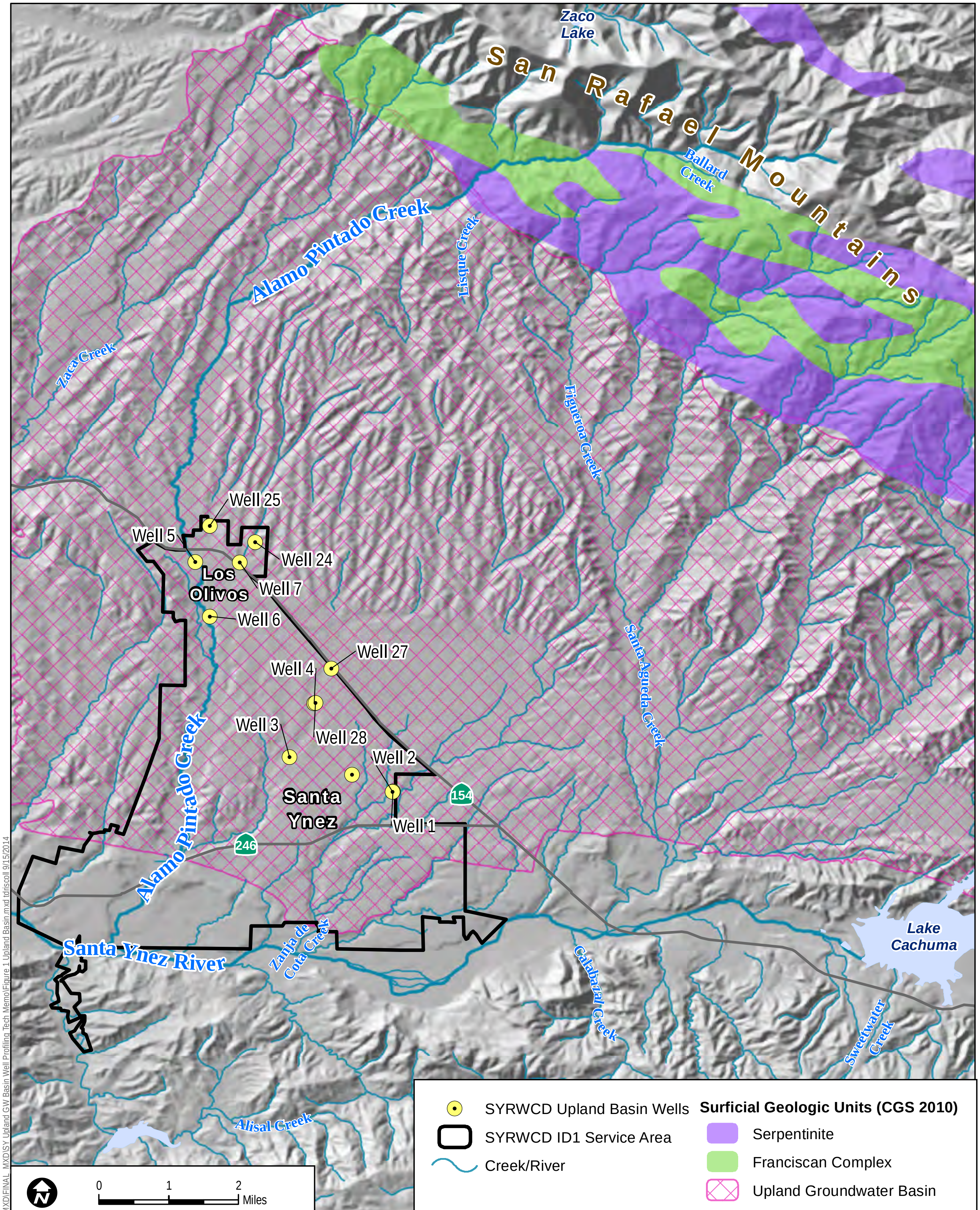
# FIGURES




DUDEK

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SEPTEMBER 2014

SOURCE: California Geological Survey (CGS) 2010; USGS 2008.

**FIGURE 1**

## Upland Groundwater Basin Map

Santa Ynez Upland Groundwater Basin Well Profiling - Technical Memorandum

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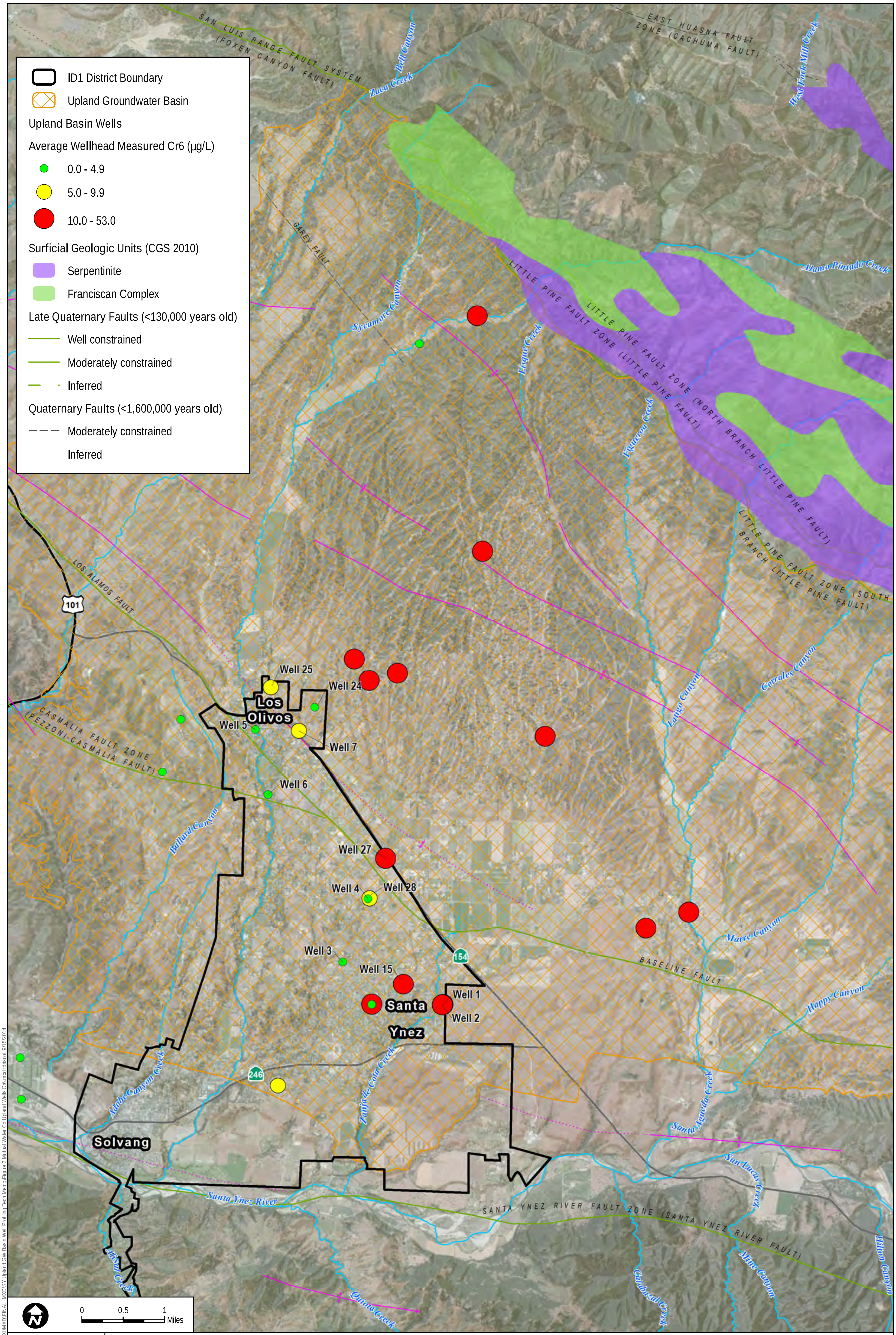


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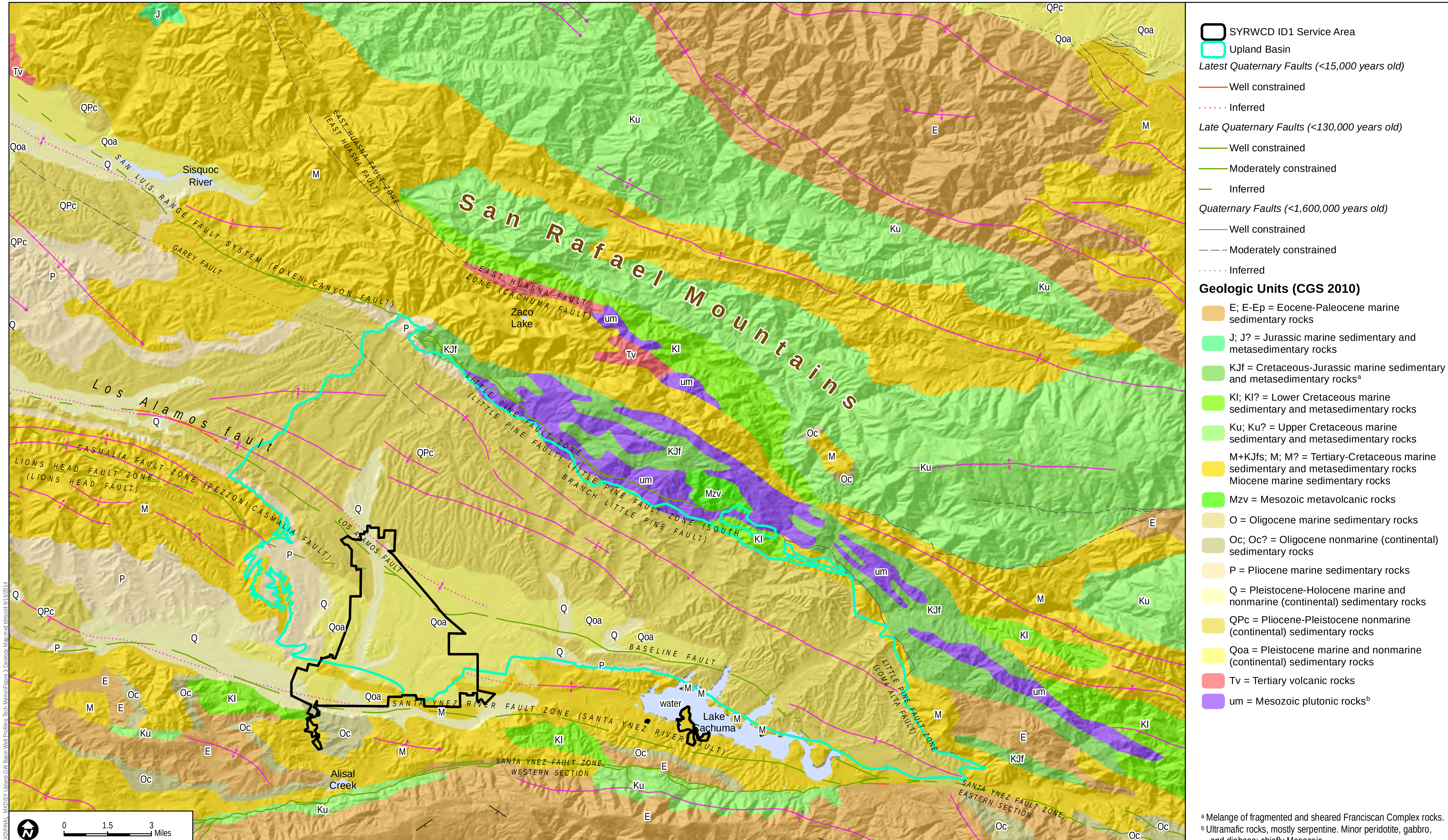
SOURCE: ID1 2012; Santa Barbara County Public Health 2014

FIGURE 2

**Upland Groundwater Basin Wellhead Cr6 Concentrations Map**

Santa Ynez Upland Groundwater Basin Well Profiling - Technical Memorandum

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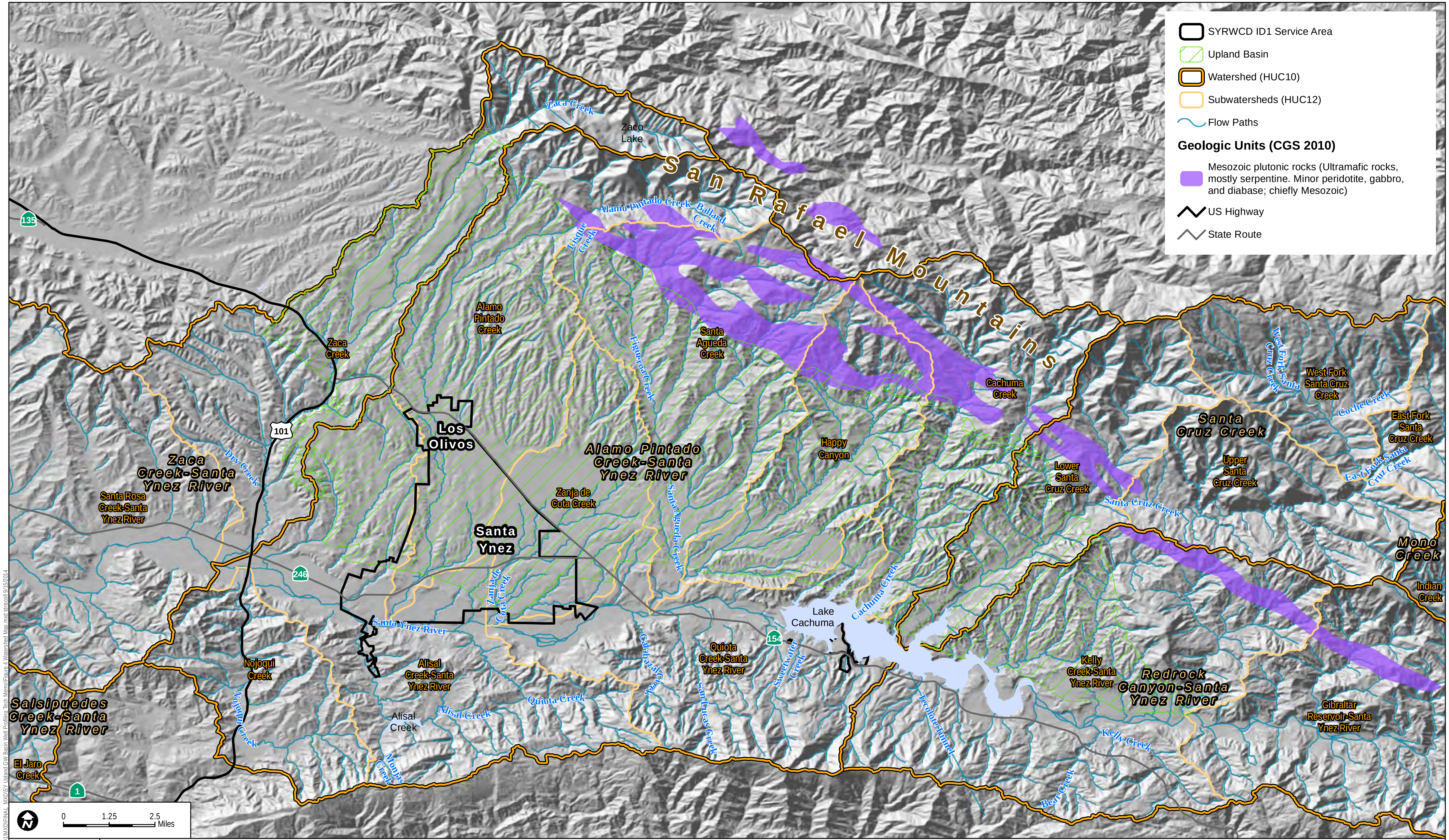
SOURCE: USGS 2004; CGS 2010.

FIGURE 3

**Geologic Map**

Santa Ynez Upland Groundwater Basin Well Profiling - Technical Memorandum




DUDEK

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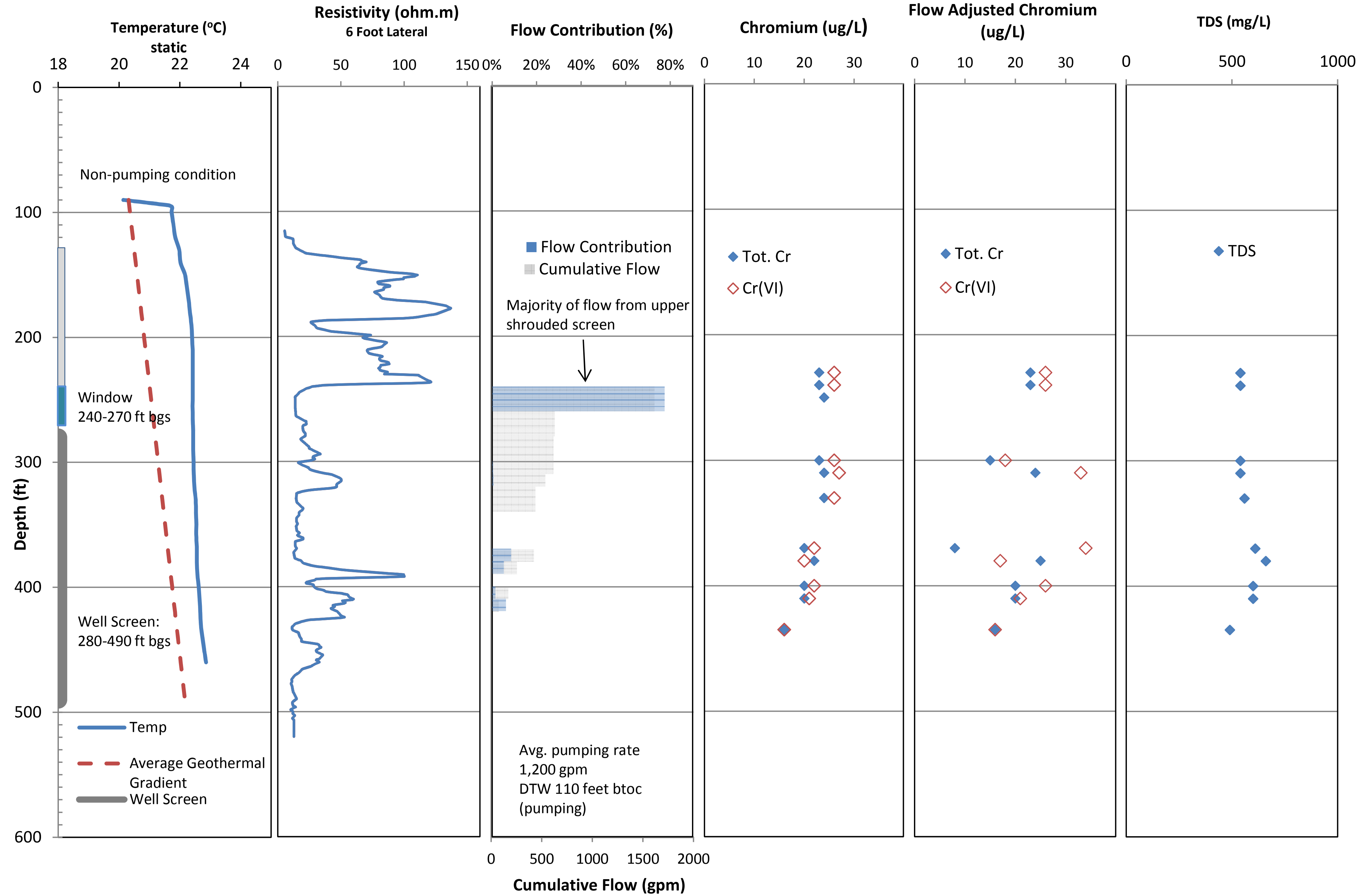
SEPTEMBER 2014

SOURCE: USGS 2010.

FIGURE 4

## Watershed Map

Santa Ynez Upland Groundwater Basin Well Profiling - Technical Memorandum

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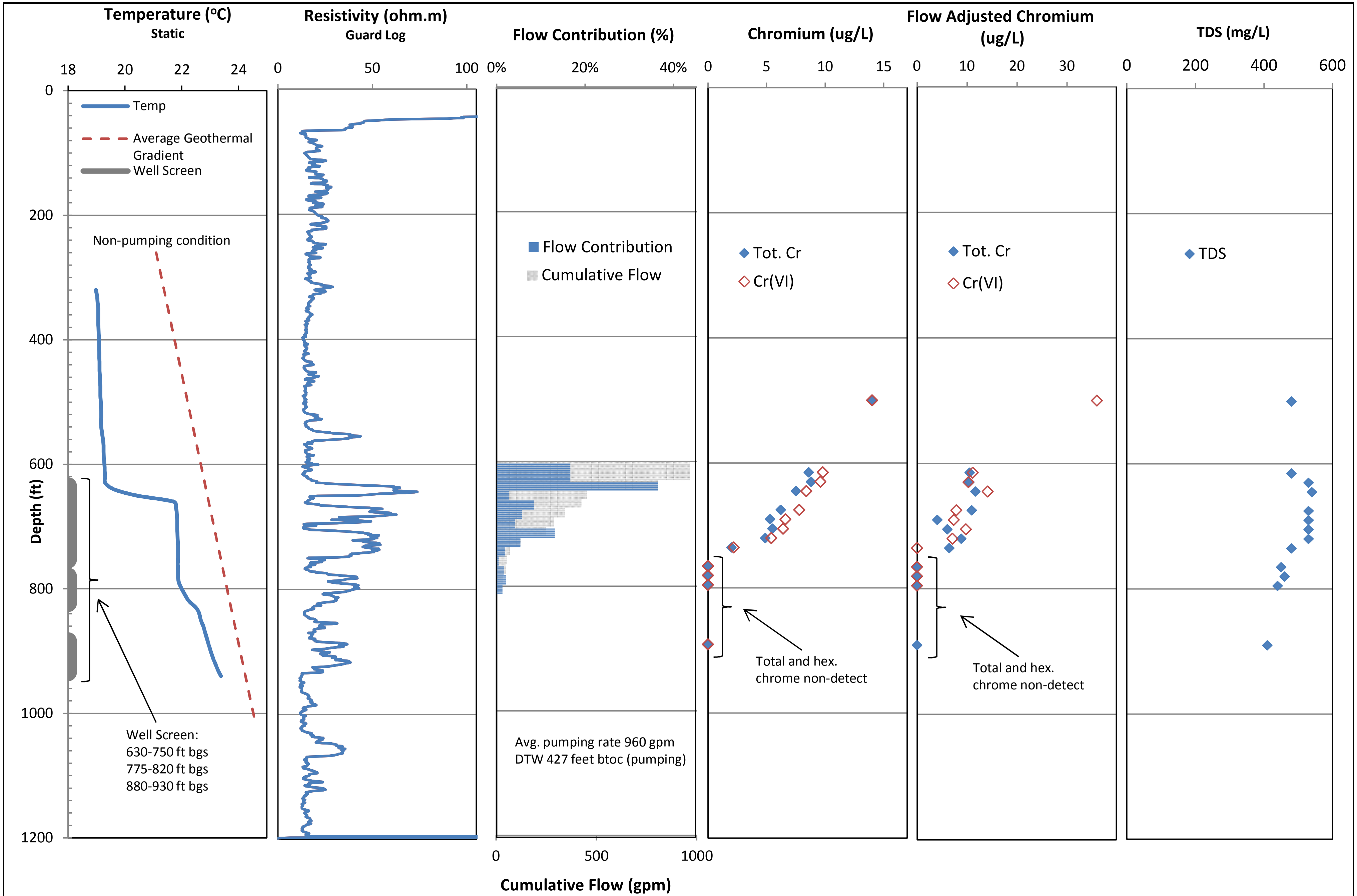
September 2014

Figure 5
Down-Hole Temperature, Resistivity, Flow and Chromium Data from Well 15

Santa Ynez Upland Groundwater Basin Well Profiling – Technical Memorandum




DUDEK

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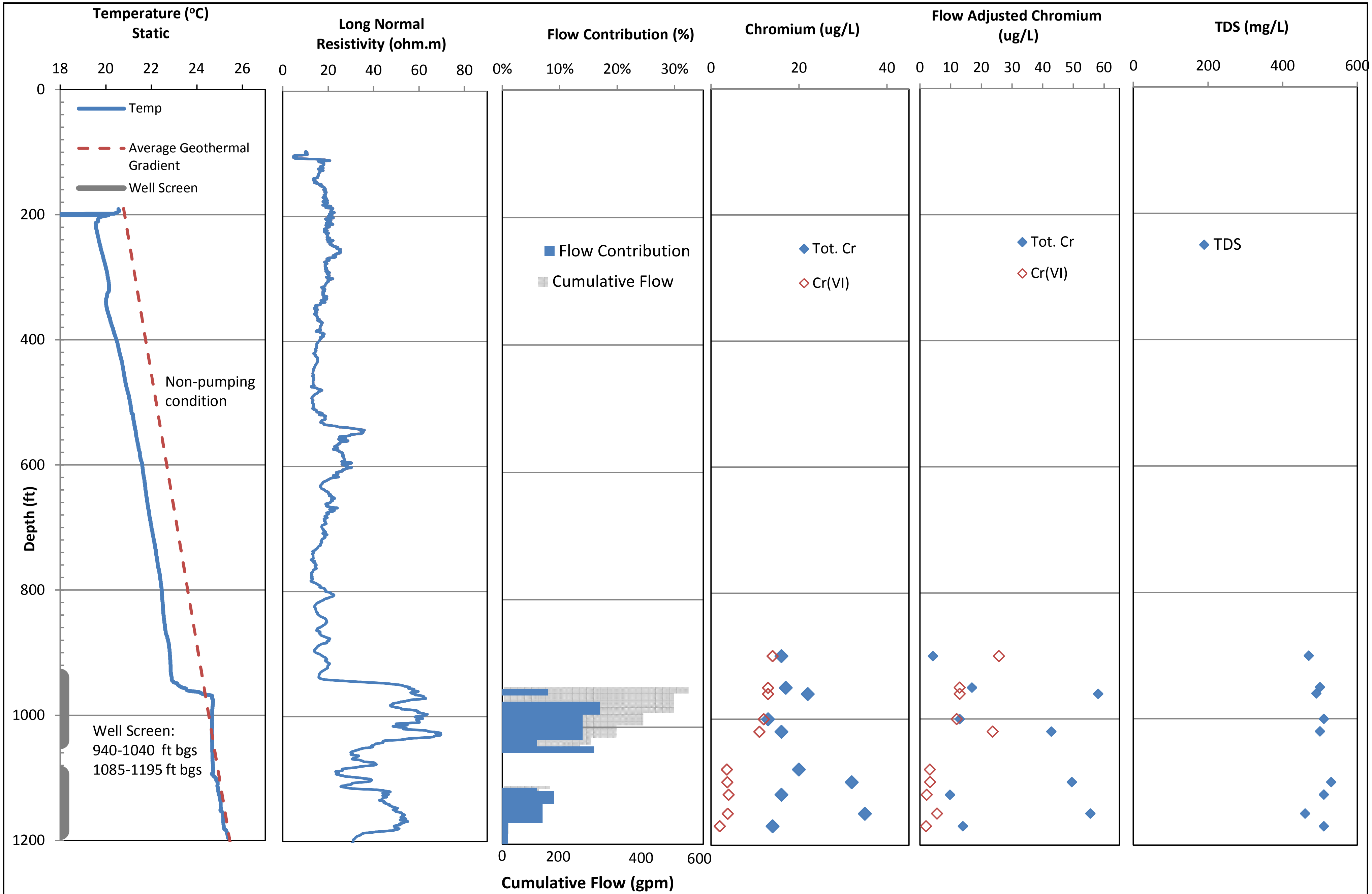
September 2014

Figure 6
Down-Hole Temperature, Resistivity, Flow and Chromium Data from Well 25

Santa Ynez Upland Groundwater Basin Well Profiling – Technical Memorandum

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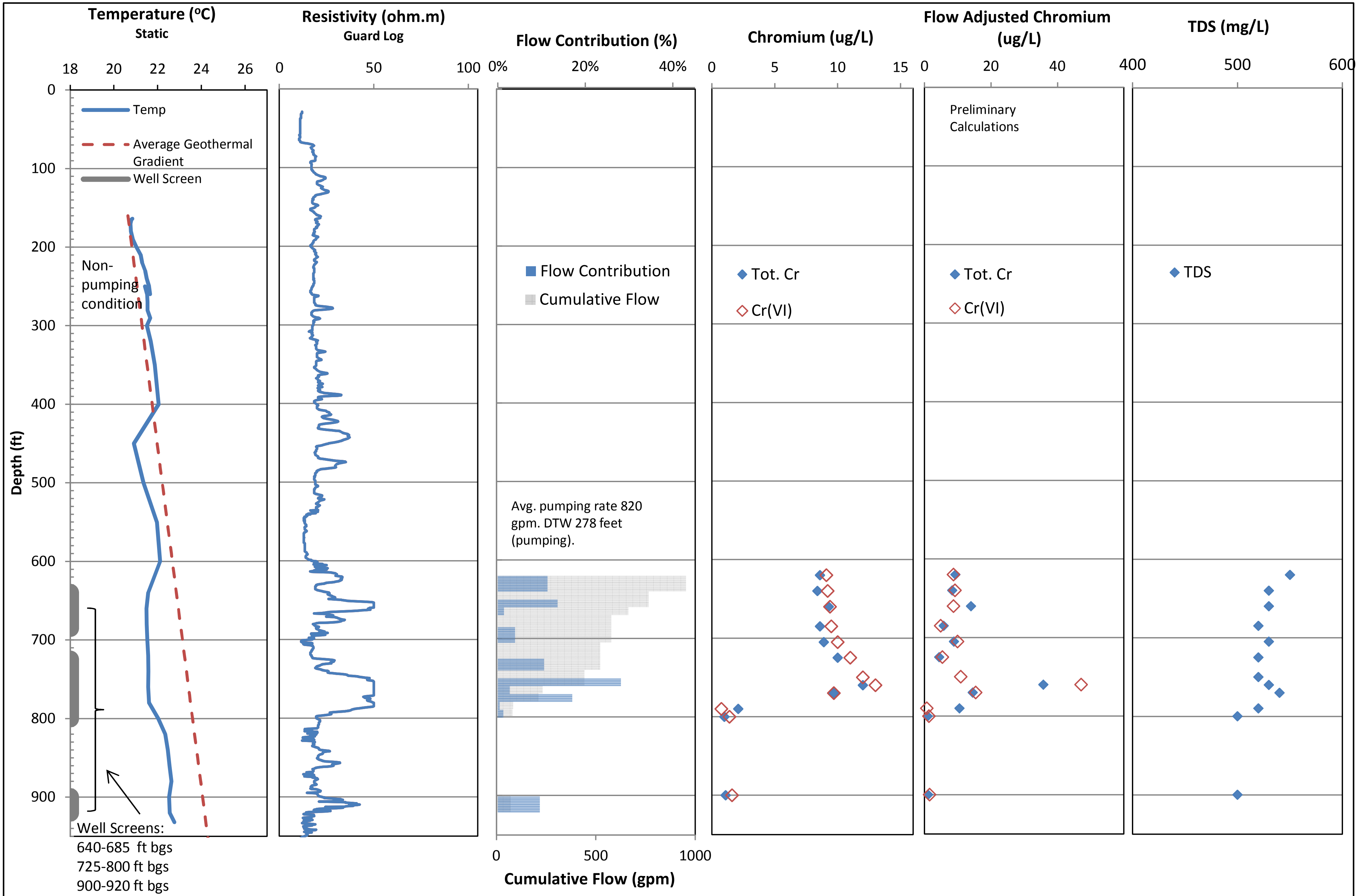
September 2014

Figure 7

Down-Hole Temperature, Resistivity, Flow and Chromium Data from Well 27

Santa Ynez Upland Groundwater Basin Well Profiling - Technical Memorandum




DUDEK

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September 2014

Figure 8
Down-Hole Temperature, Resistivity, Flow and Chromium Data from Well 28

Santa Ynez Upland Groundwater Basin Well Profiling – Technical Memorandum

# APPENDIX D1

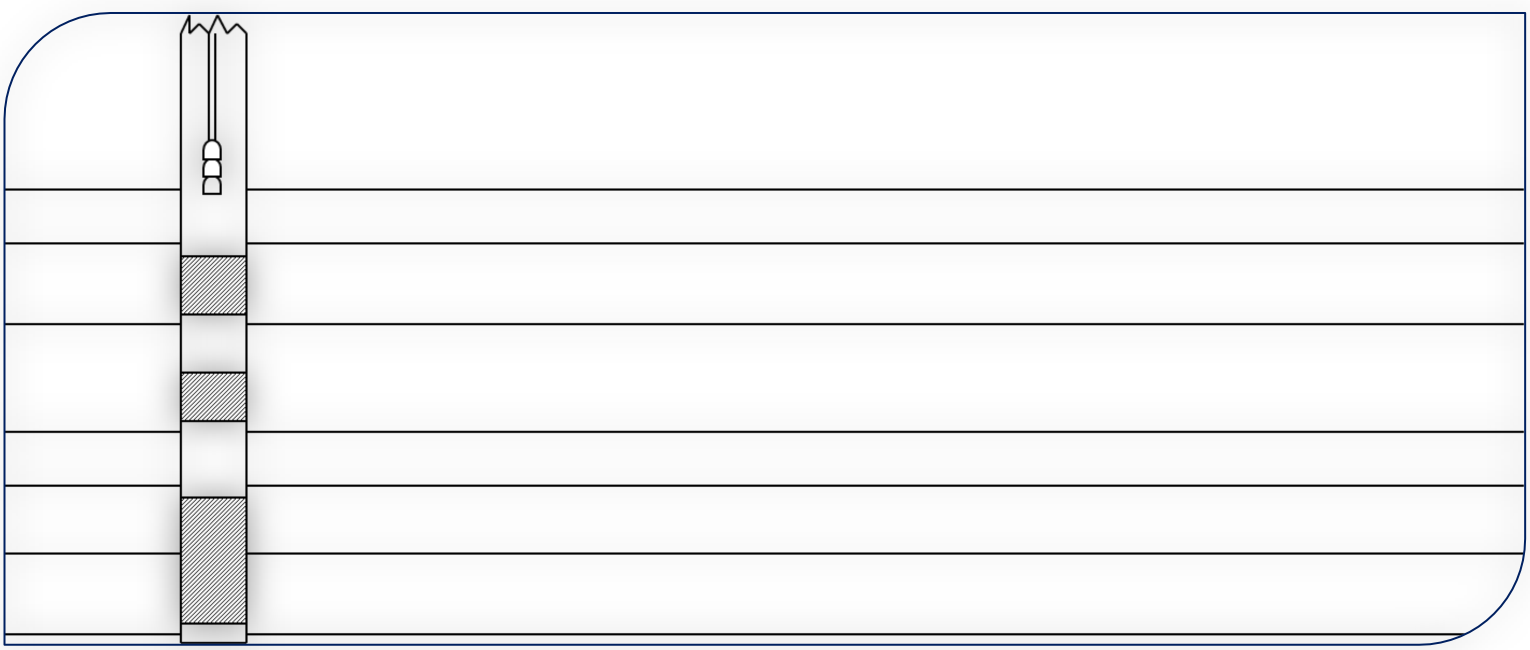
## *BESST Inc. Report Well 15*

# Dynamic Flow and Chemistry Profiling Report: Santa Ynez River Water Conservation District Well 15

## Santa Ynez, CA

Prepared by:
Kim Miles and Debra Cerda

Reviewed by:
Debra Cerda and Noah Heller



**BESST, Inc., 50 Tiburon St, Ste 7, San Rafael, CA 94901 ¤ (P) 415/453.2501 ¤ (F) 415/453.2509 http://www.besstinc.com**

May 12, 2014

## Executive Summary

On February 25 – 26, 2014, BESST, Inc. performed a dynamic flow and water quality chemistry profile for **Well 15,** which is owned and operated by **Santa Ynez River Water Conservation District**.

The dynamic flow and water quality profile was performed to measure and calculate flow contribution as well as water quality concentrations and contributions from two perforated intervals measuring 310 feet in total length.

The purpose of this profiling event for Well 15 was to investigate levels of hexavalent chromium above the proposed state MCL of 10 micrograms per liter (ug/L).

The dynamic flow profile was performed using the USGS Tracer Pulse Dynamic Flow Profile method to measure flow contribution along the length of the well. Sampling depths were determined through assessment of the well completion diagram (Figure 1) and resistivity log (Figure 7).

A temperature survey and pressure survey were conducted (Figures 2 & 3). The temperature graph in Figure 2 indicates that cool water enters the well at the casing window, and moves down toward the bottom of the well.

BESST conducted dynamic water quality sampling using the HydroBooster sampling method on February 26, 2014, collecting water samples at 11 discrete depths. Sample results are shown by analyte in Figures 8 through 13.

With the exception of TDS, all tested analytes are under the maximum contaminant level (MCL) for the National Primary Drinking Water Regulations (NPDWR) as well as secondary MCLs at the wellhead.

All analytical results at all sampling points for hexavalent chromium exceeded the proposed State of California MCL of 0.010 mg/L (10 µg/L).

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## Introduction

BESST performed a dynamic flow and water chemistry profile on February 25 - 26, 2014, for the **Santa Ynez River Water Conservation District Well 15**, located in Santa Ynez, California.

### Flow Contribution

Flow contribution in **Well 15** was measured at thirteen (13) discrete depths along the well bore from **240** to **420** feet below ground surface (ft bgs). The apparent travel time collected from Well 15 was used to calculate zonal flow contribution.

### Water Quality Sampling

BESST conducted dynamic water quality sampling using the HydroBooster sampling method on February 26, 2014, collecting water samples at eleven (11) discrete depths and two (2) well head samples. Sample results are shown by analyte in figures 8 through 13.

Chemical analysis was performed by Eurofins Eaton Analytical. The water quality constituents and parameters included:

### Conventional Chemistry

- Alkalinity
- Chloride
- Sulfate ($SO_4$)
- Total Chromium
- Hexavalent Chromium
- Total Dissolved Solids

### Conventional Chemistry

Each graph shows the dynamic chemical contribution of the analyte versus the sampling depth interval (ft bgs). The dynamic chemistry profile estimates geologic water (zonal) chemistry by considering dilution and mixing factors inside the steady state (pumping) water supply well.

Below the pump, water is flowing into the well casing through the screen sections and upward in the well towards the pump intake.

## Well Information Summary

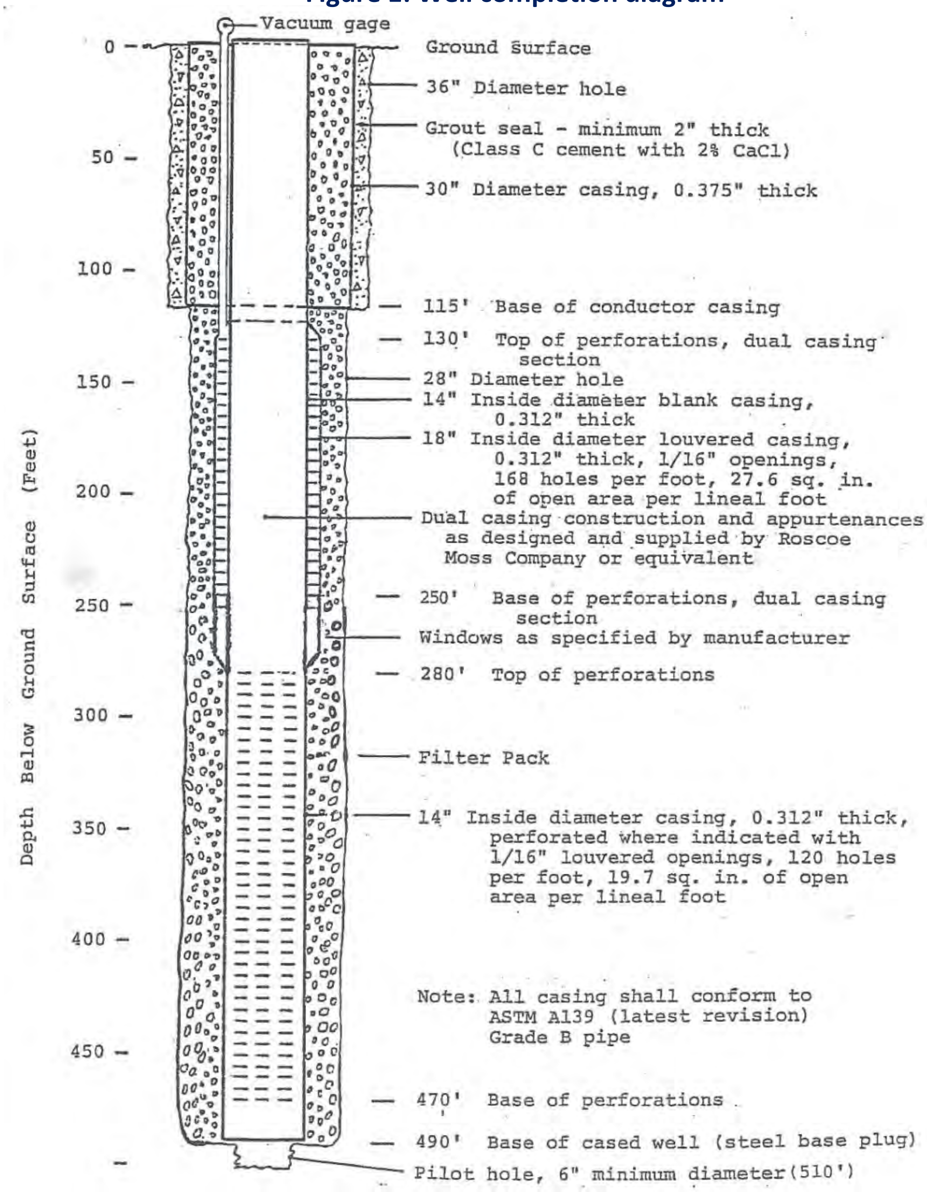
The following information for Santa Ynez River Water Conservation District Well 15 is based on technical information provided by DUDEK.

### Well Construction

- Outer Casing: 18" inside diameter by 0.312" thick 130'-250'
- Outer Screen: 1/16" louvered openings 130'-250'
- Window: outer → inner casing 250'-280'
- Inner Casing: 14" inside diameter by 0.31" thick 0'- 490'
- Inner Casing Screen: 1/16" louvered openings 280'-470'

The pump is set at approximately 205 ft bgs with a 12" O.D. pump column diameter. Observed pumping water level is 110 ft bgs with a static water level of 95 ft bgs. The pumping rate is 1230 gpm.

**Figure 1: Well completion diagram**



## Temperature Survey

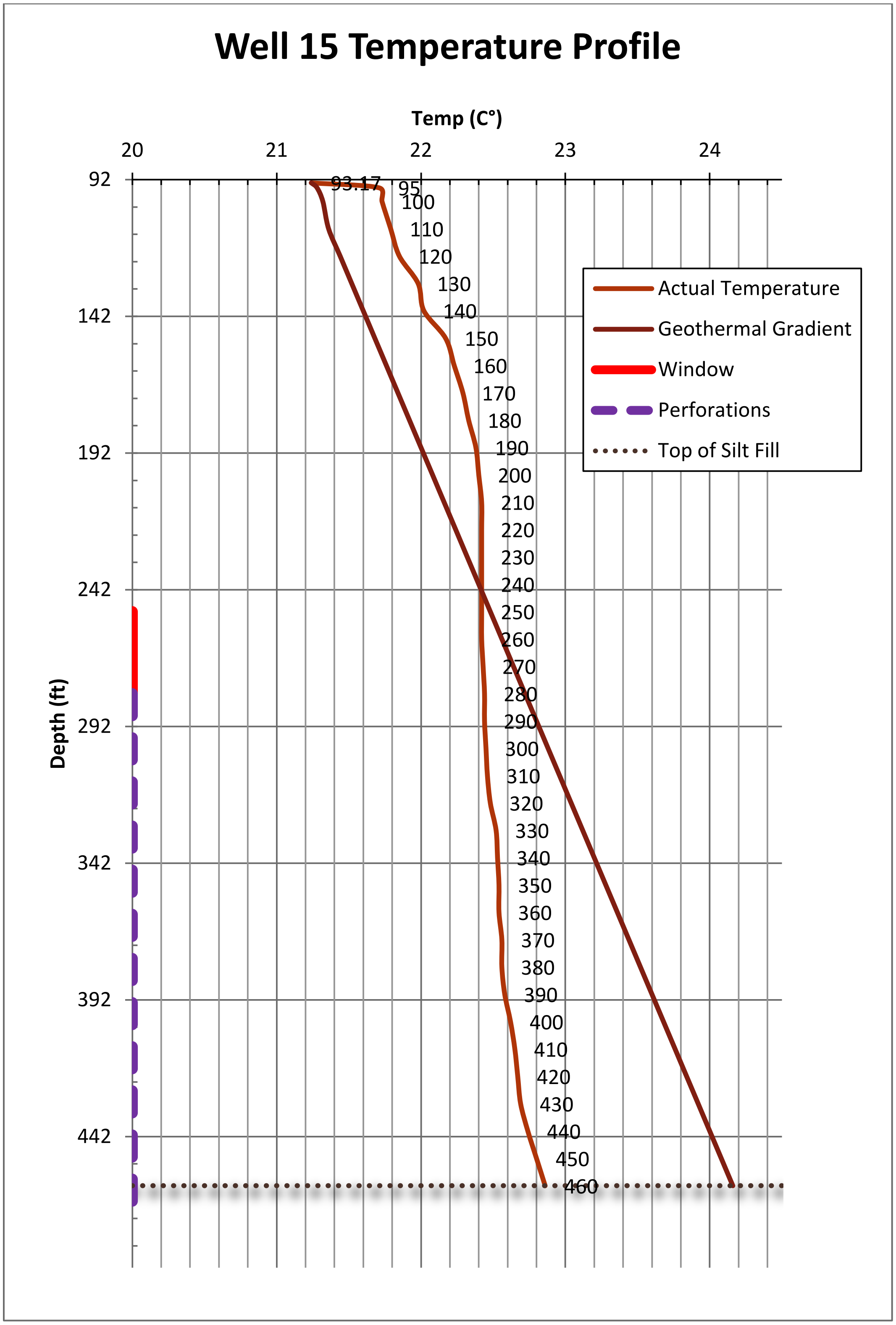



**Figure 2: Ambient temperature profile of Well 15. Data collected by BESST Inc. Interpretation courtesy DUDEK. (Data starts at static water level of 95.08 feet below top pf casing)**

## Pressure Survey

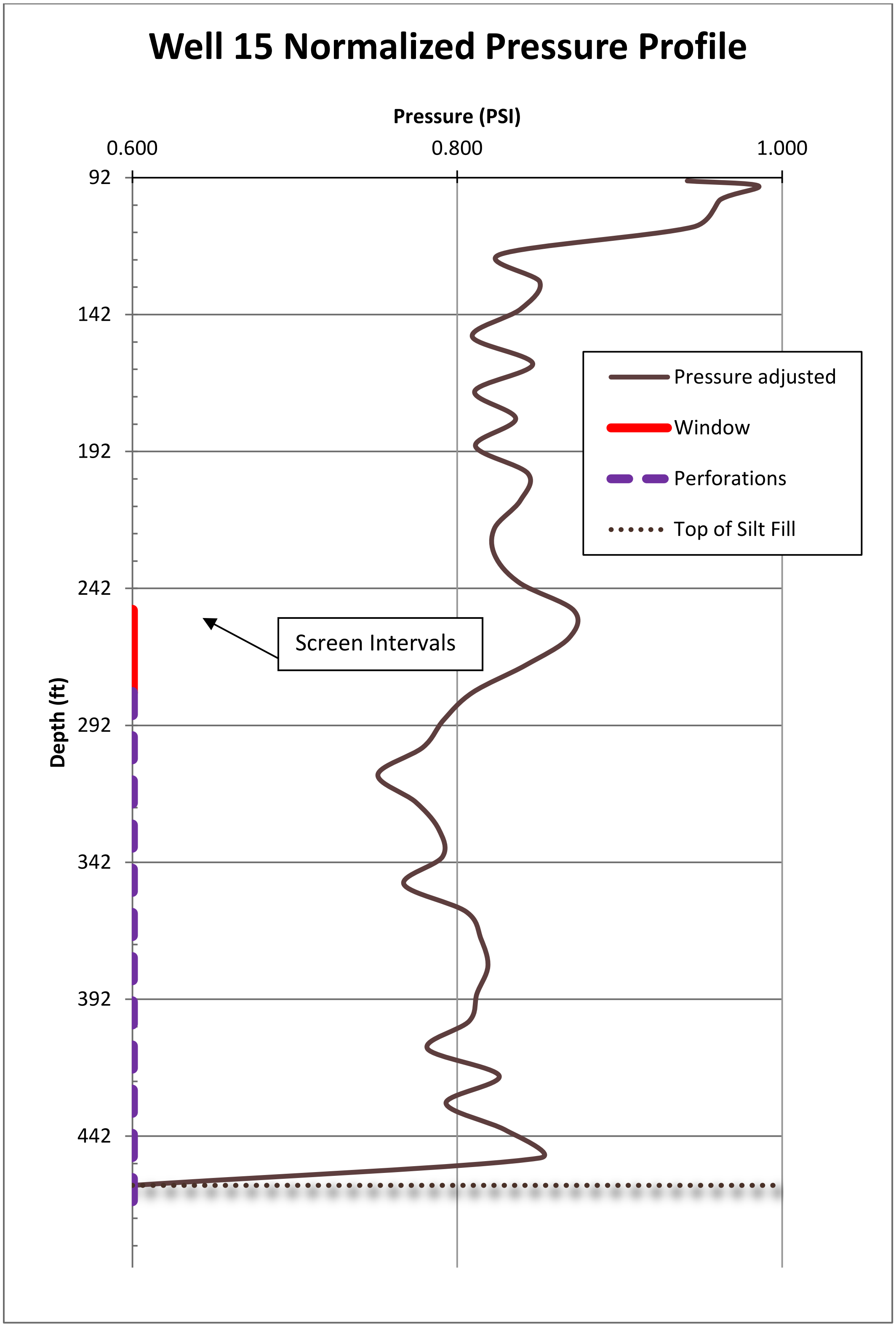



**Figure 3: Normalized pressure vs. depth under ambient (non-pumping conditions).**

Under ambient conditions inside a well, groundwater flows from the highest to lowest potential( i.e., highest to lowest pressure). Normalized pressure is arithmetically defined as the difference between the theoretical pressure gradient and measured or actual gradient. The theoretical gradient is generally defined as 1 PSI/2.31 ft for pure water. Being that groundwater inside the well is not pure, we know that there is a small amount of error when using pure water to estimate the normalized pressure gradient. Therefore we cannot interpret outflow and inflow zones along the length of the well screen on the basis of an individual point but rather as a trend defined from a series of depth-dependent point measurements. The totality of these measurements is what helps in the understanding of the flow gradient inside a well.

The pressure survey was performed using a vented Level Troll 700 manufactured by In-Situ, Inc. The maximum head differential measured inside Well 15 was 350 feet, and within the accuracy and resolution range specifications stated by the manufacturer.

## Dynamic Flow Profile

The dynamic flow profile was performed using the USGS Tracer Pulse Dynamic Flow Profile method to measure flow contribution along the length of the well (Figures 4 through 6). The profile was conducted at a flow rate of 1230 gallons per minute (gpm), which is the normal operating rate of the well.

Corrected discharge shows the cumulative flow profile along the length of the well. The raw cumulative flow data was corrected by a factor of 0.96 (actual pump rate over theoretical pump rate) to match the field pumping rate.

Incremental flow is calculated by finding the difference in corrected discharge (cumulative flow) depths. The incremental flow graph shows zonal flow contribution between each dye injection location.

The percent contribution graph is in principal the same information as incremental flow. Adding up all labeled values in incremental flow will give the pumping rate, and the same calculation for percent will add up to 100% of the pumping rate. Percent contribution is calculated by dividing incremental flow by the pumping rate of 1230 gpm.

### Percent Contributions

Flow calculations indicate that upper screen contributes 80% towards the total pumping rate through the casing window. BESST Inc. observed no dye returns below 420 ft bgs. This means the measurable upward movement of water toward the pump intake stops just below 420 ft bgs.

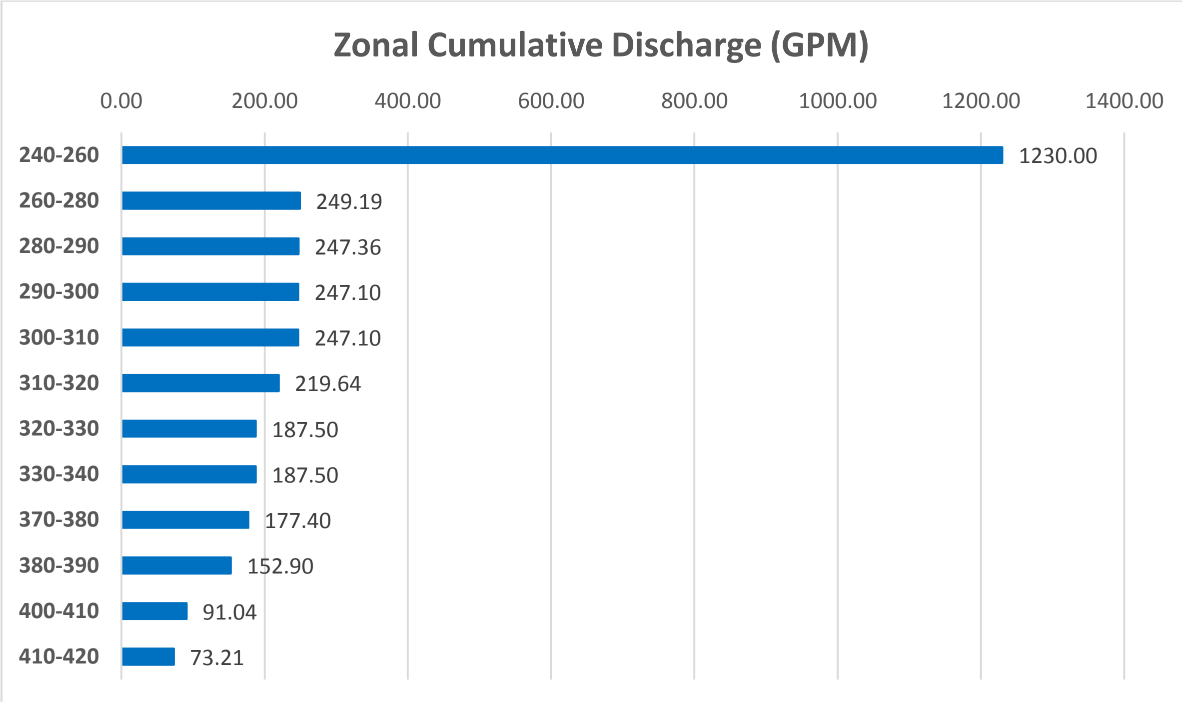



**Figure 4: Cumulative discharge for Well 15 at 1230 gpm.**

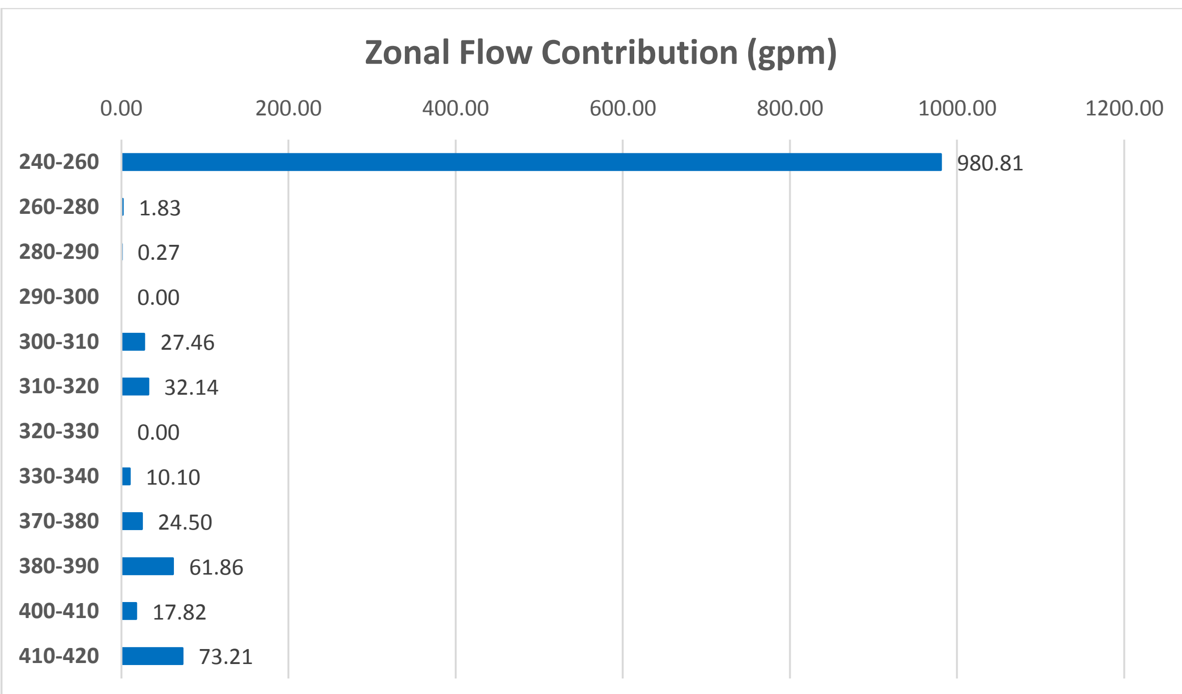



**Figure 5: Zonal flow contribution for Well 15 at 1230 gpm.**

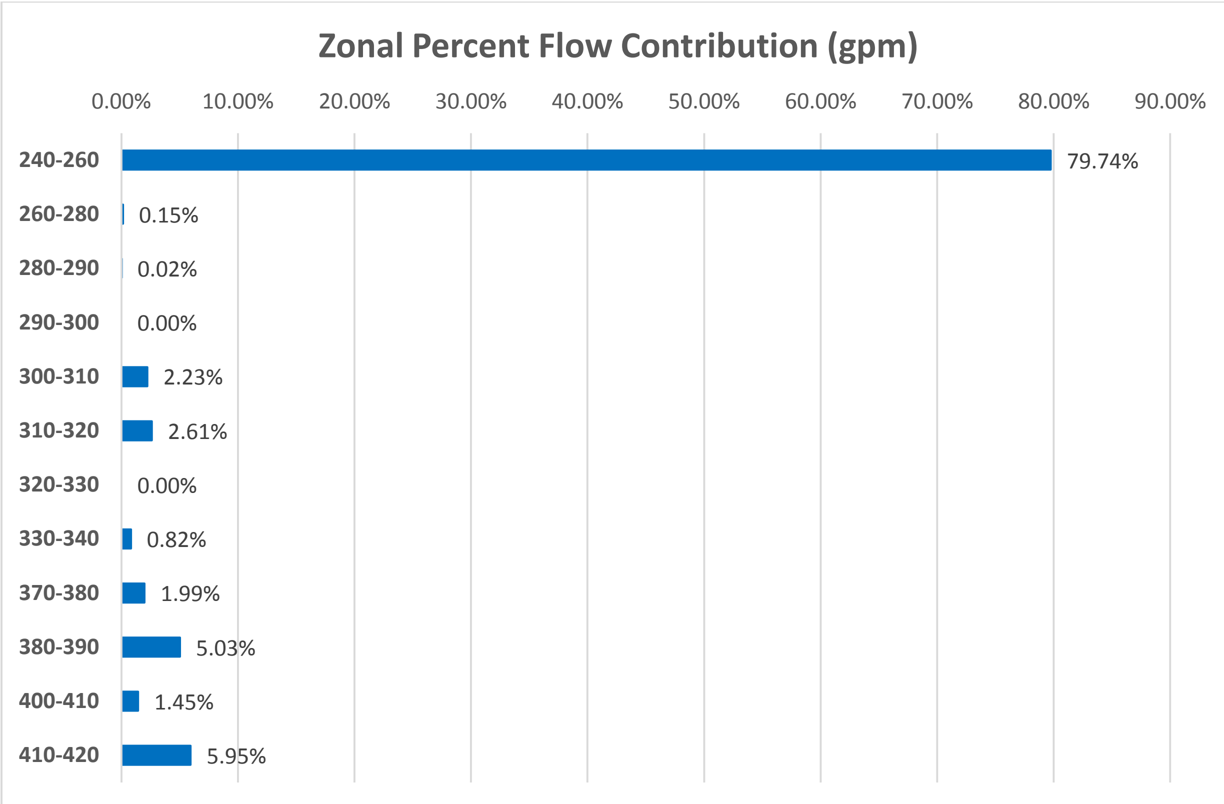



**Figure 6: Zonal percent Flow contribution for Well 15 at 1230 gpm.**

## Down-hole Geophysics and Flow Contribution Comparison

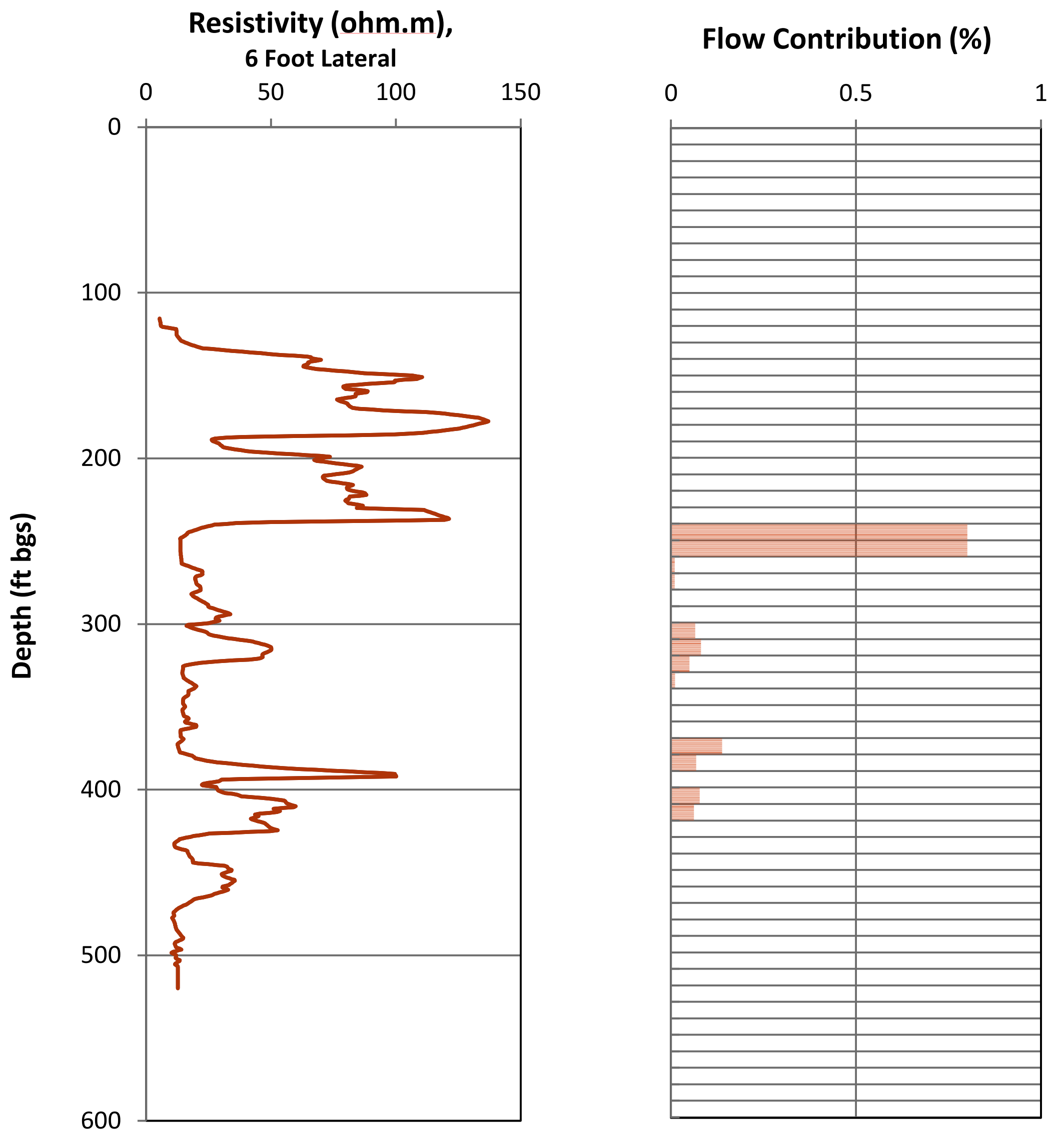



**Figure 7: Resistivity Log and Flow Contribution Comparison**

Resistivity data provided by DUDEK, correlates with BESST Inc. dynamic flow contribution data as seen in Figure 7. Major contributing zones under 1230 gpm pumping condition are correlated with the window at 280 ft bgs. Although BESST Inc. did not establish flow contribution below 420 ft bgs, the resistivity graph suggests there is high flow potential. Well modification could result in a shift of flow production, and pull more water from deeper high resistivity zones.

## Dynamic Chemistry Profile

### Results

The actual reported laboratory result for each analyte is listed in Appendix A, and includes the reported values as well as significant digits for analytes that fall below laboratory detection limit. Detected analytes are listed below.

#### Conventional Chemistry

- Alkalinity
- Chloride
- Sulfate ($SO_4$)
- Total Chromium
- Hexavalent Chromium
- Total Dissolved Solids

The measured lab result values used in the mass balance calculation are shown in Appendix A on page 18.

### Calculations

In figures 8 - 13, the incremental concentration is a calculated value that has been “mass balanced” using the measured concentration and the flow contribution for each depth interval.

When working with results that are reported as “below laboratory detection limit”, in order to still perform the mass balance calculation, a value of one-half of the detection limit was assigned. This adds a degree of uncertainty as to exactly how low the measured value actually was, but the calculated value is still a useful number in that it yields a relatively low incremental concentration.

## Zonal Concentrations of Water Quality Parameters

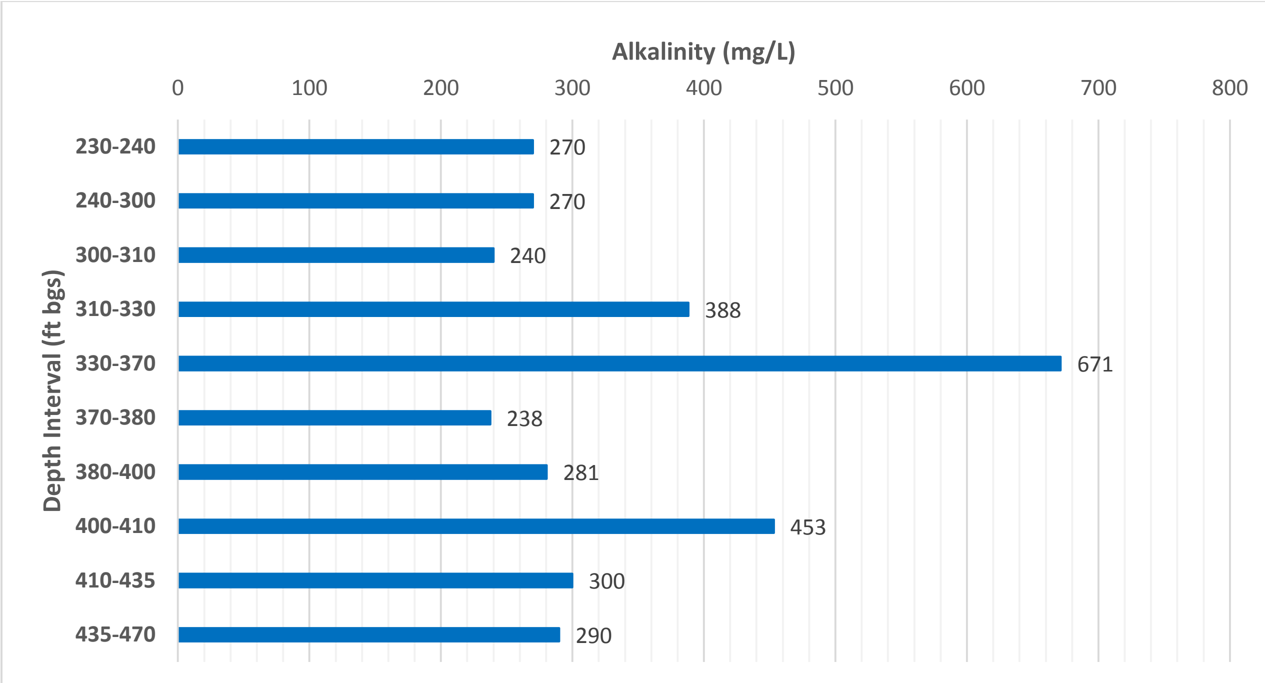



**Figure 8: Zonal alkalinity concentration.**

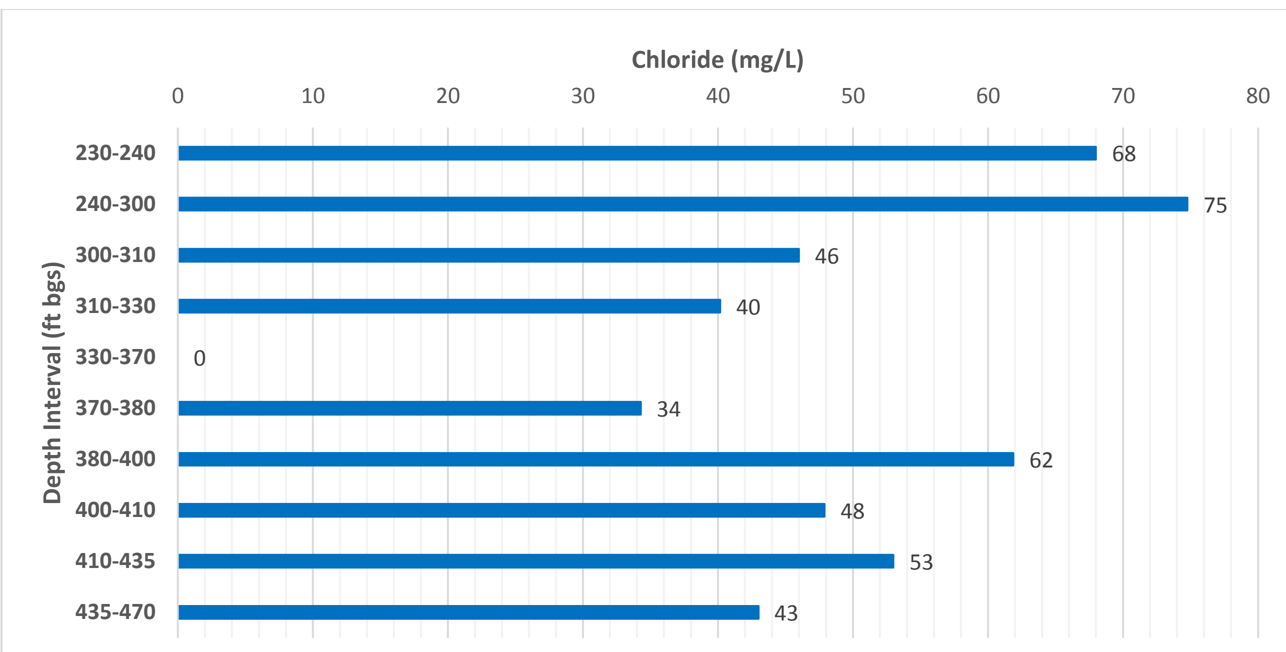



**Figure 9: Zonal chloride concentration.**

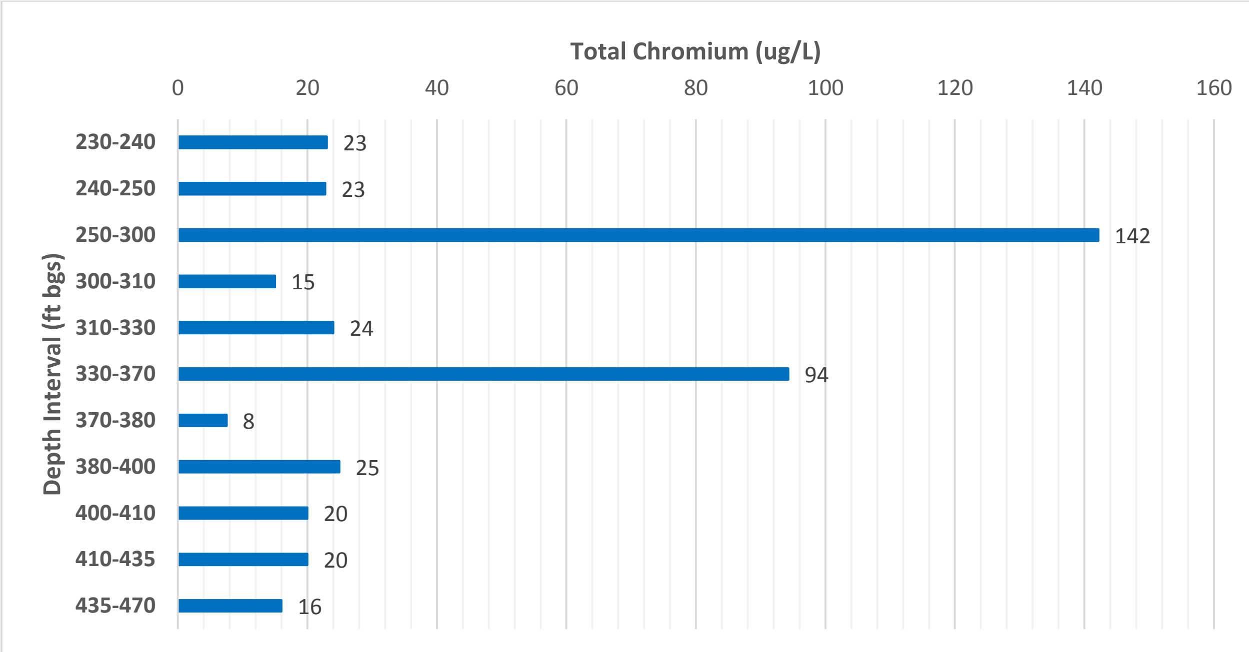



**Figure 10: Zonal total chromium concentration.**

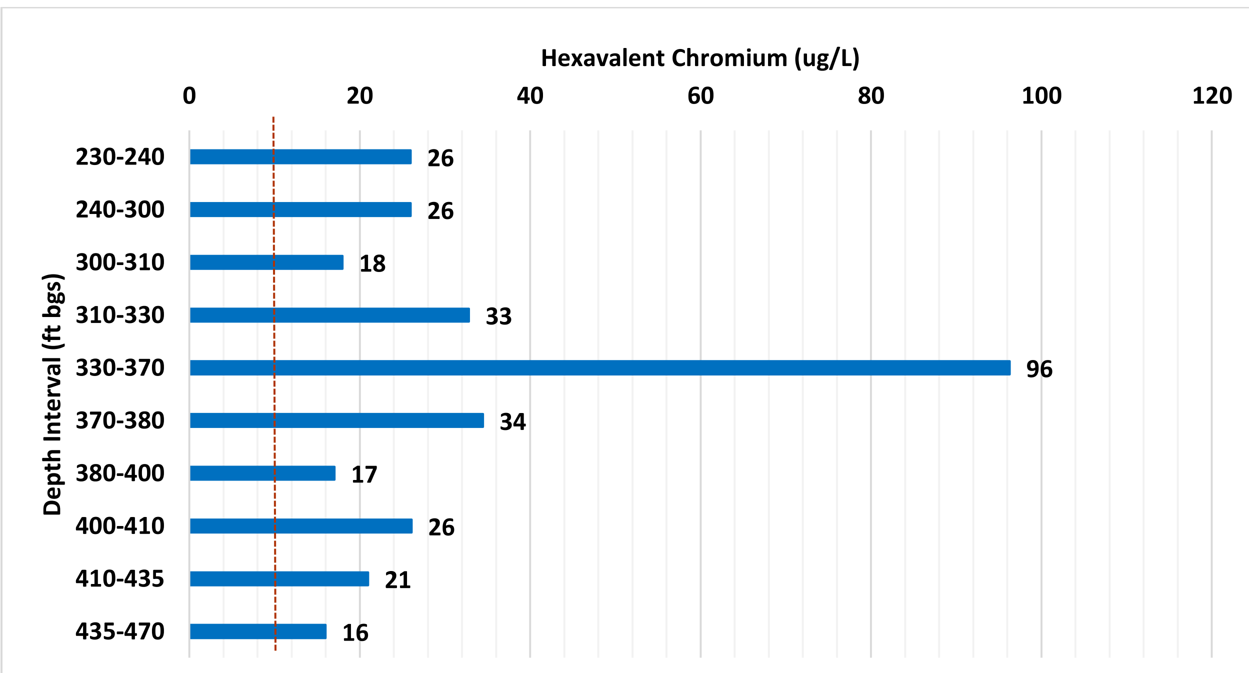



**Figure 11: Zonal hexavalent chromium concentration. Proposed State of California MCL of 0.010 mg/L (10 ug/L) indicated by the dotted line.**

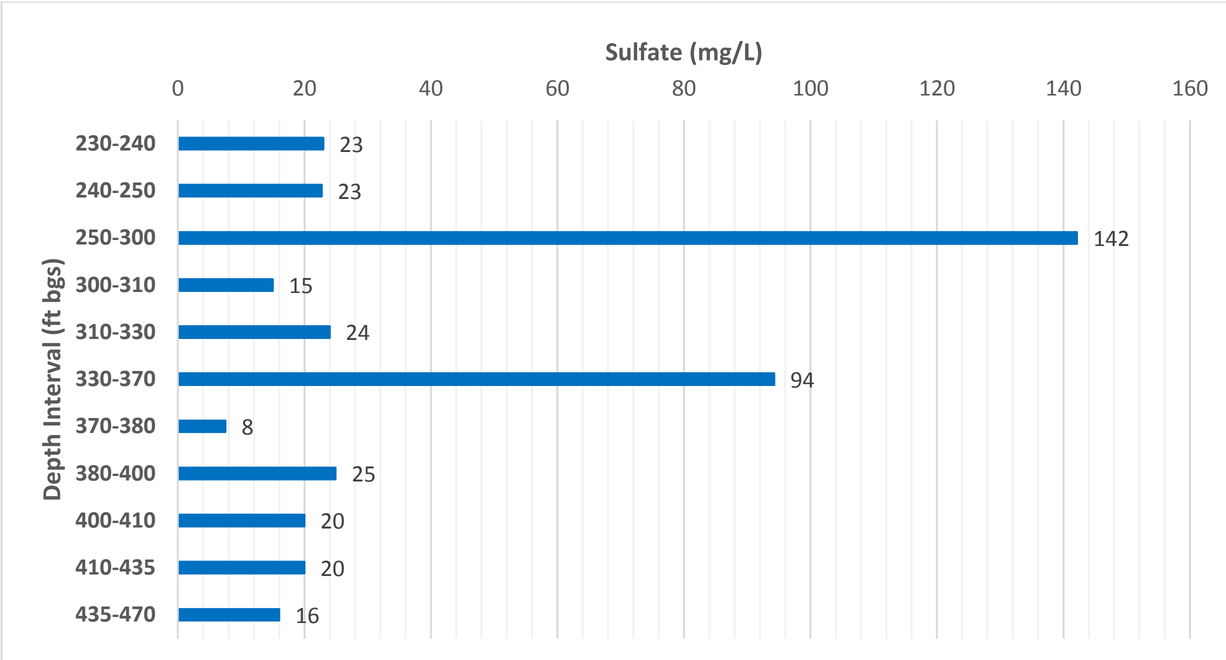



**Figure 12: Zonal sulfate concentration.**

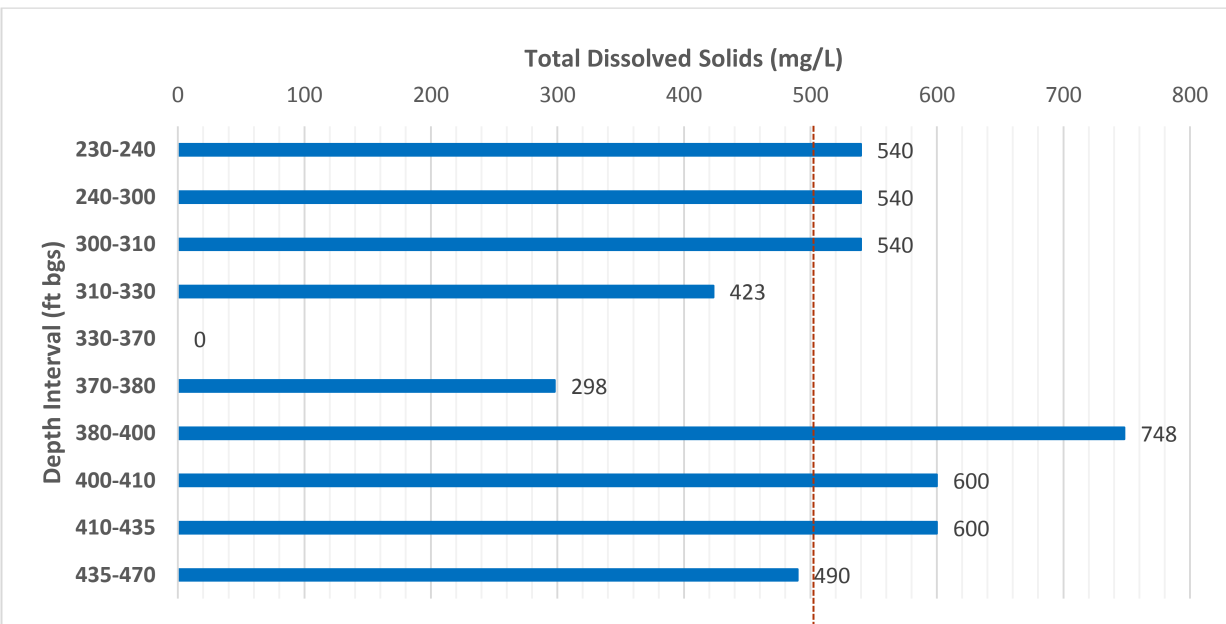



**Figure 13: Zonal TDS concentration. The federal secondary MCL of 500 mg/L is indicated by the dotted line.**

# Discussion

## Water Chemistry

The sample analysis results are used in conjunction with the flow calculations and principles of conservation of mass to determine the specific water quality of various zones along the well screen.

## Well Modification Scenario

Important Points:

- BESSST Inc. estimates that roughly 80% of flow contribution originates from the screen section above the window. Eliminating the upper screen alone does not lower projected chromium wellhead concentrations.
- Lowering packers 130 ft below the window lower theoretical chromium concentrations. However, chromium concentration in the lower part of well 15 ranges from about 16-25ppb. It is unlikely that well modification alone will reduce chromium levels below 10 µg/L.

| Analyte (Well 15) | Unit | MCL | Theoretical Concentration | Average Wellhead Concentration | Block Window 0'-250' | Block: 0'-380' |
|---|---|---|---|---|---|---|
| Maximum Production Loss | % | - | 0% | 0% | 80% | 88% |
| Alkalinity | mg/L | - | **320** | **290** | 320 | 310 |
| Chloride | mg/L | 250 | **69** | **69** | 48 | 56 |
| Total Chromium | ug/L | 10 | **23** | **23** | 24 | 22 |
| Hexavalent Chromium (Dissolved) | ug/L | 10 | 26 | 25 | 26 | 20 |
| Sulfate | mg/L | 250 | 91 | 90 | 110 | 160 |
| Total Dissolved Solids | mg/L | 500 | 540 | 550 | 540 | 660 |

**Figure 14: Well Modification Scenario**

## Appendix A: Lab Results Summary

| Parameter | Alkalinity | Chloride | Total Chromium | Hexavalent Chromium Dissolved | pH | Sulfate | Total Dissolved Solids |
|---|---|---|---|---|---|---|---|
| Unit | mg/L | mg/L | ug/L | ug/L | Units | mg/L | mg/L |
| Fed. MCL | - | 250 | 100 | - | - | 250 | 500 |
| **230** | 270 | 68 | 23 | 26 | 8.2 | 90 | 540 |
| **240** | 280 | 69 | 23 | 26 | 8.3 | 91 | 540 |
| **250** | - | - | 24 | - | - | - | - |
| **300** | 320 | 46 | 23 | 26 | 8.1 | 110 | 540 |
| **310** | 330 | 46 | 24 | 27 | 8.1 | 110 | 540 |
| **330** | 320 | 47 | 24 | 26 | 8.2 | 120 | 560 |
| **370** | 300 | 53 | 20 | 22 | 8.1 | 140 | 610 |
| **380** | 310 | 56 | 22 | 20 | 8.4 | 160 | 660 |
| **400** | 330 | 52 | 20 | 22 | 8.1 | 130 | 600 |
| **410** | 300 | 53 | 20 | 21 | 8.1 | 140 | 600 |
| **435** | 290 | 43 | 16 | 16 | 8 | 89 | 490 |
| **WH1** | 280 | 68 | 23 | 25 | 8 | 90 | 550 |
| **WH2** | 300 | 69 | 23 | 25 | 8 | 90 | 550 |

## Appendix B Flow Weighted Results Summary

| Sample Depth | Depth Interval | Zonal Flow Contribution | Alkalinity CaCO3 | Chloride | Hexavalent Chromium Dissolved | Sulfate | Total Dissolved Solids | Sample Interval | Total Chromium |
|---|---|---|---|---|---|---|---|---|---|
| **Ft BGS** | **Ft BGS** | **GPM** | **mg/L** | **mg/L** | **µg/L** | **mg/L** | **mg/L** | **ft bgs** | **µg/L** |
| MCL | - | - | - | 250 | 10 | 250 | 500 | MCL | 10 |
| **WH1** | **-** | **-** | **280** | **68** | **25** | **90** | **550.00** | **WH1** | **23** |
| **WH2** | **-** | **-** | **300** | **69** | **25** | **90** | **550.00** | **WH2** | **23** |
| **WH AVG** | **-** | **-** | **290.00** | **68.50** | **25.00** | **90.00** | **550.00** | **WH AVG** | **23.00** |
| **230** | 230-240 | 0.00 | 270 | 68 | 26 | 90 | 540 | 230-240 | 23 |
| **240** | 240-300 | 1230.00 | 270 | 75 | 26 | 86 | 540 | 240-250 | 23 |
| **300** | 300-310 | 247.10 | 240 | 46 | 18 | 110 | 540 | 250-300 | 142 |
| **310** | 310-330 | 219.64 | 388 | 40 | 33 | 52 | 423 | 300-310 | 15 |
| **330** | 330-370 | 187.50 | 671 | 0 | **96** | 0 | 0 | 310-330 | 24 |
| **370** | 370-380 | 177.40 | 238 | 34 | 34 | 15 | 298 | 330-370 | 94 |
| **380** | 380-400 | 152.90 | 281 | 62 | 17 | 204 | 748 | 370-380 | 8 |
| **400** | 400-410 | 91.04 | 453 | 48 | 26 | 89 | 600 | 380-400 | 25 |
| **410** | 410-435 | 73.21 | 300 | 53 | 21 | 140 | 600 | 400-410 | 20 |
| **435** | 435-470 | 0.00 | 290 | 43 | 16 | 89 | 490 | 410-435 | 20 |
| | | | | | | | | 435-470 | 16 |

# APPENDIX D2

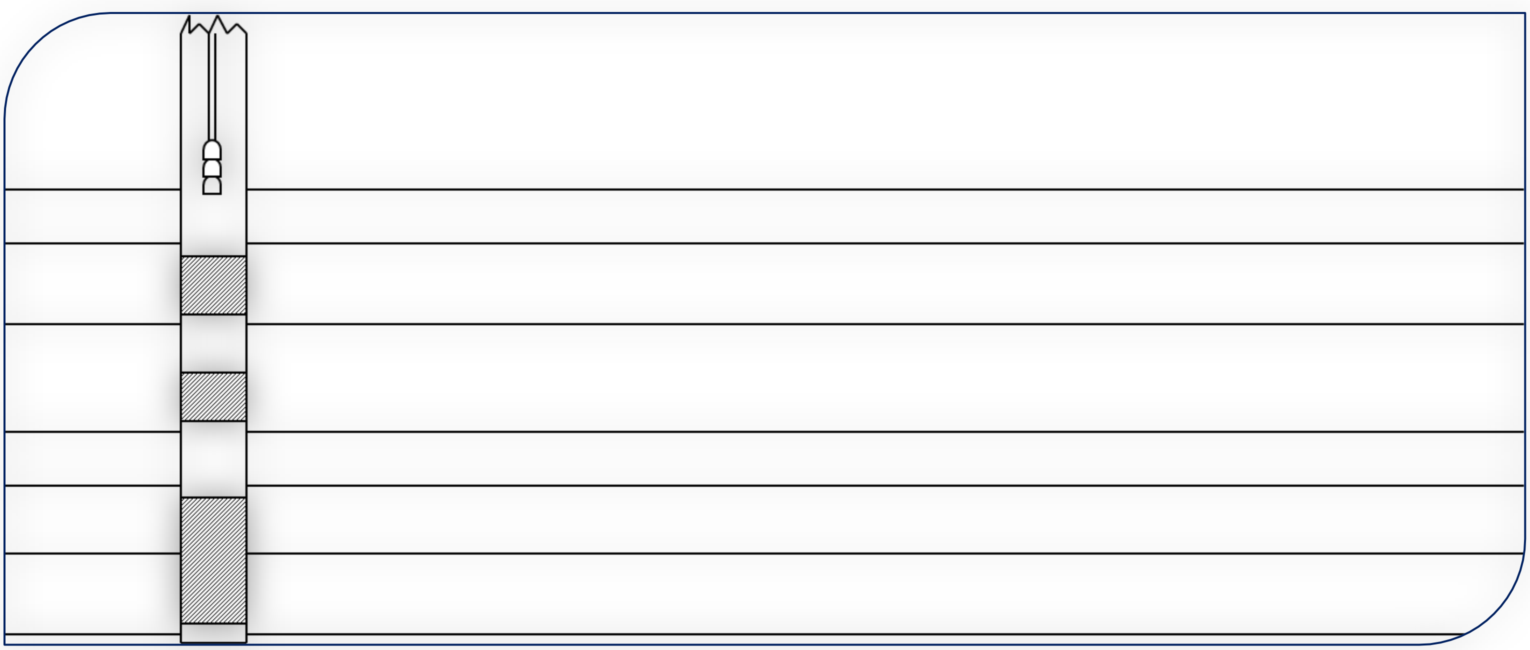
## *BESST Inc. Report Well 25*

BESST INC.
GLOBAL SUBSURFACE TECHNOLOGIES

# Dynamic Flow and Chemistry Profiling Report: Santa Ynez River Water Conservation District Well 25 Los Olivos, CA


Prepared by:
James Conrad and Kim Miles

Reviewed by:
Debra Cerda and Noah Heller


BESST, Inc., 50 Tiburon St, Ste 7, San Rafael, CA 94901 ¤ (P) 415/453.2501 ¤ (F) 415/453.2509 http://www.besstinc.com


May 1, 2014

## Executive Summary

On February 12 – 14, 2014, BESST, Inc. performed a dynamic flow and water quality chemistry profile for **Well 25,** which is owned and operated by **Santa Ynez River Water Conservation District**.

The dynamic flow and water quality profile was performed to measure and calculate flow contribution as well as water quality concentrations and contributions from three screened intervals measuring 215 feet in total length.

The purpose of this profiling event for Well 25 was to investigate levels of hexavalent chromium above the proposed state MCL of 10 micrograms per liter (ug/L). Other reported constituents of concern for this well include uranium and total dissolved solids.

The dynamic flow profile was performed using the USGS Tracer Pulse Dynamic Flow Profile method to measure flow contribution along the length of the well. Sampling depths were determined through assessment of available well information which is summarized in the Well Information Summary.

A temperature survey (Figure 2) and pressure survey were conducted. The normalized pressure curve presented in Figure 3 shows a strong positive pressure kick starting at a depth of about 750 feet below ground surface and increasing with depth, suggesting an upward gradient inside the well from the lower, middle and possibly the lower part of the upper well screens. The outflow zone appears to be within the middle to upper portions of the upper well screen. The potential benefit of such hydraulic behavior is to minimize the downward migration of higher concentrations of undesirable constituents.

BESST conducted dynamic water quality sampling using the HydroBooster sampling method on February 13, 2014, collecting water samples at six discrete depths. Sample results are shown by analyte in figures 10 through 16.

With the exception of TDS, all tested analytes are under the maximum contaminant level (MCL) for the National Primary Drinking Water Regulations (NPDWR) as well as secondary MCLs at the wellhead.

Based on the data results, it is recommended that a feasibility test be performed on Well 25. The feasibility test would consist of the placement of a packer in the cased section of the well between the upper and middle screen for the purpose of blocking groundwater production from the upper screen.

Additionally, an engineered suction should extend from the bottom of the packer and then into and through the middle and lower screen sections of the well.

Total chromium and hexavalent chromium theoretical wellhead concentration estimates decrease as the blocked length in the uppermost well screen is increased (from top to bottom).

TDS theoretical wellhead concentration is reduced below the Federal MCL when well screen is block from 500-765 feet bgs. While this scenario exhibits a maximum production loss of 94%, it is possible that installing an engineered suction between the middle and lower screens could compensate for production loss.

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## Introduction

BESST performed a dynamic flow and water chemistry profile on February 12-14, 2014, for the **Santa Ynez River Water Conservation District Well 25**, located in Los Olivos, California.

### Flow Contribution

Flow contribution in **Well 25** was measured at thirteen (13) discrete depths along the well bore from **600** to **810** feet below ground surface (ft bgs). The apparent travel time collected from Well 25 was used to calculate zonal flow contribution.

### Water Quality Sampling

BESST conducted dynamic water quality sampling using the HydroBooster sampling method on February 13, 2014, collecting water samples at thirteen (13) discrete depths. Sample results are shown by analyte in figures 10 through 16.

Chemical analysis was performed by Eurofins Eaton Analytical. The water quality constituents and parameters included:

#### Conventional Chemistry

- Alkalinity
- Chloride
- Sulfate ($SO_4$)
- Total Chromium
- Hexavalent Chromium
- pH
- Total Dissolved Solids
- Uranium

#### Conventional Chemistry

Each graph shows the dynamic chemical contribution of the analyte versus the sampling depth interval (ft bgs). The dynamic chemistry profile estimates geologic water (zonal) chemistry by considering dilution and mixing factors inside the steady state (pumping) water supply well.

Below the pump, water is flowing into the well casing through the screen sections and upward in the well towards the pump intake.

## Well Information Summary

The following information for Santa Ynez River Water Conservation District Well 25 is based on technical information provided by DUDEK.

### Well Construction

The well screen is a single slot louvered screen, 14.5 inches O.D. by 5/16" wall with screened intervals at the following depths (ft bgs):

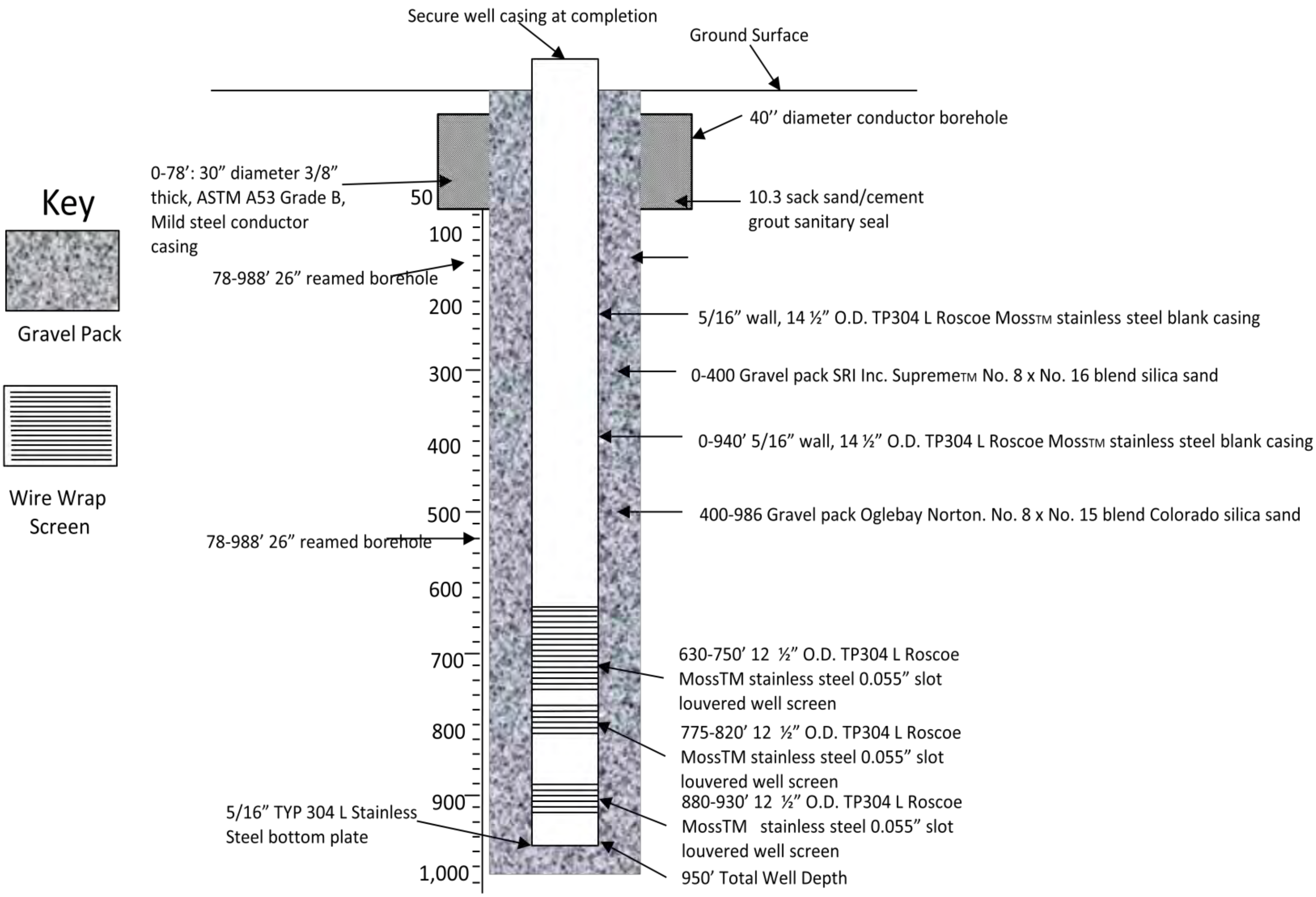
- 630'- 750'
- 775' - 820'
- 880' - 930'

In September of 2012, Well 25 was fitted with the following patches:

- 1st patch: 117.4' - 122.5'
- 2nd patch: 158.6' - 163.7'
- 3rd patch: 197.6' - 202.6'
- 4th patch: 277.3' - 282.3'

The pump is set at approximately 520 ft bgs with a 10" O.D. pump column diameter. Observed pumping water level is 427 ft bgs with a pumping rate of 966 gpm.

**Figure 1: Well completion diagram**



## Temperature Survey

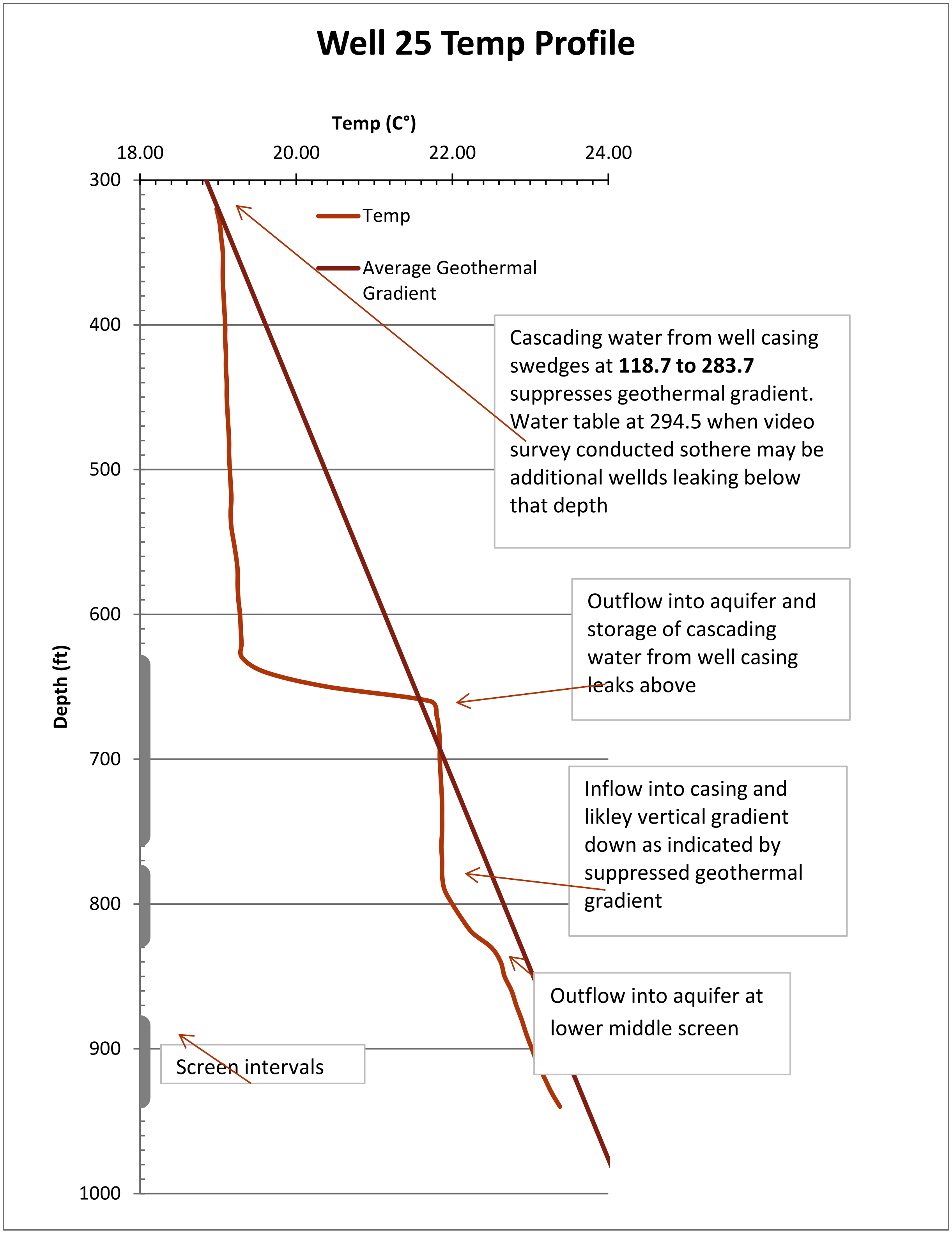



**Figure 2: Ambient temperature profile of Well 25. Data collected by BESST Inc. Interpretation courtesy DUDEK.**

## Pressure Survey

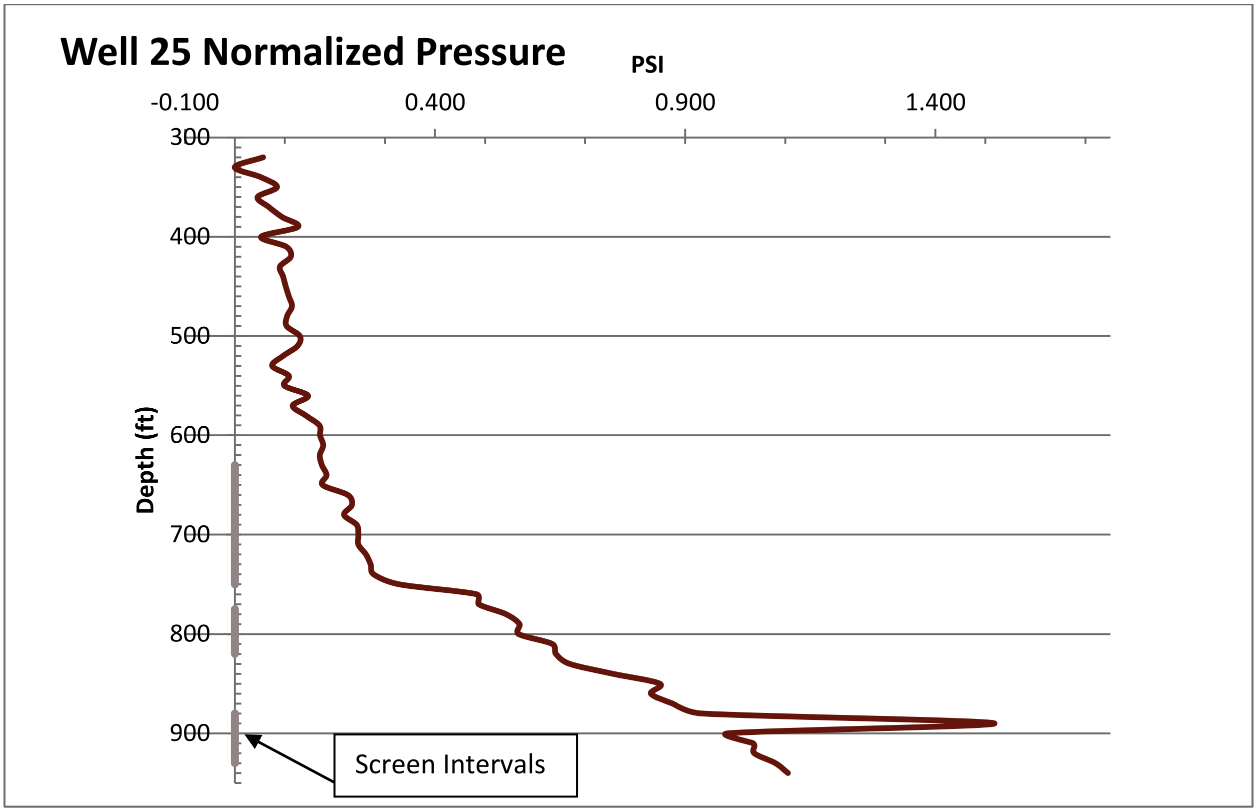



**Figure 3: Normalized pressure vs. depth under ambient (non-pumping conditions).**

Under ambient conditions inside a well, groundwater flows from the highest to lowest potential, i.e., highest to lowest pressure. Normalized pressure is arithmetically defined as the difference between the theoretical pressure gradient and measured or actual gradient. The theoretical gradient is generally defined as 1 PSI/2.31 ft for pure water. Being that groundwater inside the well is not pure, we know that there is a small amount of error when using pure water to estimate the normalized pressure gradient. Therefore we cannot interpret outflow and inflow zones along the length of the well screen on the basis of an individual point but rather as a trend defined from a series of depth-dependent point measurements. The totality of these measurements is what helps in the understanding of the flow gradient inside a well.

The pressure survey was performed using a vented Level Troll 700 manufactured by In-Situ, Inc. The head differential measured inside Well 25 was 634 feet, and within the accuracy and resolution range specifications stated by the manufacturer.

The normalized pressure curve presented in Figure 3 shows a strong positive pressure kick starting at a depth of about 750 feet below ground surface and increasing with depth. These data suggest an upward gradient inside the well from the lower, middle and possibly the lower part of the upper well screens. The outflow zone appears to be within the middle to upper portions of the upper well screen. The potential benefit of such hydraulic behavior is to minimize the downward migration of higher concentrations of undesirable constituents.

## Dynamic Flow Profile

The dynamic flow profile was performed using the USGS Tracer Pulse Dynamic Flow Profile method to measure flow contribution along the length of the well (Figures 4 through 6). The profile was conducted at a flow rate of 966 gallons per minute (gpm).

Corrected discharge shows the cumulative flow profile along the length of the well. The raw cumulative flow data was corrected by a factor of 1.01 (actual pump rate over theoretical pump rate) to match the field pumping rate.

Incremental flow is calculated by finding the difference in corrected discharge (cumulative flow) depths. The incremental flow graph shows zonal flow contribution between each dye injection location.

The percent contribution graph is in principal the same information as incremental flow. Adding up all labeled values in incremental flow will give the pumping rate, and the same calculation for percent will add up to 100% of the pumping rate. Percent contribution is calculated by dividing incremental flow by the pumping rate of 966 gpm.

### Percent Contributions

Flow calculations indicate that the top two sections of screen contribute 100% towards the total pumping rate. BESST Inc. saw no dye returns below 810 ft bgs. This means the measurable upward movement of water toward the pump intake stops just below 810 ft bgs.

The two remaining zones that contribute flow include the sections from 630 ft bgs - 750 ft bgs and 775 - 820 ft bgs. The geophysical log (Figure 7) indicates that the potential for flow is highest from 600-750 ft bgs. This correlates with the 630 -750 ft well screen which contributes about 95% of the total flow. The second well screen (775-820 ft bgs) produces the remaining 5% of the total flow. The second well screen also correlates with a high resistivity spike (Figure 7).

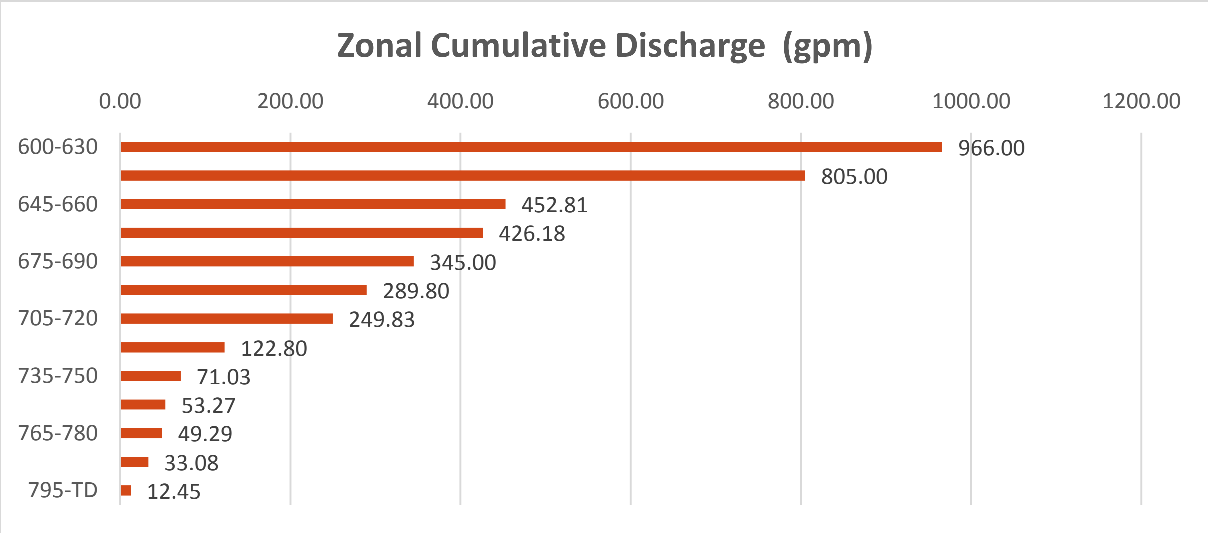



**Figure 4: Cumulative discharge for Well 25 at 966 gpm.**

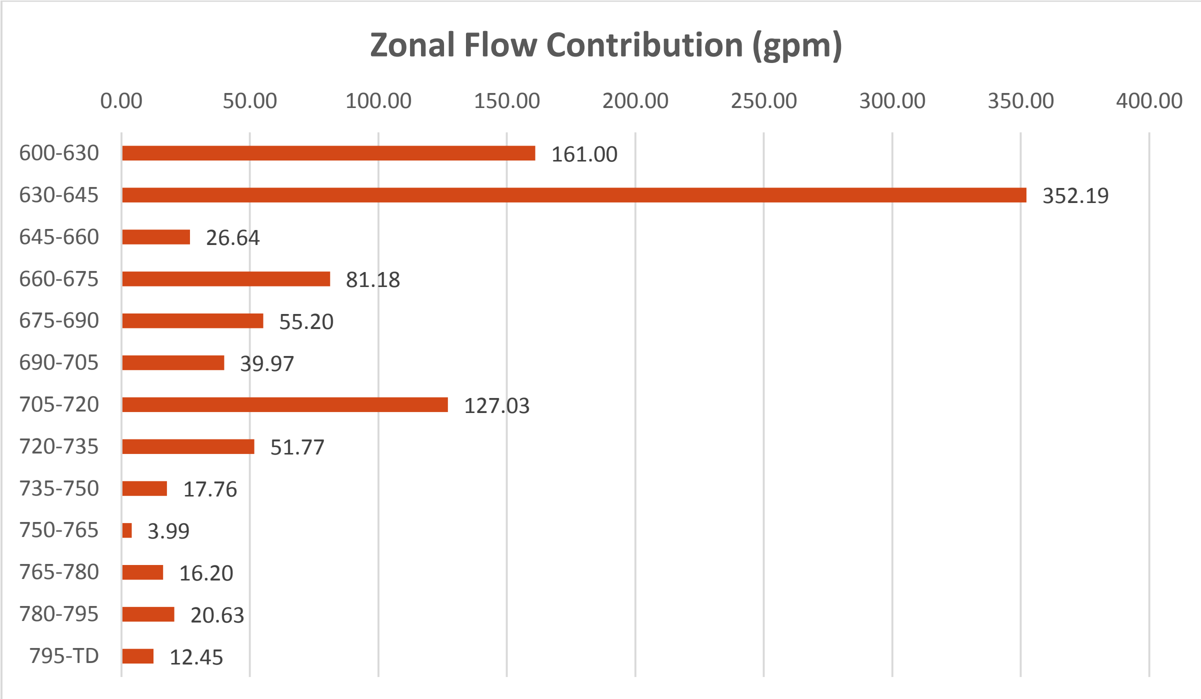



**Figure 5: Zonal flow contribution for Well 25 at 966 gpm.**

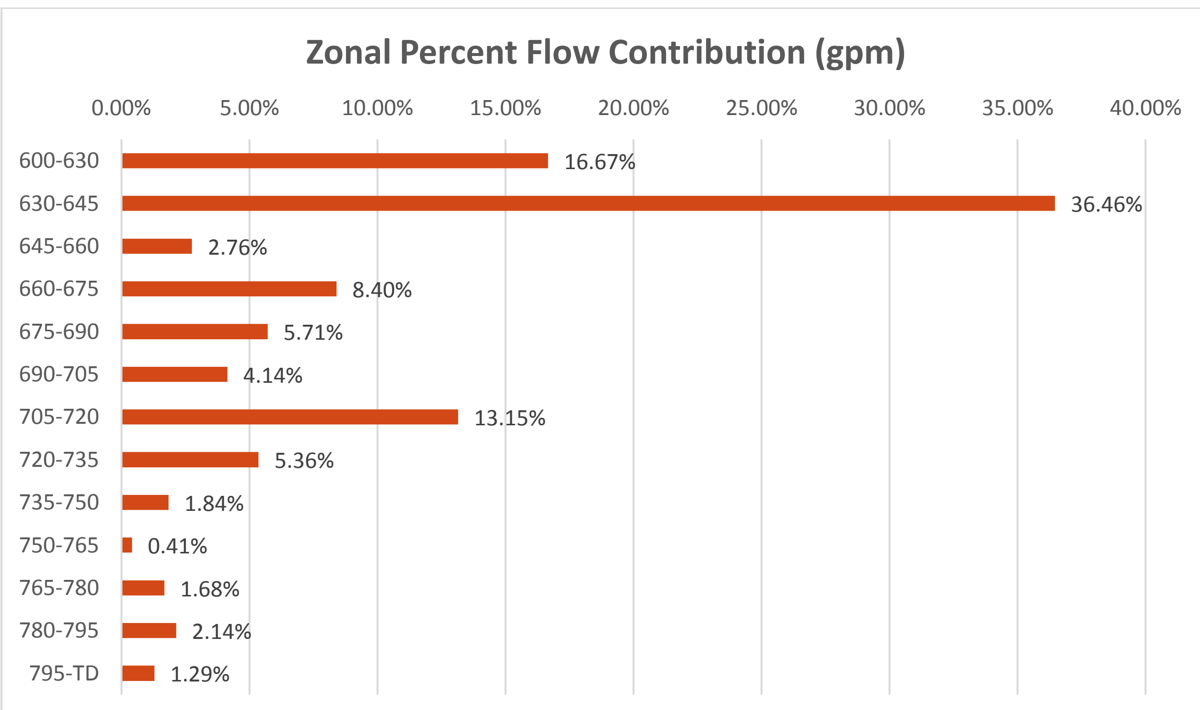



**Figure 6: Zonal percent Flow contribution for Well 25 at 966 gpm.**

## Down-hole Geophysics and Flow Contribution Comparison

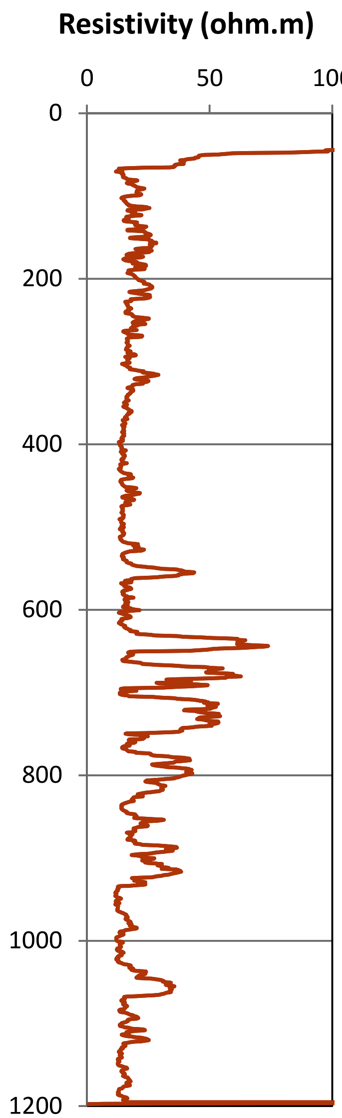



Figure 7: Resistivity

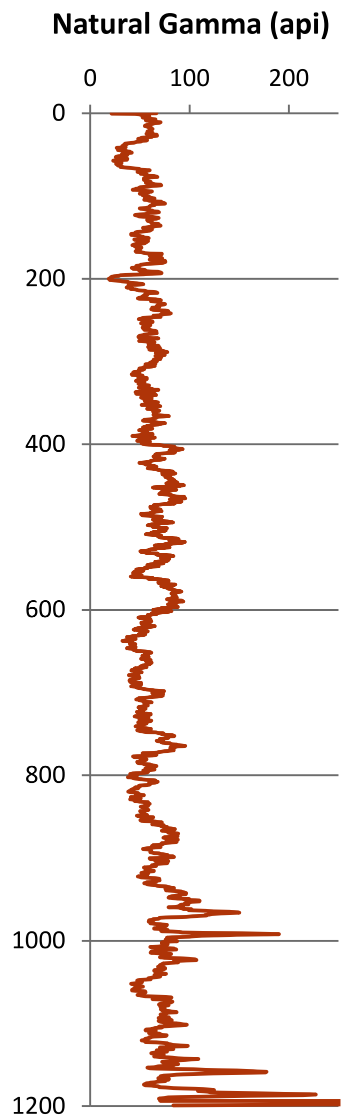



Figure 8: Natural Gamma

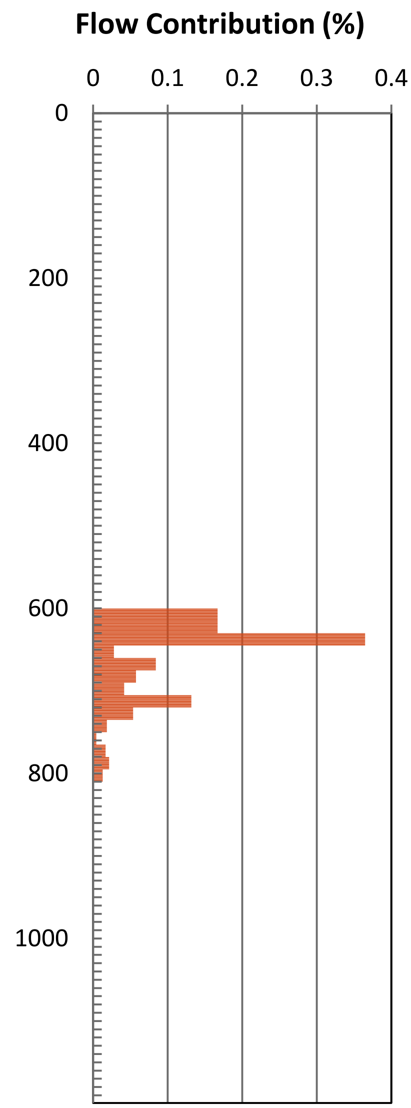



Figure 9: Percent Flow Contribution

Resistivity and natural gamma data, as provided by DUDEK, correlate with BESST Inc. dynamic flow contribution data as seen in Figures 6 - 8. Major contributing zones under 966 gpm pumping condition are restricted to the upper two screen sections.

Although BESST Inc. did not establish flow contribution from the deepest screened section (880-930 ft bgs), the resistivity graph (Figure 7) suggests there is high potential for flow. Well modification could result in a shift of flow production to the lower zone.

# Dynamic Chemistry Profile

## Results

The actual reported laboratory result for each analyte is listed in Appendix A, and includes the reported values as well as significant digits for analytes that fall below laboratory detection limit. Detected analytes are listed below.

### Conventional Chemistry

- Alkalinity
- Chloride
- Sulfate ($SO_4$)
- Total Chromium
- Hexavalent Chromium
- Total Dissolved Solids
- Uranium

The measures lab result values used in the mass balance calculation are shown in Appendix A on page 19.

## Calculations

In figures 10 - 16, the incremental concentration is a calculated value that has been "mass balanced" using the measured concentration and the flow contribution for each depth interval.

When working with results that are reported as "below laboratory detection limit", in order to still perform the mass balance calculation, a value of one-half of the detection limit was assigned. This adds a degree of uncertainty as to exactly how low the measured value actually was, but the calculated value is still a useful number in that it yields a relatively low incremental concentration.

## Zonal Concentrations of Water Quality Parameters

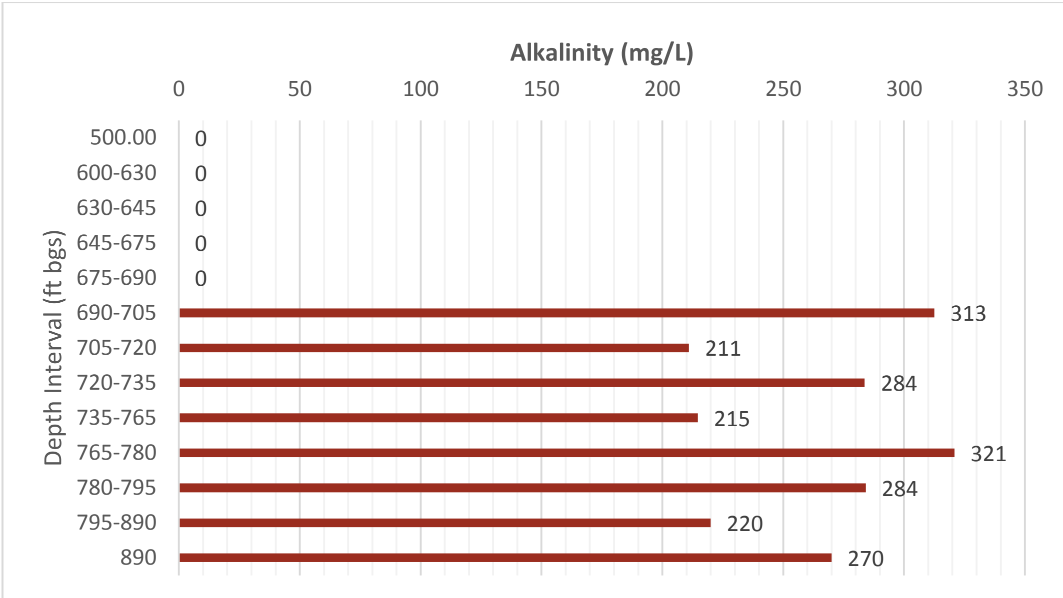



**Figure 10: Zonal alkalinity concentration.**

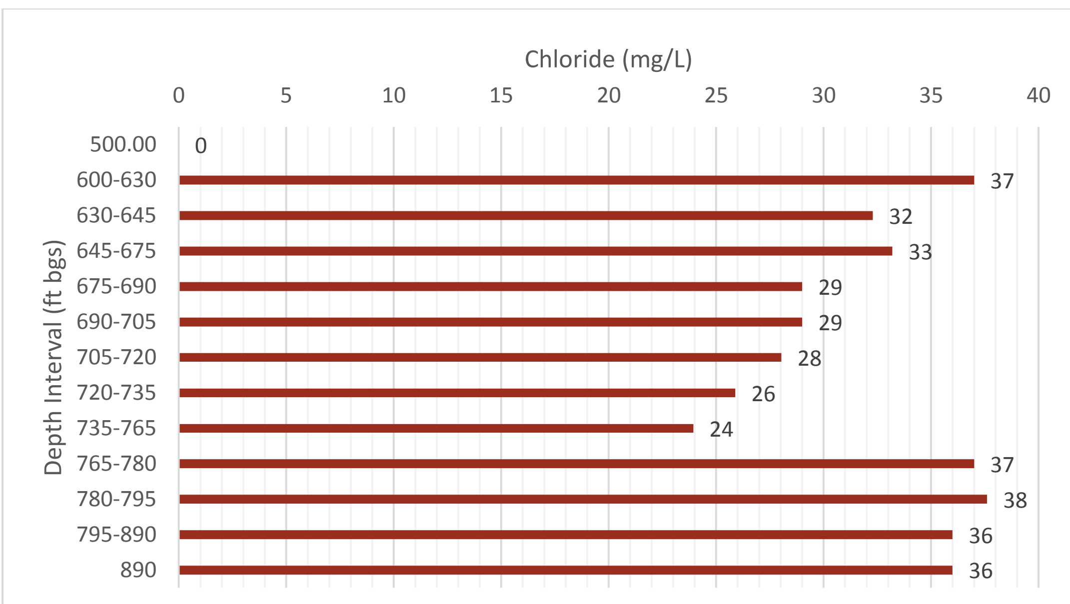



**Figure 11: Zonal chloride concentration.**

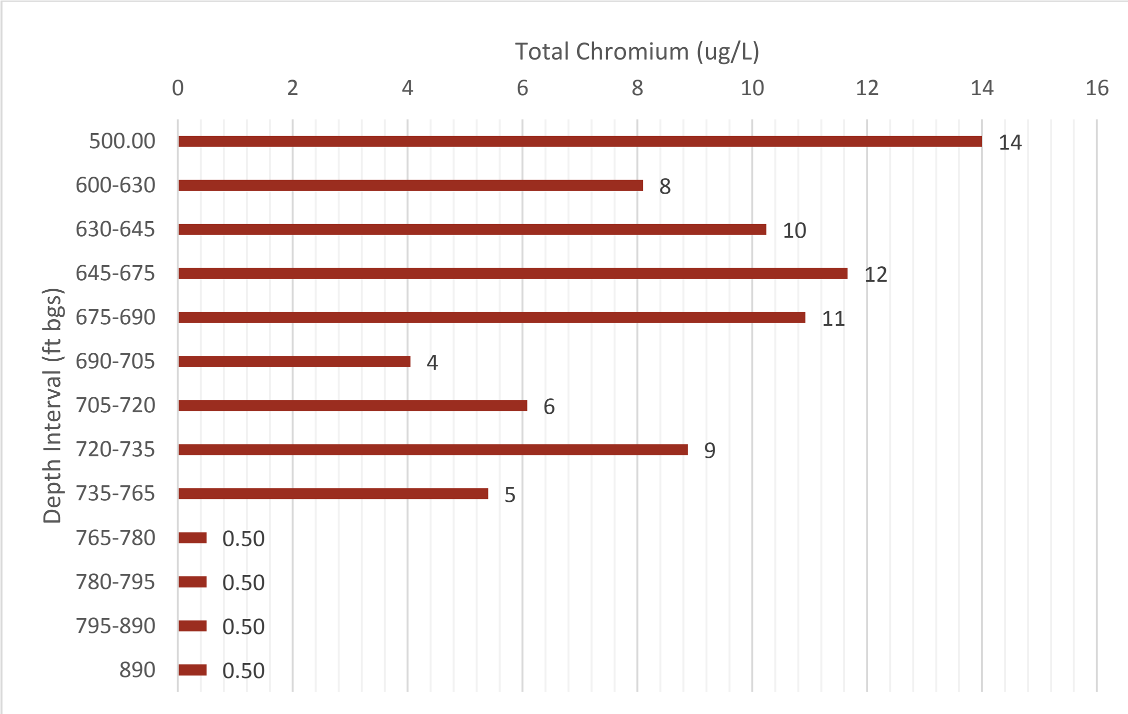



**Figure 12: Zonal total chromium concentration.**

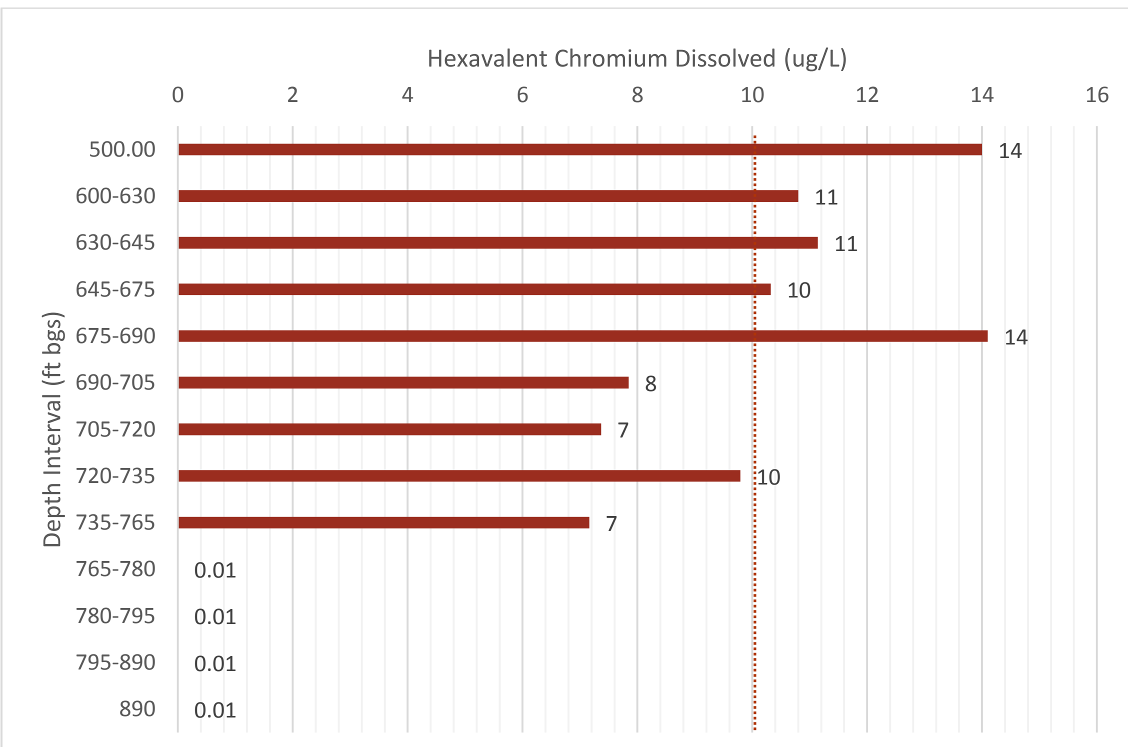



**Figure 13: Zonal hexavalent chromium concentration. Proposed State of California MCL of 0.10 mg/L (10 ug/L) indicated by the dotted line.**

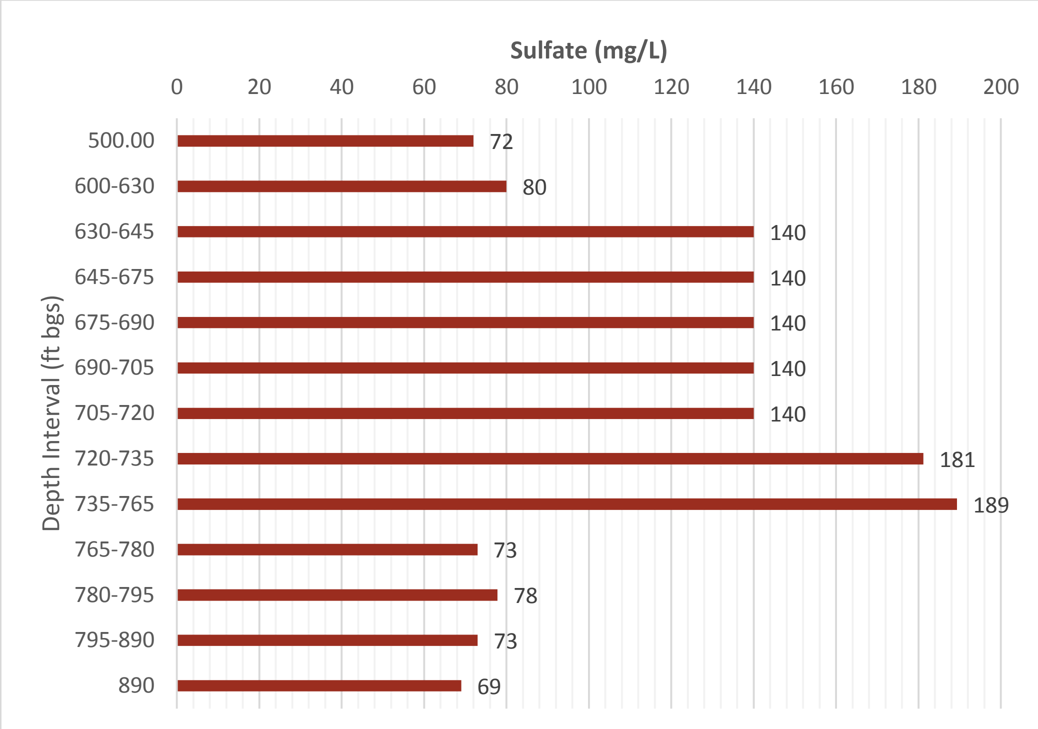



**Figure 14: Zonal sulfate concentration.**

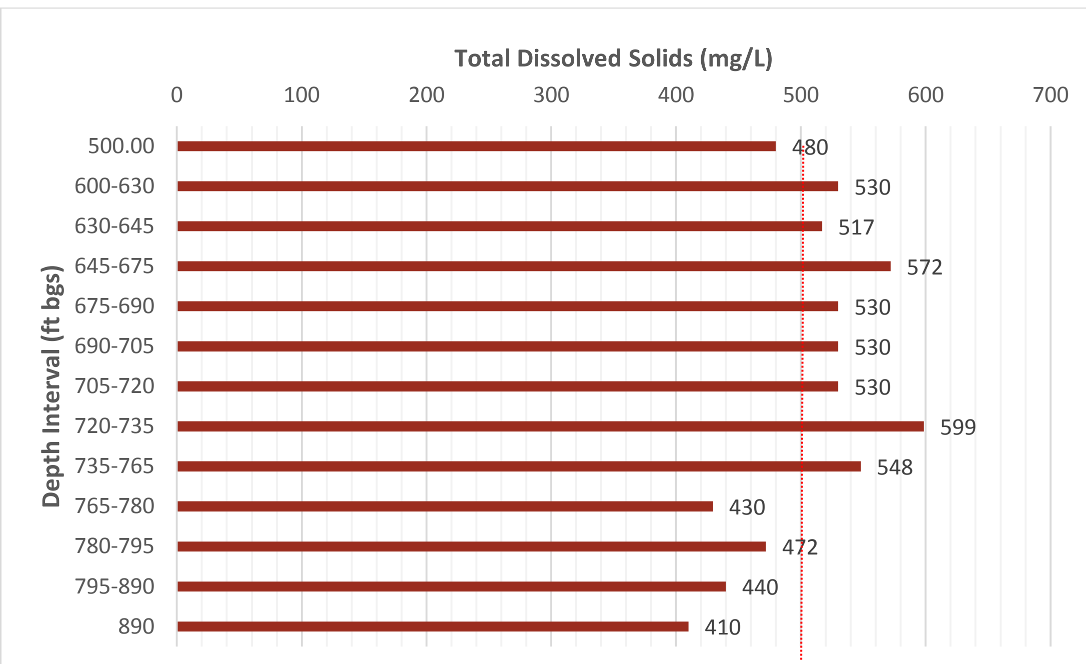



**Figure 15: Zonal TDS concentration. The federal secondary MCL of 500 mg/L is indicated by the dotted line.**

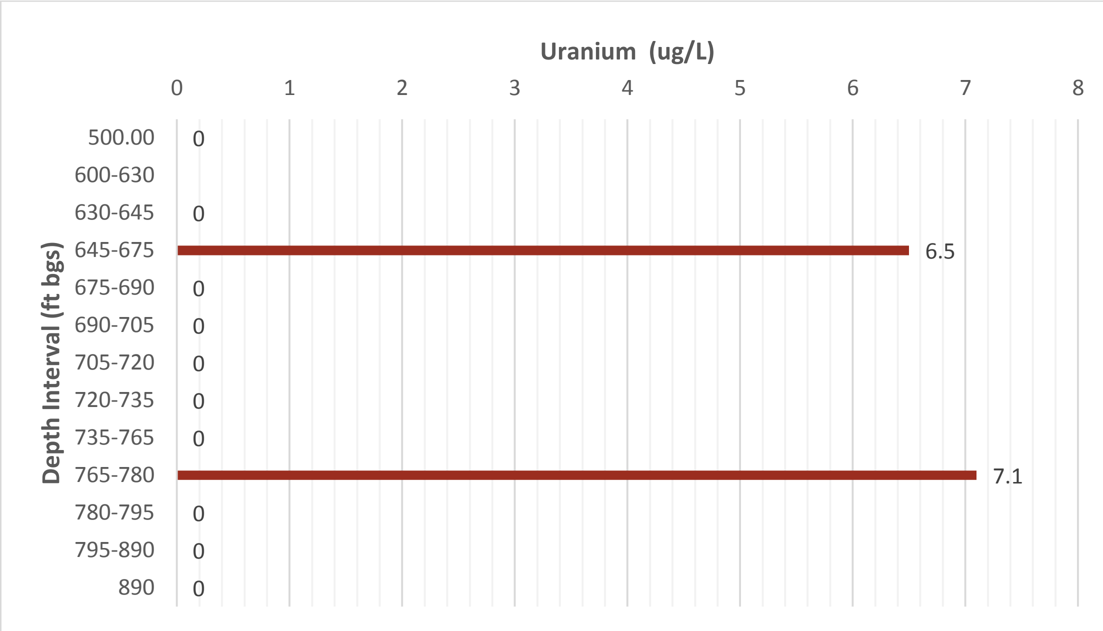



**Figure 16: Uranium concentration.**

NOTE: These values are not indicative of formational concentration. BESST Inc. does not have sufficient data at this time to conduct mass balance for Uranium. Values shown are lab results.

## Discussion

### Water Chemistry

The sample analysis results are used in conjunction with the flow calculations and principles of conservation of mass to determine the specific water quality of various zones along the well screen.

### Well Modification Scenario

Important Points:

- All tested analytes excluding total dissolved solids (TDS) are under the maximum contaminant level (MCL) for the National Primary Drinking Water Regulations (NPDWR).
- The given scenario is based on the decreasing chromium concentration with depth. A change is observed after 690 ft bgs in total chromium and hexavalent chromium, from 10.9 and 14.1 ppb down to 4.1 and 7.8 ppb, respectively (Figure 18).
- Total chromium and hexavalent chromium theoretical wellhead concentration estimates decrease as the blocked length in the uppermost well screen is increased (from top to bottom).
- TDS theoretical wellhead concentration is reduced below the Federal MCL when well screen is block from 500-765 feet bgs. While this scenario exhibits a maximum production loss of 94%, it is possible that installing an engineered suction between the middle and lower screens could compensate for production loss.

| Analyte: | Unit | MCL | Average Wellhead Concentration | Theoretical Concentration: | Block: 500'-630' | Block: 500'-645' | Block: 500'-675' | Block: 500'-690' | Block: 500'-765' |
|---|---|---|---|---|---|---|---|---|---|
| **Maximum Production Loss** | **%** | **-** | **0%** | **0%** | **17%** | **53%** | **64%** | **70%** | **94%** |
| Alkalinity CaCO3 | mg/L | - | 267 | 270 | 270 | 260 | 270 | 250 | 280 |
| Chloride | mg/L | 250 | 32 | 32 | 31 | 30 | 29 | 29 | 37 |
| Total Chromium | ug/L | 10 | 8.7 | 8.6 | 8.7 | 7.5 | 6.2 | 5.3 | 0.5 |
| Hexavalent Chromium Dissolved | ug/L | 10 | 9.8 | 9.8 | 9.6 | 8.4 | 7.8 | 6.6 | 0.01 |
| Sulfate | mg/L | 250 | 130 | 130 | 140 | 140 | 140 | 140 | 75 |
| Total Dissolved Solids | mg/L | 500 | 523 | 530 | 530 | 540 | 530 | 530 | 450 |

**Figure 17: Calculated versus actual wellhead concentrations. Dissimilar values may point to data that does not fully explain actual wellhead analyte results. Dissimilar wellhead results are highlighted.**

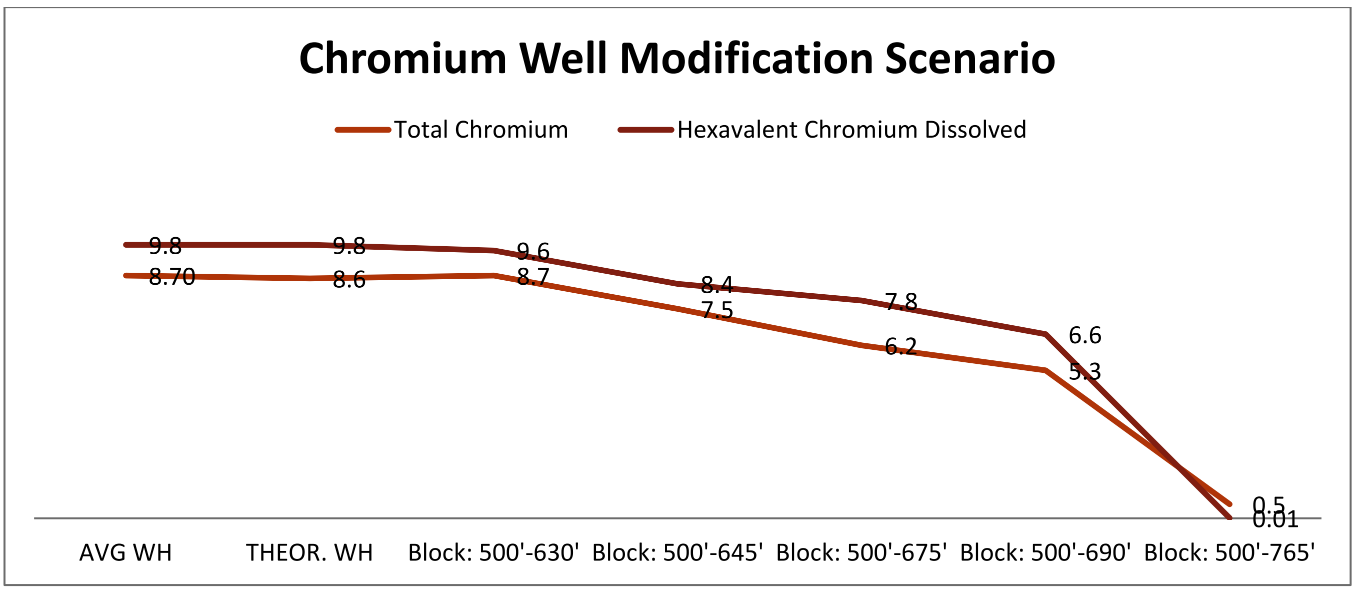



**Figure 18: This graph shows the theoretical chromium well head concentration as the length of blocked off screen section is increased.**

## Recommendations

Based on the data results, it is highly recommended that a feasibility test be performed on Well 25. The feasibility test would consist of the placement of a packer in the cased section of the well between the upper and middle screen for the purpose of blocking groundwater production from the upper screen.

Additionally, an engineered suction should extend from the bottom of the packer and then into and through the middle and lower screen sections of the well. The perforations on the engineered section should coincide in depth with the middle and bottom screen intervals of the well. The distance between the bottom of the packer and the top perforations of the engineered suction should be carefully considered. Enough vertical distance is required between these two points to ensure that water from the upper screen is not pulled down through the sand pack to the middle screen. A separation distance of at least 20 feet is recommended.

The diameter of the engineered suction is of great importance. It should be between 50 to 60% of the diameter of the well.

An additional option to the packer design is to use a “pass-through packer” which is constructed with two mandrels rather than one as in standard packer construction. The inflatable elastomer is formed around the outside mandrel and a stainless steel pass-through pipe is welded between the outer and the inner mandrel. The pass-through pipe can be anywhere between 1” to 1 ¼” ID and threaded on each end where it exits the packer from the top and the bottom. PVC pipe can then be threaded onto the top and/or bottom. From the top the PVC pipe can extend to the ground surface.

This design creates an accessible port through which a miniaturized camera, flow or sampling device can be inserted at a later time to perform surveys inside the well and below the packer if required. For example, the miniaturized camera can be used to inspect the condition of the well screen at some later point to determine if rehabilitation is necessary. The access port can also be used following the installation to see if the separation distance between the bottom of the packer and top perforation of the engineered suction is sufficient.

To determine whether this distance is sufficient, a tracer injection tool would be lowered into the well and placed in the annulus directly above the packer. The tracer would be released with a fluorometer plumbed into the discharge port at the ground surface. If tracer is detected, then it can be assumed that some of the water from the upper well screen is being drawn down through the sand pack. The test would only be performed if the desired result from the feasibility test is not achieved.

Lastly, feasibility tests are not performed over a short-term time frame, but rather over a 3 to 6 month time frame to prove out sustainability of the well modification. It is recommended that the Santa Ynez River Water Conservation District utilize the services of a consultant to oversee the feasibility test, including installation of the packer and engineered suction.

# Appendix A Lab Results Summary

| Depth Intervals | Alkalinity | Chloride | Total Chromium | Hexavalent Chromium Dissolved | pH | Sulfate | Total Dissolved Solids | Uranium |
|---|---|---|---|---|---|---|---|---|
| | mg/L | mg/L | ug/L | ug/L | Units | mg/L | mg/L | ug/L |
| Fed. MCL | - | 250 | 100 | - | - | 250 | 500 | 30 |
| 500 | 270 | 49 | 14 | 14 | 8.4 | 72 | 480 | - |
| 600 | 270 | 32 | 8.6 | 9.8 | 7.9 | 130 | 530 | - |
| 630 | 270 | 31 | 8.7 | 9.6 | 7.8 | 140 | 530 | - |
| 645 | 260 | 30 | 7.5 | 8.4 | 8.5 | 140 | 540 | 6.5 |
| 675 | 270 | 29 | 6.2 | 7.8 | 7.8 | 140 | 530 | - |
| 690 | 250 | 29 | 5.3 | 6.6 | 8.5 | 140 | 530 | - |
| 705 | 240 | 29 | 5.5 | 6.4 | 8.6 | 140 | 530 | - |
| 720 | 270 | 30 | 4.9 | 5.4 | 8.6 | 140 | 530 | - |
| 735 | 260 | 33 | 2 | 2.2 | 7.9 | 110 | 480 | - |
| 765 | 280 | 37 | ND | ND | 8 | 75 | 450 | 7.1 |
| 780 | 260 | 37 | ND | ND | 8 | 76 | 460 | - |
| 795 | 220 | 36 | ND | ND | 8 | 73 | 440 | - |
| 890 | 270 | 36 | ND | ND | 7.9 | 69 | 410 | - |
| **WH1** | **270** | **32** | **8.9** | **9.7** | **7.8** | **130** | **530** | **6.7** |
| **WH2** | **270** | **32** | **8.6** | **9.8** | **7.8** | **130** | **520** | **-** |
| **WH3** | **260** | **32** | **8.5** | **9.8** | **7.8** | **130** | **520** | **-** |

## Appendix B Flow Weighted Results Summary

| Depth Interval | Flow Rate | Alkalinity | Chloride | Total Chromium | Hexavalent Chromium Dissolved | Sulfate | Total Dissolved Solids | Uranium |
|---|---|---|---|---|---|---|---|---|
| Ft bgs | gpm | mg/L | mg/L | ug/L | ug/L | mg/L | mg/L | ug/L |
| **MCL** | **-** | **-** | **250** | **100** | **-** | **250** | **500** | **30** |
| 500 | 0 | 270 | 49 | 14 | 14 | 72 | 480 | - |
| 600-630 | 161 | 270 | 37 | 8.1 | 10.8 | 80 | 530 | |
| 630-645 | 352 | 282 | 32 | 10.2 | 11.1 | 140 | 517 | - |
| 645-675 | 107 | 228 | 33 | 11.7 | 10.3 | 140 | 572 | 6.5 |
| 675-690 | 55 | 375 | 29 | 10.9 | 14.1 | 140 | 530 | - |
| 690-705 | 39 | 313 | 29 | 4.1 | 7.8 | 140 | 530 | - |
| 705-720 | 127 | 211 | 28 | 6.1 | 7.4 | 140 | 530 | - |
| 720-735 | 51 | 283 | 26 | 8.9 | 9.8 | 181 | 599 | - |
| 735-765 | 21 | 214 | 24 | 5.4 | 7.2 | 189 | 548 | - |
| 765-780 | 16 | 320 | 37 | 0.5 | 0.0 | 73 | 430 | 7.1 |
| 780-795 | 20 | 284 | 38 | 0.5 | 0.0 | 78 | 472 | - |
| 795-890 | 12 | 220 | 36 | 0.5 | 0.0 | 73 | 440 | - |
| 890 | 0 | 270 | 36 | 0.5 | 0.0 | 69 | 410 | - |
| **WH #1** | **-** | **270** | **32** | **8.9** | **9.7** | **130** | **530** | **6.7** |
| **WH #2** | **-** | **270** | **32** | **8.6** | **9.8** | **130** | **520** | **-** |
| **WH #3** | **-** | **260** | **32** | **8.5** | **9.8** | **130** | **520** | **-** |

# APPENDIX D3

## *Pacific Surveys Data Well 27*

**PACIFIC SURVEYS**

# TEMPERATURE
# DELTA TEMPERATURE
# FLUID RESISTIVITY
# DELTA FLUID RESISTIVITY

| | |
|---|---|
| Job No. | 18505 |
| Company | DUDEK ENGINEERING |
| Well | UPLAND WELL #27 |
| Field | SANTA YNEZ |
| County | SANTA BARBARA |
| State | CA |

Location: 2121 HWY 154
GPS:N34o38.573" W120o05.376'

Other Services: NONE

Sec. Twp. Rge.

| | | | |
|---|---|---|---|
| Permanent Datum | Top of Casing | Elevation above perm. datum | Elevation K.B. D.F. G.L. |
| Log Measured From | Top of Casing | | |
| Drilling Measured From | N/A | | |

| | | | |
|---|---|---|---|
| Date | 06/20/2014 | | |
| Run Number | ONE | | |
| Depth Driller | 1200' | | |
| Depth Logger | 1199' | | |
| Bottom Logged Interval | 1199' | | |
| Top Log Interval | 200' | | |
| Pump Set @ | 318' | | |
| Time Pumping Prior to Survey | N/A | | |
| Density / Viscosity | N/A | | |
| Max. Recorded Temp. | 77.6 F | | |
| Pump Rate (GPM) | STATIC | | |
| Time Well Ready | 10:15 AM | | |
| Time Logger on Bottom | 10:30 AM | | |
| Equipment Number | PS-5 | | |
| Location | L.A. | | |
| Recorded By | ABREAU | | |
| Witnessed By | J. KUBRAN | | |

| Borehole Record | | | Tubing Record | | | |
|---|---|---|---|---|---|---|
| Run Number | Bit | From | To | Size | Weight | From | To |
| | | | | | | | |

| Casing Record | Size | Wgt/Ft | Top | Bottom |
|---|---|---|---|---|
| Surface String | | | | |
| Prot. String | | | | |
| Production String | 14.5" OD | N/A | 0' | 1200' |
| Liner | | | | |

<<< Fold Here >>>

All interpretations are opinions based on inferences from electrical or other measurements and Pacific Surveys cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to Pacific Surveys' general terms and conditions set out in our current Price Schedule.

## Comments

## Calibration Report

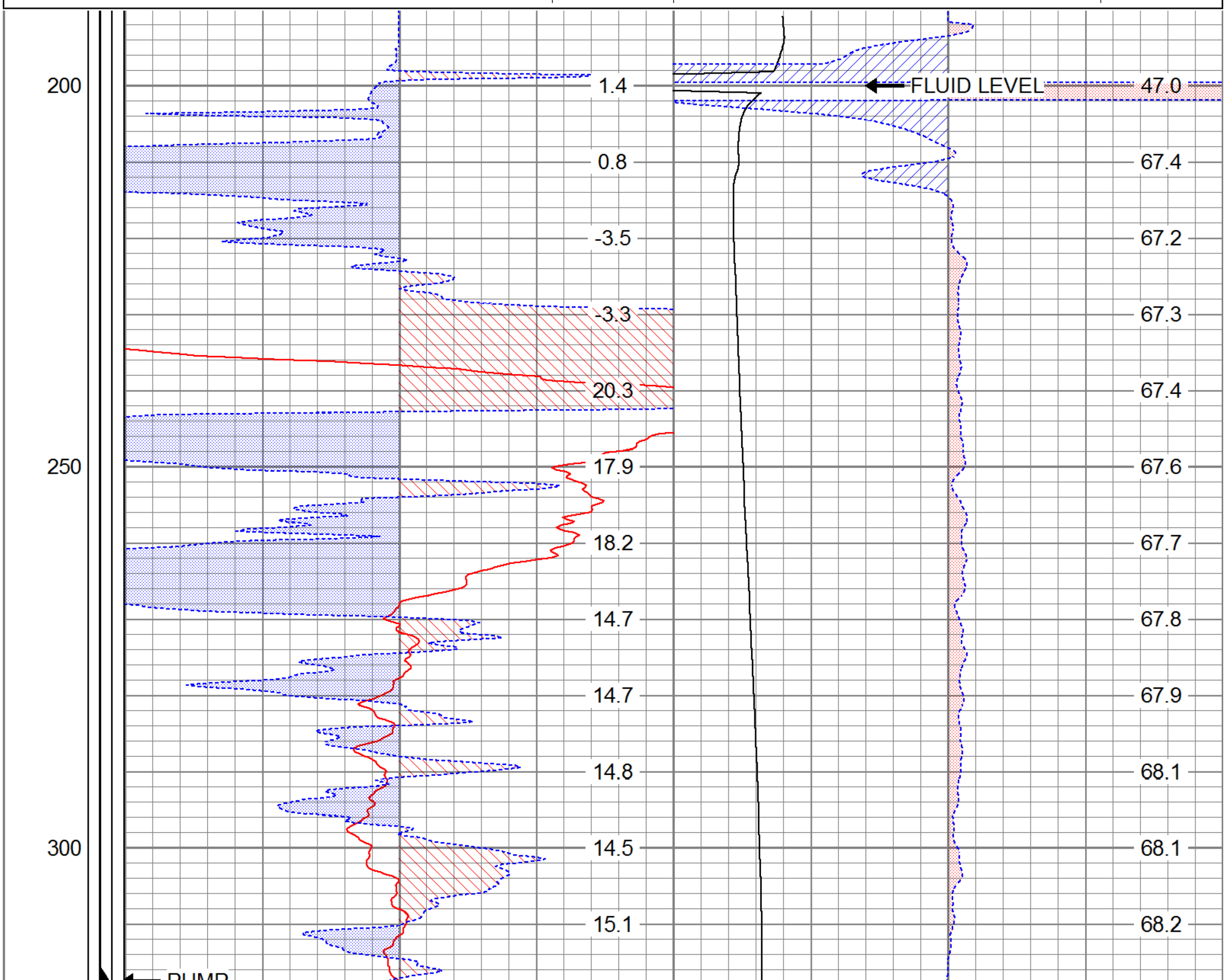
| | |
|---|---|
| Database File | 18505.db |
| Dataset Pathname | tmp |
| Dataset Creation | Fri Jun 20 10:46:07 2014 |

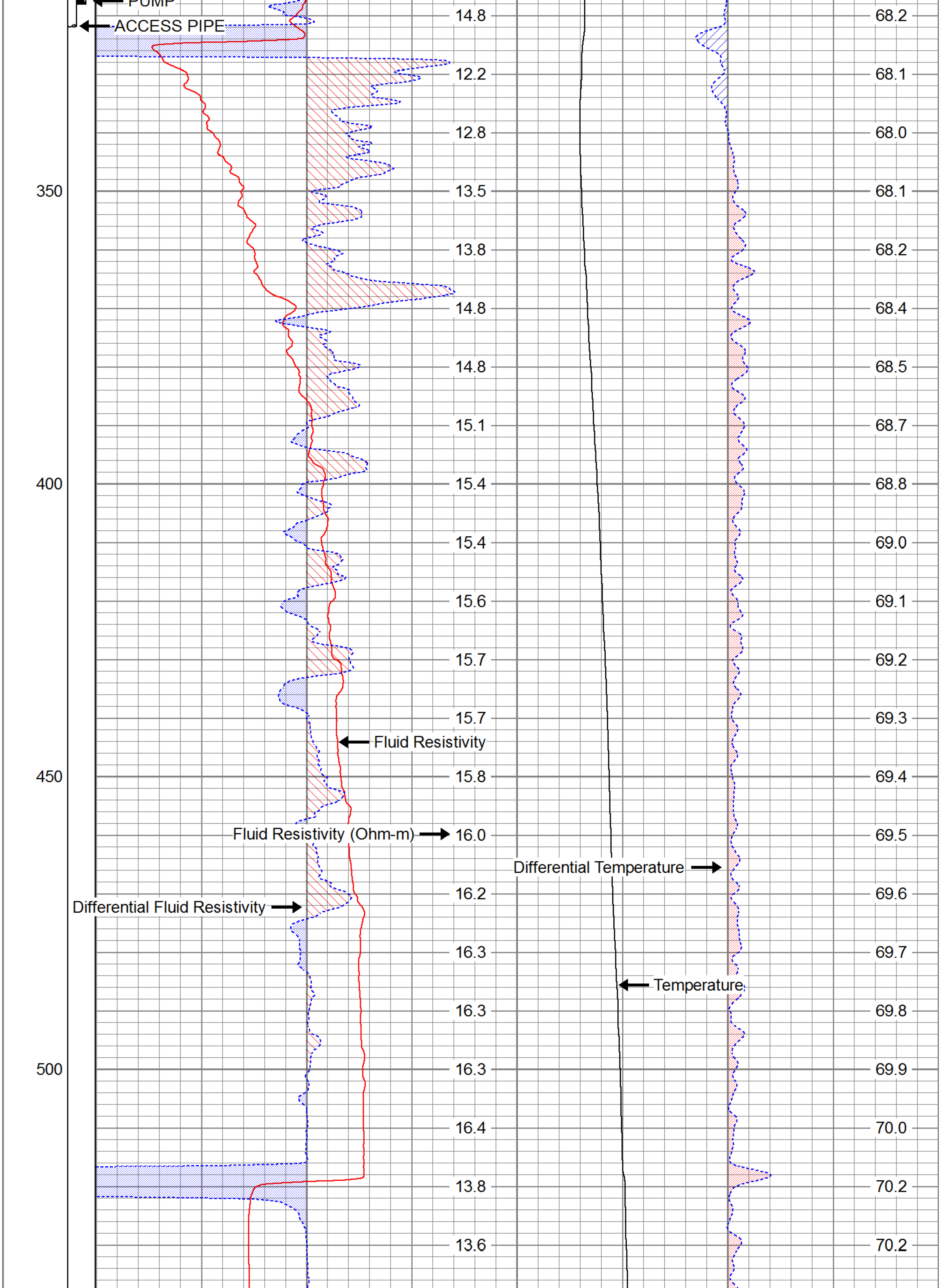
## Temperature Calibration Report

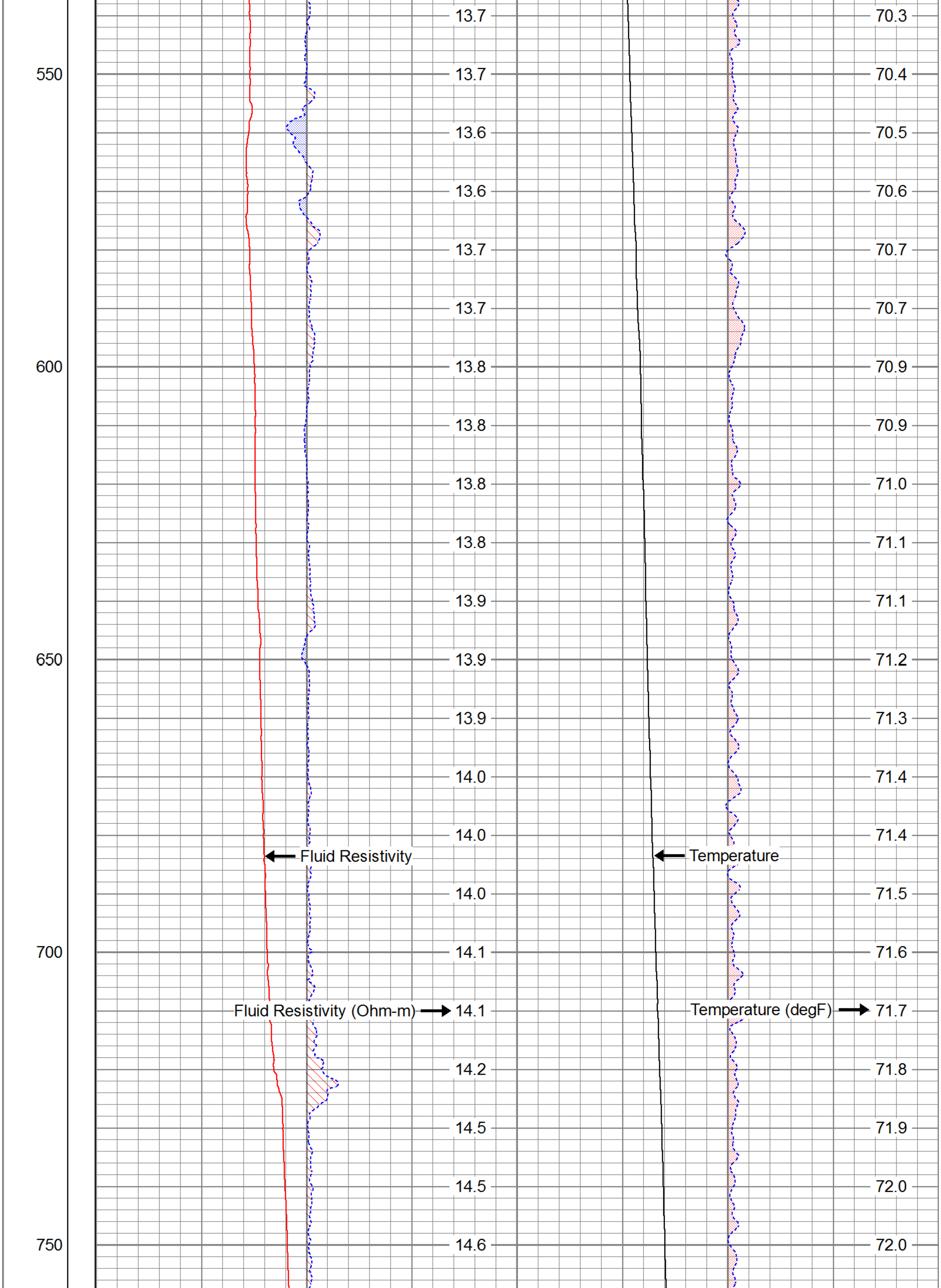
| | | |
|---|---|---|
| Serial Number: | 5269 | |
| Tool Model: | MLS | |
| Performed: | Tue Nov 19 16:37:00 2013 | |
| | Reference | Reading |
| Low Reference: | 46.04 degF | 1527.00cps |
| High Reference: | 146.30 degF | 4253.00cps |
| Gain: | 0.04 | |
| Offset: | -10.12 | |
| Delta Spacing | 2 | |

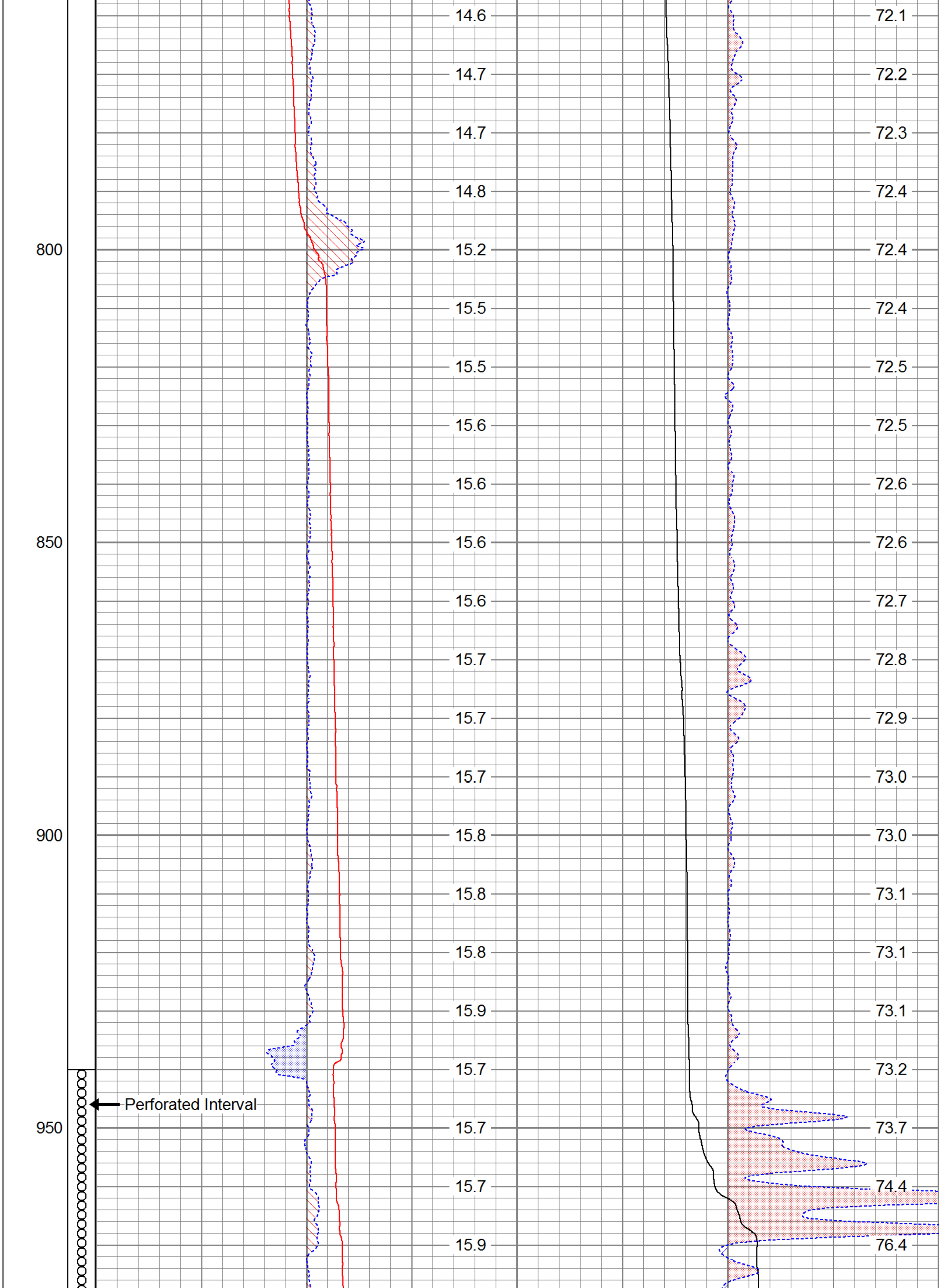
| | |
|---|---|
| Database File | 18505.db |
| Dataset Pathname | tmp |
| Presentation Format | frttemp2 |
| Dataset Creation | Fri Jun 20 10:46:07 2014 |
| Charted by | Depth in Feet scaled 1:240 |

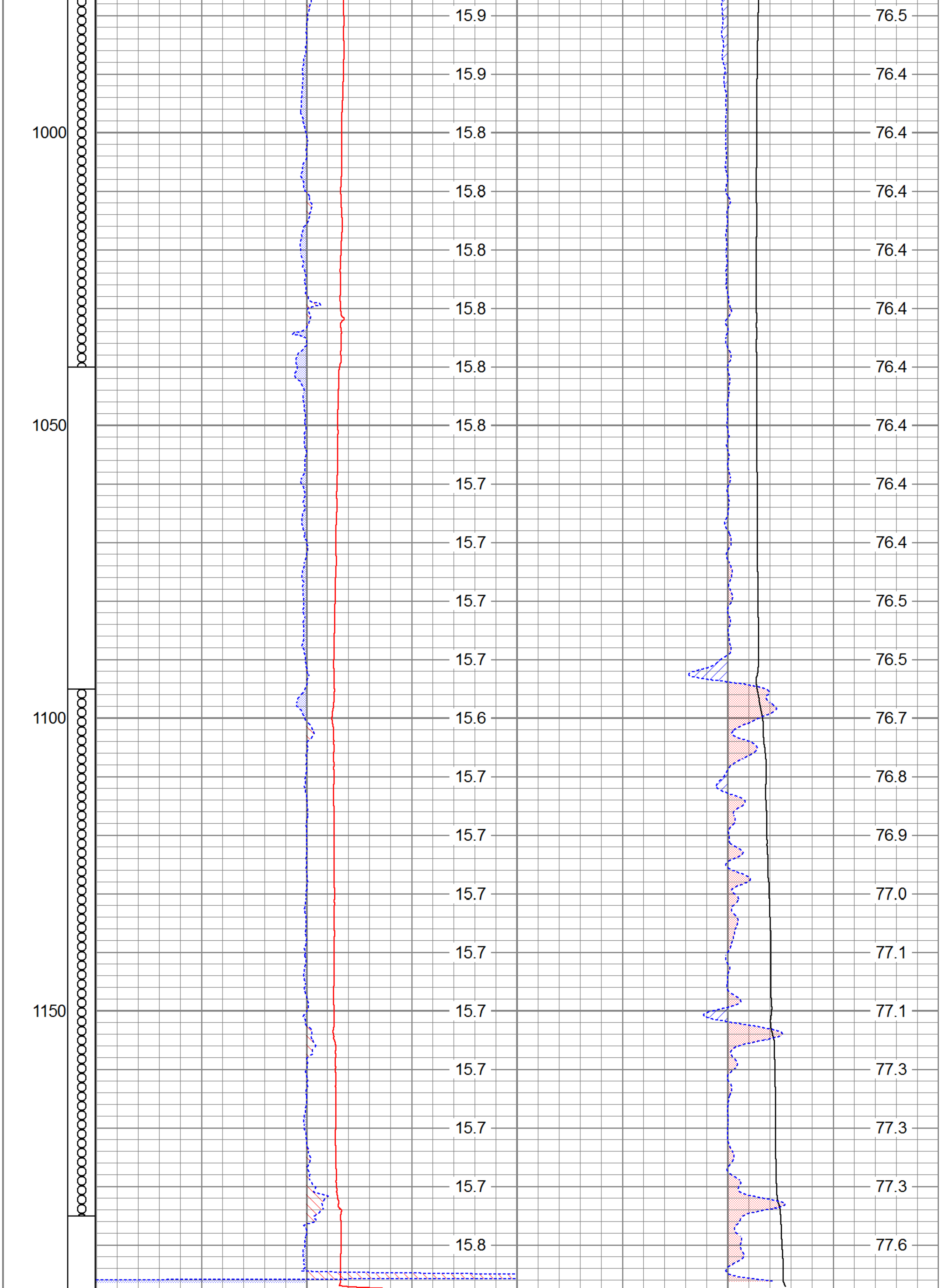
| | | | | | |
|---|---|---|---|---|---|
| 10 | Fluid Resistivity (Ohm-m) | 20 | 65 | Temperature (degF) | 85 |
| -0.25 | Differential Fluid Resistivity (Ohm-m) | 0.25 | -0.25 | Differential Temperature (degF) | 0.25 |
| | | FRES (Ohm-m) | | | TEMP (degF) |




PUMP
ACCESS PIPE
350
400
450
500
14.8
12.2
12.8
13.5
13.8
14.8
14.8
15.1
15.4
15.4
15.6
15.7
15.7
15.8
16.0
16.2
16.3
16.3
16.3
16.4
13.8
13.6
68.2
68.1
68.0
68.1
68.2
68.4
68.5
68.7
68.8
69.0
69.1
69.2
69.3
69.4
69.5
69.6
69.7
69.8
69.9
70.0
70.2
70.2
Fluid Resistivity
Fluid Resistivity (Ohm-m)
Differential Temperature
Differential Fluid Resistivity
Temperature


550
600
650
700
750
13.7
13.7
13.6
13.6
13.7
13.7
13.8
13.8
13.8
13.8
13.9
13.9
13.9
14.0
14.0
14.0
14.1
14.1
14.2
14.5
14.5
14.6
70.3
70.4
70.5
70.6
70.7
70.7
70.9
70.9
71.0
71.1
71.1
71.2
71.3
71.4
71.4
71.5
71.6
71.7
71.8
71.9
72.0
72.0
Fluid Resistivity
Temperature
Fluid Resistivity (Ohm-m)
Temperature (degF)


800
850
900
950
Perforated Interval
14.6
14.7
14.7
14.8
15.2
15.5
15.5
15.6
15.6
15.6
15.6
15.7
15.7
15.7
15.8
15.8
15.8
15.9
15.7
15.7
15.7
15.9
72.1
72.2
72.3
72.4
72.4
72.4
72.5
72.5
72.6
72.6
72.7
72.8
72.9
73.0
73.0
73.1
73.1
73.1
73.2
73.7
74.4
76.4



1000
1050
1100
1150
15.9
15.9
15.8
15.8
15.8
15.8
15.8
15.8
15.7
15.7
15.7
15.7
15.6
15.7
15.7
15.7
15.7
15.7
15.7
15.7
15.7
15.8
76.5
76.4
76.4
76.4
76.4
76.4
76.4
76.4
76.4
76.4
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76.5
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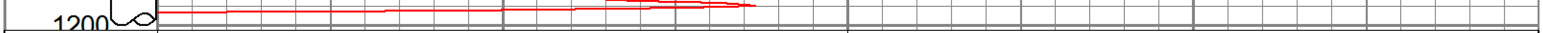
77.1
77.3
77.3
77.3
77.6




| | | |
|---|---|---|
| 10 Fluid Resistivity (Ohm-m) 20 | 65 Temperature (degF) 85 |
| -0.25 Differential Fluid Resistivity (Ohm-m) 0.25 | -0.25 Differential Temperature (degF) 0.25 |
| FRES (Ohm-m) | TEMP (degF) |

# PACIFIC SURVEYS

# SPINNER DOWN RUNS PUMPING CONDITION

| | |
|---|---|
| Job No. | 18524 |
| File No. | |
| Company | DUDEK ENGINEERING |
| Well | UPLAND WELL #27 |
| Field | SANTA YNEZ |
| County | SANTA BARBARA |
| State | CA |

Location:
2121 HWY 154
GPS:N34o38.573" W120o05.376'

Other Services:
SPINNER ANALYSIS
SAMPLING
STOP COUNTS

Sec. Twp. Rge.

| | | | |
|---|---|---|---|
| Permanent Datum | Top of Casing | Elevation | Elevation K.B. D.F. G.L. |
| Log Measured From | Top of Casing | above perm. datum | |
| Drilling Measured From | N/A | | |

| | | |
|---|---|---|
| Date | 06/24/2014 | |
| Run Number | ONE | |
| Depth Driller | 1200' | |
| Depth Logger | 1199' | |
| Bottom Logged Interval | 1199' | |
| Top Log Interval | 850' | |
| Pump Set @ | 318' | |
| Time Pumping Prior to Survey | 24 HOURS | |
| Pumping Water Level | 245' | |
| Max. Recorded Temp. | 77.6 F | |
| Pump Rate (GPM) | 560 | |
| Time Well Ready | 9:00 AM | |
| Time Logger on Bottom | 9:30 AM | |
| Equipment Number | PS-5 | |
| Location | L.A. | AFOH |
| Recorded By | ABREAU | |
| Witnessed By | S. DICKEY | J. KUBRAN |

| Perforation Record | | | | Perforation Record | | | |
|---|---|---|---|---|---|---|---|
| Type | Slot Size | From | To | Type | Slot Size | From | To |
| LOUVERS | .055" | 940' | 1040' | | | | |
| LOUVERS | .055" | 1095' | 1185' | | | | |

| Casing Record | Size | Wgt/Ft | Top | Bottom |
|---|---|---|---|---|
| Surface String | | | | |
| Camera Tube | | | | |
| Production String | 14.5" OD | N/A | 0' | 1200' |
| Liner | | | | |

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## Comments

| | |
|---|---|
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| Dataset Pathname | spn4 |
| Presentation Format | spinmerg |
| Dataset Creation | Tue Jun 24 11:49:54 2014 |
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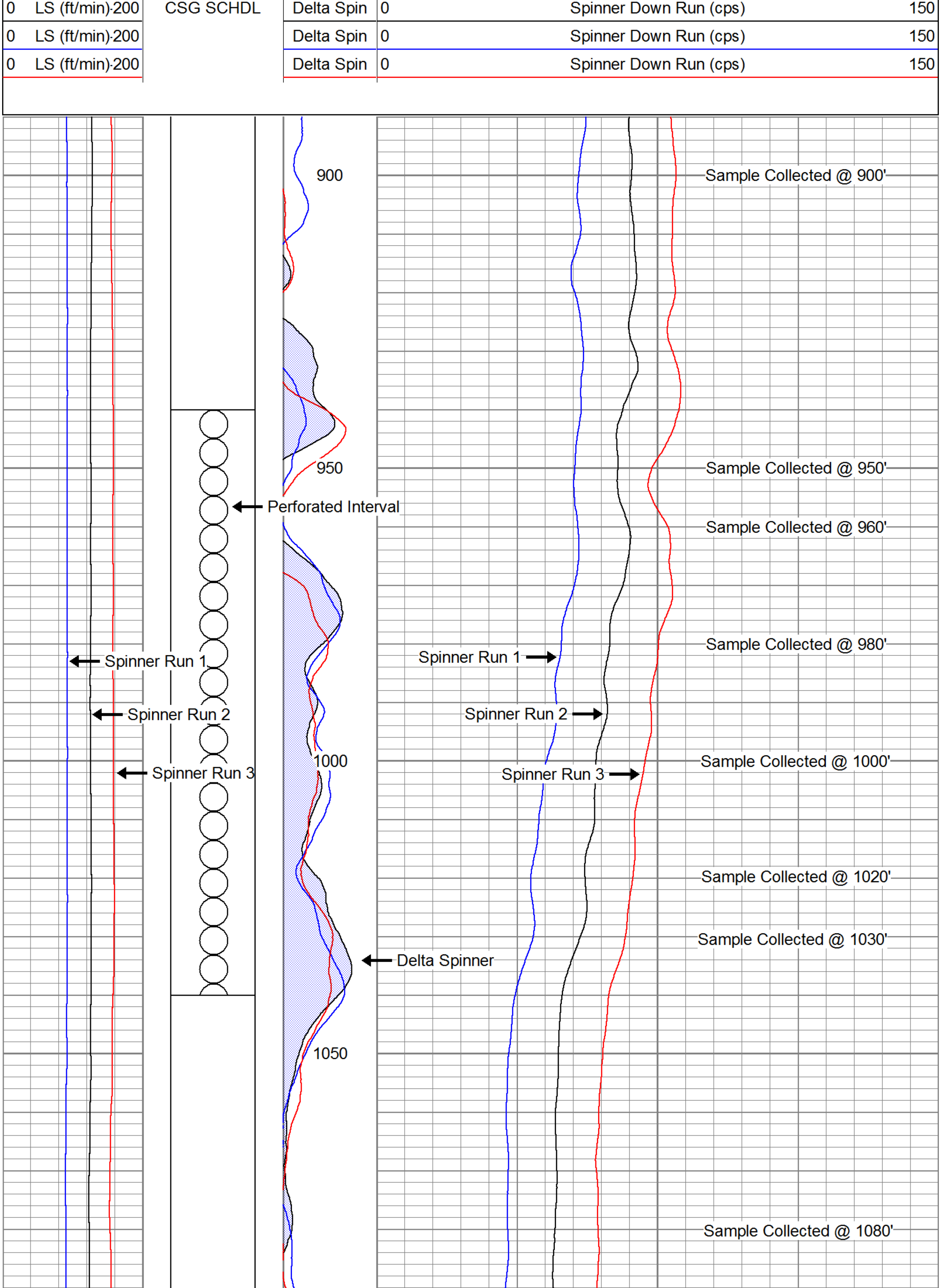
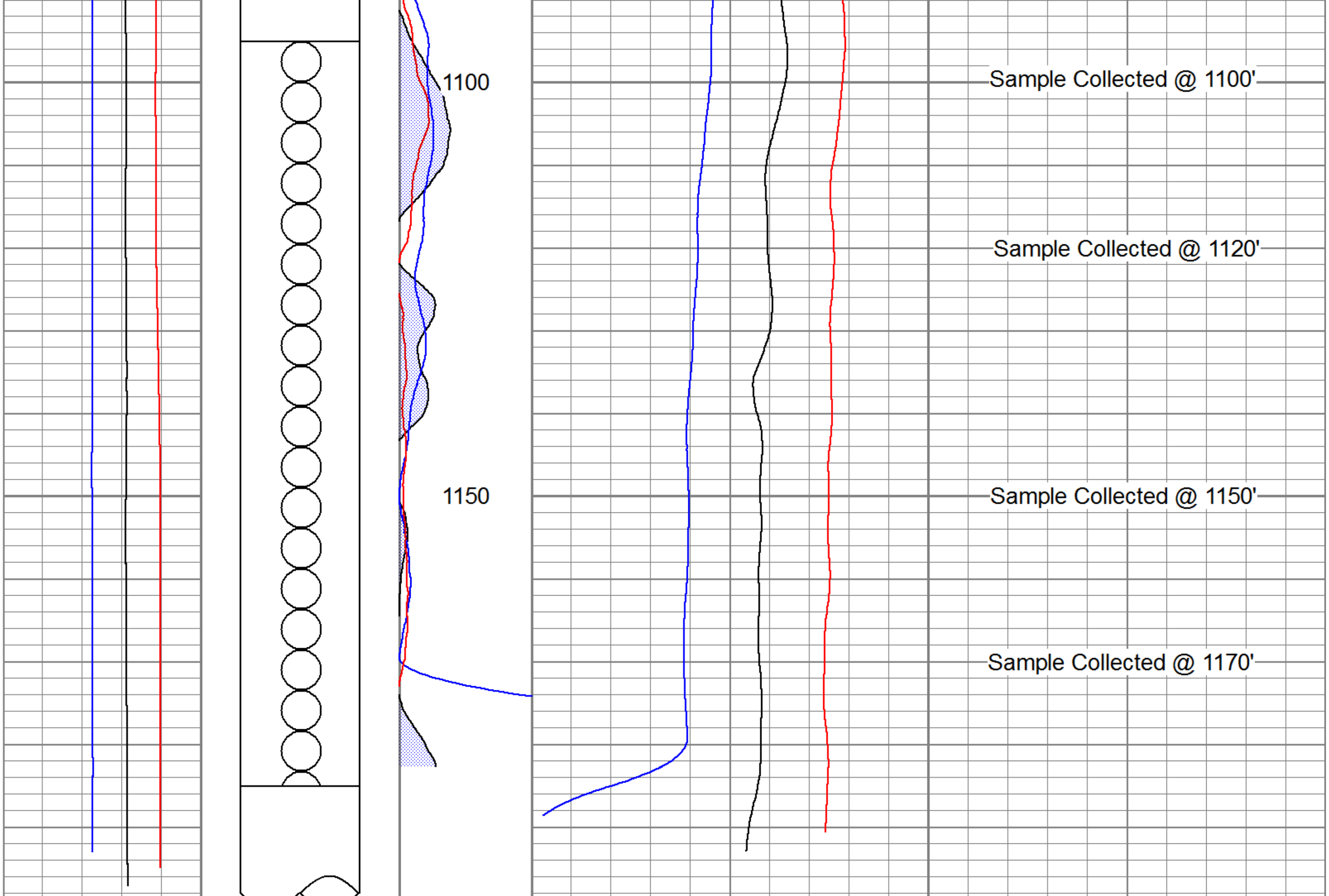

0 LS (ft/min) 200
0 LS (ft/min) 200
0 LS (ft/min) 200
CSG SCHDL
Delta Spin
Delta Spin
Delta Spin
0 Spinner Down Run (cps) 150
0 Spinner Down Run (cps) 150
0 Spinner Down Run (cps) 150
900
950
1000
1050
Perforated Interval
Spinner Run 1
Spinner Run 2
Spinner Run 3
Delta Spinner
Sample Collected @ 900'
Sample Collected @ 950'
Sample Collected @ 960'
Sample Collected @ 980'
Sample Collected @ 1000'
Sample Collected @ 1020'
Sample Collected @ 1030'
Sample Collected @ 1080'




| | | | |
|---|---|---|---|
| 0 LS (ft/min) 200 | CSG SCHDL | Delta Spin | 0 Spinner Down Run (cps) 150 |
| 0 LS (ft/min) 200 | | Delta Spin | 0 Spinner Down Run (cps) 150 |
| 0 LS (ft/min) 200 | | Delta Spin | 0 Spinner Down Run (cps) 150 |

PACIFIC SURVEYS

# SPINNER
# FLUID VELOCITY
# SPINNER ANALYSIS
# PUMPING CONDITION

| | | |
|---|---|---|
| Job No. 18524 | Company | DUDEK ENGINEERING |
| | Well | UPLAND WELL #27 |
| | Field | SANTA YNEZ |
| File No. | County | SANTA BARBARA State CA |

Location:

2121 HWY 154
GPS:N34o38.573" W120o05.376'

Sec. Twp. Rge.

Other Services:

DYNAMIC SPINNER
SAMPLING
STOP COUNTS

| | | | |
|---|---|---|---|
| Permanent Datum | Top of Casing | Elevation above perm. datum | Elevation K.B. D.F. G.L. |
| Log Measured From | Top of Casing | | |
| Drilling Measured From | N/A | | |

| | | | |
|---|---|---|---|
| Date | 06/24/2014 | | |
| Run Number | ONE | | |
| Depth Driller | 1200' | | |
| Depth Logger | 1199' | | |
| Bottom Logged Interval | 1199' | | |
| Top Log Interval | 850' | | |
| Pump Set @ | 318' | | |
| Time Pumping Prior to Survey | 24 HOURS | | |
| Pumping Water Level | 245' | | |
| Max. Recorded Temp. | 77.6 F | | |
| Pump Rate (GPM) | 560 | | |
| Time Well Ready | 9:00 AM | | |
| Time Logger on Bottom | 9:30 AM | | |
| Equipment Number | PS-5 | | |
| Location | L.A. | | |
| Recorded By | ABREAU | AFOH | |
| Witnessed By | S. DICKEY | J. KUBRAN | |

| Perforation Record | | | | Perforation Record | | | |
|---|---|---|---|---|---|---|---|
| Type | Slot Size | From | To | Type | Slot Size | From | To |
| LOUVERS | .055" | 940' | 1040' | | | | |
| LOUVERS | .055" | 1095' | 1185' | | | | |
| | | | | | | | |
| | | | | | | | |

| Casing Record | Size | Wgt/Ft | Top | Bottom |
|---|---|---|---|---|
| Surface String | | | | |
| Camera Tube | | | | |
| Production String | 14.5" OD | N/A | 0' | 1200' |
| Liner | | | | |
| | | | | |

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Comments

| | |
|---|---|
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| Presentation Format | spinmerg |
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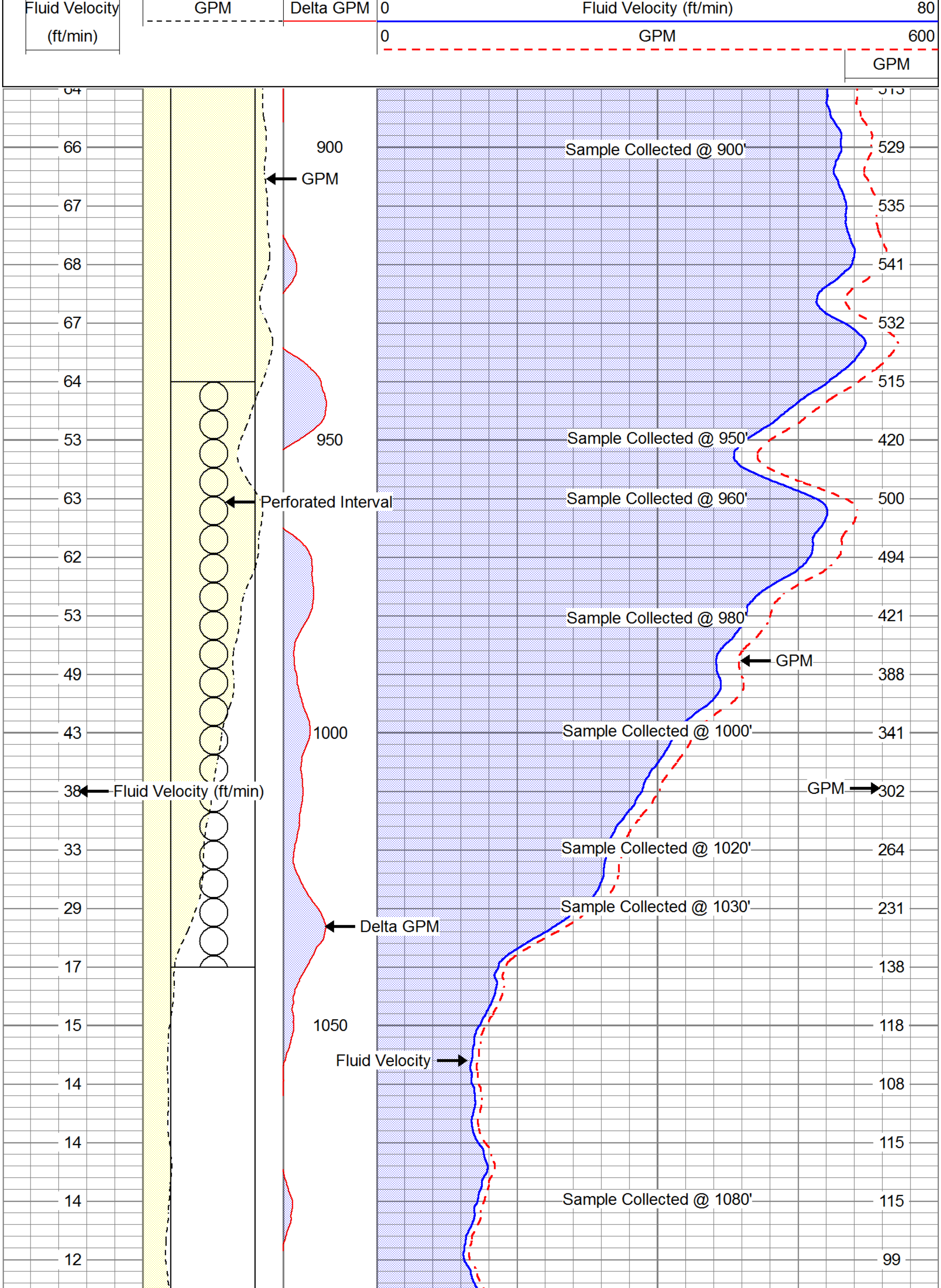
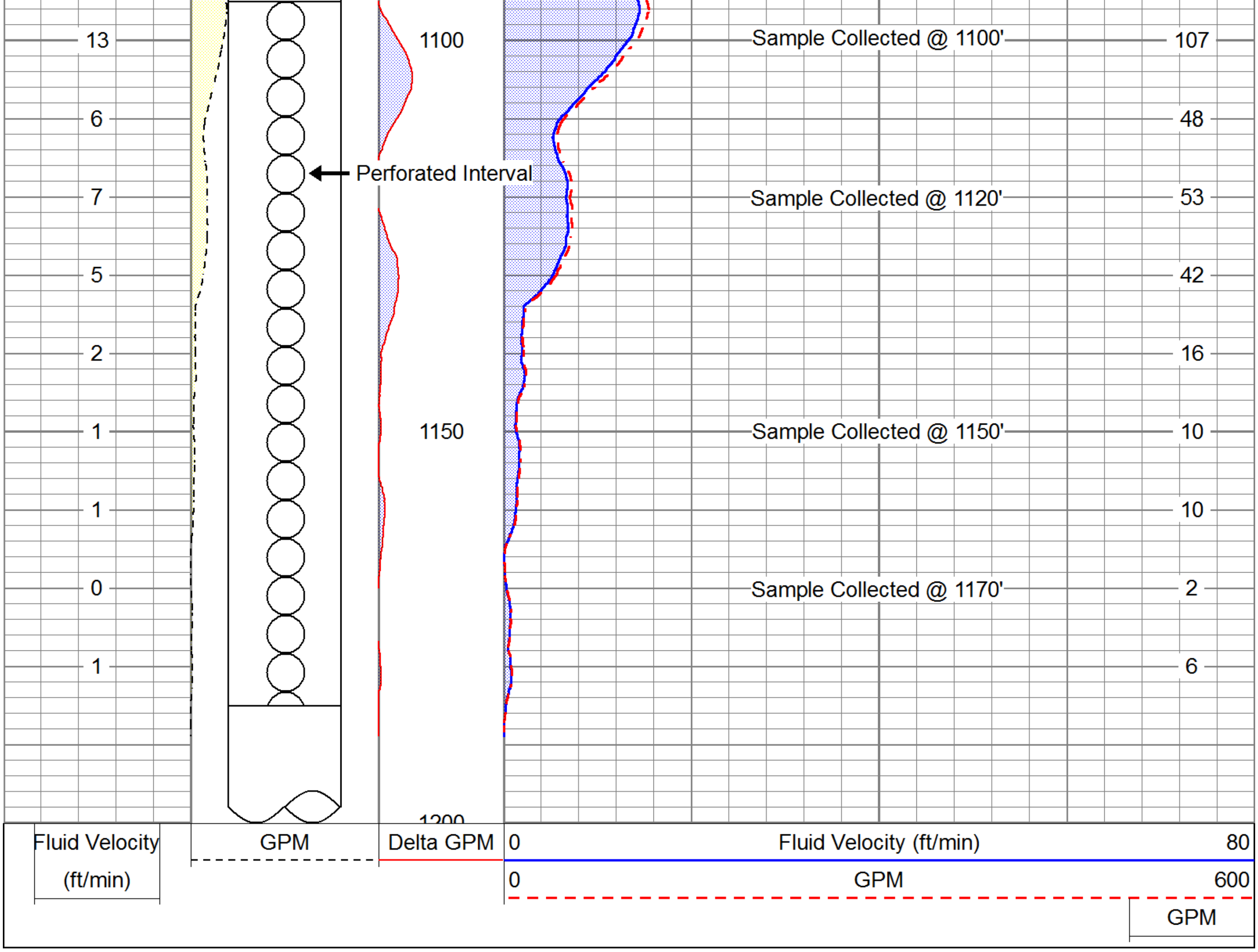
| Charted by | Depth in Feet scaled 1:240 |



Fluid Velocity (ft/min)
GPM
Delta GPM
0 Fluid Velocity (ft/min) 80
0 GPM 600
GPM
66
67
68
67
64
53
63
62
53
49
43
38
33
29
17
15
14
14
14
12
900
950
1000
1050
GPM
Perforated Interval
Fluid Velocity (ft/min)
Delta GPM
Fluid Velocity
Sample Collected @ 900'
Sample Collected @ 950'
Sample Collected @ 960'
Sample Collected @ 980'
Sample Collected @ 1000'
Sample Collected @ 1020'
Sample Collected @ 1030'
Sample Collected @ 1080'
GPM
529
535
541
532
515
420
500
494
421
388
341
302
264
231
138
118
108
115
115
99



13
6
7
5
2
1
1
0
1
Perforated Interval
1100
1150
1200
Sample Collected @ 1100'
Sample Collected @ 1120'
Sample Collected @ 1150'
Sample Collected @ 1170'
107
48
53
42
16
10
10
2
6
Fluid Velocity (ft/min)
GPM
Delta GPM
0
Fluid Velocity (ft/min)
80
0
GPM
600
GPM

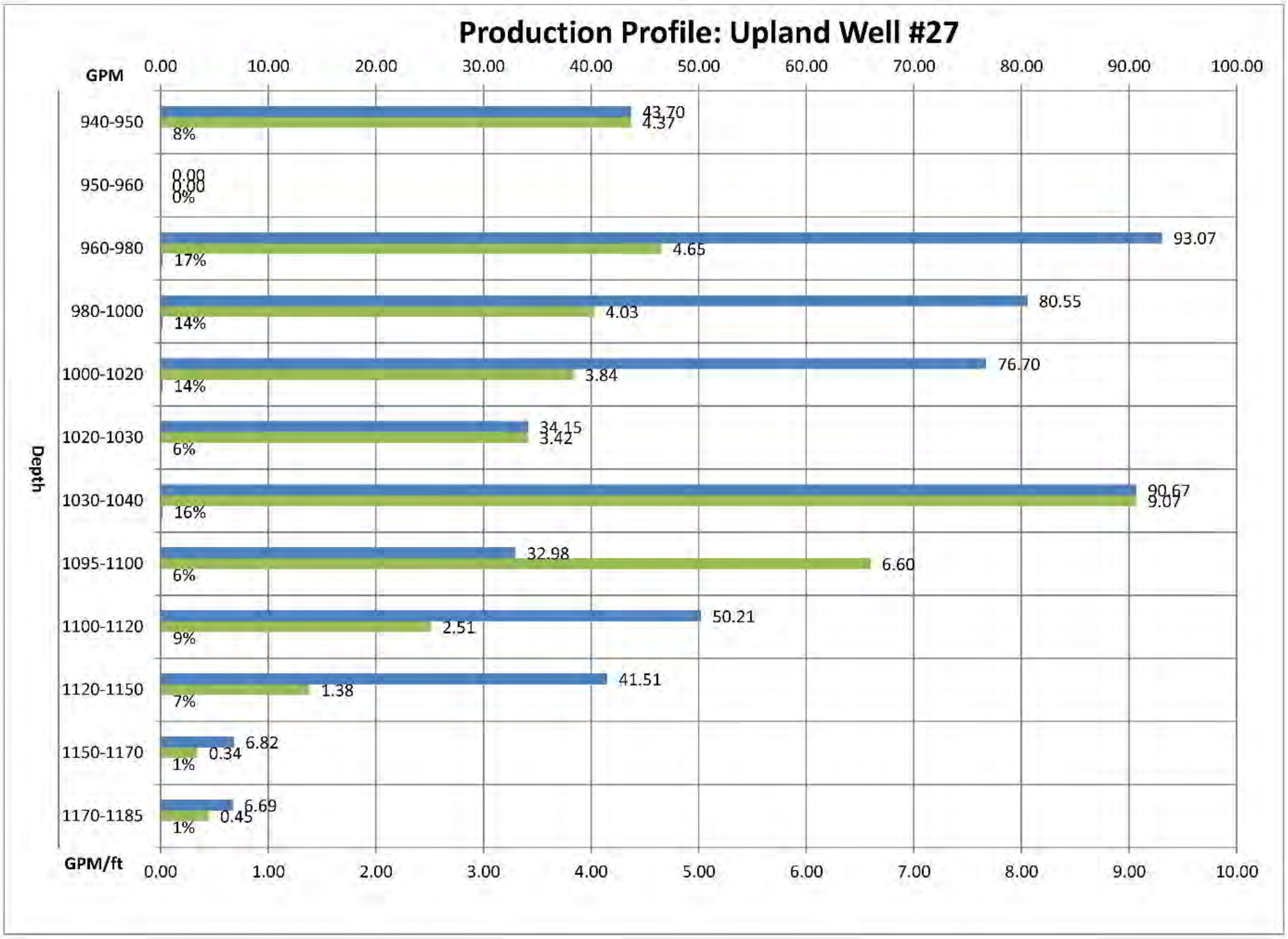
**Upland Well #27**

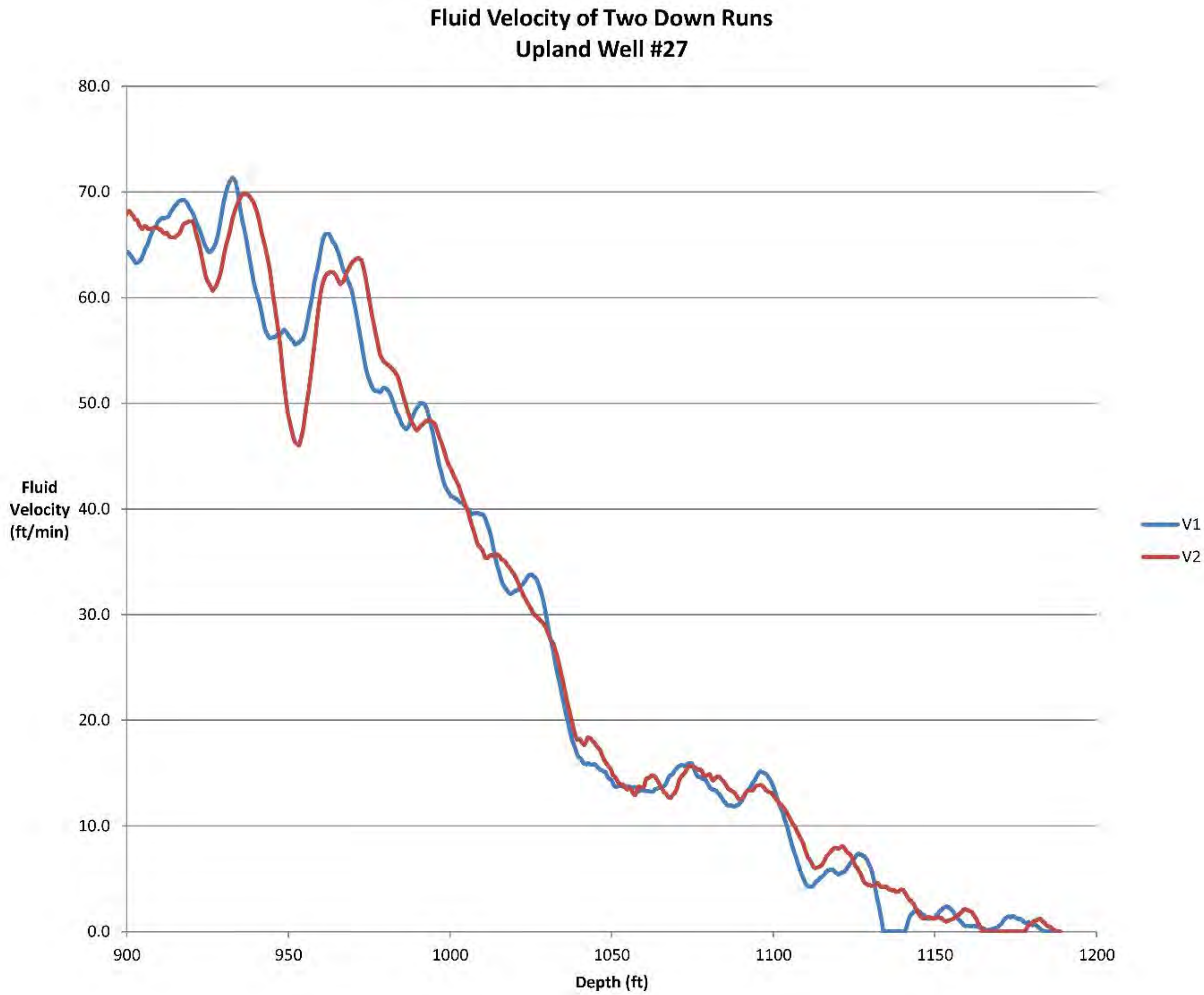
## SPINNER LOG ANALYSIS

Pacific Surveys

MAX
FLOW RATE 557.05 GPM

| PERFS DEPTHS | PRODUCTION GPM | % OF FLOW ZONES | GPM/FT | THICKNESS ft |
|---|---|---|---|---|
| 940-950 | 43.70 | 8% | 4.37 | 10 |
| 950-960 | 0.00 | 0% | 0.00 | 10 |
| 960-980 | 93.07 | 17% | 4.65 | 20 |
| 980-1000 | 80.55 | 14% | 4.03 | 20 |
| 1000-1020 | 76.70 | 14% | 3.84 | 20 |
| 1020-1030 | 34.15 | 6% | 3.42 | 10 |
| 1030-1040 | 90.67 | 16% | 9.07 | 10 |
| 1095-1100 | 32.98 | 6% | 6.60 | 5 |
| 1100-1120 | 50.21 | 9% | 2.51 | 20 |
| 1120-1150 | 41.51 | 7% | 1.38 | 30 |
| 1150-1170 | 6.82 | 1% | 0.34 | 20 |
| 1170-1185 | 6.69 | 1% | 0.45 | 15 |
| | | | | |


Production Profile: Upland Well #27
GPM
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Depth
940-950
950-960
960-980
980-1000
1000-1020
1020-1030
1030-1040
1095-1100
1100-1120
1120-1150
1150-1170
1170-1185
43.70
4.37
8%
0.00
0.00
0%
93.07
4.65
17%
80.55
4.03
14%
76.70
3.84
14%
34.15
3.42
6%
90.67
9.07
16%
32.98
6.60
6%
50.21
2.51
9%
41.51
1.38
7%
6.82
0.34
1%
6.69
0.45
1%
GPM/ft
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00


Fluid Velocity of Two Down Runs
Upland Well #27
Fluid Velocity (ft/min)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
900
950
1000
1050
1100
1150
1200
Depth (ft)
V1
V2

# APPENDIX D4

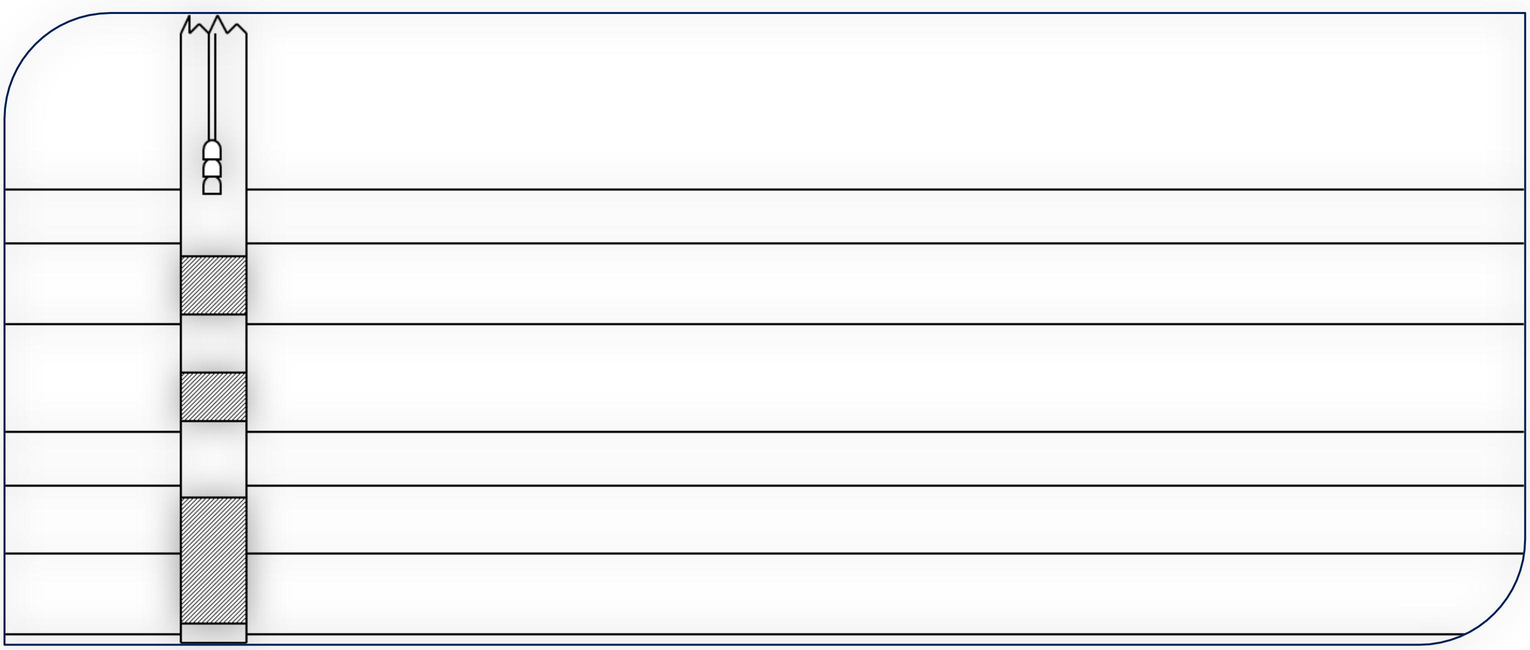
## *BESST Inc. Report Well 28*

BESST INC.
GLOBAL SUBSURFACE TECHNOLOGIES

# Dynamic Flow and Chemistry Profiling Report: Santa Ynez River Water Conservation District Well 28 Los Olivos, CA

Prepared by:
Kim Miles and Debra Cerda

Reviewed by:
Debra Cerda and Noah Heller



BESST, Inc., 50 Tiburon St, Ste 7, San Rafael, CA 94901 ¤ (P) 415/453.2501 ¤ (F) 415/453.2509 http://www.besstinc.com

June 9, 2014

## Executive Summary

On March 7 and 10, 2014, BESST, Inc. (BESST) performed a dynamic flow and water quality chemistry profile for **Well 28,** which is owned and operated by **Santa Ynez River Water Conservation District**.

The dynamic flow and water quality profile was performed to measure and calculate flow contribution as well as water quality concentrations and contributions from three screened intervals measuring 140 feet in total length.

The purpose of this profiling event for Well 28 was to investigate levels of hexavalent chromium above the proposed state MCL of 10 micrograms per liter (µg/L).

The dynamic flow profile was performed using the USGS Tracer Pulse Dynamic Flow Profile method to measure flow contribution along the length of the well. Sampling depths were determined through assessment of available well information, which is summarized in the Well Information Summary.

A temperature survey (Figure 2) and pressure survey were conducted. The normalized pressure curve is presented in Figure 3.

BESST conducted dynamic water quality sampling using the HydroBooster sampling method on March 10, 2014, collecting water samples at 12 discrete depths. Sample results are shown by analyte in Figures 9 through 14.

There is a distinct zone of elevated chromium levels from about 750 to 790 feet below ground surface (ft bgs). Total chromium and hexavalent chromium theoretical wellhead concentration estimates decrease when the high chromium section within the middle screen is blocked.

However, the TDS theoretical wellhead concentration cannot be reduced below the federal MCL in this scenario. While this scenario exhibits a maximum production loss of 50%, it is possible that installing an engineered suction to avoid the middle section could compensate for production loss.

It is difficult to estimate the chemical production from the lower screen at this time considering it was not producing water during the dynamic flow and chemistry profile. Lab results show dramatically lower chromium concentrations in the deepest screen (non-producing) section.

Based on the data results, it is highly recommended that a feasibility test be performed on Well 28. The feasibility test would consist of the placement two packers for the purpose of blocking groundwater production from contaminated section of the middle screen.

Additionally, an engineered suction should extend from the bottom of the packer and then into and through the middle and lower screen sections of the well.

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*Conventional Chemistry .................................................5*

*Conventional Chemistry .................................................5*

Well Information Summary............................................6

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# Introduction

BESST performed a dynamic flow and water chemistry profile on March 7 and 10, 2014, for the **Santa Ynez River Water Conservation District Well 28**, located in Los Olivos, California.

## Flow Contribution

Flow contribution in **Well 28** was measured at fifteen (15) discrete depths along the well bore from **620** to **800** feet below ground surface (ft bgs). The apparent travel time collected from Well 28 was used to calculate zonal flow contribution.

## Water Quality Sampling

BESST conducted dynamic water quality sampling using the HydroBooster sampling method on March 10, 2014, collecting water samples at twelve (12) discrete depths. Sample results are shown by analyte in figures 10 through 16.

Chemical analysis was performed by Eurofins Easton Analytical. The water quality constituents and parameters included:

### Conventional Chemistry

- Alkalinity ($CaCO_3$)
- Chloride
- Sulfate ($SO_4$)
- Total Chromium
- Hexavalent Chromium
- Total Dissolved Solids
- Uranium

### Conventional Chemistry

Each graph shows the dynamic chemical contribution of the analyte versus the sampling depth interval (ft bgs). The dynamic chemistry profile estimates geologic water (zonal) chemistry by considering dilution and mixing factors inside the steady state (pumping) water supply well.

Below the pump, water is flowing into the well casing through the screen sections and upward in the well towards the pump intake.

## Well Information Summary

The following information for Santa Ynez River Water Conservation District Well 28 is based on technical information provided by DUDEK.

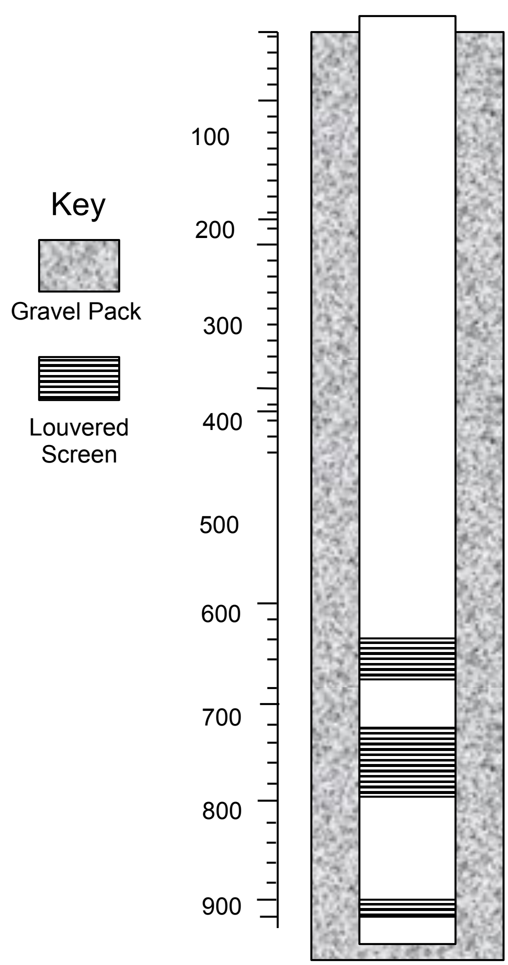
### Well Construction

The well screen is a single slot louvered screen, 14 inches O.D. with screened intervals at the following depths (ft bgs):

- 640'-685'
- 725'-800'
- 900'-920'

The pump is set at approximately 450 ft bgs with an 8" O.D. pump column diameter. Observed pumping water level is 281 ft bgs with a pumping rate of 750 gallons per minute (gpm), which is the normal operating rate of the well.

**Figure 1: Well completion diagram**



## Temperature Survey and Resistivity Long Well 28

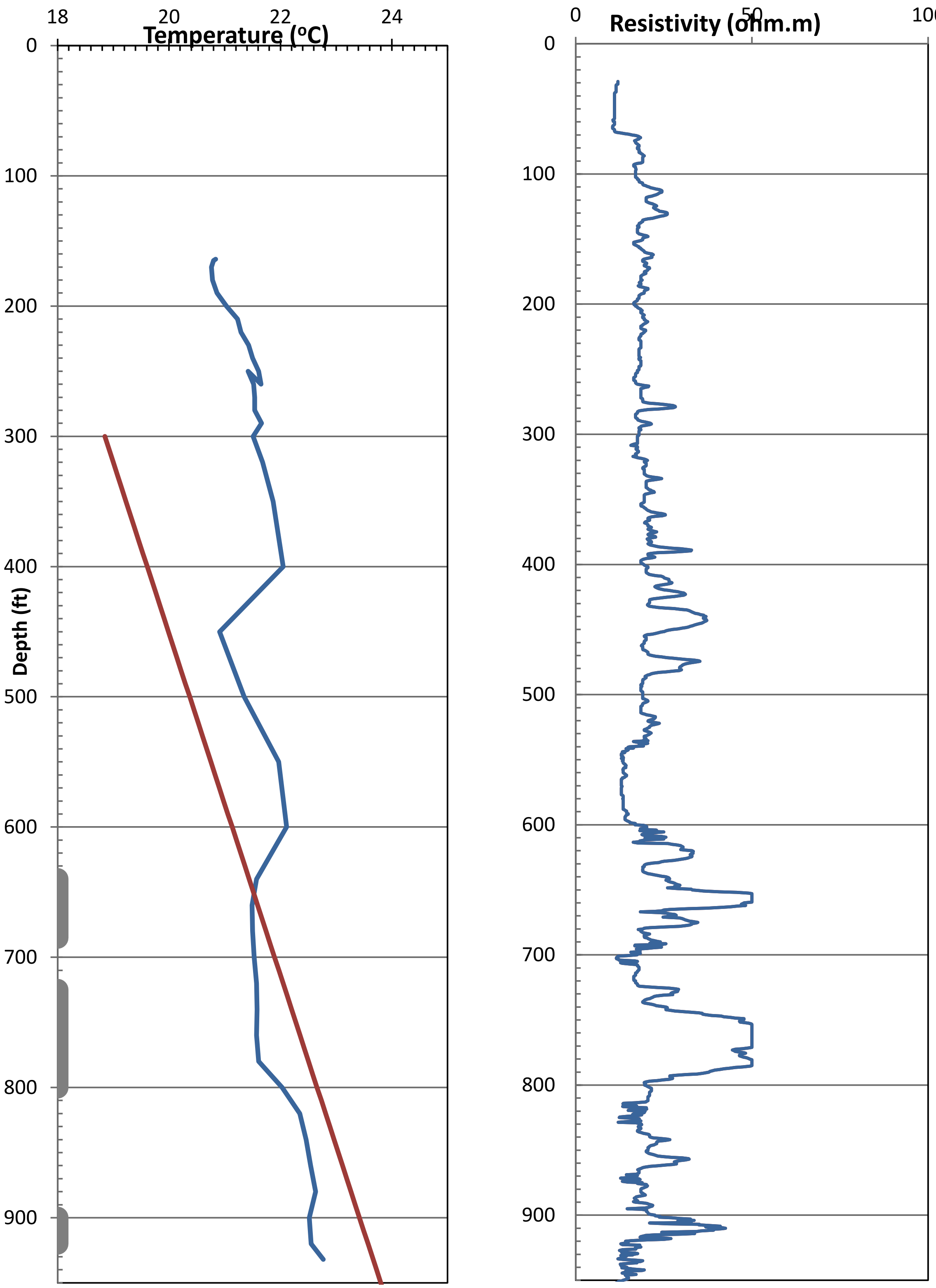



**Figure 2: Ambient temperature profile of Well 28. Data collected by BESST. Resistivity Figure courtesy DUDEK.**

## Pressure Survey Well 28

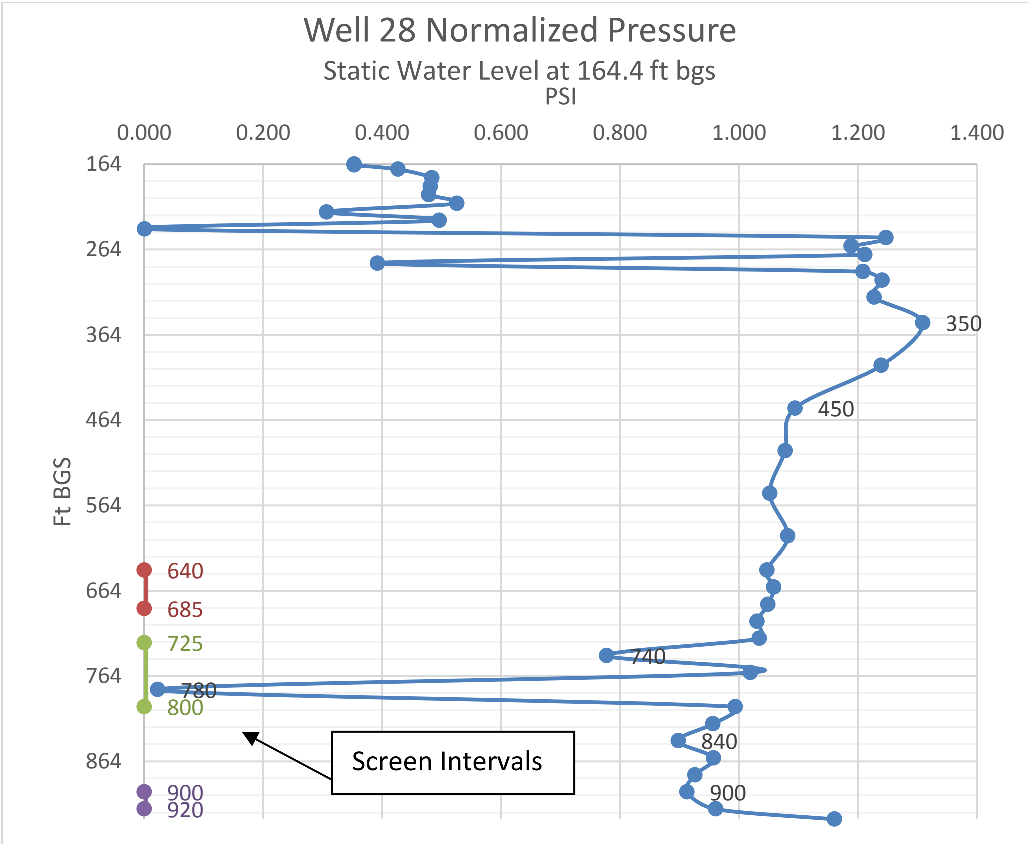



**Figure 3: Normalized pressure vs. depth under ambient (non-pumping conditions).**

Under ambient conditions inside a well, groundwater flows from the highest to lowest potential, i.e., highest to lowest pressure. Normalized pressure is arithmetically defined as the difference between the theoretical pressure gradient and measured or actual gradient. The theoretical gradient is generally defined as 1 PSI/2.31 ft for pure water. Being that groundwater inside the well is not pure, we know that there is a small amount of error when using pure water to estimate the normalized pressure gradient. Therefore we cannot interpret outflow and inflow zones along the length of the well screen on the basis of an individual point but rather as a trend defined from a series of depth-dependent point measurements. The totality of these measurements is what helps in the understanding of the flow gradient inside a well.

The pressure survey was performed using a vented Level Troll 700 manufactured by In-Situ, Inc. The head differential measured inside Well 28 was 768 feet.

## Dynamic Flow Profile

The dynamic flow profile was performed using the USGS Tracer Pulse Dynamic Flow Profile method to measure flow contribution along the length of the well (Figures 4 through 6). The profile was conducted at a flow rate of 750 gpm.

Corrected discharge shows the cumulative flow profile along the length of the well. The raw cumulative flow data was corrected by a factor of 1.07 (actual pump rate over theoretical pump rate) to match the field pumping rate.

Incremental flow is calculated by finding the difference in corrected discharge (cumulative flow) depths. The incremental flow graph shows zonal flow contribution between each dye injection location.

The percent contribution graph is in principal the same information as incremental flow. Adding up all labeled values in incremental flow will give the pumping rate, and the same calculation for percent will add up to 100% of the pumping rate. Percent contribution is calculated by dividing incremental flow by the pumping rate of 750 gpm.

### Percent Contributions

Flow calculations indicate that the top two sections of screen contribute 100% towards the total pumping rate. BESST observed  no dye returns starting at 850 ft bgs. This means the measurable upward movement of water toward the pump intake stops just below 800 ft bgs.

The two remaining zones that contribute flow include the sections from 640 ft bgs - 685 ft bgs and 725 - 800 ft bgs. The geophysical log (Figure 7) correlates with relative high flow production zones in the two upper well screens.

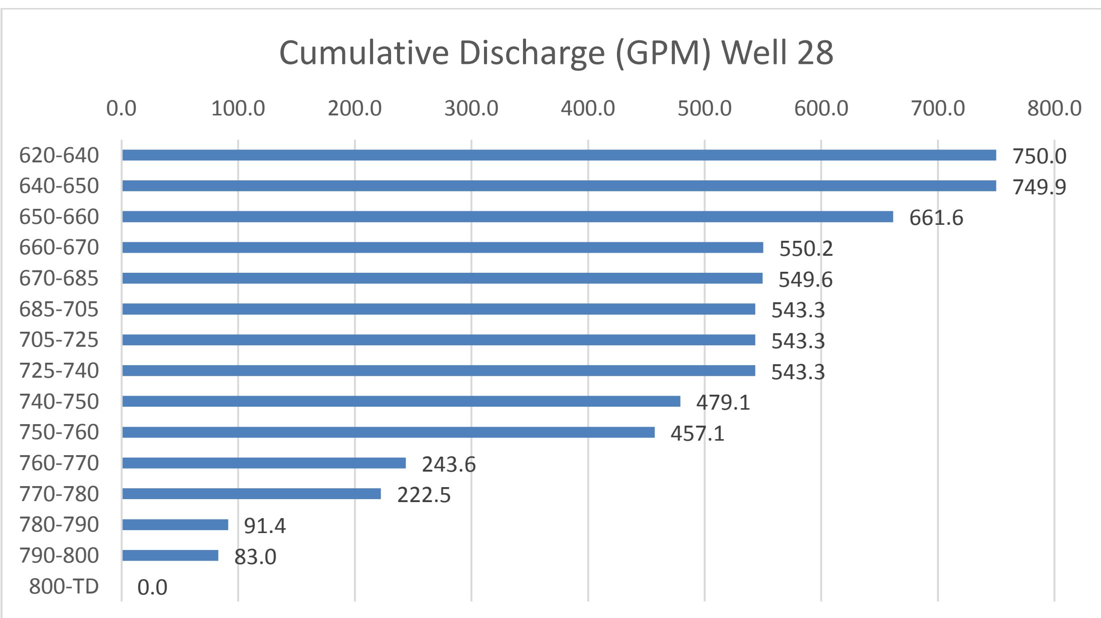



**Figure 4: Cumulative discharge for Well 28 at 750 gpm**

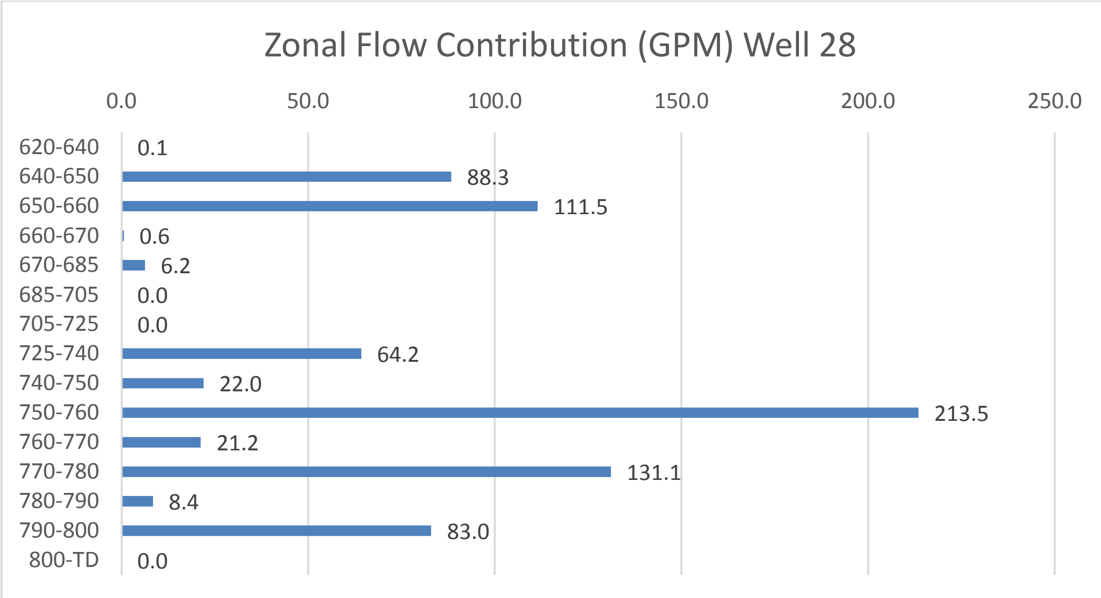



**Figure 5: Zonal flow contribution for Well 28 at 750 gpm.**

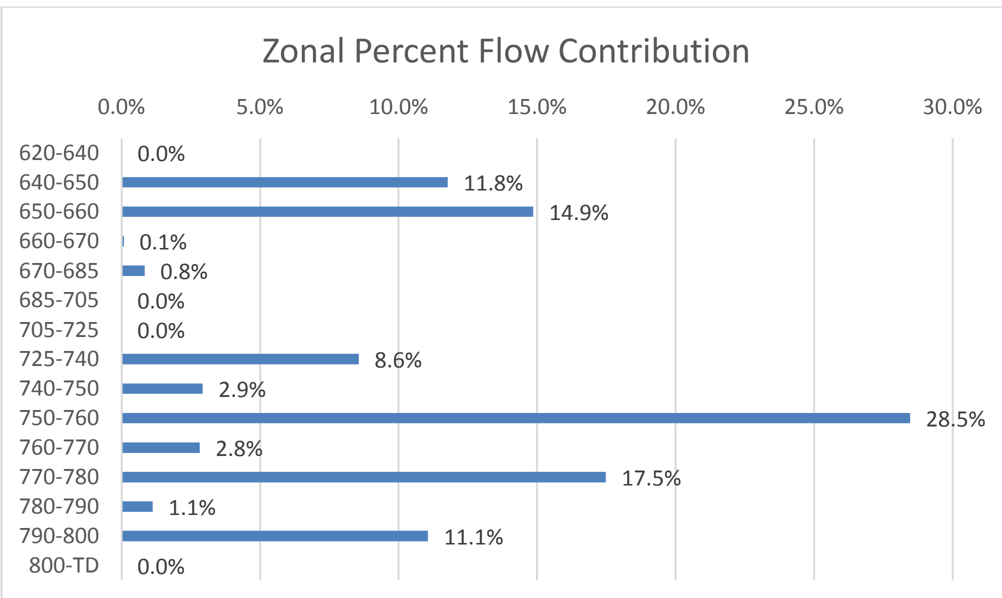
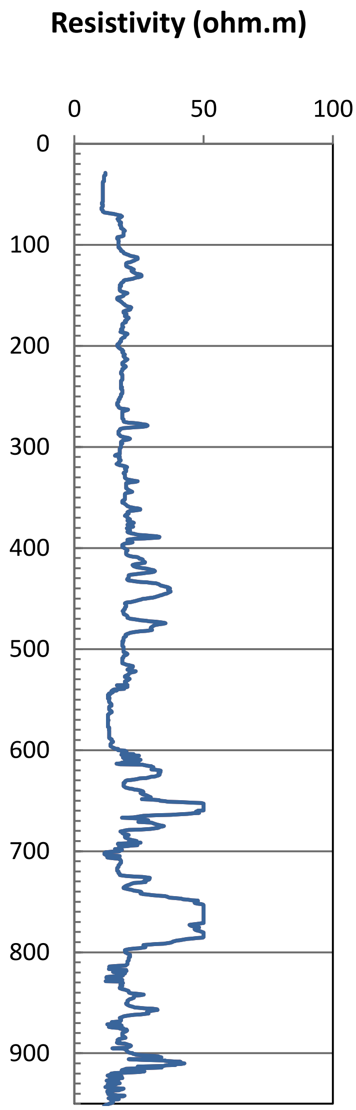



**Figure 6: Zonal percent Flow contribution for Well 28 at 750 gpm.**

## Down-hole Geophysics and Flow Contribution Comparison



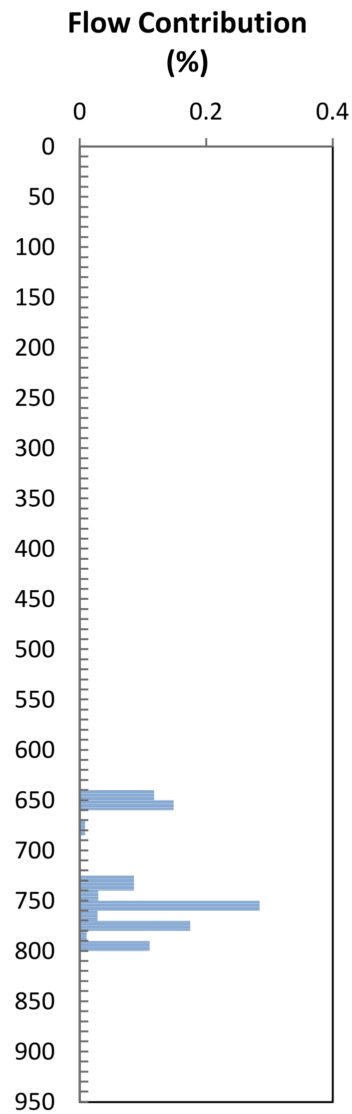




**Figure 7: Resistivity**

**Figure 8: Percent Flow Contribution**

Resistivity data provided by DUDEK, correlates with BESST dynamic flow contribution data as seen in Figures 7 - 8. Major contributing zones under 750 gpm pumping condition are restricted to the upper two screen sections.

Although BESST did not establish flow contribution from the deepest screened section (900-920 ft bgs), the resistivity graph (Figure 7) suggests there is high potential for flow. Well modification could result in a shift of flow production to the lower zone.

## Dynamic Chemistry Profile

### Results

The actual reported laboratory result for each analyte is listed in Appendix A, and includes the reported values as well as significant digits for analytes that fall below laboratory detection limit. Detected analytes are listed below.

#### Conventional Chemistry

- Alkalinity
- Chloride
- Sulfate ($SO_4$)
- Total Chromium
- Hexavalent Chromium
- Total Dissolved Solids
- Uranium
- pH

The measures lab result values used in the mass balance calculation are shown in Appendix A on page 19.

### Calculations

In figures 9 - 15, the incremental concentration is a calculated value that has been "mass balanced" using the measured concentration and the flow contribution for each depth interval.

When working with results that are reported as "below laboratory detection limit", in order to still perform the mass balance calculation, a value of one-half of the detection limit was assigned. This adds a degree of uncertainty as to exactly how low the measured value actually was, but the calculated value is still a useful number in that it yields a relatively low incremental concentration.

## Zonal Concentrations of Water Quality Parameters

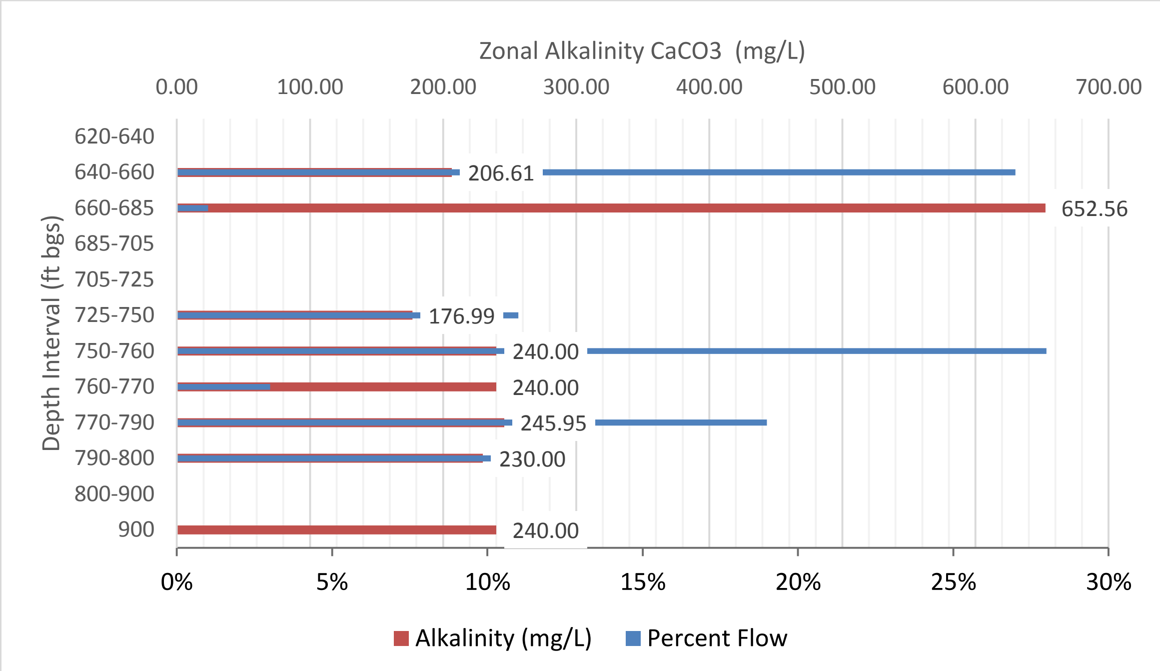



**Figure 9: Zonal alkalinity concentration.**

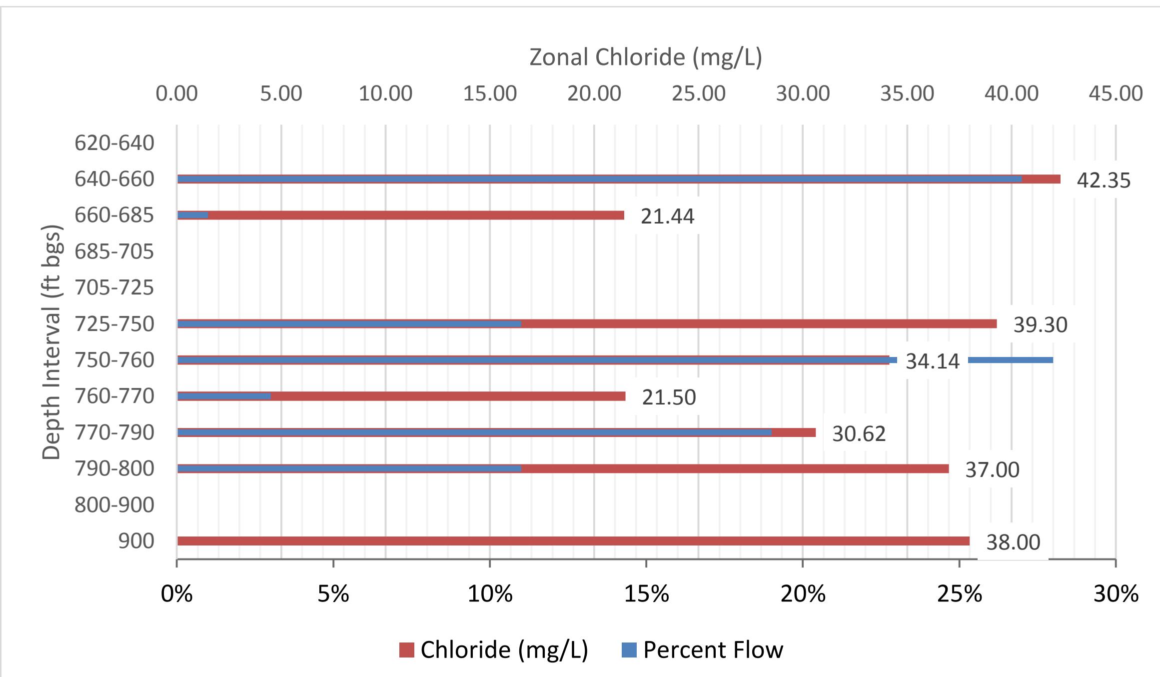



**Figure 10: Zonal chloride concentration.**

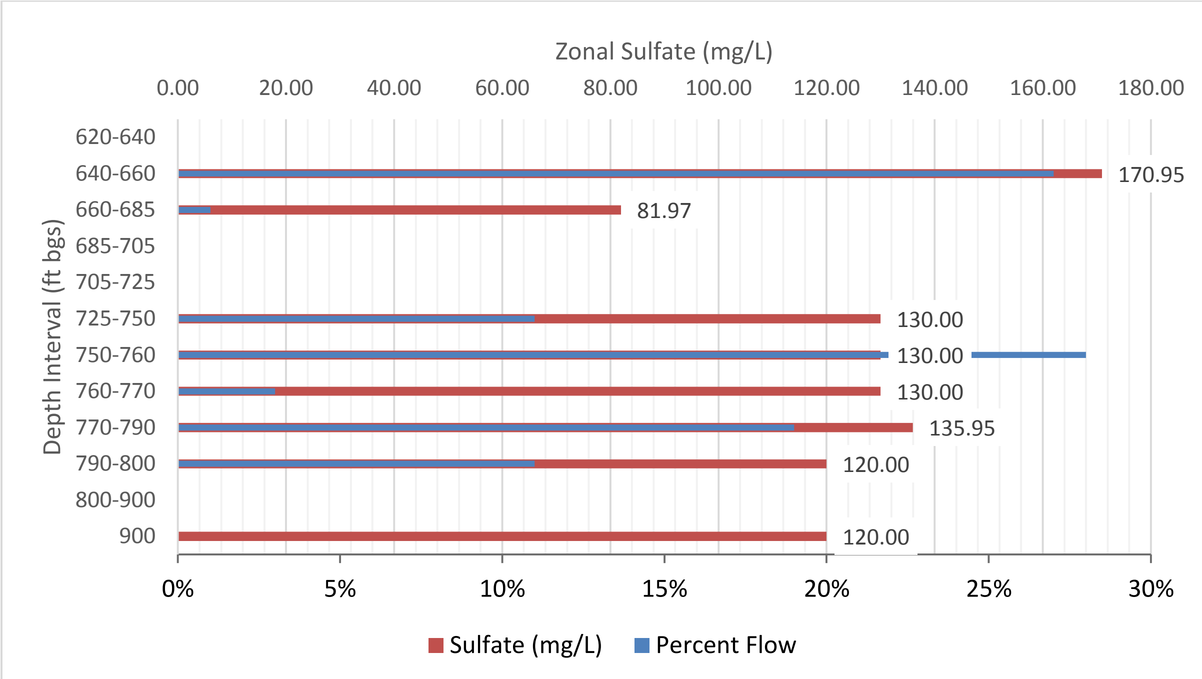



**Figure 11: Zonal sulfate concentration.**

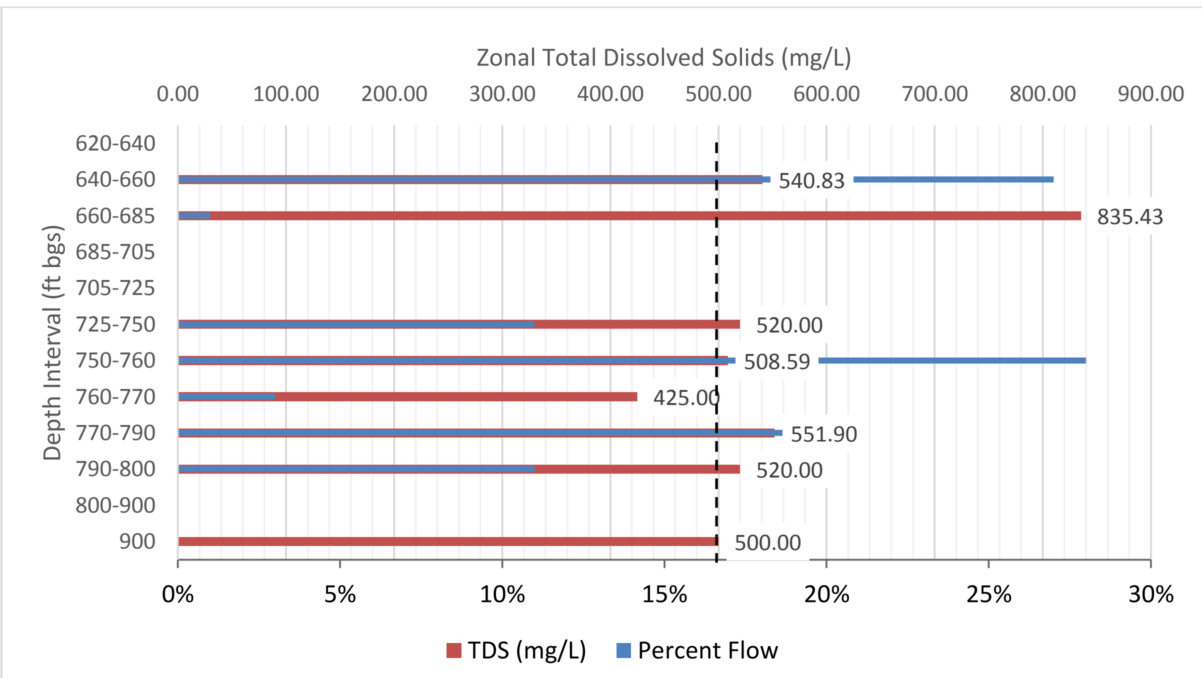



**Figure 12: Zonal TDS concentration. The federal secondary MCL of 500 mg/L is indicated by the dashed line.**

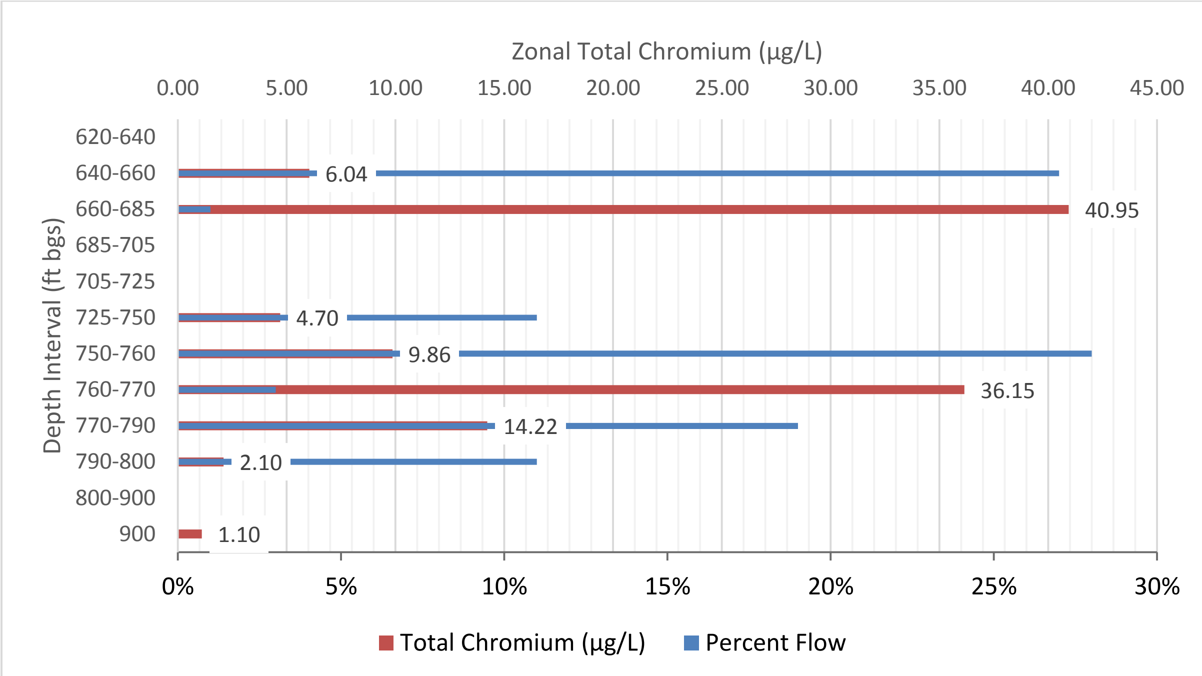



**Figure 13: Zonal total chromium concentration. The MCL for total chromium is 50 ug/L.**

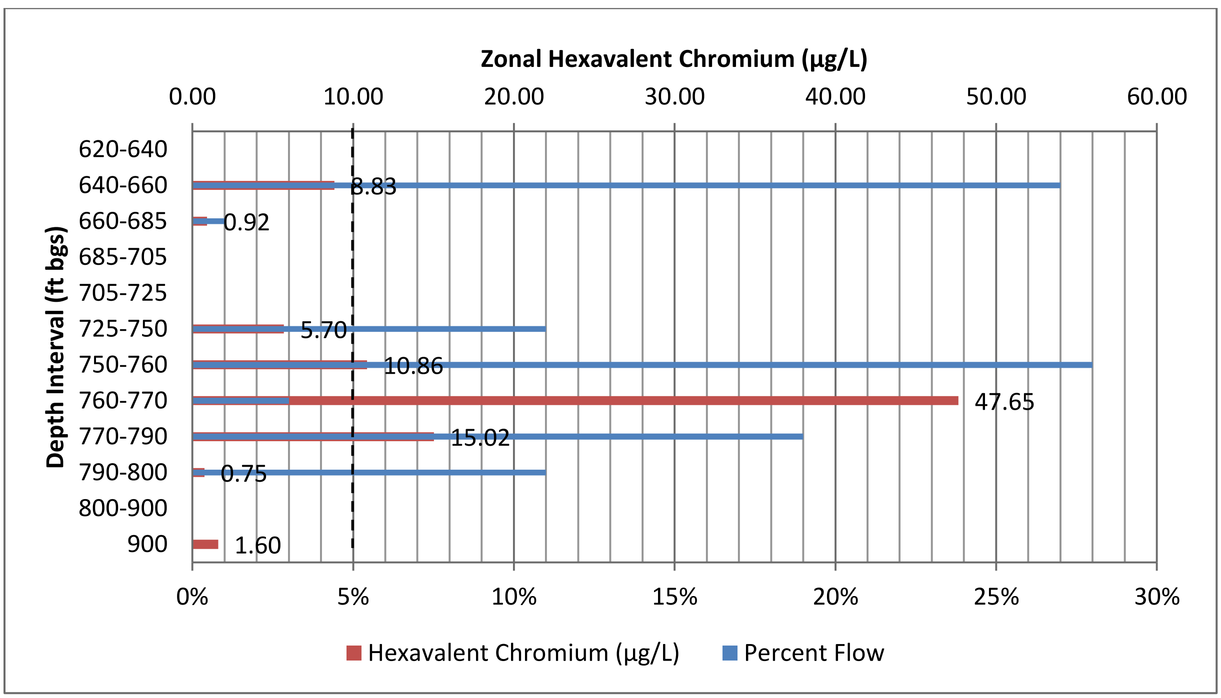



**Figure 14: Zonal hexavalent chromium concentration. Proposed State of California MCL of 10.0 ug/L (10 ug/L) indicated by the dashed line.**

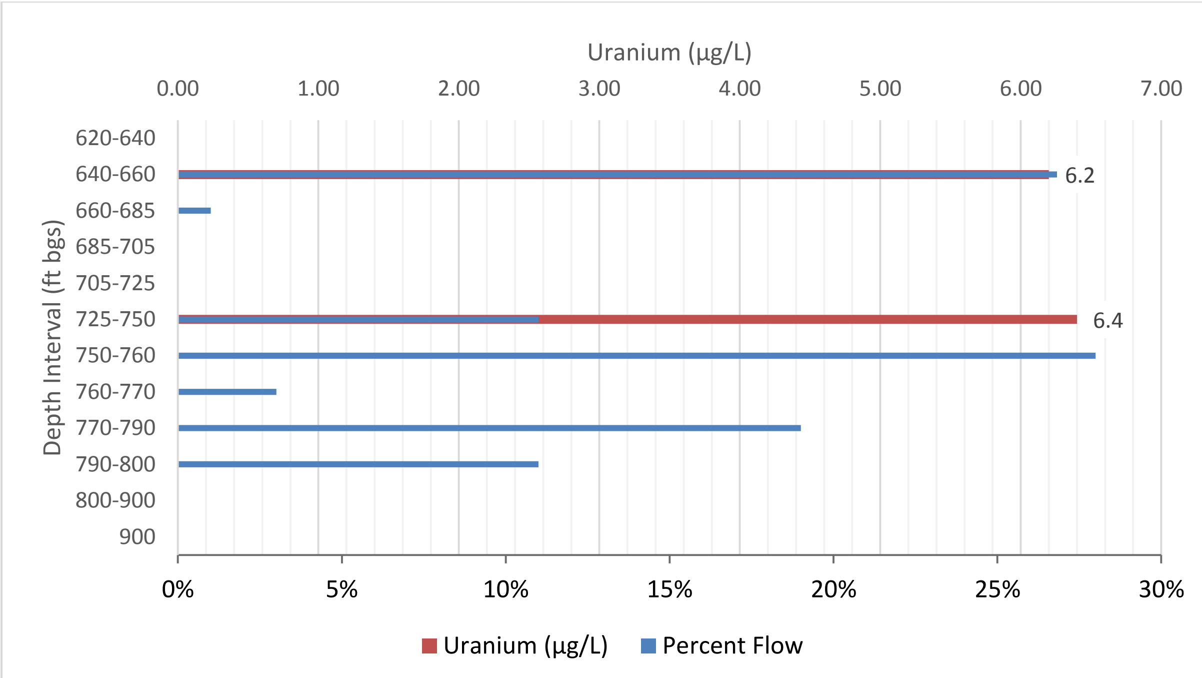



**Figure 15: Uranium lab results. These values are not indicative of formation concentration. BESST does not have sufficient data at this time to conduct mass balance for uranium.**

# Discussion

## Water Chemistry

The sample analysis results are used in conjunction with the flow calculations and principles of conservation of mass to determine the specific water quality of various zones along the well screen.

## Well Modification Scenario

Important Points:

- The given scenario is based on a spike in chromium concentration from 750-790 ft bgs.
- Total chromium and hexavalent chromium theoretical wellhead concentration estimates decrease when the high chromium section within the middle screen is blocked.
- TDS theoretical wellhead concentration cannot be reduced below the federal MCL in this scenario.
- While this scenario exhibits a maximum production loss of 50%, it is possible that installing an engineered suction to avoid the middle section could compensate for production loss.
- It is difficult to estimate the chemical production from the lower screen at this time considering it was not producing water during the dynamic flow and chemistry profile. Lab results show dramatically lower chromium concentrations in the deepest screen (non-producing) section.

| Analyte: | Unit | MCL | AVG WH | THEOR. WH | Block: 620'-685' | Block: 760'-790' | Block: 750'-790' | Block: 760'-770' |
|---|---|---|---|---|---|---|---|---|
| **Maximum Production Loss** | **%** | **-** | **0%** | **0%** | **28%** | **21%** | **50%** | **3%** |
| Alkalinity CaCO3 | mg/L | - | 245 | 228 | 230 | 226 | 218 | 230 |
| Chloride | mg/L | 250 | 36 | 36 | 34 | 38 | 40 | 36 |
| Total Chromium | µg/L | 10 | 8.30 | 9.23 | **10.00** | 7.31 | 5.87 | 8.64 |
| Hexavalent Chromium Dissolved | µg/L | 10 | 8.95 | **10.33** | **11.00** | 7.82 | 6.10 | 9.2 |
| Sulfate | mg/L | 250 | 140 | 140 | 130 | 141 | 148 | 140 |
| Total Dissolved Solids | mg/L | 500 | **560** | **528** | **520** | **528** | **539** | **533** |

**Figure 16: Calculated versus actual wellhead concentrations and wellhead modification scenario. Dissimilar values may point to data that does not fully explain actual wellhead analyte results. Analyte values that exceed the MCL are highlighted in red.**

## Recommendations

Based on the data results, it is highly recommended that a feasibility test be performed on Well 28. The feasibility test would consist of the placement two packers for the purpose of blocking groundwater production from contaminated section of the middle screen. There is a distinct zone of elevated chromium levels from about 750 to 790 ft bgs. Maximum production loss versus chromium reduction can be compared in figure 16.

Additionally, an engineered suction should extend from the bottom of the packer and then into and through the middle and lower screen sections of the well. The perforations on the engineered section should coincide in depth with the middle and bottom screen intervals of the well. The distance between the bottom of the packer and the top perforations of the engineered suction should be carefully considered. Enough vertical distance is required between these two points to ensure that water from the blocked portion of the middle screen is not pulled through the sand pack. A separation distance of at least 20 feet is recommended.

The diameter of the engineered suction is of great importance. It should be between 50 to 60% of the diameter of the well.

An additional option to the packer design is to use a “pass-through packer” which is constructed with two mandrels rather than one as in standard packer construction. The inflatable elastomer is formed around the outside mandrel and a stainless steel pass-through pipe is welded between the outer and the inner mandrel. The pass-through pipe can be anywhere between 1” to 1 ¼” ID and threaded on each end where it exits the packer from the top and the bottom. PVC pipe can then be threaded onto the top and/or bottom. From the top the PVC pipe can extend to the ground surface.

This design creates an accessible port through which a miniaturized camera, flow or sampling device can be inserted at a later time to perform surveys inside the well and below the packer if required. For example, the miniaturized camera can be used to inspect the condition of the well screen at some later point to determine if rehabilitation is necessary. The access port can also be used following the installation to see if the separation distance between the bottom of the packer and top perforation of the engineered suction is sufficient.

To determine whether this distance is sufficient, a tracer injection tool would be lowered into the well and placed in the annulus directly above the packer. The tracer would be released with a fluorometer plumbed into the discharge port at the ground surface. If tracer is detected, then it can be assumed that some of the water from the upper well screen is being drawn down through the sand pack. The test would only be performed if the desired result from the feasibility test is not achieved.

Lastly, feasibility tests are not performed over a short-term time frame, but rather over a 3 to 6 month time frame to prove out sustainability of the well modification. It is recommended that the Santa Ynez River Water Conservation District utilize the services of a consultant to oversee the feasibility test, including installation of the packer and engineered suction.

## Appendix A Lab Results Summary

| Well 28 Analytical Results | Alkalinity CaCO3 | Chloride | Total Chromium | Hexavalent Chromium Dissolved | pH | Sulfate | Total Dissolved Solids | Uranium |
|---|---|---|---|---|---|---|---|---|
| Units | mg/L | mg/L | ug/L | ug/L | Units | mg/L | mg/L | ug/L |
| Fed. MCL | - | 250 | 100 | - | - | 250 | 500 | 30 |
| 620 | 260 | 36 | 8.6 | 9.1 | 8.2 | 140 | 550 | - |
| 640 | 230 | 36 | 8.4 | 9.2 | 7.8 | 140 | 530 | 6.2 |
| 660 | 240 | 34 | 9.3 | 9.4 | 7.8 | 130 | 530 | - |
| 685 | 230 | 34 | 8.6 | 9.5 | 7.9 | 130 | 520 | - |
| 705 | 240 | 34 | 8.9 | 10 | 7.8 | 130 | 530 | - |
| 725 | 230 | 34 | 10 | 11 | 8.5 | 130 | 520 | 6.4 |
| 750 | 240 | 33 | 11 | 12 | 7.8 | 130 | 520 | - |
| 760 | 240 | 32 | 12 | 13 | 7.8 | 130 | 530 | - |
| 770 | 240 | 33 | 9.7 | 9.7 | 7.7 | 130 | 540 | - |
| 790 | 230 | 37 | 2.1 | 0.75 | 7.7 | 120 | 520 | - |
| 800 | 230 | 37 | 1 | 1.4 | 7.8 | 120 | 500 | - |
| 900 | 240 | 38 | 1.1 | 1.6 | 7.8 | 120 | 500 | - |
| **WH1** | **250** | **36** | **8.7** | **8.9** | **7.8** | **140** | **550** | **-** |
| **WH2** | **240** | **36** | **7.9** | **9** | **7.7** | **140** | **570** | **-** |

## Appendix B Flow Weighted Results Summary

| Sample Depth | Incremental Flow | Alkalinity CaCO3 | Chloride | Total Chromium | Hexavalent Chromium Dissolved | Sulfate | Total Dissolved Solids | Uranium |
|---|---|---|---|---|---|---|---|---|
| Ft BGS | GPM | mg/L | mg/L | ug/L | ug/L | mg/L | mg/L | ug/L |
| Fed. MCL | - | - | 250 | 100 | - | 250 | 500 | 30 |
| 620-640 | 0.00 | - | - | - | - | - | - | - |
| 640-660 | 0.00 | 206.61 | 42.35 | 6.04 | 8.83 | 170.95 | 540.83 | 6.2 |
| 660-685 | 0.11 | 652.56 | 21.44 | 40.95 | 0.92 | 81.97 | 835.43 | - |
| 685-705 | 0.19 | - | - | - | - | - | - | - |
| 705-725 | 0.03 | - | - | - | - | - | - | - |
| 725-750 | 0.28 | 176.99 | 39.30 | 4.70 | 5.70 | 130.00 | 520.00 | 6.4 |
| 750-760 | 0.11 | 240.00 | 34.14 | 9.86 | 10.86 | 130.00 | 508.59 | - |
| 760-770 | 0.00 | 240.00 | 21.50 | 36.15 | 47.65 | 130.00 | 425.00 | - |
| 770-790 | 0.00 | 245.95 | 30.62 | 14.22 | 15.02 | 135.95 | 551.90 | - |
| 790-800 | 0.01 | 230.00 | 37.00 | 2.10 | 0.75 | 120.00 | 520.00 | - |
| 800-900 | 0.27 | - | - | - | - | - | - | - |
| 900 | 0.00 | 240.00 | 38.00 | 1.10 | 1.60 | 120.00 | 500.00 | - |
| **WH1** | - | **250** | **36** | **8.7** | **8.90** | **140** | **550** | **-** |
| **WH2** | - | **240** | **36** | **7.9** | **9.00** | **140** | **570** | **-** |
| **AVG WH** | - | **245** | **36** | **8.3** | **8.95** | **140** | **560** | **-** |
| **Theor, WH** | - | **230** | **36** | **9.4** | **10.3** | **140** | **530** | **-** |

# APPENDIX D5

## *Eaton Analytical Laboratory Reports*

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

ORELAP 4034

AT-1807

# Laboratory Report

for

Santa Ynez River WCD
Post Office Box 157
Santa Ynez, CA 93460
Attention: Eric Tambini
Fax: 805-688-3078

Date of Issue
03/12/2014
EUROFINS EATON ANALYTICAL

FWH: Fred Haley

Project Manager

Report: 470833
Project: CHROMIUM
Group: well sampling

* Accredited in accordance with NELAP.
* Laboratory certifies that the test results meet all **TNI NELAP** requirements unless noted under the individual analysis.
* Following the cover page are State Certification List, ISO 17025 Accredited Method List, Acknowledgement of Samples Received, Comments, Hits Report, Data Report, QC Summary, QC Report and Regulatory Forms, as applicable.
* Test results relate only to the sample(s) tested.
* This report shall not be reproduced except in full, without the written approval of the laboratory.

eurofins | Eaton Analytical

# STATE CERTIFICATION LIST

| State | Certification Number | State | Certification Number |
|---|---|---|---|
| **Alabama** | 41060 | **Mississippi** | Certified |
| **Alaska** | CA00006 | **Montana** | Cert 0035 |
| **Arizona** | AZ0778 | **Nebraska** | Certified |
| **Arkansas** | Certified | **Nevada** | CA00006-2012-1 |
| **California-Monrovia-ELAP** | 2813 | **New Hampshire *** | 2959 |
| **California-Colton- ELAP** | 2812 | **New Jersey *** | CA 008 |
| **California-Folsom- ELAP** | 2820 | **New Mexico** | Certified |
| **Colorado** | Certified | **New York *** | 11320 |
| **Connecticut** | PH-0107 | **North Carolina** | 06701 |
| **Delaware** | CA 006 | **North Dakota** | R-009 |
| **Florida *** | E871024 | **Oregon (Primary AB) *** | **ORELAP 4034** |
| **Georgia** | 947 | **Pennsylvania *** | 68-565 |
| **Guam** | 13-004r | **Rhode Island** | LAO00326 |
| **Hawaii** | Certified | **South Carolina** | 87016 |
| **Idaho** | Certified | **South Dakota** | Certified |
| **Illinois *** | 200033 | **Tennessee** | TN02839 |
| **Indiana** | C-CA-01 | **Texas *** | T104704230-14-6 |
| **Kansas *** | E-10268 | **Utah *** | CA000062014-6 |
| **Kentucky** | 90107 | **Vermont** | VT0114 |
| **Louisiana *** | LA140009 | **Virginia *** | 00210 |
| **Maine** | CA0006 | **Washington** | C838 |
| **Maryland** | 224 | **West Virginia** | 9943 C |
| **Commonwealth of Northern Marianas Is.** | MP0004 | **Wisconsin** | 998316660 |
| **Massachusetts** | M-CA006 | **Wyoming** | 8TMS-L |
| **Michigan** | 9906 | **EPA Region 5** | Certified |
| **Los Angeles County Sanitation Districts** | 10264 | | |

* NELAP/TNI Recognized Accreditation Bodies

Eurofins Eaton Analytical, Inc.
750 Royal Oaks Drive, Suite 100
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T | 626-386-1100
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www.EatonAnalytical.com

**The tests listed below are accredited and meet the requirements of ISO 17025 as verified by the ANSI-ASQ National Accreditation Board/ACLASS. Refer to Certificate and scope of accreditation (AT 1807) found at: http://www.eatonanalytical.com**

| SPECIFIC TESTS | METHOD OR TECHNIQUE USED | Drinking Water | Food & Beverage | Waste Water |
|---|---|---|---|---|
| 1,4-Dioxane | EPA 522 | x | x | |
| 2,3,7,8-TCDD | Modified EPA 1613B | x | x | |
| Acrylamide | In House Method | x | x | |
| Alkalinity | SM 2320B | x | x | x |
| Ammonia | EPA 350.1 | | x | x |
| Ammonia | SM 4500-NH3 H (18th) | | x | x |
| Anions and DBPs by IC | EPA 300.0 | x | x | x |
| Anions and DBPs by IC | EPA 300.1 | x | x | |
| Asbestos | EPA 100.2 | x | | |
| Bicarbonate Alkalinity as HCO3 | SM 2330B | x | x | x |
| BOD / CBOD | SM 5210B | | x | x |
| Bromate | In House Method | x | x | |
| Carbamates | EPA 531.2 | x | x | |
| Carbonate as CO3 | SM 2330B | x | x | x |
| Carbonyls | EPA 556 | x | x | |
| COD | EPA 410.4 / SM 5220D | | | x |
| Chloramines | SM 4500-CL G | x | x | x |
| Chlorinated Acids | EPA 515.4 | x | x | |
| Chlorinated Acids | EPA 555 | x | x | |
| Chlorine Dioxide | SM 4500-CLO2 D | x | x | |
| Chlorine -Total/Free/ Combined Residual | SM 4500-Cl G | x | x | x |
| Conductivity | EPA 120.1 | | | x |
| Conductivity | SM 2510B | x | x | x |
| Corrosivity (Langelier Index) | SM 2330B | x | x | |
| Cyanide, Amenable | SM 4500-CN G | x | | x |
| Cyanide, Free | SM 4500CN F | x | x | x |
| Cyanide, Total | EPA 335.4 | x | x | x |
| Cyanogen Chloride (screen) | In House Method | x | x | |
| Diquat and Paraquat | EPA 549.2 | x | x | |
| DBP/HAA | SM 6251B | x | x | |
| Dissolved Oxygen | SM 4500-O G | | x | x |
| E. Coli | (MTF/EC+MUG) | x | | |
| E. Coli | CFR 141.21(f)(6)(i) | | x | x |
| E. Coli | SM 9223 | | | x |
| E. Coli (Enumeration) | SM 9221B.1/ SM 9221F | x | x | |
| E. Coli (Enumeration) | SM 9223B | x | x | |
| EDB/DCBP | EPA 504.1 | x | | |
| EDB/DBCP and DBP | EPA 551.1 | x | x | |
| EDTA and NTA | In House Method | x | x | |
| Endothall | EPA 548.1 | x | x | |
| Enterococci | SM 9230B | x | | x |
| Fecal Coliform | SM 9221 E (MTF/EC) | x | | |
| Fecal Coliform | SM 9221C, E (MTF/EC) | | | x |
| Fecal Coliform (Enumeration) | SM 9221E (MTF/EC) | x | x | |
| Fecal Coliform with Chlorine Present | SM 9221E | | | x |
| Fecal Streptococci | SM 9230B | x | | x |
| Fluoride | SM 4500-F C | x | x | x |
| Glyphosate | EPA 547 | x | x | |
| Gross Alpha/Beta | EPA 900.0 | x | x | x |
| HAAs/ Dalapon | EPA 552.3 | x | x | |
| Hardness | SM 2340B | x | x | x |
| Heterotrophic Bacteria | In House Method | x | x | |
| Heterotrophic Bacteria | SM 9215 B | x | x | |
| Hexavalent Chromium | EPA 218.6 | x | x | x |
| Hexavalent Chromium | EPA 218.7 | x | x | |
| Hexavalent Chromium | SM 3500-Cr B or C (20th) | | | x |

| SPECIFIC TESTS | METHOD OR TECHNIQUE USED | Drinking Water | Food & Beverage | Waste Water |
|---|---|---|---|---|
| Hormones | EPA 539 | x | x | |
| Hydroxide as OH Calc. | SM 2330B | x | x | |
| Kjeldahl Nitrogen | EPA 351.2 | | | x |
| Mercury | EPA 245.1 | x | x | x |
| Metals | EPA 200.7 / 200.8 | x | x | x |
| Microcystin LR | ELISA | x | x | |
| NDMA | EPA 521 | x | x | |
| Nitrate/Nitrite Nitrogen | EPA 353.2 | x | x | x |
| OCL, Pesticides/PCB | EPA 505 | x | x | |
| Ortho Phosphate | EPA 365.1 | x | x | |
| Ortho Phosphate and Total Phosphorous | EPA 365.1/SM 4500-P E | | | x |
| Ortho Phosphorous | SM 4500P E | x | x | |
| Oxyhalides Disinfection Byproducts | EPA 317.0 | x | x | |
| Perchlorate | EPA 331.0 | x | x | |
| Perchlorate | EPA 314.0 | x | x | |
| Perfluorinated Alkyl Acids | EPA 537 | x | x | |
| pH | EPA 150.1 | x | | |
| pH | SM 4500-H+B | x | x | x |
| Phenylurea Pesticides/ Herbicides | In House Method | x | x | |
| Pseudomonas | IDEXX Pseudalert | x | x | |
| Radium-226 | RA-226 GA | x | x | |
| Radium-228 | RA-228 GA | x | x | |
| Radon-222 | SM 7500RN | x | x | |
| Residue, Filterable | SM 2540C | x | x | x |
| Residue, Non-filterable | SM 2540D | | | x |
| Residue, Total | SM 2540B | | x | x |
| Residue, Volatile | EPA 160.4 | | | x |
| Semi-VOC | EPA 525.2 | x | x | |
| Semi-VOC | EPA 625 | x | x | x |
| Silica | SM 4500-Si D | x | x | x |
| Silica | SM 4500-SiO2 C | x | | x |
| Sulfide | SM 4500-$S^{=}$ D | | | x |
| Surfactants | SM 5540C | x | x | x |
| Taste and Odor Analytes | SM 6040E | x | x | |
| Total Coliform | SM 9221 A, B | x | x | |
| Total Coliform (Enumeration) | SM 9221 A, B, C | x | x | |
| Total Coliform / E. coli | Colisure | x | x | |
| Total Coliform | SM 9221B | | | x |
| Total Coliform with Chlorine Present | SM 9221B | | | x |
| Total Coliform / E.coli | SM 9223 | x | x | |
| TOC | SM 5310C | | x | x |
| TOC/DOC | SM 5310C | x | x | |
| TOX | SM 5320B | | | x |
| Total Phenols | EPA 420.1 | | | x |
| Total Phenols | EPA 420.4 | x | x | x |
| Total Phosphorous | SM 4500 P F | | | x |
| Turbidity | EPA 180.1 | x | x | x |
| Turbidity | SM 2130B | x | | x |
| Uranium by ICP/MS | EPA 200.8 | x | x | |
| UV 254 | SM 5910B | x | | |
| VOC | EPA 524.2/EPA 524.3 | x | x | |
| VOC | EPA 624 | x | x | x |
| VOC | EPA SW 846 8260 | x | x | |
| VOC | In House Method | x | x | |
| Yeast and Mold | SM 9610 | x | x | |

## Acknowledgement of Samples Received

Addr: **Santa Ynez River WCD**
Post Office Box 157
Santa Ynez, CA 93460

Client ID: SANTAYNEZWD-CA
Folder #: 470833
Project: CHROMIUM
Sample Group: well sampling

Attn: Eric Tambini
Phone: 805-688-6015

Project Manager: Fred Haley
Phone: (626) 386-1127

The following samples were received from you on **February 28, 2014**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical.

| Sample # | Sample ID | | Sample Date |
|---|---|---|---|
| 201402280442 | W15-230 | | 02/26/2014 1315 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402280443 | W15-240 | | 02/26/2014 1345 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402280444 | W15-250 | | 02/26/2014 1415 |
| | Chromium Total ICAP/MS | | |
| 201402280445 | W15-300 | | 02/26/2014 1500 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402280446 | W15-310 | | 02/26/2014 1545 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402280447 | W15-330 | | 02/26/2014 1605 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402280448 | W15-370 | | 02/26/2014 1630 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402280449 | W15-380 | | 02/26/2014 1710 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402280450 | W15-400 | | 02/26/2014 1740 |

# Acknowledgement of Samples Received

Addr: **Santa Ynez River WCD**
Post Office Box 157
Santa Ynez, CA 93460

Attn: Eric Tambini
Phone: 805-688-6015

Client ID: SANTAYNEZWD-CA
Folder #: 470833
Project: CHROMIUM
Sample Group: well sampling

Project Manager: Fred Haley
Phone: (626) 386-1127

The following samples were received from you on **February 28, 2014**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical.

| Sample # | Sample ID | | Sample Date |
|---|---|---|---|
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402280451 | W15-410 | | 02/26/2014 1800 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402280452 | W15-435 | | 02/26/2014 1820 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402280453 | WH15-1 | | 02/26/2014 1250 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402280454 | WH15-2 | | 02/26/2014 1835 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |

**Test Description**

270833

FWH

eurofins | Eaton Analytical

# CHAIN OF CUSTODY RECORD

750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629

Phone: 626 386 1100
Fax: 626 386 1101

800 566 LABS (800 566 5227)

Website: www.EatonAnalytical.com

*EUROFINS EATON ANALYTICAL USE ONLY:*

**LOGIN COMMENTS:**

**SAMPLES CHECKED AGAINST COC BY:** DJ

**SAMPLES LOGGED IN BY:** W

**SAMPLES REC'D DAY OF COLLECTION?** ☐ (check for yes)

**SAMPLE TEMP RECEIVED AT:**

☐ Colton / No. California / Arizona ____ °C (Compliance: 4 ± 2 °C)

☑ Monrovia 2.0 °C (Compliance: 4 ± 2 °C)

**CONDITION OF BLUE ICE:** Frozen ____ Partially Frozen ____ Thawed ____ Wet Ice ✓ No Ice ____

**METHOD OF SHIPMENT:** Pick-Up / Walk-In / (FedEx) / UPS / DHL / Area Fast / Top Line / Other: ____

*TO BE COMPLETED BY SAMPLER:*

**COMPANY/AGENCY NAME:** Dudek / Santa Ynez WD-CA

**PROJECT CODE:** Chromium

**EEA CLIENT CODE:**

**COC ID:**

**SAMPLE GROUP:** Well 15

**TAT requested: rush by adv notice only** STD ___ 1 wk ___ 3 day ___ 2 day ___ 1 day ___

**COMPLIANCE SAMPLES** ☐ (check for yes) - Requires state forms ☐

**NON-COMPLIANCE SAMPLES** ☒ (check for yes)

REGULATION INVOLVED:

Type of samples (circle one): ROUTINE (SPECIAL) CONFIRMATION (eg. SDWA, Phase V, NPDES, FDA,...)

***SEE ATTACHED BOTTLE ORDER FOR ANALYSES*** ☐ (check for yes), ***OR***

**list ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)**

| SAMPLE DATE | SAMPLE TIME | SAMPLE ID | CLIENT LAB ID | MATRIX * | FIELD DATA | FIELD DATA | Alk, pH | Chloride, Sulfate | TDS | Hex Cr Diss | CR-MS | ~~UE CAP/MS~~ | SAMPLER COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2/26 | 1315 | W15 - 230 | | RGW | | | x | x | x | x | x | | |
| 2/26 | 1345 | W15 - 240 | | RGW | | | x | x | x | x | x | | |
| 2/26 | 1415 | W15 - 250 | | RGW | | | ~~x~~ | ~~x~~ | ~~x~~ | ~~x~~ | x | | CR-MS Only |
| 2/26 | 1500 | W15 - 300 | | RGW | | | x | x | x | x | x | | |
| 2/26 | 1545 | W15 - 310 | | RGW | | | x | x | x | x | x | | |
| 2/26 | 1605 | W15 - 330 | | RGW | | | x | x | x | x | x | | |
| 2/26 | 1630 | W15 - 370 | | RGW | | | x | x | x | x | x | | |
| 2/26 | 1710 | W15 - 380 | | RGW | | | x | x | x | x | x | | |
| 2/26 | 1740 | W15 - 400 | | RGW | | | x | x | x | x | x | | |
| 2/26 | 1860 | W15 - 410 | | RGW | | | x | x | x | x | x | | |

*** MATRIX TYPES:** **RSW** = Raw Surface Water, **RGW** = Raw Ground Water, **CFW** = Chlor(am)inated Finished Water, **FW** = Other Finished Water, **SEAW** = Sea Water, **WW** = Waste Water, **BW** = Bottled Water, **SW** = Storm Water, **SO** = Soil, **SL** = Sludge, **O** = Other - Please Identify

| | SIGNATURE | PRINT NAME | COMPANY/TITLE | DATE | TIME |
|---|---|---|---|---|---|
| SAMPLED BY: | Jeff Kubran, Kim Miles, Steve Dickey | | Dudek / BESST | 2/27/14 | 1125 |
| RELINQUISHED BY: | [signature] | Jeff Kubran | FEDEX | | |
| RECEIVED BY: | [signature] | D. Smily | CCA | 2.28.14 | 1144 |
| RELINQUISHED BY: | | | | | |
| RECEIVED BY: | | | | | |

PAGE 1 OF 2

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# CHAIN OF CUSTODY RECORD

750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629

Phone: 626 386 1100
Fax: 626 386 1101

800 566 LABS (800 566 5227)

*EUROFINS EATON ANALYTICAL USE ONLY:*

**LOGIN COMMENTS:** ______

**SAMPLES CHECKED AGAINST COC BY:** JJ

**SAMPLES LOGGED IN BY:** ______

**SAMPLES REC'D DAY OF COLLECTION?** [ ] (check for yes)

**SAMPLE TEMP RECEIVED AT:**
[ ] Colton / No. California / Arizona ______ °C ( Compliance: 4 ± 2 °C )
[✓] Monrovia 2.0 °C ( Compliance: 4 ± 2 °C )

**CONDITION OF BLUE ICE:** Frozen ______ Partially Frozen ______ Thawed ______ Wet Ice ✓ No Ice ______

**METHOD OF SHIPMENT:** Pick-Up / Walk-In / (FedEx) / UPS / DHL / Area Fast / Top Line / Other: ______

*TO BE COMPLETED BY SAMPLER:*

**COMPANY/AGENCY NAME:** Dudek / Santa Ynez WD - CA

**PROJECT CODE:** Chromium

**EEA CLIENT CODE:**

**COC ID:**

**SAMPLE GROUP:**

**COMPLIANCE SAMPLES** [ ] (check for yes) - Requires state forms [ ]

**NON-COMPLIANCE SAMPLES** [x] (check for yes)

REGULATION INVOLVED: ______

Type of samples (circle one): ROUTINE (SPECIAL) CONFIRMATION (eg. SDWA, Phase V, NPDES, FDA,...)

***SEE ATTACHED BOTTLE ORDER FOR ANALYSES*** [ ] (check for yes), OR

list ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)

TAT requested: rush by adv notice only STD ___ 1 wk ___ 3 day ___ 2 day ___ 1 day ___

| SAMPLE DATE | SAMPLE TIME | SAMPLE ID | CLIENT LAB ID | MATRIX * | FIELD DATA | FIELD DATA | Alk, pH | Chloride, Sulfate | TDS | Hex Cr Diss | CR-MS | | | | | | | | | | SAMPLER COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2/26 | 1820 | W15-435 | | RGW | | | x | x | x | x | x | | | | | | | | | | |
| 2/26 | 1250 | WH15-1 | | RGW | | | x | x | x | x | x | | | | | | | | | | |
| 2/26 | 1835 | WH15-2 | | RGW | | | x | x | x | x | x | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |

*** MATRIX TYPES:** RSW = Raw Surface Water, RGW = Raw Ground Water, CFW = Chlor(am)inated Finished Water, FW = Other Finished Water, SEAW = Sea Water, WW = Waste Water, BW = Bottled Water, SW = Storm Water, SO = Soil, SL = Sludge, O = Other - Please Identify

| | SIGNATURE | PRINT NAME | COMPANY/TITLE | DATE | TIME |
|---|---|---|---|---|---|
| SAMPLED BY: | [signature] | Jeff Kubran | Dudek | 2/27/14 | 11:51 |
| RELINQUISHED BY: | [signature] | Jeff Kubran | FEDEX | | |
| RECEIVED BY: | [signature] | D Smith | EEA | 2.28.14 | 1144 |
| RELINQUISHED BY: | | | | | |
| RECEIVED BY: | | | | | |

QA FO 0029 (06/26/2013)

eurofins | Eaton Analytical
formerly MWH Laboratories

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
(626) 386-1100 FAX (626) 386-1101

# Kit Order for Santa Ynez River WCD

Fred Haley is your Eurofins Eaton Analytical Project Manager

**Note: Sampler Please return this paper with your samples**

**Kit #:** 85470
**Created By:** FWH
**Deliver By:** 02/18/2014
**STG:** Bottle Orders
**Ice Type:** W

**Client ID:** SANTAYNEZWD-CA
**Project Code:** CHROMIUM Bottle Orders
**Group Name:** well profile sampling
**PO#/JOB#:**

| Ship Sample Kits to | Send Report to | Billing Address |
|---|---|---|
| Santa Ynez River WCD<br>3622 Sagunto Street<br>Santa Ynez, CA 93460<br><br>Attn: District Office<br>Phone: 805-688-6015<br>Fax: 805-688-3078 | Santa Ynez River WCD<br>Post Office Box 157<br>Santa Ynez, CA 93460<br><br>Attn: Eric Tambini<br>Phone: 805-688-6015<br>Fax: 805-688-3078 | Santa Ynez River WCD<br>Post Office Box 157<br>Santa Ynez, CA 93460<br><br>Attn: Eric Tambini<br>Phone: 805-688-6015<br>Fax: 805-688-3078 |

| # of Sample | Tests | Bottles - Qty for each sample, type & preservative if ai | UN DOT # |
|---|---|---|---|
| 1 | Alkalinity in CaCO3 units, PH (H3=past HT not compliant) | 30 250ml poly no preservative | |
| 1 | Chloride, Sulfate | 30 125ml poly no preservative | |
| 1 | Chromium Total ICAP/MS, Uranium ICAP/MS | 38 500ml acid poly 2ml HNO3 (18%) | UN2031 |
| 1 | Hexavalent Chromium (Dissolved) | 12 125ml poly 1.25 ml NH4SO4/NH4OH buffer | |
| 1 | Total Dissolved Solid (TDS) | 30 500ml poly TDS - no preservative | |

## Comments

LABEL COOLERS "well profile sampling"

Ship two coolers

no gel packs

provide wet ice packing instructions

| Code | Status | Date Shipped | Via | Tracking # | # of Coolers | Prepared By |
|---|---|---|---|---|---|---|
| | | | | | | |

eurofins Eaton Analytical
750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

**Laboratory Comments**
**Report: 470833**

Santa Ynez River WCD
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

---

**The Comments Report may be blank if there are no comments for this report.**

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

**Laboratory Hits**
**Report: 470833**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/28/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| | **201402280442** | **W15-230** | | | | |
| 03/04/2014 17:15 | Alkalinity in CaCO3 units | | 270 | | mg/L | 2 |
| 03/01/2014 23:48 | Chloride | | 68 | 250 | mg/L | 5 |
| 03/04/2014 11:32 | Chromium Total ICAP/MS | | 23 | 100 | ug/L | 1 |
| 03/03/2014 11:20 | Hexavalent chromium(Dissolved) | | 26 | | ug/L | 0.04 |
| 03/04/2014 17:15 | PH (H3=past HT not compliant) | | 8.2 | | Units | 0.1 |
| 03/01/2014 23:48 | Sulfate | | 90 | 250 | mg/L | 2.5 |
| 03/04/2014 16:16 | Total Dissolved Solids (TDS) | | 540 | 500 | mg/L | 10 |
| | **201402280443** | **W15-240** | | | | |
| 03/04/2014 17:42 | Alkalinity in CaCO3 units | | 280 | | mg/L | 2 |
| 03/02/2014 00:01 | Chloride | | 69 | 250 | mg/L | 5 |
| 03/04/2014 11:42 | Chromium Total ICAP/MS | | 23 | 100 | ug/L | 1 |
| 03/03/2014 13:00 | Hexavalent chromium(Dissolved) | | 26 | | ug/L | 0.04 |
| 03/04/2014 17:42 | PH (H3=past HT not compliant) | | 8.3 | | Units | 0.1 |
| 03/02/2014 00:01 | Sulfate | | 91 | 250 | mg/L | 2.5 |
| 03/04/2014 16:18 | Total Dissolved Solids (TDS) | | 540 | 500 | mg/L | 10 |
| | **201402280444** | **W15-250** | | | | |
| 03/07/2014 18:09 | Chromium Total ICAP/MS | | 24 | 100 | ug/L | 1 |
| | **201402280445** | **W15-300** | | | | |
| 03/04/2014 17:55 | Alkalinity in CaCO3 units | | 320 | | mg/L | 2 |
| 03/02/2014 00:26 | Chloride | | 46 | 250 | mg/L | 5 |
| 03/04/2014 12:04 | Chromium Total ICAP/MS | | 23 | 100 | ug/L | 1 |
| 03/03/2014 12:30 | Hexavalent chromium(Dissolved) | | 26 | | ug/L | 0.04 |
| 03/04/2014 17:55 | PH (H3=past HT not compliant) | | 8.1 | | Units | 0.1 |
| 03/02/2014 00:26 | Sulfate | | 110 | 250 | mg/L | 2.5 |
| 03/04/2014 16:19 | Total Dissolved Solids (TDS) | | 540 | 500 | mg/L | 10 |
| | **201402280446** | **W15-310** | | | | |
| 03/04/2014 18:04 | Alkalinity in CaCO3 units | | 330 | | mg/L | 2 |
| 03/02/2014 00:39 | Chloride | | 46 | 250 | mg/L | 5 |
| 03/04/2014 12:10 | Chromium Total ICAP/MS | | 24 | 100 | ug/L | 1 |
| 03/03/2014 12:00 | Hexavalent chromium(Dissolved) | | 27 | | ug/L | 0.04 |
| 03/04/2014 18:04 | PH (H3=past HT not compliant) | | 8.1 | | Units | 0.1 |
| 03/02/2014 00:39 | Sulfate | | 110 | 250 | mg/L | 2.5 |
| 03/04/2014 16:20 | Total Dissolved Solids (TDS) | | 540 | 500 | mg/L | 10 |
| | **201402280447** | **W15-330** | | | | |

**SUMMARY OF POSITIVE DATA ONLY**

eurofins | Eaton Analytical

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

**Laboratory Hits**
**Report: 470833**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/28/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| 03/04/2014 18:13 | Alkalinity in CaCO3 units | | 320 | | mg/L | 2 |
| 03/02/2014 00:52 | Chloride | | 47 | 250 | mg/L | 5 |
| 03/04/2014 11:39 | Chromium Total ICAP/MS | | 24 | 100 | ug/L | 1 |
| 03/03/2014 12:10 | Hexavalent chromium(Dissolved) | | 26 | | ug/L | 0.04 |
| 03/04/2014 18:13 | PH (H3=past HT not compliant) | | 8.2 | | Units | 0.1 |
| 03/02/2014 00:52 | Sulfate | | 120 | 250 | mg/L | 2.5 |
| 03/04/2014 16:21 | Total Dissolved Solids (TDS) | | 560 | 500 | mg/L | 10 |
| | **201402280448** | **W15-370** | | | | |
| 03/04/2014 18:21 | Alkalinity in CaCO3 units | | 300 | | mg/L | 2 |
| 03/02/2014 01:05 | Chloride | | 53 | 250 | mg/L | 5 |
| 03/04/2014 12:07 | Chromium Total ICAP/MS | | 20 | 100 | ug/L | 1 |
| 03/03/2014 11:50 | Hexavalent chromium(Dissolved) | | 22 | | ug/L | 0.04 |
| 03/04/2014 18:21 | PH (H3=past HT not compliant) | | 8.1 | | Units | 0.1 |
| 03/02/2014 01:05 | Sulfate | | 140 | 250 | mg/L | 2.5 |
| 03/04/2014 16:22 | Total Dissolved Solids (TDS) | | 610 | 500 | mg/L | 10 |
| | **201402280449** | **W15-380** | | | | |
| 03/04/2014 18:30 | Alkalinity in CaCO3 units | | 310 | | mg/L | 2 |
| 03/02/2014 01:18 | Chloride | | 56 | 250 | mg/L | 5 |
| 03/04/2014 11:45 | Chromium Total ICAP/MS | | 22 | 100 | ug/L | 1 |
| 03/03/2014 13:40 | Hexavalent chromium(Dissolved) | | 20 | | ug/L | 0.04 |
| 03/04/2014 18:30 | PH (H3=past HT not compliant) | | 8.4 | | Units | 0.1 |
| 03/02/2014 01:18 | Sulfate | | 160 | 250 | mg/L | 2.5 |
| 03/04/2014 16:23 | Total Dissolved Solids (TDS) | | 660 | 500 | mg/L | 10 |
| | **201402280450** | **W15-400** | | | | |
| 03/04/2014 18:38 | Alkalinity in CaCO3 units | | 330 | | mg/L | 2 |
| 03/03/2014 16:06 | Chloride | | 52 | 250 | mg/L | 5 |
| 03/04/2014 11:48 | Chromium Total ICAP/MS | | 20 | 100 | ug/L | 1 |
| 03/03/2014 12:20 | Hexavalent chromium(Dissolved) | | 22 | | ug/L | 0.04 |
| 03/04/2014 18:38 | PH (H3=past HT not compliant) | | 8.1 | | Units | 0.1 |
| 03/03/2014 16:06 | Sulfate | | 130 | 250 | mg/L | 2.5 |
| 03/04/2014 17:34 | Total Dissolved Solids (TDS) | | 600 | 500 | mg/L | 10 |
| | **201402280451** | **W15-410** | | | | |
| 03/04/2014 18:47 | Alkalinity in CaCO3 units | | 300 | | mg/L | 2 |
| 03/03/2014 16:19 | Chloride | | 53 | 250 | mg/L | 5 |
| 03/04/2014 11:51 | Chromium Total ICAP/MS | | 20 | 100 | ug/L | 1 |
| 03/03/2014 12:40 | Hexavalent chromium(Dissolved) | | 21 | | ug/L | 0.04 |

**SUMMARY OF POSITIVE DATA ONLY**

eurofins Eaton Analytical

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

**Laboratory Hits**
**Report: 470833**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/28/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| 03/04/2014 18:47 | PH (H3=past HT not compliant) | | 8.1 | | Units | 0.1 |
| 03/03/2014 16:19 | Sulfate | | 140 | 250 | mg/L | 2.5 |
| 03/04/2014 17:35 | Total Dissolved Solids (TDS) | | 600 | 500 | mg/L | 10 |
| | **201402280452** | **W15-435** | | | | |
| 03/04/2014 18:55 | Alkalinity in CaCO3 units | | 290 | | mg/L | 2 |
| 03/03/2014 17:10 | Chloride | | 43 | 250 | mg/L | 5 |
| 03/04/2014 11:29 | Chromium Total ICAP/MS | | 16 | 100 | ug/L | 1 |
| 02/28/2014 18:39 | Hexavalent chromium(Dissolved) | | 16 | | ug/L | 0.02 |
| 03/04/2014 18:55 | PH (H3=past HT not compliant) | | 8.0 | | Units | 0.1 |
| 03/03/2014 17:10 | Sulfate | | 89 | 250 | mg/L | 2.5 |
| 03/04/2014 17:36 | Total Dissolved Solids (TDS) | | 490 | 500 | mg/L | 10 |
| | **201402280453** | **WH15-1** | | | | |
| 03/04/2014 16:29 | Alkalinity in CaCO3 units | | 280 | | mg/L | 2 |
| 03/03/2014 17:23 | Chloride | | 68 | 250 | mg/L | 5 |
| 03/04/2014 11:36 | Chromium Total ICAP/MS | | 23 | 100 | ug/L | 1 |
| 03/03/2014 13:10 | Hexavalent chromium(Dissolved) | | 25 | | ug/L | 0.04 |
| 03/04/2014 16:29 | PH (H3=past HT not compliant) | | 8.0 | | Units | 0.1 |
| 03/03/2014 17:23 | Sulfate | | 90 | 250 | mg/L | 2.5 |
| 03/04/2014 17:38 | Total Dissolved Solids (TDS) | | 550 | 500 | mg/L | 10 |
| | **201402280454** | **WH15-2** | | | | |
| 03/04/2014 16:37 | Alkalinity in CaCO3 units | | 300 | | mg/L | 2 |
| 03/03/2014 17:36 | Chloride | | 69 | 250 | mg/L | 5 |
| 03/04/2014 12:13 | Chromium Total ICAP/MS | | 23 | 100 | ug/L | 1 |
| 03/03/2014 12:50 | Hexavalent chromium(Dissolved) | | 25 | | ug/L | 0.04 |
| 03/04/2014 16:37 | PH (H3=past HT not compliant) | | 8.0 | | Units | 0.1 |
| 03/03/2014 17:36 | Sulfate | | 90 | 250 | mg/L | 2.5 |
| 03/04/2014 17:39 | Total Dissolved Solids (TDS) | | 550 | 500 | mg/L | 10 |

**SUMMARY OF POSITIVE DATA ONLY**

eurofins | Eaton Analytical

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

**Laboratory Data Report: 470833**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on: 02/28/2014

| Prepared | Analyzed | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|
| **W15-230 (201402280442)** | | | | | | **Sampled on 02/26/2014 1315** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/3/2014 | 03/04/2014 | 11:32 755058 | (EPA 200.8) | Chromium Total ICAP/MS | 23 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/03/2014 | 11:20 754995 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 26 | ug/L | 0.04 | 2 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/01/2014 | 23:48 754886 | (EPA 300.0) | Chloride | 68 | mg/L | 5 | 5 |
| | 03/01/2014 | 23:48 754886 | (EPA 300.0) | Sulfate | 90 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/04/2014 | 17:15 755306 | (SM 2320B) | Alkalinity in CaCO3 units | 270 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/3/2014 | 03/04/2014 | 16:16 755144 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 540 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/04/2014 | 17:15 755353 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.2 | Units | 0.1 | 1 |
| **W15-240 (201402280443)** | | | | | | **Sampled on 02/26/2014 1345** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/3/2014 | 03/04/2014 | 11:42 755058 | (EPA 200.8) | Chromium Total ICAP/MS | 23 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/03/2014 | 13:00 754995 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 26 | ug/L | 0.04 | 2 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/02/2014 | 00:01 754886 | (EPA 300.0) | Chloride | 69 | mg/L | 5 | 5 |
| | 03/02/2014 | 00:01 754886 | (EPA 300.0) | Sulfate | 91 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/04/2014 | 17:42 755306 | (SM 2320B) | Alkalinity in CaCO3 units | 280 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/3/2014 | 03/04/2014 | 16:18 755144 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 540 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/04/2014 | 17:42 755353 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.3 | Units | 0.1 | 1 |
| **W15-250 (201402280444)** | | | | | | **Sampled on 02/26/2014 1415** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/3/2014 | 03/07/2014 | 18:09 755975 | (EPA 200.8) | Chromium Total ICAP/MS | 24 | ug/L | 1 | 1 |
| **W15-300 (201402280445)** | | | | | | **Sampled on 02/26/2014 1500** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/3/2014 | 03/04/2014 | 12:04 755058 | (EPA 200.8) | Chromium Total ICAP/MS | 23 | ug/L | 1 | 1 |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data Report: 470833**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on: 02/28/2014

| Prepared | Analyzed | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/03/2014 12:30 | 754995 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 26 | ug/L | 0.04 | 2 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/02/2014 00:26 | 754886 | (EPA 300.0) | Chloride | 46 | mg/L | 5 | 5 |
| | 03/02/2014 00:26 | 754886 | (EPA 300.0) | Sulfate | 110 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/04/2014 17:55 | 755306 | (SM 2320B) | Alkalinity in CaCO3 units | 320 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/3/2014 | 03/04/2014 16:19 | 755144 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 540 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/04/2014 17:55 | 755353 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.1 | Units | 0.1 | 1 |
| **W15-310 (201402280446)** | | | | | **Sampled on 02/26/2014 1545** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/3/2014 | 03/04/2014 12:10 | 755058 | (EPA 200.8) | Chromium Total ICAP/MS | 24 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/03/2014 12:00 | 754995 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 27 | ug/L | 0.04 | 2 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/02/2014 00:39 | 754886 | (EPA 300.0) | Chloride | 46 | mg/L | 5 | 5 |
| | 03/02/2014 00:39 | 754886 | (EPA 300.0) | Sulfate | 110 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/04/2014 18:04 | 755306 | (SM 2320B) | Alkalinity in CaCO3 units | 330 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/3/2014 | 03/04/2014 16:20 | 755144 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 540 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/04/2014 18:04 | 755353 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.1 | Units | 0.1 | 1 |
| **W15-330 (201402280447)** | | | | | **Sampled on 02/26/2014 1605** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/3/2014 | 03/04/2014 11:39 | 755058 | (EPA 200.8) | Chromium Total ICAP/MS | 24 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/03/2014 12:10 | 754995 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 26 | ug/L | 0.04 | 2 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/02/2014 00:52 | 754886 | (EPA 300.0) | Chloride | 47 | mg/L | 5 | 5 |
| | 03/02/2014 00:52 | 754886 | (EPA 300.0) | Sulfate | 120 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/04/2014 18:13 | 755306 | (SM 2320B) | Alkalinity in CaCO3 units | 320 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data Report: 470833**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/28/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| 3/3/2014 | 03/04/2014 | 16:21 | 755144 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 560 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 03/04/2014 | 18:13 | 755353 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.2 | Units | 0.1 | 1 |
| **W15-370 (201402280448)** | | | | | | **Sampled on 02/26/2014 1630** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 3/3/2014 | 03/04/2014 | 12:07 | 755058 | (EPA 200.8) | Chromium Total ICAP/MS | 20 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 03/03/2014 | 11:50 | 754995 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 22 | ug/L | 0.04 | 2 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 03/02/2014 | 01:05 | 754886 | (EPA 300.0) | Chloride | 53 | mg/L | 5 | 5 |
| | 03/02/2014 | 01:05 | 754886 | (EPA 300.0) | Sulfate | 140 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 03/04/2014 | 18:21 | 755306 | (SM 2320B) | Alkalinity in CaCO3 units | 300 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/3/2014 | 03/04/2014 | 16:22 | 755144 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 610 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 03/04/2014 | 18:21 | 755353 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.1 | Units | 0.1 | 1 |
| **W15-380 (201402280449)** | | | | | | **Sampled on 02/26/2014 1710** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 3/3/2014 | 03/04/2014 | 11:45 | 755058 | (EPA 200.8) | Chromium Total ICAP/MS | 22 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 03/03/2014 | 13:40 | 754995 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 20 | ug/L | 0.04 | 2 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 03/02/2014 | 01:18 | 754886 | (EPA 300.0) | Chloride | 56 | mg/L | 5 | 5 |
| | 03/02/2014 | 01:18 | 754886 | (EPA 300.0) | Sulfate | 160 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 03/04/2014 | 18:30 | 755306 | (SM 2320B) | Alkalinity in CaCO3 units | 310 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/3/2014 | 03/04/2014 | 16:23 | 755144 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 660 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 03/04/2014 | 18:30 | 755353 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.4 | Units | 0.1 | 1 |
| **W15-400 (201402280450)** | | | | | | **Sampled on 02/26/2014 1740** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 3/3/2014 | 03/04/2014 | 11:48 | 755058 | (EPA 200.8) | Chromium Total ICAP/MS | 20 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data**
**Report: 470833**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/28/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| | 03/03/2014 | 12:20 | 754995 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 22 | ug/L | 0.04 | 2 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 03/03/2014 | 16:06 | 755207 | (EPA 300.0) | Chloride | 52 | mg/L | 5 | 5 |
| | 03/03/2014 | 16:06 | 755207 | (EPA 300.0) | Sulfate | 130 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 03/04/2014 | 18:38 | 755306 | (SM 2320B) | Alkalinity in CaCO3 units | 330 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/4/2014 | 03/04/2014 | 17:34 | 755147 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 600 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 03/04/2014 | 18:38 | 755353 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.1 | Units | 0.1 | 1 |
| **W15-410 (201402280451)** | | | | | | | **Sampled on 02/26/2014 1800** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 3/3/2014 | 03/04/2014 | 11:51 | 755058 | (EPA 200.8) | Chromium Total ICAP/MS | 20 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 03/03/2014 | 12:40 | 754995 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 21 | ug/L | 0.04 | 2 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 03/03/2014 | 16:19 | 755207 | (EPA 300.0) | Chloride | 53 | mg/L | 5 | 5 |
| | 03/03/2014 | 16:19 | 755207 | (EPA 300.0) | Sulfate | 140 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 03/04/2014 | 18:47 | 755306 | (SM 2320B) | Alkalinity in CaCO3 units | 300 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/4/2014 | 03/04/2014 | 17:35 | 755147 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 600 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 03/04/2014 | 18:47 | 755353 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.1 | Units | 0.1 | 1 |
| **W15-435 (201402280452)** | | | | | | | **Sampled on 02/26/2014 1820** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 3/3/2014 | 03/04/2014 | 11:29 | 755058 | (EPA 200.8) | Chromium Total ICAP/MS | 16 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/28/2014 | 18:39 | 754707 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 16 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 03/03/2014 | 17:10 | 755207 | (EPA 300.0) | Chloride | 43 | mg/L | 5 | 5 |
| | 03/03/2014 | 17:10 | 755207 | (EPA 300.0) | Sulfate | 89 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 03/04/2014 | 18:55 | 755306 | (SM 2320B) | Alkalinity in CaCO3 units | 290 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/4/2014 | 03/04/2014 | 17:36 | 755147 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 490 | mg/L | 10 | 1 |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data Report: 470833**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on: 02/28/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | |
| | 03/04/2014 | 18:55 | 755353 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.0 | Units | 0.1 | 1 |
| **WH15-1 (201402280453)** | | | | | | | **Sampled on 02/26/2014 1250** | | |
| | | | | **EPA 200.8 - ICPMS Metals** | | | | | |
| 3/3/2014 | 03/04/2014 | 11:36 | 755058 | (EPA 200.8) | Chromium Total ICAP/MS | 23 | ug/L | 1 | 1 |
| | | | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | |
| | 03/03/2014 | 13:10 | 754995 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 25 | ug/L | 0.04 | 2 |
| | | | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | |
| | 03/03/2014 | 17:23 | 755207 | (EPA 300.0) | Chloride | 68 | mg/L | 5 | 5 |
| | 03/03/2014 | 17:23 | 755207 | (EPA 300.0) | Sulfate | 90 | mg/L | 2.5 | 5 |
| | | | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | |
| | 03/04/2014 | 16:29 | 755306 | (SM 2320B) | Alkalinity in CaCO3 units | 280 | mg/L | 2 | 1 |
| | | | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | |
| 3/4/2014 | 03/04/2014 | 17:38 | 755147 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 550 | mg/L | 10 | 1 |
| | | | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | |
| | 03/04/2014 | 16:29 | 755353 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.0 | Units | 0.1 | 1 |
| **WH15-2 (201402280454)** | | | | | | | **Sampled on 02/26/2014 1835** | | |
| | | | | **EPA 200.8 - ICPMS Metals** | | | | | |
| 3/3/2014 | 03/04/2014 | 12:13 | 755058 | (EPA 200.8) | Chromium Total ICAP/MS | 23 | ug/L | 1 | 1 |
| | | | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | |
| | 03/03/2014 | 12:50 | 754995 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 25 | ug/L | 0.04 | 2 |
| | | | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | |
| | 03/03/2014 | 17:36 | 755207 | (EPA 300.0) | Chloride | 69 | mg/L | 5 | 5 |
| | 03/03/2014 | 17:36 | 755207 | (EPA 300.0) | Sulfate | 90 | mg/L | 2.5 | 5 |
| | | | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | |
| | 03/04/2014 | 16:37 | 755306 | (SM 2320B) | Alkalinity in CaCO3 units | 300 | mg/L | 2 | 1 |
| | | | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | |
| 3/4/2014 | 03/04/2014 | 17:39 | 755147 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 550 | mg/L | 10 | 1 |
| | | | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | |
| | 03/04/2014 | 16:37 | 755353 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.0 | Units | 0.1 | 1 |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory**
**QC Summary: 470833**

Santa Ynez River WCD

**QC Ref # 754707 - Hexavalent chromium(Dissolved)** **Analysis Date: 02/28/2014**

| | | |
|---|---|---|
| 201402280452 | W15-435 | Analyzed by: TLH |

**QC Ref # 754886 - Chloride, Sulfate by EPA 300.0** **Analysis Date: 03/01/2014**

| | | |
|---|---|---|
| 201402280442 | W15-230 | Analyzed by: CYP |
| 201402280443 | W15-240 | Analyzed by: CYP |
| 201402280445 | W15-300 | Analyzed by: CYP |
| 201402280446 | W15-310 | Analyzed by: CYP |
| 201402280447 | W15-330 | Analyzed by: CYP |
| 201402280448 | W15-370 | Analyzed by: CYP |
| 201402280449 | W15-380 | Analyzed by: CYP |

**QC Ref # 754995 - Hexavalent chromium(Dissolved)** **Analysis Date: 03/03/2014**

| | | |
|---|---|---|
| 201402280442 | W15-230 | Analyzed by: TLH |
| 201402280443 | W15-240 | Analyzed by: TLH |
| 201402280445 | W15-300 | Analyzed by: TLH |
| 201402280446 | W15-310 | Analyzed by: TLH |
| 201402280447 | W15-330 | Analyzed by: TLH |
| 201402280448 | W15-370 | Analyzed by: TLH |
| 201402280449 | W15-380 | Analyzed by: TLH |
| 201402280450 | W15-400 | Analyzed by: TLH |
| 201402280451 | W15-410 | Analyzed by: TLH |
| 201402280453 | WH15-1 | Analyzed by: TLH |
| 201402280454 | WH15-2 | Analyzed by: TLH |

**QC Ref # 755058 - ICPMS Metals** **Analysis Date: 03/04/2014**

| | | |
|---|---|---|
| 201402280442 | W15-230 | Analyzed by: SXK |
| 201402280443 | W15-240 | Analyzed by: SXK |
| 201402280445 | W15-300 | Analyzed by: SXK |
| 201402280446 | W15-310 | Analyzed by: SXK |
| 201402280447 | W15-330 | Analyzed by: SXK |
| 201402280448 | W15-370 | Analyzed by: SXK |
| 201402280449 | W15-380 | Analyzed by: SXK |
| 201402280450 | W15-400 | Analyzed by: SXK |
| 201402280451 | W15-410 | Analyzed by: SXK |
| 201402280452 | W15-435 | Analyzed by: SXK |
| 201402280453 | WH15-1 | Analyzed by: SXK |
| 201402280454 | WH15-2 | Analyzed by: SXK |

**QC Ref # 755144 - Total Dissolved Solids (TDS)** **Analysis Date: 03/04/2014**

| | | |
|---|---|---|
| 201402280442 | W15-230 | Analyzed by: JRF |
| 201402280443 | W15-240 | Analyzed by: JRF |
| 201402280445 | W15-300 | Analyzed by: JRF |
| 201402280446 | W15-310 | Analyzed by: JRF |
| 201402280447 | W15-330 | Analyzed by: JRF |
| 201402280448 | W15-370 | Analyzed by: JRF |
| 201402280449 | W15-380 | Analyzed by: JRF |

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Santa Ynez River WCD

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**QC Ref # 755147 - Total Dissolved Solids (TDS)** **Analysis Date: 03/04/2014**

| | | |
|---|---|---|
| 201402280450 | W15-400 | Analyzed by: JRF |
| 201402280451 | W15-410 | Analyzed by: JRF |
| 201402280452 | W15-435 | Analyzed by: JRF |
| 201402280453 | WH15-1 | Analyzed by: JRF |
| 201402280454 | WH15-2 | Analyzed by: JRF |

**QC Ref # 755207 - Chloride, Sulfate by EPA 300.0** **Analysis Date: 03/03/2014**

| | | |
|---|---|---|
| 201402280450 | W15-400 | Analyzed by: CYP |
| 201402280451 | W15-410 | Analyzed by: CYP |
| 201402280452 | W15-435 | Analyzed by: CYP |
| 201402280453 | WH15-1 | Analyzed by: CYP |
| 201402280454 | WH15-2 | Analyzed by: CYP |

**QC Ref # 755306 - Alkalinity in CaCO3 units** **Analysis Date: 03/04/2014**

| | | |
|---|---|---|
| 201402280442 | W15-230 | Analyzed by: JMO |
| 201402280443 | W15-240 | Analyzed by: JMO |
| 201402280445 | W15-300 | Analyzed by: JMO |
| 201402280446 | W15-310 | Analyzed by: JMO |
| 201402280447 | W15-330 | Analyzed by: JMO |
| 201402280448 | W15-370 | Analyzed by: JMO |
| 201402280449 | W15-380 | Analyzed by: JMO |
| 201402280450 | W15-400 | Analyzed by: JMO |
| 201402280451 | W15-410 | Analyzed by: JMO |
| 201402280452 | W15-435 | Analyzed by: JMO |
| 201402280453 | WH15-1 | Analyzed by: JMO |
| 201402280454 | WH15-2 | Analyzed by: JMO |

**QC Ref # 755353 - PH (H3=past HT not compliant)** **Analysis Date: 03/04/2014**

| | | |
|---|---|---|
| 201402280442 | W15-230 | Analyzed by: JMO |
| 201402280443 | W15-240 | Analyzed by: JMO |
| 201402280445 | W15-300 | Analyzed by: JMO |
| 201402280446 | W15-310 | Analyzed by: JMO |
| 201402280447 | W15-330 | Analyzed by: JMO |
| 201402280448 | W15-370 | Analyzed by: JMO |
| 201402280449 | W15-380 | Analyzed by: JMO |
| 201402280450 | W15-400 | Analyzed by: JMO |
| 201402280451 | W15-410 | Analyzed by: JMO |
| 201402280452 | W15-435 | Analyzed by: JMO |
| 201402280453 | WH15-1 | Analyzed by: JMO |
| 201402280454 | WH15-2 | Analyzed by: JMO |

**QC Ref # 755975 - ICPMS Metals** **Analysis Date: 03/07/2014**

| | | |
|---|---|---|
| 201402280444 | W15-250 | Analyzed by: SXK |

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**Laboratory QC**
**Report: 470833**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| **QC Ref# 754707 - Hexavalent chromium(Dissolved) by EPA 218.6** | | | | | | **Analysis Date: 02/28/2014** | | | |
| LCS1 | Hexavalent chromium(Dissolved) | | 2.0 | 2.00 | ug/L | 100 | (90-110) | | |
| LCS2 | Hexavalent chromium(Dissolved) | | 2.0 | 2.01 | ug/L | 100 | (90-110) | | |
| MBLK | Hexavalent chromium(Dissolved) | | | <0.020 | ug/L | | | | |
| MRL_CHK | Hexavalent chromium(Dissolved) | | 0.02 | 0.0201 | ug/L | 100 | (50-150) | | |
| MS_201402260722 | Hexavalent chromium(Dissolved) | 0.14 | 2.0 | 2.18 | ug/L | 102 | (90-110) | | |
| MS_201402280357 | Hexavalent chromium(Dissolved) | ND | 2.0 | 2.09 | ug/L | 103 | (90-110) | | |
| MSD_201402260722 | Hexavalent chromium(Dissolved) | 0.14 | 2.0 | 2.19 | ug/L | 103 | (90-110) | 20 | 0.46 |
| MSD_201402280357 | Hexavalent chromium(Dissolved) | ND | 2.0 | 2.03 | ug/L | 100 | (90-110) | 20 | 2.9 |
| **QC Ref# 754886 - Chloride, Sulfate by EPA 300.0 by EPA 300.0** | | | | | | **Analysis Date: 03/01/2014** | | | |
| LCS1 | Chloride | | 25 | 25.3 | mg/L | 101 | (90-110) | | |
| LCS2 | Chloride | | 25 | 25.4 | mg/L | 102 | (90-110) | 20 | 0.79 |
| MBLK | Chloride | | | <0.5 | mg/L | | | | |
| MRL_CHK | Chloride | | 0.5 | 0.428 | mg/L | 86 | (50-150) | | |
| MS_201403010112 | Chloride | 59 | 13 | 83.8 | mg/L | 98 | (80-120) | | |
| MS_201403010129 | Chloride | 59 | 13 | 83.4 | mg/L | 96 | (80-120) | | |
| MSD_201403010112 | Chloride | 59 | 13 | 82.5 | mg/L | 92 | (80-120) | 20 | 1.6 |
| MSD_201403010129 | Chloride | 59 | 13 | 84.0 | mg/L | 99 | (80-120) | 20 | 0.60 |
| LCS1 | Sulfate | | 50 | 49.7 | mg/L | 99 | (90-110) | | |
| LCS2 | Sulfate | | 50 | 50.0 | mg/L | 100 | (90-110) | 20 | 0.60 |
| MBLK | Sulfate | | | <0.25 | mg/L | | | | |
| MRL_CHK | Sulfate | | 1.0 | 0.928 | mg/L | 93 | (50-150) | | |
| MRLLW | Sulfate | | 0.25 | 0.246 | mg/L | 98 | (50-150) | | |
| MS_201403010112 | Sulfate | 7.6 | 25 | 56.8 | mg/L | 99 | (80-120) | | |
| MS_201403010129 | Sulfate | 130 | 25 | 179 | mg/L | 93 | (80-120) | | |
| MSD_201403010112 | Sulfate | 7.6 | 25 | 54.5 | mg/L | 94 | (80-120) | 20 | 4.1 |
| MSD_201403010129 | Sulfate | 130 | 25 | 180 | mg/L | 96 | (80-120) | 20 | 0.56 |
| **QC Ref# 754995 - Hexavalent chromium(Dissolved) by EPA 218.6** | | | | | | **Analysis Date: 03/03/2014** | | | |
| LCS1 | Hexavalent chromium(Dissolved) | | 2.0 | 2.00 | ug/L | 100 | (90-110) | | |
| LCS2 | Hexavalent chromium(Dissolved) | | 2.0 | 1.99 | ug/L | 99 | (90-110) | | |
| MBLK | Hexavalent chromium(Dissolved) | | | <0.020 | ug/L | | | | |
| MRL_CHK | Hexavalent chromium(Dissolved) | | 0.02 | 0.0165 | ug/L | 83 | (50-150) | | |
| MS_201402280442 | Hexavalent chromium(Dissolved) | 26 | 2.0 | 29.4 | ug/L | 97 | (90-110) | | |
| MS_201403010009 | Hexavalent chromium(Dissolved) | 5.4 | 2.0 | 7.40 | ug/L | 102 | (90-110) | | |
| MSD_201402280442 | Hexavalent chromium(Dissolved) | 26 | 2.0 | 29.6 | ug/L | 102 | (90-110) | 20 | 0.68 |
| MSD_201403010009 | Hexavalent chromium(Dissolved) | 5.4 | 2.0 | 7.40 | ug/L | 102 | (90-110) | 20 | 0.0 |

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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**Laboratory QC**
**Report: 470833**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| **QC Ref# 755058 - ICPMS Metals by EPA 200.8** | | | | | | **Analysis Date: 03/04/2014** | | | |
| LCS1 | Chromium Total ICAP/MS | | 100 | 101 | ug/L | 101 | (85-115) | | |
| LCS2 | Chromium Total ICAP/MS | | 100 | 101 | ug/L | 101 | (85-115) | 20 | 0.0 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 1.02 | ug/L | 102 | (50-150) | | |
| MS_201402280359 | Chromium Total ICAP/MS | ND | 100 | 96.7 | ug/L | 97 | (70-130) | | |
| MS2_201402260735 | Chromium Total ICAP/MS | ND | 100 | 97.6 | ug/L | 98 | (70-130) | | |
| MSD_201402280359 | Chromium Total ICAP/MS | ND | 100 | 110 | ug/L | 110 | (70-130) | 20 | 13 |
| MSD2_201402260735 | Chromium Total ICAP/MS | ND | 100 | 104 | ug/L | 104 | (70-130) | 20 | 6.3 |
| **QC Ref# 755144 - Total Dissolved Solids (TDS) by E160.1/SM2540C** | | | | | | **Analysis Date: 03/04/2014** | | | |
| DUP_201402280442 | Total Dissolved Solid (TDS) | 540 | | 546 | mg/L | | (0-20) | 20 | 0.37 |
| DUP_201403030300 | Total Dissolved Solid (TDS) | 290 | | 294 | mg/L | | (0-20) | 20 | 0.68 |
| LCS1 | Total Dissolved Solid (TDS) | | 175 | 166 | mg/L | 95 | (80-114) | | |
| LCS2 | Total Dissolved Solid (TDS) | | 700 | 668 | mg/L | 95 | (80-114) | | |
| MBLK | Total Dissolved Solid (TDS) | | | <10 | mg/L | | | | |
| MRL_CHK | Total Dissolved Solid (TDS) | | 10 | 9.00 | mg/L | 90 | (50-150) | | |
| **QC Ref# 755147 - Total Dissolved Solids (TDS) by E160.1/SM2540C** | | | | | | **Analysis Date: 03/04/2014** | | | |
| DUP_201402260738 | Total Dissolved Solid (TDS) | 740 | | 736 | mg/L | | (0-20) | | |
| DUP_201402261005 | Total Dissolved Solid (TDS) | 660 | | 670 | mg/L | | (0-20) | 20 | 1.5 |
| LCS1 | Total Dissolved Solid (TDS) | | 175 | 154 | mg/L | 88 | (80-114) | | |
| LCS2 | Total Dissolved Solid (TDS) | | 700 | 670 | mg/L | 96 | (80-114) | | |
| MBLK | Total Dissolved Solid (TDS) | | | <10 | mg/L | | | | |
| MRL_CHK | Total Dissolved Solid (TDS) | | 10 | 9.00 | mg/L | 90 | (50-150) | | |
| **QC Ref# 755207 - Chloride, Sulfate by EPA 300.0 by EPA 300.0** | | | | | | **Analysis Date: 03/03/2014** | | | |
| LCS1 | Chloride | | 25 | 25.3 | mg/L | 101 | (90-110) | | |
| LCS2 | Chloride | | 25 | 25.5 | mg/L | 102 | (90-110) | 20 | 0.79 |
| MBLK | Chloride | | | <0.5 | mg/L | | | | |
| MRL_CHK | Chloride | | 0.5 | 0.428 | mg/L | 86 | (50-150) | | |
| MS_201402280073 | Chloride | 15 | 13 | 28.6 | mg/L | 106 | (80-120) | | |
| MS_201403030142 | Chloride | 15 | 13 | 28.2 | mg/L | 107 | (80-120) | | |
| MSD_201402280073 | Chloride | 15 | 13 | 28.5 | mg/L | 106 | (80-120) | 20 | 0.35 |
| MSD_201403030142 | Chloride | 15 | 13 | 28.3 | mg/L | 108 | (80-120) | 20 | 0.35 |
| LCS1 | Sulfate | | 50 | 49.8 | mg/L | 100 | (90-110) | | |
| LCS2 | Sulfate | | 50 | 50.2 | mg/L | 100 | (90-110) | 20 | 0.60 |
| MBLK | Sulfate | | | <0.25 | mg/L | | | | |
| MRL_CHK | Sulfate | | 1.0 | 0.930 | mg/L | 93 | (50-150) | | |

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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**Laboratory QC**
**Report: 470833**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| MRLLW | Sulfate | | 0.25 | 0.253 | mg/L | 101 | (50-150) | | |
| MS_201402280073 | Sulfate | 7.9 | 25 | 33.6 | mg/L | 103 | (80-120) | | |
| MS_201403030142 | Sulfate | 14 | 25 | 39.8 | mg/L | 104 | (80-120) | | |
| MSD_201402280073 | Sulfate | 7.9 | 25 | 33.6 | mg/L | 103 | (80-120) | 20 | 0.0 |
| MSD_201403030142 | Sulfate | 14 | 25 | 39.9 | mg/L | 105 | (80-120) | 20 | 0.25 |
| **QC Ref# 755306 - Alkalinity in CaCO3 units by SM 2320B** | | | | | | **Analysis Date: 03/04/2014** | | | |
| LCS1 | Alkalinity in CaCO3 units | | 100 | 101 | mg/L | 101 | (90-110) | | |
| LCS2 | Alkalinity in CaCO3 units | | 100 | 100 | mg/L | 100 | (90-110) | 20 | 0.0 |
| MBLK | Alkalinity in CaCO3 units | | | <2 | mg/L | | | | |
| MRL_CHK | Alkalinity in CaCO3 units | | 2.0 | 2.56 | mg/L | 128 | (50-150) | | |
| MS_201402270384 | Alkalinity in CaCO3 units | 110 | 100 | 173 | mg/L | <u>**61**</u> | (80-120) | | |
| MS_201402280442 | Alkalinity in CaCO3 units | 270 | 100 | 361 | mg/L | 94 | (80-120) | | |
| MSD_201402270384 | Alkalinity in CaCO3 units | 110 | 100 | 169 | mg/L | <u>**57**</u> | (80-120) | 20 | 2.3 |
| MSD_201402280442 | Alkalinity in CaCO3 units | 270 | 100 | 348 | mg/L | 81 | (80-120) | 20 | 3.7 |
| **QC Ref# 755353 - PH (H3=past HT not compliant) by SM4500-HB** | | | | | | **Analysis Date: 03/04/2014** | | | |
| DUP_201402270386 | PH (H3=past HT not compliant) | 9.6 | | 9.61 | Units | | (0-20) | 20 | 0.21 |
| DUP_201402280443 | PH (H3=past HT not compliant) | 8.3 | | 8.28 | Units | | (0-20) | 20 | 0.0 |
| LCS1 | PH (H3=past HT not compliant) | | 6.0 | 6.00 | Units | 100 | (98-102) | | |
| LCS2 | PH (H3=past HT not compliant) | | 6.0 | 6.00 | Units | 100 | (98-102) | 20 | 0.0 |
| **QC Ref# 755975 - ICPMS Metals by EPA 200.8** | | | | | | **Analysis Date: 03/07/2014** | | | |
| LCS1 | Chromium Total ICAP/MS | | 100 | 100 | ug/L | 100 | (85-115) | | |
| LCS2 | Chromium Total ICAP/MS | | 100 | 105 | ug/L | 105 | (85-115) | 20 | 4.9 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 0.968 | ug/L | 97 | (50-150) | | |
| MS_201403030098 | Chromium Total ICAP/MS | ND | 100 | 105 | ug/L | 105 | (70-130) | | |
| MS2_201403030066 | Chromium Total ICAP/MS | ND | 100 | 103 | ug/L | 102 | (70-130) | | |
| MSD_201403030098 | Chromium Total ICAP/MS | ND | 100 | 104 | ug/L | 104 | (70-130) | 20 | 0.96 |
| MSD2_201403030066 | Chromium Total ICAP/MS | ND | 100 | 114 | ug/L | 113 | (70-130) | 20 | 10 |

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by <u>Underlining.</u>
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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ORELAP 4034

AT-1807

# Laboratory Report

for

Santa Ynez River WCD
Post Office Box 157
Santa Ynez, CA 93460
Attention: Eric Tambini
Fax: 805-688-3078

Date of Issue
03/11/2014
EUROFINS EATON ANALYTICAL

FWH: Fred Haley

Project Manager

Report: 470148
Project: CHROMIUM
Group: well sampling

* Accredited in accordance with NELAP.
* Laboratory certifies that the test results meet all **TNI NELAP** requirements unless noted under the individual analysis.
* Following the cover page are State Certification List, ISO 17025 Accredited Method List, Acknowledgement of Samples Received, Comments, Hits Report, Data Report, QC Summary, QC Report and Regulatory Forms, as applicable.
* Test results relate only to the sample(s) tested.
* This report shall not be reproduced except in full, without the written approval of the laboratory.

# STATE CERTIFICATION LIST

| State | Certification Number | State | Certification Number |
|---|---|---|---|
| **Alabama** | 41060 | **Mississippi** | Certified |
| **Alaska** | CA00006 | **Montana** | Cert 0035 |
| **Arizona** | AZ0778 | **Nebraska** | Certified |
| **Arkansas** | Certified | **Nevada** | CA00006-2012-1 |
| **California-Monrovia-ELAP** | 2813 | **New Hampshire *** | 2959 |
| **California-Colton- ELAP** | 2812 | **New Jersey *** | CA 008 |
| **California-Folsom- ELAP** | 2820 | **New Mexico** | Certified |
| **Colorado** | Certified | **New York *** | 11320 |
| **Connecticut** | PH-0107 | **North Carolina** | 06701 |
| **Delaware** | CA 006 | **North Dakota** | R-009 |
| **Florida *** | E871024 | **Oregon (Primary AB) *** | **ORELAP 4034** |
| **Georgia** | 947 | **Pennsylvania *** | 68-565 |
| **Guam** | 13-004r | **Rhode Island** | LAO00326 |
| **Hawaii** | Certified | **South Carolina** | 87016 |
| **Idaho** | Certified | **South Dakota** | Certified |
| **Illinois *** | 200033 | **Tennessee** | TN02839 |
| **Indiana** | C-CA-01 | **Texas *** | T104704230-14-6 |
| **Kansas *** | E-10268 | **Utah *** | CA000062014-6 |
| **Kentucky** | 90107 | **Vermont** | VT0114 |
| **Louisiana *** | LA140009 | **Virginia *** | 00210 |
| **Maine** | CA0006 | **Washington** | C838 |
| **Maryland** | 224 | **West Virginia** | 9943 C |
| **Commonwealth of Northern Marianas Is.** | MP0004 | **Wisconsin** | 998316660 |
| **Massachusetts** | M-CA006 | **Wyoming** | 8TMS-L |
| **Michigan** | 9906 | **EPA Region 5** | Certified |
| **Los Angeles County Sanitation Districts** | 10264 | | |

* NELAP/TNI Recognized Accreditation Bodies

**The tests listed below are accredited and meet the requirements of ISO 17025 as verified by the ANSI-ASQ National Accreditation Board/ACLASS.**
**Refer to Certificate and scope of accreditation (AT 1807) found at: http://www.eatonanalytical.com**

| SPECIFIC TESTS | METHOD OR TECHNIQUE USED | Drinking Water | Food & Beverage | Waste Water |
|---|---|---|---|---|
| 1,4-Dioxane | EPA 522 | x | x | |
| 2,3,7,8-TCDD | Modified EPA 1613B | x | x | |
| Acrylamide | In House Method | x | x | |
| Alkalinity | SM 2320B | x | x | x |
| Ammonia | EPA 350.1 | | x | x |
| Ammonia | SM 4500-NH3 H (18th) | | x | x |
| Anions and DBPs by IC | EPA 300.0 | x | x | x |
| Anions and DBPs by IC | EPA 300.1 | x | x | |
| Asbestos | EPA 100.2 | x | | |
| Bicarbonate Alkalinity as HCO3 | SM 2330B | x | x | x |
| BOD / CBOD | SM 5210B | | x | x |
| Bromate | In House Method | x | x | |
| Carbamates | EPA 531.2 | x | x | |
| Carbonate as CO3 | SM 2330B | x | x | x |
| Carbonyls | EPA 556 | x | x | |
| COD | EPA 410.4 / SM 5220D | | | x |
| Chloramines | SM 4500-CL G | x | x | x |
| Chlorinated Acids | EPA 515.4 | x | x | |
| Chlorinated Acids | EPA 555 | x | x | |
| Chlorine Dioxide | SM 4500-CLO2 D | x | x | |
| Chlorine -Total/Free/ Combined Residual | SM 4500-Cl G | x | x | x |
| Conductivity | EPA 120.1 | | | x |
| Conductivity | SM 2510B | x | x | x |
| Corrosivity (Langelier Index) | SM 2330B | x | x | |
| Cyanide, Amenable | SM 4500-CN G | x | | x |
| Cyanide, Free | SM 4500CN F | x | x | x |
| Cyanide, Total | EPA 335.4 | x | x | x |
| Cyanogen Chloride (screen) | In House Method | x | x | |
| Diquat and Paraquat | EPA 549.2 | x | x | |
| DBP/HAA | SM 6251B | x | x | |
| Dissolved Oxygen | SM 4500-O G | | x | x |
| E. Coli | (MTF/EC+MUG) | x | | |
| E. Coli | CFR 141.21(f)(6)(i) | | x | x |
| E. Coli | SM 9223 | | | x |
| E. Coli (Enumeration) | SM 9221B.1/ SM 9221F | x | x | |
| E. Coli (Enumeration) | SM 9223B | x | x | |
| EDB/DCBP | EPA 504.1 | x | | |
| EDB/DBCP and DBP | EPA 551.1 | x | x | |
| EDTA and NTA | In House Method | x | x | |
| Endothall | EPA 548.1 | x | x | |
| Enterococci | SM 9230B | x | | x |
| Fecal Coliform | SM 9221 E (MTF/EC) | x | | |
| Fecal Coliform | SM 9221C, E (MTF/EC) | | | x |
| Fecal Coliform (Enumeration) | SM 9221E (MTF/EC) | x | x | |
| Fecal Coliform with Chlorine Present | SM 9221E | | | x |
| Fecal Streptococci | SM 9230B | x | | x |
| Fluoride | SM 4500-F C | x | x | x |
| Glyphosate | EPA 547 | x | x | |
| Gross Alpha/Beta | EPA 900.0 | x | x | x |
| HAAs/ Dalapon | EPA 552.3 | x | x | |
| Hardness | SM 2340B | x | x | x |
| Heterotrophic Bacteria | In House Method | x | x | |
| Heterotrophic Bacteria | SM 9215 B | x | x | |
| Hexavalent Chromium | EPA 218.6 | x | x | x |
| Hexavalent Chromium | EPA 218.7 | x | x | |
| Hexavalent Chromium | SM 3500-Cr B or C (20th) | | | x |

| SPECIFIC TESTS | METHOD OR TECHNIQUE USED | Drinking Water | Food & Beverage | Waste Water |
|---|---|---|---|---|
| Hormones | EPA 539 | x | x | |
| Hydroxide as OH Calc. | SM 2330B | x | x | |
| Kjeldahl Nitrogen | EPA 351.2 | | | x |
| Mercury | EPA 245.1 | x | x | x |
| Metals | EPA 200.7 / 200.8 | x | x | x |
| Microcystin LR | ELISA | x | x | |
| NDMA | EPA 521 | x | x | |
| Nitrate/Nitrite Nitrogen | EPA 353.2 | x | x | x |
| OCL, Pesticides/PCB | EPA 505 | x | x | |
| Ortho Phosphate | EPA 365.1 | x | x | |
| Ortho Phosphate and Total Phosphorous | EPA 365.1/SM 4500-P E | | | x |
| Ortho Phosphorous | SM 4500P E | x | x | |
| Oxyhalides Disinfection Byproducts | EPA 317.0 | x | x | |
| Perchlorate | EPA 331.0 | x | x | |
| Perchlorate | EPA 314.0 | x | x | |
| Perfluorinated Alkyl Acids | EPA 537 | x | x | |
| pH | EPA 150.1 | x | | |
| pH | SM 4500-H+B | x | x | x |
| Phenylurea Pesticides/ Herbicides | In House Method | x | x | |
| Pseudomonas | IDEXX Pseudalert | x | x | |
| Radium-226 | RA-226 GA | x | x | |
| Radium-228 | RA-228 GA | x | x | |
| Radon-222 | SM 7500RN | x | x | |
| Residue, Filterable | SM 2540C | x | x | x |
| Residue, Non-filterable | SM 2540D | | | x |
| Residue, Total | SM 2540B | | x | x |
| Residue, Volatile | EPA 160.4 | | | x |
| Semi-VOC | EPA 525.2 | x | x | |
| Semi-VOC | EPA 625 | x | x | x |
| Silica | SM 4500-Si D | x | x | x |
| Silica | SM 4500-SiO2 C | x | | x |
| Sulfide | SM 4500-$S^{=}$ D | | | x |
| Surfactants | SM 5540C | x | x | x |
| Taste and Odor Analytes | SM 6040E | x | x | |
| Total Coliform | SM 9221 A, B | x | x | |
| Total Coliform (Enumeration) | SM 9221 A, B, C | x | x | |
| Total Coliform / E. coli | Colisure | x | x | |
| Total Coliform | SM 9221B | | | x |
| Total Coliform with Chlorine Present | SM 9221B | | | x |
| Total Coliform / E.coli | SM 9223 | x | x | |
| TOC | SM 5310C | | x | x |
| TOC/DOC | SM 5310C | x | x | |
| TOX | SM 5320B | | | x |
| Total Phenols | EPA 420.1 | | | x |
| Total Phenols | EPA 420.4 | x | x | x |
| Total Phosphorous | SM 4500 P F | | | x |
| Turbidity | EPA 180.1 | x | x | x |
| Turbidity | SM 2130B | x | | x |
| Uranium by ICP/MS | EPA 200.8 | x | x | |
| UV 254 | SM 5910B | x | | |
| VOC | EPA 524.2/EPA 524.3 | x | x | |
| VOC | EPA 624 | x | x | x |
| VOC | EPA SW 846 8260 | x | x | |
| VOC | In House Method | x | x | |
| Yeast and Mold | SM 9610 | x | x | |

## Acknowledgement of Samples Received

Addr: **Santa Ynez River WCD**
Post Office Box 157
Santa Ynez, CA 93460

Attn: Eric Tambini
Phone: 805-688-6015

Client ID: SANTAYNEZWD-CA
Folder #: 470148
Project: CHROMIUM
Sample Group: well sampling

Project Manager: Fred Haley
Phone: (626) 386-1127

The following samples were received from you on **February 25, 2014**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical.

| Sample # | Sample ID | | Sample Date |
|---|---|---|---|
| 201402250585 | WH25-1 | | 02/22/2014 1000 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | Uranium ICAP/MS | |
| 201402250586 | W25-500 | | 02/22/2014 1339 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402250587 | W25-600 | | 02/22/2014 1500 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402250588 | W25-630 | | 02/22/2014 1525 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402250589 | W25-645 | | 02/22/2014 1555 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | Uranium ICAP/MS | |
| 201402250590 | W25-675 | | 02/22/2014 1615 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402250591 | W25-690 | | 02/22/2014 1640 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201402250592 | W25-705 | | 02/22/2014 1710 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |

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# Acknowledgement of Samples Received

| | | | |
|---|---|---|---|
| Addr: | **Santa Ynez River WCD** | Client ID: | SANTAYNEZWD-CA |
| | Post Office Box 157 | Folder #: | 470148 |
| | Santa Ynez, CA 93460 | Project: | CHROMIUM |
| | | Sample Group: | well sampling |
| Attn: | Eric Tambini | Project Manager: | Fred Haley |
| Phone: | 805-688-6015 | Phone: | (626) 386-1127 |

The following samples were received from you on **February 25, 2014**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical.

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201402250593 | W25-720 | 02/22/2014 1735 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201402250594 | W25-735 | 02/24/2014 1015 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201402250595 | W25-765 | 02/24/2014 1055 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | Uranium ICAP/MS | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201402250596 | W25-780 | 02/24/2014 1115 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201402250597 | W25-795 | 02/24/2014 1150 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201402250598 | W25-890 | 02/24/2014 1220 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201402250599 | WH25-2 | 02/24/2014 1255 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201402250600 | WH25-3 | 02/24/2014 1300 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

## Acknowledgement of Samples Received

Addr: **Santa Ynez River WCD**
Post Office Box 157
Santa Ynez, CA 93460

Attn: Eric Tambini
Phone: 805-688-6015

Client ID: SANTAYNEZWD-CA
Folder #: 470148
Project: CHROMIUM
Sample Group: well sampling

Project Manager: Fred Haley
Phone: (626) 386-1127

The following samples were received from you on **February 25, 2014**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical.

| Sample # | Sample ID | Sample Date |
|---|---|---|

**Test Description**


750 Royal Oaks Drive, Suite 100, Monrovia, CA 91016 Tel (626) 386-1100 Fax (626) 386-1101 http://www.EatonAnalytical.com

# CHAIN OF CUSTODY RECORD

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470148

750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629

Phone: 626 386 1100
Fax: 626 386 1101

800 566 LABS (800 566 5227)

Website: www.EatonAnalytical.com

*EUROFINS EATON ANALYTICAL USE ONLY:*

**LOGIN COMMENTS:** ____________

**SAMPLES CHECKED AGAINST COC BY:** KF
**SAMPLES LOGGED IN BY:** JW
**SAMPLES REC'D DAY OF COLLECTION?** ☐ (check for yes)

**SAMPLE TEMP RECEIVED AT:**
☐ Colton / No. California / Arizona ____ °C ( Compliance: 4 ± 2 °C )
☑ Monrovia 3.4 °C ( Compliance: 4 ± 2 °C )

**CONDITION OF BLUE ICE:** Frozen ____ Partially Frozen ____ Thawed ____ Wet Ice ✓ No Ice ____

**METHOD OF SHIPMENT:** Pick-Up / Walk-In / (FedEx) / UPS / DHL / Area Fast / Top Line / Other: ____

*TO BE COMPLETED BY SAMPLER:*

**COMPANY/AGENCY NAME:** DUDEK / SANTA YNEZ RIVER WATER CONSERVATION DIST

**PROJECT CODE:**

Total Cr Only

**EEA CLIENT CODE:**

**COC ID:**

**SAMPLE GROUP:**

**TAT requested: rush by adv notice only** (STD) ___ 1 wk ___ 3 day ___ 2 day ___ (1 day)

**COMPLIANCE SAMPLES** ☐ (check for yes) - Requires state forms ☐

**NON-COMPLIANCE SAMPLES** ☐ (check for yes)
REGULATION INVOLVED: ____

Type of samples (circle one): **ROUTINE SPECIAL CONFIRMATION** (eg. SDWA, Phase V, NPDES, FDA,...)

***SEE ATTACHED BOTTLE ORDER FOR ANALYSES*** ☐ (check for yes), ***OR***

**list ANALYSES REQUIRED** (enter number of bottles sent for each test for each sample)

| SAMPLE DATE | SAMPLE TIME | SAMPLE ID | CLIENT LAB ID | MATRIX * | FIELD DATA | FIELD DATA | Tot Cr | Cr(+6) | Cl, Sulfate | TDS | pH, Alk | CR-MS, HEXCR/MS | [illegible] | SAMPLER COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | WH25-1 | | RGW | | | X | X | X | X | X | | X | Cooler A |
| 2/22 | 13:39 | W25-500 | | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | | | ↓ |
| 2/22 | 1500 | W25-600 | | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | | | ↓ |
| 2/22 | 15:25 | W25-630 | | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | | | ↓ |
| 2/22 | 15:55 | W25-645 | | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | | X | ↓ |
| 2/22 | 16:15 | W25-675 | | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | | | ↓ |
| 2/22 | 16:40 | W25-690 | | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | | | cooler B |
| 2/22 | 17:10 | W25-705 | | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | | | cooler B |
| 2/22 | 17:35 | W25-720 | | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | | | cooler B |
| | | | | | | | | | | | | | | 1 DAY TAT ON Total Chromium ONLY |

*** MATRIX TYPES:** RSW = Raw Surface Water, RGW = Raw Ground Water, CFW = Chlor(am)inated Finished Water, FW = Other Finished Water, SEAW = Sea Water, WW = Waste Water, BW = Bottled Water, SW = Storm Water, SO = Soil, SL = Sludge, O = Other - Please Identify

| | SIGNATURE | PRINT NAME | COMPANY/TITLE | DATE | TIME |
|---|---|---|---|---|---|
| SAMPLED BY: | Troy Driscoll | Jeff Kubran / Troy Driscoll | Dudek / Hydrogeologist | 2/22/14 | 18:00 |
| RELINQUISHED BY: | Troy Driscoll | Troy Driscoll | Dudek / Hydrogeologist | 2/24/14 | 14:00 |
| RECEIVED BY: | [illegible] | Kris Hilger | EEA | 2/25/14 | 1230 |
| RELINQUISHED BY: | | | | | |
| RECEIVED BY: | | | | | |

PAGE 1 OF 1

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750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629

Phone: 626 386 1100
Fax: 626 386 1101

800 566 LABS (800 566 5227)

Website: www.EatonAnalytical.com

# CHAIN OF CUSTODY RECORD

*EUROFINS EATON ANALYTICAL USE ONLY:*

**LOGIN COMMENTS:** ____

**SAMPLES CHECKED AGAINST COC BY:** KP

**SAMPLES LOGGED IN BY:** ____

**SAMPLES REC'D DAY OF COLLECTION?** ☐ (check for yes)

**SAMPLE TEMP RECEIVED AT:**

☑ Colton / No. California / Arizona ____ °C ( Compliance: 4 ± 2 °C )

☑ Monrovia 3.4 °C ( Compliance: 4 ± 2 °C )

**CONDITION OF BLUE ICE:** Frozen ____ Partially Frozen ____ Thawed ____ Wet Ice ✓ No Ice ____

**METHOD OF SHIPMENT:** Pick-Up / Walk-In / (FedEx) / UPS / DHL / Area Fast / Top Line / Other: ____

*TO BE COMPLETED BY SAMPLER:*

**COMPANY/AGENCY NAME:** DUDEK / SANTA YNEZ RIVER WATER CONSERVATION DIST

**PROJECT CODE:**

**EEA CLIENT CODE:**

**COC ID:**

**SAMPLE GROUP:**

**TAT requested: rush by adv notice only** (STD) ___ 1 wk ___ 3 day ___ 2 day ___ (1 day) Total Cr Only

**COMPLIANCE SAMPLES** ☐ (check for yes)
- Requires state forms ☐

**NON-COMPLIANCE SAMPLES** ☐ (check for yes)
REGULATION INVOLVED: ____

Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION (eg. SDWA, Phase V, NPDES, FDA,...)

***SEE ATTACHED BOTTLE ORDER FOR ANALYSES*** ☐ (check for yes), OR

**list ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)**

| SAMPLE DATE | SAMPLE TIME | SAMPLE ID | CLIENT LAB ID | MATRIX * | FIELD DATA | FIELD DATA | Total Cr | Cr6 (Hex) | Cl, Sulfate | TDS | pH, Alk | | UICAP/ms | | | | | | | | SAMPLER COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2/24 | 10:15 | W25 - 735 | | RGW | | | X | X | X | X | X | | | | | | | | | | cooler B |
| 2/24 | 10:55 | W25 - 765 | | | | | ↓ | ↓ | ↓ | ↓ | ↓ | | X | | | | | | | | ↓ |
| 2/24 | 11:15 | W25 - 780 | | | | | ↓ | ↓ | ↓ | ↓ | ↓ | | | | | | | | | | ↓ |
| 2/24 | 11:50 | W25 - 795 | | | | | ↓ | ↓ | ↓ | ↓ | ↓ | | | | | | | | | | ↓ |
| 2/24 | 12:20 | W25 - 890 | | | | | ↓ | ↓ | ↓ | ↓ | ↓ | | | | | | | | | | ↓ |
| 2/24 | 12:55 | WH25 - 2 | | | | | ↓ | ↓ | ↓ | ↓ | ↓ | | | | | | | | | | cooler A |
| 2/24 | 13:00 | WH25 - 3 | | | | | ↓ | ↓ | ↓ | ↓ | ↓ | | | | | | | | | | cooler A |
| | | | | | | | | | | | | | | | | | | | | | 1 DAY TAT |
| | | | | | | | | | | | | | | | | | | | | | on total |
| | | | | | | | | | | | | | | | | | | | | | chromium only |

*** MATRIX TYPES:** **RSW** = Raw Surface Water **RGW** = Raw Ground Water **CFW** = Chlor(am)inated Finished Water **FW** = Other Finished Water **SEAW** = Sea Water **WW** = Waste Water **BW** = Bottled Water **SW** = Storm Water **SO** = Soil **SL** = Sludge **O** = Other - Please Identify

| | SIGNATURE | PRINT NAME | COMPANY/TITLE | DATE | TIME |
|---|---|---|---|---|---|
| SAMPLED BY: | Trey Driscoll | Jeff Kubran / Trey Driscoll | Dudek / Hydrogeologist | 2/24/14 | |
| RELINQUISHED BY: | Trey Driscoll | Trey Driscoll | Dudek / Hydrogeologist | 2/24/14 | 14:00 |
| RECEIVED BY: | [signature] | Kris Filger | EEA | 2/25/14 | 1222 |
| RELINQUISHED BY: | | | | | |
| RECEIVED BY: | | | | | |

PAGE 1 OF 1

eurofins
Eaton Analytical
750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

**Laboratory Comments**
**Report: 470148**

Santa Ynez River WCD
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

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**The Comments Report may be blank if there are no comments for this report.**

eurofins Eaton Analytical
750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

**Laboratory Hits**
**Report: 470148**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/25/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| | **201402250585** | **WH25-1** | | | | |
| 02/28/2014 16:03 | Alkalinity in CaCO3 units | | 270 | | mg/L | 2 |
| 02/28/2014 05:32 | Chloride | | 32 | 250 | mg/L | 5 |
| 02/26/2014 12:47 | Chromium Total ICAP/MS | | 8.9 | 100 | ug/L | 1 |
| 02/26/2014 11:33 | Hexavalent chromium(Dissolved) | | 9.7 | | ug/L | 0.02 |
| 02/28/2014 16:03 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 02/28/2014 05:32 | Sulfate | | 130 | 250 | mg/L | 2.5 |
| 02/27/2014 16:16 | Total Dissolved Solids (TDS) | | 530 | 500 | mg/L | 10 |
| 02/26/2014 12:47 | Uranium ICAP/MS | | 6.7 | 30 | ug/L | 1 |
| | **201402250586** | **W25-500** | | | | |
| 02/28/2014 16:11 | Alkalinity in CaCO3 units | | 270 | | mg/L | 2 |
| 02/28/2014 05:45 | Chloride | | 49 | 250 | mg/L | 5 |
| 02/26/2014 12:50 | Chromium Total ICAP/MS | | 14 | 100 | ug/L | 1 |
| 02/26/2014 10:33 | Hexavalent chromium(Dissolved) | | 14 | | ug/L | 0.02 |
| 02/28/2014 16:11 | PH (H3=past HT not compliant) | | 8.4 | | Units | 0.1 |
| 02/28/2014 05:45 | Sulfate | | 72 | 250 | mg/L | 2.5 |
| 02/27/2014 16:19 | Total Dissolved Solids (TDS) | | 480 | 500 | mg/L | 10 |
| | **201402250587** | **W25-600** | | | | |
| 02/28/2014 16:19 | Alkalinity in CaCO3 units | | 270 | | mg/L | 2 |
| 02/28/2014 05:58 | Chloride | | 32 | 250 | mg/L | 5 |
| 02/26/2014 12:53 | Chromium Total ICAP/MS | | 8.6 | 100 | ug/L | 1 |
| 02/26/2014 11:43 | Hexavalent chromium(Dissolved) | | 9.8 | | ug/L | 0.02 |
| 02/28/2014 16:19 | PH (H3=past HT not compliant) | | 7.9 | | Units | 0.1 |
| 02/28/2014 05:58 | Sulfate | | 130 | 250 | mg/L | 2.5 |
| 02/27/2014 16:20 | Total Dissolved Solids (TDS) | | 530 | 500 | mg/L | 10 |
| | **201402250588** | **W25-630** | | | | |
| 02/28/2014 16:27 | Alkalinity in CaCO3 units | | 270 | | mg/L | 2 |
| 02/28/2014 06:10 | Chloride | | 31 | 250 | mg/L | 5 |
| 03/11/2014 12:05 | Chromium Total ICAP/MS | | 8.7 | 100 | ug/L | 1 |
| 02/26/2014 11:13 | Hexavalent chromium(Dissolved) | | 9.6 | | ug/L | 0.02 |
| 02/28/2014 16:27 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 02/28/2014 06:10 | Sulfate | | 140 | 250 | mg/L | 2.5 |
| 02/27/2014 16:21 | Total Dissolved Solids (TDS) | | 530 | 500 | mg/L | 10 |
| | **201402250589** | **W25-645** | | | | |
| 02/28/2014 16:35 | Alkalinity in CaCO3 units | | 260 | | mg/L | 2 |

**SUMMARY OF POSITIVE DATA ONLY**

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750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

**Laboratory Hits**
**Report: 470148**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/25/2014

| Analyzed | Analyte / Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|
| 02/28/2014 06:23 | Chloride | 30 | 250 | mg/L | 5 |
| 02/26/2014 12:58 | Chromium Total ICAP/MS | 7.5 | 100 | ug/L | 1 |
| 02/26/2014 11:23 | Hexavalent chromium(Dissolved) | 8.4 | | ug/L | 0.02 |
| 02/28/2014 16:35 | PH (H3=past HT not compliant) | 8.5 | | Units | 0.1 |
| 02/28/2014 06:23 | Sulfate | 140 | 250 | mg/L | 2.5 |
| 02/27/2014 16:22 | Total Dissolved Solids (TDS) | 540 | 500 | mg/L | 10 |
| 02/26/2014 12:58 | Uranium ICAP/MS | 6.5 | 30 | ug/L | 1 |
| | **201402250590** **W25-675** | | | | |
| 02/28/2014 16:43 | Alkalinity in CaCO3 units | 270 | | mg/L | 2 |
| 02/28/2014 07:02 | Chloride | 29 | 250 | mg/L | 5 |
| 02/26/2014 13:01 | Chromium Total ICAP/MS | 6.2 | 100 | ug/L | 1 |
| 02/25/2014 23:55 | Hexavalent chromium(Dissolved) | 7.8 | | ug/L | 0.02 |
| 02/28/2014 16:43 | PH (H3=past HT not compliant) | 7.8 | | Units | 0.1 |
| 02/28/2014 07:02 | Sulfate | 140 | 250 | mg/L | 2.5 |
| 02/27/2014 16:23 | Total Dissolved Solids (TDS) | 530 | 500 | mg/L | 10 |
| | **201402250591** **W25-690** | | | | |
| 02/28/2014 18:09 | Alkalinity in CaCO3 units | 250 | | mg/L | 2 |
| 02/28/2014 07:41 | Chloride | 29 | 250 | mg/L | 5 |
| 02/26/2014 13:04 | Chromium Total ICAP/MS | 5.3 | 100 | ug/L | 1 |
| 02/26/2014 12:13 | Hexavalent chromium(Dissolved) | 6.6 | | ug/L | 0.02 |
| 02/28/2014 18:09 | PH (H3=past HT not compliant) | 8.5 | | Units | 0.1 |
| 02/28/2014 07:41 | Sulfate | 140 | 250 | mg/L | 2.5 |
| 03/01/2014 16:33 | Total Dissolved Solids (TDS) | 530 | 500 | mg/L | 10 |
| | **201402250592** **W25-705** | | | | |
| 02/28/2014 18:18 | Alkalinity in CaCO3 units | 240 | | mg/L | 2 |
| 02/28/2014 07:54 | Chloride | 29 | 250 | mg/L | 5 |
| 02/26/2014 13:13 | Chromium Total ICAP/MS | 5.5 | 100 | ug/L | 1 |
| 02/26/2014 12:03 | Hexavalent chromium(Dissolved) | 6.4 | | ug/L | 0.02 |
| 02/28/2014 18:18 | PH (H3=past HT not compliant) | 8.6 | | Units | 0.1 |
| 02/28/2014 07:54 | Sulfate | 140 | 250 | mg/L | 2.5 |
| 03/01/2014 16:34 | Total Dissolved Solids (TDS) | 530 | 500 | mg/L | 10 |
| | **201402250593** **W25-720** | | | | |
| 02/28/2014 18:26 | Alkalinity in CaCO3 units | 270 | | mg/L | 2 |
| 02/28/2014 08:07 | Chloride | 30 | 250 | mg/L | 5 |
| 02/26/2014 13:16 | Chromium Total ICAP/MS | 4.9 | 100 | ug/L | 1 |
| 02/25/2014 23:25 | Hexavalent chromium(Dissolved) | 5.4 | | ug/L | 0.02 |

**SUMMARY OF POSITIVE DATA ONLY**

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**Laboratory Hits**
**Report: 470148**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/25/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| 02/28/2014 18:26 | PH (H3=past HT not compliant) | | 8.6 | | Units | 0.1 |
| 02/28/2014 08:07 | Sulfate | | 140 | 250 | mg/L | 2.5 |
| 03/01/2014 16:35 | Total Dissolved Solids (TDS) | | 530 | 500 | mg/L | 10 |
| | **201402250594** | **W25-735** | | | | |
| 02/28/2014 18:35 | Alkalinity in CaCO3 units | | 260 | | mg/L | 2 |
| 02/28/2014 08:20 | Chloride | | 33 | 250 | mg/L | 5 |
| 02/26/2014 13:19 | Chromium Total ICAP/MS | | 2.0 | 100 | ug/L | 1 |
| 02/26/2014 00:25 | Hexavalent chromium(Dissolved) | | 2.2 | | ug/L | 0.02 |
| 02/28/2014 18:35 | PH (H3=past HT not compliant) | | 7.9 | | Units | 0.1 |
| 02/28/2014 08:20 | Sulfate | | 110 | 250 | mg/L | 2.5 |
| 03/01/2014 16:40 | Total Dissolved Solids (TDS) | | 480 | 500 | mg/L | 10 |
| | **201402250595** | **W25-765** | | | | |
| 02/28/2014 18:44 | Alkalinity in CaCO3 units | | 280 | | mg/L | 2 |
| 02/28/2014 08:32 | Chloride | | 37 | 250 | mg/L | 5 |
| 02/28/2014 18:44 | PH (H3=past HT not compliant) | | 8.0 | | Units | 0.1 |
| 02/28/2014 08:32 | Sulfate | | 75 | 250 | mg/L | 2.5 |
| 03/01/2014 16:43 | Total Dissolved Solids (TDS) | | 450 | 500 | mg/L | 10 |
| 02/26/2014 13:22 | Uranium ICAP/MS | | 7.1 | 30 | ug/L | 1 |
| | **201402250596** | **W25-780** | | | | |
| 02/28/2014 18:52 | Alkalinity in CaCO3 units | | 260 | | mg/L | 2 |
| 02/28/2014 09:10 | Chloride | | 37 | 250 | mg/L | 5 |
| 02/28/2014 18:52 | PH (H3=past HT not compliant) | | 8.0 | | Units | 0.1 |
| 02/28/2014 09:10 | Sulfate | | 76 | 250 | mg/L | 2.5 |
| 03/01/2014 16:44 | Total Dissolved Solids (TDS) | | 460 | 500 | mg/L | 10 |
| | **201402250597** | **W25-795** | | | | |
| 02/28/2014 19:00 | Alkalinity in CaCO3 units | | 220 | | mg/L | 2 |
| 02/28/2014 09:23 | Chloride | | 36 | 250 | mg/L | 5 |
| 02/28/2014 19:00 | PH (H3=past HT not compliant) | | 8.0 | | Units | 0.1 |
| 02/28/2014 09:23 | Sulfate | | 73 | 250 | mg/L | 2.5 |
| 03/01/2014 16:45 | Total Dissolved Solids (TDS) | | 440 | 500 | mg/L | 10 |
| | **201402250598** | **W25-890** | | | | |
| 02/28/2014 19:08 | Alkalinity in CaCO3 units | | 270 | | mg/L | 2 |
| 02/28/2014 09:35 | Chloride | | 36 | 250 | mg/L | 5 |
| 02/28/2014 19:08 | PH (H3=past HT not compliant) | | 7.9 | | Units | 0.1 |
| 02/28/2014 09:35 | Sulfate | | 69 | 250 | mg/L | 2.5 |

**SUMMARY OF POSITIVE DATA ONLY**

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**Laboratory Hits**
**Report: 470148**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/25/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| 03/01/2014 16:46 | Total Dissolved Solids (TDS) | | 410 | 500 | mg/L | 10 |
| | **201402250599** | **WH25-2** | | | | |
| 02/28/2014 20:48 | Alkalinity in CaCO3 units | | 270 | | mg/L | 2 |
| 02/28/2014 09:48 | Chloride | | 32 | 250 | mg/L | 5 |
| 02/26/2014 13:33 | Chromium Total ICAP/MS | | 8.6 | 100 | ug/L | 1 |
| 02/25/2014 23:45 | Hexavalent chromium(Dissolved) | | 9.8 | | ug/L | 0.02 |
| 02/28/2014 20:48 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 02/28/2014 09:48 | Sulfate | | 130 | 250 | mg/L | 2.5 |
| 03/01/2014 16:47 | Total Dissolved Solids (TDS) | | 520 | 500 | mg/L | 10 |
| | **201402250600** | **WH25-3** | | | | |
| 02/28/2014 20:56 | Alkalinity in CaCO3 units | | 260 | | mg/L | 2 |
| 03/01/2014 01:56 | Chloride | | 32 | 250 | mg/L | 5 |
| 02/26/2014 13:48 | Chromium Total ICAP/MS | | 8.5 | 100 | ug/L | 1 |
| 02/26/2014 11:53 | Hexavalent chromium(Dissolved) | | 9.8 | | ug/L | 0.02 |
| 02/28/2014 20:56 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 03/01/2014 01:56 | Sulfate | | 130 | 250 | mg/L | 2.5 |
| 03/01/2014 16:48 | Total Dissolved Solids (TDS) | | 520 | 500 | mg/L | 10 |

**SUMMARY OF POSITIVE DATA ONLY**

eurofins Eaton Analytical

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**Laboratory Data Report: 470148**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on: 02/25/2014

| Prepared | Analyzed | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|
| **WH25-1 (201402250585)** | | | | | | **Sampled on 02/22/2014 1000** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 2/26/2014 | 02/26/2014 12:47 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | 8.9 | ug/L | 1 | 1 |
| 2/26/2014 | 02/26/2014 12:47 | 754053 | (EPA 200.8) | Uranium ICAP/MS | 6.7 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 02/26/2014 11:33 | 754283 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 9.7 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 02/28/2014 05:32 | 754599 | (EPA 300.0) | Chloride | 32 | mg/L | 5 | 5 |
| | 02/28/2014 05:32 | 754599 | (EPA 300.0) | Sulfate | 130 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 02/28/2014 16:03 | 754549 | (SM 2320B) | Alkalinity in CaCO3 units | 270 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 2/26/2014 | 02/27/2014 16:16 | 754309 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 530 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 02/28/2014 16:03 | 754564 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W25-500 (201402250586)** | | | | | | **Sampled on 02/22/2014 1339** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 2/26/2014 | 02/26/2014 12:50 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | 14 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 02/26/2014 10:33 | 754283 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 14 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 02/28/2014 05:45 | 754599 | (EPA 300.0) | Chloride | 49 | mg/L | 5 | 5 |
| | 02/28/2014 05:45 | 754599 | (EPA 300.0) | Sulfate | 72 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 02/28/2014 16:11 | 754549 | (SM 2320B) | Alkalinity in CaCO3 units | 270 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 2/26/2014 | 02/27/2014 16:19 | 754309 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 480 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 02/28/2014 16:11 | 754564 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.4 | Units | 0.1 | 1 |
| **W25-600 (201402250587)** | | | | | | **Sampled on 02/22/2014 1500** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 2/26/2014 | 02/26/2014 12:53 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | 8.6 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 02/26/2014 11:43 | 754283 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 9.8 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data Report: 470148**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on: 02/25/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| | 02/28/2014 | 05:58 | 754599 | (EPA 300.0) | Chloride | 32 | mg/L | 5 | 5 |
| | 02/28/2014 | 05:58 | 754599 | (EPA 300.0) | Sulfate | 130 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 16:19 | 754549 | (SM 2320B) | Alkalinity in CaCO3 units | 270 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 2/26/2014 | 02/27/2014 | 16:20 | 754309 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 530 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 02/28/2014 | 16:19 | 754564 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.9 | Units | 0.1 | 1 |
| **W25-630 (201402250588)** | | | | | | | **Sampled on 02/22/2014 1525** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 2/26/2014 | 03/11/2014 | 12:05 | 756492 | (EPA 200.8) | Chromium Total ICAP/MS | 8.7 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/26/2014 | 11:13 | 754283 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 9.6 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 02/28/2014 | 06:10 | 754599 | (EPA 300.0) | Chloride | 31 | mg/L | 5 | 5 |
| | 02/28/2014 | 06:10 | 754599 | (EPA 300.0) | Sulfate | 140 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 16:27 | 754549 | (SM 2320B) | Alkalinity in CaCO3 units | 270 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 2/26/2014 | 02/27/2014 | 16:21 | 754309 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 530 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 02/28/2014 | 16:27 | 754564 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W25-645 (201402250589)** | | | | | | | **Sampled on 02/22/2014 1555** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 2/26/2014 | 02/26/2014 | 12:58 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | 7.5 | ug/L | 1 | 1 |
| 2/26/2014 | 02/26/2014 | 12:58 | 754053 | (EPA 200.8) | Uranium ICAP/MS | 6.5 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/26/2014 | 11:23 | 754283 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 8.4 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 02/28/2014 | 06:23 | 754599 | (EPA 300.0) | Chloride | 30 | mg/L | 5 | 5 |
| | 02/28/2014 | 06:23 | 754599 | (EPA 300.0) | Sulfate | 140 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 16:35 | 754549 | (SM 2320B) | Alkalinity in CaCO3 units | 260 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 2/26/2014 | 02/27/2014 | 16:22 | 754309 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 540 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data**
**Report: 470148**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/25/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| | 02/28/2014 | 16:35 | 754564 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.5 | Units | 0.1 | 1 |
| **W25-675 (201402250590)** | | | | | | | **Sampled on 02/22/2014 1615** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 2/26/2014 | 02/26/2014 | 13:01 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | 6.2 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/25/2014 | 23:55 | 753894 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 7.8 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 02/28/2014 | 07:02 | 754599 | (EPA 300.0) | Chloride | 29 | mg/L | 5 | 5 |
| | 02/28/2014 | 07:02 | 754599 | (EPA 300.0) | Sulfate | 140 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 16:43 | 754549 | (SM 2320B) | Alkalinity in CaCO3 units | 270 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 2/26/2014 | 02/27/2014 | 16:23 | 754309 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 530 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 02/28/2014 | 16:43 | 754564 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W25-690 (201402250591)** | | | | | | | **Sampled on 02/22/2014 1640** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 2/26/2014 | 02/26/2014 | 13:04 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | 5.3 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/26/2014 | 12:13 | 754283 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 6.6 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 02/28/2014 | 07:41 | 754599 | (EPA 300.0) | Chloride | 29 | mg/L | 5 | 5 |
| | 02/28/2014 | 07:41 | 754599 | (EPA 300.0) | Sulfate | 140 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 18:09 | 754551 | (SM 2320B) | Alkalinity in CaCO3 units | 250 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/1/2014 | 03/01/2014 | 16:33 | 754713 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 530 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 02/28/2014 | 18:09 | 754554 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.5 | Units | 0.1 | 1 |
| **W25-705 (201402250592)** | | | | | | | **Sampled on 02/22/2014 1710** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 2/26/2014 | 02/26/2014 | 13:13 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | 5.5 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/26/2014 | 12:03 | 754283 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 6.4 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data**
**Report: 470148**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/25/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| | 02/28/2014 | 07:54 | 754599 | (EPA 300.0) | Chloride | 29 | mg/L | 5 | 5 |
| | 02/28/2014 | 07:54 | 754599 | (EPA 300.0) | Sulfate | 140 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 18:18 | 754551 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/1/2014 | 03/01/2014 | 16:34 | 754713 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 530 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 02/28/2014 | 18:18 | 754554 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.6 | Units | 0.1 | 1 |
| **W25-720 (201402250593)** | | | | | | **Sampled on 02/22/2014 1735** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 2/26/2014 | 02/26/2014 | 13:16 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | 4.9 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/25/2014 | 23:25 | 753894 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 5.4 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 02/28/2014 | 08:07 | 754599 | (EPA 300.0) | Chloride | 30 | mg/L | 5 | 5 |
| | 02/28/2014 | 08:07 | 754599 | (EPA 300.0) | Sulfate | 140 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 18:26 | 754551 | (SM 2320B) | Alkalinity in CaCO3 units | 270 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/1/2014 | 03/01/2014 | 16:35 | 754713 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 530 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 02/28/2014 | 18:26 | 754554 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.6 | Units | 0.1 | 1 |
| **W25-735 (201402250594)** | | | | | | **Sampled on 02/24/2014 1015** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 2/26/2014 | 02/26/2014 | 13:19 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | 2.0 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/26/2014 | 00:25 | 753894 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 2.2 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 02/28/2014 | 08:20 | 754599 | (EPA 300.0) | Chloride | 33 | mg/L | 5 | 5 |
| | 02/28/2014 | 08:20 | 754599 | (EPA 300.0) | Sulfate | 110 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 18:35 | 754551 | (SM 2320B) | Alkalinity in CaCO3 units | 260 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/1/2014 | 03/01/2014 | 16:40 | 754713 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 480 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 02/28/2014 | 18:35 | 754554 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.9 | Units | 0.1 | 1 |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data**
**Report: 470148**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/25/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| **W25-765 (201402250595)** | | | | | | **Sampled on 02/24/2014 1055** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 2/26/2014 | 02/26/2014 | 13:22 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | ND | ug/L | 1 | 1 |
| 2/26/2014 | 02/26/2014 | 13:22 | 754053 | (EPA 200.8) | Uranium ICAP/MS | 7.1 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/26/2014 | 00:15 | 753894 | (EPA 218.6) | Hexavalent chromium(Dissolved) | ND | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 02/28/2014 | 08:32 | 754599 | (EPA 300.0) | Chloride | 37 | mg/L | 5 | 5 |
| | 02/28/2014 | 08:32 | 754599 | (EPA 300.0) | Sulfate | 75 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 18:44 | 754551 | (SM 2320B) | Alkalinity in CaCO3 units | 280 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/1/2014 | 03/01/2014 | 16:43 | 754713 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 450 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 02/28/2014 | 18:44 | 754554 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.0 | Units | 0.1 | 1 |
| **W25-780 (201402250596)** | | | | | | **Sampled on 02/24/2014 1115** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 2/26/2014 | 02/26/2014 | 13:25 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | ND | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/26/2014 | 00:05 | 753894 | (EPA 218.6) | Hexavalent chromium(Dissolved) | ND | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 02/28/2014 | 09:10 | 754599 | (EPA 300.0) | Chloride | 37 | mg/L | 5 | 5 |
| | 02/28/2014 | 09:10 | 754599 | (EPA 300.0) | Sulfate | 76 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 18:52 | 754551 | (SM 2320B) | Alkalinity in CaCO3 units | 260 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/1/2014 | 03/01/2014 | 16:44 | 754713 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 460 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 02/28/2014 | 18:52 | 754554 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.0 | Units | 0.1 | 1 |
| **W25-795 (201402250597)** | | | | | | **Sampled on 02/24/2014 1150** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 2/26/2014 | 02/26/2014 | 13:28 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | ND | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/25/2014 | 23:35 | 753894 | (EPA 218.6) | Hexavalent chromium(Dissolved) | ND | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data**
**Report: 470148**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/25/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| | 02/28/2014 | 09:23 | 754599 | (EPA 300.0) | Chloride | 36 | mg/L | 5 | 5 |
| | 02/28/2014 | 09:23 | 754599 | (EPA 300.0) | Sulfate | 73 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 19:00 | 754551 | (SM 2320B) | Alkalinity in CaCO3 units | 220 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/1/2014 | 03/01/2014 | 16:45 | 754713 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 440 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 02/28/2014 | 19:00 | 754554 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.0 | Units | 0.1 | 1 |
| **W25-890 (201402250598)** | | | | | | | **Sampled on 02/24/2014 1220** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 2/26/2014 | 02/26/2014 | 13:31 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | ND | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/26/2014 | 11:03 | 754283 | (EPA 218.6) | Hexavalent chromium(Dissolved) | ND | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 02/28/2014 | 09:35 | 754599 | (EPA 300.0) | Chloride | 36 | mg/L | 5 | 5 |
| | 02/28/2014 | 09:35 | 754599 | (EPA 300.0) | Sulfate | 69 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 19:08 | 754551 | (SM 2320B) | Alkalinity in CaCO3 units | 270 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/1/2014 | 03/01/2014 | 16:46 | 754713 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 410 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 02/28/2014 | 19:08 | 754554 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.9 | Units | 0.1 | 1 |
| **WH25-2 (201402250599)** | | | | | | | **Sampled on 02/24/2014 1255** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 2/26/2014 | 02/26/2014 | 13:33 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | 8.6 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/25/2014 | 23:45 | 753894 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 9.8 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 02/28/2014 | 09:48 | 754599 | (EPA 300.0) | Chloride | 32 | mg/L | 5 | 5 |
| | 02/28/2014 | 09:48 | 754599 | (EPA 300.0) | Sulfate | 130 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 20:48 | 754551 | (SM 2320B) | Alkalinity in CaCO3 units | 270 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/1/2014 | 03/01/2014 | 16:47 | 754713 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 520 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 02/28/2014 | 20:48 | 754554 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data Report: 470148**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
02/25/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| **WH25-3 (201402250600)** | | | | | | **Sampled on 02/24/2014 1300** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 2/26/2014 | 02/26/2014 | 13:48 | 754053 | (EPA 200.8) | Chromium Total ICAP/MS | 8.5 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 02/26/2014 | 11:53 | 754283 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 9.8 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 03/01/2014 | 01:56 | 754730 | (EPA 300.0) | Chloride | 32 | mg/L | 5 | 5 |
| | 03/01/2014 | 01:56 | 754730 | (EPA 300.0) | Sulfate | 130 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 02/28/2014 | 20:56 | 754551 | (SM 2320B) | Alkalinity in CaCO3 units | 260 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/1/2014 | 03/01/2014 | 16:48 | 754713 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 520 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 02/28/2014 | 20:56 | 754554 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory**
**QC Summary: 470148**

Santa Ynez River WCD

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**QC Ref # 753894 - Hexavalent chromium(Dissolved)** — **Analysis Date: 02/25/2014**

| | | |
|---|---|---|
| 201402250590 | W25-675 | Analyzed by: TLH |
| 201402250593 | W25-720 | Analyzed by: TLH |
| 201402250594 | W25-735 | Analyzed by: TLH |
| 201402250595 | W25-765 | Analyzed by: TLH |
| 201402250596 | W25-780 | Analyzed by: TLH |
| 201402250597 | W25-795 | Analyzed by: TLH |
| 201402250599 | WH25-2 | Analyzed by: TLH |

**QC Ref # 754053 - ICPMS Metals** — **Analysis Date: 02/26/2014**

| | | |
|---|---|---|
| 201402250585 | WH25-1 | Analyzed by: SXK |
| 201402250586 | W25-500 | Analyzed by: SXK |
| 201402250587 | W25-600 | Analyzed by: SXK |
| 201402250589 | W25-645 | Analyzed by: SXK |
| 201402250590 | W25-675 | Analyzed by: SXK |
| 201402250591 | W25-690 | Analyzed by: SXK |
| 201402250592 | W25-705 | Analyzed by: SXK |
| 201402250593 | W25-720 | Analyzed by: SXK |
| 201402250594 | W25-735 | Analyzed by: SXK |
| 201402250595 | W25-765 | Analyzed by: SXK |
| 201402250596 | W25-780 | Analyzed by: SXK |
| 201402250597 | W25-795 | Analyzed by: SXK |
| 201402250598 | W25-890 | Analyzed by: SXK |
| 201402250599 | WH25-2 | Analyzed by: SXK |
| 201402250600 | WH25-3 | Analyzed by: SXK |

**QC Ref # 754283 - Hexavalent chromium(Dissolved)** — **Analysis Date: 02/26/2014**

| | | |
|---|---|---|
| 201402250585 | WH25-1 | Analyzed by: TLH |
| 201402250586 | W25-500 | Analyzed by: TLH |
| 201402250587 | W25-600 | Analyzed by: TLH |
| 201402250588 | W25-630 | Analyzed by: TLH |
| 201402250589 | W25-645 | Analyzed by: TLH |
| 201402250591 | W25-690 | Analyzed by: TLH |
| 201402250592 | W25-705 | Analyzed by: TLH |
| 201402250598 | W25-890 | Analyzed by: TLH |
| 201402250600 | WH25-3 | Analyzed by: TLH |

**QC Ref # 754309 - Total Dissolved Solids (TDS)** — **Analysis Date: 02/27/2014**

| | | |
|---|---|---|
| 201402250585 | WH25-1 | Analyzed by: JRF |
| 201402250586 | W25-500 | Analyzed by: JRF |
| 201402250587 | W25-600 | Analyzed by: JRF |
| 201402250588 | W25-630 | Analyzed by: JRF |
| 201402250589 | W25-645 | Analyzed by: JRF |
| 201402250590 | W25-675 | Analyzed by: JRF |

**QC Ref # 754549 - Alkalinity in CaCO3 units** — **Analysis Date: 02/28/2014**

| | | |
|---|---|---|
| 201402250585 | WH25-1 | Analyzed by: AF1 |
| 201402250586 | W25-500 | Analyzed by: AF1 |

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| | | |
|---|---|---|
| 201402250587 | W25-600 | Analyzed by: AF1 |
| 201402250588 | W25-630 | Analyzed by: AF1 |
| 201402250589 | W25-645 | Analyzed by: AF1 |
| 201402250590 | W25-675 | Analyzed by: AF1 |

**QC Ref # 754551 - Alkalinity in CaCO3 units** **Analysis Date: 02/28/2014**

| | | |
|---|---|---|
| 201402250591 | W25-690 | Analyzed by: AF1 |
| 201402250592 | W25-705 | Analyzed by: AF1 |
| 201402250593 | W25-720 | Analyzed by: AF1 |
| 201402250594 | W25-735 | Analyzed by: AF1 |
| 201402250595 | W25-765 | Analyzed by: AF1 |
| 201402250596 | W25-780 | Analyzed by: AF1 |
| 201402250597 | W25-795 | Analyzed by: AF1 |
| 201402250598 | W25-890 | Analyzed by: AF1 |
| 201402250599 | WH25-2 | Analyzed by: AF1 |
| 201402250600 | WH25-3 | Analyzed by: AF1 |

**QC Ref # 754554 - PH (H3=past HT not compliant)** **Analysis Date: 02/28/2014**

| | | |
|---|---|---|
| 201402250591 | W25-690 | Analyzed by: AF1 |
| 201402250592 | W25-705 | Analyzed by: AF1 |
| 201402250593 | W25-720 | Analyzed by: AF1 |
| 201402250594 | W25-735 | Analyzed by: AF1 |
| 201402250595 | W25-765 | Analyzed by: AF1 |
| 201402250596 | W25-780 | Analyzed by: AF1 |
| 201402250597 | W25-795 | Analyzed by: AF1 |
| 201402250598 | W25-890 | Analyzed by: AF1 |
| 201402250599 | WH25-2 | Analyzed by: AF1 |
| 201402250600 | WH25-3 | Analyzed by: AF1 |

**QC Ref # 754564 - PH (H3=past HT not compliant)** **Analysis Date: 02/28/2014**

| | | |
|---|---|---|
| 201402250585 | WH25-1 | Analyzed by: AF1 |
| 201402250586 | W25-500 | Analyzed by: AF1 |
| 201402250587 | W25-600 | Analyzed by: AF1 |
| 201402250588 | W25-630 | Analyzed by: AF1 |
| 201402250589 | W25-645 | Analyzed by: AF1 |
| 201402250590 | W25-675 | Analyzed by: AF1 |

**QC Ref # 754599 - Chloride, Sulfate by EPA 300.0** **Analysis Date: 02/28/2014**

| | | |
|---|---|---|
| 201402250585 | WH25-1 | Analyzed by: CYP |
| 201402250586 | W25-500 | Analyzed by: CYP |
| 201402250587 | W25-600 | Analyzed by: CYP |
| 201402250588 | W25-630 | Analyzed by: CYP |
| 201402250589 | W25-645 | Analyzed by: CYP |
| 201402250590 | W25-675 | Analyzed by: CYP |
| 201402250591 | W25-690 | Analyzed by: CYP |
| 201402250592 | W25-705 | Analyzed by: CYP |
| 201402250593 | W25-720 | Analyzed by: CYP |
| 201402250594 | W25-735 | Analyzed by: CYP |

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Santa Ynez River WCD

| | | |
|---|---|---|
| 201402250595 | W25-765 | Analyzed by: CYP |
| 201402250596 | W25-780 | Analyzed by: CYP |
| 201402250597 | W25-795 | Analyzed by: CYP |
| 201402250598 | W25-890 | Analyzed by: CYP |
| 201402250599 | WH25-2 | Analyzed by: CYP |

**QC Ref # 754713 - Total Dissolved Solids (TDS)** **Analysis Date: 03/01/2014**

| | | |
|---|---|---|
| 201402250591 | W25-690 | Analyzed by: JRF |
| 201402250592 | W25-705 | Analyzed by: JRF |
| 201402250593 | W25-720 | Analyzed by: JRF |
| 201402250594 | W25-735 | Analyzed by: JRF |
| 201402250595 | W25-765 | Analyzed by: JRF |
| 201402250596 | W25-780 | Analyzed by: JRF |
| 201402250597 | W25-795 | Analyzed by: JRF |
| 201402250598 | W25-890 | Analyzed by: JRF |
| 201402250599 | WH25-2 | Analyzed by: JRF |
| 201402250600 | WH25-3 | Analyzed by: JRF |

**QC Ref # 754730 - Chloride, Sulfate by EPA 300.0** **Analysis Date: 03/01/2014**

| | | |
|---|---|---|
| 201402250600 | WH25-3 | Analyzed by: CYP |

**QC Ref # 755674 - ICPMS Metals** **Analysis Date: 03/06/2014**

| | | |
|---|---|---|
| 201402250588 | W25-630 | Analyzed by: SXK |

**QC Ref # 756492 - ICPMS Metals** **Analysis Date: 03/11/2014**

| | | |
|---|---|---|
| 201402250588 | W25-630 | Analyzed by: SXK |

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**Laboratory QC Report: 470148**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| **QC Ref# 753894 - Hexavalent chromium(Dissolved) by EPA 218.6** | | | | | | **Analysis Date: 02/25/2014** | | | |
| LCS1 | Hexavalent chromium(Dissolved) | | 2.0 | 1.98 | ug/L | 99 | (90-110) | | |
| LCS2 | Hexavalent chromium(Dissolved) | | 2.0 | 1.99 | ug/L | 99 | (90-110) | | |
| MBLK | Hexavalent chromium(Dissolved) | | | <0.020 | ug/L | | | | |
| MRL_CHK | Hexavalent chromium(Dissolved) | | 0.02 | 0.0216 | ug/L | 108 | (50-150) | | |
| MS_201402240246 | Hexavalent chromium(Dissolved) | 3.4 | 2.0 | 5.37 | ug/L | 101 | (90-110) | | |
| MS_201402250550 | Hexavalent chromium(Dissolved) | 8.6 | 2.0 | 10.6 | ug/L | 104 | (90-110) | | |
| MSD_201402240246 | Hexavalent chromium(Dissolved) | 3.4 | 2.0 | 5.41 | ug/L | 103 | (90-110) | 20 | 0.74 |
| MSD_201402250550 | Hexavalent chromium(Dissolved) | 8.6 | 2.0 | 10.6 | ug/L | 103 | (90-110) | 20 | 0.0 |
| **QC Ref# 754053 - ICPMS Metals by EPA 200.8** | | | | | | **Analysis Date: 02/26/2014** | | | |
| LCS1 | Chromium Total ICAP/MS | | 100 | 103 | ug/L | 103 | (85-115) | | |
| LCS2 | Chromium Total ICAP/MS | | 100 | 103 | ug/L | 103 | (85-115) | 20 | 0.0 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 0.950 | ug/L | 95 | (50-150) | | |
| MS_201402250599 | Chromium Total ICAP/MS | 8.6 | 100 | 111 | ug/L | 102 | (70-130) | | |
| MS2_201402250600 | Chromium Total ICAP/MS | 8.5 | 100 | 115 | ug/L | 106 | (70-130) | | |
| MSD_201402250599 | Chromium Total ICAP/MS | 8.6 | 100 | 106 | ug/L | 97 | (70-130) | 20 | 4.6 |
| MSD2_201402250600 | Chromium Total ICAP/MS | 8.5 | 100 | 113 | ug/L | 105 | (70-130) | 20 | 1.8 |
| LCS1 | Uranium ICAP/MS | | 20 | 20.0 | ug/L | 100 | (85-115) | | |
| LCS2 | Uranium ICAP/MS | | 20 | 19.8 | ug/L | 99 | (85-115) | 20 | 1.0 |
| MBLK | Uranium ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Uranium ICAP/MS | | 1.0 | 1.04 | ug/L | 104 | (50-150) | | |
| MS_201402250599 | Uranium ICAP/MS | 6.7 | 20 | 29.3 | ug/L | 113 | (70-130) | | |
| MS2_201402250600 | Uranium ICAP/MS | 6.5 | 20 | 29.7 | ug/L | 116 | (70-130) | | |
| MSD_201402250599 | Uranium ICAP/MS | 6.7 | 20 | 26.9 | ug/L | 101 | (70-130) | 20 | 8.5 |
| MSD2_201402250600 | Uranium ICAP/MS | 6.5 | 20 | 28.8 | ug/L | 111 | (70-130) | 20 | 3.1 |
| **QC Ref# 754283 - Hexavalent chromium(Dissolved) by EPA 218.6** | | | | | | **Analysis Date: 02/26/2014** | | | |
| LCS1 | Hexavalent chromium(Dissolved) | | 2.0 | 1.99 | ug/L | 100 | (90-110) | | |
| LCS2 | Hexavalent chromium(Dissolved) | | 2.0 | 1.99 | ug/L | 99 | (90-110) | | |
| MBLK | Hexavalent chromium(Dissolved) | | | <0.020 | ug/L | | | | |
| MRL_CHK | Hexavalent chromium(Dissolved) | | 0.02 | 0.0202 | ug/L | 101 | (50-150) | | |
| MS_201402250586 | Hexavalent chromium(Dissolved) | 14 | 2.0 | 15.6 | ug/L | 101 | (90-110) | | |
| MS_201402260372 | Hexavalent chromium(Dissolved) | 9.6 | 2.0 | 11.7 | ug/L | 101 | (90-110) | | |
| MSD_201402250586 | Hexavalent chromium(Dissolved) | 14 | 2.0 | 15.7 | ug/L | 102 | (90-110) | 20 | 0.0 |
| MSD_201402260372 | Hexavalent chromium(Dissolved) | 9.6 | 2.0 | 11.7 | ug/L | 102 | (90-110) | 20 | 0.0 |
| **QC Ref# 754309 - Total Dissolved Solids (TDS) by E160.1/SM2540C** | | | | | | **Analysis Date: 02/27/2014** | | | |

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by <u>Underlining.</u>
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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**Laboratory QC**
**Report: 470148**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| DUP_201402200457 | Total Dissolved Solid (TDS) | 760 | | 754 | mg/L | | (0-20) | 20 | 1.1 |
| DUP_201402250585 | Total Dissolved Solid (TDS) | 530 | | 530 | mg/L | | (0-20) | 20 | 0.76 |
| LCS1 | Total Dissolved Solid (TDS) | | 175 | 160 | mg/L | 91 | (80-114) | | |
| LCS2 | Total Dissolved Solid (TDS) | | 700 | 690 | mg/L | 99 | (80-114) | | |
| MBLK | Total Dissolved Solid (TDS) | | | <10 | mg/L | | | | |
| MRL_CHK | Total Dissolved Solid (TDS) | | 10 | 8.00 | mg/L | 80 | (50-150) | | |
| **QC Ref# 754549 - Alkalinity in CaCO3 units by SM 2320B** | | | | | | **Analysis Date: 02/28/2014** | | | |
| LCS1 | Alkalinity in CaCO3 units | | 100 | 97.3 | mg/L | 97 | (90-110) | | |
| LCS2 | Alkalinity in CaCO3 units | | 100 | 99.0 | mg/L | 99 | (90-110) | 20 | 1.7 |
| MBLK | Alkalinity in CaCO3 units | | | <2 | mg/L | | | | |
| MRL_CHK | Alkalinity in CaCO3 units | | 2.0 | 2.88 | mg/L | 144 | (50-150) | | |
| MS_201402250609 | Alkalinity in CaCO3 units | ND | 100 | 92.4 | mg/L | 91 | (80-120) | | |
| MS_201402260735 | Alkalinity in CaCO3 units | 170 | 100 | 278 | mg/L | 106 | (80-120) | | |
| MSD_201402250609 | Alkalinity in CaCO3 units | ND | 100 | 92.5 | mg/L | 91 | (80-120) | 20 | 0.0 |
| MSD_201402260735 | Alkalinity in CaCO3 units | 170 | 100 | 278 | mg/L | 106 | (80-120) | 20 | 0.0 |
| **QC Ref# 754551 - Alkalinity in CaCO3 units by SM 2320B** | | | | | | **Analysis Date: 02/28/2014** | | | |
| LCS1 | Alkalinity in CaCO3 units | | 100 | 94.8 | mg/L | 95 | (90-110) | | |
| LCS2 | Alkalinity in CaCO3 units | | 100 | 101 | mg/L | 101 | (90-110) | 20 | 6.3 |
| MBLK | Alkalinity in CaCO3 units | | | <2 | mg/L | | | | |
| MRL_CHK | Alkalinity in CaCO3 units | | 2.0 | 2.74 | mg/L | 137 | (50-150) | | |
| MS_201402250389 | Alkalinity in CaCO3 units | 11 | 100 | 101 | mg/L | 90 | (80-120) | | |
| MS_201402270107 | Alkalinity in CaCO3 units | 22 | 100 | 108 | mg/L | 86 | (80-120) | | |
| MSD_201402250389 | Alkalinity in CaCO3 units | 11 | 100 | 101 | mg/L | 90 | (80-120) | 20 | 0.0 |
| MSD_201402270107 | Alkalinity in CaCO3 units | 22 | 100 | 110 | mg/L | 88 | (80-120) | 20 | 1.8 |
| **QC Ref# 754554 - PH (H3=past HT not compliant) by SM4500-HB** | | | | | | **Analysis Date: 02/28/2014** | | | |
| DUP_201402260756 | PH (H3=past HT not compliant) | 7.9 | | 7.86 | Units | | (0-20) | 20 | 0.0 |
| DUP2_201402260804 | PH (H3=past HT not compliant) | 5.6 | | 5.55 | Units | | (0-20) | 20 | 1.8 |
| LCS1 | PH (H3=past HT not compliant) | | 6.0 | 6.01 | Units | 100 | (98-102) | | |
| LCS2 | PH (H3=past HT not compliant) | | 6.0 | 6.01 | Units | 100 | (98-102) | 20 | 0.0 |
| **QC Ref# 754564 - PH (H3=past HT not compliant) by SM4500-HB** | | | | | | **Analysis Date: 02/28/2014** | | | |
| DUP_201402260735 | PH (H3=past HT not compliant) | 7.8 | | 7.81 | Units | | (0-20) | 20 | 0.13 |
| DUP2_201402250564 | PH (H3=past HT not compliant) | 5.5 | | 5.45 | Units | | (0-20) | 20 | 1.5 |
| LCS1 | PH (H3=past HT not compliant) | | 6.0 | 6.01 | Units | 100 | (98-102) | | |
| LCS2 | PH (H3=past HT not compliant) | | 6.0 | 6.01 | Units | 100 | (98-102) | 20 | 0.0 |
| **QC Ref# 754599 - Chloride, Sulfate by EPA 300.0 by EPA 300.0** | | | | | | **Analysis Date: 02/28/2014** | | | |
| LCS1 | Chloride | | 25 | 26.0 | mg/L | 104 | (90-110) | | |

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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**Laboratory QC Report: 470148**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| LCS2 | Chloride | | 25 | 26.7 | mg/L | 107 | (90-110) | 20 | 2.7 |
| MBLK | Chloride | | | <0.5 | mg/L | | | | |
| MRL_CHK | Chloride | | 0.5 | 0.424 | mg/L | 85 | (50-150) | | |
| MS_201402250590 | Chloride | 29 | 13 | 95.9 | mg/L | 107 | (80-120) | | |
| MS_201402270110 | Chloride | 3.6 | 13 | 17.3 | mg/L | 110 | (80-120) | | |
| MSD_201402250590 | Chloride | 29 | 13 | 96.0 | mg/L | 108 | (80-120) | 20 | 0.21 |
| MSD_201402270110 | Chloride | 3.6 | 13 | 17.3 | mg/L | 110 | (80-120) | 20 | 0.0 |
| LCS1 | Sulfate | | 50 | 51.2 | mg/L | 103 | (90-110) | | |
| LCS2 | Sulfate | | 50 | 52.4 | mg/L | 105 | (90-110) | 20 | 2.1 |
| MBLK | Sulfate | | | <0.25 | mg/L | | | | |
| MRL_CHK | Sulfate | | 1.0 | 0.961 | mg/L | 96 | (50-150) | | |
| MRLLW | Sulfate | | 0.25 | 0.248 | mg/L | 99 | (50-150) | | |
| MS_201402250590 | Sulfate | 140 | 25 | 274 | mg/L | 103 | (80-120) | | |
| MS_201402270110 | Sulfate | 11 | 25 | 37.4 | mg/L | 106 | (80-120) | | |
| MSD_201402250590 | Sulfate | 140 | 25 | 276 | mg/L | 104 | (80-120) | 20 | 0.73 |
| MSD_201402270110 | Sulfate | 11 | 25 | 37.4 | mg/L | 106 | (80-120) | 20 | 0.0 |
| **QC Ref# 754713 - Total Dissolved Solids (TDS) by E160.1/SM2540C** | | | | | | **Analysis Date: 03/01/2014** | | | |
| DUP_201402240236 | Total Dissolved Solid (TDS) | 570 | | 564 | mg/L | | (0-20) | 20 | 1.1 |
| DUP_201402270307 | Total Dissolved Solid (TDS) | 1200 | | 1190 | mg/L | | (0-20) | 20 | 3.1 |
| LCS1 | Total Dissolved Solid (TDS) | | 175 | 164 | mg/L | 94 | (80-114) | | |
| LCS2 | Total Dissolved Solid (TDS) | | 700 | 660 | mg/L | 94 | (80-114) | | |
| MBLK | Total Dissolved Solid (TDS) | | | <10 | mg/L | | | | |
| MRL_CHK | Total Dissolved Solid (TDS) | | 10 | 8.00 | mg/L | 80 | (50-150) | | |
| **QC Ref# 754730 - Chloride, Sulfate by EPA 300.0 by EPA 300.0** | | | | | | **Analysis Date: 02/28/2014** | | | |
| LCS1 | Chloride | | 25 | 26.1 | mg/L | 105 | (90-110) | | |
| LCS2 | Chloride | | 25 | 26.2 | mg/L | 105 | (90-110) | 20 | 0.38 |
| MBLK | Chloride | | | <0.5 | mg/L | | | | |
| MRL_CHK | Chloride | | 0.5 | 0.419 | mg/L | 84 | (50-150) | | |
| MS_201402270181 | Chloride | 820 | 13 | 1490 | mg/L | 107 | (80-120) | | |
| MS_201403010071 | Chloride | 4.0 | 13 | 17.7 | mg/L | 110 | (80-120) | | |
| MSD_201402270181 | Chloride | 820 | 13 | 1500 | mg/L | 108 | (80-120) | 20 | 0.67 |
| MSD_201403010071 | Chloride | 4.0 | 13 | 17.8 | mg/L | 111 | (80-120) | 20 | 0.56 |
| LCS1 | Sulfate | | 50 | 51.6 | mg/L | 103 | (90-110) | | |
| LCS2 | Sulfate | | 50 | 51.7 | mg/L | 103 | (90-110) | 20 | 0.19 |
| MBLK | Sulfate | | | <0.25 | mg/L | | | | |
| MRL_CHK | Sulfate | | 1.0 | 0.975 | mg/L | 98 | (50-150) | | |
| MRLLW | Sulfate | | 0.25 | 0.266 | mg/L | 106 | (50-150) | | |

Spike recovery is already corrected for native results.
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Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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(I) - Indicates internal standard compound.

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**Laboratory QC Report: 470148**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| MS_201402270181 | Sulfate | 370 | 25 | 1670 | mg/L | 104 | (80-120) | | |
| MS_201403010071 | Sulfate | 2.1 | 25 | 28.3 | mg/L | 105 | (80-120) | | |
| MSD_201402270181 | Sulfate | 370 | 25 | 1680 | mg/L | 105 | (80-120) | 20 | 0.60 |
| MSD_201403010071 | Sulfate | 2.1 | 25 | 28.6 | mg/L | 106 | (80-120) | 20 | 1.1 |

**QC Ref# 755674 - ICPMS Metals by EPA 200.8** **Analysis Date: 03/06/2014**

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| LCS1 | Chromium Total ICAP/MS | | 100 | 101 | ug/L | 101 | (85-115) | | |
| LCS2 | Chromium Total ICAP/MS | | 100 | 101 | ug/L | 101 | (85-115) | 20 | 0.0 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 0.990 | ug/L | 99 | (50-150) | | |
| MS_201402250588 | Chromium Total ICAP/MS | 8.7 | 200 | 181 | ug/L | 86 | (70-130) | | |
| MS2_201402210367 | Chromium Total ICAP/MS | ND | 100 | 105 | ug/L | 105 | (70-130) | | |
| MSD_201402250588 | Chromium Total ICAP/MS | 8.7 | 100 | 117 | ug/L | 109 | (70-130) | 20 | **43** |
| MSD2_201402210367 | Chromium Total ICAP/MS | ND | 100 | 98.2 | ug/L | 98 | (70-130) | 20 | 6.7 |
| LCS1 | Uranium ICAP/MS | | 20 | 18.9 | ug/L | 95 | (85-115) | | |
| LCS2 | Uranium ICAP/MS | | 20 | 19.4 | ug/L | 97 | (85-115) | 20 | 2.6 |
| MBLK | Uranium ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Uranium ICAP/MS | | 1.0 | 0.878 | ug/L | 88 | (50-150) | | |
| MS_201402250588 | Uranium ICAP/MS | 5.9 | 40 | 43.1 | ug/L | 93 | (70-130) | | |
| MS2_201402210367 | Uranium ICAP/MS | ND | 20 | 24.8 | ug/L | 124 | (70-130) | | |
| MSD_201402250588 | Uranium ICAP/MS | 5.9 | 20 | 29.1 | ug/L | 116 | (70-130) | 20 | **39** |
| MSD2_201402210367 | Uranium ICAP/MS | ND | 20 | 22.9 | ug/L | 115 | (70-130) | 20 | 8.0 |

**QC Ref# 756492 - ICPMS Metals by EPA 200.8** **Analysis Date: 03/11/2014**

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| LCS1 | Chromium Total ICAP/MS | | 100 | 105 | ug/L | 105 | (85-115) | | |
| LCS2 | Chromium Total ICAP/MS | | 100 | 108 | ug/L | 108 | (85-115) | 20 | 2.8 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 1.08 | ug/L | 108 | (50-150) | | |
| MS_201402280083 | Chromium Total ICAP/MS | ND | 100 | 91.7 | ug/L | 92 | (70-130) | | |
| MS2_201402280085 | Chromium Total ICAP/MS | ND | 100 | 99.6 | ug/L | 100 | (70-130) | | |
| MSD_201402280083 | Chromium Total ICAP/MS | ND | 100 | 103 | ug/L | 103 | (70-130) | 20 | 12 |
| MSD2_201402280085 | Chromium Total ICAP/MS | ND | 100 | 103 | ug/L | 103 | (70-130) | 20 | 3.4 |
| LCS1 | Uranium ICAP/MS | | 20 | 20.6 | ug/L | 103 | (85-115) | | |
| LCS2 | Uranium ICAP/MS | | 20 | 20.3 | ug/L | 101 | (85-115) | 20 | 1.5 |
| MBLK | Uranium ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Uranium ICAP/MS | | 1.0 | 1.13 | ug/L | 113 | (50-150) | | |
| MS_201402280083 | Uranium ICAP/MS | ND | 20 | 16.8 | ug/L | 84 | (70-130) | | |
| MS2_201402280085 | Uranium ICAP/MS | ND | 20 | 19.2 | ug/L | 96 | (70-130) | | |
| MSD_201402280083 | Uranium ICAP/MS | ND | 20 | 19.8 | ug/L | 99 | (70-130) | 20 | 17 |

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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**Laboratory QC
Report: 470148**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| MSD2_201402280085 | Uranium ICAP/MS | ND | 20 | 20.4 | ug/L | 102 | (70-130) | 20 | 6.1 |

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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ORELAP 4034

AT-1807

# Laboratory Report

for

Santa Ynez River WCD
Post Office Box 157
Santa Ynez, CA  93460
Attention: Eric Tambini
Fax: 805-688-3078

Date of Issue
07/10/2014
EUROFINS EATON ANALYTICAL

FWH: Fred Haley

Project Manager

Report: 487417
Project: CHROMIUM
Group: well sampling

* Accredited in accordance with TNI 2009 and ISO/IEC 17025:2005.
* Laboratory certifies that the test results meet all **TNI 2009 and ISO/IEC 17025:2005** requirements unless noted under the individual analysis.
* Following the cover page are State Certification List, ISO 17025 Accredited Method List, Acknowledgement of Samples Received, Comments, Hits Report, Data Report, QC Summary, QC Report and Regulatory Forms, as applicable.
* Test results relate only to the sample(s) tested.

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# STATE CERTIFICATION LIST

| State | Certification Number | State | Certification Number |
|---|---|---|---|
| **Alabama** | 41060 | **Mississippi** | Certified |
| **Alaska** | CA00006 | **Montana** | Cert 0035 |
| **Arizona** | AZ0778 | **Nebraska** | Certified |
| **Arkansas** | Certified | **Nevada** | CA00006-2014-1 |
| **California-Monrovia-ELAP** | 2813 | **New Hampshire *** | 2959 |
| **California-Colton- ELAP** | 2812 | **New Jersey *** | CA 008 |
| **California-Folsom- ELAP** | 2820 | **New Mexico** | Certified |
| **Colorado** | Certified | **New York *** | 11320 |
| **Connecticut** | PH-0107 | **North Carolina** | 06701 |
| **Delaware** | CA 006 | **North Dakota** | R-009 |
| **Florida *** | E871024 | **Oregon (Primary AB) *** | **ORELAP 4034** |
| **Georgia** | 947 | **Pennsylvania *** | 68-565 |
| **Guam** | 14-003r | **Rhode Island** | LAO00326 |
| **Hawaii** | Certified | **South Carolina** | 87016 |
| **Idaho** | Certified | **South Dakota** | Certified |
| **Illinois *** | 200033 | **Tennessee** | TN02839 |
| **Indiana** | C-CA-01 | **Texas *** | T104704230-14-6 |
| **Kansas *** | E-10268 | **Utah *** | CA000062014-7 |
| **Kentucky** | 90107 | **Vermont** | VT0114 |
| **Louisiana *** | LA140009 | **Virginia *** | 460260 |
| **Maine** | CA0006 | **Washington** | C838 |
| **Maryland** | 224 | **West Virginia** | 9943 C |
| **Commonwealth of Northern Marianas Is.** | MP0004 | **Wisconsin** | 998316660 |
| **Massachusetts** | M-CA006 | **Wyoming** | 8TMS-L |
| **Michigan** | 9906 | **EPA Region 5** | Certified |
| **Los Angeles County Sanitation Districts** | 10264 | | |

* NELAP/TNI Recognized Accreditation Bodies

**The tests listed below are accredited and meet the requirements of ISO 17025 as verified by the ANSI-ASQ National Accreditation Board/ACLASS.**
**Refer to Certificate and scope of accreditation (AT 1807) found at: http://www.eatonanalytical.com**

| SPECIFIC TESTS | METHOD OR TECHNIQUE USED | Drinking Water | Food & Beverage | Waste Water |
|---|---|---|---|---|
| 1,4-Dioxane | EPA 522 | x | x | |
| 2,3,7,8-TCDD | Modified EPA 1613B | x | x | |
| Acrylamide | In House Method | x | x | |
| Alkalinity | SM 2320B | x | x | x |
| Ammonia | EPA 350.1 | | x | x |
| Ammonia | SM 4500-NH3 H (18th) | | x | x |
| Anions and DBPs by IC | EPA 300.0 | x | x | x |
| Anions and DBPs by IC | EPA 300.1 | x | x | |
| Asbestos | EPA 100.2 | x | | |
| Bicarbonate Alkalinity as HCO3 | SM 2330B | x | x | x |
| BOD / CBOD | SM 5210B | | x | x |
| Bromate | In House Method | x | x | |
| Carbamates | EPA 531.2 | x | x | |
| Carbonate as CO3 | SM 2330B | x | x | x |
| Carbonyls | EPA 556 | x | x | |
| COD | EPA 410.4 / SM 5220D | | | x |
| Chloramines | SM 4500-CL G | x | x | x |
| Chlorinated Acids | EPA 515.4 | x | x | |
| Chlorinated Acids | EPA 555 | x | x | |
| Chlorine Dioxide | SM 4500-CLO2 D | x | x | |
| Chlorine -Total/Free/ Combined Residual | SM 4500-Cl G | x | x | x |
| Conductivity | EPA 120.1 | | | x |
| Conductivity | SM 2510B | x | x | x |
| Corrosivity (Langelier Index) | SM 2330B | x | x | |
| Cyanide, Amenable | SM 4500-CN G | x | | x |
| Cyanide, Free | SM 4500CN F | x | x | x |
| Cyanide, Total | EPA 335.4 | x | x | x |
| Cyanogen Chloride (screen) | In House Method | x | x | |
| Diquat and Paraquat | EPA 549.2 | x | x | |
| DBP/HAA | SM 6251B | x | x | |
| Dissolved Oxygen | SM 4500-O G | | x | x |
| E. Coli | (MTF/EC+MUG) | x | | |
| E. Coli | CFR 141.21(f)(6)(i) | | x | x |
| E. Coli | SM 9223 | | | x |
| E. Coli (Enumeration) | SM 9221B.1/ SM 9221F | x | x | |
| E. Coli (Enumeration) | SM 9223B | x | x | |
| EDB/DCBP | EPA 504.1 | x | | |
| EDB/DBCP and DBP | EPA 551.1 | x | x | |
| EDTA and NTA | In House Method | x | x | |
| Endothall | EPA 548.1 | x | x | |
| Enterococci | SM 9230B | x | | x |
| Fecal Coliform | SM 9221 E (MTF/EC) | x | | |
| Fecal Coliform | SM 9221C, E (MTF/EC) | | | x |
| Fecal Coliform (Enumeration) | SM 9221E (MTF/EC) | x | x | |
| Fecal Coliform with Chlorine Present | SM 9221E | | | x |
| Fecal Streptococci | SM 9230B | x | | x |
| Fluoride | SM 4500-F C | x | x | x |
| Glyphosate | EPA 547 | x | x | |
| Gross Alpha/Beta | EPA 900.0 | x | x | x |
| HAAs/ Dalapon | EPA 552.3 | x | x | |
| Hardness | SM 2340B | x | x | x |
| Heterotrophic Bacteria | In House Method | x | x | |
| Heterotrophic Bacteria | SM 9215 B | x | x | |
| Hexavalent Chromium | EPA 218.6 | x | x | x |
| Hexavalent Chromium | EPA 218.7 | x | x | |
| Hexavalent Chromium | SM 3500-Cr B or C (20th) | | | x |

| SPECIFIC TESTS | METHOD OR TECHNIQUE USED | Drinking Water | Food & Beverage | Waste Water |
|---|---|---|---|---|
| Hormones | EPA 539 | x | x | |
| Hydroxide as OH Calc. | SM 2330B | x | x | |
| Kjeldahl Nitrogen | EPA 351.2 | | | x |
| Mercury | EPA 245.1 | x | x | x |
| Metals | EPA 200.7 / 200.8 | x | x | x |
| Microcystin LR | ELISA | x | x | |
| NDMA | EPA 521 | x | x | |
| Nitrate/Nitrite Nitrogen | EPA 353.2 | x | x | x |
| OCL, Pesticides/PCB | EPA 505 | x | x | |
| Ortho Phosphate | EPA 365.1 | x | x | |
| Ortho Phosphate and Total Phosphorous | EPA 365.1/SM 4500-P E | | | x |
| Ortho Phosphorous | SM 4500P E | x | x | |
| Oxyhalides Disinfection Byproducts | EPA 317.0 | x | x | |
| Perchlorate | EPA 331.0 | x | x | |
| Perchlorate | EPA 314.0 | x | x | |
| Perfluorinated Alkyl Acids | EPA 537 | x | x | |
| pH | EPA 150.1 | x | | |
| pH | SM 4500-H+B | x | x | x |
| Phenylurea Pesticides/ Herbicides | In House Method | x | x | |
| Pseudomonas | IDEXX Pseudalert | x | x | |
| Radium-226 | RA-226 GA | x | x | |
| Radium-228 | RA-228 GA | x | x | |
| Radon-222 | SM 7500RN | x | x | |
| Residue, Filterable | SM 2540C | x | x | x |
| Residue, Non-filterable | SM 2540D | | | x |
| Residue, Total | SM 2540B | | x | x |
| Residue, Volatile | EPA 160.4 | | | x |
| Semi-VOC | EPA 525.2 | x | x | |
| Semi-VOC | EPA 625 | x | x | x |
| Silica | SM 4500-Si D | x | x | x |
| Silica | SM 4500-SiO2 C | x | | x |
| Sulfide | SM 4500-$S^{=}$ D | | | x |
| Sulfite | SM 4500-$SO^{3}$B | x | x | x |
| Surfactants | SM 5540C | x | x | x |
| Taste and Odor Analytes | SM 6040E | x | x | |
| Total Coliform | SM 9221 A, B | x | x | |
| Total Coliform (Enumeration) | SM 9221 A, B, C | x | x | |
| Total Coliform / E. coli | Colisure | x | x | |
| Total Coliform | SM 9221B | | | x |
| Total Coliform with Chlorine Present | SM 9221B | | | x |
| Total Coliform / E.coli | SM 9223 | x | x | |
| TOC | SM 5310C | | x | x |
| TOC/DOC | SM 5310C | x | x | |
| TOX | SM 5320B | | | x |
| Total Phenols | EPA 420.1 | | | x |
| Total Phenols | EPA 420.4 | x | x | x |
| Total Phosphorous | SM 4500 P F | | | x |
| Turbidity | EPA 180.1 | x | x | x |
| Turbidity | SM 2130B | x | | x |
| Uranium by ICP/MS | EPA 200.8 | x | x | |
| UV 254 | SM 5910B | x | | |
| VOC | EPA 524.2/EPA 524.3 | x | x | |
| VOC | EPA 624 | x | x | x |
| VOC | EPA SW 846 8260 | x | x | |
| VOC | In House Method | x | x | |
| Yeast and Mold | SM 9610 | x | x | |

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# Acknowledgement of Samples Received

Addr: **Santa Ynez River WCD**
Post Office Box 157
Santa Ynez, CA 93460

Client ID: SANTAYNEZWD-CA
Folder #: 487417
Project: CHROMIUM
Sample Group: well sampling

Attn: Eric Tambini
Phone: 805-688-6015

Project Manager: Fred Haley
Phone: (626) 386-1127

The following samples were received from you on **June 26, 2014**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical.

| Sample # | Sample ID | | Sample Date |
|---|---|---|---|
| 201406260378 | WH27-1 | | 06/24/2014 1320 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201406260382 | W27-1170 | | 06/24/2014 1350 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201406260383 | W27-1150 | | 06/24/2014 1405 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201406260384 | W27-1120 | | 06/24/2014 1435 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201406260385 | W27-1100 | | 06/24/2014 1515 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201406260386 | W27-1080 | | 06/24/2014 1540 |
| | Alkalinity in CaCO3 units | PH (H3=past HT not compliant) | |
| 201406260387 | W27-1030 | | 06/24/2014 1625 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| | Total Dissolved Solid (TDS) | | |
| 201406260388 | W27-1080-2 | | 06/24/2014 1540 |
| | Chromium Total ICAP/MS | Hexavalent chromium(Dissolved) | |
| 201406260389 | W27-1020 | | 06/24/2014 1645 |

## Acknowledgement of Samples Received


Addr: **Santa Ynez River WCD**
Post Office Box 157
Santa Ynez, CA 93460

Attn: Eric Tambini
Phone: 805-688-6015


Client ID: SANTAYNEZWD-CA
Folder #: 487417
Project: CHROMIUM
Sample Group: well sampling

Project Manager: Fred Haley
Phone: (626) 386-1127

The following samples were received from you on **June 26, 2014**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical.

| Sample # | Sample ID | | | Sample Date |
|---|---|---|---|---|
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS | |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate | |
| | Total Dissolved Solid (TDS) | | | |
| 201406260390 | W27-1000 | | | 06/24/2014 1730 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS | |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate | |
| | Total Dissolved Solid (TDS) | | | |
| 201406260391 | W27-980 | | | 06/24/2014 1745 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS | |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate | |
| | Total Dissolved Solid (TDS) | | | |
| 201406260392 | W27-960 | | | 06/24/2014 1810 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS | |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate | |
| | Total Dissolved Solid (TDS) | | | |
| 201406260393 | W27-950 | | | 06/24/2014 1840 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS | |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate | |
| | Total Dissolved Solid (TDS) | | | |
| 201406260394 | W27-900 | | | 06/24/2014 1855 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS | |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate | |
| | Total Dissolved Solid (TDS) | | | |
| 201406260395 | WH27-2 | | | 06/24/2014 1910 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS | |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate | |
| | Total Dissolved Solid (TDS) | | | |

### Test Description

eurofins | Eaton Analytical

# CHAIN OF CUSTODY RECORD

(2 ice chests) 487417

750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629

Phone: 626 386 1100
Fax: 626 386 1101

800 566 LABS (800 566 5227)

*EUROFINS EATON ANALYTICAL USE ONLY:*

**LOGIN COMMENTS:** ______

**SAMPLES CHECKED AGAINST COC BY:** DJ
**SAMPLES LOGGED IN BY:** [initials]
**SAMPLES REC'D DAY OF COLLECTION?** ☐ (check for yes)

**SAMPLE TEMP RECEIVED AT:**
☐ Colton / No. California / Arizona ____ °C ( Compliance: 4 ± 2 °C )
☑ Monrovia 3.6 °C ( Compliance: 4 ± 2 °C )

**CONDITION OF BLUE ICE:** Frozen ____ Partially Frozen ____ Thawed ____ Wet Ice ✓ No Ice ____

**METHOD OF SHIPMENT:** Pick-Up / Walk-In / (FedEx) / UPS / DHL / Area Fast / Top Line / Other: ______

*TO BE COMPLETED BY SAMPLER:*

**COMPANY/AGENCY NAME:** Santa Ynez Rive Water Conservation District
**PROJECT CODE:** Chromium
**EEA CLIENT CODE:**
**COC ID:**
**SAMPLE GROUP:**

**COMPLIANCE SAMPLES** ☐ (check for yes) - Requires state forms ☐
**NON-COMPLIANCE SAMPLES** ☐ (check for yes) REGULATION INVOLVED: ______
Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION (eg. SDWA, Phase V, NPDES, FDA,...)

***SEE ATTACHED BOTTLE ORDER FOR ANALYSES*** ☐ (check for yes), ***OR***
**list ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)**

**TAT requested: rush by adv notice only** (STD) 1 wk ___ 3 day ___ 2 day ___ 1 day ___

| SAMPLE DATE | SAMPLE TIME | SAMPLE ID | CLIENT LAB ID | MATRIX * | FIELD DATA | FIELD DATA | Tot Cr | Hex Cr | Cl, Sulfate | TDS | pH, Alk | SAMPLER COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/24/14 | 1320 | W1127-1 | | RGW | | | X | X | X | X | X | |
| ↓ | 1350 | ~~W1~~ W27-1170 | | ↓ | | | X | X | X | X | X | |
| ↓ | 1405 | W27-1150 | | ↓ | | | X | X | X | X | X | |
| ↓ | 1435 | W27-1120 | | ↓ | | | X | X | X | X | X | |
| ↓ | 1515 | W27-1100 | | ↓ | | | X | X | X | X | X | |
| ↓ | 1540 | W27-1080 | | ↓ | | | O | O | | | X | O= HOLD |
| ↓ | 1625 | W27-1030 | | ↓ | | | X | X | X | X | X | |
| ↓ | 1540 | W27-1080-2 | | ↓ | | | X | X | | | | |
| ↓ | 1645 | W27-1020 | | ↓ | | | X | X | X | X | X | |
| ↓ | 1730 | W27-1000 | | ↓ | | | X | X | X | X | X | |

*** MATRIX TYPES:** **RSW** = Raw Surface Water, **RGW** = Raw Ground Water, **CFW** = Chlor(am)inated Finished Water, **FW** = Other Finished Water, **SEAW** = Sea Water, **WW** = Waste Water, **BW** = Bottled Water, **SW** = Storm Water, **SO** = Soil, **SL** = Sludge, **O** = Other - Please Identify

| | SIGNATURE | PRINT NAME | COMPANY/TITLE | DATE | TIME |
|---|---|---|---|---|---|
| SAMPLED BY: | [signature] | Jeff Kubran | Dudek / Hydrogeologist | 6/24/14 | 1925 |
| RELINQUISHED BY: | [signature] | Eric Tambini | SYRWCD, ID#1 | 6/25/14 | 13:30 |
| RECEIVED BY: | [signature] | Darius Smith | EEA | 6/26/14 | 1212 |
| RELINQUISHED BY: | | | | | |
| RECEIVED BY: | | | | | |

QA FO 0029 (06/26/2013)

eurofins | Eaton Analytical

# CHAIN OF CUSTODY RECORD

(2 ice chests)

750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629

Phone: 626 386 1100
Fax: 626 386 1101

800 566 LABS (800 566 5227)

*EUROFINS EATON ANALYTICAL USE ONLY:*

**LOGIN COMMENTS:** ____________

**SAMPLES CHECKED AGAINST COC BY:** DS
**SAMPLES LOGGED IN BY:** ____
**SAMPLES REC'D DAY OF COLLECTION?** ☐ (check for yes)

**SAMPLE TEMP RECEIVED AT:**
☐ Colton / No. California / Arizona ____ °C ( Compliance: 4 ± 2 °C )
☑ Monrovia 3.6 °C ( Compliance: 4 ± 2 °C )

**CONDITION OF BLUE ICE:** Frozen ____ Partially Frozen ____ Thawed ____ Wet Ice ✓ No Ice ____

**METHOD OF SHIPMENT:** Pick-Up / Walk-In / (FedEx) / UPS / DHL / Area Fast / Top Line / Other: ____

*TO BE COMPLETED BY SAMPLER:*

**COMPANY/AGENCY NAME:** Santa Ynez River Water Conservation District
**PROJECT CODE:** Chromium
**EEA CLIENT CODE:**
**COC ID:**
**SAMPLE GROUP:**

**COMPLIANCE SAMPLES** ☐ (check for yes) - Requires state forms ☐
**NON-COMPLIANCE SAMPLES** ☐ (check for yes)
REGULATION INVOLVED: ____
Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION (eg. SDWA, Phase V, NPDES, FDA,...)

***SEE ATTACHED BOTTLE ORDER FOR ANALYSES*** ☐ (check for yes), ***OR***
list ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)

**TAT requested: rush by adv notice only** (STD) ✓ 1 wk ___ 3 day ___ 2 day ___ 1 day ___

| SAMPLE DATE | SAMPLE TIME | SAMPLE ID | CLIENT LAB ID | MATRIX* | FIELD DATA | FIELD DATA | Tot Cr | Hex Cr | Cl, Sulfate | TDS | pH, Alk | | | | | | | | | | SAMPLER COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/24/14 | 1745 | W27-980 | | RGW | | | X | X | X | X | X | | | | | | | | | | |
| ↓ | 1810 | W27-960 | | RGW | | | X | X | X | X | X | | | | | | | | | | |
| ↓ | 1840 | W27-950 | | RGW | | | X | X | X | X | X | | | | | | | | | | |
| ↓ | 1855 | W27-900 | | RGW | | | X | X | X | X | X | | | | | | | | | | |
| ↓ | 1910 | WH27-2 | | RGW | | | X | X | X | X | X | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |

*** MATRIX TYPES:** **RSW** = Raw Surface Water **RGW** = Raw Ground Water **CFW** = Chlor(am)inated Finished Water **FW** = Other Finished Water **SEAW** = Sea Water **WW** = Waste Water **BW** = Bottled Water **SW** = Storm Water **SO** = Soil **SL** = Sludge **O** = Other - Please Identify

| | SIGNATURE | PRINT NAME | COMPANY/TITLE | DATE | TIME |
|---|---|---|---|---|---|
| SAMPLED BY: | [signature] | Jeff Kubran | Dudek / Hydrogeologist | 6/24/14 | 19:18 |
| RELINQUISHED BY: | [signature] | Eric Tambini | SYRWCD, ID#1 | 6/25/14 | 13:30 |
| RECEIVED BY: | [signature] | Dennis Smith | EEA | 6/26/14 | 1010 |
| RELINQUISHED BY: | | | | | |
| RECEIVED BY: | | | | | |

QA FO 0029 (06/26/2013)

PAGE 2 OF 2

eurofins | Eaton Analytical
formerly MWH Laboratories
750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
(626) 386-1100 FAX (626) 386-1101

# Kit Order for Santa Ynez River WCD

Fred Haley is your Eurofins Eaton Analytical Project Manager

**Note: Sampler Please return this paper with your samples**

**Kit #:** 92260
**Created By:** FWH
**Deliver By:** 06/16/2014
**STG:** Bottle Orders
**Ice Type:** W

**Client ID:** SANTAYNEZWD-CA
**Project Code:** CHROMIUM Bottle Orders
**Group Name:** well sampling
**PO#/JOB#:**

| **Ship Sample Kits to** | **Send Report to** | **Billing Address** |
|---|---|---|
| Santa Ynez River WCD | Santa Ynez River WCD | Santa Ynez River WCD |
| 3622 Sagunto Street | Post Office Box 157 | Post Office Box 157 |
| Santa Ynez, CA 93460 | Santa Ynez, CA 93460 | Santa Ynez, CA 93460 |
| Attn: District Office | Attn: Eric Tambini | Attn: Eric Tambini |
| Phone: 805-688-6015 | Phone: 805-688-6015 | Phone: 805-688-6015 |
| Fax: 805-688-3078 | Fax: 805-688-3078 | Fax: 805-688-3078 |

| # of Sample | Tests | Bottles - Qty for each sample, type & preservative if ai | UN DOT # |
|---|---|---|---|
| 1 | Alkalinity in CaCO3 units, PH (H3=past HT not compliant) | 13 250ml poly no preservative | |
| 1 | Chloride, Sulfate | 15 125ml poly no preservative | |
| 1 | Chromium Total ICAP/MS | 16 500ml acid poly 2ml HNO3 (18%) | UN2031 |
| 1 | Hexavalent Chromium (Dissolved) | 14 125ml poly 1.25 ml NH4SO4/NH4OH buffer | |
| 1 | Total Dissolved Solid (TDS) | 13 500ml poly TDS - no preservative | |

## Comments

LABEL COOLERS "well profile sampling"

Ship two coolers

no gel packs

provide wet ice packing instructions

| Code | Status | Date Shipped | Via | Tracking # | # of Coolers | Prepared By |
|---|---|---|---|---|---|---|
| | | | | | | |

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

**Laboratory Comments**
**Report: 487417**

Santa Ynez River WCD
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

---

**Flags Legend:**

M2 - Matrix spike recovery was low; the associated blank spike recovery was acceptable.

**The Comments Report may be blank if there are no comments for this report.**

eurofins | Eaton Analytical

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

**Laboratory Hits**
**Report: 487417**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
06/26/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| | **201406260378** | **WH27-1** | | | | |
| 07/02/2014 22:50 | Alkalinity in CaCO3 units | | 240 | | mg/L | 2 |
| 06/30/2014 16:28 | Chloride | | 32 | 250 | mg/L | 5 |
| 06/30/2014 17:58 | Chromium Total ICAP/MS | | 13 | 100 | ug/L | 1 |
| 06/26/2014 16:52 | Hexavalent chromium(Dissolved) | | 14 | | ug/L | 0.02 |
| 07/02/2014 22:50 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 06/30/2014 16:28 | Sulfate | | 100 | 250 | mg/L | 2.5 |
| 06/27/2014 16:08 | Total Dissolved Solids (TDS) | | 500 | 500 | mg/L | 10 |
| | **201406260382** | **W27-1170** | | | | |
| 07/02/2014 22:58 | Alkalinity in CaCO3 units | | 240 | | mg/L | 2 |
| 06/30/2014 16:42 | Chloride | | 30 | 250 | mg/L | 5 |
| 07/03/2014 19:18 | Chromium Total ICAP/MS | | 14 | 100 | ug/L | 1 |
| 06/26/2014 17:22 | Hexavalent chromium(Dissolved) | | 2.0 | | ug/L | 0.02 |
| 07/02/2014 22:58 | PH (H3=past HT not compliant) | | 7.7 | | Units | 0.1 |
| 06/30/2014 16:42 | Sulfate | | 120 | 250 | mg/L | 2.5 |
| 06/27/2014 16:09 | Total Dissolved Solids (TDS) | | 510 | 500 | mg/L | 10 |
| | **201406260383** | **W27-1150** | | | | |
| 07/02/2014 23:06 | Alkalinity in CaCO3 units | | 250 | | mg/L | 2 |
| 06/30/2014 16:55 | Chloride | | 30 | 250 | mg/L | 5 |
| 07/08/2014 20:20 | Chromium Total ICAP/MS | | 35 | 100 | ug/L | 1 |
| 06/26/2014 17:32 | Hexavalent chromium(Dissolved) | | 3.8 | | ug/L | 0.02 |
| 07/02/2014 23:06 | PH (H3=past HT not compliant) | | 7.7 | | Units | 0.1 |
| 06/30/2014 16:55 | Sulfate | | 120 | 250 | mg/L | 2.5 |
| 06/27/2014 16:10 | Total Dissolved Solids (TDS) | | 460 | 500 | mg/L | 10 |
| | **201406260384** | **W27-1120** | | | | |
| 07/02/2014 23:35 | Alkalinity in CaCO3 units | | 230 | | mg/L | 2 |
| 06/30/2014 17:08 | Chloride | | 30 | 250 | mg/L | 5 |
| 07/08/2014 20:22 | Chromium Total ICAP/MS | | 16 | 100 | ug/L | 1 |
| 06/26/2014 17:42 | Hexavalent chromium(Dissolved) | | 4.0 | | ug/L | 0.02 |
| 07/02/2014 23:35 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 06/30/2014 17:08 | Sulfate | | 120 | 250 | mg/L | 2.5 |
| 06/27/2014 16:11 | Total Dissolved Solids (TDS) | | 510 | 500 | mg/L | 10 |
| | **201406260385** | **W27-1100** | | | | |
| 07/03/2014 00:09 | Alkalinity in CaCO3 units | | 230 | | mg/L | 2 |
| 06/30/2014 17:22 | Chloride | | 31 | 250 | mg/L | 5 |

**SUMMARY OF POSITIVE DATA ONLY**

eurofins | Eaton Analytical

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

**Laboratory Hits**
**Report: 487417**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
06/26/2014

| Analyzed | Analyte / Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|
| 07/03/2014 19:15 | Chromium Total ICAP/MS | 32 | 100 | ug/L | 1 |
| 06/26/2014 17:52 | Hexavalent chromium(Dissolved) | 3.7 | | ug/L | 0.02 |
| 07/03/2014 00:09 | PH (H3=past HT not compliant) | 7.7 | | Units | 0.1 |
| 06/30/2014 17:22 | Sulfate | 120 | 250 | mg/L | 2.5 |
| 06/27/2014 16:12 | Total Dissolved Solids (TDS) | 530 | 500 | mg/L | 10 |
| | **201406260386 W27-1080** | | | | |
| 07/03/2014 00:17 | Alkalinity in CaCO3 units | 240 | | mg/L | 2 |
| 07/03/2014 00:17 | PH (H3=past HT not compliant) | 7.7 | | Units | 0.1 |
| | **201406260387 W27-1030** | | | | |
| 07/03/2014 00:25 | Alkalinity in CaCO3 units | 240 | | mg/L | 2 |
| 06/30/2014 18:02 | Chloride | 31 | 250 | mg/L | 5 |
| 07/03/2014 19:24 | Chromium Total ICAP/MS | 12 | 100 | ug/L | 1 |
| 06/26/2014 18:12 | Hexavalent chromium(Dissolved) | 9.1 | | ug/L | 0.02 |
| 07/03/2014 00:25 | PH (H3=past HT not compliant) | 7.8 | | Units | 0.1 |
| 06/30/2014 18:02 | Sulfate | 99 | 250 | mg/L | 2.5 |
| 06/27/2014 16:13 | Total Dissolved Solids (TDS) | 470 | 500 | mg/L | 10 |
| | **201406260388 W27-1080-2** | | | | |
| 07/08/2014 20:24 | Chromium Total ICAP/MS | 20 | 100 | ug/L | 1 |
| 06/26/2014 18:22 | Hexavalent chromium(Dissolved) | 3.6 | | ug/L | 0.02 |
| | **201406260389 W27-1020** | | | | |
| 07/03/2014 00:33 | Alkalinity in CaCO3 units | 240 | | mg/L | 2 |
| 06/30/2014 18:42 | Chloride | 31 | 250 | mg/L | 5 |
| 07/03/2014 19:30 | Chromium Total ICAP/MS | 16 | 100 | ug/L | 1 |
| 06/26/2014 18:32 | Hexavalent chromium(Dissolved) | 11 | | ug/L | 0.02 |
| 07/03/2014 00:33 | PH (H3=past HT not compliant) | 7.9 | | Units | 0.1 |
| 06/30/2014 18:42 | Sulfate | 100 | 250 | mg/L | 2.5 |
| 06/27/2014 16:14 | Total Dissolved Solids (TDS) | 500 | 500 | mg/L | 10 |
| | **201406260390 W27-1000** | | | | |
| 07/03/2014 00:41 | Alkalinity in CaCO3 units | 240 | | mg/L | 2 |
| 06/30/2014 18:56 | Chloride | 31 | 250 | mg/L | 5 |
| 07/03/2014 19:00 | Chromium Total ICAP/MS | 13 | 100 | ug/L | 1 |
| 06/26/2014 18:42 | Hexavalent chromium(Dissolved) | 12 | | ug/L | 0.02 |
| 07/03/2014 00:41 | PH (H3=past HT not compliant) | 7.8 | | Units | 0.1 |
| 06/30/2014 18:56 | Sulfate | 100 | 250 | mg/L | 2.5 |
| 06/27/2014 16:15 | Total Dissolved Solids (TDS) | 510 | 500 | mg/L | 10 |

**SUMMARY OF POSITIVE DATA ONLY**

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**Laboratory Hits**
**Report: 487417**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
06/26/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| | **201406260391** | **W27-980** | | | | |
| 07/03/2014 00:49 | Alkalinity in CaCO3 units | | 240 | | mg/L | 2 |
| 06/30/2014 19:09 | Chloride | | 31 | 250 | mg/L | 5 |
| 07/03/2014 18:58 | Chromium Total ICAP/MS | | 14 | 100 | ug/L | 1 |
| 06/26/2014 19:12 | Hexavalent chromium(Dissolved) | | 13 | | ug/L | 0.02 |
| 07/03/2014 00:49 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 06/30/2014 19:09 | Sulfate | | 100 | 250 | mg/L | 2.5 |
| 06/27/2014 16:16 | Total Dissolved Solids (TDS) | | 500 | 500 | mg/L | 10 |
| | **201406260392** | **W27-960** | | | | |
| 07/03/2014 00:57 | Alkalinity in CaCO3 units | | 250 | | mg/L | 2 |
| 06/30/2014 19:22 | Chloride | | 31 | 250 | mg/L | 5 |
| 07/08/2014 20:26 | Chromium Total ICAP/MS | | 22 | 100 | ug/L | 1 |
| 06/26/2014 19:42 | Hexavalent chromium(Dissolved) | | 13 | | ug/L | 0.02 |
| 07/03/2014 00:57 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 06/30/2014 19:22 | Sulfate | | 100 | 250 | mg/L | 2.5 |
| 06/27/2014 16:18 | Total Dissolved Solids (TDS) | | 490 | 500 | mg/L | 10 |
| | **201406260393** | **W27-950** | | | | |
| 07/03/2014 01:06 | Alkalinity in CaCO3 units | | 250 | | mg/L | 2 |
| 06/30/2014 19:36 | Chloride | | 32 | 250 | mg/L | 5 |
| 07/08/2014 20:28 | Chromium Total ICAP/MS | | 17 | 100 | ug/L | 1 |
| 06/26/2014 19:52 | Hexavalent chromium(Dissolved) | | 13 | | ug/L | 0.02 |
| 07/03/2014 01:06 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 06/30/2014 19:36 | Sulfate | | 100 | 250 | mg/L | 2.5 |
| 06/27/2014 16:19 | Total Dissolved Solids (TDS) | | 500 | 500 | mg/L | 10 |
| | **201406260394** | **W27-900** | | | | |
| 07/03/2014 01:14 | Alkalinity in CaCO3 units | | 250 | | mg/L | 2 |
| 06/30/2014 19:49 | Chloride | | 32 | 250 | mg/L | 5 |
| 07/03/2014 19:20 | Chromium Total ICAP/MS | | 16 | 100 | ug/L | 1 |
| 06/26/2014 20:02 | Hexavalent chromium(Dissolved) | | 14 | | ug/L | 0.02 |
| 07/03/2014 01:14 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 06/30/2014 19:49 | Sulfate | | 100 | 250 | mg/L | 2.5 |
| 06/30/2014 17:37 | Total Dissolved Solids (TDS) | | 470 | 500 | mg/L | 10 |
| | **201406260395** | **WH27-2** | | | | |
| 07/03/2014 17:01 | Alkalinity in CaCO3 units | | 230 | | mg/L | 2 |
| 06/30/2014 20:03 | Chloride | | 32 | 250 | mg/L | 5 |

**SUMMARY OF POSITIVE DATA ONLY**

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**Laboratory Hits**
**Report: 487417**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
06/26/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| 07/08/2014 20:30 | Chromium Total ICAP/MS | | 15 | 100 | ug/L | 1 |
| 06/26/2014 20:12 | Hexavalent chromium(Dissolved) | | 14 | | ug/L | 0.02 |
| 07/03/2014 17:01 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 06/30/2014 20:03 | Sulfate | | 99 | 250 | mg/L | 2.5 |
| 06/30/2014 17:38 | Total Dissolved Solids (TDS) | | 460 | 500 | mg/L | 10 |

**SUMMARY OF POSITIVE DATA ONLY**

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**Laboratory Data Report: 487417**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
06/26/2014

| Prepared | Analyzed | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|
| **WH27-1 (201406260378)** | | | | | | **Sampled on 06/24/2014 1320** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 6/27/2014 | 06/30/2014 | 17:58 778488 | (EPA 200.8) | Chromium Total ICAP/MS | 13 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 06/26/2014 | 16:52 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 14 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 06/30/2014 | 16:28 778456 | (EPA 300.0) | Chloride | 32 | mg/L | 5 | 5 |
| | 06/30/2014 | 16:28 778456 | (EPA 300.0) | Sulfate | 100 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 07/02/2014 | 22:50 779031 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 6/27/2014 | 06/27/2014 | 16:08 778121 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 500 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 07/02/2014 | 22:50 779042 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W27-1170 (201406260382)** | | | | | | **Sampled on 06/24/2014 1350** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 6/27/2014 | 07/03/2014 | 19:18 779470 | (EPA 200.8) | Chromium Total ICAP/MS | 14 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 06/26/2014 | 17:22 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 2.0 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 06/30/2014 | 16:42 778456 | (EPA 300.0) | Chloride | 30 | mg/L | 5 | 5 |
| | 06/30/2014 | 16:42 778456 | (EPA 300.0) | Sulfate | 120 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 07/02/2014 | 22:58 779031 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 6/27/2014 | 06/27/2014 | 16:09 778121 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 510 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 07/02/2014 | 22:58 779042 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.7 | Units | 0.1 | 1 |
| **W27-1150 (201406260383)** | | | | | | **Sampled on 06/24/2014 1405** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 6/27/2014 | 07/08/2014 | 20:20 779522 | (EPA 200.8) | Chromium Total ICAP/MS | 35 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 06/26/2014 | 17:32 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 3.8 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 06/30/2014 | 16:55 778456 | (EPA 300.0) | Chloride | 30 | mg/L | 5 | 5 |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data Report: 487417**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on: 06/26/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| | 06/30/2014 | 16:55 | 778456 | (EPA 300.0) | Sulfate | 120 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 07/02/2014 | 23:06 | 779031 | (SM 2320B) | Alkalinity in CaCO3 units | 250 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 6/27/2014 | 06/27/2014 | 16:10 | 778121 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 460 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 07/02/2014 | 23:06 | 779042 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.7 | Units | 0.1 | 1 |
| **W27-1120 (201406260384)** | | | | | | **Sampled on 06/24/2014 1435** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 6/27/2014 | 07/08/2014 | 20:22 | 779522 | (EPA 200.8) | Chromium Total ICAP/MS | 16 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 06/26/2014 | 17:42 | 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 4.0 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 06/30/2014 | 17:08 | 778456 | (EPA 300.0) | Chloride | 30 | mg/L | 5 | 5 |
| | 06/30/2014 | 17:08 | 778456 | (EPA 300.0) | Sulfate | 120 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 07/02/2014 | 23:35 | 779031 | (SM 2320B) | Alkalinity in CaCO3 units | 230 (M2) | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 6/27/2014 | 06/27/2014 | 16:11 | 778121 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 510 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 07/02/2014 | 23:35 | 779042 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W27-1100 (201406260385)** | | | | | | **Sampled on 06/24/2014 1515** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 6/27/2014 | 07/03/2014 | 19:15 | 779470 | (EPA 200.8) | Chromium Total ICAP/MS | 32 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 06/26/2014 | 17:52 | 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 3.7 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 06/30/2014 | 17:22 | 778456 | (EPA 300.0) | Chloride | 31 | mg/L | 5 | 5 |
| | 06/30/2014 | 17:22 | 778456 | (EPA 300.0) | Sulfate | 120 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 07/03/2014 | 00:09 | 779031 | (SM 2320B) | Alkalinity in CaCO3 units | 230 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 6/27/2014 | 06/27/2014 | 16:12 | 778121 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 530 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 07/03/2014 | 00:09 | 779042 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.7 | Units | 0.1 | 1 |
| **W27-1080 (201406260386)** | | | | | | **Sampled on 06/24/2014 1540** | | | |

Rounding on totals after summation.
(c) - indicates calculated results

**Laboratory Data Report: 487417**

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**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on: 06/26/2014

| Prepared | Analyzed | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|
| | | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | |
| | 07/03/2014 00:17 | 779031 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | |
| | 07/03/2014 00:17 | 779042 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.7 | Units | 0.1 | 1 |
| **W27-1030 (201406260387)** | | | | | **Sampled on 06/24/2014 1625** | | | |
| | | | **EPA 200.8 - ICPMS Metals** | | | | | |
| 6/27/2014 | 07/03/2014 19:24 | 779470 | (EPA 200.8) | Chromium Total ICAP/MS | 12 | ug/L | 1 | 1 |
| | | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | |
| | 06/26/2014 18:12 | 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 9.1 | ug/L | 0.02 | 1 |
| | | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | |
| | 06/30/2014 18:02 | 778456 | (EPA 300.0) | Chloride | 31 | mg/L | 5 | 5 |
| | 06/30/2014 18:02 | 778456 | (EPA 300.0) | Sulfate | 99 | mg/L | 2.5 | 5 |
| | | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | |
| | 07/03/2014 00:25 | 779031 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | |
| 6/27/2014 | 06/27/2014 16:13 | 778121 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 470 | mg/L | 10 | 1 |
| | | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | |
| | 07/03/2014 00:25 | 779042 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W27-1080-2 (201406260388)** | | | | | **Sampled on 06/24/2014 1540** | | | |
| | | | **EPA 200.8 - ICPMS Metals** | | | | | |
| 6/27/2014 | 07/08/2014 20:24 | 779522 | (EPA 200.8) | Chromium Total ICAP/MS | 20 | ug/L | 1 | 1 |
| | | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | |
| | 06/26/2014 18:22 | 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 3.6 | ug/L | 0.02 | 1 |
| **W27-1020 (201406260389)** | | | | | **Sampled on 06/24/2014 1645** | | | |
| | | | **EPA 200.8 - ICPMS Metals** | | | | | |
| 6/27/2014 | 07/03/2014 19:30 | 779470 | (EPA 200.8) | Chromium Total ICAP/MS | 16 | ug/L | 1 | 1 |
| | | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | |
| | 06/26/2014 18:32 | 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 11 | ug/L | 0.02 | 1 |
| | | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | |
| | 06/30/2014 18:42 | 778456 | (EPA 300.0) | Chloride | 31 | mg/L | 5 | 5 |
| | 06/30/2014 18:42 | 778456 | (EPA 300.0) | Sulfate | 100 | mg/L | 2.5 | 5 |
| | | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | |
| | 07/03/2014 00:33 | 779031 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data Report: 487417**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on: 06/26/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| 6/27/2014 | 06/27/2014 | 16:14 | 778121 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 500 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 07/03/2014 | 00:33 | 779042 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.9 | Units | 0.1 | 1 |
| **W27-1000 (201406260390)** | | | | | | | **Sampled on 06/24/2014 1730** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 6/27/2014 | 07/03/2014 | 19:00 | 779470 | (EPA 200.8) | Chromium Total ICAP/MS | 13 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 06/26/2014 | 18:42 | 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 12 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 06/30/2014 | 18:56 | 778456 | (EPA 300.0) | Chloride | 31 | mg/L | 5 | 5 |
| | 06/30/2014 | 18:56 | 778456 | (EPA 300.0) | Sulfate | 100 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 07/03/2014 | 00:41 | 779031 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 6/27/2014 | 06/27/2014 | 16:15 | 778121 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 510 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 07/03/2014 | 00:41 | 779042 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W27-980 (201406260391)** | | | | | | | **Sampled on 06/24/2014 1745** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 6/27/2014 | 07/03/2014 | 18:58 | 779470 | (EPA 200.8) | Chromium Total ICAP/MS | 14 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 06/26/2014 | 19:12 | 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 13 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 06/30/2014 | 19:09 | 778456 | (EPA 300.0) | Chloride | 31 | mg/L | 5 | 5 |
| | 06/30/2014 | 19:09 | 778456 | (EPA 300.0) | Sulfate | 100 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 07/03/2014 | 00:49 | 779031 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 6/27/2014 | 06/27/2014 | 16:16 | 778121 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 500 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 07/03/2014 | 00:49 | 779042 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W27-960 (201406260392)** | | | | | | | **Sampled on 06/24/2014 1810** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 6/27/2014 | 07/08/2014 | 20:26 | 779522 | (EPA 200.8) | Chromium Total ICAP/MS | 22 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |

Rounding on totals after summation.
(c) - indicates calculated results

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**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
06/26/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| | 06/26/2014 | 19:42 | 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 13 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 06/30/2014 | 19:22 | 778456 | (EPA 300.0) | Chloride | 31 | mg/L | 5 | 5 |
| | 06/30/2014 | 19:22 | 778456 | (EPA 300.0) | Sulfate | 100 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 07/03/2014 | 00:57 | 779031 | (SM 2320B) | Alkalinity in CaCO3 units | 250 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 6/27/2014 | 06/27/2014 | 16:18 | 778121 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 490 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 07/03/2014 | 00:57 | 779042 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W27-950 (201406260393)** | | | | | | | **Sampled on 06/24/2014 1840** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 6/27/2014 | 07/08/2014 | 20:28 | 779522 | (EPA 200.8) | Chromium Total ICAP/MS | 17 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 06/26/2014 | 19:52 | 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 13 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 06/30/2014 | 19:36 | 778456 | (EPA 300.0) | Chloride | 32 | mg/L | 5 | 5 |
| | 06/30/2014 | 19:36 | 778456 | (EPA 300.0) | Sulfate | 100 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 07/03/2014 | 01:06 | 779031 | (SM 2320B) | Alkalinity in CaCO3 units | 250 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 6/27/2014 | 06/27/2014 | 16:19 | 778121 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 500 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 07/03/2014 | 01:06 | 779042 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W27-900 (201406260394)** | | | | | | | **Sampled on 06/24/2014 1855** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 6/27/2014 | 07/03/2014 | 19:20 | 779470 | (EPA 200.8) | Chromium Total ICAP/MS | 16 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 06/26/2014 | 20:02 | 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 14 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 06/30/2014 | 19:49 | 778456 | (EPA 300.0) | Chloride | 32 | mg/L | 5 | 5 |
| | 06/30/2014 | 19:49 | 778456 | (EPA 300.0) | Sulfate | 100 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 07/03/2014 | 01:14 | 779031 | (SM 2320B) | Alkalinity in CaCO3 units | 250 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 6/30/2014 | 06/30/2014 | 17:37 | 778428 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 470 | mg/L | 10 | 1 |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data Report: 487417**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on: 06/26/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 07/03/2014 | 01:14 | 779042 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **WH27-2 (201406260395)** | | | | | | | **Sampled on 06/24/2014 1910** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 6/27/2014 | 07/08/2014 | 20:30 | 779522 | (EPA 200.8) | Chromium Total ICAP/MS | 15 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 06/26/2014 | 20:12 | 778032 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 14 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 06/30/2014 | 20:03 | 778456 | (EPA 300.0) | Chloride | 32 | mg/L | 5 | 5 |
| | 06/30/2014 | 20:03 | 778456 | (EPA 300.0) | Sulfate | 99 | mg/L | 2.5 | 5 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 07/03/2014 | 17:01 | 779065 | (SM 2320B) | Alkalinity in CaCO3 units | 230 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 6/30/2014 | 06/30/2014 | 17:38 | 778428 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 460 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 07/03/2014 | 17:01 | 779344 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory**
**QC Summary: 487417**

Santa Ynez River WCD

**QC Ref # 778032 - Hexavalent chromium(Dissolved)** — **Analysis Date: 06/26/2014**

| | | |
|---|---|---|
| 201406260378 | WH27-1 | Analyzed by: TLH |
| 201406260382 | W27-1170 | Analyzed by: TLH |
| 201406260383 | W27-1150 | Analyzed by: TLH |
| 201406260384 | W27-1120 | Analyzed by: TLH |
| 201406260385 | W27-1100 | Analyzed by: TLH |
| 201406260387 | W27-1030 | Analyzed by: TLH |
| 201406260388 | W27-1080-2 | Analyzed by: TLH |
| 201406260389 | W27-1020 | Analyzed by: TLH |
| 201406260390 | W27-1000 | Analyzed by: TLH |
| 201406260391 | W27-980 | Analyzed by: TLH |
| 201406260392 | W27-960 | Analyzed by: TLH |
| 201406260393 | W27-950 | Analyzed by: TLH |
| 201406260394 | W27-900 | Analyzed by: TLH |
| 201406260395 | WH27-2 | Analyzed by: TLH |

**QC Ref # 778121 - Total Dissolved Solids (TDS)** — **Analysis Date: 06/27/2014**

| | | |
|---|---|---|
| 201406260378 | WH27-1 | Analyzed by: W8E1 |
| 201406260382 | W27-1170 | Analyzed by: W8E1 |
| 201406260383 | W27-1150 | Analyzed by: W8E1 |
| 201406260384 | W27-1120 | Analyzed by: W8E1 |
| 201406260385 | W27-1100 | Analyzed by: W8E1 |
| 201406260387 | W27-1030 | Analyzed by: W8E1 |
| 201406260389 | W27-1020 | Analyzed by: W8E1 |
| 201406260390 | W27-1000 | Analyzed by: W8E1 |
| 201406260391 | W27-980 | Analyzed by: W8E1 |
| 201406260392 | W27-960 | Analyzed by: W8E1 |
| 201406260393 | W27-950 | Analyzed by: W8E1 |

**QC Ref # 778428 - Total Dissolved Solids (TDS)** — **Analysis Date: 06/30/2014**

| | | |
|---|---|---|
| 201406260394 | W27-900 | Analyzed by: JRF |
| 201406260395 | WH27-2 | Analyzed by: JRF |

**QC Ref # 778456 - Chloride, Sulfate by EPA 300.0** — **Analysis Date: 06/30/2014**

| | | |
|---|---|---|
| 201406260378 | WH27-1 | Analyzed by: CYP |
| 201406260382 | W27-1170 | Analyzed by: CYP |
| 201406260383 | W27-1150 | Analyzed by: CYP |
| 201406260384 | W27-1120 | Analyzed by: CYP |
| 201406260385 | W27-1100 | Analyzed by: CYP |
| 201406260387 | W27-1030 | Analyzed by: CYP |
| 201406260389 | W27-1020 | Analyzed by: CYP |
| 201406260390 | W27-1000 | Analyzed by: CYP |
| 201406260391 | W27-980 | Analyzed by: CYP |
| 201406260392 | W27-960 | Analyzed by: CYP |
| 201406260393 | W27-950 | Analyzed by: CYP |
| 201406260394 | W27-900 | Analyzed by: CYP |
| 201406260395 | WH27-2 | Analyzed by: CYP |

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**QC Ref # 778488 - ICPMS Metals** — **Analysis Date: 06/30/2014**

| | | |
|---|---|---|
| 201406260378 | WH27-1 | Analyzed by: SXK |

**QC Ref # 779031 - Alkalinity in CaCO3 units** — **Analysis Date: 07/02/2014**

| | | |
|---|---|---|
| 201406260378 | WH27-1 | Analyzed by: JMO |
| 201406260382 | W27-1170 | Analyzed by: JMO |
| 201406260383 | W27-1150 | Analyzed by: JMO |
| 201406260384 | W27-1120 | Analyzed by: JMO |
| 201406260385 | W27-1100 | Analyzed by: JMO |
| 201406260386 | W27-1080 | Analyzed by: JMO |
| 201406260387 | W27-1030 | Analyzed by: JMO |
| 201406260389 | W27-1020 | Analyzed by: JMO |
| 201406260390 | W27-1000 | Analyzed by: JMO |
| 201406260391 | W27-980 | Analyzed by: JMO |
| 201406260392 | W27-960 | Analyzed by: JMO |
| 201406260393 | W27-950 | Analyzed by: JMO |
| 201406260394 | W27-900 | Analyzed by: JMO |

**QC Ref # 779042 - PH (H3=past HT not compliant)** — **Analysis Date: 07/02/2014**

| | | |
|---|---|---|
| 201406260378 | WH27-1 | Analyzed by: JMO |
| 201406260382 | W27-1170 | Analyzed by: JMO |
| 201406260383 | W27-1150 | Analyzed by: JMO |
| 201406260384 | W27-1120 | Analyzed by: JMO |
| 201406260385 | W27-1100 | Analyzed by: JMO |
| 201406260386 | W27-1080 | Analyzed by: JMO |
| 201406260387 | W27-1030 | Analyzed by: JMO |
| 201406260389 | W27-1020 | Analyzed by: JMO |
| 201406260390 | W27-1000 | Analyzed by: JMO |
| 201406260391 | W27-980 | Analyzed by: JMO |
| 201406260392 | W27-960 | Analyzed by: JMO |
| 201406260393 | W27-950 | Analyzed by: JMO |
| 201406260394 | W27-900 | Analyzed by: JMO |

**QC Ref # 779065 - Alkalinity in CaCO3 units** — **Analysis Date: 07/03/2014**

| | | |
|---|---|---|
| 201406260395 | WH27-2 | Analyzed by: JMO |

**QC Ref # 779344 - PH (H3=past HT not compliant)** — **Analysis Date: 07/03/2014**

| | | |
|---|---|---|
| 201406260395 | WH27-2 | Analyzed by: JMO |

**QC Ref # 779470 - ICPMS Metals** — **Analysis Date: 07/03/2014**

| | | |
|---|---|---|
| 201406260382 | W27-1170 | Analyzed by: AZS |
| 201406260385 | W27-1100 | Analyzed by: AZS |
| 201406260387 | W27-1030 | Analyzed by: AZS |
| 201406260389 | W27-1020 | Analyzed by: AZS |
| 201406260390 | W27-1000 | Analyzed by: AZS |
| 201406260391 | W27-980 | Analyzed by: AZS |
| 201406260394 | W27-900 | Analyzed by: AZS |

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**Laboratory**
**QC Summary: 487417**

Santa Ynez River WCD

**QC Ref # 779522 - ICPMS Metals** **Analysis Date: 07/08/2014**

| | | |
|---|---|---|
| 201406260383 | W27-1150 | Analyzed by: RPD |
| 201406260384 | W27-1120 | Analyzed by: RPD |
| 201406260388 | W27-1080-2 | Analyzed by: RPD |
| 201406260392 | W27-960 | Analyzed by: RPD |
| 201406260393 | W27-950 | Analyzed by: RPD |
| 201406260395 | WH27-2 | Analyzed by: RPD |

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**Laboratory QC**
**Report: 487417**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| **QC Ref# 778032 - Hexavalent chromium(Dissolved) by EPA 218.6** | | | | | | **Analysis Date: 06/26/2014** | | | |
| LCS1 | Hexavalent chromium(Dissolved) | | 2.0 | 1.95 | ug/L | 97 | (90-110) | | |
| LCS2 | Hexavalent chromium(Dissolved) | | 2.0 | 1.95 | ug/L | 98 | (90-110) | | |
| MBLK | Hexavalent chromium(Dissolved) | | | <0.020 | ug/L | | | | |
| MRL_CHK | Hexavalent chromium(Dissolved) | | 0.02 | 0.0180 | ug/L | 90 | (50-150) | | |
| MS_201406260378 | Hexavalent chromium(Dissolved) | 14 | 2.0 | 15.5 | ug/L | 96 | (90-110) | | |
| MS_201406260391 | Hexavalent chromium(Dissolved) | 13 | 2.0 | 15.0 | ug/L | 103 | (90-110) | | |
| MSD_201406260378 | Hexavalent chromium(Dissolved) | 14 | 2.0 | 15.5 | ug/L | 95 | (90-110) | 20 | 0.0 |
| MSD_201406260391 | Hexavalent chromium(Dissolved) | 13 | 2.0 | 15.0 | ug/L | 102 | (90-110) | 20 | 0.0 |
| **QC Ref# 778121 - Total Dissolved Solids (TDS) by E160.1/SM2540C** | | | | | | **Analysis Date: 06/27/2014** | | | |
| DUP_201406240368 | Total Dissolved Solid (TDS) | 360 | | 362 | mg/L | | ( 0.000-20) | 20 | 0.0 |
| DUP_201406260391 | Total Dissolved Solid (TDS) | 500 | | 476 | mg/L | | ( 0.000-20) | 20 | 4.1 |
| LCS1 | Total Dissolved Solid (TDS) | | 175 | 160 | mg/L | 91 | (80-114) | | |
| LCS2 | Total Dissolved Solid (TDS) | | 700 | 638 | mg/L | 91 | (80-114) | | |
| MBLK | Total Dissolved Solid (TDS) | | | <10 | mg/L | | | | |
| MRL_CHK | Total Dissolved Solid (TDS) | | 10 | 9.00 | mg/L | 90 | (50-150) | | |
| **QC Ref# 778428 - Total Dissolved Solids (TDS) by E160.1/SM2540C** | | | | | | **Analysis Date: 06/30/2014** | | | |
| DUP_201406240620 | Total Dissolved Solid (TDS) | 570 | | 594 | mg/L | | ( 0.000-20) | 20 | 3.8 |
| DUP_201406270447 | Total Dissolved Solid (TDS) | 910 | | 906 | mg/L | | ( 0.000-20) | 20 | <u>**22**</u> |
| LCS1 | Total Dissolved Solid (TDS) | | 175 | 160 | mg/L | 91 | (80-114) | | |
| LCS2 | Total Dissolved Solid (TDS) | | 700 | 644 | mg/L | 92 | (80-114) | | |
| MBLK | Total Dissolved Solid (TDS) | | | <10 | mg/L | | | | |
| MRL_CHK | Total Dissolved Solid (TDS) | | 10 | 12.0 | mg/L | 120 | (50-150) | | |
| **QC Ref# 778456 - Chloride, Sulfate by EPA 300.0 by EPA 300.0** | | | | | | **Analysis Date: 06/30/2014** | | | |
| LCS1 | Chloride | | 25 | 24.2 | mg/L | 97 | (90-110) | | |
| LCS2 | Chloride | | 25 | 24.2 | mg/L | 97 | (90-110) | 20 | 0.41 |
| MBLK | Chloride | | | <0.5 | mg/L | | | | |
| MRL_CHK | Chloride | | 0.5 | 0.410 | mg/L | 82 | (50-150) | | |
| MS_201406260387 | Chloride | 31 | 13 | 94.0 | mg/L | 100 | (80-120) | | |
| MS_201406270442 | Chloride | 260 | 13 | 381 | mg/L | 95 | (80-120) | | |
| MSD_201406260387 | Chloride | 31 | 13 | 94.2 | mg/L | 101 | (80-120) | 20 | 0.21 |
| MSD_201406270442 | Chloride | 260 | 13 | 380 | mg/L | 94 | (80-120) | 20 | 0.26 |
| LCS1 | Sulfate | | 50 | 50.7 | mg/L | 101 | (90-110) | | |
| LCS2 | Sulfate | | 50 | 50.8 | mg/L | 102 | (90-110) | 20 | 0.20 |
| MBLK | Sulfate | | | <0.25 | mg/L | | | | |
| MRL_CHK | Sulfate | | 1.0 | 0.895 | mg/L | 90 | (50-150) | | |

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by <u>Underlining.</u>
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| MRLLW | Sulfate | | 0.25 | 0.235 | mg/L | 94 | (50-150) | | |
| MS_201406260387 | Sulfate | 99 | 25 | 229 | mg/L | 104 | (80-120) | | |
| MS_201406270442 | Sulfate | 150 | 25 | 403 | mg/L | 102 | (80-120) | | |
| MSD_201406260387 | Sulfate | 99 | 25 | 229 | mg/L | 104 | (80-120) | 20 | 0.0 |
| MSD_201406270442 | Sulfate | 150 | 25 | 404 | mg/L | 103 | (80-120) | 20 | 0.25 |

**QC Ref# 778488 - ICPMS Metals by EPA 200.8** — **Analysis Date: 06/30/2014**

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| LCS1 | Chromium Total ICAP/MS | | 100 | 102 | ug/L | 102 | (85-115) | | |
| LCS2 | Chromium Total ICAP/MS | | 100 | 102 | ug/L | 102 | (85-115) | 20 | 0.98 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 0.965 | ug/L | 97 | (50-150) | | |
| MS_201406170947 | Chromium Total ICAP/MS | 1.1 | 100 | 96.5 | ug/L | 95 | (70-130) | | |
| MS2_201406260618 | Chromium Total ICAP/MS | ND | 100 | 89.1 | ug/L | 89 | (70-130) | | |
| MS2_201406260618 | Chromium Total ICAP/MS | ND | 100 | 89.1 | ug/L | 89 | (70-130) | | |
| MSD_201406170947 | Chromium Total ICAP/MS | 1.1 | 100 | 91.0 | ug/L | 90 | (70-130) | 20 | 5.9 |
| MSD2_201406260618 | Chromium Total ICAP/MS | ND | 100 | 92.9 | ug/L | 93 | (70-130) | 20 | 4.2 |
| MSD2_201406260618 | Chromium Total ICAP/MS | ND | 100 | 92.9 | ug/L | 93 | (70-130) | 20 | 4.2 |

**QC Ref# 779031 - Alkalinity in CaCO3 units by SM 2320B** — **Analysis Date: 07/02/2014**

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| LCS1 | Alkalinity in CaCO3 units | | 100 | 96.4 | mg/L | 96 | (90-110) | | |
| LCS2 | Alkalinity in CaCO3 units | | 100 | 95.7 | mg/L | 96 | (90-110) | 20 | 0.73 |
| MBLK | Alkalinity in CaCO3 units | | | <2 | mg/L | | | | |
| MRL_CHK | Alkalinity in CaCO3 units | | 2.0 | 2.26 | mg/L | 113 | (50-150) | | |
| MS_201406260267 | Alkalinity in CaCO3 units | 74 | 100 | 165 | mg/L | 91 | (80-120) | | |
| MS_201406260384 | Alkalinity in CaCO3 units | 230 | 100 | 315 | mg/L | 83 | (80-120) | | |
| MSD_201406260267 | Alkalinity in CaCO3 units | 74 | 100 | 168 | mg/L | 94 | (80-120) | 20 | 1.8 |
| MSD_201406260384 | Alkalinity in CaCO3 units | 230 | 100 | 312 | mg/L | 79 | (80-120) | 20 | 0.96 |

**QC Ref# 779042 - PH (H3=past HT not compliant) by SM4500-HB** — **Analysis Date: 07/02/2014**

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| DUP_201406260267 | PH (H3=past HT not compliant) | 8.2 | | 8.28 | Units | | ( 0.000-20) | 20 | 0.85 |
| DUP_201406260384 | PH (H3=past HT not compliant) | 7.8 | | 7.79 | Units | | ( 0.000-20) | 20 | 0.39 |
| LCS1 | PH (H3=past HT not compliant) | | 6.0 | 6.02 | Units | 100 | (98-102) | | |
| LCS2 | PH (H3=past HT not compliant) | | 6.0 | 6.01 | Units | 100 | (98-102) | 20 | 0.17 |

**QC Ref# 779065 - Alkalinity in CaCO3 units by SM 2320B** — **Analysis Date: 07/03/2014**

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| LCS1 | Alkalinity in CaCO3 units | | 100 | 95.5 | mg/L | 96 | (90-110) | | |
| LCS2 | Alkalinity in CaCO3 units | | 100 | 91.7 | mg/L | 92 | (90-110) | 20 | 4.1 |
| MBLK | Alkalinity in CaCO3 units | | | <2 | mg/L | | | | |
| MRL_CHK | Alkalinity in CaCO3 units | | 2.0 | 1.97 | mg/L | 99 | (50-150) | | |
| MS_201406260606 | Alkalinity in CaCO3 units | 120 | 100 | 190 | mg/L | 72 | (80-120) | | |

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

eurofins
Eaton Analytical

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (626) 386-1101
1 800 566 LABS (1 800 566 5227)

**Laboratory QC**
**Report: 487417**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| MS_201406270451 | Alkalinity in CaCO3 units | 270 | 100 | 287 | mg/L | 15 | (80-120) | | |
| MSD_201406260606 | Alkalinity in CaCO3 units | 120 | 100 | 193 | mg/L | 75 | (80-120) | 20 | 1.0 |
| MSD_201406270451 | Alkalinity in CaCO3 units | 270 | 100 | 306 | mg/L | 34 | (80-120) | 20 | 6.4 |
| **QC Ref# 779344 - PH (H3=past HT not compliant) by SM4500-HB** | | | | | | **Analysis Date: 07/03/2014** | | | |
| DUP_201406270451 | PH (H3=past HT not compliant) | 8.4 | | 8.37 | Units | | ( 0.000-20) | 20 | 0.24 |
| LCS1 | PH (H3=past HT not compliant) | | 6.0 | 5.99 | Units | 100 | (98-102) | | |
| LCS2 | PH (H3=past HT not compliant) | | 6.0 | 5.99 | Units | 100 | (98-102) | 20 | 0.0 |
| **QC Ref# 779470 - ICPMS Metals by EPA 200.8** | | | | | | **Analysis Date: 07/03/2014** | | | |
| LCS1 | Chromium Total ICAP/MS | | 100 | 103 | ug/L | 103 | (85-115) | | |
| LCS2 | Chromium Total ICAP/MS | | 100 | 103 | ug/L | 103 | (85-115) | 20 | 0.0 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 1.19 | ug/L | 119 | (50-150) | | |
| MS_201406180694 | Chromium Total ICAP/MS | 1.8 | 100 | 97.6 | ug/L | 96 | (70-130) | | |
| MS_201406250101 | Chromium Total ICAP/MS | ND | 100 | 105 | ug/L | 105 | (70-130) | | |
| MSD_201406180694 | Chromium Total ICAP/MS | 1.8 | 100 | 106 | ug/L | 104 | (70-130) | 20 | 8.3 |
| MSD_201406250101 | Chromium Total ICAP/MS | ND | 100 | 103 | ug/L | 103 | (70-130) | 20 | 1.9 |
| **QC Ref# 779522 - ICPMS Metals by EPA 200.8** | | | | | | **Analysis Date: 07/08/2014** | | | |
| LCS1 | Chromium Total ICAP/MS | | 100 | 93.4 | ug/L | 94 | (85-115) | | |
| LCS2 | Chromium Total ICAP/MS | | 100 | 96.2 | ug/L | 96 | (85-115) | 20 | 2.9 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 1.07 | ug/L | 107 | (50-150) | | |
| MS_201406180510 | Chromium Total ICAP/MS | ND | 100 | 95.6 | ug/L | 95 | (70-130) | | |
| MS2_201406180532 | Chromium Total ICAP/MS | ND | 100 | 95.3 | ug/L | 95 | (70-130) | | |
| MSD_201406180510 | Chromium Total ICAP/MS | ND | 100 | 95.4 | ug/L | 95 | (70-130) | 20 | 0.21 |
| MSD2_201406180532 | Chromium Total ICAP/MS | ND | 100 | 95.8 | ug/L | 96 | (70-130) | 20 | 0.52 |

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

750 Royal Oaks Drive, Suite 100
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1 800 566 LABS (1 800 566 5227)

ORELAP 4034

AT-1807

# Laboratory Report

for

Santa Ynez River WCD
Post Office Box 157
Santa Ynez, CA 93460
Attention: Eric Tambini
Fax: 805-688-3078

Date of Issue
03/27/2014
EUROFINS EATON ANALYTICAL

FWH: Fred Haley

Project Manager

Report: 472440
Project: CHROMIUM
Group: well sampling

* Accredited in accordance with NELAP.
* Laboratory certifies that the test results meet all **TNI NELAP** requirements unless noted under the individual analysis.
* Following the cover page are State Certification List, ISO 17025 Accredited Method List, Acknowledgement of Samples Received, Comments, Hits Report, Data Report, QC Summary, QC Report and Regulatory Forms, as applicable.
* Test results relate only to the sample(s) tested.
* This report shall not be reproduced except in full, without the written approval of the laboratory.

# STATE CERTIFICATION LIST

| State | Certification Number | State | Certification Number |
|---|---|---|---|
| **Alabama** | 41060 | **Mississippi** | Certified |
| **Alaska** | CA00006 | **Montana** | Cert 0035 |
| **Arizona** | AZ0778 | **Nebraska** | Certified |
| **Arkansas** | Certified | **Nevada** | CA00006-2012-1 |
| **California-Monrovia-ELAP** | 2813 | **New Hampshire *** | 2959 |
| **California-Colton- ELAP** | 2812 | **New Jersey *** | CA 008 |
| **California-Folsom- ELAP** | 2820 | **New Mexico** | Certified |
| **Colorado** | Certified | **New York *** | 11320 |
| **Connecticut** | PH-0107 | **North Carolina** | 06701 |
| **Delaware** | CA 006 | **North Dakota** | R-009 |
| **Florida *** | E871024 | **Oregon (Primary AB) *** | **ORELAP 4034** |
| **Georgia** | 947 | **Pennsylvania *** | 68-565 |
| **Guam** | 13-004r | **Rhode Island** | LAO00326 |
| **Hawaii** | Certified | **South Carolina** | 87016 |
| **Idaho** | Certified | **South Dakota** | Certified |
| **Illinois *** | 200033 | **Tennessee** | TN02839 |
| **Indiana** | C-CA-01 | **Texas *** | T104704230-14-6 |
| **Kansas *** | E-10268 | **Utah *** | CA000062014-6 |
| **Kentucky** | 90107 | **Vermont** | VT0114 |
| **Louisiana *** | LA140009 | **Virginia *** | 00210 |
| **Maine** | CA0006 | **Washington** | C838 |
| **Maryland** | 224 | **West Virginia** | 9943 C |
| **Commonwealth of Northern Marianas Is.** | MP0004 | **Wisconsin** | 998316660 |
| **Massachusetts** | M-CA006 | **Wyoming** | 8TMS-L |
| **Michigan** | 9906 | **EPA Region 5** | Certified |
| **Los Angeles County Sanitation Districts** | 10264 | | |

* NELAP/TNI Recognized Accreditation Bodies

Eurofins Eaton Analytical, Inc.
750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629
T | 626-386-1100
F | 626-386-1101
www.EatonAnalytical.com

**The tests listed below are accredited and meet the requirements of ISO 17025 as verified by the ANSI-ASQ National Accreditation Board/ACLASS.**
**Refer to Certificate and scope of accreditation (AT 1807) found at: http://www.eatonanalytical.com**

| SPECIFIC TESTS | METHOD OR TECHNIQUE USED | Drinking Water | Food & Beverage | Waste Water |
|---|---|---|---|---|
| 1,4-Dioxane | EPA 522 | x | x | |
| 2,3,7,8-TCDD | Modified EPA 1613B | x | x | |
| Acrylamide | In House Method | x | x | |
| Alkalinity | SM 2320B | x | x | x |
| Ammonia | EPA 350.1 | | x | x |
| Ammonia | SM 4500-NH3 H (18th) | | x | x |
| Anions and DBPs by IC | EPA 300.0 | x | x | x |
| Anions and DBPs by IC | EPA 300.1 | x | x | |
| Asbestos | EPA 100.2 | x | | |
| Bicarbonate Alkalinity as HCO3 | SM 2330B | x | x | x |
| BOD / CBOD | SM 5210B | | x | x |
| Bromate | In House Method | x | x | |
| Carbamates | EPA 531.2 | x | x | |
| Carbonate as CO3 | SM 2330B | x | x | x |
| Carbonyls | EPA 556 | x | x | |
| COD | EPA 410.4 / SM 5220D | | | x |
| Chloramines | SM 4500-CL G | x | x | x |
| Chlorinated Acids | EPA 515.4 | x | x | |
| Chlorinated Acids | EPA 555 | x | x | |
| Chlorine Dioxide | SM 4500-CLO2 D | x | x | |
| Chlorine -Total/Free/ Combined Residual | SM 4500-Cl G | x | x | x |
| Conductivity | EPA 120.1 | | | x |
| Conductivity | SM 2510B | x | x | x |
| Corrosivity (Langelier Index) | SM 2330B | x | x | |
| Cyanide, Amenable | SM 4500-CN G | x | | x |
| Cyanide, Free | SM 4500CN F | x | x | x |
| Cyanide, Total | EPA 335.4 | x | x | x |
| Cyanogen Chloride (screen) | In House Method | x | x | |
| Diquat and Paraquat | EPA 549.2 | x | x | |
| DBP/HAA | SM 6251B | x | x | |
| Dissolved Oxygen | SM 4500-O G | | x | x |
| E. Coli | (MTF/EC+MUG) | x | | |
| E. Coli | CFR 141.21(f)(6)(i) | | x | x |
| E. Coli | SM 9223 | | | x |
| E. Coli (Enumeration) | SM 9221B.1/ SM 9221F | x | x | |
| E. Coli (Enumeration) | SM 9223B | x | x | |
| EDB/DCBP | EPA 504.1 | x | | |
| EDB/DBCP and DBP | EPA 551.1 | x | x | |
| EDTA and NTA | In House Method | x | x | |
| Endothall | EPA 548.1 | x | x | |
| Enterococci | SM 9230B | x | | x |
| Fecal Coliform | SM 9221 E (MTF/EC) | x | | |
| Fecal Coliform | SM 9221C, E (MTF/EC) | | | x |
| Fecal Coliform (Enumeration) | SM 9221E (MTF/EC) | x | x | |
| Fecal Coliform with Chlorine Present | SM 9221E | | | x |
| Fecal Streptococci | SM 9230B | x | | x |
| Fluoride | SM 4500-F C | x | x | x |
| Glyphosate | EPA 547 | x | x | |
| Gross Alpha/Beta | EPA 900.0 | x | x | x |
| HAAs/ Dalapon | EPA 552.3 | x | x | |
| Hardness | SM 2340B | x | x | x |
| Heterotrophic Bacteria | In House Method | x | x | |
| Heterotrophic Bacteria | SM 9215 B | x | x | |
| Hexavalent Chromium | EPA 218.6 | x | x | x |
| Hexavalent Chromium | EPA 218.7 | x | x | |
| Hexavalent Chromium | SM 3500-Cr B or C (20th) | | | x |

| SPECIFIC TESTS | METHOD OR TECHNIQUE USED | Drinking Water | Food & Beverage | Waste Water |
|---|---|---|---|---|
| Hormones | EPA 539 | x | x | |
| Hydroxide as OH Calc. | SM 2330B | x | x | |
| Kjeldahl Nitrogen | EPA 351.2 | | | x |
| Mercury | EPA 245.1 | x | x | x |
| Metals | EPA 200.7 / 200.8 | x | x | x |
| Microcystin LR | ELISA | x | x | |
| NDMA | EPA 521 | x | x | |
| Nitrate/Nitrite Nitrogen | EPA 353.2 | x | x | x |
| OCL, Pesticides/PCB | EPA 505 | x | x | |
| Ortho Phosphate | EPA 365.1 | x | x | |
| Ortho Phosphate and Total Phosphorous | EPA 365.1/SM 4500-P E | | | x |
| Ortho Phosphorous | SM 4500P E | x | x | |
| Oxyhalides Disinfection Byproducts | EPA 317.0 | x | x | |
| Perchlorate | EPA 331.0 | x | x | |
| Perchlorate | EPA 314.0 | x | x | |
| Perfluorinated Alkyl Acids | EPA 537 | x | x | |
| pH | EPA 150.1 | x | | |
| pH | SM 4500-H+B | x | x | x |
| Phenylurea Pesticides/ Herbicides | In House Method | x | x | |
| Pseudomonas | IDEXX Pseudalert | x | x | |
| Radium-226 | RA-226 GA | x | x | |
| Radium-228 | RA-228 GA | x | x | |
| Radon-222 | SM 7500RN | x | x | |
| Residue, Filterable | SM 2540C | x | x | x |
| Residue, Non-filterable | SM 2540D | | | x |
| Residue, Total | SM 2540B | | x | x |
| Residue, Volatile | EPA 160.4 | | | x |
| Semi-VOC | EPA 525.2 | x | x | |
| Semi-VOC | EPA 625 | x | x | x |
| Silica | SM 4500-Si D | x | x | x |
| Silica | SM 4500-SiO2 C | x | | x |
| Sulfide | SM 4500-$S^{=}$ D | | | x |
| Surfactants | SM 5540C | x | x | x |
| Taste and Odor Analytes | SM 6040E | x | x | |
| Total Coliform | SM 9221 A, B | x | x | |
| Total Coliform (Enumeration) | SM 9221 A, B, C | x | x | |
| Total Coliform / E. coli | Colisure | x | x | |
| Total Coliform | SM 9221B | | | x |
| Total Coliform with Chlorine Present | SM 9221B | | | x |
| Total Coliform / E.coli | SM 9223 | x | x | |
| TOC | SM 5310C | | x | x |
| TOC/DOC | SM 5310C | x | x | |
| TOX | SM 5320B | | | x |
| Total Phenols | EPA 420.1 | | | x |
| Total Phenols | EPA 420.4 | x | x | x |
| Total Phosphorous | SM 4500 P F | | | x |
| Turbidity | EPA 180.1 | x | x | x |
| Turbidity | SM 2130B | x | | x |
| Uranium by ICP/MS | EPA 200.8 | x | x | |
| UV 254 | SM 5910B | x | | |
| VOC | EPA 524.2/EPA 524.3 | x | x | |
| VOC | EPA 624 | x | x | x |
| VOC | EPA SW 846 8260 | x | x | |
| VOC | In House Method | x | x | |
| Yeast and Mold | SM 9610 | x | x | |

## Acknowledgement of Samples Received

Addr: **Santa Ynez River WCD**
Post Office Box 157
Santa Ynez, CA 93460

Attn: Eric Tambini
Phone: 805-688-6015

Client ID: SANTAYNEZWD-CA
Folder #: 472440
Project: CHROMIUM
Sample Group: well sampling

Project Manager: Fred Haley
Phone: (626) 386-1127

The following samples were received from you on **March 12, 2014**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical.

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120734 | WH28-1 | 03/10/2014 1125 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120735 | Well 6 | 03/10/2014 1100 |

| | | |
|---|---|---|
| Chromium Total ICAP/MS | Hexavalent chromium(Dissolved) | RUSH |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120736 | W28-620 | 03/10/2014 1205 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120737 | W28-640 | 03/10/2014 1250 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | Uranium ICAP/MS | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120738 | W28-660 | 03/10/2014 1320 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120739 | W28-685 | 03/10/2014 1350 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120740 | W28-705 | 03/10/2014 1420 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120741 | W28-725 | 03/10/2014 1440 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | Uranium ICAP/MS | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120742 | W28-760 | 03/10/2014 1540 |



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## Acknowledgement of Samples Received

Addr: **Santa Ynez River WCD**
Post Office Box 157
Santa Ynez, CA 93460

Attn: Eric Tambini
Phone: 805-688-6015

Client ID: SANTAYNEZWD-CA
Folder #: 472440
Project: CHROMIUM
Sample Group: well sampling

Project Manager: Fred Haley
Phone: (626) 386-1127

The following samples were received from you on **March 12, 2014**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical.

| Sample # | Sample ID | | | Sample Date |
|---|---|---|---|---|
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS | |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate | |
| | Total Dissolved Solid (TDS) | | | |
| 201403120743 | W28-750 | | | 03/10/2014 1510 |
| | Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS | |
| | Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate | |
| | Total Dissolved Solid (TDS) | | | |

### Test Description

472440

eurofins | Eaton Analytical

# CHAIN OF CUSTODY RECORD

750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629

Phone: 626 386 1100
Fax: 626 386 1101

800 566 LABS (800 566 5227)

Website: www.EatonAnalytical.com

*EUROFINS EATON ANALYTICAL USE ONLY:*

**LOGIN COMMENTS:** ______

**SAMPLES CHECKED AGAINST COC BY:** KR
**SAMPLES LOGGED IN BY:** W
**SAMPLES REC'D DAY OF COLLECTION?** ☐ (check for yes)

**SAMPLE TEMP RECEIVED AT:**
☐ Colton / No. California / Arizona ____ °C ( Compliance: 4 ± 2 °C )
☑ Monrovia 2.2 °C ( Compliance: 4 ± 2 °C )

**CONDITION OF BLUE ICE:** Frozen ____ Partially Frozen ____ Thawed ____ Wet Ice ✓ No Ice ____

**METHOD OF SHIPMENT:** Pick-Up / Walk-In / (FedEx) / UPS / DHL / Area Fast / Top Line / Other: ______

*TO BE COMPLETED BY SAMPLER:*

**COMPANY/AGENCY NAME:** Santa Ynez River Water Conservation District

**PROJECT CODE:**

**EEA CLIENT CODE:** | **COC ID:** | **SAMPLE GROUP:** Well 6

**TAT requested: rush by adv notice only** (STD) 1 wk ___ 3 day ___ (2 day) 1 day ___

**COMPLIANCE SAMPLES** ☐ (check for yes) - Requires state forms ☐
**NON-COMPLIANCE SAMPLES** ☐ (check for yes) REGULATION INVOLVED: ______
Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION (eg. SDWA, Phase V, NPDES, FDA,...)

***SEE ATTACHED BOTTLE ORDER FOR ANALYSES*** ☐ (check for yes), OR
**list ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)**

| SAMPLE DATE | SAMPLE TIME | SAMPLE ID | CLIENT LAB ID | MATRIX* | FIELD DATA | FIELD DATA | Alkalinity | Chloride | Sulfate | Cr6 Dissolved | TDS | pH | Uranium | Cr Total | | | | | | | | SAMPLER COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/10/14 | 11:25 | WH28-1 | | RGW | | | X | X | X | X | X | X | | X | | | | | | | | cooler 1 (c1) |
| ↓ | 11:00 | Well 6 | | ↓ | | | O | O | O | X | O | O | O | X | | | | | | | | 2 bottles c1 2 DAY |
| | 12:05 | W28-620 | | | | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ | | | | | | | | c1 |
| | 12:50 | W28-640 | | | | | | | | | | | X | | | | | | | | | c1 |
| | 13:20 | W28-660 | | | | | | | | | | | | | | | | | | | | c1 |
| | 13:50 | W28-685 | | | | | | | | | | | | | | | | | | | | c1 |
| | 14:20 | W28-705 | | | | | | | | | | | | | | | | | | | | c1 |
| | 14:40 | W28-725 | 2ND COOLER? -KR | | | | | | | | | | X | | | | | | | | | c1 |
| | 15:10 | W28-750 | | | | | | | | | | | | | | | | | | | | c2 |
| ↓ | 15:40 | W28-760 | | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ | | | | | | | | c2 |

*** MATRIX TYPES:** **RSW** = Raw Surface Water **RGW** = Raw Ground Water **CFW** = Chlor(am)inated Finished Water **FW** = Other Finished Water **SEAW** = Sea Water **WW** = Waste Water **BW** = Bottled Water **SW** = Storm Water **SO** = Soil **SL** = Sludge **O** = Other - Please Identify

| | SIGNATURE | PRINT NAME | COMPANY/TITLE | DATE | TIME |
|---|---|---|---|---|---|
| SAMPLED BY: | Trey Driscoll | Trey Driscoll/Jeff Kubran | Dudek/Hydrogeologists | 3/10/14 | 18:20 |
| RELINQUISHED BY: | Trey Driscoll | Trey Driscoll | Dudek | 3/11/14 | 11:00 |
| RECEIVED BY: | [signature] | KARLOS RUELLORO | EEA | 3/12/14 | 1158 |
| RELINQUISHED BY: | | | | | |
| RECEIVED BY: | | | | | |

PAGE 1 OF 1

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1 800 566 LABS (1 800 566 5227)

**Laboratory Comments**
**Report: 472440**

Santa Ynez River WCD
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

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**The Comments Report may be blank if there are no comments for this report.**

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**Laboratory Hits**
**Report: 472440**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
03/12/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| | **201403120734** | **WH28-1** | | | | |
| 03/18/2014 16:22 | Alkalinity in CaCO3 units | | 250 | | mg/L | 2 |
| 03/20/2014 21:29 | Chloride | | 36 | 250 | mg/L | 2 |
| 03/13/2014 14:06 | Chromium Total ICAP/MS | | 8.7 | 100 | ug/L | 1 |
| 03/13/2014 14:31 | Hexavalent chromium(Dissolved) | | 8.9 | | ug/L | 0.02 |
| 03/18/2014 16:22 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 03/20/2014 21:29 | Sulfate | | 140 | 250 | mg/L | 1 |
| 03/17/2014 16:59 | Total Dissolved Solids (TDS) | | 550 | 500 | mg/L | 10 |
| | **201403120735** | **Well 6** | | | | |
| 03/14/2014 15:19 | Chromium Total ICAP/MS | | 3.2 | 100 | ug/L | 1 |
| | **201403120736** | **W28-620** | | | | |
| 03/18/2014 16:36 | Alkalinity in CaCO3 units | | 260 | | mg/L | 2 |
| 03/20/2014 21:41 | Chloride | | 36 | 250 | mg/L | 2 |
| 03/13/2014 14:35 | Chromium Total ICAP/MS | | 8.6 | 100 | ug/L | 1 |
| 03/13/2014 16:01 | Hexavalent chromium(Dissolved) | | 9.1 | | ug/L | 0.02 |
| 03/18/2014 16:36 | PH (H3=past HT not compliant) | | 8.2 | | Units | 0.1 |
| 03/20/2014 21:41 | Sulfate | | 140 | 250 | mg/L | 1 |
| 03/17/2014 17:00 | Total Dissolved Solids (TDS) | | 550 | 500 | mg/L | 10 |
| | **201403120737** | **W28-640** | | | | |
| 03/18/2014 16:44 | Alkalinity in CaCO3 units | | 230 | | mg/L | 2 |
| 03/20/2014 21:54 | Chloride | | 36 | 250 | mg/L | 2 |
| 03/13/2014 14:20 | Chromium Total ICAP/MS | | 8.4 | 100 | ug/L | 1 |
| 03/13/2014 13:41 | Hexavalent chromium(Dissolved) | | 9.2 | | ug/L | 0.02 |
| 03/18/2014 16:44 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 03/20/2014 21:54 | Sulfate | | 140 | 250 | mg/L | 1 |
| 03/17/2014 17:01 | Total Dissolved Solids (TDS) | | 530 | 500 | mg/L | 10 |
| 03/13/2014 14:20 | Uranium ICAP/MS | | 6.2 | 30 | ug/L | 1 |
| | **201403120738** | **W28-660** | | | | |
| 03/18/2014 16:52 | Alkalinity in CaCO3 units | | 240 | | mg/L | 2 |
| 03/20/2014 22:07 | Chloride | | 34 | 250 | mg/L | 2 |
| 03/14/2014 14:52 | Chromium Total ICAP/MS | | 9.3 | 100 | ug/L | 1 |
| 03/13/2014 14:01 | Hexavalent chromium(Dissolved) | | 9.4 | | ug/L | 0.02 |
| 03/18/2014 16:52 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 03/20/2014 22:07 | Sulfate | | 130 | 250 | mg/L | 1 |
| 03/17/2014 17:02 | Total Dissolved Solids (TDS) | | 530 | 500 | mg/L | 10 |

**SUMMARY OF POSITIVE DATA ONLY**

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**Laboratory Hits**
**Report: 472440**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
03/12/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| | **201403120739** | **W28-685** | | | | |
| 03/18/2014 17:00 | Alkalinity in CaCO3 units | | 230 | | mg/L | 2 |
| 03/20/2014 22:20 | Chloride | | 34 | 250 | mg/L | 2 |
| 03/13/2014 14:41 | Chromium Total ICAP/MS | | 8.6 | 100 | ug/L | 1 |
| 03/13/2014 14:41 | Hexavalent chromium(Dissolved) | | 9.5 | | ug/L | 0.02 |
| 03/18/2014 17:00 | PH (H3=past HT not compliant) | | 7.9 | | Units | 0.1 |
| 03/20/2014 22:20 | Sulfate | | 130 | 250 | mg/L | 1 |
| 03/17/2014 17:03 | Total Dissolved Solids (TDS) | | 520 | 500 | mg/L | 10 |
| | **201403120740** | **W28-705** | | | | |
| 03/18/2014 17:08 | Alkalinity in CaCO3 units | | 240 | | mg/L | 2 |
| 03/20/2014 23:25 | Chloride | | 34 | 250 | mg/L | 2 |
| 03/13/2014 14:43 | Chromium Total ICAP/MS | | 8.9 | 100 | ug/L | 1 |
| 03/13/2014 14:21 | Hexavalent chromium(Dissolved) | | 10 | | ug/L | 0.02 |
| 03/18/2014 17:08 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 03/20/2014 23:25 | Sulfate | | 130 | 250 | mg/L | 1 |
| 03/17/2014 17:04 | Total Dissolved Solids (TDS) | | 530 | 500 | mg/L | 10 |
| | **201403120741** | **W28-725** | | | | |
| 03/18/2014 17:16 | Alkalinity in CaCO3 units | | 230 | | mg/L | 2 |
| 03/20/2014 23:37 | Chloride | | 34 | 250 | mg/L | 2 |
| 03/13/2014 14:38 | Chromium Total ICAP/MS | | 10 | 100 | ug/L | 1 |
| 03/13/2014 16:21 | Hexavalent chromium(Dissolved) | | 11 | | ug/L | 0.02 |
| 03/18/2014 17:16 | PH (H3=past HT not compliant) | | 8.5 | | Units | 0.1 |
| 03/20/2014 23:37 | Sulfate | | 130 | 250 | mg/L | 1 |
| 03/17/2014 17:05 | Total Dissolved Solids (TDS) | | 520 | 500 | mg/L | 10 |
| 03/13/2014 14:38 | Uranium ICAP/MS | | 6.4 | 30 | ug/L | 1 |
| | **201403120742** | **W28-760** | | | | |
| 03/18/2014 17:25 | Alkalinity in CaCO3 units | | 240 | | mg/L | 2 |
| 03/22/2014 10:06 | Chloride | | 32 | 250 | mg/L | 2 |
| 03/19/2014 15:06 | Chromium Total ICAP/MS | | 12 | 100 | ug/L | 1 |
| 03/13/2014 16:11 | Hexavalent chromium(Dissolved) | | 13 | | ug/L | 0.02 |
| 03/18/2014 17:25 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 03/22/2014 10:06 | Sulfate | | 130 | 250 | mg/L | 1 |
| 03/17/2014 17:06 | Total Dissolved Solids (TDS) | | 530 | 500 | mg/L | 10 |
| | **201403120743** | **W28-750** | | | | |
| 03/18/2014 17:33 | Alkalinity in CaCO3 units | | 240 | | mg/L | 2 |

**SUMMARY OF POSITIVE DATA ONLY**

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**Laboratory Hits**
**Report: 472440**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
03/12/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| 03/22/2014 10:19 | Chloride | | 33 | 250 | mg/L | 2 |
| 03/13/2014 14:12 | Chromium Total ICAP/MS | | 11 | 100 | ug/L | 1 |
| 03/13/2014 13:51 | Hexavalent chromium(Dissolved) | | 12 | | ug/L | 0.02 |
| 03/18/2014 17:33 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 03/22/2014 10:19 | Sulfate | | 130 | 250 | mg/L | 1 |
| 03/17/2014 17:08 | Total Dissolved Solids (TDS) | | 520 | 500 | mg/L | 10 |

**SUMMARY OF POSITIVE DATA ONLY**

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**Laboratory Data Report: 472440**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on: 03/12/2014

| Prepared | Analyzed | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|
| **WH28-1 (201403120734)** | | | | | | **Sampled on 03/10/2014 1125** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/13/2014 | 03/13/2014 | 14:06 757266 | (EPA 200.8) | Chromium Total ICAP/MS | 8.7 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/13/2014 | 14:31 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 8.9 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/20/2014 | 21:29 758836 | (EPA 300.0) | Chloride | 36 | mg/L | 2 | 2 |
| | 03/20/2014 | 21:29 758836 | (EPA 300.0) | Sulfate | 140 | mg/L | 1 | 2 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/18/2014 | 16:22 758032 | (SM 2320B) | Alkalinity in CaCO3 units | 250 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/16/2014 | 03/17/2014 | 16:59 757827 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 550 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/18/2014 | 16:22 758036 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **Well 6 (201403120735)** | | | | | | **Sampled on 03/10/2014 1100** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/13/2014 | 03/14/2014 | 15:19 757430 | (EPA 200.8) | Chromium Total ICAP/MS | 3.2 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/13/2014 | 13:11 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | ND | ug/L | 0.02 | 1 |
| **W28-620 (201403120736)** | | | | | | **Sampled on 03/10/2014 1205** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/13/2014 | 03/13/2014 | 14:35 757266 | (EPA 200.8) | Chromium Total ICAP/MS | 8.6 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/13/2014 | 16:01 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 9.1 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/20/2014 | 21:41 758836 | (EPA 300.0) | Chloride | 36 | mg/L | 2 | 2 |
| | 03/20/2014 | 21:41 758836 | (EPA 300.0) | Sulfate | 140 | mg/L | 1 | 2 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/18/2014 | 16:36 758032 | (SM 2320B) | Alkalinity in CaCO3 units | 260 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/16/2014 | 03/17/2014 | 17:00 757827 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 550 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/18/2014 | 16:36 758036 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.2 | Units | 0.1 | 1 |
| **W28-640 (201403120737)** | | | | | | **Sampled on 03/10/2014 1250** | | |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data Report: 472440**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on: 03/12/2014

| Prepared | Analyzed | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/13/2014 | 03/13/2014 14:20 | 757266 | (EPA 200.8) | Chromium Total ICAP/MS | 8.4 | ug/L | 1 | 1 |
| 3/13/2014 | 03/13/2014 14:20 | 757266 | (EPA 200.8) | Uranium ICAP/MS | 6.2 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/13/2014 13:41 | 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 9.2 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/20/2014 21:54 | 758836 | (EPA 300.0) | Chloride | 36 | mg/L | 2 | 2 |
| | 03/20/2014 21:54 | 758836 | (EPA 300.0) | Sulfate | 140 | mg/L | 1 | 2 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/18/2014 16:44 | 758032 | (SM 2320B) | Alkalinity in CaCO3 units | 230 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/16/2014 | 03/17/2014 17:01 | 757827 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 530 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/18/2014 16:44 | 758036 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W28-660 (201403120738)** | | | | | | **Sampled on 03/10/2014 1320** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/13/2014 | 03/14/2014 14:52 | 757430 | (EPA 200.8) | Chromium Total ICAP/MS | 9.3 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/13/2014 14:01 | 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 9.4 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/20/2014 22:07 | 758836 | (EPA 300.0) | Chloride | 34 | mg/L | 2 | 2 |
| | 03/20/2014 22:07 | 758836 | (EPA 300.0) | Sulfate | 130 | mg/L | 1 | 2 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/18/2014 16:52 | 758032 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/16/2014 | 03/17/2014 17:02 | 757827 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 530 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/18/2014 16:52 | 758036 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W28-685 (201403120739)** | | | | | | **Sampled on 03/10/2014 1350** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/13/2014 | 03/13/2014 14:41 | 757266 | (EPA 200.8) | Chromium Total ICAP/MS | 8.6 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/13/2014 14:41 | 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 9.5 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/20/2014 22:20 | 758836 | (EPA 300.0) | Chloride | 34 | mg/L | 2 | 2 |
| | 03/20/2014 22:20 | 758836 | (EPA 300.0) | Sulfate | 130 | mg/L | 1 | 2 |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data Report: 472440**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on: 03/12/2014

| Prepared | Analyzed | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/18/2014 | 17:00 758032 | (SM 2320B) | Alkalinity in CaCO3 units | 230 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/16/2014 | 03/17/2014 | 17:03 757827 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 520 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/18/2014 | 17:00 758036 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.9 | Units | 0.1 | 1 |
| **W28-705 (201403120740)** | | | | | | **Sampled on 03/10/2014 1420** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/13/2014 | 03/13/2014 | 14:43 757266 | (EPA 200.8) | Chromium Total ICAP/MS | 8.9 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/13/2014 | 14:21 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 10 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/20/2014 | 23:25 758836 | (EPA 300.0) | Chloride | 34 | mg/L | 2 | 2 |
| | 03/20/2014 | 23:25 758836 | (EPA 300.0) | Sulfate | 130 | mg/L | 1 | 2 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/18/2014 | 17:08 758032 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/16/2014 | 03/17/2014 | 17:04 757827 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 530 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/18/2014 | 17:08 758036 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W28-725 (201403120741)** | | | | | | **Sampled on 03/10/2014 1440** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/13/2014 | 03/13/2014 | 14:38 757266 | (EPA 200.8) | Chromium Total ICAP/MS | 10 | ug/L | 1 | 1 |
| 3/13/2014 | 03/13/2014 | 14:38 757266 | (EPA 200.8) | Uranium ICAP/MS | 6.4 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/13/2014 | 16:21 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 11 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/20/2014 | 23:37 758836 | (EPA 300.0) | Chloride | 34 | mg/L | 2 | 2 |
| | 03/20/2014 | 23:37 758836 | (EPA 300.0) | Sulfate | 130 | mg/L | 1 | 2 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/18/2014 | 17:16 758032 | (SM 2320B) | Alkalinity in CaCO3 units | 230 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/16/2014 | 03/17/2014 | 17:05 757827 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 520 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/18/2014 | 17:16 758036 | (SM4500-HB) | PH (H3=past HT not compliant) | 8.5 | Units | 0.1 | 1 |
| **W28-760 (201403120742)** | | | | | | **Sampled on 03/10/2014 1540** | | |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data Report: 472440**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
03/12/2014

| Prepared | Analyzed | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/13/2014 | 03/19/2014 | 15:06 758419 | (EPA 200.8) | Chromium Total ICAP/MS | 12 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/13/2014 | 16:11 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 13 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/22/2014 | 10:06 759004 | (EPA 300.0) | Chloride | 32 | mg/L | 2 | 2 |
| | 03/22/2014 | 10:06 759004 | (EPA 300.0) | Sulfate | 130 | mg/L | 1 | 2 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/18/2014 | 17:25 758032 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/16/2014 | 03/17/2014 | 17:06 757827 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 530 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/18/2014 | 17:25 758036 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W28-750 (201403120743)** | | | | | | **Sampled on 03/10/2014 1510** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/13/2014 | 03/13/2014 | 14:12 757266 | (EPA 200.8) | Chromium Total ICAP/MS | 11 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/13/2014 | 13:51 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 12 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/22/2014 | 10:19 759004 | (EPA 300.0) | Chloride | 33 | mg/L | 2 | 2 |
| | 03/22/2014 | 10:19 759004 | (EPA 300.0) | Sulfate | 130 | mg/L | 1 | 2 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/18/2014 | 17:33 758032 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/16/2014 | 03/17/2014 | 17:08 757827 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 520 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/18/2014 | 17:33 758036 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |

Rounding on totals after summation.
(c) - indicates calculated results

Laboratory
QC Summary: 472440

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**QC Ref # 757266 - ICPMS Metals** — **Analysis Date: 03/13/2014**

| | | |
|---|---|---|
| 201403120734 | WH28-1 | Analyzed by: SXK |
| 201403120736 | W28-620 | Analyzed by: SXK |
| 201403120737 | W28-640 | Analyzed by: SXK |
| 201403120739 | W28-685 | Analyzed by: SXK |
| 201403120740 | W28-705 | Analyzed by: SXK |
| 201403120741 | W28-725 | Analyzed by: SXK |
| 201403120743 | W28-750 | Analyzed by: SXK |

**QC Ref # 757323 - Hexavalent chromium(Dissolved)** — **Analysis Date: 03/13/2014**

| | | |
|---|---|---|
| 201403120734 | WH28-1 | Analyzed by: TLH |
| 201403120735 | Well 6 | Analyzed by: TLH |
| 201403120736 | W28-620 | Analyzed by: TLH |
| 201403120737 | W28-640 | Analyzed by: TLH |
| 201403120738 | W28-660 | Analyzed by: TLH |
| 201403120739 | W28-685 | Analyzed by: TLH |
| 201403120740 | W28-705 | Analyzed by: TLH |
| 201403120741 | W28-725 | Analyzed by: TLH |
| 201403120742 | W28-760 | Analyzed by: TLH |
| 201403120743 | W28-750 | Analyzed by: TLH |

**QC Ref # 757430 - ICPMS Metals** — **Analysis Date: 03/14/2014**

| | | |
|---|---|---|
| 201403120735 | Well 6 | Analyzed by: AZS |
| 201403120738 | W28-660 | Analyzed by: AZS |

**QC Ref # 757827 - Total Dissolved Solids (TDS)** — **Analysis Date: 03/17/2014**

| | | |
|---|---|---|
| 201403120734 | WH28-1 | Analyzed by: JRF |
| 201403120736 | W28-620 | Analyzed by: JRF |
| 201403120737 | W28-640 | Analyzed by: JRF |
| 201403120738 | W28-660 | Analyzed by: JRF |
| 201403120739 | W28-685 | Analyzed by: JRF |
| 201403120740 | W28-705 | Analyzed by: JRF |
| 201403120741 | W28-725 | Analyzed by: JRF |
| 201403120742 | W28-760 | Analyzed by: JRF |
| 201403120743 | W28-750 | Analyzed by: JRF |

**QC Ref # 758032 - Alkalinity in CaCO3 units** — **Analysis Date: 03/18/2014**

| | | |
|---|---|---|
| 201403120734 | WH28-1 | Analyzed by: AF1 |
| 201403120736 | W28-620 | Analyzed by: AF1 |
| 201403120737 | W28-640 | Analyzed by: AF1 |
| 201403120738 | W28-660 | Analyzed by: AF1 |
| 201403120739 | W28-685 | Analyzed by: AF1 |
| 201403120740 | W28-705 | Analyzed by: AF1 |
| 201403120741 | W28-725 | Analyzed by: AF1 |
| 201403120742 | W28-760 | Analyzed by: AF1 |
| 201403120743 | W28-750 | Analyzed by: AF1 |

**QC Ref # 758036 - PH (H3=past HT not compliant)** — **Analysis Date: 03/18/2014**

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| | | |
|---|---|---|
| 201403120734 | WH28-1 | Analyzed by: AF1 |
| 201403120736 | W28-620 | Analyzed by: AF1 |
| 201403120737 | W28-640 | Analyzed by: AF1 |
| 201403120738 | W28-660 | Analyzed by: AF1 |
| 201403120739 | W28-685 | Analyzed by: AF1 |
| 201403120740 | W28-705 | Analyzed by: AF1 |
| 201403120741 | W28-725 | Analyzed by: AF1 |
| 201403120742 | W28-760 | Analyzed by: AF1 |
| 201403120743 | W28-750 | Analyzed by: AF1 |

**QC Ref # 758419 - ICPMS Metals** **Analysis Date: 03/19/2014**

| | | |
|---|---|---|
| 201403120742 | W28-760 | Analyzed by: SXK |

**QC Ref # 758836 - Chloride, Sulfate by EPA 300.0** **Analysis Date: 03/20/2014**

| | | |
|---|---|---|
| 201403120734 | WH28-1 | Analyzed by: CYP |
| 201403120736 | W28-620 | Analyzed by: CYP |
| 201403120737 | W28-640 | Analyzed by: CYP |
| 201403120738 | W28-660 | Analyzed by: CYP |
| 201403120739 | W28-685 | Analyzed by: CYP |
| 201403120740 | W28-705 | Analyzed by: CYP |
| 201403120741 | W28-725 | Analyzed by: CYP |

**QC Ref # 759004 - Chloride, Sulfate by EPA 300.0** **Analysis Date: 03/22/2014**

| | | |
|---|---|---|
| 201403120742 | W28-760 | Analyzed by: CYP |
| 201403120743 | W28-750 | Analyzed by: CYP |

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**Laboratory QC**
**Report: 472440**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| **QC Ref# 757266 - ICPMS Metals by EPA 200.8** | | | | | | **Analysis Date: 03/13/2014** | | | |
| LCS1 | Chromium Total ICAP/MS | | 100 | 98.5 | ug/L | 99 | (85-115) | | |
| LCS2 | Chromium Total ICAP/MS | | 100 | 98.8 | ug/L | 99 | (85-115) | 20 | 0.30 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 0.947 | ug/L | 95 | (50-150) | | |
| MS_201403050932 | Chromium Total ICAP/MS | ND | 100 | 103 | ug/L | 103 | (70-130) | | |
| MS2_201403100207 | Chromium Total ICAP/MS | 3.8 | 100 | 106 | ug/L | 102 | (70-130) | | |
| MSD_201403050932 | Chromium Total ICAP/MS | ND | 100 | 102 | ug/L | 102 | (70-130) | 20 | 0.98 |
| MSD2_201403100207 | Chromium Total ICAP/MS | 3.8 | 100 | 106 | ug/L | 102 | (70-130) | 20 | 0.0 |
| LCS1 | Uranium ICAP/MS | | 20 | 18.3 | ug/L | 92 | (85-115) | | |
| LCS2 | Uranium ICAP/MS | | 20 | 18.3 | ug/L | 92 | (85-115) | 20 | 0.0 |
| MBLK | Uranium ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Uranium ICAP/MS | | 1.0 | 0.929 | ug/L | 93 | (50-150) | | |
| MS_201403050932 | Uranium ICAP/MS | ND | 20 | 21.6 | ug/L | 108 | (70-130) | | |
| MS2_201403100207 | Uranium ICAP/MS | 17 | 20 | 40.4 | ug/L | 115 | (70-130) | | |
| MS2_201403100207 | Uranium ICAP/MS | NA | 20 | 40.4 | ug/L | 115 | (70-130) | | |
| MSD_201403050932 | Uranium ICAP/MS | ND | 20 | 21.4 | ug/L | 107 | (70-130) | 20 | 0.93 |
| MSD2_201403100207 | Uranium ICAP/MS | 17 | 20 | 39.7 | ug/L | 112 | (70-130) | 20 | 1.8 |
| MSD2_201403100207 | Uranium ICAP/MS | NA | 20 | 39.7 | ug/L | 112 | (70-130) | 20 | 1.8 |
| **QC Ref# 757323 - Hexavalent chromium(Dissolved) by EPA 218.6** | | | | | | **Analysis Date: 03/13/2014** | | | |
| LCS1 | Hexavalent chromium(Dissolved) | | 2.0 | 1.99 | ug/L | 100 | (90-110) | | |
| LCS2 | Hexavalent chromium(Dissolved) | | 2.0 | 2.00 | ug/L | 100 | (90-110) | | |
| MBLK | Hexavalent chromium(Dissolved) | | | <0.020 | ug/L | | | | |
| MRL_CHK | Hexavalent chromium(Dissolved) | | 0.02 | 0.0204 | ug/L | 102 | (50-150) | | |
| MS_201403120728 | Hexavalent chromium(Dissolved) | 0.75 | 2.0 | 2.84 | ug/L | 104 | (90-110) | | |
| MS_201403120735 | Hexavalent chromium(Dissolved) | ND | 2.0 | 2.06 | ug/L | 103 | (90-110) | | |
| MSD_201403120728 | Hexavalent chromium(Dissolved) | 0.75 | 2.0 | 2.83 | ug/L | 104 | (90-110) | 20 | 0.35 |
| MSD_201403120735 | Hexavalent chromium(Dissolved) | ND | 2.0 | 2.04 | ug/L | 102 | (90-110) | 20 | 0.98 |
| **QC Ref# 757430 - ICPMS Metals by EPA 200.8** | | | | | | **Analysis Date: 03/14/2014** | | | |
| LCS1 | Chromium Total ICAP/MS | | 100 | 99.0 | ug/L | 99 | (85-115) | | |
| LCS2 | Chromium Total ICAP/MS | | 100 | 101 | ug/L | 101 | (85-115) | 20 | 2.0 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 1.05 | ug/L | 105 | (50-150) | | |
| MS_201403120738 | Chromium Total ICAP/MS | 9.3 | 100 | 111 | ug/L | 102 | (70-130) | | |
| MSD_201403120738 | Chromium Total ICAP/MS | 9.3 | 100 | 112 | ug/L | 103 | (70-130) | 20 | 1.8 |
| LCS1 | Uranium ICAP/MS | | 20 | 18.7 | ug/L | 93 | (85-115) | | |
| LCS2 | Uranium ICAP/MS | | 20 | 18.9 | ug/L | 94 | (85-115) | 20 | 1.1 |

Spike recovery is already corrected for native results.
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Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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**Laboratory QC Report: 472440**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| MBLK | Uranium ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Uranium ICAP/MS | | 1.0 | 0.932 | ug/L | 93 | (50-150) | | |
| MS_201403120738 | Uranium ICAP/MS | 6.1 | 20 | 27.1 | ug/L | 105 | (70-130) | | |
| MSD_201403120738 | Uranium ICAP/MS | 6.1 | 20 | 27.4 | ug/L | 107 | (70-130) | 20 | 1.1 |
| **QC Ref# 757827 - Total Dissolved Solids (TDS) by E160.1/SM2540C** | | | | | | **Analysis Date: 03/17/2014** | | | |
| DUP_201403120729 | Total Dissolved Solid (TDS) | 500 | | 516 | mg/L | | (0-20) | 20 | 2.8 |
| DUP_201403120742 | Total Dissolved Solid (TDS) | 530 | | 530 | mg/L | | (0-20) | 20 | 0.38 |
| LCS1 | Total Dissolved Solid (TDS) | | 175 | 170 | mg/L | 97 | (80-114) | | |
| LCS2 | Total Dissolved Solid (TDS) | | 700 | 688 | mg/L | 98 | (80-114) | | |
| MBLK | Total Dissolved Solid (TDS) | | | <10 | mg/L | | | | |
| MRL_CHK | Total Dissolved Solid (TDS) | | 10 | 9.00 | mg/L | 90 | (50-150) | | |
| **QC Ref# 758032 - Alkalinity in CaCO3 units by SM 2320B** | | | | | | **Analysis Date: 03/18/2014** | | | |
| LCS1 | Alkalinity in CaCO3 units | | 100 | 101 | mg/L | 101 | (90-110) | | |
| LCS2 | Alkalinity in CaCO3 units | | 100 | 102 | mg/L | 102 | (90-110) | 20 | 0.99 |
| MBLK | Alkalinity in CaCO3 units | | | <2 | mg/L | | | | |
| MRL_CHK | Alkalinity in CaCO3 units | | 2.0 | 2.37 | mg/L | 119 | (50-150) | | |
| MS_201403130521 | Alkalinity in CaCO3 units | 150 | 100 | 189 | mg/L | <u>40</u> | (80-120) | | |
| MS_201403130524 | Alkalinity in CaCO3 units | 72 | 100 | 156 | mg/L | 85 | (80-120) | | |
| MSD_201403130521 | Alkalinity in CaCO3 units | 150 | 100 | 186 | mg/L | <u>37</u> | (80-120) | 20 | 1.6 |
| MSD_201403130524 | Alkalinity in CaCO3 units | 72 | 100 | 156 | mg/L | 85 | (80-120) | 20 | 0.0 |
| **QC Ref# 758036 - PH (H3=past HT not compliant) by SM4500-HB** | | | | | | **Analysis Date: 03/18/2014** | | | |
| DUP_201403120734 | PH (H3=past HT not compliant) | 7.8 | | 7.76 | Units | | (0-20) | 20 | 0.13 |
| DUP_201403130540 | PH (H3=past HT not compliant) | 12 | | 11.6 | Units | | (0-20) | 20 | 0.0 |
| LCS1 | PH (H3=past HT not compliant) | | 6.0 | 6.01 | Units | 100 | (98-102) | | |
| LCS2 | PH (H3=past HT not compliant) | | 6.0 | 6.00 | Units | 100 | (98-102) | 20 | 0.17 |
| **QC Ref# 758419 - ICPMS Metals by EPA 200.8** | | | | | | **Analysis Date: 03/19/2014** | | | |
| LCS1 | Chromium Total ICAP/MS | | 100 | 99.1 | ug/L | 99 | (85-115) | | |
| LCS2 | Chromium Total ICAP/MS | | 100 | 95.8 | ug/L | 96 | (85-115) | 20 | 3.4 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 0.970 | ug/L | 97 | (50-150) | | |
| MS_201403160031 | Chromium Total ICAP/MS | ND | 100 | 107 | ug/L | 107 | (70-130) | | |
| MS2_201403160034 | Chromium Total ICAP/MS | ND | 100 | 98.5 | ug/L | 99 | (70-130) | | |
| MSD_201403160031 | Chromium Total ICAP/MS | ND | 100 | 104 | ug/L | 104 | (70-130) | 20 | 2.8 |
| MSD2_201403160034 | Chromium Total ICAP/MS | ND | 100 | 97.8 | ug/L | 98 | (70-130) | 20 | 0.71 |
| LCS1 | Uranium ICAP/MS | | 20 | 18.0 | ug/L | 90 | (85-115) | | |
| LCS2 | Uranium ICAP/MS | | 20 | 17.7 | ug/L | 89 | (85-115) | 20 | 1.7 |

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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**Laboratory QC**
**Report: 472440**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| MBLK | Uranium ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Uranium ICAP/MS | | 1.0 | 0.959 | ug/L | 96 | (50-150) | | |
| MS_201403160031 | Uranium ICAP/MS | ND | 20 | 21.0 | ug/L | 105 | (70-130) | | |
| MS2_201403160034 | Uranium ICAP/MS | ND | 20 | 18.2 | ug/L | 91 | (70-130) | | |
| MSD_201403160031 | Uranium ICAP/MS | ND | 20 | 20.9 | ug/L | 104 | (70-130) | 20 | 0.48 |
| MSD2_201403160034 | Uranium ICAP/MS | ND | 20 | 18.5 | ug/L | 93 | (70-130) | 20 | 1.6 |
| **QC Ref# 758836 - Chloride, Sulfate by EPA 300.0 by EPA 300.0** | | | | | | **Analysis Date: 03/20/2014** | | | |
| LCS1 | Chloride | | 25 | 25.2 | mg/L | 101 | (90-110) | | |
| LCS2 | Chloride | | 25 | 25.2 | mg/L | 101 | (90-110) | 20 | 0.0 |
| MBLK | Chloride | | | <0.5 | mg/L | | | | |
| MRL_CHK | Chloride | | 0.5 | 0.428 | mg/L | 86 | (50-150) | | |
| MS_201403120739 | Chloride | 34 | 13 | 59.9 | mg/L | 102 | (80-120) | | |
| MS_201403190518 | Chloride | 9 | 13 | 22.4 | mg/L | 107 | (80-120) | | |
| MSD_201403120739 | Chloride | 34 | 13 | 59.4 | mg/L | 100 | (80-120) | 20 | 0.84 |
| MSD_201403190518 | Chloride | 9 | 13 | 22.5 | mg/L | 107 | (80-120) | 20 | 0.45 |
| LCS1 | Sulfate | | 50 | 49.5 | mg/L | 99 | (90-110) | | |
| LCS2 | Sulfate | | 50 | 49.5 | mg/L | 99 | (90-110) | 20 | 0.0 |
| MBLK | Sulfate | | | <0.25 | mg/L | | | | |
| MRL_CHK | Sulfate | | 1.0 | 0.928 | mg/L | 93 | (50-150) | | |
| MRLLW | Sulfate | | 0.25 | 0.241 | mg/L | 97 | (50-150) | | |
| MS_201403120739 | Sulfate | 130 | 25 | 180 | mg/L | 96 | (80-120) | | |
| MS_201403190518 | Sulfate | 5.5 | 25 | 30.9 | mg/L | 102 | (80-120) | | |
| MSD_201403120739 | Sulfate | 130 | 25 | 178 | mg/L | 94 | (80-120) | 20 | 1.1 |
| MSD_201403190518 | Sulfate | 5.5 | 25 | 31.0 | mg/L | 102 | (80-120) | 20 | 0.32 |
| **QC Ref# 759004 - Chloride, Sulfate by EPA 300.0 by EPA 300.0** | | | | | | **Analysis Date: 03/22/2014** | | | |
| LCS1 | Chloride | | 25 | 25.6 | mg/L | 103 | (90-110) | | |
| LCS2 | Chloride | | 25 | 25.7 | mg/L | 103 | (90-110) | 20 | 0.39 |
| MBLK | Chloride | | | <0.5 | mg/L | | | | |
| MRL_CHK | Chloride | | 0.5 | 0.404 | mg/L | 81 | (50-150) | | |
| MS_201403120743 | Chloride | 33 | 13 | 58.1 | mg/L | 100 | (80-120) | | |
| MS_201403220256 | Chloride | 76 | 13 | 98.1 | mg/L | 89 | (80-120) | | |
| MSD_201403120743 | Chloride | 33 | 13 | 58.3 | mg/L | 101 | (80-120) | 20 | 0.34 |
| MSD_201403220256 | Chloride | 76 | 13 | 98.0 | mg/L | 89 | (80-120) | 20 | 0.10 |
| LCS1 | Sulfate | | 50 | 51.0 | mg/L | 102 | (90-110) | | |
| LCS2 | Sulfate | | 50 | 51.0 | mg/L | 102 | (90-110) | 20 | 0.20 |
| MBLK | Sulfate | | | <0.25 | mg/L | | | | |
| MRL_CHK | Sulfate | | 1.0 | 0.912 | mg/L | 91 | (50-150) | | |

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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**Report: 472440**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| MRLLW | Sulfate | | 0.25 | 0.234 | mg/L | 94 | (50-150) | | |
| MS_201403120743 | Sulfate | 130 | 25 | 179 | mg/L | 93 | (80-120) | | |
| MS_201403220256 | Sulfate | 120 | 25 | 164 | mg/L | 95 | (80-120) | | |
| MSD_201403120743 | Sulfate | 130 | 25 | 180 | mg/L | 94 | (80-120) | 20 | 0.56 |
| MSD_201403220256 | Sulfate | 120 | 25 | 163 | mg/L | 94 | (80-120) | 20 | 0.61 |

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

eurofins Eaton Analytical
750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
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1 800 566 LABS (1 800 566 5227)

ORELAP 4034

AT-1807

# Laboratory Report

for

Santa Ynez River WCD
Post Office Box 157
Santa Ynez, CA  93460
Attention: Eric Tambini
Fax: 805-688-3078

Date of Issue
03/27/2014
EUROFINS EATON ANALYTICAL

FWH: Fred Haley

Project Manager

Report: 472438
Project: CHROMIUM
Group: well sampling

* Accredited in accordance with NELAP.
* Laboratory certifies that the test results meet all **TNI NELAP** requirements unless noted under the individual analysis.
* Following the cover page are State Certification List, ISO 17025 Accredited Method List, Acknowledgement of Samples Received, Comments, Hits Report, Data Report, QC Summary, QC Report and Regulatory Forms, as applicable.
* Test results relate only to the sample(s) tested.
* This report shall not be reproduced except in full, without the written approval of the laboratory.

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# STATE CERTIFICATION LIST

| State | Certification Number | State | Certification Number |
|---|---|---|---|
| Alabama | 41060 | Mississippi | Certified |
| Alaska | CA00006 | Montana | Cert 0035 |
| Arizona | AZ0778 | Nebraska | Certified |
| Arkansas | Certified | Nevada | CA00006-2012-1 |
| California-Monrovia-ELAP | 2813 | New Hampshire * | 2959 |
| California-Colton- ELAP | 2812 | New Jersey * | CA 008 |
| California-Folsom- ELAP | 2820 | New Mexico | Certified |
| Colorado | Certified | New York * | 11320 |
| Connecticut | PH-0107 | North Carolina | 06701 |
| Delaware | CA 006 | North Dakota | R-009 |
| Florida * | E871024 | Oregon (Primary AB) * | ORELAP 4034 |
| Georgia | 947 | Pennsylvania * | 68-565 |
| Guam | 13-004r | Rhode Island | LAO00326 |
| Hawaii | Certified | South Carolina | 87016 |
| Idaho | Certified | South Dakota | Certified |
| Illinois * | 200033 | Tennessee | TN02839 |
| Indiana | C-CA-01 | Texas * | T104704230-14-6 |
| Kansas * | E-10268 | Utah * | CA000062014-6 |
| Kentucky | 90107 | Vermont | VT0114 |
| Louisiana * | LA140009 | Virginia * | 00210 |
| Maine | CA0006 | Washington | C838 |
| Maryland | 224 | West Virginia | 9943 C |
| Commonwealth of Northern Marianas Is. | MP0004 | Wisconsin | 998316660 |
| Massachusetts | M-CA006 | Wyoming | 8TMS-L |
| Michigan | 9906 | EPA Region 5 | Certified |
| Los Angeles County Sanitation Districts | 10264 | | |

* NELAP/TNI Recognized Accreditation Bodies

**The tests listed below are accredited and meet the requirements of ISO 17025 as verified by the ANSI-ASQ National Accreditation Board/ACLASS.**
**Refer to Certificate and scope of accreditation (AT 1807) found at: http://www.eatonanalytical.com**

| SPECIFIC TESTS | METHOD OR TECHNIQUE USED | Drinking Water | Food & Beverage | Waste Water |
|---|---|---|---|---|
| 1,4-Dioxane | EPA 522 | x | x | |
| 2,3,7,8-TCDD | Modified EPA 1613B | x | x | |
| Acrylamide | In House Method | x | x | |
| Alkalinity | SM 2320B | x | x | x |
| Ammonia | EPA 350.1 | | x | x |
| Ammonia | SM 4500-NH3 H (18th) | | x | x |
| Anions and DBPs by IC | EPA 300.0 | x | x | x |
| Anions and DBPs by IC | EPA 300.1 | x | x | |
| Asbestos | EPA 100.2 | x | | |
| Bicarbonate Alkalinity as HCO3 | SM 2330B | x | x | x |
| BOD / CBOD | SM 5210B | | x | x |
| Bromate | In House Method | x | x | |
| Carbamates | EPA 531.2 | x | x | |
| Carbonate as CO3 | SM 2330B | x | x | x |
| Carbonyls | EPA 556 | x | x | |
| COD | EPA 410.4 / SM 5220D | | | x |
| Chloramines | SM 4500-CL G | x | x | x |
| Chlorinated Acids | EPA 515.4 | x | x | |
| Chlorinated Acids | EPA 555 | x | x | |
| Chlorine Dioxide | SM 4500-CLO2 D | x | x | |
| Chlorine -Total/Free/ Combined Residual | SM 4500-Cl G | x | x | x |
| Conductivity | EPA 120.1 | | | x |
| Conductivity | SM 2510B | x | x | x |
| Corrosivity (Langelier Index) | SM 2330B | x | x | |
| Cyanide, Amenable | SM 4500-CN G | x | | x |
| Cyanide, Free | SM 4500CN F | x | x | x |
| Cyanide, Total | EPA 335.4 | x | x | x |
| Cyanogen Chloride (screen) | In House Method | x | x | |
| Diquat and Paraquat | EPA 549.2 | x | x | |
| DBP/HAA | SM 6251B | x | x | |
| Dissolved Oxygen | SM 4500-O G | | x | x |
| E. Coli | (MTF/EC+MUG) | x | | |
| E. Coli | CFR 141.21(f)(6)(i) | | x | x |
| E. Coli | SM 9223 | | | x |
| E. Coli (Enumeration) | SM 9221B.1/ SM 9221F | x | x | |
| E. Coli (Enumeration) | SM 9223B | x | x | |
| EDB/DCBP | EPA 504.1 | x | | |
| EDB/DBCP and DBP | EPA 551.1 | x | x | |
| EDTA and NTA | In House Method | x | x | |
| Endothall | EPA 548.1 | x | x | |
| Enterococci | SM 9230B | x | | x |
| Fecal Coliform | SM 9221 E (MTF/EC) | x | | |
| Fecal Coliform | SM 9221C, E (MTF/EC) | | | x |
| Fecal Coliform (Enumeration) | SM 9221E (MTF/EC) | x | x | |
| Fecal Coliform with Chlorine Present | SM 9221E | | | x |
| Fecal Streptococci | SM 9230B | x | | x |
| Fluoride | SM 4500-F C | x | x | x |
| Glyphosate | EPA 547 | x | x | |
| Gross Alpha/Beta | EPA 900.0 | x | x | x |
| HAAs/ Dalapon | EPA 552.3 | x | x | |
| Hardness | SM 2340B | x | x | x |
| Heterotrophic Bacteria | In House Method | x | x | |
| Heterotrophic Bacteria | SM 9215 B | x | x | |
| Hexavalent Chromium | EPA 218.6 | x | x | x |
| Hexavalent Chromium | EPA 218.7 | x | x | |
| Hexavalent Chromium | SM 3500-Cr B or C (20th) | | | x |

| SPECIFIC TESTS | METHOD OR TECHNIQUE USED | Drinking Water | Food & Beverage | Waste Water |
|---|---|---|---|---|
| Hormones | EPA 539 | x | x | |
| Hydroxide as OH Calc. | SM 2330B | x | x | |
| Kjeldahl Nitrogen | EPA 351.2 | | | x |
| Mercury | EPA 245.1 | x | x | x |
| Metals | EPA 200.7 / 200.8 | x | x | x |
| Microcystin LR | ELISA | x | x | |
| NDMA | EPA 521 | x | x | |
| Nitrate/Nitrite Nitrogen | EPA 353.2 | x | x | x |
| OCL, Pesticides/PCB | EPA 505 | x | x | |
| Ortho Phosphate | EPA 365.1 | x | x | |
| Ortho Phosphate and Total Phosphorous | EPA 365.1/SM 4500-P E | | | x |
| Ortho Phosphorous | SM 4500P E | x | x | |
| Oxyhalides Disinfection Byproducts | EPA 317.0 | x | x | |
| Perchlorate | EPA 331.0 | x | x | |
| Perchlorate | EPA 314.0 | x | x | |
| Perfluorinated Alkyl Acids | EPA 537 | x | x | |
| pH | EPA 150.1 | x | | |
| pH | SM 4500-H+B | x | x | x |
| Phenylurea Pesticides/ Herbicides | In House Method | x | x | |
| Pseudomonas | IDEXX Pseudalert | x | x | |
| Radium-226 | RA-226 GA | x | x | |
| Radium-228 | RA-228 GA | x | x | |
| Radon-222 | SM 7500RN | x | x | |
| Residue, Filterable | SM 2540C | x | x | x |
| Residue, Non-filterable | SM 2540D | | | x |
| Residue, Total | SM 2540B | | x | x |
| Residue, Volatile | EPA 160.4 | | | x |
| Semi-VOC | EPA 525.2 | x | x | |
| Semi-VOC | EPA 625 | x | x | x |
| Silica | SM 4500-Si D | x | x | x |
| Silica | SM 4500-SiO2 C | x | | x |
| Sulfide | SM 4500-$S^{=}$ D | | | x |
| Surfactants | SM 5540C | x | x | x |
| Taste and Odor Analytes | SM 6040E | x | x | |
| Total Coliform | SM 9221 A, B | x | x | |
| Total Coliform (Enumeration) | SM 9221 A, B, C | x | x | |
| Total Coliform / E. coli | Colisure | x | x | |
| Total Coliform | SM 9221B | | | x |
| Total Coliform with Chlorine Present | SM 9221B | | | x |
| Total Coliform / E.coli | SM 9223 | x | x | |
| TOC | SM 5310C | | x | x |
| TOC/DOC | SM 5310C | x | x | |
| TOX | SM 5320B | | | x |
| Total Phenols | EPA 420.1 | | | x |
| Total Phenols | EPA 420.4 | x | x | x |
| Total Phosphorous | SM 4500 P F | | | x |
| Turbidity | EPA 180.1 | x | x | x |
| Turbidity | SM 2130B | x | | x |
| Uranium by ICP/MS | EPA 200.8 | x | x | |
| UV 254 | SM 5910B | x | | |
| VOC | EPA 524.2/EPA 524.3 | x | x | |
| VOC | EPA 624 | x | x | x |
| VOC | EPA SW 846 8260 | x | x | |
| VOC | In House Method | x | x | |
| Yeast and Mold | SM 9610 | x | x | |

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# Acknowledgement of Samples Received

Addr: **Santa Ynez River WCD**
Post Office Box 157
Santa Ynez, CA 93460

Client ID: SANTAYNEZWD-CA
Folder #: 472438
Project: CHROMIUM
Sample Group: well sampling

Attn: Eric Tambini
Phone: 805-688-6015

Project Manager: Fred Haley
Phone: (626) 386-1127

The following samples were received from you on **March 12, 2014**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical.

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120727 | W28-770 | 03/10/2014 1605 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120728 | W28-790 | 03/10/2014 1640 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120729 | W28-800 | 03/10/2014 1710 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120730 | W28-900 | 03/10/2014 1750 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

| Sample # | Sample ID | Sample Date |
|---|---|---|
| 201403120731 | WH28-2 | 03/10/2014 1810 |

| | | |
|---|---|---|
| Alkalinity in CaCO3 units | Chloride | Chromium Total ICAP/MS |
| Hexavalent chromium(Dissolved) | PH (H3=past HT not compliant) | Sulfate |
| Total Dissolved Solid (TDS) | | |

## Test Description

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# CHAIN OF CUSTODY RECORD

472438

750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629

Phone: 626 386 1100
Fax: 626 386 1101

800 566 LABS (800 566 5227)

Website: www.EatonAnalytical.com

*EUROFINS EATON ANALYTICAL USE ONLY:*

**LOGIN COMMENTS:** ____________

**SAMPLES CHECKED AGAINST COC BY:** DS

**SAMPLES LOGGED IN BY:** [initials]

**SAMPLES REC'D DAY OF COLLECTION?** ☐ (check for yes)

**SAMPLE TEMP RECEIVED AT:**

☐ Colton / No. California / Arizona ______ °C ( Compliance: 4 ± 2 °C )

☑ Monrovia 4.0 °C ( Compliance: 4 ± 2 °C )

**CONDITION OF BLUE ICE:** Frozen ______ Partially Frozen ______ Thawed ______ Wet Ice ✓ No Ice ______

**METHOD OF SHIPMENT:** Pick-Up / Walk-In / (FedEx) / UPS / DHL / Area Fast / Top Line / Other: ______

*TO BE COMPLETED BY SAMPLER:*

**COMPANY/AGENCY NAME:** Santa Ynez River Water Conservation District

**PROJECT CODE:**

**COMPLIANCE SAMPLES** ☐ (check for yes) - Requires state forms ☐

**NON-COMPLIANCE SAMPLES** ☐ (check for yes) REGULATION INVOLVED:

Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION (eg. SDWA, Phase V, NPDES, FDA,...)

**EEA CLIENT CODE:** **COC ID:** **SAMPLE GROUP:**

***SEE ATTACHED BOTTLE ORDER FOR ANALYSES*** ☐ (check for yes), ***OR***

**list ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)**

**TAT requested: rush by adv notice only** (STD) ✓ 1 wk ___ 3 day ___ 2 day ___ 1 day ___

| SAMPLE DATE | SAMPLE TIME | SAMPLE ID | CLIENT LAB ID | MATRIX * | FIELD DATA | FIELD DATA | Alkalinity | Chloride | Sulfate | Cr 6 Dissolved | TDS | pH | Uranium | Cr Total | | | | | | | | SAMPLER COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/10/14 | 16:05 | W28-770 | | RGW | | | X | X | X | X | X | X | | X | | | | | | | | cooler 2 (c2) |
| ↓ | 16:40 | W28-790 | | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ | | | | | | | | c2 |
| ↓ | 17:10 | W28-800 | | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ | | | | | | | | c2 |
| ↓ | 17:50 | W28-900 | | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ | | | | | | | | c2 |
| ↓ | 18:10 | WH28-2 | | ↓ | | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ | | | | | | | | c2 |

* **MATRIX TYPES: RSW** = Raw Surface Water **CFW** = Chlor(am)inated Finished Water **SEAW** = Sea Water **BW** = Bottled Water **SO** = Soil **O** = Other - Please Identify
**RGW** = Raw Ground Water **FW** = Other Finished Water **WW** = Waste Water **SW** = Storm Water **SL** = Sludge

| | SIGNATURE | PRINT NAME | COMPANY/TITLE | DATE | TIME |
|---|---|---|---|---|---|
| SAMPLED BY: | Trey Driscoll | Trey Driscoll / Jeff Kubran | Dudek / Hydrogeologists | 3/10/14 | 18:20 |
| RELINQUISHED BY: | Trey Driscoll | Trey Driscoll | Dudek | 3/11/14 | 11:00 |
| RECEIVED BY: | [signature] | Darcus Smith | EEA | 3/12/14 | 1209 |
| RELINQUISHED BY: | | | | | |
| RECEIVED BY: | | | | | |

PAGE 1 OF 1

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**Laboratory Comments**
**Report: 472438**

Santa Ynez River WCD
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

---

**The Comments Report may be blank if there are no comments for this report.**

eurofins Eaton Analytical

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**Laboratory Hits**
**Report: 472438**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
03/12/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| | **201403120727** | **W28-770** | | | | |
| 03/18/2014 14:44 | Alkalinity in CaCO3 units | | 240 | | mg/L | 2 |
| 03/20/2014 20:24 | Chloride | | 33 | 250 | mg/L | 2 |
| 03/14/2014 15:41 | Chromium Total ICAP/MS | | 9.7 | 100 | ug/L | 1 |
| 03/13/2014 15:01 | Hexavalent chromium(Dissolved) | | 9.7 | | ug/L | 0.02 |
| 03/18/2014 14:44 | PH (H3=past HT not compliant) | | 7.7 | | Units | 0.1 |
| 03/20/2014 20:24 | Sulfate | | 130 | 250 | mg/L | 1 |
| 03/16/2014 16:46 | Total Dissolved Solids (TDS) | | 540 | 500 | mg/L | 10 |
| | **201403120728** | **W28-790** | | | | |
| 03/18/2014 14:52 | Alkalinity in CaCO3 units | | 230 | | mg/L | 2 |
| 03/20/2014 20:37 | Chloride | | 37 | 250 | mg/L | 2 |
| 03/13/2014 14:09 | Chromium Total ICAP/MS | | 2.1 | 100 | ug/L | 1 |
| 03/13/2014 15:31 | Hexavalent chromium(Dissolved) | | 0.75 | | ug/L | 0.02 |
| 03/18/2014 14:52 | PH (H3=past HT not compliant) | | 7.7 | | Units | 0.1 |
| 03/20/2014 20:37 | Sulfate | | 120 | 250 | mg/L | 1 |
| 03/16/2014 16:48 | Total Dissolved Solids (TDS) | | 520 | 500 | mg/L | 10 |
| | **201403120729** | **W28-800** | | | | |
| 03/18/2014 15:00 | Alkalinity in CaCO3 units | | 230 | | mg/L | 2 |
| 03/20/2014 20:50 | Chloride | | 37 | 250 | mg/L | 2 |
| 03/14/2014 15:32 | Chromium Total ICAP/MS | | 1.0 | 100 | ug/L | 1 |
| 03/13/2014 16:31 | Hexavalent chromium(Dissolved) | | 1.4 | | ug/L | 0.02 |
| 03/18/2014 15:00 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 03/20/2014 20:50 | Sulfate | | 120 | 250 | mg/L | 1 |
| 03/17/2014 16:55 | Total Dissolved Solids (TDS) | | 500 | 500 | mg/L | 10 |
| | **201403120730** | **W28-900** | | | | |
| 03/18/2014 15:08 | Alkalinity in CaCO3 units | | 240 | | mg/L | 2 |
| 03/20/2014 21:03 | Chloride | | 38 | 250 | mg/L | 2 |
| 03/14/2014 14:03 | Chromium Total ICAP/MS | | 1.1 | 100 | ug/L | 1 |
| 03/13/2014 14:11 | Hexavalent chromium(Dissolved) | | 1.6 | | ug/L | 0.02 |
| 03/18/2014 15:08 | PH (H3=past HT not compliant) | | 7.8 | | Units | 0.1 |
| 03/20/2014 21:03 | Sulfate | | 120 | 250 | mg/L | 1 |
| 03/17/2014 16:57 | Total Dissolved Solids (TDS) | | 500 | 500 | mg/L | 10 |
| | **201403120731** | **WH28-2** | | | | |
| 03/18/2014 15:16 | Alkalinity in CaCO3 units | | 240 | | mg/L | 2 |
| 03/20/2014 21:16 | Chloride | | 36 | 250 | mg/L | 2 |

**SUMMARY OF POSITIVE DATA ONLY**

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
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**Laboratory Hits**
**Report: 472438**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
03/12/2014

| Analyzed | Analyte | Sample ID | Result | Federal MCL | Units | MRL |
|---|---|---|---|---|---|---|
| 03/13/2014 14:17 | Chromium Total ICAP/MS | | 7.9 | 100 | ug/L | 1 |
| 03/13/2014 14:51 | Hexavalent chromium(Dissolved) | | 9.0 | | ug/L | 0.02 |
| 03/18/2014 15:16 | PH (H3=past HT not compliant) | | 7.7 | | Units | 0.1 |
| 03/20/2014 21:16 | Sulfate | | 140 | 250 | mg/L | 1 |
| 03/17/2014 16:58 | Total Dissolved Solids (TDS) | | 570 | 500 | mg/L | 10 |

**SUMMARY OF POSITIVE DATA ONLY**

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**Laboratory Data Report: 472438**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on:
03/12/2014

| Prepared | Analyzed | | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|---|
| **W28-770 (201403120727)** | | | | | | **Sampled on 03/10/2014 1605** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 3/13/2014 | 03/14/2014 | 15:41 | 757708 | (EPA 200.8) | Chromium Total ICAP/MS | 9.7 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 03/13/2014 | 15:01 | 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 9.7 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 03/20/2014 | 20:24 | 758836 | (EPA 300.0) | Chloride | 33 | mg/L | 2 | 2 |
| | 03/20/2014 | 20:24 | 758836 | (EPA 300.0) | Sulfate | 130 | mg/L | 1 | 2 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 03/18/2014 | 14:44 | 758028 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/16/2014 | 03/16/2014 | 16:46 | 757621 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 540 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 03/18/2014 | 14:44 | 758035 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.7 | Units | 0.1 | 1 |
| **W28-790 (201403120728)** | | | | | | **Sampled on 03/10/2014 1640** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 3/13/2014 | 03/13/2014 | 14:09 | 757266 | (EPA 200.8) | Chromium Total ICAP/MS | 2.1 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 03/13/2014 | 15:31 | 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 0.75 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 03/20/2014 | 20:37 | 758836 | (EPA 300.0) | Chloride | 37 | mg/L | 2 | 2 |
| | 03/20/2014 | 20:37 | 758836 | (EPA 300.0) | Sulfate | 120 | mg/L | 1 | 2 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | | |
| | 03/18/2014 | 14:52 | 758028 | (SM 2320B) | Alkalinity in CaCO3 units | 230 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | | |
| 3/16/2014 | 03/16/2014 | 16:48 | 757621 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 520 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | | |
| | 03/18/2014 | 14:52 | 758035 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.7 | Units | 0.1 | 1 |
| **W28-800 (201403120729)** | | | | | | **Sampled on 03/10/2014 1710** | | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | | |
| 3/13/2014 | 03/14/2014 | 15:32 | 757708 | (EPA 200.8) | Chromium Total ICAP/MS | 1.0 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | | |
| | 03/13/2014 | 16:31 | 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 1.4 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | | |
| | 03/20/2014 | 20:50 | 758836 | (EPA 300.0) | Chloride | 37 | mg/L | 2 | 2 |

Rounding on totals after summation.
(c) - indicates calculated results

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**Laboratory Data Report: 472438**

**Santa Ynez River WCD**
Eric Tambini
Post Office Box 157
Santa Ynez, CA 93460

Samples Received on: 03/12/2014

| Prepared | Analyzed | QC Ref # | Method | Analyte | Result | Units | MRL | Dilution |
|---|---|---|---|---|---|---|---|---|
| | 03/20/2014 20:50 | 758836 | (EPA 300.0) | Sulfate | 120 | mg/L | 1 | 2 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/18/2014 15:00 | 758028 | (SM 2320B) | Alkalinity in CaCO3 units | 230 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/16/2014 | 03/17/2014 16:55 | 757827 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 500 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/18/2014 15:00 | 758035 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **W28-900 (201403120730)** | | | | | | **Sampled on 03/10/2014 1750** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/13/2014 | 03/14/2014 14:03 | 757354 | (EPA 200.8) | Chromium Total ICAP/MS | 1.1 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/13/2014 14:11 | 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 1.6 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/20/2014 21:03 | 758836 | (EPA 300.0) | Chloride | 38 | mg/L | 2 | 2 |
| | 03/20/2014 21:03 | 758836 | (EPA 300.0) | Sulfate | 120 | mg/L | 1 | 2 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/18/2014 15:08 | 758028 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/16/2014 | 03/17/2014 16:57 | 757827 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 500 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/18/2014 15:08 | 758035 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.8 | Units | 0.1 | 1 |
| **WH28-2 (201403120731)** | | | | | | **Sampled on 03/10/2014 1810** | | |
| | | **EPA 200.8 - ICPMS Metals** | | | | | | |
| 3/13/2014 | 03/13/2014 14:17 | 757266 | (EPA 200.8) | Chromium Total ICAP/MS | 7.9 | ug/L | 1 | 1 |
| | | **EPA 218.6 - Hexavalent chromium(Dissolved)** | | | | | | |
| | 03/13/2014 14:51 | 757323 | (EPA 218.6) | Hexavalent chromium(Dissolved) | 9.0 | ug/L | 0.02 | 1 |
| | | **EPA 300.0 - Chloride, Sulfate by EPA 300.0** | | | | | | |
| | 03/20/2014 21:16 | 758836 | (EPA 300.0) | Chloride | 36 | mg/L | 2 | 2 |
| | 03/20/2014 21:16 | 758836 | (EPA 300.0) | Sulfate | 140 | mg/L | 1 | 2 |
| | | **SM 2320B - Alkalinity in CaCO3 units** | | | | | | |
| | 03/18/2014 15:16 | 758028 | (SM 2320B) | Alkalinity in CaCO3 units | 240 | mg/L | 2 | 1 |
| | | **E160.1/SM2540C - Total Dissolved Solids (TDS)** | | | | | | |
| 3/16/2014 | 03/17/2014 16:58 | 757827 | (E160.1/SM2540C) | Total Dissolved Solids (TDS) | 570 | mg/L | 10 | 1 |
| | | **SM4500-HB - PH (H3=past HT not compliant)** | | | | | | |
| | 03/18/2014 15:16 | 758035 | (SM4500-HB) | PH (H3=past HT not compliant) | 7.7 | Units | 0.1 | 1 |

Rounding on totals after summation.
(c) - indicates calculated results

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**QC Ref # 757266 - ICPMS Metals** — **Analysis Date: 03/13/2014**

| | | |
|---|---|---|
| 201403120728 | W28-790 | Analyzed by: SXK |
| 201403120731 | WH28-2 | Analyzed by: SXK |

**QC Ref # 757323 - Hexavalent chromium(Dissolved)** — **Analysis Date: 03/13/2014**

| | | |
|---|---|---|
| 201403120727 | W28-770 | Analyzed by: TLH |
| 201403120728 | W28-790 | Analyzed by: TLH |
| 201403120729 | W28-800 | Analyzed by: TLH |
| 201403120730 | W28-900 | Analyzed by: TLH |
| 201403120731 | WH28-2 | Analyzed by: TLH |

**QC Ref # 757354 - ICPMS Metals** — **Analysis Date: 03/14/2014**

| | | |
|---|---|---|
| 201403120730 | W28-900 | Analyzed by: SXK |

**QC Ref # 757621 - Total Dissolved Solids (TDS)** — **Analysis Date: 03/16/2014**

| | | |
|---|---|---|
| 201403120727 | W28-770 | Analyzed by: JRF |
| 201403120728 | W28-790 | Analyzed by: JRF |

**QC Ref # 757708 - ICPMS Metals** — **Analysis Date: 03/14/2014**

| | | |
|---|---|---|
| 201403120727 | W28-770 | Analyzed by: SXK |
| 201403120729 | W28-800 | Analyzed by: SXK |

**QC Ref # 757827 - Total Dissolved Solids (TDS)** — **Analysis Date: 03/17/2014**

| | | |
|---|---|---|
| 201403120729 | W28-800 | Analyzed by: JRF |
| 201403120730 | W28-900 | Analyzed by: JRF |
| 201403120731 | WH28-2 | Analyzed by: JRF |

**QC Ref # 758028 - Alkalinity in CaCO3 units** — **Analysis Date: 03/18/2014**

| | | |
|---|---|---|
| 201403120727 | W28-770 | Analyzed by: AF1 |
| 201403120728 | W28-790 | Analyzed by: AF1 |
| 201403120729 | W28-800 | Analyzed by: AF1 |
| 201403120730 | W28-900 | Analyzed by: AF1 |
| 201403120731 | WH28-2 | Analyzed by: AF1 |

**QC Ref # 758035 - PH (H3=past HT not compliant)** — **Analysis Date: 03/18/2014**

| | | |
|---|---|---|
| 201403120727 | W28-770 | Analyzed by: AF1 |
| 201403120728 | W28-790 | Analyzed by: AF1 |
| 201403120729 | W28-800 | Analyzed by: AF1 |
| 201403120730 | W28-900 | Analyzed by: AF1 |
| 201403120731 | WH28-2 | Analyzed by: AF1 |

**QC Ref # 758836 - Chloride, Sulfate by EPA 300.0** — **Analysis Date: 03/20/2014**

| | | |
|---|---|---|
| 201403120727 | W28-770 | Analyzed by: CYP |
| 201403120728 | W28-790 | Analyzed by: CYP |
| 201403120729 | W28-800 | Analyzed by: CYP |
| 201403120730 | W28-900 | Analyzed by: CYP |
| 201403120731 | WH28-2 | Analyzed by: CYP |

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**Laboratory QC**
**Report: 472438**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| **QC Ref# 757266 - ICPMS Metals by EPA 200.8** | | | | | | **Analysis Date: 03/13/2014** | | | |
| LCS1 | Chromium Total ICAP/MS | | 100 | 98.5 | ug/L | 99 | (85-115) | | |
| LCS2 | Chromium Total ICAP/MS | | 100 | 98.8 | ug/L | 99 | (85-115) | 20 | 0.30 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 0.947 | ug/L | 95 | (50-150) | | |
| MS_201403050932 | Chromium Total ICAP/MS | ND | 100 | 103 | ug/L | 103 | (70-130) | | |
| MS2_201403100207 | Chromium Total ICAP/MS | 3.8 | 100 | 106 | ug/L | 102 | (70-130) | | |
| MSD_201403050932 | Chromium Total ICAP/MS | ND | 100 | 102 | ug/L | 102 | (70-130) | 20 | 0.98 |
| MSD2_201403100207 | Chromium Total ICAP/MS | 3.8 | 100 | 106 | ug/L | 102 | (70-130) | 20 | 0.0 |
| **QC Ref# 757323 - Hexavalent chromium(Dissolved) by EPA 218.6** | | | | | | **Analysis Date: 03/13/2014** | | | |
| LCS1 | Hexavalent chromium(Dissolved) | | 2.0 | 1.99 | ug/L | 100 | (90-110) | | |
| LCS2 | Hexavalent chromium(Dissolved) | | 2.0 | 2.00 | ug/L | 100 | (90-110) | | |
| MBLK | Hexavalent chromium(Dissolved) | | | <0.020 | ug/L | | | | |
| MRL_CHK | Hexavalent chromium(Dissolved) | | 0.02 | 0.0204 | ug/L | 102 | (50-150) | | |
| MS_201403120728 | Hexavalent chromium(Dissolved) | 0.75 | 2.0 | 2.84 | ug/L | 104 | (90-110) | | |
| MS_201403120735 | Hexavalent chromium(Dissolved) | ND | 2.0 | 2.06 | ug/L | 103 | (90-110) | | |
| MSD_201403120728 | Hexavalent chromium(Dissolved) | 0.75 | 2.0 | 2.83 | ug/L | 104 | (90-110) | 20 | 0.35 |
| MSD_201403120735 | Hexavalent chromium(Dissolved) | ND | 2.0 | 2.04 | ug/L | 102 | (90-110) | 20 | 0.98 |
| **QC Ref# 757354 - ICPMS Metals by EPA 200.8** | | | | | | **Analysis Date: 03/14/2014** | | | |
| LCS1 | Chromium Total ICAP/MS | | 100 | 99.4 | ug/L | 99 | (85-115) | | |
| LCS2 | Chromium Total ICAP/MS | | 100 | 99.2 | ug/L | 99 | (85-115) | 20 | 0.20 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 0.962 | ug/L | 96 | (50-150) | | |
| MS_201403130514 | Chromium Total ICAP/MS | 1.8 | 100 | 93.8 | ug/L | 92 | (70-130) | | |
| MS2_201403130513 | Chromium Total ICAP/MS | 9.0 | 100 | 106 | ug/L | 97 | (70-130) | | |
| MSD_201403130514 | Chromium Total ICAP/MS | 1.8 | 100 | 98.7 | ug/L | 97 | (70-130) | 20 | 5.1 |
| MSD2_201403130513 | Chromium Total ICAP/MS | 9.0 | 100 | 110 | ug/L | 101 | (70-130) | 20 | 3.7 |
| **QC Ref# 757621 - Total Dissolved Solids (TDS) by E160.1/SM2540C** | | | | | | **Analysis Date: 03/16/2014** | | | |
| DUP_201403100304 | Total Dissolved Solid (TDS) | 370 | | 374 | mg/L | | (0-20) | 20 | 1.6 |
| DUP_201403120727 | Total Dissolved Solid (TDS) | 540 | | 514 | mg/L | | (0-20) | 20 | 4.2 |
| LCS1 | Total Dissolved Solid (TDS) | | 175 | 160 | mg/L | 91 | (80-114) | | |
| LCS2 | Total Dissolved Solid (TDS) | | 700 | 686 | mg/L | 98 | (80-114) | | |
| MBLK | Total Dissolved Solid (TDS) | | | <10 | mg/L | | | | |
| MRL_CHK | Total Dissolved Solid (TDS) | | 10 | 13.0 | mg/L | 130 | (50-150) | | |
| **QC Ref# 757708 - ICPMS Metals by EPA 200.8** | | | | | | **Analysis Date: 03/14/2014** | | | |
| LCS1 | Chromium Total ICAP/MS | | 100 | 99.0 | ug/L | 99 | (85-115) | | |

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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**Laboratory QC**
**Report: 472438**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| LCS2 | Chromium Total ICAP/MS | | 100 | 101 | ug/L | 101 | (85-115) | 20 | 2.0 |
| MBLK | Chromium Total ICAP/MS | | | <1 | ug/L | | | | |
| MRL_CHK | Chromium Total ICAP/MS | | 1.0 | 0.922 | ug/L | 92 | (50-150) | | |
| MS_201403050934 | Chromium Total ICAP/MS | ND | 100 | 105 | ug/L | 105 | (70-130) | | |
| MS2_201403120729 | Chromium Total ICAP/MS | 1.0 | 100 | 99.0 | ug/L | 98 | (70-130) | | |
| MSD_201403050934 | Chromium Total ICAP/MS | ND | 100 | 102 | ug/L | 102 | (70-130) | 20 | 2.9 |
| MSD2_201403120729 | Chromium Total ICAP/MS | 1.0 | 100 | 107 | ug/L | 106 | (70-130) | 20 | 7.8 |
| **QC Ref# 757827 - Total Dissolved Solids (TDS) by E160.1/SM2540C** | | | | | | **Analysis Date: 03/17/2014** | | | |
| DUP_201403120729 | Total Dissolved Solid (TDS) | 500 | | 516 | mg/L | | (0-20) | 20 | 2.8 |
| DUP_201403120742 | Total Dissolved Solid (TDS) | 530 | | 530 | mg/L | | (0-20) | 20 | 0.38 |
| LCS1 | Total Dissolved Solid (TDS) | | 175 | 170 | mg/L | 97 | (80-114) | | |
| LCS2 | Total Dissolved Solid (TDS) | | 700 | 688 | mg/L | 98 | (80-114) | | |
| MBLK | Total Dissolved Solid (TDS) | | | <10 | mg/L | | | | |
| MRL_CHK | Total Dissolved Solid (TDS) | | 10 | 9.00 | mg/L | 90 | (50-150) | | |
| **QC Ref# 758028 - Alkalinity in CaCO3 units by SM 2320B** | | | | | | **Analysis Date: 03/18/2014** | | | |
| LCS1 | Alkalinity in CaCO3 units | | 100 | 101 | mg/L | 101 | (90-110) | | |
| LCS2 | Alkalinity in CaCO3 units | | 100 | 102 | mg/L | 102 | (90-110) | 20 | 0.99 |
| MBLK | Alkalinity in CaCO3 units | | | <2 | mg/L | | | | |
| MRL_CHK | Alkalinity in CaCO3 units | | 2.0 | 2.45 | mg/L | 123 | (50-150) | | |
| MS_201403120706 | Alkalinity in CaCO3 units | 69 | 100 | 152 | mg/L | 83 | (80-120) | | |
| MS_201403120708 | Alkalinity in CaCO3 units | 93 | 100 | 175 | mg/L | 81 | (80-120) | | |
| MSD_201403120706 | Alkalinity in CaCO3 units | 69 | 100 | 154 | mg/L | 85 | (80-120) | 20 | 1.3 |
| MSD_201403120708 | Alkalinity in CaCO3 units | 93 | 100 | 176 | mg/L | 83 | (80-120) | 20 | 0.57 |
| **QC Ref# 758035 - PH (H3=past HT not compliant) by SM4500-HB** | | | | | | **Analysis Date: 03/18/2014** | | | |
| DUP_201403120710 | PH (H3=past HT not compliant) | 8.9 | | 8.85 | Units | | (0-20) | 20 | 0.23 |
| DUP2_201403130538 | PH (H3=past HT not compliant) | 7.9 | | 7.87 | Units | | (0-20) | 20 | 0.13 |
| LCS1 | PH (H3=past HT not compliant) | | 6.0 | 6.02 | Units | 100 | (98-102) | | |
| LCS2 | PH (H3=past HT not compliant) | | 6.0 | 6.01 | Units | 100 | (98-102) | 20 | 0.17 |
| **QC Ref# 758836 - Chloride, Sulfate by EPA 300.0 by EPA 300.0** | | | | | | **Analysis Date: 03/20/2014** | | | |
| LCS1 | Chloride | | 25 | 25.2 | mg/L | 101 | (90-110) | | |
| LCS2 | Chloride | | 25 | 25.2 | mg/L | 101 | (90-110) | 20 | 0.0 |
| MBLK | Chloride | | | <0.5 | mg/L | | | | |
| MRL_CHK | Chloride | | 0.5 | 0.428 | mg/L | 86 | (50-150) | | |
| MS_201403120739 | Chloride | 34 | 13 | 59.9 | mg/L | 102 | (80-120) | | |
| MS_201403190518 | Chloride | 9 | 13 | 22.4 | mg/L | 107 | (80-120) | | |
| MSD_201403120739 | Chloride | 34 | 13 | 59.4 | mg/L | 100 | (80-120) | 20 | 0.84 |

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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**Laboratory QC**
**Report: 472438**

Santa Ynez River WCD

| QC Type | Analyte | Native | Spiked | Recovered | Units | Yield (%) | Limits (%) | RPDLimit (%) | RPD% |
|---|---|---|---|---|---|---|---|---|---|
| MSD_201403190518 | Chloride | 9 | 13 | 22.5 | mg/L | 107 | (80-120) | 20 | 0.45 |
| LCS1 | Sulfate | | 50 | 49.5 | mg/L | 99 | (90-110) | | |
| LCS2 | Sulfate | | 50 | 49.5 | mg/L | 99 | (90-110) | 20 | 0.0 |
| MBLK | Sulfate | | | <0.25 | mg/L | | | | |
| MRL_CHK | Sulfate | | 1.0 | 0.928 | mg/L | 93 | (50-150) | | |
| MRLLW | Sulfate | | 0.25 | 0.241 | mg/L | 97 | (50-150) | | |
| MS_201403120739 | Sulfate | 130 | 25 | 180 | mg/L | 96 | (80-120) | | |
| MS_201403190518 | Sulfate | 5.5 | 25 | 30.9 | mg/L | 102 | (80-120) | | |
| MSD_201403120739 | Sulfate | 130 | 25 | 178 | mg/L | 94 | (80-120) | 20 | 1.1 |
| MSD_201403190518 | Sulfate | 5.5 | 25 | 31.0 | mg/L | 102 | (80-120) | 20 | 0.32 |

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

# APPENDIX D6

## *Ambient Pressure and Temperature Down-Well Surveys*

# Appendix E6: Ambient Pressure and Temperature Down-Well Surveys

## 1 DOWN-WELL SURVEYS

### 1.1 Ambient Pressure and Temperature Surveys

Prior to conducting the dynamic flow survey, ambient temperature and pressure surveys were conducted for wells No. 15, No. 25, No. 27, and No. 28. The temperature and pressure surveys were completed using an In-Situ Level TROLL 700 transducer, which measures both temperature and pressure, for wells No. 15, No. 25 and No. 28. The transducer was lowered into the well through a Hykon Cable Meter that measures the length of cable in the well. For well No. 27, a Mount Sopris temperature and fluid resistivity tool was lowered into the well on a wireline to record temperature and resistivity (Appendix E3).

The pressure and temperature surveys were conducted in order to determine the potential vertical flow within the well casing. Vertical flow within the well casing is induced by differences in pressure, or hydraulic head, between zones in an aquifer. When two zones with different hydraulic heads are connected by a well, water can flow vertically through the well casing from the zone with higher hydraulic head to the zone with lower hydraulic head. Flow within the well casing can be estimated by comparing the measured pressure gradient in the well to the theoretical pressure gradient in pure water, defined as 1 PSI/2.31 ft.

Flow within the well casing can also be estimated by comparing the measured ambient temperature at depth with the average geothermal gradient. If there is no vertical flow within a well, the temperature of the water in the well will equal that of the surrounding formation and the temperature profile will be a straight line with a slope equal to the local geothermal gradient. If, however, there is vertical flow within a well, there will be inflections in the measured temperature profile indicating zones where water is entering and exiting the well. The average geothermal gradient for the Upland Basin was determined from the ambient temperature log in well No. 27. This well was chosen because the shallowest screen interval is from 940 to 1040 feet bgs. The long section of blank casing above this interval allows water within the well casing to equilibrate with the formation temperature, thereby providing an estimate of the local geothermal gradient. Based on the temperature log from well No.27, the geothermal gradient in the Upland Basin is approximately 1.7 $^{o}$F/ 100 ft (0.013 $^{o}$C/m).

Identifying the zones in which water enters and exits the wells is critical for evaluating the depth distribution of Cr(VI) in the wells. If water with higher concentrations of Cr(VI) enters the well at one depth and exits the well at a different depth, it can increase the concentration of Cr(VI) in the depth interval at which it exits the well. Depth discrete samples from this interval may contain elevated concentrations of Cr(VI) relative to the concentrations in the formation farther from the well. Conversely, if water with lower concentrations of Cr(VI) exits the well in a zone of higher Cr(VI) concentrations, it could dilute the Cr(VI) concentrations in the formation adjacent to the well and potentially mask the zone of higher Cr(VI) concentrations.

#### 1.1.1 <u>Pressure Surveys</u>

The results of the pressure surveys are presented in Appendices E1, E2 and E3 and are summarized below.

- Well 15: An increase in the normalized pressure (the difference between the theoretical and measured pressure gradients) between 240 and 270 feet bgs indicates that water enters well No. 15 in this interval and flows downward within the well casing (Appendix E1).

- Well 25: An increase in the normalized pressure between 750 and 930 feet bgs indicates water enters well No. 25 through the lower and middle well screens. The water flows upward within the well and may exit the well within the middle to upper portions of the upper well screen (Appendix E2).

- Well 28: An increase in the normalized pressure between 300 and 350 feet bgs indicates that water enters the well in this interval and flows downward within the well casing. Water likely exits the well in the lower portion of the middle screen, at approximately 780 feet bgs (Appendix E3).

1.1.2 Temperature Surveys

The results of the temperature surveys are presented in Figures 5 through 8 of the main text and are summarized below.

- Well 15: The measured temperatures in well No. 15 are consistently higher than the estimated geothermal gradient (Figure 5). This is inconsistent with the pressure survey that suggests water enters the well between 240 and 250 feet bgs and flows downward within the well.

- Well 25: Between 310 and 630 feet bgs, there is little increase in the measured temperatures (Figure 6). This suggests water enters the well through the welds between the sections of blank casing and flows downward in the well to the top of the upper screen interval. At 630 feet bgs the measured temperature increases by approximately 4 $^{o}$C, and then remains stable from 630 to 800 feet bgs. Between 800 and 930 feet bgs, the temperature profile increases at a higher rate than that of the estimated geothermal gradient. This is consistent with the pressure survey, which indicates water enters the well in the lower and middle screen intervals and exits the well in the upper screen interval.

- Well 27: Between 200 and 970 feet bgs the temperature increases at a rate that was used to define the local geothermal gradient (Figure 7). At 970 feet bgs, the temperature increases by approximately 3 $^{o}$C . Between 970 and 1090 feet bgs there is little increase in the measured temperatures. Between 1090 and 1195 feet bgs, the temperatures increase at the rate of the geothermal gradient. This suggests water enters the well in the upper portion of the lower screen interval, at approximately 1090 feet bgs, and flows upward in the well to the top of the lower screen interval, at approximately 970 feet bgs.

- Well 28: There are multiple inflection points in the temperature profile (Figure 8). Between 640 and 920 feet bgs, the interval in which the well is screened, there is an inflection point at approximately 780 feet bgs. Above this point the temperature profile is isothermal and below this point, the temperature increases at the rate of the local geothermal gradient. This suggests that water flows downward in the well above 780 feet bgs where it exits the well into the formation, and is consistent with the pressure survey.