APPENDIX 4.2

CECorps Design Report for Johnson Road

September 2016

546 – Design Report for Community Engineering Corps Projects

PROJECT TEAM: Engineers Without Borders - Kansas City Professional Chapter
STATE: California
COMMUNITY: Johnson Road
PROJECT: Salinas River Valley Water System Evaluation and Design

PREPARED BY
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2.0 PROJECT DISCIPLINE(S):

Water Supply
____ Source Development
__x__ Water Storage
__x__ Water Distribution
__x__ Water Treatment
__x__ Water Pump

Sanitation
____ Latrine
____ Gray Water System
____ Black Water System

Structures
____ Bridge
____ Building

Information Systems
____ Computer Service

Civil Works
____ Roads
____ Drainage
____ Dams

Energy
____ Fuel
____ Electricity

Agriculture
____ Irrigation Pump
____ Irrigation Line
____ Water Storage
____ Soil Improvement
____ Fish Farm
____ Crop Processing Equipment

3.0 PROJECT LOCAITON

Latitude: 36.8563039
Longitude: -121.7062063
Nearest Population Center: Las Lomas, California

4.0 PURPOSE OF REPORT

____ Report Prepared for Review by Regulatory Authority
Name of Regulatory Authority:____

__x__ Design Submittal for Partner Community

PART 2 – TECHNICAL INFORMATION

1.0 INTRODUCTION

The United States Department of Agriculture (USDA) has awarded the Community Engineering Corps (CEC) a grant to conduct studies to evaluate solutions to water related problems in small, rural, disadvantaged communities in the United States. The Environmental Justice Coalition for Water (EJCW), with the help of the CEC, has identified multiple communities in the Salinas River Valley of California which are in need of engineering services. The unincorporated community of Johnson Rd., located in North Monterey County outside of Las Lomas, is experiencing compliance issues regarding excessive nitrates in a number of their small water systems and domestic wells.

The Kansas City Professional Chapter of Engineers Without Borders (EWB-KC) has been selected by the CEC to provide engineering support services to the Johnson Rd. community. No construction is anticipated to be included in this project, and it is the understanding of EWB-KC that the community will be able to apply for financial assistance funding for the recommended improvements once provided with the appropriate engineering evaluation.

2.0 DESCRIPTION OF COMMUNITY

The Johnson Rd. community is a small, rural neighborhood located within the Salinas River Valley in California. The community is in North Monterey County, approximately 1.5 miles southeast of Las Lomas, California. The population of this community was estimated by EJCW using approximately 85 homes and 4 people per home for a total of 340 residents. Census data from 2010 from Census Tract 010202 Monterey County support the accuracy of this estimate. Many of the homes within this community are disadvantaged and do not have the financial resources to hire engineering expertise using their own funds.

3.0 DESCRIPTION OF EXISTING WATER SYSTEM

3.1 OVERVIEW OF WATER SYSTEM IN COMMUNITY

The primary source of water supply for the homes within the Johnson Rd. community is from privately owned domestic wells. It is estimated that over 50 wells serve the 85 homes/dwellings that make up the community. Six of these wells have been identified as local small water systems. Figure 1 below shows the boundaries of the Johnson Rd. community and the approximate locations of these six local small water systems.

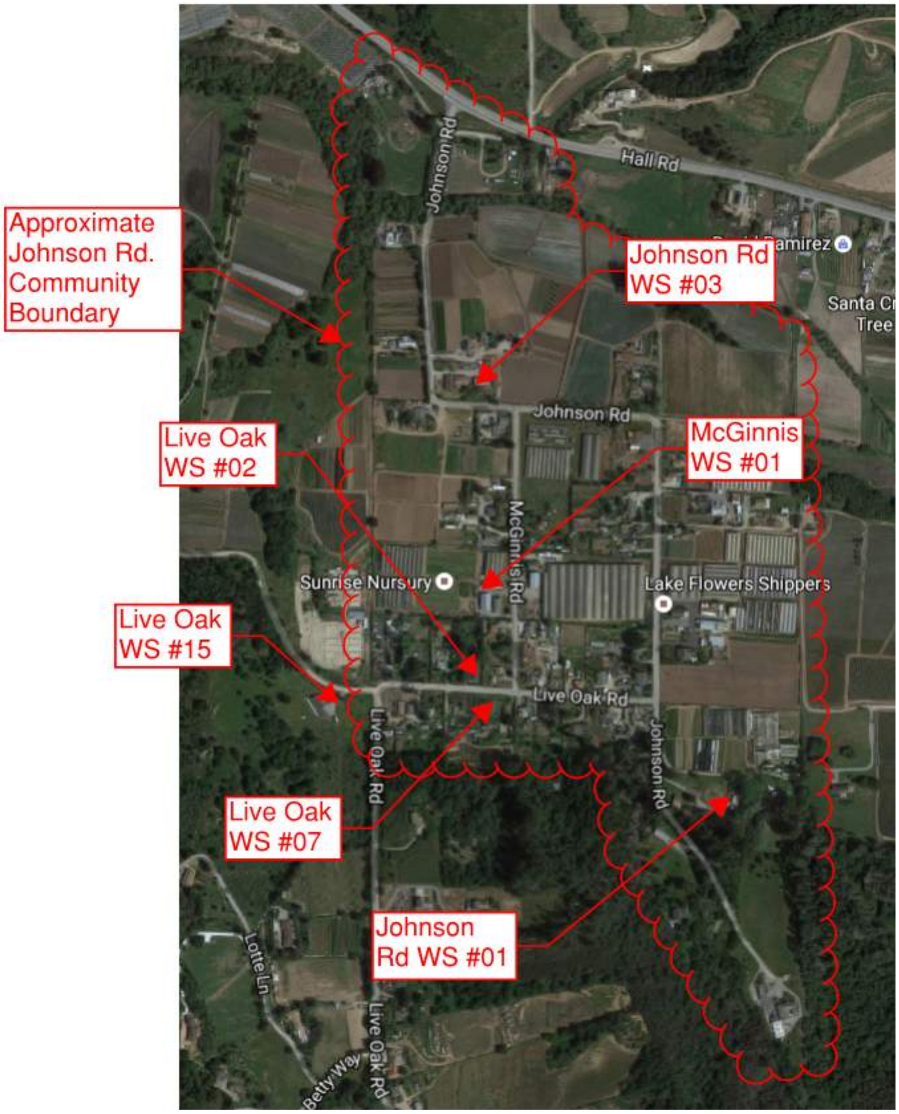

Figure 1 - Locations of Known Water Systems within Community

Each well is owned and operated by the property owner(s) being served by the well, and all costs associated with maintaining the system are the responsibility of these property owner(s). As part of the condition assessment process, EWB-KC visited the Johnson Rd. community to collect site samples of the water supply and interview community members. While on site, EWB-KC met with 4 community members and reviewed each of their existing water systems. Notes from these interviews can be found in Appendix A. Table 1 below summarizes each of these water systems.

Table 1 - Summary of Water Systems Evaluated

Address	Well Specifications	Approximate Number of Connections
150 Johnson Rd.	Pump Capacity: 60 gpm Screen Depth: 120 ft	2
30 McGinnis Rd.	Pump Capacity: 55 gpm Screen Depth: 200 ft	8
48 McGinnis Rd.	Pump Capacity: 75 gpm Screen Depth: 275 ft	3
58 Johnson Rd.	Pump Capacity: Unknown Screen Depth: 140 ft	2

Approximately 30 of the 85 homes currently receive bottled water through a grant from the State Water Resources Control Board (State Board). This grant provides bottled water to qualifying disadvantaged families whose water supply is contaminated. The bottled water program is intended to be an interim solution until a long term solution is provided.

3.2 WATER QUALITY

3.2.1 HISTORIC DATA

Prior to the EJCW's involvement in this project, there was limited historic data available to determine the water quality within the Johnson Rd. community. Data from the Monterey County Health Department shows that nitrate concentrations have been above the Maximum Contaminant Level (MCL) since the late 1980s. Nitrate concentrations in wells located on Johnson Rd. and McGinnis Rd. have been increasing over time and in recent years have exceeded 200 mg/L. Wells located along Live Oak Rd. (east to west segment) have historically shown lower nitrate concentrations than other areas of the community. A summary of the available Monterey County Health Department's water quality data can be seen in Appendix B of the report.

The EJCW carried out additional water sampling and testing during their study to determine the homes that would qualify for the bottled water program. Samples were taken from homes throughout the community and tested for nitrate concentration. Figure 2 below combines this data with the historic data from the Monterey County Health Department and depicts the varying concentrations of nitrate throughout the community.

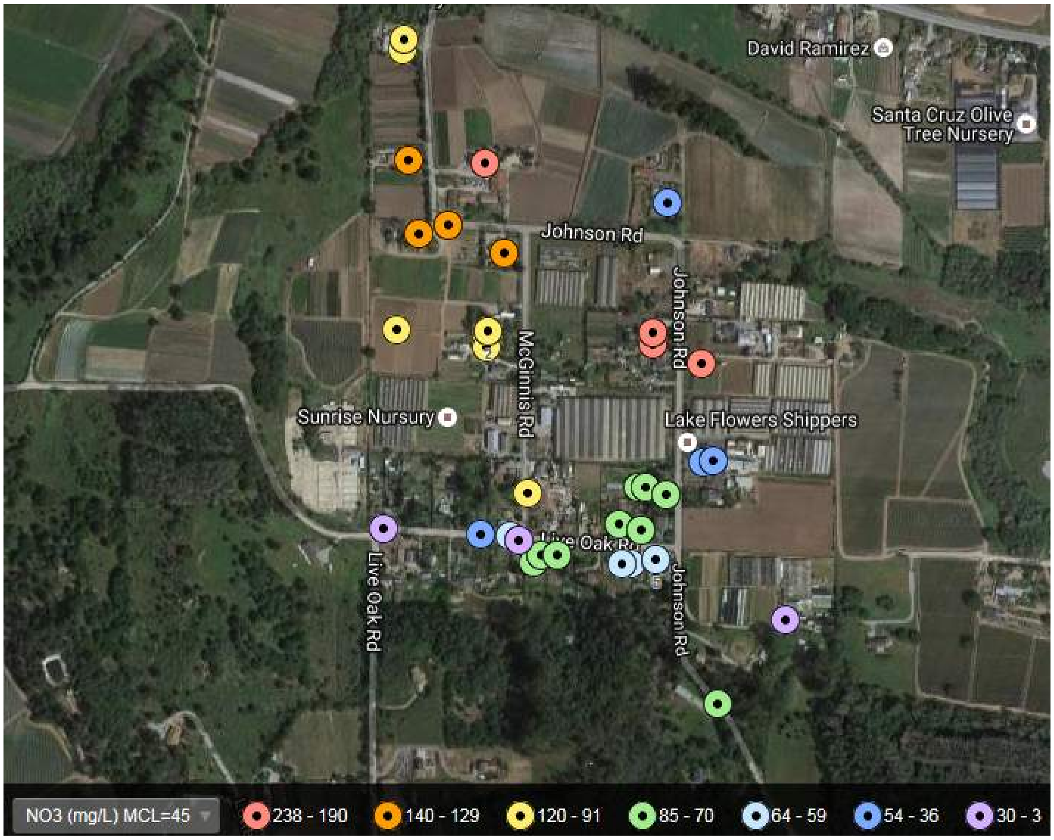

Figure 2 - Nitrate Concentrations in Johnson Rd. Community

3.2.2 DATA FROM EWB-KC SAMPLING

The historical water quality data shows that the constituents analyzed were almost exclusively nitrates and coliforms. A more comprehensive list of analyses was needed to confirm the type and concentrations of constituents present so as to identify appropriate treatment technologies and related costs. While on site, the EWB-KC team coordinated the sampling and testing of two of the wells within the community, on the properties of 30 McGinnis Rd. and 150 Johnson Rd. These two wells are assumed to be representative of the water systems within this community. Budget constraints limited the number of well that could be tested for this project, but additional sampling should be conducted as part of the preliminary design phase. Figure 3 below shows the locations of the wells on each of these properties.

Figure 3 - Location of Wells Tested by EWK-KC

At both sites, multiple samples were collected to perform testing for nitrates, hexavalent chromium (chromium VI), bacteria, and numerous others covered under Title 22 testing procedures. A time series of nitrate contaminants was also collected at 150 Johnson Rd to determine whether the concentration of nitrate varied over a 2 hour period.

3.2.3 DESCRIPTION OF WATER QUALITY ISSUES

The complete lab reports of the water quality sampling performed by EWB-KC can be found in Appendix F. A summary of the pertinent findings from the testing can be seen in Table 2 below.

Table 2 - Water Quality Results (EWB-KC Sampling)

Contaminant		30 McGinnis Rd	150 Johnson Rd	MCL (California)
Nitrate (as NO3)	Range	102 mg/L	191-194 mg/L	45 mg/L
	Average		193 mg/L	
Chromium VI		20 µg/L	5.4 µg/L	10 µg/L
Total Dissolved Solids (TDS)		391 mg/L	548 mg/L	500 mg/L
E. Coli.		<1.0 MPN/100mL	<1.0 MPN/100mL	0 MPN/100mL(1)

(1) Violation of E. Coli. MCL does not occur unless consecutive samples indicate positive coliform presence.

As expected, the results confirm the presence of high concentrations of nitrate in the groundwater for this community. The concentration of nitrate at 150 Johnson Dr. is over four times the MCL. These excessive concentrations of nitrate in the community's water supply subject the community members to health risks such as methemoglobinemia, a blood disorder which reduces the blood's capacity to carry oxygen.

The testing also revealed the presence of chromium VI in the groundwater. The well at 30 McGinnis Rd shows chromium VI concentrations twice as high as the MCL. The concentration of Total Dissolved Solids (TDS) is also above the MCL at 150 Johnson Rd. and near the limit at 30 McGinnis Rd. Reduction of TDS is can be achieved through filtration, and should be accounted for to achieve compliance with California's MCL. The testing results also showed that total coliform and E. Coli were not detected in the two wells tested. As shown in Appendix B, historical data from Monterey County also indicate an absence of bacteria. Therefore, the treatment alternatives evaluated within this report will assume bacteria are not present in the groundwater.

The unsafe levels of nitrate and chromium VI in the community's groundwater supply subject the community to health risks. The community should consider the alternative solutions presented in this report to determine a feasible long term solution to the issues with their water quality. Regardless of the preferred alternative, it will be necessary for the community to come together to advocate the need for a solution that works for the majority of the community members.

4.0 ALTERNATIVE SOLUTIONS

The alternative solutions evaluated in this report will consist of either providing an alternate water supply to the community through consolidation to a nearby public water system or treatment of the contaminated water source to reduce the contaminants to safe levels. The four alternative solutions evaluated in this report are as follows:

- Alternative 1: Consolidation with Cal Water
- Alternative 2: Community Treatment Facility
- Alternative 3: Divided Treatment Facilities
- Alternative 4: Point of Entry (POE) Treatment

A contamination source study was not performed as part of this assessment, but the nitrate contamination is likely due to the agricultural activity that has taken place throughout the Salinas River Valley for the past century. This prolonged pollution of nitrates into the groundwater is assumed to have resulted in widespread contamination for this area. Regardless of the proposed location or depth for any new wells, it is assumed that the continued draw toward the well's screen will eventually result in the presence of nitrates in the water supply. For the purpose of this evaluation, any alternative that includes a well within the community will be assumed to have the same contaminant concentrations as those present in the water samples taken by EWB-KC during their site visit.

The available treatment technologies to reduce these contaminants include ion exchange, reverse osmosis, and biological denitrification. Of these available technologies, ion exchange is the preferred treatment method for this application due to its lowest comparative cost and operational simplicity. Reverse osmosis systems typically have a waste stream of approximately 25% of the process influent. Without the presence of a sewer system in the community, this technology was not considered as a feasible solution. Biological denitrification is a proven treatment method in wastewater applications, but has limited active installations in drinking water applications. Treatment involves a more complicated process train which includes substrate addition, aeration, filtration, and disinfection. This treatment technology was ruled out primarily due to its operational complexity.

The Safe Water Drinking Act states that public water systems which use only groundwater sources are not required to disinfect if serving less than 4,900 people. Since total coliform and E. Coli were not detected in the water samples taken during the site visit, disinfection is assumed to not be required for each treatment alternative. However, in accordance with the Title 22 of the California Code of Regulations (Title 22), monthly samples will be required to be tested and reported to indicate continued compliance.

The design flow for each of the alternatives was developed based upon peaking factors provided in Title 22. No growth is projected for the population of this community, and the design future demands for this report are assumed to be equal to the existing calculated demands. The Average Day Demand (ADD) was calculated based upon an assumed 60 gpdc (gallons per day per capita), 4 people per home, and 85 homes. The Max Day Demand (MDD) is assumed to be 2.25 times the ADD, while the Peak Hour Demand (PHD) is assumed to be 1.5 times the MDD. As indicated by the North County Fire District, this area will be required to provide 1,000 gpm for 2 hours at 20 psi. Table 3 below shows a summary of the design demands assumed for each of the alternatives evaluated within this section.

Table 3 - Design Demands

Description	Flow (gpm)
Average Day Demand (ADD)	14.2
Max Day Demand (MDD)	31.9
Peak Hour Demand (PHD)	47.8
Required Fire Flow	1,000

It should be noted that the listed fire flow requirement is over 30 times as much as the calculated MDD for the community. Meeting this requirement will significantly impact the costs of the evaluated alternatives. Per American Water Works Association (AWWA) M31, the required fire flow for one or two family dwellings can be less than 1,000 gpm and is dependent upon the distance between structures. The alternatives evaluated in this report were based upon meeting this requirement; however, thorough analysis of this requirement should be investigated prior to final design.

4.1 DESCRIPTION OF ALTERNATIVES

4.1.1 ALTERNATIVE 1 - CONSOLIDATION WITH CAL WATER

Alternative 1 is the consolidation of the Johnson Rd. water system with the nearest available public water system, California Water Service (Cal Water). For system consolidation, the Johnson Rd. community water system will connect to Cal Water's existing water main at its nearest location to the community, near Las Lomas. This alternative would include the construction of approximately 13,800 feet of new water main along with new flow meters, isolation valves, and backflow preventers on each service lateral.

The final design for this alternative would need to conform to all Cal Water standards, but it is assumed the system would be sized to provide fire flow plus MDD and would include fire hydrants spaced in accordance with California Fire Code. For Cal Water to be able to serve this area, a specific process must be followed which is started by a "Request to Serve" letter from the community. Because the ADD for this community is less than 10% of the maximum day production of the Las Lomas Water Treatment Plant, a water supply assessment will likely not be required. If approved by Cal Water, a "Will Serve" letter will be returned to the community. The community will then need to provide a deposit along with a basic engineering plan which will include a map showing each of the proposed locations and sizes for service connections. Additional details about this process can be found in Appendix C. Figure 4 below shows the proposed water main alignment and location of connection to Cal Water's distribution system.

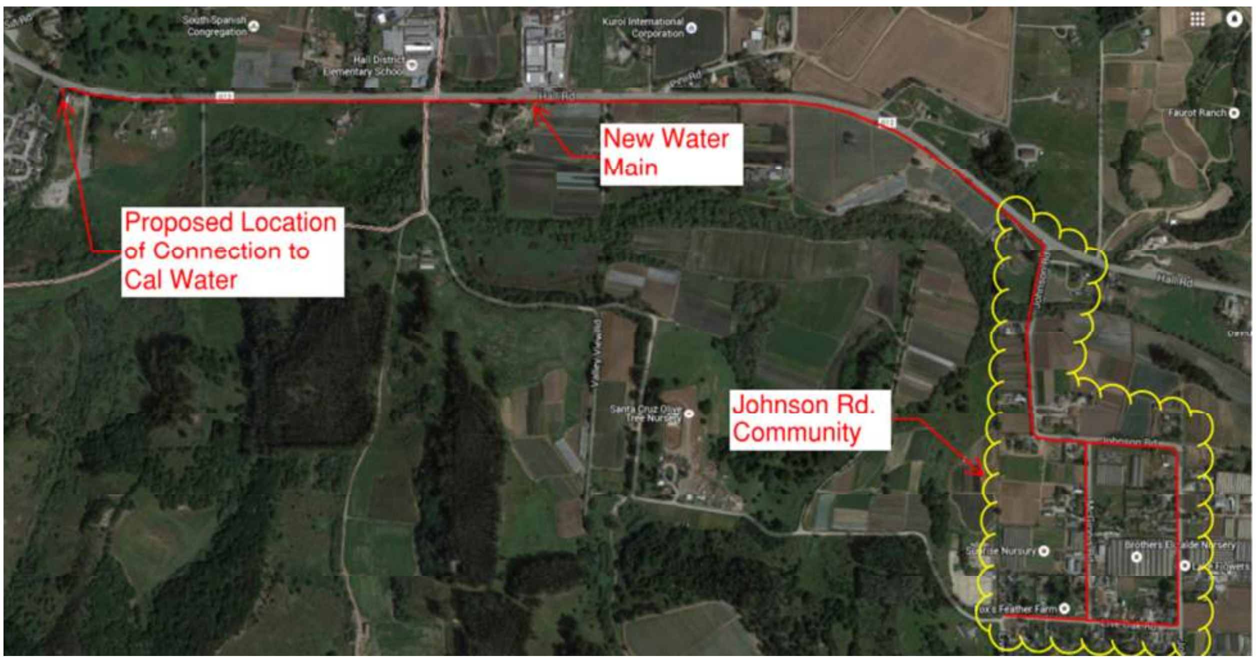

Figure 4 - Proposed Water Main Alignment for Consolidation

As shown above, the connection to Cal Water's system would be on the south side on Hall Rd., approximately 1.5 miles west of Johnson Rd. The proposed location of connection to Cal Water's system is at an elevation of approximately 20 ft and will have a pressure that ranges between 78 - 87 psi. General Order 103 of the California Public Utilities commission requires for new distribution systems to be designed to provide a minimum operating pressure at each service connection of no less than 40 psi during PHD. Title 22 states that the minimum operating pressure at the service line connection shall be no less than 20 psi at all times. Since the system will be sized to include fire flow, the controlling design condition is to meet the minimum pressure requirement of 20 psi during fire flow.

The majority of the community is at an elevation between 35 and 95 ft. To meet the regulatory pressure requirements for these homes without a booster pump station, a 12 inch water main would be required. It is noted that the ADF through this size water main would result in low velocities and increased potential for stale water. It would be recommended for the system to be periodically flushed by opening hydrants within the community.

Once installed, the system would be owned and operated by Cal Water. All costs associated with maintaining the system would be included in the water service and commodity charges that are paid by each home owner. It should be noted that Cal Water institutes a Low-Income Rate Assistance (LIRA) program which offers a discount to qualifying low-income customers. A number of the community members currently qualify for Pacific Gas & Electric's (PG&E) payment assistance program. As indicated by Cal Water, customers which quality for PG&E's rate assistant program will automatically qualify for the LIRA program. Additional details related to the consolidation alternative were discussed with Cal Water during the team's site visit. The notes from this meeting can be found in Appendix C.

Approximately 4-5 homes on the southern most portion of Johnson Road are located at elevations above 95 ft and will require a booster pump station to connect to Cal Water's system. This booster pump would be located at the bottom of the hill as shown in Figure 5 below and would be sized to meet the PHD of the homes on the southern portion of Johnson Rd with a 4 inch water main.

Figure 5 - Proposed Booster Pump Station

This booster pump station likely be supplied as a packaged system from a vendor and would include 2 pumps (1 firm/1 standby) that would discharge to a hydropneumatic tank. The hydropneumatic tank would be critical in regulating system pressures and prevent excessive cycling of the pumps. The pump station must also have a secondary energy supply which could be provided with a backup generator. Since the booster pump station would only be sized to meet the PHD of these homes, fire flow would need to be provided by extending the 12" water main to a distance within 1,000 ft of the home at the top of the hill. The fire department would be required to utilize pumps on their truck to provide adequate pressure to facilitate fire flow to the top of the hill.

Because the costs associated with connecting these 4-5 homes to Cal Water's system will significantly increase the cost to consolidate the Cal Water, they will be separated out in the economic evaluation of this report and referred to as Alternative 1A. Additional outreach to the members of these homes is required to determine their specific need and desire to consolidate with Cal Water.

4.1.2 ALTERNATIVE 2 - COMMUNITY TREATMENT FACILITY

Alternative 2 includes the construction of a new water treatment facility to provide treated water to the entire community. The facility would be located within the community and would include the construction of two new wells, an ion exchange treatment system to remove contaminants from the groundwater, a hydropneumatic storage tank, backup electric generator, and new distribution water mains. This alternative will also include a separate system for providing the required fire flow. This system will include a ground storage tank, two new fire protection pumps, and new fire flow water mains which run parallel to the distribution water mains and will convey untreated groundwater to hydrants throughout the community.

In accordance with Title 22, each pump for the treatment system will be sized to meet the MDD of the community. The pumps would operate in a 1 firm/ 1 standby operation, with the standby pump considered as a backup source of water. The location of the new wells and treatment facility will be highly dependent on land availability. Potential location will be assessed and determined during the preliminary design phase, which would ideally include additional groundwater sampling, soil borings, and an aquifer pumping test to confirm well capacity. For the purpose of this evaluation, a well depth of 600 ft was assumed based upon discussions with a local well drilling contractor, Maggiora Bros., who have previously installed wells within the community. The wells are also assumed to be gravel packed with an 8" casing and sanitary seal to a depth of approximately 400 ft. The well pumps will have a common discharge header which connects to the treatment system.

The recommended treatment strategy for this application will be treating a side stream and blending to achieve desired nitrate and chromium VI reduction. The treatment train will utilize ion exchange vessels to reduce the nitrate and chromium VI concentrations from the groundwater. This technology is offered from a number of manufacturers, including Evoqua and Ionex. While each manufacture may have varying vessel sizes and configurations, the general treatment strategy is the same. The proposed system is offered by Evoqua and will include a bag filtration system to reduce the TSS prior to entering the ion exchange vessels. Because nitrate and chromium VI are both cations, they can both be removed through the use of a strong base anion resin. The ion exchange system will include eight vessels in a lead/lag configuration. The four lead vessels are sized to provide the needed nitrate reduction while the four lag vessels are available as standby units to treat any residual nitrates. As shown in Figure 6 below, a nitrate monitor will be located between the lead and lag vessels to monitor the nitrate concentration of the flow exiting the lead vessels. An additional nitrate monitor will be included downstream of the blended flow. This will be used to control a modulating valve on the bypass line to adjust the amount of flow to bypass the system in order to maintain a target concentration of nitrate in the system effluent. These nitrate monitors provide a continuous reading of the nitrate concentration and are an operational necessity for the system. They will not be used for compliance monitoring. Instead, the system's operator will be responsible for taking grab samples of the systems influent and effluent for testing and reporting to the permitting agency.

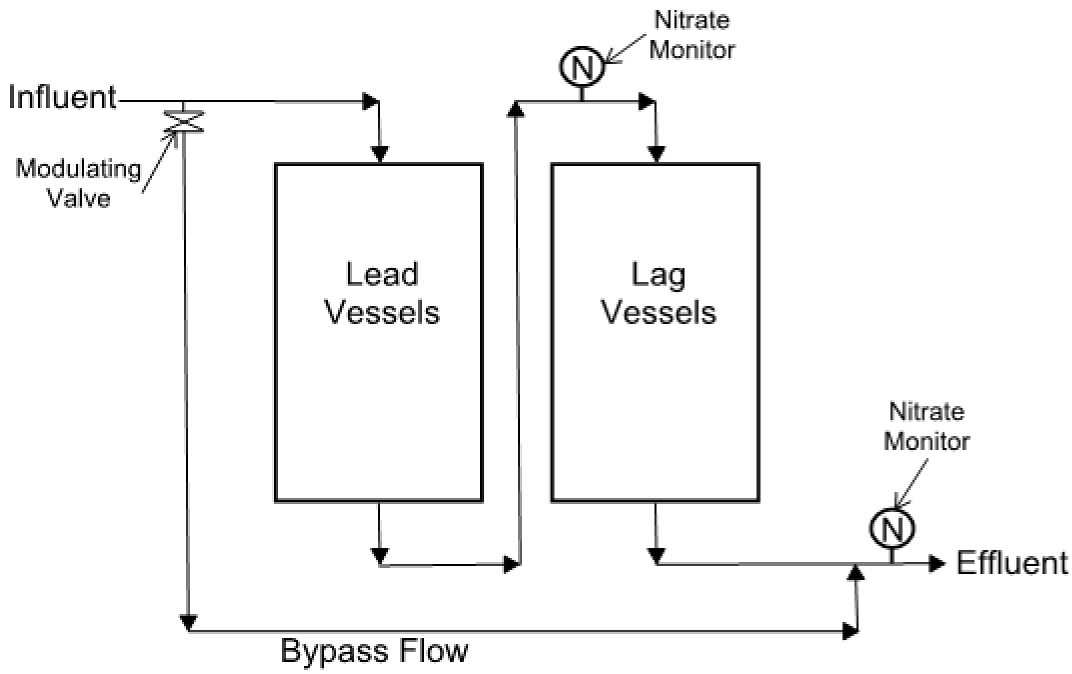

Figure 6 - Schematic of Proposed Ion Exchange Treatment System

When the resin is exhausted in the lead vessels and the nitrate monitor reaches a set point concentration, a signal will be sent to the manufacturer and a vessel exchange will be scheduled. The manufacturer will move the lag vessels to the lead position, install four new vessels with freshly regenerated resin in the lag position, and haul off the four spent vessels back to their facility for regeneration. The frequency of this vessel exchange will be dependent on the contaminant levels in the influent, but could be as frequent as twice a month. The manufacturer has indicated they are able to perform this task at this frequency. Effluent from the treatment system will discharge into a 5,000 gallon hydropneumatic tank which will be pressurized with a single compressor to regulate distribution system pressures and prevent excessive pump cycling.

The size of the distribution water mains will be controlled by Title 22 requirements for minimum water main size, which is 4 inches. This alternative includes costs for new water mains along Johnson Rd., Live Oak Rd., and McGinnis Rd. It will also include new service laterals for each service connection along with new water meters and backflow preventers.

To provide fire flow under this alternative, it is recommended utilize a 120,000 gallon ground storage tank to store untreated groundwater. By opening a valve on the discharge header of the new well pumps, the storage tank could be filled to provide adequate storage for fire protection. A 1,000 gpm pump would then be used to convey flow to the fire hydrants at the required minimum pressure of 20 psi. Since the fire flow will be designated as non-potable water, consideration must be given to the required distance between the fire flow piping and the finished water piping.

This alternative would require the formation for a new public water system, such as a Mutual Water Company (MWC), which would encompass the entire Johnson Rd. community.

The permitting process for an initial permit for a public water system in outlined in Title 22 and could take over a year to obtain all necessary permits. Appendix D shows a partially completed permit application for creation of a new public water supply system. Once formed, the MWC would be responsible for setting water rates, collecting fees, operating and maintaining the system, including energy bills and staffing costs to have a certified operator monitor the system.

The level of operator required will be dependent on the water treatment facility classification as defined in Title 22. Based upon preliminary assumptions, the proposed treatment facility would be classified as a T1 or T2 facility, which would require a T1 or T2 chief operator. The public water system must designate at least 1 chief operator that meets the certification requirements for the treatment facility classification. The chief operator may not be required to remain on-site if the system can demonstrate reliability while under unmanned operation. As indicated by the manufacturer, the proposed treatment system should require no more than 2 hours per day of operator attention. If the system is properly maintained by the chief operator, the treatment equipment could last approximately 20 years before requiring major rehabilitation or replacement.

4.1.3 ALTERNATIVE 3 - DIVIDED TREATMENT FACILITIES

Alternative 3 consists of dividing the community into five public water systems, each with their own supply, treatment, and storage equipment. Since there are approximately 85 homes in the community, this alternative assumes each water system will have at least 15 service connections. Each system will therefore be considered a public water system and will need to comply with the standards outlined in Title 22. Figure 7 below shows a map of a potential grouping of the five public water systems.

Figure 7 - Proposed Service Areas for New Public Water Systems

Under this alternative, each system would be required to have water supply from two sources. This evaluation assumes that each public water system could reuse an existing well within the community. This is allowable if the existing pump can meet the MDD of the population of its water system. However, the availability of a second existing well is uncertain and a new well will likely have to be installed within each new public water system. The two wells will be piped together to allow either source to supply groundwater to the treatment system.

The treatment system for each of these systems will be similar to the ion exchange system described in Alternative 2, but on a smaller scale. The system would include require a total of four ion exchange vessels in a lead/ lag configuration. The two lead vessels will be used to provide the required nitrate reduction and the two lag vessels will be available as standby units to treat any residual nitrates. Prior to final design of each system, it is recommended that additional water quality testing and a geohydraulic investigation be performed to properly size the ion exchange vessels. The location of each treatment system will need to allow for truck access to facilitate periodic exchange of vessels as described in Section 4.1.2. The effluent from the treatment system will be stored in a hydropnuematic tank which will provide adequate system pressure for the distribution piping.

Similar to Alternative 2, this alternative will include a single 120,000 gallon ground storage tank to store untreated groundwater for use in fire protection. During a fire, a fire protection pump would be used to convey flow to the fire hydrants at the required minimum pressure of 20 psi. Since the fire flow will be designated as non-potable water, consideration must be given to the required distance between the fire flow piping and the finished water piping. Because this fire protection system will service the homes within multiple public water systems, costs associated with operation and maintenance will need to be shared among each water system.

4.1.4 ALTERNATIVE 4 - POINT OF ENTRY (POE) TREATMENT

Alternative 4 will include the costs for a POE treatment system to be installed for each of the homes in the Johnson Rd. community. This alternative will utilize the same ion exchange treatment technology as was evaluated in Alternatives 2 and 3, but this system is small enough to be installed within or adjacent to each home. An area of approximately 12 sf is needed to install the treatment equipment. This alternative assumes that formation of a public water system will not be required, as existing water sources and service connections will remain unchanged.

The treatment system is offered by Culligan and consists of three pressure tanks. The first stage of treatment includes twin nitrate exchangers which use a nitrate selective strong base anion exchange resin. The twin tanks are furnished with a brine tank for onsite resin regeneration. When the resin in a nitrate exchanger tank is depleted, a regeneration cycle is initiated and the brine solution flushes through the tank to recharge the resin. As indicated by the manufacturer, the waste solution will contain dilute brine solution, similar to a water softener, and concentrated nitrates. For a single dwelling residence, this flow is typically sent to the property's septic system and is estimated to be approximately 100 gallons per month based upon the assumed consumption of brine solution. The second stage of treatment is a chromium VI exchanger which uses a weak base anion resin. The resin in this exchanger has a long design life and is not anticipated to require regeneration at the design chromium VI concentration. Figure 8 below shows a schematic of this treatment system.

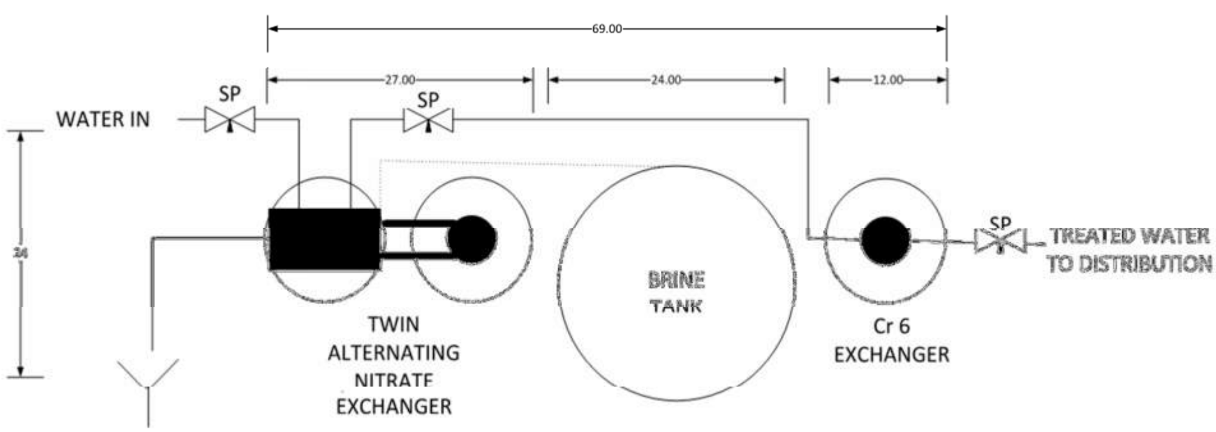

Figure 8 - Schematic of Proposed POE Treatment System

This alternative will not include provisions for providing fire protection to the community, as it does not include formation of a new public water system. The costs for operating this system will be responsibility of the property owner and will primarily consist of costs for monthly service from the manufacturer. Monthly service will include filling the salt tank for the nitrate exchangers, testing influent and effluent for nitrate and chromium VI concentrations, and system inspection.

4.2 ANALYSIS OF ALTERNATIVES

The presented alternative solutions were evaluated using both economic and non-economic criteria. For the economic evaluation, the capital and O&M costs were developed using vendor proposals for major equipment. Smaller equipment and material costs were developed using typical industry unit costs. When necessary, general assumptions were made in efforts to provide a complete cost estimate. The costs presented in this report should not be considered as an engineer's estimate of probable cost and are intended to be used to provide a comparison of the available alternatives in efforts to identify feasible solutions. It should be noted that final project costs will vary.

The economic evaluation also includes a comparison of the Net Present Value (NPV) of each alternative, which assumes an O&M inflation rate of 1.9% and annual discount rate of 3.1% over a 20 year term. The costs presented in this evaluation are in 2016 dollars, and the backup for these cost estimates can be found in Appendix F. A summary of the economic evaluation is shown in the Table 4 below.

Table 4 - Economic Evaluation of Alternatives

	Alt. 1	Alt. 1A	Alt. 2	Alt. 3	Alt. 4
Capital Cost	**$4,140,000**	**$4,850,000**	**$5,181,000**	**$8,506,000**	**$938,000**
Annual O&M Cost	**$44,190**	**$48,480**	**$238,000**	**$576,000**	**$84,000**
Net Present Value (NPV)	**$4,914,000**	**$5,699,000**	**$9,351,000**	**$18,598,000**	**$2,410,000**

(1) Includes costs associated with providing fire protection.

To evaluate each alternative's cost impact on the community members, the estimated annual O&M costs were divided to the show the amount that would be paid by each household on a monthly basis. Table 5 below shows the projected monthly cost per home for each alternative.

Table 5 - Projected Monthly Cost per Home

	Alt. 1	Alt. 1A	Alt. 2	Alt. 3	Alt. 4
Estimated Average Monthly Cost per Home	**$43.33**	**$47.53**	**$233.34**	**$564.71**	**$82.36**

The non-economic evaluation is intended to cover the aspects of the alternative that do not have a direct impact on cost. Alternatives were rated on a scale of 1 to 4 (1 = worst or least favorable; 4 = best or most favorable). Table 6 below shows the results of the non-economic evaluation.

Table 6 - Non-Economic Evaluation of Alternatives

Description	Alternative 1/1A	Alternative 2	Alternative 3	Alternative 4
Water Quality	4	3	3	3
Sustainability	4	2	1	1
System Reliability	4	2	2	1
Ease of Regulatory Acceptance	4	2	1	2

Alternative 1 is considered to have the best water quality of all the evaluated alternatives. This is due to the fact that the water quality will be monitored by a sizeable public water system that has been in operation for many years. Alternatives 2 through 4 were all scored lower due to their source water being the contaminated groundwater within the community. Any failure in the treatment system for these alternatives would result in exposure of the contaminants to the community members. Alternatives 2 through 4 also do not include a residual disinfectant, which could result in the presence of bacteria in the water supply.

For sustainability and reliability, Alternative 1 is scored the highest because it will be operated by a large corporate utility which employs experienced staff to maintain the system. Alternatives 2 and 3 will require the formation of a new public water system and will likely result in less experienced staff maintaining the system. Alternative 4 is also not considered to be a reliable alternative because each home owner will be responsible for scheduling service at the required intervals, which could result in unkempt treatment systems and contaminants in the effluent.

Alternative 1 is considered the most likely alternative to be accepted by reviewing agencies because it includes consolidation with an existing permitted water system. It is the stated goal of the California Department of Public Health to promote consolidation of small community water systems. Alternatives 2 and 3 are scored lower due to the permitting requirements associated with creating new public water systems. Although Alternative 4 does not require creation of a new public water system, it is noted that Title 22 has recently been updated to included POE systems as an acceptable form of treatment, if approved by the State Board.

4.3 RECOMMENDATION

Based upon the results of the economic and non-economic evaluations, the recommendation of EWB-KC is that the Johnson Rd. community moves forward with Alternatives 1 and 1A, which include consolidation with Cal Water. While the initial capital cost is high, the O&M costs are significantly lower than the other alternatives. Additionally, the potential maintenance needs of the other alternatives could arise suddenly and take a big financial toll on the community members.

Further, the California Department of Public Health administers programs which fund improvements to small community water systems and encourages consolidation. These programs are a potential funding source that should be pursued by EJCW and the Johnson Rd. community.

APPENDIX B
SUMMARY OF HISTORIC WATER QUALITY DATA

Well Data from Monterey County File for Johnson Rd Project

The information below has been compiled from the files posted on the Google Drive for Johnson Rd, McGinnis Rd, and Live Oak, in the Monterey County folder, as of April 11, 2016. This data should not be considered as complete, as some information may have been missed. Based on the County file, it appears there are several other wells in the Johnson Rd area, but details were not in the file.

1. Johnson Rd WS #1
    a. Address: 225 Johnson Rd
    b. Nitrate Range: 21-100 mg/l
    c. Coliform Bacteria:
        i. Total Coliform: Present in 11 of 23 samples over 23 years
        ii. E. coli: absent
    d. Well details: None found
    e. Comments: Installed new well in 1998

2. Johnson Rd WS #3
    a. Address: 57 Johnson Rd
    b. Nitrate Range: 16-226 mg/l
    c. Coliform Bacteria:
        i. Total Coliform: Present in 9 of 23 samples over 21 years
        ii. E. coli: appears to be only one hit in July 5, 1996, but absent in August sample
    d. Other Analyses:
        i. VOCs were analyzed in April 1987 with all being non-detect
        ii. Agricultural organic analysis (alicarb, diuron, diazinon, dinoseb, and 2,4-d) in April 1987 and all were non-detect.
    e. Well Details:
        i. Well permit dated: Feb 9, 1978
        ii. Well depth: 100 ft
        iii. Depth to water: 60 ft
        iv. Well diameter: 10 inches
        v. Well sealed to: 50 ft
        vi. Expected capacity: 500+ gpm
    f. Comments: Well is to serve a labor camp of 15 people (design flow of 75 gallons per day per person or 1,125 gpd) with a proposed RO system (400 gpd) to partially treat the well discharge using blended water approach that resulted in 822 gpd not requiring treatment, per hand written notes in County file. County stated that the proposed RO treatment system was not acceptable and required that the RO capacity be doubled by having a second RO unit to provide backup and additional treatment capacity and that the existing well be deepen or a new well installed. Not sure if those changes were made.

3. McGinnis Rd WS #1 (apparently the well at 28 McGinnis was connected to WS#1 but is no longer per undated note in the file)

a. Address: 48 McGinnis Rd
b. Nitrate Range: 2-64 mg/l
c. Coliform Bacteria:
    i. Total Coliform: Present in 8 of 20 samples over 24 years
    ii. E. coli: Did not see any test results showing presence
d. Well Details:
    i. Installed: March 10, 1980
    ii. Total well drilled depth: 275 ft
    iii. Well completed to: 253 ft
    iv. Depth to water: 58 ft
    v. Well casing: 8 inches
    vi. Well screen: 213 – 253 ft
    vii. Test pump rate: 75 gpm with 10 ft of draw down
e. Comments: Notes in County phone log in Feb 22, 1999, that they were going to disconnect 50, 55, 32 and 30 [presumably addresses on McGinnis]. Another note in the phone log in Feb 23, 2007 states that owner at 30 McGinnis called in and stated that he is on his own well that has much lower nitrates.

4. Individual Well
    a. Address: 28 McGinnis Rd
    b. Nitrate Range: 410 mg/l on Feb 27, 1989 test (from McGinnis Rd #1 results table)
    c. Coliform Bacteria:
        i. Total Coliform: absent from two tests
        ii. E. coli: absent from two tests
    d. Well Details: None found.

APPENDIX E
COST ESTIMATE BACKUP

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Capital Cost Summary
Alternative 1 - Consolidation with Cal Water

Item Description	Units	Unit Cost	Quantity	Total Cost
Distribution Piping				
Project Cost (Cal Water Estimate, Includes Adders)	LF	$300	13,800	$4,140,000
Subtotal				***$4,140,000***
Adders				
Mobilization	LS	0%		$0
Subtotal				***$4,140,000***
Material Contingency	LS	0%		$0
Subtotal				***$4,140,000***
Engineering	LS	0%		$0
Total Capital Cost				***$4,140,000***

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Capital Cost Summary
Alternative 1A - Consolidation with Cal Water (Includes Booster Pump Station)

Item Description	Units	Unit Cost	Quantity	Total Cost
Distribution Piping				
Project Cost (Cal Water Estimate, Includes Adders)	LF	$300	15,550	$4,665,000
				$0
Booster Pump Station				$0
Packaged Booster Pump Station (1)	LS	$100,000	1	$100,000
Backup Electric Generator	LS	$40,000	1	$40,000
Installation	LS	25%		$35,000
Land Acquisition	LS	$10,000	1	$10,000
Subtotal				***$4,850,000***
Adders				
Mobilization	LS	0%		$0
Subtotal				***$4,850,000***
Material Contingency	LS	0%		$0
Subtotal				***$4,850,000***
Engineering	LS	0%		$0
Total Capital Cost				***$4,850,000***

(1) Includes two 25 gpm pumps, hydropneumatic tank, and enclosure.

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Capital Cost Summary
Alternative 2 - Community Treatment Facility

Item Description	Units	Unit Cost	Quantity	Total Cost
Treatment Facility				
50 GPM Wells (600' Casing and Pump)	EA	$100,000	2	$200,000
Ion Exchange Equipment	LS	$400,000	1	$400,000
Hydropneumatic Tank (5,000 Gal)	EA	$35,000	1	$35,000
Backup Electric Generator	LS	$50,000	1	$50,000
Concrete Pad (30'x30')	CY	$750	33	$25,000
Fencing	LF	$30	200	$6,000
Installation	LS	25%		$179,000
Misc. Site Work	LS	$50,000	1	$50,000
Land Acquisition	LS	$20,000	1	$20,000
Subtotal				**$965,000**
Distribution Piping				
4" PVC (C-900)	LF	$35	6,000	$210,000
Service Connections	EA	$3,000	85	$255,000
Air Release Valves (w/ Manhole)	EA	$6,000	5	$30,000
Water Meters	EA	$1,500	85	$128,000
Isolation Valves	EA	$400	85	$34,000
Backflow Preventers	EA	$500	85	$43,000
Installation	LS	25%		$175,000
Subtotal				**$875,000**
Fire Protection				
Ground Storage Tank (120,000 Gal)	LS	$120,000	1	$120,000
Fire Pumps (1,000 GPM)	EA	$110,000	2	$220,000
12" PVC (C-900)	LF	$80	6,000	$480,000
Air Release Valves (w/ Manhole)	EA	$6,000	5	$30,000
Fire Hydrants	EA	$6,000	15	$90,000
Isolation Valves	EA	$2,500	15	$38,000
Installation	LS	25%		$245,000
Subtotal				**$1,223,000**
Subtotal				***$3,063,000***
Miscellaneous				
Mobilization	LS	5%		$153,150
Permitting	LS	$100,000	1	$100,000
Subtotal				***$3,316,000***
Contingency	LS	25%		$829,000
Subtotal				***$4,145,000***
Engineering	LS	25%		$1,036,000
Total Capital Cost				***$5,181,000***

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Capital Cost Summary
Alternative 3 - Divided Treatment Facilities

Item Description	**Units**	**Unit Cost**	**Quantity**	**Total Cost**
Treatment Facilities				
20 GPM Wells (Casing and Pump)	EA	$50,000	5	$250,000
Ion Exchange Equipment	EA	$260,000	5	$1,300,000
Hydropneumatic Tank (3,200 Gal)	EA	$30,000	5	$150,000
Backup Electric Generator	EA	$50,000	5	$250,000
Concrete Pad (20'x20')	CY	$750	15	$11,000
Fencing	LF	$30	800	$24,000
Installation	LS	25%		$496,000
Misc. Site Work	EA	$30,000	5	$150,000
Land Acquisition	EA	$15,000	5	$75,000
Subtotal				**$2,706,000**
Distribution Piping				
4" PVC (C-900)	LF	$35	6,000	$210,000
Service Connections	EA	$3,000	85	$255,000
Air Release Valves (w/ Manhole)	EA	$6,000	5	$30,000
Water Meters	EA	$1,500	85	$128,000
Isolation Valves	EA	$400	85	$34,000
Backflow Preventers	EA	$500	85	$43,000
Installation	LS	25%		$175,000
Subtotal				**$875,000**
Fire Protection				
Ground Storage Tank (120,000 Gal)	EA	$120,000	1	$120,000
Fire Pumps (1,000 GPM)	EA	$110,000	2	$220,000
12" PVC (C-900)	LF	$80	6,000	$480,000
Air Release Valves (w/ Manhole)	EA	$6,000	5	$30,000
Fire Hydrants	EA	$6,000	15	$90,000
Isolation Valves	EA	$2,500	15	$38,000
Installation	LS	25%		$245,000
Subtotal				**$1,223,000**
Subtotal				***$4,804,000***
Miscellaneous				
Mobilization	LS	5%		$240,200
Permitting	LS	$80,000	5	$400,000
Subtotal				***$5,444,000***
Contingency	LS	25%		$1,361,000
Subtotal				***$6,805,000***
Engineering	LS	25%		$1,701,000
Total Capital Cost				***$8,506,000***

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Capital Cost Summary
Alternative 4 - Point of Entry (POE) Treatment

Item Description	**Units**	**Unit Cost**	**Quantity**	**Total Cost**
Treatment Equipment				
POE Packaged System[1]	EA	$6,000	85	$510,000
Installation	LS	25%		$128,000
Subtotal				**$638,000**
Piping				
1" Copper Pipe	LF	$20	2,550	$51,000
1" Copper Pipe Fittings	LS	20%		$10,200
Installation	LS	25%		$15,000
Subtotal				**$76,200**
Subtotal				***$714,000***
Miscellaneous				
Mobilization	LS	5%		$35,700
Subtotal				***$750,000***
Contingency	LS	25%		$188,000
Total Capital Cost				***$938,000***

(1) Includes twin nitrate exchangers, brine storage tank, and Cr VI exchange tank.

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Annual O&M Cost Summary
Alternative 1 - Consolidation with Cal Water

Item Description	Units	Unit Cost	Quantity	Total Cost
Service and Usage Costs				
Service Charge[1] (12 Months)	EA	$189	85	$16,090
Usage Rate (12 Months)	CCF	$2.75	9,823	$27,020
Annual Hydrant Service Charge	EA	$72	15	$1,080
Subtotal				***$44,190***
Total Annual O&M Cost				***$44,190***

(1) Qualifying homes will receive 50% discount on service charge due to Low Income Ratepayer Assistance (LIRA) program.

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Annual O&M Cost Summary
Alternative 1A - Consolidation with Cal Water (Includes Booster Pump Station)

Item Description	Units	Unit Cost	Quantity	Total Cost
Service and Usage Costs				
Service Charge[1] (12 Months)	EA	$189	85	$16,090
Usage Rate (12 Months)	CCF	$2.75	9,823	$27,020
Annual Hydrant Service Charge	EA	$72	16	$1,150
Booster Pump Station				
Pump Energy Cost[2]	LS	$1,225	1	$1,220
Annual Repair and Replacement (3% Equipment Cost)	LS	$3,000	1	$3,000
Subtotal				***$48,480***
Total Annual O&M Cost				***$48,480***

(1) Qualifying homes will receive 50% discount on service charge due to Low Income Ratepayer Assistance (LIRA) program.

(2) Assumes 15 hp motor at 2 hours per day and $0.15 per kWh.

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Annual O&M Cost Summary
Alternative 2 - Community Treatment Facility

Item Description	Units	Unit Cost	Quantity	Total Cost
Treatment System Costs				
Vessel Exchange	EA	$4,800	24	$115,000
Well Pump Energy Cost[1]	LS	$11,000	1	$11,000
Annual Repair and Replacement (3% Equipment Cost)	LS	$16,000	1	$16,000
Certified Operator (quarter time)	LS	$10,000	1	$10,000
Sampling and Testing	EA	$3,000	12	$36,000
Subtotal				***$188,000***
Distribution Maintenance Costs				
Preventative/Corrective Maintenance	LS	$30,000	1	$30,000
Subtotal				***$30,000***
Administrative Costs[2]				
Misc (Meter Reading, Bill Preparation, etc)	LS	$20,000	1	$20,000
Subtotal				***$20,000***
Total Annual O&M Cost				***$238,000***

(1) Assumes 35 hp motor at 7 hours per day and $0.15 per kWh.
(2) Office space is assumed to not be required.

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Annual O&M Cost Summary
Alternative 3 - Divided Treatment Facilities

Item Description	**Units**	**Unit Cost**	**Quantity**	**Total Cost**
Treatment System Costs				
Vessel Exchange	EA	$3,000	50	$150,000
Well Pump Energy Cost[(2)]	EA	$3,000	5	$15,000
Annual Repair and Replacement (3% Equipment Cost)	LS	$51,000	1	$51,000
Certified Operator (quarter time)	LS	$10,000	5	$50,000
Sampling and Testing	EA	$3,000	60	$180,000
Subtotal				***$446,000***
Distribution Maintenance Costs				
Preventative/Corrective Maintenance	LS	$30,000	1	$30,000
Subtotal				***$30,000***
Administrative Costs[(1)]				
Misc (Meter Reading, Bill Preparation, etc)	EA	$20,000	5	$100,000
Subtotal				***$100,000***
Total Annual O&M Cost				***$576,000***

(1) Office space is assumed to not be required.
(2) Assumes 10 hp motor at 7 hours per day and $0.15 per kWh.

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Annual O&M Cost Summary
Alternative 4 - Point of Entry (POE) Treatment

Item Description	**Units**	**Unit Cost**	**Quantity**	**Total Cost**
Treatment System Costs				
Scheduled Service Contract [1]	EA	$660	85	$56,000
Chemical (Salt) Consumption	EA	$60	85	$5,000
Cr6 Media	EA	$96	85	$8,000
Annual Repair and Replacement (3% Equipment Cost)	LS	$15,000	1	$15,000
Subtotal				***$84,000***
Total Annual O&M Cost				***$84,000***

(1) Assumes certified operator is not required.

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Net Present Value (NPV)
Alternative 1 - Consolidation with Cal Water

Base Year for Cost Estimate	**2016**
First Year of Service	**2018**
Mid-Point of Construction	**2017**

Economic Assumptions

O&M Escalation (Inflation) Rate	1.90%
Annual Interest (Discount) Rate	3.10%

Capital Costs (Modify as Required)

Total NPV of Capital Costs[1]		$4,140,000

O&M Costs (Modify As Required)

		Base Year Cost	Mid-Point of Construction	First Year of Service																				
		2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**
Total O&M Cost		$44,190	-	$45,885	$46,757	$47,645	$48,551	$49,473	$50,413	$51,371	$52,347	$53,342	$54,355	$55,388	$56,440	$57,513	$58,605	$59,719	$60,853	$62,010	$63,188	$64,388	$65,612
NPV of O&M Cost at Base Year				$43,167	$42,665	$42,168	$41,677	$41,192	$40,713	$40,239	$39,771	$39,308	$38,850	$38,398	$37,951	$37,509	$37,073	$36,641	$36,215	$35,793	$35,377	$34,965	$34,558

Total NPV of O&M Costs		$774,000

NPV Summary	
Capital Cost	$4,140,000
O&M	$774,000
Total NPV	**$4,914,000**

Notes:
(1) NPV Capital Cost is calculated in 2016 dollars.

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Net Present Value (NPV)
Alternative 1A - Consolidation with Cal Water (Includes Booster Pump Station)

Base Year for Cost Estimate	**2016**
First Year of Service	**2018**
Mid-Point of Construction	**2017**

Economic Assumptions

O&M Escalation (Inflation) Rate	1.90%
Annual Interest (Discount) Rate	3.10%

Capital Costs (Modify as Required)

Total NPV of Capital Costs[1]		$4,850,000

O&M Costs (Modify As Required)

		Base Year Cost	**Mid-Point of Construction**	**First Year of Service**																				
		2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**
Total O&M Cost		$48,480	-	$50,340	$51,296	$52,271	$53,264	$54,276	$55,307	$56,358	$57,429	$58,520	$59,632	$60,765	$61,919	$63,096	$64,295	$65,516	$66,761	$68,030	$69,322	$70,639	$71,981
NPV of O&M Cost at Base Year				$47,358	$46,807	$46,262	$45,724	$45,191	$44,665	$44,146	$43,632	$43,124	$42,622	$42,126	$41,636	$41,151	$40,672	$40,199	$39,731	$39,268	$38,811	$38,360	$37,913

Total NPV of O&M Costs		$849,000

NPV Summary	
Capital Cost	$4,850,000
O&M	$849,000
Total NPV	**$5,699,000**

Notes:
(1) NPV Capital Cost is calculated in 2016 dollars.

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Net Present Value (NPV)
Alternative 2 - Community Treatment Facility

Base Year for Cost Estimate	**2016**
First Year of Service	**2018**
Mid-Point of Construction	**2017**

Economic Assumptions

O&M Escalation (Inflation) Rate	1.90%
Annual Interest (Discount) Rate	3.10%

Capital Costs (Modify as Required)

Total NPV of Capital Costs[1]		$5,181,000

O&M Costs (Modify As Required)

		Base Year Cost	Mid-Point of Construction	First Year of Service																			
		2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**
Total O&M Cost		$238,000	-	$247,130	$251,825	$256,610	$261,486	$266,454	$271,517	$276,675	$281,932	$287,289	$292,747	$298,310	$303,977	$309,753	$315,638	$321,635	$327,747	$333,974	$340,319	$346,785	$353,374
NPV of O&M Cost at Base Year				$232,492	$229,786	$227,111	$224,468	$221,855	$219,273	$216,721	$214,199	$211,706	$209,241	$206,806	$204,399	$202,020	$199,669	$197,345	$195,048	$192,777	$190,534	$188,316	$186,124

Total NPV of O&M Costs		$4,170,000

NPV Summary	
Capital Cost	$5,181,000
O&M	$4,170,000
Total NPV	**$9,351,000**

Notes:
(1) NPV Capital Cost is calculated in 2016 dollars.

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Net Present Value (NPV)
Alternative 3 - Divided Treatment Facilities

Base Year for Cost Estimate	**2016**
First Year of Service	**2018**
Mid-Point of Construction	**2017**

Economic Assumptions

O&M Escalation (Inflation) Rate	1.90%
Annual Interest (Discount) Rate	3.10%

Capital Costs (Modify as Required)

Total NPV of Capital Costs[1]		$8,506,000

O&M Costs (Modify As Required)

		Base Year Cost	Mid-Point of Construction	First Year of Service																			
		2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**
Total O&M Cost		$576,000	-	$598,096	$609,460	$621,039	$632,839	$644,863	$657,116	$669,601	$682,323	$695,287	$708,498	$721,959	$735,676	$749,654	$763,898	$778,412	$793,202	$808,272	$823,630	$839,279	$855,225
NPV of O&M Cost at Base Year				$562,670	$556,121	$549,648	$543,250	$536,927	$530,678	$524,501	$518,397	$512,363	$506,399	$500,505	$494,680	$488,922	$483,232	$477,607	$472,048	$466,554	$461,124	$455,756	$450,452

Total NPV of O&M Costs		$10,092,000

NPV Summary	
Capital Cost	$8,506,000
O&M	$10,092,000
Total NPV	**$18,598,000**

Notes:
(1) NPV Capital Cost is calculated in 2016 dollars.

Salinas River Valley Water System Evaluation and Design
Johnson Rd. Community
Net Present Value (NPV)
Alternative 4 - Point of Entry (POE) Treatment

Base Year for Cost Estimate	**2016**
First Year of Service	**2018**
Mid-Point of Construction	**2017**

Economic Assumptions

O&M Escalation (Inflation) Rate	1.90%
Annual Interest (Discount) Rate	3.10%

Capital Costs (Modify as Required)

Total NPV of Capital Costs[(1)]		$938,000

O&M Costs (Modify As Required)

		Base Year Cost	Mid-Point of Construction	First Year of Service																			
		2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**
Total O&M Cost		$84,000	-	$87,222	$88,880	$90,568	$92,289	$94,043	$95,829	$97,650	$99,505	$101,396	$103,323	$105,286	$107,286	$109,325	$111,402	$113,518	$115,675	$117,873	$120,113	$122,395	$124,720
NPV of O&M Cost at Base Year				$82,056	$81,101	$80,157	$79,224	$78,302	$77,391	$76,490	$75,600	$74,720	$73,850	$72,990	$72,141	$71,301	$70,471	$69,651	$68,840	$68,039	$67,247	$66,464	$65,691

Total NPV of O&M Costs		$1,472,000

NPV Summary	
Capital Cost	$938,000
O&M	$1,472,000
Total NPV	**$2,410,000**

Notes:
(1) NPV Capital Cost is calculated in 2016 dollars.

APPENDIX F
WATER QUALITY LAB REPORTS

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Wednesday, May 04, 2016

Lab Number: **AB46039**

Collection Date/Time:	4/21/2016	11:50	Sample Collector:	WEIDNER-HOLLAND, MASON	Client Sample #: Royal Oaks
Submittal Date/Time:	4/21/2016	14:51	Sample ID	30 MCGINNIS ROAD	Coliform Designation: Special

Sample Description: 30 McGinnis Road, Spigot Closest To Well

Analyte	Method	Unit	**Result**	Qual	PQL	MCL	Date Analyzed	Analyst:
Aggressivity Index	Calculation		**11.3**				4/27/2016	MW
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**93**		10		4/22/2016	LRH
Aluminum, Total	EPA200.8	µg/L	**Not Detected**		10	1000	4/26/2016	SM
Antimony, Total	EPA200.8	µg/L	**Not Detected**		1.0	6	4/26/2016	SM
Arsenic, Total	EPA200.8	µg/L	**Not Detected**		1	10	4/26/2016	SM
Barium, Total	EPA200.8	µg/L	**35**		10	1000	4/26/2016	SM
Beryllium, Total	EPA200.8	µg/L	**Not Detected**		1	4	4/26/2016	SM
Bicarbonate (as HCO3-)	SM2320B	mg/L	**113**		10		4/22/2016	LRH
Biochemical Oxygen Demand	SM5210B	mg/L	**Not Detected**		2		4/22/2016	MP
Bromide	EPA300.0	mg/L	**0.5**		0.1		4/22/2016	HM
Cadmium, Total	EPA200.8	µg/L	**Not Detected**		0.5	5	2/26/2016	SM
Calcium	EPA200.7	mg/L	**37**		0.5		4/27/2016	MW
Carbonate as CaCO3	SM2320B	mg/L	**Not Detected**		10		4/22/2016	LRH
Chloride	EPA300.0	mg/L	**50**		1	250	4/22/2016	HM
Chlorine Residual (Field Test)	SM4500-Cl G	mg/L	**Not Detected**		0.05	4.00	4/21/2016	MWH
Chromium VI	EPA 218.6	µg\L	**20**	E	0.2		4/27/2016	BSK
Chromium, Total	EPA200.8	µg/L	**22**		2	50	4/26/2016	SM
Color, Apparent (Unfiltered)	SM2120B	Color Units	**Not Detected**		3	15	4/21/2016	MP
Copper, Total	EPA200.8	µg/L	**Not Detected**		4	1300	4/26/2016	SM
Cyanide	QuikChem 10-20	µg/L	**Not Detected**		5	200	4/29/2016	LRH
E. Coli (Quantitray)	SM9223B	MPN/100mL	**<1**		1		4/21/2016	MW/LJ/H
Fluoride	EPA300.0	mg/L	**0.2**		0.1	2.0	4/22/2016	HM
Hardness (as CaCO3)	SM2340B/Calc	mg/L	**167**		10		4/27/2016	MW
Hydroxide	SM2320B	mg/L	**Not Detected**		10		4/22/2016	LRH
Iron	EPA200.7	µg/L	**Not Detected**		10	300	4/27/2016	MW
Langlier Index, 15°C	SM2330B		**-0.58**				4/27/2016	MP
Langlier Index, 60°C	SM2330B		**0.02**				4/27/2016	MP
Lead, Total	EPA200.8	µg/L	**Not Detected**		5	15	4/26/2016	SM
Magnesium	EPA200.7	mg/L	**18**		0.5		4/27/2016	MW
Manganese, Total	EPA200.7	µg/L	**Not Detected**		10	50	4/27/2016	MW
MBAS (Surfactants)	SM5540C	mg/L	**Not Detected**		0.05	0.50	4/22/2016	HM
Mercury, Total	EPA200.8	µg/L	**Not Detected**		0.5	2	4/26/2016	SM

mg/L: Milligrams per liter   ug/L : Micrograms per liter   PQL : Practical Quantitation Limit   MCL: Maximum Contamination Level
H = Analyzed ouside of hold time   E = Analysis performed by External Laboratory; See Report attachments.   T = Temperature Exceedance

 Wednesday, May 04, 2016

Lab Number: AB46039

Collection Date/Time:	4/21/2016	11:50	Sample Collector:	WEIDNER-HOLLAND, MASON	Client Sample #: Royal Oaks
Submittal Date/Time:	4/21/2016	14:51	Sample ID	30 MCGINNIS ROAD	Coliform Designation: Special

Sample Description: 30 McGinnis Road, Spigot Closest To Well

Analyte	Method	Unit	**Result**	Qual	PQL	MCL	Date Analyzed	Analyst:
Nickel, Total	EPA200.8	µg/L	**Not Detected**		10	100	4/26/2016	SM
Nitrate as NO3	EPA300.0	mg/L	**102**		1	45	4/22/2016	HM
Nitrate as NO3-N	EPA300.0	mg/L	**23.0**		0.1	10	4/22/2016	HM
Nitrate+Nitrite as N	EPA300.0	mg/L	**23.2**		0.1		4/22/2016	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.2**		0.1	1.0	4/22/2016	HM
Odor Threshold at 60 C	SM2150B	TON	**1**		1	3	4/21/2016	MP
o-Phosphate-P, Dissolved	EPA300.0	mg/L	**Not Detected**		0.1		4/22/2016	HM
Perchlorate	EPA314	µg/L	**Not Detected**	E	2.0		4/25/2016	BSK
pH (Laboratory)	SM4500-H+B	pH (H)	**7.4**		0.1		4/21/2016	MP
Potassium	EPA200.7	mg/L	**2.2**		0.5		4/27/2016	MW
QC Anion Sum x 100	Calculation	%	**93%**				4/22/2016	HM
QC Anion-Cation Balance	Calculation	%	**1**				4/27/2016	MW
QC Cation Sum x 100	Calculation	%	**95%**				4/27/2016	MW
QC Ratio TDS/SEC	Calculation		**0.70**				4/27/2016	MP
Selenium, Total	EPA200.8	µg/L	**2**		2	50	4/26/2016	SM
Silica as SiO2, Total	EPA200.7	mg/L	**47**		0.5		4/27/2016	MW
Silver, Total	EPA200.8	µg/L	**Not Detected**		10	100	4/26/2016	SM
Sodium	EPA200.7	mg/L	**44**		0.5		4/27/2016	MW
Specific Conductance (E.C)	SM2510B	µmhos/cm	**558**		1	900	4/22/2016	LJ
Sulfate	EPA300.0	mg/L	**12**		1	250	4/22/2016	HM
Synthetic Organic Compounds - Mont		µg/L	**Not Detected**	E			5/3/2016	BSK
TCP Low Level	SRL524M-TCP	ug/L	**Not Detected**	E	0.0007		4/22/2016	BSK
Thallium, Total	EPA200.8	µg/L	**Not Detected**		1.0	2	4/26/2016	SM
Total Coliform (Quantitray)	SM9223B	MPN/100mL	**<1**		1		4/21/2016	MW/LJ/H
Total Diss. Solids	SM2540C	mg/L	**391**		10	500	4/25/2016	HM/MP
Turbidity	EPA180.1	NTU	**0.20**		0.05	5.0	4/22/2016	BS
Volatile Org. Compounds (524)	EPA524	µg/L	**Not Detected**	E			5/3/2016	BSK
Zinc	EPA200.7	µg/L	**Not Detected**		10		4/27/2016	MW

Sample Comments:

Report Approved by:

David Holland, Laboratory Director

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Wednesday, May 04, 2016

Lab Number: AB46040

Collection Date/Time: 4/21/2016 12:00 Sample Collector: WEIDNER-HOLLAND, MASON Client Sample #: Royal Oaks
Submittal Date/Time: 4/21/2016 14:51 Sample ID 30 MCGINNIS ROAD Coliform Designation: Special

Sample Description: 30 McGinnis Road, Unit-C Spigot

Analyte	Method	Unit	**Result**	Qual	PQL	MCL	Date Analyzed	Analyst:
Chlorine Residual (Field Test)	SM4500-Cl G	mg/L	**Not Detected**		0.05	4.00	4/21/2016	MWH
E. Coli (Quantitray)	SM9223B	MPN/100mL	**<1**		1		4/21/2016	MW/LJ/H
Total Coliform (Quantitray)	SM9223B	MPN/100mL	**<1**		1		4/21/2016	MW/LJ/H

Sample Comments:

Lab Number: AB46041

Collection Date/Time: 4/21/2016 12:12 Sample Collector: WEIDNER-HOLLAND, MASON Client Sample #: Royal Oaks
Submittal Date/Time: 4/21/2016 14:51 Sample ID 30 MCGINNIS ROAD Coliform Designation: Special

Sample Description: 30 McGinnis Road, Unit-B Spigot

Analyte	Method	Unit	**Result**	Qual	PQL	MCL	Date Analyzed	Analyst:
Chlorine Residual (Field Test)	SM4500-Cl G	mg/L	**Not Detected**		0.05	4.00	4/21/2016	MWH
E. Coli (Quantitray)	SM9223B	MPN/100mL	**<1**		1		4/21/2016	MW/LJ/H
Total Coliform (Quantitray)	SM9223B	MPN/100mL	**<1**		1		4/21/2016	MW/LJ/H

Sample Comments:

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter ug/L : Micrograms per liter PQL : Practical Quantitation Limit MCL: Maximum Contamination Level
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Wednesday, May 04, 2016

Lab Number: AB46032

Collection Date/Time:	4/21/2016	9:15	Sample Collector:	FERGUSON, J	Client Sample #:	Royal Oaks
Submittal Date/Time:	4/21/2016	14:51	Sample ID	150 JOHNSON ROAD	Coliform Designation:	

Sample Description: 150 Johnson Road, Well

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed	Analyst:
Nitrate as NO3	EPA300.0	mg/L	**191**		1	45	4/21/2016	HM
Nitrate as NO3-N	EPA300.0	mg/L	**43.1**		0.1	10	4/21/2016	HM

Sample Comments:

Lab Number: AB46033

Collection Date/Time:	4/21/2016	9:25	Sample Collector:	FERGUSON, J	Client Sample #:	Royal Oaks
Submittal Date/Time:	4/21/2016	14:51	Sample ID	150 JOHNSON ROAD	Coliform Designation:	

Sample Description: 150 Johnson Road, Well

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed	Analyst:
Nitrate as NO3	EPA300.0	mg/L	**193**		1	45	4/21/2016	HM
Nitrate as NO3-N	EPA300.0	mg/L	**43.6**		0.1	10	4/21/2016	HM

Sample Comments:

Lab Number: AB46034

Collection Date/Time:	4/21/2016	9:40	Sample Collector:	FERGUSON, J	Client Sample #:	Royal Oaks
Submittal Date/Time:	4/21/2016	14:51	Sample ID	150 JOHNSON ROAD	Coliform Designation:	

Sample Description: 150 Johnson Road, Well

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed	Analyst:
Nitrate as NO3	EPA300.0	mg/L	**194**		1	45	4/21/2016	HM
Nitrate as NO3-N	EPA300.0	mg/L	**43.8**		0.1	10	4/21/2016	HM

Sample Comments:

Lab Number: AB46036

Collection Date/Time:	4/21/2016	11:10	Sample Collector:	WEIDNER-HOLLAND, MASON	Client Sample #:	Royal Oaks
Submittal Date/Time:	4/21/2016	14:51	Sample ID	150 JOHNSON ROAD	Coliform Designation:	

Sample Description: 150 Johnson Road, Well

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed	Analyst:
Nitrate as NO3	EPA300.0	mg/L	**194**		1	45	4/21/2016	HM
Nitrate as NO3-N	EPA300.0	mg/L	**43.8**		0.1	10	4/21/2016	HM

Sample Comments:

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter   ug/L : Micrograms per liter   PQL : Practical Quantitation Limit   MCL: Maximum Contamination Level
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Wednesday, May 04, 2016

Lab Number: AB46035

Collection Date/Time:	4/21/2016 10:10	Sample Collector:	WEIDNER-HOLLAND, MASON	Client Sample #:	Royal Oaks
Submittal Date/Time:	4/21/2016 14:51	Sample ID	150 JOHNSON ROAD	Coliform Designation:	Special

Sample Description: 150 Johnson Road, Well

Analyte	Method	Unit	**Result**	Qual	PQL	MCL	Date Analyzed	Analyst:
Aggressivity Index	Calculation		**10.5**				4/27/2016	MW
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**55**		10		4/22/2016	LRH
Aluminum, Total	EPA200.8	µg/L	**Not Detected**		10	1000	4/26/2016	SM
Antimony, Total	EPA200.8	µg/L	**Not Detected**		1.0	6	4/26/2016	SM
Arsenic, Total	EPA200.8	µg/L	**1**		1	10	4/26/2016	SM
Barium, Total	EPA200.8	µg/L	**154**		10	1000	4/26/2016	SM
Beryllium, Total	EPA200.8	µg/L	**Not Detected**		1	4	4/26/2016	SM
Bicarbonate (as HCO3-)	SM2320B	mg/L	**67**		10		4/22/2016	LRH
Biochemical Oxygen Demand	SM5210B	mg/L	**Not Detected**		2		4/22/2016	MP
Bromide	EPA300.0	mg/L	**1.2**		0.1		4/21/2016	HM
Cadmium, Total	EPA200.8	µg/L	**Not Detected**		0.5	5	2/26/2016	SM
Calcium	EPA200.7	mg/L	**53**		0.5		4/27/2016	MW
Carbonate as CaCO3	SM2320B	mg/L	**Not Detected**		10		4/22/2016	LRH
Chloride	EPA300.0	mg/L	**78**		1	250	4/21/2016	HM
Chlorine Residual (Field Test)	SM4500-Cl G	mg/L	**Not Detected**		0.05	4.00	4/21/2016	MWH
Chromium VI	EPA 218.6	µg\L	**5.4**	E	0.2		4/26/2016	BSK
Chromium, Total	EPA200.8	µg/L	**9**		2	50	4/26/2016	SM
Color, Apparent (Unfiltered)	SM2120B	Color Units	**Not Detected**		3	15	4/21/2016	MP
Copper, Total	EPA200.8	µg/L	**Not Detected**		4	1300	4/26/2016	SM
Cyanide	QuikChem 10-20	µg/L	**Not Detected**		5	200	4/29/2016	LRH
E. Coli (Quantitray)	SM9223B	MPN/100mL	**<1**		1		4/21/2016	MW/LJ/H
Fluoride	EPA300.0	mg/L	**0.1**		0.1	2.0	4/21/2016	HM
Hardness (as CaCO3)	SM2340B/Calc	mg/L	**239**		10		4/27/2016	MW
Hydroxide	SM2320B	mg/L	**Not Detected**		10		4/22/2016	LRH
Iron	EPA200.7	µg/L	**Not Detected**		10	300	4/27/2016	MW
Langlier Index, 15°C	SM2330B		**-1.48**				4/27/2016	MP
Langlier Index, 60°C	SM2330B		**-0.88**				4/27/2016	MP
Lead, Total	EPA200.8	µg/L	**Not Detected**		5	15	4/26/2016	SM
Magnesium	EPA200.7	mg/L	**26**		0.5		4/27/2016	MW
Manganese, Total	EPA200.7	µg/L	**Not Detected**		10	50	4/27/2016	MW
MBAS (Surfactants)	SM5540C	mg/L	**Not Detected**		0.05	0.50	4/22/2016	HM
Mercury, Total	EPA200.8	µg/L	**Not Detected**		0.5	2	4/26/2016	SM

mg/L: Milligrams per liter ug/L : Micrograms per liter PQL : Practical Quantitation Limit MCL: Maximum Contamination Level
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Lab Number: AB46035

Collection Date/Time:	4/21/2016 10:10	Sample Collector:	WEIDNER-HOLLAND, MASON	Client Sample #:	Royal Oaks
Submittal Date/Time:	4/21/2016 14:51	Sample ID	150 JOHNSON ROAD	Coliform Designation:	Special

Sample Description: 150 Johnson Road, Well

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed	Analyst:
Nickel, Total	EPA200.8	µg/L	**Not Detected**		10	100	4/26/2016	SM
Nitrate as NO3	EPA300.0	mg/L	**194**		1	45	4/21/2016	HM
Nitrate as NO3-N	EPA300.0	mg/L	**43.8**		0.1	10	4/21/2016	HM
Nitrate+Nitrite as N	EPA300.0	mg/L	**44.0**		0.1		4/21/2016	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.2**		0.1	1.0	4/21/2016	HM
Odor Threshold at 60 C	SM2150B	TON	**1**		1	3	4/21/2016	MP
o-Phosphate-P, Dissolved	EPA300.0	mg/L	**0.1**		0.1		4/21/2016	HM
Perchlorate	EPA314	µg/L	**Not Detected**	E	2.0		4/25/2016	BSK
pH (Laboratory)	SM4500-H+B	pH (H)	**6.6**		0.1		4/21/2016	MP
Potassium	EPA200.7	mg/L	**2.0**		0.5		4/27/2016	MW
QC Anion Sum x 100	Calculation	%	**91%**				4/22/2016	HM
QC Anion-Cation Balance	Calculation	%	**1**				4/27/2016	MW
QC Cation Sum x 100	Calculation	%	**92%**				4/27/2016	MW
QC Ratio TDS/SEC	Calculation		**0.68**				4/27/2016	MP
Selenium, Total	EPA200.8	µg/L	**4**		2	50	4/26/2016	SM
Silica as SiO2, Total	EPA200.7	mg/L	**56**		0.5		4/27/2016	MW
Silver, Total	EPA200.8	µg/L	**Not Detected**		10	100	4/26/2016	SM
Sodium	EPA200.7	mg/L	**60**		0.5		4/27/2016	MW
Specific Conductance (E.C)	SM2510B	µmhos/cm	**805**		1	900	4/22/2016	LJ
Sulfate	EPA300.0	mg/L	**44**		1	250	4/21/2016	HM
Synthetic Organic Compounds - Mont		µg/L	**Not Detected**	E			5/3/2016	BSK
TCP Low Level	SRL524M-TCP	ug/L	**Not Detected**	E	0.0007		4/22/2016	BSK
Thallium, Total	EPA200.8	µg/L	**Not Detected**		1.0	2	4/26/2016	SM
Total Coliform (Quantitray)	SM9223B	MPN/100mL	**<1**		1		4/21/2016	MW/LJ/H
Total Diss. Solids	SM2540C	mg/L	**548**		10	500	4/25/2016	HM/MP
Turbidity	EPA180.1	NTU	**Not Detected**		0.05	5.0	4/22/2016	BS
Volatile Org. Compounds (524)	EPA524	µg/L	**Not Detected**	E			4/29/2016	BSK
Zinc	EPA200.7	µg/L	**Not Detected**		10		4/27/2016	MW

Sample Comments:

Report Approved by:

David Holland, Laboratory Director

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Wednesday, May 04, 2016

Lab Number: AB46037

Collection Date/Time:	4/21/2016	10:31	Sample Collector:	WEIDNER-HOLLAND, MASON	Client Sample #:	Royal Oaks
Submittal Date/Time:	4/21/2016	14:51	Sample ID	150 JOHNSON ROAD	Coliform Designation:	Special

Sample Description: 150 Johnson Road, Home 1

Analyte	Method	Unit	**Result**	Qual	PQL	MCL	Date Analyzed	Analyst:
Chlorine Residual (Field Test)	SM4500-Cl G	mg/L	**Not Detected**		0.05	4.00	4/21/2016	MWH
E. Coli (Quantitray)	SM9223B	MPN/100mL	**<1**		1		4/21/2016	MW/LJ/H
Total Coliform (Quantitray)	SM9223B	MPN/100mL	**<1**		1		4/21/2016	MW/LJ/H

Sample Comments:

Lab Number: AB46038

Collection Date/Time:	4/21/2016	10:43	Sample Collector:	WEIDNER-HOLLAND, MASON	Client Sample #:	Royal Oaks
Submittal Date/Time:	4/21/2016	14:51	Sample ID	150 JOHNSON ROAD	Coliform Designation:	Special

Sample Description: 150 Johnson Road, Home 2

Analyte	Method	Unit	**Result**	Qual	PQL	MCL	Date Analyzed	Analyst:
Chlorine Residual (Field Test)	SM4500-Cl G	mg/L	**Not Detected**		0.05	4.00	4/21/2016	MWH
E. Coli (Quantitray)	SM9223B	MPN/100mL	**<1**		1		4/21/2016	MW/LJ/H
Total Coliform (Quantitray)	SM9223B	MPN/100mL	**<1**		1		4/21/2016	MW/LJ/H

Sample Comments:

Report Approved by:

David Holland, Laboratory Director

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