6
ALTERNATIVE ANALYSIS

6.1 INTRODUCTION

The primary objective of the Santa Clarita Valley Sanitation District Chloride Compliance Facilities Plan (Facilities Plan) is to recommend a plan of action needed to comply with the Santa Clara River (SCR) Chloride Total Maximum Daily Load (TMDL), referred to as the Chloride TMDL.

Background information on regulatory requirements, existing conditions, system capabilities, and projections of future conditions can be found in Sections 1 through 5 of this Facilities Plan. In this section, alternatives to compliance are successively screened, evaluated and refined to determine the recommended project. A summary of this process can be found in Section 6.8.

6.2 PLANNING GOAL AND OBJECTIVES

The goal of this Facilities Plan is to identify a plan that meets the project objectives in a cost-effective and environmentally sound manner. As presented in Section 1, the objectives of the Facilities Plan are:

- Provide compliance with the Chloride TMDL for Santa Clarita Valley Sanitation District (SCVSD) wastewater treatment and discharge facilities
- Provide the necessary wastewater treatment facilities and programs for chloride removal while conserving the area designated for future Valencia Wastewater Reclamation Plant (VWRP) Stage VI expansion
- Provide a wastewater treatment and effluent management program that accommodates recycled water reuse opportunities in the community while protecting beneficial uses of the SCR

6.3 ALTERNATIVES ANALYSIS METHODOLOGY

This sub-section describes the methodology and criteria used for development and evaluation of alternatives and, ultimately, selection of the recommended project.

6.3.1 Methodology

The alternatives analysis process began with identifying a large range of conceptual approaches that would either entirely or partly provide compliance with the Chloride TMDL. These approaches were screened against criteria closely derived from the project objectives, and only approaches meeting all project objectives were deemed potentially feasible and considered further.

Potentially feasible approaches were then refined as to technology, configuration and location using a series of evaluations. Refined feasible approaches were assembled into alternatives intended to provide full compliance with the Chloride TMDL. Prior to comparing these alternatives, each alternative was developed through a series of evaluations such as whether to use brine minimization, ultraviolet light (UV) disinfection, or supplemental water. Developed alternatives were screened and remaining alternatives became the four final alternatives.

The final alternatives were analyzed for environmental impacts in the Environmental Impact Report (EIR) portion of this document (Section 8 onward) and technically evaluated to determine the top-ranked final alternative. A simplified version of this process is illustrated on Figure 6-1.

For most evaluations, alternatives were rated for each criterion using a scale of superior (+), neutral (0), or inferior (-) relative to other alternatives. The ratings were summed and the top-ranked alternative was carried forward. In some cases, alternatives were screened with only the surviving alternatives being rated and ranked. For the final alternative evaluation, alternatives were rated for each criterion using a scale of 1 (least favorable) to 5 (most favorable) for environmental/social factors and a scale of 1 (least favorable) to 10 (most favorable) for cost factors. The ratings were summed and the top-ranked alternative became the recommended project.

6.3.2 Evaluation Criteria

For each evaluation, applicable criteria from the following list were selected and used to rate alternatives. A description of each criterion follows.

- Ability to Meet Compliance Deadline
- Available Land/Rights-of-Way (ROW)
- Conserves WRP Space
- Constructability
- Cost-Effective
- Environmentally Sound
- Expandability
- Institutional Feasibility
- Operational Considerations
- Proven in Needed Application
- Public Acceptability
- Regulatory Compliance
- Water Reuse Supportive

Figure 6-1

Alternatives Analysis Process Illustration

6.3.2.1 Ability to Meet Compliance Deadline

Evaluating whether an approach can be implemented within the Chloride TMDL deadline takes into account the time required to permit, design, and construct necessary infrastructure. Alternatives that require less time were rated more favorably.

6.3.2.2 Available Land/Rights-of-Way

Land requirements and ROW are important in assessing the feasibility of any public works project. Rights-of-way will need to be acquired for construction of any facilities outside plant boundaries and not within public ROW. Alternatives that minimize overall land requirements and the number of ROW procurements were rated more favorably.

6.3.2.3 Conserves WRP Space

The Saugus Water Reclamation Plant (SWRP) has reached its build-out capacity of 6.5 million gallons per day (mgd) and no expansion is planned for the site. There is limited undeveloped space immediately west of the northernmost aeration tank that could be used for future SWRP improvements. The existing capacity of the VWRP is 21.6 mgd. The previously approved 2015 Santa Clarita Valley Joint Sewerage System Facilities Plan and EIR (2015 Plan) included a 6-mgd Stage VI expansion that would build-out VWRP capacity to 27.6 mgd. The area designated for the Stage VI expansion is currently unused and situated in the northern portion of the site. While most of the alternatives under consideration require land at the VWRP for new facilities, the ability to implement the previously approved Stage VI expansion must also be conserved. Alternatives that minimize use of valuable space dedicated for future WRP needs were rated more favorably.

6.3.2.4 Constructability

Constructability considers the relative ease or difficulty of constructing facilities. Construction is complicated when new facilities need to be built over existing facilities while keeping the existing facilities operational. Another potential complication is when construction takes place within limited space and requires complex phasing to enable continued operation of existing facilities. The more constructible a facility is, the lower construction cost will be. Alternatives that require standard construction techniques in locations with adequate space were rated more favorably.

6.3.2.5 Cost-Effective

In general, the most cost-effective approach is the approach that delivers the necessary level of service at the least cost. Assessments of cost-effectiveness take into account the life-cycle costs, which include capital costs and operations and maintenance (O&M) costs. Effectiveness factors include flexibility in handling changing regulations or environmental conditions. Equivalent Annual Cost (EAC) provides a way to compare the life-cycle costs of alternatives. A project’s capital costs are amortized over 20 years at the assumed State Revolving Fund interest rate. This annual capital payment is added to the annual O&M cost in today’s dollars to determine the EAC.

6.3.2.6 Environmentally Sound

An environmentally sound alternative minimizes potentially adverse impacts to the environment. This environmental review is for initial screening purposes and does not represent the more comprehensive analysis undertaken in the EIR. Impacts result from both construction and operation of projects and can be short-term (e.g., construction noise) or long-term (energy consumption). Examples of potential construction impacts include air emissions from construction equipment, construction noise, and traffic restriction from work in public roads. Operational impacts include impacts to water quality and water supply, energy consumption, and greenhouse gas emissions associated with generation of energy required for the project. Alternatives with lower impacts were rated more favorably.

6.3.2.7 Expandability

Facilities are often sized and constructed to meet near term needs with an opportunity to expand later when needed due to increased flows or new regulatory requirements. Some locations have sufficient space to accommodate future expansions while others do not. Alternatives that would enable economic facility expansion were rated more favorably.

6.3.2.8 Institutional Feasibility

Reviews, approvals, and permits must be obtained from outside parties before implementing the project. Institutional feasibility refers to the SCVSD's ability to independently implement the project, and the difficulty of implementing the project considering the availability of the necessary infrastructure, degree of political support, external approvals required, and cooperation required. A more institutionally feasible alternative requires fewer reviews, approvals, permits, and contractual agreements.

6.3.2.9 Operational Considerations

Operational considerations include flexibility, reliability, simplicity, and operator familiarity. Flexibility allows personnel to adjust for changing conditions such as flow increases or influent water quality variations. In general, the SCVSD's preference is to implement systems that provide operational flexibility while minimizing any associated cost premium. The SCVSD routinely designs its facilities for reliability. Examples include standby mechanical systems, redundant critical facilities, backup power supply, and instrumentation and control flexibility. Therefore, no difference in reliability is expected between alternatives. Simplicity of the system depends on the number of system components and the location and interaction of these components. Typically, simple systems result in less operational and maintenance issues and lower costs. The cost, reliability, and overall effectiveness of facilities operations are impacted by the operational staff's familiarity with the systems involved. Facilities that are consistent with existing systems and processes were rated more favorably. Alternatives that incorporate systems that utilize less proven technologies or are significantly different or considerably more complex than existing systems were rated less favorably.

6.3.2.10 Proven in Needed Application

Technologies that have been successfully utilized for similar applications (i.e., wastewater treatment), have a longer track record, and have performance documented and recognized by the industry and regulatory agencies were rated more favorably.

6.3.2.11 Public Acceptability

The rating of public acceptability accounts for perceived support or opposition from different groups representing public opinion such as:

- Individuals
- Businesses
- Community groups
- Political entities
- Environmental groups

Input regarding public acceptability was gathered through meetings, presentations, public hearings, and public comments during the public review period for the Draft Facilities Plan and EIR.

6.3.2.12 Regulatory Compliance

Wastewater treatment and effluent management is subject to a wide array of federal, state, and local regulations. The recommended project from this facilities planning effort must comply with the Chloride TMDL including the deadline when the new limits become effective. As last revised in 2008, the Chloride TMDL requires the SCVSD to comply with either the 100 milligrams per liter (mg/L) chloride limit or a 117 mg/L chloride limit conditioned upon the facilities in the Alternative Water Resources Management Plan (AWRM). As currently written, compliance with the chloride limit, including permitting, design, and construction of the project, should be achieved by May 2015. The SCVSD has requested that the California Regional Water Quality Control Board-Los Angeles Region (RWQCB-LA) extend the Chloride TMDL compliance deadline to provide the needed time to permit, design, and construct the recommended project. Alternatives were screened against their ability to meet the appropriate chloride limit including the requested implementation deadline.

6.3.2.13 Water Reuse Supportive

Water is a valuable commodity in Southern California. The SCVSD's two water reclamation plants (WRPs) produce high-quality recycled water that can be reused in a variety of ways. Alternatives that foster use of recycled water were rated more favorably while alternatives that hamper reuse efforts were rated less favorably.

6.4 CONCEPTUAL APPROACHES FOR CHLORIDE TMDL COMPLIANCE

Chloride levels in the VWRP and SWRP effluent do not consistently meet the Chloride TMDL limit that will become effective at the Chloride TMDL compliance deadline. The chloride levels in the plant discharges are influenced by chloride levels in the water supply serving the Santa Clarita Valley (SCV), chloride added by the community, and chloride added during wastewater treatment. Different conceptual approaches for achieving compliance with the Chloride TMDL are described below, and their feasibility is evaluated. Conceptual approaches are grouped into the following categories: Alternative Discharge Location, Source Control, and Additional Treatment.

6.4.1 Alternative Discharge Location

This category of approaches would relocate the effluent discharge location from the current locations in SCR to a location with a higher chloride limit or no chloride limit. All of these approaches are limited by the need to continue discharging a portion of the effluent to the SCR to sustain the river's biological resources ("minimum discharge"). Water rights of downstream water users are also a consideration, but upstream biological concerns appear to be the driving factor in determining the minimum discharge flow. The minimum discharge would have to comply with the Chloride TMDL and would require partial advanced wastewater treatment (AWT). To determine the minimum discharge flow, the SCVSD conducted a Reduced Discharge Technical Study that is included as Appendix 6-A and discussed in Sections 11 and 15. The Reduced Discharge Technical Study concluded that the average minimum discharge flows from the VWRP and SWRP are 8.5 and 4.5 mgd, respectively, based on the level of analysis completed to date. A 13 mgd discharge would require a 3.5 mgd AWT facility to comply with the Chloride TMDL and would generate 0.3 to 0.6 mgd of brine that would require a disposal system. At today's combined discharge of approximately 19.5 mgd, 6 mgd (31 percent) could be diverted after meeting the minimum discharge. Various approaches to changing the discharge location for this 6 mgd are described and evaluated below. In approaches involving facilities that cannot be easily expanded such as long pipelines, the SCVSD's ultimate build-out flow (48 mgd average/72 mgd peak) was used for pipeline sizing and cost estimating. Depending on the selected pipeline alignment, different pipeline sizes would be required to convey the same amount of flow. Thus, pipelines would need to convey a peak flow of 59 mgd after subtracting 13 mgd for the minimum discharge.

6.4.1.1 Convey Treated Effluent to Ventura for Ocean Discharge

In this approach, the tertiary-treated flow remaining after meeting the minimum discharge and community recycled water needs would be conveyed to the ocean where chloride levels in the treated effluent would not be a concern. Effluent conveyed to the ocean would only require secondary treatment rather than the tertiary treatment that is currently provided which would reduce treatment costs for that portion of the WRP's flow. Brine produced by the AWT would be blended with the effluent and conveyed to the ocean, which would eliminate the need for a separate brine disposal system. The ocean discharge system would consist of a 54-inch diameter, 50-mile long pipeline from the SWRP and VWRP to the Ventura coast and an ocean outfall and diffuser system. Adding the cost of such a large and long pipeline and a new ocean outfall to a 3.5 mgd AWT facility for the minimum discharge makes this approach cost over $600 million, which is much more costly than the final alternatives described in Section 6.7. Discharge to the ocean would require a variety of permits including permits from the RWQCB-LA, U.S. Army Corps of Engineers (Corps), and California Coastal Commission. Acquisition of such permits is a lengthy process that can take several years. The time to permit, design and construct such extensive facilities is likely to exceed the Chloride TMDL compliance deadline. Thus, this approach is not feasible.

6.4.1.2 Convey Raw Sewage to Joint Outfall System (JOS) for Treatment and Ocean Discharge

In this approach, only flows required to meet the minimum discharge and community recycled water needs would be treated by VWRP and SWRP. The remaining raw sewage (average flow of 6 mgd currently and up to 35 mgd in the future) would be conveyed to the Sanitation Districts of Los Angeles County's (Sanitation Districts') JOS, which leads to the Joint Water Pollution Control Plant (JWPCP) for secondary treatment and eventually to an existing ocean outfall where the chloride levels would not be a concern. Brine produced by the AWT could be blended with the raw sewage and conveyed to the ocean, which would eliminate the need for a separate brine disposal system. This approach would require a 48-inch diameter, 46-mile pipeline and at least two pump stations to convey flow over the Newhall Pass to the nearest point in the JOS with sufficient capacity. Since raw sewage would be pumped over the Newhall Pass, a double force main would be required to minimize the likelihood of noncompliance with the EPA prohibition regarding discharge of raw sewage. Relocating the treatment of 6 mgd from the SCVSD's plants to the lower cost JWPCP would result in reduced O&M costs at the VWRP and SWRP of $5 million per year. However, the discharge of raw sewage to the JOS would result in increased costs for the JOS sewer system and JWPCP that would, in turn, result in a significant connection fee and service charge to the SCVSD (approximately $105 million and $4 million per year, respectively). Pumping such a large flow into the Los Angeles Basin would result in much higher energy consumption compared to the final alternatives evaluated in Section 6.7. Adding the connection fee and the cost of such a large and long pipeline to a 3.5 mgd AWT facility for the minimum discharge would result in a total cost over $750 million, which is much more costly than the final alternatives described in Section 6.7. The time to permit, design and construct such extensive facilities is likely to exceed the Chloride TMDL compliance deadline. Thus, this approach is not feasible.

As a variation, the SWRP could be taken out of service, flows required to meet the minimum discharge and community recycled water needs could be treated by VWRP only, and the remaining raw sewage could be conveyed to the JOS and treated at the JWPCP as discussed above. By taking the SWRP out of service, the SCVSD can save approximately $2.5 million per year in O&M costs. However, to comply with minimum discharge requirements at SWRP, a pipeline would have to be constructed to pump 4.5 mgd of treated effluent to the SWRP discharge point. Construction of this pipeline and a pump station would cost approximately $16 million. The discharge of raw sewage to the JOS would result in a significant connection fee and service charge to the SCVSD (approximately $105 million and $4 million per year, respectively). The total cost of this approach would be over $760 million, which is much more costly than the final alternatives described in Section 6.7. Thus, this variation is also not feasible.

6.4.1.3 Convey Treated Effluent to a JOS Sewer for Ocean Discharge

In this approach, the tertiary-treated flow remaining after meeting the minimum discharge and community recycled water needs would be conveyed to the JOS, which leads to the JWPCP and eventually to an existing ocean outfall where the chloride levels would not be a concern. Brine produced by the AWT would be blended with the effluent and ultimately conveyed to the ocean, which would eliminate the need for a separate brine disposal system. This approach would require a 48-inch diameter, 46-mile pipeline and at least two pump stations to convey flow over the Newhall Pass to the nearest point in the JOS with sufficient capacity. The discharge of treated effluent to the JOS would result in increased costs for the JOS sewer system and JWPCP that would, in turn, result in a significant connection fee and service charge to the SCVSD even though these fees are significantly lower than when discharging raw sewage (approximately $65 million and $1.1 million per year, respectively). Pumping such a large flow into the Los Angeles Basin would result in much higher energy consumption compared to the final alternatives evaluated in Section 6.7. Adding the connection fee and the cost of such a large and long pipeline to a 3.5 mgd AWT facility for the minimum discharge would result in a total cost over $600 million, which is much more costly than the final alternatives described in Section 6.7. The time to permit, design and construct such extensive facilities is likely to exceed the Chloride TMDL compliance deadline. Thus, this approach is not feasible.

6.4.1.4 Convey Treated Effluent to a City of Los Angeles Sewer for Ocean Discharge

In this approach, the tertiary-treated flow remaining after meeting the minimum discharge and community recycled water needs would be conveyed to the nearest City of Los Angeles sewer leading to the Hyperion Treatment Plant and eventually to an existing ocean outfall where the chloride levels would not be a concern. Brine produced by the AWT could potentially be blended with the effluent and conveyed to the Hyperion Treatment Plant, thereby eliminating the need for a separate brine disposal system. However, the City of Los Angeles has salinity concerns at Hyperion that may prohibit such blending. This approach would require a 48-inch diameter, 27-mile pipeline and at least two pump stations to convey flow over the Newhall Pass to the nearest point in the City of Los Angeles sewer system with sufficient capacity. The discharge of treated effluent to the City of Los Angeles is subject to approval by the city and, if approved, would result in significant service charges to the SCVSD. Pumping such a large flow into the Los Angeles Basin would result in much higher energy consumption compared to the final alternatives described in Section 6.7. Adding the cost of such a large and long pipeline to a 3.5 mgd AWT facility for the minimum discharge would result in a construction cost over $400 million, which is much more costly than the final alternatives described in Section 6.7. It is uncertain whether the City of Los Angeles has the available system capacity to accept such a large flow and would accept a high salinity discharge. Further, the time to permit, design and construct such extensive facilities is likely to exceed the Chloride TMDL compliance deadline. Thus, this approach is not feasible.

6.4.1.5 Complete Reuse by Community

In this approach, the tertiary-treated flow remaining after meeting the minimum discharge requirements would be reused by the community. In 2012, 301 acre-feet were reused compared to 22,600 acre-feet produced by WRPs. At today’s flows, this approach would require water reuse to increase to 6 mgd or 6,700 acre-feet per year (afy) – a 20-fold increase – in less than ten years. Efforts to increase water reuse have been significantly hampered by the high cost to install recycled water piping systems in an already developed area. Further, the region’s hilly nature necessitates pumping that also raises costs. Even if funding were available, the seasonal demand for landscape irrigation, the predominant use identified in the Recycled Water Master Plan prepared by Castaic Lake Water Agency (CLWA), makes complete reuse impractical. Recycled water demands for landscape irrigation are high in the summer and low in the winter. Historically, reuse flows drop to zero from December to February (CLWA, Recycled Water Master Plan). There is no significant seasonal fluctuation in chloride concentration in the WRP’s effluent that would enable discharge to the river during winter months. Therefore, during low demand periods, unused recycled water would need to be stored. At today’s flows, 90 days of storage would require construction of a 0.5 billion-gallon storage reservoir. For context, this volume of water would fill six Rose Bowl stadiums. Such a reservoir would be difficult to site in such a developed and hilly area. Thus, this approach is not feasible.

6.4.1.6 Complete Reuse by Groundwater Recharge

In this approach, the tertiary-treated flow remaining after meeting the minimum discharge and community recycled water needs would be used for groundwater recharge. Groundwater recharge is accomplished in two ways: by percolating treated water underground (via spreading grounds) or by direct injection into an aquifer. The first significant impediment to this approach is that groundwater recharge projects have historically taken up to ten years to permit, which is longer than the Chloride TMDL compliance deadline. Second, the state requires that tertiary-treated wastewater used in spreading ground applications be diluted with stormwater or potable water. The required amount of dilution water is determined by the California Department of Public Health based on a variety of site specific factors, but has historically been between 20 and 50 percent. Stormwater is only available a fraction of the year, and potable water is relatively costly and difficult to obtain rights to. Consequently, such projects are economically feasible only when there is insufficient groundwater supply or ready sources of stormwater that can be captured for blending. An additional issue with surface spreading is that much of the Santa Clarita area has a groundwater objective of 100 mg/L for chloride. As a result, tertiary-treated wastewater would likely require some AWT before surface spreading. There are two aquifers in Santa Clarita that could be recharged: the shallow Alluvial Aquifer and the deeper Saugus Formation. The Alluvial Aquifer is quickly recharged by natural precipitation. Thus, filling this aquifer with a blend of treated wastewater and potable water provides no benefit other than disposing of high chloride water. Groundwater recharge into the Saugus Formation is possible only through direct injection. Injected water does not receive the treatment provided by the soil that percolated water does. As a result, only advanced treated water can be direct injected. Consequently, the SCVSD would need an AWT facility sized to treat the entire plant flow (some for the minimum discharge and the rest for direct injection) resulting in a more costly solution than the final alternatives in Section 6.7. Thus, groundwater recharge is not a feasible approach for this project.

6.4.1.7 Convey Treated Effluent to Upstream Portion of the SCR

In this approach, the recycled water discharge point would be relocated approximately 16 miles upstream to Reach 7 of the SCR. This approach could provide compliance if the river and underlying groundwater were able to naturally reduce chloride levels to 100 mg/L by the time flows reach the point downstream where agricultural use begins. Modeling concluded that this approach would not consistently achieve compliance with the 100 mg/L chloride limit. Thus, this approach is not feasible.

6.4.1.8 Convey Treated Effluent to a Flood Control Channel for Ocean Discharge

In this approach, tertiary-treated flow remaining after meeting the minimum discharge and community recycled water needs would be conveyed to the nearest flood control channel that has no chloride limit or a sufficiently high chloride limit. All flood control channels in the SCV discharge to the SCR, which would be subject to the Chloride TMDL limit. The nearest potential flood control channel that does not drain to the SCR is located in the north end of the San Fernando Valley about 14 miles south of the VWRP. This flood control channel discharges to the Los Angeles River, which has a chloride limit of 150 mg/L. Even with a chloride concentration below 150 mg/L, is it uncertain whether the RWQCB-LA would issue an NPDES permit for such a discharge. This approach is likely to be met with strong opposition by stakeholders in the Los Angeles River watershed who might view this project as Santa Clarita residents disposing their waste in another community's jurisdiction. Whether this flood control channel has enough excess capacity to accept a large flow from the SCVSD is also uncertain. In addition, this approach would require a 48-inch diameter, 14-mile pipeline and at least two pump stations. Adding the cost of such a large and long pipeline to a 3.5 mgd AWT facility and associated brine disposal system for the minimum discharge results in capital costs of approximately $300 million, which makes this approach more costly than the final alternatives described in Section 6.7. Thus, this approach is not feasible.

6.4.1.9 Convey Treated Effluent to an Existing Drinking Water Reservoir

In this approach, tertiary-treated flow remaining after meeting the minimum discharge and community recycled water needs would be conveyed to the nearest drinking water reservoir such as Castaic Lake or Pyramid Lake. The California Department of Public Health regulates recycled water use in the State of California. Per Title 22, tertiary-treated wastewater (recycled water) is safe for human contact including irrigation and recreational use; however, mixing tertiary-treated wastewater with drinking water is prohibited. Tertiary-treated wastewater would need to undergo advanced treatment to be considered for mixing in a potable water reservoir. The City of San Diego had been exploring such a project since the mid-1990s for the San Vicente Reservoir and completed a 1 mgd demonstration project in 2011 that is currently in operation. This project has been slow to develop due to lack of public acceptance. Consequently, the time to permit such a project is likely to exceed the Chloride TMDL compliance deadline. Thus, this approach is not feasible.

6.4.1.10 Discharge Treated Effluent to a Rubber Dam for Blending With Stormwater

In this approach, a rubber dam would be constructed downstream of the VWRP to retain tertiary-treated effluent from the WRPs until a storm occurs allowing for the effluent to be diluted by the stormwater. The maximum amount of water that could be dammed before flooding local business and residential properties is approximately 480 million gallons, which is approximately 20 days of storage at current discharge rates. Such a dam would have to be 20 feet tall and 1,500 feet long, which is much longer than the 300 foot typical length and 600 feet specially designed length of rubber dams (Chanson 1998). This amount of storage is much less than the 7 to 9 months that would be needed to span many Southern California dry seasons. Installation of a dam is likely to result in significant environmental impacts to biological resources in the river, which rely on relatively continuous and shallow flow except during rain events. The SCVSD would have to comply with the existing NPDES permit and Chloride TMDL since the RWQCB-LA would consider discharge to the pool behind the dam as a discharge to the SCR. The RWQCB-LA is unlikely to modify the existing permit because the dammed water with high chloride level would percolate into the groundwater and exceed the groundwater objective of 100 mg/L. Thus, this approach is not feasible.

6.4.2 Source Control

The water supply serving the SCV is currently the largest source of chlorides. Chloride is also added by the community and during wastewater treatment. The following approaches are aimed at reducing the chloride reaching the end of the treatment plant to achieve compliance or reduce the amount of AWT needed.

6.4.2.1 Residential Automatic Water Softeners (AWS) Removal

In this approach, the SCVSD has taken several steps to reduce the chloride contribution from residential AWS that discharge to the sewer system. In 2002, residential AWS were identified as the primary controllable source of chloride in the SCVSD service area. Based on this study, the SCVSD adopted an ordinance in 2003 prohibiting the installation of residential AWS. Chloride loading from AWS peaked in 2003/2004 at approximately 9,000 pounds per day, representing approximately 59 mg/L of chloride in the SCVSD effluent. The SCVSD implemented AWS Rebate Programs in 2005 (Phase I) and 2007 (Phase II) and initiated a 2008 voter approved ordinance that requires removal and disposal of all existing residential AWS in the SCVSD's service area. These efforts have resulted in removal of more than 7,900 AWS units. As of December 2011, the chloride contribution from residential AWS to the SCVSD's effluent had been reduced to approximately 6 mg/L. It is expected that the remaining discharging residential AWS units will be removed from operation through additional public outreach and enforcement of ordinances. Because removal of remaining residential AWS is already in progress, residential AWS removal is not included as part of the recommended project.

6.4.2.2 Chloride Control Measures for Industrial and Commercial Dischargers

The SCVSD has developed a strictly regulated system for industrial and commercial dischargers. Since 2002, the SCVSD has been systematically implementing more stringent requirements for industrial dischargers in the SCV. Industrial dischargers contribute 1 to 3 percent of the chloride load in the WRP's effluent. Nevertheless, the target chloride limit for every industrial discharger is 100 mg/L. Dischargers that cannot achieve 100 mg/L chloride limit due to technological or economic reasons are required to submit a Chloride Reduction Workplan detailing all technologically and economically feasible chloride reduction actions. In 2002, the SCVSD identified saline discharges at commercial businesses and developed mandatory best management practices (BMPs) for chloride reduction. The SCVSD conducts systematic inspections to ensure that residential AWS are not utilized and that BMPs are being implemented. Because chloride control measures for industrial and commercial dischargers are already in progress, these measures are not included as part of the recommended project.

6.4.2.3 Satellite Chloride Treatment Systems

In this approach, homeowners and businesses in the SCV would have individual water treatment systems to reduce chloride in drinking water prior to its use. Typical home water treatment systems use activated carbon, reverse osmosis (RO), or ion exchange technologies. Activated carbon does not remove chloride. RO is effective in removing chloride but produces a brine stream that requires proper disposal. Normally, home units discharge to the sewer but, in this case, sewering brine would defeat the purpose of a satellite treatment system because the chloride would still reach the WRPs and SCR. Using brine for irrigation at residences would be inappropriate because the salts would build up in the ground and eventually prevent vegetation growth and potentially percolate into groundwater. The RWQCB-LA would likely prohibit such a discharge. Consequently, brine would have to be stored and then periodically picked up and trucked to an offsite disposal location. To transport brine generated by the treatment units, between 300 and 500 trucks would be added to the city traffic every day. With approximately 15 percent of the water treated by RO becoming brine, this offsite trucking would be frequent and prohibitively expensive.

Home ion exchange units are configured with a resin that removes hardness but does not remove chloride. Industrial ion exchange units can be configured to remove chloride, but such units are expensive. The resins in an ion exchange unit must be periodically regenerated to retain their performance. Resins that would remove chloride require regeneration chemicals that are relatively costly and unsafe for homes and most businesses. Another option is for a service provider to periodically replace a spent resin unit with a regenerated one. The SCVSD is unaware of a company providing this service for a resin capable of removing chloride. Even if such a service existed, the cost of this service per gallon of water treated would likely be higher than the cost of the centralized salt removal and brine disposal alternatives discussed in Section 6.7. Last, this approach would require a large portion of the community to install these devices and keep them functioning properly. The SCVSD would have limited ability to ensure the proper maintenance and continued operation of these units that would be necessary for compliance with the Chloride TMDL. For cost and institutional feasibility concerns, this approach is not feasible.

6.4.2.4 Delta Improvements

In this approach, the SCVSD would rely upon future implementation of the Bay Delta Conveyance Facility to dramatically improve chloride levels such that no other actions would be required for Chloride TMDL compliance. About half of the SCV water supply is comprised of imported water from the State Water Project (SWP). Most of the chloride in SWP water comes from water passing through the Sacramento-San Joaquin Delta (Delta) and mixing with seawater. For decades, there have been discussions about providing a new water conveyance facility around the Delta. In 1982, this conveyance was known as the “peripheral canal” and was defeated in a ballot initiative (California Proposition 9, the Peripheral Canal Act, June 1982). The more recent name is the Bay Delta Conveyance Facility. In May 2013, a complete Administrative Draft of the Bay Delta Conservation Plan was released for comment. The information in this draft indicates that implementation of the Bay Delta Conveyance Facility would provide a much smaller improvement in the chloride level of the water delivered to the SCV during drought conditions than previously expected. Consequently, implementation of the Bay Delta Conveyance Facility would not be sufficient to provide compliance with the Chloride TMDL. Thus, this approach is not feasible.

6.4.2.5 Delivering Water From a Different Source

In this approach, the SCV’s imported water supply would be switched either partly or entirely from the SWP to a source that has lower chloride levels. CLWA is Santa Clarita’s water importer and would have a major role in switching water supplies. There are two potential sources of alternative water supply close enough to be considered. One is the Los Angeles Aqueduct (aqueduct), which conveys water from Owens Valley and is operated by the City of Los Angeles Department of Water and Power. From a physical standpoint, this approach would require construction of a relatively large pipeline from the aqueduct to the nearest SCV drinking water treatment plant or storage reservoir. However, the City of Los Angeles Charter prohibits the sale of aqueduct water outside of the city limits. Thus, this approach is not feasible.

The other source is low chloride water from the Kern River. CLWA has existing contracts with Kern County entities that allow them to divert storm water from the Kern River to a water bank for later use. However, this water is supplied to CLWA via the California Aqueduct. By mixing with SWP water, the benefit of low chloride Kern River water would be lost. To maintain a low chloride level, a separate 90-mile long pipeline would need to be constructed from the Kern River to the SCV, and large pumping facilities would need to be constructed to convey water over

Tejon Pass. From both an environmental impact and cost standpoint, this alternative is far inferior to the final alternatives considered in Section 6.7. Thus, this approach is not feasible.

6.4.2.6 Chloride Treatment at Drinking Water Treatment Plants

In this approach, advanced treatment facilities for chloride removal would be added to Santa Clarita's drinking water treatment plants. This approach would have the benefit of providing softer water to the homes and businesses receiving this water. However, about half of SCV's water supply comes from groundwater wells that are directly connected to the water supply distribution (i.e., does not pass through a water treatment plant). Since most hardness, a common quality concern expressed by residents of the SCV, comes from groundwater, this approach would provide limited water softening benefits. Further, for every gallon of wastewater received by the SCVSD, 3 gallons of drinking water are supplied to the community. This difference largely results from water used for landscape irrigation. Consequently, this approach would require approximately 3 times more advanced treatment and brine disposal. Such a large brine flow would negatively affect the viability of the brine disposal alternatives discussed later in this section and this additional brine flow would be water that is no longer usable for meeting community water demands. Relative to the final alternatives described in Section 6.7, this approach is expected to cost three times more and require three times more energy. Thus, this approach is not feasible.

6.4.2.7 Modify WRP Operations

In this approach, WRP facilities and operational practices would be modified to reduce or eliminate chloride addition during wastewater treatment. In the past, there were three treatment processes that added chloride to the WRPs effluent: coagulation during primary treatment, odor control for the flow equalization basin, and the chlorine-based disinfection process. To minimize chloride addition, ferric chloride was replaced with ferric sulfate as a coagulant. Sodium hypochlorite is still used for odor control, but the quantities are so low that this use has a negligible impact on effluent chloride level. Thus, chlorine-based disinfection is the only remaining significant chloride contributor from wastewater treatment. To minimize the amount of chloride added by disinfection, the SCVSD has been optimizing chlorine dosage. At this time, consistently achieving further reductions is not possible, and the only option to reduce chloride contribution is to replace some or all of the disinfection process with a non-chlorine based disinfection technology such as ultraviolet light (UV) or ozonation. This approach is deemed potentially feasible and carried into further analysis.

6.4.3 Additional Treatment

6.4.3.1 Advanced Wastewater Treatment

In this approach, tertiary-treated wastewater from each plant would continue to be discharged to the SCR; however, a portion of the wastewater would be desalinated using AWT technology and blended with the remaining tertiary-treated wastewater to achieve a chloride level that meets the Chloride TMDL limit. Several technologies are capable of removing chlorides to the levels required. All of the processes result in a product water flow with most of the chloride removed and a residual flow containing highly concentrated levels of chloride and other constituents that must be properly disposed. The required capacity of the AWT process would be based upon treating enough tertiary-treated wastewater such that a blend of the AWT treated flow and the non-AWT treated flow consistently achieves the 100 mg/L chloride limit at the "end of pipe" discharge to the SCR. This approach is deemed potentially feasible and carried into further analysis.

6.4.3.2 Supplemental Water

In this approach, tertiary-treated wastewater from each plant would be mixed with low chloride groundwater (supplemental water) to achieve a blend that meets the Chloride TMDL limit. To replace the groundwater used for blending and ensure no net loss of water supply to the SCV, additional water would be imported. This replacement water would be obtained via purchase and bank arrangements through CLWA. The amount of supplemental water needed would vary depending on the chloride levels reaching the WRPs and how supplemental water is combined with other approaches. Consequently, this approach is deemed potentially feasible and carried into further analysis.

6.4.4 No Project Alternative Approach

In this approach, the SCVSD would take no additional actions towards Chloride TMDL compliance which would result in exceeding the Chloride TMDL limit and violating discharge requirements set by RWQCB-LA pursuant to the federal Clean Water Act and the state's Porter Cologne Act. Violations would result in fines to the SCVSD, which would be passed on to the SCVSD's ratepayers. The penalties could include fines for every day that the SCVSD's WRPs violate the chloride limit and fines for every gallon of treated wastewater that is above the legal chloride limit. Additionally, third party lawsuits can be filed against the SCVSD with the potential of more expensive penalties totaling in the millions of dollars. The SCVSD's ratepayers would pay the cost of the fines, third party lawsuit fines, and eventually the cost of facilities for Chloride TMDL compliance. If the SCVSD refused or was unable to pay fines, a court would place the SCVSD into receivership wherein a third party would make decisions for the SCVSD rather than the SCVSD's Board of Directors. Such an outcome would result in loss of local control in decision-making on sanitation issues. In May 2011, the RWQCB-LA issued Notices of Violation for the VWRP and SWRP non-compliance with the Chloride TMDL (included in Appendix 6-B). In November 2012, the RWQCB-LA issued an administrative civil liability complaint to the SCVSD seeking a fine of $280,250 for failure to complete a Facilities Plan and EIR in 2011. In March of 2013, the SCVSD reached a settlement with the RWQCB-LA that reduced the fine to $225,000. Thus, this approach is not feasible but is analyzed in the EIR as required by California Environmental Quality Act (CEQA).

6.4.5 Evaluation of Conceptual Approaches

The conceptual approaches were evaluated as shown in Table 6-1. Conceptual approaches that met all criteria were deemed potentially feasible and carried into further analysis.

Table 6-1. Screening of Conceptual Approaches

Conceptual Approaches	Criteria				
	Cost Effective	**Environmentally Sound**	**Institutionally Feasible**	**Able to Meet Compliance Deadline**	**Potentially Feasible**
Alternative Discharge Location					
Convey Treated Effluent to Ventura for Ocean Discharge	-	-	-	-	No
Convey Raw Sewage to JOS for Treatment and Ocean Discharge	-	-	-	-	No
Convey Treated Effluent to JOS Sewer for Ocean Discharge	-	-	-	-	No
Convey Treated Effluent to City of LA Sewer for Ocean Discharge	-	-	-	-	No
Complete Reuse by Community	-	✓	-	-	No
Complete Reuse by GW Recharge	-	✓	-	-	No
Convey Treated Effluent to Upstream Portion of SCR	✓	✓	✓	-	No
Convey Treated Effluent to Flood Control Channel for Ocean Discharge	-	-	-	✓	No
Convey Treated Effluent to an Existing Drinking Water Reservoir	-	-	-	-	No
Discharge Treated Effluent to a Rubber Dam for Blending with Stormwater	-	-	-	-	No
Source Control					
Residential AWS Removal	✓	✓	✓	✓	**Yes**
Chloride Control Measures for Industrial and Commercial Dischargers	✓	✓	✓	✓	**Yes**
Satellite Chloride Treatment Systems	-	-	-	-	No
Delta Improvements	✓	✓	-	-	No
Delivering Water From a Different Source	-	✓	-	-	No
Chloride Treatment at Drinking Water Treatment Plants	-	✓	-	-	No
Modify WRP Operations	✓	✓	✓	✓	**Yes**
Additional Treatment					
AWT	✓	✓	✓	✓	**Yes**
Supplemental Water	✓	✓	✓	✓	**Yes**
No Project Alternative	-	-	✓	-	No

Note: Comparative ratings are meets a criterion (✓) or does not meet a criterion (-).

After evaluating conceptual approaches, it was concluded that only five were potentially feasible. Because two of the potentially feasible approaches – Residential AWS Removal and Chloride Control Measures for Industrial and Commercial Dischargers – are in progress and will continue into the future, they are not included as part of the recommended project. Modifying WRP Operations, AWT, and Supplemental Water approaches are potentially feasible and carried into further analysis.

6.5 REFINEMENT OF FEASIBLE APPROACHES

Two of the feasible approaches – AWT and Modifying WRP Operations – could be implemented using multiple technologies. Further, these processes can be sited and configured in several ways. In the case of AWT, some of these processes produce a waste stream (brine) that can be managed in several ways. Because of the high cost to manage brine, it may be desirable to add equipment to minimize the amount of brine produced. The supplemental water approach might be used alone or in combination with other approaches. These issues are identified and evaluated to refine the feasible approaches prior to assembling approaches into full compliance alternatives in Section 6.6.

6.5.1 Advanced Wastewater Treatment

This sub-section evaluates technologies used to provide advanced wastewater treatment and sites for the selected technology.

6.5.1.1 Advanced Wastewater Treatment Technologies

The only way to remove chloride from wastewater is through use of AWT technologies. Three technologies were identified and evaluated for their suitability in removing chlorides:

- Ion exchange
- Thermal processes
- Membrane processes

Ion Exchange

This method is a rapid and reversible process in which undesired ions present in the water are replaced by ions released by an ion-exchange resin. The undesired ions are taken up by the resin, which must be periodically regenerated to maintain its function. This technology is highly sensitive to fluctuations in influent water quality. Ion-exchange resins are prone to inorganic and biological fouling from the components found in recycled water, which may result in irreversible degradation of the resins. Regeneration is a lengthy and frequent process that requires large amounts of sodium hydroxide and sulfuric acid for resin regeneration and pH balancing. The ion exchange process is mainly used in drinking water purification for the removal of hardness ions and for water demineralization and has not been used for selective anion removal. This technology has very limited application in recycled water desalination, has very high O&M costs, and is not considered an appropriate technology for this Facilities Plan.

Thermal Processes

These methods include multi-stage flash (MSF) distillation, multi-effect distillation, and vapor compression distillation. Thermal processes have found their primary application in the desalination of seawater. For recycled water desalination, this category of technology is considerably less energy efficient than comparable membrane processes and is subject to volatile constituent carry-over. As a result, this technology has very limited application in recycled water desalination and is not considered an appropriate technology for this Facilities Plan.

Membrane Processes

These processes can be divided into two categories depending on whether the fundamental driving force is electrical potential or pressure. In the electrodialysis reversal (EDR) process, electrical potential is used to transport charged molecules (ions) through a semi-permeable membrane. There is only one U.S. manufacturer of EDR equipment, which could result in high costs for replacement parts once a system is installed since there would not be any competition. At the time of this writing, there was only one full-scale wastewater treatment plant utilizing this technology in the U.S. and that facility had experienced significant membrane fouling. This technology has not been proven to be cost-effective in recycled water desalination and cannot be considered an appropriate technology for this Facilities Plan at this time. The SCVSD will continue to monitor the development of EDR technologies and may recommend implementation in the future.

Membrane processes driven by pressure work by applying relatively high pressure to force water through a membrane. The water passing the membrane is known as product water and is essentially free of other constituents such as chloride. Chloride and other larger molecules remain in the water outside of the membrane that is known as brine. The level of rejection for a particular constituent depends on the pore size of the membrane, the size of the compound, and the constituent’s electrical charge. Membrane treatment of wastewater typically involves two stages. The first stage is pre-treatment for solids removal with a microfiltration (MF) or ultrafiltration (UF) membrane. This pre-treatment physically protects the second stage membranes by removing suspended solids and particulates. The selection of MF or UF is usually made during design. For this document, MF is used for simplicity. The second stage membranes remove inorganic constituents, organic constituents, bacteria, and viruses employing either RO or nanofiltration (NF) membranes. Again, the selection of RO or NF is usually made during design. For this document, RO is used for simplicity. There are a growing number of MF/RO facilities being used to provide AWT including the 3 mgd Leo J. Vander Lans Water Treatment Facility in Long Beach and Orange County’s 70 mgd Groundwater Replenishment System in Fountain Valley.

Summary of AWT Technologies

Membrane processes are the only technology appropriate for this Facilities Plan. The combination of MF and RO (MF/RO) is the industry standard for removing salts from wastewater and is thus the top-ranked AWT technology. MF/RO is used in all subsequent discussions of AWT technology.

6.5.1.2 Site for MF/RO Facilities

MF/RO facilities constructed within existing WRPs would require approximately half of an acre. When constructed offsite, MF/RO facilities would require a total of one acre because extra space would be needed for a control building, parking, and other support facilities. The following sites were evaluated for the MF/RO facilities:

- VWRP and SWRP
- VWRP Only
- Offsite
- Newhall Ranch WRP (NRWRP)

VWRP and SWRP

Under this alternative, MF/RO facilities would be constructed at each SCVSD WRP. The VWRP is the larger of the two WRPs currently serving the SCVSD and occupies a 27-acre site. Of the two WRPs, the VWRP has the larger onsite operational staff. The VWRP alternative could accommodate the new facilities completely within the plant's footprint. This plant has not reached its build-out capacity and has space available for additional facilities. However, most of this unused space has been designated for other purposes such as the planned Stage VI expansion.

The SWRP occupies a 4-acre site east of San Fernando Road in the City of Santa Clarita. The plant has reached its build-out capacity and has very limited space available for new facilities. To construct MF/RO facilities, some of the existing facilities would have to be taken out of service and demolished, which would require phased implementation of the MF/RO facilities to enable continued plant operations during construction and would significantly increase construction costs. The potential to expand MF/RO facilities in the future to meet new regulations would be severely limited by site space constraints.

VWRP Only

Under this alternative, MF/RO facilities at the VWRP would be sized to produce blending water for both plants. To meet end-of-pipe chloride requirements, an RO product water conveyance system to the SWRP would be constructed. This system would include a pump station and pipe line to convey approximately 1.7 to 2.2 mgd of RO product water from the VWRP to the SWRP for blending with the SWRP discharge. The pump station would be constructed within the VWRP site, while the 3.5 mile pipeline would be constructed within existing public ROW. Because the SWRP discharge joins the VWRP discharge far upstream from salt-sensitive uses, the SCVSD is working with the RWQCB-LA to investigate the acceptability of discharging "SWRP blend water" at the VWRP discharge location. If successful, this would eliminate costs associated with construction and operation of the RO product water conveyance system.

Offsite

Under this alternative, MF/RO facilities would be constructed at an offsite location, which would require the SCVSD to procure land and potentially obtain a conditional use permit. Pump stations and pipelines would be constructed to convey water to and from the MF/RO facilities. This alternative would preserve space at both WRPs for other facilities. Sufficient property could be procured to enable future expansion of the MF/RO facilities. Procuring an offsite location and obtaining permits would add cost and time for implementation and could result in public opposition. The site would also have development costs such as installation of fencing, establishing power and communications, and construction of a control building. Being separated from the existing WRPs may require new staff or shared staff that would spend a portion of their time driving to and from the site. Consequently, operating and maintaining separate facilities would be more costly than adding facilities to an existing WRP.

NRWRP

Under this alternative, the NRWRP MF/RO facilities would be expanded to provide advanced treatment for VWRP and SWRP flows. The NRWRP is a planned WRP that would be operated by the Newhall Ranch County Sanitation District and serve the Newhall Ranch community. The NRWRP site is south of State Route 126 (SR-126), north of the SCR, and immediately east of the Los Angeles-Ventura County line (approximately 6.5 miles from the VWRP). MF/RO facilities are planned at the NRWRP but at a relatively small capacity compared to the SCVSD's needs. A pump station and 6.5 miles of 22-inch diameter pipeline would be constructed to convey tertiary-treated wastewater from the VWRP to the NRWRP. Pump stations and pipelines would be needed to convey RO product water from the NRWRP to the VWRP and SWRP for blending unless the RWQCB-LA allows the blend water to be discharged at the NRWRP. This alternative would eliminate concerns relative to available plant space at either of the SCVSD WRPs but would consume limited space at the NRWRP. Consolidating all MF/RO at a single location could lead to staffing and operational efficiencies. Upsizing the NRWRP's MF/RO facilities might be achieved at lower capital costs due to economies of scale. However, there is significant uncertainty over the rate at which Newhall Ranch homes will be built and when there will be a sufficient number of homes to trigger construction of the NRWRP. In February 2013, the Newhall Land and Farming Company indicated that the NRWRP construction would likely take place between 2021 and 2025 depending on the rate at which homes are built.

Top-Ranked Alternative: VWRP Only

The VWRP Only alternative is the least costly, minimizes environmental impacts, and can be implemented by the Chloride TMDL compliance deadline. This alternative does not require additional land purchases or interagency agreements. By limiting construction to the existing plant site, public acceptability concerns are not anticipated. This alternative is top-ranked and used in all subsequent discussions of MF/RO facilities.

Evaluation of MF/RO Facilities Sites

MF/RO facilities site alternatives were evaluated as shown in Table 6-2.

Table 6-2. Evaluation of MF/RO Facilities Sites

Evaluation Criteria	VWRP & SWRP	VWRP Only	Offsite	NRWRP
Environmentally Sound	0	0	-	-
Cost-Effective	0	+	-	-
Conserves Stage VI Expansion Area	-	-	+	+
Ability to Meet Compliance Deadline	+	+	0	-
Operational Considerations	0	+	-	0
Public Acceptability	+	+	0	+
Institutional Feasibility	+	+	0	-
Available Land/Rights-of-Way	0	+	0	-
Overall Rating	+2	+5	-2	-3

Note: Comparative ratings are Superior (+), Neutral (0), and Inferior (-).

Eliminated Alternatives

The following alternatives were eliminated from further consideration.

VWRP and SWRP

This alternative would have higher construction costs due to limited space at the SWRP and lost economies of scale by constructing MF/RO facilities at two locations. Having MF/RO facilities at both plants would increase staff demands resulting in higher O&M costs.

Offsite

This alternative would have higher capital costs due to the costs associated with land procurement and site development. Capital costs would also be higher because tertiary-treated effluent would need to be pumped further to and from the MF/RO facilities. The ability to locate, procure, and permit property within the required timeframe required for the Chloride TMDL is uncertain. Although the treatment processes involved should not create nuisance conditions, there could be a negative public reaction to any facilities associated with wastewater processing. O&M costs would be higher compared to other alternatives due to staffing a new site or shared staff driving to and from the site.

This alternative would require that the NRWRP be constructed and operational by 2015 to 2019 depending on the final Chloride TMDL compliance deadline. The timing for implementation of the NRWRP is undefined and, based on information currently available, the NRWRP is unlikely to be operational within the timeframe required for Chloride TMDL compliance. This schedule uncertainty alone eliminates the NRWRP alternative from further consideration. However, this alternative would also be more expensive to build and operate since tertiary-treated effluent would need to be pumped 6.5 miles for MF/RO treatment, and the RO product water would then need to be pumped back for blending at the VWRP and SWRP (unless the RWQCB-LA approved discharge at the NRWRP).

6.5.1.3 Location of MF/RO Facilities at VWRP

The eight alternatives listed below and shown on Figure 6-2 were evaluated as potential locations for MF/RO facilities at the VWRP.

- South End of Stage VI Expansion
- North of Chlorine Contact Tanks
- Top of Chlorine Contact Tanks
- South of Pressure Filters
- Top of Flow Equalization Basins
- Newhall Ranch Rail Right-of-Way
- North of Flow Equalization Basins
- South End of Plant Site

The eight alternatives were reduced to four after an initial evaluation of area adequacy, future conflicts, and ability to procure property. North of Chlorine Contact Tanks is the location currently planned for potential future chlorine contact tanks or UV disinfection facilities and is

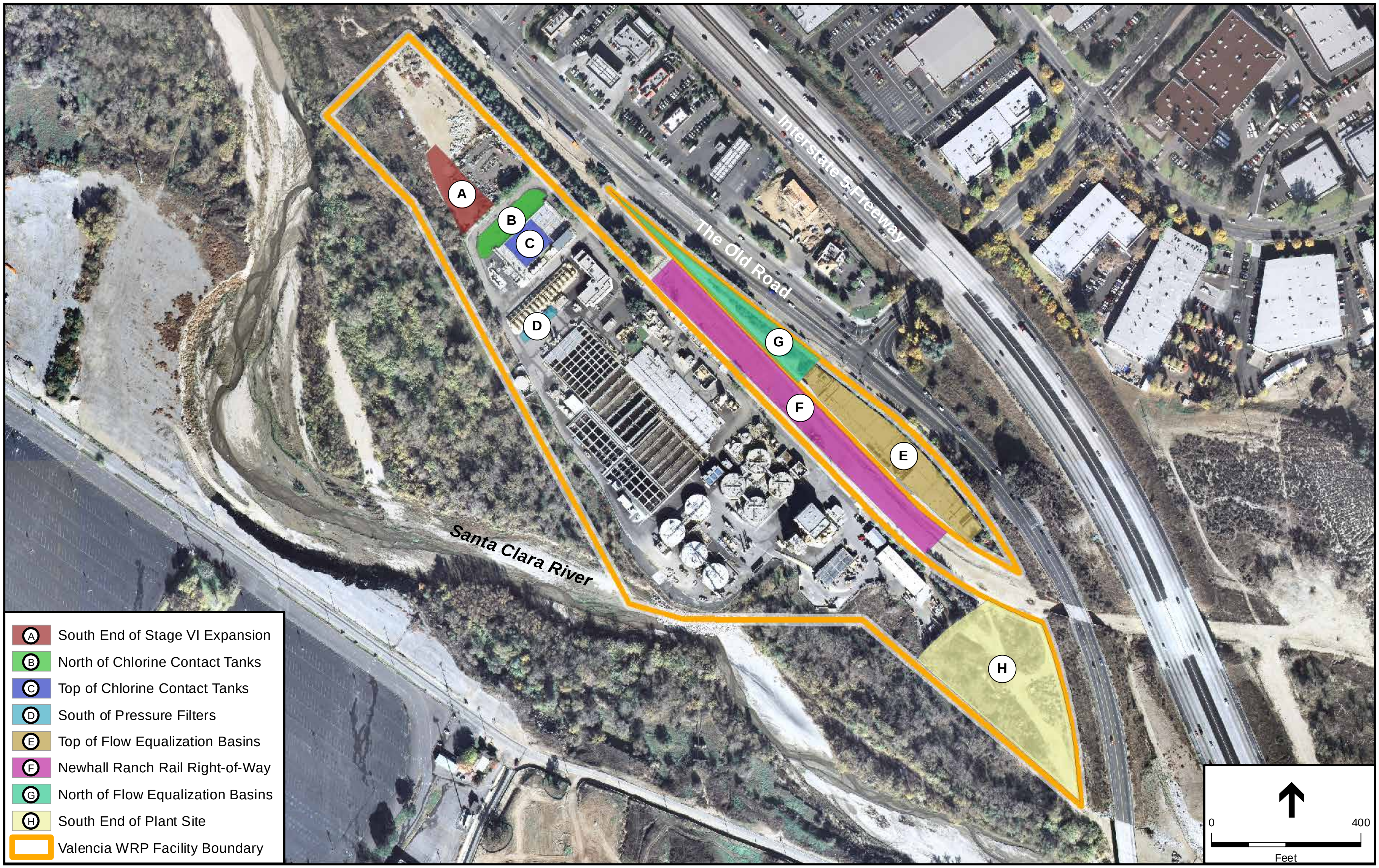


Figure 6-2
Valencia WRP MF/RO Facility Alternative Locations

therefore unavailable. This area also may not have enough space for the MF/RO facilities. South of Pressure Filters has insufficient space. Procurement of agreements enabling use of the Newhall Ranch Rail Right-of-Way alternative is unlikely and, once this corridor is needed for transportation, the MF/RO facilities would need to be relocated. North of Flow Equalization Basins is an area designated for future flow equalization facilities and is, therefore, unavailable. The four remaining alternatives were further evaluated.

South End of Stage VI Expansion

This area is located in the northern portion of the plant site in an area that is designated for the Stage VI expansion. If a portion of this area is used for the MF/RO facilities, then a more space-efficient (and potentially more costly) secondary treatment system such as a membrane bioreactor (MBR) would be required to obtain 6 mgd of Stage VI capacity compared to the previously planned activated sludge system.

Top of Chlorine Contact Tanks

This area would require the co-location of treatment systems by stacking the MF/RO facilities on the top of existing chlorine contact tanks. Such an approach would require structural modifications to the existing tanks and would limit access for maintenance and repair activities. In addition, the limited space at this location would preclude future expansion of the MF/RO capacity at this location. This approach would have increased construction complexity and construction costs.

Top of Flow Equalization Basins

This area would also require the co-location of treatment systems by stacking the MF/RO facilities on the top of existing flow equalization basins. Such an approach would require structural modifications to the existing flow equalization basins. Significant yard piping would be required to convey the flow to and from the MF/RO facilities. This approach would have increased construction complexity and construction costs.

South End of Plant Site

This area is located on the southernmost portion of the plant site, which is currently open space. Locating the MF/RO facilities in this area would require more yard piping and pumping to convey flow to and from the facilities.

Evaluation of MF/RO Facilities Locations at VWRP

MF/RO facilities locations were evaluated using criteria as shown in Table 6-3.

Table 6-3. Evaluation of MF/RO Facilities Locations at VWRP

Evaluation Criteria	South End of Stage VI Expansion	Top of Chlorine Contact Tanks	Top of Flow Equalization Basins	South End of Plant Site
Cost-Effective	+	-	-	0
Conserves Stage VI Expansion Area	-	+	+	+
Expandability	0	-	-	+
Constructability	+	-	-	0
Operational Considerations	+	-	-	0
Overall Rating	+2	-3	-3	+2

Note: Comparative ratings are Superior (+), Neutral (0), and Inferior (-).

Top-Ranked Alternative: South End of Stage VI Expansion

The South End of Stage VI Expansion alternative offers many relative advantages including the least initial cost of all alternatives. However, this location would impact the planned Stage VI expansion by either: (1) requiring use of a more space-efficient treatment process than was conceived in the 2015 Plan, or (2) requiring a reduced Stage VI capacity of 3 to 4 mgd. The need for Stage VI capacity is not anticipated until the year 2036. This alternative is top-ranked and used in all subsequent discussions of MF/RO facilities.

Conditionally Top-Ranked Alternative: South End of Plant Site

This location received the same rating as the top-ranked alternative and offers the same advantages with the added benefit of preserving the area designated for the Stage VI expansion in its entirety. This location has the largest available area but is the most remote from the existing processes. This alternative would require additional pumping, substantial yard piping, and extension of access roads and utilities. The site roadways are already highly congested with yard piping and electrical duct banks. During design of the MF/RO facilities, the cost for yard piping and pumping under this alternative would be examined in greater detail. The decision regarding where to construct the MF/RO facilities would then be revisited.

Eliminated Alternatives

The following alternatives were eliminated from further consideration.

Top of Chlorine Contact Tanks

This alternative would result in the dual-use of a space and would preserve other site locations for potential future uses. However, the construction would be complex and costly, and future maintenance of the disinfection system would be challenging and costly due to limited access.

Top of Flow Equalization Basins

This alternative would also result in dual-use of a space and would preserve other site locations for potential future uses. However, the construction would be complex and costly. Due to the somewhat remote location, this alternative would require substantial yard piping resulting in additional costs.

6.5.2 Brine Disposal Approaches

A byproduct of the RO process is a concentrated brine waste stream equivalent to 15 percent of the RO influent flow if no brine minimization processes are employed. Without supplemental water or a change in disinfection process, 0.6 mgd of brine would be produced under peak conditions. With a switch to UV disinfection, the peak brine flow would drop to 0.5 mgd. The RO process would operate on a continuous basis resulting in continuous brine production. Of all project components, brine disposal is the most costly and would result in the most environmental impact. Thus, consideration of a wide range of options was essential. The following brine disposal approaches are described and evaluated below: Deep Well Injection (DWI), Ocean Disposal via Pipeline, Zero Liquid Discharge (ZLD), Trucking, and Brine Reuse for Local Applications.

Deep Well Injection

DWI provides a safe and proven way to dispose of waste fluids. This technology has been successfully used for decades by the oil and natural gas industry throughout California and the U.S. There are over 47,000 injection wells in California alone. The entire design and operation is closely regulated by the Environmental Protection Agency (EPA) under its Underground Injection Control Program to ensure that potential drinking water sources are not affected. Injection wells installed by the SCVSD would be permitted as Class I non-hazardous waste injection wells.

A Class I DWI system consists of wells typically over one mile deep that inject brine into a porous layer called the injection zone. The injection zone contains groundwater that is nearly as salty as seawater and not suitable for drinking. Brine injected by the SCVSD would be similar to or less salty than the naturally occurring groundwater in the injection zone. The injection zone is isolated from potential drinking water sources (what EPA refers to as underground sources of drinking water [USDW]) by a thick, low-permeability soil layer called the confinement zone. Further protection is provided by alternating high-permeability and low-permeability soil layers called the containment zone. The containment zone would be above the confinement zone and would accept any fluid escaping the injection zone. Unlike the hydraulic fracturing (or "fracking") process used by the natural gas industry, DWI injection pressures are maintained below fracture pressure to ensure that the confinement and containment zones are not fractured, which could jeopardize the protection provided by those zones.

Injection wells are constructed with multiple levels of protection to prevent the injected fluid from reaching potential drinking water. A schematic of an injection well is shown on Figure 6-3. The fluid is injected through tubing inside an inner steel casing surrounded by cement, all contained within an outer steel casing that extends from the ground surface to the base of the USDW. The space between the outer casing and borehole is also sealed with cement. The space between the tubing and the first steel casing is filled with an inert fluid, which is continuously monitored for signs of a tubing leak. Temperature sensors are also placed along the inside of the inner steel casing to detect potential leaks.

Feasibility analyses for DWI were completed by Terralog Technologies and CH2M HILL. Both concluded that the regional geology was conducive to DWI because there are permeable geologic zones containing briny water suitable for injection, and these zones were overlain by impermeable zones that would protect potential drinking water. Thus, DWI is considered a feasible approach and carried into Section 6.6 for further evaluation.

Co-Disposal With Oil Field Operations

Oil extraction operations are ongoing in the Santa Clarita area including the Placerita Field located approximately 6 miles southeast of the VWRP. During oil extraction, a mixture of oil and water is removed from the ground, the oil and water are separated, the oil is refined for productive use, and the water (brine) is disposed in some manner. Often, brine from oil operations is disposed using the DWI technology described above. At times, the location of brine injection is strategically selected to raise formation pressures in a way that forces oil towards the oil extraction wells. This process is known as enhanced oil recovery, and, at times, oil operators would like more water than they can produce themselves to optimize oil recovery.

This approach would involve conveying the SCVSD's brine to an oil operator that has excess brine disposal capacity or is interested in more water for enhanced oil recovery. A company that provides service to the oil industry was hired to contact oil operators in the region and gauge their interest in utilizing the SCVSD's brine. Forty well operators and owners were contacted. Oil operators indicated that they had sufficient water and were not interested in taking the SCVSD's brine. Thus, this approach is not feasible for this Facilities Plan.

Ocean Discharge via Pipeline

Ocean discharge represents an established method of brine disposal. Although much saltier than drinking water, most RO brines are less salty than ocean water and the discharge of this salt would not result in negative water quality impacts. Ocean discharges are normally accomplished with an "outfall," which is a pipeline on the ocean floor with an outlet that is distant from the shoreline to facilitate mixing of the discharge with ocean water. This approach would require construction of a brine conveyance pipeline, potentially one or more pump stations, and an ocean outfall. Discharge to the ocean would require a variety of permits including permits from the RWQCB-LA, Corps, and California Coastal Commission. Acquisition of such permits is a lengthy process that can take several years. While this approach is feasible, its viability depends on the selected alignment. Ocean discharge is considered a feasible approach and carried into Section 6.6 for further evaluation.

Zero Liquid Discharge

Achieving ZLD requires processes that can remove water and concentrate brine mineral content to a degree such that the final material can be disposed as a solid waste product. These processes include mechanical and thermal evaporation, crystallization, and combinations of enhanced membrane and thermal processes. ZLD technologies are complex, costly to install and operate, energy intensive, and consequently employed when other brine disposal methods are infeasible. Even though ZLD technologies have been successfully implemented in industrial water treatment, they have not been widely utilized in wastewater treatment for brine disposal. Disposal of solid waste produced by a ZLD process can be very expensive if a suitable landfill is not located nearby. The Sanitation Districts' landfills and most Southern California landfills are Class III and cannot accept the soluble waste produced by the ZLD processes. The nearest Class I and Class II landfills that could accept such waste are the Clean Harbors Buttonwillow and the Waste Management McKittrick Landfills, respectively, in Central California about 100 miles from the VWRP. These processes are complex from an O&M perspective, are not proven with wastewater-derived brine, require considerable energy, and generate a residual that would be costly to haul and dispose. Thus, this approach is not feasible for this Facilities Plan.

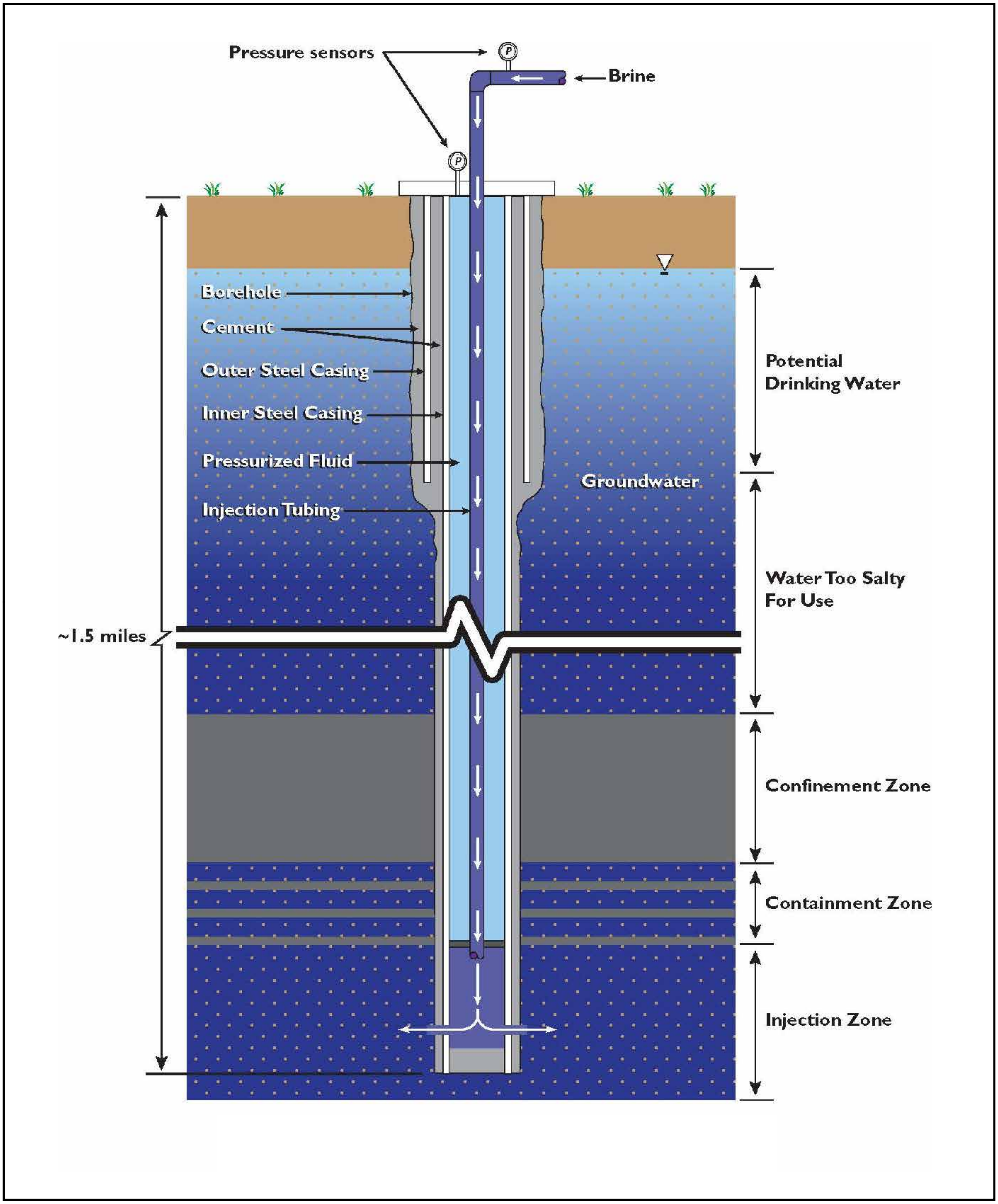


Figure 6-3
Brine Injection Well Detail

Trucking to a Sewer Leading to a Treatment Plant With an Ocean Discharge

This approach would involve truck hauling brine from the VWRP to the nearest sewer with adequate capacity and tributary to a treatment plant having an ocean discharge and capable of accepting high salinity waste. With each truck capable of carrying approximately 5,500 gallons, disposing of 0.6 mgd of brine would require 115 truck trips per day or about 10 trips per hour for a 12-hour operation. With a switch to UV disinfection, peak brine flow would drop to 0.5 mgd, which would require 90 trips per day or about 8 trips per hour for a 12-hour operation. This approach would require construction of brine truck loading and unloading terminals. While this approach is technically feasible, its viability depends on the number of trucks trips per day and cycle times. Thus, at this level, brine trucking is considered a feasible approach and carried into Section 6.6 for further evaluation.

Brine Reuse for Local Construction

This approach would involve using brine for local construction needs such as dust control or moisture control for compacted soil fills. Use of brine for dust control rather than potable water would be beneficial in that brine minerals absorb moisture from the air thereby helping to bond soil particles and make soil less likely to become dust. In addition, brine reuse would save drinking water for other uses. However, to reuse 0.6 mgd of brine would require approximately 240 truckloads of water to be used each day assuming a typical dust control truck carrying 2,500 gallons. Typical construction projects utilize two dust control trucks during a day. If each truck uses 10 loads per day, 12 construction projects would need to be active every day during the entire year. Such an amount of activity is improbable, especially on a sustained basis through rainy periods when construction typically stops. There are approximately 35 rain days per year in Santa Clarita during which brine would have to be stored or otherwise disposed. Storage of brine beyond a few million gallons (a few days) would be expensive and difficult to site. Further, construction contractors would likely want their water trucks filled from a source near the construction site to minimize the costs and traffic related to filling. Brine could be made available for construction purposes to reduce the volume of brine disposed of in some other manner, but such reuse is not reliable enough to reduce the disposal capacity required by another solution. This approach would not replace the need for another brine disposal solution and is not further considered. Thus, this approach is not feasible for this Facilities Plan.

Evaporation Ponds

In this approach, the sun’s solar energy would be used to evaporate water leaving residual salts that could be periodically collected and disposed at an appropriate landfill. Such salts would likely need to go to the nearest Class I landfill, which is the Clean Harbors Buttonwillow Landfill in central California (about 100 miles from the VWRP). In Santa Clarita, total annual evaporation is about 74 inches, while annual precipitation is 12 inches resulting in net evaporation of 62 inches. Even with this relatively high net evaporation, a 150-acre lined reservoir would be needed to evaporate 0.6 mgd of brine. Thus, this approach is not feasible from a cost and land availability standpoint and is not further considered. Note that the concept of trucking brine to large new evaporation ponds in the Antelope Valley is examined in Section 6.6 as a trucking option.

Summary of Brine Disposal Approaches

The pipeline to the ocean, DWI, and trucking approaches are deemed feasible and are carried into Section 6.6 for further evaluation. Other approaches were deemed infeasible and are not further considered.

6.5.3 Brine Minimization Approaches

Since brine disposal is the most costly component of AWT, minimizing the amount of brine to be disposed of has the potential to save significant costs. In a typical RO system without brine minimization, 85 percent of water treated becomes product water and 15 percent becomes brine. There are a number of processes that could be incorporated to minimize the quantity of brine including some that would result in over 99 percent product water and less than 1 percent brine. Some processes like second-pass RO are emerging uses. Others like softening followed by second-pass RO have been successfully used for potable water treatment and industrial treatment but have limited use on wastewater effluents. Several brine minimization processes can be used in combination to achieve various levels of brine volume reduction. Most of these processes are sensitive to the chemistry of the water being treated, which means that the composition being fed to the process can have a major impact on the stability of the operation and the costs to operate and maintain the process. Pilot testing would be needed to better define design parameters, chemical needs and, ultimately, costs.

The following brine minimization processes are described and evaluated below: Second-Pass RO, Softening followed by Second-Pass RO, Enhanced Membrane Systems (EMS), EDR, Mechanical and Thermal Evaporation, and Natural Treatment Systems (NTS).

Second-Pass RO

In this process, brine generated by the primary RO system is passed through a second RO system consisting of similar membranes for a “second pass” of desalination. The product water from the second RO system is blended with the product water from the primary RO system thereby resulting in a higher overall recovery (and lower production of brine). The additional recovery provided by a second-pass RO system is approximately 50 percent resulting in 7 percent overall brine generation. This system has a small footprint, much smaller than the primary RO system. In terms of operation and maintenance, the second-pass RO system is similar to the primary RO system; however, due to high TDS in the feed, the second-pass RO units would require more frequent system cleaning and membrane replacement than the primary RO system. The Leo J. Vander Lans Water Treatment Facility in Long Beach successfully pilot tested such a system and is in the process of installing a second-pass RO system. Although a relatively new concept, this process has been successfully tested to a level that warrants consideration as a feasible approach and carrying in Section 6.6 for further evaluation.

Softening Followed by Second-Pass RO

Softening is a process that is coupled with a membrane system like RO to increase product water recovery (thereby decreasing brine volume) by precipitating and removing sparingly soluble inorganic salts that would otherwise reduce the performance of a downstream membrane system like RO. This process uses chemicals like lime, soda ash or sodium hydroxide to raise pH and cause salts to precipitate. These precipitates are then removed with a clarifier and filter and become sludge that must be dewatered and disposed. Additional chemicals are added to lower the pH to appropriate levels for membrane treatment. The additional recovery provided by precipitative softening followed by a second-pass RO system is approximately 50 percent more than second-pass RO alone, resulting in 4 percent overall brine generation. Softening would prolong the life of the second-pass RO membranes. This process requires a relatively large footprint due to the required clarifier, filters, chemical management facilities, and dewatering facilities. Softening followed by RO is a proven technology for potable water and industrial applications and has been used with treated wastewater. Thus, this process is considered a feasible approach and carried into Section 6.6 for further evaluation. Softening with lime is the most common practice and is assumed in all subsequent discussions of softening. If the recommended project includes softening, alternative softening chemicals will be evaluated during design of the softening system.

Enhanced Membrane Systems

EMS are used to reduce brine volume by increasing the recovery of the RO process. One type of EMS is the patented High-Efficiency Reverse Osmosis (HERO) system. This process requires softening to remove hardness and alkalinity, ion exchange to provide hardness polishing, a degasification process to remove carbon dioxide, addition of caustic to increase pH as well as limit silica scaling and organic fouling, and specialized second-pass RO membranes. EMS are relatively complex and would require detailed evaluation prior to implementation to assess system effectiveness and costs. The SCVSD will continue to monitor the development of these technologies and may recommend implementation in the future.

Electrodialysis Reversal

EDR is a process that uses an electrical current and membranes to remove salt ions from water. The key to the EDR process is a membrane that allows passage of either positively charged ions (cations) or negatively charged ions (anions) but excludes passage of ions of the opposite charge. Depending on the number of membrane passes in an EDR unit, EDR can provide similar recovery rates as RO. For the SCVSD's case where removal of compounds other than chloride is not important, EDR does have an advantage relative to RO in that nonionic components such as silica pass through the unit and do not contribute to membrane fouling. There is only one U.S. manufacturer of EDR equipment and, at the time of this writing, only one full scale wastewater treatment plant utilizing this technology in the U.S. The level of organics typically found in brines of wastewater origin limits the use of this technology for brine minimization. The SCVSD will continue to monitor the development of this technology and may recommend implementation in the future.

Mechanical and Thermal Evaporation

In this approach, mechanical and thermal processes are used to evaporate water and later condense this water to clean product water. The water not evaporated contains concentrated salts and becomes a brine or slurry depending on the final amount of water relative to salts. Evaporation is a proven technology for brine volume reduction in industrial applications. Evaporators have a relatively small footprint with a tall tower profile. They are complex and require specialized labor skills for operations and maintenance. Evaporators have high capital and O&M costs. Particular operational concerns are high energy demand and prevention of scale from significantly reducing process performance. Despite these challenges, this process is considered a feasible approach and carried into Section 6.6 for further evaluation.

Natural Treatment Systems

NTS use natural processes for brine volume reduction. There are two common configurations of NTS: (1) halophytes (plants with unusually high tolerance to salinity), and (2) wetlands. Halophytes and wetlands could be planted and irrigated with brine relying on salt removal in the root zone and allowing evapotranspiration to reduce the volume of flow. NTS are an established technology for polishing and treatment of wastewater effluent, but have not been used widely as a method for brine minimization. These systems would require a large footprint. To prevent negative impacts to soil salinity and groundwater quality, such a system would likely need to be constructed on top of an impermeable liner. With a liner, salts would accumulate over time and necessitate a periodic replacement of soil and vegetation. Replaced soil and vegetation would likely be landfilled. Due to the limited space for such a system in the Santa Clarita Valley, this technology is not appropriate for this Facilities Plan.

Summary of Brine Minimization Approaches

Second-Pass RO, Softening followed by Second-Pass RO, and Mechanical and Thermal Evaporation are deemed feasible and are carried into further analysis. Other approaches are not further considered. To minimize costs, brine minimization facilities would be constructed adjacent to the MF/RO facilities.

6.5.4 Non-Chlorine Based Disinfection

In Section 6.4.2, modifying WRP operations to reduce chloride addition during wastewater treatment was identified as a feasible approach. As noted earlier, chlorine-based disinfection is the only remaining significant chloride contributor from wastewater treatment. Over time, chlorine doses for disinfection at the WRPs have been reduced to minimize chloride addition while still producing the needed level of disinfection. Switching to a non-chlorine based disinfection process is expected to reduce chloride loading at the WRPs by up to 7 mg/L and reduce the formation of undesirable disinfection byproducts that result from chlorination. This reduction would assist in complying with the Chloride TMDL but would not be enough to provide compliance without combining with one or more other approaches. This sub-section evaluates disinfection technologies that are not chlorine based as well as locations for the selected technology. Although chloride dioxide is chlorine based, this technology was included because it produces a low amount of chloride relative to conventional chlorine-based disinfection.

6.5.4.1 Non-Chlorine Based Disinfection Technologies

A number of processes can be used to disinfect wastewater. Chemical processes use compounds like chlorine, bromine, iodine, acids, alkalis, hydrogen peroxide, and ozone. Physical processes include irradiation by different sources such as UV. The most widely used disinfection process for wastewater is chlorination using chlorine gas or sodium hypochlorite (bleach). Chlorination is highly effective in the destruction of bacteria, viruses, and other disease-causing organisms. Disadvantages to chlorination are that it adds chloride to the water and can form undesirable chemical byproducts.

In reuse applications that include significant residence times within a distribution system, chlorine is typically added to create a disinfectant residual that will prevent microbial and biofilm growth within the piping network. In other cases, such as discharge to a water body, no chlorine residual should remain in the effluent so that aquatic species are protected. Unlike chlorination, UV and ozone do not leave a disinfectant residual in the treated effluent. If a residual is desired when using such technologies, chlorine could be added as the water enters the distribution system. The following disinfection technologies are discussed below:

- UV
- Chlorine dioxide
- Ozone
- Hydrogen peroxide
- Peracetic acid

Ultraviolet

The UV disinfection process has replaced chlorination at a number of wastewater facilities within the U.S. Of more than 4,000 publicly owned treatment works (POTWs) in the U.S. with design capacities greater than 1 mgd, approximately 75 percent use chlorination and more than 20 percent use UV disinfection (Leong et al. 2008). The remaining 5 percent use other methods, such as ozone treatment. Using UV for drinking water disinfection in the United States dates back to 1916, but its use for disinfecting wastewater has only become popular in the last 20 years as system costs have declined and the concern regarding chlorination byproducts has increased. UV disinfection systems transfer electromagnetic energy to an organism's genetic materials, which inhibits the organism's ability to reproduce. The main components of a UV disinfection system are reactors (tanks, piping, or channels) containing lamps and ballasts, power distribution equipment, and a control system. A variety of reactor configurations and lamp types exist. UV produces no harmful byproducts and no residual toxicity that could adversely impact human or aquatic life. The Sanitation Districts have operational experience with UV disinfection at the Whittier Narrows WRP (WNWRP) and Lancaster WRP, and the technology is becoming more widely used. Protocols for permitting in Title 22 municipal reuse applications have been developed but are still evolving.

Chlorine Dioxide

Chlorine dioxide (ClO_2) gas is effective as both a disinfectant and an oxidant. Sodium chlorate, combined with a strong acid solution and a reducing agent, is used to produce chlorine dioxide. An onsite chlorine dioxide generator is required as chlorine dioxide deteriorates quickly. Chlorine dioxide is applied as a dilute solution of dissolved gas in water and is used primarily for wood pulp bleaching. Chlorine dioxide is not currently used for wastewater disinfection at any facilities in California.

Chlorine dioxide has several advantages compared to conventional chlorination, the main being that it is a stronger oxidizer and, therefore, requires lower doses than chlorine. Chlorine dioxide is a broad-spectrum microbiocide effective over a wide pH range. Chlorine dioxide is as effective as chlorine in destroying coliform populations in wastewater effluents and is superior to chlorine in the treatment of viruses found in wastewater. Chlorine dioxide is nonreactive with ammonia and most nitrogen-containing compounds and, thus, is effective at lower doses than chlorine. Some chloride is produced when chlorine dioxide reacts with natural organic matter.

Chlorine dioxide is an explosive gas requiring onsite generation. The Sanitation Districts have no operating systems of this type. The limited experience of using chlorine dioxide for wastewater disinfection would require extended periods of time for pre-design testing and permitting. Chlorine dioxide is not cost-effective due to the high cost of the sodium chlorate raw material.

Operation of this system is expected to be much more costly than a UV disinfection system. Chlorine dioxide has not been evaluated in meeting California's Title 22 disinfection standards and would thus require extensive field testing. Therefore, this technology is not appropriate for this Facilities Plan.

Ozone

Ozone is principally used for potable water disinfection including the Los Angeles Department of Water and Power's 600 mgd Los Angeles Aqueduct Filtration Plant. CLWA's Rio Vista Water Treatment Plant uses ozone for oxidation and disinfection prior to filtration, but final disinfection is accomplished with chloramines. Within the U.S., there are several full-scale installations operating on wastewater, with a number of additional facilities expected to be commissioned within the next couple of years. Ozone is similar to the oxygen molecule except that instead of two oxygen atoms (O_2), ozone has three oxygen atoms (O_3). The ozone molecule is highly reactive and unstable, changing rapidly from ozone to oxygen. As a result, ozone must be generated onsite. The main components of an ozone disinfection system are the feed gas preparation, ozone generation, ozone contacting, and ozone destruction.

Ozone is an extremely effective oxidant and is effective in destroying viruses and bacteria. Ozone disinfection also increases the dissolved oxygen levels of the recycled water. There are preliminary indications that ozone may reduce levels of trace organics. However, bromate, a suspected carcinogen, has a limit of 10 micrograms per liter (μg/L) in drinking water and is formed from the reaction of ozone with naturally occurring bromide in the source water.

Ozonation is a complex technology requiring onsite generation of an unstable gas. Ozone is very reactive and corrosive, requiring the use of corrosion resistant materials. Retrofitting an existing plant to such corrosion resistant materials would be costly. Ozone is not commonly used for wastewater disinfection because of the high ozone demand of wastewater and the high cost for ozone contactors and generation equipment. The Sanitation Districts have no operating systems of this type. Ozone systems designed for plant flows similar to the VWRP are costly to construct and have a relatively large footprint, which is a significant concern due to the limited space at the VWRP. Space is even more limited at the SWRP. Therefore, this technology is not appropriate for this Facilities Plan.

Hydrogen Peroxide

Hydrogen peroxide is a strong oxidant that has been used successfully in wastewater applications for the removal of hydrogen sulfide and iron and for controlling sludge bulking in secondary treatment. Hydrogen peroxide has also been used in combination with UV light for the oxidation of complex organic constituents. However, hydrogen peroxide has not been used for full-scale wastewater disinfection in the U.S.

Although hydrogen peroxide is a strong oxidant, its effectiveness as a disinfectant is low compared to chlorine or other disinfectants. The need for longer contact times would likely require construction of additional contact tanks, which may be infeasible due to space limitations at both WRP sites. Because of the relatively high dosage and contact time required to meet regulatory limits, disinfection of the entire plant flow with hydrogen peroxide would be uneconomical. Hydrogen peroxide does not meet California's Title 22 disinfection standards. Since very little information is available to support the use of hydrogen peroxide as a conventional wastewater disinfectant, full scale testing would be needed to prove its efficacy. Therefore, this technology is not appropriate for this Facilities Plan.

Peracetic Acid

Peracetic acid, also known as peroxyacetic acid, has been cited by some as an alternative means of wastewater disinfection that produces less disinfection byproducts and requires shorter contact time. Peracetic acid is a strong oxidant that can be produced by a reaction between hydrogen peroxide and acetic acid. However, current studies suggest that peracetic acid is not very effective in inactivating viruses and protozoans. Peracetic acid also costs much more than chlorine. Peracetic acid has not been used for wastewater disinfection in the U.S.

Peracetic acid is similar to hydrogen peroxide in that its effectiveness as a disinfectant is relatively low. Although it removes coliform, peracetic acid is not effective against viruses and protozoans. Peracetic acid's inability to remove viruses prevents it from meeting California's Title 22 disinfection standards. Therefore, this technology is not appropriate for this Facilities Plan.

Summary of Non-Chlorine Based Disinfection Technologies

In summary, UV disinfection is the only non-chlorine based disinfection technology appropriate for this Facilities Plan. Application of UV disinfection reduces environmental health and safety risks because it does not involve transport, storage, generation, and use of dangerous chemicals. UV disinfection can effectively control all types of microorganisms, eliminates formation of disinfection byproducts, does not alter the aesthetic qualities of the water, and eliminates any concerns with chemical over dosing. UV disinfection requires less contact time and footprint than typical chlorination systems. UV disinfection is the top-ranked technology because this process is proven and less costly than the other options. UV disinfection is used in all subsequent discussions of non-chlorine based disinfection technology.

6.5.4.2 Location of UV Disinfection Facilities at VWRP

The alternatives listed below and shown on Figure 6-4 were evaluated as potential locations for UV disinfection facilities at the VWRP.

- South End of Stage VI Expansion
- North of Chlorine Contact Tanks
- Top of Chlorine Contact Tanks
- South of Pressure Filters
- Top of Flow Equalization Basins
- Newhall Ranch Rail Right-of-Way
- North of Flow Equalization Basins
- South End of Plant Site

The eight alternatives were reduced to two after an initial evaluation of area adequacy, complexity/construction cost, future conflicts, and ability to procure property. The six eliminated locations would all require pumping, extensive yard piping, and/or complex and costly construction.

South End of Stage VI Expansion

This area is located in the northern portion of the plant site and is currently designated for the Stage VI expansion and potentially MF/RO facilities. If a portion of this area is used for UV disinfection and/or MF/RO facilities, then a more space-efficient (and potentially more costly) secondary treatment system such as a membrane bioreactor (MBR) would be required to obtain 6 mgd of Stage VI capacity rather than the planned activated sludge system.

North of Chlorine Contact Tanks

This area is located immediately north of the existing chlorine contact tanks and is currently designated for expansion of the contact tanks. However, a conversion from chlorination to the UV disinfection alternative would free this area for other uses.

Evaluation of UV Disinfection Facilities Locations at VWRP

Alternatives for the location of UV disinfection facilities at the VWRP were evaluated as shown in Table 6-4.

Table 6-4. Evaluation of UV Disinfection Facilities Locations at VWRP

Evaluation Criteria	South End of Stage VI Expansion	North of Chlorine Contact Tanks
Cost-Effective	0	+
Conserves Stage VI Expansion Area	-	+
Expandability	-	+
Constructability	0	0
Operational Considerations	0	+
Overall Rating	-2	+4

Note: Comparative ratings are Superior (+), Neutral (0), and Inferior (-).

Top-Ranked Alternative: North of Chlorine Contact Tanks

North of the Chlorine Contact Tanks is located immediately adjacent to the existing disinfection systems and, as such, this location would reduce the cost of process conversion and provide better future operational flexibility when backup chlorination is necessary. This alternative is top-ranked and used in all subsequent discussions of UV disinfection facilities at the VWRP.

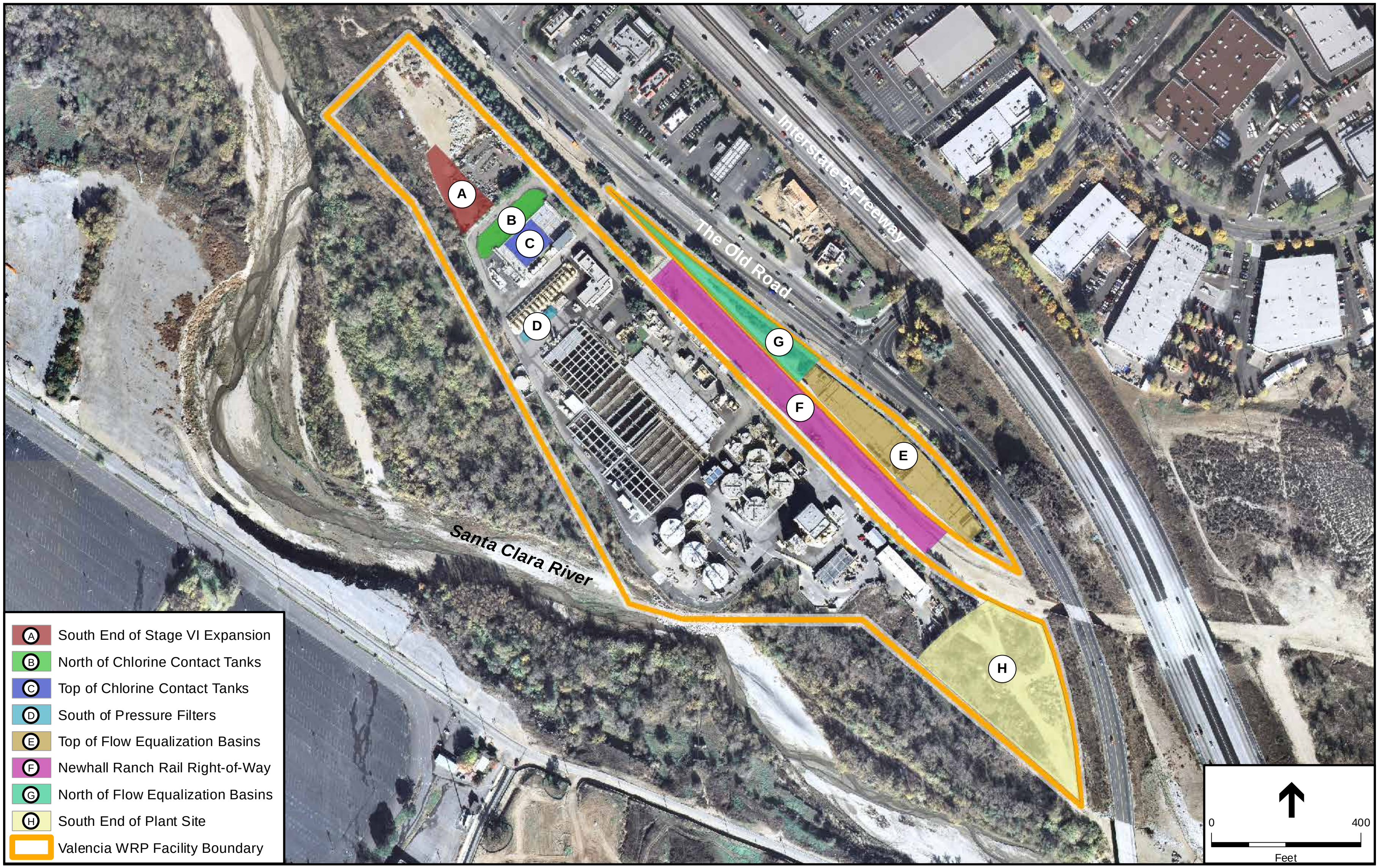
Eliminated Alternative

Use of the South End of Stage VI Expansion area would impede use of the surrounding area for MF/RO facilities and a future plant expansion. With a road separating this area from the existing disinfection systems, interconnecting piping would be slightly more complex than the top-ranked alternative. This alternative was eliminated from further consideration.

6.5.4.3 Location of UV Disinfection Facilities at SWRP

The alternatives listed below and shown on Figure 6-5 were evaluated as potential locations for UV disinfection facilities at the SWRP.

- Top of Chlorine Contact Tanks
- West of Aeration Tank No. 4



Santa Clarita Valley Sanitation District Chloride Compliance Facilities Plan and EIR

Figure 6-4

Valencia WRP UV Disinfection Facility Alternative Locations

Figure 6-5

Saugus WRP UV Disinfection Facility Alternative Locations

Top of Chlorine Contact Tanks

This alternative would utilize the top of the existing chlorine contact tanks, which would require significant structural modifications to the existing tanks. Construction complexity would be greater due to the construction phasing required for continuous operation of the chlorination system during upgrades and structural modifications. However, the Sanitation Districts have successfully completed similar construction at the WNWRP. This alternative would require minimal piping and could require additional pumps.

West of Aeration Tank No. 4

This alternative would utilize the area immediately west of the northernmost existing aeration tank. This area is the last sizable undeveloped area on the plant site. Relative to the Top of Chlorine Contact Tanks alternative, the West of Aeration Tank No. 4 alternative would require additional piping and pumps to convey flow to and from the UV disinfection facilities.

Evaluation of UV Disinfection Facilities Locations at SWRP

The alternatives for the location of UV disinfection facilities at the SWRP were evaluated as shown in Table 6-5.

Table 6-5. Evaluation of UV Disinfection Facilities Locations at SWRP

Evaluation Criteria	Top of Chlorine Contact Tanks	West of Aeration Tank No. 4
Cost-Effective	0	0
Conserves Existing Undeveloped Area	+	-
Expandability	0	0
Constructability	0	+
Operational Considerations	0	0
Overall Rating	+1	0

Note: Comparative ratings are Superior (+), Neutral (0), and Inferior (-).

Top-Ranked Alternative: Top of Chlorine Contact Tanks

Based on a preliminary assessment, both alternatives are considered feasible and to be comparable in cost. While somewhat more difficult to construct, the Top of Chlorine Contact Tanks location would preserve the West of Aeration Tank No. 4 area for future facilities. This location is thus top-ranked and used in all subsequent discussions of UV disinfection facilities at the SWRP.

Conditionally Top-Ranked Alternative: West of Aeration Tank No. 4

The location West of Aeration Tank No. 4 would provide simpler construction but require additional pumping and yard piping to convey flow to and from the UV disinfection facilities. Further, this alternative would utilize the last sizable undeveloped area on the plant site. If UV disinfection is implemented at the SWRP, the cost for both alternatives would be examined in greater detail during design and the decision regarding where to construct the UV disinfection facilities would be revisited.

6.5.5 Supplemental Water Approaches

In Section 6.4.3, dilution with supplemental water was identified as a potentially feasible approach for Chloride TMDL compliance. As noted earlier, the amount of supplemental water needed would vary depending on the chloride levels reaching the WRPs and how supplemental water is combined with other chloride reducing technologies, if at all. The following supplemental water approaches are evaluated below: (1) supplemental water as the sole method of compliance, (2) supplemental water with UV disinfection, and (3) supplemental water with MF/RO facilities. For all scenarios, the supplemental water source is assumed to be Saugus Formation groundwater, which has relatively low chloride levels. The concept of using Saugus Formation groundwater contaminated with perchlorate was investigated. In short, relatively low WRP discharge limits for perchlorate necessitate that such water receive separate treatment for perchlorate removal prior to such flow being added to the SCVSD's sewer system. The requirement for treatment and the distance between the VWRP and perchlorate contaminated wells (or the existing perchlorate treatment facility) make use of perchlorate contaminated groundwater more costly. A key factor in assessing the viability of these approaches is the cost and feasibility of obtaining "replacement water," which is additional water that would be imported to replace groundwater used for blending and ensure no net loss of water supply to the SCV.

6.5.5.1 Supplemental Water as the Sole Method of Compliance

In this approach, tertiary-treated wastewater from each plant would be mixed with low chloride groundwater (supplemental water) to achieve a blend that meets the Chloride TMDL limit. Without implementation of any other approaches, approximately 8 mgd (8,800 afy) of supplemental water would be needed during non-drought conditions and 14 mgd (15,700 afy) during drought. Relative to the 39,000 acre-feet CLWA imported in 2009, the replacement water under this approach would equate to a 23 to 40 percent increase in imported water. Given the price of imported water and the limited ability to obtain imported water, such quantities are infeasible. Therefore, this approach is not feasible and is not further considered.

6.5.5.2 Supplemental Water Combined With UV Disinfection

In this approach, chlorine-based disinfection would be replaced with UV disinfection resulting in removal of approximately 7 mg/L of chloride, and the tertiary-treated effluent from each plant would be mixed with supplemental water. In this case, approximately 5 mgd (5,600 afy) of supplemental water would be needed during non-drought conditions and 11 mgd (12,000 afy) during drought. Relative to the 39,000 acre-feet CLWA imported in 2009, the replacement water under this approach would equate to a 14 to 32 percent increase in imported water. Given the price of imported water and the limited ability to obtain imported water, such quantities are infeasible. Therefore, this approach is not feasible and is not further considered.

6.5.5.3 Supplemental Water Combined With MF/RO

In this approach, MF/RO facilities would be sized to treat the typical chloride concentration reaching the VWRP. When chloride levels exceed typical, supplemental water would be blended with plant effluent to produce a blend meeting the chloride discharge limit of 100 mg/L. Such use of supplemental water would avoid sizing expensive MF/RO and brine disposal facilities for peak chloride levels that are about 20 percent higher than typical levels and only expected to occur three out of every ten years (during drought). Under these conditions, approximately 6 mgd (6,400 afy) of supplemental water would be needed during drought years or 1.7 mgd

(1,900 afy) on average. CLWA has confirmed the availability of such replacement water quantities from the Buena Vista-Rosedale source described in the 2010 Urban Water Management Plan through the year 2050. However, replacement water is expected to be relatively costly. Utilization of supplemental water would require use of two or three existing or new groundwater wells along with new pipelines to convey water from these wells to the VWRP. The RWQCB-LA would have to approve the use of supplemental water, and it is unclear whether such approval would be granted. Overall, this approach is deemed feasible and is used in all subsequent discussions of supplemental water.

6.6 DEVELOPMENT OF FULL COMPLIANCE ALTERNATIVES

Potentially feasible approaches from Section 6.4 along with refinements from Section 6.5 were assembled to form a variety of alternatives intended to provide full compliance with the Chloride TMDL. Treatment capacities of these alternatives are based on current average system capacity of 28.1 mgd and a worst case water supply chloride level of 85 mg/L based on CLWA's report titled State Water Project Chloride Modeling Analysis (February 2012) included in Appendix 4-A. Removal of AWS and chloride control measures for industrial and commercial dischargers (discussed in Section 6.4.2) are ongoing efforts that would have similar effect on all of the full compliance alternatives and are assumed to be completed for the purposes of this Facilities Plan.

The following full compliance alternatives are described and developed in this sub-section:

- MF/RO Facilities With Brine Disposal via Pipeline
- MF/RO Facilities With Brine Disposal via DWI
- MF/RO Facilities With Brine Disposal via Trucking
- Alternative Water Resources Management Plan (AWRM)
- Phased AWRM

A variety of analyses were performed to develop the first three alternatives including whether or not to incorporate brine minimization, incorporate UV disinfection, and utilize supplemental water. The AWRM and Phased AWRM were developed through negotiations with stakeholders and the scope presented herein is the result of those negotiations as of the time of this writing. Brine minimization involves adding additional equipment to the MF/RO facilities to reduce brine volume and potentially overall costs since brine disposal is the most costly part of these alternatives. Use of UV disinfection would eliminate approximately 7 mg/L of chloride added by chlorination and thereby reduce the size of the MF/RO facilities needed and the amount of brine to be disposed. UV disinfection would also avoid the production of disinfection byproducts thereby producing a higher quality effluent.

In scenarios using supplemental water, the MF/RO facilities would be sized to treat the typical chloride concentration reaching the VWRP per Section 6.5.5. When chloride levels exceed typical, low chloride groundwater (supplemental water) would be mixed with treatment plant effluent to produce a blend meeting the chloride discharge limit of 100 mg/L. Such use of supplemental water would avoid sizing the MF/RO and brine disposal facilities for peak chloride levels that are about 20 percent higher than typical levels and only expected to occur three out of every ten years (during drought). Utilization of supplemental water would require use of two or three existing or new groundwater wells along with new pipelines to convey water from these wells to the VWRP. To ensure no net loss of water supply to the SCV, additional replacement water would be imported, which is expected to be relatively costly.

Support for Municipal Reuse of Recycled Water

CLWA provides recycled water to the Santa Clarita Valley. In their most recent Recycled Water Master Plan drafted in 2002, CLWA projected an increasing need for recycled water that will reach 17,400 acre-feet per year by the year 2030. In 2010, CLWA along with the other three SCV retail water purveyors adopted an Urban Water Management Plan that refined the recycled water needs to 22,800 acre-feet per year by the year 2050. Using recycled water reduces the use of potable water and eases concerns of a water shortage during drought. The California Legislature declared its intent that the State undertake all possible steps to encourage development of water recycling facilities so that recycled water may be made available to help meet the growing water requirements of the State. Consistent with this policy and the third project objective in Section 6.2, each alternative would make recycled water available in quantities needed to support CLWA's Master Plan.

Currently, the VWRP and SWRP produce tertiary-treated water that has suitable quality to meet CLWA needs. Depending on how quickly demand for recycled water increases relative to growth in wastewater flow due to population growth, discharge of treated wastewater from the WRPs to the SCR could decrease. However, the combined WRP discharges would not be lower than the minimum flow of 13 mgd identified to sustain the river's biological resources. The basis for these minimum discharges is summarized in Section 11 and described in greater detail in Appendix 6-A.

6.6.1 MF/RO With Brine Disposal via Pipeline

Under this alternative, MF/RO facilities would be constructed at the VWRP, and brine would be disposed to the ocean by a pipeline. This alternative would also include the RO product water conveyance system to the SWRP described in Section 6.5.1.2. To develop this alternative, the following sub-analyses are described below: discharge locations/pipeline alignments, use of brine minimization, use of UV disinfection, and use of supplemental water.

6.6.1.1 Pipeline Discharge Locations

The following pipeline scenarios are described and evaluated below:

- Pipeline to Los Angeles Basin and Joint Water Pollution Control Plant (JWPCP)
- Pipeline to Los Angeles Basin and WNWRP
- Pipeline to City of Los Angeles Sewer System
- Pipeline to Calleguas Salinity Management Pipeline (SMP) via Moorpark Connection
- Pipeline to Calleguas SMP via Port Hueneme Connection
- Pipeline to Ventura Coast via New Pipeline and Outfall
- Pipeline to Ventura Coast via Crimson Pipeline and New Pipeline and Outfall
- Pipeline to Nearest Flood Control Channel in the Los Angeles Basin
- Pipeline to Nearest Ventura County Flood Control Channel That Drains to the Ocean

In the following discussion, the number of pump stations and pipeline diameter are based on 7.4 mgd of product water produced by MF/RO facilities and 1.3 mgd of brine. Depending on subsequent refinements regarding the use of brine minimization, UV disinfection and supplemental water, the brine flow could drop.

Pipeline to Los Angeles Basin and JWPCP

In this scenario, brine from the VWRP would be conveyed to the nearest sewer in the Sanitation Districts' JOS sewer system that flows to the JWPCP, which discharges to the ocean. The JWPCP is the Sanitation Districts' largest treatment plant with a capacity of 400 mgd and has higher salinity influent wastewater than the other Sanitation Districts' treatment plants due to the large number of industrial dischargers tributary to the plant. The JWPCP provides secondary treatment and disinfection, and all of its effluent is discharged to the ocean.

The JOS sewer nearest to the VWRP is the City Terrace Trunk Sewer, which is located in the unincorporated Los Angeles County community known as City Terrace. Connecting to this sewer would require 37 miles of 8- to 14-inch diameter pipe, which would be constructed in public ROW to the maximum extent practicable (see Figure 6-6). Conveying brine over the Newhall Pass would require two pumping plants: one at the VWRP, and a booster pump station located offsite. In addition to constructing and operating new facilities, the SCVSD would also need to pay a connection fee and annual service charge (approximately $14.4 million and $0.3 million per year, respectively) for its impacts to JOS capacity and the cost of conveyance and treatment of the SCVSD's brine.

Because of the relatively high salt content of the existing JWPCP wastewater and the low volume of the SCVSD's brine relative to the existing plant flows (less than 1 percent), acceptance of this brine would not adversely affect JWPCP operations, would have a negligible impact on the quality of the plant's effluent, and would not cause the JWPCP to violate its ocean disposal permits. Institutional arrangements required for this scenario include acquisition of easements and ROW for a booster pump station and any portions of the pipeline outside of public ROW. Encroachment permits from local jurisdictions for pipeline construction in public ROW would also be required. Compared to a pipeline that must carry sewage and have numerous connections along its length, this brine pipeline would be easier to design and construct. The long overall distance primarily through a dense urban environment would make design and construction challenging, but not infeasible. Thus, this scenario is considered feasible and is evaluated below.

Pipeline to Los Angeles Basin and WNWRP

In this scenario, brine flow from the VWRP would be conveyed to the nearest JOS sewer regardless of which treatment plant the sewer would discharge to. This connection point is 30 miles from the VWRP (7 miles shorter than the connection tributary to the JWPCP) and is tributary to the WNWRP (see Figure 6-6). The WNWRP accepts relatively high quality wastewater and produces high quality recycled water that is completely reused for groundwater recharge at the Rio Hondo and San Gabriel Coastal Spreading Grounds or for irrigation. The WNWRP effluent chloride concentration cannot exceed 100 mg/L. The WNWRP already has challenges complying with this limit and cannot accept this brine stream. Thus, this scenario is not feasible and is not further considered.

Pipeline to City of Los Angeles Sewer System

In this scenario, brine flow from the VWRP would be discharged to a City of Los Angeles sewer that is tributary to the city's Hyperion Treatment Plant, which has an ocean outfall. Similar to the Sanitation Districts, the City of Los Angeles operates water reclamation plants that produce high quality recycled water where brine input is not acceptable. The nearest City of Los Angeles sewer that is only tributary to the Hyperion Treatment Plant is just downstream of the Los Angeles-Glendale Water Reclamation Plant in South Glendale, 29 miles from the VWRP (see Figure 6-6). Approximately 30 mgd of effluent from the Hyperion Treatment Plant is supplied to the West Basin Municipal Water District (West Basin) for tertiary and advanced treatment. West Basin produces treated water of high to very high quality to meet the specific needs of their customers. In discussions about the City of Los Angeles' ability to accept the SCVSD's brine, city representatives have stated that minimizing salinity was important in their commitment to providing high quality recycled water to West Basin and that they will probably not be able to accept the SCVSD's brine. Thus, this scenario does not appear to be feasible for this Facilities Plan. However, the SCVSD will continue to investigate this issue.

Pipeline to Calleguas SMP via Moorpark Connection

The Calleguas Creek watershed is south of the SCR watershed, separated by the Santa Susana Mountains. The RWQCB-LA established a TMDL for salts in this watershed including chloride. The agencies affected by this TMDL have chosen to comply by constructing an SMP discharging to the ocean via an ocean outfall. The SMP will carry brine, saline groundwater, and treatment plant effluent with unacceptable salt levels. In this scenario, the SCVSD's brine would be discharged to the ocean using the SMP and its outfall. Connecting to the SMP in the City of Moorpark would require 32 miles of 10- to 14-inch diameter pipeline and two pump stations to convey flow over the Santa Susana Mountains along SR-23 (see Figure 6-7).

Alternatively, brine could be conveyed over the Santa Susana Mountains along Balcom Canyon Road, which is slightly lower in elevation but would require an additional 1.5 miles of pipeline. Connection would be to the same phase of the SMP, and construction conditions along Balcom Canyon Road are similar to those along SR-23. The savings in pumping costs would be minor compared to the additional capital costs for this alignment. Therefore, this alignment is rejected in favor of the SR-23 alignment.

In preliminary discussions with the Calleguas Municipal Water District (CMWD), the lead agency for the SMP project, there appears to be sufficient capacity for the SCVSD's brine flow, and the anticipated composition of the SCVSD brine is expected to meet the SMP's ocean discharge limits. The SCVSD would need to pay fees for its share of the capital and operational costs of the SMP. The SMP is being constructed in phases as shown on Figure 6-7, and approximately 21 miles must be constructed to meet the proposed Moorpark connection. The easternmost segment to Moorpark (Phases 2E and 2F) is tentatively scheduled for completion in 2017. However, a firm approval and financing commitment to proceed have not been made, which leaves some doubt about whether the full 21 miles will be completed within the timeframe required for the Chloride TMDL. Last, there is some concern about the long-term costs of this project as the SCVSD would need to rely on an outside party to limit cost increases over time. Overall, this scenario is considered feasible and is evaluated below.

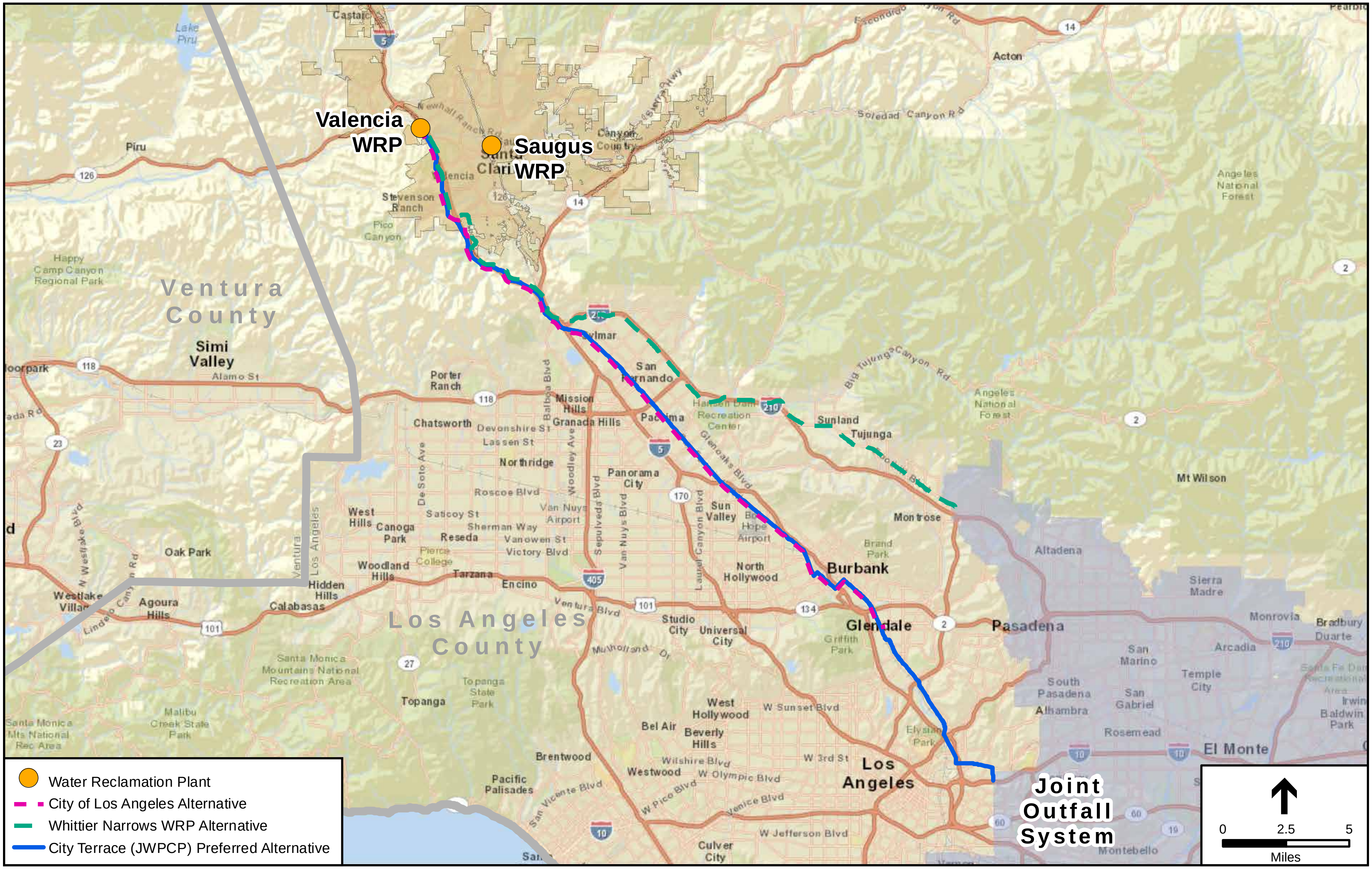


Figure 6-6

Alternative Brine Pipelines to Los Angeles Basin

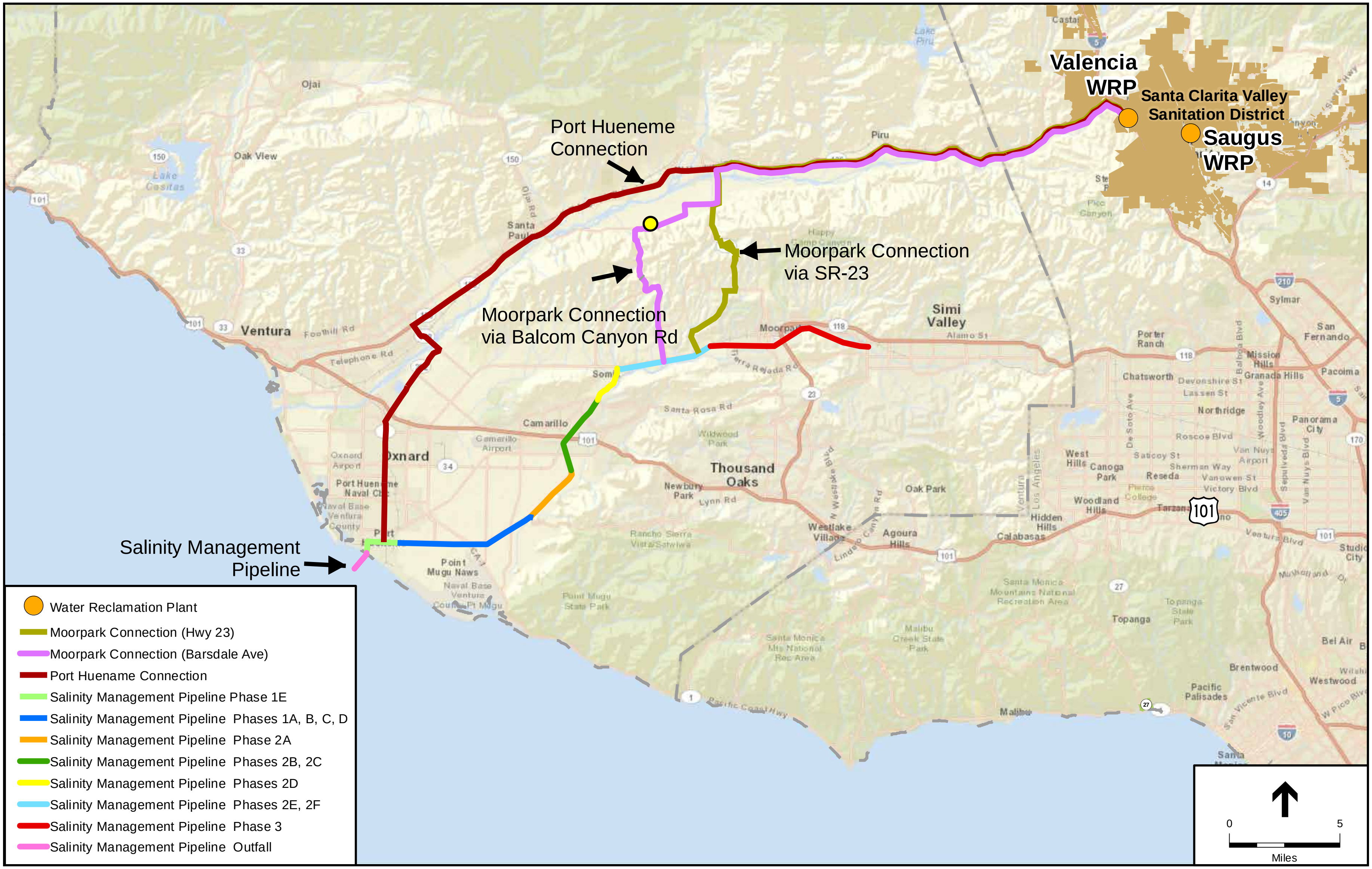


Figure 6-7

Brine Pipeline to Calleguas Salinity Management Pipeline Alternatives

Pipeline to Calleguas SMP via Port Hueneme Connection

This scenario is similar to the preceding Calleguas SMP scenario except that the alignment is changed to connect near Port Hueneme (see Figure 6-7). This scenario would have the benefit of being gravity flow its entire length, eliminating the cost to build and operate two pump stations needed to cross the Santa Susana Mountains and reach the Moorpark connection. The Port Hueneme connection would also avoid construction in the winding and narrow section of SR-23 that passes over the Santa Susana Mountains. Last, this scenario would connect to a point in the SMP that is already constructed, thereby eliminating any uncertainty about whether the SMP would be available within the timeframe required for the Chloride TMDL. Connection near Port Hueneme would require 47 miles of 10- to 16-inch diameter pipeline (15 miles longer than the Moorpark connection scenario). This scenario would also involve the SCVSD paying fees for its share of the SMP costs. Compared to the Moorpark connection, this scenario would have lower O&M costs by avoiding pumping, but higher construction costs due to longer length, which would make this scenario more costly overall. Consequently, this scenario is rejected in favor of the Moorpark scenario and is not further considered.

Pipeline to Ventura Coast

This scenario entails the discharge of brine to the ocean off the Ventura coastline and would require construction of 45 miles of 16-inch diameter gravity pipeline and an ocean outfall with a diffuser system. Discharge to the ocean would require a variety of permits including permits from the RWQCB-LA, Corps, and California Coastal Commission. Acquisition of such permits is a lengthy process that can take several years. Relative to other pipeline scenarios, this scenario has the added time burden of permitting and constructing an ocean outfall, which raises concerns about whether this scenario could be completed within the timeframe required for the Chloride TMDL. In terms of required facilities, this scenario is similar to the Calleguas SMP via Port Hueneme except the addition of an ocean outfall construction. From cost, environmental impact, and time to implement standpoints, this scenario is inferior to the Port Hueneme scenario. Thus, this scenario is also rejected in favor of the Calleguas SMP via Moorpark scenario and is not further considered.

Pipeline to Ventura Coast via Crimson Pipeline and New Pipeline and Outfall

This scenario is similar to the preceding Ventura Coast option but would use 32 miles of an existing pipeline known as the Crimson pipeline and thereby reduce the length of new pipeline required to 16 miles. The Crimson pipeline is an 8-inch diameter, unlined steel pipeline that was originally used to convey crude oil from the SCV to the Ventura Coast and is now out of service. The Crimson pipeline has an existing submarine pipeline that extends approximately one mile offshore. This submarine pipeline was used to convey oil to and from oil tankers and is not configured as an ocean outfall. As a result, a new ocean outfall would need to be constructed adding to construction costs and implementation time. Discharge to the ocean would require a variety of permits including permits from the RWQCB-LA, Corps, and California Coastal Commission. Acquisition of such permits is a lengthy process that can take several years. The owner of the pipeline reports that ROW for the pipeline have lapsed. The cost to purchase the pipeline and secure necessary ROW is unknown. There are discontinuities in the pipeline totaling approximately 1 mile that would need to be reconstructed. The structural integrity of the Crimson pipeline is unknown. The pipeline may not have the strength to safely handle the pressures required for force main service. To prevent internal corrosion while conveying brine, the pipe would need to be lined, which would add to construction costs. Thus, this scenario is not feasible and is not further considered.

Pipeline to Nearest Flood Control Channel in the Los Angeles Basin

In this scenario, the SCVSD's brine flow would be conveyed to the nearest flood control channel, which is 14 miles south of the VWRP in the Los Angeles Basin. However, this and other flood control channels in that region drain to the Los Angeles River, which has a chloride limit of 150 mg/L. The SCVSD's brine would have a chloride level of approximately 800 mg/L. An NPDES permit would be required from the RWQCB-LA for discharge to the flood control channel, and this permit would not be issued due to high levels of chloride and other constituents. Thus, this scenario is not feasible and is not further considered.

Pipeline to Nearest Ventura County Flood Control Channel That Drains to the Ocean

This scenario is similar to the preceding scenario except that brine would be sent westward. In that area, most flood control channels discharge to the SCR, which has strict chloride limits making discharge to these flood control channels infeasible. Closer to the Ventura County coast, flood control channels discharge to the ocean. Nonetheless, an NPDES permit would be required from the RWQCB-LA for discharge to the flood control channel, and this permit would not be issued due to high levels of chloride and other constituents. Thus, this scenario is not feasible and is not further considered.

Evaluation of Pipeline Discharge Locations

The pipeline discharge locations that were feasible and preferred after initial screening were evaluated as shown in Table 6-6.

Table 6-6. Evaluation of Pipeline Discharge Locations

Evaluation Criteria	Pipeline to LA Basin and JWPCP	Pipeline to Calleguas SMP via Moorpark Connection
Environmentally Sound	0	0
Cost-Effective	0	0
Ability to Meet Compliance Deadline	+	-
Constructability	0	0
Institutional Feasibility	+	-
Operational Considerations	0	0
Overall Rating	+2	-2

Note: Comparative ratings are Superior (+), Neutral (0), and Inferior (-).

Both pipeline discharge locations were ranked the same for environmental impacts, costs, constructability, and operational considerations. The Pipeline to Calleguas SMP would have a shorter length but would require more pumping resulting in a larger force main diameter and slightly higher energy consumption. Construction of the Pipeline to Los Angeles Basin would be through highly developed areas. Construction of the Pipeline to Calleguas SMP would take place on a narrow, rural road, which would complicate construction. One disadvantage of the Pipeline to Calleguas SMP is the uncertainty regarding whether the necessary SMP segments will be completed within the timeframe required for the Chloride TMDL. A second disadvantage is the need to coordinate and negotiate with another agency to make this option feasible and the subsequent need to rely on another agency to control costs. Therefore, the Pipeline to Los Angeles Basin and JWPCP was the top-ranked scenario and is used in all subsequent discussions of brine pipelines. Other scenarios were eliminated from further consideration after being deemed infeasible or clearly inferior to the top-ranked scenario.

6.6.1.2 Use of Brine Minimization for Brine Pipeline Alternative

As noted in Section 6.5.3, there are several technologies to minimize the amount of brine that must be disposed. This sub-section evaluates the brine pipeline alternative under the following brine minimization scenarios: no brine minimization, second-pass RO, and softening followed by second-pass RO. Brine minimization using an evaporator was not evaluated because such a high-cost, low-brine system is not cost-effective with brine disposal via a pipeline. Each scenario assumes no UV disinfection, MF/RO facilities at the VWRP, a brine pipeline to the Los Angeles Basin and JWPCP, an RO product water conveyance system to the SWRP, and no use of supplemental water. The brine pipeline size changes between scenarios due to the different brine flows to be conveyed. All brine minimization processes would be located within the VWRP boundary.

No Brine Minimization

Under this scenario, no brine minimization would be implemented and 1.3 mgd of brine would be generated. Brine would be conveyed by a 10-inch diameter force main and 14-inch diameter gravity pipeline.

Second-Pass RO

Under this scenario, 1.3 mgd of brine generated by the primary RO system would receive additional treatment by a second-pass RO system. This would result in 0.6 mgd of brine, which would be conveyed by a 6-inch diameter force main and 10-inch diameter gravity pipeline.

Softening Followed by Second-Pass RO

Under this scenario, softening consisting of clarifiers and granular filters would be added upstream of a second-pass RO system. The softening system would reduce brine flow to 0.3 mgd, which could be conveyed by a 6-inch diameter force main and 8-inch diameter gravity pipeline and would require construction of chemical storage and handling facilities, clarifiers, filters, and a sludge dewatering system. Approximately two trucks per day of dewatered sludge would need to be trucked to an appropriate disposal facility. The Chiquita Canyon Landfill (about 4 miles from the VWRP) could be used if the sludge is 50 percent or more solids and can pass the “paint filter liquids” test. Otherwise, dewatered sludge would likely go to the nearest Class I landfill, which is the Clean Harbors Buttonwillow Landfill in central California (about 100 miles from the VWRP).

Relevant data for the brine minimization scenarios including costs and energy consumption are shown in Table 6-7.

Use of the second-pass RO system would reduce brine flow by 50 percent, which would result in significant capital cost savings with only a nominal increase in annual O&M cost. Use of second-pass RO would also reduce energy consumption by about 6 percent. Although addition of softening would reduce brine flow by another 50 percent, O&M costs would increase significantly, in large part due to the cost of softening chemicals and sludge disposal. Consequently, second-pass RO is the selected brine minimization scenario and is used in all subsequent discussions of the brine pipeline alternative.

Table 6-7. Brine Minimization Scenarios[a] for Brine Pipeline Alternative

	No Minimization	Second-Pass RO	Softening + Second-Pass RO
Brine Flow (max.)	1.3 mgd	0.6 mgd	0.3 mgd
Capital Costs			
Brine Minimization	-	$2 M	$14 M
Brine Pipeline	$109 M	$85 M	$72 M
Other Components	$63 M	$63 M	$60 M
Total Capital	$172 M	$150 M	$146 M
Annual O&M Cost (avg.)	$4.2 M/yr	$4.3 M/yr	$7.5 M/yr
Equivalent Annual Cost[b]	$15.5 M/yr	$14.2 M/yr	$17.1 M/yr
Total Annual Energy Consumption (avg.)	11.8 GWh/yr	11.1 GWh/yr	10.9 GWh/yr

[a] Brine minimization using an evaporator system was not evaluated because such a high-cost, low-brine system is not cost-effective with brine disposal via a pipeline.
[b] Equivalent Annual Cost is defined in Section 6.3.2 under the "Cost-Effective" criterion.

6.6.1.3 Use of UV Disinfection for the Brine Pipeline Alternative

As noted in Section 6.5.4, replacing the existing chlorine-based disinfection with UV disinfection would reduce chloride loading by about 7 mg/L as well as produce effluent with improved water quality. This sub-section evaluates the brine pipeline alternative under two scenarios: UV at Both WRPs, and No UV. Both scenarios assume MF/RO facilities at the VWRP, brine minimization via second-pass RO, a brine pipeline to the Los Angeles Basin and JWPCP, an RO product water conveyance system to the SWRP, and no use of supplemental water. The MF/RO facilities and brine pipeline have different sizes between scenarios due to the higher amount of chloride removal required for the No UV scenario.

Relevant data for the UV disinfection scenarios including costs and energy consumption are shown in Table 6-8.

Table 6-8. UV Disinfection Scenarios for Brine Pipeline Alternative

	UV at Both WRPs	No UV
MF/RO Product Water Flow (primary + secondary max.)	6.1 mgd	7.7 mgd
Brine Flow (max.)	0.5 mgd	0.6 mgd
Capital Costs		
UV Disinfection	$30 M	-
MF/RO+Second-Pass RO	$47 M	$52 M
Brine Pipeline	$84 M	$85 M
Other Components	$10 M	$13 M
Total Capital	$171 M	$150 M
Annual O&M Cost (avg.)	$3.7 M/yr	$4.3 M/yr
Equivalent Annual Cost[a]	$15.0 M/yr	$14.2 M/yr
Total Annual Energy Consumption (avg.)	8.7 GWh/yr	11.1 GWh/yr

[a] Equivalent Annual Cost is defined in Section 6.3.2 under the "Cost-Effective" criterion.

The No UV scenario would save $21 million in capital costs (12 percent) because building slightly larger MF/RO facilities and brine pipeline is less costly than building UV disinfection facilities. Despite its higher O&M costs, the No UV scenario would have an EAC about $0.8 million less per year, a 5 percent savings. The No UV scenario would avoid construction-related environmental impacts associated with construction of UV disinfection facilities and this scenario has two fewer facilities to design, construct and startup within the tight TMDL implementation window. The No UV scenario would require 27 percent more energy and would not provide the improved water quality gained by switching to UV disinfection. Overall, No UV is the selected UV disinfection scenario based on significant capital cost savings and lower EAC.

Modeling indicates that discharge of SWRP blend water (the water to be conveyed to SWRP in the RO product water conveyance system) with VWRP effluent would result in the same chloride levels at Reach 4B of the SCR (where high chloride level becomes a concern) as would occur if the blend water was pumped to the SWRP for discharge. The SCVSD has requested that the RWQCB-LA modify discharge requirements in a way that would eliminate the need for the RO product water conveyance system. If the RWQCB-LA agrees to this request, the $12 million cost of the RO product water conveyance system would be eliminated.

In summary, No UV is the selected UV disinfection scenario and is used in all subsequent discussions of the brine pipeline alternative. UV disinfection at the SWRP would be added to this alternative if such implementation eliminates the need for the RO product water conveyance system.

6.6.1.4 Use of Supplemental Water for the Brine Pipeline Alternative

The approach of using supplemental water was first described in Section 6.4.3 and later developed in Section 6.5.5. This sub-section evaluates the brine pipeline alternative with and without supplemental water. Both scenarios assume no UV disinfection, MF/RO facilities at the VWRP, brine minimization via second-pass RO, a brine pipeline to the Los Angeles Basin and JWPCP, and an RO product water conveyance system to the SWRP. The MF/RO facilities and brine pipeline have different sizes between scenarios because the sizing with supplemental water is based on typical chloride levels (non-drought) and the sizing without supplemental water is based on maximum chloride levels (drought). Relevant data for the supplemental water scenarios including costs and energy consumption are shown in Table 6-9.

Table 6-9. Supplemental Water Scenarios for Brine Pipeline Alternative

	Without Supplemental Water	With Supplemental Water
MF/RO Product Water Flow (primary + secondary max.)	7.7 mgd	4.8 mgd
Brine Flow (max.)	0.6 mgd	0.4 mgd
Supplemental Water Usage (max./avg.)	-	5.2/1.6 mgd
Capital Costs		
MF/RO + Second-Pass RO	$52 M	$42 M
Brine Pipeline	$85 M	$72 M
Supplemental Water Facilities	-	$7 M
Other Components	$13 M	$13 M
Total Capital	$150 M	$134 M
Annual Supplemental Water Cost (avg.)	-	$1.5 M/yr
Annual O&M Cost (avg.)[a]	$4.3 M/yr	$5.4 M/yr
Equivalent Annual Cost[a,b]	$14.2 M/yr	$14.3 M/yr
Total Annual Energy Consumption (avg.)	11.1 GWh/yr	15.0 GWh/yr

[a] Includes supplemental water cost.
[b] Equivalent Annual Cost is defined in Section 6.3.2 under the "Cost-Effective" criterion.

Utilization of supplemental water would allow construction of smaller MF/RO facilities and a smaller brine pipeline, which would result in a capital cost savings of $16 million or 11 percent. However, the cost to obtain supplemental water is relatively high resulting in $1.1 million per year in added O&M costs on average (26 percent). As a result, the EACs for both scenarios are essentially the same. Using supplemental water would require 35 percent more energy, would require RWQCB-LA approval, and would require agreements with and the ongoing cooperation of other agencies. In conclusion, the scenario without supplemental water is selected because this scenario has the same EAC as the other scenario but requires less energy and fewer external approvals. All subsequent discussions of the brine pipeline alternative do not include use of supplemental water.

6.6.1.5 Final Brine Pipeline Alternative

The final brine pipeline alternative consists of MF/RO facilities at the VWRP, brine minimization via second-pass RO, a brine pipeline to the Los Angeles Basin and JWPCP, and an RO product water conveyance system to the SWRP. Use of UV disinfection and supplemental water are not part of the final brine pipeline alternative. This final brine pipeline alternative is carried into the EIR for detailed analysis and into Section 6.7 for evaluation among other final alternatives.

6.6.2 MF/RO With Brine Disposal via DWI

As introduced in Section 6.5.2, DWI is a well-established practice for brine disposal in California and the U.S. Under this alternative, MF/RO facilities would be constructed at the VWRP and brine would be disposed via DWI. This alternative would also include a pump station and pipeline to convey brine from the VWRP to each DWI site, and the RO product water conveyance system to the SWRP described in Section 6.5.1.2. To develop this alternative, the following sub-analyses are described below: siting analysis, use of brine minimization, use of UV disinfection, and use of supplemental water.

An extensive DWI feasibility analysis was completed that included review of geologic records, review of well logs for 80 nearby wells, and numeric modeling. Alternatives for Chloride TMDL compliance would produce 0.3 to 1.3 mgd of brine, which is projected to require 3 to 12 wells. This projection is based on available information, and the actual number of wells may vary depending on conditions encountered during well drilling. Like any work related to the earth’s subsurface, the projected DWI facilities are based on data that is often inferred rather than exact. The permeability and pressure of the formation are primary characteristics that govern the amount of flow a particular well can inject. These characteristics will not be known until a well has been drilled and tested. Even then, the permeability may change over time if minerals in brine react with the soil being injected into.

Injection wells would be drilled 7,000 to 12,000 feet below ground surface for injection into the relatively permeable Pico and Modelo formations. These formations contain relatively poor quality, naturally-occurring liquids that have similar or higher salinity than brine to be injected. The Pico and Modelo formations are beneath the lowermost potential drinking water source (what EPA refers to as a USDW) and are isolated from the USDW by layers of relatively impermeable shale. Wells would be deviated – that is, the bottom of the well (bottom hole location) would be located about one mile away from the top of the well (wellhead) when viewed on a map. Thus, well casings would extend beneath the property of neighboring land owners but would be at depths over 500 feet below ground surface. Deviated wells allow for multiple wellheads to be located on a single site to reduce overall costs.

6.6.2.1 DWI Siting Analysis

The purpose of this analysis was to identify the best wellhead sites within the SCV region. The first step was to exclude areas near known faults or a high number of existing wells. Faults can act as a barrier to the injected formation and lead to rapid pressure increase and exhaustion of formation capacity. Areas with a high density of existing wells or borings were avoided to reduce the probability of encountering inadequately abandoned wells. The remaining area, termed the Study Area, was carried forward for further analysis.

As part of the EPA permitting process, existing wells and exploratory borings within an Area of Review (AOR) must be investigated to ensure that the proposed injection would not cause these wells or borings to become a conduit for migration of naturally occurring liquids from the injection zone to a potential drinking water source. The AOR must cover at least a 0.5-mile radius, but this radius could increase depending on factors such as injection flow and the formation pressure. An AOR analysis was completed for existing wells and borings in and near the Study Area. A total of 80 wells were assessed including 31 within or adjacent to the Study Area. Of the 31 wells, 22 were not abandoned to EPA's standards. A 0.5-mile buffer was placed around each inadequately abandoned well and boring, and the buffered areas were excluded from further analysis.

In assessing whether to issue a permit, EPA also considers the suitability of the geology for DWI. The geology within the Study Area was characterized using published geologic information and well logs from the California Division of Oil, Gas and Geothermal Recovery (DOGGR) database. With the exception of the southern and southwestern portions of the Study Area, the regional geology is suitable for DWI. Unsuitable areas were excluded from further analysis.

Within the remaining portion of the Study Area, the boundaries of two screening areas for wellhead sites, Site A and Site B, were identified using an iterative process. In this process, potential wellhead sites and associated bottom hole locations were successively located in a clockwise fashion to create the boundaries shown on Figure 6-8. Each potential wellhead site was situated to meet the following constraints: (1) EPA's 0.5 mile AOR radius must not cover any inadequately abandoned wells, and (2) all bottom hole locations must be reachable from the wellhead site by no more than a one-mile deviation.

Site A and Site B screening areas include a large number of potential parcels. These potential parcels were screened for feasibility using the following criteria: (1) minimum footprint of 0.5 acre of land with a minimum dimension of 80 feet (minimums required for DWI construction and operation), (2) location outside of a floodplain and not under power transmission lines, and (3) appropriate zoning and development status. Feasible parcels were then evaluated using the following criteria: (1) conveyance pipeline distance from the VWRP, (2) compatible surrounding land use, (3) development suitability, (4) distance from formation outcrop and/or fault, (5) distance from screening area boundary, and (6) ability to site additional bottom hole location(s). This process resulted in two top-ranked parcels for Site A and two for Site B as shown on Figure 6-9. Based on the AOR analysis and numeric modeling mentioned in Section 6.6.2, Site A is expected to accommodate up to seven injection wells and Site B up to four injection wells. For more details of this analysis, see Appendix 6-C.

6.6.2.2 Use of Brine Minimization for DWI Alternative

As noted in Section 6.5.3, there are several technologies to minimize the amount of brine that must be disposed. This sub-section evaluates the DWI alternative under the following brine minimization scenarios: no brine minimization, second-pass RO, and softening followed by second-pass RO. Brine minimization using an evaporator was not evaluated because such a high-cost, low-brine system is not cost-effective with brine disposal via DWI. Each scenario assumes UV disinfection facilities at the VWRP and SWRP, MF/RO facilities at the VWRP, a pump station and pipeline to convey brine from the VWRP to each DWI site, DWI wellhead facilities, an RO product water conveyance system to the SWRP, and no use of supplemental water. The number of injection wells and the size of the brine conveyance pipeline change between scenarios due to the different brine flows to be disposed. All brine minimization processes would be located within the VWRP boundary.

No Brine Minimization

Under this scenario, no brine minimization would be implemented and 1.0 mgd of brine would be generated (this amount is less than in Section 6.6.1.2 because this scenario assumes a switch to UV disinfection while the earlier scenario did not). Brine would be conveyed to Site A and Site B by a 10-inch diameter pipeline and disposed via a total of nine injections wells.

Second-Pass RO

Under this scenario, 1.0 mgd of brine generated by the primary RO system would receive additional treatment by a second-pass RO system. This would result in 0.5 mgd of brine, which would be conveyed to Site A by an 8-inch diameter pipeline and injected using five wells.

Softening Followed by Second-Pass RO

Under this scenario, softening consisting of clarifiers and granular filters would be added upstream of a second-pass RO system. The softening system would reduce brine flow to 0.2 mgd, which could be conveyed to Site A by an 8-inch diameter pipeline and injected using three wells. Softening would require construction of chemical storage and handling facilities, clarifiers, filters, and a sludge dewatering system. Approximately two trucks per day of dewatered sludge would need to be trucked to an appropriate disposal facility. The Chiquita Canyon Landfill (about 4 miles from the VWRP) could be used if the sludge is 50 percent or more solids and can pass the “paint filter liquids” test. Otherwise, dewatered sludge would likely go to the nearest Class I landfill, which is the Clean Harbors Buttonwillow Landfill in central California (about 100 miles from the VWRP).

Relevant data for the brine minimization scenarios including costs and energy consumption are shown in Table 6-10.

Table 6-10. Brine Minimization Scenarios[a] for DWI Alternative

	No Minimization	Second-Pass RO	Softening +Second-Pass RO
Brine Flow (max.)	1.0 mgd	0.5 mgd	0.2 mgd
Number of Injection Wells	9	5	3
Injection Sites	Site A and Site B	Site A	Site A
Capital Costs			
Brine Minimization	-	$2 M	$13 M
DWI	$76 M	$42 M	$30 M
Other Components	$87 M	$86 M	$86 M
Total Capital	$163 M	$130 M	$129 M
Annual O&M Cost (avg.)	$4.6 M/yr	$4.1 M/yr	$6.5 M/yr
Equivalent Annual Cost[b]	$15.3 M/yr	$12.7 M/yr	$15.0 M/yr
Total Annual Energy Consumption (avg.)	14.2 GWh/yr	11.3 GWh/yr	13.2 GWh/yr

[a] Brine minimization using an evaporator system was not evaluated because such a high-cost, low-brine system is not cost-effective with brine disposal via DWI.
[b] Equivalent Annual Cost is defined in Section 6.3.2 under the “Cost-Effective” criterion.

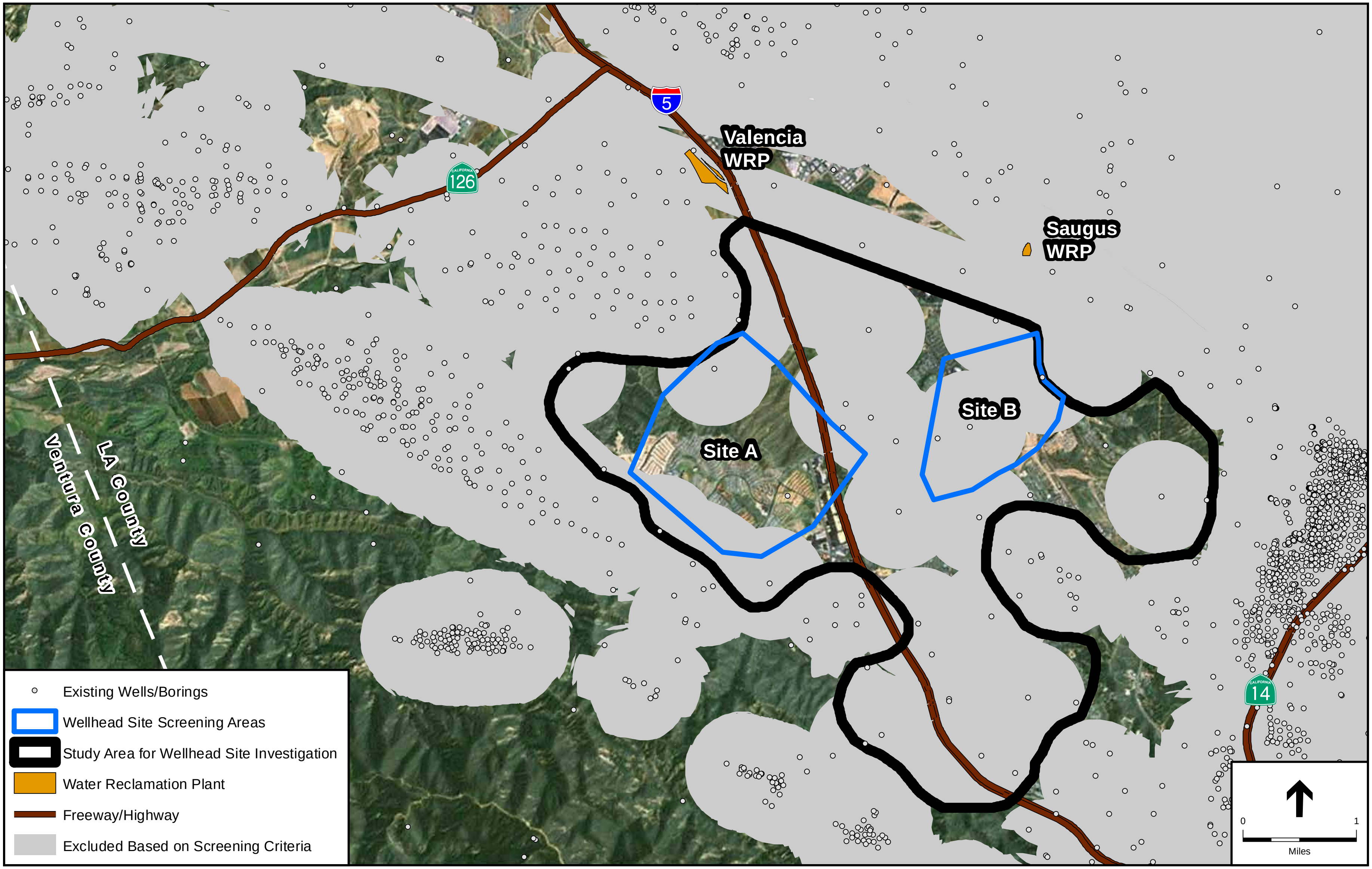


Figure 6-8
Deep Well Injection Wellhead Site Screening

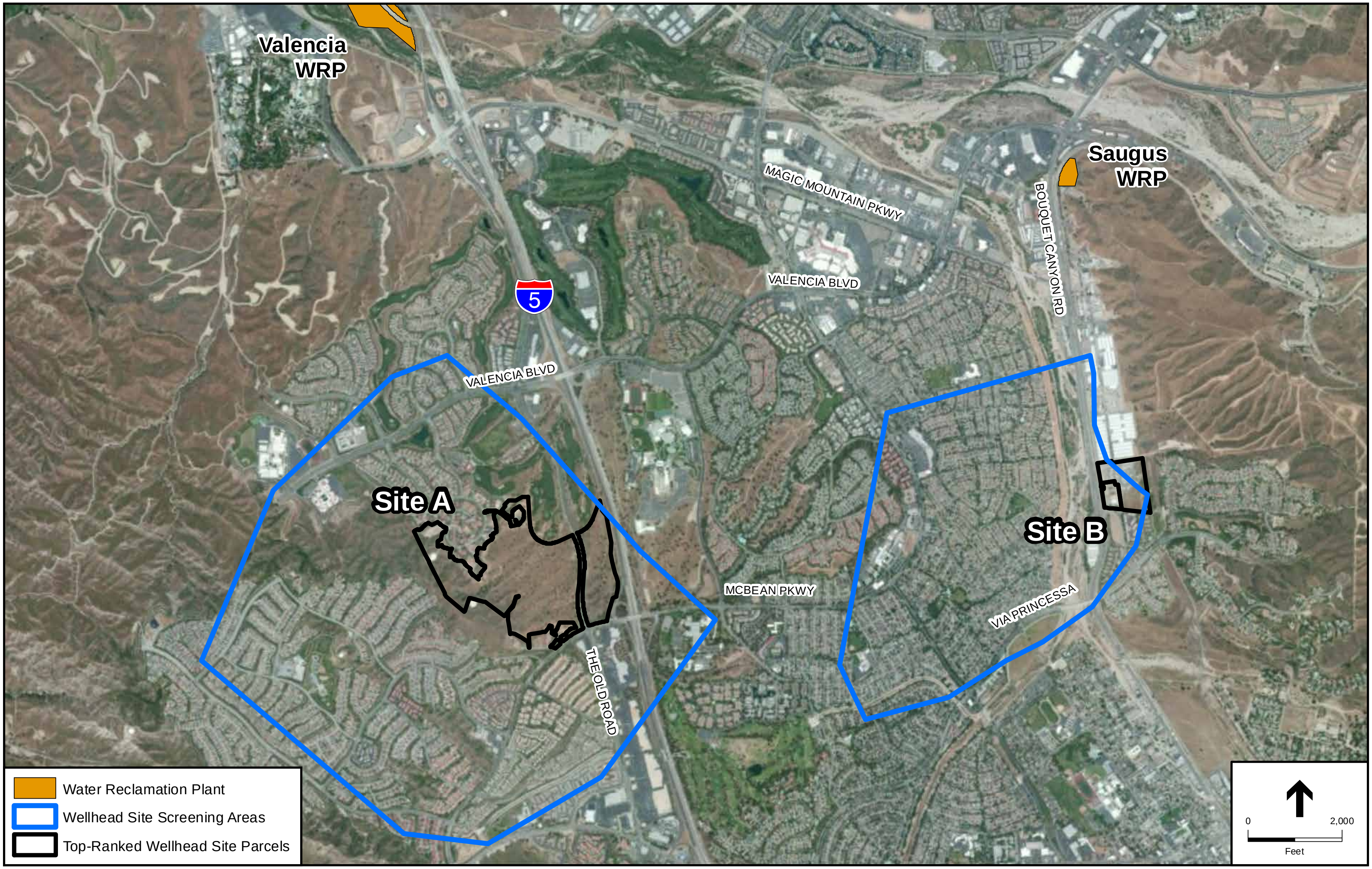


Figure 6-9

Deep Well Injection Feasible Wellhead Site Parcels

Use of the second-pass RO system would reduce brine flow by 50 percent, which would reduce the number of injection wells from 9 to 5 and only require development of Site A. These reductions would result in $33 million in capital cost savings (20 percent) and $0.5 million per year in O&M cost savings (11 percent). Use of second-pass RO would also reduce energy consumption by about 20 percent. Although addition of softening would reduce brine flow by another 50 percent, O&M costs would increase significantly, in large part due to the cost of softening chemicals and sludge disposal. Consequently, second-pass RO is the selected brine minimization scenario and is used in all subsequent discussions of the DWI alternative.

6.6.2.3 Use of UV Disinfection for DWI Alternative

As noted in Section 6.5.4, replacing the existing chlorine-based disinfection with UV disinfection would reduce chloride loading by about 7 mg/L as well as produce effluent with improved water quality. This sub-section evaluates the DWI alternative under two scenarios: UV at Both WRPs and No UV. Both scenarios assume MF/RO facilities at the VWRP, brine minimization via second-pass RO, a pump station and pipeline to convey brine from the VWRP to Site A, DWI wellhead facilities, an RO product water conveyance system to the SWRP, and no use of supplemental water. The MF/RO facilities have different sizes between scenarios due to the higher amount of chloride removal required and brine generated under the No UV scenario. Similarly, the No UV scenario would result in more brine generation and more injection wells. Relevant data for the UV disinfection scenarios including costs and energy consumption are shown in Table 6-11.

Table 6-11. UV Disinfection Scenarios for DWI Alternative

	UV at Both WRPs	No UV
MF/RO Product Water Flow (primary + secondary max.)	6.1 mgd	7.7 mgd
Brine Flow (max.)	0.5 mgd	0.6 mgd
Number of Injection Wells	5	6
Injection Sites	Site A	Site A
Capital Costs		
UV Disinfection	$30 M	-
MF/RO + Second-Pass RO	$47 M	$52 M
DWI	$42 M	$49 M
Other Components	$11 M	$13 M
Total Capital	$130 M	$114 M
Annual O&M Cost (avg.)	$4.1 M/yr	$4.9 M/yr
Equivalent Annual Cost[a]	$12.7 M/yr	$12.4 M/yr
Total Annual Energy Consumption (avg.)	11.3 GWh/yr	14.7 GWh/yr

[a] Equivalent Annual Cost is defined in Section 6.3.2 under the “Cost-Effective” criterion.

The UV at Both WRPs scenario has higher capital costs because it is more costly to build UV disinfection facilities than build slightly larger MF/RO facilities and an additional injection well. However, UV at Both WRPs would save $0.8 million per year in O&M costs (11 percent). As a result, EACs for both scenarios are essentially the same. UV at Both WRPs scenario would require 23 percent less energy and would provide the improved water quality gained by switching to UV disinfection. Overall, UV at Both WRPs is the selected UV scenario based on similar EAC, lower energy consumption, and improved effluent water quality.

Section 6.6.1.3 discusses the SCVSD’s request to the RWQCB-LA that they modify discharge requirements in a way that would eliminate the need for the RO product water conveyance system. If the RWQCB-LA agrees to this request, the $12 million cost of the RO product water conveyance system would be eliminated.

In summary, UV at Both WRPs is the selected UV disinfection scenario and is used in all subsequent discussions of the DWI alternative.

6.6.2.4 Use of Supplemental Water for DWI Alternative

The approach of using supplemental water was first described in Section 6.4.3 and later developed in Section 6.5.5. This sub-section evaluates the DWI alternative with and without supplemental water. Both scenarios assume UV disinfection facilities at the VWRP and SWRP, MF/RO facilities at the VWRP, brine minimization via second-pass RO, a pump station and pipeline to convey brine from the VWRP to Site A, DWI wellhead facilities, and an RO product water conveyance system to the SWRP. The size of MF/RO facilities and number of injection wells vary between scenarios because the sizing with supplemental water is based on typical chloride levels (non-drought) and the sizing without supplemental water is based on maximum chloride levels (drought). Relevant data for the supplemental water scenarios including costs and energy consumption are shown in Table 6-12.

Table 6-12. Supplemental Water Scenarios for DWI Alternative

	Without Supplemental Water	With Supplemental Water
MF/RO Product Water Flow (primary + secondary max.)	6.1 mgd	3.0 mgd
Brine Flow (max.)	0.5 mgd	0.2 mgd
Number of Injection Wells	5	3
Injection Sites	Site A	Site A
Supplemental Water Usage (max./avg.)	-	5.8/1.7 mgd
Capital Costs		
MF/RO + Second-Pass RO	$47 M	$36 M
DWI	$42 M	$30 M
Supplemental Water Facilities	-	$7 M
Other Components	$41 M	$41 M
Total Capital	$130 M	$114 M
Annual Supplemental Water Cost (avg.)	-	$1.6 M/yr
Annual O&M Cost (avg.)[a]	$4.1 M/yr	$5.2 M/yr
Equivalent Annual Cost[a,b]	$12.7 M/yr	$12.7 M/yr
Total Annual Energy Consumption (avg.)	11.3 GWh/yr	14.6 GWh/yr

[a] Includes supplemental water cost.
[b] Equivalent Annual Cost is defined in Section 6.3.2 under the "Cost-Effective" criterion.

Utilization of supplemental water would allow construction of smaller MF/RO facilities and two less injection wells, which would result in capital cost savings of $16 million or 11 percent. However, the cost to obtain supplemental water is relatively high resulting in $1.1 million per year in added O&M costs on average (27 percent). As a result, EACs for both scenarios are the same. Using supplemental water would require 30 percent more energy, would require RWQCB-LA approval, and would require agreements with and the ongoing cooperation of other agencies. In conclusion, the scenario without supplemental water is selected because this scenario has the same EAC as the other scenario but requires less energy and fewer external approvals. All subsequent discussions of the DWI alternative do not include use of supplemental water.

6.6.2.5 Final DWI Alternative

The final DWI alternative consists of UV disinfection facilities at the VWRP and SWRP, MF/RO facilities at the VWRP, brine minimization via second-pass RO, five injection wells at Site A, and an RO product water conveyance system to the SWRP. This final DWI alternative is carried into the EIR for detailed analysis and into Section 6.7 for evaluation among other final alternatives.

6.6.3 MF/RO With Brine Disposal via Trucking

Under this alternative, MF/RO facilities would be constructed at the VWRP and brine would be disposed by trucking to the nearest sewer with adequate capacity and tributary to the JWPCP (the only Sanitation Districts' wastewater treatment plant capable of accepting high salinity waste). This alternative would also include facilities for loading and unloading brine trucks (truck loading and unloading terminals), a pump station and pipeline to convey brine from the MF/RO facilities to the loading terminal, a connecting pipeline sewer from the unloading terminal to the nearest sewer with sufficient capacity, and an RO product water conveyance system to the SWRP as described in Section 6.5.1.2. To develop this alternative, the following sub-analyses are described below: brine truck loading terminal locations, brine truck unloading terminal locations, use of brine minimization, use of UV disinfection, and use of supplemental water.

6.6.3.1 Brine Truck Loading Terminal Locations

Four brine truck loading terminal locations were evaluated and are shown on Figure 6-10. The main criteria used to identify and evaluate these locations were sufficient size for the anticipated truck traffic and facilities, and safe and quick ingress and egress for the truck fleet. At 60 trucks per day, every additional 15 minutes of cycle time would increase operational costs by $500,000 per year. Thus, maximizing loading efficiency would be critical to cost-effective operations.

Site A

This location is on VWRP property adjacent to the proposed MF/RO facilities. Construction of the truck loading terminal at the VWRP would eliminate the need for additional land acquisition and would result in the shortest brine conveyance pipeline. There is sufficient space for loading multiple trucks simultaneously; however, use of this location would reduce the space remaining for a Stage VI expansion or future expansion of the MF/RO facilities. Use of the existing VWRP site entrance is not practical because the number of brine hauling trucks per day would conflict with other site operations and maintenance activities, and brine hauling trucks would move slowly through the narrow roads and tight corners at the VWRP. To optimize safety and efficiency, inbound trucks would access the site via a left turn signal from The Old Road into a new site entrance. Outbound trucks would leave through the same entrance for immediate access to the I-5 southbound.

Site B

This location is on vacant land adjacent to the northern boundary of the VWRP. There is sufficient space for loading multiple trucks simultaneously. Inbound trucks would access Site B by making a left turn from a new protected left-turn pocket on The Old Road. Outbound trucks would leave via a new VWRP site entrance at the signalized intersection on The Old Road for immediate access to the I-5 southbound. This option would require acquisition of approximately one acre and development of undisturbed land. A preliminary examination of the site suggests that the site elevation is high enough not to be flooded by the adjacent SCR and that site development would not require removal of riparian habitat.

Site C

This location is on the opposite side of The Old Road from the VWRP where there are currently several vacant parcels. These parcels have sufficient space for loading multiple trucks simultaneously. Inbound trucks would access Site C by making a right turn from The Old Road. Outbound trucks would make a left turn crossing two lanes of northbound traffic on The Old Road and using a striped middle lane to safely merge with southbound traffic. From there, outbound trucks would make a signalized left turn onto I-5 southbound.

Site D

This location is on the west side of The Old Road approximately 2,000 feet north of the VWRP. There is sufficient space for loading multiple trucks simultaneously. Inbound trucks would access Site D by making a left turn from a new protected left-turn pocket on The Old Road. Outbound trucks would make a right turn onto The Old Road and then a signalized left turn onto I-5 southbound. There is some safety concern about the right turn leaving the site due to relatively high speeds along this segment of The Old Road and limited sight distance. This option would require acquisition of approximately two acres and development of undisturbed land. A preliminary examination of the site suggests that the site elevation is high enough not to be flooded by the adjacent SCR and that site development would not require removal of riparian habitat.

A truck loading terminal could be constructed at any of the sites evaluated. Relative to Site A, Sites B, C and D would preserve important space for future expansions of the VWRP. Site C is less desirable than Site B due to its less safe and efficient egress path and the longer conveyance piping required to reach Site C. Further, the parcels near site C look like prime locations for commercial development. Thus, the value of this property is likely to be higher than properties at Sites B and D, and the industrial use as a truck loading terminal would be less compatible with neighboring properties. Site D is similar to Site B but less desirable due to the longer distance to the freeway and the VWRP, longer conveyance piping required, and less safe egress. Thus, Site B is the selected truck loading terminal location and is used in all subsequent discussions of the trucking alternative.

6.6.3.2 Brine Truck Unloading Terminal Locations

The cost of trucking operations is very sensitive to cycle time. As noted in Section 6.6.3.1, every additional 15 minutes of cycle time would increase operational costs by $500,000 per year. For the brine truck unloading terminal, the main factors influencing cycle time are: freeway distance and traffic, and surface street distance and traffic. The following criteria were used with a Geographic Information System (GIS) to identify general locations for a truck unloading terminal:

- The selected area should be close to a Sanitation Districts’ sewer that is tributary to the JWPCP. Further, the sewer must have at least 0.6 mgd of available capacity to accommodate maximum brine flows.
- The selected area should be close to freeway ramps to minimize driving distance on the surface streets.

Figure 6-10

Brine Truck Loading Terminal Alternative Locations

- The selected area should be located within industrial or commercial areas to maximize compatibility with surrounding land uses.

Five areas resulted from this process (Areas A through E). Two scenarios involving trucking to evaporation ponds in the Antelope Valley were also evaluated (Areas F and G). A final location involving trucking to the JWPCP (Area H) was added for comparison. All of the areas are shown on Figure 6-11, and each area is described below followed by an evaluation.

Area A

This area is located approximately 39 miles from the VWRP in the City of Inglewood, northeast of Los Angeles International Airport and close to I-405 and Florence Avenue (see Figure 6-12). To reach Area A, trucks would use I-5 and I-405. The I-405 has heavy traffic for much of the day from Highway 101 to Florence Avenue. No residential properties would be passed entering or leaving this area. Area A has a variety of commercial and industrial properties surrounded by residential land use within 1 mile of freeway ramps. A number of smaller parcels close to the size required for the truck unloading terminal are available; however, nearly all properties are covered by buildings. The nearest Sanitation Districts' sewer is within 1 mile. Constructing a connecting pipeline to this sewer would not be unusually difficult.

Area B

This area is located approximately 39 miles from the VWRP in an unincorporated portion of Los Angeles County known as City Terrace, north of I-10 at the Marengo Street exit (see Figure 6-13). To reach Area B, trucks would use I-5 and I-10. Approximately 30 homes would be passed entering and leaving this area. Area B has several blocks of industrial properties surrounded by residential land use within 1 mile of freeway ramps. Most properties are similar to the size required for the truck unloading terminal. A number of properties in this area contain large buildings although several have limited improvements that would be ideal for redevelopment as a truck unloading terminal. The nearest Sanitation Districts' sewer is approximately 1,500 feet from the middle of this area. Constructing a connecting pipeline to this sewer would not be unusually difficult.

Area C

This area is located 40 miles from the VWRP in an unincorporated portion of Los Angeles County known as East Los Angeles, east of I-710 at Floral Drive (see Figure 6-14). To reach Area C, trucks would use I-5, I-10 and I-710. Less than 10 homes would be passed entering and leaving this area. Area C has a few blocks of commercial property within 0.5 mile of freeway ramps. The four industrial parcels in the area all have substantial improvements. The limited amount of industrial property reduces the compatibility of a truck unloading terminal with surrounding properties. Parcels and buildings at Area C are relatively large. The nearest Sanitation Districts' sewer with available capacity is located on the west side of I-710. Constructing a connecting pipeline to this sewer would be more complicated than other options.

Area D

This area is located 42 miles from the VWRP in the City of Commerce near the intersection of I-5 and I-710 (see Figure 6-15). To reach Area D, trucks would use I-5. Depending on the route, there is the potential for no homes to be passed entering or leaving this area. Area D has several blocks of industrial and commercial property surrounded by residential land use within 0.5 mile of freeway ramps. Most parcels and the buildings in the area are large. There are a few undeveloped parcels within the area but these are located within Union Pacific Railroad (UPRR) ROW. It is unclear whether UPRR would grant an easement or lease such property. During a site visit, significant surface street congestion was encountered in this area including 11 minutes to travel 1.5 miles. There are a few Sanitation Districts' sewers in this area. Constructing a connecting pipeline to any of these sewers would not be unusually difficult although temporary traffic impacts due to construction would result in a greater impact in this congested area.

Area E

This area is located approximately 43 miles from the VWRP in the City of Commerce near I-710 and Atlantic Boulevard (see Figure 6-16). To reach Area E, trucks would use I-5 and I-710. No homes would be passed entering or leaving this area. Area E has a large area of industrial and commercial properties within one mile of freeway ramps. This area is bordered by residential land use to the north and south, the Los Angeles River to the west, and more commercial and industrial development to the east. This area is located near Area D and has similar composition – mostly parcels that are larger than required for a truck unloading terminal and covered by buildings. During a site visit, significant street congestion was encountered in this area. A Sanitation Districts' sewer passes through this area. Constructing a pipeline to this sewer would not be unusually difficult although temporary traffic impacts due to construction would result in a greater impact in this congested area.

Area F

In this scenario, brine would be trucked to new evaporation ponds near the Palmdale WRP. The Palmdale WRP is 48 miles from the VWRP in the City of Palmdale, east of CA-14 between East Avenue Q and East Avenue P. To reach this area, trucks would use I-5 and CA-14. Trucks would have to drive through residential and light commercial areas along East Palmdale Boulevard and 30th Avenue East when entering and leaving Area F. This area is located approximately 5 miles from the CA-14 resulting in a total travel time of approximately 3 hours. Since this area is located in the Antelope Valley with high ambient temperatures and no connection to the ocean, a truck unloading terminal at this site would include evaporation ponds. Approximately 90 acres of lined ponds would need to be constructed at a cost of $10 million. This cost is higher than the capital cost of a truck unloading terminal and connection fee for the other areas. Further, the longer haul distance and extensive surface street driving would result in significantly higher O&M costs than other areas. Thus, this scenario is clearly inferior to other scenarios and was eliminated from further consideration.

Area G

In this scenario, brine would be trucked to new evaporation ponds near the Lancaster WRP. The Lancaster WRP is 59 miles from the VWRP north of the City of Lancaster, near CA-14 and West Avenue D. To reach this area, trucks would use I-5 and CA-14. The Lancaster WRP is less than 0.25 mile from freeway ramps and no homes would be passed entering or leaving Area G. Similar to Area F, approximately 90 acres of lined ponds would need to be constructed at a cost higher than the capital cost of an unloading terminal and connection fee for the other areas. This scenario has the longest haul distance of all locations which would result in significantly higher O&M costs than other areas. Thus, this scenario is clearly inferior to other scenarios and was eliminated from further consideration.

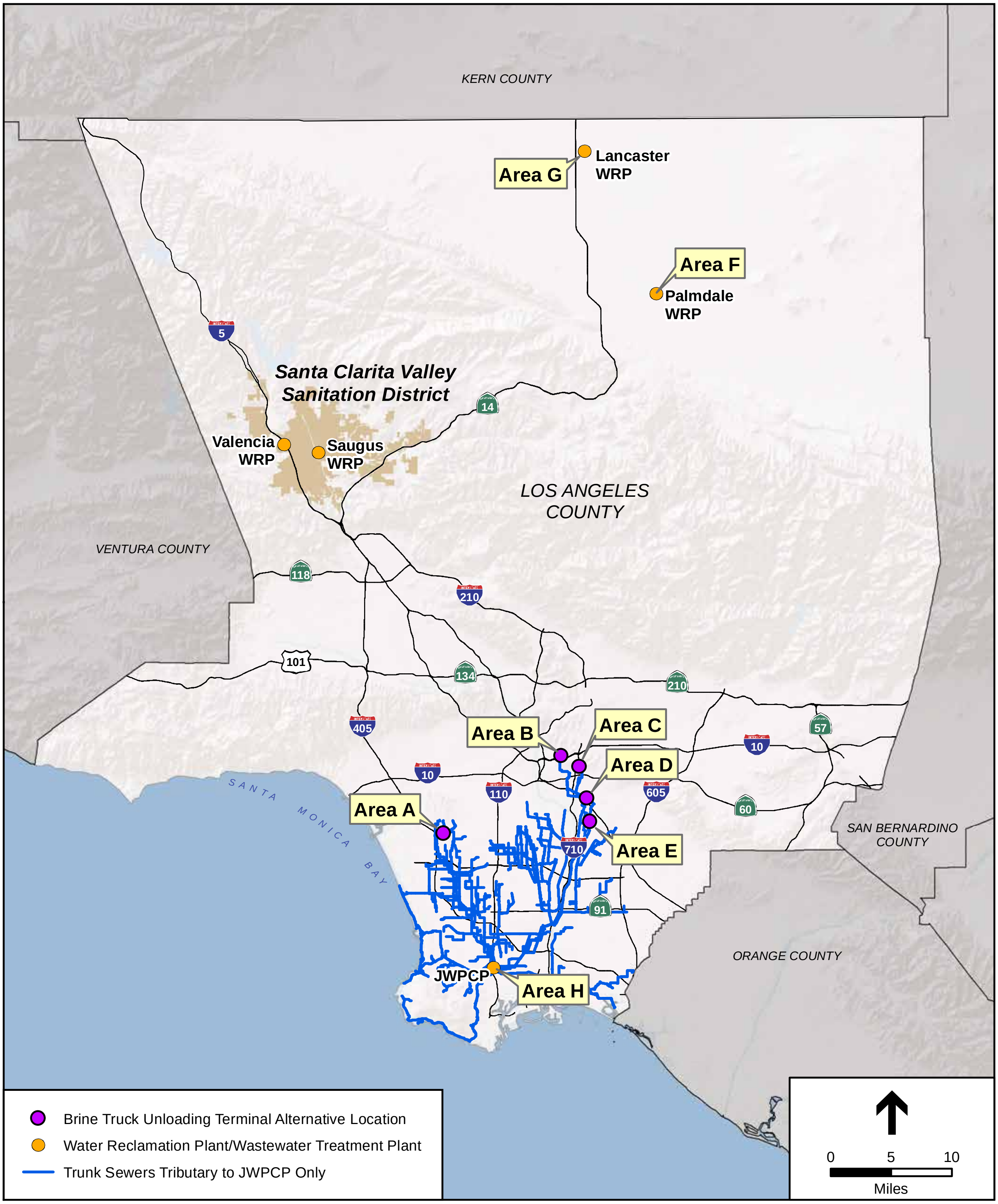


Figure 6-11
Brine Truck Unloading Terminal Alternative Areas

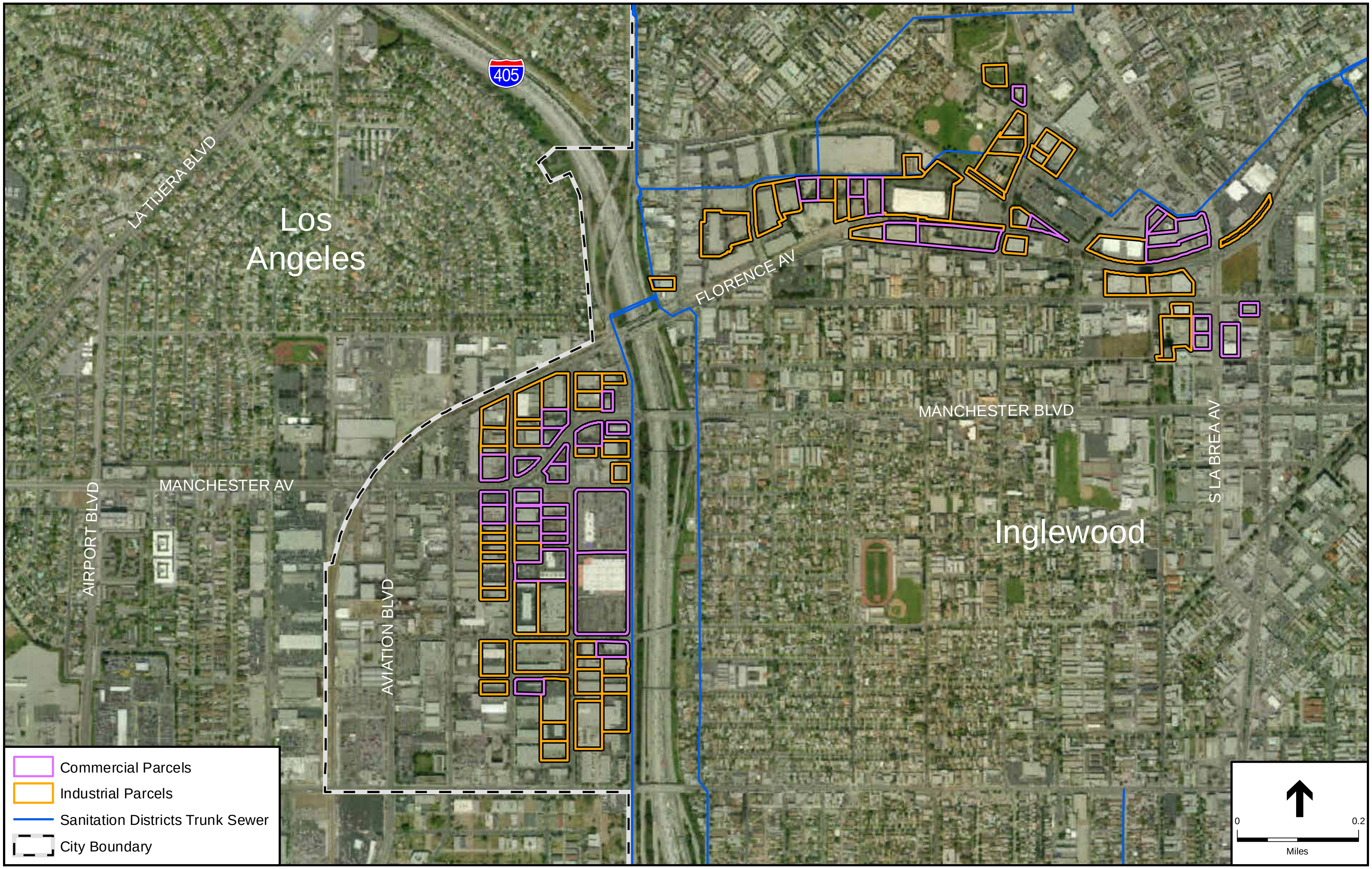


Figure 6-12

Brine Truck Unloading Terminal Area A

Figure 6-13

Brine Truck Unloading Terminal Area B

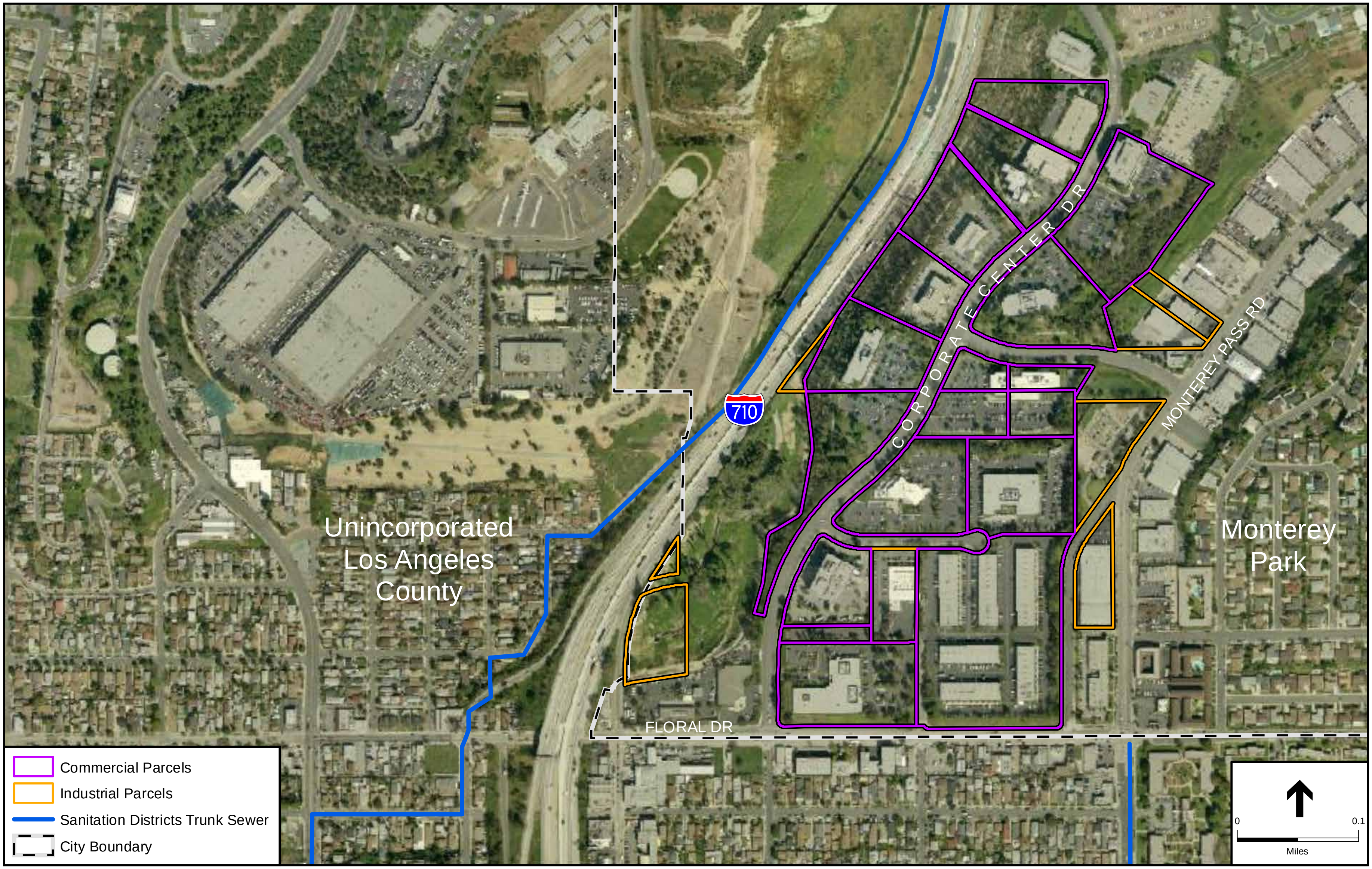


Figure 6-14

Brine Truck Unloading Terminal Area C

Figure 6-15

Brine Truck Unloading Terminal Area D

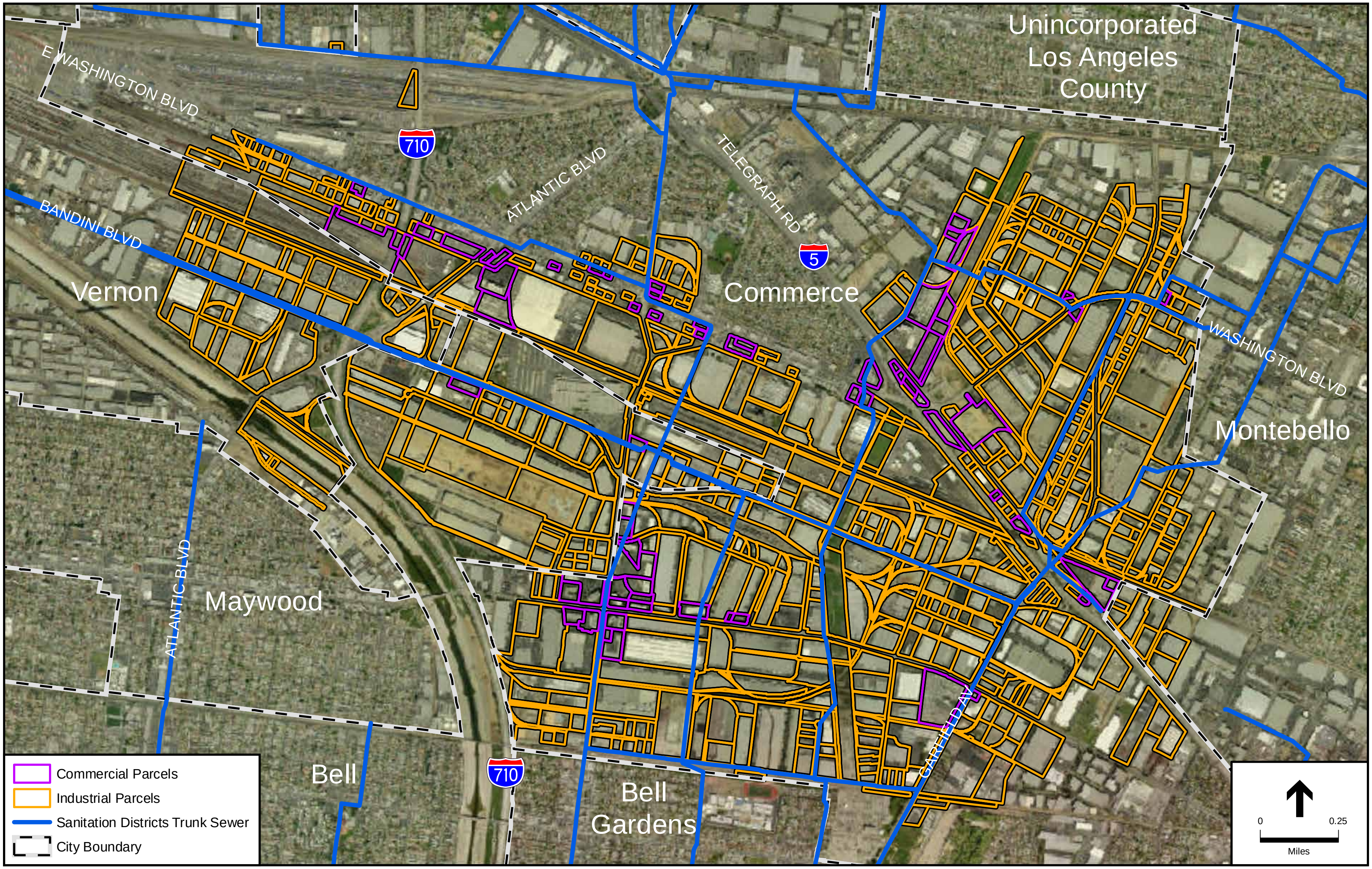


Figure 6-16

Brine Truck Unloading Terminal Area E

Area H

In this scenario, brine would be trucked to an unloading terminal constructed on unused land at the JWPCP. The JWPCP is 53 miles from the VWRP in the City of Carson, east of I-110 near Sepulveda Boulevard (see Figure 6-17). To reach this area, trucks would use I-5, I-405 and I-110. No homes would be passed entering or leaving Area F. The JWPCP is a large industrial site that has suitable areas for development of a truck unloading terminal. Constructing a pipeline to an appropriate point in the treatment plant would not be unusually difficult.

Areas F and G were found to be clearly inferior to other options and were eliminated from further consideration. Remaining truck unloading terminal locations were evaluated as shown in Table 6-13.

Table 6-13. Evaluation of Brine Truck Unloading Terminal Locations

Evaluation Criteria	Area A	Area B	Area C	Area D	Area E	Area H
Freeway Travel Time	0	+	+	0	0	-
Surface-Street Travel Time	+	+	+	-	-	+
Compatibility With Surrounding Land Use	+	0	0	+	+	+
Cost of Connecting to Suitable Sewer	+	+	-	+	+	+
Availability of Properties With Needed Size Requiring Limited Demolition	0	+	-	0	0	+
Overall Rating	+3	+4	0	+1	+1	+3

Note: Comparative ratings are Superior (+), Neutral (0), and Inferior (-).

Area B was the top-ranked location including a top rating in all but one criterion. Area B was the only parcel to receive a top ranking on both freeway travel time and surface-street travel time – critical criteria in minimizing costs. With the exception of Area H (JWPCP), Area B was better than all other sites in the availability of several parcels having the right size and limited existing development. Such parcels would minimize the cost to purchase land and construct a truck unloading terminal compared to larger parcels of land or land with expensive improvements such as a building. Area A and Area H were second-highest ranked. For Area A, freeway travel time is expected to be worse due to traffic on I-405 south of I-101. Area A had only a few properties requiring limited demolition. For Area H, each trip would be 30 miles longer resulting in additional cost of $1.1 million per year compared to Area B, and 1,800 miles per day of additional traffic and vehicle emissions. Consequently, Area B (City Terrace) is selected for further analysis as the truck unloading terminal location and is used in all subsequent discussions of brine disposal via trucking alternative. However, there could be problems with property acquisition, public opposition, and ability to get necessary permits to install and operate the trunk unloading terminal.

6.6.3.3 Use of Brine Minimization for Trucking Alternative

As noted in Section 6.5.3, there are several technologies to minimize the amount of brine that must be disposed. This sub-section evaluates the trucking alternative under the following brine minimization scenarios: no brine minimization, second-pass RO, softening followed by second-pass RO, and softening followed by second-pass RO and evaporation. Each scenario assumes UV disinfection facilities at the VWRP and SWRP, MF/RO facilities at the VWRP, brine trucking, an RO product water conveyance system to the SWRP, and no use of supplemental water. Brine trucking is assumed to occur between a loading terminal adjacent to the VWRP (Site B) and an unloading terminal in City Terrace (Area B). A brine storage tank sized for one day's brine production would be constructed at the VWRP or the truck loading terminal. This tank is needed to accommodate disruptions in the trucking operation. The number of truck trips and size of the brine storage tank changes between scenarios due to the different brine flows to be disposed. All brine minimization processes would be located within the VWRP boundary.

No Brine Minimization

Under this scenario, no brine minimization would be implemented and 1.0 mgd of brine would be generated. This scenario would require 190 truck trips per day during peak conditions and 120 trips per day on average. The brine storage tank would be sized for 1 million gallons, which is about 100 feet in diameter.

Second-Pass RO

Under this scenario, 1.0 mgd of brine generated by the primary RO system would receive additional treatment by a second-pass RO system. This would result in 0.5 mgd of brine, which would require 90 truck trips per day during peak conditions and 60 trips per day on average. The brine storage tank would be sized for 0.5 million gallons, which is about 70 feet in diameter.

Softening Followed by Second-Pass RO

Under this scenario, softening consisting of clarifiers and granular filters would be added upstream of a second-pass RO system. The softening system would reduce brine flow to 0.2 mgd, which would require 45 truck trips per day during peak conditions and 30 trips per day on average. The brine storage tank would be sized for 0.2 million gallons, which is about 45 feet in diameter. Softening would require construction of chemical storage and handling facilities, clarifiers, filters, and a sludge dewatering system. Approximately two trucks per day of dewatered sludge would need to be trucked to an appropriate disposal facility. The Chiquita Canyon Landfill (about 4 miles from the VWRP) could be used if the sludge is 50 percent or more solids and can pass the "paint filter liquids" test. Otherwise, dewatered sludge would likely go to the nearest Class I landfill, which is the Clean Harbors Buttonwillow Landfill in central California (about 100 miles from the VWRP).

Evaporation

Under this scenario, the 0.2 mgd of brine produced by the softening and second-pass RO system would be conveyed to an evaporator. The evaporator would reduce brine flow to approximately 0.01 mgd, which would require 5 truck trips per day during peak conditions and 3 truck trips per day on average. The brine storage tank would be sized for 0.2 million gallons, which is about 10 feet in diameter. Softening would require construction of chemical storage and handling facilities, clarifiers, filters, and a sludge dewatering system. Approximately two trucks per day of dewatered sludge would need to be trucked to an appropriate disposal facility. The Chiquita Canyon Landfill (about 4 miles from the VWRP) could be used if the sludge is 50 percent or more solids and can pass the "paint filter liquids" text. Otherwise, dewatered sludge would likely go to the nearest Class I landfill, which is the Clean Harbors Buttonwillow Landfill in central California (about 100 miles from the VWRP). The evaporator would require a chemical storage station.

Relevant data for the brine minimization scenarios including costs and energy consumption are shown in Table 6-14.

Figure 6-17

Brine Truck Unloading Terminal Area H

Use of the second-pass RO system would reduce brine flow by 50 percent, which would reduce the average number of trucks from 120 to 60 and result in $5.7 million per year in O&M cost savings (40 percent). Use of second-pass RO would also reduce energy consumption by 37 percent and truck emissions by 50 percent. Although addition of softening and evaporation

Table 6-14. Brine Minimization Scenarios for Trucking Alternative

	No Minimization	Second-Pass RO	Softening + Second-Pass RO	Softening + Second-Pass RO + Evaporation
Brine Flow (max.)	1 mgd	0.5 mgd	0.2 mgd	0.01 mgd
Daily Truck Trips (max./avg.)	190/120	90/60	45/30	5/3
Capital Costs				
Brine Minimization	-	$2 M	$13 M	$48 M
Brine Disposal	$22 M	$17 M	$13 M	$10 M
Other Components	$87 M	$86 M	$86 M	$86 M
Total Capital	$109 M	$105 M	$112 M	$144 M
Annual O&M Cost (avg.)				
Brine Minimization	-	$0.4 M/yr	$3.0 M/yr	$5.3 M/yr
Brine Disposal	$11.5 M/yr	$5.4 M/yr	$2.6 M/yr	$0.3 M/yr
Other Components	$2.9 M/yr	$2.9 M/yr	$3.0 M/yr	$2.9 M/yr
Total O&M	$14.4 M/yr	$8.7 M/yr	$8.6 M/yr	$8.5 M/yr
Equivalent Annual Cost[a]	$21.6 M/yr	$15.6 M/yr	$16.0 M/yr	$17.9 M/yr
Total Annual Energy Consumption[b] (avg.)	27.9 GWh/yr	17.7 GWh/yr	15.7 GWh/yr	16.6 GWh/yr

[a] Equivalent Annual Cost is defined in Section 6.3.2 under the “Cost-Effective” criterion.
[b] Includes energy equivalent from diesel used for trucking.

would reduce brine flow by another 50 and 98 percent, respectively, capital costs would increase with each additional brine minimization process (6 percent for softening and 37 percent for evaporation). Trucking costs would drop under the softening and evaporator scenarios but overall O&M costs are similar due to the cost of softening chemicals, sludge disposal, and, for the evaporator, high energy consumption. Softening and evaporation would lower total energy consumption by 11 and 6 percent, respectively, but would require a significant increase in the types and volumes of chemicals used at the VWRP as well as the operational complication of handling softening chemicals like lime and softening sludge. Overall, the reduced trucking and energy from these scenarios is judged to be equivalent to the relative simplicity and reliability of second-pass RO. Consequently, second-pass RO is the selected brine minimization scenario and is used in all subsequent discussions of the trucking alternative.

6.6.3.4 Use of UV Disinfection for Trucking Alternative

As noted in Section 6.5.4, replacing the existing chlorine-based disinfection with UV disinfection would reduce chloride loading by about 7 mg/L as well as produce effluent with improved water quality. This sub-section evaluates the trucking alternative under two scenarios: UV at Both WRPs and No UV. Both scenarios assume MF/RO facilities at the VWRP, brine minimization via second-pass RO, brine trucking, an RO product water conveyance system to the SWRP, and no use of supplemental water. Brine trucking is assumed to occur between a loading terminal adjacent to the VWRP (Site B) and an unloading terminal in City Terrace (Area B). The size of MF/RO facilities and number of truck trips changes between scenarios due to higher amount of chloride removal required and brine generated under the No UV scenario. Relevant data for the UV disinfection scenarios including costs and energy consumption are shown in Table 6-15.

The UV at Both WRPs scenario has higher capital costs because it is more costly to build UV disinfection facilities than build slightly larger MF/RO facilities. However, UV at Both WRPs would result in $3.1 million per year in O&M cost savings (27 percent). As a result, the EAC for

Table 6-15. UV Disinfection Scenarios for Trucking Alternative

	UV at Both WRPs	No UV
MF/RO Product Water Flow (primary + secondary max.)	6.1 mgd	7.7 mgd
Brine Flow (max.)	0.5 mgd	0.6 mgd
Daily Truck Trips (max./avg.)	90/60	115/85
Capital Costs		
UV Disinfection	$30 M	-
MF/RO + Second-Pass RO	$47 M	$52 M
Brine Disposal		
Other Components	$28 M	$31 M
Total Capital	$105 M	$83 M
Annual O&M Cost (avg.)		
Brine Disposal	$5.4 M/yr	$7.9 M/yr
Other Components	$3.3 M/yr	$3.9 M/yr
Total O&M	$8.7 M/yr	$11.8 M/yr
Equivalent Annual Cost[a]	$15.6 M/yr	$17.3 M/yr
Total Annual Energy Consumption[b] (avg.)	17.7 GWh/yr	24.3 GWh/yr

[a] Equivalent Annual Cost is defined in Section 6.3.2 under the "Cost-Effective" criterion.
[b] Includes energy equivalent from diesel used for trucking.

the UV at Both WRPs scenario is $1.7 million per year lower (10 percent). The UV at Both WRPs scenario would require 27 percent less energy and would provide the improved water quality gained by switching to UV disinfection. Overall, UV at Both WRPs is the selected UV scenario.

Section 6.6.1.3 discusses the SCVSD's request to the RWQCB-LA that they modify discharge requirements in a way that would eliminate the need for the RO product water conveyance system. If the RWQCB-LA agrees to this request, the $11 million cost of the RO product water conveyance system would be eliminated.

In summary, UV at Both WRP is the selected UV disinfection scenario and is used in all subsequent discussions of the trucking alternative.

6.6.3.5 Use of Supplemental Water for Trucking Alternative

The approach of using supplemental water was first described in Section 6.4.3 and later developed in Section 6.5.5. This sub-section evaluates the trucking alternative with and without supplemental water. Both scenarios assume UV disinfection facilities at the VWRP and SWRP, MF/RO facilities at the VWRP, brine minimization via second-pass RO, brine trucking, and an RO product water conveyance system to the SWRP. Brine trucking is assumed to occur between a loading terminal adjacent to the VWRP (Site B) and an unloading terminal in City Terrace (Area B). The size of MF/RO facilities and number of truck trips changes between scenarios because the sizing with supplemental water is based on typical chloride levels (non-drought) and the sizing without supplemental water is based on maximum chloride levels (drought).

Relevant data for the supplemental water scenarios including costs and energy consumption are shown in Table 6-16.

Utilization of supplemental water would allow construction of smaller MF/RO facilities, which would result in capital cost savings of $8 million or 8 percent. Utilization of supplemental water would also reduce the number of truck trips per day by 33 percent on average and 50 percent during peak periods. However, the cost to obtain supplemental water is relatively high, resulting in essentially the same O&M costs and only a 3 percent savings in EAC. Using supplemental water would require 11 percent more energy, would require RWQCB-LA approval, and would require agreements with and the ongoing cooperation of other agencies. In conclusion, the scenario without supplemental water is selected because this scenario has nearly the same EAC but requires less energy and fewer external approvals. All subsequent discussions of the trucking alternative do not include use of supplemental water.

Table 6-16. Supplemental Water Scenarios for Trucking Alternative

	Without Supplemental Water	With Supplemental Water
MF/RO Product Water Flow (primary + secondary max.)	6.1 mgd	3 mgd
Brine Flow (max.)	0.5 mgd	0.2 mgd
Daily Truck Trips (max./avg.)	90/60	45/45
Supplemental Water Usage (max./avg.)	-	5.8/1.7 mgd
Capital Costs		
MF/RO + Second-Pass RO	$47 M	$36 M
Supplemental Water Facilities	-	$7 M
Other Components	$58 M	$54 M
Total Capital	$105 M	$97 M
Annual O&M Cost (avg.)		
Annual Supplemental Water Cost	-	$1.6 M/yr
Brine Disposal	$5.4 M/yr	$4.1 M/yr
Other Components	$3.3 M/yr	$3.1 M/yr
Total O&M	$8.7 M/yr	$8.8 M/yr
Equivalent Annual Cost[a]	$15.6 M/yr	$15.2 M/yr
Total Annual Energy Consumption[b] (avg.)	17.7 GWh/yr	19.6 GWh/yr

[a] Equivalent Annual Cost is defined in Section 6.3.2 under the "Cost-Effective" criterion.
[b] Includes energy equivalent from diesel used for trucking.

6.6.3.6 Final Trucking Alternative

The final trucking alternative consists of UV disinfection facilities at the VWRP and SWRP, MF/RO facilities at the VWRP, brine minimization via second-pass RO, brine trucking, and an RO product water conveyance system to the SWRP. Brine trucking would be between a loading terminal adjacent to the VWRP (Site B) and an unloading terminal in City Terrace (Area B). Trucking would consist of 90 truck trips per day during peak conditions and 60 trips per day on average. A brine storage tank sized for 0.5 million gallons would be constructed at the VWRP or the truck loading terminal. This final trucking alternative is carried into the EIR for detailed analysis and into Section 6.7 for evaluation among other final alternatives.

6.6.4 AWRM

The AWRM (also known as the Alternative Compliance Plan or ACP) was developed in conjunction with regional stakeholders from 2006 to 2008. Under this alternative, the RWQCB-

LA and downstream interests in Ventura County agreed to support chloride limits higher than 100 mg/L (130 mg/L during drought and 117 mg/L at other times) conditioned upon implementation of a specific set of facilities that were judged to provide valuable regional benefits to water quality and water supply. The AWRM elements include:

- Elimination of residential AWS within the SCVSD service area
- Construction of UV disinfection facilities at the VWRP and SWRP to nearly eliminate chloride added during wastewater treatment
- Construction of a 3-mgd MF/RO facility at the VWRP to produce high quality RO product water for blending with effluent to: (1) meet river discharge requirements, (2) blend with high chloride groundwater to make a new water supply, and (3) use in other water projects
- Construction of disposal facilities for 0.5 mgd of brine produced by the MF/RO facilities
- Construction of a 24-inch diameter, 12-mile long RO product water pipeline to the eastern portion of the Piru groundwater basin in Ventura County
- Construction of approximately 10 groundwater extraction wells in the eastern portion of the Piru Subbasin
- Construction of a 54-inch diameter, 6.5-mile long blend water pipeline to convey a blend of RO product water and East Piru Subbasin groundwater to a point in the SCR with perennial flow (near the Fillmore Fish Hatchery)
- Utilization of supplemental water in the form of low chloride groundwater from the Saugus formation in the SCV to achieve compliance during peak conditions
- Delivery of imported water to replace groundwater used as supplemental water

The AWRM was based, in part, on the assumption that historical peak chloride levels in the community's water supply would continue into the future. Under this assumption, all RO product water would be blended with tertiary-treated wastewater prior to river discharge to meet the chloride limit during drought conditions (about 30 percent of the time). In non-drought conditions, the MF/RO facilities would remain in operation, and the RO product water would be delivered to: (1) salt management facilities to facilitate export of salt from the eastern portion of the Piru Subbasin, and (2) future water projects in the SCV.

In addition to the salt removal resulting from the MF/RO facilities, additional salt export would be achieved by extracting high chloride groundwater from the eastern portion of the Piru Subbasin and allowing the groundwater basin to naturally recharge with higher quality surface waters. The extracted groundwater would be combined with RO product water to produce blended water having a chloride level suitable for irrigation or river discharge. These actions would improve the salt balance within the watershed and provide a new water supply. The new water supply could offset groundwater pumping in the Oxnard Plain (near the coast), which contributes to saltwater intrusion (including chloride) into that basin.

Changes in SWP operation suggest that future chloride levels will not reach the peak levels observed in the past. Based on updated predictions of water supply chloride level, a subset of the original AWRM elements (see Phased AWRM in Section 6.6.5) can provide similar water quality and water supply benefits as the AWRM. Thus, if acceptable to stakeholders and the RWQCB-LA, the Phased AWRM alternative would be superior to the AWRM alternative. The AWRM capital cost was estimated at $250 million in 2009. Even assuming the improved water quality described in Section 6.6.5 and using a better understanding of project components such as the number of wells needed for brine disposal by DWI, the AWRM capital cost and EAC are estimated at $230 million and $20 million per year, respectively. These costs are significantly higher than those of the final alternatives discussed in Section 6.7. Thus, the AWRM alternative is eliminated from further consideration.

6.6.5 Phased AWRM

This alternative is based on implementing most of the AWRM elements described in Section 6.6.4 (hereinafter "original AWRM") in a way that provides similar water quality and water supply benefits and meets the same regulatory standards (namely chloride limits at Reach 4B of 130 mg/L during drought and 117 mg/L at other times) should they be granted, while deferring, potentially indefinitely, the remaining more costly and environmentally impactful elements. Such an approach can be considered based on new information about future water supply chloride levels that was not available when the original AWRM was developed. As noted earlier, the original AWRM was developed from 2006 to 2008 and was based, in part, on the assumption that historical peak chloride levels in the community's water supply would continue into the future. SWP water comprises about half of the SCV's potable water supply and has historically been the most significant contributor to high chloride levels during drought. Since 2007, the Sacramento-San Joaquin Delta operational criteria and other SWP operational information indicate that future peak chloride levels will be lower than what have been observed historically. CLWA prepared a report titled State Water Project Chloride Modeling Analysis that indicates future SWP chloride levels would remain in the low 80 mg/L range during dry and critically dry years based on projected SWP operating criteria. Further, the 2010 Urban Water Management Plan compiled by CLWA and three SCV retail water purveyors calls for a shift to more use of Saugus formation groundwater during drought conditions. The Saugus formation has a much lower chloride level than other potable water sources and such use would mitigate increases in SWP chloride level. Finally, recent progress on the Bay Delta Conservation Plan leads some to believe that the Bay Delta Conveyance Facility will be built. In May 2013, a complete Administrative Draft of the Bay Delta Conservation Plan was released for comment. The information in this draft indicates that implementation of the Bay Delta Conveyance Facility would provide a much smaller improvement in the chloride level of the water delivered to the Santa Clarita Valley during drought conditions than previously expected. If the Bay Delta Conveyance Facility is implemented, overall chloride levels in the SCV water supply would improve but would not provide compliance with the Chloride TMDL without additional facilities. Such improvement would reduce the volume of supplemental water required and provide greater ability to stay under the proposed triggers for the Phase II facilities described below. Based on the preceding new information, the phased AWRM divides original AWRM elements into two phases: (1) initial facilities believed to be sufficient to meet the original AWRM chloride limits and provide similar water quality and water supply benefits as the original AWRM and (2) deferred facilities consisting of the remaining original AWRM elements.

<u>Phase I Elements</u>

Phase I elements are described below and shown on Figure 6-18:

- **UV Disinfection Facilities.** Existing chlorination systems at the VWRP and SWRP would be replaced with UV disinfection facilities to minimize the addition of chloride during wastewater treatment.

- **Supplemental Water.** Supplemental water in the form of low chloride groundwater from the Saugus formation would be added to VWRP effluent to meet conditional SSOs and any chloride goals. This groundwater would be replaced with imported water. There is a potential to share capital, operations and maintenance costs for supplemental water facilities between the SCVSD and SCV water suppliers. However, no cost allocation has been agreed to at this time, and all costs presented herein assume SCVSD pays the entire cost.

- **Salt Management Facilities.** The following facilities would be sized to provide similar total water production capability as the original AWRM salt management facilities and would be able to provide the chloride export requirements in the Chloride TMDL for the original AWRM:
  - Approximately five groundwater extraction wells in the eastern portion of the Piru Subbasin where chloride levels are relatively high.
  - Approximately six groundwater extraction wells in the west portion of the Piru Subbasin where chloride levels are relatively low.
  - A pipeline and pump stations to connect the well fields and convey blended water to a point in the SCR with perennial flow (near the Fillmore Fish Hatchery).

  In order to operate the East Piru well field at maximum capacity (10,000 gpm or 14 mgd), analyses indicate that the West Piru well field would need to operate at 5,500 gpm or 8 mgd on average to produce blend water with 95 mg/L chloride. On average, the system would produce 22 mgd of blend water; however, constraints associated with species or nearby groundwater pumpers could reduce the average amount pumped. Further, if the system can meet its objectives operating at less than full capacity, the average amount pumped would be less.

<u>Phase II Elements</u>

Phase II represents a formal backup plan in case Phase I facilities cannot consistently provide water quality in the SCR that complies with the modified chloride limits. The specific conditions that would constitute lack of compliance and trigger Phase II are under negotiation with stakeholders and the RWQCB-LA. To minimize the time to implement Phase II if Phase II is ever triggered, the SCVSD would complete certain Phase II studies and design tasks concurrent with design of Phase I. Phase II has the following elements.

- **MF/RO Facilities.** MF/RO facilities would be constructed at the VWRP. The facilities would be sized to reliably meet chloride limits. Based on current predictions of water supply chloride level, no facilities are expected to be needed. However, for the purposes of cost estimating and evaluating alternatives, MF/RO facilities producing 2 mgd of product water and 0.4 mgd of brine are assumed.

- **Brine Disposal Facilities.** The specific brine disposal method could involve a pipeline, DWI or trucking like the alternatives evaluated earlier. Based on the anticipated brine flow, DWI is the recommended method.

- **RO Product Water Conveyance System to Ventura County.** A pump station at the VWRP and a 24-inch diameter, 12-mile RO product water pipeline may be needed to provide low chloride water to the eastern portion of the Piru Subbasin for use as blending water and as a low-chloride water source for users of river water if SCR chloride levels are expected to exceed 117 mg/L after implementation of MF/RO facilities.

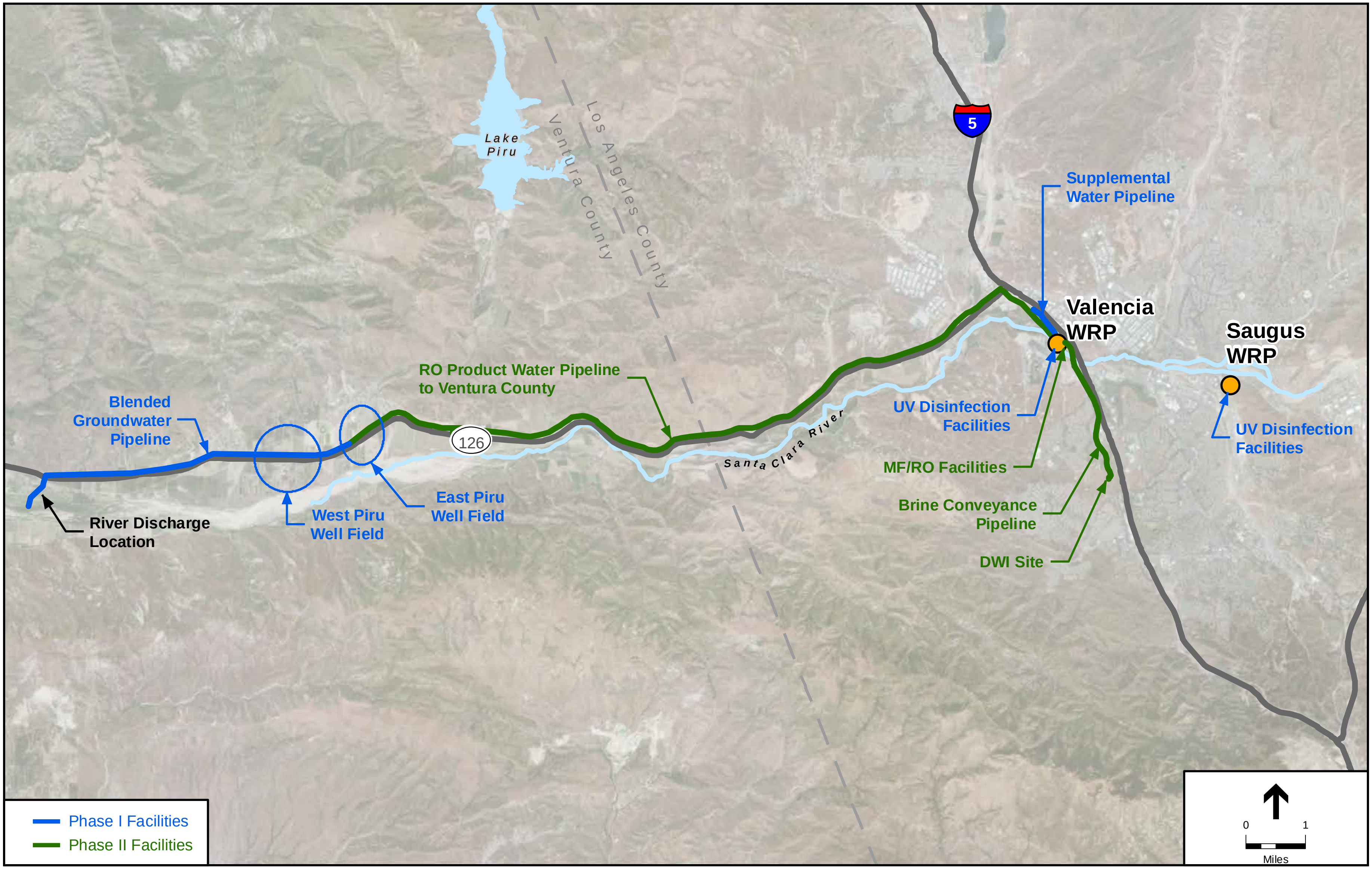


Figure 6-18

Phased AWRM Facilities

As currently written, the Chloride TMDL provides two options for compliance: (1) WRP effluent below 100 mg/L or (2) implementation of the original AWRM facilities to obtain the conditional SSO of 117 mg/L in Reach 4B of the SCR. Implementation of the Phased AWRM alternative would require support by Ventura County stakeholders and would require the RWQCB-LA to modify the Chloride TMDL. Negotiations with Ventura County stakeholders on the scope of the salt management facilities are ongoing in an effort to reduce the operational impacts and cost of these facilities. If the scope of these facilities changes in the future, the SCVSD will conduct appropriate environmental review as needed to comply with CEQA. At this time, the RWQCB-LA has not indicated support for such a modification, which makes this alternative infeasible from a regulatory standpoint. However, this alternative would generally meet the water quality and water supply objectives of the original AWRM and, thus, the RWQCB-LA might support this alternative in the future. Given this possibility, this alternative is carried into the EIR for detailed analysis and into Section 6.7 for evaluation among other alternatives.

6.7 FINAL ALTERNATIVES

6.7.1 Description of Final Alternatives

Approaches to compliance were identified and screened in Section 6.4. Various refinements, such as the general and specific location of the MF/RO facilities and the locations of UV disinfection facilities (if implemented), were subsequently evaluated in Section 6.5. In Section 6.6, full compliance alternatives were identified and developed through a series of evaluations such as whether to use brine minimization, UV disinfection, or supplemental water. Developed alternatives were screened and surviving alternatives became the four final alternatives detailed below. The environmental impacts of the final alternatives are analyzed in the EIR (Section 8 onward). For Alternatives 1 and 2, the assessments regarding whether to implement UV disinfection facilities were not conclusive and could change pending further design and refined costs estimates. Consequently, the EIR considers UV disinfection facilities as a potential component for Alternatives 1 and 2, and impacts were analyzed using the worst-case scenario for each particular resource area.

The components and overall costs for the final alternatives are summarized in Table 6-17. The capital cost, O&M costs and energy consumption of each final alternative component are presented in Table 6-18, Table 6-19, and Table 6-20, respectively. Note that current energy consumption at the VWRP and SWRP is 23.5 GWh per year. The pipeline diameters mentioned in the following descriptions are approximate and may change during design.

6.7.1.1 Alternative 1 – MF/RO With Brine Disposal via Pipeline

In this alternative, a portion of the VWRP's tertiary-treated wastewater would receive advanced treatment via MF/RO facilities to remove chloride. The low chloride RO product water would be combined with the remaining tertiary-treated wastewater to produce a blend that meets the Chloride TMDL limit of 100 mg/L for chloride. Brine from the MF/RO facilities would be disposed via a pipeline to an existing trunk sewer within the JOS. From there, brine would flow to the Sanitation Districts' JWPCP in the City of Carson, and eventually to the ocean using the JWPCP's existing ocean outfall. Alternative 1 facilities are shown on Figure 6-19.

MF/RO facilities would be constructed at the northern end of the VWRP site. The primary MF/RO facilities would be sized to produce 7.1 mgd of RO product water, which would result in

1.3 mgd of brine. This brine would be treated by a second-pass RO system located adjacent to the primary MF/RO facilities. The second-pass RO system would produce 0.6 mgd of RO product water and 0.6 mgd of brine. The product water from the primary and second-pass RO systems would be combined and blended with tertiary-treated wastewater to meet discharge limits. Brine from the second-pass RO system would be disposed via a 37-mile pipeline consisting of 6-inch diameter force main and 10-inch diameter gravity sections. A pump station at the VWRP and an offsite booster pump station would be constructed to convey brine over the Newhall Pass. The brine pipeline would be constructed within public ROW to the maximum extent practicable.

Table 6-17. Final Alternative Project Components

				Alternative 4	
Component	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Phase I**	**Phases I & II**
UV	—	@ VWRP & SWRP	@ VWRP & SWRP	@ VWRP & SWRP	@ VWRP & SWRP
MF/RO[a]	7.1 mgd @ VWRP	5.6 mgd @ VWRP	5.6 mgd @ VWRP	—	2.0 mgd @ VWRP
Second-Pass RO[a]	0.6 mgd	0.5 mgd	0.5 mgd	—	0.2 mgd
RO Product Water Conveyance System	2.3 mgd[b]	1.8 mgd[b]	1.8 mgd[b]	—	2.0 mgd[c]
Brine Disposal	0.6 mgd (Pipeline to Los Angeles Basin and JWPCP)	0.5 mgd (DWI)	0.5 mgd (Trucking to City Terrace)	—	0.2 mgd (DWI)
Salt Management Facilities	—	—	—	32 mgd via 11 Groundwater Extraction Wells	32 mgd via 11 Groundwater Extraction Wells
Supplemental Water	—	—	—	6.0 mgd max. 1.7 mgd avg.	6.0 mgd max. 1.7 mgd avg.
Capital Cost[d]	$150 M	$130 M	$105 M	$110 M	$225 M
O&M (avg.)[d]	$4.3 M/yr	$4.1 M/yr	$8.7 M/yr	$3.8 M/yr	$5.5 M/yr
Equivalent Annual Cost [d]	$14.2 M/yr	$12.7 M/yr	$15.6 M/yr	$11.1 M/yr	$20.4 M/yr

[a] Per industry practice, RO capacities are presented as product water produced, not flow into the unit.
[b] This component may be eliminated if the RWQCB-LA modifies discharge requirements as requested by the SCVSD.
[c] This component may be eliminated if an alternative source of dilution water is identified.
[d] All costs are shown in 2012 dollars. O&M is an abbreviation for operations and maintenance costs. O&M costs are based on non-drought conditions 70 percent of the time and drought conditions the remaining 30 percent of the time. Equivalent Annual Cost is defined in Section 6.3.2 under the "Cost-Effective" criterion. Capital costs were amortized over 20 years at 2.8 percent interest.

Figure 6-19
Alternative 1: MF/RO With Brine Disposal via Pipeline

Table 6-18. Final Alternative Capital Cost Breakdown

Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4 Phase I	Alternative 4 Phases I & II
UV	—	$30 M	$30 M	$30 M	$30 M
MF/RO	$50 M	$45 M	$45 M	—	$32 M
Second-Pass RO	$2 M	$2 M	$2 M	—	$1 M
RO Product Water Conveyance System	$12 M[a]	$11 M[a]	$11 M[a]	—	$53 M[b]
Brine Disposal	$85 M	$42 M	$17 M	—	$29 M
Salt Management Facilities	—	—	—	$73 M	$73 M
Supplemental Water	—	—	—	$6 M	$6 M
Total Capital Cost[c]	$150 M	$130 M	$105 M	$110 M	$225 M

[a] This component may be eliminated if the RWQCB-LA modifies discharge requirements as requested by the SCVSD.
[b] This component may be eliminated if an alternative source of dilution water is identified.
[c] All costs are shown in 2012 dollars.

Table 6-19. Final Alternative O&M Cost Breakdown

Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4 Phase I	Alternative 4 Phases I & II
UV	—	$0.1 M/yr	$0.1 M/yr	$0.1 M/yr	$0.1 M/yr
MF/RO	$3.1 M/yr	$2.7 M/yr	$2.7 M/yr	—	$0.7 M/yr
Second-Pass RO	$0.5 M/yr	$0.4 M/yr	$0.4 M/yr	—	$0.3 M/yr
RO Product Water Conveyance System	$0.1 M/yr[a]	$0.1 M/yr[a]	$0.1 M/yr[a]	—	$0.3 M/yr[b]
Brine Disposal	$0.5 M/yr	$0.9 M/yr	$5.5 M/yr	—	$0.4 M/yr
Salt Management Facilities	—	—	—	$2.0 M/yr	$2.0 M/yr
Supplemental Water[d]	—	—	—	$1.7 M/yr	$1.7 M/yr
Total O&M Cost[c]	$4.3 M/yr	$4.1 M/yr	$8.7 M/yr	$3.8 M/yr	$5.5 M/yr

[a] This component may be eliminated if the RWQCB-LA modifies discharge requirements as requested by the SCVSD.
[b] This component may be eliminated if an alternative source of dilution water is identified.
[c] All costs are shown in 2012 dollars.
[d] Supplemental water costs include the cost to purchase and convey replacement water, operation and maintenance costs for Saugus groundwater wells and a conveyance pipeline.

Table 6-20. Average Energy Consumption of Final Alternatives (GWh/yr)

				Alternative 4	
Component	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Phase I**	**Phases I & II**
UV	—	0.8	0.8	0.8	0.8
MF/RO	8.9	6.3	6.3	—	1.1
Second-Pass RO	0.8	0.6	0.6	—	0.3
RO Product Water Conveyance System[a]	0.6	0.5	0.5	—	—
Brine Disposal	0.8	3.1	9.6[b]	—	0.6
Salt Management Facilities	—	—	—	9.8[c]	9.8[c]
Supplemental Water	—	—	—	6.6[d]	6.6[d]
Total Energy Consumption	11.1	11.3	17.7	17.2	19.2

[a] This component may be eliminated if the RWQCB-LA modifies discharge requirements as requested by the SCVSD.
[b] Includes energy equivalent from diesel used for trucking.
[c] Maximum energy demand is based on operation of 11 wells with 150 ft lift with each well producing 1,400 gpm and conveyance pipeline operation.
[d] Energy for bringing in additional State Water Project water used to replace local groundwater used for dilution for chloride compliance.

The existing chlorine-based disinfection systems would remain at the VWRP and SWRP. To meet Chloride TMDL requirements for SWRP discharge, approximately 2.3 mgd of the RO product water would be pumped to the SWRP for blending with tertiary-treated wastewater. The RO product water conveyance system would consist of a pump station at the VWRP and 3.5 miles of 16-inch diameter pipeline. Modeling indicates that discharge of SWRP blend water (the water to be conveyed to SWRP in the RO product water conveyance system) with VWRP effluent would result in the same chloride levels at Reach 4B of the SCR (where high chloride level becomes a concern) as would occur if the blend water was pumped to the SWRP for discharge. The SCVSD has requested that the RWQCB-LA modify discharge requirements in a way that would eliminate the need for the RO product water conveyance system. If the RWQCB-LA agrees to this request, this alternative would avoid the $12 million cost of the RO product water conveyance system. Note that this system is slightly larger and more costly than the systems for Alternative 2 and 3 because not implementing UV disinfection results in the requirement for more RO product water.

Alternative 1 also includes support for municipal reuse of recycled water as described in Section 6.6. However, the combined WRP discharges would not be lower than the minimum flow of 13 mgd identified to sustain the river's biological resources.

6.7.1.2 Alternative 2 – MF/RO With Brine Disposal via DWI

This alternative is similar to Alternative 1 except that brine would be disposed via DWI and UV disinfection would replace the existing chlorine-based disinfection systems at both WRPs. Alternative 2 facilities are shown on Figure 6-20. At the VWRP, the UV disinfection facilities would be located immediately north of the existing chlorine contact tanks. At the SWRP, the UV disinfection facilities would be located on the top of the existing chlorine contact tanks. Conversion to UV disinfection would reduce the size of the MF/RO facilities to 5.6 mgd and the amount of brine from the primary RO system to 1.0 mgd. The second-pass RO system would produce 0.5 mgd of RO product water and 0.5 mgd of brine. As noted in Section 6.6.2.1, DWI Site A is expected to accommodate up to seven wells and Site B up to four wells. Consequently,

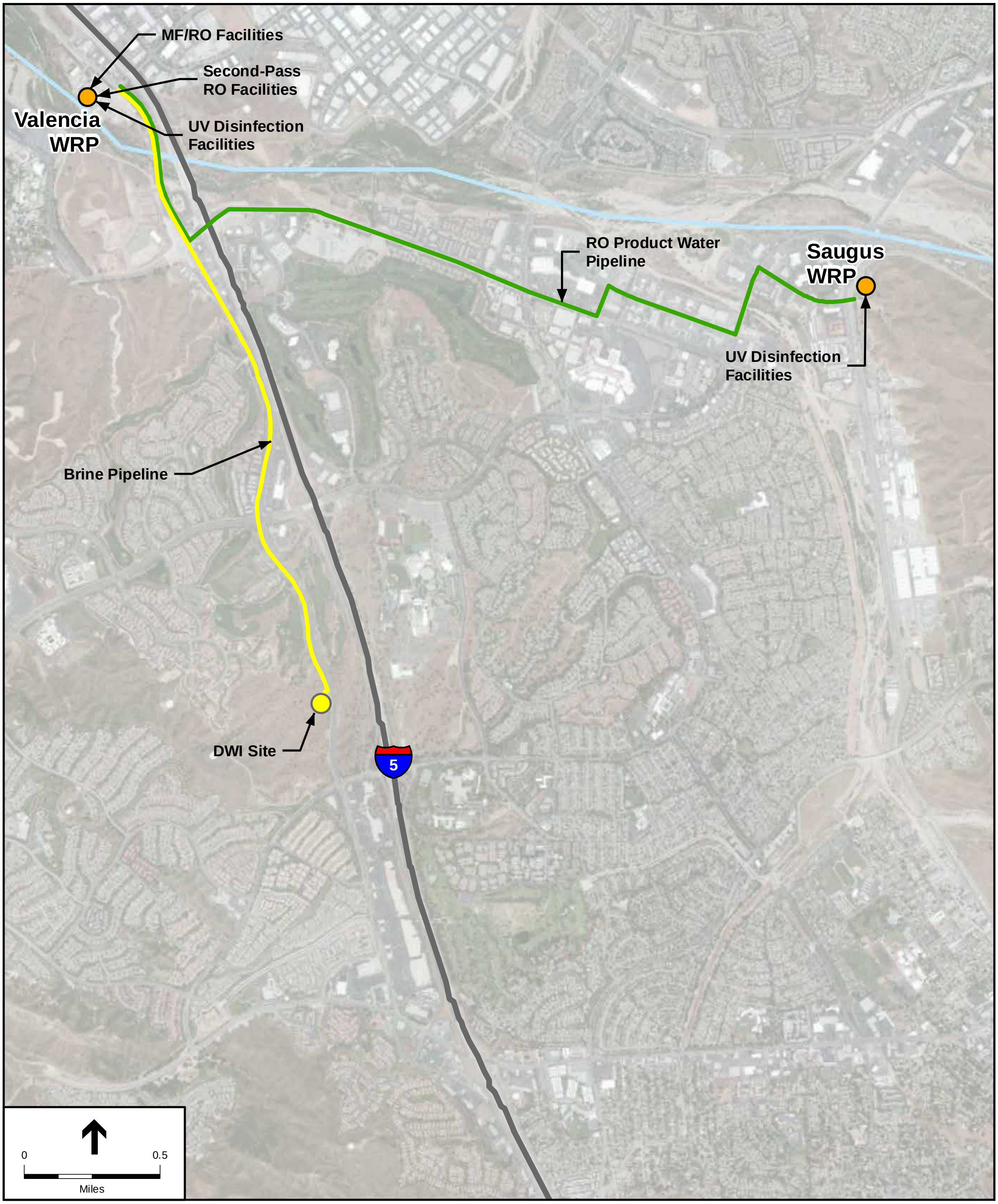


Figure 6-20

Alternative 2: MF/RO With Brine Disposal via Deep Well Injection

Site A is the preferred site because it is expected to handle all five wells while use of Site B would require development of Site A as well as construction of two pipelines. Brine would be conveyed to DWI Site A via a pump station located at the VWRP and an 8-inch diameter, 2.5-mile long force main. Five injection wells would be constructed at Site A along with appurtenant facilities such as injection pumps, chemicals storage tanks, and electrical switchgear. Wells would be deviated – that is, the bottom of the well (bottom hole location) would be located about one mile away from the top of the well (wellhead) when viewed on a map. Thus, well casings would extend beneath the property of neighboring land owners but would be at depths over 500 feet below ground surface. Deviated wells allow for multiple wellheads to be located on a single site to reduce overall costs. If there is a need to use Site B as a second or alternate injection site, the SCVSD would conduct appropriate environmental review as needed to comply with CEQA.

To meet the Chloride TMDL requirements for SWRP discharge, approximately 1.8 mgd of the RO product water would be pumped to the SWRP for blending with tertiary-treated water. The RO product water conveyance system would require construction of a pump station at the VWRP and 3.5 miles of 14-inch diameter pipeline. Similar to Alternative 1, it is hoped that the RWQCB-LA would modify discharge requirements in a way that would eliminate the need for the RO product water conveyance system.

Alternative 2 also includes support for municipal reuse of recycled water as described in Section 6.6. However, the combined WRP discharges would not be lower than the minimum flow of 13 mgd identified to sustain the river's biological resources.

6.7.1.3 Alternative 3 – MF/RO With Brine Disposal via Trucking

This alternative is similar to Alternative 2 except that brine would be disposed via trucking to an unloading terminal. From there, brine would flow to the JWPCP and eventually to the ocean using the JWPCP's existing ocean outfall. The trucking operation would require acquisition and development of properties for truck loading and unloading terminals. The loading terminal would be located on a one-acre property adjacent to the northern boundary of the VWRP and would consist of four brine loading stations, paving and fencing. A 500,000 gallon brine storage tank (approximately 70-foot in diameter) would be constructed at the VWRP or at the loading terminal to accommodate disruptions in the trucking operation. A pump station at the VWRP and a brine conveyance pipeline would be constructed to deliver brine to the loading terminal. The unloading terminal would require a two-acre property located in the unincorporated Los Angeles County community of City Terrace. The unloading terminal would also consist of four brine loading stations, paving and fencing. An 18-inch diameter pipeline would be constructed from the unloading terminal to the City Terrace Trunk Sewer. The trucking operation would involve 90 truck trips per day during peak conditions and 60 trips per day on average. Similar to Alternative 1, it is hoped that the RWQCB-LA would modify discharge requirements in a way that would eliminate the need for the RO product water conveyance system. Alternative 3 facilities are shown on Figure 6-21.

Alternative 3 also includes support for municipal reuse of recycled water as described in Section 6.6. However, the combined WRP discharges would not be lower than the minimum flow of 13 mgd identified to sustain the river's biological resources.

6.7.1.4 Alternative 4 – Phased AWRM

This alternative consists of two phases: Phase I and Phase II. Based on predictions of future water supply chloride levels, Phase I elements should be sufficient to meet a chloride limit of 117 mg/L at Reach 4B of the SCR. Phase II represents a formal backup plan in case Phase I facilities cannot consistently provide water quality in the SCR that complies with the modified chloride limits. The specific conditions that would constitute lack of compliance and trigger Phase II are under negotiation with stakeholders and the RWQCB-LA. To minimize the time to implement Phase II if Phase II is ever triggered, the SCVSD would complete certain Phase II studies and design tasks concurrent with design of Phase I.

Phase I includes construction of UV disinfection facilities at the VWRP and SWRP, salt management facilities in the Piru Subbasin, and use of supplemental water. UV disinfection facilities would be located as described for Alternative 2. Salt management facilities would consist of approximately five groundwater extraction wells in the eastern portion of the Piru Subbasin, approximately six groundwater extraction wells in the western portion of the Piru Subbasin, at least one pump station for each well field, and a 36-inch diameter, 6-mile long pipeline to deliver blended groundwater to a point in the SCR with perennial flow (near the Fillmore Fish Hatchery). In order to operate the East Piru well field at maximum capacity (10,000 gpm or 14 mgd), analyses indicate that the West Piru well field would need to operate at 5,500 gpm or 8 mgd on average to produce blend water with 95 mg/L chloride. On average, the system would produce 22 mgd of blend water; however, constraints associated with species or nearby groundwater pumpers could reduce the average amount pumped. Further, if the system can meet its objectives operating at less than full capacity, the average amount pumped would be less. The hydrologic analyses in the EIR assume this pumping regime while all other EIR analyses are based on the worst day, which is both well fields operating at full capacity (22,000 gpm or 32 mgd).

The supplemental water system would consist of a 24-inch diameter pipeline less than 1 mile long to two or three existing or new groundwater wells. There is a potential to share capital and operations and maintenance costs for supplemental water facilities between the SCVSD and SCV water suppliers. However, no cost allocation has been agreed to, and all costs presented herein assume SCVSD pays the entire cost. The low chloride water provided by these wells would be added to the VWRP discharge to meet the required limit at Reach 4B of the SCR during peak conditions. To replace this water and ensure no net loss of water supply to the SCV, additional water would be imported by CLWA on the SCVSD's behalf. This replacement water would be obtained from the Buena Vista-Rosedale (BV-R) project in the Central Valley of California under existing agreements between CLWA and the BV-R operator and would be conveyed using existing infrastructure. Phase I of Alternative 4 also includes support for municipal reuse of recycled water as described in Section 6.6. However, the combined WRP discharges would not be lower than the minimum flow of 13 mgd identified to sustain the river's biological resources.

Phase II, if needed, would include MF/RO facilities at the VWRP, a brine disposal system, and potentially an RO product water conveyance system to Ventura County. Based on current predictions of water supply chloride level, no MF/RO facilities are expected to be needed. For the purposes of cost estimating and evaluating alternatives, MF/RO facilities producing 2 mgd of product water and 0.4 mgd of brine are assumed and would be located as described for Alternative 1. Similar to Alternatives 1, 2 and 3, the MF/RO facilities are assumed to include second-pass RO for brine minimization, which would reduce brine flows to 0.2 mgd. Based on the relatively small anticipated brine flow, DWI is the recommended method of brine disposal. Similar to Alternative 2, brine would be conveyed to DWI Site A via a pump station located at

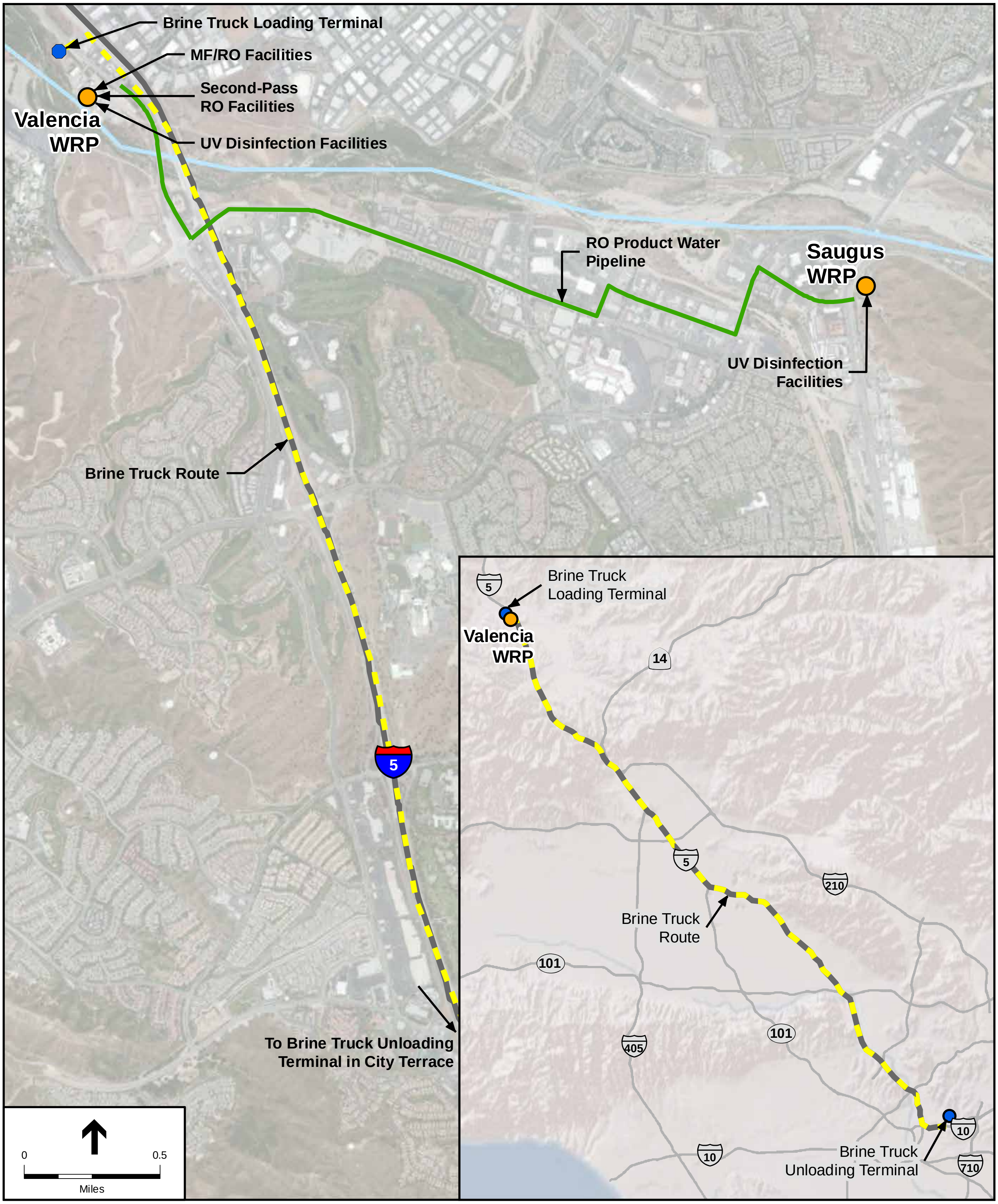


Figure 6-21

Alternative 3: MF/RO With Brine Disposal via Trucking the VWRP and a 6-inch diameter, 2.5-mile long force main. Three injection wells would be constructed at Site A along with appurtenant facilities such as injection pumps, chemical storage tanks, and electrical switchgear. The RO product water conveyance system to Ventura County may be needed to supply low-chloride water for users of river water during drought if SCR chloride levels are expected to exceed 117 mg/L after implementation of MF/RO facilities. The conveyance system would consist of a 24-inch diameter, 12-mile pipeline from the VWRP to the eastern portion of the Piru Subbasin. Alternative 4 facilities are shown on Figure 6-18. There is the possibility of lower costs and environmental impacts for Phase II than shown in Tables 6-17, 6-18, and 6-19 through the replacement of the 12-mile pipeline with an alternate solution. However, the lack of final regulatory requirements and the required size of the advanced treatment and brine disposal systems prevent meaningful analysis of alternate solutions at this time.

As currently written, the Chloride TMDL provides two options for compliance: (1) WRP effluent chloride below 100 mg/L or (2) implementation of the original AWRM facilities to obtain the conditional SSO of 117 mg/L chloride measured in Reach 4B of the SCR. Implementation of the Phased AWRM alternative would require support by Ventura County stakeholders and would require the RWQCB-LA to modify the Chloride TMDL. Negotiations with Ventura County stakeholders on the scope of the salt management facilities are ongoing in an effort to reduce the operational impacts and cost of these facilities. If the scope of these facilities changes in the future, the SCVSD will conduct appropriate environmental review as needed to comply with CEQA. At this time, the RWQCB-LA has not indicated support for such a modification, which makes this alternative infeasible from a regulatory standpoint. However, this alternative would generally meet the water quality and water supply objectives of the original AWRM and, thus, the RWQCB-LA might support this alternative in the future.

6.7.2 Evaluation of Final Alternatives

The final alternatives were evaluated based on environmental and social factors as shown in Table 6-21 and costs as shown in Table 6-22. These two sets of ratings are combined in Table 6-23 to present final rankings.

The environmental criteria were determined by reviewing each environmental resource area analyzed in the EIR and selecting those areas where there is a meaningful difference between alternatives. Energy and greenhouse gases are so closely linked that those resource areas were combined for rating purposes. Of the remaining criteria, most are described in Section 6.3.2. Criteria added specifically for this evaluation are described below.

Table 6-21. Evaluation of Environmental/Social Factors for Final Alternatives

Criteria				Alternative 4	
	Alternative 1	Alternative 2	Alternative 3	Phase I	Phases I & II
Air Emissions	3	4	1	5	3
Energy Usage/GHG	5	4	1	3	2
Biology	4	4	5	3	2
Cultural Resources	3	5	5	4	2
Hydrology	4	4	5	5	4
Traffic	4	5	2	5	4
Adaptability	2	3	5	4	3
Constructability	3	3	5	4	2
Institutional Feasibility	4	3	2	2	1
Public Acceptability[a,b]	5	3	1	2	1
Risk	5	3	4	4	3
Time to Implement	3	4	5	4	4
Total Points (60 Possible)	45	45	41	45	31
Percent of Total	75%	75%	68%	75%	52%

[a] The "Potential for Stranded Assets" criterion in the Draft Facilities Plan has been removed based on new information published in May 2013 in the Administrative Draft of the Bay Delta Conservation Plan. The information in this draft indicates that implementation of the Bay Delta Conveyance Facility would provide a much smaller improvement in the chloride level of the water delivered to the SCV during drought conditions than previously expected and would not provide compliance with Chloride TMDL without additional facilities. Consequently, there would be no stranded assets since the constructed chloride treatment facilities would be needed regardless of whether the Bay Delta Conveyance Facility is implemented.

[b] The Public Acceptability criterion was added to incorporate public opinion solicited during the public review period.

Note: Comparative ratings are Superior (5) and Inferior (1).

Table 6-22. Cost Evaluation of Final Alternatives[a]

Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4	
				Phase I	Phases I & II
Capital Cost + Interest	$201 M	$173 M	$140 M	$147 M	$300 M
Annual O&M	$4.3 M/yr	$4.1 M/yr	$8.7 M/yr	$3.8 M/yr	$5.5 M/yr
Equivalent Annual Cost[b]	$14.2 M/yr	$12.7 M/yr	$15.6 M/yr	$10.7 M/yr	$20.4 M/yr
Cumulative $ Spent[c] by 2030	$276 M	$247 M	$286 M	$220 M	$387 M
Cumulative $ Spent by 2045	$420 M	$398 M	$578 M	$335 M	$556 M
Equivalent Annual Cost[b] (15 points max)	9	11	7	15	4
Cumulative $ Spent by 2030 (15 points max)	10	13	9	15	5
Cumulative $ Spent by 2045 (10 points max)	7	8	4	10	4
Total Points (40 Possible)	26	32	20	40	13
Percent of Total	65%	80%	50%	100%	33%

Note: Comparative ratings are Superior (max points) and Inferior (1).

[a] All costs are shown in actual dollars assuming construction in 2015 and operation begins in 2018, except for Phase 2 of Alternative 4 where operations were assumed to start in 2026.

[b] Equivalent Annual Cost is defined in Section 6.3.2 under the "Cost-Effective" criterion.

[c] "Cumulative $ Spent" is Capital Cost + Interest and the sum of annual O&M costs (adjusted for inflation) over the specified time period.

Table 6-23. Overall Evaluation of Final Alternatives

Criteria	Points Possible	Alternative 1	Alternative 2	Alternative 3	Alternative 4	
					Phase I	Phases I & II
Environmental/ Social	50	75% / 38	75% / 38	68% / 34	75% / 38	52% / 26
Cost	50	65% / 33	80% / 40	50% / 25	100% / 50	33% / 16
Overall Rating		71	78	59	88	42
Overall Ranking		3	2	4	1	5

Adaptability. Adaptability describes the ability of an alternative to change to fit changed circumstances. The size of facilities required depends on chloride levels in the water supply and the amount of chloride added by the community, neither of which can be predicted with certainty. Consequently, alternatives that can be readily scaled up or down to fit changed circumstances would be more economical overall and were rated more favorably.

Risk. The risk ratings incorporate several types of risk. One type is the risk of costs being higher than estimated. An example is DWI where certain geologic parameters are not well known and actual parameters could significantly affect capital and O&M costs.

Another type of risk is unexpected environmental impacts such as the low probability of an induced seismic event from DWI. A third risk is that the facilities do not provide compliance (because actual conditions are much worse than predicted) and that additional facilities like Phase II of Alternative 4 are needed.

6.7.2.1 Evaluation of Alternative 1 – MF/RO Facilities With Brine Disposal via Pipeline

Alternative 1 was ranked third overall with the third ranking for costs. This alternative tied with Alternatives 2 and 4 (Phase I) for top ranking in environmental/social factors. This alternative received the highest rating for energy usage and greenhouse gas emissions because its brine disposal method requires the least energy. Alternative 1 also received the highest rating for risk because pipeline construction is commonplace and because, once constructed, there is limited risk of operational problems with a pipeline and pump station. This alternative received the highest rating for public acceptability because it received the most comments of support and fewest comments in opposition during the public review period.

Alternative 1 received the lowest rating for adaptability because a pipeline has limited ability to handle changing flows. Alternative 1 received the lowest rating for time to implement because the time to design, permit and construct the long brine disposal pipeline would result in the longest implementation schedule of all final alternatives.

From a cost standpoint, Alternative 1 has the highest capital cost which is $27 million (16 percent) higher than the next closest alternative. This alternative has the second highest O&M cost and EAC. Consequently, Alternative 1 received lower cost rating than Alternatives 2 and 4 (Phase I).

6.7.2.2 Evaluation of Alternative 2 – MF/RO Facilities With Brine Disposal via DWI

Alternative 2 was ranked second overall with the second ranking for costs. This alternative tied with Alternatives 1 and 4 (Phase I) for top ranking in environmental/social factors. In summing the ratings for environmental factors, this alternative received the highest total in large part due to the limited footprint of disturbance which resulted in the highest ratings for cultural and traffic impacts. While Alternative 2 rated highest in only a couple of criteria, no ratings below 3 were received, which indicates no significant concerns in any particular area.

The DWI component of Alternative 2 would require land acquisition, an EPA permit and easements, which resulted in a lower rating for institutional feasibility. Due to uncertain geological conditions, the need to construct a test well, and higher potential for unexpected environmental impacts and cost increases, this alternative rated lower in risk and constructability criteria.

Alternative 2 had the second best O&M cost and EAC while having the second worst capital cost. On the whole, this alternative was ranked second for costs because this alternative would result in the second lowest costs after only 7 years of operation.

6.7.2.3 Evaluation of Alternative 3 – MF/RO Facilities With Brine Disposal via Trucking

Alternative 3 was ranked fourth (last) overall with the lowest ranking for environmental/social factors and lowest ranking for costs. This alternative was ranked highest for biological, cultural, and hydrology impacts due to limited footprint of disturbance but ranked lowest for air emissions, energy consumption, greenhouse gases and traffic due to the sizable trucking operation needed for brine disposal. Additionally, Alternative 3 received the lowest ranking in public acceptability due to strong public opposition from the City Terrace community.

Due to the limited number of new facilities and facility construction primarily taking place at the VWRP and SWRP, Alternative 3 rated highest in constructability and time to implement. This alternative is also the most adaptable because trucks could be added or removed from the brine trucking operation as needed to manage changing brine flow.

Alternative 3 has the lowest capital cost because it has the fewest facilities. However brine disposal by trucking makes this alternative the most costly by far in terms of O&M costs. On the whole, this alternative ranked last in terms of costs because it would have the second lowest costs initially but the significant O&M costs would make this alternative third best after 7 years of operation, and last after 12 years of operation.

6.7.2.4 Evaluation of Alternative 4 – Phased AWRM

Phase I of Alternative 4 was conditionally ranked first overall including first for costs. This alternative tied with Alternatives 1 and 2 for top ranking in environmental/social factors. The ranking is conditional upon the RWQCB-LA modifying the Chloride TMDL to make this alternative feasible from a regulatory standpoint. This alternative received the highest ratings for air emissions, hydrology and traffic. This alternative received a relatively high rating for adaptability because the use of supplemental water can be decreased or increased (to some extent) to match changed circumstances.

Alternative 4 was rated lowest for biology because the discharge from the salt management facilities would need to be carefully controlled to avoid a significant impact to endangered Southern California steelhead. This alternative received a lower rating for energy and greenhouse gases due to the energy required for supplemental water and the salt management facilities. However, this concern would be mitigated to the extent that water discharged from the salt management facilities reduces existing groundwater pumping elsewhere and thereby reduces energy consumption. Alternative 4 received the lowest rating for institutional feasibility due to the extensive number of agreements and approvals required. This alternative received the lowest rating for public acceptability because it received the most comments of opposition and fewest comments in support during the public review period.

Alternative 4 Phase I received the highest rating for all cost criteria because it has the lowest O&M cost, lowest EAC, and nearly the lowest capital cost.

Alternative 4 with Phases I and II received the lowest rating for nearly all criteria. If Phase II is needed, Alternative 4 would become the most costly alternative and would generate the most environmental impacts.

6.7.3 Recommended Project

Alternative 4 (Phased AWRM) Phase I is the top-ranked alternative but requires regulatory approvals to be implemented. If Phase II is triggered, Alternative 4 is the lowest-ranked and most costly alternative. However, based on the triggers being proposed, Phase II is not expected to be needed. Alternative 2 is the second-highest ranked alternative and would comply with the existing 100 mg/L chloride limit. Therefore, the recommended project consists of Alternative 4 and, as a backup, Alternative 2 if Alternative 4 does not receive the necessary regulatory approvals or if the final negotiated Phase II triggers are unacceptable to the SCVSD.

As part of the planning process, input from the public and interested parties has been used to guide the selection of the final recommended project.

6.8 SUMMARY OF ALTERNATIVES ANALYSIS

The alternatives analysis began with identifying the universe of approaches that would either entirely or partly provide compliance with the Chloride TMDL. Examples include conveying treated wastewater to the ocean where there is essentially no chloride limit; conveying raw sewage out of the basin for treatment where chloride limits are not an issue; recycling all treated wastewater; and treating the drinking water supply to remove chloride.

Minimum discharges of 8.5 and 4.5 mgd are needed from the VWRP and SWRP, respectively, to support biological resources such as the unarmored threespine stickleback, an endangered species. The combined minimum discharge of 13 mgd represents two-thirds of today’s combined discharge, leaving only one-third to be reused or discharged to another location. The minimum discharge would have to comply with the Chloride TMDL which necessitates addition of advanced treatment since normal wastewater treatment processes, such as those employed at the VWRP and SWRP, do not remove chloride.

Conceptual approaches were screened against their ability to meet the project goals and objectives, and the five approaches meeting all criteria were deemed potentially feasible and considered further. Two of the potentially feasible approaches – Residential AWS Removal and Chloride Control Measures for Industrial and Commercial Dischargers – are in progress, will continue into the future, and are thus not included as part of the recommended project. The remaining three – Modifying WRP Operations, Advanced Wastewater Treatment, and Supplemental Water – are potentially feasible and were carried into further analysis. The only modification to WRP operations that would yield a perceptible change in chloride levels is a switch to a non-chlorine based disinfection process. Supplemental water is low chloride groundwater that would be mixed with tertiary-treated wastewater to achieve a blend that meets the Chloride TMDL limit.

Potentially feasible approaches were then refined in a number of ways such as identifying the type of technology, process configuration, and location for new facilities. MF/RO was found to be the best advanced treatment technology, and UV disinfection was found to be the best non-chlorine based disinfection process. Individually or in combination, UV disinfection and supplemental water would not consistently provide compliance with the 100 mg/L Chloride TMDL limit. Thus, advanced wastewater treatment (MF/RO) is needed to comply. Addition of UV disinfection or supplemental water to MF/RO may result in a better overall alternative.

The MF/RO process produces a brine byproduct that must be disposed in a safe manner. Several brine disposal approaches were evaluated, and three were considered feasible and carried into further evaluation: conveyance via pipeline to an ocean discharge point, deep well injection, and trucking to a sewer tributary to a wastewater treatment plant with an ocean discharge.

Brine disposal is the most costly component of any alternative utilizing MF/RO. As such, minimizing brine volume has the potential to save significant costs. A number of brine minimization processes were examined, and three were found to be appropriate for further consideration: second-pass RO, softening followed by second-pass RO, and evaporation by mechanical or thermal means.

Refined feasible approaches were then assembled into the following alternatives intended to provide full compliance with the Chloride TMDL.

- MF/RO Facilities With Brine Disposal via Pipeline
- MF/RO Facilities With Brine Disposal via DWI
- MF/RO Facilities With Brine Disposal via Trucking
- AWRM
- Phased AWRM

Each alternative includes support for municipal reuse of recycled water as first described in Section 6.6. However, the combined WRP discharges would not be lower than the minimum flow of 13 mgd identified to sustain the river's biological resources. Prior to comparing alternatives, alternatives with MF/RO facilities were further developed through a series of evaluations to address issues such as whether to use UV disinfection and supplemental water. The best brine minimization process, pipeline routes, DWI locations, and locations for brine truck loading and unloading terminals were also evaluated. Developed alternatives were screened, and the AWRM alternative was found to be clearly less favorable than the other alternatives and eliminated from further consideration. The remaining four alternatives became the final alternatives.

Final alternatives were analyzed for environmental impacts and were then evaluated based on environmental/social factors and costs. Alternative 4 (Phased AWRM) Phase I was the top-ranked alternative but requires regulatory approvals to be implemented. If Phase II is triggered, Alternative 4 would be the lowest-ranked and most costly alternative. However, based on the triggers being proposed, Phase II is not expected to be needed. Alternative 2 was the second-highest ranked alternative and would comply with the existing 100 mg/L chloride limit.

Therefore, the recommended project consists of Alternative 4 and, as a backup, Alternative 2 if Alternative 4 does not receive the necessary regulatory approvals or if the final negotiated Phase II triggers are unacceptable to the SCVSD.

As part of the planning process, input from the public and interested parties has been used to guide the selection of the final recommended project.

Figures 6-22a and 6-22b illustrate the alternatives analysis process in detail including the four steps in the process and a box for each of the 24 different evaluations. Each box contains a title for the particular evaluation, a listing of the options considered, indication of option(s) carried forward, and a reference to where the particular evaluation is described.

Step 1: Determine Feasibility of Conceptual Approaches (§6.4.5)

Conceptual Approaches (§6.4)

Alternative Discharge Location (§6.4.1)

- Convey Effluent to Ventura for Ocean Discharge
- Convey Raw Sewage to JOS for Treatment and Ocean Discharge
- SWRP Out of Service/Convey Raw Sewage to JOS for Treatment and Ocean Discharge
- Convey Treated Effluent to JOS for Treatment and Ocean Discharge
- Convey Effluent to City of LA Sewer for Ocean Discharge
- Complete Reuse by Community
- Complete Reuse by Groundwater Recharge
- Convey Effluent to Upstream Portion of the SCR
- Convey Effluent to Flood Control Channel for Ocean Discharge
- Convey Effluent to Existing Drinking Water Reservoir
- Discharge Effluent to Rubber Dam for Blending with Stormwater

Source Control (§6.4.2)

- ***Automatic Water Softeners Removal***
- ***Control Measures for Industrial and Commercial Dischargers***
- Satellite Treatment with Home RO/ Ion Exchange
- Delta Improvements
- Delivering Water from Different Source
- Chloride Treatment at Drinking Water Plants
- **Modify WRP Operations (Change Disinfection Process)**

Additional Treatment (§6.4.3)

- **Advanced Wastewater Treatment**
- **Supplemental Water**

CEQA Requirement (§6.4.4)

- "No Project Alternative"

Step 2: Refine Feasible Approaches (§6.5)

Advanced Wastewater Treatment Technologies (§6.5.1.1)

- Ion Exchange
- Thermal Processes
- EDR
- **MF/RO**

Site of MF/RO Facilities (§6.5.1.2)

- VWRP and SWRP
- **VWRP Only**
- Offsite
- Newhall Ranch WRP

Location of MF/RO at VWRP (§6.5.1.3)

- **South End of Stage VI Expansion**
- North of Chlorine Contact Tanks
- Top of Chlorine Contact Tanks
- South of Pressure Filters
- Top of Flow Equalization Basins
- Newhall Ranch Rail Right-of-Way
- North of Flow Equalization Basins
- ***South End of Plant Site***

Non-Chlorine Disinfection Technologies (§6.5.4.1)

- **UV**
- Chlorine Dioxide
- Ozone
- Hydrogen Peroxide
- Peracetic Acid

Location of UV Facilities at VWRP (§6.5.4.2)

- South End of Stage VI Expansion
- **North of Chlorine Contact Tanks**
- Top of Chlorine Contact Tanks
- South of Pressure Filters
- Top of Flow Equalization Basins
- Newhall Ranch Rail Right-of-Way
- North of Flow Equalization Basins
- South End of Plant Site

Location of UV Facilities at SWRP (§6.5.4.3)

- **Top of Chlorine Contact Tanks**
- ***West of Aeration Tank No. 4***

Brine Disposal Approaches (§6.5.2)

- **Deep Well Injection (DWI)**
- Co-Disposal with Oil Field Operations
- **Ocean Discharge via Pipeline**
- Zero Liquid Discharge
- **Truck to Sewer Tributary to Plant with Ocean Discharge**
- Brine Reuse for Local Construction
- Evaporation Ponds

Brine Minimization (§6.5.3)

- **Second-Pass RO**
- **Softening with Second-Pass RO**
- Enhanced Membrane Systems
- Electrodialysis Reversal
- **Mechanical and Thermal Evaporation**
- Natural Treatment Systems

Supplemental Water SWRP (§6.5.5)

- Sole Method of Compliance
- Combined with UV Disinfection
- **Combined with MF/RO Treatment**

CONTINUED ON FIGURE 6-22b

Figure 6-22a
Chloride Compliance Alternatives Analysis

Step 3: Identify and Develop Full Compliance Alternatives (§6.6)

Brine Disposal via Pipeline

Discharge Locations (§6.6.1.1)
- **To LA Basin and JWPCP**
- To Los Angeles Basin and WNWRP
- To City of Los Angeles Sewer
- To Calleguas SMP via Moorpark
- To Calleguas SMP via Port Hueneme
- To Ventura via New Pipeline & Outfall
- To Ventura via Crimson Pipeline
- To Flood Control Channel in LA Basin
- To Ventura County Flood Control Channel

Use of Brine Minimization (§6.6.1.2)
- No Brine Minimization
- **Second-Pass RO**
- Lime Softening and Second-Pass RO

Use of UV Disinfection (§6.6.1.3)
- UV at Both WRPs
- **No UV**

Use of Supplemental Water (§6.6.1.4)
- With Supplemental Water
- **Without Supplemental Water**

Brine Disposal via DWI

DWI Siting Analysis (§6.6.2.1)
- **Site A and Site B**

Use of Brine Minimization (§6.6.2.2)
- No Brine Minimization
- **Second-Pass RO**
- Lime Softening and Second-Pass RO

Use of UV Disinfection (§6.6.2.3)
- **UV at Both WRPs**
- No UV

Use of Supplemental Water (§6.6.2.4)
- With Supplemental Water
- **Without Supplemental Water**

Brine Disposal via Trucking

Loading Terminal Locations (§6.6.3.1)
- Site A
- **Site B**
- Site C
- Site D

Unloading Terminal Locations (§6.6.3.2)
- Area A
- **Area B**
- Area C
- Area D
- Area E
- Area F
- Area G
- Area H

Use of Brine Minimization (§6.6.3.3)
- No Minimization
- **Second-Pass RO**
- Lime Softening and Second-Pass RO
- Partial Evaporation

Use of UV Disinfection (§6.6.3.4)
- **UV at Both WRPs**
- No UV

Use of Supplemental Water (§6.6.3.5)
- With Supplemental Water
- **Without Supplemental Water**

Step 4: Evaluate Final Alternatives and Identify Recommended Project (§6.7)

Final Alternatives (§6.7.2)
- Alternative 1 - MF/RO With Brine Disposal via Pipeline
- **Alternative 2 - MF/RO With Brine Disposal via DWI**
- **Alternative 3 - MF/RO With Brine Disposal via Trucking**
- ***Alternative 4 - Phased AWRM***

LEGEND
BOLD = Alternative carried forward/selected
BOLD/ITALICS = In progress or conditionally recommended alternative
§ = Section of Facilities Plan where evaluation is discussed

Figure 6-22b
Chloride Compliance Alternatives Analysis