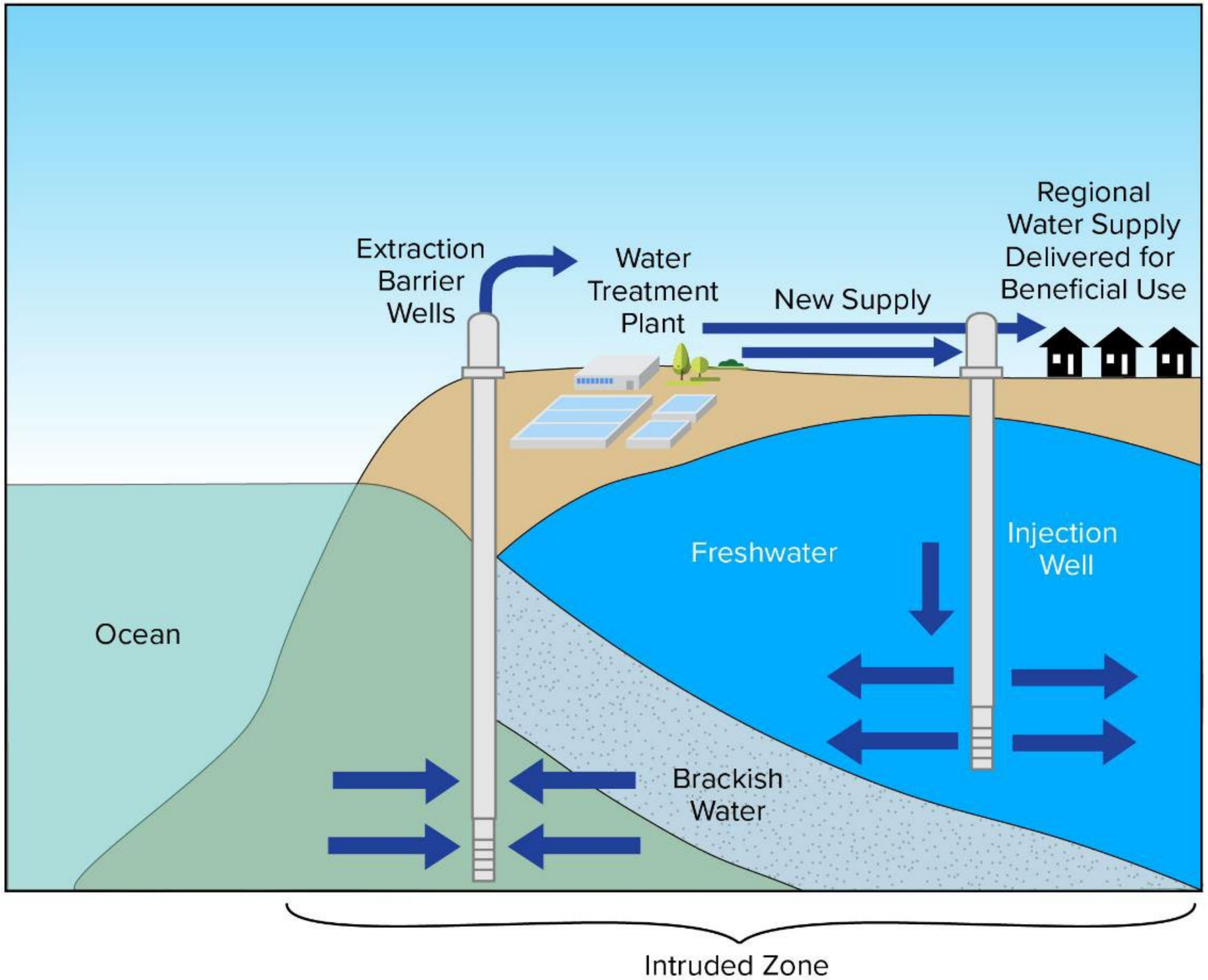
Brackish Groundwater Restoration Project: Overview and Modeling Results

Prepared for the SVBGSA 180/400-Foot Aquifer Subbasin Implementation Committee

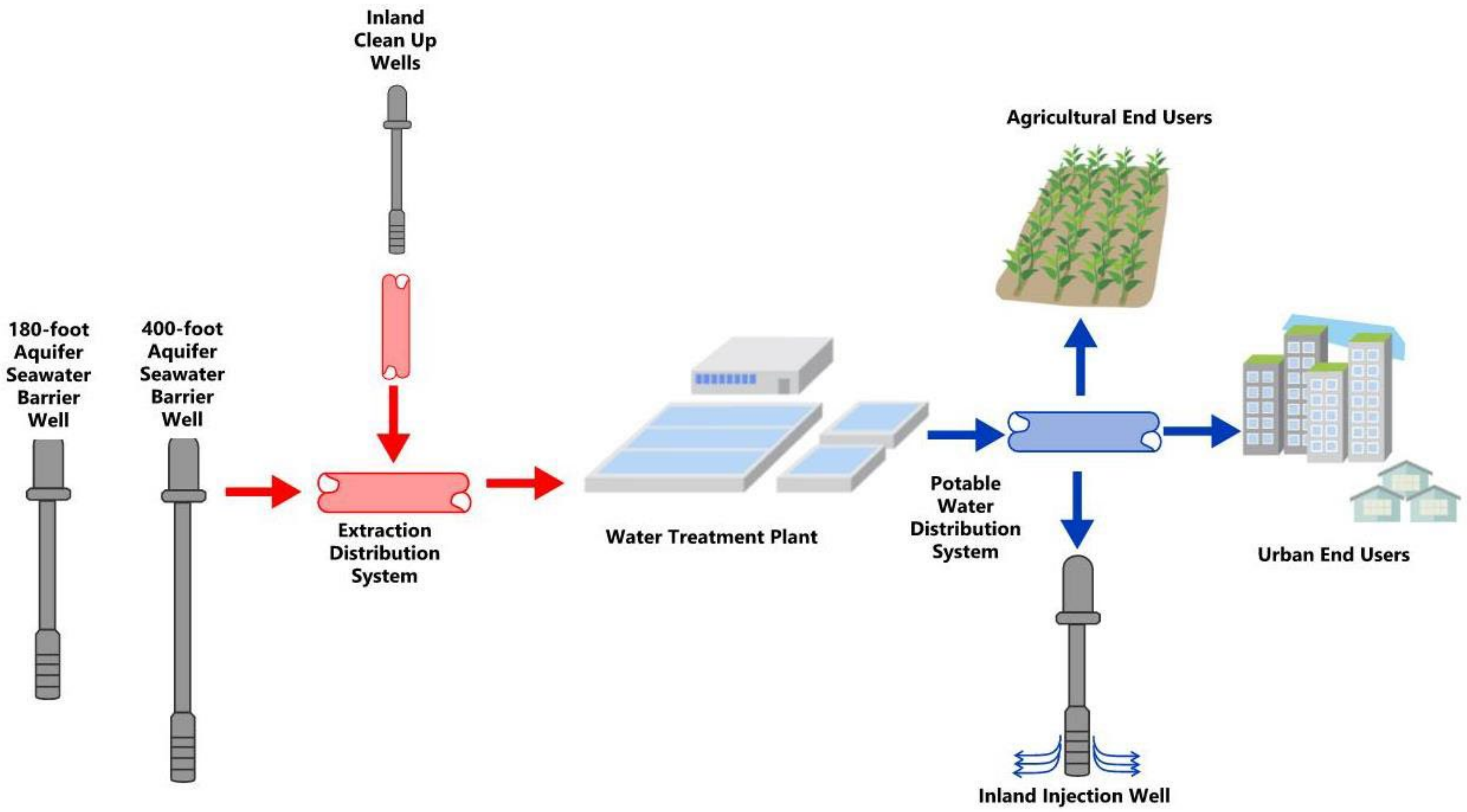
MONTGOMERY & ASSOCIATES

Brackish Groundwater Restoration Project - Concept

- Series of groundwater extraction wells to inhibit the progression of seawater intrusion
- Centralized brackish water treatment facility
- Delivery to both agricultural and municipal end users



Brackish Groundwater Restoration Components

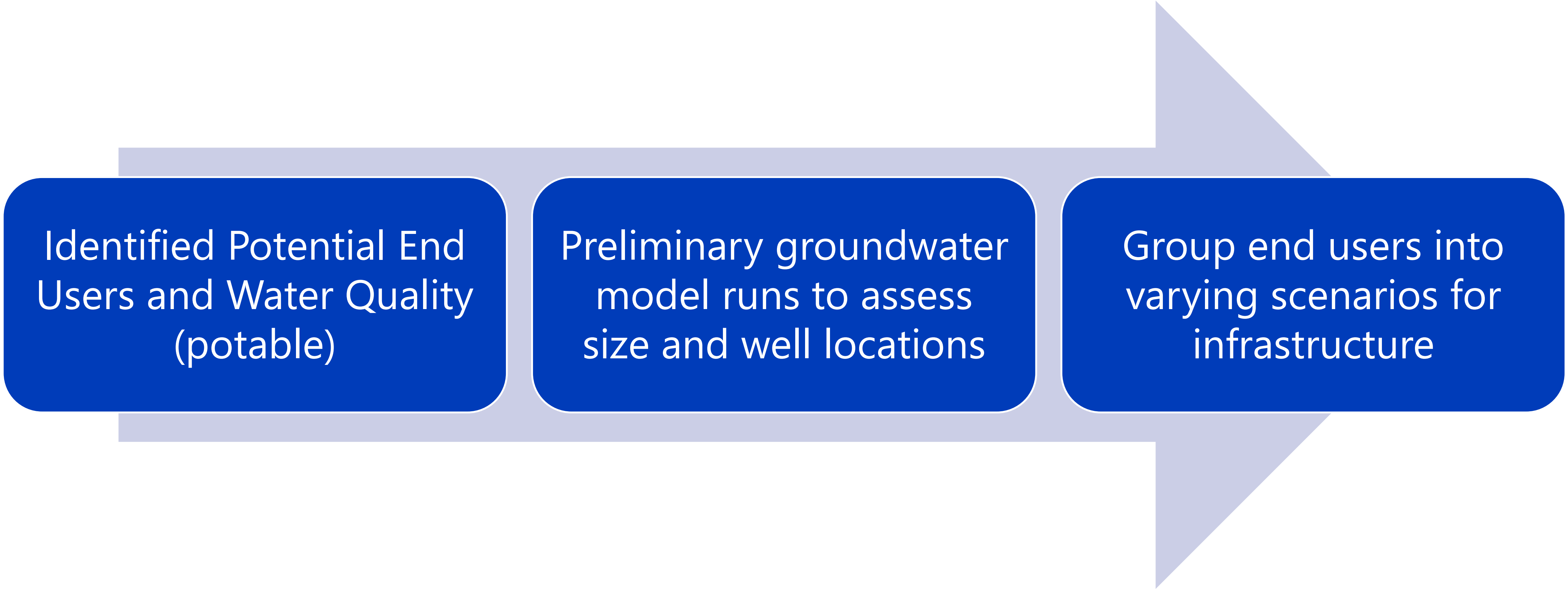


Alternative Development

Process for groundwater modeling

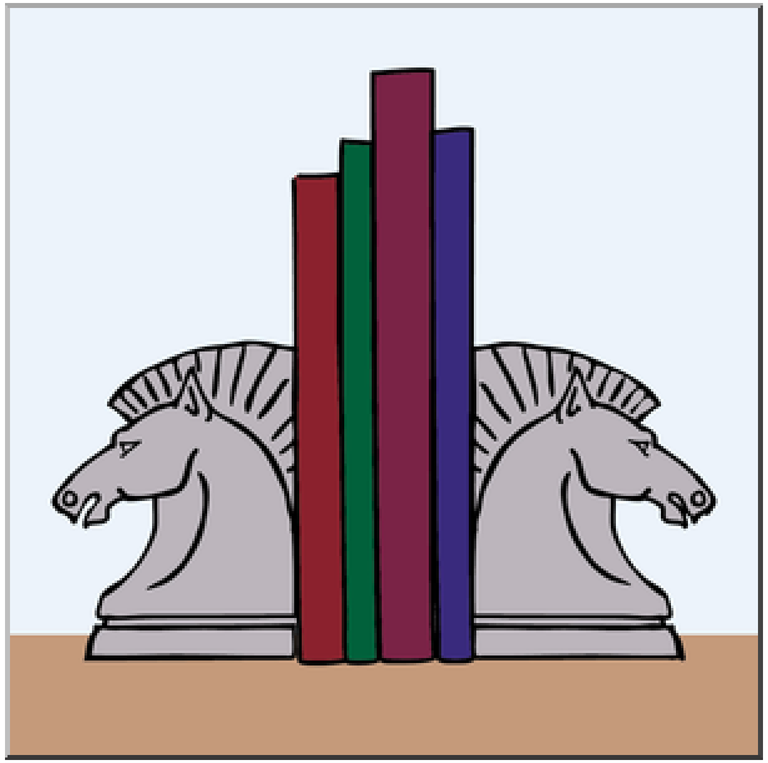
1. Conduct preliminary model runs assessing extraction wells distance inland
2. Iterative preliminary modeling to refine clean-up wells, injection wells, and well spacing
3. Final model runs with updated groundwater model and final alternatives

Process for developing alternatives



Philosophy for Developing Scenarios - Bookends

Large – Try to meet GSP measurable objective (pull intruded zone back to Hwy 1)



Small - Minimum to meet GSP minimum threshold (hold intrusion to 2017 levels)

Medium – Reasonable project between small and large scenarios

Alternatives Designed to be "Bookends"

Small

- Extraction = 40,000 AFY
- ≈70% recovery = 28,000 AFY
- Inland Injection Wells
- No Clean Up wells
- Partial large municipal users
- 100% of CSIP groundwater use

Lower Extraction, lower delivery, no clean up wells

Medium

- Extraction = 67,000 AFY
- ≈70% recovery = 46,900 AFY
- Inland injection wells
- No clean up wells
- 100% of large municipal users
- 100% of CSIP groundwater use

Medium Extraction + Medium use + Injection in lieu of clean up wells

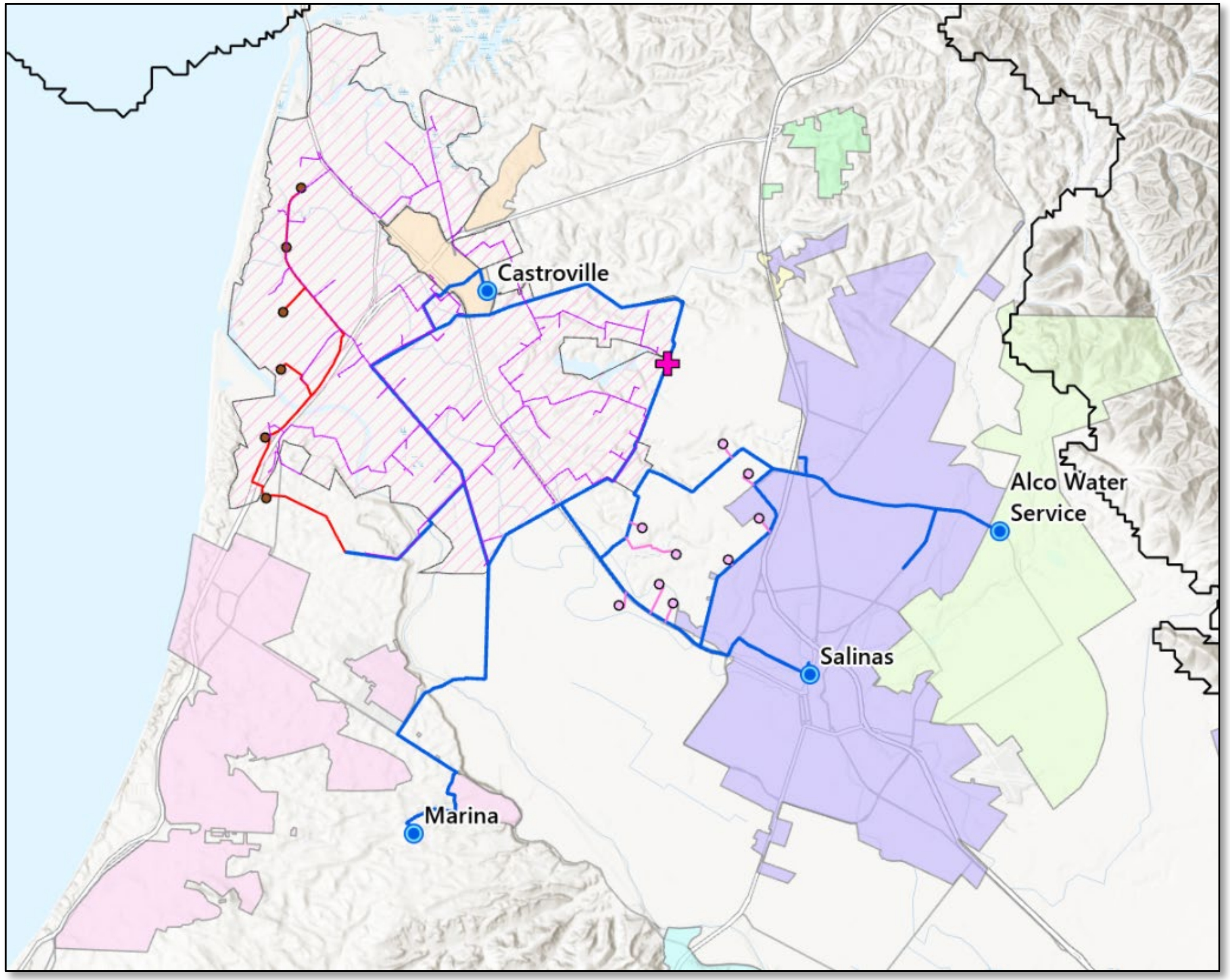
Large

- Extraction = 96,800 AFY
- ≈70% recovery = 64,900 AFY
- Inland injection wells
- Clean up wells
- 100% municipal users
- 100% of CSIP groundwater use
- Includes private ag users

Largest Extraction + Largest Use + Injection

Modeling of Alternatives

Small Alternative - 40,000 AFY

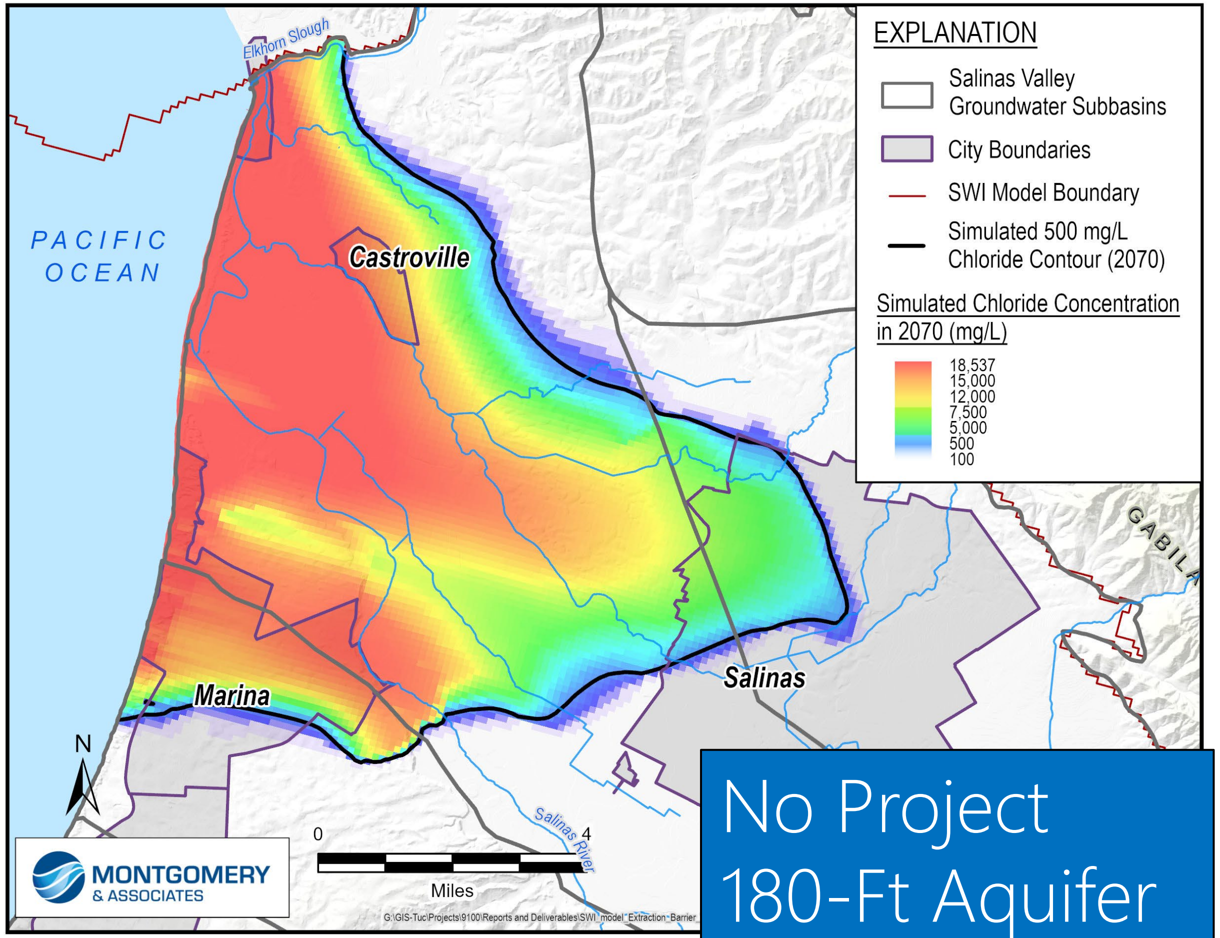


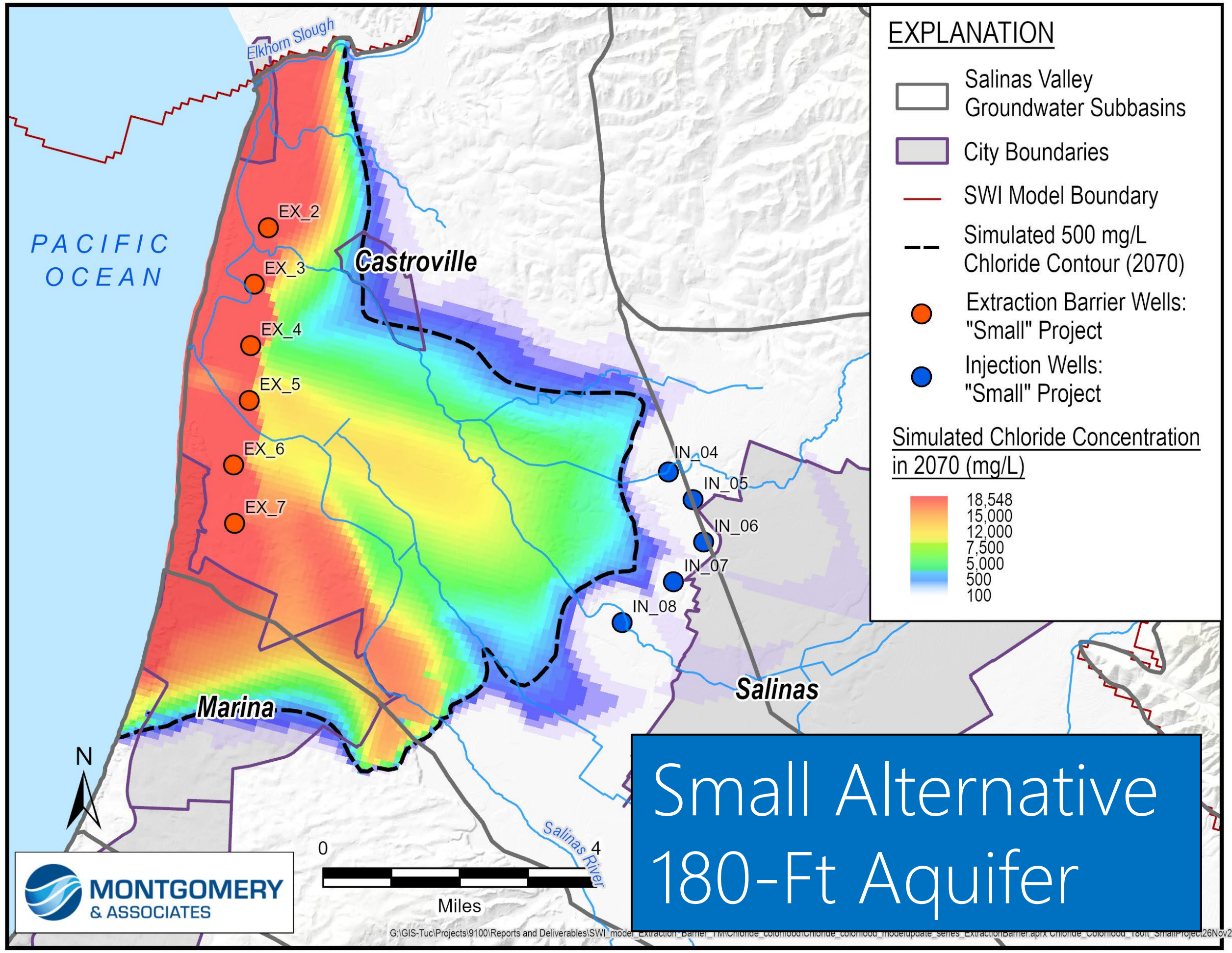
End Users	Volume Offset	% of Total
Alco Water Service	3,222	*80%*
Cal Water - Salinas	10,152	*70%*
Castroville Community Services District	738	*100%*
Marina Coast Water District	1,697	*53%*
CSIP	3,606	*100%*
Injection Volume	8,593	-
Total (AFY)	**28,008**	

Legend

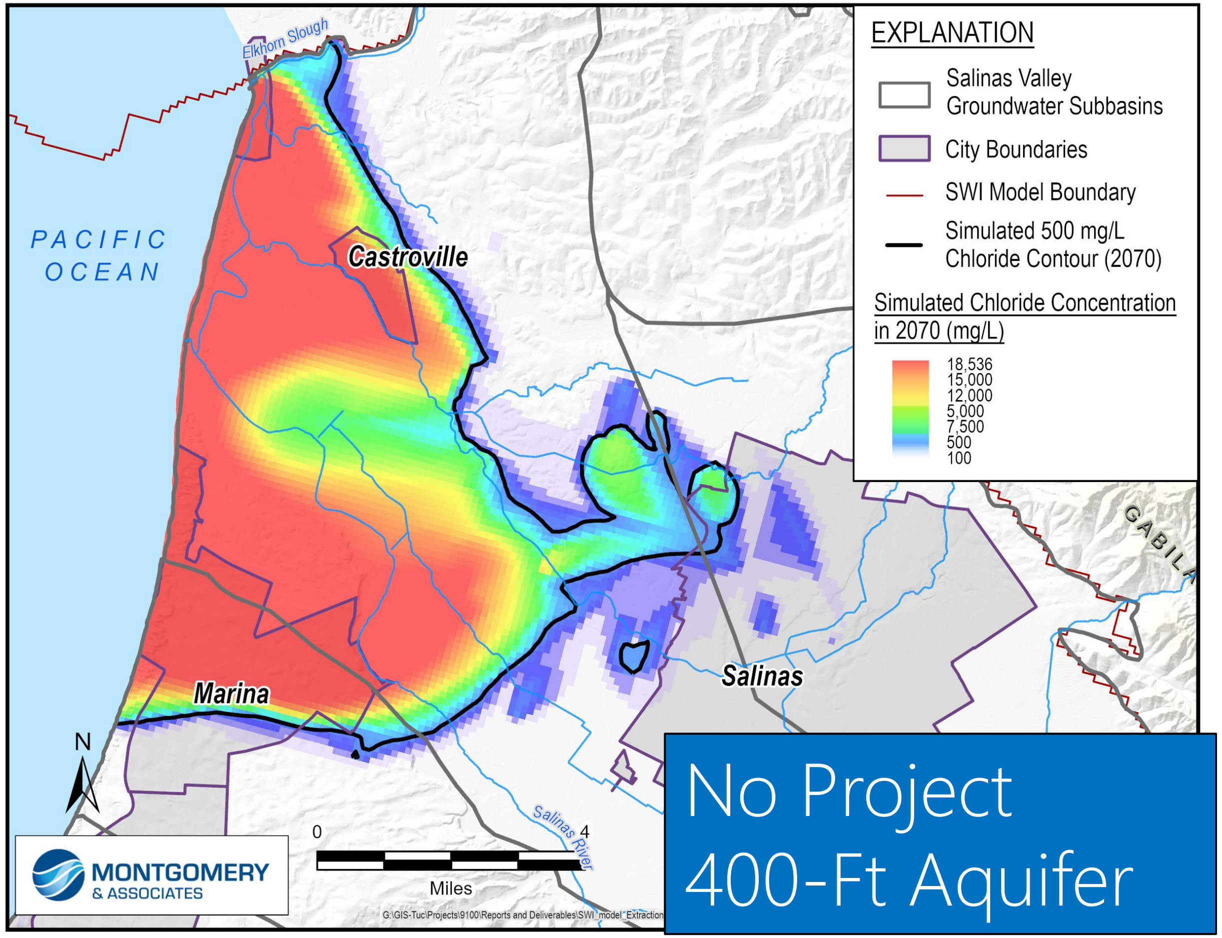
- Potable Water Distribution System
- Extraction Conveyance System
- Existing CSIP Pipelines
- Injection Well Laterals
- Seawater Extraction Barrier Well
- Potable Water Injection Well

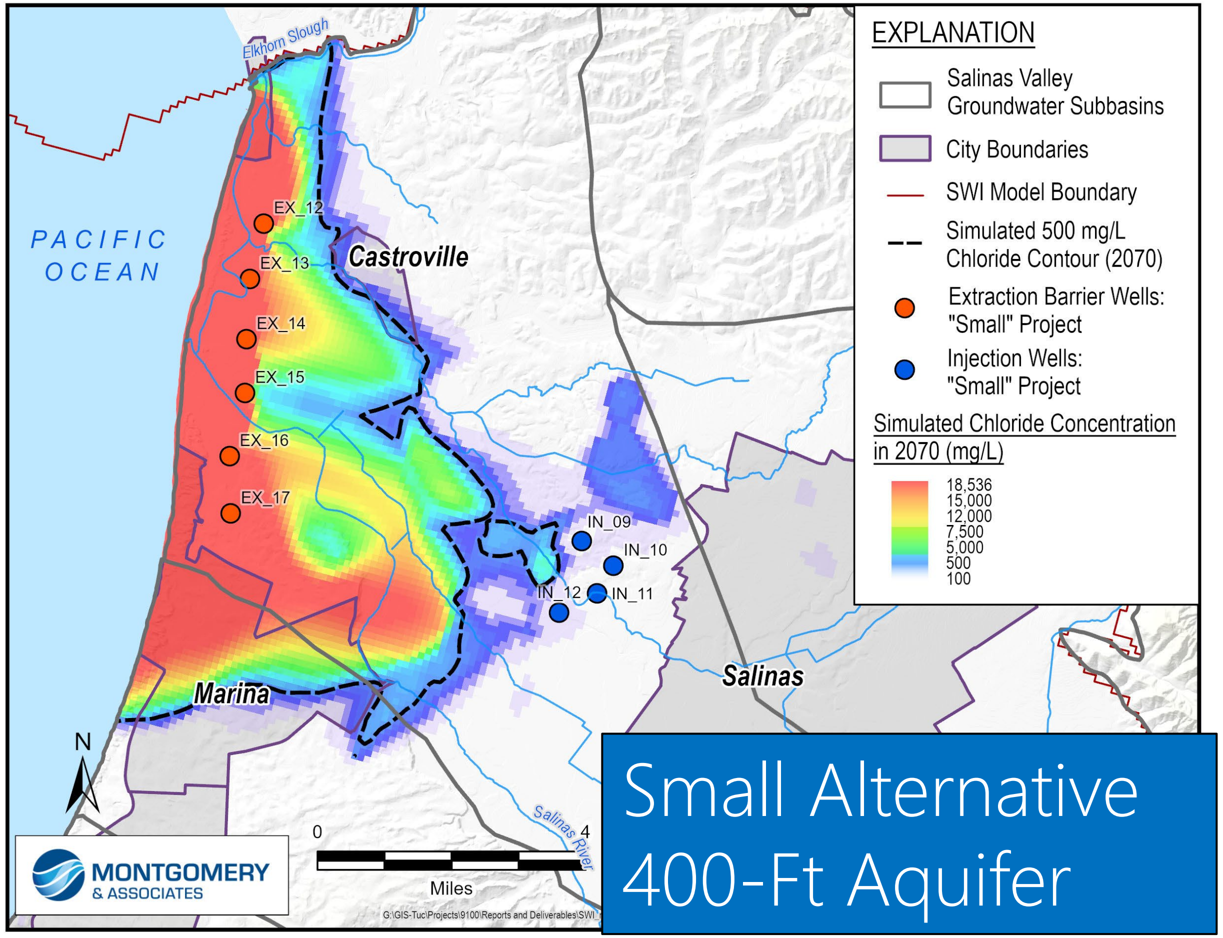
Chloride Concentration
No Project Compared to Small Alternative at 2070



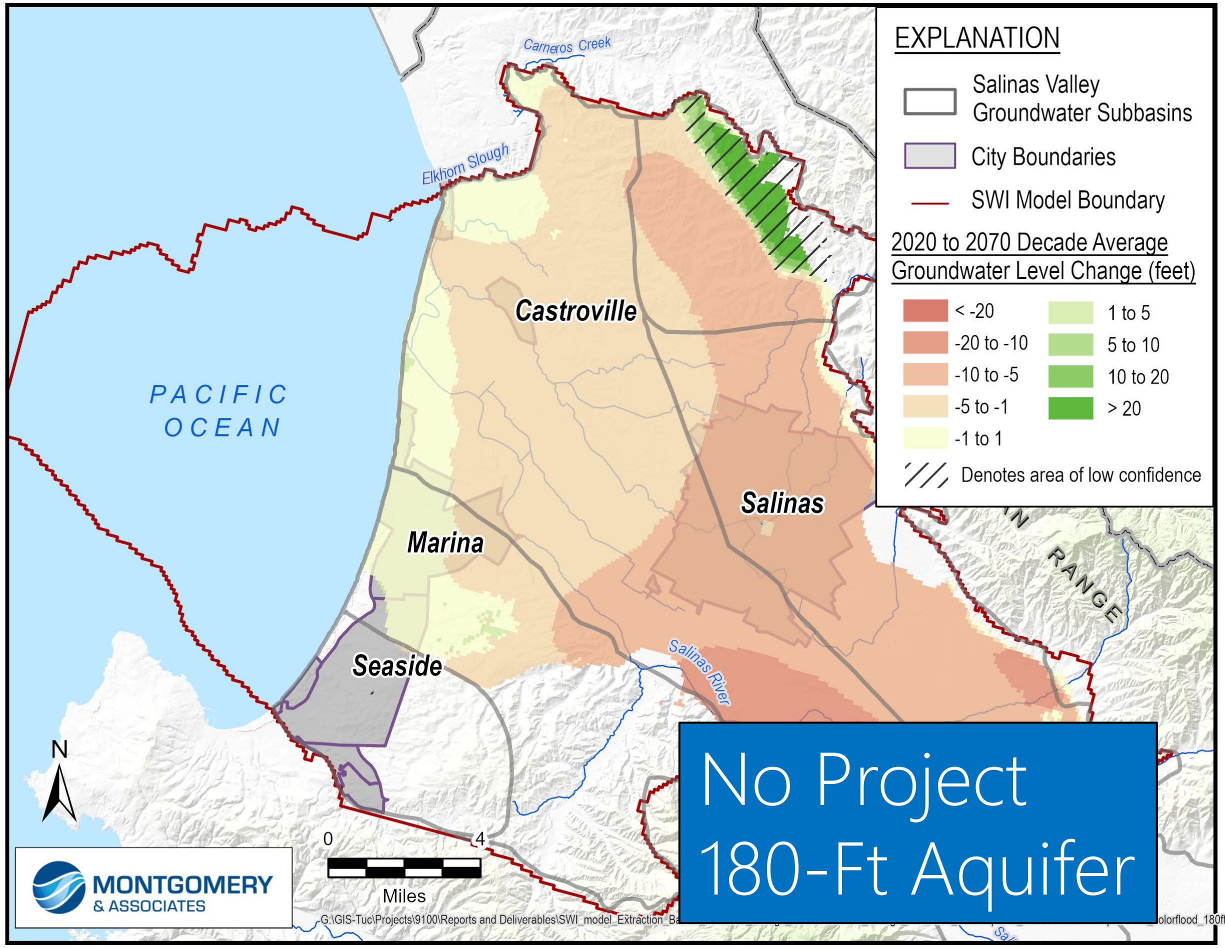


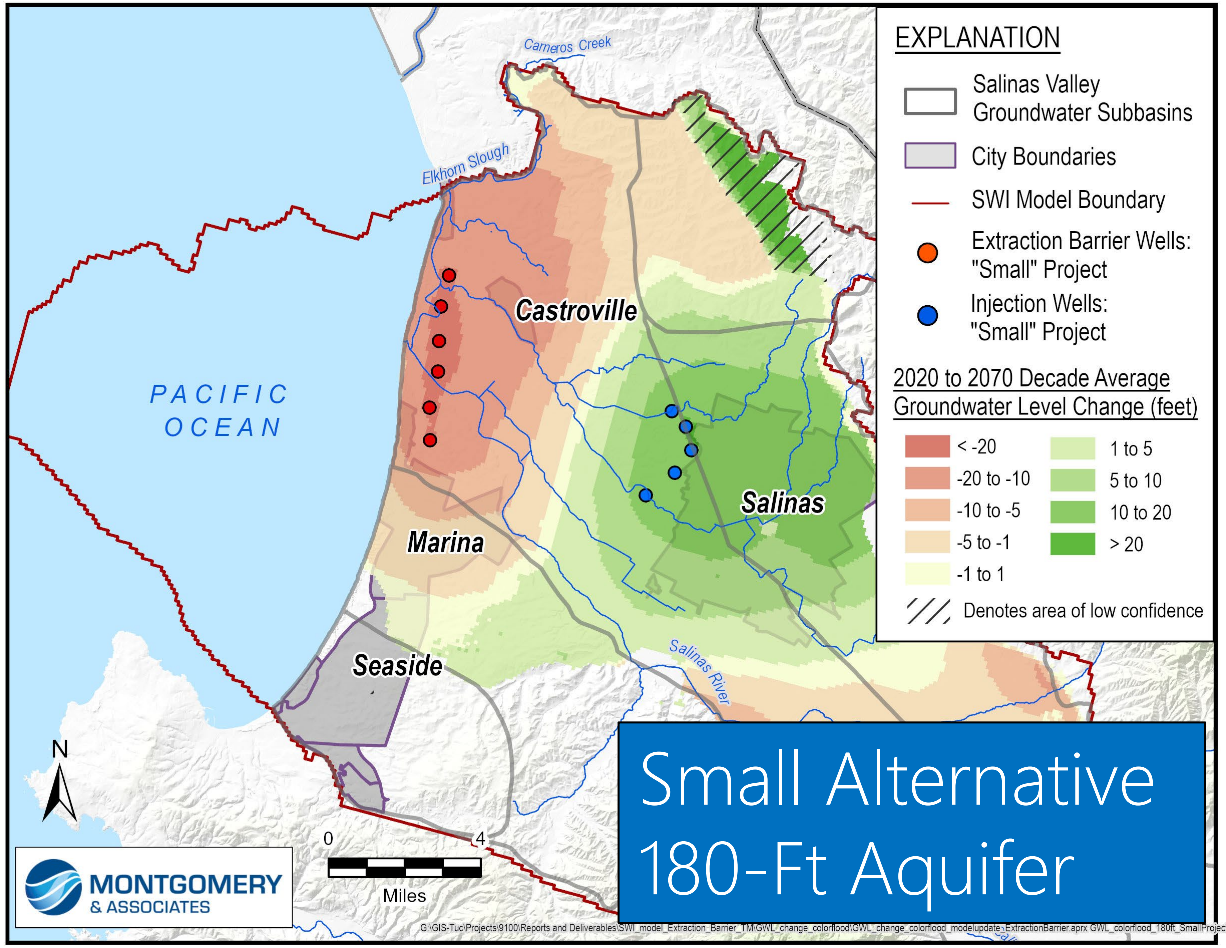
Chloride Concentration
No Project Compared to Small Alternative at 2070



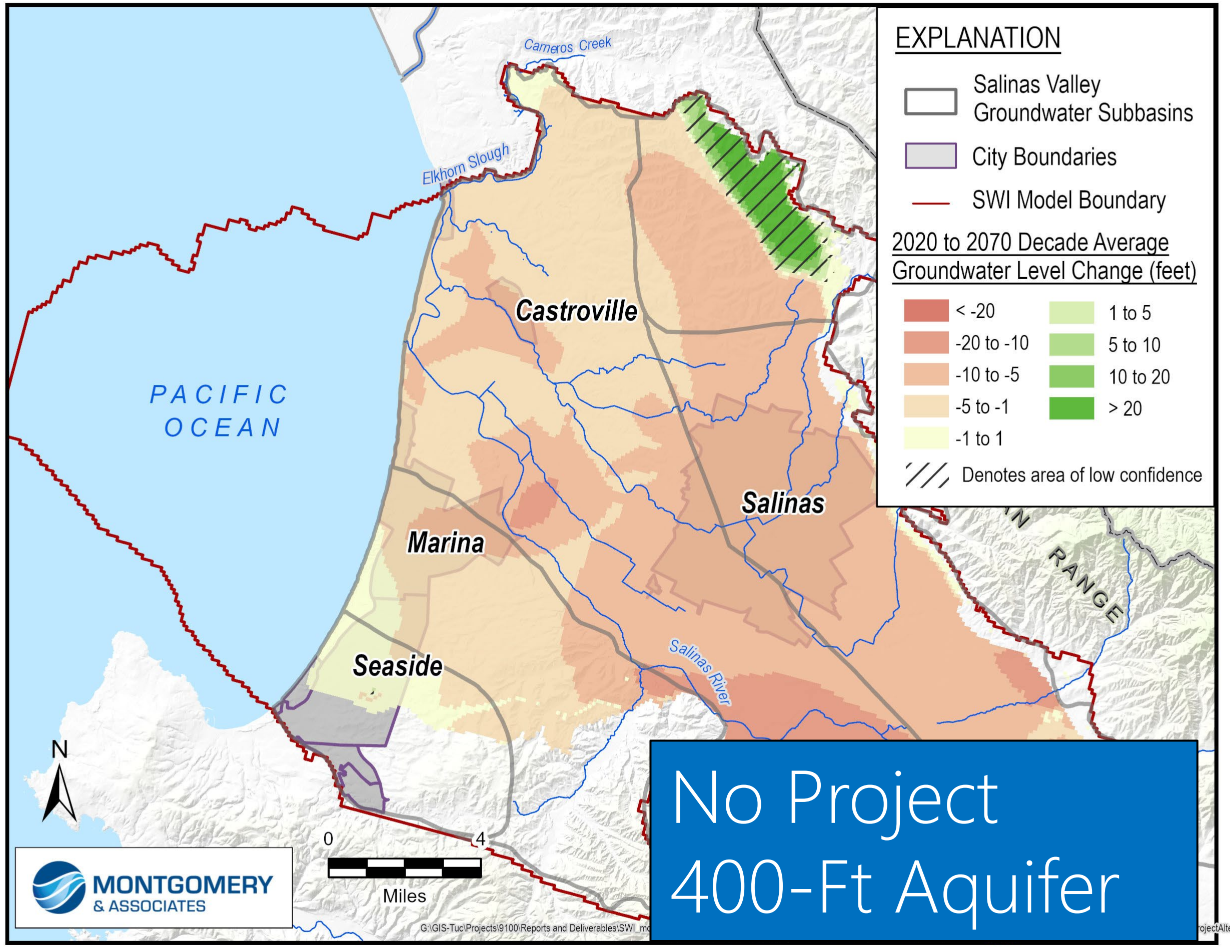


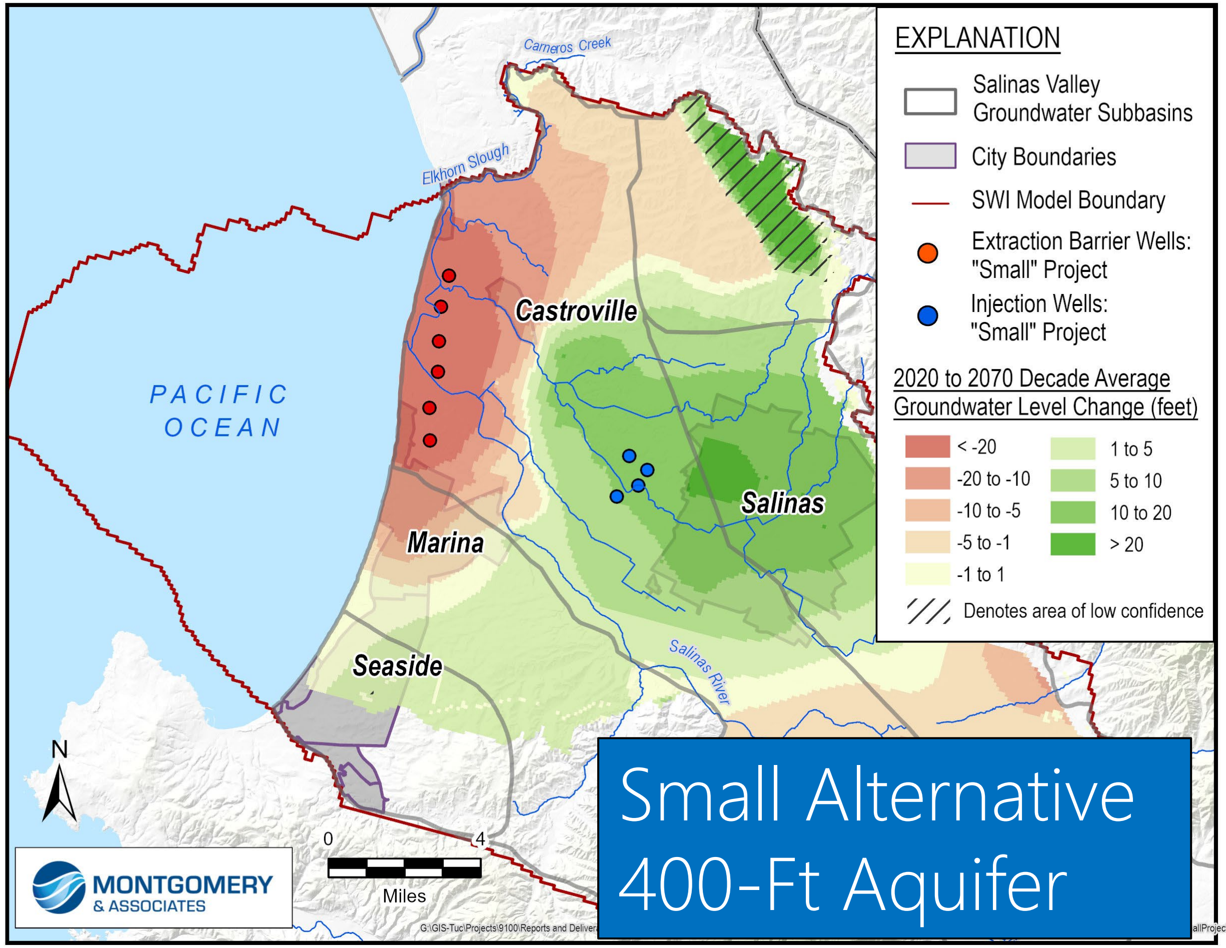
Groundwater Levels
No Project Compared to Small Alternative at 2070



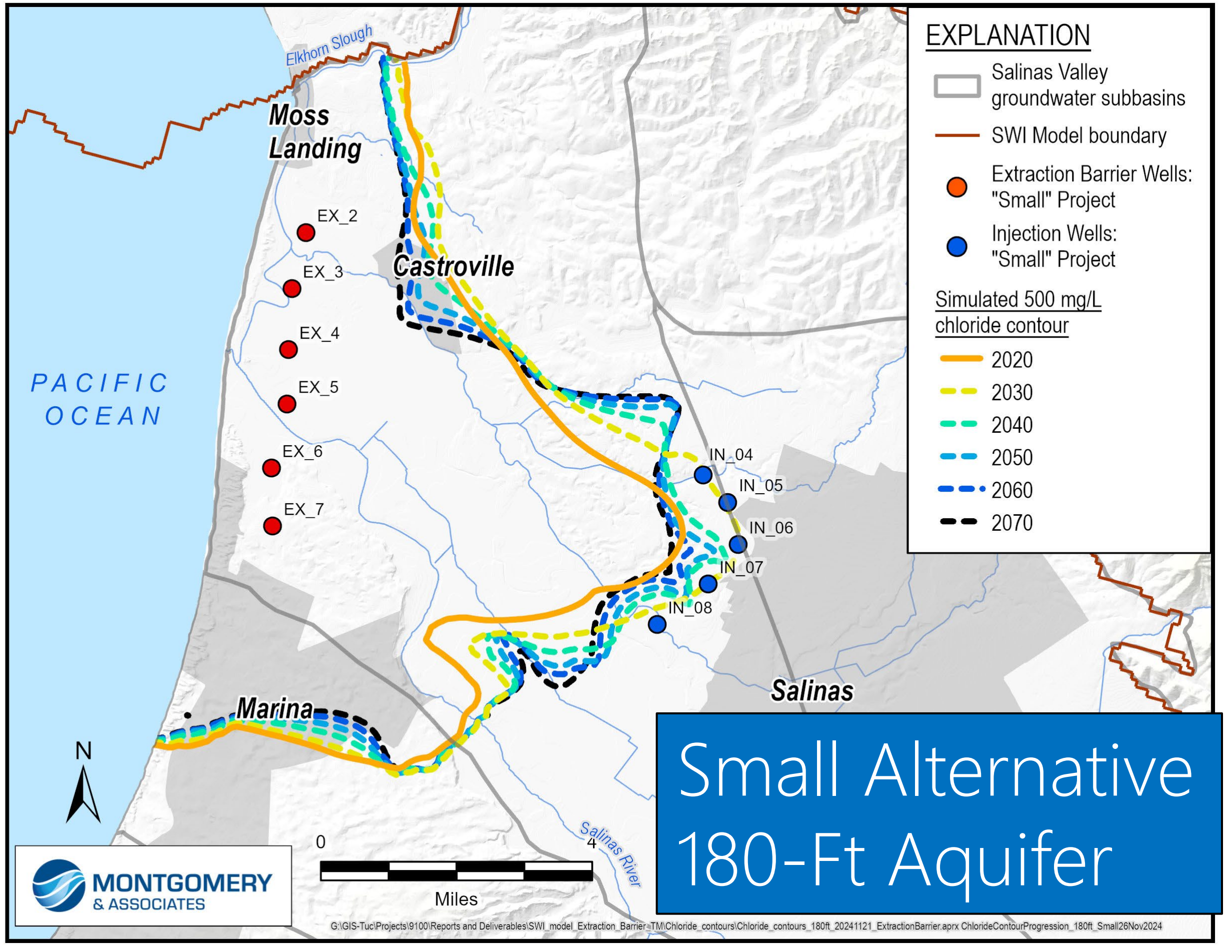


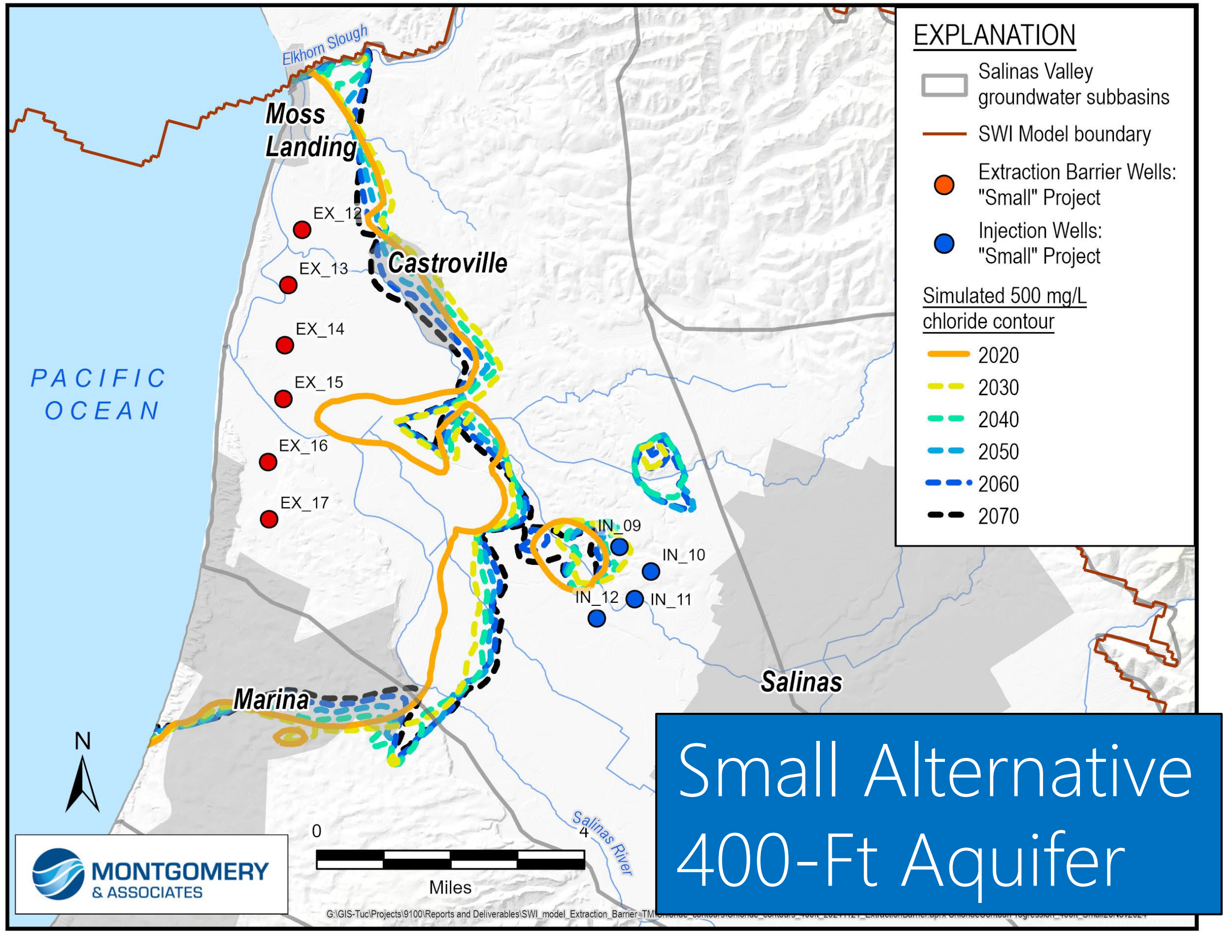
Groundwater Levels
No Project Compared to Small Alternative at 2070



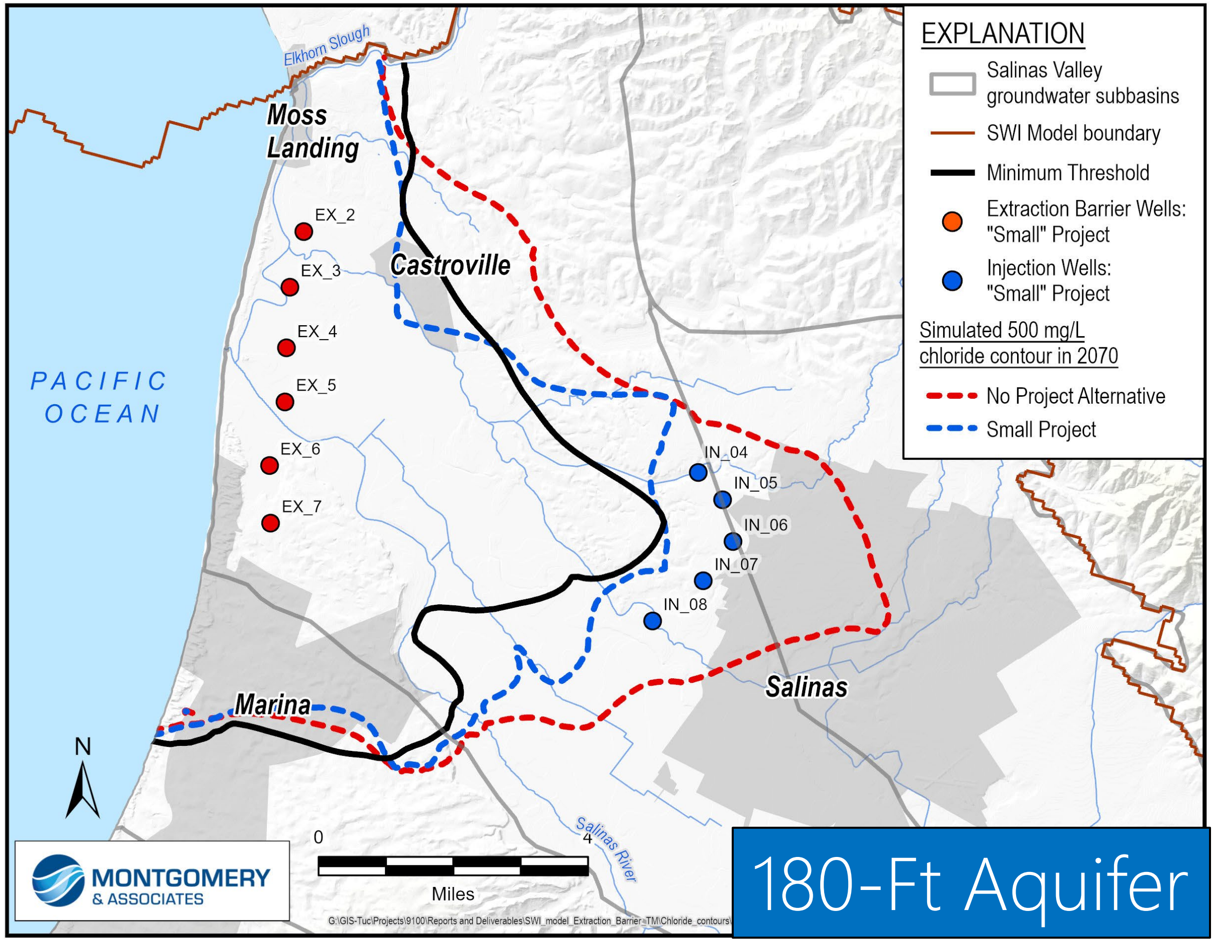


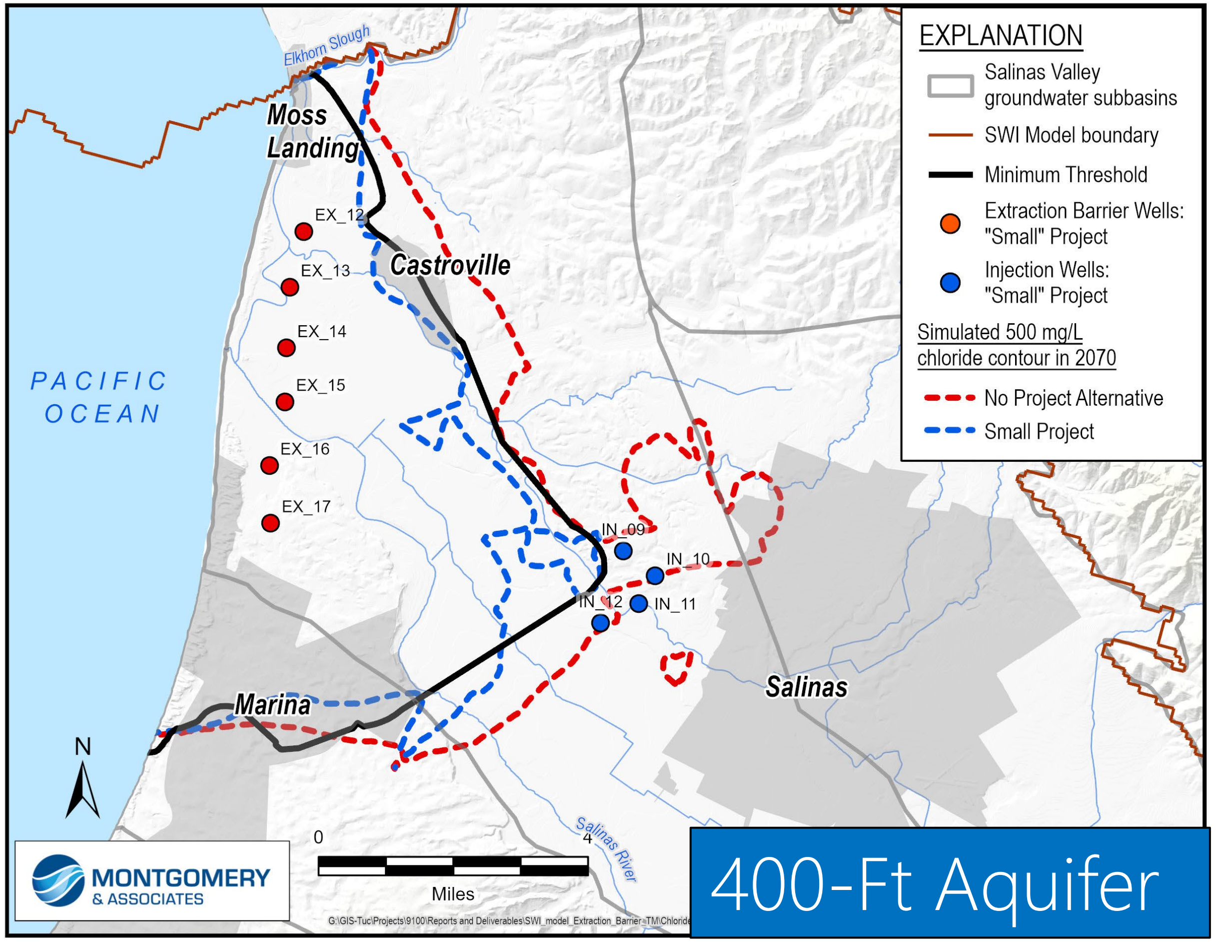
2070 Small Alternative Scenario – Simulated Progression of Seawater Intrusion Over Time



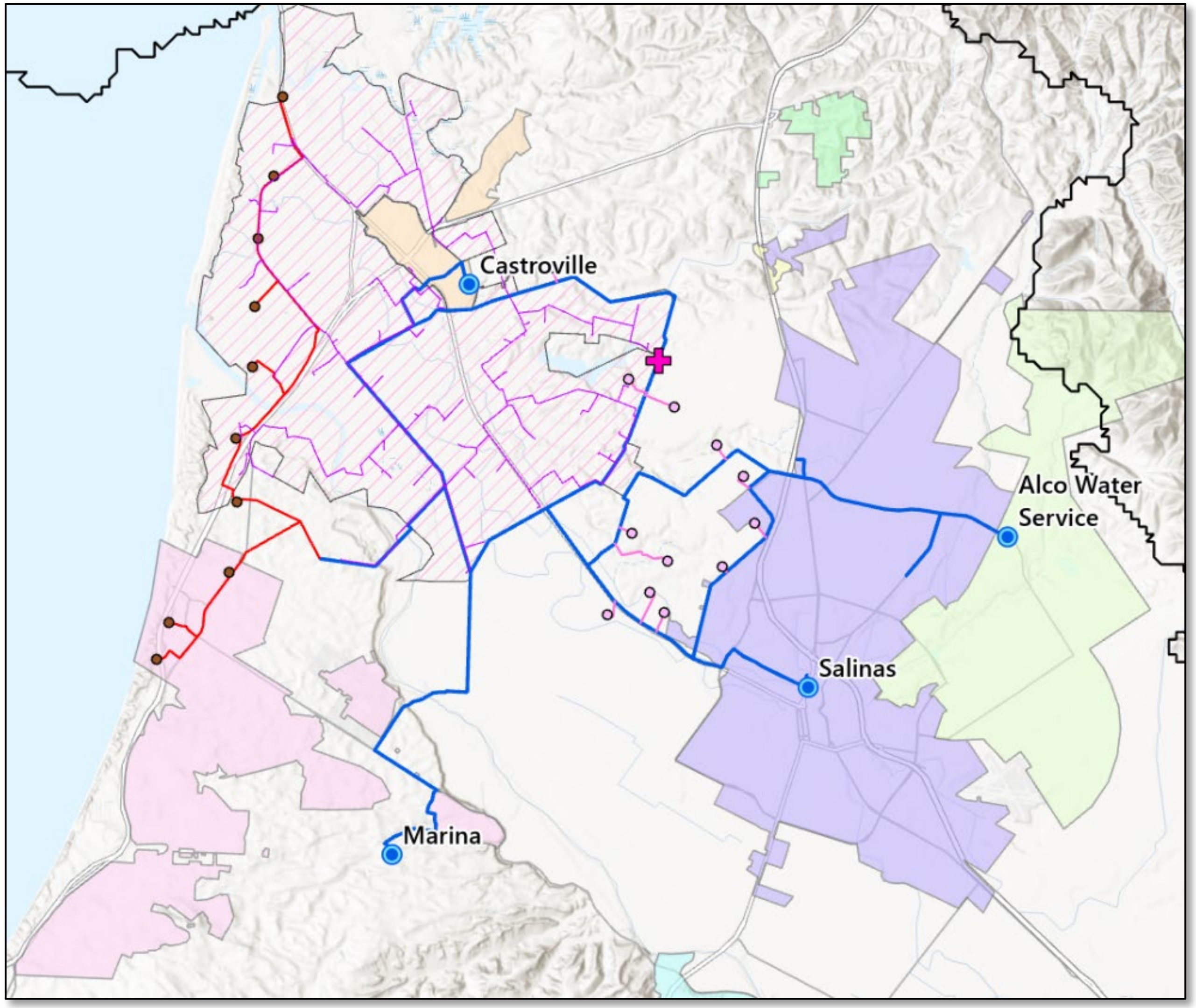


Seawater Intrusion Isocontour
Minimum Threshold Compared to Small Alternative at 2070

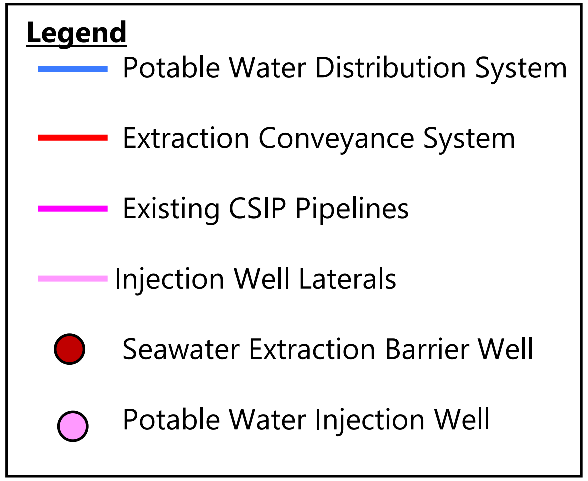




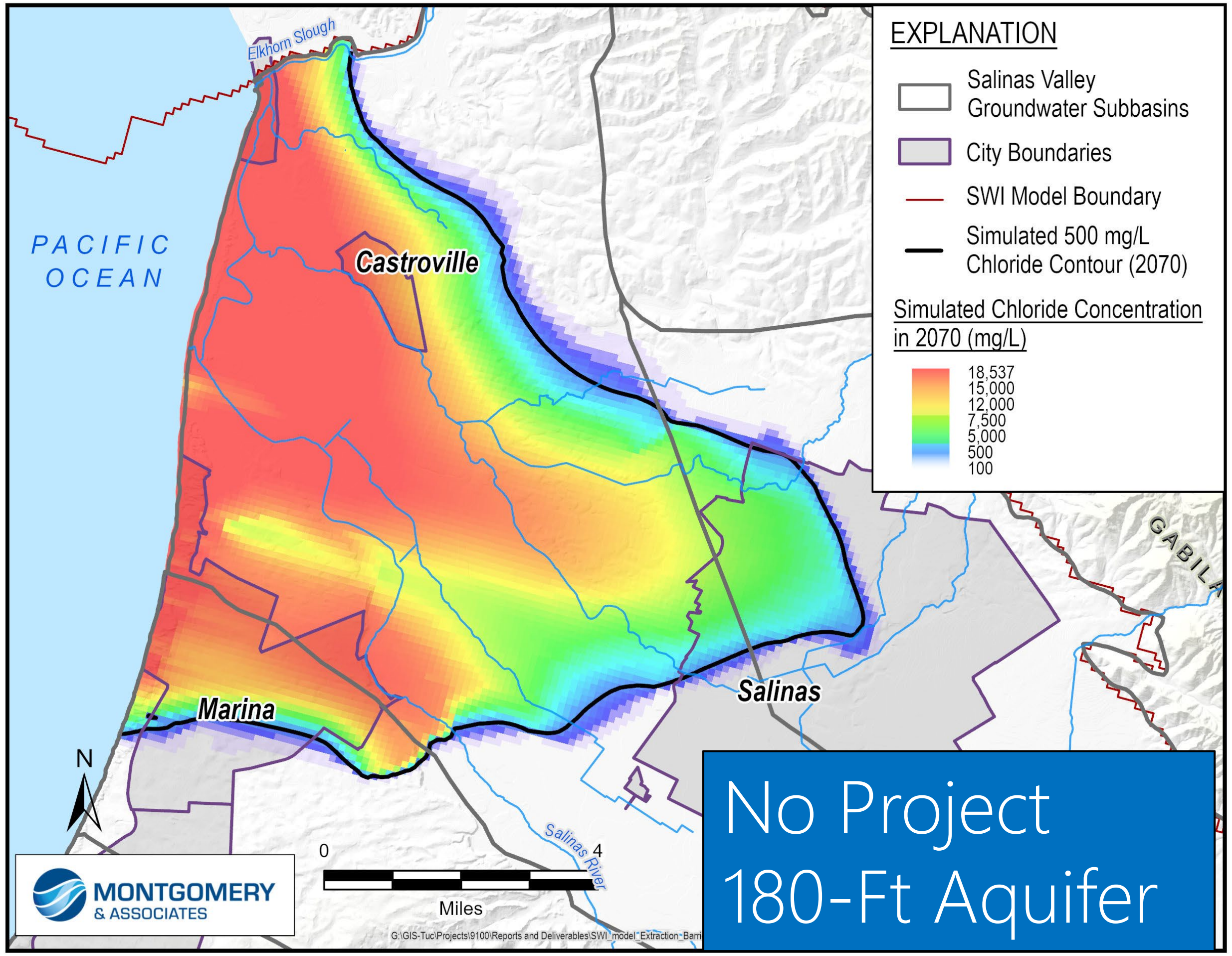
Medium Alternative – 67,000 AFY Extraction

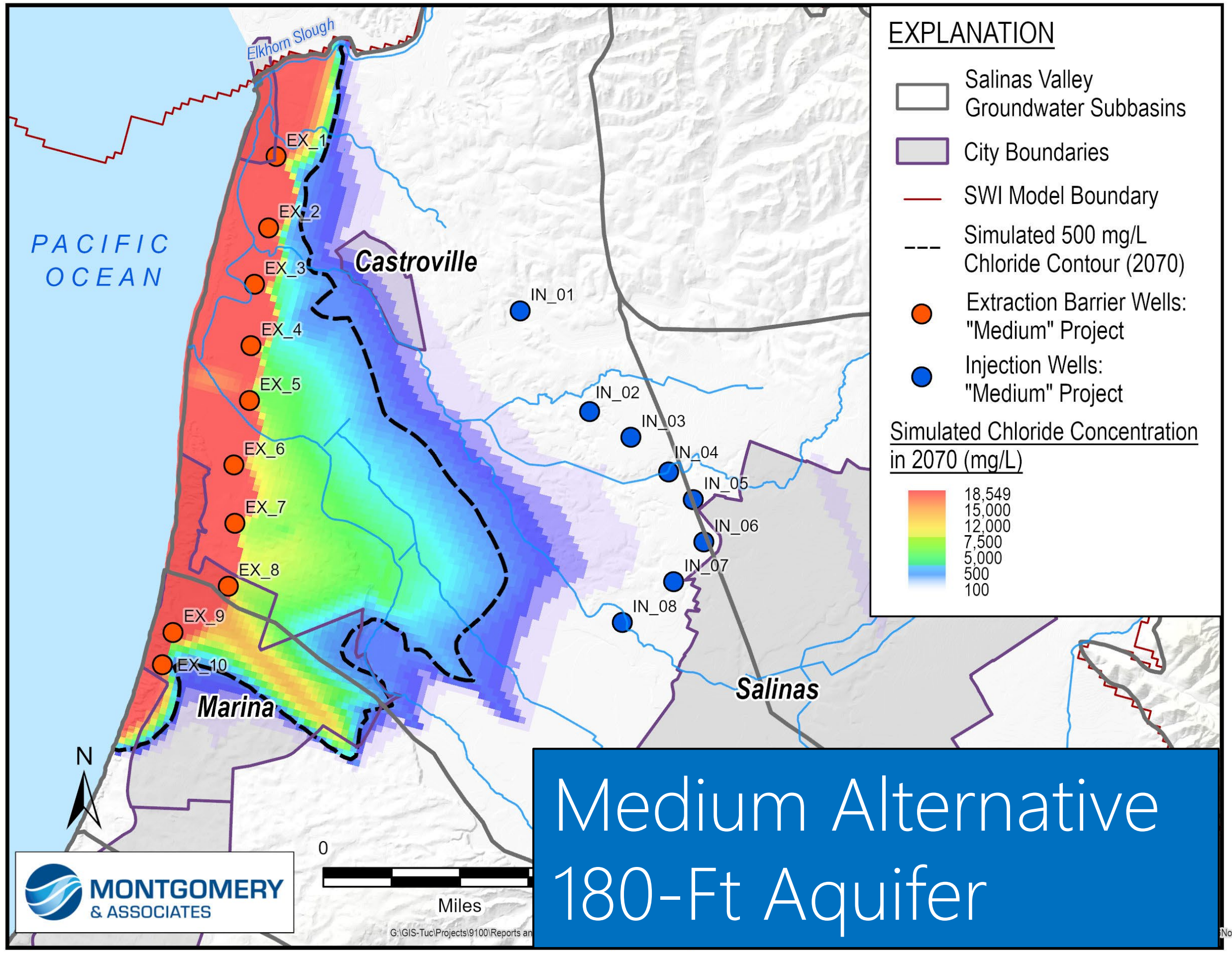


End Users	Volume Offset	% of Total
Alco Water Service	4,027	*100%*
Cal Water - Salinas	14,503	*100%*
Castroville Community Services District	738	*100%*
Marina Coast Water District	3,217	*100%*
CSIP	5,271	*100%*
Injection Volume	19,101	-
Total (AFY)	**46,858**	

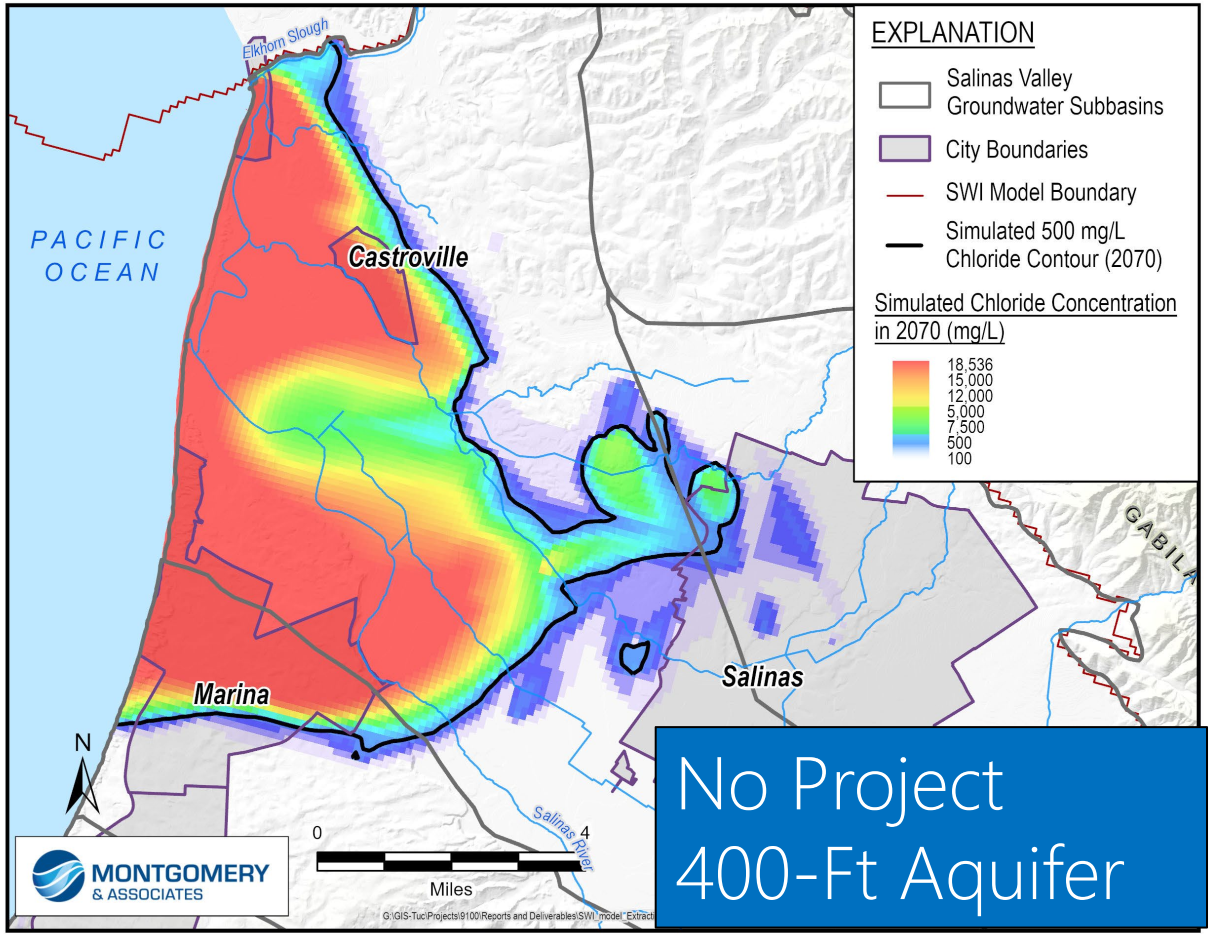


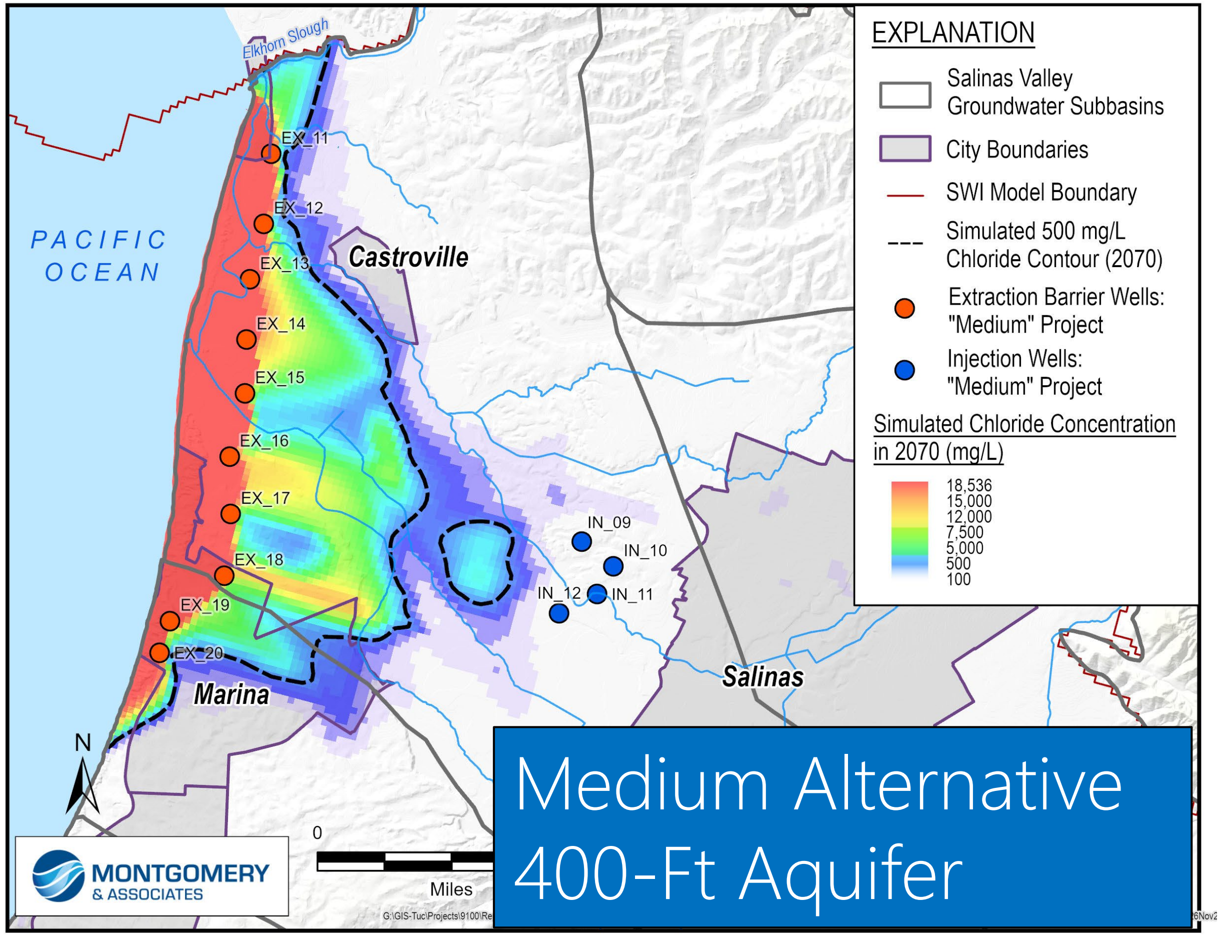
Chloride Concentration
No Project Compared to Medium Alternative at 2070



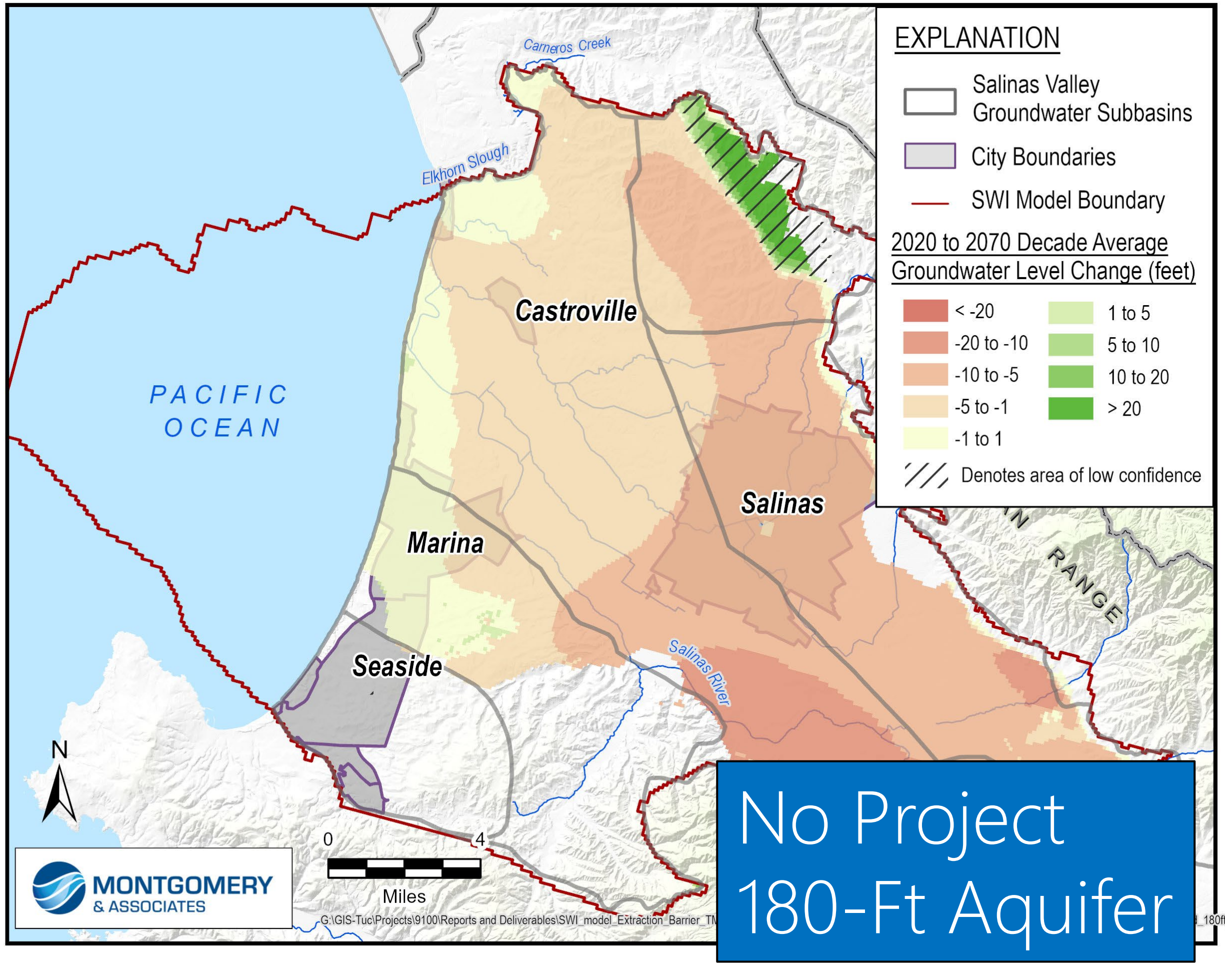


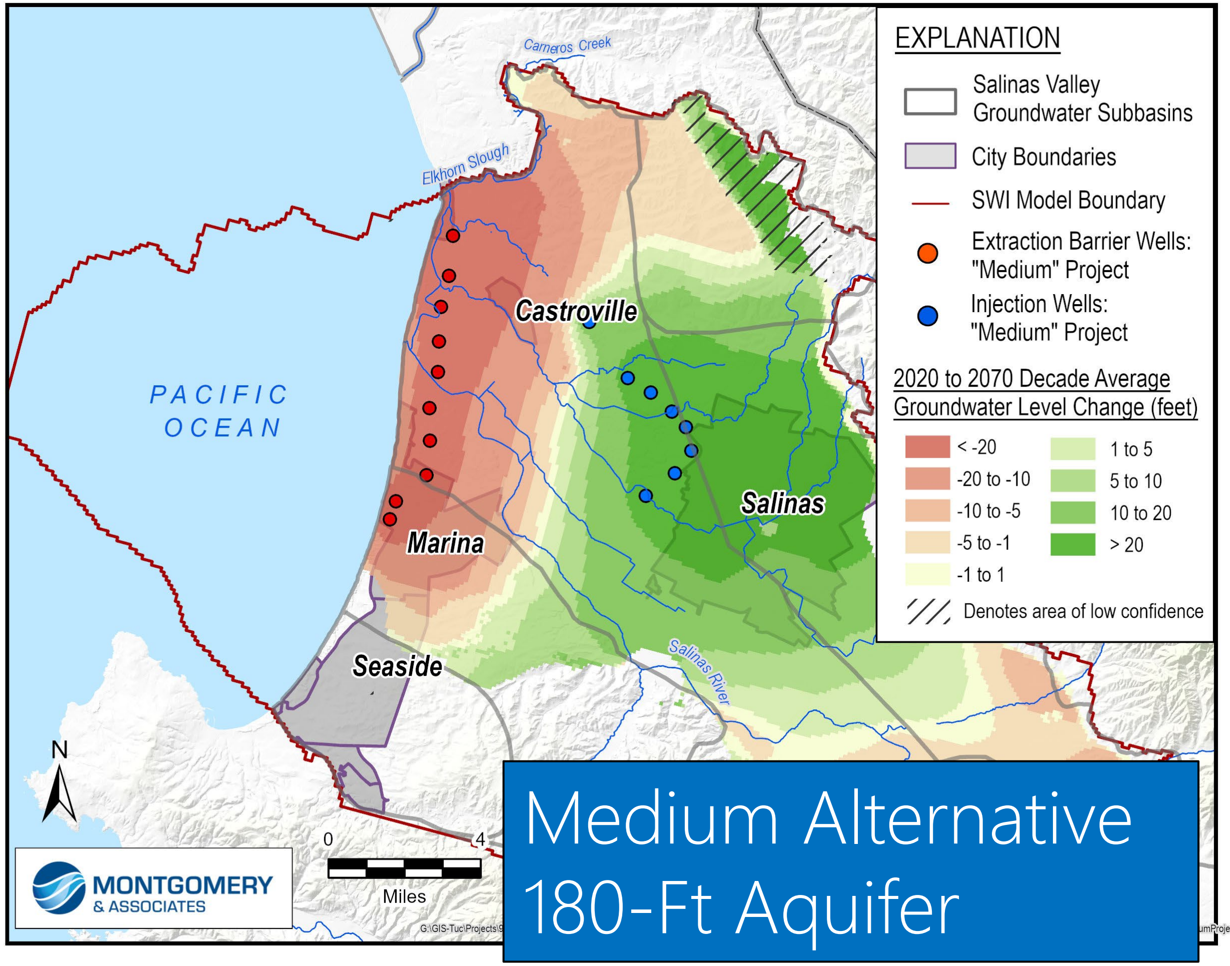
Chloride Concentration
No Project Compared to Medium Alternative at 2070



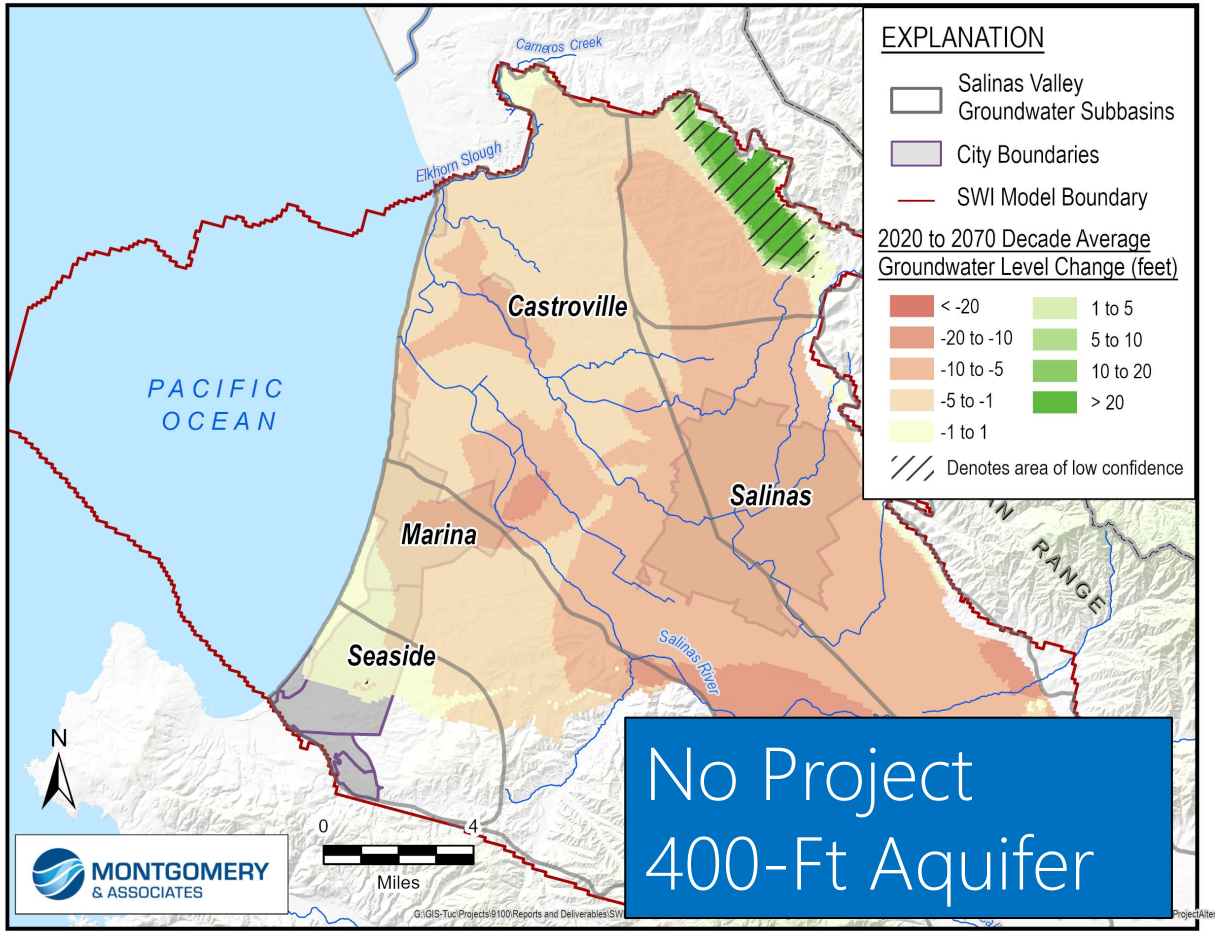


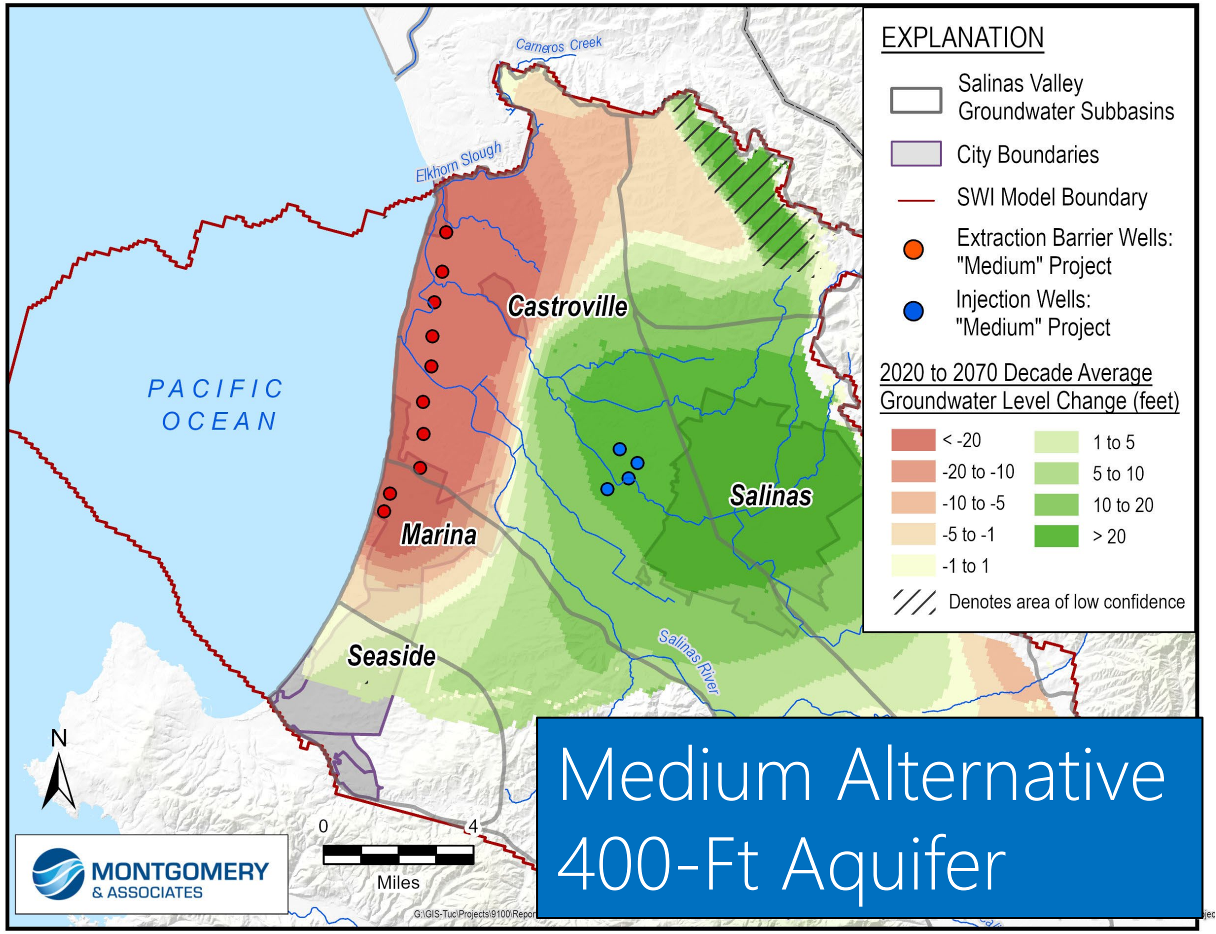
Groundwater Levels
No Project Compared to Medium Alternative at 2070



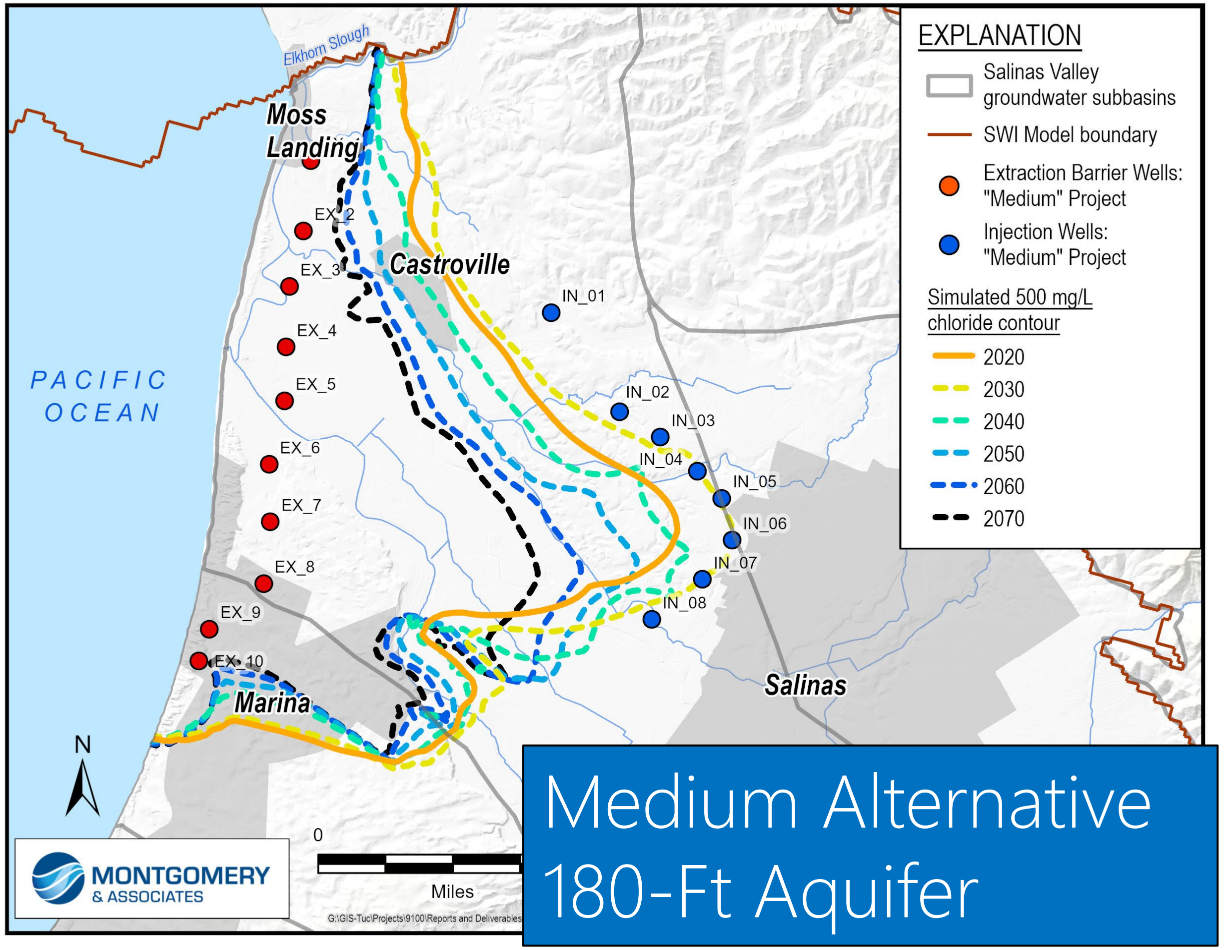


Groundwater Levels
No Project Compared to Medium Alternative at 2070

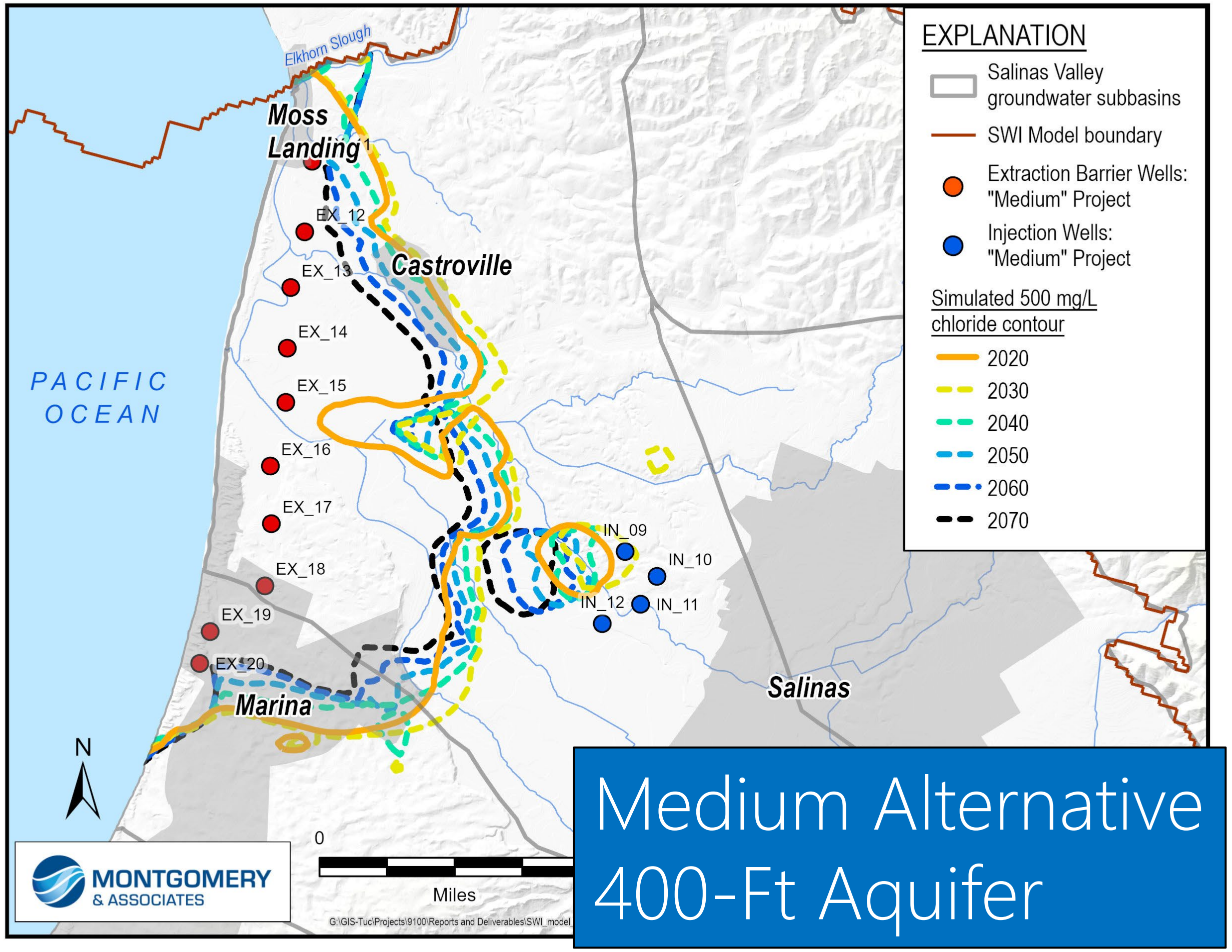




2070 Medium Alternative Scenario – Simulated Progression of Seawater Intrusion Over Time

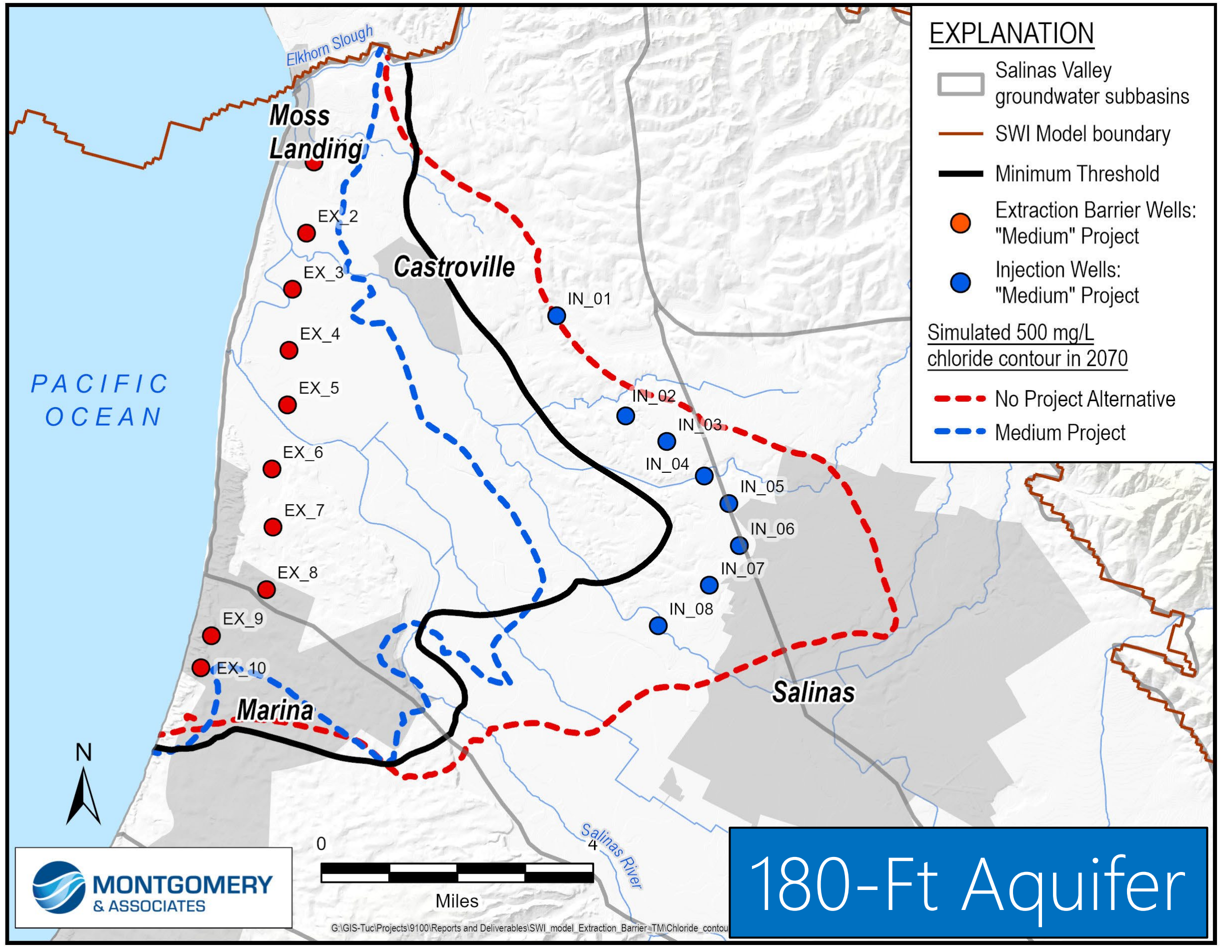


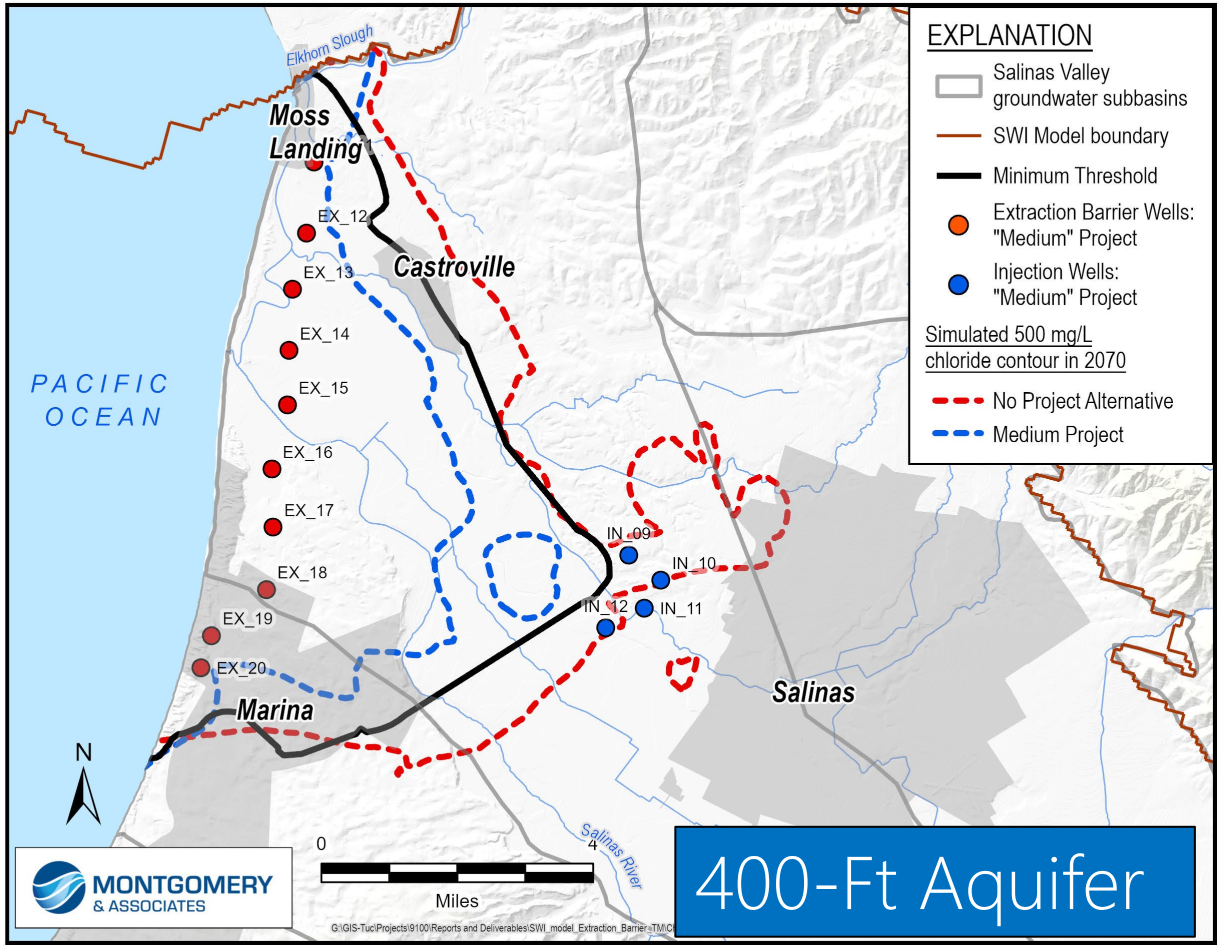
Medium Alternative 180-Ft Aquifer



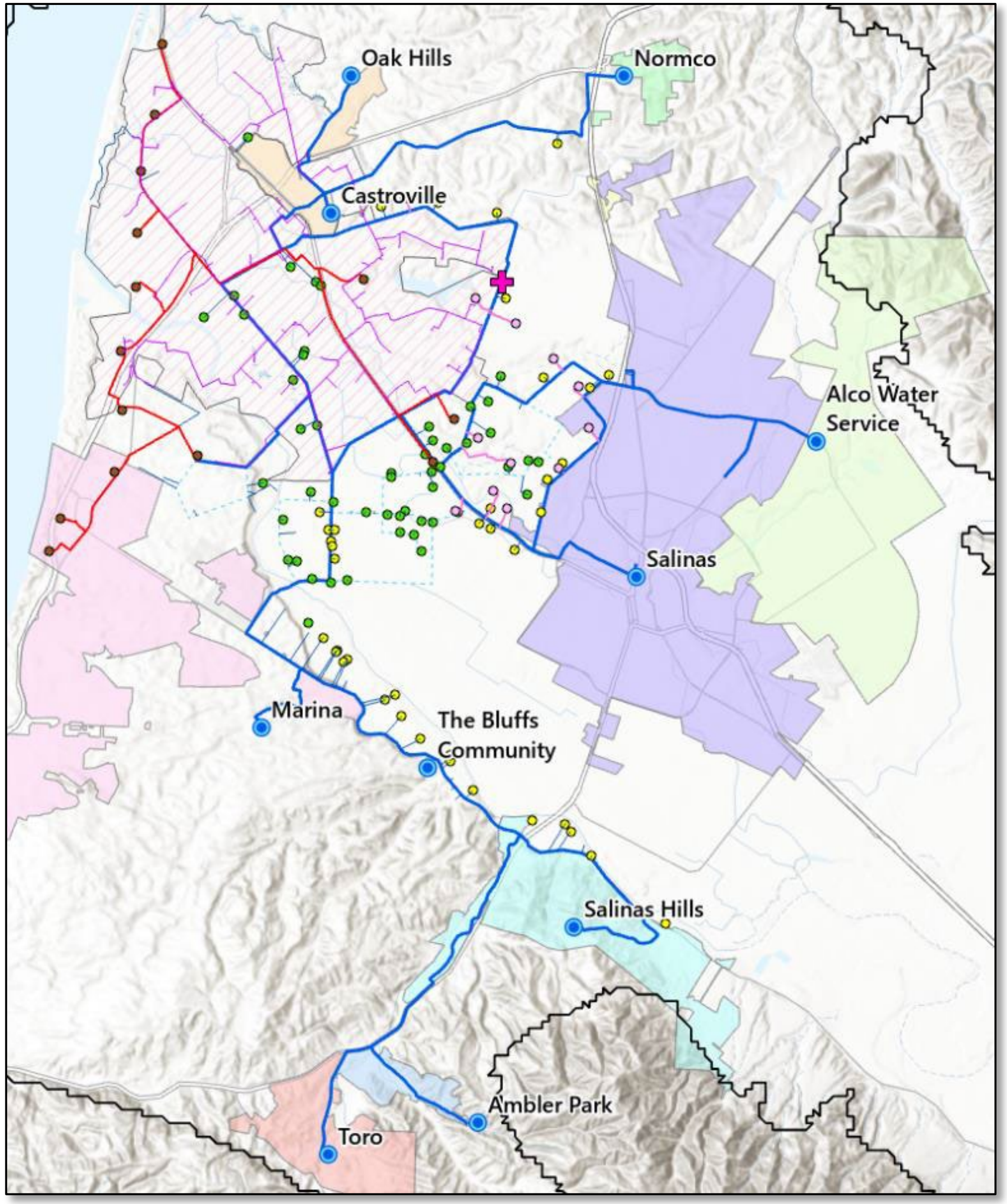
Medium Alternative 400-Ft Aquifer

Seawater Intrusion Isocontour
Minimum Threshold Compared to Medium Alternative at 2070





Large Alternative – 96,780 AFY Extraction

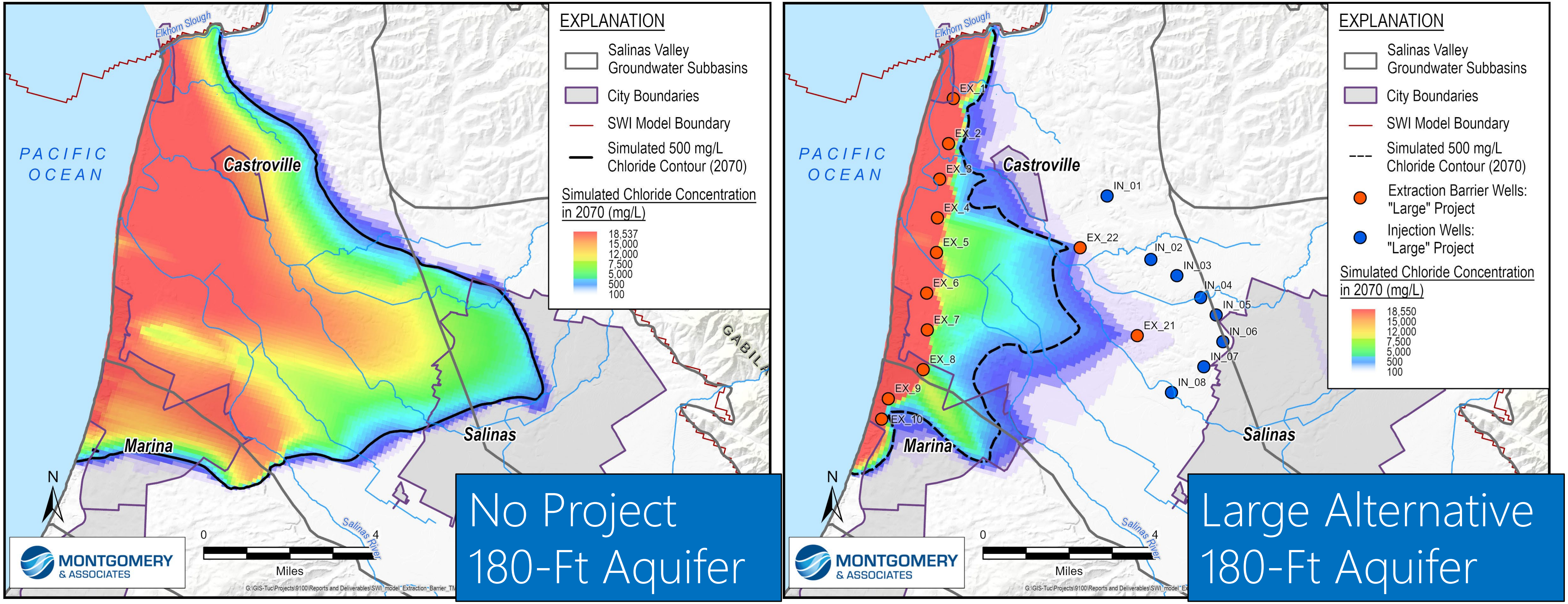


Legend

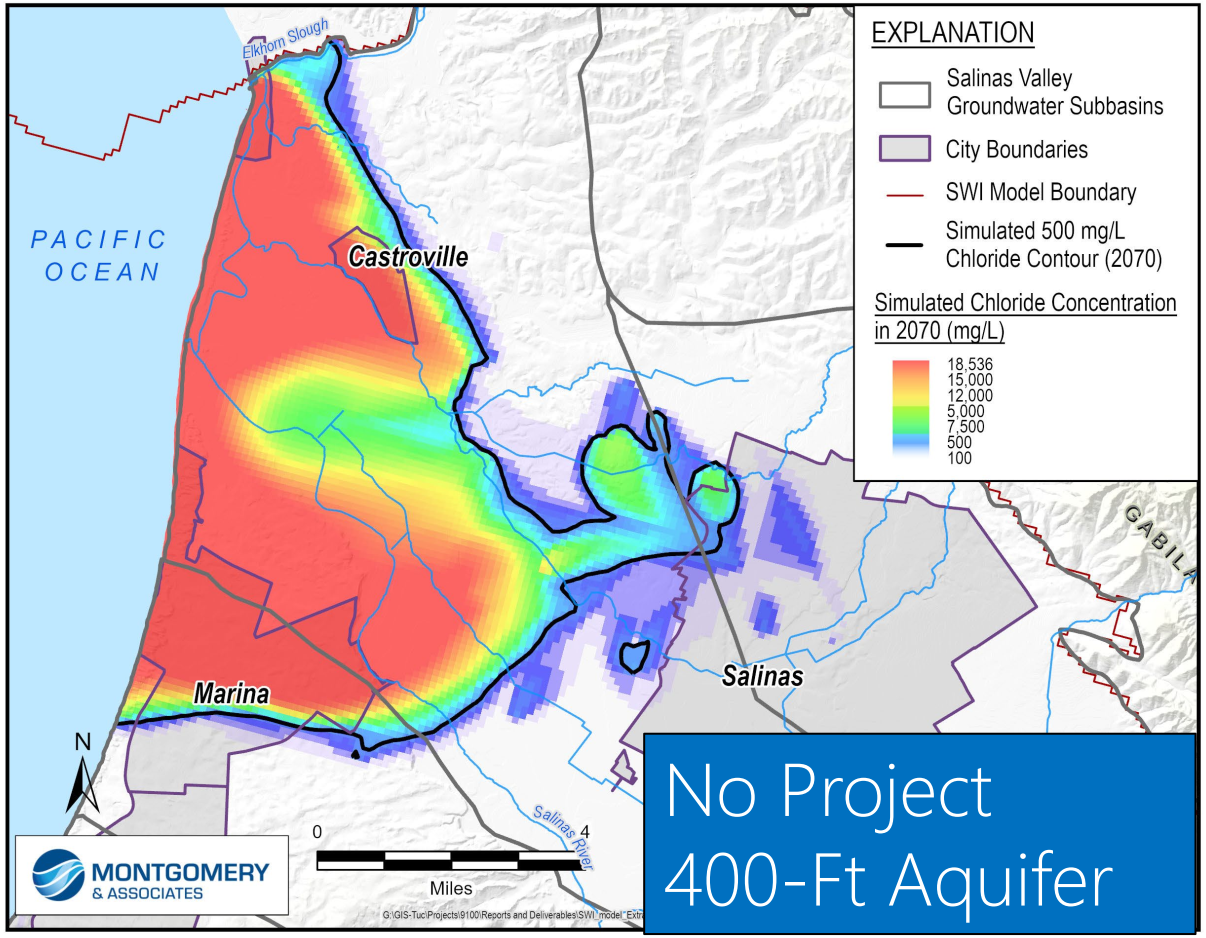
- Potable Water Distribution System
- Extraction Conveyance System
- Existing CSIP Pipelines
- Injection Well Laterals
- Potable Water Laterals
- Seawater Extraction Barrier Well
- Potable Water Injection Well
- Adjacent Private Ag Wells
- Private Ag Wells within SWI Boundary

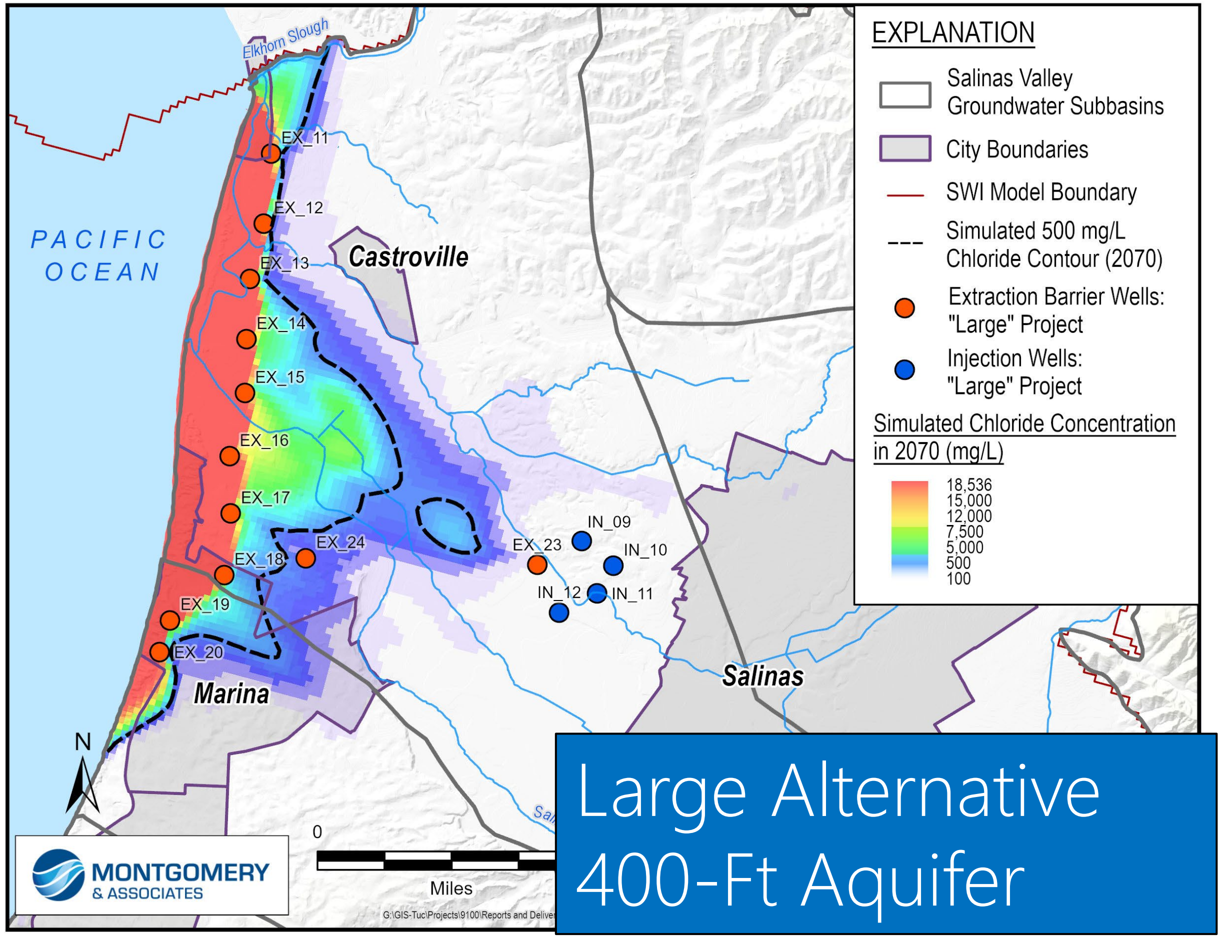
End Users	Volume Offset	% of Total
Alco Water Service	4,027	100%
Cal Water - Salinas	14,503	100%
Castroville Community Services District	738	100%
Marina Coast Water District	3,217	100%
CSIP	5,271	100%
Cal Water - Salinas Hills	1,806	100%
All Ag well within 180/400 and Other within SWI	6,034	100%
Ag wells within 1,000 Feet of Transmission Main	2,390	100%
Satellite Municipal Facilities (Normco, Toro, Oak Hills, Ambler Park)	765	100%
Injection Volume	26,168	
Total	**64,920**	

Chloride Concentration
No Project Compared to Large Alternative at 2070

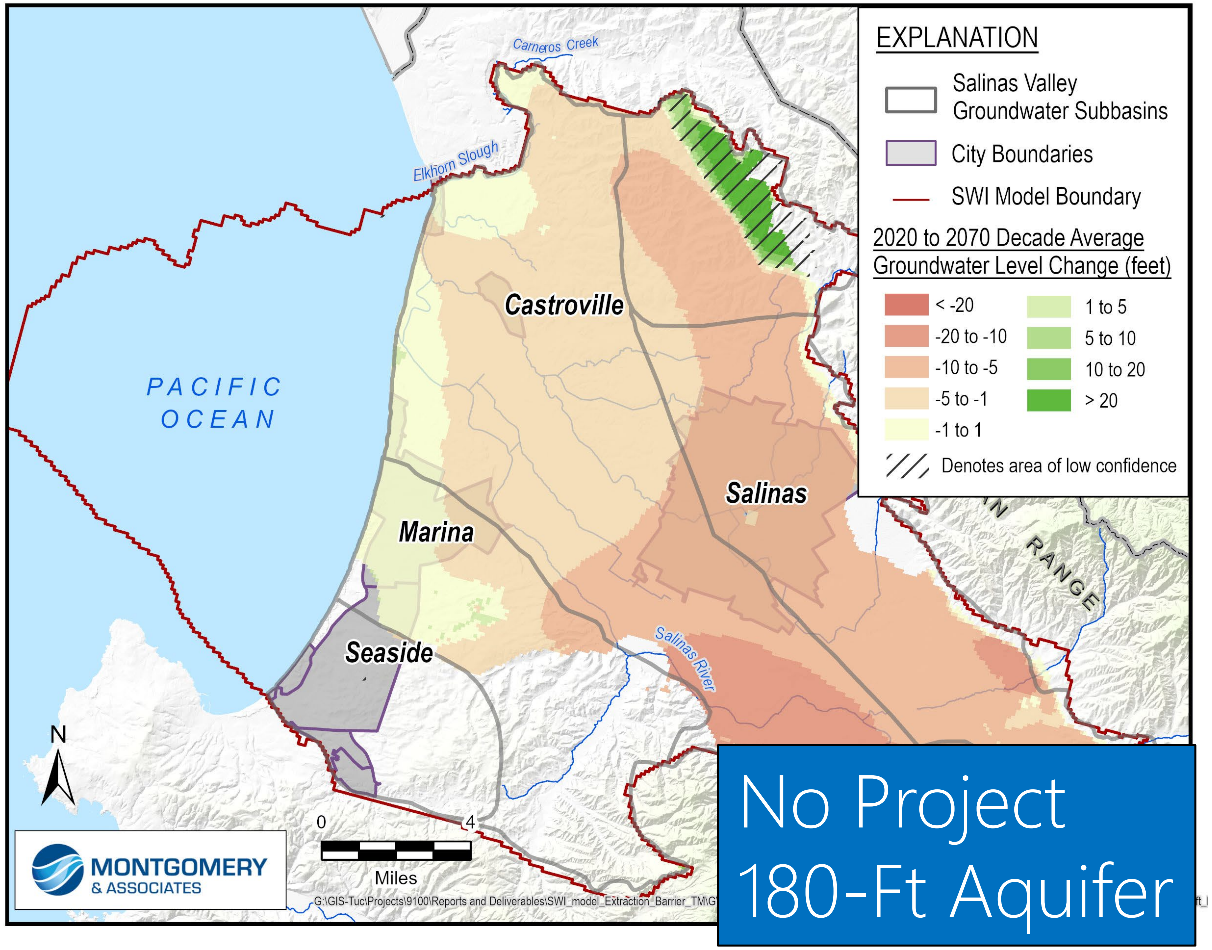


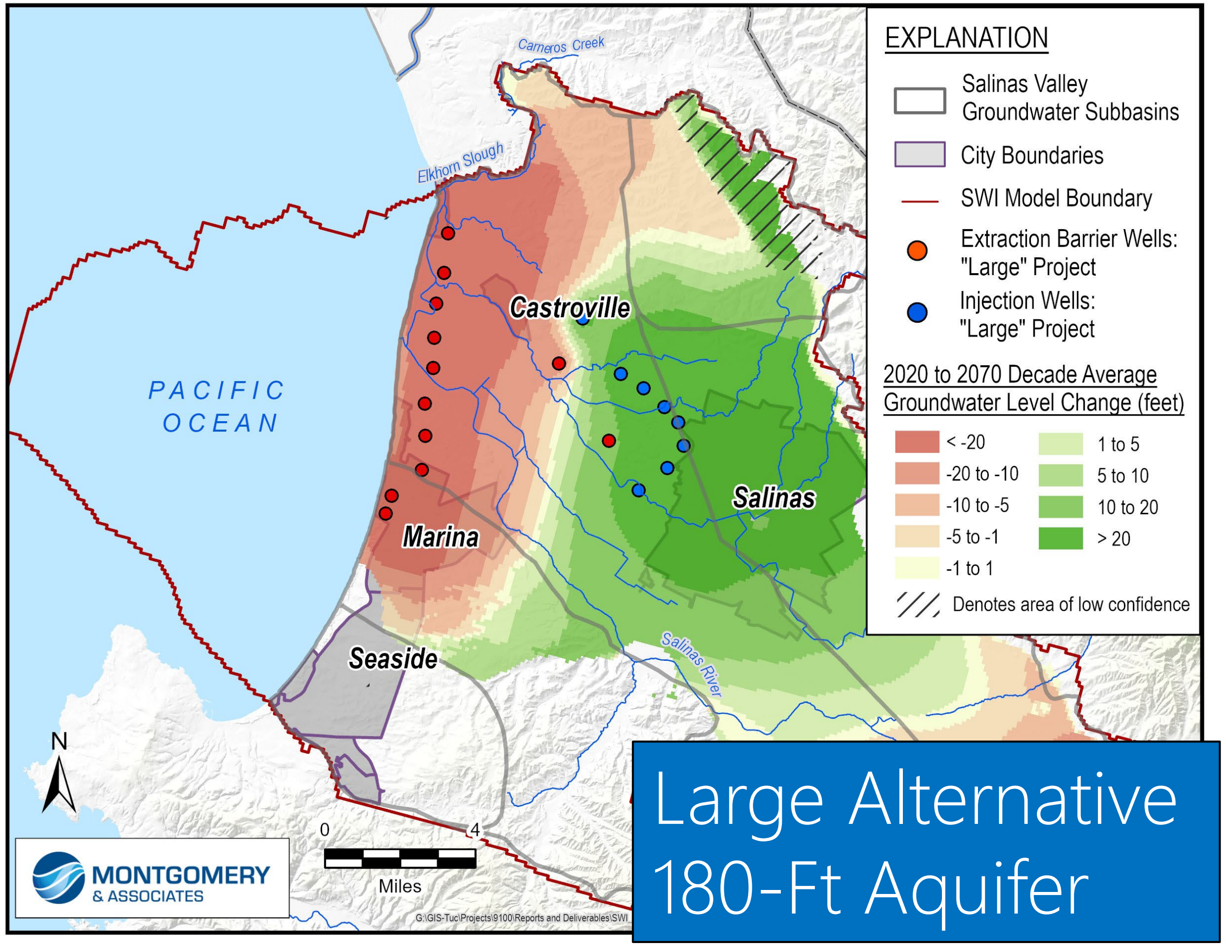
Chloride Concentration
No Project Compared to Large Alternative at 2070



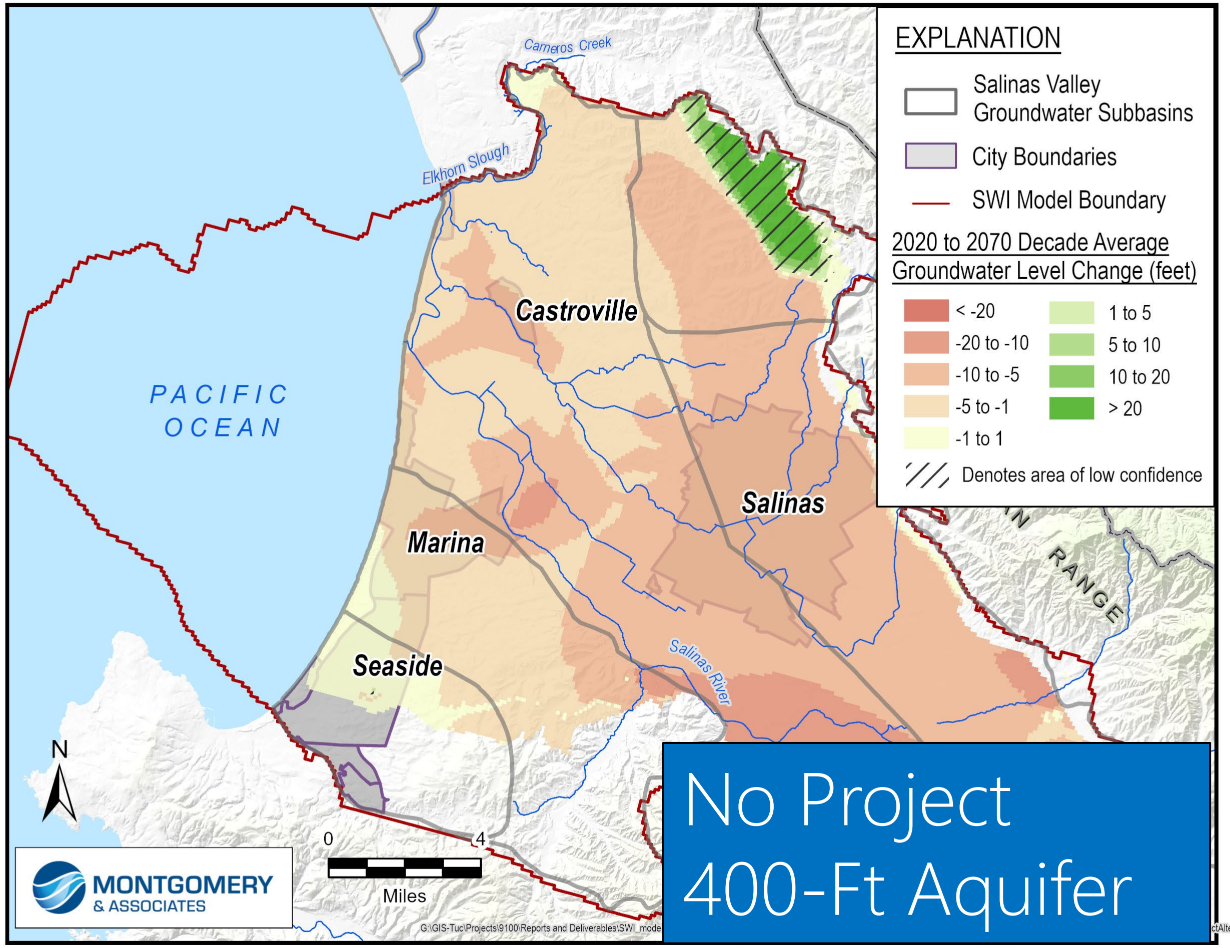


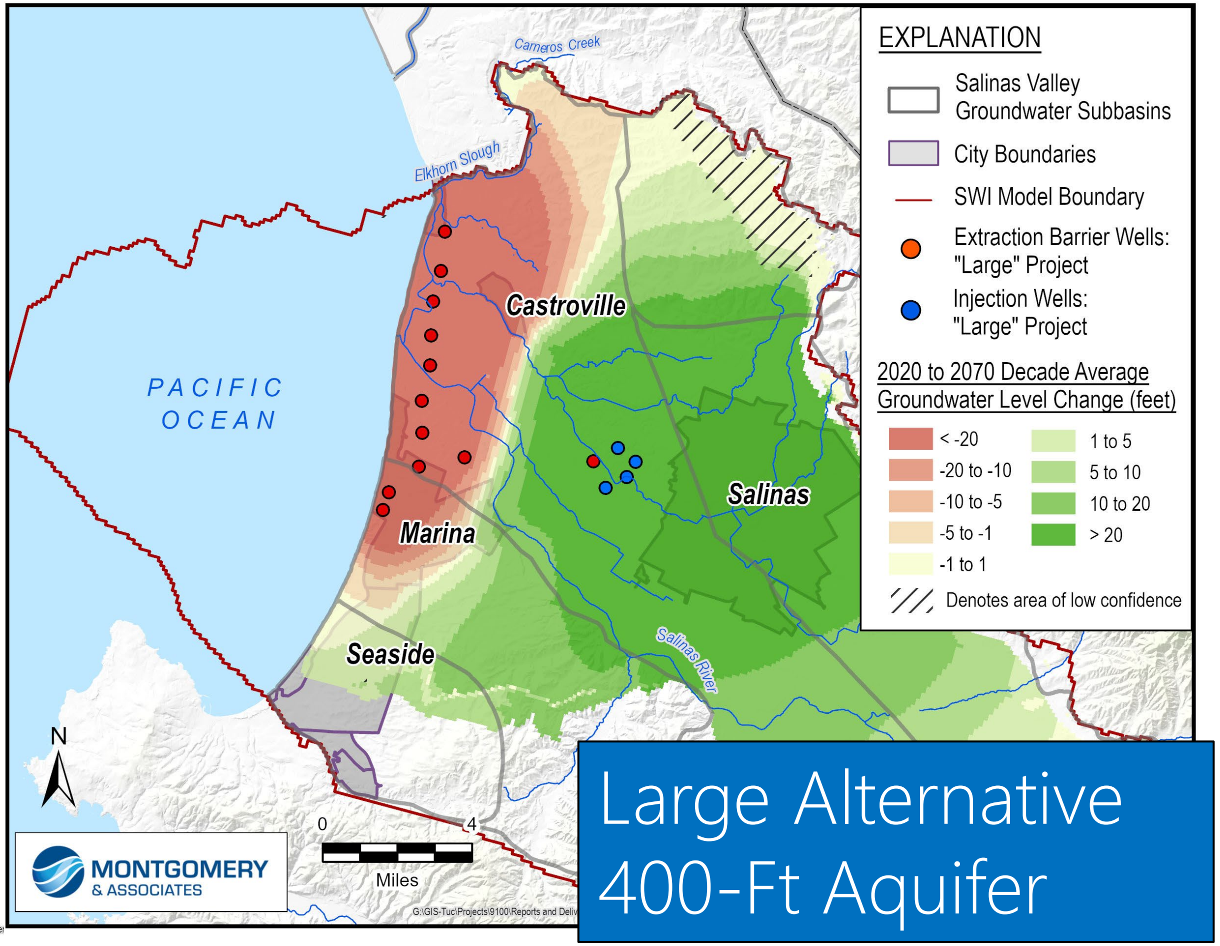
Groundwater Levels
No Project Compared to Large Alternative at 2070



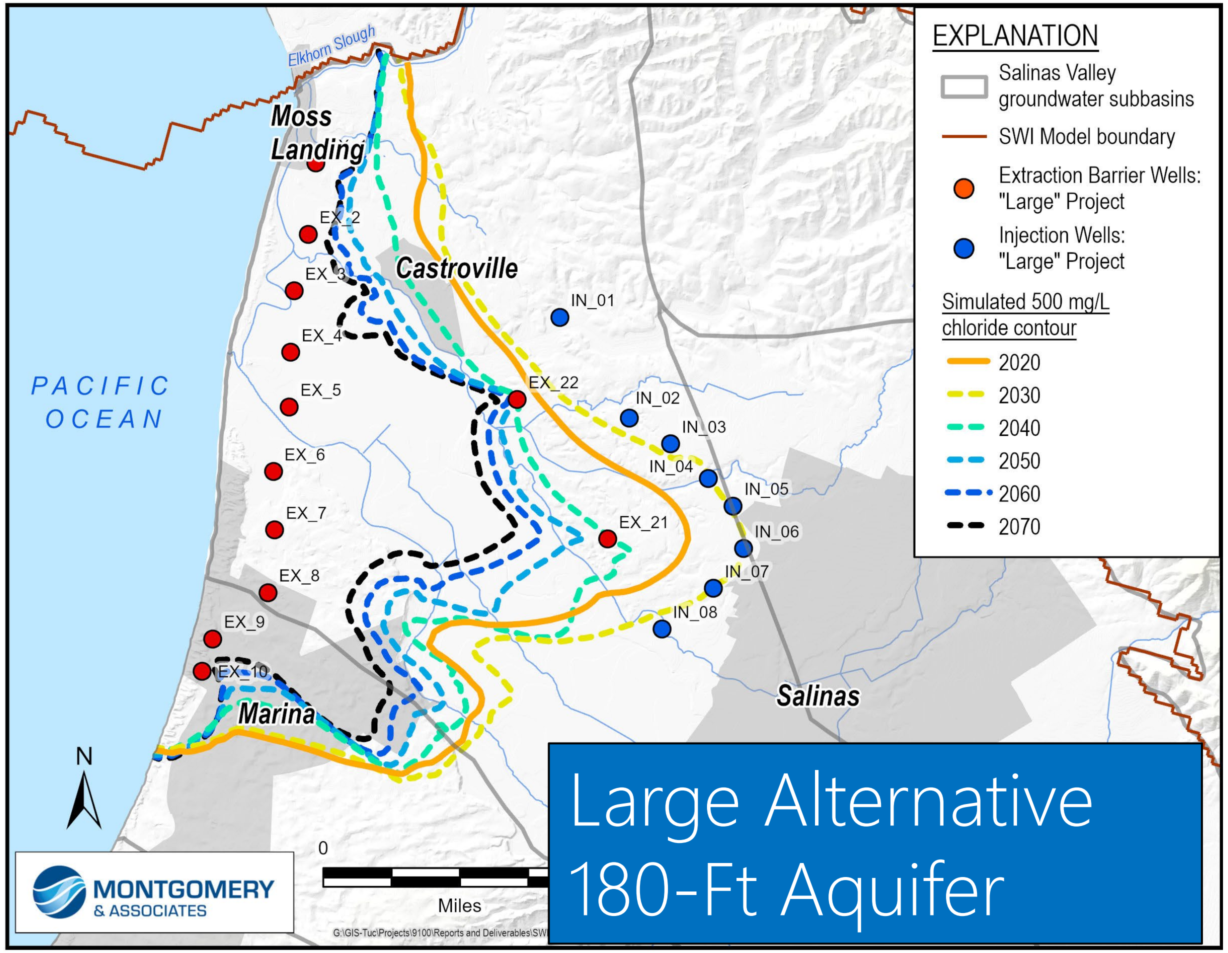


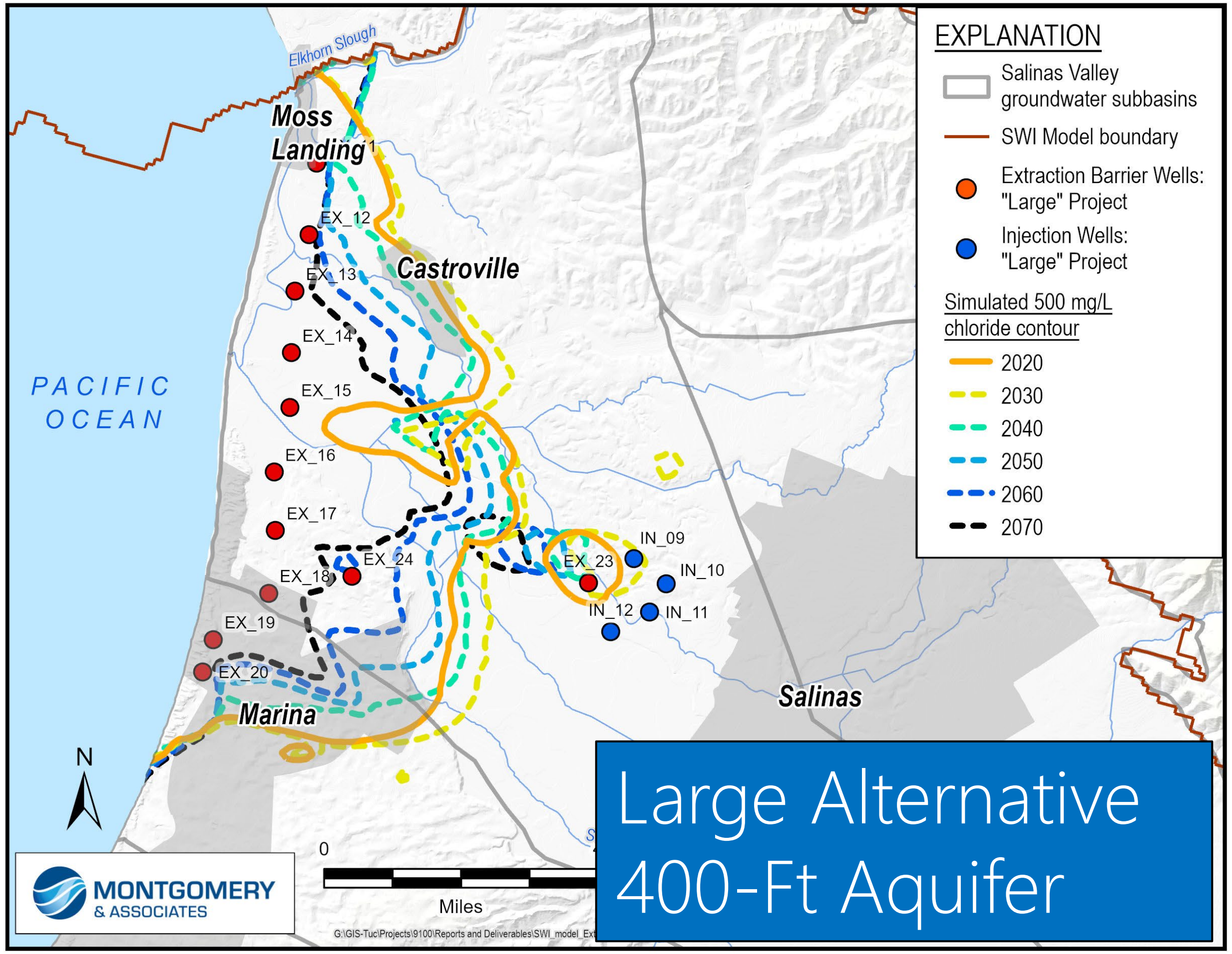
Groundwater Levels
No Project Compared to Large Alternative at 2070



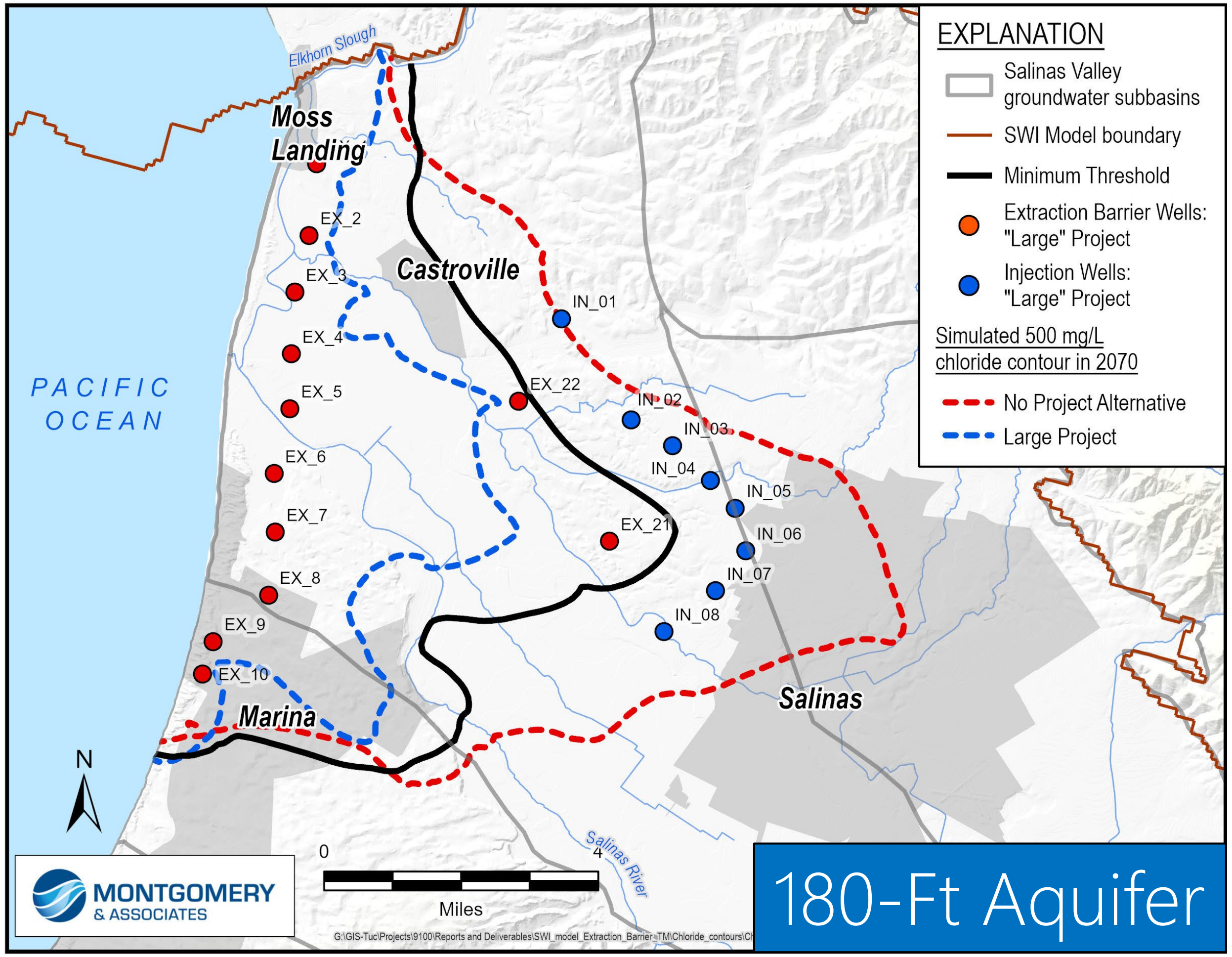


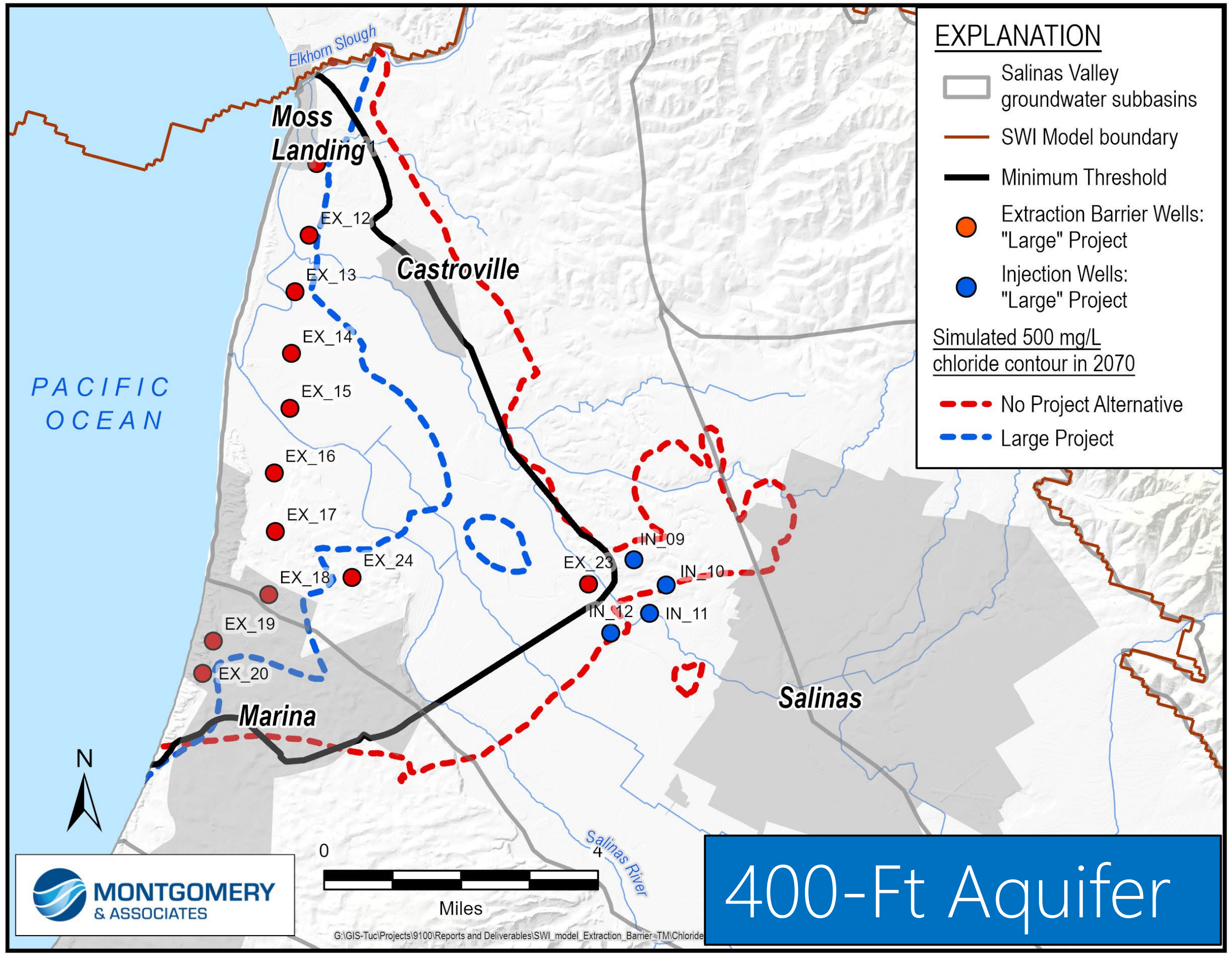
2070 Large Project Scenario – Simulated Progression of Seawater Intrusion Over Time





Seawater Intrusion Isocontour
Minimum Threshold Compared to Large Alternative at 2070





Project Alternative Costs

Basis of Costs - Assumptions

Project Cost Estimate and Financing Term Assumptions	
Project Construction Contingency	30%
Construction Administration Contingency	25%
Sales Tax	7.75% (Monterey County)
Escalation to Midpoint of Construction	0.25% per month to 2030
Construction Cost Total	
Soft Costs (Design, Permitting, Admin, Legal…)	17%
Project Cost Total	
Inflation rate	2.25%
Discount Rate	2.75%
Low Interest Financing Interest Rate	4%
Loan Term (years)	30
Projected Lifecycle (years)	40

Capital Costs

Project Element	Small Alternative	Medium Alternative	Large Alternative
Extraction Well Sites	$43,900,000	$53,600,000	$58,800,000
Clean Up Well Sites	N/A	N/A	$10,350,000
Outfall Cleaning and Modifications	$6,250,000	$6,250,000	$6,250,000
Extraction Distribution	$58,500,000	$58,500,000	$97,650,000
Potable Water Distribution Transmission Mains	$143,400,000	$164,150,000	$234,900,000
Potable Water Booster Pump	$7,100,000	$11,100,000	$15,600,000
Injection Well Sites	$37,500,000	$37,500,000	$47,250,000
ROC Storage	$4,950,000	$4,950,000	$4,950,000
Land Costs	$3,100,000	$11,200,000	$11,600,000
1,000-foot Agricultural Wells Laterals	N/A	N/A	$11,700,000
Offset MCWRA Wells Laterals	N/A	N/A	$12,150,000
Water Treatment Facility	$335,000,000	$522,000,000	$758,000,000
Construction Subtotal	**$639,700,000**	**$869,250,000**	**$1,269,200,000**
Soft Costs at 17% (Planning, Permitting, Design, Administration, Legal, Construction Management) Subtotal	$108,750,000	$147,780,000	$215,760,000
Grand Total Project Cost	**$748,450,000**	**$1,017,030,000**	**$1,484,960,000**
Notes: All costs include: 30 percent Construction Contingency, Monterey County Sales Tax of 7.75 percent applied to 50 percent of costs, and 0.25 percent monthly escalation to July 2030 as the estimated midpoint of construction.			

Annualized and Net Present Value Costs

Element	Small Alternative	Medium Alternative	Large Alternative
Grand Total Project Cost	$748,450,000	$1,017,030,000	$1,484,960,000
Total Project Annual O&M Costs	$69,334,000	$106,655,000	$147,621,000
Estimated Annual Loan Repayment Amount	$41,682,779	$58,621,793	$85,744,110
Estimated Total Annual Costs	$111,016,779	$165,276,793	$233,365,110
Net Present Value of Project + Annual Costs	**$3,283,577,291**	**$4,939,768,373**	**$6,930,634,896**
Annualized Net Present Value of Project Costs	**$82,089,432**	**$23,494,209**	**$173,265,872**
Total Water Supply Yield (AFY)	28,008	46,858	64,920
Estimated Annualized Unit Costs	**$2,931/AF**	**$2,365/AF**	**$2,669/AF**
Notes: 1. Annualization and NPV calculations assume 40 year life, 30 year loan at 4% interest, inflation at 2.25%.			

- Used to compare present day unit cost of water
- Net Present Value = current value of future costs (bring future costs back to today's value using assumptions on interest, inflation and discount rates

Comparison to other large CA water supply projects

- Sacramento – Echo Water and Harvest Water = $1.74B for 50,000 AFY new recycled water supply for agriculture
- Pure Water San Diego = $1.5B for 34,000 AFY indirect potable reuse (new supply for urban area)
- LA Hyperion 2035 = $5-10B for 195,000 AFY potable reuse for urban supply

How to consider these costs….

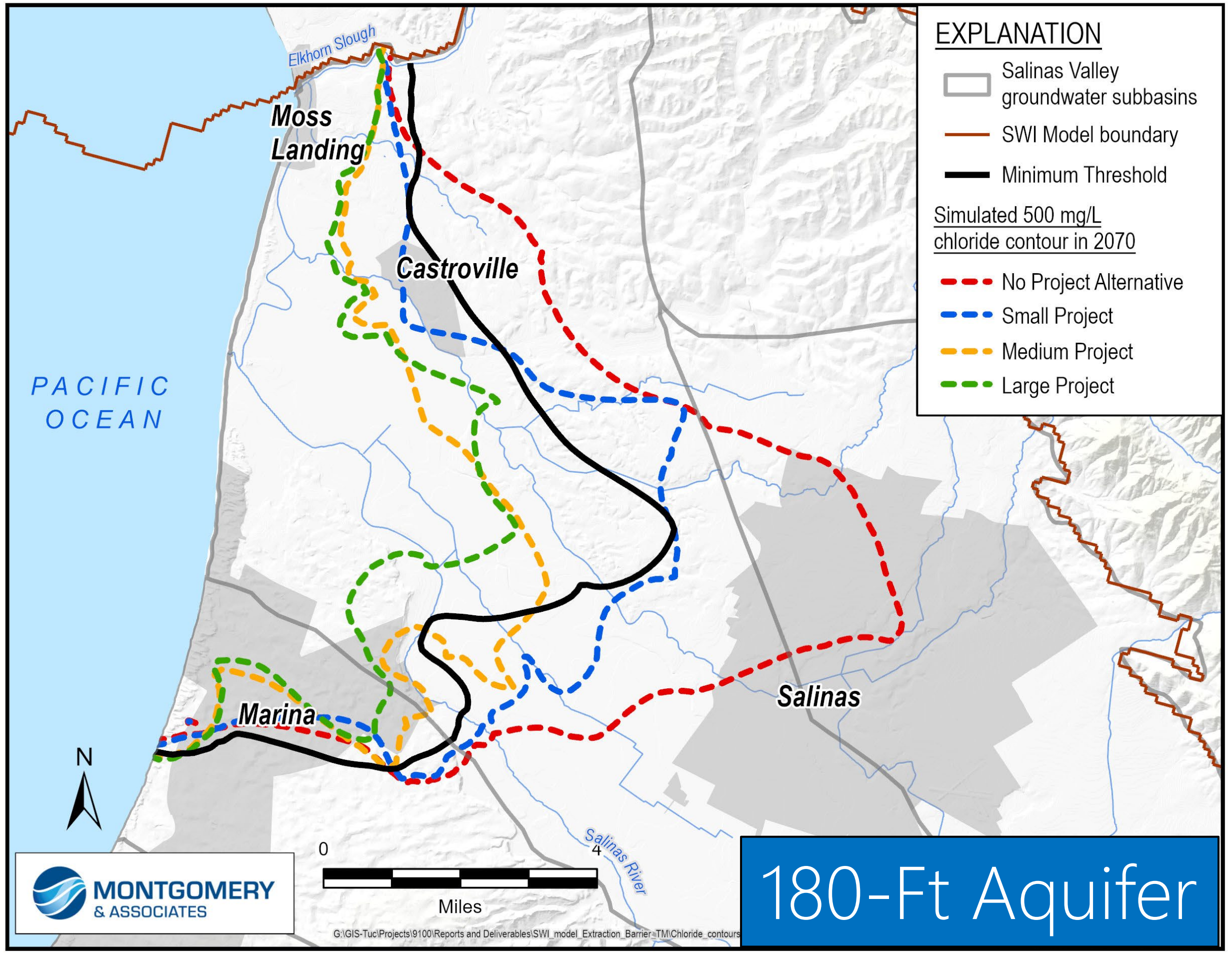
- Total project costs are high…. But comparable to other large new water supply projects being developed in the state
- The $/AFY estimates are not the cost for end users:
  - The larger regional benefits of the project need to be defined (addressing SWI, declining GW levels and SGMA compliance)
  - Need to do funding/financing study to assess how costs can be shared across all beneficiaries
- The GSA intends to pursue grant funding for any new project that would reduce the costs to the region. No grant funding has been assumed in these costs

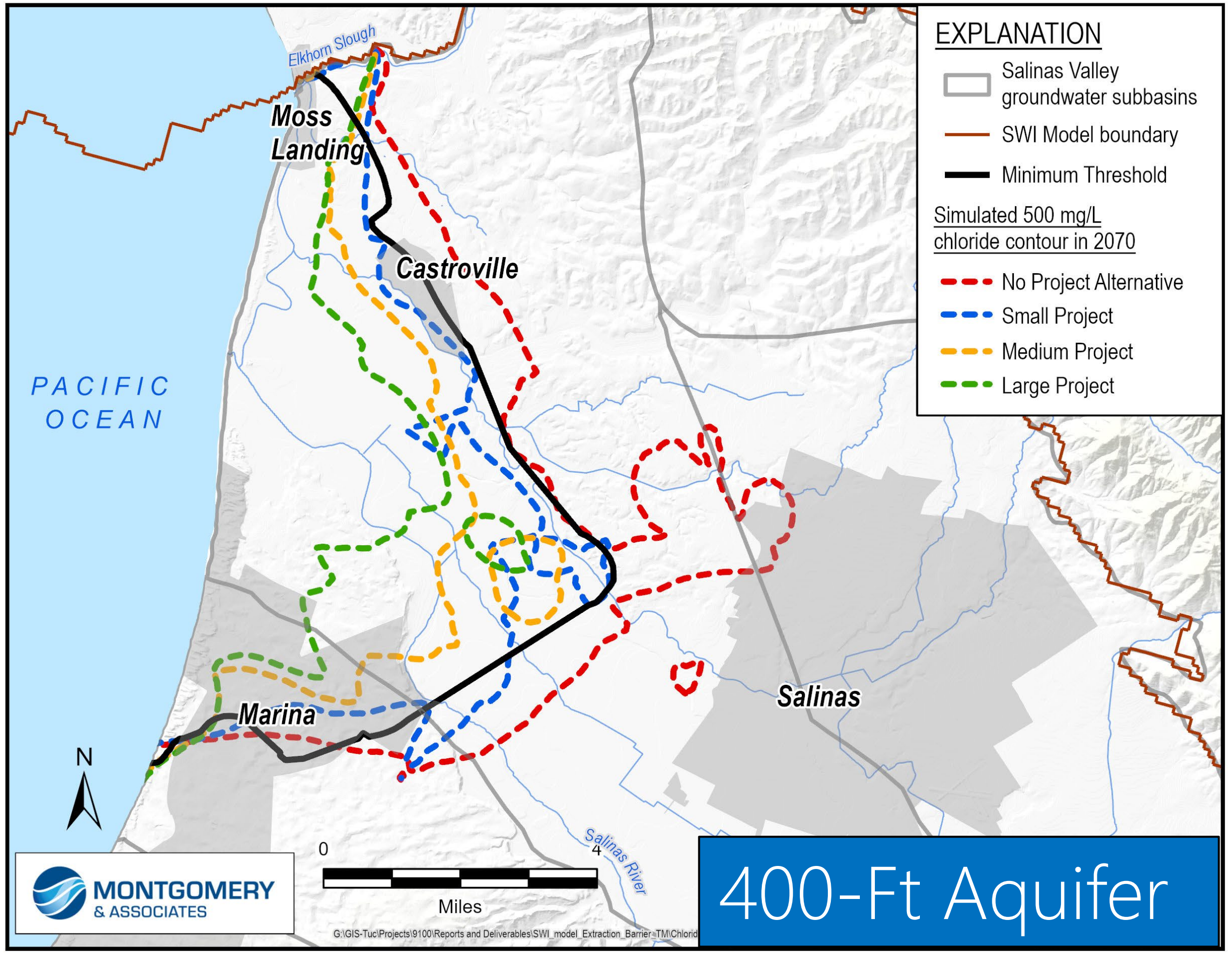
Benefits of Projects

Major Benefits of Brackish GW Restoration Project:

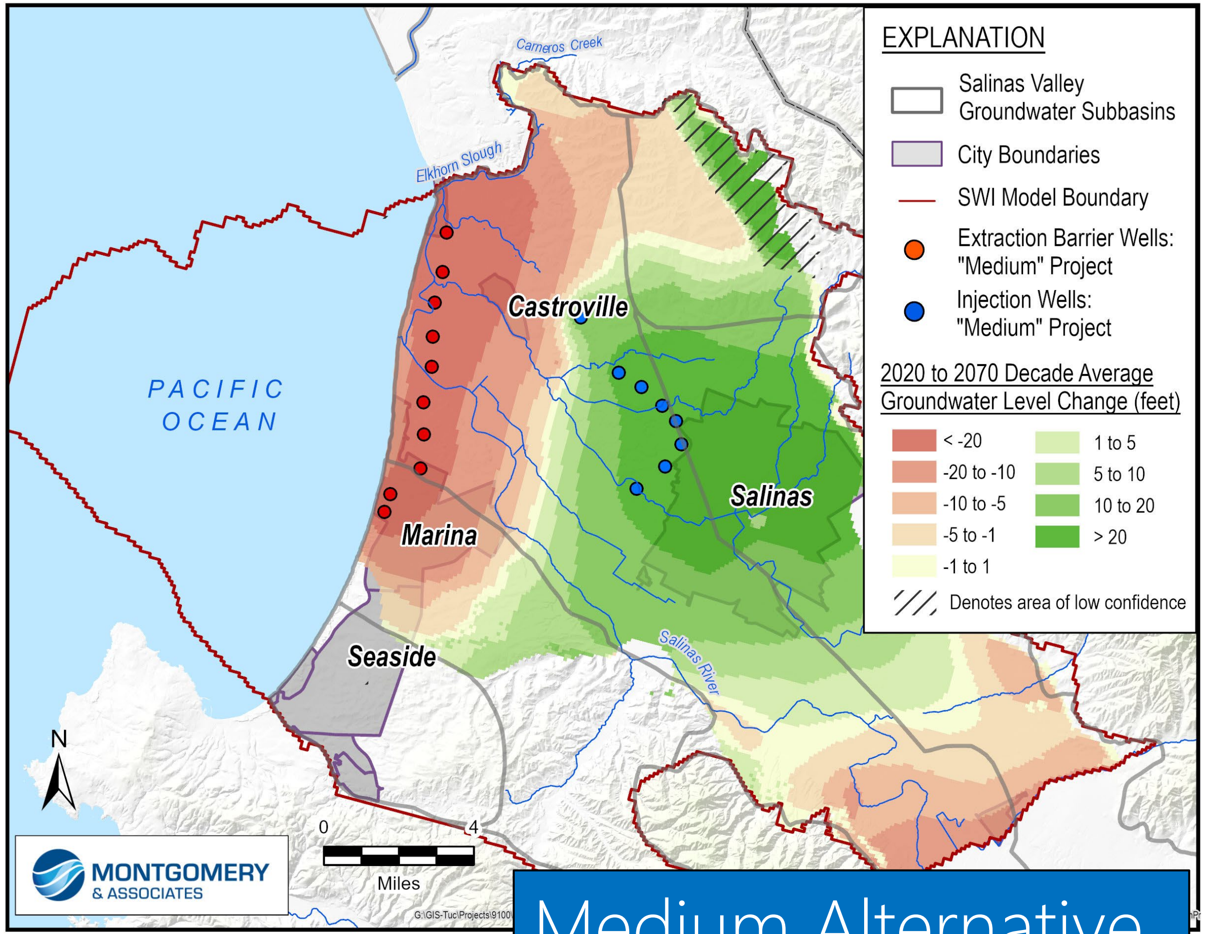
Benefit:	Result:
Improved groundwater quality	Extraction near coast and injection inland creates conditions (groundwater levels) which pushes sea water intruded zone toward coast to meet minimum threshold chloride goals
Increases groundwater levels	Decreasing GW pumping and injection of new supply raises inland GW levels
New drought proof, reliable water supply for region	From treating brackish GW extracted near the coast and delivering to inland users to offset pumping

Summary of Modeling - Seawater Intrusion Isocontour Minimum Threshold Compared to 3 Alternatives at 2070

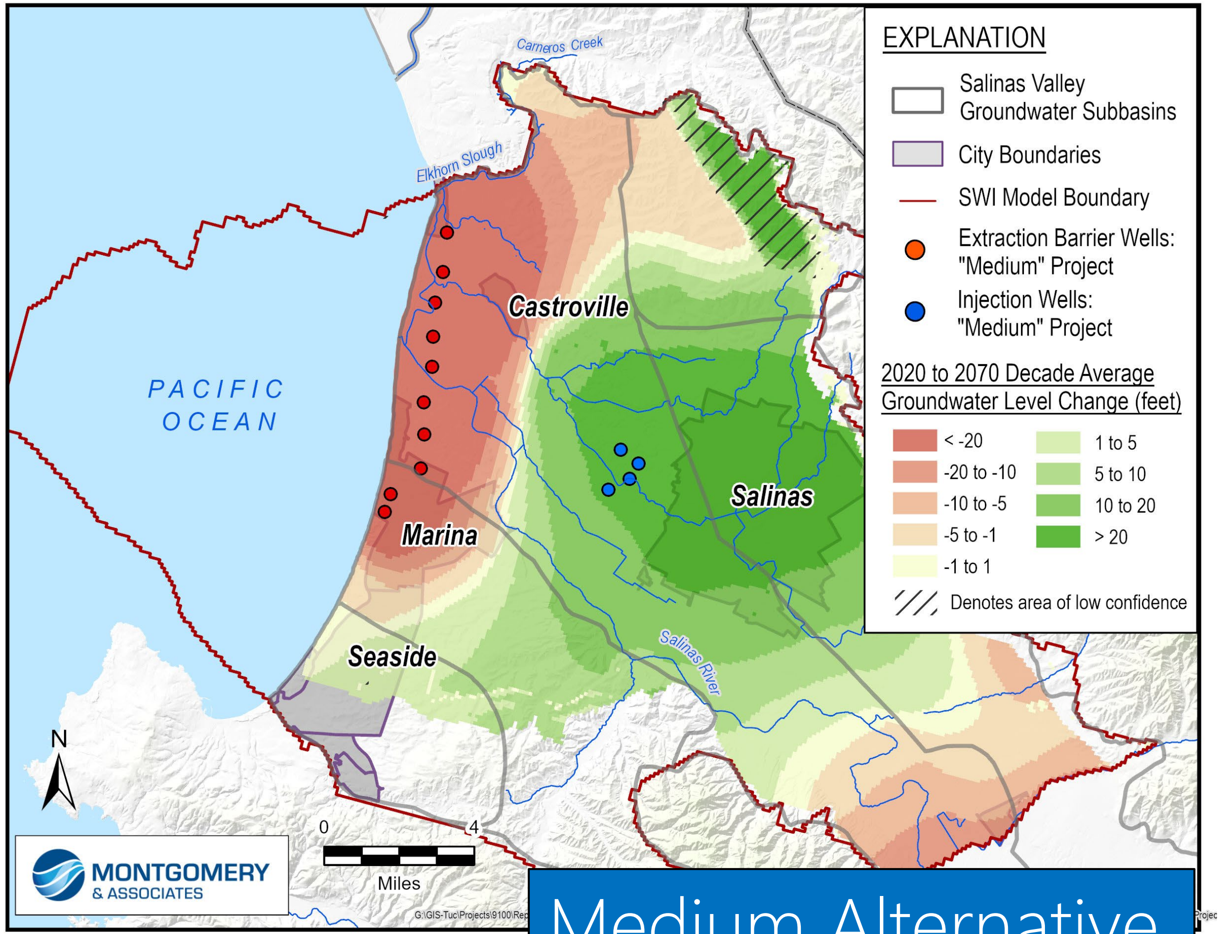




Groundwater Levels
No Project Compared to Medium Alternative at 2070



Medium Alternative
180-Ft Aquifer



Medium Alternative
400-Ft Aquifer

What are the economic costs of not doing Project?

1. Eventually economic value of agriculture to region would decline as land becomes unusable if SWI not addressed.
2. New supply sources would be required to offset lack of suitable GW supplies, if want to keep land in production.
3. New supply sources or treatment would be required for potable users to address the deteriorated water quality

How do you Monetize these benefits?

- Next steps in project is to develop a benefit/cost ratio (required for US Bureau of Reclamation Feasibility Study)
- Goal is to assign dollar value to benefits (monetization)
- Example:

Benefit:	**How to Monetize Benefit (Cost if not do project)**
Improved groundwater quality	Estimate cost to develop a different new supply project (for example surface water treatment and delivery to offset wells that have to be abandoned due to poor quality from SWI)
Increases groundwater levels	Without project, SWI and GW level declines will drive landowners to deepen their wells. Estimate cost for deepening wells (Deep Aquifers not long term sustainable supply).
New drought proof reliable water supply for region	Project allows economic base of region (agriculture) to continue. Develop estimate of the economic value of agriculture in this region for crop production, jobs, housing….

Next Steps

Next Steps for this Feasibility Study

- Monetize Benefits as required by USBR
  - Need to build off work ERA doing with demand management study as well as the ASR study
- Complete chapters of USBR Feasibility Study
- Board consideration of Feasibility Study to submit to USBR and apply for grant funds (in consideration of other projects)

Additional Research and Evaluation

- Next Steps for Project (next 10 years)
  - » Position for Funding
  - » Additional Studies
  - » Financial Plan and Rate Study
  - » Partners and Regional agreements
  - » CEQA/NEPA environmental review and clearance
  - » Permitting
  - » Design
  - » Construction

- Additional Research and Study
  - » Reverse Osmosis Pilot Study with CCSD
    - – Intruded water quality
    - – Pretreatment for Iron and Manganese
    - – System configuration and % recovery
    - – Brine quality
  - » Additional groundwater data
  - » Pilot Injection Well

Questions?