



TECHNICAL MEMORANDUM

DATE: October 2, 2025 **PROJECT #:** 9100.94

TO: Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA)

CC: 180/400-Foot Aquifer Subbasin Implementation Committee

FROM: Hanni Blair, Derrik Williams, P.G., C.Hg., Abby Ostovar, Ph.D., and Kayla Bicknell

PROJECT: Salinas Valley Brackish Groundwater Restoration Project

SUBJECT: Brackish Groundwater Restoration Project Scenarios Modeling Results

INTRODUCTION

The 180/400-Foot Aquifer Subbasin (180/400 Subbasin) Groundwater Sustainability Plan (GSP) and GSP Amendment 1 identified projects and management actions to mitigate the undesirable effects of seawater intrusion in the Salinas Valley, including a seawater extraction barrier project and a regional water supply project. The Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) combined both the seawater extraction barrier and regional water supply projects into 1 project called the Salinas Valley Brackish Groundwater Restoration (BGR) Project. Working with Carollo Engineers, Montgomery & Associates (M&A) conducted groundwater modeling to evaluate if the project concept could effectively achieve GSP goals of preventing further seawater intrusion into the 180-Foot and 400-Foot Aquifers and drawing existing seawater intrusion back toward the coast.

The seawater extraction barrier consists of a series of extraction wells near the coastline in the 180/400 and Monterey Subbasins. These wells operate continuously to create a hydraulic barrier by lowering groundwater levels and intercepting seawater. The extracted water is brackish—a mixture of fresh water and salt water—which can be desalinated to produce a consistent source of treated water for direct use or injection. The treated brackish water could be used in lieu of groundwater pumping for municipal or agricultural water demands or could be injected into the 180-Foot and/or 400-Foot Aquifers. During periods of reduced groundwater demand, such as the winter months, the treated brackish water would be injected back into the aquifers. Reducing inland groundwater pumping and injecting treated water complements and enhances the extraction barrier's effectiveness by raising inland groundwater elevations and creating local hydraulic gradients near the injection sites that reverse the direction of seawater intrusion and improve groundwater quality.

Results from initial groundwater modeling informed the development of the first 3 project scenarios presented in the BGR Project Feasibility Study:

- Extraction, Treatment, and Direct Deliveries Plus Injection Wells (Small)
- Extraction, Treatment, and Direct Deliveries Plus Injection (Medium)
- Extraction, Treatment, and Direct Deliveries Plus Injection (Large)

These project scenarios vary in scope and cost, but are developed to target specific GSP seawater intrusion goals. Building on these first 3 projects, 4 additional project scenarios were introduced to investigate alternative strategies:

- Extraction, Treatment, and Injection Only (Injection Only)
- Extraction, Treatment, and Eastside Injection Only (Eastside Injection Only)
- Extraction North of River Only, Treatment, and Direct Deliveries Plus Injection (North of River Only)
- Extraction from the 180-Foot Aquifer, Treatment, and Injection Only in the 400-Foot Aquifer (Extract from 180/Inject into 400)

These additional project scenarios provide further insight into the potential performance and flexibility of the project concept under different implementation strategies.

While the Study focuses on the year 2040—the SGMA-mandated deadline for achieving groundwater sustainability—this memo extends the analysis through 2070 to evaluate the full SGMA implementation period and approximate lifespan of the project. Initial groundwater modeling indicated that several years of project operation will be necessary to halt and reverse seawater intrusion in the Salinas Valley. The time required to fully meet the GSP’s seawater intrusion goals will depend on the project’s size and scope and the duration of planning and construction. The following sections summarize the groundwater modeling of all 7 project scenarios.

PROJECT SCENARIO MODELING SETUP

M&A conducted groundwater modeling with a predictive version of the Salinas Valley Seawater Intrusion Model (SWI Model), version 2 released in 2024. The SWI Model is a variable density regional groundwater flow and solute transport model that includes the ability to simulate chloride concentration changes (M&A, 2023 and 2024). It is calibrated to historical groundwater elevations and the historical rate and direction of seawater intrusion, based largely on the 500 milligrams per liter (mg/L) chloride isocontours developed by Monterey County Water

Resources Agency (MCWRA). The SWI Model simulates groundwater conditions on a regional scale and may not reflect specific conditions in any particular location.

The predictive version of the SWI Model was first used to estimate future groundwater conditions if no new projects and management actions are implemented (M&A, 2024). This simulation is referred to as the No Project Scenario. It simulates potential seawater intrusion from water year (WY) 2021 through WY 2070. Project scenarios are then assessed by comparing project scenario simulation results to the No Project Scenario model results.

Project scenarios are developed by modifying the No Project Scenario; these modifications include the addition of extraction and injection wells in the 180-Foot and/or 400-Foot Aquifers, and for some scenarios the elimination, or offset, of pumping by selected groundwater users that receive treated water from the project. Project scenarios were simulated using various well locations, numbers of wells, extraction and injection rates, and pumping offsets for existing groundwater users.

Working with Carollo Engineers and SVBGSA, the project scenarios were developed to represent a range of costs and potential benefits while still being technically feasible and meeting GSP goals. The first 3 project scenarios were developed to target the following groundwater sustainability goals:

- Small: Designed to meet the GSP minimum threshold for seawater intrusion, which if not met, is considered an undesirable result under SGMA. The minimum threshold in the 180/400 Subbasin corresponds to the 2017 extent of the 500 mg/L chloride concentration isocontours as mapped by MCWRA in both the 180-Foot and 400-Foot Aquifers.
- Medium: Designed to represent a middle ground between the Small and Large Projects in terms of scope and cost.
- Large: Designed to achieve the GSP measurable objective, which is the target for groundwater sustainability. The measurable objective is to reduce the extent of seawater intrusion to Highway 1.

The 4 additional project scenarios were developed to evaluate alternative strategies to meeting the GSP goals:

- Injection Only: Designed to minimize direct delivery of treated water and allow continued groundwater pumping by existing wells. Rather than delivering treated water, the treated water is solely injected into the 180- and 400-Foot Aquifers.
- Eastside Injection Only: Designed to emphasize raising groundwater levels in the Eastside Subbasin through injection of treated water from the extraction barrier.

- North of River Only: Designed to minimize any influence of the extraction barrier on the Monterey Subbasin by testing the effectiveness of a smaller barrier located only within the 180/400 Subbasin and north of the Salinas River.
- Extract from 180/Inject into 400: Designed to reduce extraction barrier drawdown effects on existing wells by only extracting from the 180-Foot Aquifer and injecting the treated water into the 400-Foot Aquifer.

The objectives of the simulated scenarios are summarized in Table 1 and assumptions for the various project scenarios are detailed in the following sections.

Table 1. Project Goals by Scenario

Scenario Name	Goal	Description
No Project Scenario	No project or management actions; "status quo"	
Small	Achieve GSP minimum threshold; avoid undesirable results	2017 extent of the 500 mg/L chloride concentration isocontours as mapped by MCWRA in both the 180-Foot and 400-Foot Aquifers*
Medium	Middle ground between GSP minimum threshold and measurable objective	
Large	Achieve GSP measurable objective; achieve groundwater sustainability	500 mg/L chloride concentration isocontours at Highway 1 in both the 180-Foot and 400-Foot Aquifers*
Injection Only	Similar to the Medium Project Scenario – Achieve minimum thresholds but will likely be short of measurable objectives	
Eastside Injection Only		
North of River Only		
Extract from 180/Inject into 400		

*When modeling the projects, the simulated 2017 extent of the 500 mg/L chloride isocontour is used to be able to compare simulated results to simulated results.

No Project Scenario Assumptions

The SWI Model No Project Scenario includes the following assumptions:

- Land use remains constant throughout the simulation. The average groundwater demands from the last 5 years of the historical SWI Model (WY 2016-2020 monthly average) are carried forward.
- Boundary conditions are a continuation of recent hydrologic conditions (WY 1996-2018) in the Salinas Valley.
- Climate change and sea level rise are not simulated.

For a detailed summary of the SWI Model No Project Scenario, see Attachment 2 of the *2024 Seawater Intrusion Model Updates (Addendum 2 to the Salinas Valley Seawater Intrusion Model Report)* technical memorandum (M&A, 2024).

Brackish Groundwater Restoration Project Scenario Model Conceptualizations and Assumptions

SVBGSA, Carollo Engineers, and M&A jointly developed the BGR project scenarios. For each of these scenarios, the team determined the project components including location and number of extraction barrier wells, injection wells, clean-up wells, the rates of extraction and injection, and the pumping offsets resulting from treated water being provided to current groundwater users. All simulations assume project wells, including extraction barrier, clean-up, and injection wells, are installed by October 2030. The project operates continuously from WY 2031 through WY 2070.

Extraction Barrier and Clean-Up Wells Assumptions

The simulated extraction barriers consist of a line of wells that extract at rates sufficient to create a continuous groundwater depression along or near the coast, thereby preventing the advance of seawater inland past the wells. The wells draw some water from the ocean side of the line of wells and some from the inland side. Any land between the extraction barrier and the coast is assumed to remain permanently seawater intruded during the operation of the extraction wells. For this reason, the extraction barrier wells should be placed relatively close to the coast. The locations of the extraction barrier wells are informed by pre-modeling estimates of well spacing, comments received from stakeholders, and adjustments made after viewing initial model results. The extraction barrier wells in this study are placed between the coastline and Highway 1 to avoid coastal environmental resources and floodplains while not placing the wells too far inland.

Pumping rates and well spacing were adjusted based on initial modeling results to increase the efficacy of the wells. Wells spaced farther apart must pump at higher rates to create a continuous groundwater depression, forming a barrier to seawater intrusion. Closer spacing between wells allow for lower pumping rates but requires a greater number of wells along the same length of coastline. Well spacing and pumping rates also depend on the aquifer's thickness and hydraulic conductivity. Based on the aquifer properties in the model, well spacings of 2,600 to 5,600 feet are used for the extraction wells, with most being spaced approximately 4,500 feet apart. Pumping rates of 2,000 to 2,500 gallons per minute (gpm) are used for extraction wells in the 180-Foot Aquifer and pumping rates of 1,400 to 2,500 gpm are used for extraction wells in the 400-Foot Aquifer.

Extraction barrier and clean-up wells are assumed to operate continuously at a steady rate to provide constant protection against seawater intrusion. The total extraction rates of the extraction

barrier and clean-up wells (if applicable) ranges from approximately 29,900 acre-feet per year (AF/yr) for the North of the River Project, to 96,800 AF/yr for the Large Project. Table 2 summarizes the number of extraction wells by type and total extraction rates for each scenario.

Table 2. Brackish Groundwater Restoration Project Extraction Summary

Scenario Name	No. Extraction Barrier Wells (+ Clean-up Wells)			Total Extraction (AF/yr)		
	180-Foot Aquifer	400-Foot Aquifer	Total	180-Foot Aquifer	400-Foot Aquifer	Total
Small Project	6	6	12	23,400	16,300	39,700
Medium Project	10	10	20	36,300	30,700	67,000
Large Project	10 (+2)	10 (+2)	20 (+4)	51,600	45,200	96,800
Injection Only Project	10	10	20	36,300	30,700	67,000
Eastside Injection Only Project	10	10	20	36,300	30,700	67,000
North of River Only Project	5	5	10	18,600	11,300	29,900
Extract from 180/Inject into 400	10	0	10	41,400	0	41,400

The extraction barrier well locations in the 180-Foot and 400-Foot Aquifers for the 3 initial project scenarios are shown with dark blue and red dots on Figure 1. Each extraction well location includes 1 well screened in the 180-Foot Aquifer and 1 well screened in the 400-Foot Aquifer. The extraction barrier wells are co-located to reduce infrastructure needs. Extraction barrier well locations are the same in the project scenarios, though the number of wells range from 6 barrier wells in each aquifer in the Small Project Scenario, shown with the dark blue dots on Figure 1, to 10 barrier wells in each aquifer in the Medium and Large Project Scenarios, shown with the dark blue and red dots on Figure 1.

The Large Project Scenario includes the addition of clean-up extraction wells located inland of the barrier wells. The clean-up well locations in the 180-Foot and 400-Foot Aquifers are shown with green dots on Figure 1. Clean-up wells serve a purpose distinct from the extraction barrier wells by addressing seawater that has already intruded and is either too far inland to be captured by the extraction barrier wells, or would take too long to be drawn back to the extraction barrier wells. Clean-up wells extract impacted groundwater closer to the seawater intrusion front, similar to wells used in groundwater remediation projects. In the Large Project Scenario, 2 clean-up wells are placed in both the 180-Foot Aquifer and the 400-Foot Aquifer. The 2 clean-up wells in the 180-Foot Aquifer are placed within the seawater intruded area, close to the seawater intrusion front. One clean-up well is placed in the most inland intruded area in the 400-Foot Aquifer; the other 400-Foot Aquifer clean-up well is placed within the area of highest projected chloride

concentrations inland of the proposed extraction barrier. The clean-up wells are assumed to extract at a rate of 2,500 gpm in both aquifers. Addition of clean-up wells significantly increases project costs because additional piping must be constructed to transport extracted water from the inland wells to the treatment plant. For this reason, clean-up wells are only included in the Large Project Scenario.

The extraction barrier well locations in the 180-Foot and 400-Foot Aquifers for the 4 additional project scenarios are shown with dark blue and red dots on Figure 2. As with the 3 initial project scenario simulations, each extraction well location includes 1 well screened in the 180-Foot Aquifer and 1 well screened in the 400-Foot Aquifer. The 4 additional project scenarios do not include any clean-up wells.

The North of River only Project scenario extracts water from only the wells shown with dark blue dots. All other additional project scenarios extract water from the wells shown with both dark blue and red dots.

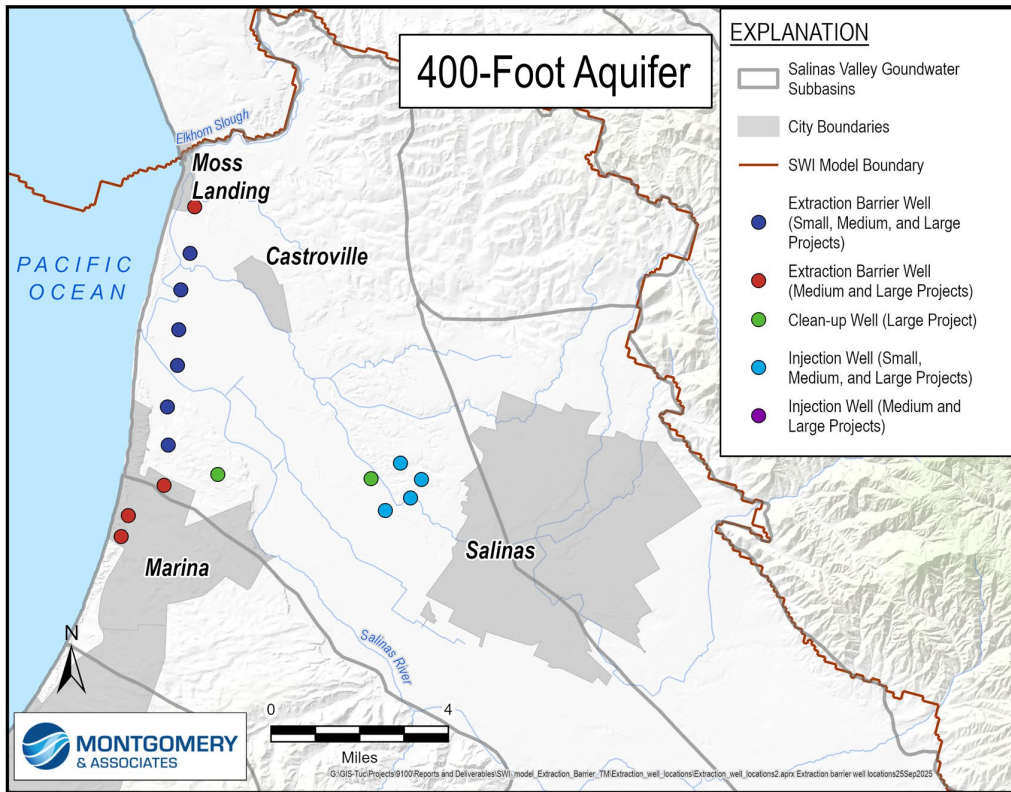
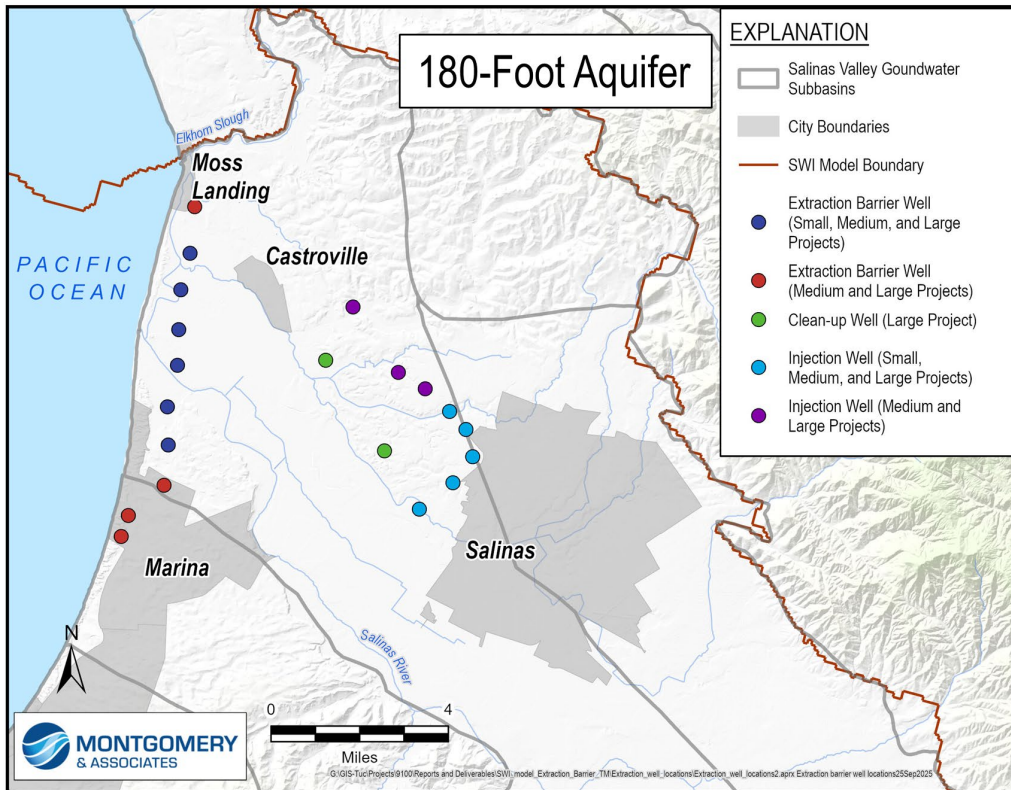


Figure 1. Extraction Barrier and Injection Well Locations in 180-Foot and 400-Foot Aquifers for the 3 Initial Project Scenarios

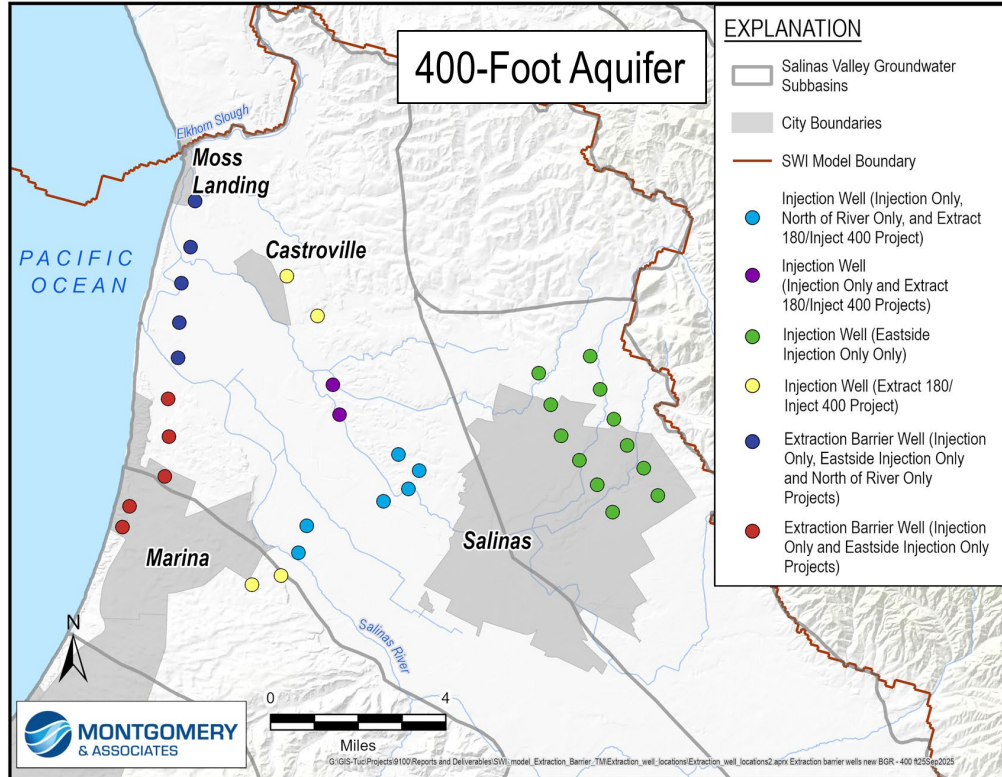
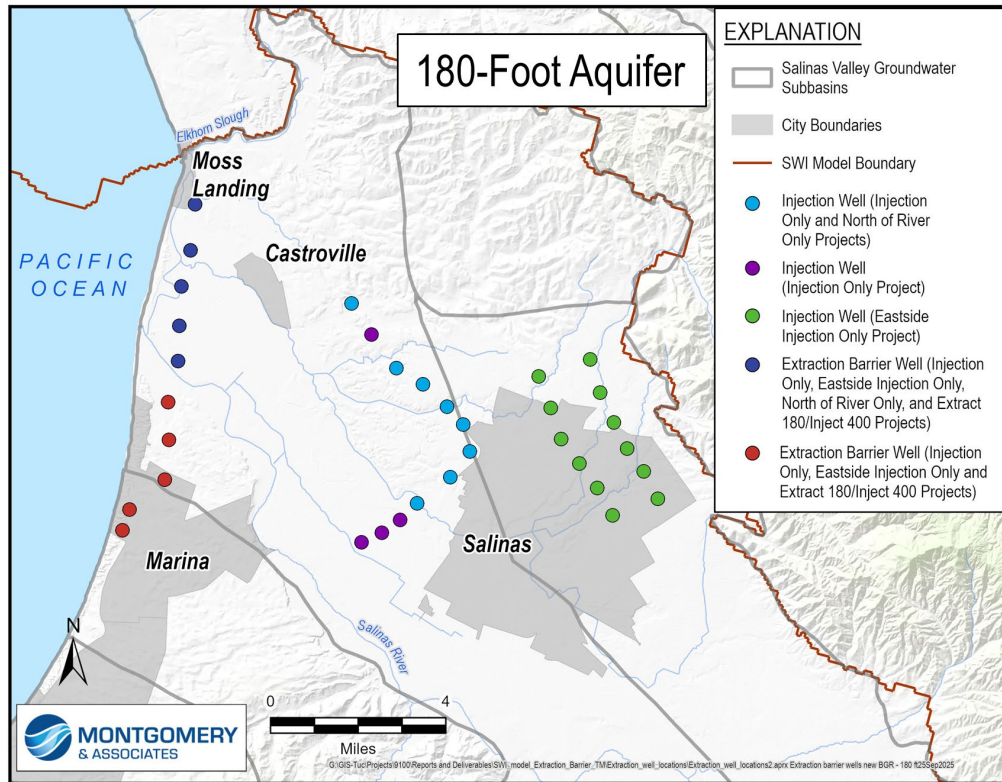


Figure 2. Extraction Barrier and Injection Well Locations in 180-Foot and 400-Foot Aquifers for the 4 Additional Project Scenarios

Regional Water Supply Project End User Assumptions (Pumping Offsets)

The project scenarios couple the extraction barrier with a Regional Water Supply Project that delivers treated water to end users in some of the project scenarios. Delivery of treated water as an alternative water supply reduces groundwater pumping, which improves groundwater conditions in locations of pumping offsets. Brackish groundwater pumped from the extraction barrier wells is assumed to be treated at a desalting facility. Carollo Engineers determined that 70% of the extracted groundwater could be recovered through treatment at a desalting facility and served in lieu of groundwater pumping from a selected group of end users. Groundwater users that are provided treated water in the modeling simulations include a group of public water systems and agricultural groundwater users within or nearby the mapped areas of seawater intrusion, or in areas of critical overdraft.

End use was initially focused on public water systems based on the project description in GSP Amendment 1, and through the feasibility study was expanded to include agricultural users (SVBGSA, 2022). These do not represent any commitment on the part of these end users, further evaluation of which is a next step beyond this feasibility study. At this stage of feasibility and project modeling, end users for delivery of treated water and corresponding pumping offsets were selected to show the potential effectiveness of the BGR project concept.

Public water systems were selected based on size and proximity to the treatment plant location. These include California Water Service (Cal Water)-Salinas, Cal Water-Salinas Hills, Alisal Water Corporation (Alco), Castroville Community Services District (CCSD), Marina Coast Water District (MCWD), and several smaller public water systems including California American Water Company (Cal Am) Toro, Cal Am Ambler Park, Cal Water-Oak Hills, and Normco Water Company (Normco). M&A assumed that treated water would be provided to the Castroville Seawater Intrusion Project (CSIP) to substitute for CSIP supplemental well pumping. Additionally, in the Large Project Scenario, treated water would also be provided to other agricultural groundwater end users whose wells are either within the 2020 MCWRA seawater intruded area in the 180-Foot or 400-Foot Aquifers, or to those who are located within a serviceable distance (1,000 feet) of the treated water distribution system.

Delivery of treated water in lieu of groundwater pumping is represented in the SWI Model by reducing the simulated pumping at groundwater wells for each selected end user by the amount of treated water delivered. This is referred to as a groundwater pumping offset. Pumping offsets replace all or a portion of the pumping for these end users.

Wells at least partially screened in the 180-Foot or 400-Foot Aquifers were targeted first for inclusion in the groundwater pumping offset. In some of the extraction barrier scenarios, wells screened in the Deep Aquifers are also included. The pumping rates of wells included in the offsets are reduced once the extraction barrier wells become active in WY 2031. The offset

groundwater pumping in the project model simulations is summarized by user and aquifer in Table 3. The Injection Only, Eastside Injection Only, and Extract from 180/Inject into 400 have no direct delivery of treated water or pumping offset, so are not included.

A pumping offset of 100% in Table 3 means that starting in WY 2031, all of the pumping is offset and therefore the wells corresponding to that groundwater user have zero pumping from then on. For pumping offsets greater than zero but less than 100% in Table 3 (Small Project), groundwater pumping is reduced by a flat percentage. This simplifying assumption is reasonable, although pumping offsets are likely to adjust to variation in total demand. The pumping rate of the CSIP supplemental wells for WY 2016-2020 and simulated in the No Project Scenario is 3,600 AF/yr. Based on the WY 2014-2023 Groundwater Extraction Management System (GEMS) pumping data, Carollo Engineers estimated that future demand for the CSIP supplemental wells is 5,300 AF/yr. For this reason, a 100% offset of CSIP supplemental well pumping in Table 3 is represented as 5,300 AF/yr of delivered treated water.

Table 3. Regional Water Supply End User Summary by Scenario

Groundwater User	User Type	No Project Scenario Pumping Rate (AF/yr)			Pumping Offset %				Pumping Offset (AF/yr)			
		180- or 400-Foot Aquifer Wells	Deep Aquifer Wells	Total	Small Project	Medium Project	Large Project	North of River Only Project	Small Project	Medium Project	Large Project	North of River Only Project
Alco Water Service	Municipal	3,100	900	4,000	72%	100%	100%	0%	2,900	4,000	4,000	0
Cal Water – Salinas	Municipal	9,900	4,600	14,500	62%	100%	100%	0%	9,000	14,500	14,500	0
Cal Water – Salinas Hills	Municipal	0	1,800	1,800	0%	0%	100%	0%	0	0	1,800	0
Castroville Community Services District	Municipal	600	100	700	100%	100%	100%	100%	700	700	700	700
Marina Coast Water District	Municipal	1,500	1,700	3,200	47%	100%	100%	0%	1,500	3,200	3,200	0
CSIP Supplemental Wells	Agriculture	3,600	0	3,600	100%	100%	100%	100%	3,600	3,600	3,600	3,600
Other 180/400 Subbasin groundwater users in 2020 MCWRA seawater intrusion area	Agriculture	6,000	0	6,000	0%	0%	100%	0%	0	0	6,000	0
Servable Agricultural Users	Agriculture	5,000	200	5,200	0%	0%	100%	0%	0	0	5,200	0
Normco, Toro, Oak Hills, Ambler Park	Municipal	800	800		0%	0%	100%	0%	0	0	800	0
Total		30,500	9,300	39,800					17,700	26,000	39,800	4,300

*Note: Pumping rates in this table are rounded to the nearest 100. Simulated groundwater pumping offsets are based on WY 2016-2020 average pumping rates.

Injection Wells

Injection wells are included in the BGR Project to account for the seasonality of groundwater demands and to reverse existing seawater intrusion at the front. Injection well locations in the 180-Foot and 400-Foot Aquifers are shown with light blue, purple, and yellow dots for the initial 3 project scenarios on Figure 1 and the light blue, purple, yellow, and green dots for the 4 additional project scenarios on Figure 2.

The primary focus of the injection wells in the initial 3 project scenarios is seasonal disposal of treated water. Monthly groundwater pumping volumes were analyzed for the 10 years between WY 2014 and WY 2023 to calculate factors which represent how demand varies seasonally. Because the simulated pumping is based on average rates during a different time period (WY 2016-2020), the amount of pumping turned off or offset in the model may not be exactly equal to the estimated demand for treated water delivery. The analysis showed demand varies by approximately 50% between winter (wet) and summer (dry) months. During the winter, there are months where the total demand of the selected end users is less than the treated extraction barrier water available. In the initial 3 project scenarios, water that cannot be used by end users seasonally is piped to injection wells using the same infrastructure that is used to deliver to end users and injected into the 180-Foot and/or 400-Foot Aquifers. The locations of these injection wells are shown on Figure 1.

The primary focus of the injection wells in the additional 4 project scenarios is controlling and reversing existing seawater intrusion. Except for the Eastside Injection Only Project Scenario, injection wells are placed to aid in halting and reversing the seawater intrusion front. The injected water forms a groundwater mound that reverses the local groundwater gradient, pushing seawater back toward the coast. The strategy of adding injection wells was tested during initial groundwater modeling and it was found that injection significantly increased the overall effectiveness of the project. Injection wells are placed near the projected 2030 500 mg/L chloride isocontour to increase their impact on the seawater intrusion front when the project comes online in 2030. Unlike the extraction barrier wells, the injection wells are not co-located in the 180-Foot and 400-Foot Aquifers. This is because the 500 mg/L chloride isocontour is in different locations in the 180-Foot and 400-Foot Aquifers and the injection wells would not be as effective if they were co-located. The locations of these injection wells are shown on Figure 2.

The number of injection wells vary by project scenario, keeping the locations similar between project scenarios when possible:

- Small – 5 injection wells in the 180-Foot Aquifer and 4 injection wells in the 400-Foot Aquifer

- Medium and Large – 8 injection wells in the 180-Foot Aquifer and 4 injection wells in the 400-Foot Aquifer
- Injection Only – 12 injection wells in the 180-Foot Aquifer and 8 injection wells in the 400-Foot Aquifer. The number of injection wells was increased for this scenario to accommodate the larger injection volume
- Eastside Injection Only – 12 injection wells each screened in both Eastside Shallow and Eastside Deep Zones
- North of River Only – 8 injection wells in the 180-Foot Aquifer and 6 injection wells in the 400-Foot Aquifer
- Extract from 180/Inject into 400 – 12 injection wells in the 400-Foot Aquifer

The injection rates are determined by the total available water for injection, which is then divided among individual wells. The total available water is assumed to be the difference between total monthly treated water volume and the total monthly demand of any end users. In most scenarios, more water is injected into the 180-Foot Aquifer wells than the 400-Foot Aquifer wells because the high aquifer transmissivity requires a higher injection rate to build a groundwater mound:

- Small, Medium, Large, and Injection Only – approximately 75% of the total available water is injected into the 180-Foot Aquifer and 25% into the 400-Foot Aquifer
- North of River – approximately 60% of the total available water is injected into the 180-Foot Aquifer and 40% into the 400-Foot Aquifer.
- Eastside Injection Only – water is injected into both the Eastside Shallow and Eastside Deep Zones. The wells are assumed to have screen penetrating both aquifers. The model calculates the injection volume into the respective model layers depending on the transmissivity and head in the surrounding aquifer
- Extract from 180/Inject into 400 – all water is injected into the 400-Foot Aquifer

All injection wells in a single aquifer inject at equal rates except in the Medium and North of River Only Project Scenarios. In the Medium and North of River Only Project Scenarios, the 5 main injection wells (light blue dots) in the 180-Foot Aquifer inject at a higher rate than the 3 additional injection wells (purple dots) on Figure 1. More water was injected through the 5 main wells to prioritize stopping intrusion toward the City of Salinas, while the remaining water was divided among the 3 additional wells to stop seawater intrusion to the north.

Injection rates vary based on aquifer parameters, well proximity to the leading edge of seawater intrusion, availability of treated water, and rate needed to address seawater intrusion. The number of injection wells and annual rates of injection are summarized by project scenario in

Table 4. Between scenarios, average monthly rates range from 475 gpm to 1,700 gpm in the 180-Foot Aquifer, and from 315 gpm to 1,000 gpm in the 400-Foot Aquifer. In the Eastside Injection Only scenario, average monthly injection rates in the combined Eastside Shallow and Deep Zones were 2,300 gpm. The monthly rate varies substantially for the initial 3 project scenarios because these 3 project scenarios include direct end user deliveries (Small, Medium, Large, and North of the River Project Scenarios); the monthly rates are relatively constant for the other 3 project scenarios that do not have direct end user deliveries. The monthly injection rates per well are shown on Figure 3 through Figure 9. Extract from 180/Inject into 400 Project Scenario Injection Rate per Well.

Table 4. Brackish Groundwater Restoration Project Injection Summary

Scenario Name	Treated Water Available Assuming 70% RO (AF/yr)	No. Injection Wells			Total Injection (AF/yr)			Water Delivered to Groundwater Users/ Pumping Offset ** (AF/yr)
		180-Foot Aquifer	400-Foot Aquifer	Total	180-Foot Aquifer	400-Foot Aquifer	Total	
Small Project	28,000	5	4	9	6,600	2,000	8,600	19,400/17,700
Medium Project	46,900	8	4	12	14,900	4,300	19,200	27,800/26,000
Large Project	67,800	8	4	12	19,700	6,600	26,300	41,700/39,800
Injection Only Project	46,900	12	8	20	33,000	11,800	44,800	0
Eastside Injection Only Project	46,900	12*			44,800			0
North of River Only Project	20,900	8	6	14	8,600	6,300	14,900	6,000/4,300
Extract from 180/Inject into 400	29,000	0	12	12	0	29,000	29,000	0

*Injection into both Eastside Shallow (180-Foot Aquifer equivalent) and Eastside Deep (400-Foot Aquifer equivalent) Zones.

**Because simulated pumping is based on average rates WY 2016-2020 and delivery demand is estimated based on WY 2014-2023, the treated water delivery is not necessarily the same as the pumping offset.

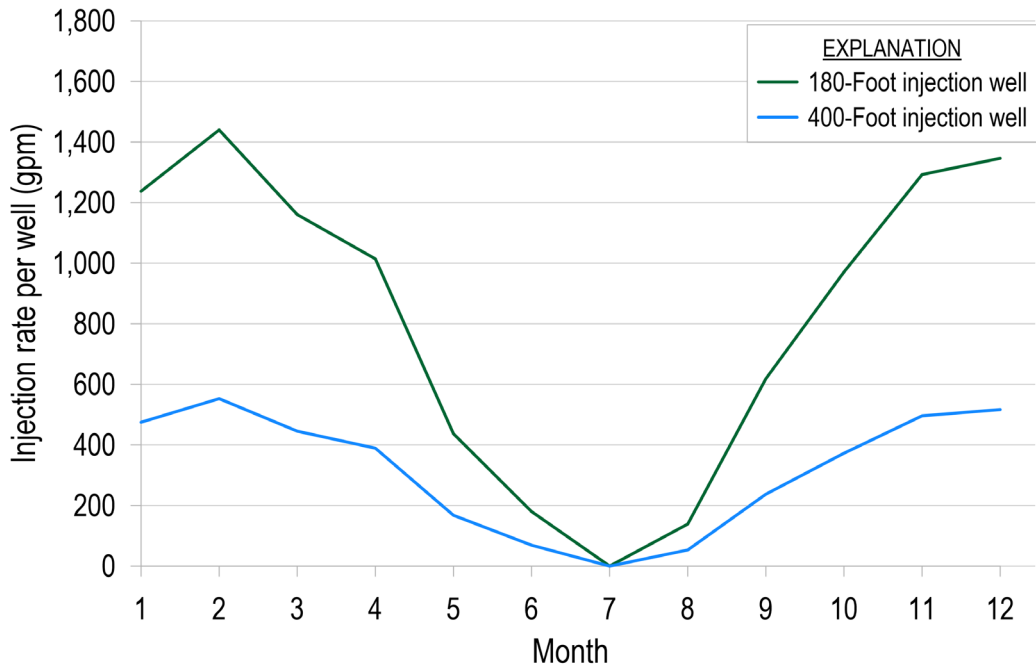


Figure 3. Small Project Scenario Injection Rate per Well

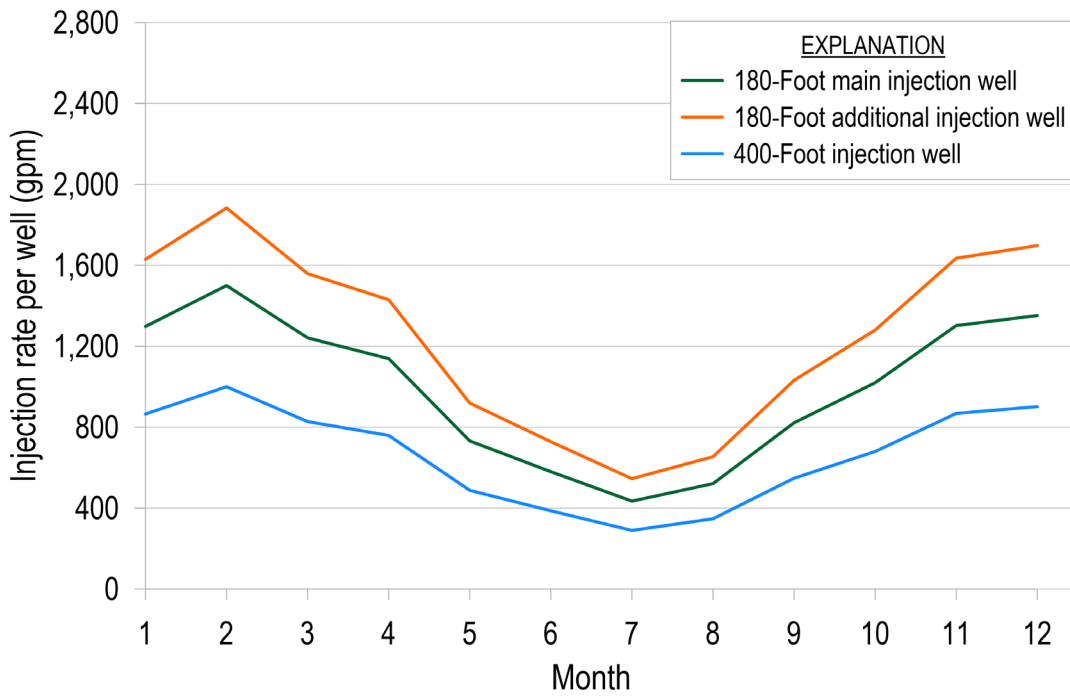


Figure 4. Medium Project Scenario Injection Rate per Well

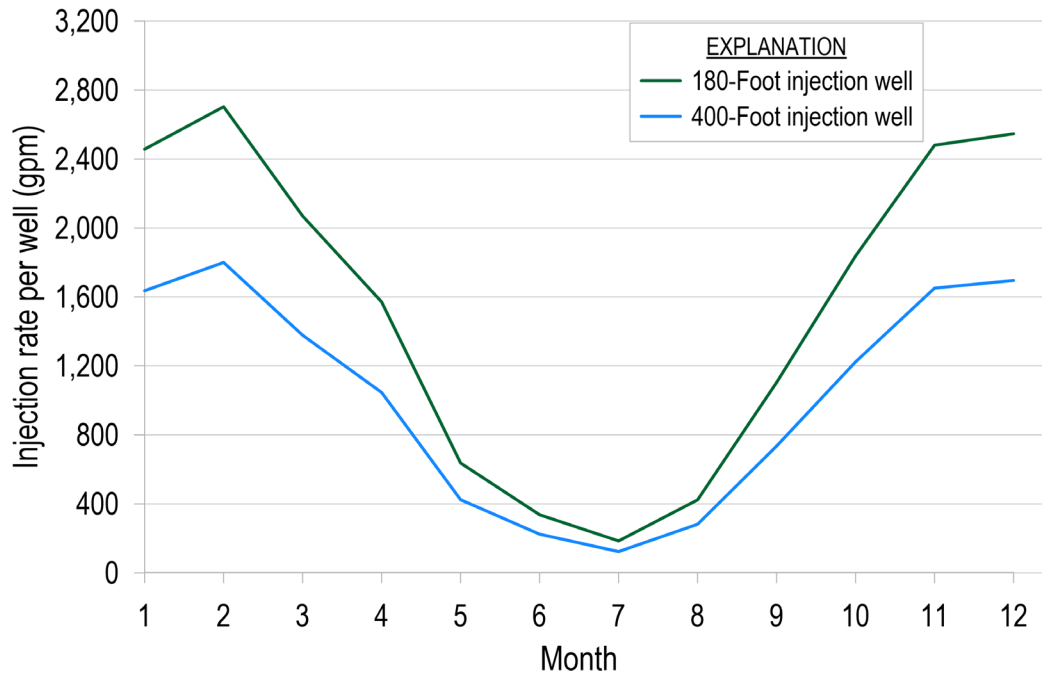


Figure 5. Large Project Scenario Injection Rate per Well

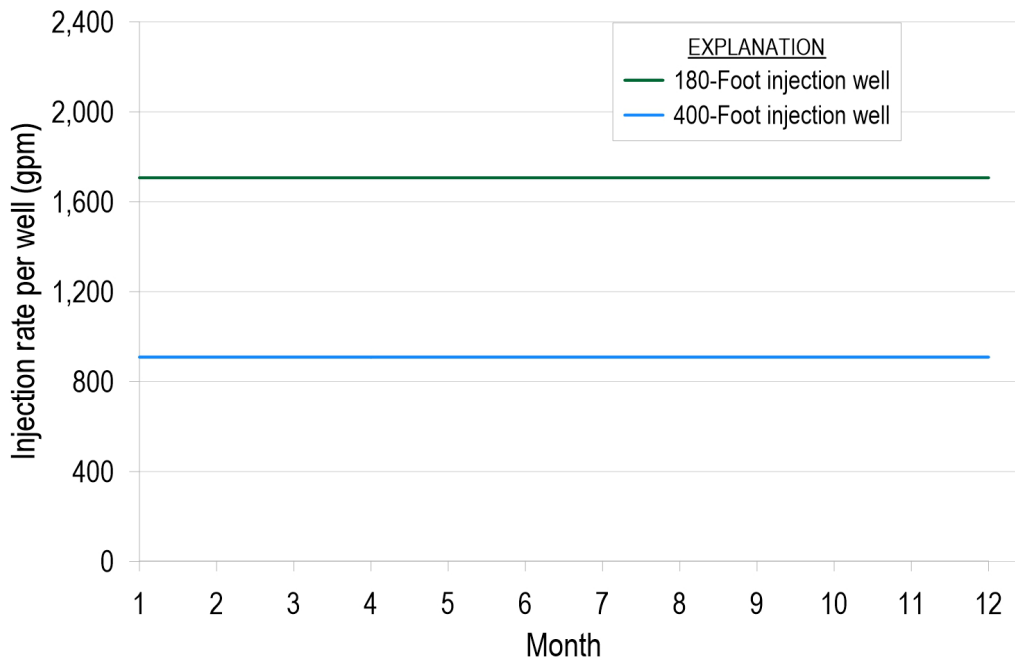


Figure 6. Injection Only Project Scenario Injection Rate per Well

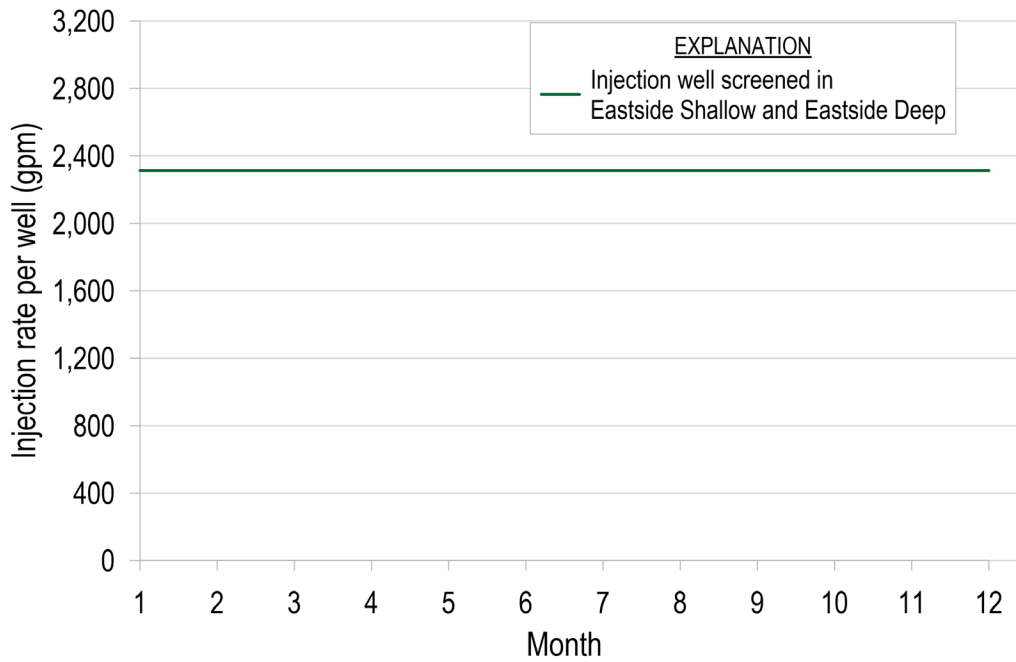


Figure 7. Eastside Injection Only Project Scenario Injection Rate per Well

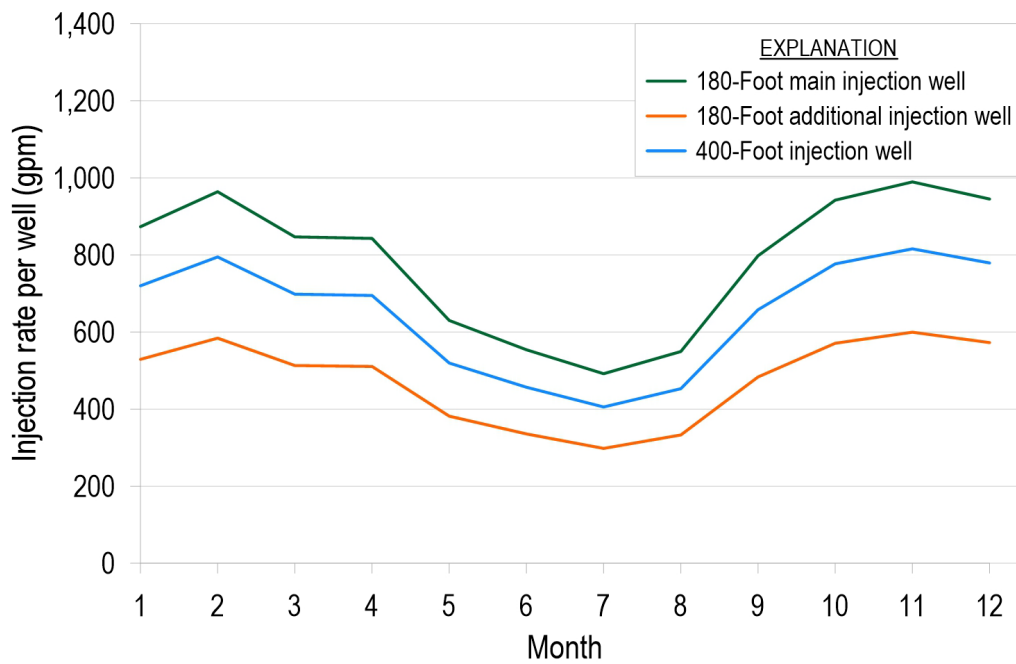


Figure 8. North of River Only Project Scenario Injection Rate per Well

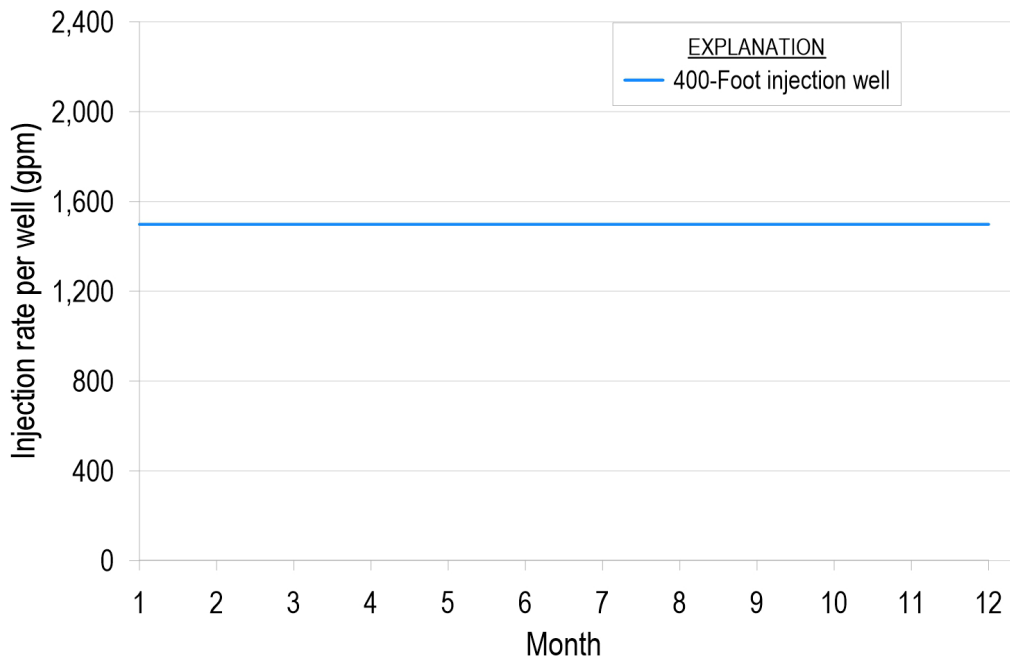


Figure 9. Extract from 180/Inject into 400 Project Scenario Injection Rate per Well

MODEL RESULTS

The following sections summarize the modeling results of the No Project Scenario and 7 BGR Project Scenarios. The BGR Project Scenario models are evaluated based on the following criteria:

1. Location of the 500 mg/L chloride isocontour in 2040 (in main report) and 2070 (in this memorandum) compared to:
 - a. The 2017 simulated 500 mg/L chloride isocontour (GSP seawater intrusion minimum threshold)
 - b. The No Project Scenario simulated 500 mg/L chloride isocontour
2. Change in the spatial distribution of chloride within the seawater intruded area, showing the extent and location of the high salinity areas
3. Change in average groundwater levels from the beginning of the simulation to the end of the simulation
4. Change in the area impacted by chloride concentrations greater than 500 mg/L to the east of the extraction barrier
5. Change in the mass of chloride within the seawater intruded area east of the extraction barrier

Model layers 3 through 5 represent the 180-Foot Aquifer in the 180/400 Subbasin and the Eastside Shallow Zone in the Eastside Subbasin. Results showing the 180-Foot Aquifer include the equivalent alluvial fans in the Eastside Subbasin. For the above criteria 1 and 2, the chloride concentrations in model layer 5 are evaluated as representative of the 180-Foot Aquifer because the lower portion of the aquifer generally exhibits more advanced seawater intrusion. Criteria 4 and 5 are evaluated across layers 3-5 for the 180-Foot Aquifer. Model layer 7 represents the 400-Foot Aquifer in the 180/400 Subbasin and the Eastside Deep Zone in the Eastside Subbasin. The 5 criteria above are evaluated across layer 7 for the 400-Foot Aquifer.

Simulated change in groundwater level (criteria 3 above) is calculated by comparing the groundwater levels at the beginning of the No Project Scenario to the levels at the end of the simulation. To avoid comparing head variations due to seasonal and interannual climate fluctuations, the average heads of the first 10 years of the No Project Scenario are compared to the average heads of the last 10 years of the model. The calculations are performed for the 180-Foot Aquifer, 400-Foot Aquifer, and Eastside equivalent alluvial aquifers. The 180-Foot Aquifer is represented by the model layer 3 through 5 average head difference. The 400-Foot Aquifer is represented by the head difference in model layer 7.

Of the 7 BGR project scenarios, the following are likely to be able to meet the minimum threshold requirements for seawater intrusion with only minor refinements:

- Medium
- Large
- Injection Only

The following project scenarios are unlikely to meet the minimum threshold requirements for seawater intrusion without more substantial refinements:

- Small
- Eastside Injection Only
- North of River Only
- Extract from 180/Inject into 400

Table 5 summarizes the results for criteria 4 and 5—the increasing mass of chloride and area of seawater intrusion—for all the simulated alternatives. The results for criteria 1, 2, and 3 are displayed graphically in the following sections.

Table 5. BGR Project Modeling Results Summary Calculations

Scenario	180-Foot Aquifer		400-Foot Aquifer	
	2030-2070 Change in chloride mass (kg)	2030-2070 Change in seawater intruded area (ac)	2030-2070 Change in chloride mass (kg)	2030-2070 Change in seawater intruded area (ac)
No Project Scenario	+740,000	+29,000	+3,700,000	+7,500
Small Project	-1,200,000	-8,800	-540,000	-1,200
Medium Project	-2,200,000	-37,000	-2,400,000	-5,700
Large Project	-2,400,000	-44,000	-2,900,000	-10,000
Injection Only Project	-2,500,000	-45,000	-2,400,000	-6,100
Eastside Injection Only Project	-1,700,000	-21,000	-1,800,000	-4,100
North of River Only Project	-920,000	-5,300	+1,500,000	+730
Extract from 180/ Inject into 400	-1,900,000	-19,000	+540,000	-2,300

kg = kilogram
 ac = acres

The BGR Project scenarios were not evaluated based on impacts to the Deep Aquifers. Seawater intrusion has not been observed in the Deep Aquifers in the 180/400 or Monterey Subbasins and is not predicted to occur based on the SWI Model. We recommend re-evaluating the impacts of the proposed project on the Deep Aquifer following refinement of SWI Model.

No Project Scenario

In the No Project Scenario, seawater intrusion in the 180-Foot and 400-Foot Aquifers is projected to continue advancing inland from 2020 through 2070. Seawater advances inland because inland groundwater elevations remain below sea level and there continues to be a groundwater depression north of the City of Salinas in the Eastside Subbasin creating a hydraulic gradient that draws seawater toward it. The progression of the chloride isocontours in the No Project Scenario is shown on Figure 10. Each line on Figure 10 shows the 500 mg/L chloride front's progress every 10 years after 2020. The maps show the 2070 location of the 500 mg/L chloride front (black dashed line) relative to its position in 2020 (orange line). Seawater intrusion progresses inland toward the City of Salinas in both the 180-Foot and 400-Foot Aquifers. The 500 mg/L chloride isocontour reaches the City of Salinas in the 180-Foot Aquifer between 2030 and 2040.

In the 400-Foot Aquifer, seawater intrusion advances toward the northern portion of the City of Salinas. The main lobe of seawater advances as far as where the isolated island of seawater was in 2020. The island of seawater slowly disperses and shrinks in size while continuing to move inland. On the northern side of the seawater intrusion front in the 400-Foot Aquifer near Castroville, seawater intrusion is projected to continue but at a slower rate than near Salinas. On the southern side of the seawater intrusion front, additional seawater intrusion is projected east of the City of Marina between 2020 and 2070. Some additional seawater intrusion is projected in the southern direction near the City of Marina.

From 2030 through 2070, additional seawater islands appear between the advancing front of seawater in the 400-Foot Aquifer and the City of Salinas. The appearance of these seawater islands in the 400-Foot Aquifer is caused by downward vertical flow from the 180-Foot Aquifer through wells screened across both aquifers. These model results demonstrate that seawater could flow from the 180-Foot Aquifer into the 400-Foot Aquifer in the future through cross-screened wells. However, the locations of wells screened in multiple aquifers are only estimated in the model, results of which should not be interpreted as an accurate prediction of where new seawater intrusion islands may appear. These results highlight the importance of gathering accurate data on wells screened in multiple aquifers to prevent this as a potential migration pathway in the future.

Figure 11 shows simulated 2070 chloride concentrations in the 180-Foot Aquifer and 400-Foot Aquifer. By 2070, seawater intrusion in the 180-Foot Aquifer is projected to advance an additional 3 miles inland at concentrations generally between 500 mg/L and 5,000 mg/L. In the 400-Foot Aquifer, chloride concentrations are highest south of the Salinas River and near Castroville. In the 400-Foot Aquifer there are areas west of the City of Salinas with concentrations between 100 mg/L and 500 mg/L due to chloride migrating downward from the 180-Foot Aquifer.

Figure 12 shows simulated groundwater level declines between 2020 and 2070. Average groundwater levels generally decrease in the models between 1 and 20 feet in both the 180-Foot and 400-Foot Aquifers under the No Project Scenario. There is an area with increasing groundwater levels predicted in the Granite Ridge area in eastern Langlely; however, it is poorly calibrated in the model, and the predicted results are likely unreliable in this area.

At the beginning of the predictive model period, groundwater elevations inland of the seawater intrusion front are already up to 80 feet below sea level, and the No Project Scenario shows further decline from those levels. Figure 13 shows the average simulated groundwater levels during the last 10 years of the predictive model period: between 2060 and 2070. By 2070, groundwater elevations along the coast continue to be below sea level (simulated as approximately 3 feet NAVD88 in the predictive model) in both aquifers. The groundwater

gradient is inland toward the depression north and to the east of the City of Salinas in the Eastside Subbasin.

Table 5 summarizes the increasing mass of chloride as well as the increasing area of seawater intrusion. In the No Project Scenario, the area of seawater intrusion increases more in the 180-Foot Aquifer than in the 400-Foot Aquifer. But the mass of chloride increases more in the 400-Foot Aquifer than in the 180-Foot Aquifer, most likely because the 400-Foot Aquifer is generally much thicker than the 180-Foot Aquifer.

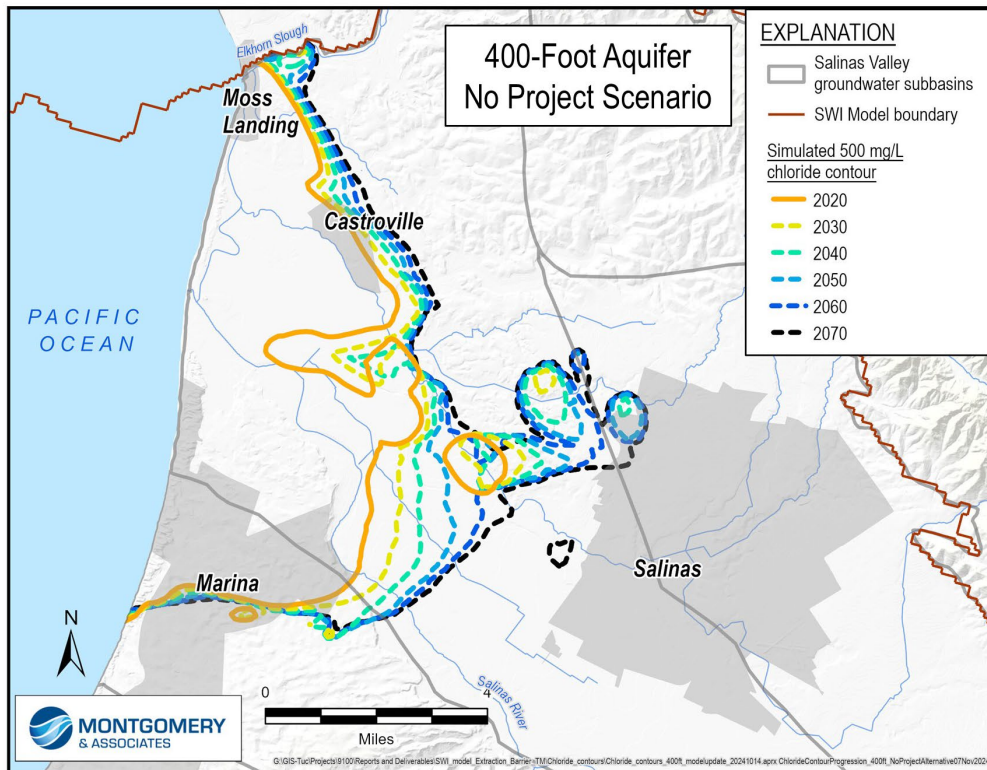
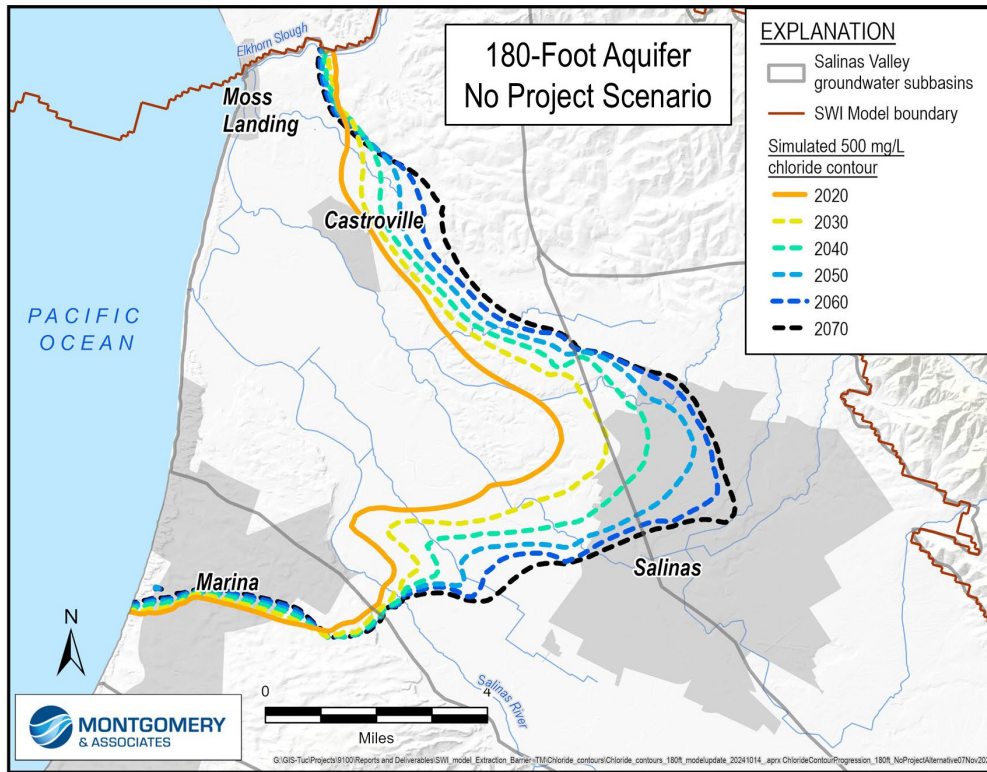


Figure 10. Progression of Simulated Chloride Contours for the No Project Scenario

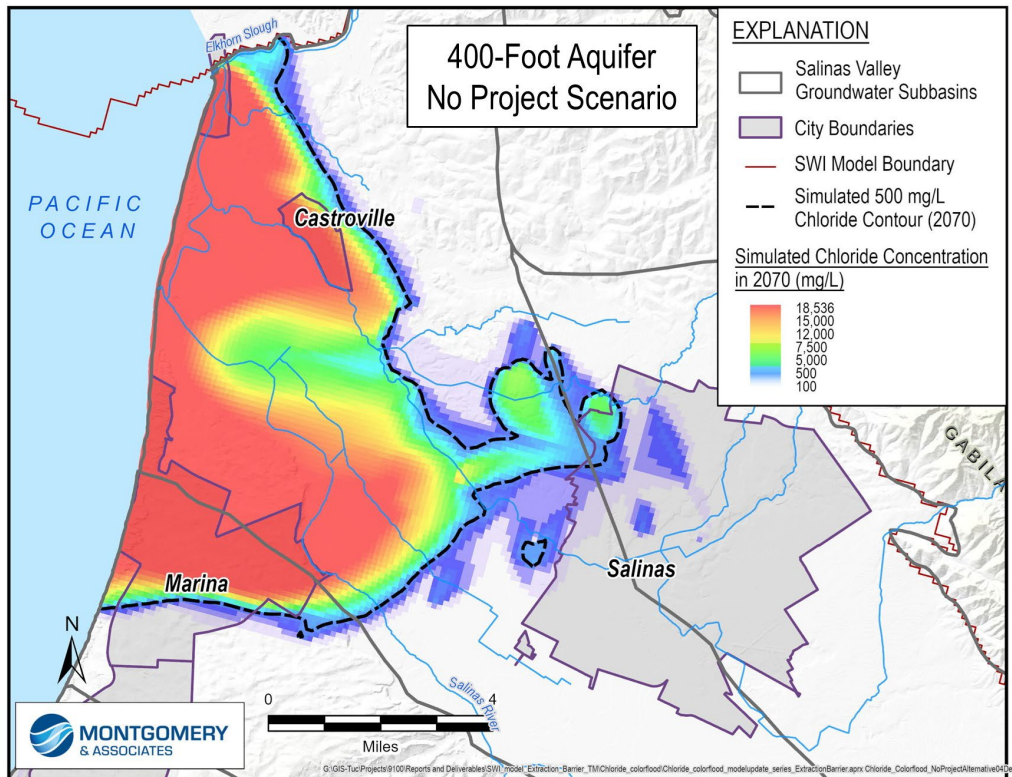
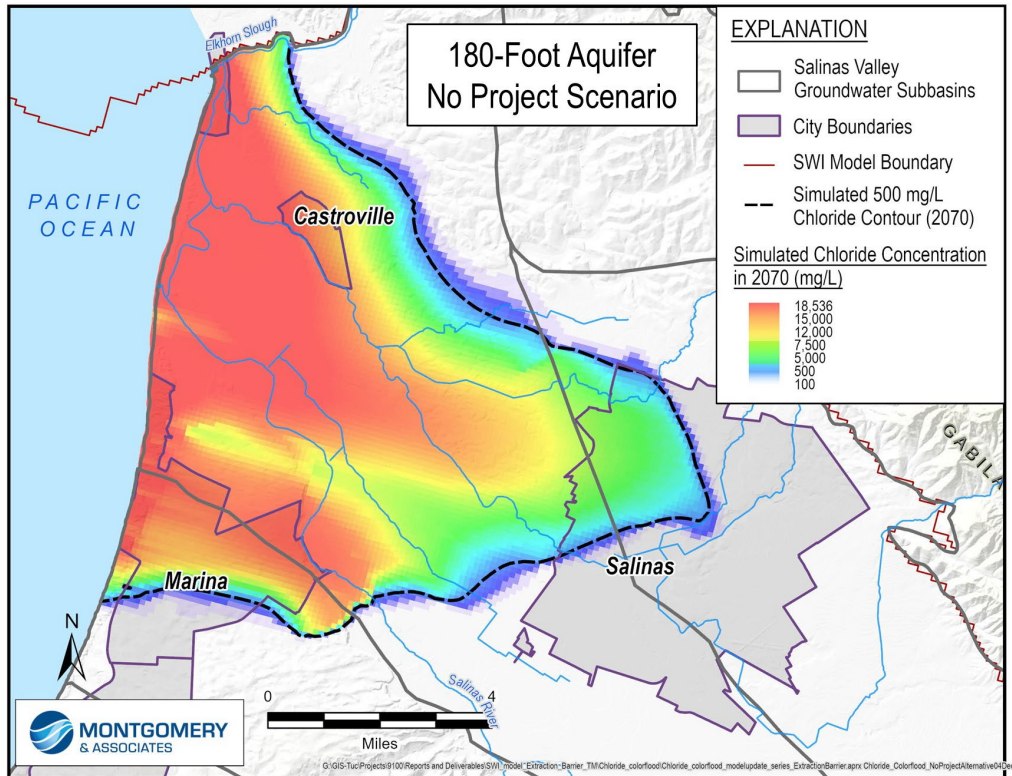


Figure 11. Simulated Chloride Concentration in 2070 for the No Project Scenario

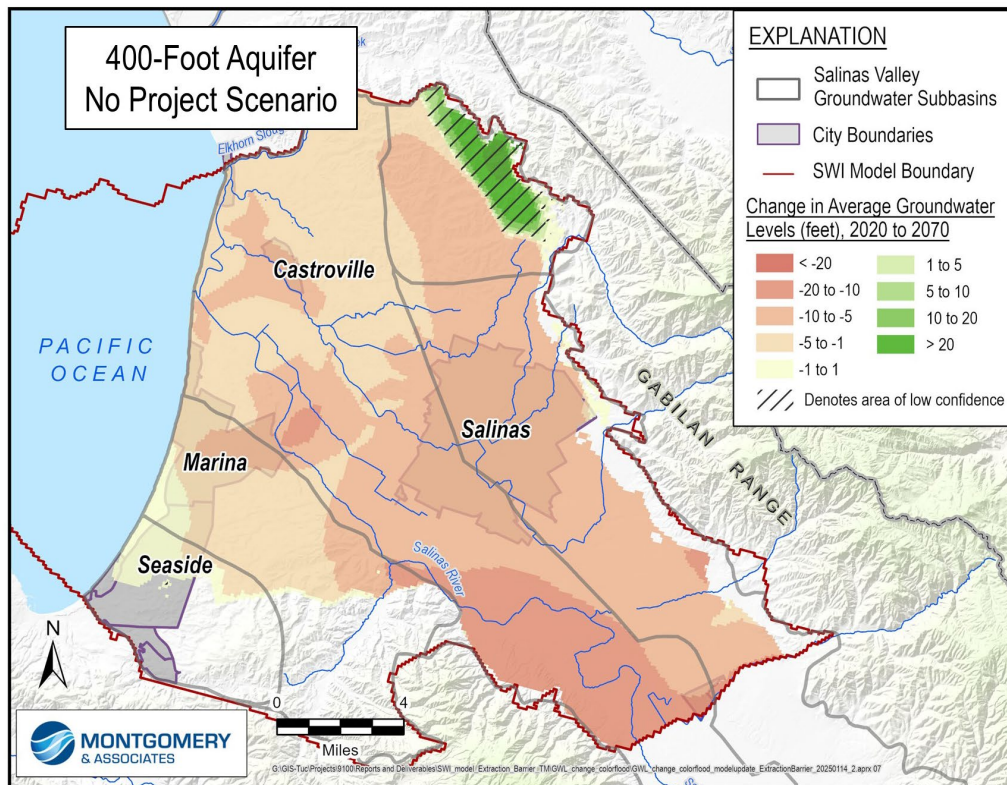
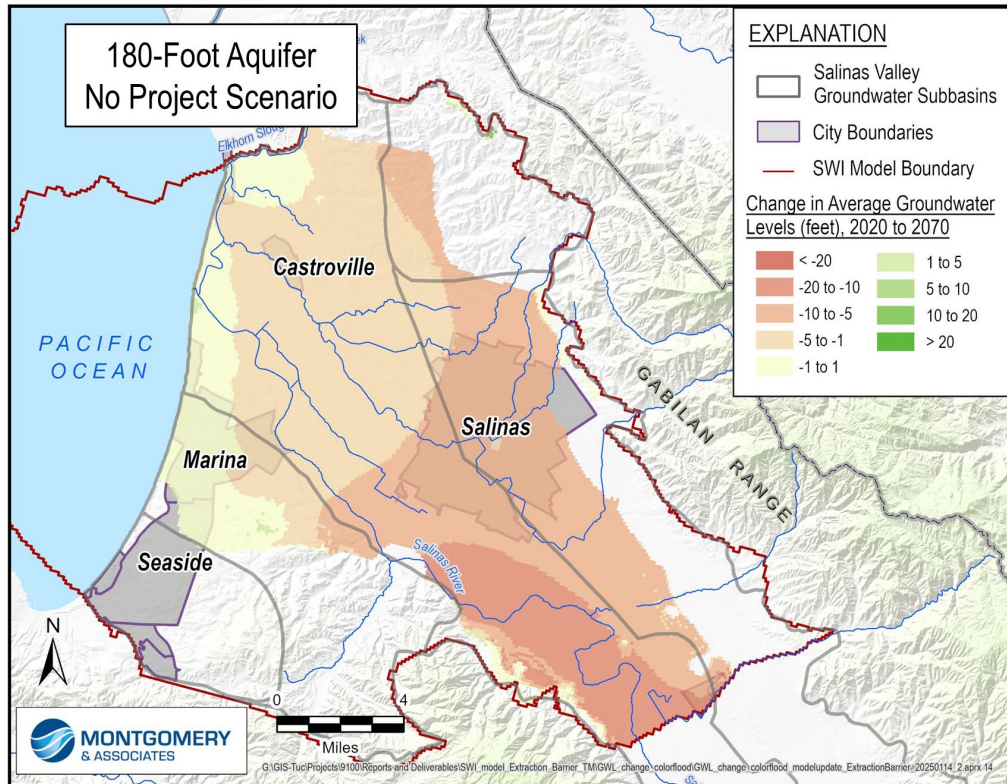


Figure 12. Simulated Change in Groundwater Levels for the No Project Scenario

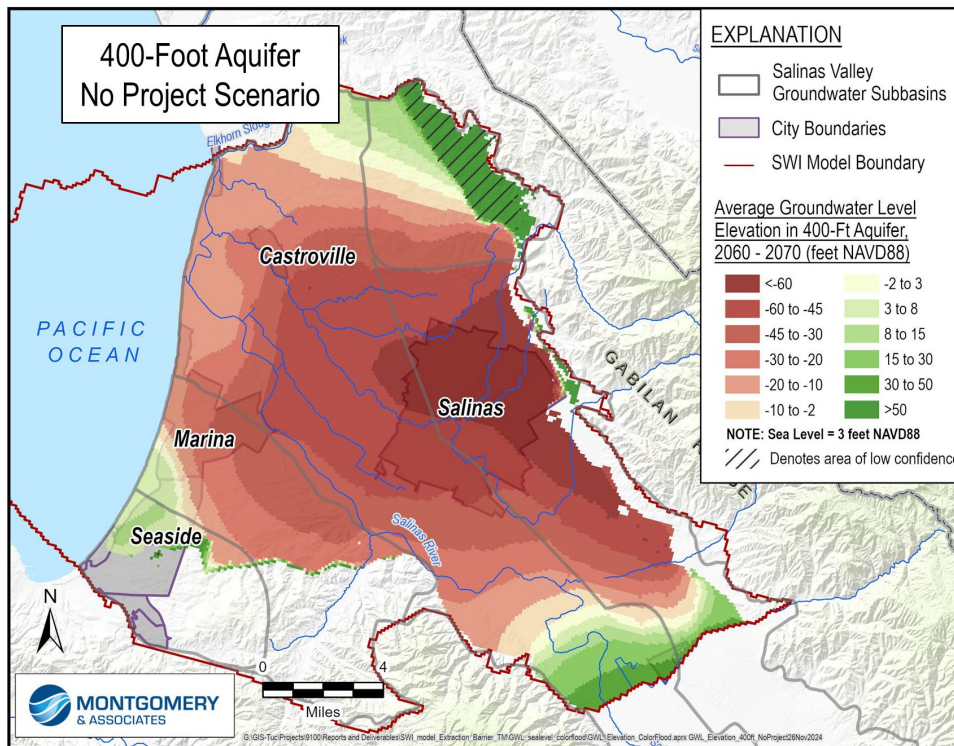
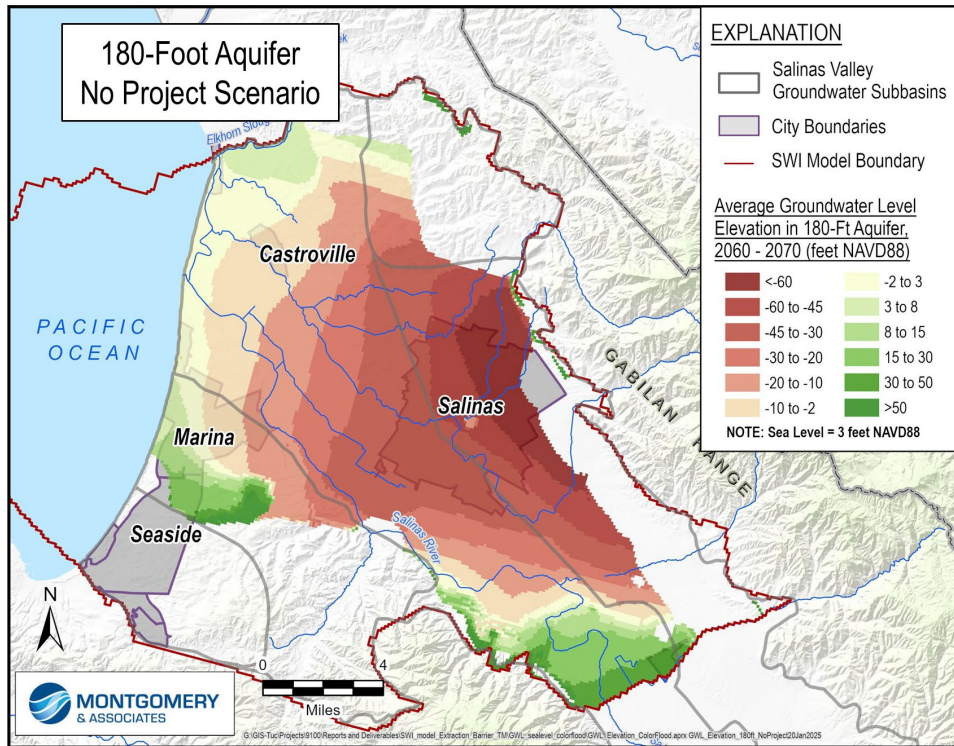


Figure 13. Simulated Groundwater Elevation for the No Project Scenario

Small Project Scenario

The Small Project scenario is unable to contain and fully reverse ongoing seawater intrusion. Figure 14 shows maps of the 500 mg/L chloride front simulated by the SWI Model for the Small Project Scenario. By 2070, seawater intrusion spreads north and south of its current position: impacting previously unintruded areas. The injection wells are positioned near the 500 mg/L chloride contour in 2030, which is the start date of the BGR project. Figure 14 shows that the 500 mg/L chloride front is slowed near the injection wells in the 180-Foot and 400-Foot Aquifers; seawater intrusion toward the City of Salinas is slowed or reversed slightly by 2070. Seawater intrusion near Castroville and within the City of Marina is also reversed as shown by the 500 mg/L chloride front being pulled back toward the coast in the 180-Foot and 400-Foot Aquifers. However, seawater intrusion continues to spread in the area between Castroville and the City of Salinas in the 180-Foot Aquifer, as well as the area east of the City of Marina in both the 180-Foot and 400-Foot Aquifers.

Figure 15 compares the simulated 2070 intrusion extent (blue dashed line) with the 2070 No Project intrusion extent (red dashed line) and the seawater intrusion minimum threshold (black line). Compared to the No Project Scenario, the 2070 500 mg/L chloride contour is closer to the coast and the minimum threshold in most areas. Areas with the most notable improvement relative to the No Project Scenario are directly west of the City of Salinas and near the City of Castroville.

By 2070, the Small Project Scenario's 500 mg/L chloride contour is not pulled back to the minimum threshold criterion in either the 180-Foot or 400-Foot Aquifers. Areas in the 180-Foot Aquifer between Castroville and the City of Salinas—as well as between the cities of Marina and Salinas—extend beyond the minimum threshold line.

Figure 16 shows the 2070 chloride concentrations in the 180-Foot and 400-Foot Aquifers resulting from the Small Project. The Small Project effectively halts future seawater intrusion with the extraction barrier wells, as shown by high chloride concentration on the seaward side and lower chloride concentrations on the landward side of the barrier. However, seawater continues to intrude into the 180-Foot and 400-Foot Aquifers south of the extraction barrier, near the City of Marina.

High-salinity groundwater east of the extraction barrier is drawn back toward the coast, reducing the inland salinity relative to the No Project Scenario. The blue area north of the injection wells in the 400-Foot Aquifer represents an isolated island of groundwater with chloride concentrations between 100 and 500 mg/L. Because the concentration is less than 500 mg/L in this area by 2070, it does not appear on Figure 15, but it is visible in earlier years from 2030 through 2060 on Figure 14. This is an area where saline groundwater was already migrating from the 180-Foot Aquifer to the 400-Foot Aquifer by 2030. The Small Project injection wells appear

to have slightly improved the groundwater quality in this area compared to the No Project Scenario. As in the No Project Scenario, this model result should not be interpreted as an accurate prediction of where new seawater intrusion islands may appear in the 400-Foot Aquifer.

Chloride mass and seawater intruded area decreases compared to the No Project Scenario in both the 180-Foot and 400-Foot Aquifers (Table 5).

Figure 17 shows average groundwater level changes between 2020 and 2070 in the Small Project Scenario. By 2070, average groundwater levels in the 180-Foot Aquifer decrease in the general vicinity around the extraction barrier by approximately 10 to 20 feet, and by more than 20 feet close to the extraction barrier wells. Average groundwater levels in the 400-Foot Aquifer decrease around the extraction barrier by approximately 20 feet, and up to 40 feet close to the extraction barrier wells. Due to injection and offset of Salinas' groundwater pumping, average groundwater levels near the City of Salinas are projected to increase slightly by about 20 feet in the 180-Foot Aquifer and 10 to 20 feet in the 400-Foot Aquifer.

Figure 17 shows the change in groundwater levels, not absolute groundwater levels. Therefore, the green area on Figure 17 should not be interpreted as being above sea level. Figure 18 shows the average groundwater levels for the Small Project Scenario between 2060 and 2070. The groundwater levels in the 180-Foot Aquifer and 400-Foot Aquifer are still projected to be below sea level in 2070, even where average groundwater levels increase. The groundwater depression near the City of Salinas in the Eastside Subbasin is still projected in 2070.

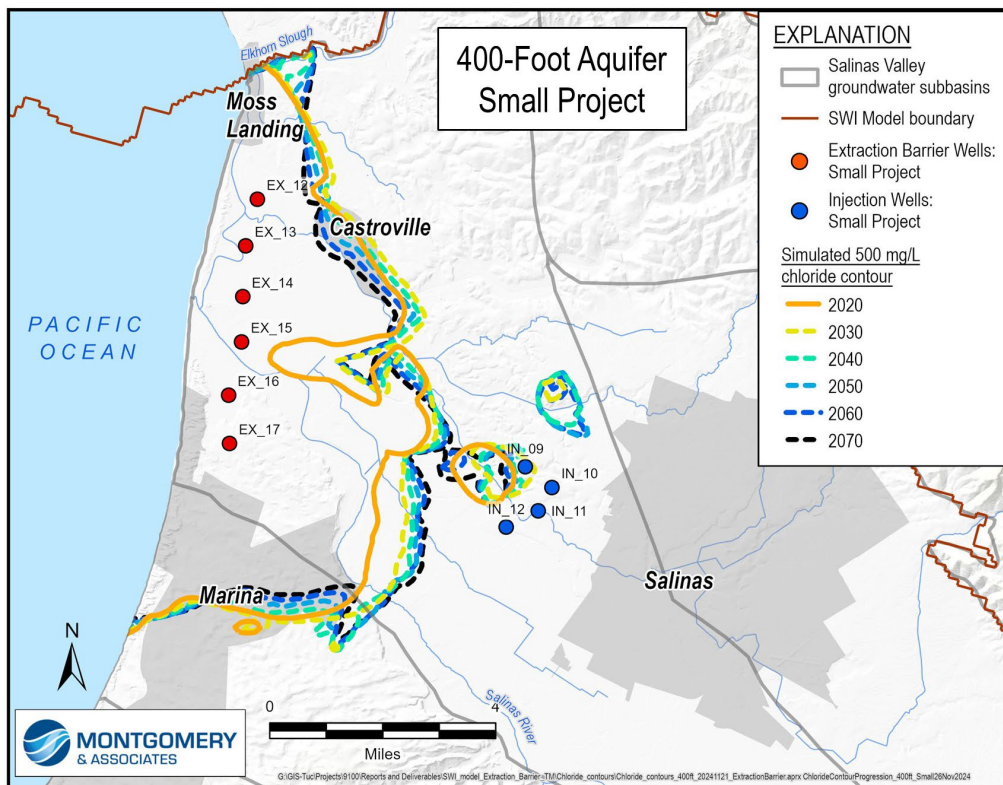
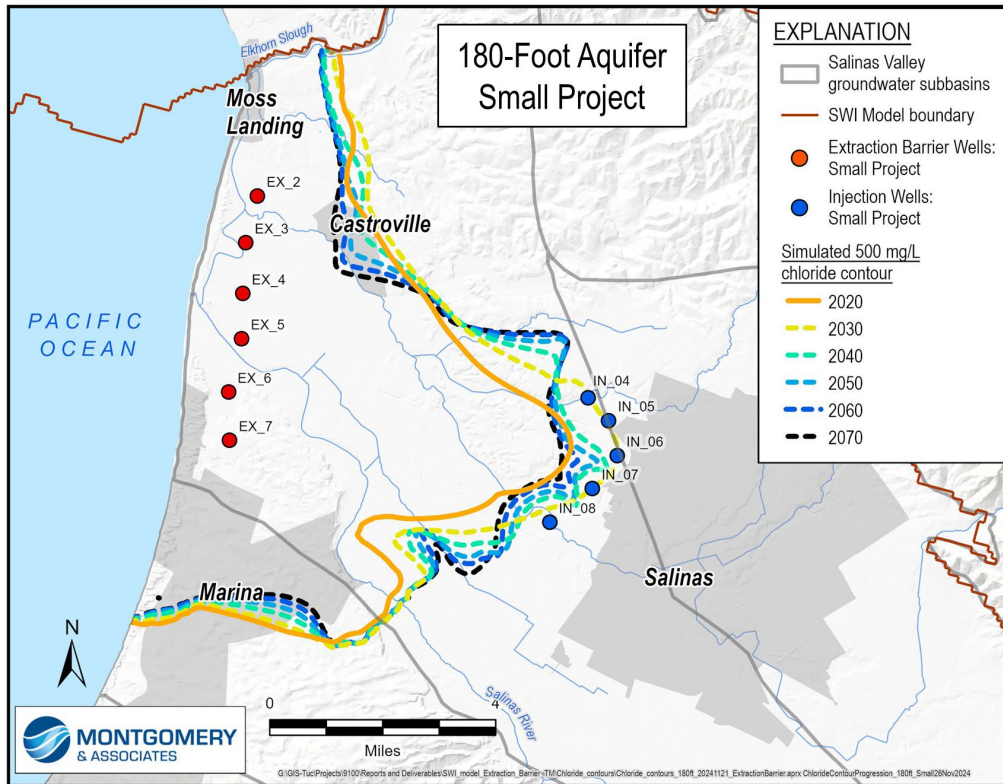


Figure 14. Progression of Simulated Chloride Contours for the Small Project Scenario

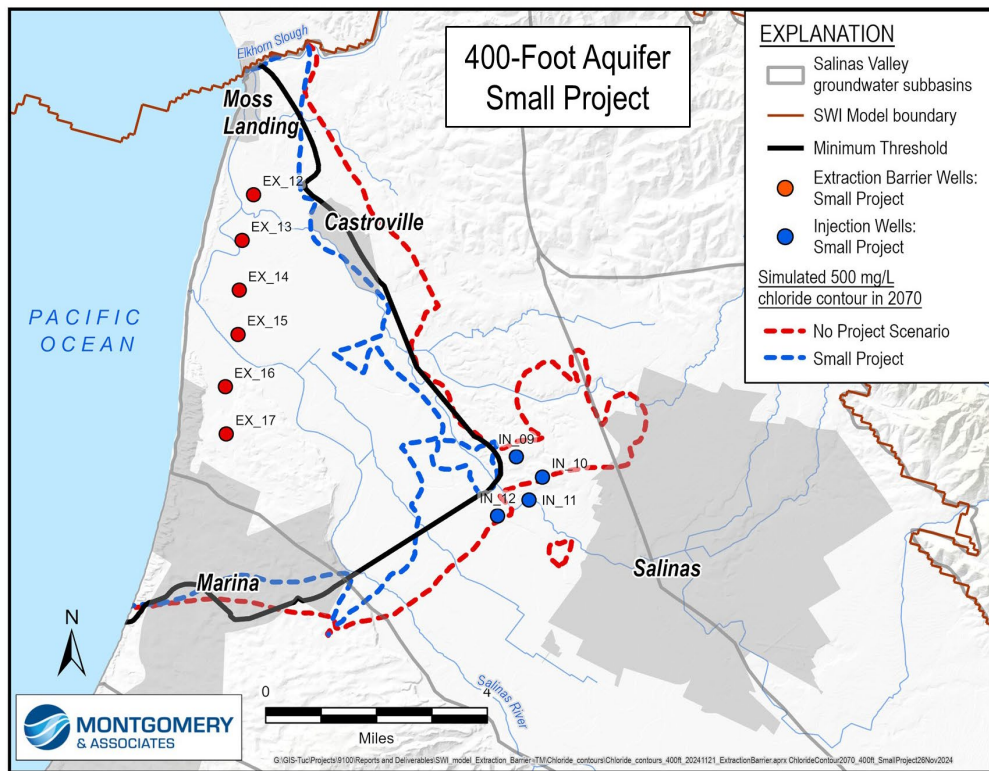
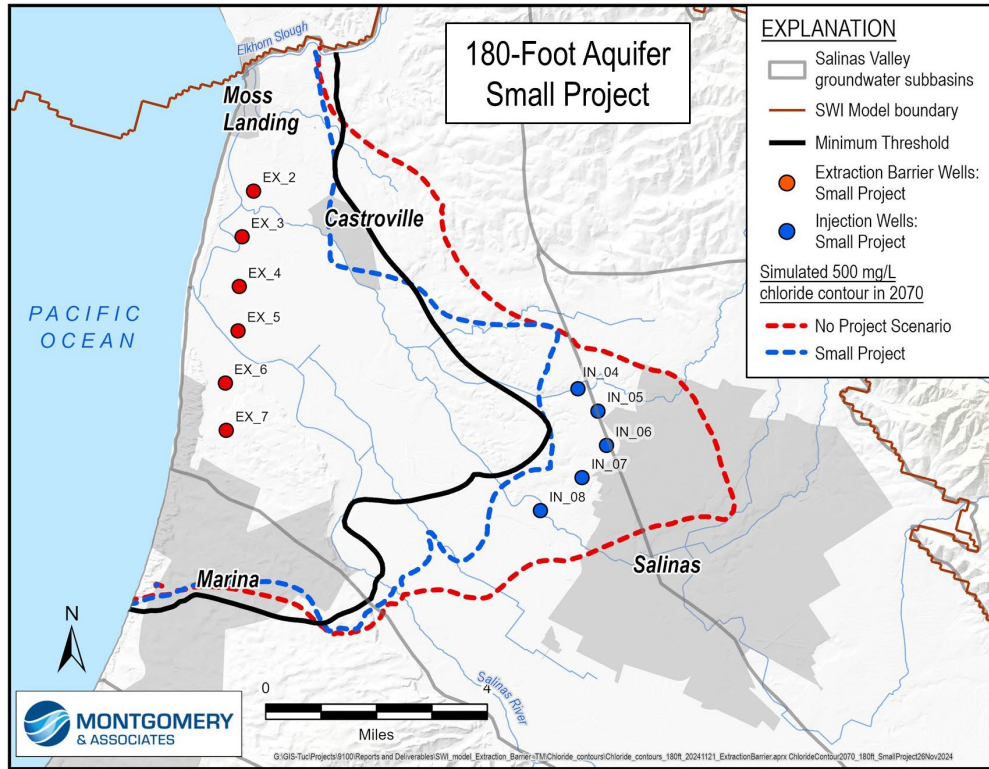


Figure 15. Small Project – 2070 500 mg/L Chloride Contours Comparison to No Project Scenario and Minimum Threshold

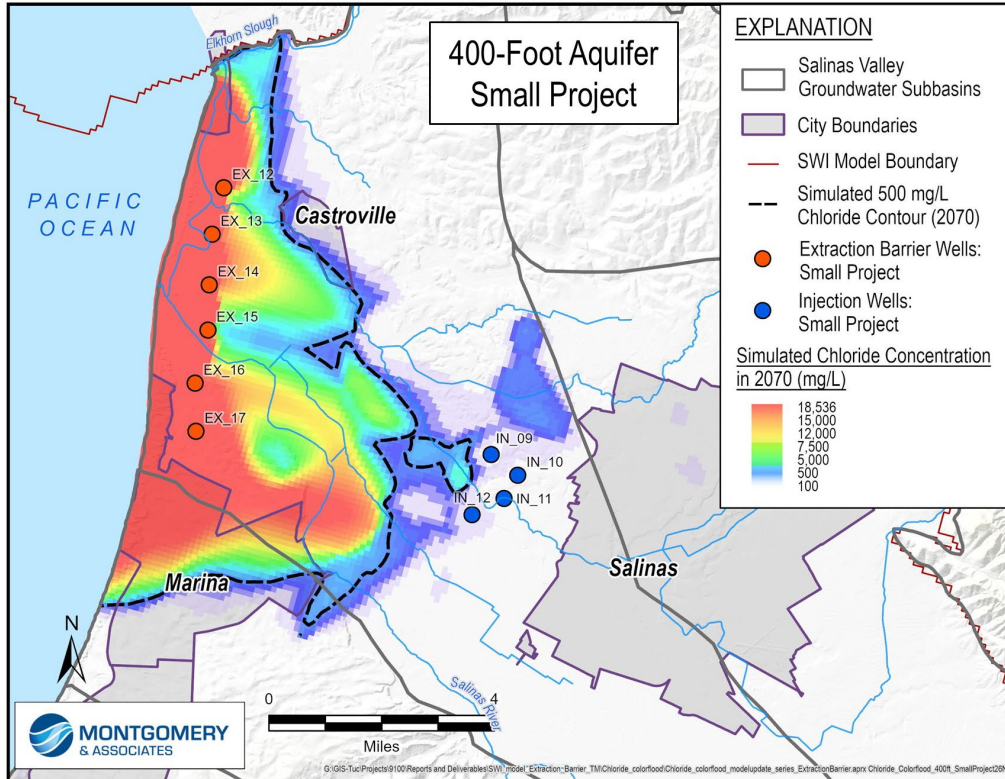
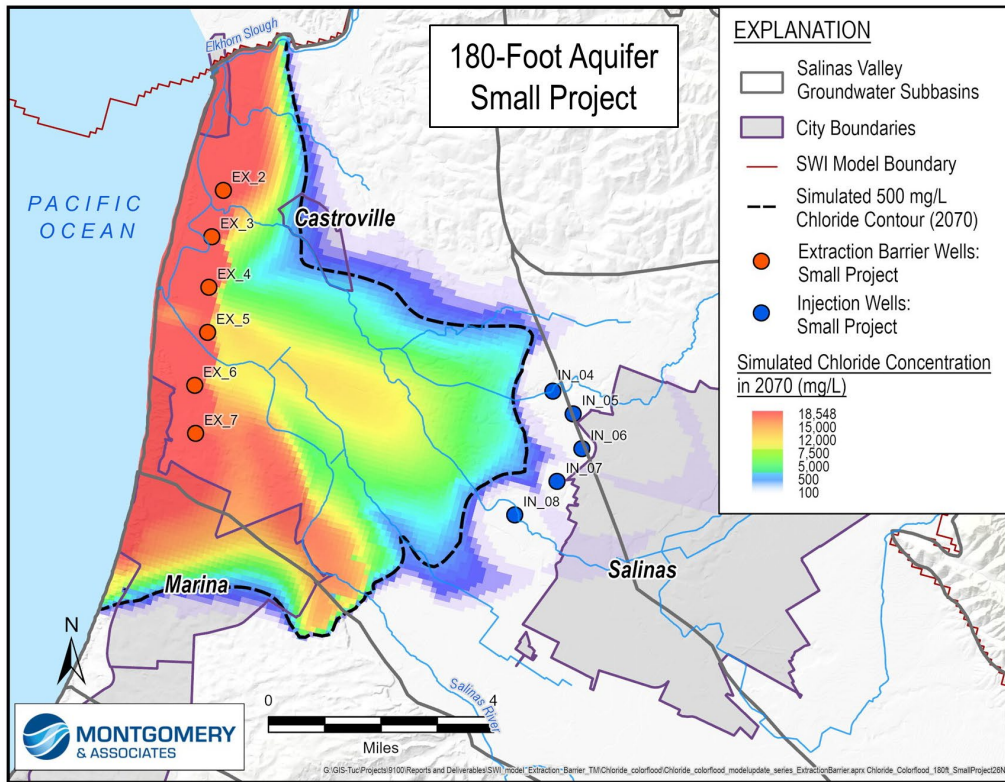


Figure 16. Simulated Chloride Concentration in 2070 for the Small Project Scenario

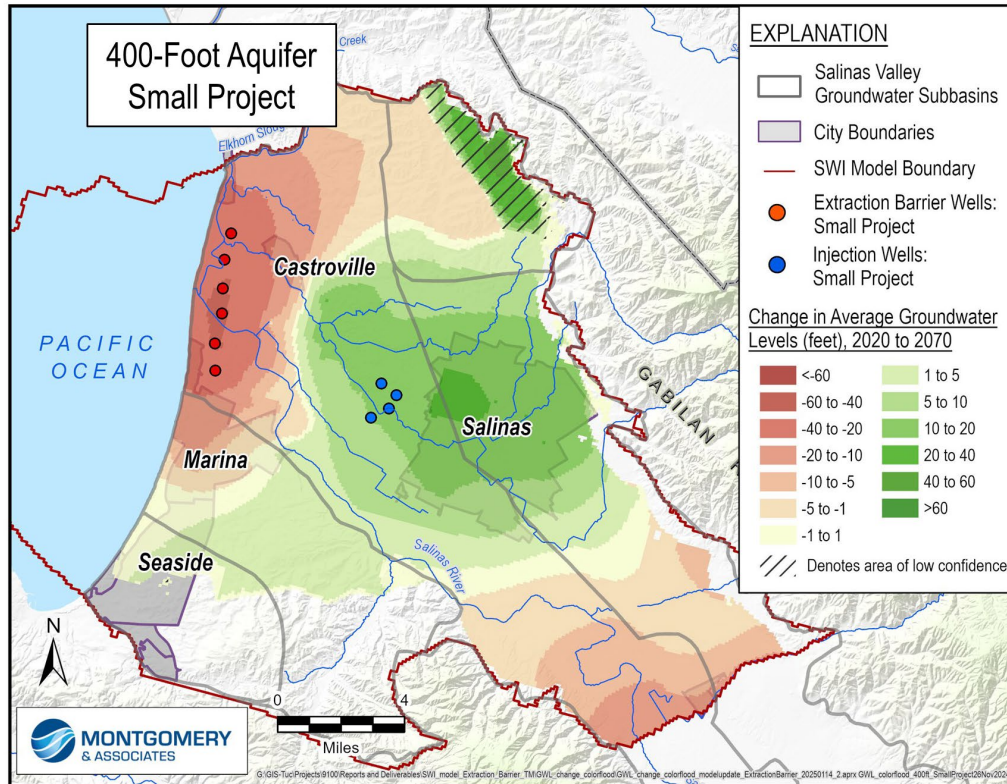
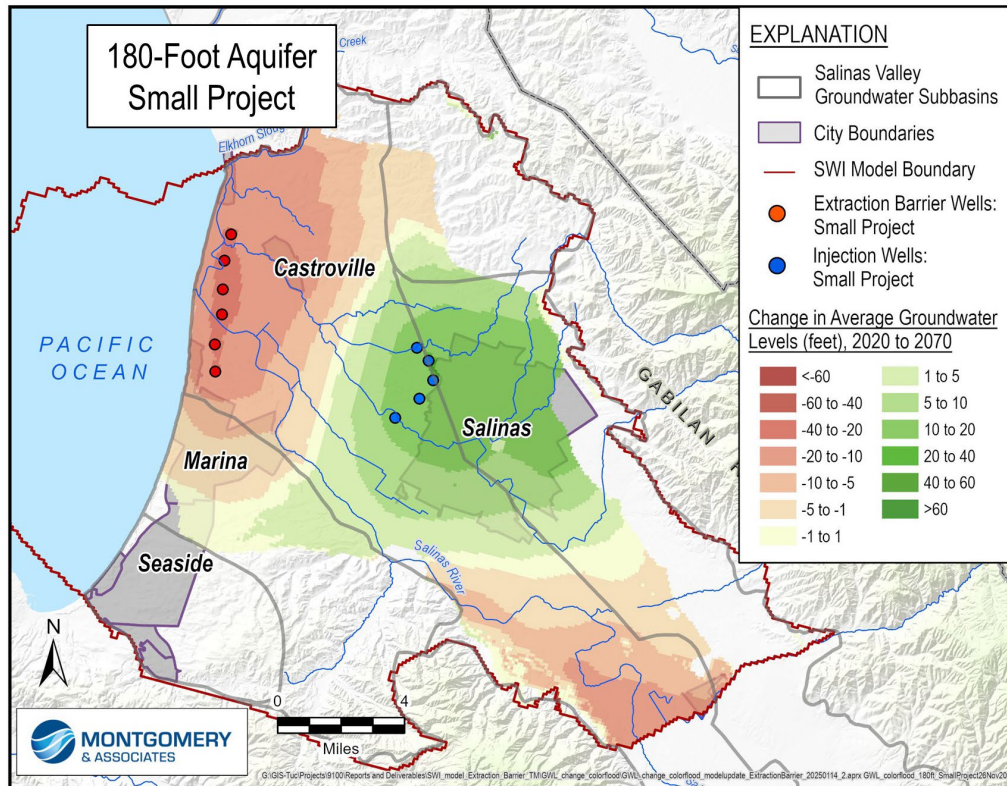


Figure 17. Simulated Change in Groundwater Levels for the Small Project Scenario

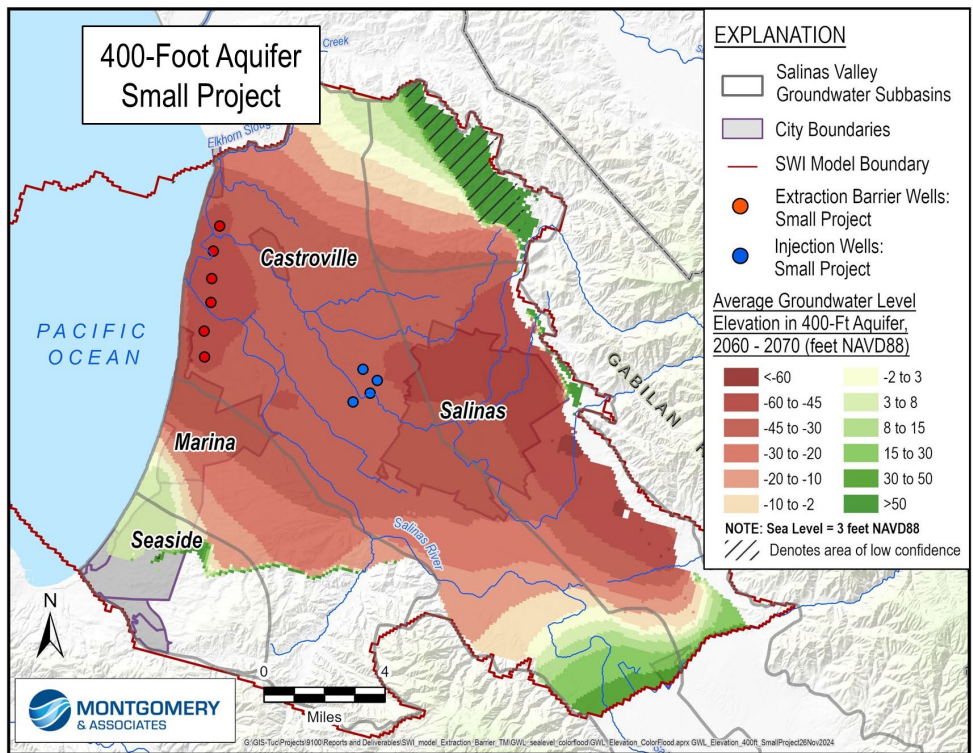
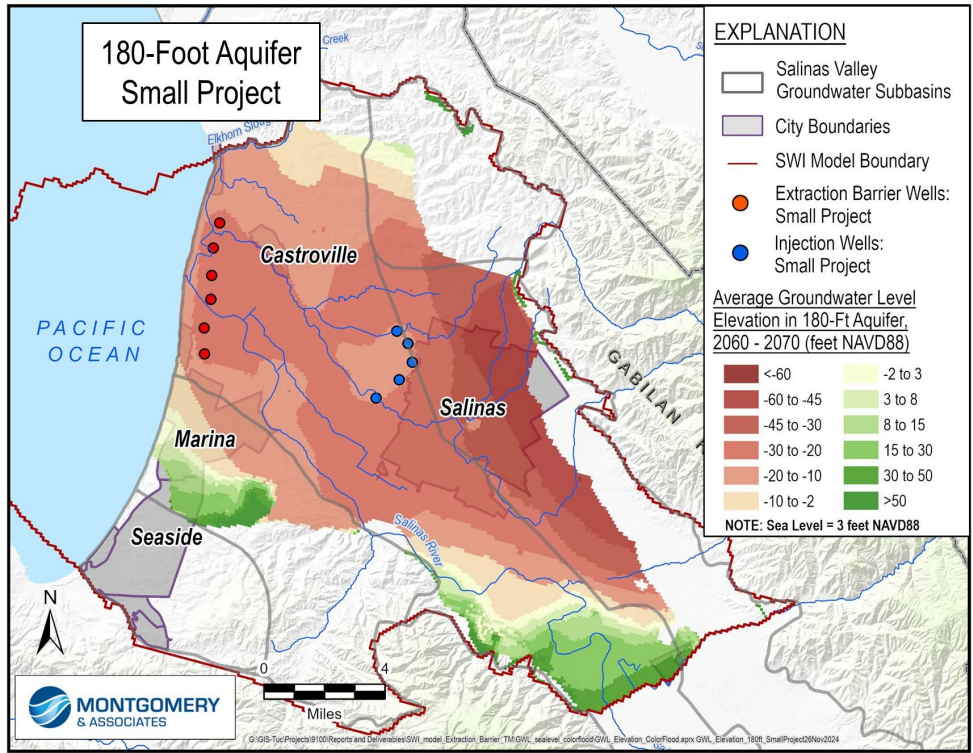


Figure 18. Simulated Groundwater Elevation for the Small Project Scenario

Medium Project Scenario

Figure 19 shows maps of the 500 mg/L chloride front simulated by the SWI Model for the Medium Project Scenario. The Medium Project includes additional extraction barrier wells and injection wells compared to the Small Project. Figure 19 shows that between 2030 and 2070, the 500 mg/L chloride front retreats toward the coast in both the 180-Foot and 400-Foot Aquifers. The most dramatic improvements are in the 180-Foot Aquifer between Castroville and the City of Salinas. This most likely results from the inclusion of 3 additional injection wells in the 180-Foot Aquifer in this area. In the 400-Foot Aquifer, the 500 mg/L chloride contour migrates toward the coastline between 2030 and 2070 due to the inclusion of additional extraction barrier wells within the City of Marina.

Figure 20 compares the Medium Project Scenario simulated 2070 intrusion extent with the 2070 No Project intrusion extent and the seawater intrusion minimum threshold. The Medium Project simulation generally meets the seawater intrusion minimum threshold criterion in both the 180-Foot and 400-Foot Aquifers. Only a small area in the 180-Foot Aquifer east of the City of Marina is still beyond the minimum threshold in 2070.

Figure 21 shows the chloride concentrations in the 180-Foot and 400-Foot Aquifers resulting from the Medium Project in 2070. Future seawater intrusion is halted along the entire coast, including in the City of Marina. Narrow bands of higher salinity groundwater remaining east of the extraction barrier (orange on Figure 21) could be influenced by local wells and groundwater gradients. Particle tracking could be used to further investigate the flow dynamics between the extraction barrier wells to refine pumping rates in this area. The injection wells in the 180-Foot Aquifer push brackish groundwater back toward the coast and prevent the formation of some inland seawater islands in the 400-Foot Aquifer that were visible in the No Project Scenario and Small Project Scenario.

Table 5 demonstrates how the extraction barrier in the Medium Project Scenario is more effective at preventing seawater intrusion than the Small Project. The mass of chloride in the 180-Foot Aquifer decreases by twice as much and decreases more than 4 times as much in the 400-Foot Aquifer. The seawater intruded area is also significantly smaller in the Medium Project Scenario compared to the Small Project Scenario.

Figure 22 shows average groundwater level changes between 2020 and 2070 in the Medium Project Scenario. Average change in groundwater levels follows similar trends as the Small Project Scenario; the areas of increasing and decreasing groundwater levels are generally the same, though the magnitude of the change is greater in the Medium Project Scenario. By 2070, average groundwater levels in the general vicinity around the extraction barrier in the 180-Foot Aquifer decrease by 10 to 20 feet, and by up to 30 feet close to the extraction barrier wells.

Average groundwater levels in the 400-Foot Aquifer decrease in the vicinity around the extraction barrier by approximately 20 to 30 feet, and up to 60 feet close to the extraction barrier wells. Average groundwater levels near the City of Salinas are projected to increase by 20 to 30 feet in both the 180-Foot and 400-Foot Aquifers.

Figure 23 shows the average groundwater levels between 2060 and 2070 for the Medium Project Scenario. As with the Small Project Scenario, the groundwater elevations in the 180-Foot and 400-Foot Aquifers are projected to remain below sea level in 2070 even in areas where average groundwater levels increase.

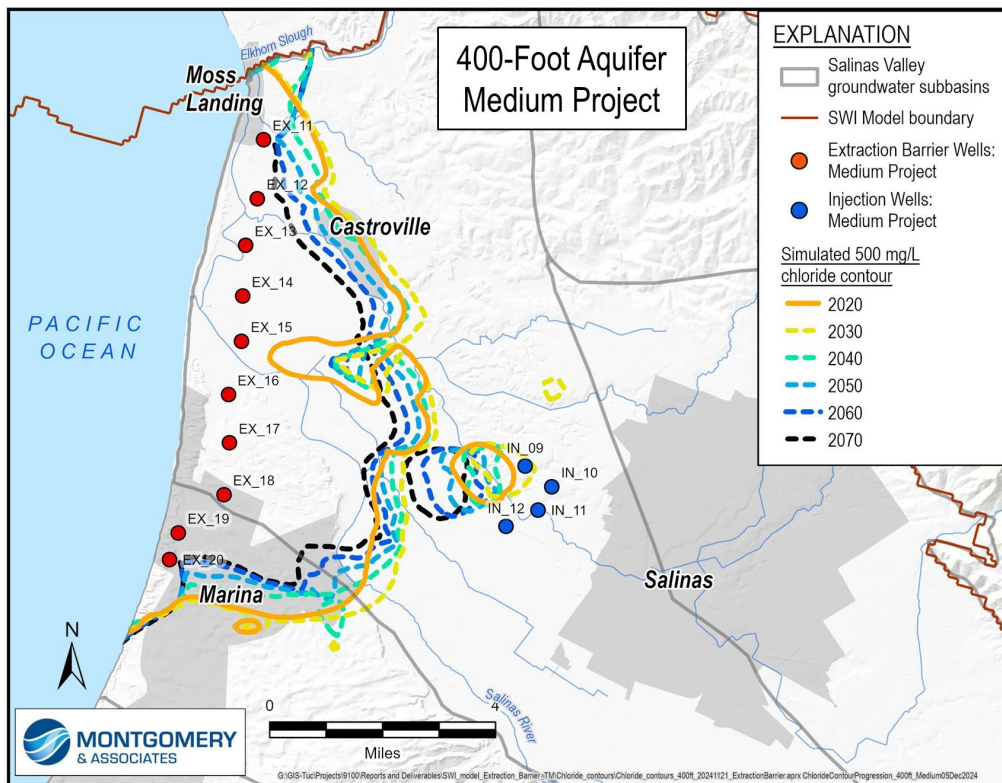
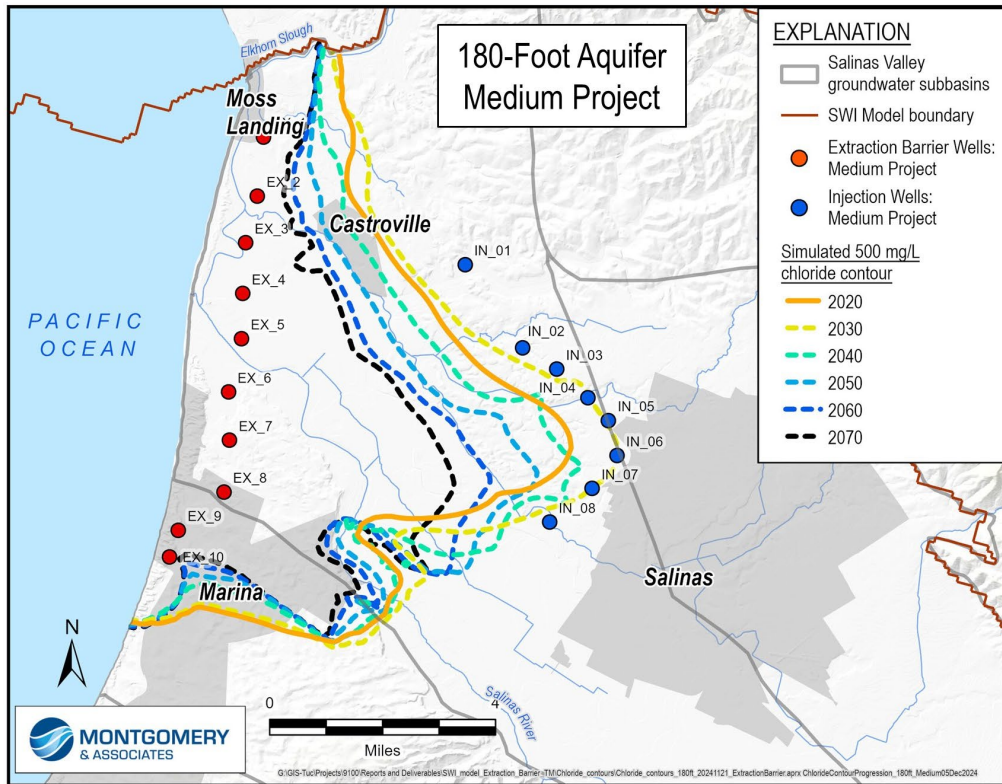


Figure 19. Progression of Simulated Chloride Contours for the Medium Project Scenario

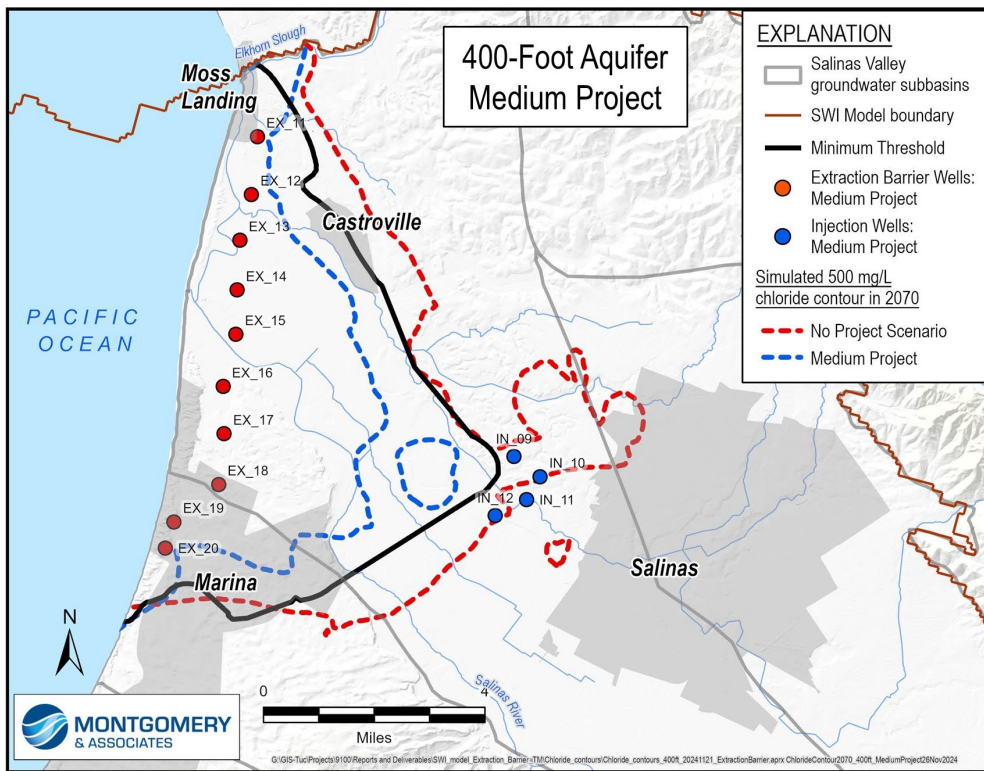
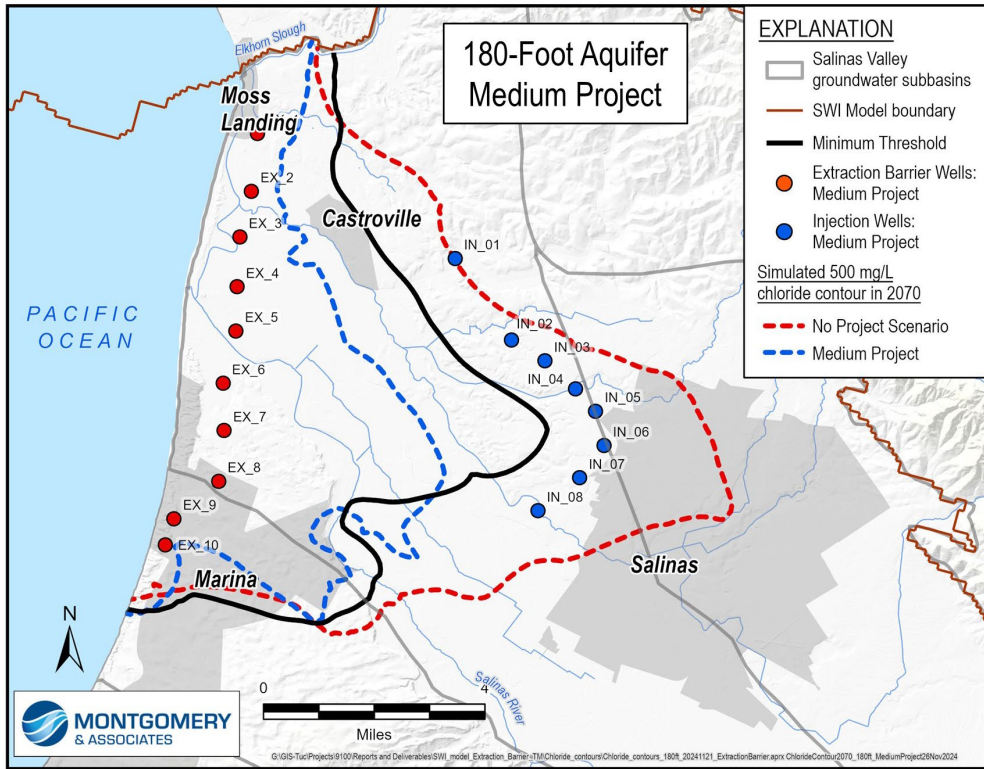


Figure 20. Medium Project – 2070 500 mg/L Chloride Contours Comparison to No Project Scenario and Minimum Threshold

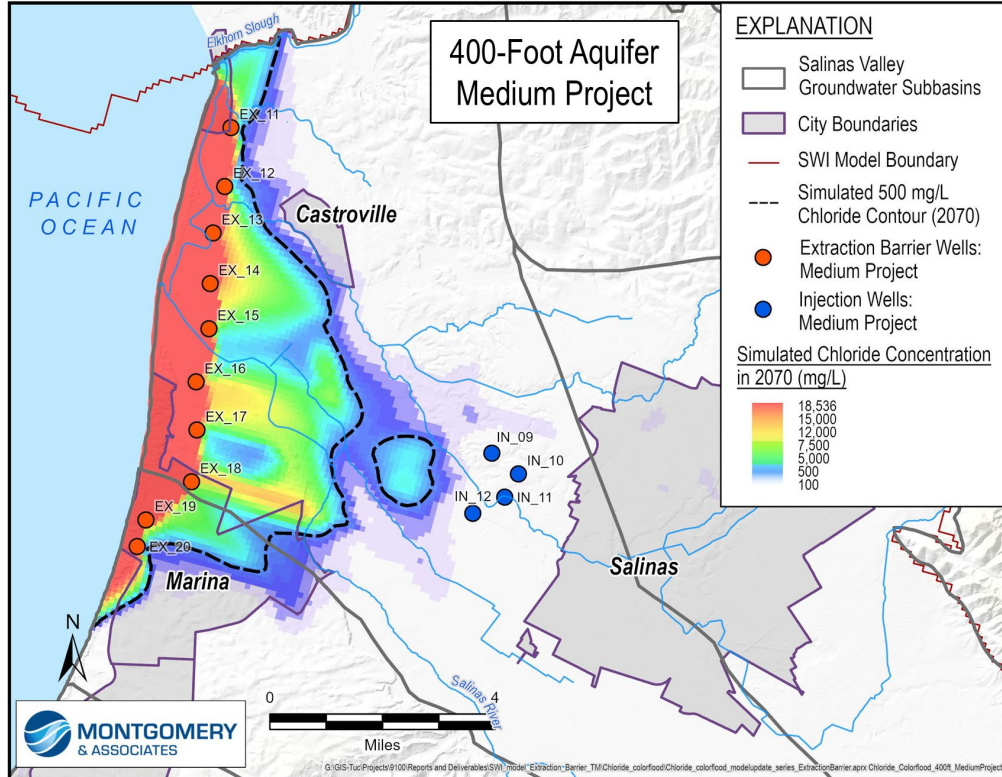
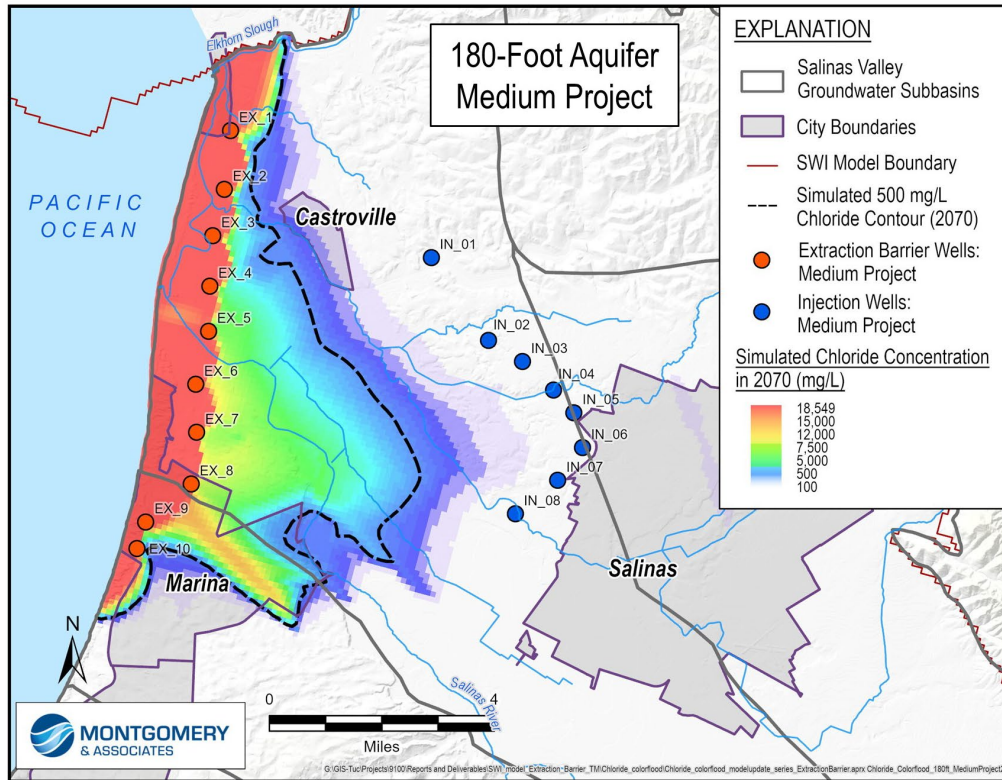


Figure 21. Simulated Chloride Concentration in 2070 for the Medium Project Scenario

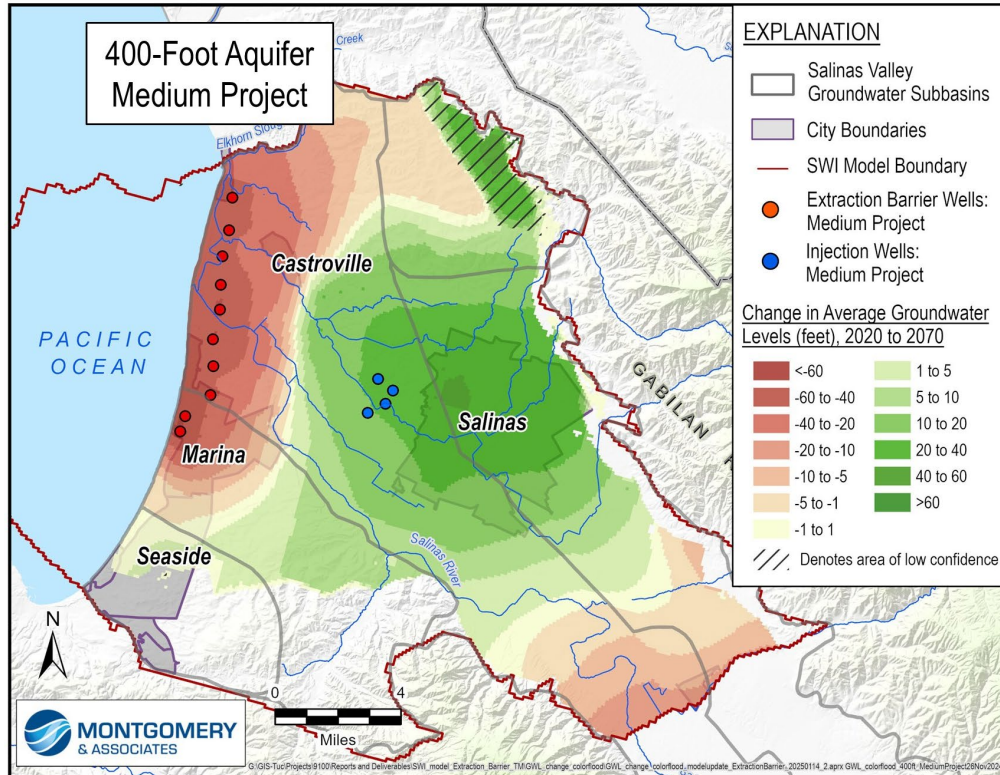
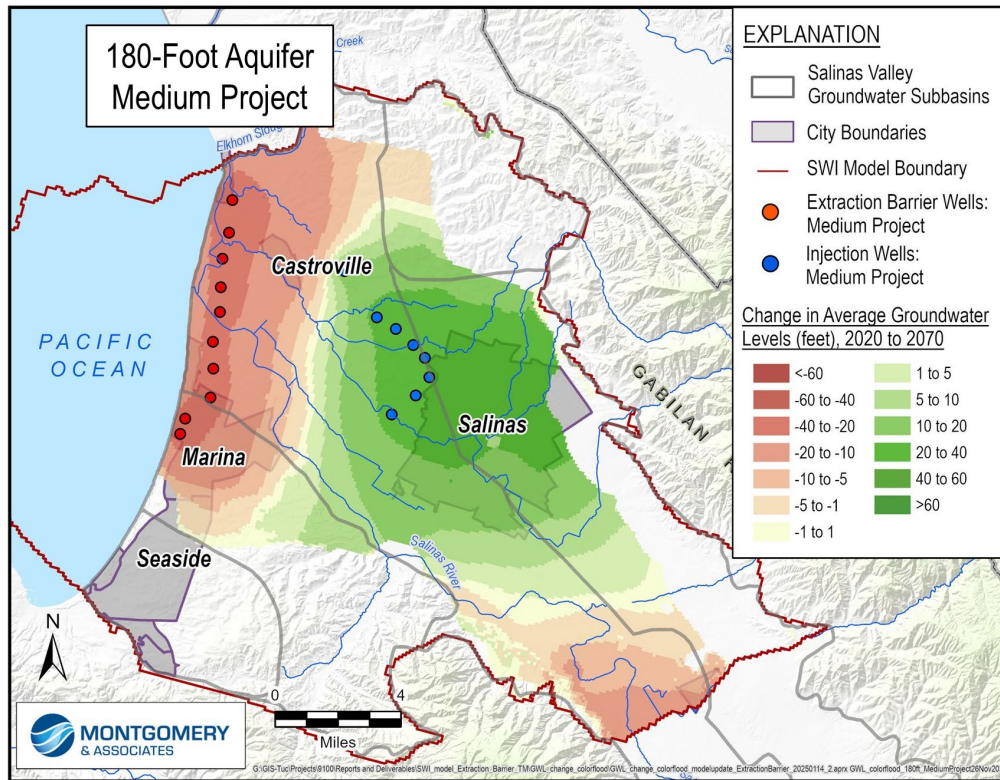


Figure 22. Simulated Change in Groundwater Levels for the Medium Project Scenario

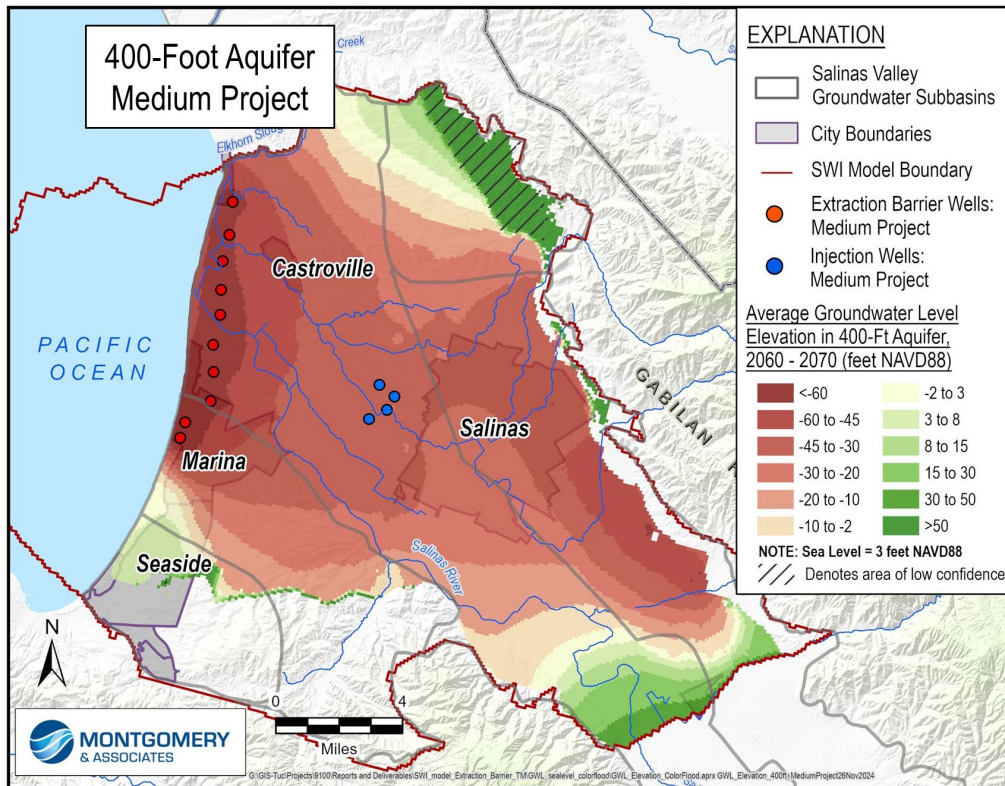
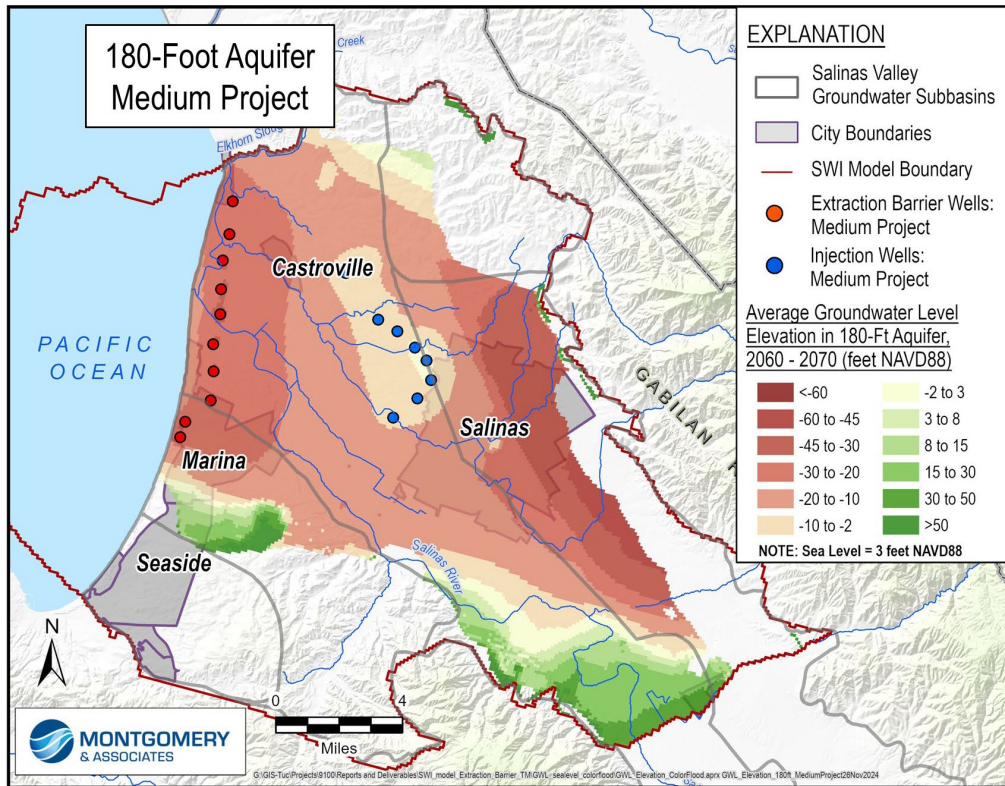


Figure 23. Simulated Groundwater Elevation for the Medium Project Scenario

Large Project Scenario

Figure 24 shows maps of the 500 mg/L chloride front simulated by the SWI Model for the Large Project Scenario. The Large Project Scenario extraction barrier wells pump at higher rates than in the Medium and Small Project Scenarios, and the Scenario includes 2 clean-up wells in each the 180-Foot and 400-Foot Aquifers (4 clean-up wells total). Figure 24 shows that the 500 mg/L chloride front retreats significantly toward the coast in the 180-Foot and 400-Foot Aquifers. There is particularly rapid coastal movement of the 500 mg/L chloride contour between 2030 and 2040 in the 180-Foot Aquifer. The clean-up wells in the 180-Foot Aquifer appear to help control of the seawater intrusion front early in the process. The clean-up well near the 400-Foot Aquifer seawater island reduces the size of the island somewhat, but the island is drawn back toward the coast by the extraction barrier and away from the clean-up well after 2040. The simulation shows that once the 500 mg/L chloride contour reaches the clean-up well they hinder rather than help the project. During project implementation, the clean-up wells should be taken offline once the water quality inland of the well improves.

Figure 25 compares the simulated 2070 intrusion extent with the 2070 No Project Scenario intrusion extent and the seawater intrusion minimum threshold. The Large Project Scenario meets and exceeds the seawater intrusion minimum threshold in both the 180-Foot and 400-Foot Aquifers and approaches the measurable objective, especially near Castroville.

Figure 21 shows the chloride concentrations in the 180-Foot and 400-Foot Aquifers resulting from the Large Project Scenario in 2070. The chloride concentrations are similar to the Medium Project Scenario, but generally lower on the landward side of the extraction barrier.

Table 5 demonstrates that the Large Project Scenario is an effective scenario for addressing seawater intrusion. The mass of chloride and seawater intruded areas are reduced more in the Large Project Scenario compared to the Small and Medium Project Scenarios. However, the relative improvement between the Medium and Large Project Scenarios is not as great as the improvement observed between the Small and Medium Project Scenarios. The outcome is the best out of the 7 simulated project scenarios for the 400-Foot Aquifer in terms of reduction to mass of chloride and seawater intruded area, and a close second best for the 180-Foot Aquifer.

Figure 27 shows average groundwater level changes between 2020 and 2070 in the Large Project Scenario. Average change in groundwater levels follows similar trends as the Medium and Small Project Scenarios. By 2070, average groundwater levels in the general vicinity around the extraction barrier in the 180-Foot Aquifer decrease by 20 to 30 feet, and by up to 40 to 50 feet close to the extraction barrier wells. Average groundwater levels in the 400-Foot Aquifer decrease in the vicinity around the extraction barrier by approximately 50 to 70 feet, and up to

80 feet close to the extraction barrier wells. Average groundwater levels near the City of Salinas are projected to increase by 30 to 40 feet in both the 180-Foot and 400-Foot Aquifers.

Figure 28 shows the average groundwater levels between 2060 and 2070 for the Large Project Scenario. As with the Medium and Small Project Scenarios, the groundwater elevations in the 180-Foot and 400-Foot Aquifers are projected to remain below sea level in 2070 even in areas where average groundwater levels would increase, except in the immediate vicinity of the injection wells in the 180-Foot Aquifer.

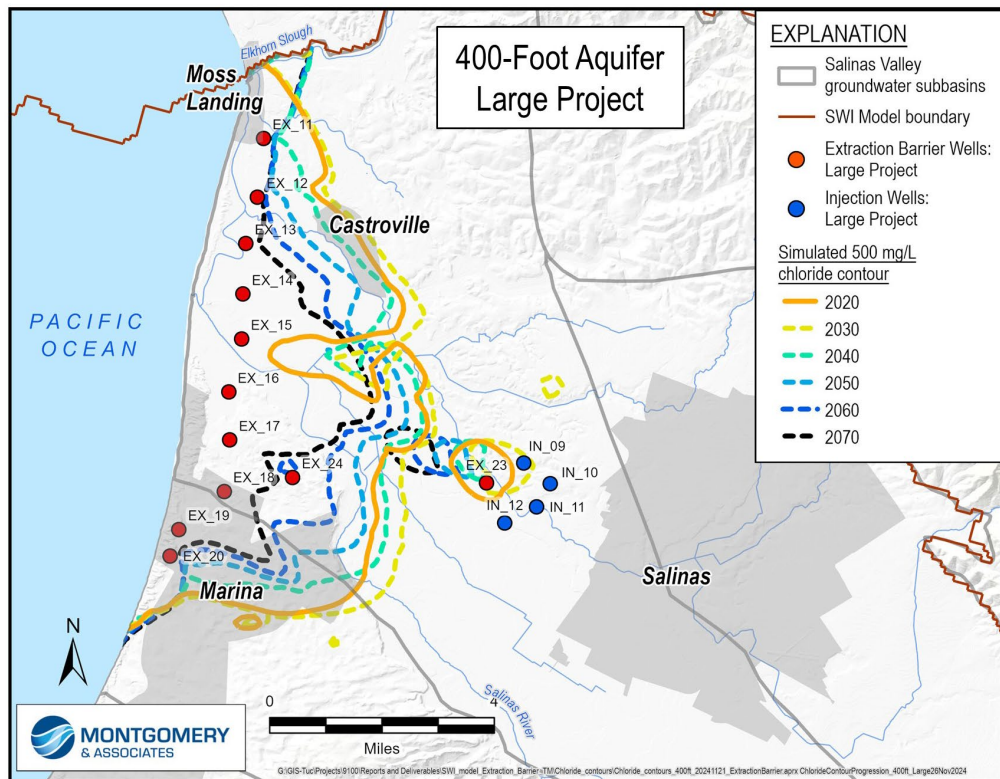
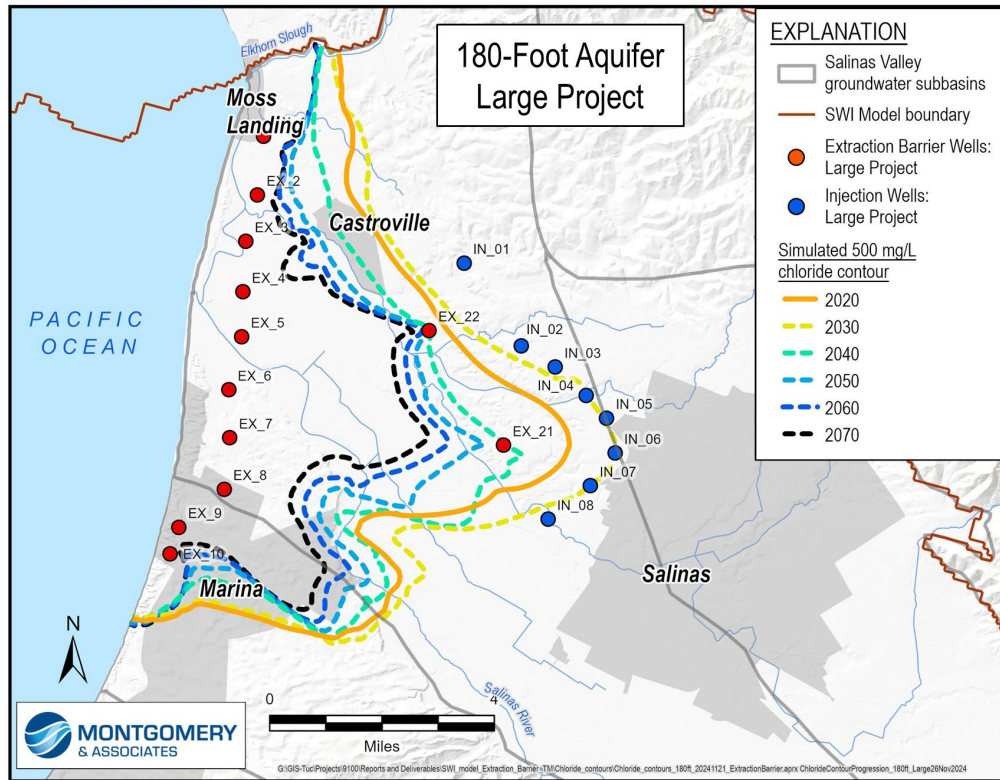


Figure 24. Progression of Simulated Chloride Contours for the Large Project Scenario

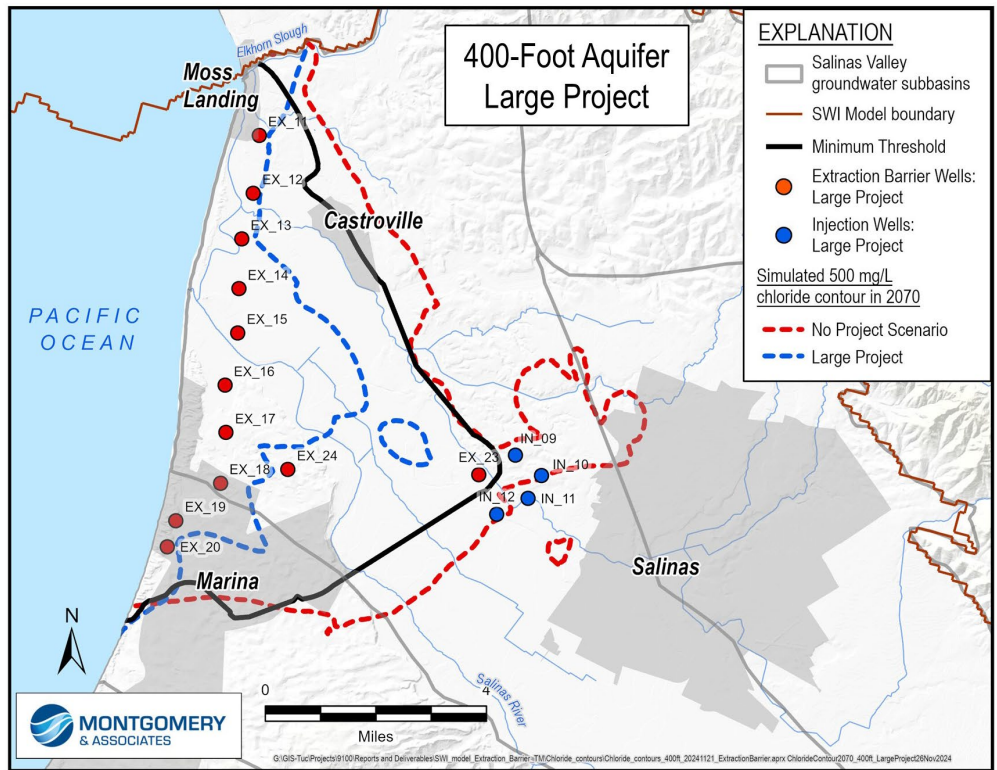
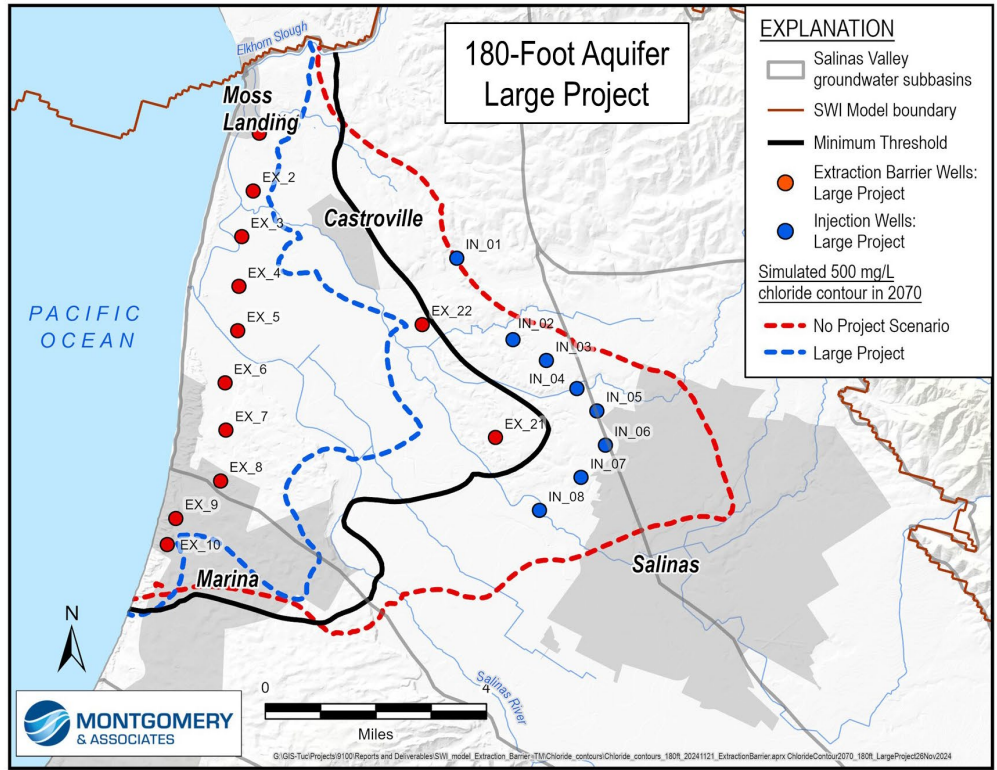


Figure 25. Large Project – 2070 500 mg/L Chloride Contours Comparison to No Project Scenario and Minimum Threshold

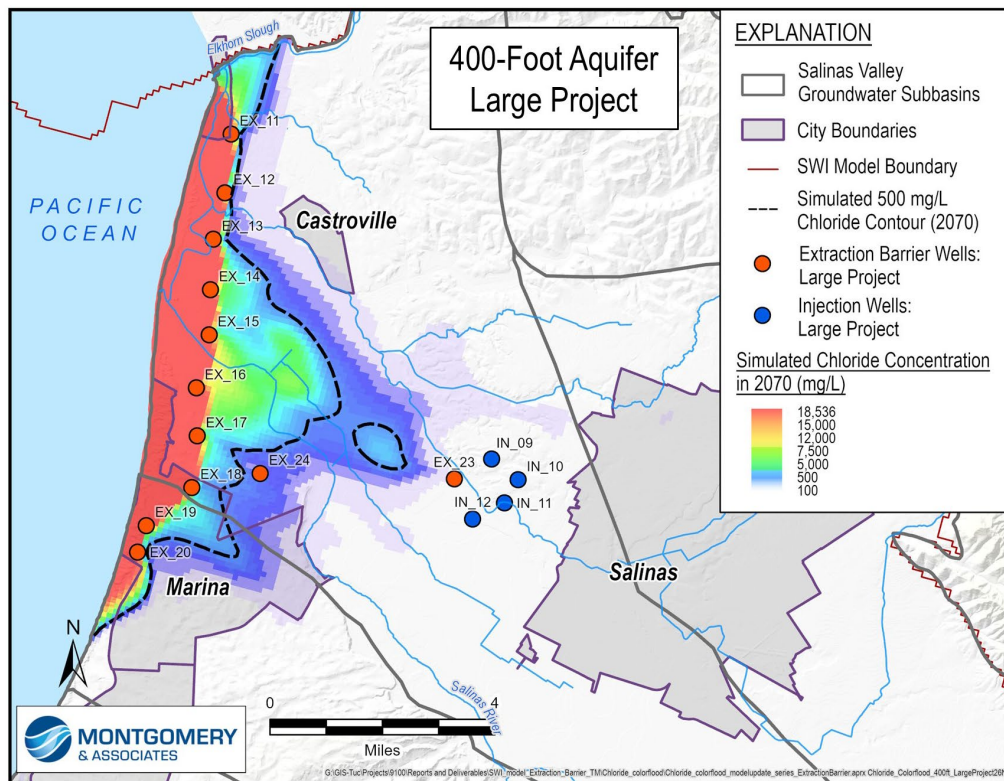
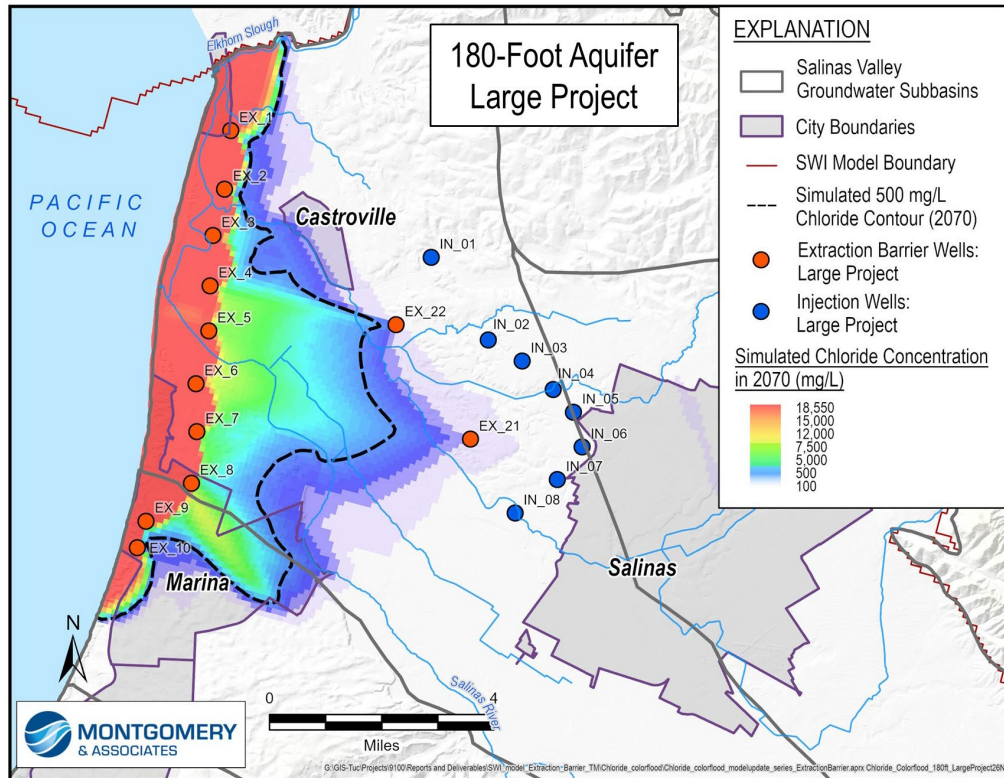


Figure 26. Simulated Chloride Concentration in 2070 for the Large Project Scenario

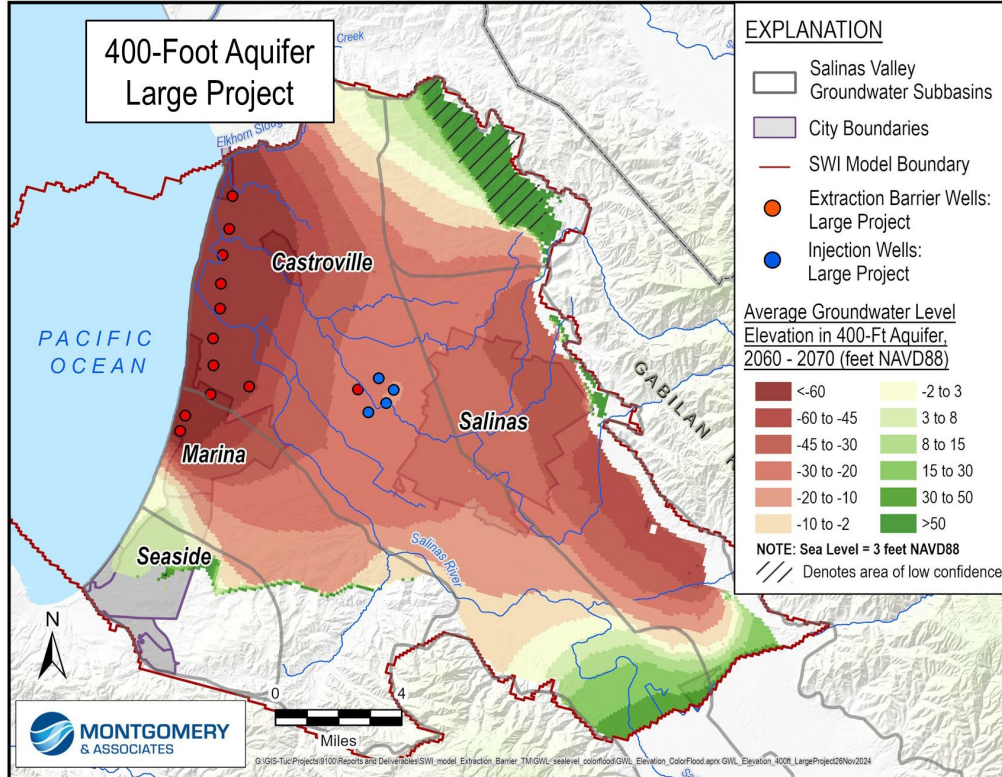
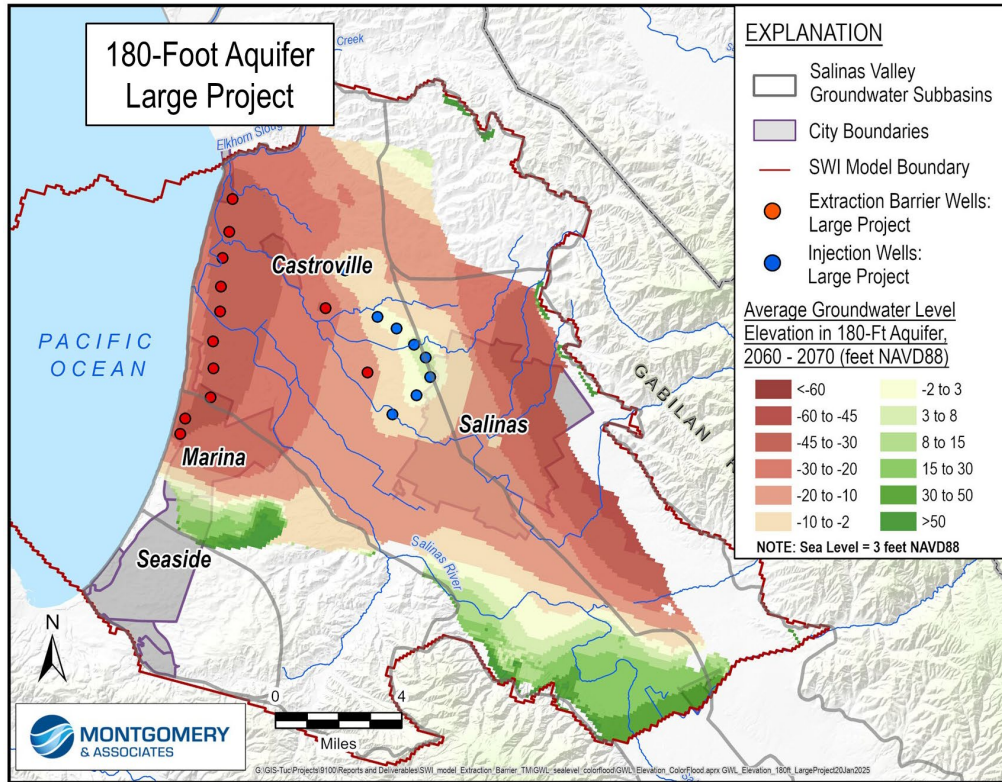


Figure 28. Simulated Groundwater Elevation for the Large Project Scenario

Injection Only Project Scenario

Figure 29 shows maps of the 500 mg/L chloride front simulated by the SWI Model for the Injection Only Project Scenario. This scenario does not include direct deliveries of treated water from the extraction barrier; existing groundwater users are assumed to continue using their existing wells and distribution systems same as in the No Project Scenario. Instead of direct deliveries, the treated water is injected. Because the injection volume is larger, there are additional injection wells in the 180-Foot and 400-Foot Aquifers compared to the Medium and Large Project Scenarios. Figure 29 shows that between 2030 and 2070, the 500 mg/L chloride front retreats toward the coast in the 180-Foot and 400-Foot Aquifers to an extent generally similar to the Medium Project Scenario. There is less movement of the 500 mg/L chloride contour toward the coast in part of the 400-Foot Aquifer near Castroville where the CSIP supplemental wells are located, and in the 400-Foot Aquifer to the east of the City of Marina where Marina Coast Water District municipal wells are located.

Figure 30 compares the simulated 2070 intrusion extent (blue dashed line) with the 2070 No Project intrusion extent (red dashed line) and the seawater intrusion minimum threshold (black line). The Injection Only Project Scenario generally meets the seawater intrusion minimum threshold criterion in both the 180-Foot and 400-Foot Aquifers. A small spur of the 500 mg/L chloride contour exceeds the minimum threshold line in the 400-Foot Aquifer to the east of the City of Marina near the Marina Coast Water District municipal wells that continue to pump.

Figure 31 shows the chloride concentrations in the 180-Foot and 400-Foot Aquifers in 2070 for the Injection Only Project Scenario. As with the Large Project Scenario, chloride concentrations are similar to the Medium Project with slightly reduced concentrations inland from the extraction barrier. The 2070 chloride concentrations for the Injection Only Project Scenario are somewhere between the Medium and Large Project Scenarios.

Table 5 demonstrates how the Injection Only Project Scenario is the most effective scenario for addressing seawater intrusion in the 180-Foot Aquifer. The mass of chloride and seawater intruded areas in the 180-Foot Aquifer are reduced the most in the Injection Only Project Scenario when compared to the 7 other project scenarios, including even a slight improvement over the Large Project Scenario. The Injection Only Project Scenario is a close second to the Large Project Scenario in terms of reduction to chloride mass and seawater intruded area in the 400-Foot Aquifer.

Figure 32 shows the average groundwater level changes between 2020 and 2070 in the Injection Only Project scenario. Average groundwater levels decrease near the extraction wells and increase near the injection wells; however, there is an important difference compared to the Small, Medium, and Large Project Scenarios. In the Injection Only Project Scenario and in other scenarios without offset pumping, the areas of increasing groundwater levels are focused around

the injection wells in the 180-Foot and 400-Foot Aquifers. The increase in groundwater levels under the City of Salinas and in Eastside is less compared to the project scenarios, which include pumping offsets. Average groundwater levels near the injection wells increased about 20 to 50 feet in the 180-Foot Aquifer and 10 to 30 feet in the 400-Foot Aquifer. Average groundwater levels around the extraction barrier decreased by approximately 10 to 25 feet in the 180-Foot Aquifer and 40 to 60 feet in the 400-Foot Aquifer.

Figure 33 shows the average groundwater level elevations between 2060 and 2070 for the Injection Only Project. As with the Small, Medium, and Large Project Scenarios, the groundwater elevations in the 180-Foot and 400-Foot Aquifers are projected to remain below sea level in 2070 even in areas where average groundwater levels would increase, except in the immediate vicinity of the injection wells in the 180-Foot Aquifer.

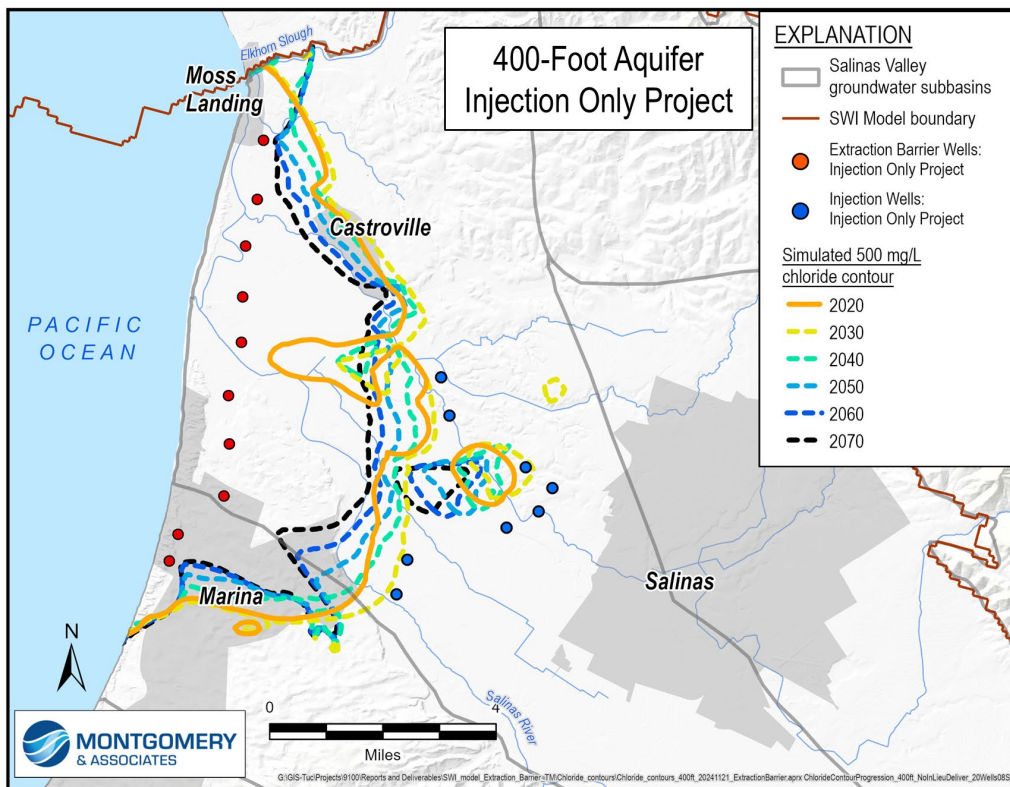
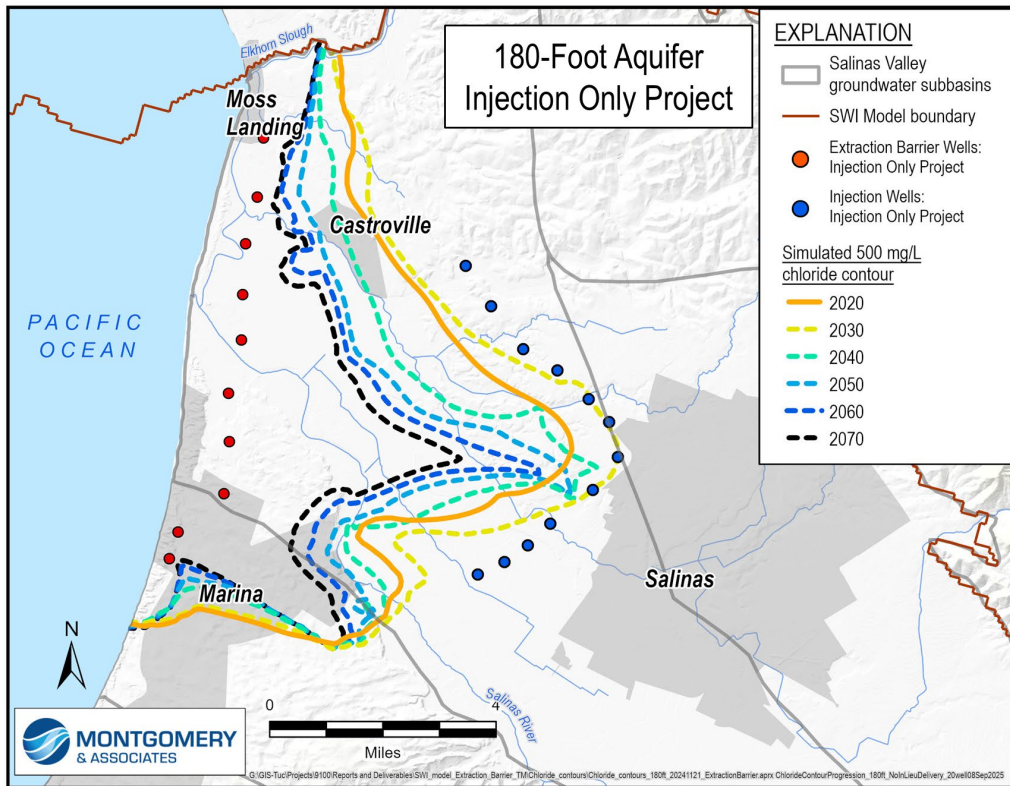


Figure 29. Progression of Simulated Chloride Contours for the Injection Only Project Scenario

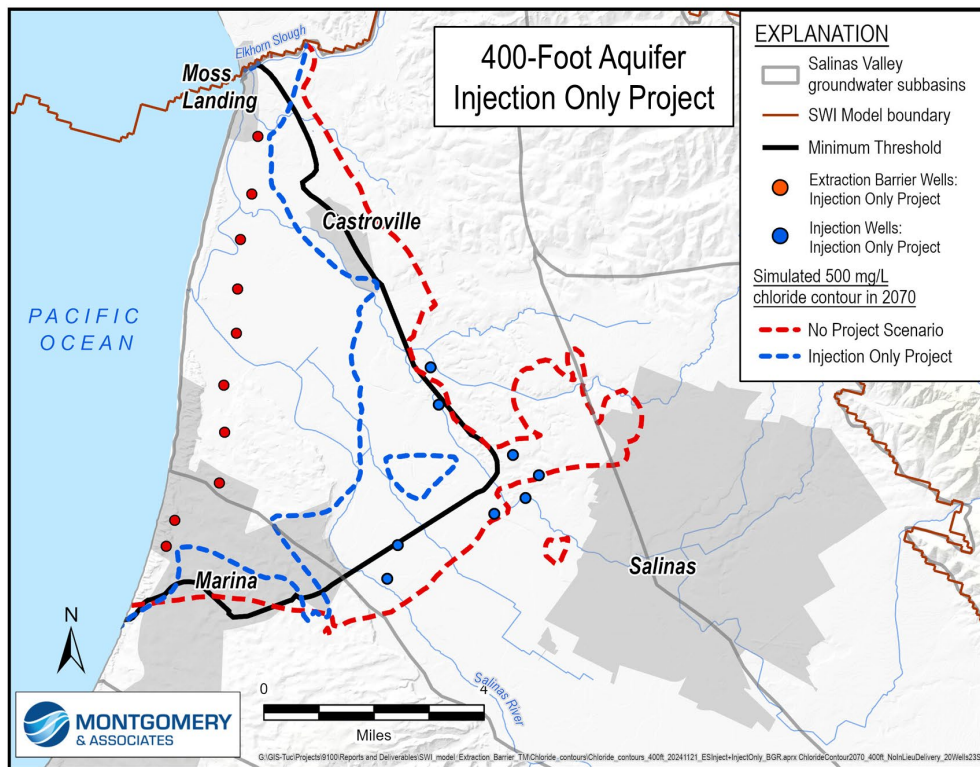
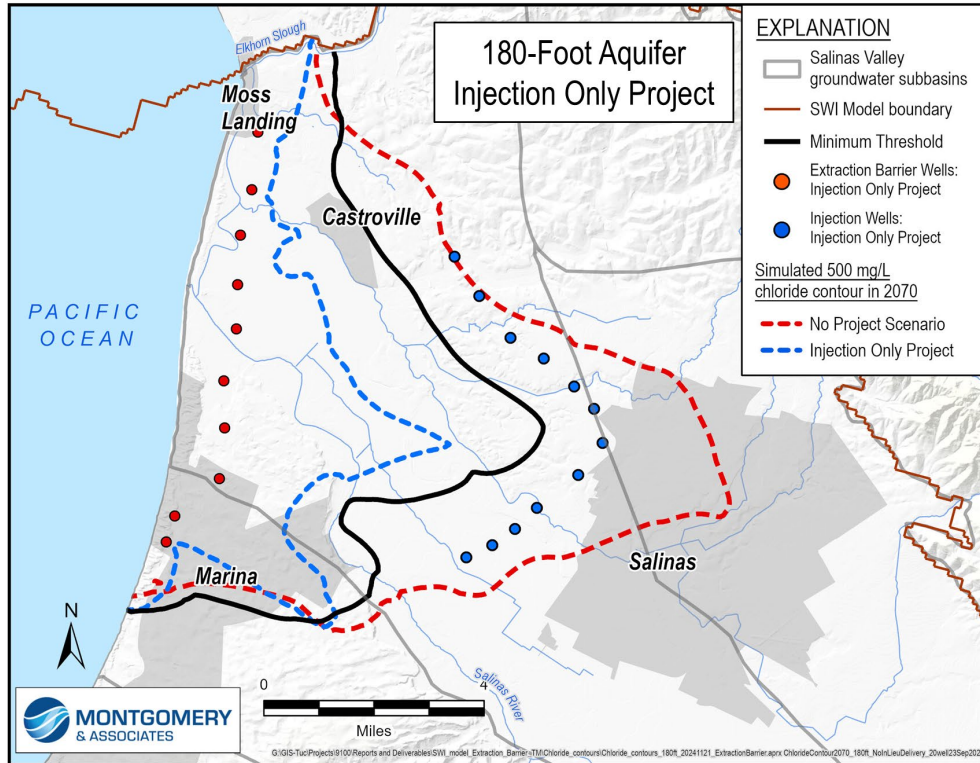


Figure 30. Injection Only Project – 2070 500 mg/L Chloride Contours Comparison to No Project Scenario and Minimum Threshold

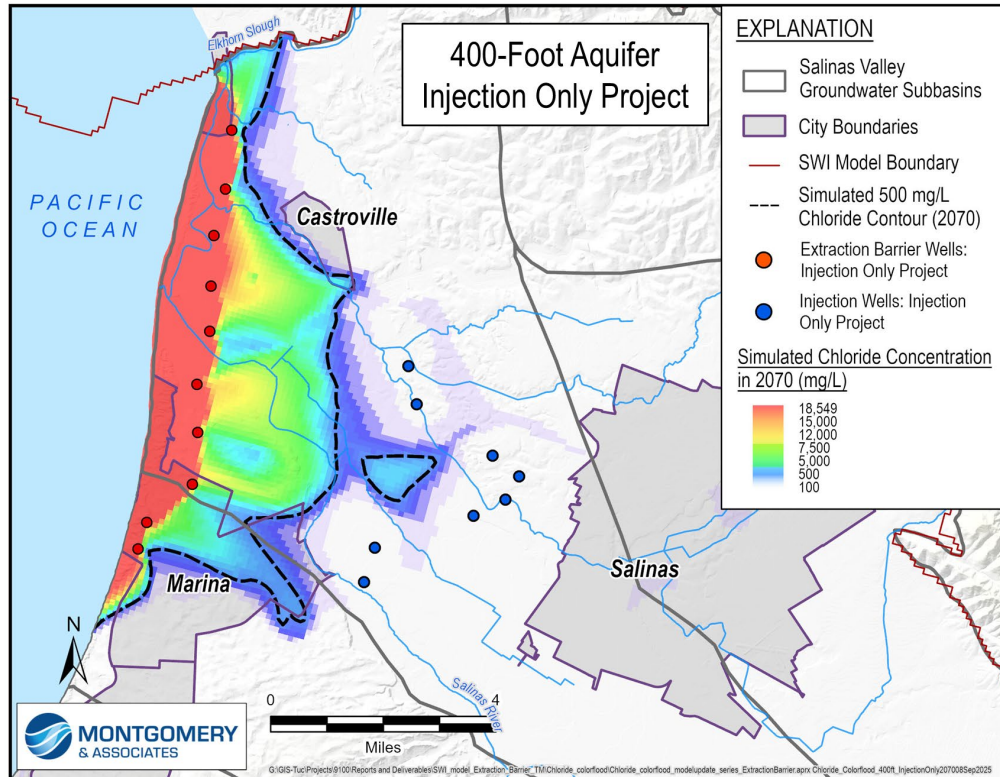
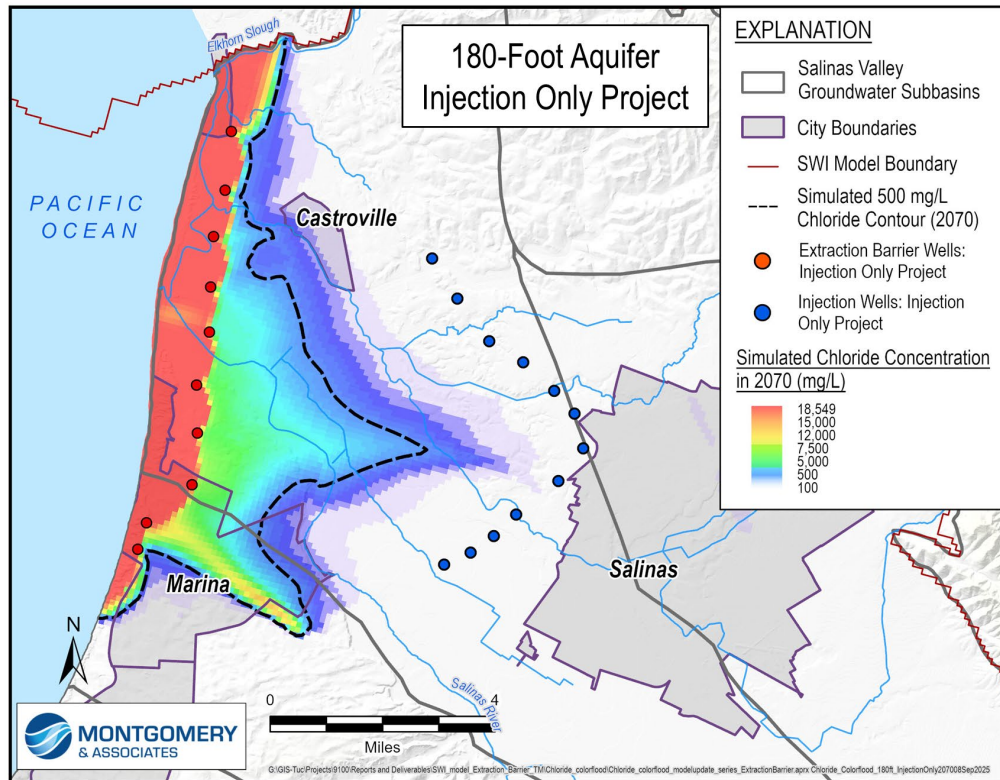


Figure 31. Simulated Chloride Concentration in 2070 for the Injection Only Project Scenario

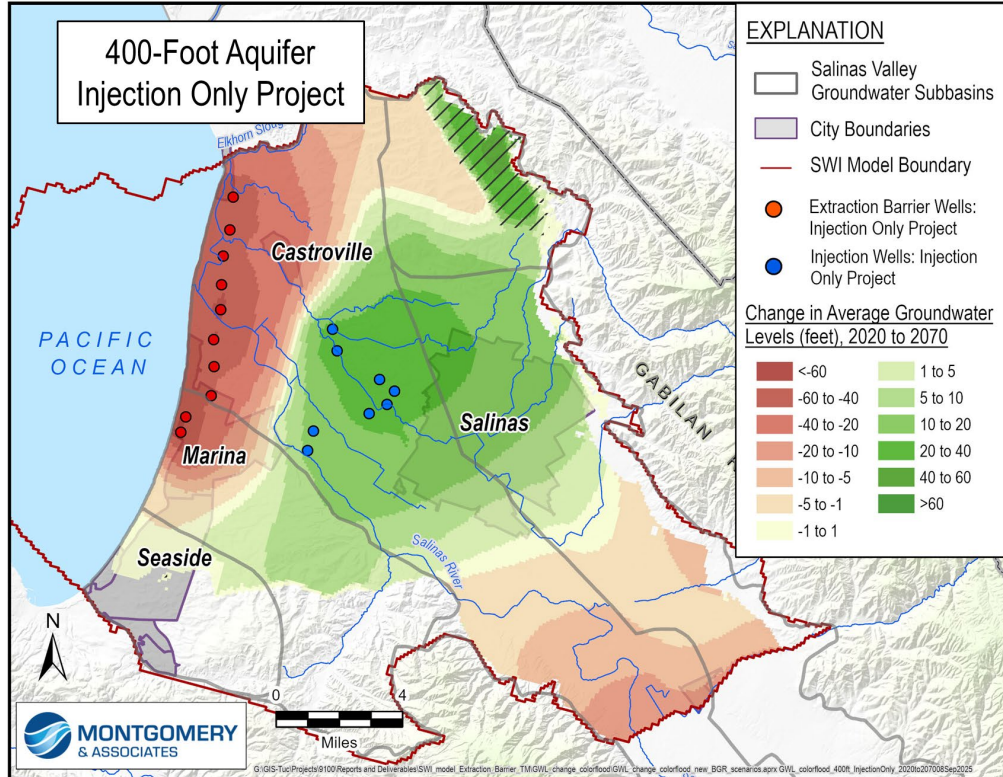
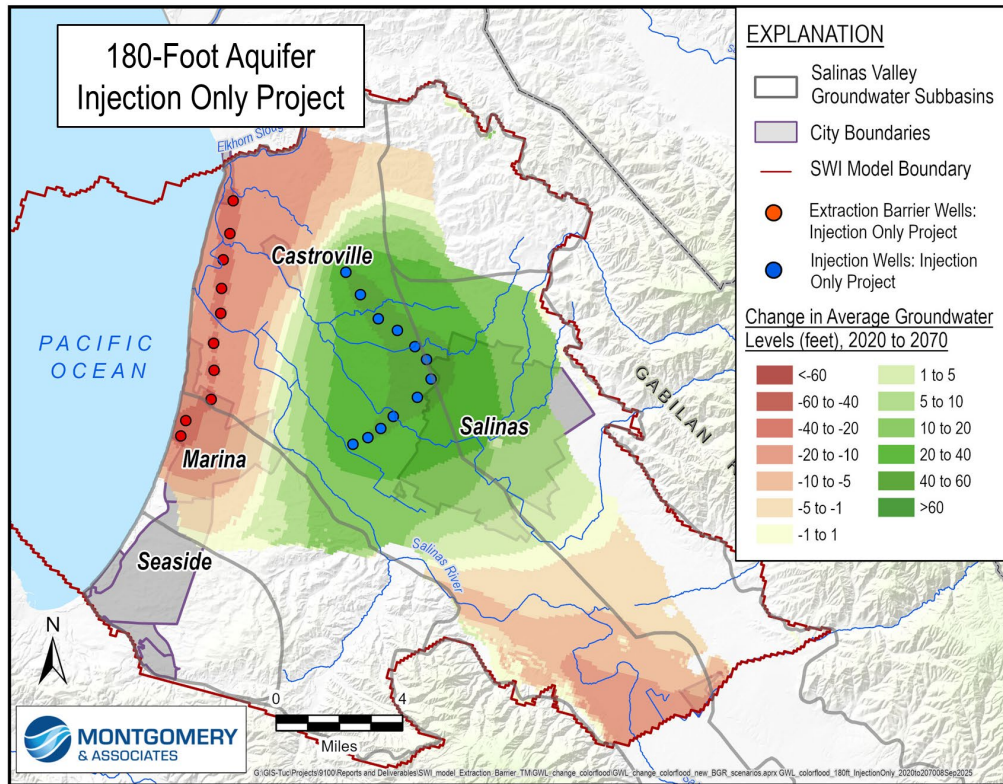


Figure 32. Simulated Change in Groundwater Levels for the Injection Only Project Scenario

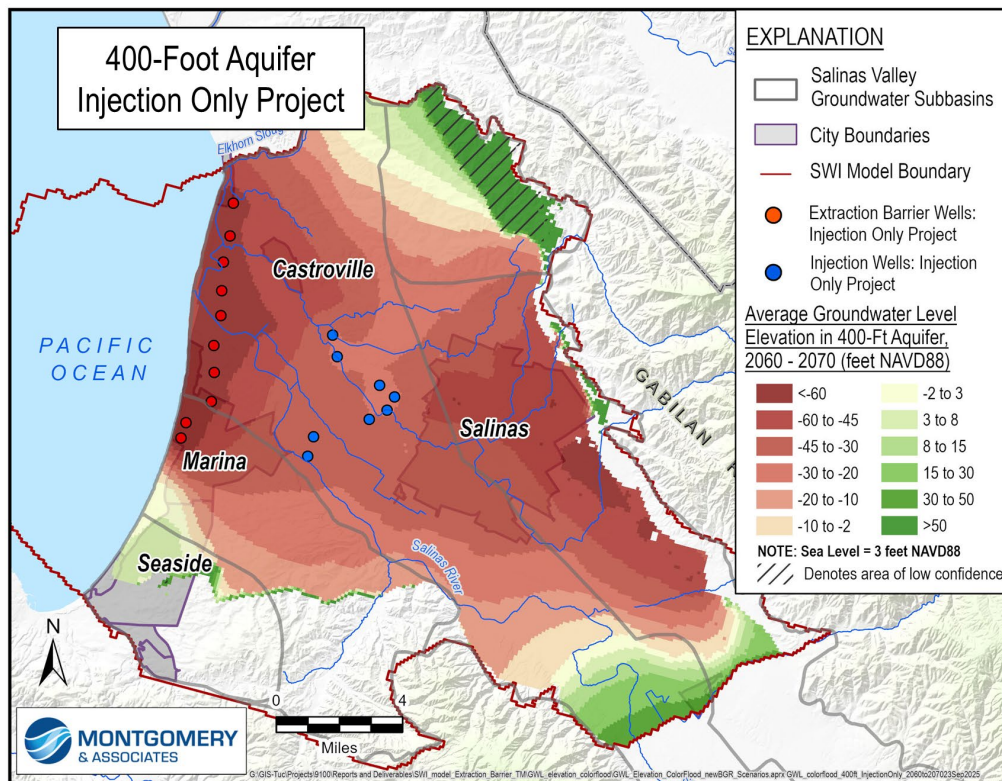
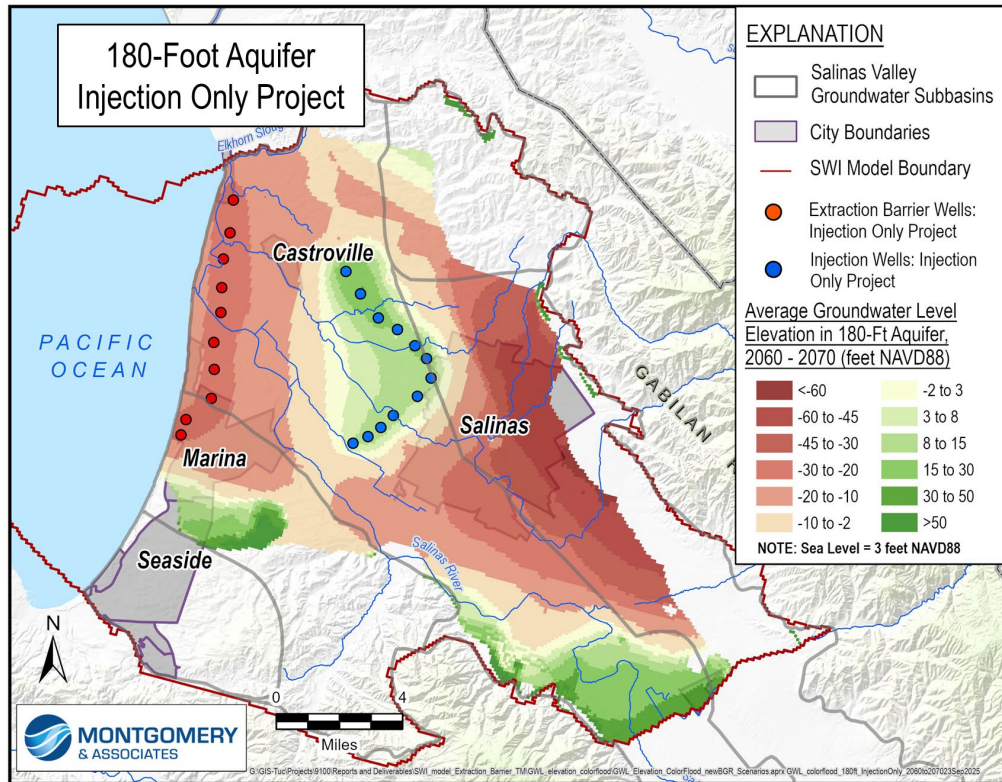


Figure 33. Simulated Groundwater Elevation for the Injection Only Project Scenario

Eastside Injection Only Project Scenario

Figure 34 shows a map of the 500 mg/L chloride front simulated by the SWI Model for the Eastside Injection Only Project Scenario. While the 180-Foot and 400-Foot Aquifers are not present in the Eastside Subbasin, model layers extend from the 180-Foot and 400-Foot Aquifers into the alluvial fans. Correspondingly, the model results for the 180-Foot Aquifer include the 180-Foot Aquifer equivalent in the Eastside Subbasin, and the result for the 400-Foot Aquifer include the 400-Foot Aquifer equivalent in the Eastside Subbasin. This project uses an extraction barrier similar to the Medium Project Scenario and treated water is injected into the Eastside Subbasin to raise groundwater levels. There is no delivery of treated water to offset groundwater pumping. Injection is farther from the seawater intrusion front than the injection in other project scenarios; therefore, it is less effective at managing seawater intrusion. Figure 34 shows that between 2030 and 2070, seawater intrusion toward the City of Salinas is reversed to about the same extent as the Small Project Scenario in the 180-Foot Aquifer. Seawater intrusion in the 400-Foot Aquifer is reversed to about the same extent as the Medium Project Scenario.

Figure 35 compares the Eastside Injection Only Project Scenario's simulated 2070 intrusion extent to the No Project Scenario's intrusion extent and seawater intrusion minimum threshold. By 2070, the Eastside Injection Only Project Scenario generally meets the minimum threshold criteria in the 400-Foot Aquifer. However, in the 180-Foot Aquifer the 2070 500 mg/L contour is still inland of the minimum threshold in some areas.

Figure 36 shows the chloride concentrations in the 180-Foot and 400-Foot Aquifer resulting from the Eastside Injection Only Project Scenario. The extraction barrier along the coast is generally effective at preventing new seawater from intruding into the Salinas Valley. The chloride concentrations in the 180-Foot Aquifer fall somewhere between the Small and Medium Project Scenario. The chloride concentrations in the 400-Foot Aquifer are similar to the Medium Project Scenario.

Table 5 demonstrates how the Eastside Injection Only Project Scenario falls somewhere between the Small and Medium Project Scenarios in its ability to address seawater intrusion. The reduction in mass of chloride and seawater intruded area for the Eastside Injection Only Project Scenario is greater than the Small Project Scenario but less than the Medium Project Scenario.

Figure 37 shows the average annual groundwater level changes between 2020 and 2070 in the Eastside Injection Only scenario. As in the Injection Only Project Scenario, increasing groundwater levels are centered around the injection wells, except this time within the alluvial fans of the Eastside Subbasin. Average change in groundwater levels near the extraction barrier decrease by about 20 to 30 feet in the 180-Foot Aquifer and 40 to 65 feet in the 400-Foot Aquifer. Average groundwater levels in the Eastside Subbasin increase dramatically due to the injection wells by 40 to 125 feet. The increase in groundwater levels extends beyond the Eastside

Subbasin into the 180/400 Subbasin, where groundwater levels also increase to a lesser extent of up to 15 feet.

Figure 38 shows the average groundwater levels between 2060 and 2070 for the Eastside Only Scenario. As with the previous project scenarios, groundwater elevations in both the 180-Foot and 400-Foot Aquifers and their equivalents are expected to remain below sea level even in areas where groundwater levels would increase, except in the vicinity of the injection wells in the Eastside Subbasin.

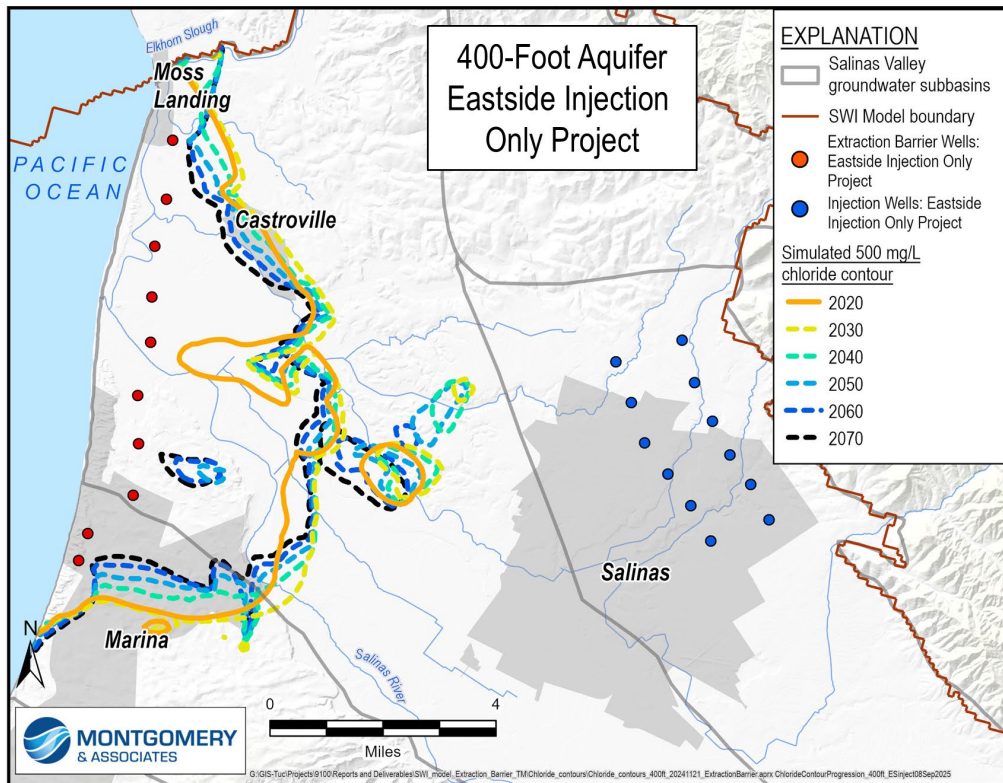
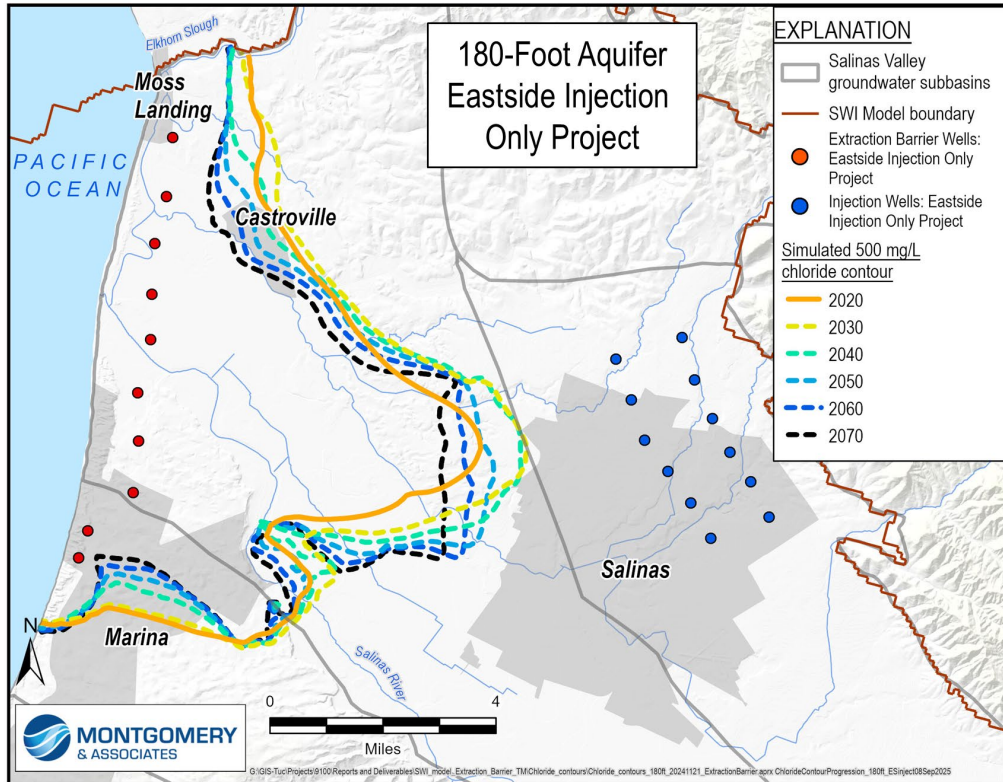


Figure 34. Progression of Simulated Chloride Contours for the Eastside Injection Only Project Scenario

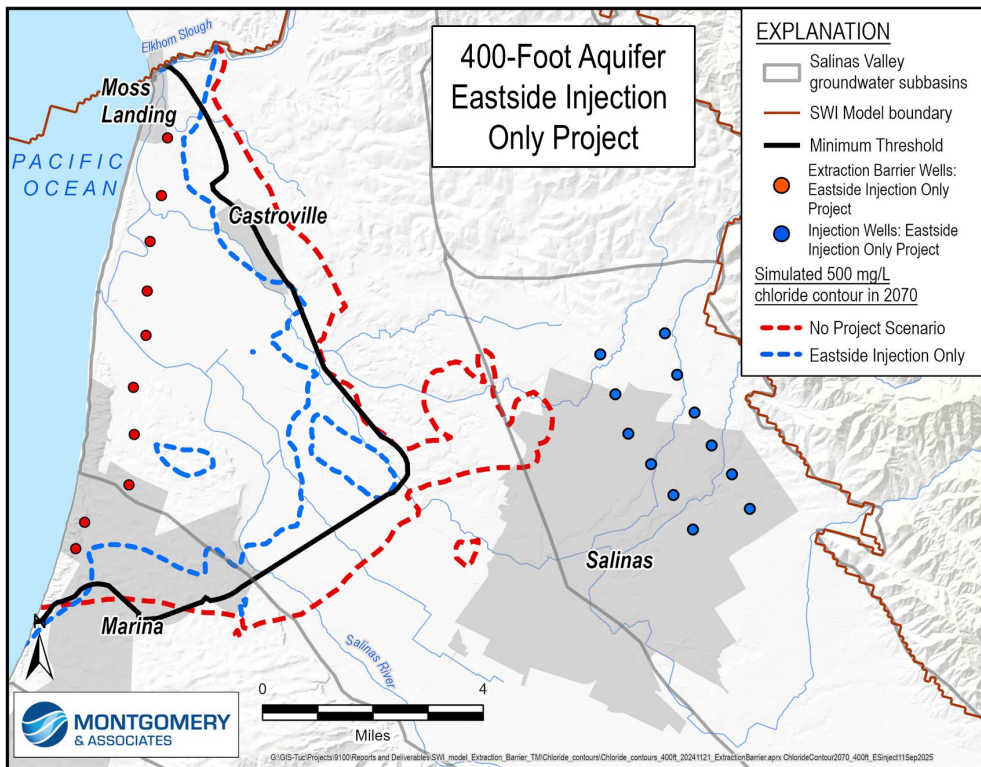
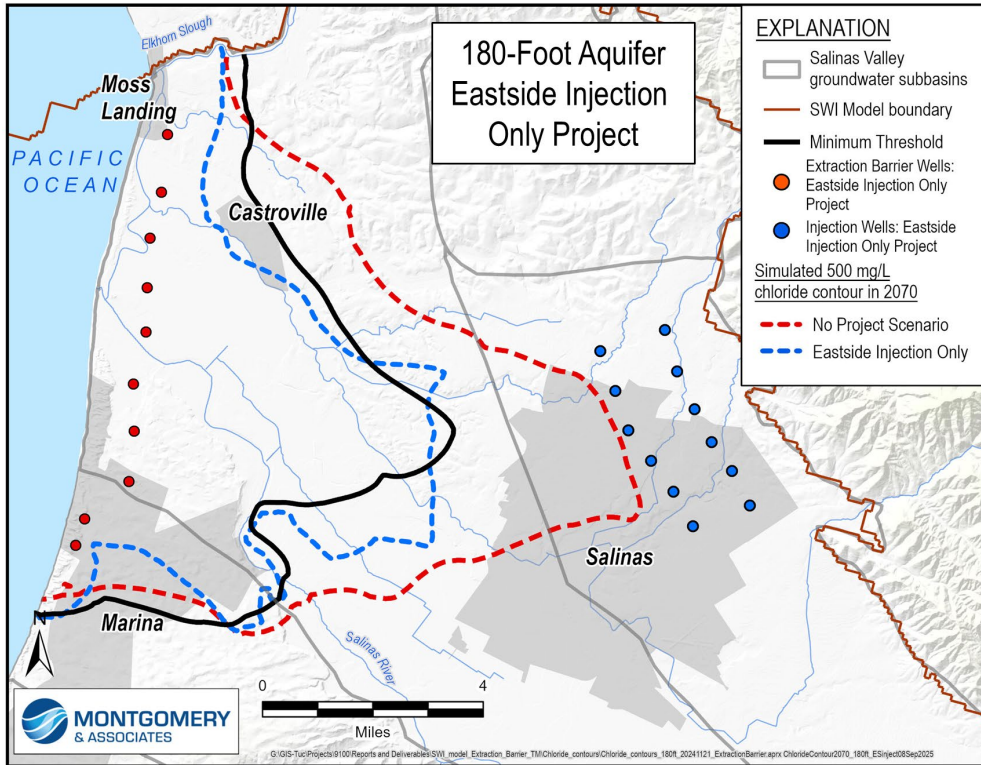


Figure 35. Eastside Injection Only Project – 2070 500 mg/L Chloride Contours Comparison to No Project Scenario and Minimum Threshold

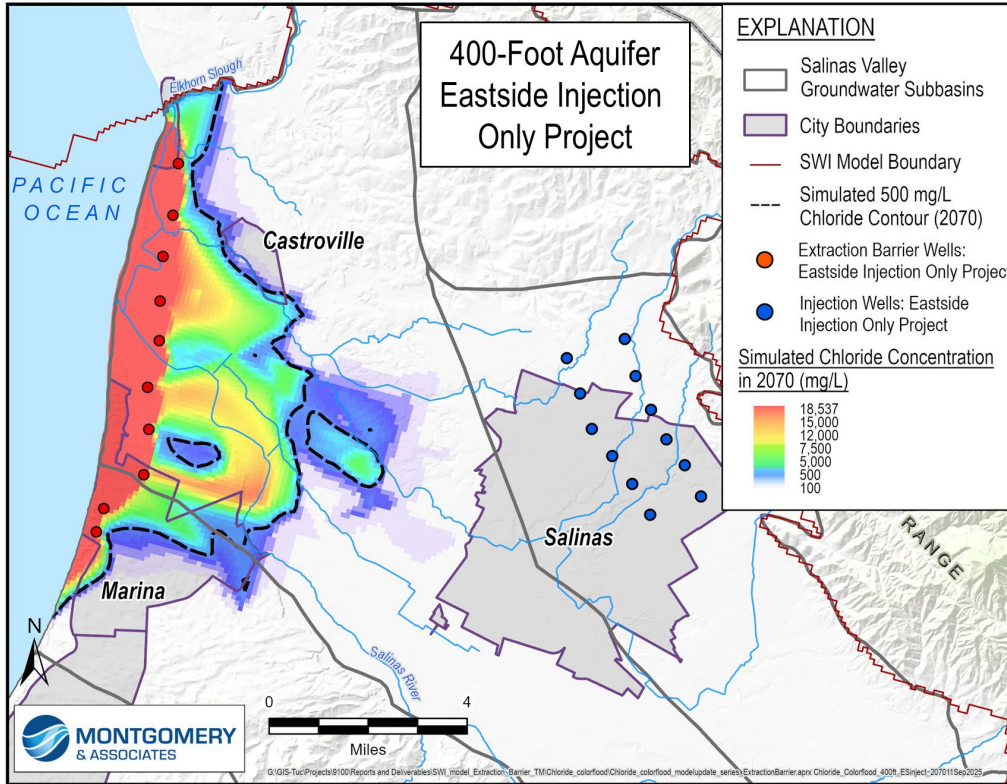
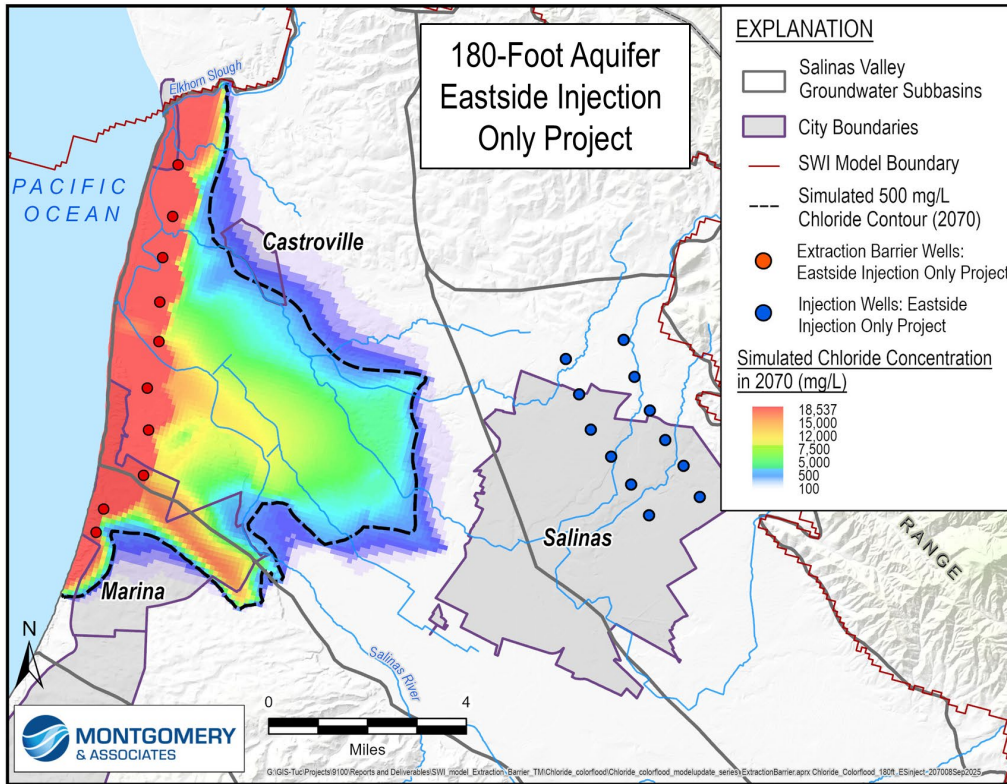


Figure 36. Simulated Chloride Concentration in 2070 for the Eastside Injection Only Project Scenario

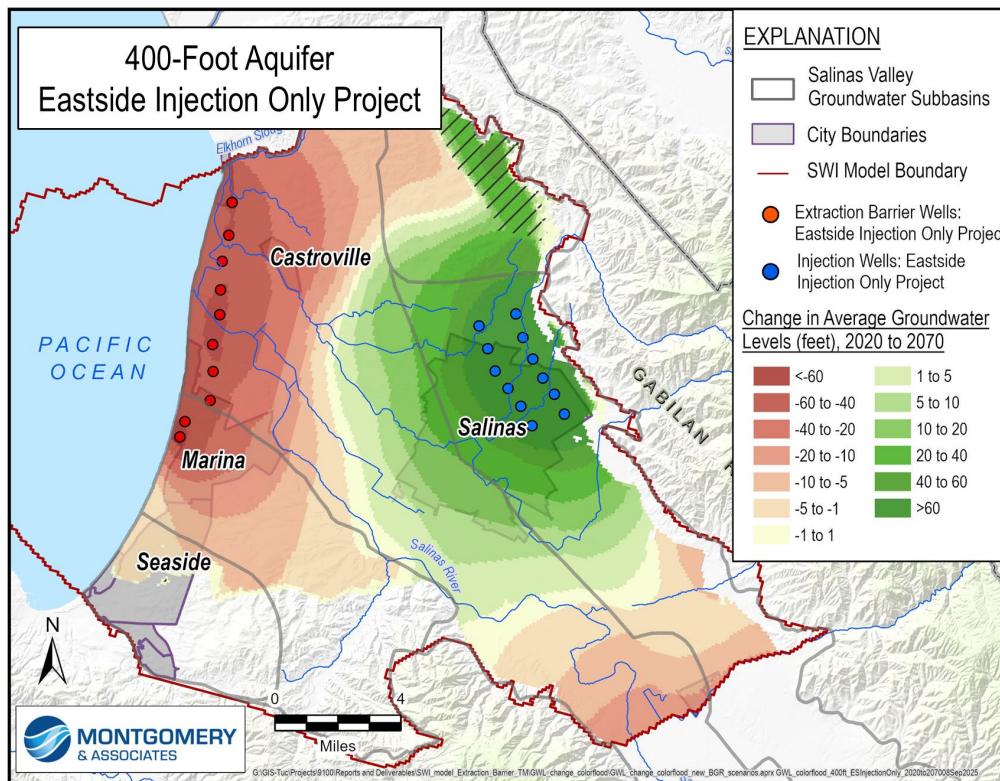
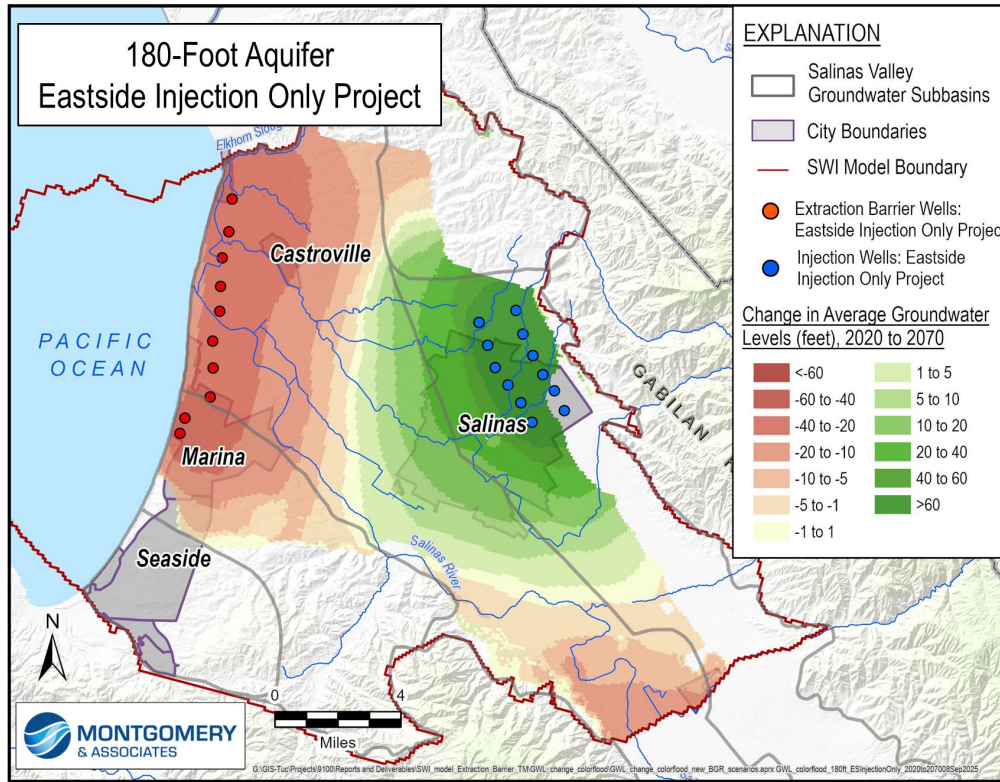


Figure 37. Simulated Change in Groundwater Levels for the Eastside Injection Only Project Scenario

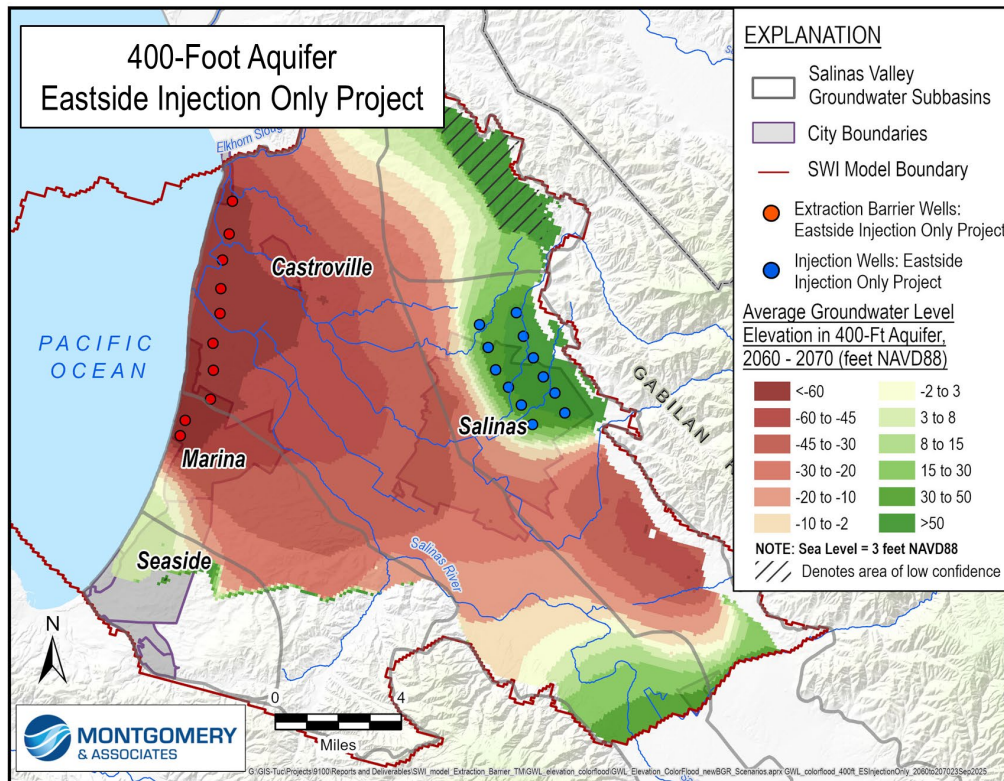
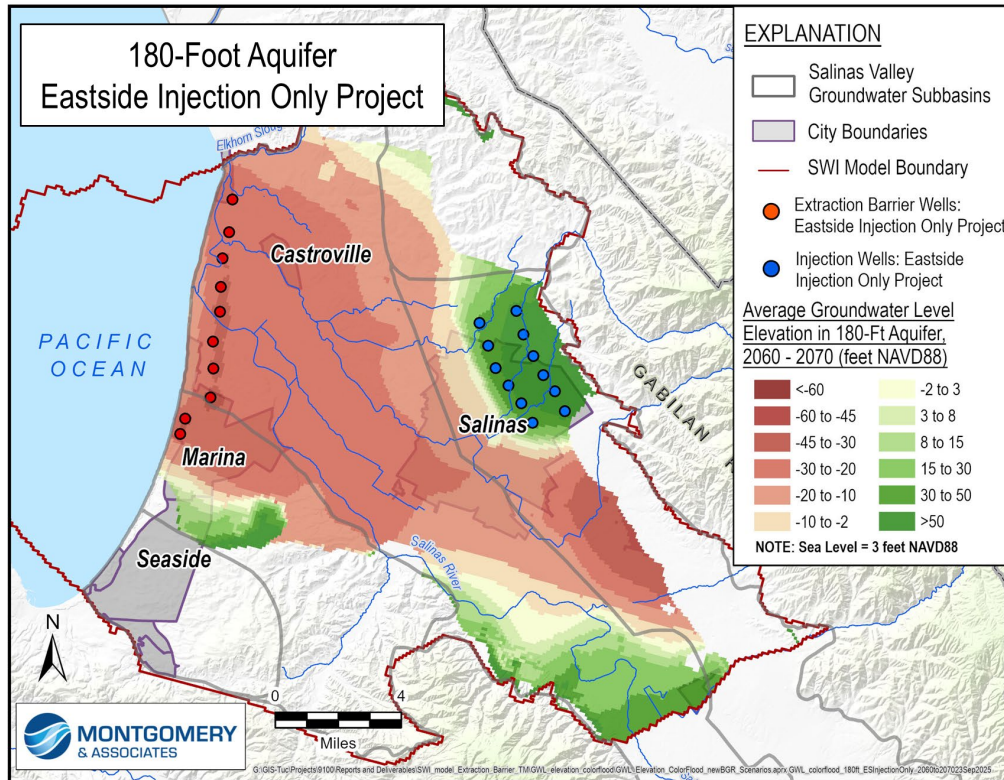


Figure 38. Simulated Groundwater Elevation for the Eastside Injection Only Project Scenario

North of River Only Project Scenario

The North of River Only Project Scenario limits the extraction and injection of groundwater to areas north of the Salinas River. Figure 39 shows the 500 mg/L chloride front simulated by the SWI Model for the North of River Only Project Scenario. Between 2030 and 2070, seawater is halted and reverses direction on the northern side of the main lobe of the seawater intruded area in the 180-Foot Aquifer, but seawater continues to progress inland toward the City of Salinas in the rest of the 180-Foot Aquifer, even between and around the injection wells. Though the injection rate in the 180-Foot Aquifer is greater than the Small Project, there is no offset of municipal pumping near the City of Salinas in the North of the River Only Project Scenario, which contributes to drawing seawater between the injection wells. The effect of the North of the River Only Project Scenario on seawater intrusion in the 400-Foot Aquifer is about the same as the Small Project Scenario. Two additional injection wells were used to help halt seawater intrusion east of the City of Marina, just north of the Salinas River. These wells appear to have helped slightly; however, some seawater was still able to penetrate inland south of, and between, the 2 injection wells. Therefore, the North of the River Project does not contain nor fully reverse ongoing seawater intrusion.

Figure 40 compares the North of River Only Project Scenario's simulated 2070 intrusion extent to the No Project Scenario's intrusion extent and the seawater intrusion minimum threshold. By 2070, the 500 mg/L chloride contour of the North of River Only Project Scenario is closer to the coast than the No Project Scenario in both the 180-Foot and 400-Foot Aquifers; however, this project scenario does not meet the minimum threshold.

Figure 41 illustrates chloride concentrations in the 180-Foot and 400-Foot Aquifers from the North of River Only Project Scenario. Seawater intrusion is effectively halted at the locations of the extraction barrier wells; however, seawater continues to intrude along the coastline south of the extraction barriers in both aquifers near the City of Marina. In the 180-Foot Aquifer, Figure 41 indicates some chloride breakthrough past the injection wells, reaching into the City of Salinas. Once seawater-impacted groundwater reaches the inland side of the injection wells, the injection can push the chloride farther inland. This is visible on Figure 41 in dark blue, which represents concentrations above background but less than 500 mg/L chloride. This is true to a lesser extent in the 400-Foot Aquifer as well; though, chloride concentrations are still lower than the No Project Scenario.

Table 5 demonstrates how the extraction barrier wells are useful in mitigating the migration of seawater inland from the coast. The North of River Only Project's extraction barrier is present only in the northern portion of the intruded area; therefore seawater can migrate inland freely south of the barrier wells. In the 180-Foot Aquifer, this scenario shows less reduction in chloride mass and area than the Small Project Scenario. The 400-Foot Aquifer shows an increase in both

mass and area due in part to the reduced size of the extraction barrier and low injection rates, but is still better than the No Project Scenario.

Figure 42 shows average groundwater level changes between 2020 and 2070 in the North of River Only Project. Average groundwater levels decrease in the general vicinity of the extraction barrier wells by about 10 to 20 feet in the 180-Foot Aquifer and 20 to 30 feet in the 400-Foot Aquifer. Close to the extraction barrier the groundwater levels decrease by up to 25 feet in the 180-Foot Aquifer and 50 feet in the 400-Foot Aquifer. The area of decreasing groundwater levels partially extends into the Monterey Subbasin. In the northern part of the City of Marina groundwater levels decline by about 1 to 10 feet. In both the 180-Foot and 400-Foot Aquifers, groundwater levels are estimated to increase by 5 to 15 feet near the injection wells west of the City of Salinas.

Groundwater elevations remain below sea level in both aquifers, as shown on Figure 43. Even though there are no extraction barrier wells in Monterey Subbasin, groundwater elevations remain below sea level along the coast in parts of the City of Marina in both the 180-Foot and 400-Foot Aquifers.

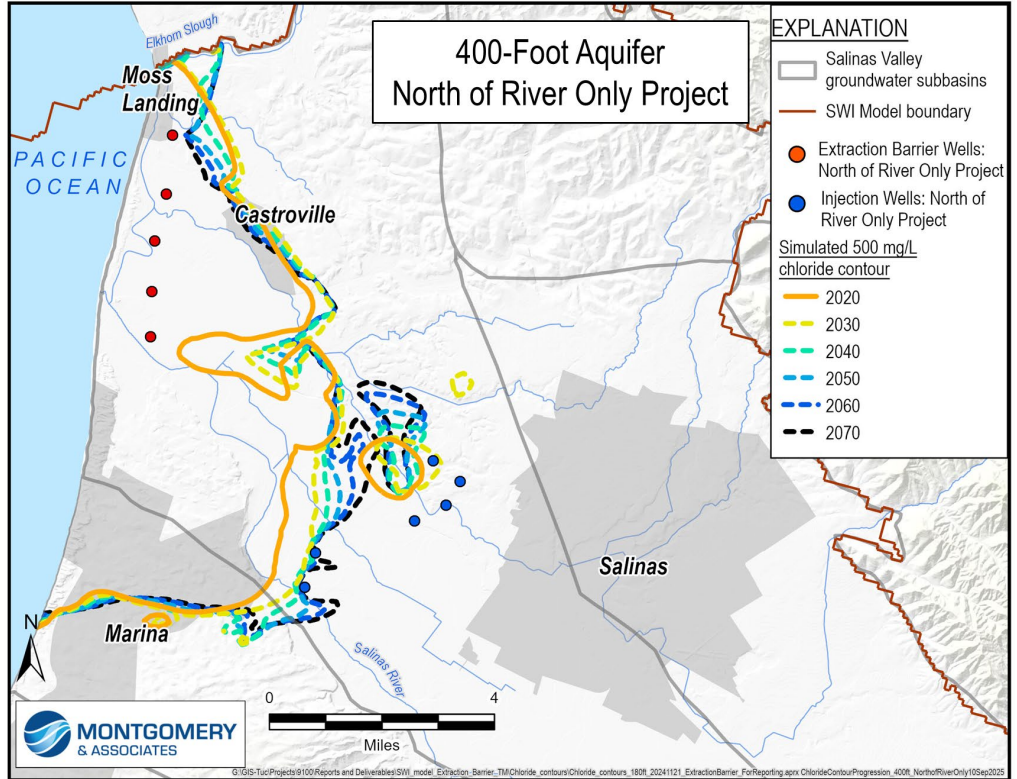
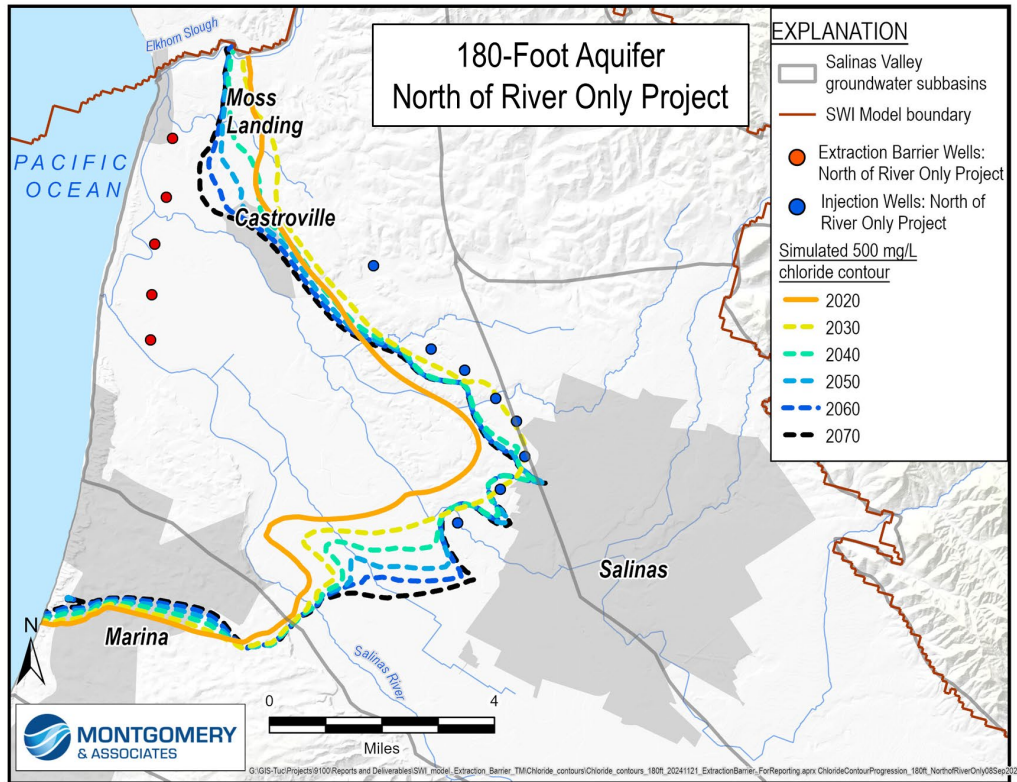


Figure 39. Progression of Simulated Chloride Contours for the North of River Only Project Scenario

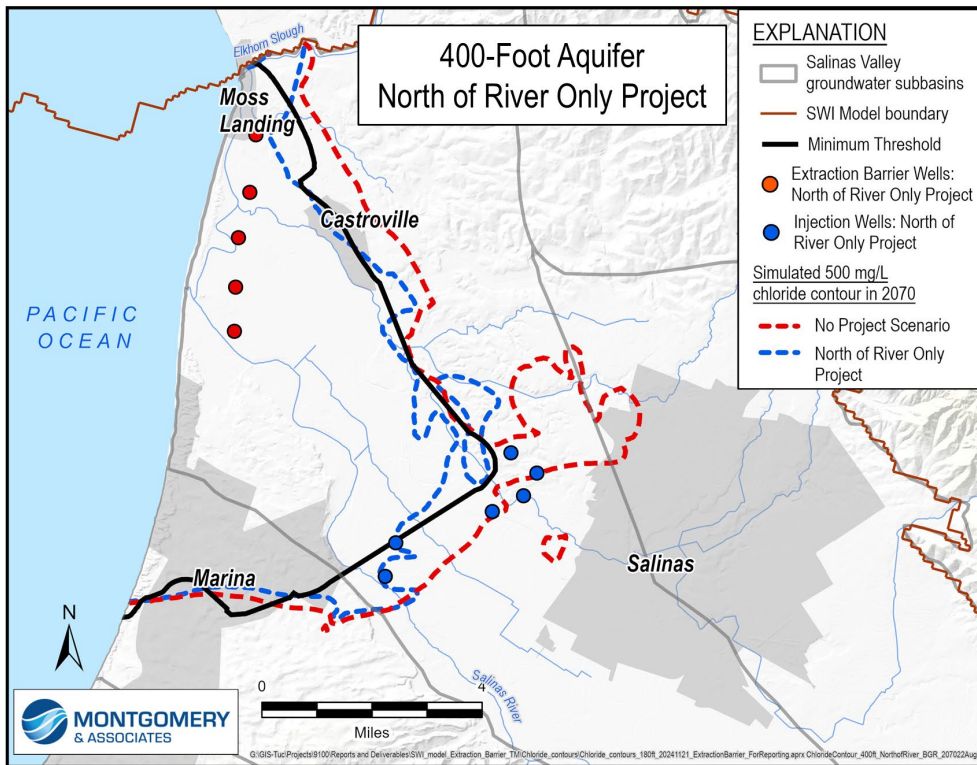
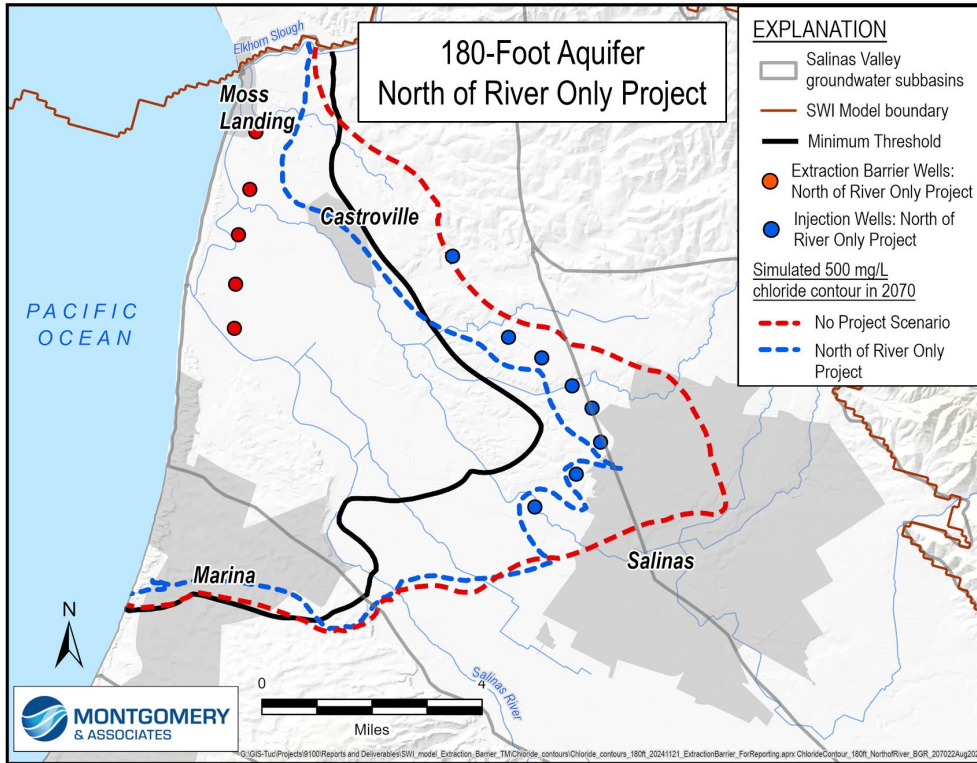


Figure 40. North of River Only Project – 2070 500 mg/L Chloride Contours Comparison to No Project Scenario and Minimum Threshold

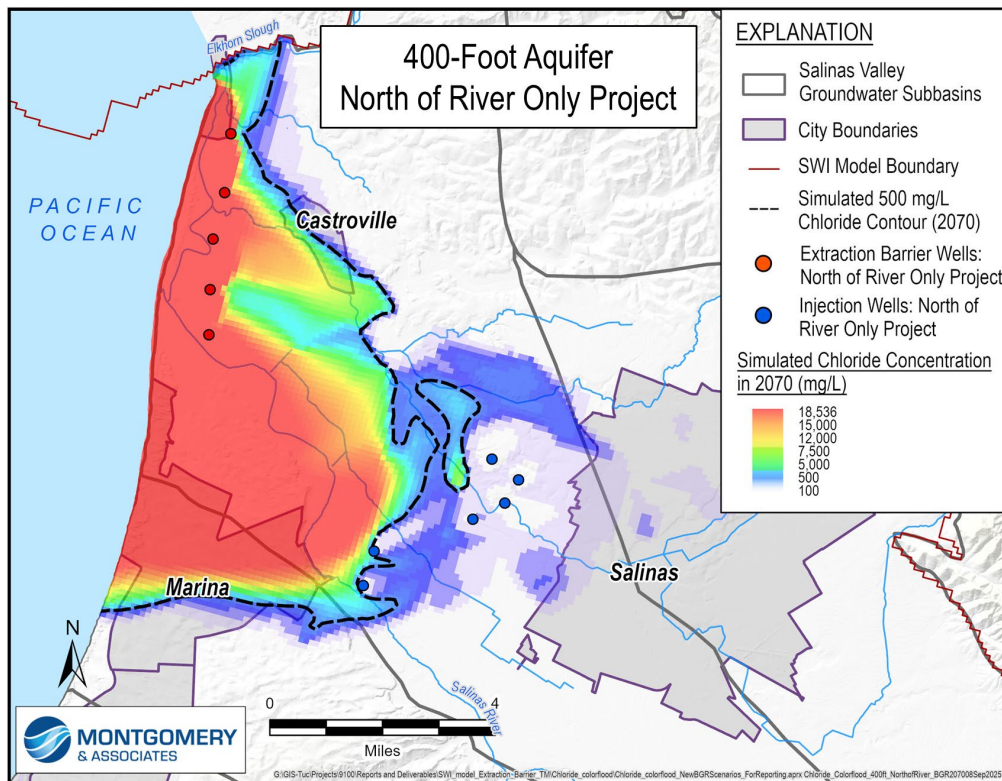
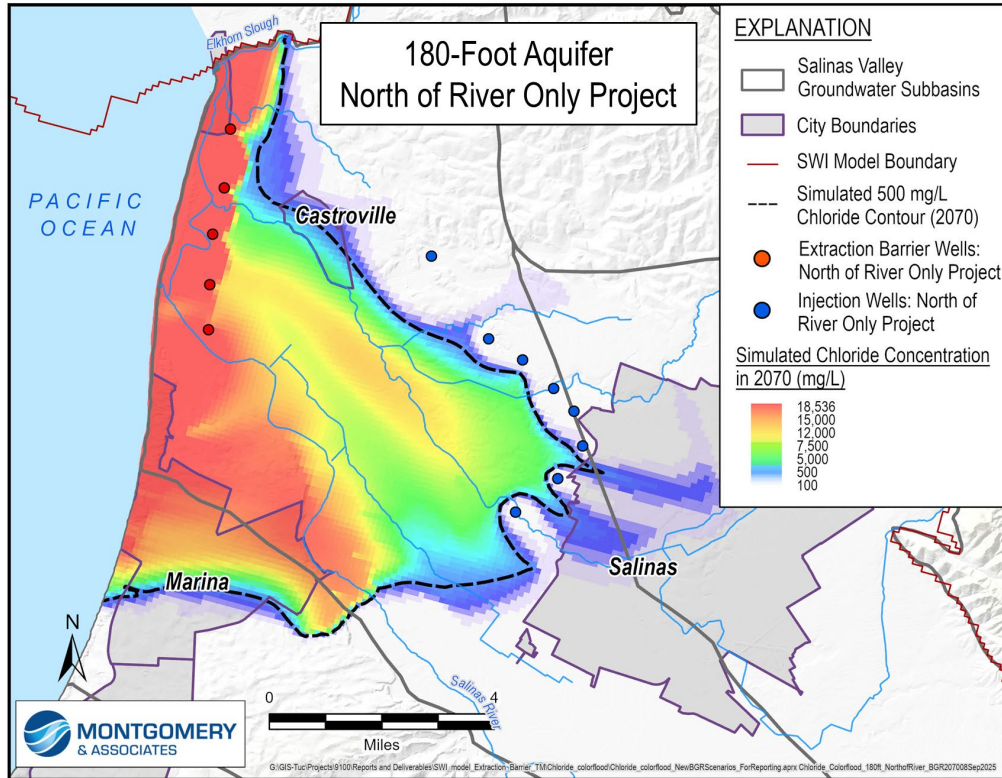


Figure 41. Simulated Chloride Concentration in 2070 for the North of River Only Project Scenario

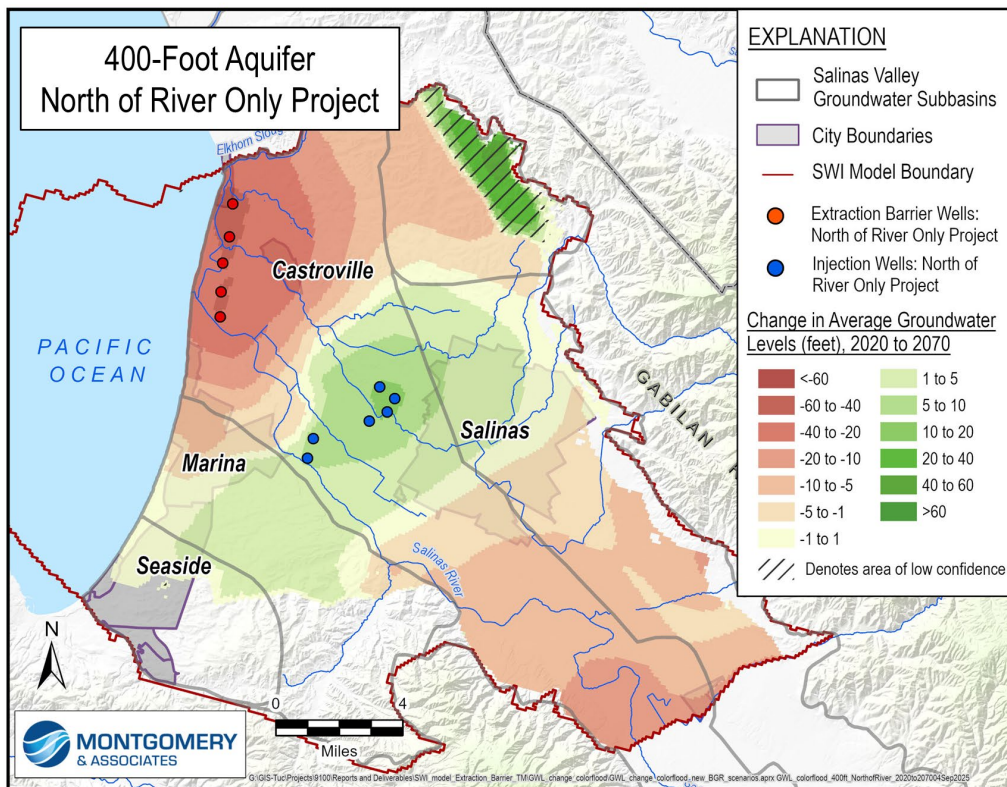
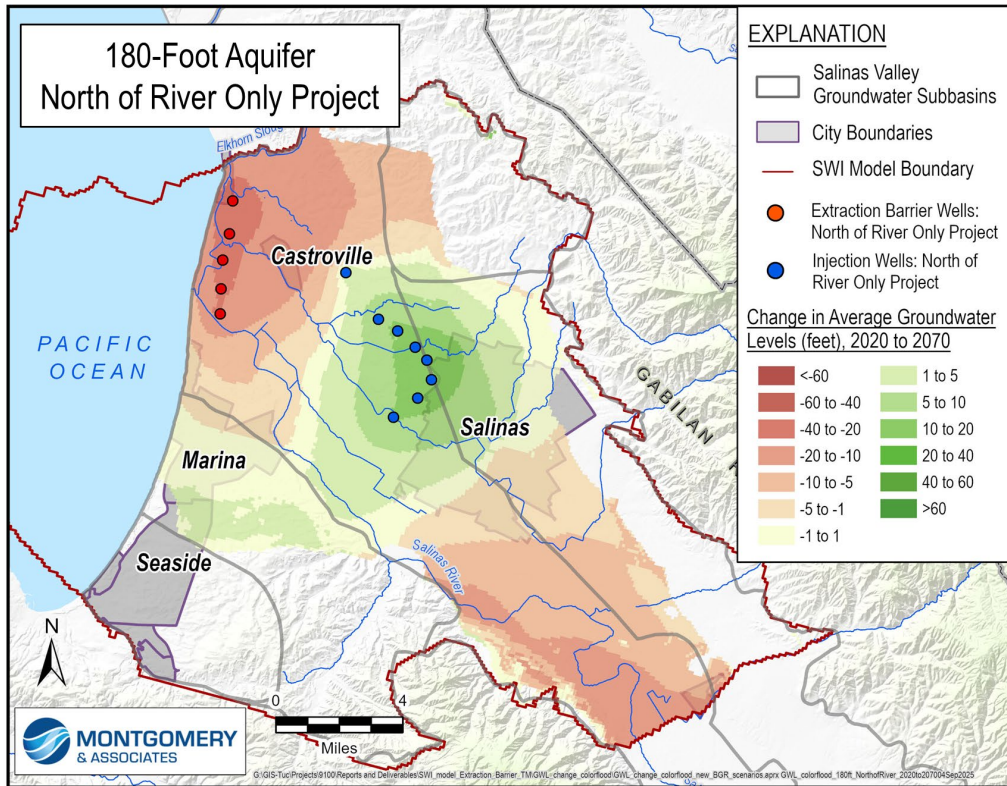


Figure 42. Simulated Change in Groundwater Levels for the North of River Only Project Scenario

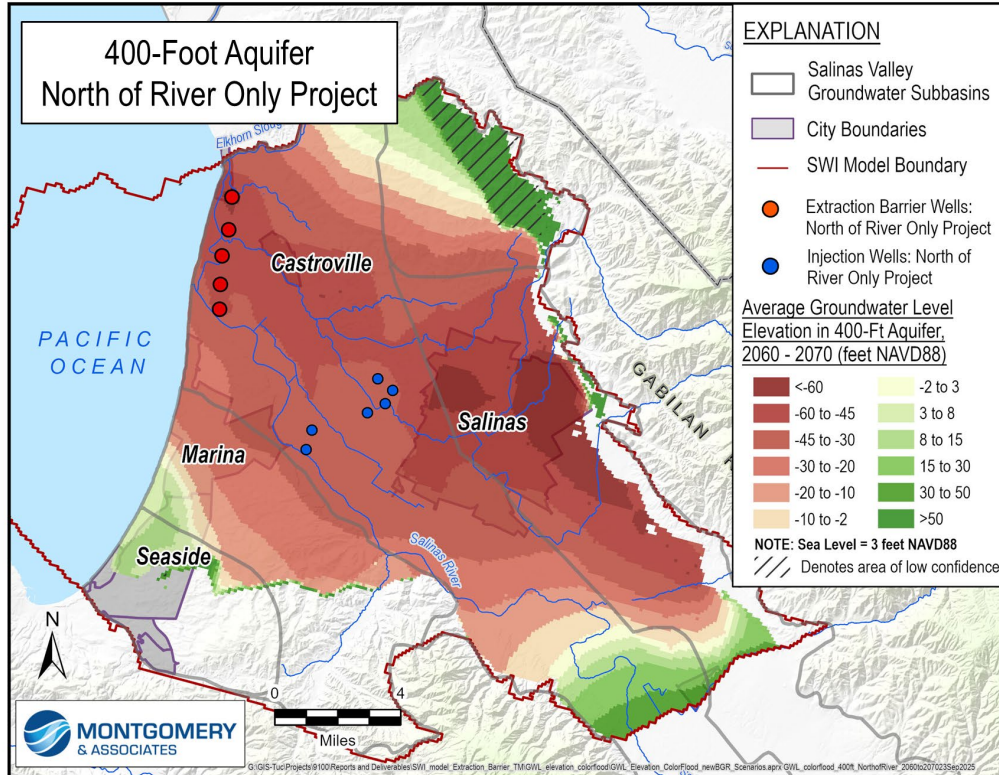
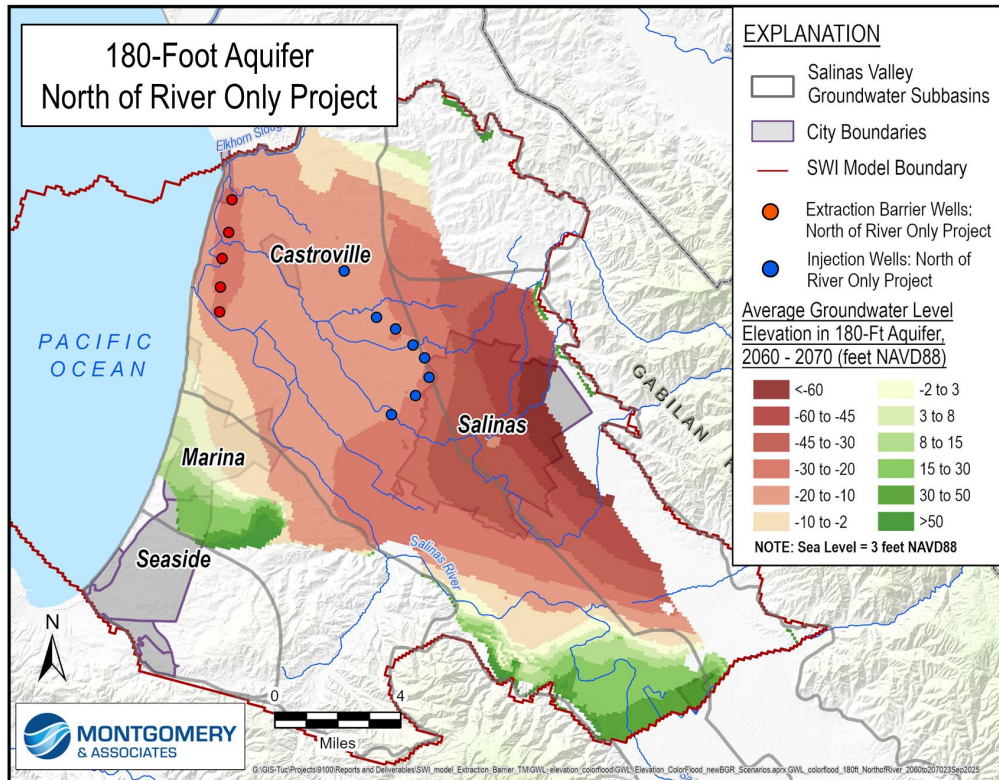


Figure 43. Simulated Groundwater Elevation for the North of River Only Project Scenario



Extract from 180/Inject into 400 Project Scenario

Figure 44 shows maps of the 500 mg/L chloride front simulated by the SWI Model for the Extract from 180/Inject into 400 Project Scenario. This scenario is designed to achieve seawater intrusion benefits roughly equivalent to the Medium Project Scenario, while limiting infrastructure costs and groundwater level impacts in the 400-Foot Aquifer. This scenario uses the 10 same 180-Foot Aquifer extraction wells that were used in the Medium Project Scenario, the same 400-Foot Aquifer injection wells used in the Injection Only Project plus 2 additional injection wells to the north near Castroville, and 2 additional wells to the south near the City of Marina. Previous simulations indicated that 29,000 AF/yr of injection alone in the 400-Foot Aquifer would be effective at stopping seawater intrusion. For that reason, the extraction rates of the 180-Foot Aquifer barrier wells were increased relative to the Medium Project Scenario from 36,300 to 41,400 AF/yr to produce approximately 29,000 AF/yr of treated water for injection.

Figure 44 shows that between 2030 and 2070, the 500 mg/L chloride front in the 180-Foot Aquifer retreats in the north away from Castroville and south away from the City of Marina, but continues inland into northern Salinas. The areas where seawater retreats are closer to the 180-Foot Aquifer extraction barrier, while the area where seawater continues to intrude is farther inland. Further refinements made to this scenario, such as including cleanup wells, may successfully halt and reverse seawater intrusion in the 180-Foot Aquifer. The 500 mg/L chloride front in the 400-Foot Aquifer retreats in most areas due to the injection wells placed in this aquifer.

Figure 45 compares the projected 2070 intrusion 500 mg/L chloride extent from the Extract from 180/Inject into 400 Project Scenario to the No Project Scenario and seawater intrusion minimum threshold. In the 400-Foot Aquifer, the Extract from 180/Inject into 400 Project Scenario is an improvement over the No Project Scenario and generally meets the minimum threshold with the exception of a small area near Moss Landing. In the 180-Foot Aquifer the extent of seawater intrusion in 2070 is an overall improvement compared to the No Project Scenario; however, seawater intrudes into northern Salinas nearly as much as the No Project Scenario. Refinements would be necessary to meet the minimum threshold in the 180-Foot Aquifer.

Figure 46 shows the 2070 chloride concentrations in the 180-Foot and 400-Foot Aquifers resulting from the Extract from 180/Inject into 400 Project Scenario. Seawater intrusion into the 180-Foot Aquifer is halted along the coast due to the extraction barrier wells. Meanwhile, groundwater with near-seawater concentrations of chloride has migrated further inland in the 400-Foot Aquifer due to the lack of extraction barrier wells along the coast. While the extraction barrier helps keep the highest salinity water from penetrating inland in the 180-Foot Aquifer, groundwater with lower concentrations of chloride migrates as far inland as the City of Salinas. In the 400-Foot Aquifer, high salinity water moves further inland but is generally halted near the

minimum threshold due to the injection wells. An island of seawater with chloride concentrations above background levels but below 500 mg/L has appeared on the inland side of the injection wells in the City of Salinas. This occurs when simulated seawater intrusion reaches the Eastside subbasin alluvial fan equivalent to the 180-Foot Aquifer and migrates downward to the 400-Foot Aquifer equivalent Eastside alluvial fan. This happens because the 180/400 Aquitard is not present in the Eastside Subbasin separating these units, however; flow may be inhibited due to the clay-rich alluvial fans.

Table 5 demonstrates that the extraction barrier wells are useful in mitigating the migration of seawater inland from the coast because it shows a reduction in intruded chloride mass and area in the 180-Foot Aquifer. The Extract from 180/Inject into 400 Project Scenario contains an extraction barrier that is present only in the 180-Foot Aquifer and no extraction barrier in the 400-Foot Aquifer, only injection wells. Seawater intrudes inland until it is influenced by the injection wells. As a result, the mass of chloride increases in the 400-Foot Aquifer while the seawater intruded area decreases.

Figure 47 shows average groundwater level changes between 2020 and 2070 in the Extract from 180/Inject into 400 Project Scenario. Average changes in groundwater level in the 180-Foot Aquifer show an increase of between 1 to 10 feet near the City of Salinas and a decrease of 20 to 30 feet near the extraction barrier. Groundwater levels increased in the 180-Foot Aquifer despite injection only into the 400-Foot Aquifer. Groundwater levels in the No Project Scenario decrease in this area, which indicates there is some net upward flux of groundwater from the 400-Foot Aquifer to the 180-Foot Aquifer due to the injection. Groundwater levels increase in the 400-Foot Aquifer between the coast and to the west of the City of Salinas by at least 5 feet. Groundwater levels increase the most around the injection wells by 20 to 40 feet and in some areas almost up to 50 feet.

Figure 48 shows the average annual groundwater levels between 2060 and 2070 for the Extract from 180/Inject into 400 Project Scenario. The 2070 groundwater levels are projected to remain below sea level across most of the 180-Foot Aquifer. The groundwater elevations in the 400-Foot Aquifer are slightly below sea level across majority of the aquifer, though the groundwater gradient has reversed direction near the injection wells in Castroville. Along the coastline in the 400-Foot Aquifer the groundwater elevations are about 5 to 13 feet below sea level.

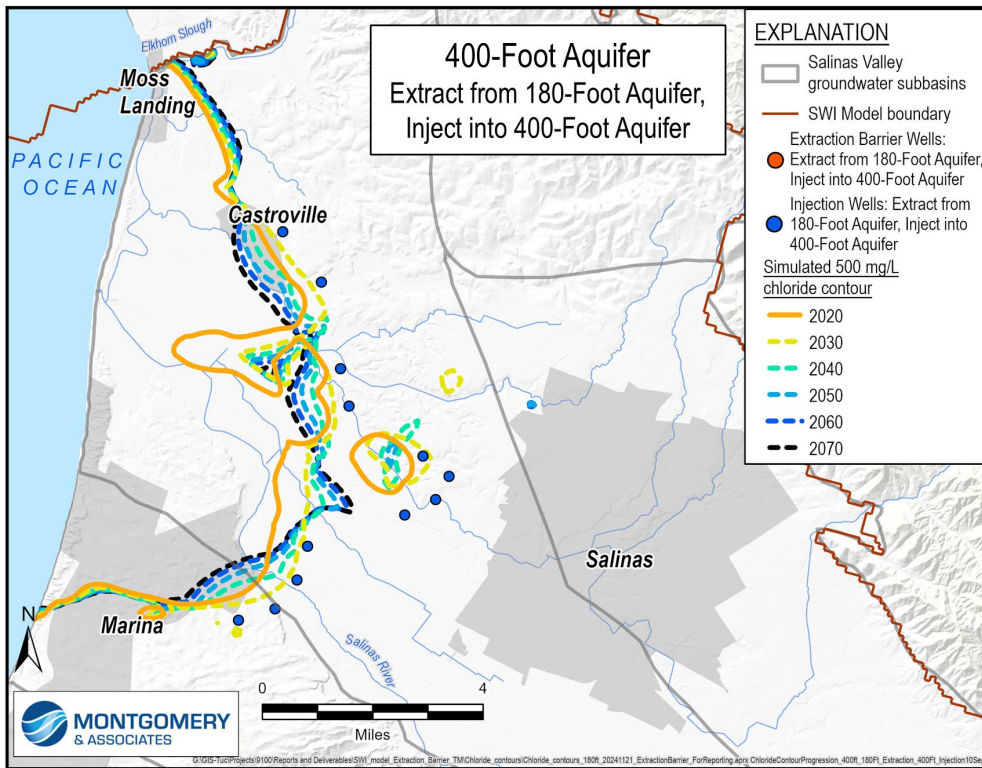
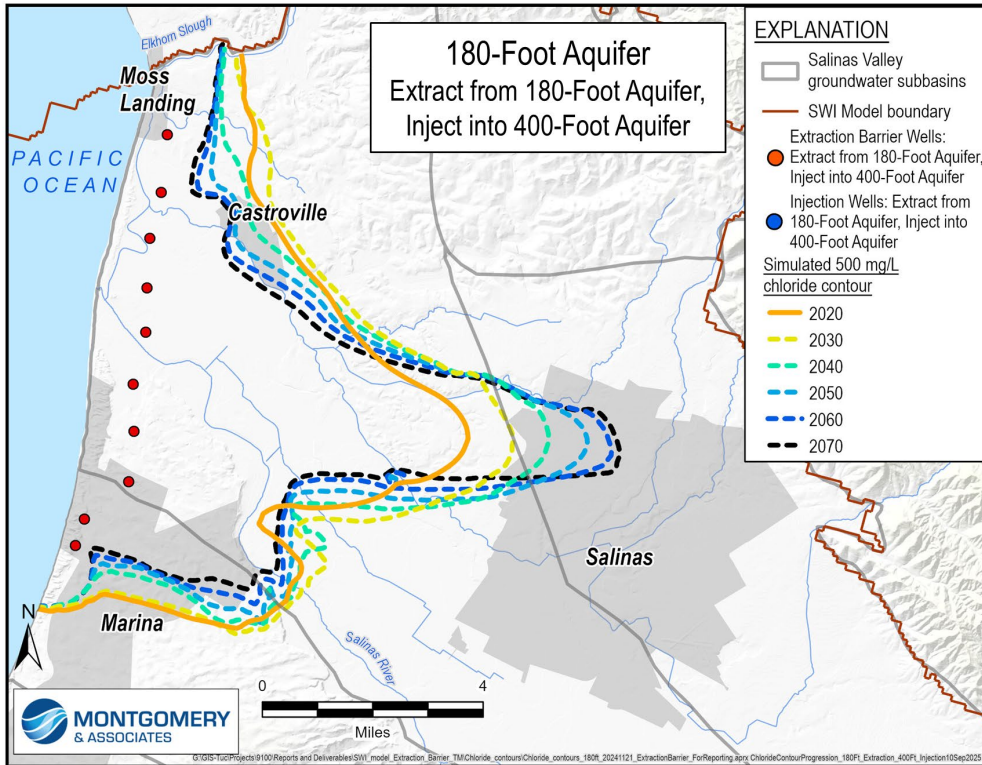


Figure 44. Progression of Simulated Chloride Contours for the Extract from 180/Inject into 400 Project Scenario

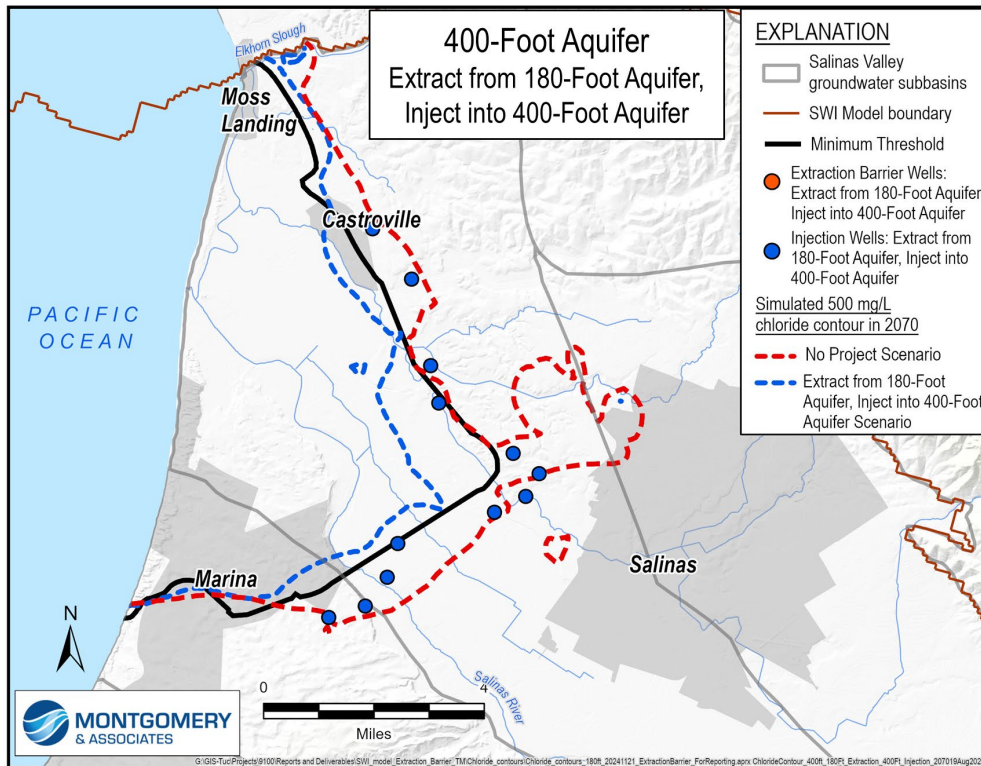
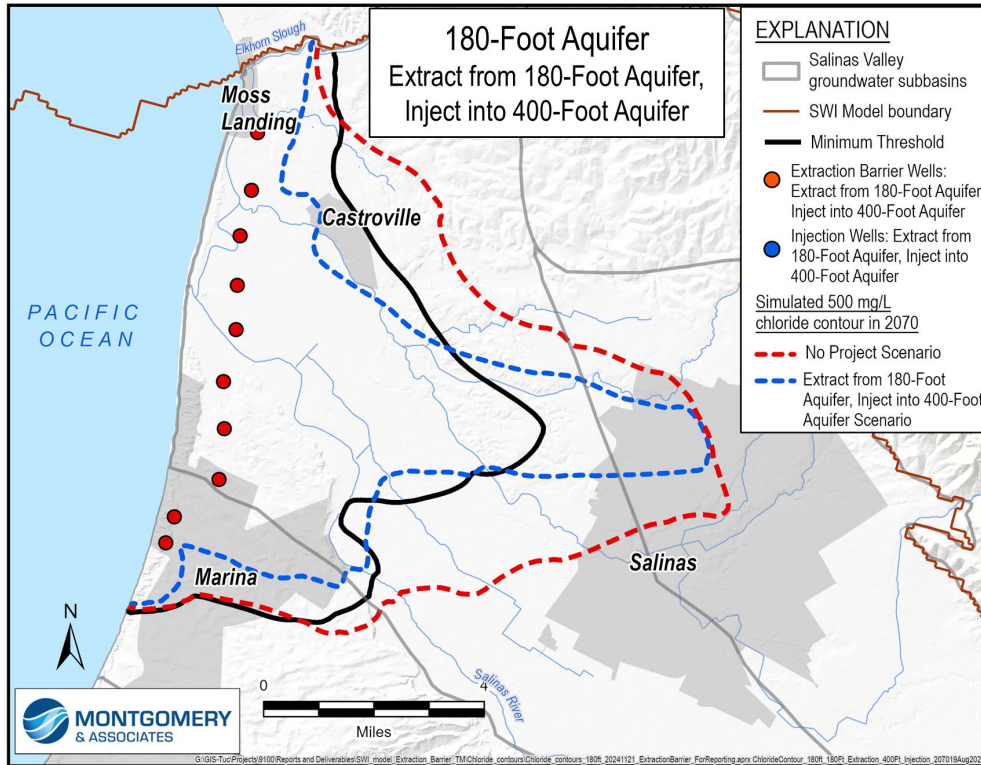


Figure 45. Extract from 180/Inject into 400 – 2070 500 mg/L Chloride Contours Comparison to No Project Scenario and Minimum Threshold

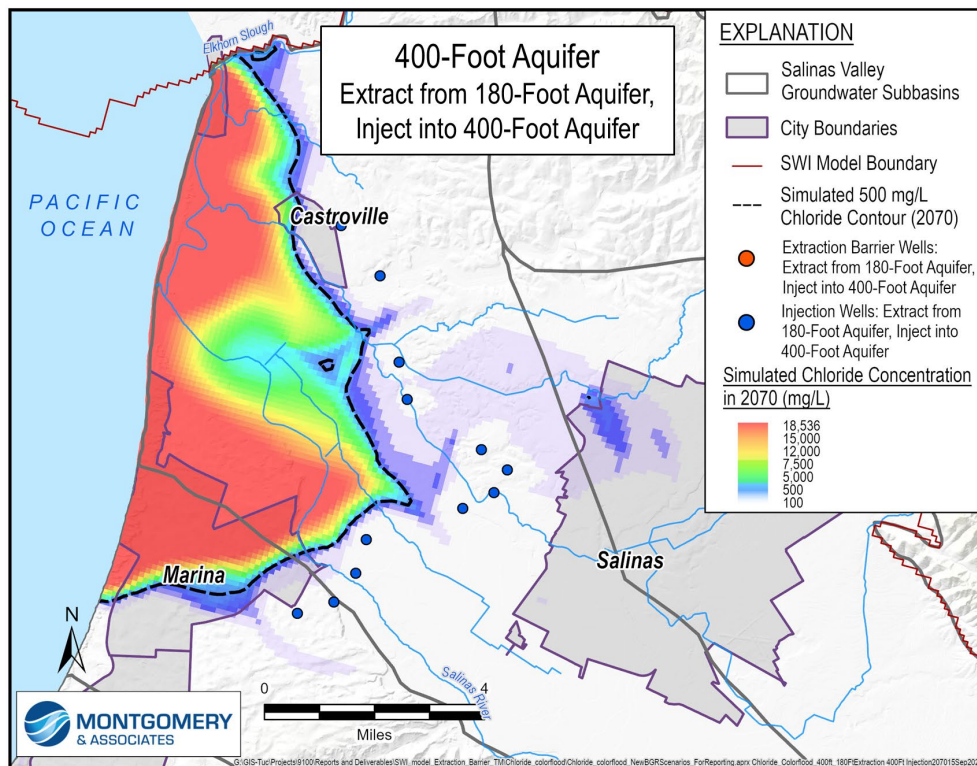
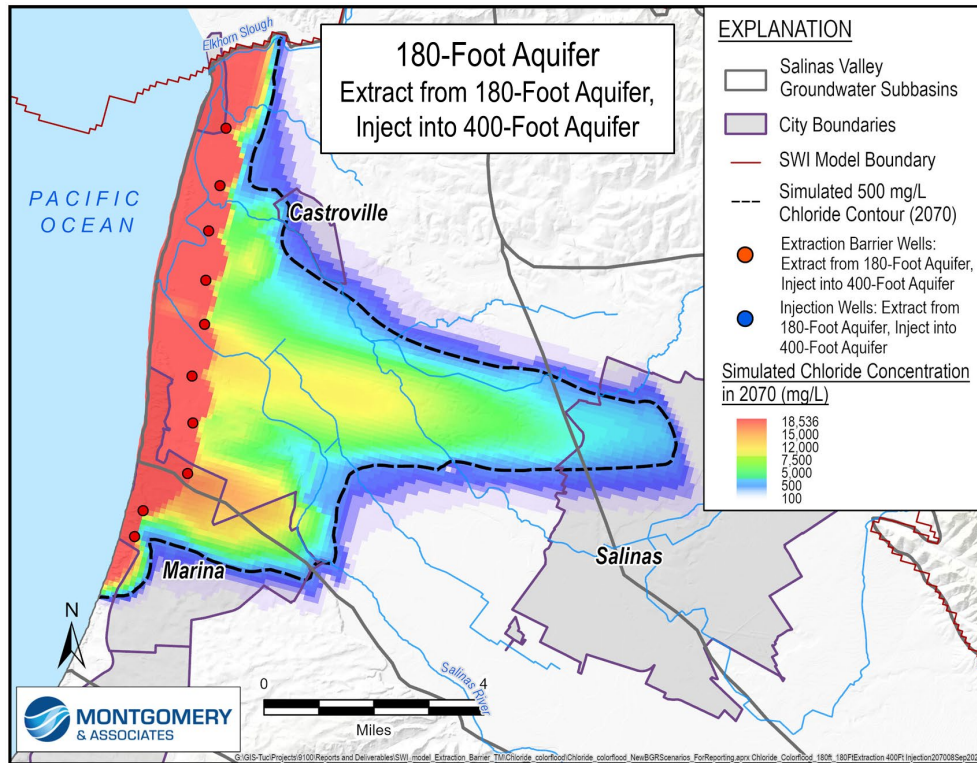


Figure 46. Simulated Chloride Concentration in 2070 for the Extract from 180/Inject into 400 Project Scenario

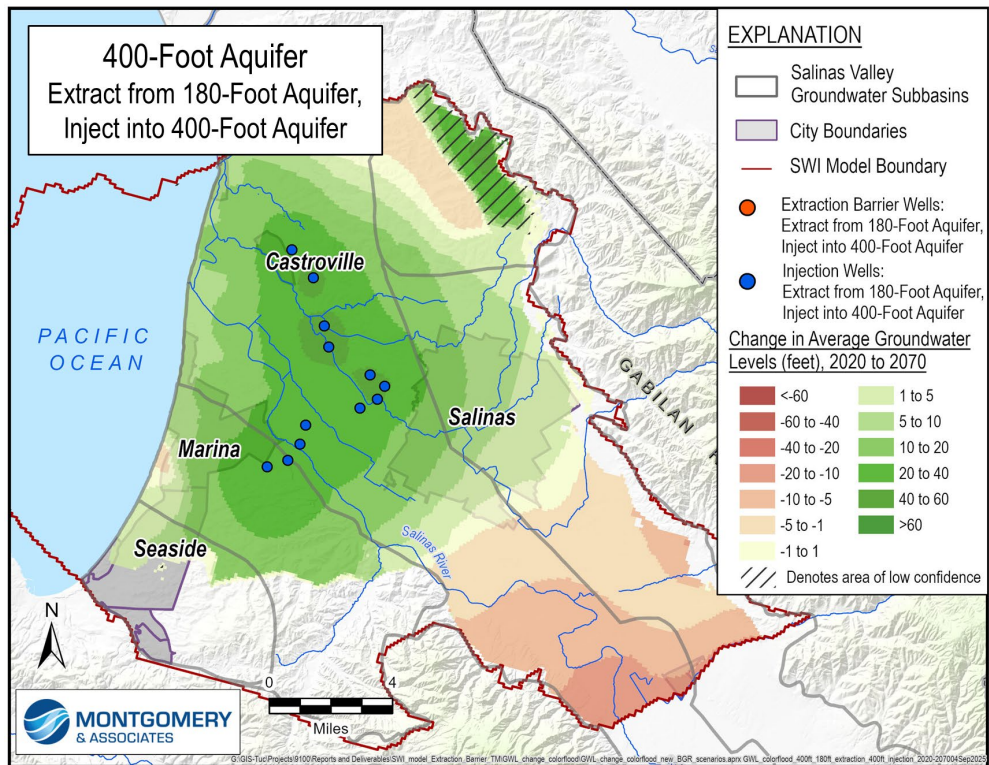
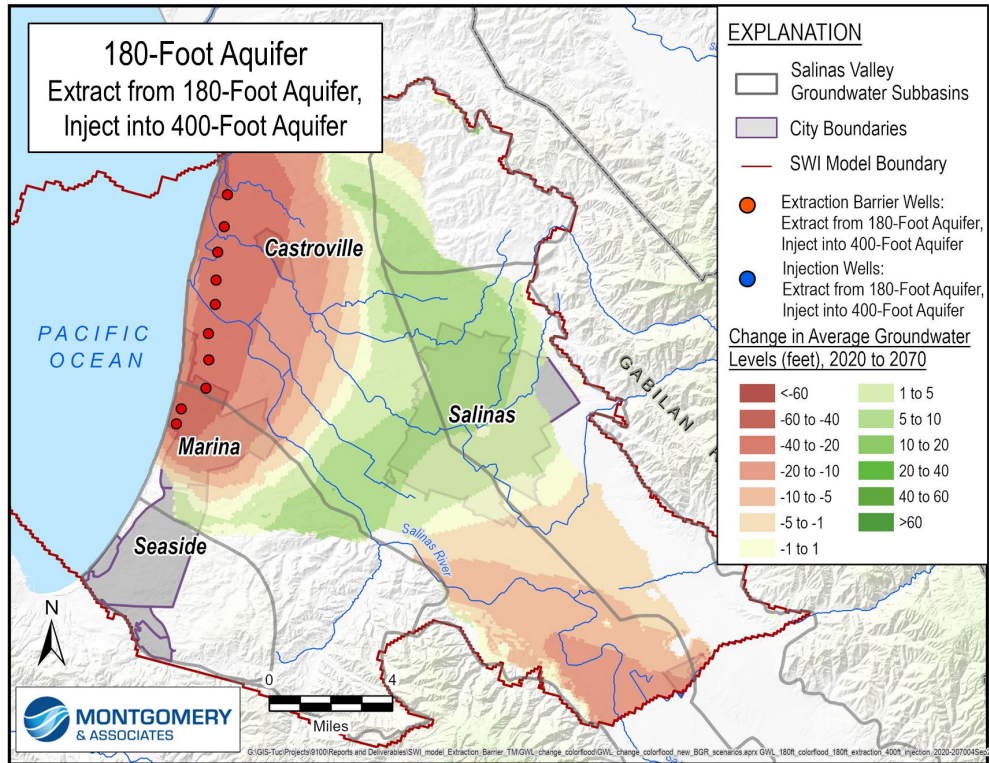


Figure 47. Simulated Change in Groundwater Levels for the Extract from 180/Inject into 400 Project Scenario

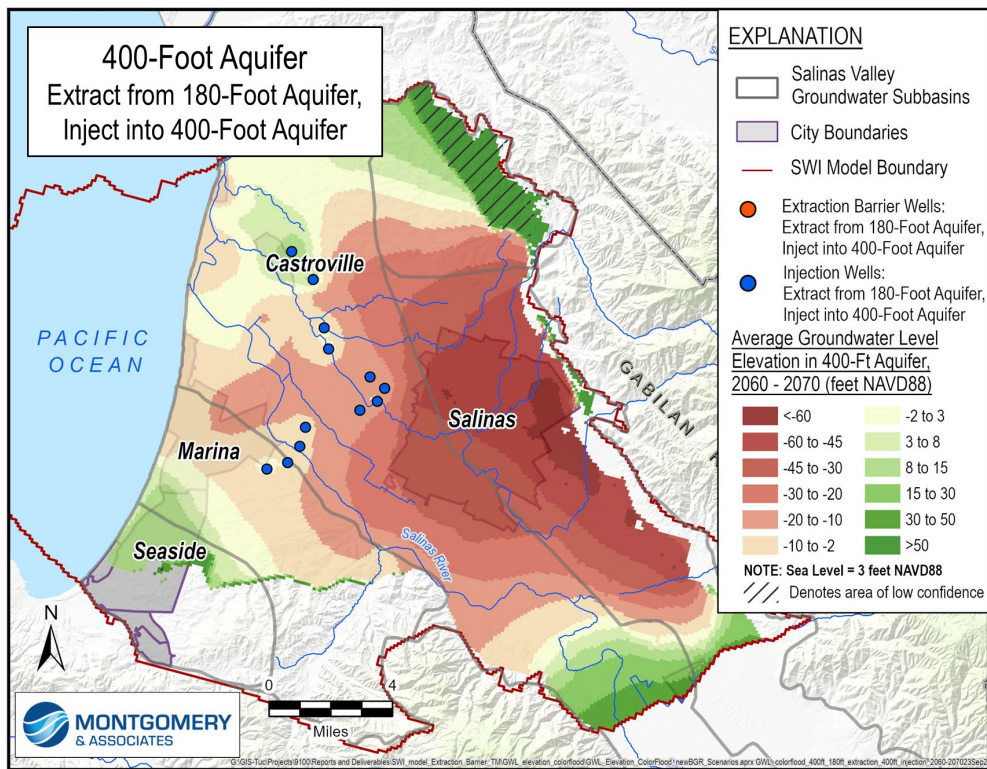
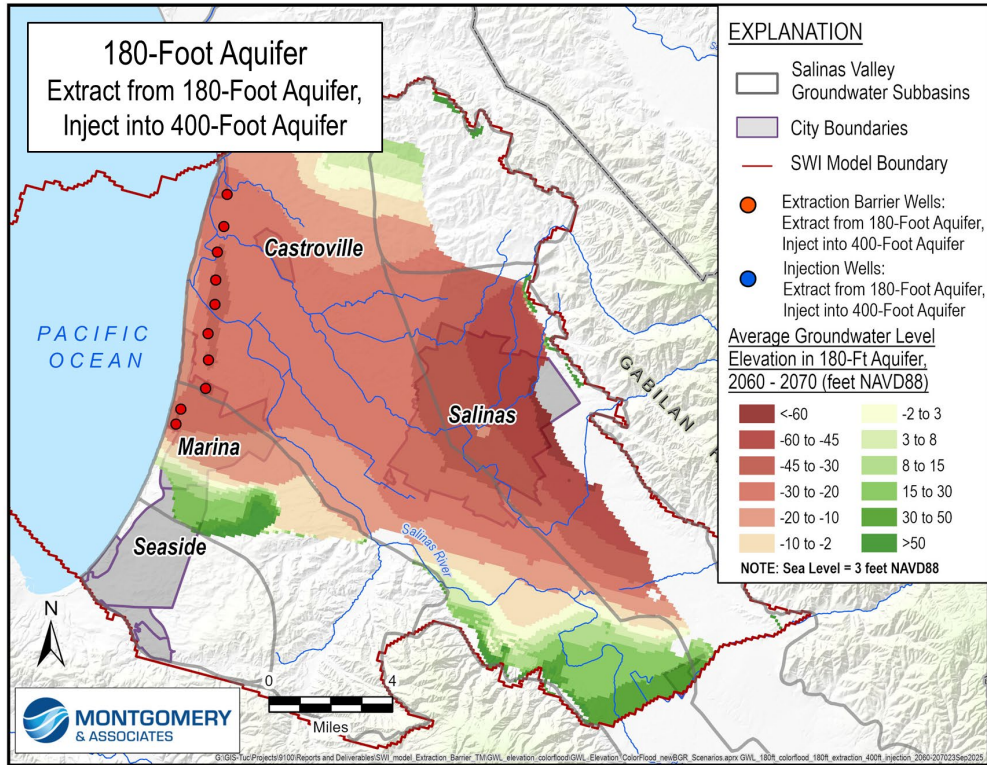


Figure 48. Simulated Groundwater Elevation for the Extract from 180/Inject into 400 Project Scenario

CONCLUSION

Groundwater modeling conducted as part of the BGR Project Feasibility Study evaluated the potential effectiveness of various project scenarios. If project scenarios advance, modeling efforts will be refined in parallel with the development of the project location and identification of end users.

Using the SWI Model, M&A simulated 7 BGR Project Scenarios, each incorporating a groundwater extraction barrier and a regional water supply component. All 7 scenarios halt the intrusion of new seawater into the 180-Foot and/or 400-Foot Aquifers at the coast in the aquifer where the extraction barrier exists. Additionally, the scenarios reduce inland migration of previously intruded seawater to varying degrees, depending on the configurations of injection wells and direct deliveries to existing groundwater users. The projects were modeled to operate continuously from 2030 to 2070, aligning with the SGMA implementation timeline and allowing for evaluation of long-term benefits and costs.

The initial 3 scenarios comprised a Small, Medium, and Large Project Scenario, providing a range of costs and potential benefits while still being technically feasible. The Small Project Scenario features a short extraction barrier with fewer wells and a limited number of injection wells. The Medium Project Scenario expands the barrier and adds more injection wells. The Large Project Scenario builds on the Medium Project Scenario configuration by increasing extraction rates, incorporating clean-up wells, and supplying water to more existing groundwater users. Across these 3 scenarios, annual groundwater extraction from the extraction barrier ranges from 39,700 to 96,800 AF/yr.

The additional 4 scenarios included alternative strategies for meeting the GSP goals by evaluating different configurations of the project components. Of the 4 additional scenarios, only 3 of them—the Injection Only Project Scenario, the Eastside Injection Only Project Scenario, and the Extract from 180/Inject into 400 Project Scenario—inject the treated water and do not deliver treated water for use in lieu of pumping. Groundwater users continue to rely on their existing wells and distribution systems in these 2 scenarios.

The North of River Only Project Scenario shortens the barrier to test the effectiveness of one located only within the 180/400 Subbasin. The Extract from 180/Inject into 400 Project Scenario attempts to reduce drawdown effects on existing wells by only extracting from the 180-Foot Aquifer and injecting only into the 400-Foot Aquifer.

Treated desalted water is delivered to various end users in some of the project scenarios, primarily municipalities and some agricultural users. The amount of treated water available depends on the total extraction – up to 67,800 AF/yr of treated water was available for direct delivery. Due to seasonal demand fluctuations, excess treated water ranging from 8,600 to

26,300 AF/yr is injected through 9 to 12 wells in these scenarios. In the project scenarios without direct delivery, injection of treated water ranges from 14,900 to 44,800 AF/yr through 12 to 20 wells. Future studies will refine extraction rates and availability of treated water for both delivery and injection into the aquifers.

The 7 scenarios demonstrate the effectiveness of an extraction barrier by preventing additional seawater intrusion into the 180-Foot and/or 400-Foot Aquifers in the aquifers where the extraction wells exist. While additional modeling will refine these results in association with further feasibility work, several key findings emerged from this groundwater modeling:

- **Proximity to Coast:** Extraction barrier wells were strategically placed west of Highway 1 to maximize proximity to the coast while avoiding sensitive environmental areas and floodplains. This placement helps maximize the area of aquifer improvement and minimize the seawater-intruded zone between the coast and the barrier.
- **Injection and Clean-up Wells:** Based on preliminary modeling, seawater that has already intruded by the time the project comes online is likely to migrate farther inland without the addition of injection wells or clean-up extraction wells. The addition of injection wells on the eastern side of the seawater intrusion front was effective at pushing pre-existing seawater intrusion toward the coast. Clean-up wells on the western side of the seawater intrusion front can rapidly improve groundwater quality near the seawater intrusion front during the first 10 years of the project. However, once the 500 mg/L chloride contour is drawn back to the clean-up wells, it will be necessary to phase them out. In general, injection wells are preferred to clean-up wells for controlling existing seawater intrusion wherever possible.
- **Use of Desalted Water:** Two options were simulated for using desalted water: direct delivery to existing groundwater pumpers and groundwater injection. Each project scenario used varying degrees of one or both options. Injecting desalted water was found to be preferable for stopping and reversing existing seawater intrusion. Some direct delivery to offset pumping may increase the effectiveness of the injection wells. Therefore, a combination of the 2 options will likely be necessary in any final project design.
- **Ability to Meet GSP Goals:** The scenarios were assessed on their ability to address specific seawater intrusion objectives outlined in the GSP, including meeting the minimum threshold of the 2017 extent of seawater intrusion. Table 6 summarizes the minimum threshold criteria results of the 7 BGR scenarios. Figure 49 and Figure 50 show the position of the 500 mg/L chloride contour in 2040 for the 7 BGR scenarios and the No Project Scenario. Figure 51 and Figure 52 show the position of the 500 mg/L chloride contour at the end of the simulation in 2070 for the 7 BGR Project Scenarios compared to the No Project Scenario.

Table 6. Project Scenario Minimum Threshold Criteria Result

Project Scenario	Meets MT by 2040		Meets MT by 2070	
	180-Foot Aquifer	400-Foot Aquifer	180-Foot Aquifer	400-Foot Aquifer
No Project Scenario	No	No	No	No
Small Project	No	No	No	No
Medium Project	Possibly with some modification	Likely with minor modification	Likely with minor modification	Yes
Large Project	Likely with minor modification	Yes	Yes	Yes
Injection Only Project	Likely with minor modification	Likely with minor modification	Yes	Likely with minor modification
Eastside Injection Only Project	Possibly with some modification	Possibly with some modification	Possibly with some modification	Yes
North of River Only Project	No	No	No	No
Extract from 180/Inject into 400	Possibly with some modification	Likely with minor modification	Possibly with some modification	Likely with minor modification

Yes – the 500 mg/L chloride contour is entirely on the seaward side of the MT(simulated 2017 500 mg/L chloride contour) for the respective aquifer by the end of the referenced water year.

No – the 500 mg/L chloride contour is significantly farther inland of the MT in at least 1 area, or is mostly or entirely inland of the MT.

Likely with minor modification – means the 500 mg/L chloride contour is mostly on the seawater side of the MT. Any areas which are to the landward side could potentially be remedied with minor modifications to the project concept.

Possibly with some modification – means the 500 mg/L chloride contour is generally on the seaward side of the MT. Areas to the landward side could potentially be remedied with broader modifications to the project concept and scale of the project.

Quantitative measures of project effectiveness (Table 5) support impressions of the relative effectiveness of the 7 BGR scenarios drawn from the 500 mg/L chloride contours shown on Figure 49. Table 5 shows that the Small Project Scenario and North of River Only Project Scenario have notably smaller benefits than the other project scenarios. This is due to the relatively short extraction barriers in the Small and North of River Only Project Scenarios, as well as the limited amount of water for delivery or injection.

The extraction barrier is projected to cause average groundwater levels to drop by approximately 10 feet to 60 feet near barrier, with declines up to 80 feet in localized areas close to extraction wells for some project scenarios. Average groundwater levels are simulated to drop slightly more in response to an extraction barrier in the 400-Foot Aquifer than in the 180-Foot Aquifer. Average groundwater levels are projected to increase around the City of Salinas due to reduced pumping, injection, and delivery of treated water. If treated water delivery is not included in the project scenario, groundwater level increases are centered around injection well locations only,

whereas pumping offsets allow groundwater levels to increase in areas beyond where the injection wells are. Despite projected increases, groundwater levels will remain below sea level in the inland portions of the 180/400 and Eastside Subbasins in most scenarios. Therefore, the constant and continued operation of the extraction barrier will be necessary to prevent future seawater intrusion into the Salinas Valley.

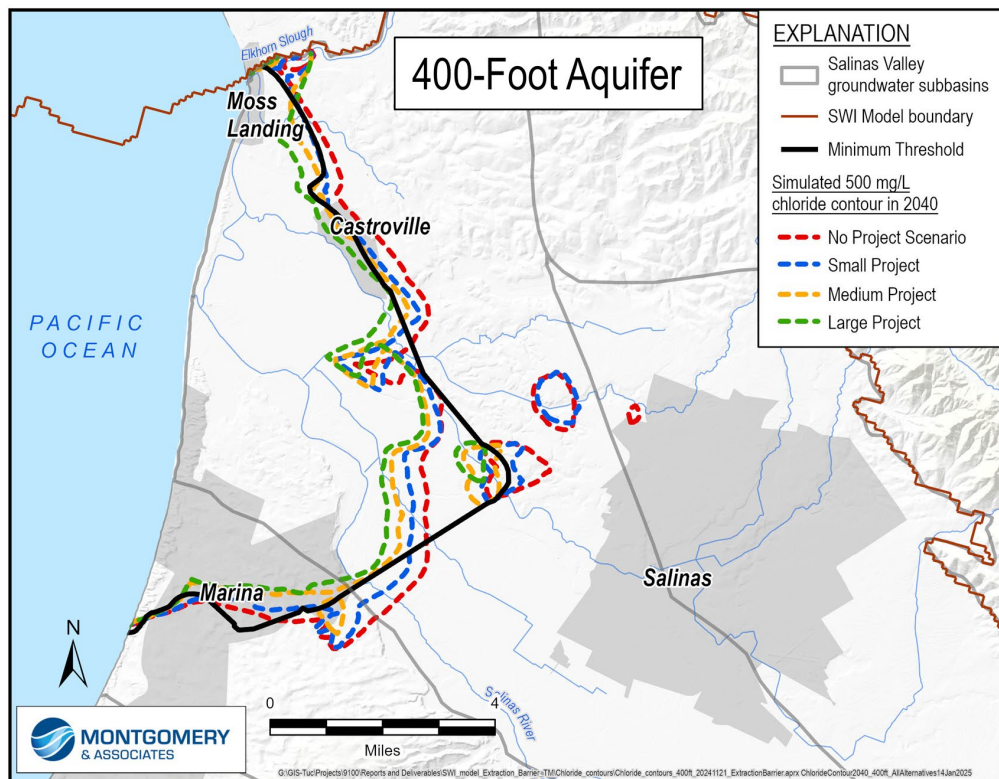
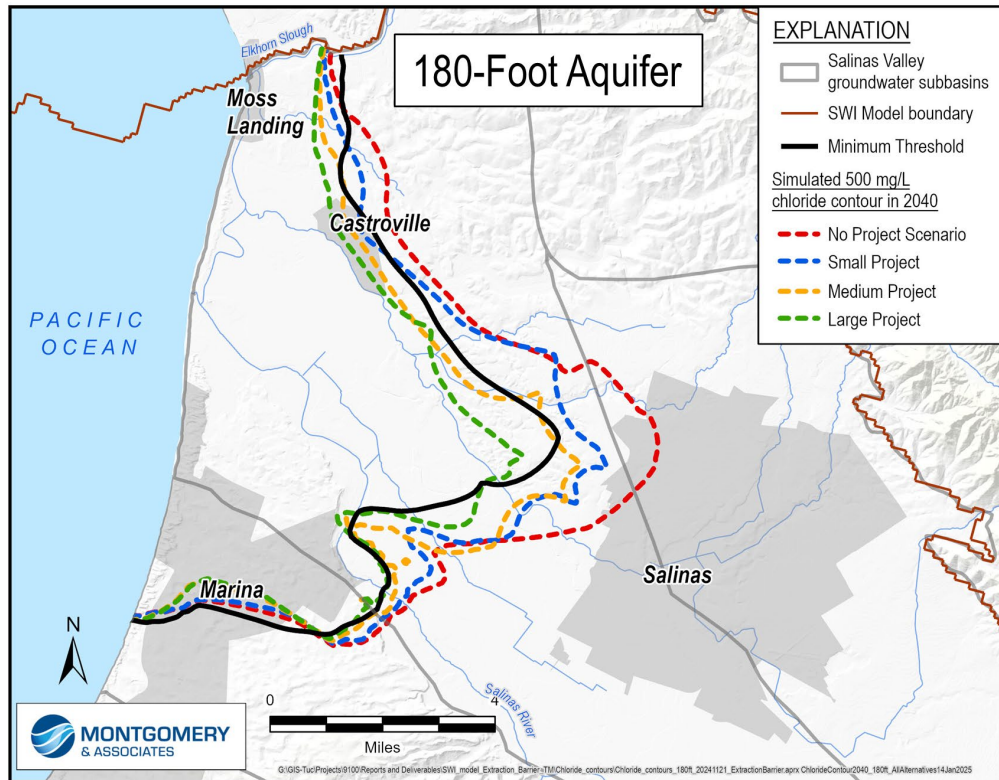


Figure 49. Comparison of 500 mg/L Chloride Contour in 2040 for all BGR Project Scenarios – Initial 3 Project Scenarios

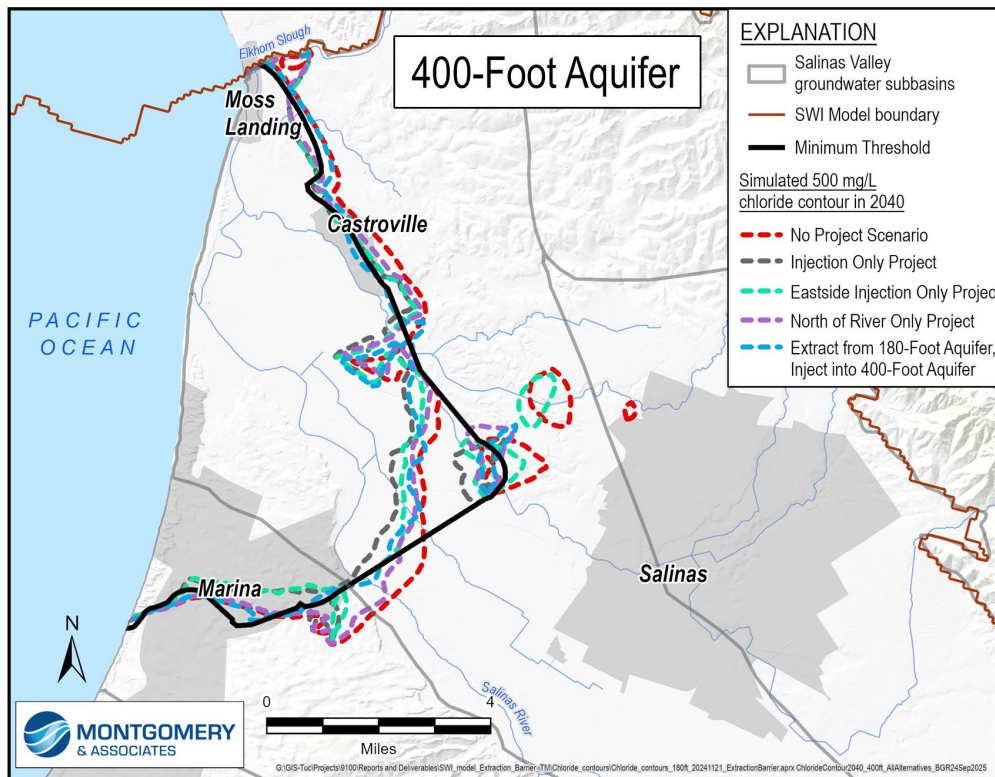
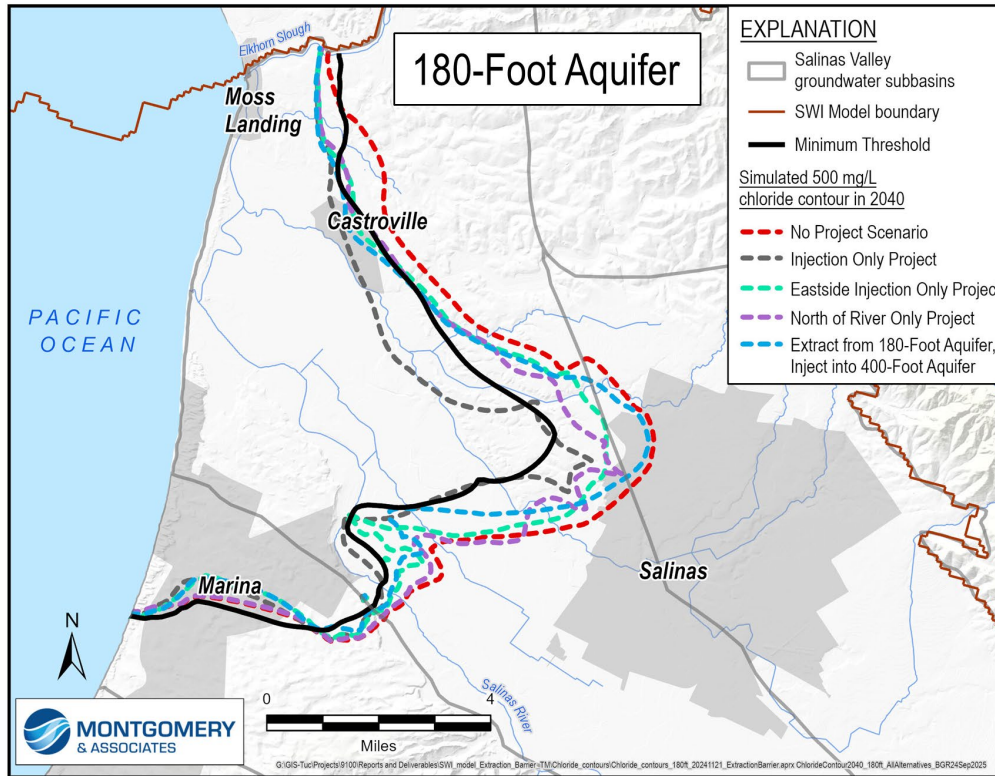


Figure 50. Comparison of 500 mg/L Chloride Contour in 2040 for all BGR Project Scenarios – Additional 4 Project Scenarios

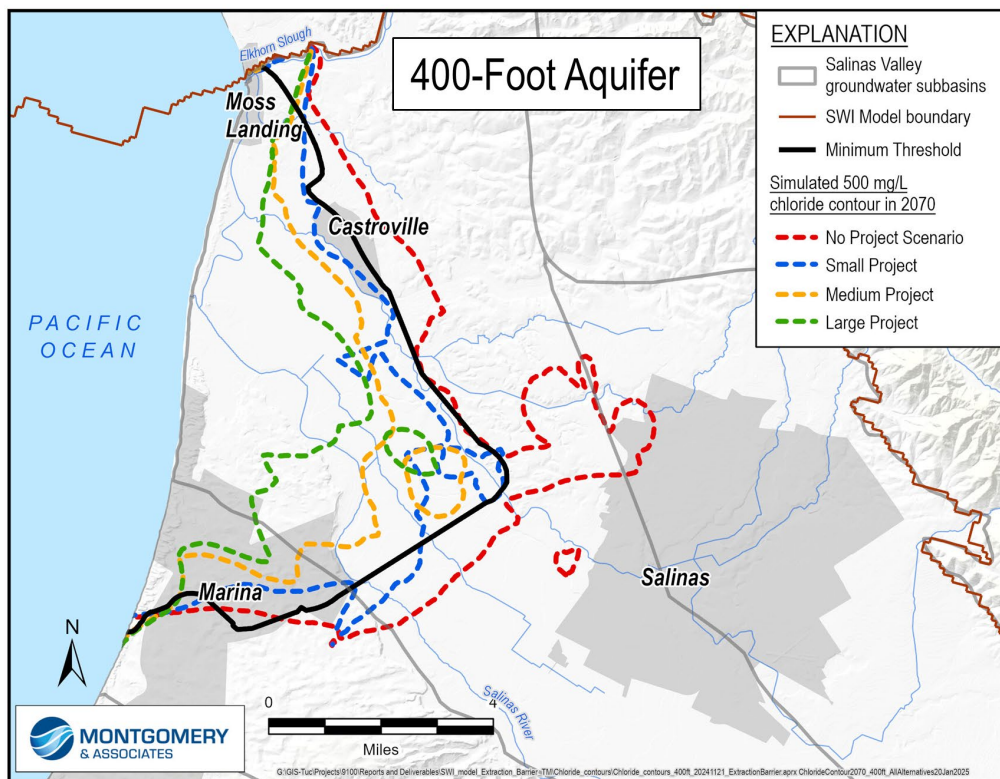
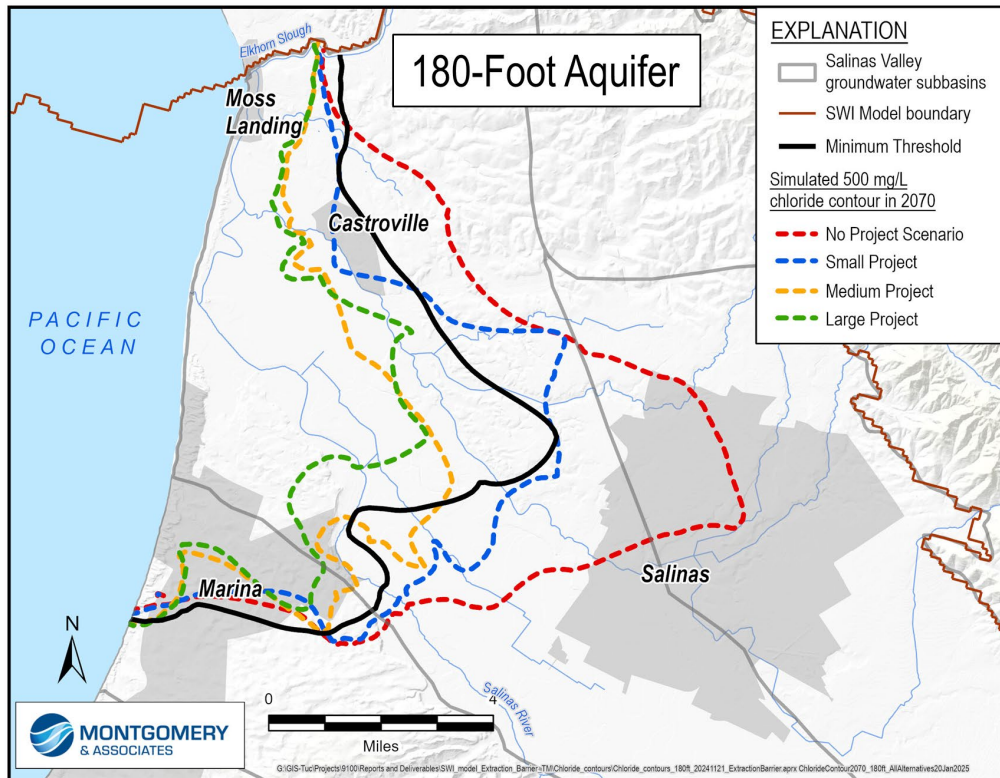


Figure 51. Comparison of 500 mg/L Chloride Contour in 2070 for all BGR Project Scenarios – Initial 3 Project Scenarios

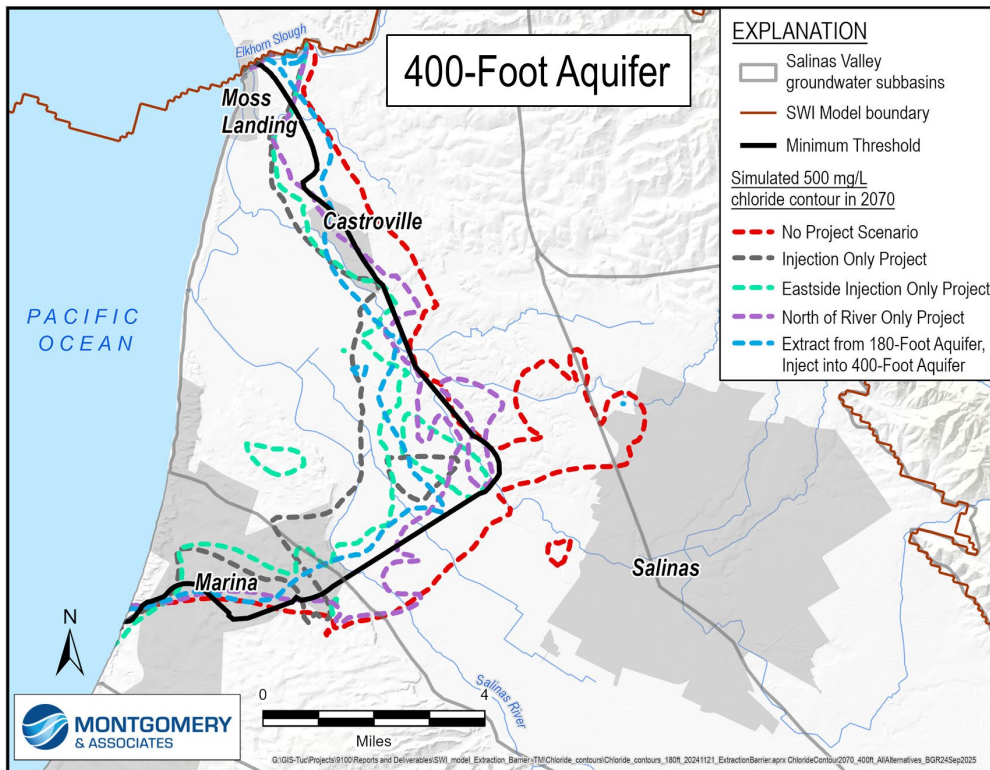
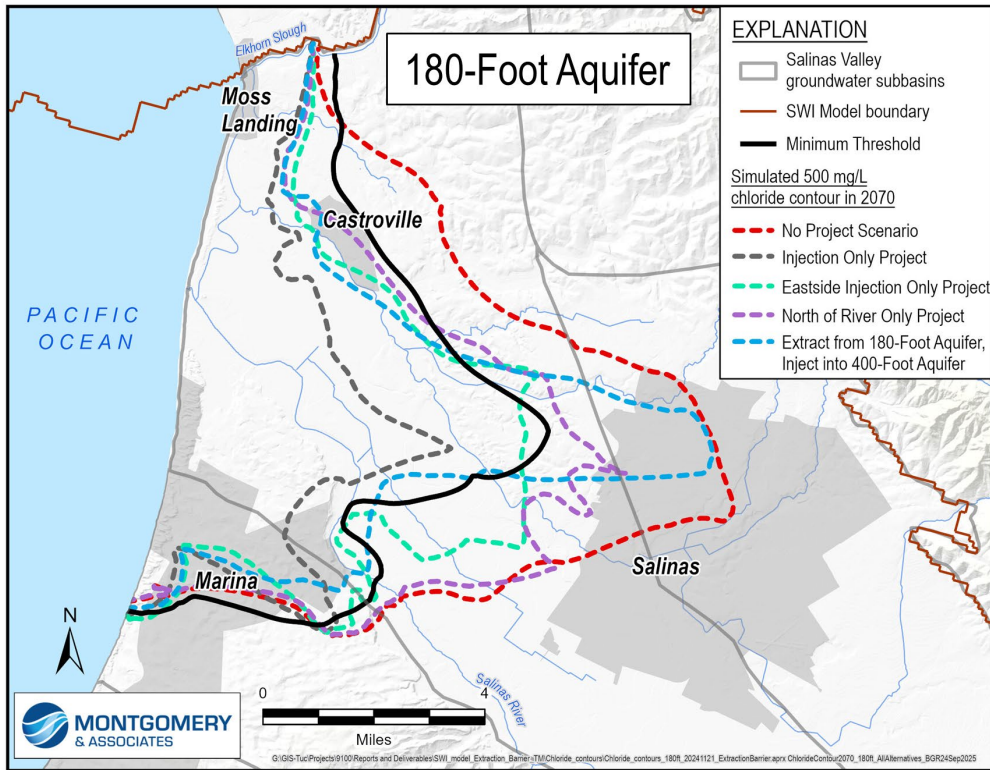


Figure 52. Comparison of 500 mg/L Chloride Contour in 2070 for all BGR Project Scenarios – Additional 4 Project Scenarios

DISCLAIMERS AND NEXT STEPS

A series of model simulations helped compare and contrast relative effects of the BGR Project Scenarios with the No Project Scenario. The model simulations reflect professional judgment and represent the best available estimates of potential groundwater conditions. The model's accuracy is affected by simplifying assumptions and data limitations that underpin the model. Given the nature of this initial preliminary feasibility analysis these simplifying assumptions were a necessary step.

The following are examples of simplifying assumptions for the current model simulations:

- Future modeling will include additional information and details related to extraction barrier and injection well construction and placement; these are currently conceptual in nature.
- We assumed that 70% of the monthly extracted water is treated and available for delivery to end users or injection and that this water would be conveyed, stored, treated, delivered, and injected within the same month.
- We assumed every delivered gallon of treated water to end users replaces 1 gallon of their groundwater pumping. Future studies will refine the group of end users to accept treated water in lieu of groundwater pumping.
- We assumed recent groundwater pumping data represent the seasonality and magnitude of future water demands. Future studies will further evaluate the amount of water delivered to satisfy water demands and the amount of injected water resulting from seasonality of demands.
- Groundwater extraction was held constant, regardless of groundwater quality, based on initial pumping rates and delivery of an in-lieu supply. However, some wells are likely to stop pumping when chloride levels in the well exceed 500 mg/L. Further analyses could turn off pumping in response to extracted groundwater quality to see if that significantly affects results.
- The model does not simulate impacts of climate change or sea level rise. Future studies should evaluate whether there could be significant implications for the project.
- The hydrogeologic connection is uncertain between the 180-Foot and 400-Foot Aquifers with the Eastside alluvial fans. The hydrogeologic connection between the Eastside Shallow Zone (180-Foot Aquifer equivalent) and Eastside Deep Zone (400-Foot Aquifer equivalent), as well as the extent of the alluvial fans is also uncertain underneath the City of Salinas. These properties may impact the trajectory of seawater intrusion if saline groundwater reaches the City of Salinas.

As the feasibility study progresses and more specific design assumptions are made, model inputs will be modified, which may alter model results. Additionally, project impacts to the Deep Aquifers should be evaluated following SWI Model improvements in this aquifer.

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- _____. 2024. 2024 Seawater Intrusion Model Updates (Addendum 2 to the Salinas Valley Seawater Intrusion Model Report). Prepared for Salinas Valley Basin Groundwater Sustainability Agency. November 2024.
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