



County of Monterey

HEALTH DEPARTMENT

ENVIRONMENTAL HEALTH BUREAU

**Drought Advisory Group for
Small Water Systems and Domestic Wells
Drought Resilience Plan Development**

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Water Resource Engineer

Stantec

Definitions

* Refer to the Water Code or [Primer-of-SB-552-052522_final.pdf \(ca.gov\)](#) for other related definitions.

<ul style="list-style-type: none">• State small water system: A system for the provision of piped water to the public for human consumption that serves at least 5, but not more than 14, service connections and does not regularly serve drinking water to more than an average of 25 individuals daily for more than 60 days out of the year, as defined in Section 116275 (n) of the Health and Safety Code.	<p>Water Code §10609.51(k)</p>
<ul style="list-style-type: none">• Local Small water system: a system for the provision of piped water for human consumption that serves at least two, but not more than four, service connections. It includes any collection, treatment, storage, and distribution facilities under control of the operator of such system which are used primarily in connection with such system, and any collection or pretreatment storage facilities not under the control of the operator which are used primarily in connection with such system. "Local small water system" does not include two or more service connections on a single lot of record where none of the dwellings are leased, rented, or offered for remuneration.	<p>Monterey County Code §15.04.020</p>
<ul style="list-style-type: none">• Domestic well: A groundwater well used to supply water for the domestic needs of an individual residence or a water system that is not a public water system and that has no more than 4 service connections, as defined in Section 116681 of the Health and Safety Code	<p>Water Code §10609.51(m)</p>
<ul style="list-style-type: none">• Drought: A period of abnormally dry weather that results in water shortages.• Water Shortage: a condition in which the demand for water exceeds the available supply.	<p>Senate Bill 552 provides these definitions and is intended to help small water suppliers and rural communities prepare for and respond to droughts and water shortages, regardless of the source of their water supply.</p>

County of Monterey Drought Resilience Plan

The County of Monterey Plan will be a stand-alone document and will be coordinated with and support:

- ✓ Monterey County General Plan
- ✓ Local Coastal Program
- ✓ Monterey County Multi-Jurisdictional Hazard Mitigation Plan
- ✓ Monterey County Community Climate Action and Adaptation Plan (CCAAP) (in development)

Plan elements must include:

- Potential drought and water shortage risks
- Proposed interim and long-term solutions for state smalls and domestic wells in the county

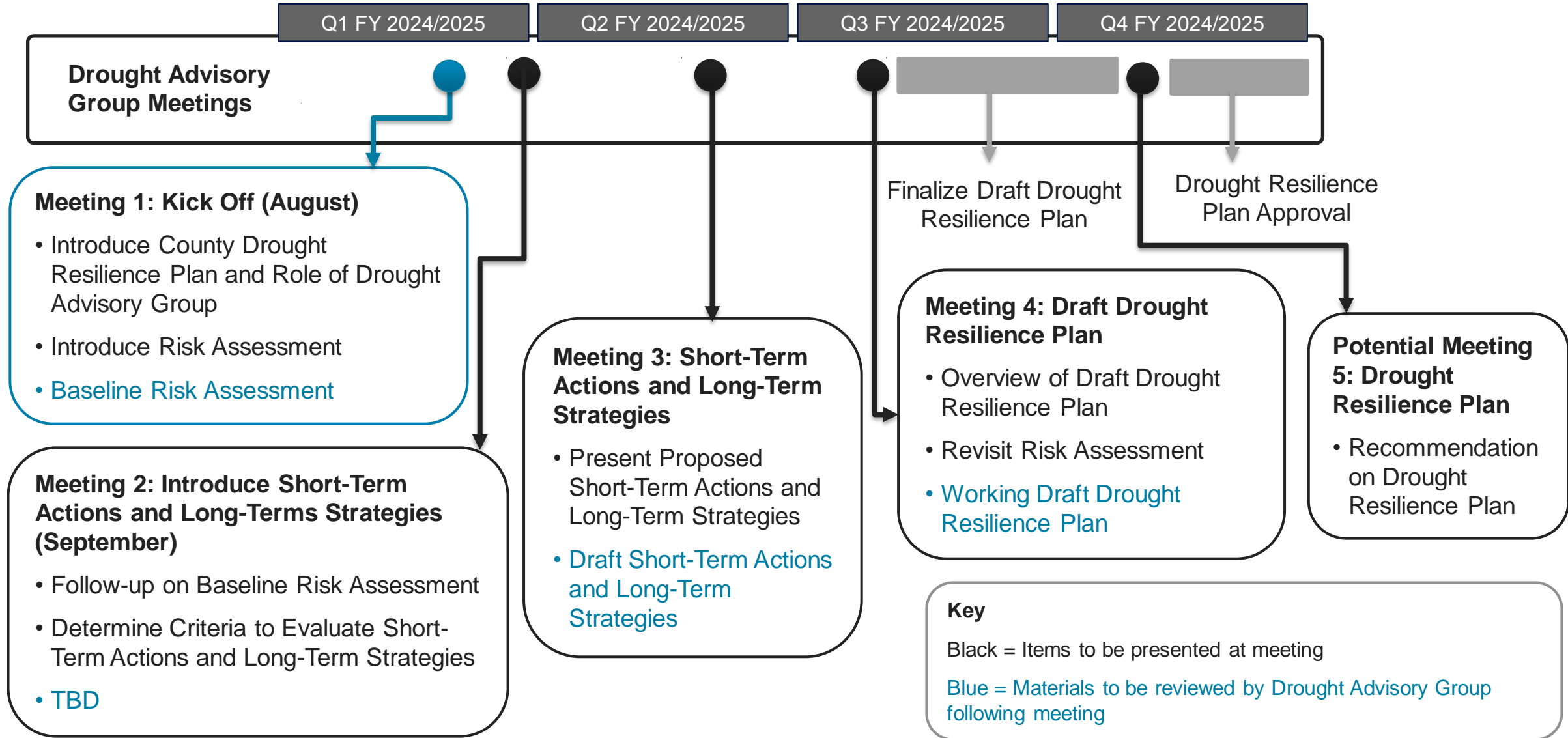
Minimum Considerations for implementation include:

- **Consolidations** for existing water systems and domestic wells
- Domestic well drinking water **mitigation programs**
- **Provision of emergency and interim drinking water solutions**
- An analysis of the **steps necessary to implement** the plan
- An analysis of **funding sources** available to implement the plan

Drought Resilience Plan Outline

- Chapter 1: Introduction
- **Chapter 2: County Drought and Water Shortage Advisory Group**
- **Chapter 3: Drought and Water Shortage Risk Assessment**
- Chapter 4: Short-Term Response Actions
- Chapter 5: Long-Term Mitigation Strategy and Actions
- Chapter 6: Implementation Considerations

Proposed Drought Advisory Group Meeting and Review Schedule



Short Break



Vulnerabilities and Risk Assessment Methodology

Risk Assessment – Key Definitions

HAZARD – Source of harm or difficulty created by a meteorological, environmental, geological, other event, or hydrological and/or other environmental conditions. In the context of SB 552, hazards are the natural, human-made, and social processes that can lead to water shortages in the county.

COMMUNITY ASSETS – The people, structures, facilities, and systems that have value to the community. The minimum assets considered as part of the DRP must include ***state small water systems*** and ***domestic wells*** and populations reliant on these water supplies.

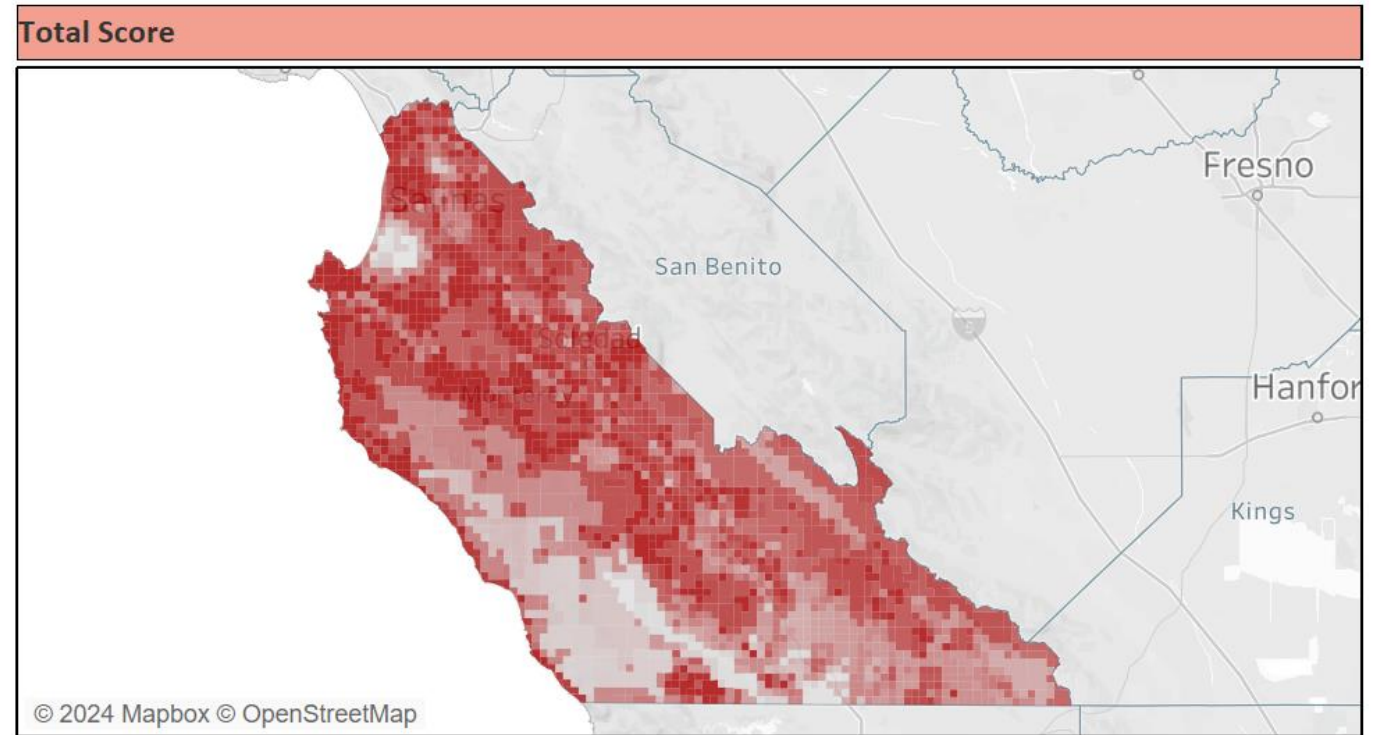
VULNERABILITY – Characteristics of community assets or population that make them susceptible to damage from a given hazard. It includes both ***physical vulnerability and social vulnerability***.

Risk Assessment Objective


Key Question: Where do physical vulnerabilities intersect with SSWS/domestic wells, and how could social vulnerabilities influence decisions and identification of short-term actions and long-term strategies?

Approach:

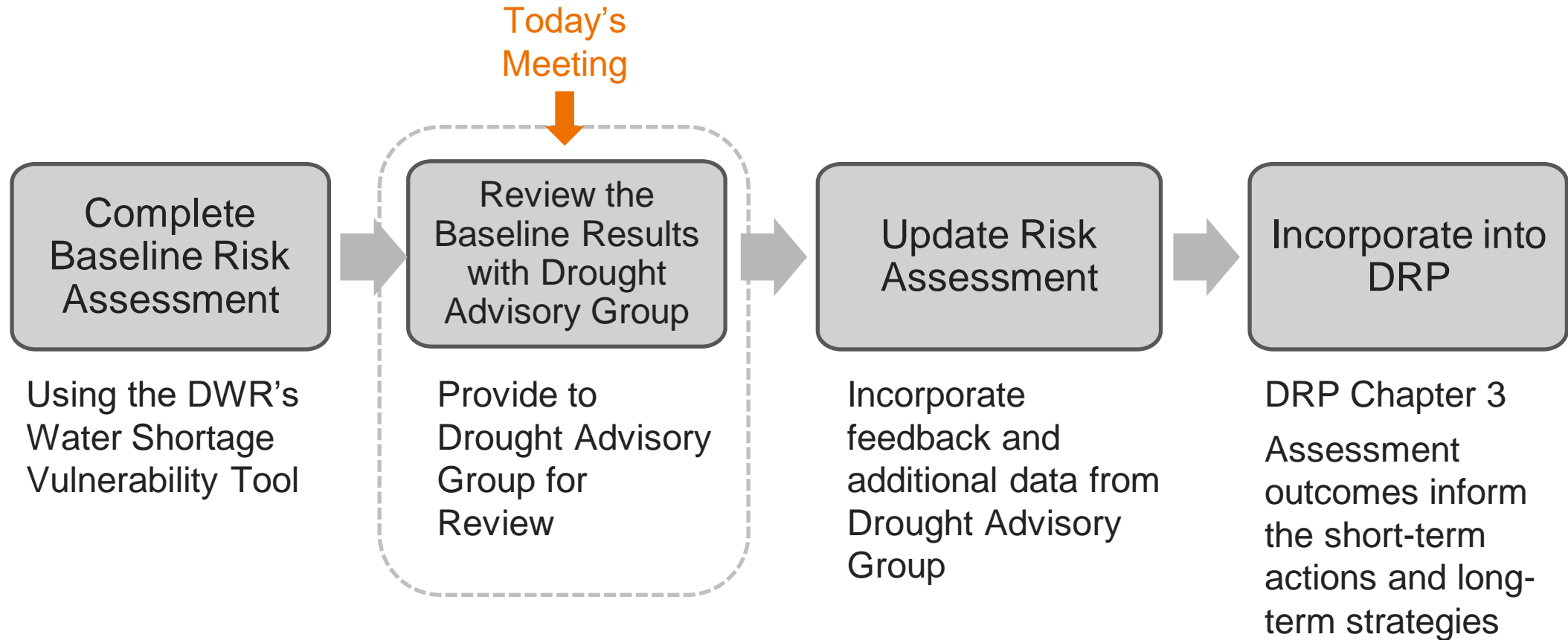
- ✓ Identify vulnerable SSWS and domestic wells within the county
- ✓ Characterize vulnerabilities
- ✓ Use outcomes to:
 - Assist in areas of focus for the county
 - Identify best short-term actions and long-term strategies



Total Score (Physical Vulnerability)

0  50 and above

Risk Assessment Process



DWR Risk Assessment Tool Analysis Approach

- Two sets of vulnerabilities: Physical and Social
- Vulnerability indicators with score that ranges from 0 (no vulnerability) to 1 (extreme vulnerability)
- GIS-based tool applied by the Stantec team
- Data, methodology, outcomes developed as part of prior effort with input from the County Drought Advisory Group (CDAG)

Physical Vulnerabilities

Climate Change Conditions

Current and Recent Environmental Conditions

Infrastructure Vulnerability

Social Vulnerabilities

Socioeconomic Status

Language and Education

Demographic

Housing and Transportation

DWR Risk Assessment Tool

Physical Vulnerability Score Methodology

- Identified 17 indicators of physical vulnerability of domestic wells and SSWSs to water shortages
- Calculate a value for each indicator
- Indicators' values are multiplied by their corresponding weighting and summed to determine the total physical vulnerability score
 - Indicators weighted based on perceived vulnerability influence
 - Aligns with the State Water Board SAFER Program's Needs Assessment
 - Indicators normalized between 0 and 1

DWR Risk Assessment Tool

Physical Vulnerability Indicators with Weights

Climate Change Conditions	Current and Recent Environmental Conditions	Infrastructure Conditions
Projected Temperature Shift 1	2022 Precipitation Pattern 2	Density of Domestic Wells in Fractured Rock Basins 5
Saltwater Intrusion in Coastal Groundwater 1	Consecutive Dry Years Between 2018 and 2022 2	Dry Well Susceptibility in Alluvial Basins 5
Wildfire Increase 1	Wildfire Risk 3	Dry Well Susceptibility in Fracture Rock Basins 5
	Fractured Rock Area 5	Reported Household Outages on Wells 3
	Presence of Subsidence 2	
	Current Saltwater Intrusion 3	
	Critically Overdrafted Basin 2	
	Chronically Declining Water Levels 3	
	Presence and Amount of Irrigated Agriculture 3	
	Groundwater Water Quality 3	

DWR Risk Assessment Tool

Social Vulnerability Score Methodology

- Applied methodology used by the Center for Disease Control for its social vulnerability index
- Indicators primarily sourced from 2020 Census data
- Indicators are normalized from 0 to 1 across the state and summed to get the Total Social Vulnerability Score

Socioeconomic Status

Poverty Level

Unemployment

Per Capita Income

Demographics

Elderly Population

Non-Adult Population

Minority Population

Disability

Single Parent Households

Language and Education

Education Attainment

English Language Proficiency

Housing and Transportation

Multi-Unit-Housed Population

Mobile Home-Housed Population

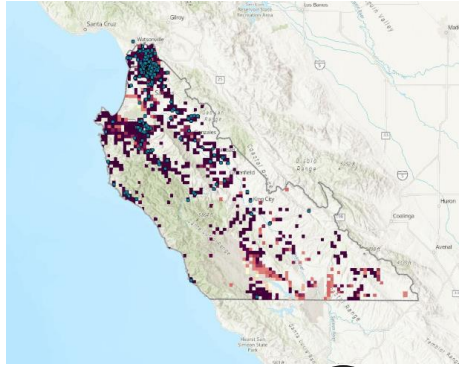
Crowded Conditions

No Vehicle Access

Risk Assessment Analysis – Example

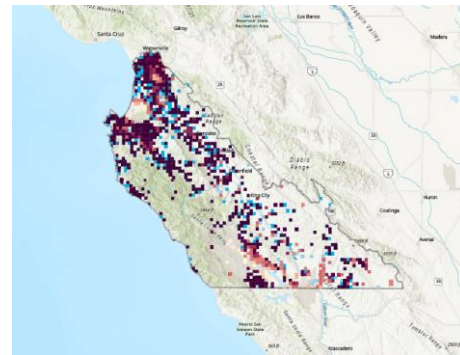
1

Use DWR Risk Assessment tool to evaluate physical vulnerabilities within the county



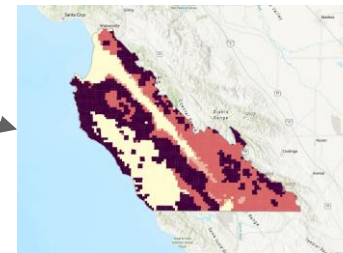
2

Merge with SSWS and domestic wells to determine where the two overlap



3

Determine what indicators drive physical vulnerability



4

Characterize how social vulnerabilities intersect

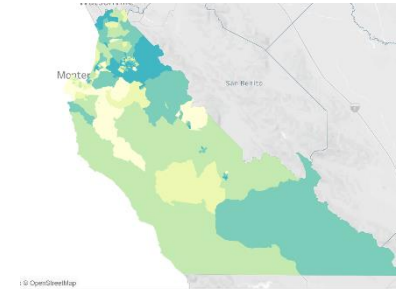




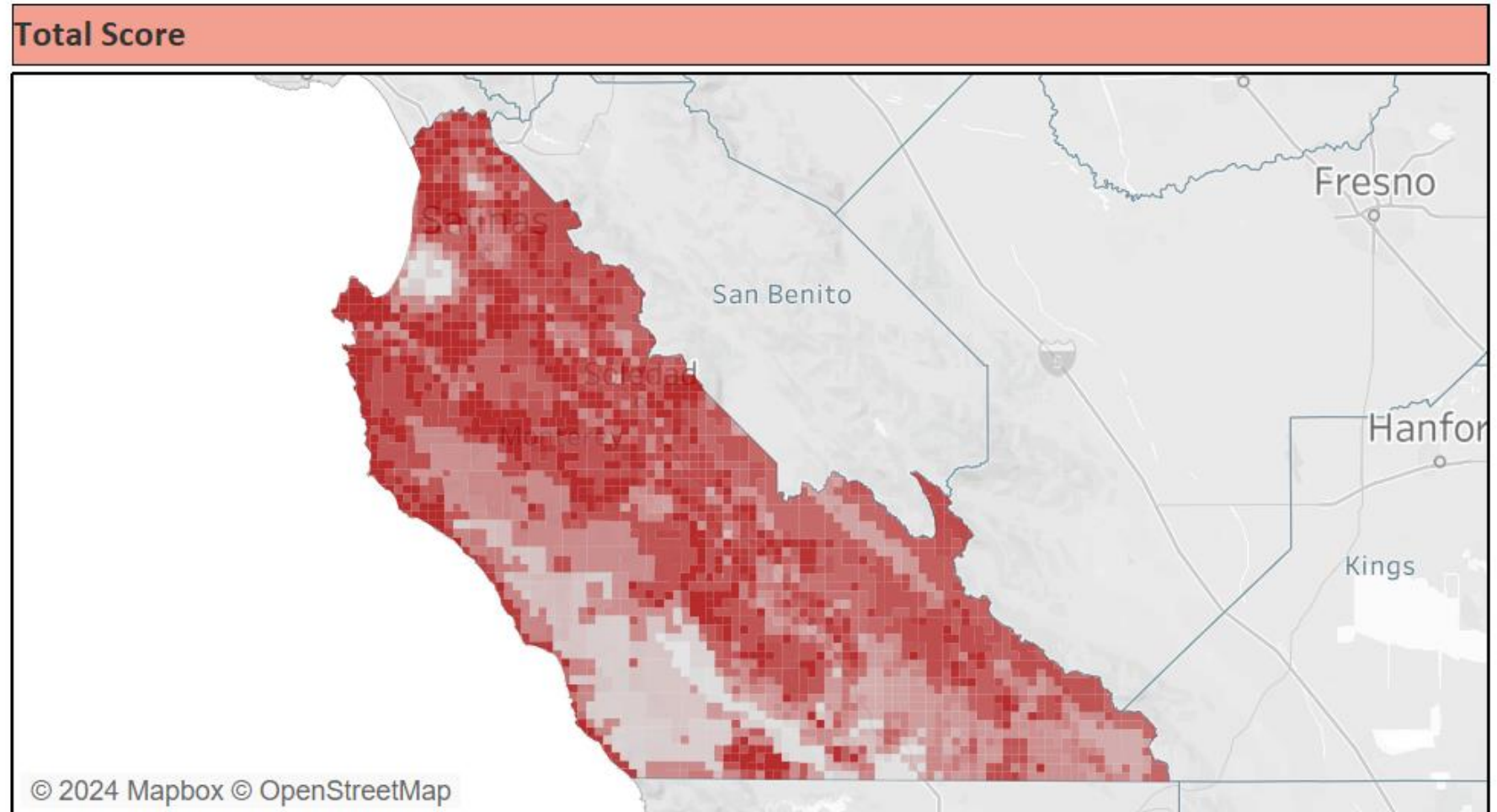
Image source: [farmworker housing study.salinas-pajaro.final.june_15-2018.complete.pdf](https://www.cityofsalinas.org/files/2018/06/farmworker_housing_study.salinas-pajaro.final.june_15-2018.complete.pdf) (cityofsalinas.org)

Vulnerabilities and Risk Assessment Initial Results for County of Monterey

Physical Vulnerability Total Score – Preliminary Results

Areas with high physical vulnerability are

- A cluster in the northern portion of the County
- Along the Salinas Valley
- Southern Monterey Bay cluster of cities and into Carmel Valley
- Cluster in Lockwood Valley area



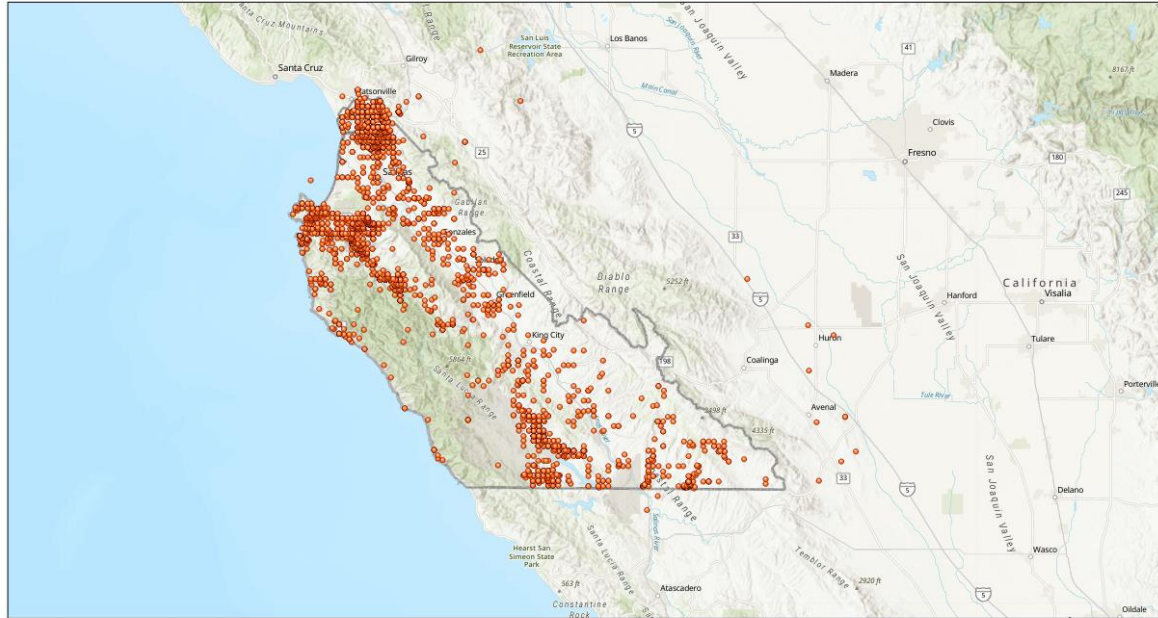
Total Score (Physical Vulnerability)



Darker represents higher vulnerability

Identified State Small Water Systems & Domestic Wells in County of Monterey

County of Monterey Domestic Wells



5/14/2024, 9:00:03 AM
● Domestic Wells (GW Live)
□ i03_CaliforniaCounties

1:1,155,581

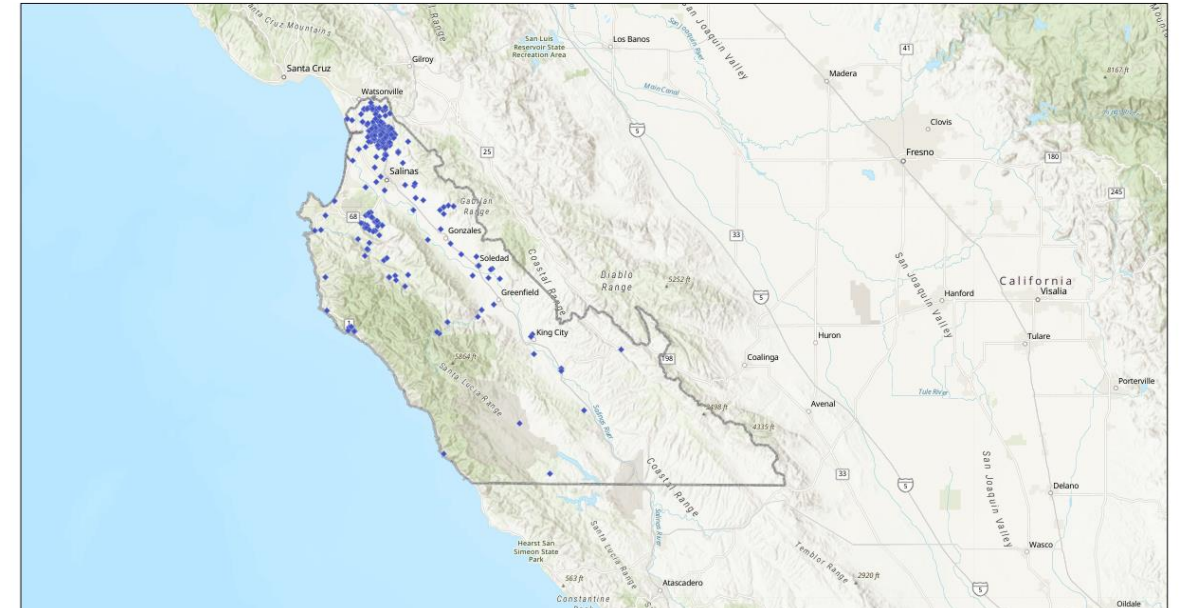
0 10 20 40 mi
0 15 30 60 km

Eri, CGIAR, USGS, U.S. Bureau of Reclamation, California Department of Conservation, California Department of Fish and Game, California Department of Forestry and Fire Protection, National Oceanic and Atmospheric Administration. Contact: gis@water.ca.gov.

California Department of Water Resources

Please refer to the Drought and Water Shortage Vulnerability Scoring: California's Domestic Wells and State Smalls Systems documentation for more information on indicators and scoring. These estimated indicator scores may sometimes be calculated in several different ways, or may have been calculated from data

County of Monterey State Small Water Systems



5/14/2024, 9:02:34 AM
● State Small Water Systems (SWRCB 2024)
□ i03_CaliforniaCounties

1:1,155,581

0 10 20 40 mi
0 15 30 60 km

Eri, CGIAR, USGS, U.S. Bureau of Reclamation, California Department of Conservation, California Department of Fish and Game, California Department of Forestry and Fire Protection, National Oceanic and Atmospheric Administration. Contact: gis@water.ca.gov.

California Department of Water Resources

Please refer to the Drought and Water Shortage Vulnerability Scoring: California's Domestic Wells and State Smalls Systems documentation for more information on indicators and scoring. These estimated indicator scores may sometimes be calculated in several different ways, or may have been calculated from data

- There are approximately **3,183 Domestic Wells** (serving 1 to 4 connections – orange dots) and **283 State Small Water Systems** (at least 5, but not more than 14 connections – blue dots)
- Note: There are approximately 703 Local Small Water Systems (subset of Domestic Wells serving between 2 to 4 connections) to be integrated into future analysis)

Physical Vulnerability Total Score – Domestic Wells

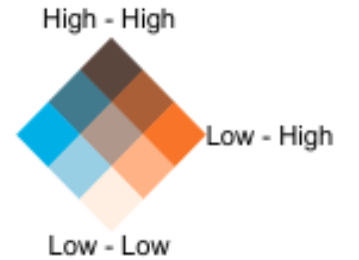
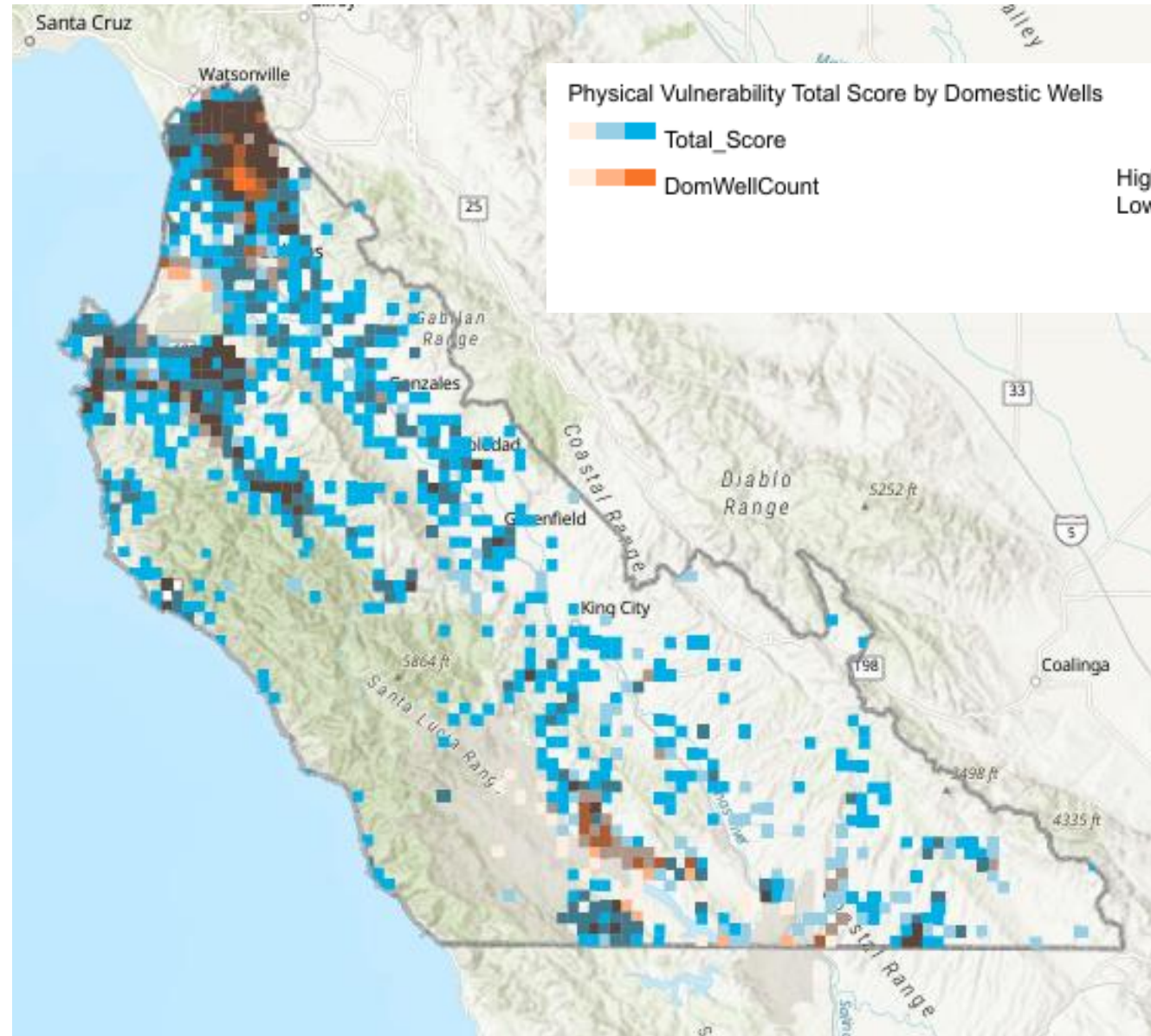
Domestic wells:

- Combines physical vulnerability and domestic well locations

High physical vulnerability +
high number of domestic wells

High physical vulnerability +
low number of domestic wells

Low physical vulnerability +
high number of domestic wells



Physical Vulnerability Total Score by Domestic Wells Overlaid with State Small Water Systems

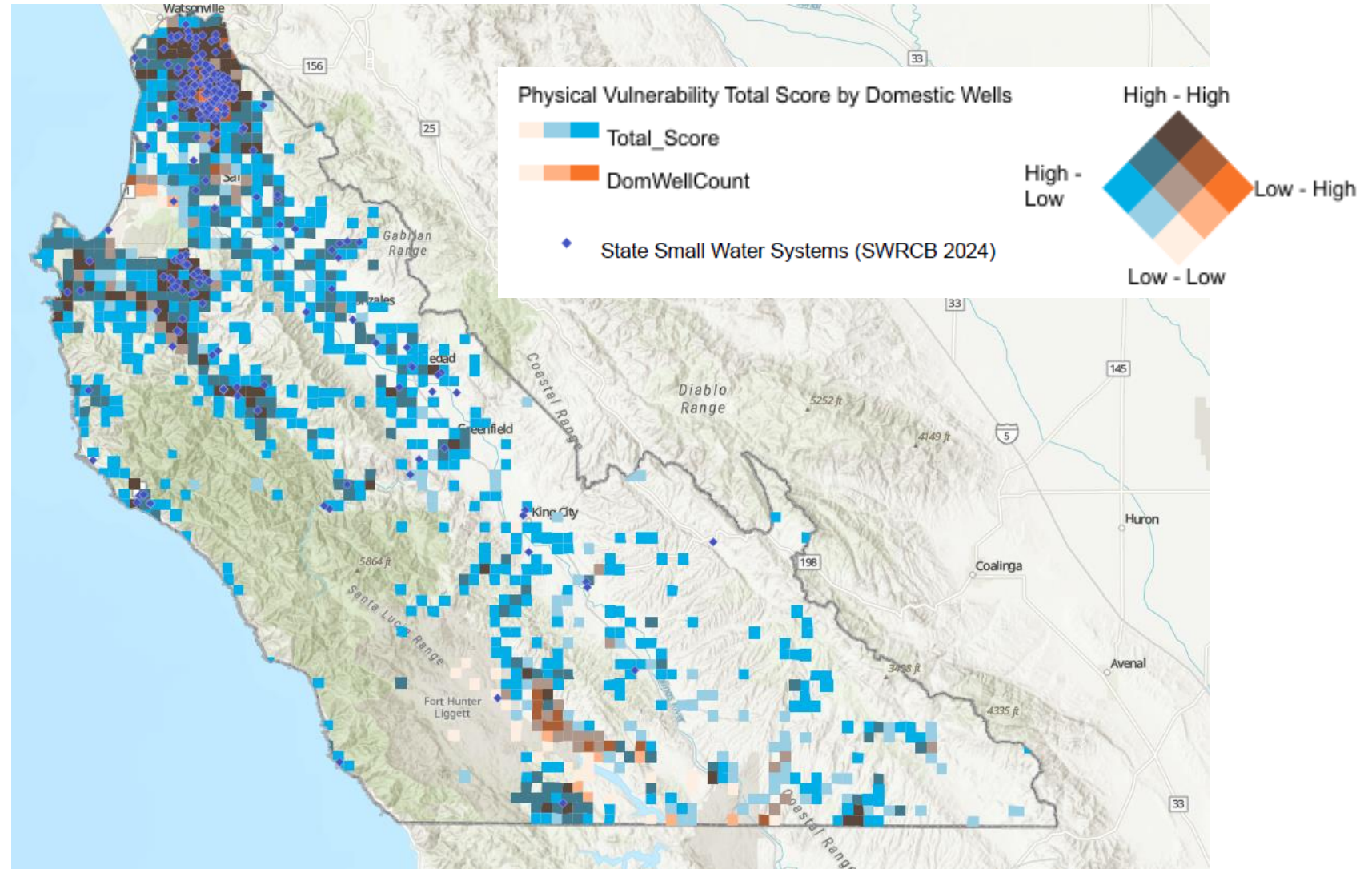
Domestic wells:

- Combines physical vulnerability and domestic well locations

High physical vulnerability + high number of domestic wells

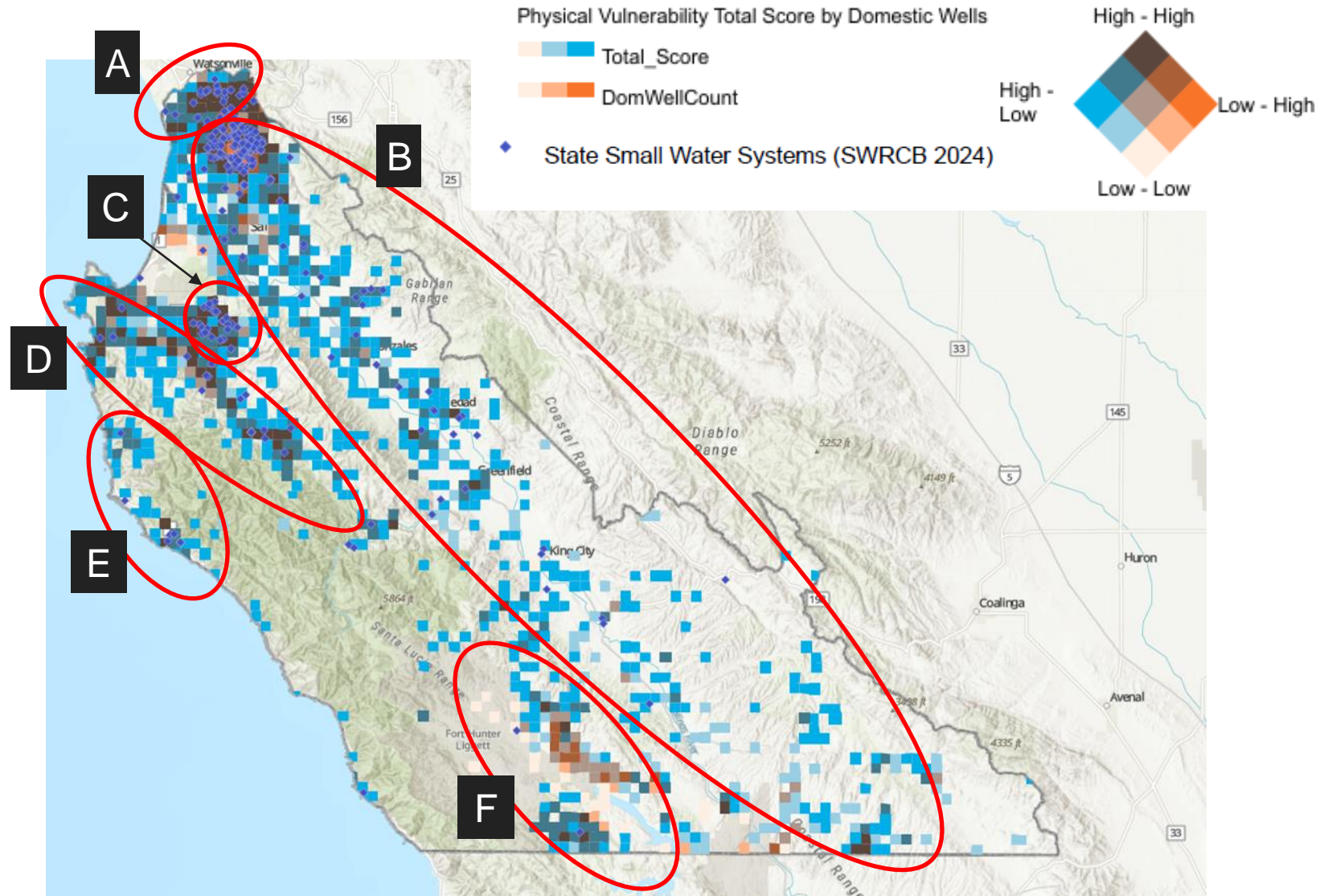
High physical vulnerability + low number of domestic wells

Low physical vulnerability + high number of domestic wells



Regions with Water Shortage Vulnerability

- A – Pajaro Valley
- B – Salinas Valley
- C – Salinas Valley (Monterey)
(Toro/Corral area)
- D – Carmel Valley
- E – Northern Big Sur
- F – Lockwood Valley



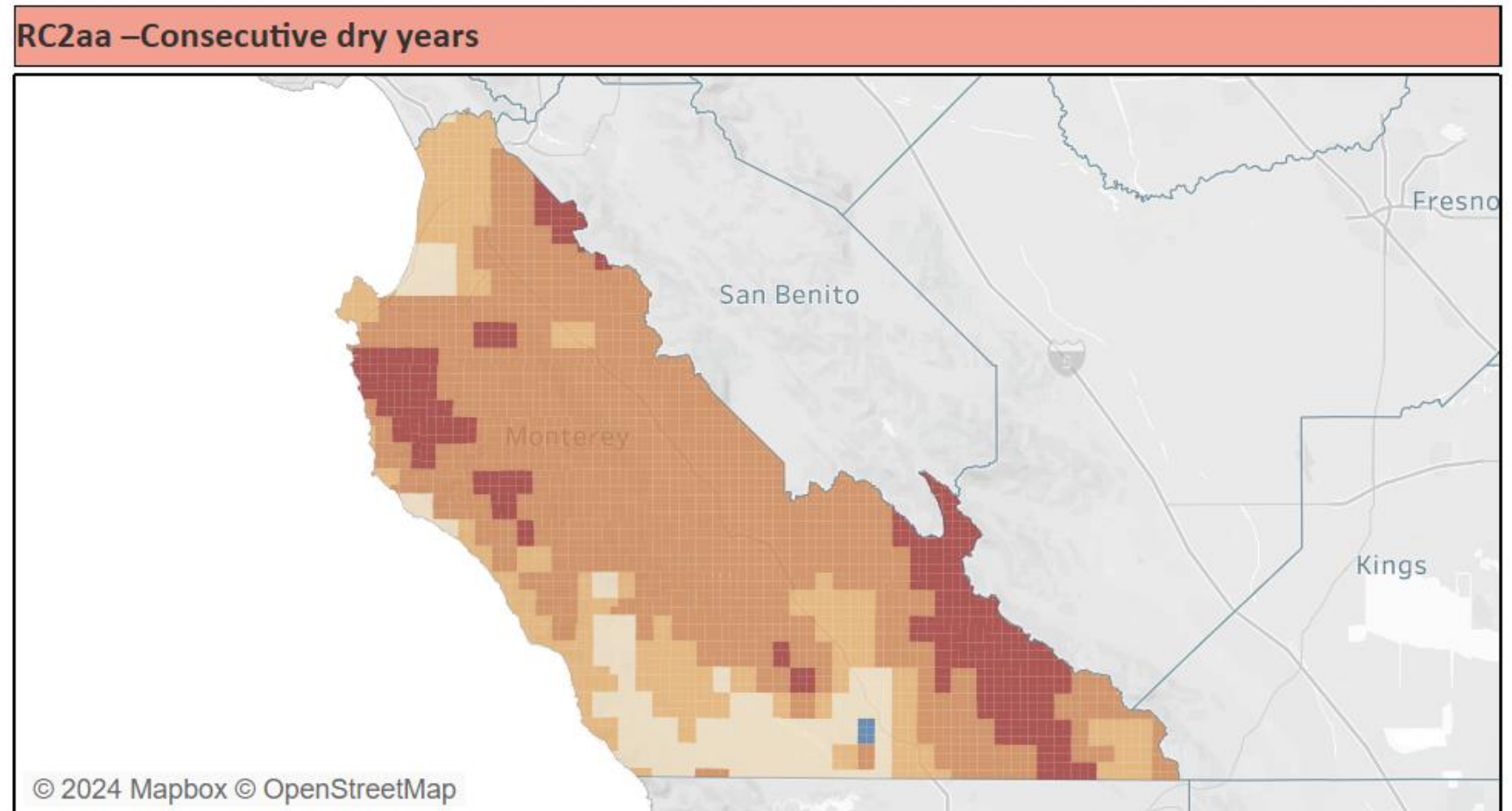
Indicator Detail: Consecutive Dry Years (2018-2022)

Indicator Metric:

Count of dry years within the five years (2018-2022)

Vulnerability Impact:

Increased water supply demands, Increasing consequences of water shortages



Count of Dry Years within the Last 5 years



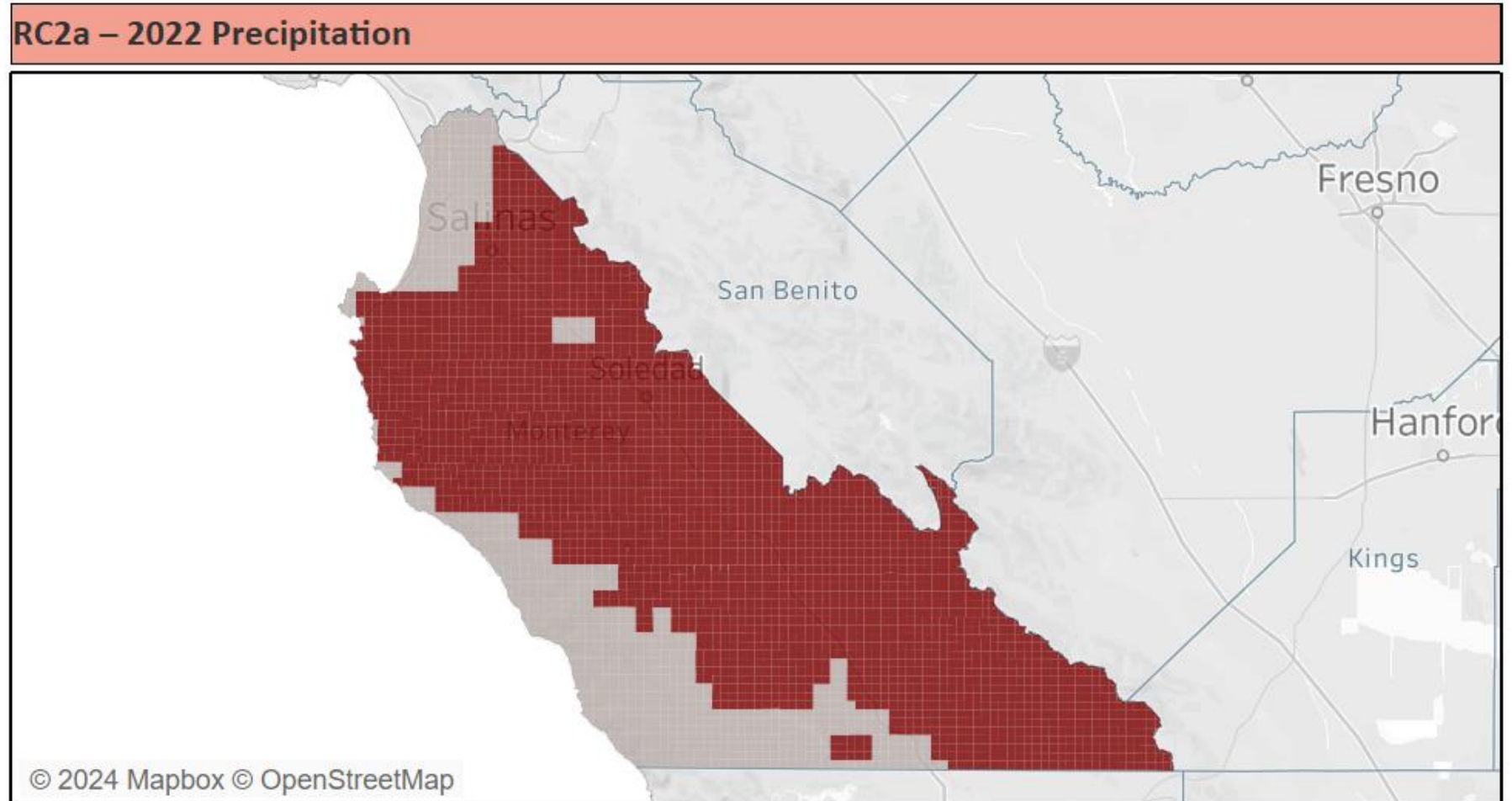
Indicator Detail: Recent Dry Water Year (2022)

Indicator Metric:

Water Year (WY) 2022 (most recent dry year); red areas indicating WY 2022 precipitation was less than 70 percent of the average rainfall

Vulnerability Impact:

Increased water supply demands, Increasing consequences of water shortages



RC2a 2022 Precipitation Below 70% of Average

■ Above 70% ■ Below 70%

Indicator Detail: Wildfire Risk

Indicator Metric:

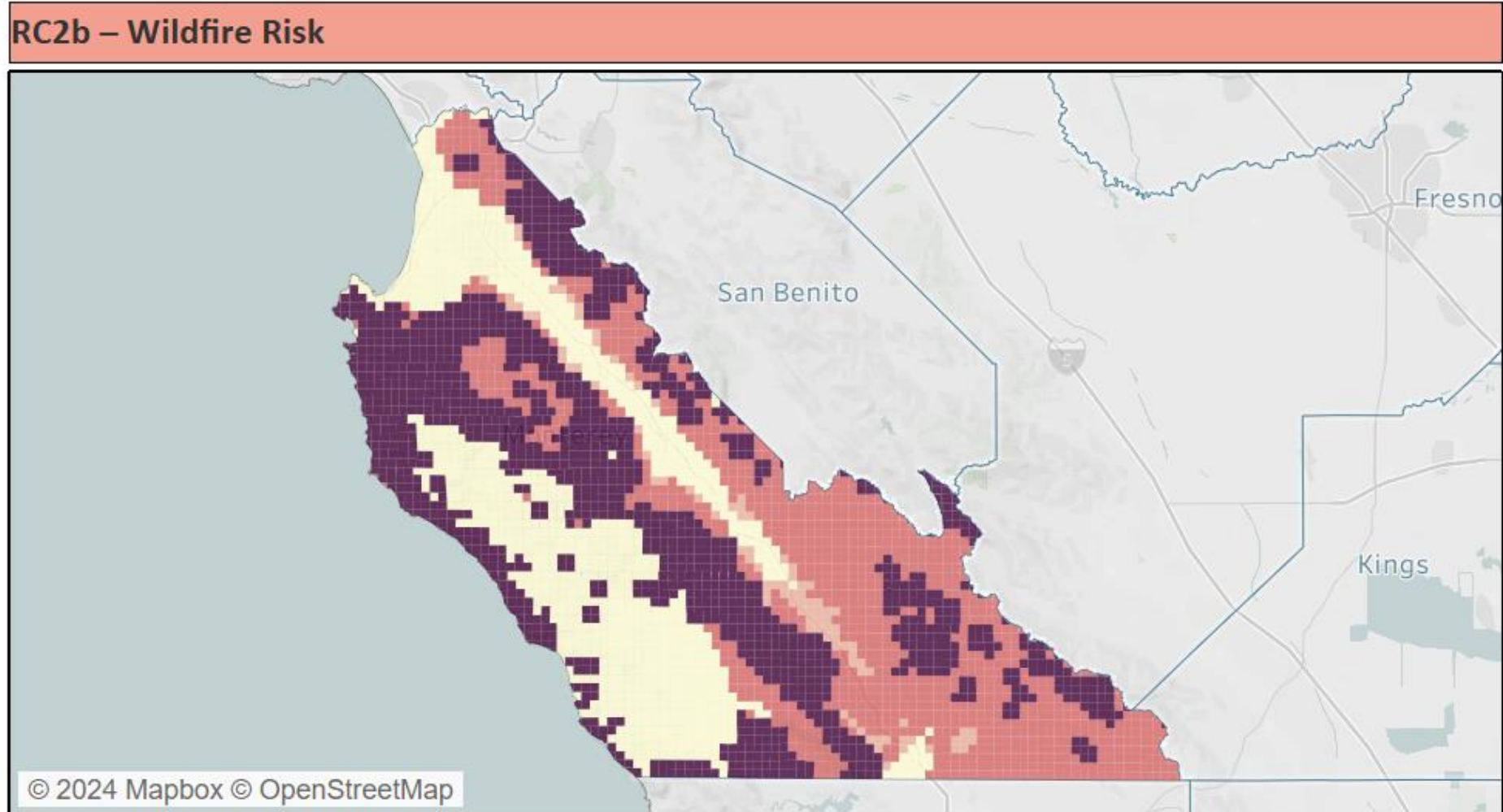
Severity of current wildfire risk

Vulnerability Impact:

Risk of wildfire; a higher risk contributes to higher physical vulnerability for water sources

Note:

CalFire dataset does not include all areas within the county.



RC2b - Current Wildfire Hazard

Very High High Moderate Low

Indicator Detail: Wildfire Risk (U.S. Forest Service)

Indicator Metric:

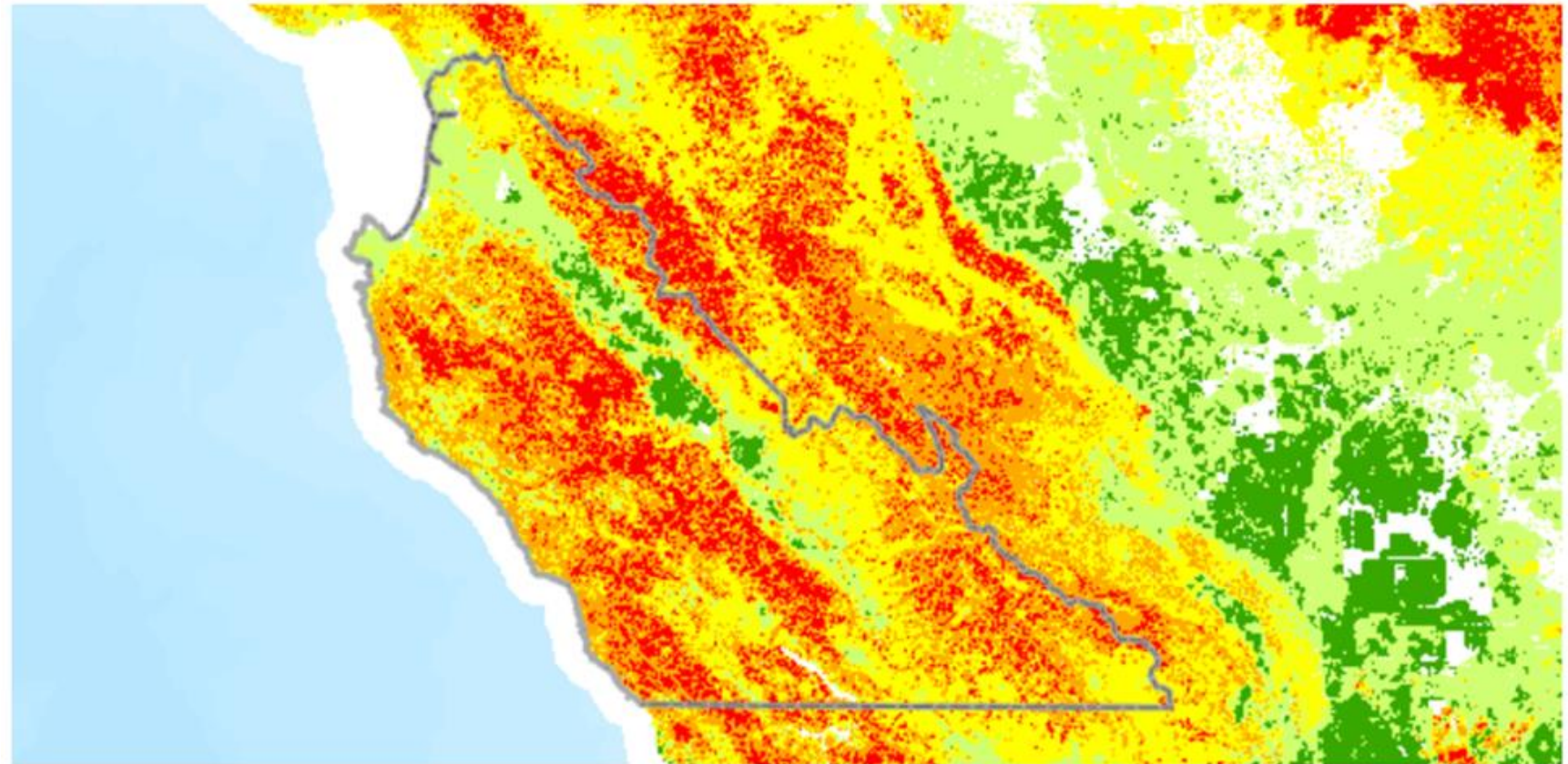
Severity of current wildfire risk

Vulnerability Impact:

Risk of wildfire; a higher risk contributes to higher physical vulnerability for water sources

Note:

Not in the risk assessment score (uses CalFire data)



6/19/2024, 4:12:53 PM

i03_CaliforniaCounties

RMRS WRC Wildfire Hazard Potential

NA

Very Low

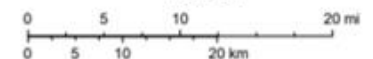
Low

Moderate

High

Very High

1:577,791



Esri, CGIAR, USGS, U.S. Bureau of Reclamation, California Department of Conservation, California Department of Fish and Game, California Department of Forestry and Fire Protection, National Oceanic and Atmospheric Administration. Contact: gis@water.ca.gov

Indicator Detail: Water Quality Aquifer Risk

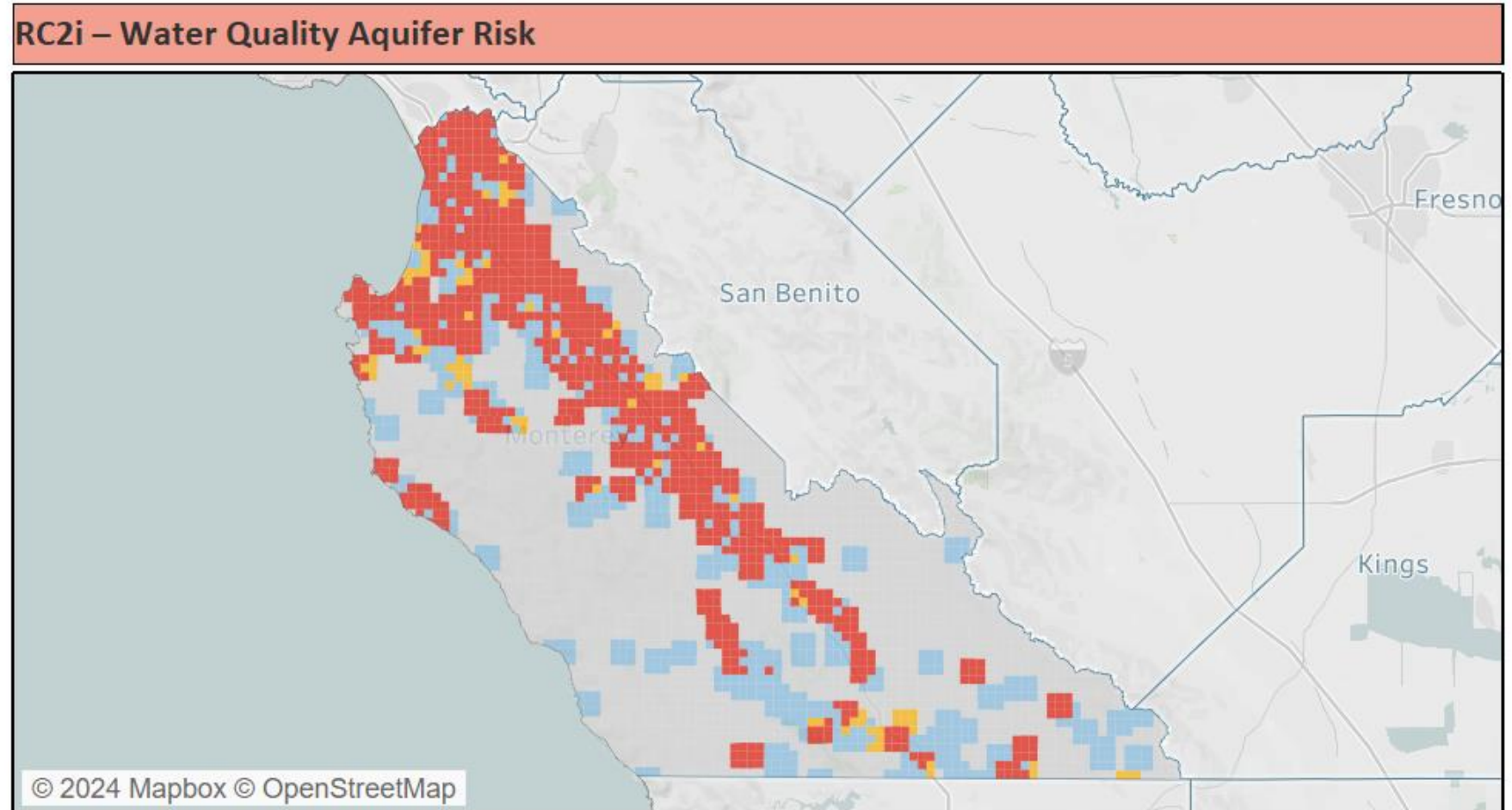
Indicator Metric:

Potential groundwater water quality problems within Public Land Survey Sections based off SAFER Needs Assessment

Vulnerability Impact:

Increased risk of domestic well or SSWS being unable to deliver drinking water due to water quality impact

Note: Does not predict or estimate actual water quality at given location



rRC2i SWRC - SAFER Water Quality Risk



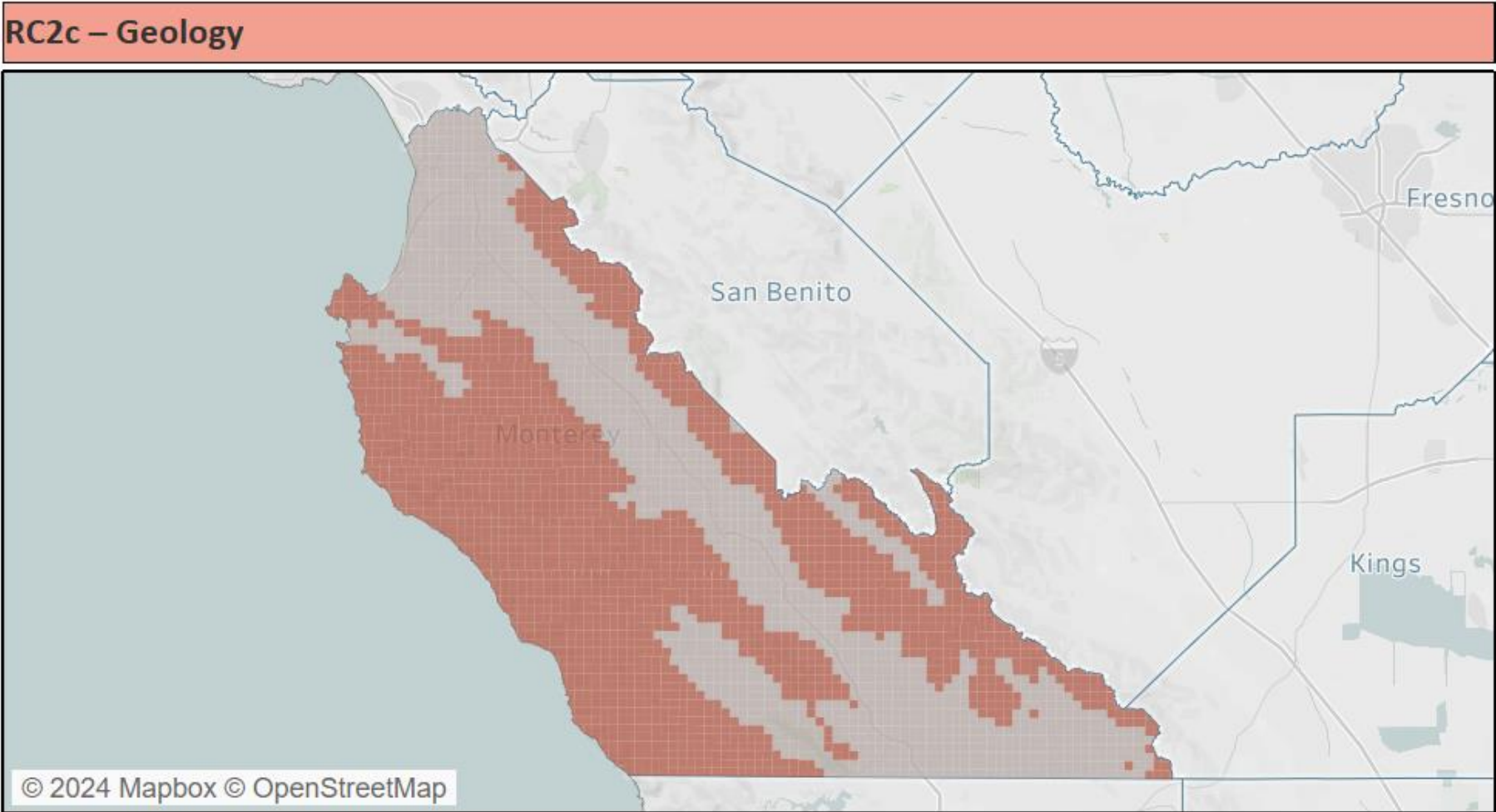
Indicator Detail: Fractured Rock Areas

Indicator Metric:

Areas that are outside alluvial basins in California, Areas with fractured rock.

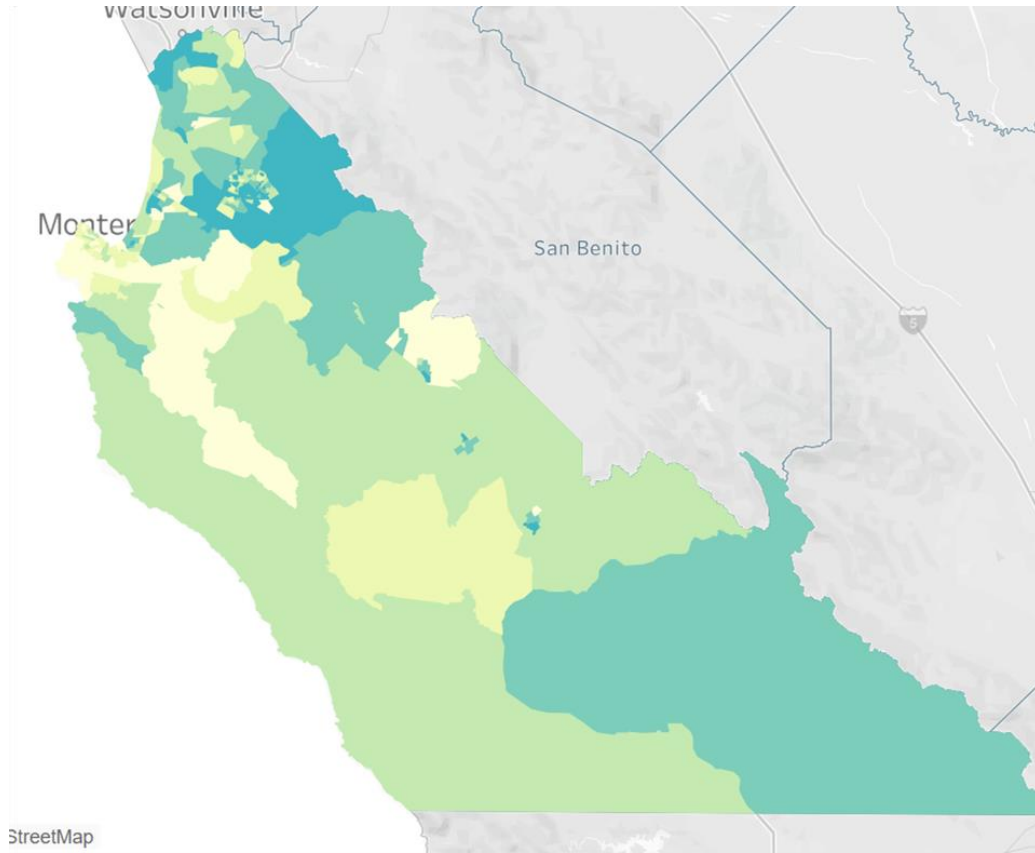
Vulnerability Impact:

Water availability in fractured rock areas is more difficult to monitor and therefore more uncertain for those relying on it as a source of water.

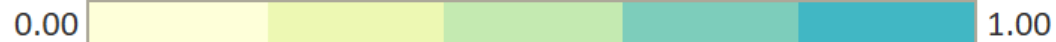


rRC2c - Fractured Rock Basin
■ Fractured Rock Basin ■ NA

Social Vulnerability Overview



Social Vulnerability Score (Low --> High Vulnerability)



Socioeconomic Status

Poverty Level

Unemployment

Per Capita Income

Language and Education

Education Attainment

English Language Proficiency

Demographics

Elderly Population

Non-Adult Population

Minority Population

Disability

Single Parent Households

Housing and Transportation

Multi-Unit-Housed Population

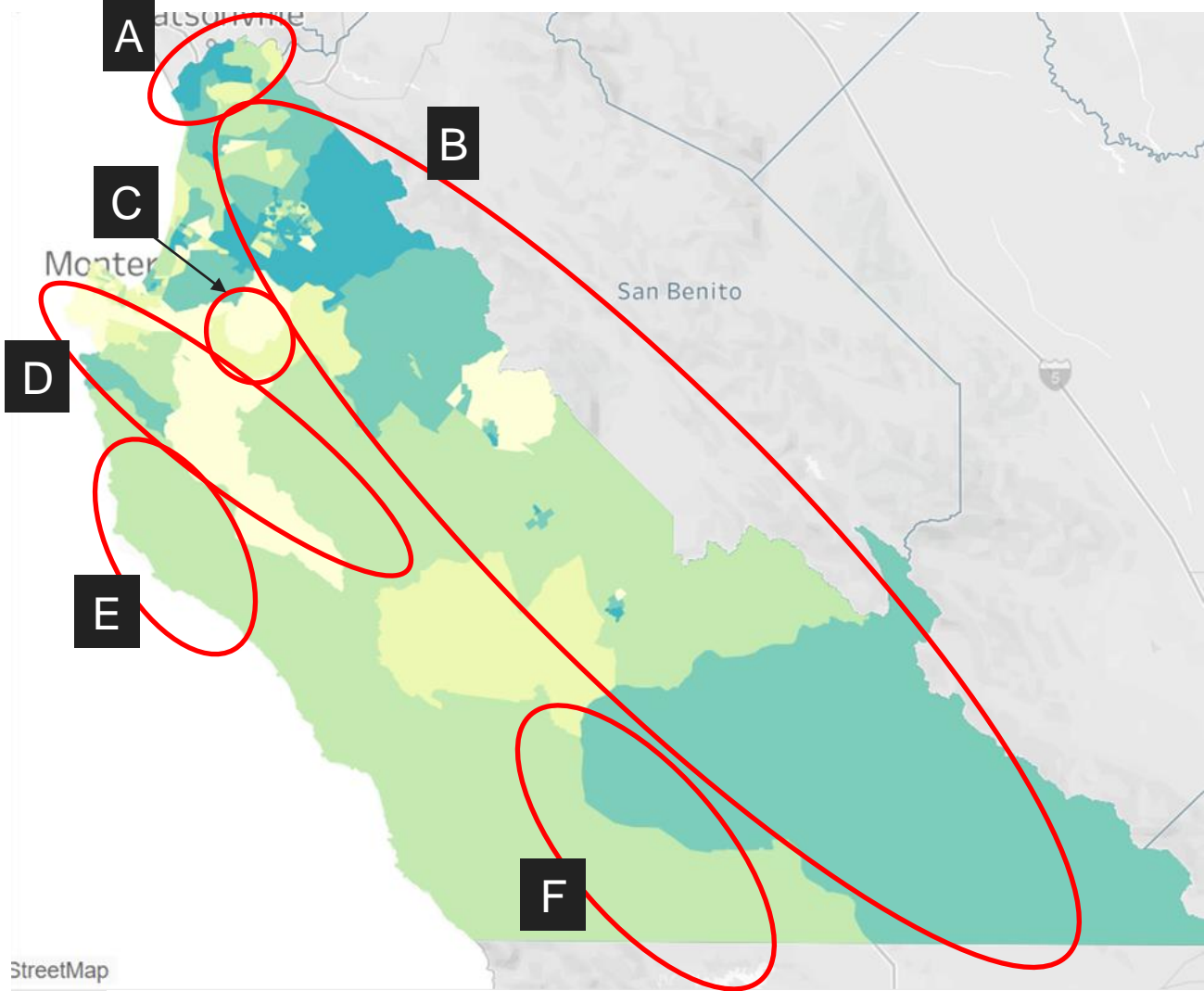
Mobile Home-Housed Population

Crowded Conditions

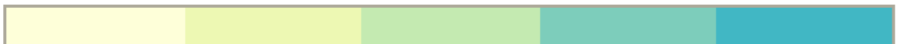
No Vehicle Access

Physical Vulnerability Intersection with Social Vulnerability

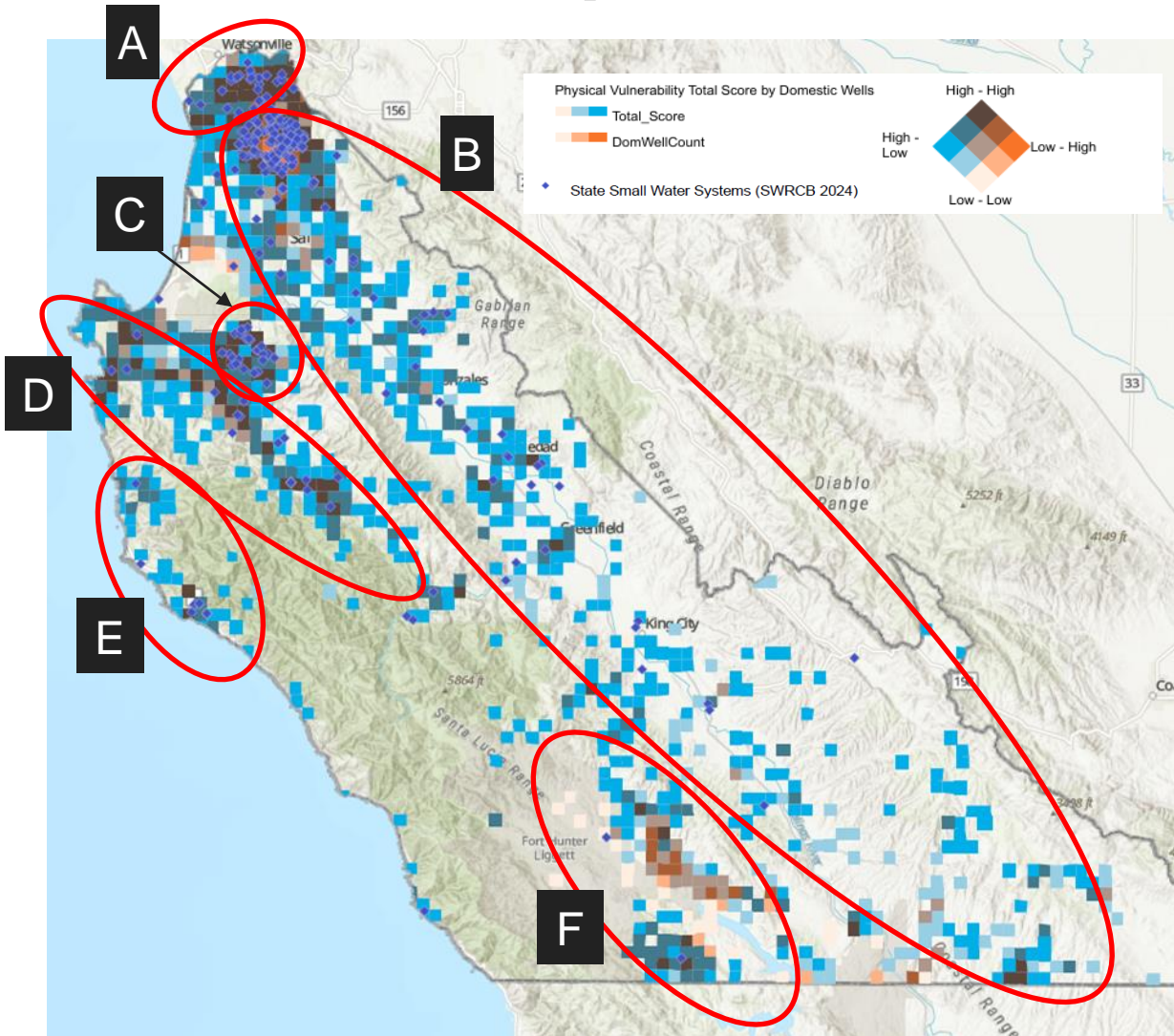
- A – Pajaro Valley
- B – Salinas Valley
- C – Salinas Valley (Monterey) (Toro/Corral area)
- D – Carmel Valley
- E – Northern Big Sur
- F – Lockwood Valley



Social Vulnerability Score (Low --> High Vulnerability)

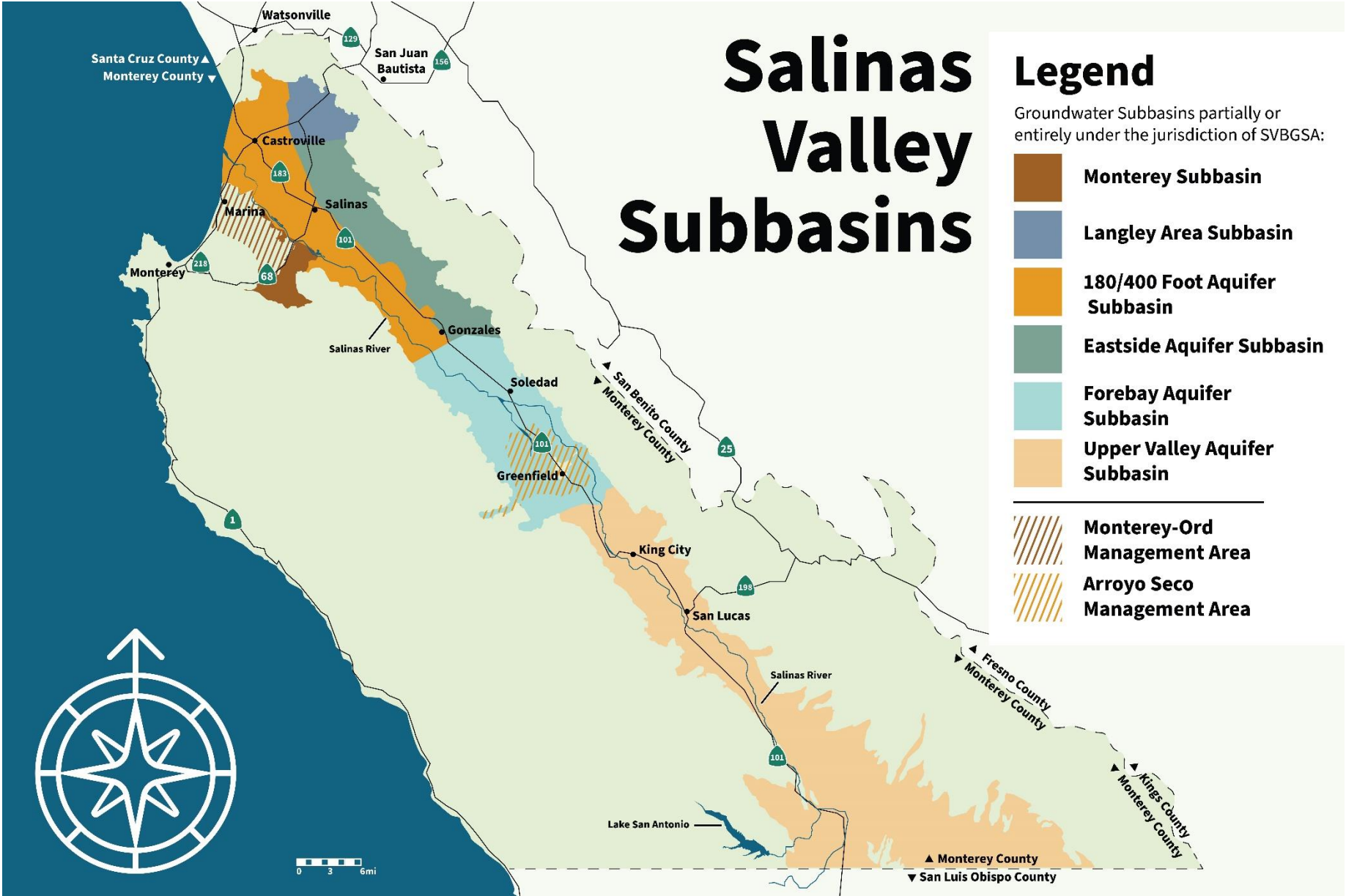
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Overview: Regions with Potential Water Shortage Vulnerability



Regions with Water Shortage Vulnerability and Domestic Wells/SSWS	Physical Vulnerability Drivers	Social Vulnerability
Pajaro Valley (A)	<ul style="list-style-type: none"> Water quality Dry year/multiple dry years within the past five years Wildfire hazard 	Medium to High
Salinas Valley (B)	<ul style="list-style-type: none"> Water quality Dry year/multiple dry years within the past five years 	Medium to High
Salinas Valley (Monterey) (Toro/Corral area) (C)	<ul style="list-style-type: none"> Water quality Dry year/multiple dry years within the past five years Wildfire hazard 	Low to Medium-Low
Carmel Valley (D)	<ul style="list-style-type: none"> Water quality Wildfire hazard Dry year/multiple dry years within the past five years Fractured rock area 	Mix of Low to Medium
Northern Big Sur (E)	<ul style="list-style-type: none"> Water quality Wildfire Fractured rock 	Medium
Lockwood Valley (F)	<ul style="list-style-type: none"> Dry year/multiple dry years within the past five years Wildfire risk Water quality 	Medium/ Medium-High

Salinas Valley Subbasins



Summary of Assessment Results – Combined Indicators

Questions we seek to address with the Risk Assessment results:

- ✓ What are the potential impacts of identified physical vulnerabilities on domestic wells and small water systems?
- ✓ What is the relationship between physical vulnerabilities and social vulnerabilities?
- ✓ Where are the most vulnerable areas and systems for which we will need to consider short-term mitigation and long-term actions?

Discussion and Questions

Closing and Next Steps

- DAG Member Preliminary Risk Assessment Feedback: Requested to be provided via email to swsdroughtadvisorygroup@countyofmonterey.gov **by COB Friday, August 30, 2024**
- DAG Meeting 2: Wednesday, September 18, 2024 from 9 am - 12 pm
 - Follow-up on Baseline Risk Assessment
 - Determine Criteria to Evaluate Short-Term Actions and Long-Term Strategies
- Questions or Concerns: swsdroughtadvisorygroup@countyofmonterey.gov

Resources

- County of Monterey Drought Advisory Group Website: [Drought Advisory Group for Small Water Systems | County of Monterey, CA](#)
- DWR Risk Assessment Tool: [Water Shortage Vulnerability Scoring and Tool](#)
 - Mythology/data: [Water Shortage Vulnerability Technical Methods - Dataset - California Natural Resources Agency Open Data](#)
- DWR Guidebook: [DWR County Drought Resilience Plan Guidebook](#)
- Groundwater Basin Maps: [SGMA Data Viewer \(ca.gov\)](#)

Back-up/Discussion Slides

Physical Vulnerability Weighting

- Indicators weighted based on perceived vulnerability influence
- Aligns with the State Water Board SAFER Program's Needs Assessment
- Sum of all indicators' scores multiplied by their corresponding weighting equals the total vulnerability score.

Indicator Weights

Projected Temperature Shift -	(1)
Projected Saline Intrusion Risk -	(1)
Projected Wildfire Risk -	(1)
Current Year's Precipitation -	(2)
Consecutive Dry Years -	(2)
Wildfire Risk -	(3)
Water Quality -	(3)
Saltwater Intrusion -	(3)
Surrounding Land Use (Farmed Areas) -	(3)
Reported Household Outages on Domestic Wells -	(5)

Alluvial Basin	Fractured Rock
Over-drafted Basin - (2)	Fractured Rock - (5)
Subsidence - (2)	Dry Well Susceptibility in Fractured Rock Areas (density) - (5)
Declining Water Levels - (3)	
Dry Well Susceptibility in basin - (5)	

Weighting and Aggregation Approach (Physical Vulnerability)

- Associated with individual indicators, NOT the groups of indicators.
- Aligns with the method used for the State Water Board SAFER Program's Needs Assessment.
- Weight of each climate change indicator is 1.
- Difference between alluvial basin and fractured rock.
- Sum of all indicators' scores multiplied by their corresponding weighting equals the total vulnerability score.
- Physical vulnerability indicators uses weights for each indicator.
- All indicators are rescaled between 0 and 1
- Weightings of indicators were adjusted to be associated with individual indicators rather than groups of indicators – which better aligns with the method used for the State Water Board SAFER Program's Needs Assessment.
- Weighted indicators are summed for the alluvial basins and fractured rock areas separately.
- Data is from domestic well drilled between 1970 and 2022 (from the DWR Well Completion Reports)

Alluvial Basin

$[rRC1a_Temperature_Change] + [rRC1b_Sea_Level_Rise] + [rRC1c_Wildfire_Projections] + 2*[RC2a_Current_Dry_Year] + 2*[rRC2aa_Multiple_Dry_Years] + 3*[rRC2b_calfire] + 3*[rRC2i_SWRCB_Water_Quality_Ris] + 3*[rRC2e_Saltwater_Intrusion] + 3*[rRC2j_Percent_Farmed_Score] + 2*[rRC2f_Critically_Overdrafted] + 2*[rRC2d_Subsidence] + 3*[rRC2g_Groundwater_Decline] + 5*[rRC3a_Well_Susceptibility] + 5*[rRC5a_Household_Water_Outage]$

Fractured Rock

$[rRC1a_Temperature_Change] + [rRC1b_Sea_Level_Rise] + [rRC1c_Wildfire_Projections] + 2*[RC2a_Current_Dry_Year] + 2*[rRC2aa_Multiple_Dry_Years] + 3*[rRC2b_calfire] + 3*[RC2c_Fractured_Rock_Area] + 3*[rRC2i_SWRCB_Water_Quality_Ris] + 3*[rRC2e_Saltwater_Intrusion] + 3*[rRC2j_Percent_Farmed_Score] + 5*[rRC3c_FRA_Dry_Wells] + 5*[rRC5a_Household_Water_Outage]$