Prepared for
SALINAS VALLEY BASIN
GROUNDWATER SUSTAINABILITY AGENCY

FEASIBILITY STUDY DRAFT SUMMARY REPORT

Brackish Groundwater Restoration Project

NOVEMBER 2024

carollo®

1.0 Introduction

The Salinas Valley is one of the most productive agricultural areas in California. Located on the Central Coast, the valley starts in the Coast Range and follows the Salinas River north and west for 90 miles to exit out into Monterey Bay. The rich agricultural lands are irrigated by groundwater. In 2014, California passed the Sustainable Groundwater Management Act, requiring development of Groundwater Sustainability Plans or GSPs to address overdraft conditions.

Based on the groundwater conditions and projects identified in the 180/400-Foot Aquifer Subbasin GSP, the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA or GSA) has commissioned Carollo Engineers Inc. to prepare a Feasibility Study evaluating the Salinas Valley Brackish Groundwater Restoration Project (Brackish Groundwater Restoration Project or Project). The project team consisted of Carollo Engineers and Montgomery & Associates (M&A) led by the SVBGSA staff to evaluate the hydrogeologic conditions from a variety of project conditions, infrastructure layouts, and demand configurations.

The Feasibility Study follows the United States Bureau of Reclamation (USBR) guidelines and organization structure for a Title XVI feasibility study. Upon completion of the Feasibility Study, the GSA will submit to USBR for approval. This will enable the GSA to apply for additional funding in the future. A summary of the project findings is presented herein.

1.1 Goal and Objectives of Project

The goal of the Brackish Groundwater Restoration Project is to complete a technically and scientifically sound study that explores the feasibility of a seawater intrusion barrier and brackish water treatment and delivery project. The project aims to meet GSP sustainability goals and objectives related to addressing seawater intrusion in the critically over drafted 180/400-Foot Aquifer Subbasin, as well as to address related chronic declining groundwater levels below sea level in this subbasin and other adjacent over drafted subbasins.

Specific objectives of this study are:

1. Evaluate whether this project could effectively achieve GSP goals to mitigate seawater intrusion in the 180/400-Foot Aquifer Subbasin.
2. Estimate costs and benefits of potential project(s) (for range of volume of new water supply and end users) to be able to compare them to other options for projects and management actions under consideration by the GSA.
3. Lay out a road map of next steps for technical, permitting, CEQA and funding potential for implementation.

1.2 Purpose of this Summary Report

A Feasibility Study has been prepared complying with the requirements of the USBR requirements for a Title XVI Feasibility Study. Conforming the Feasibility Study to USBR requirements means that this report can be submitted to USBR for approval, which is the first step toward securing federal grant funding for implementation. However, the required USBR Feasibility Study format does not necessarily lay out a clear story for the reader. This summary report is intended to be a separate document from the Feasibility Study that highlights the efforts completed in a clear, concise brief document that can be distributed to the GSA committees and board, regional partners, stakeholders and regulatory agencies as needed.

2.0 PROBLEM AND NEED

2.1 Background

While the Salinas Valley has a long history of groundwater management, additional projects and/or management actions (PMAs) are needed to eliminate overdraft in several subbasins, address seawater intrusion, and conjunctively use supplemental sources of supply. The goal of the PMAs is to ensure groundwater resources are sustainable for long-term community, economic, and environmental benefits, and to avoid undesirable effects like lasting groundwater level declines, loss of groundwater storage, and groundwater quality degradation, including seawater intrusion.

Groundwater makes up over 95% of water used within the Salinas Valley providing water for domestic, agricultural and other beneficial uses. Agriculture in Salinas Valley heavily relies on groundwater, attributing to about 90% of the extractions in the basin. Agriculture provides 1 in 5 jobs in Monterey County and is important nationally in producing a diverse selection of produce . Groundwater extraction has been the primary source of water for the Salinas Valley for over 150 years.

The two shallowest aquifers by the coast, the 180-Foot and 400-Foot Aquifers shown in Figure 1, have a direct connectivity with the Pacific Ocean, providing a pathway for seawater intrusion. Seawater intrusion into the 180-Foot and 400-Foot Aquifers occurs due to groundwater levels dropping below sea level. The Deep Aquifers also have direct connectivity with the Pacific Ocean, and though they have not been impacted by seawater intrusion to date, they are at risk. Over many decades, Monterey County Water Resources Agency (MCWRA) has studied seawater intrusion and implemented several projects to halt the seawater intrusion.

Groundwater elevation contour maps prepared over more than two decades document a landward sloping groundwater gradient in the 180-Foot and 400-Foot Aquifers from the coast towards the City of Salinas and the Gabilan Mountain Range. A prominent and persistent groundwater characteristic in the Eastside Aquifer Subbasin is the large groundwater depression referred to as the Eastside trough. Groundwater levels in portions of the shallow and deeper zones of the Eastside Aquifer remain below sea level.

Since 1998, MWCRA and Monterey One Water (M1W) have cooperated to implement Monterey County Water Recycling Projects. The M1W's Regional Treatment Plant (RTP) provides treatment of wastewater to non-potable recycled water standards and delivers it to the Castroville Seawater Intrusion Project (CSIP) to augment groundwater supplies for agricultural irrigation on about 12,000 acres in the seawater intruded area near Castroville. In 2010, MCWRA began to operate the Salinas River Diversion Facility (SRDF) to add surface water to CSIP as part of the Salinas Valley Water Project, which operates the upstream reservoirs.

While investments in supplemental supply projects have slowed the rate of seawater intrusion, they have not fully addressed the problem. Groundwater elevations remain below sea level and have continued to decline especially during recent periods of drought. Following the 2014-2016 drought, MCWRA identified new islands of seawater intrusion

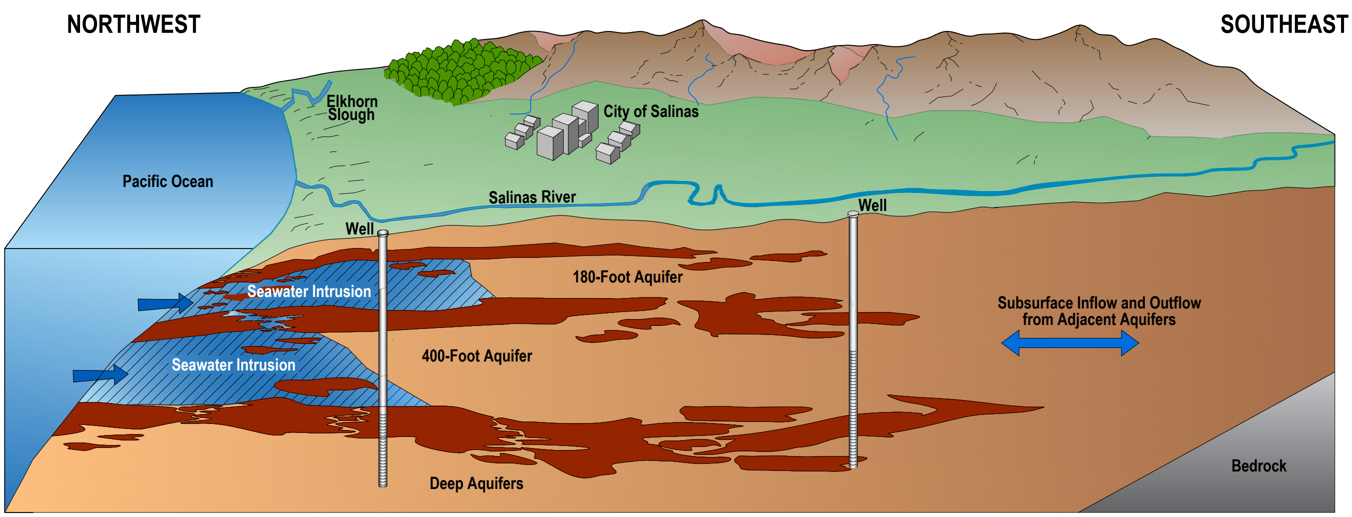

Figure 1. Cross-section of Salinas Valley near Ocean

in the 400-Foot Aquifer, prompting new investigations for actions to slow or halt the advancement of seawater intrusion.

Modeling of current and futures conditions (see Figure 2.a, 2.b) shows that groundwater levels are likely to continue to decline across the northern part of the Salinas Valley and that seawater will advance inland through the City of Salinas, compromising both agricultural and urban water supplies from Salinas to the coast. Continued groundwater extraction within and nearby the seawater intruded area, which includes the CSIP service area, is projected to be impacted by increasing chloride concentrations over time. As seawater intrusion has advanced, new wells have been drilled into the Deep Aquifers underlying the 180-Foot and 400-Foot Aquifers for a replacement supply. However, the Deep Aquifers are also over drafted and declining groundwater elevations have increased the risk of seawater intrusion in them.

Actions are needed to ensure the viability of current and future water supplies, especially within areas considered to be vulnerable due to the presence of pathways and conduits for seawater intrusion. The GSA has prepared a GSP as required by SGMA laying out potential projects, including this one, with the goal to develop a plan to address these problems.

2.2 Problem Statement

As discussed above, there is a history of groundwater concerns for the region as summarized below for
the entire Salinas Valley and the 180/400-Foot Aquifer Subbasin.

2.2.1 Valley Wide

- Groundwater is the primary source of water for all users in the Salinas Valley Basin.
- Supply and demand for groundwater is out of balance in parts of the valley.
- Groundwater levels over time have continued to decline.
- Future drought conditions present uncertainties from year to year, as does potential for flooding in extreme wet years.
- Existing infrastructure is aging and needs maintenance and improvements, some with significant costs.
- Potential supplemental supply projects come with significant costs and take time to implement.

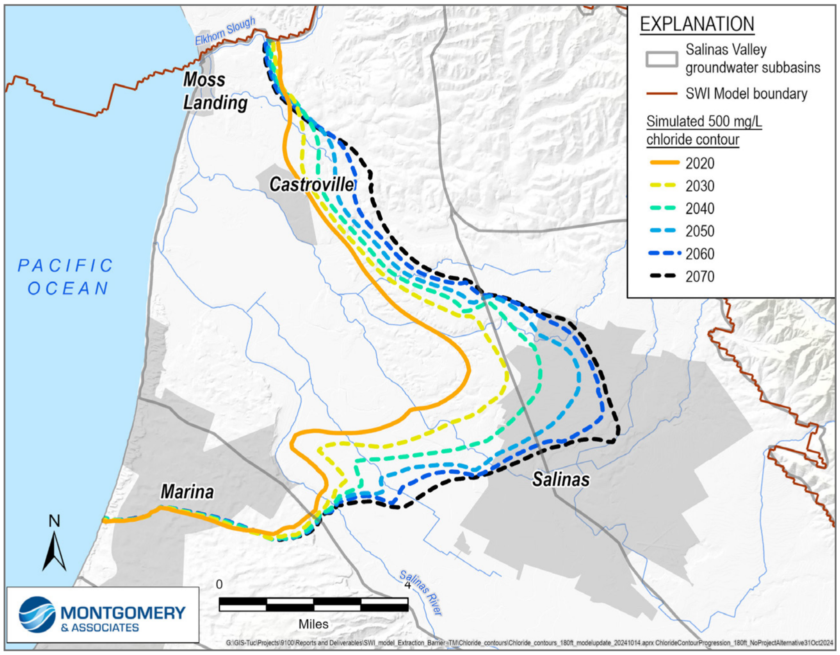

Figure 2.a. ***Seawater*** *Intrusion Projections Under No Project Alternative in 180-foot Aquifer*

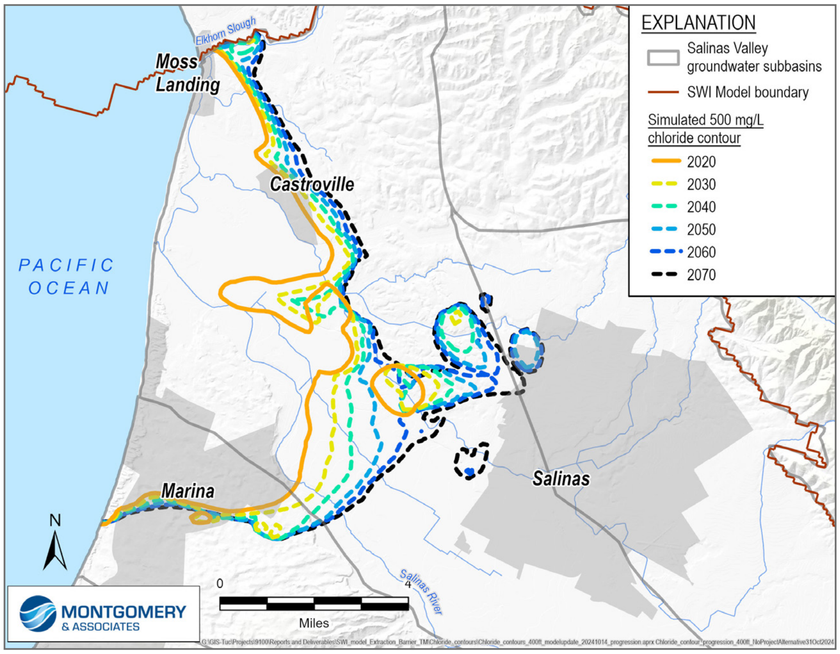

Figure 2.b. Seawater Intrusion Projections Under No Project Alternative in 400-foot Aquifer

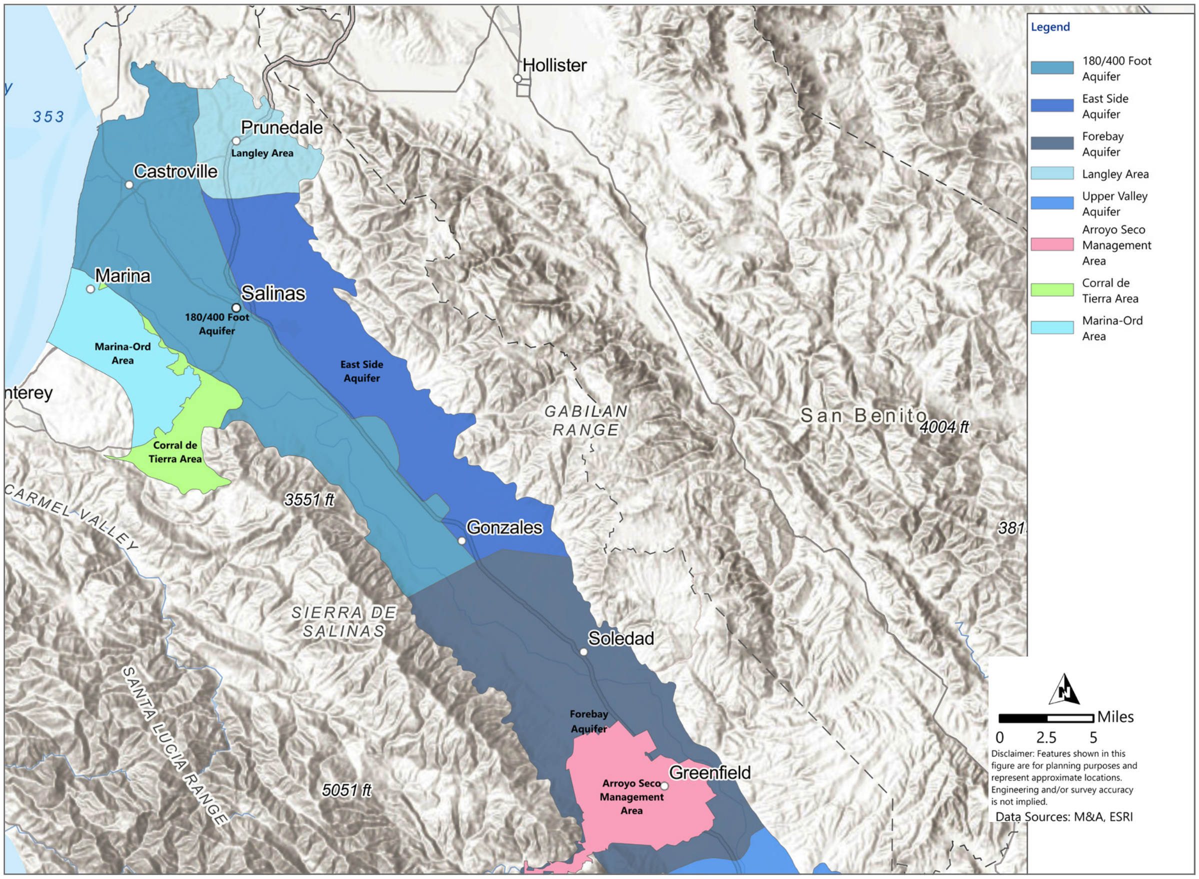

Figure 3. *Salinas Valley and Subbasins*

- Lack of cohesive regional water management has led to unsustainable groundwater conditions that pose a serious risk to current and future economic vitality of the Salinas Valley and Monterey County.
- Water quality degradation is a persistent issue.

2.2.2 180/400-Foot Aquifer Subbasin

- The Subbasin is defined by DWR as critically over drafted because of seawater intrusion.
- Seawater continues to move inland and the resulting brackish groundwater continues to impact wells.
  - Groundwater pumping continues within the CSIP area. These wells are at risk of increasing salinity over time.
  - Multiple MCWRA CSIP supplemental wells have been intruded and deemed no longer usable for irrigation.
  - Castroville, Salinas and Marina are disadvantaged communities with an at-risk water supply.
  - Castroville CSD water supply wells have been taken wells offline because of salinity increases.
- Groundwater elevations east of the seawater intrusion front remain below sea level and have continued to decline.
- On average, groundwater levels are declining with the steepest declines during periods of drought.
- Most pumping in the Subbasin occurs where supplemental recycled or surface water supplies are not available, inland of the seawater intrusion front.
- Extraction from all aquifers in the Subbasin occurs at a rate greater than it is recharged; inflows to the Deep Aquifers do not occur within a timescale for use/management. Confined aquifers recharge slowly.
- Currently, deep aquifers are not a long-term sustainable replacement supply for shallower aquifers that become impaired, because of the risk of seawater intrusion and additional undesirable results.

2.2.3 Eastside Aquifer Subbasin

- Subbasin is defined by DWR as high priority.
- On average, groundwater levels are declining with the steepest declines during periods of drought.
- Groundwater elevations east of the seawater intrusion front are below sea level and have continued to decline.

- Seawater continues to move inland towards the Subbasin.
- Pumping exceeds recharge by approximately 10,000 acre-feet per year.
- Subbasin has limited surface water that could recharge groundwater.
- Complex geology limits recharge to the depths that support many production wells.
- Decades of declining groundwater levels and loss of storage are challenging to recover.

3.0 CONCEPT FEASIBILITY

The GSA's Groundwater Sustainability Plan identified several projects that have been combined into this study:
1) a seawater intrusion extraction barrier,
2) development of a new regional water supply to offset groundwater use, and 3) injection of water into the groundwater basin to raise water levels, improve quality and further prevent seawater intrusion.

3.1 Project Concept

The concept for this project is to establish a string of extraction wells across the mouth of the aquifer, near the coast, to capture seawater on the coastal side of the wells and to start pulling back intruded seawater from the inland side of the wells. This extracted brackish groundwater would be then treated through reverse osmosis to remove salts and create a supply that meets potable water standards. The treated water would be distributed inland to offset groundwater users for both domestic and agricultural customers. The extraction wells and treatment would be run at a fairly steady flow rate to prevent seawater intrusion from leaking past the wells. This would result in times (particularly winter months) where more treated water is available than users demand. This excess treated water would be injected back into the groundwater basin inland along the edge of the seawater intrusion front to assist in raising groundwater levels to push the intruded zone back to the coast. The injection of the high-quality water would also improve groundwater quality. Graphic illustrations of the project concept and its components are shown in Figures 4 and 5.

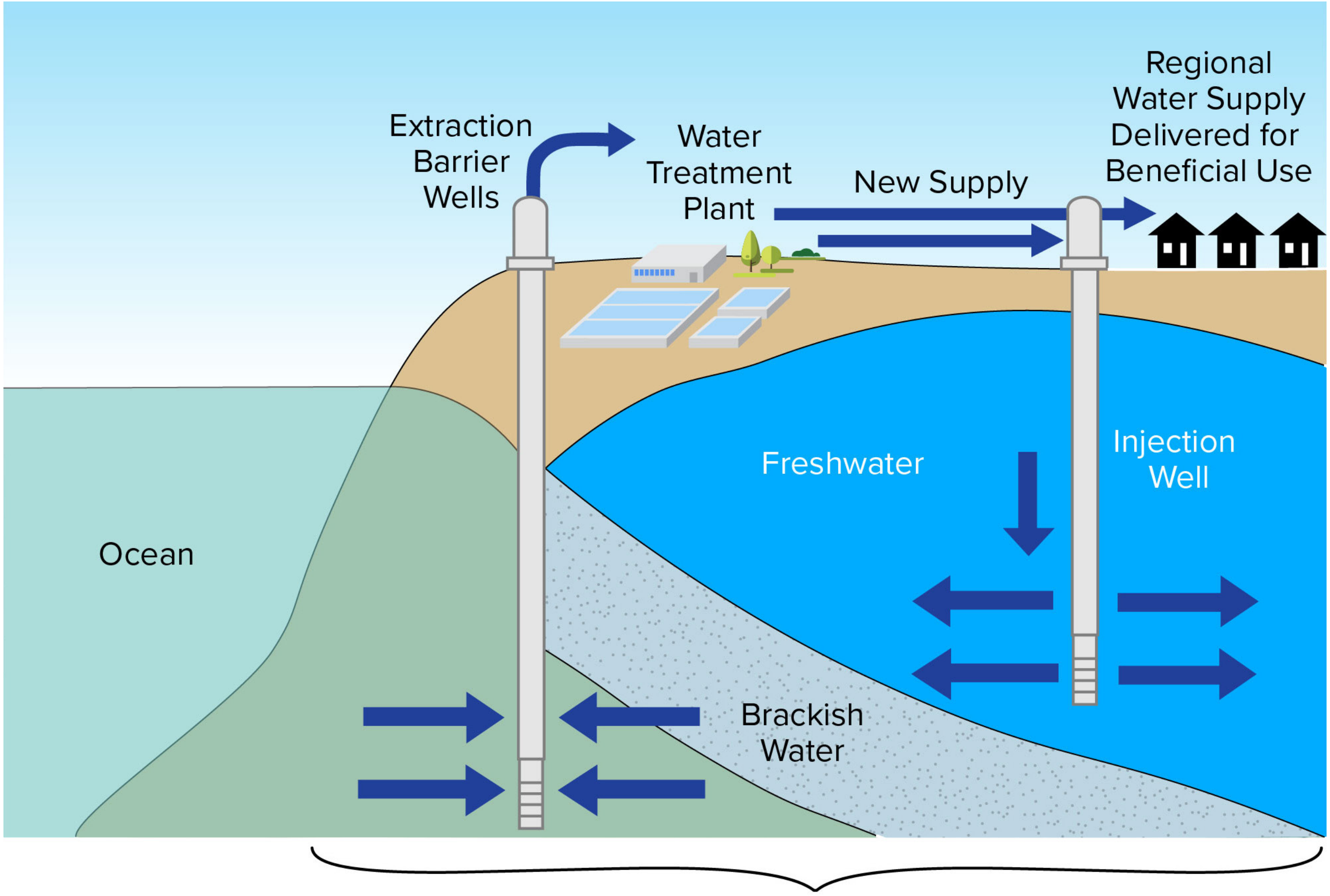

Figure 4. Concept for Brackish Groundwater Restoration Project

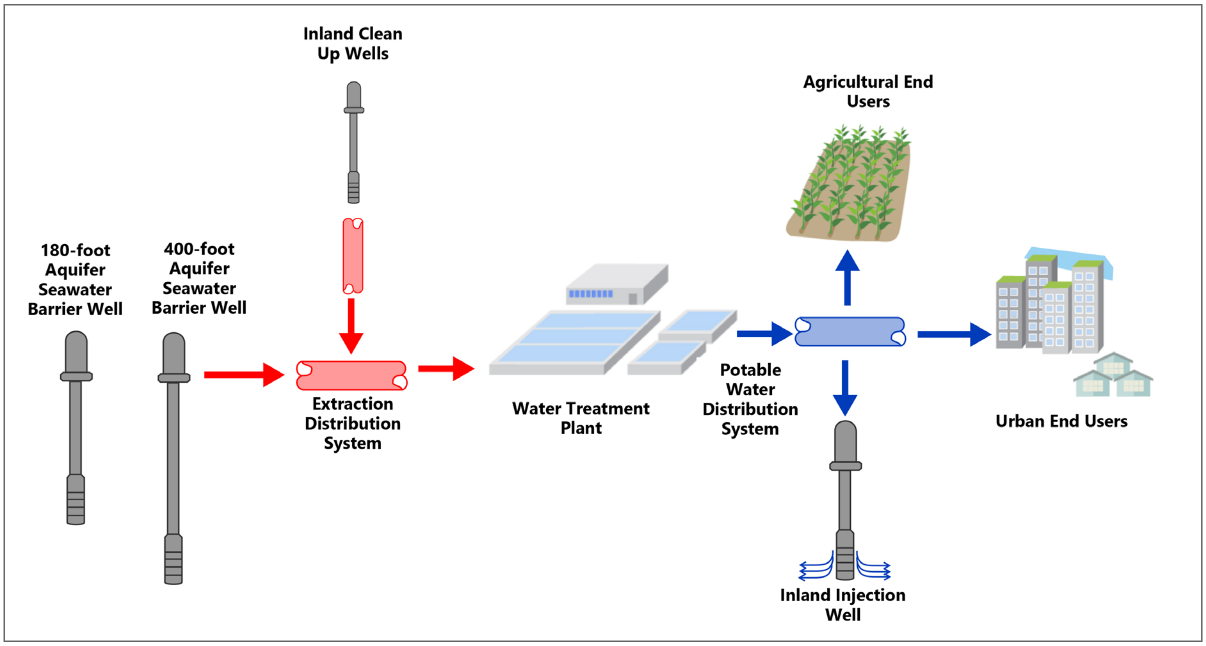

Figure 5. *Components of Brackish Groundwater Restoration Project*

3.2 Project Feasibility

The project concept was developed over the course of many months working closely with Montgomery and Associates (M&A) groundwater modeling team to assess viability and performance of different configurations of extraction wells, groundwater user offsets and injection wells. Optimal extraction well configurations were determined by trying to strike a balance between avoiding coastal environmental resources and floodplains, while not placing the wells too far inland. Potential end users and locations for deliveries were identified through review of groundwater extraction, water use records and personal communication with utility representatives. The strategy of adding injection wells was evaluated by modeling configurations with and without the injection wells. The finding from these modeling runs was that injection wells augment the overall effectiveness of the project. The groundwater modeling activities that helped define this project are summarized in a separate report by M&A.

The modeling results concluded that the proposed project is technically feasible and provides many benefits to meet the GSP objectives, specifically:

- Reducing seawater intrusion in the 180/400-Foot Aquifers (to the 2017 extent of the 500 mg/l chloride isocontour).
- Maintaining and improving groundwater qualities that have been impacted by seawater intrusion.
- Providing a supplemental regional water supply for domestic and agricultural users.
- Restoring groundwater levels.

Once the overall project feasibility was determined, the project team worked on developing a suite of alternatives in more detail.

4.0 ALTERNATIVE DEVELOPMENT

4.1 Philosophy for Alternatives

In developing alternatives, a range of alternatives were considered that could “bookend” the options and best describe the potential benefits and accompanying costs. The project alternatives range in size, largely driven by the ability to meet different goals. Three alternatives were developed with the following goals:

- Small Alternative – to meet GSP minimum threshold of holding seawater intrusion to 2017 levels.
- Medium Alternatives – to be a reasonable project between the small and large alternative.
- Large Alternative – to meet GSP measurable objective of pulling back the seawater intrusion to Highway 1.

4.2 Project Alternatives

The number of extraction wells, amount of water delivered to end users, and the amount of water injected varies for each alternative. Deliveries to CSIP is a high priority to offset any groundwater use from their supplemental supply wells that is directly under the seawater intruded zone. Service to municipal/ and urban users in the vicinity of the intruded zone is also prioritized with an initial focus on offsetting 180/400 Foot Aquifers use by larger users and then to offset deep aquifer use, if enough supply is available. For all alternatives, the treatment would be provided by a reverse osmosis (RO) system designed to meet potable standards. The distribution pipelines used to deliver water to end users would be a common pipe, so all users must be delivered the same quality water. Agricultural water quality objectives for boron also required that the treatment with RO be configured in a two pass, two stage mode. This configuration would achieve a 70% recovery of water. These assumptions can be verified by pilot testing in the future. All of the RO reject concentrate (or brine) would be conveyed to the existing M1W ocean outfall for disposal. Due to the need to use the M1W outfall, the location for the RO treatment is assumed to be located near the M1W facility.

4.2.1 Small Alternative

The Small Alternative configuration is shown in Figure 6 and the supply and demands are summarized in Table 1. This alternative provides a significant supply to end users but does not meet all of their water demand. end users would maintain their existing groundwater systems to supplement supplies and to meet peak month demands.

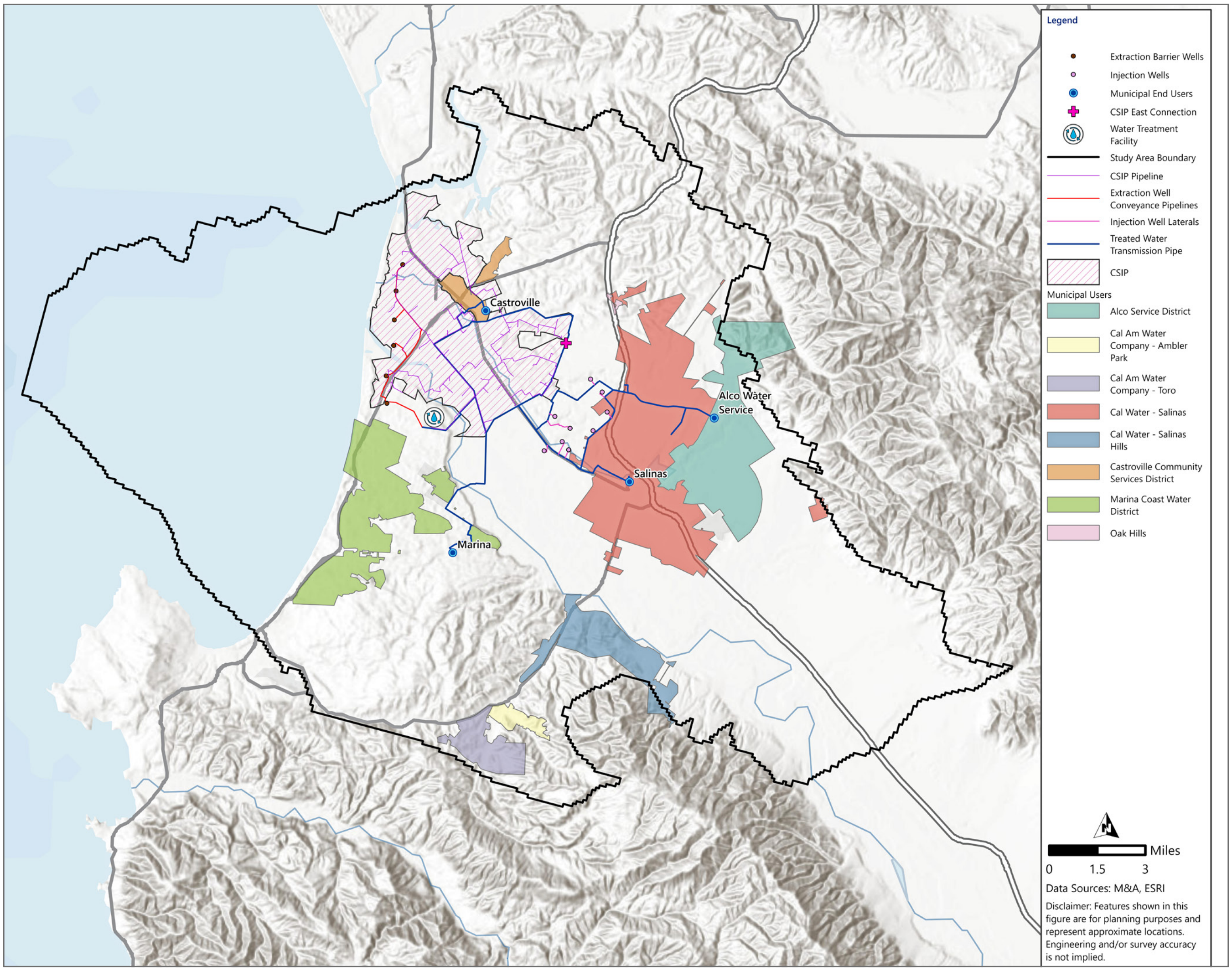

Figure 6. Small Alternative Configuration

TABLE 1. SMALL ALTERNATIVE SUPPLY AND DEMAND VOLUMES

Supply and Demand Elements: Small Alternative	
New Supply	
Number of Wells	6 in 180 ft and 6 in 400 ft aquifers
Total Extraction Capacity in 180-foot Aquifer, gpm	14,500
Total Extraction Capacity in 400-foot Aquifer, gpm	10,100
Total Extraction (gpm)	**24,600**
Total Extracted Volume (AFY)	**39,680**
Total Supply Volume AFY @ 70% Recovery	27,776
Demand Offset (AFY) [(1)]	
Alco Water Service	3,222
Cal Water - Salinas	10,152
Castroville Community Services District	738
Marina Coast Water District	1,697
CSIP	3,606
End User Demand (AFY)	**19,416**
Injection Volume (AFY)	8,593
Total Injected and End User Demand (AFY)	**28,008**

(1) Municipal user demands based on the annual average groundwater extraction volumes from 180/400 Foot Aquifers from water year 2016 – 2020. CSIP demands are based on the actual volume of groundwater extraction capacity of the CSIP supplemental wells.

The modeling results projected through 2070, presented in Figure 7, show that this alternative is able hold the seawater intrusion to the minimum threshold (2017) level in 400-Foot Aquifer, but is not quite able to meet this minimum threshold for the 180 Foot Aquifer as. Figure 7 also shows that the Small Alternative provides significant reduction in seawater intrusion as compared to the no project alternative. Figure 8 shows the modeled groundwater levels increase significantly inland due to the offset of groundwater pumping and the injection of water into the basin. There is a localized depression that forms around the project extraction wells. Mitigation measures to address this and other impacts would be included in the project should it proceed forward toward implementation.

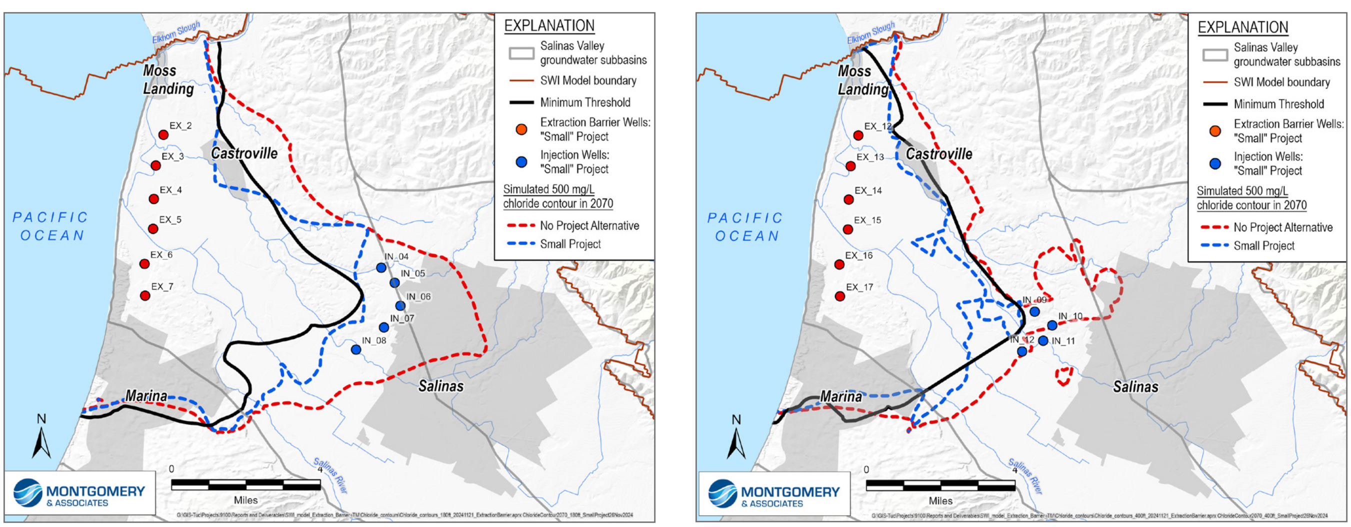

Figure 7. Small Alternative Modeling Results for Seawater Intrusion (Chloride levels) (180 and 400-foot aquifer left and right, respectively)

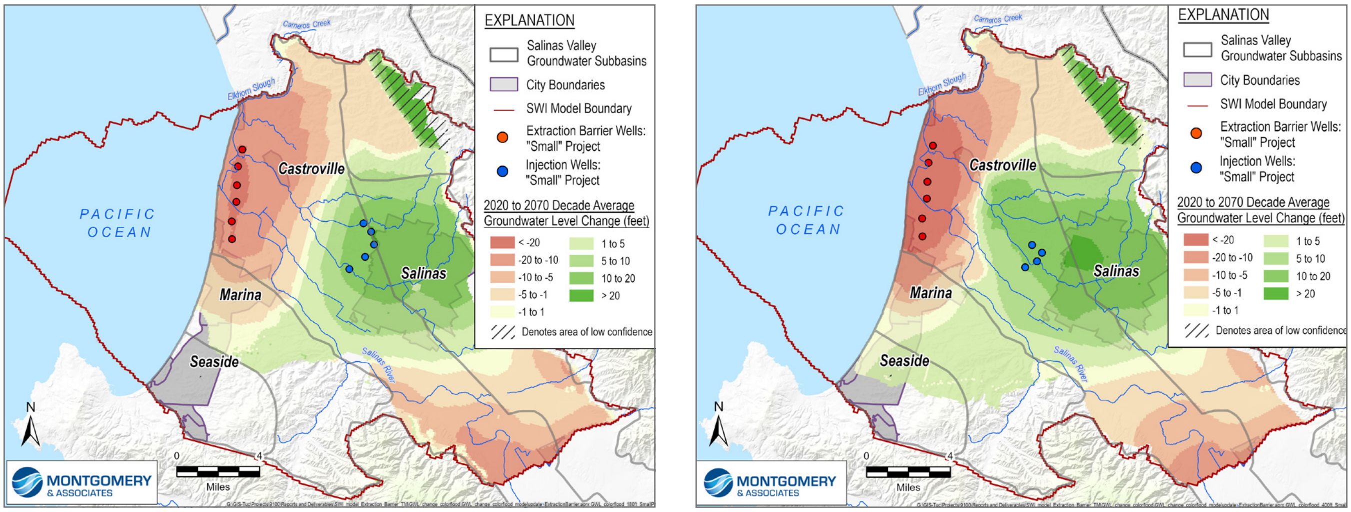

Figure 8. Small Alternative Groundwater Levels Compared to No Project Alternative (180 and 400-foot aquifer left and right, respectively)

4.2.2 Medium Alternative

The Medium Alternative configuration is shown in Figure 9 and the supply and demands summarized in Table 2. The Medium Alternative would have more extraction wells than the Small Alternative, expanding both north and south along the coast. The Medium Alternative would serve the same end users as the Small Alternative but would provide

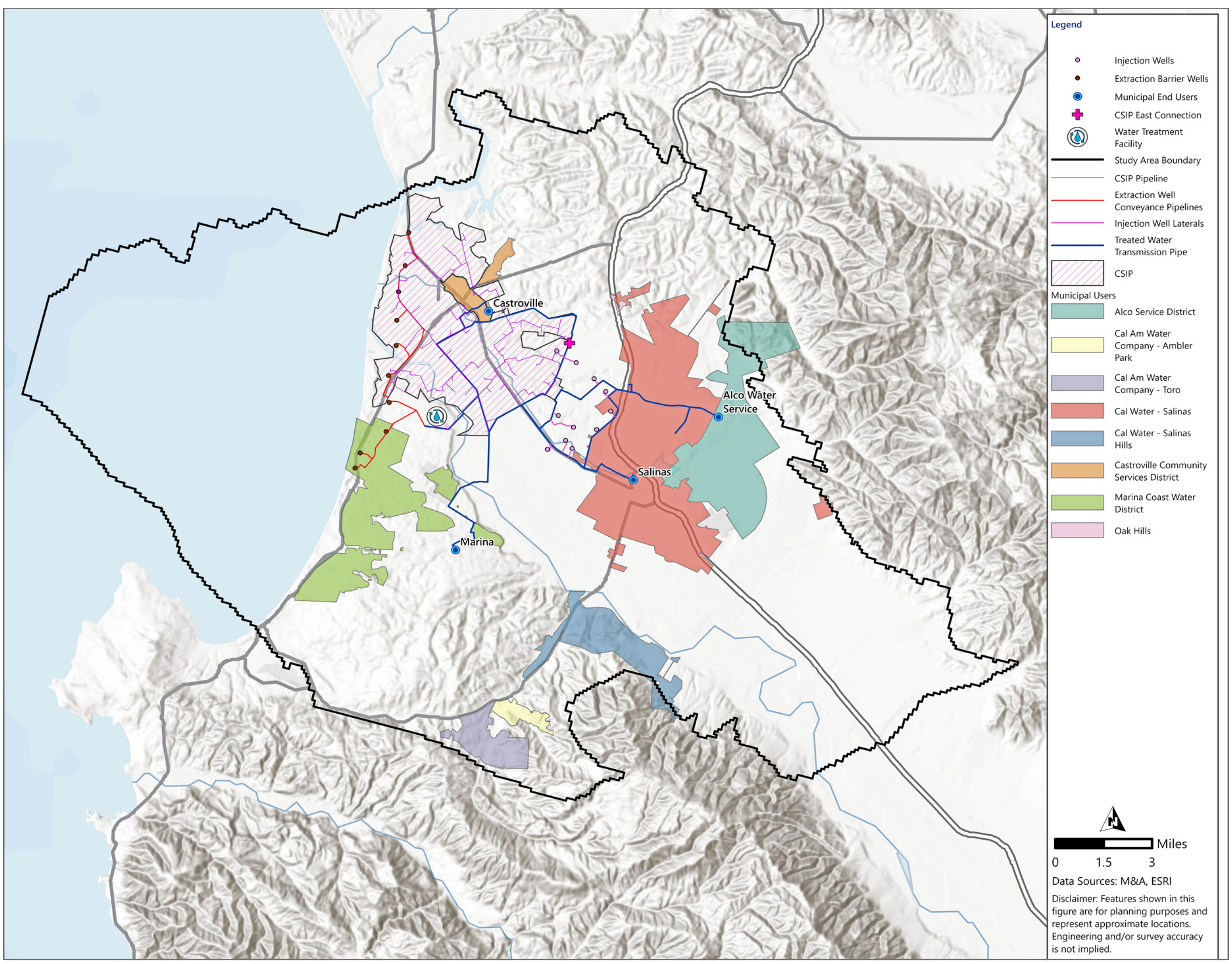

Figure 9. Medium Alternative Configuration

nearly all of the end users with their annual average demands. Peak demands would be provided by the end users' existing groundwater systems. As noted in Table 2, CSIP demand is equivalent to their current supplemental groundwater well pumping capacity which is representative of CSIP's current impact on the 180/400-Foot Aquifer. The medium alternative provides CSIP a supply of approximately 5,271 AFY which matches CSIP's 10-year historical groundwater extraction volume. However the hydrogeological model only considered a groundwater offset of 3,606 AFY, the current well capacity.

The modeling results projected though 2070 show that the Medium Alternative is able to hold the seawater intrusion to the minimum threshold (2017) level in both the 180-Foot and 400-Foot Aquifers, as well as to push the intruded zone back further toward the coast, as shown in Figure 10. Figure 11 shows the modeled groundwater levels increase significantly inland due to the offset of groundwater pumping and the injection of water into the basin. There is a localized depression that forms around the project extraction wells. Mitigation measures to address this and other impacts would be included in the project should it proceed forward toward implementation.

TABLE 2. MEDIUM ALTERNATIVE SUPPLY AND DEMAND VOLUMES

Supply and Demand Elements: Medium Alternative	
New Supply	
Number of Wells	10 in 180 ft and 10 in 400 ft aquifers
Total Extraction Capacity in 180-foot Aquifer, gpm	22,500
Total Extraction Capacity in 400-foot Aquifer, gpm	19,000
Total Extraction (gpm)	**41,500**
Total Extracted Volume (AFY)	**66,940**
Total Potable Volume AFY @ 70%	46,858
Demand Offset (AFY)[1]	
Alco Water Service	4,027
Cal Water – Salinas	14,503
Castroville Community Services District	738
Marina Coast Water District	3,217
CSIP	5,271
End User Demand Subtotal (AFY)	**27,757**
Injection Volume (AFY)	19,101
Total Injected and End User Demand (AFY)	**46,858**

1) Urban user demands based on the annual average groundwater extraction volumes from 180/400 ft aquifers from water year 2016 – 2020. CSIP demands based on average use of supplemental groundwater pumping from 180/400 ft aquifer from 2013 – 2023.

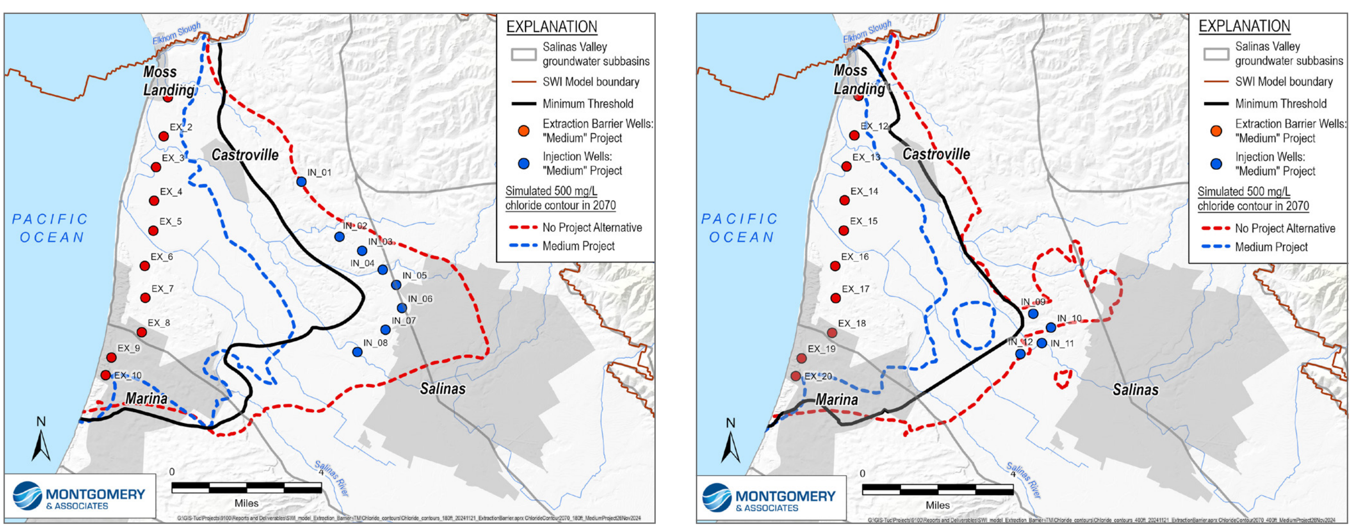

Figure 10. Medium Alternative Modeling Results for Seawater Intrusion (Chloride levels) (180 and 400-foot aquifer left and right, respectively)

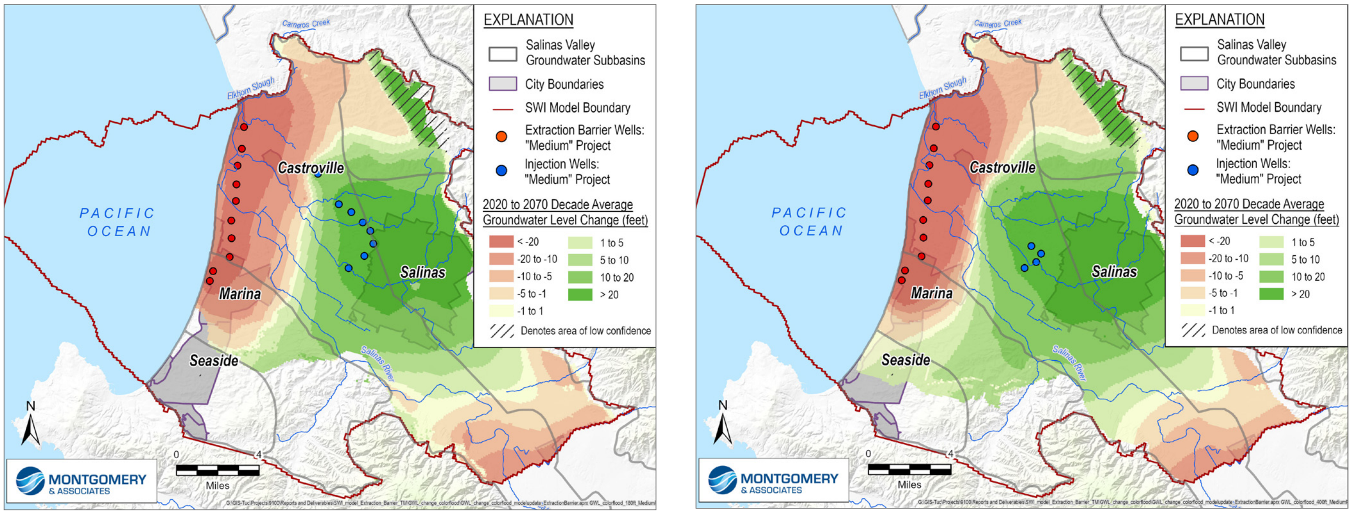

Figure 11. Medium Alternative Modeling Results on Groundwater Levels (180 and 400-foot aquifer left and right, respectively)

4.2.3 Large Alternative

The Large Alternative configuration is shown in Figure 12 and the supply and demands summarized in Table 3. The Large Alternative has more extraction wells than the Small or Medium Alternatives, expanding inland with additional "cleanup wells" that

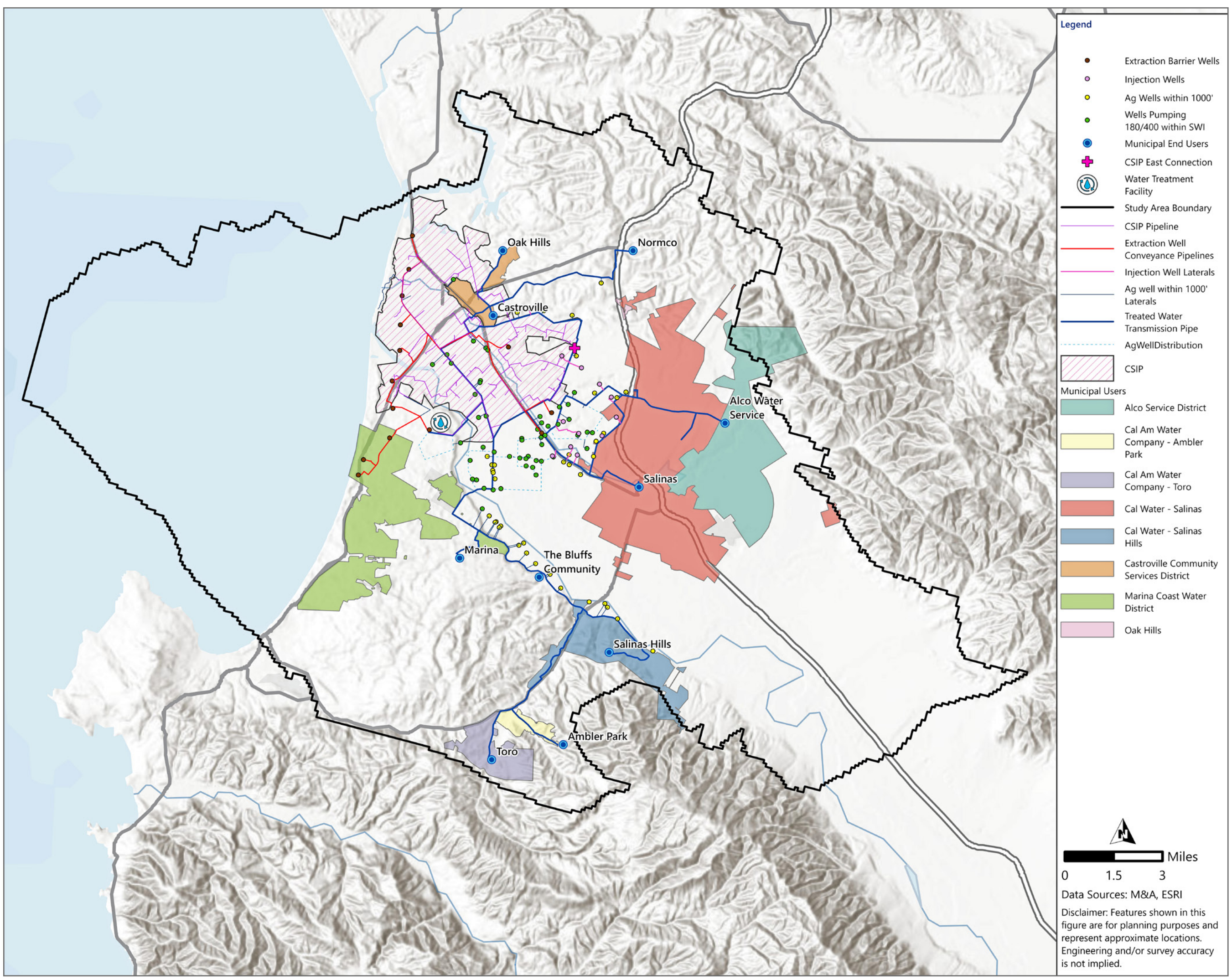

Figure 12. Large Alternative Configuration

would help remove poor quality brackish water from the basin to further restoration. The Large Alternative expands the end users out to all the smaller satellite municipal systems in the project vicinity, as well as serves agricultural end users along the way to municipal urban end users. Peak demands would still be provided by the end users' existing groundwater systems, but end users are supplied with 100% of their historical annual average. Similarly to the Medium Alternative, the Large Alternative provides approximately, 5,271 AFY to CSIP, matching the 10-year historical groundwater extraction volume. However, the hydrogeological model only considered a groundwater offset of 3,606 AFY, the current well capacity.

The modeling results projected through 2070 show that the Large Alternative pulls the seawater intrusion back to well below the minimum threshold (2017) level in both the 180-Foot and 400-Foot Aquifers, as shown in Figure 13. However, this alternative is not able to meet the measurable objective of pulling the intruded zone all the way back to Highway 1 by 2070. Figure 14 shows the modeled groundwater levels increase significantly inland due to the offset of groundwater pumping and the injection of water into the basin. There is a localized depression that forms around the extraction wells. Mitigation measures to address this and other impacts would be included in the project should it proceed forward toward implementation.

TABLE 3. LARGE ALTERNATIVE SUPPLY AND DEMAND VOLUMES

Supply and Demand Elements: Large Alternative	
Extraction Wells	
Number of Wells	14 in 180 ft and 14 in 400 ft aquifers
Total Extraction Capacity in 180-foot Aquifer (gpm)	32,022
Total Extraction Capacity in 400-foot Aquifer (gpm)	28,019
Total Extraction (gpm)	**60,042**
Total Extraction Volume (AFY)	**96,847**
Total Potable Volume AFY @ 70%	67,793
Demand Offset (AFY)[1]	
Alco Water Service	4,027
Cal Water - Salinas	14,503
Castroville Community Services District	738
Marina Coast Water District	3,217
CSIP (offsetting supplemental groundwater use)	5,271
Cal Water - Salinas Hills	1,806
All Ag well within 180/400 and Other within SWI	6,034
Ag wells within 1,000 Feet of Potable Water Transmission Main	2,390
Satellite Municipal Facilities (Normco, Toro, Oak Hills, Ambler Park)	765
End User Demand Subtotal	**38,752**
Injection Volume (AFY)	26,168
Total Injected and End User Demand (AFY)	**64,920**

1) Urban user demands based on the annual average groundwater extraction volumes from 180/400 ft aquifers from water year 2016 – 2020. CSIP demands based on average of supplemental groundwater pumping from 180/400 ft aquifer from 2013 – 2023.

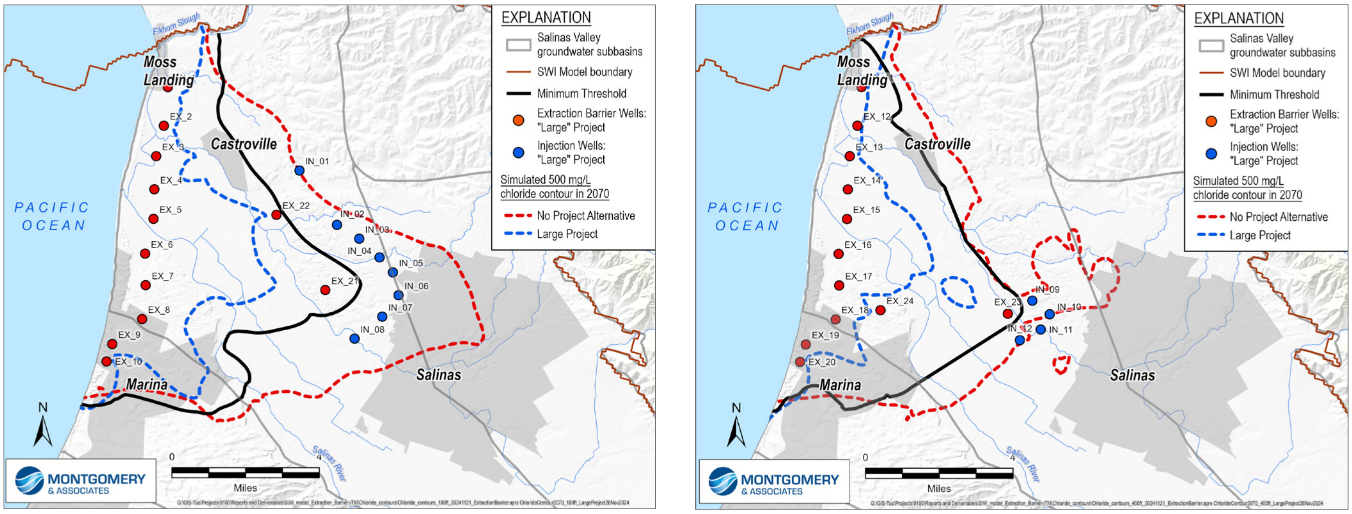

Figure 13. *Large Alternative Modeling Results for Seawater Intrusion (Chloride levels) (180 and 400-foot aquifer left and right, respectively)*

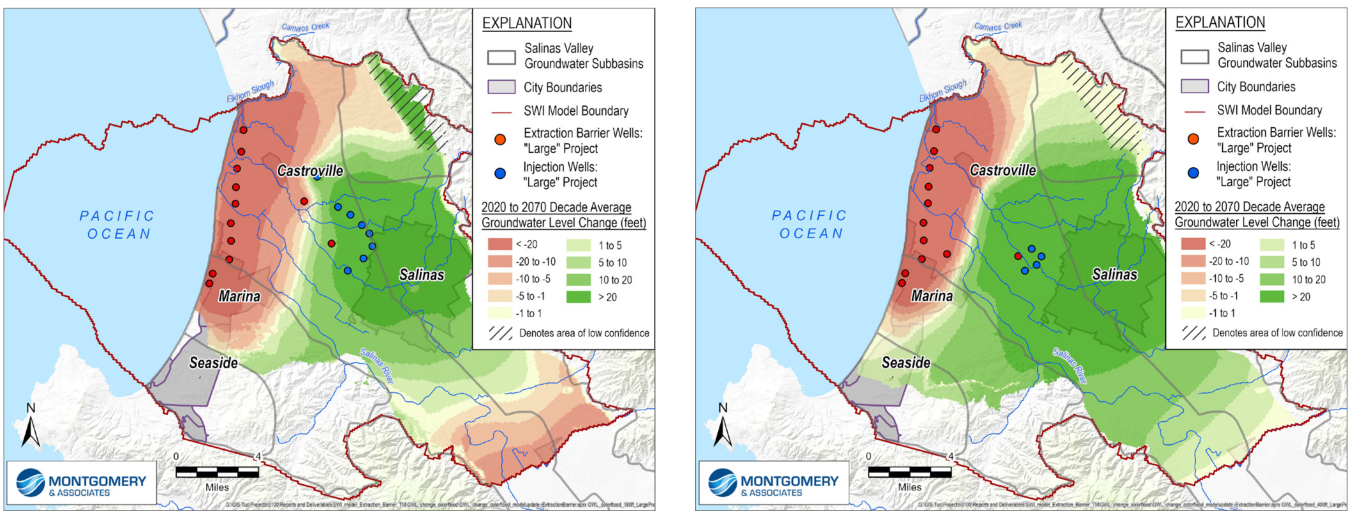

Figure 14. *Large Alternative Modeling Results on Groundwater Levels (180 and 400-foot aquifer left and right, respectively)*

4.3 Costs and Benefits

4.3.1 Estimated Project Costs

Project costs for the small, medium and large alternatives were developed at a Class 5 planning level of certainty. This means that all cost estimates had a minimum 30% contingency applied to their direct market or material costs, additionally a construction administration contingency factor of 25% was applied to the project direct costs, along with Monterey County sales tax of 7.75% on half of all direct construction costs. All project construction costs were escalated to July 2030 at a rate of 0.25% per month (4% per year) to account for inflation. Furthermore, alternatives were developed using industry standard design criteria and engineering assumptions for infrastructure development. Further detailed engineering planning, analysis, and design will be needed if the project is to continue forward.

The project financing includes the following assumptions listed in Table 4. The Small, Medium, and Large Alternative Project costs are shown in Table 5. Typical of most large infrastructure projects, it was assumed that the project would be financed through a federal or state low interest loan program (e.g. SRF or WIFIA) with a 30-year repayment period. The projected lifecycle of the project was assumed to be the same as the hydrogeological modeling, which is through the year 2070 resulting in a total lifecycle of 40 years. Lastly inflation was assumed at 2.25% per year as estimated by the Federal Reserve Bank of Cleveland for a 10-year expected inflation project. The discount rate is set at 2.75% which is the US Bureau of Reclamation recommendation for the evaluation of plans for water and related land resources.

TABLE 4. ASSUMPTIONS FOR COST ESTIMATING

Project Cost Estimate and Financing Term Assumptions	
Project Construction Contingency	30%
Construction Administration Contingency	25%
Sales Tax	7.75% (Monterey County)
Escalation to Midpoint of Construction	0.25% per month
Inflation rate	2.25%
Discount Rate	2.75%
Low Interest Financing Interest Rate	4%
Loan Term (years)	30
Projected Lifecycle (years)	40

TABLE 5. COST COMPARISON OF ALTERNATIVES

Project Cost Element	Small Alternative	Medium Alternative	Large Alternative
Extraction Well Sites	$43,600,000	$53,450,000	$58,700,000
Clean Up Well Sites	N/A	N/A	$10,300,000
Outfall Cleaning and Modifications	$6,250,000	$6,250,000	$6,250,000
Extraction Distribution	$38,900,000	$58,250,000	$97,200,000
Potable Water Distribution Transmission Mains	$142,800,000	$163,450,000	$233,900,000
Potable Water Booster Pump	$7,000,000	$11,000,000	$15,400,000
Injection Well Sites	$37,300,000	$37,300,000	$47,200,000
ROC Storage	$2,100,000	$3,500,000	$4,950,000
Land Costs	$3,100,000	$11,200,000	$11,600,000
1,000-foot Agricultural Wells Laterals	N/A	N/A	$11,650,000
Offset MCWRA Wells Laterals	N/A	N/A	$12,100,000
Water Treatment Facility	$335,000,000	$522,000,000	$758,000,000
Construction Subtotal	**$616,050,000**	**$866,400,000**	**$1,267,250,000**
Soft Costs at 17% (Planning, Permitting, Design, Administration, Legal, Construction Management) Subtotal	$104,730,000	$147,290,000	$215,440,000
Grand Total Project Cost	**$720,780,000**	**$1,013,690,000**	**$1,482,690,000**
Total Project Annual O&M Costs	$69,334,000	$106,655,000	$147,621,000
Estimated Annual Loan Repayment Amount	$41,682,779	$58,621,793	$85,744,110
Estimated Total Annual Costs	$111,016,779	$165,276,793	$233,365,110
Net Present Value of Project Lifecycle Costs	$3,283,577,291	$4,939,768,373	$6,930,634,896
Net Present Value of Project Annual Costs	$82,089,432	$23,494,209	$173,265,872
Total Water Supply Yield (AFY)	28,008	46,858	64,920
Estimated Annualized Unit Costs	**$2,931**	**$2,365**	**$2,669**

Notes:
1. All costs include: 30 percent Construction Contingency, Monterey County Sales Tax of 7.75 percent applied to 50 percent of costs, and 0.25 percent monthly escalation to July 2030 as the estimated midpoint of construction.

4.3.2 Anticipated Project Benefits

There are a multitude of project benefits associated with the Brackish Groundwater Restoration Project. The SVBGSA is working on defining the benefits of the project as compared to doing nothing. In future versions, there will be a monetization of benefits, however at this time, the benefits are discussed qualitatively.

The benefits of the three alternatives fall into three major areas:

1. **Preserving Agricultural Production Value**
   This benefit can be estimated from the value of land that would be lost to seawater intrusion without the project. The total agricultural land use that falls within the seawater intrusion boundary is modeled as 27,835 acres by 2070 under the no project scenario. If this area becomes unsuitable for agricultural use due to the inability to irrigate, then the land could represent a future loss in agricultural production across the County. Monterey County agriculture plays an important role in both economic and social aspects of the region. The value of productive irrigated farmland ranges from $25,000 to $80,000 per acre in Monterey County (Trends in Agricultural Land and Lease Values, 2023). Agriculture's value extends beyond the fields, supporting a wide array of related businesses—from input suppliers and processors to distributors and service providers—while generating jobs and income that sustain local communities. Projects that help keep irrigated land in productive farming uses support the local economy and communities.
2. **Improving Affected Wells in Intruded Area**
   Approximately up to 149 wells fall between the no project alternative (2070 seawater intrusion zone) and the Brackish Groundwater Restoration Project chloride boundaries. If this project was not implemented, water quality would continue to degrade due to seawater intrusion. All of these wells would need to either be abandoned or deepened to reach a water supply that can provide a quality suitable to meet drinking water standards and for irrigation. However, the Deep Aquifers are currently in overdraft and are not a viable or sustainable long-term replacement supply; nor is there certainty that the water quality in the Deep Aquifer would remain suitable throughout the area. The total usage of groundwater for these 149 wells is 30,077 AFY. The proposed project would protect the water quality of these wells.

3. **Providing Alternative Water Supply**
   If the region was required to develop an alternative water supply because of poor quality in the existing supply wells, there are few options available. Other supply alternatives including demand management and aquifer storage and recovery (using Salinas River water) are being studied by the SVBGSA. Developing a new surface water supply of sufficient volume would require: 1) significant surface water rights and flows, 2) expensive diversion and treatment facilities, and 3) new delivery infrastructure (either direct deliveries, storage or injection wells). So far, it does not appear that there are sufficient water rights or reliable surface water flows available to provide similar groundwater offsets as the Brackish Groundwater Restoration Project.

The ongoing studies for other alternatives to this project will inform the development of potential benefits. Monetization of the benefits will be calculated in the future when there is enough information available. A USBR Feasibility Study requires monetized benefits, and the effort will inform the economic viability of the project.

5.0 SUMMARY AND NEXT STEPS

5.1 Summary

The Brackish Groundwater Restoration Project is shown through this feasibility study to be technically viable and able to meet GSP goals. While the project costs for all three alternatives are astounding, this would be a significant new water supply project, equivalent to other large new water supply projects being developed in California such as:

- The 50,000 AFY and $1.74 Billion Echo Water and Harvest Water Project in Sacramento: The EchoWater Project is the Sacramento Area

Regional Wastewater Treatment Plant upgrades to supply safe and reliable treatment for discharge into the Sacramento River and for recycled water use for irrigation by agriculture. The Harvest Water Project includes the recycled water conveyance facility infrastructure for agricultural distribution.

- The 34,000 AFY and $1.5 Billion (Phase 1) Pure Water San Diego project: Pure Water San Diego is a multi-year program that will provide nearly half of San Diego's water supply by 2035 to significantly reduce the reliance on imported water from the California Aqueduct and Colorado River. This project will utilize wastewater and treat it to a drinking water quality through indirect potable reuse. Pure Water San Diego is split into two phases with Phase 1 including a treatment facility and conveyance infrastructure and Phase 2 a treatment expansion.
- The 195,000 AFY and $5-10 Billion Hyperion 2035 Project: The Hyperion 2035 project will help the Los Angeles region to achieve their goal of recycling 100 percent of available wastewater influent at Hyperion and sourcing 70 percent of L.A.'s potable water locally by 2035 through the City's Green New Deal. This project is a potable reuse project and includes major treatment infrastructure upgrades and has a target completion date of December 2035.

The annualized unit cost for each of this project's alternatives is shown in Table 5 at less than $3000/AFY, which is comparable to many of the recycled water projects being implemented across California to provide a drought proof, reliable source of potable water. While this cost is much greater than the existing cost to pump groundwater, as shown by the historical problems in the region, it is not sustainable to continue the current pumping practices. The regional benefits provided by this project would allow the spreading of costs out to a broader area rather than only charging the specific end users of the new water supply. The GSA will investigate ways to cost share for implementation of regional projects.

5.2 Next Steps

Should SVBGSA decide to move forward with one of these alternatives, it will be necessary to address the following project components in implementing the project (listed in no specific order):

- Continue to position for grant funding for planning, design, environmental and construction costs.
- Line up end users, regional support and agreements for participation, funding, ownership and operation of project.
- Develop financial plan and rate study.
- Design and construct the recommended alternative.
- Obtain permits and clearances from applicable regulatory agencies (RWQCB, SWRCB, State and Federal Agencies).
- Conduct environmental process (California Environmental Quality Act [CEQA] and National Environmental Policy Act [NEPA] compliance and compliance documents).

5.2.1 Additional Research and Evaluation

Looking toward future implementation, there are three areas that would benefit from additional research prior to design/environmental analysis/construction: 1) a reverse osmosis pilot to determine effectiveness and required treatment configuration, 2) additional groundwater quality data, and 3) an injection well pilot.

5.2.1.1 Reverse Osmosis Pilot/Demonstration

This feasibility study was conducted with relatively limited data on groundwater quality in the seawater intruded zone as most of the wells in this zone have been destroyed. The limited data was used with water quality modeling to estimate the size and configuration required for the RO brackish water desalination. Additional data and piloting would be beneficial to refine design criteria. There are several items related treatment to that would be helpful to better understand prior to design:

1. Better define intruded water quality.
2. Is pretreatment for iron and manganese needed?
3. Is a 2-pass system configuration for RO needed for boron removal?
4. What is the water quality of the RO concentrate (brine)?
5. What % recovery can be achieved?

These items could be investigated through additional groundwater sampling and a reverse osmosis pilot. Currently, the Castroville Community Services District (CCSD), a disadvantaged community in the project area, has had to abandon wells that have been affected by seawater intrusion due to elevated TDS and chlorides. CCSD is interested in developing a brackish water desalting project to treat their Well #3 that pulls from the 400-Foot Aquifer as an interim solution for their water supply until this (or another) project moves forward with developing new water supplies that can serve CCSD. Doing a brackish water desalting pilot project for Well #3 would provide valuable information regarding water quality, treatment efficacy and performance, and provide design criteria for a larger scale system. As a future end user for this regional project, Castroville's Well #3 Desalter Project can serve as an important demonstration and pilot for a future full scale, regional project.

5.2.1.2 Additional Groundwater Data

In addition to the research needed for brackish water desalting, more water quality data in the intruded zone is needed to better define the treatment design. While CCSD's Well #3 can provide some of the needed data, it is recommended that monitoring wells be installed across the zone of where proposed extraction would occur to obtain a broader groundwater quality data set in the existing intruded area. Monitoring wells could be placed in the approximate location of each of the proposed extraction wells and data collected at regular intervals to better define the TDS, chlorides, and general minerals that would be in the extracted water that could affect the RO treatment. Monitoring wells would need to be paired to achieve testing of both the 180 ft and 400 ft aquifers. Development of monitoring wells in the vicinity of the proposed wells would inform the effort for moving forward with full scale well drilling and implementation as easements and coordination with property owners will be critical to both efforts (monitoring wells and extraction wells).

5.2.1.3 Pilot Injection Well

This project proposes to inject treated water when there is excess volume not used by the urban and agricultural end users. It is expected that the injection would be seasonal, primarily during late fall, winter and early spring months when temperatures and precipitation reduce user demands. Injection of RO treated water is not a new concept as it has been used in recycled water groundwater recharge projects for many decades. However, each soil and aquifer have its own characteristics and the injection rates and need for maintenance can vary significantly across different locations. To help better define the local characteristics, it is suggested that injection be piloted, preferably with treated water. This would require drilling an injection well and equipping it with suitable (permanent) underground infrastructure so the well could be used for full scale use in the future. The above ground infrastructure (pumps, electrical, VFDs…) could be a temporary installation for the duration of the pilot test and equipped for permanent use later. Conversely, the well could be fully equipped for the pilot, but at a higher cost. If the Castroville Well #3 Desalter Pilot Project RO system is installed, this water could be used for the injection pilot.

5.2.2 Implementation Schedule

Table 6 presents a preliminary implementation schedule for the Brackish Groundwater Restoration Project.

TABLE 6. EXAMPLE IMPLEMENTATION SCHEDULE

Description	Start Year	
Project Planning		
Additional studies to determine end users and finalize size of project	2025	2027
Partnering and framework for implementation	2025	2027
Financial planning and rate studies	2026	2028
Pilot/Demonstration Phase – RO pilot, GW monitoring, GW injection		
Planning/Permitting/CEQA	2025	2026
Technical Design	2025	2026
Construction	2026	2027
Operation/Testing	2027	2029
Environmental Documentation for Full Project		
Environmental Impact Report (EIR)	2027	2029
Full Project Implementation		
Technical Design	2027	2030
Construction	2030	2034
Permitting	2027	2034

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