
A RIVER RUNS THROUGH IT: SUBSURFACE CONNECTIVITY AND EXCHANGES BETWEEN THE SALINAS RIVER AND GROUNDWATER SUBBASINS

CALIFORNIA WATER AND ENVIRONMENTAL MODELING FORUM
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OVERVIEW

- Conjunctive Water Use in Salinas Valley – The Lettuce Bowl of America
- Salinas Valley System Model
- Groundwater Subbasin Budgets
- Surface / Groundwater Exchanges

These data will demonstrate

Groundwater underflow from the Salinas River riparian area is a substantial source of water to groundwater basins. Effective groundwater management depends on managing the river system and coordinated basin-wide groundwater management.

SALINAS VALLEY OF CALIFORNIA— THE LETTUCE BOWL OF AMERICA

- Water Supply for 1 Million
- \$7 Billion Agricultural Industry
- 50% of America's Lettuce and Broccoli



LOCAL MANAGEMENT CHALLENGES

Conjunctive
groundwater
and surface
water use

Effective management
relies on availability of
water sources

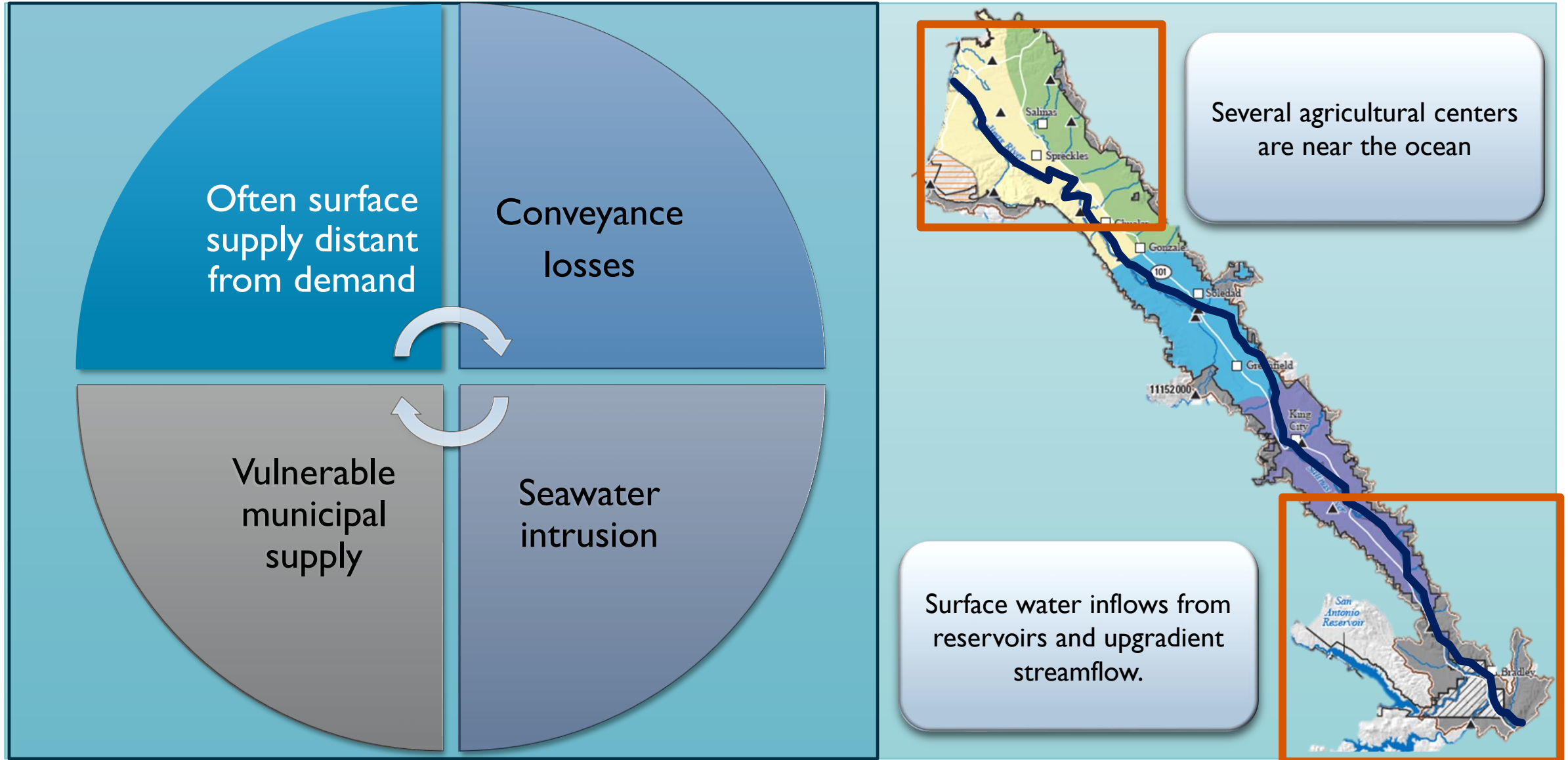
Reservoir operations,
diversions, and
minimum flows
influence streamflow

Simulating complex agricultural
operations is challenging

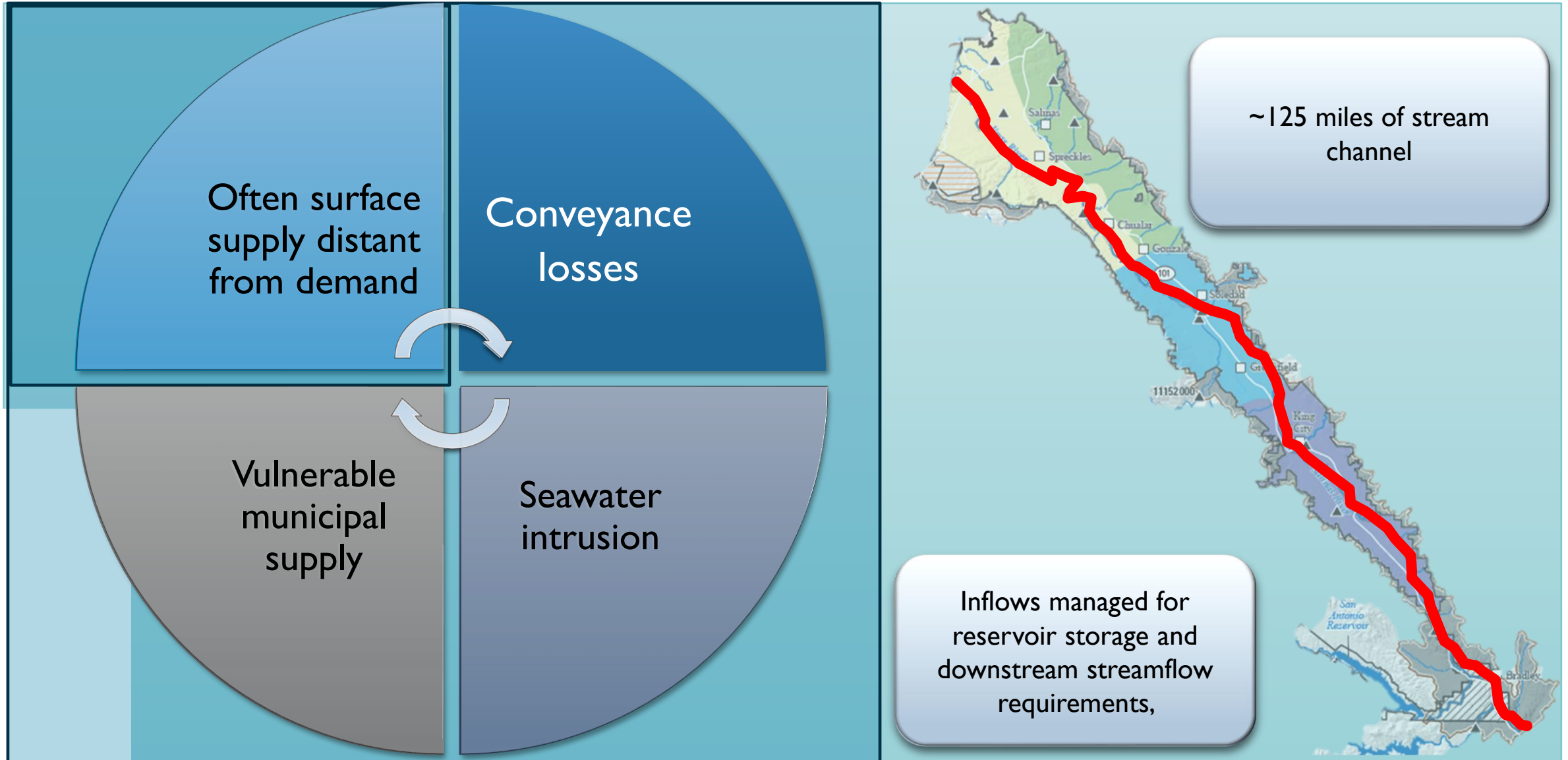
Groundwater
Sustainability

Groundwater must be
managed to prevent
undesired results

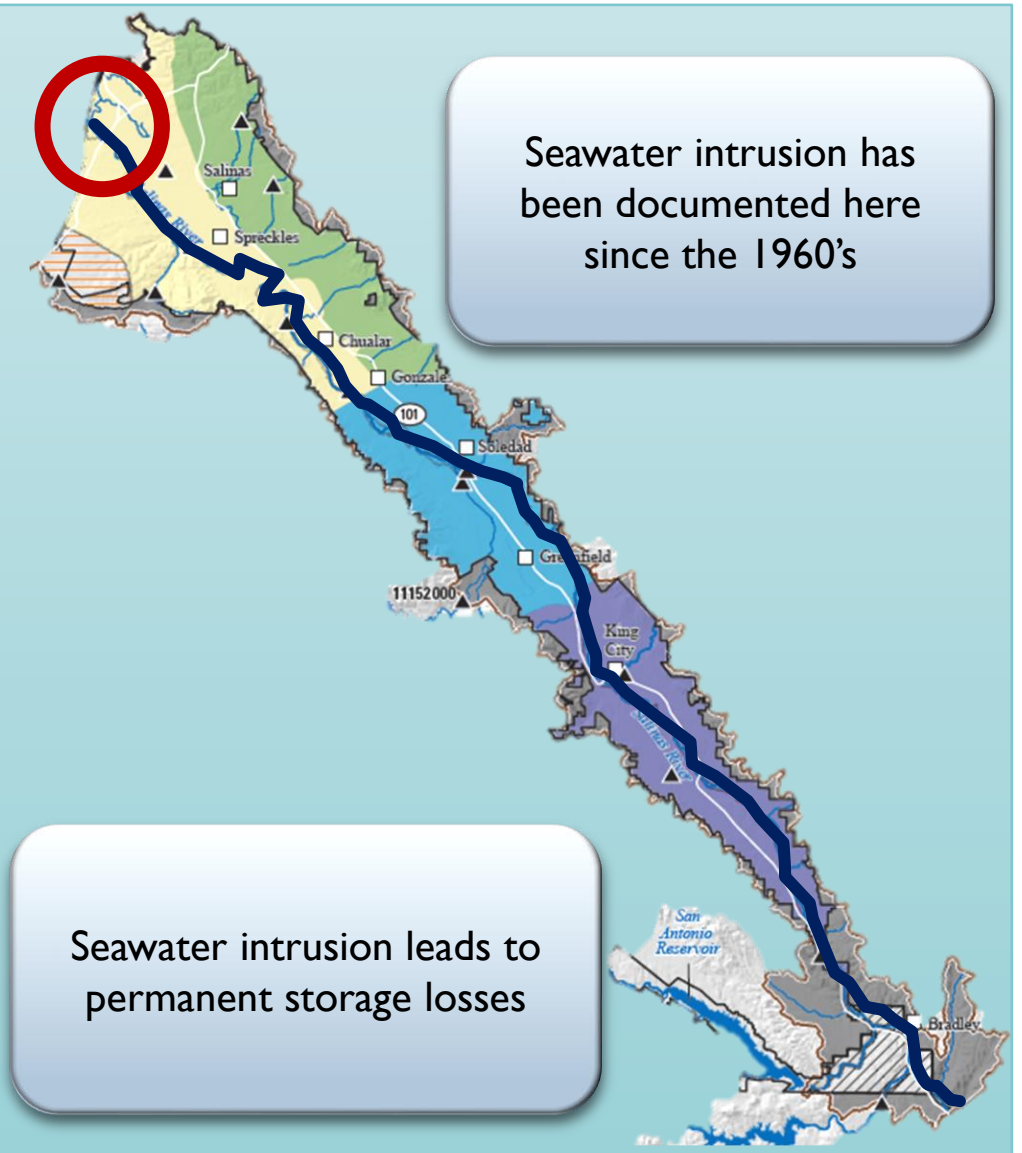
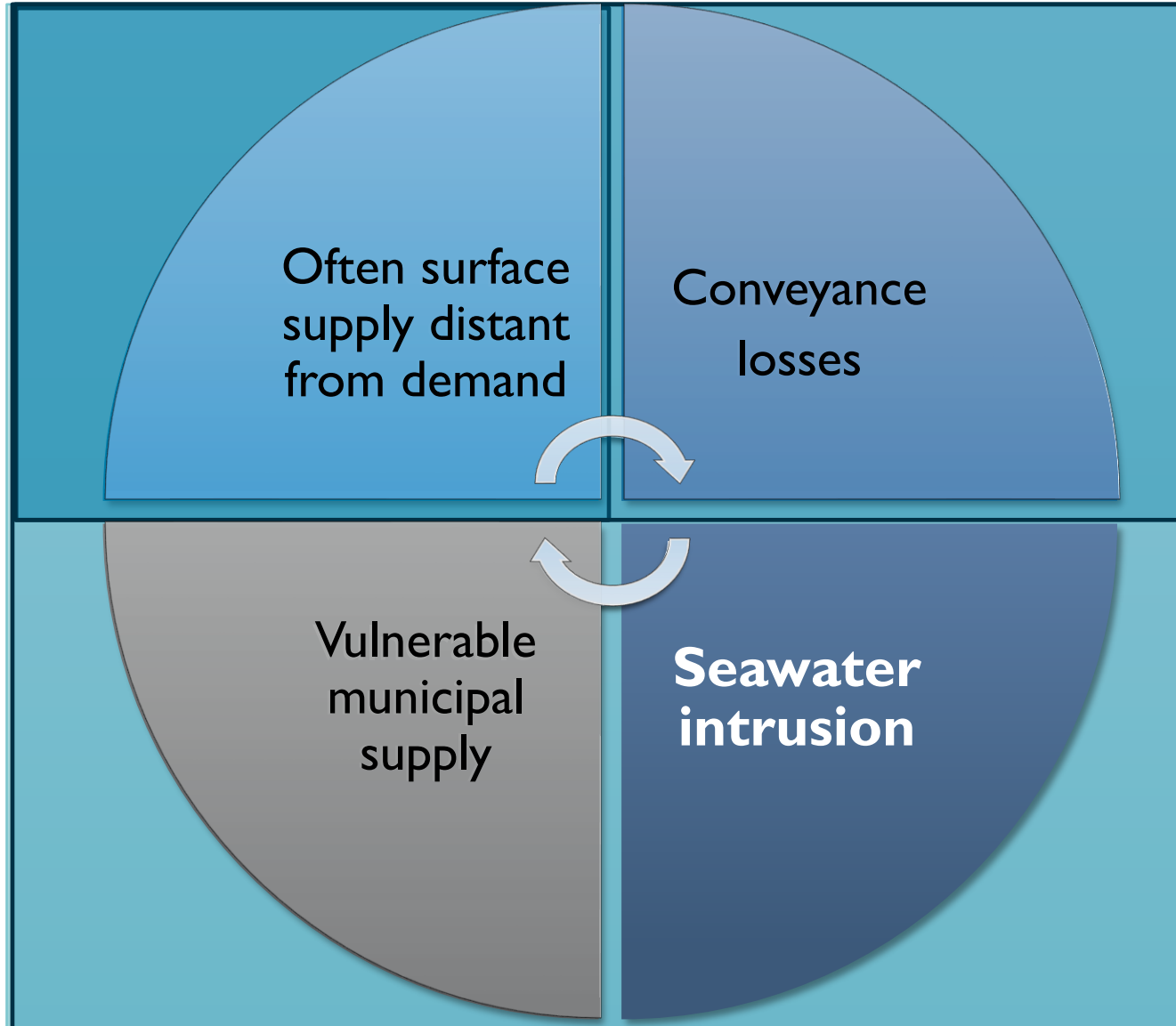
CONJUNCTIVE USE CHALLENGES



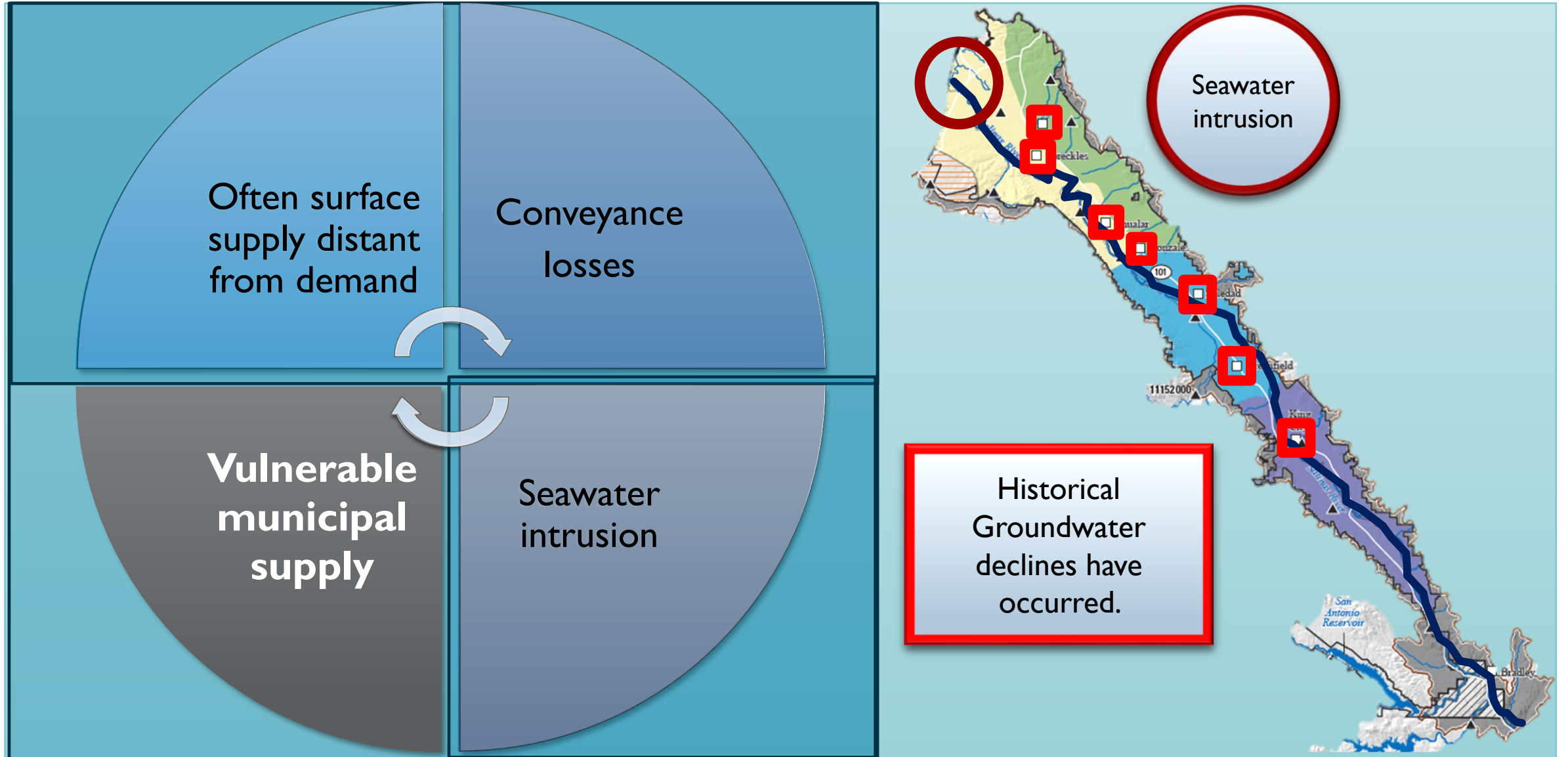
CONJUNCTIVE USE CHALLENGES



CONJUNCTIVE USE CHALLENGES



CONJUNCTIVE USE CHALLENGES



A SET OF INTEGRATED TOOLS WERE DEVELOPED



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Salinas Valley System Model

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Summary

California's Salinas Valley is one of the most productive agricultural basins in the world due to the fertile valley soil, temperate climate, and availability of water for irrigation. In the Salinas Valley, many people, industries, and ecosystems depend directly or indirectly on groundwater. Water demands and met by conjunctive use, which is the coordinated use of surface water and groundwater to meet the demand for irrigation and public water supply. Due to the high cost of groundwater development projects, it is important to understand how these projects perform to increase storage, mitigate seawater intrusion, provide flood control, and maintain healthy riparian ecosystems. The models from this study can be used to explore these questions and evaluate historical and potential future stresses on water resources to support long-term planning and decision-making toward sustainable water resource management in the basin. For the evaluation of the Salinas Valley hydrology and water resource availability, a suite of quantitative geologic and hydrologic modeling tools were developed to simulate the Salinas Valley System of surface and groundwater hydrology, agricultural, and reservoir operations — the Salinas Valley System Model. The Salinas Valley System Model was used to develop an integrated modeling framework to simulate surface-water and groundwater movement including interactions and feedback between different water sources across the basin and is comprised of the Salinas Valley Geological Framework (SVGF) and the Salinas Valley Hydrologic System. SVGF provides data describing the surface geology and elevations that are used to define the topology of the stream network and provides

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Child Items (2)

- [Digital data for the Salinas Valley Geological Framework, California](#)
- [Salinas Valley Hydrologic System](#)

Map »



Spatial Services

ScienceBase WMS : <https://www.sciencebase.gov/catalog>

Communities

- USGS California Water Science Center

Associated Items

[Lower Salinas Valley Hydrologic Models: Discretization Data](#)
[Salinas Valley Hydrologic Models: Surface Water Data](#)
[Salinas Valley Hydrologic System: Regional Climate Data](#)

[Layer, OGC WMS Service](#)

Provenance

<https://www.sciencebase.gov/catalog/item/640770fed34e76f5f75e388b>

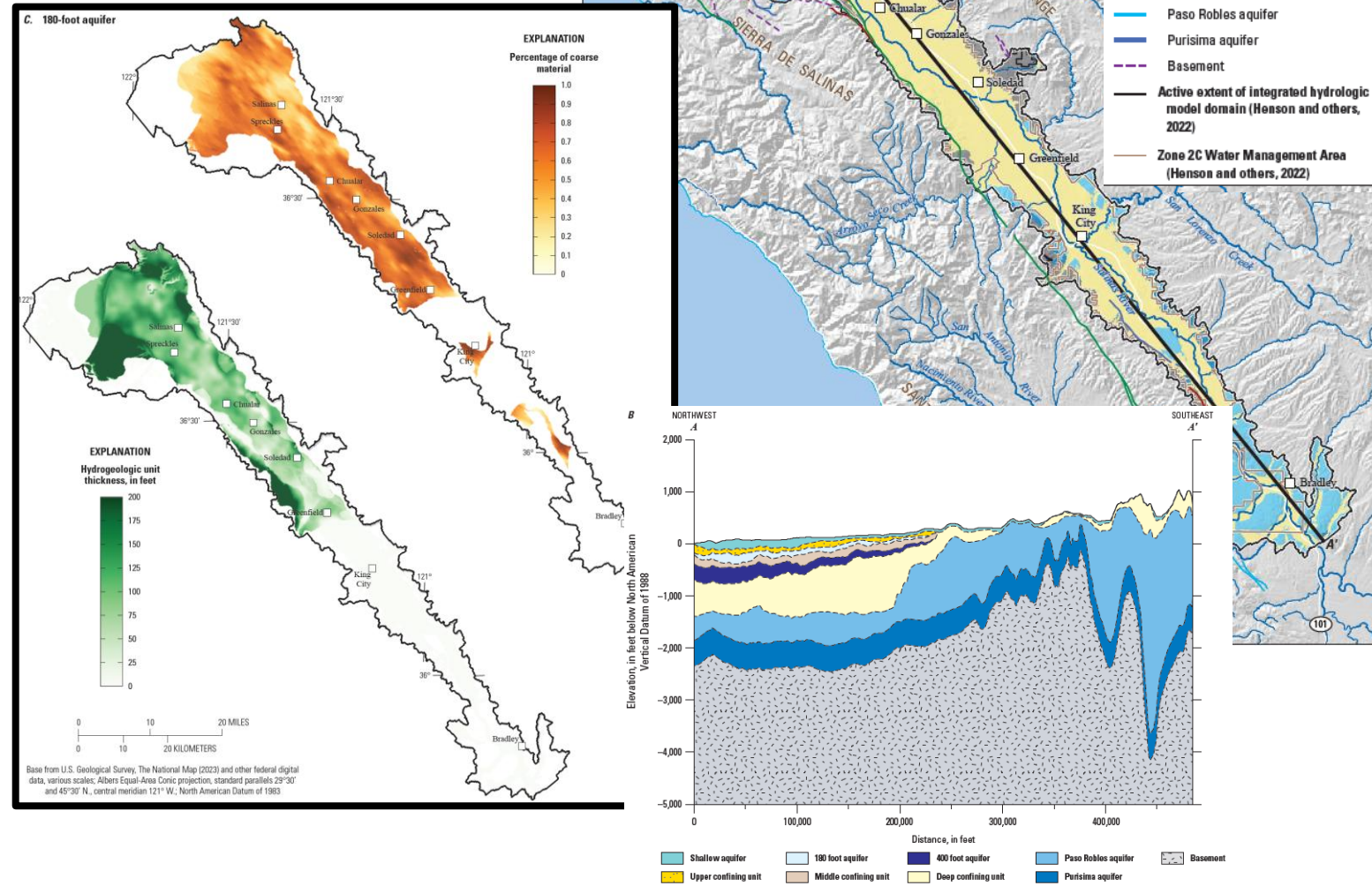


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SALINAS VALLEY GEOLOGICAL FRAMEWORK

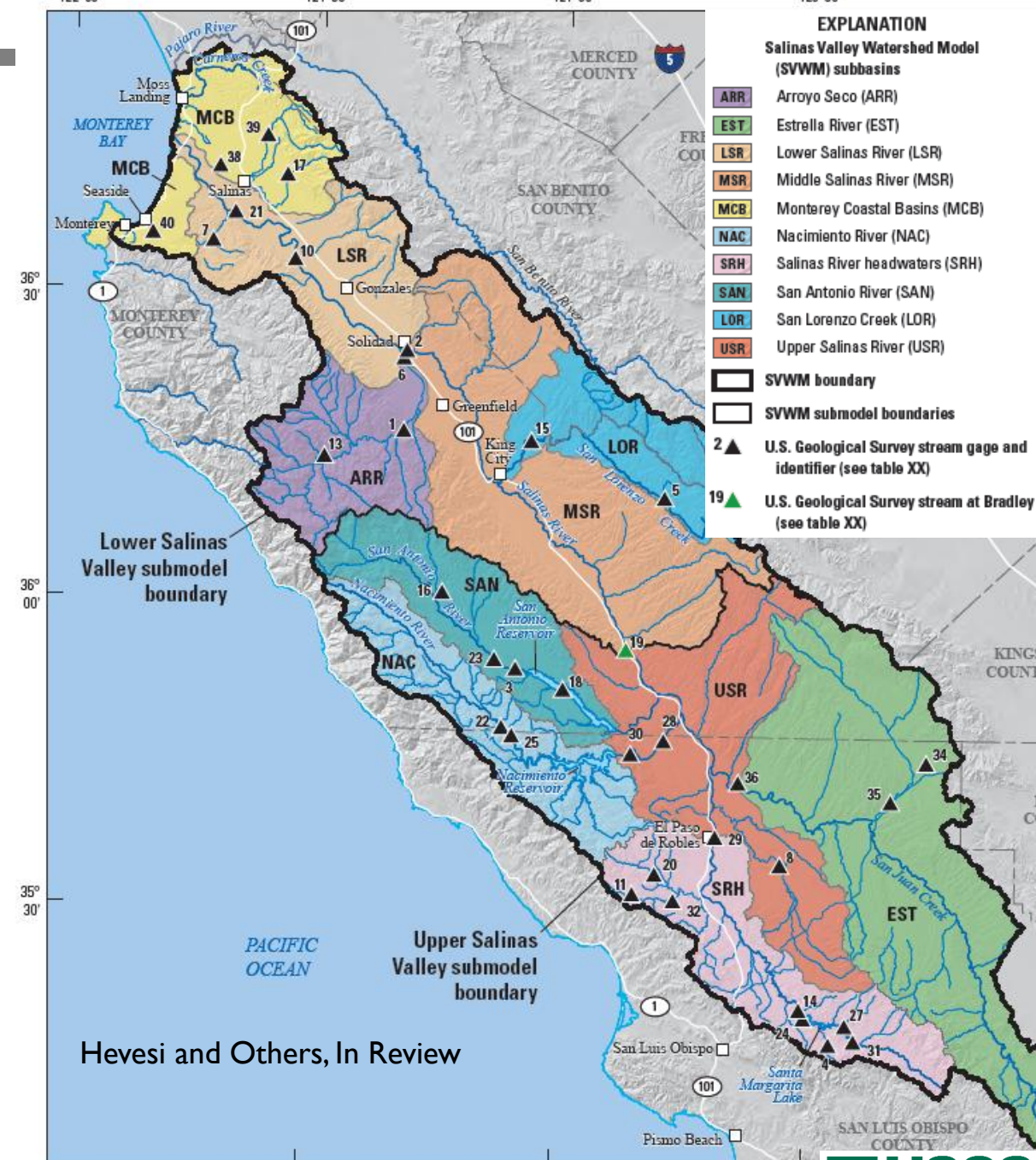
Geologic Data and 3-D Hydrogeologic framework model

- input data to 3D framework and textural models (stratigraphic and lithologic information)
- Interpolated elevation, thickness, extent, and lithology-based texture variations of 9 hydrogeologic units in Salinas Valley



SALINAS VALLEY WATERSHED MODEL (SVWM)

- Simulates watershed processes for the entire Salinas River Valley from San Luis Obispo to the coast
- Regionally downscaled climate from the Basin Characterization Model
- Provides surface inflows to integrated models from hillslopes to valley floors
- Sediment and contaminant transport capable



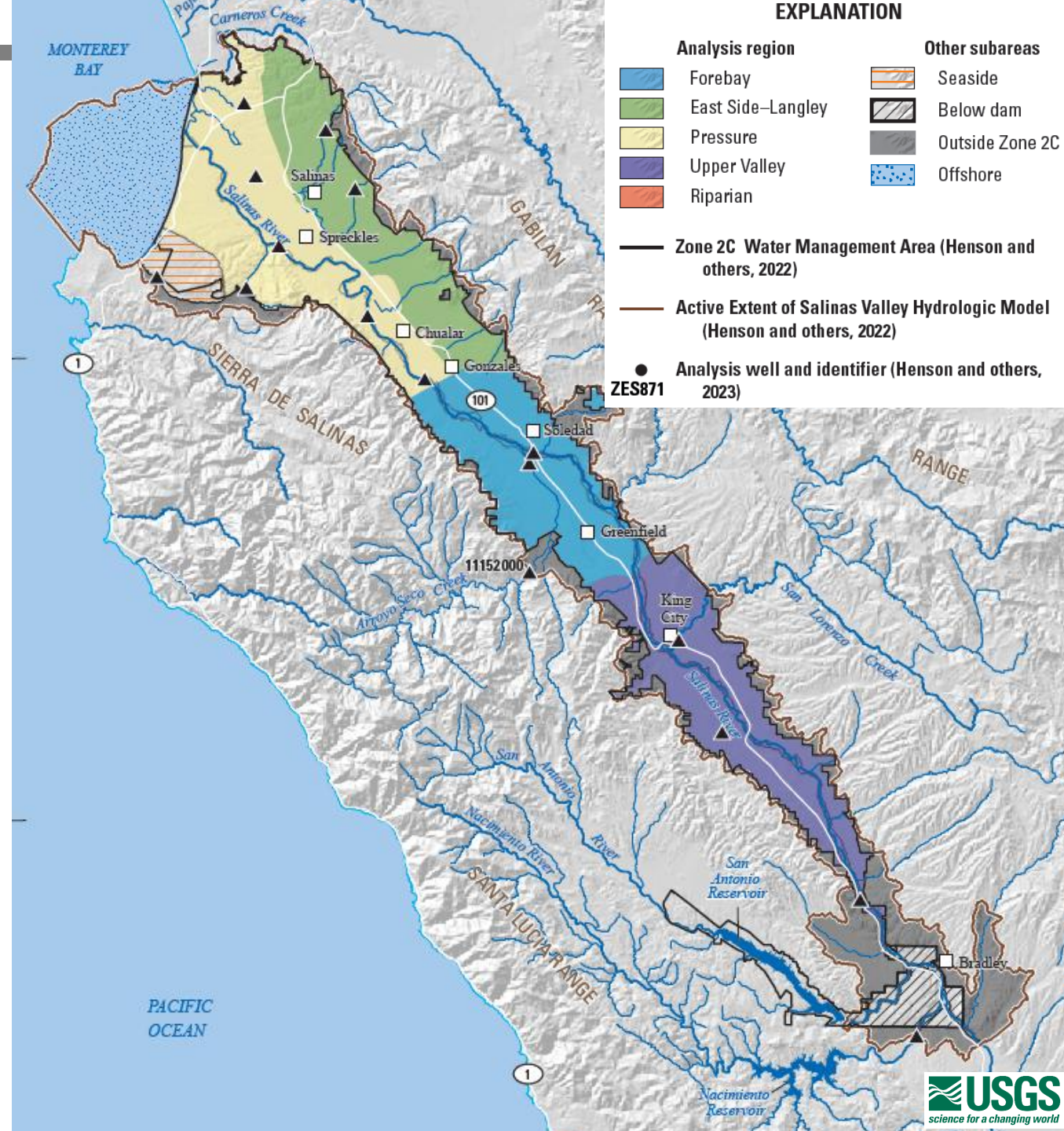
Base from U.S. Geological Survey, The National Map (2023) and other federal digital data, various scales; California IV State Plane Coordinate System (FIPS 0404); North American Datum of 1983

SALINAS VALLEY INTEGRATED HYDROLOGIC MODEL (SVIHM)

SVIHM Simulates Historical conditions

- Water years 1968 through 2022
- Monthly stress periods with 2-week time steps
- Municipal and industrial water use
- Agricultural water demands
- Stream Gains/Losses
- Diversions and recycled water deliveries
- Landscape and subsurface water budgets

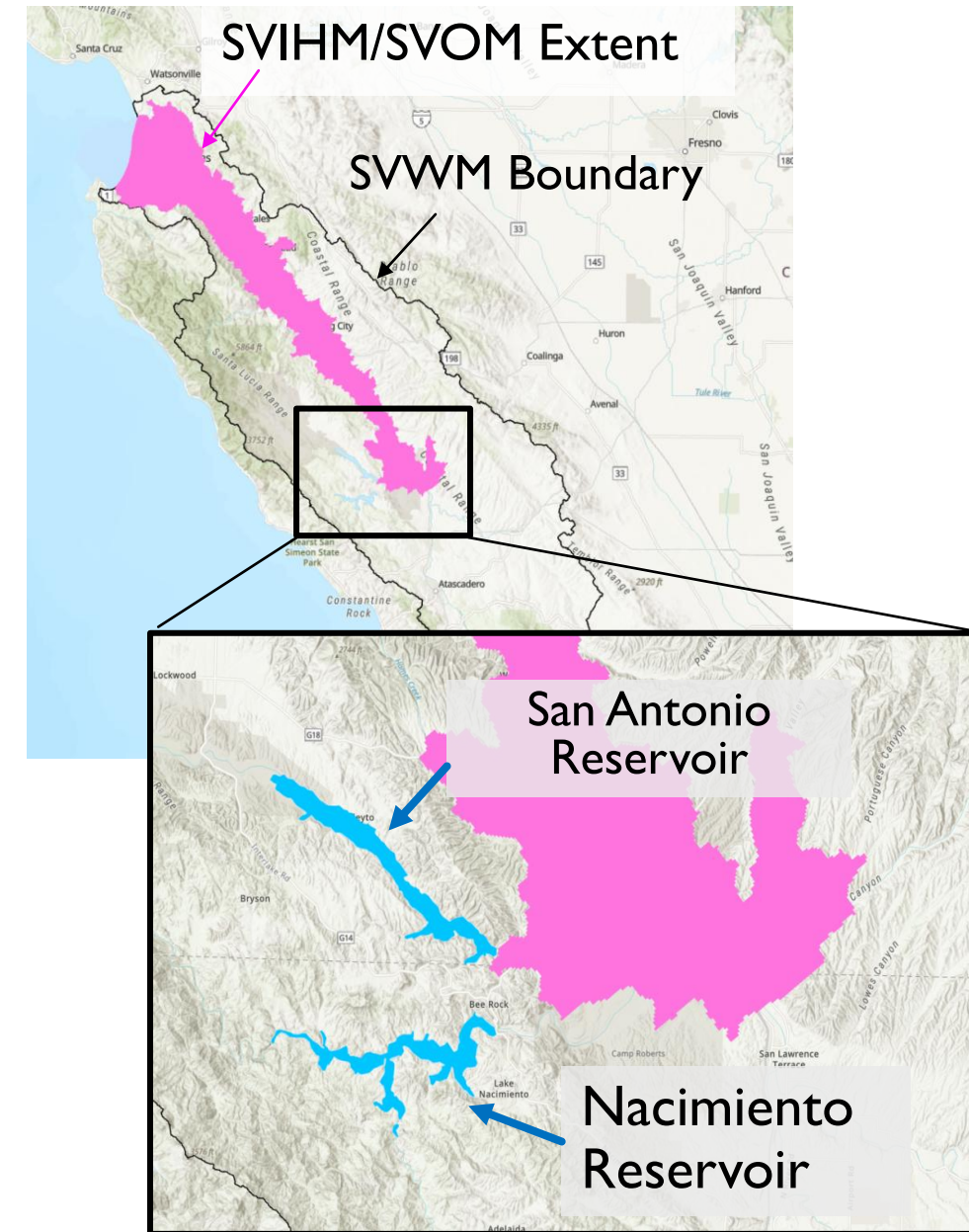
This tool continues to be developed and updated for regional water supply management and scenario evaluation.



SALINAS VALLEY OPERATIONAL MODEL (SVOM)

Incorporates and adds reservoir operations to the SVIHM

- Static 2014 Land Use
- Monthly stress periods with 5-day timesteps
- Fully integrated reservoir management
 - Network Gains/Losses
 - Downstream demands
 - Flexible operational rules
 - Reservoir and system budgets
- Captures current operations for
 - Fish passage
 - Conservation
 - Sea water intrusion mitigation projects
 - Complex reservoir management objectives

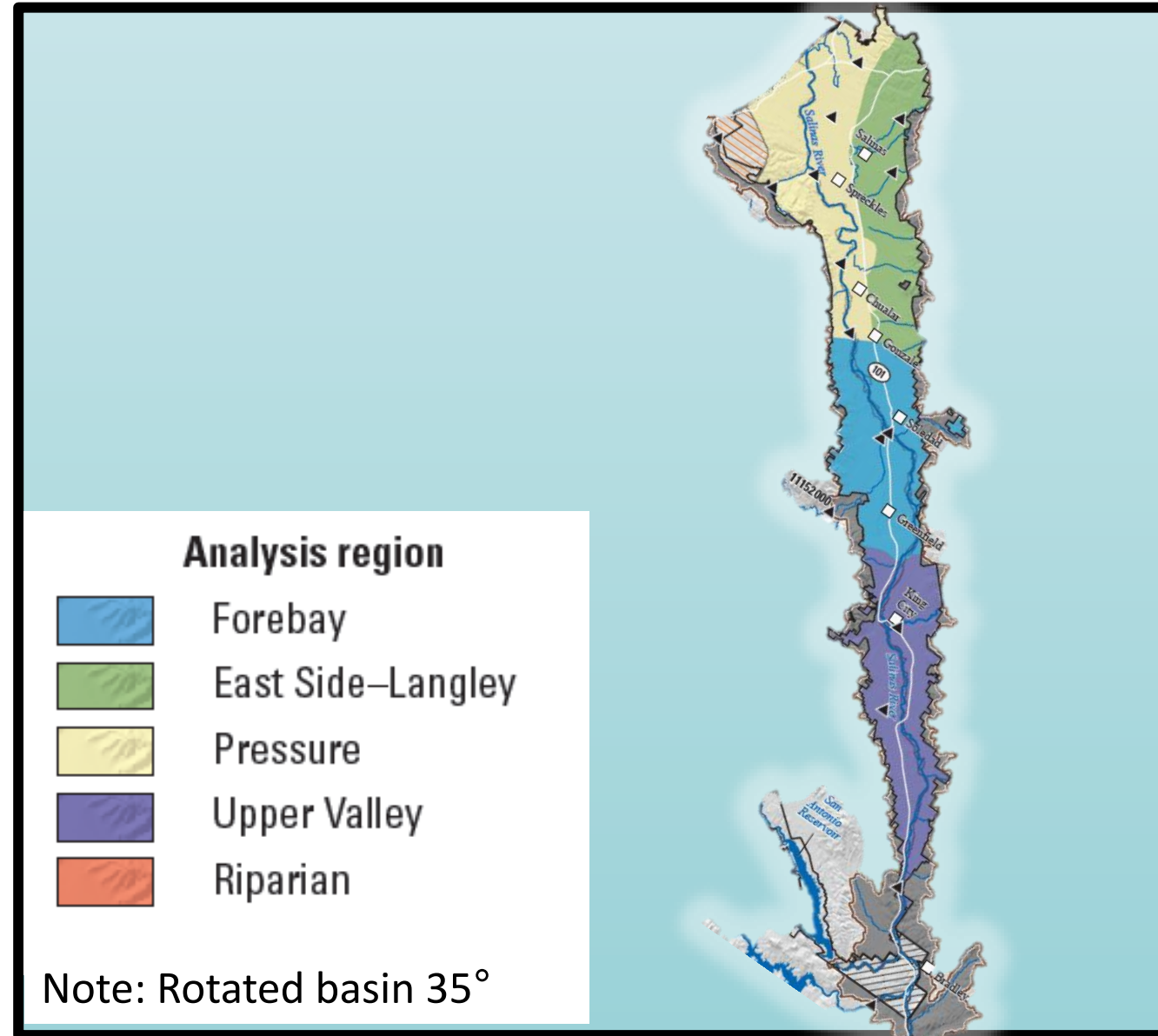


SALINAS VALLEY INTEGRATED HYDROLOGIC MODEL (SVIHM)

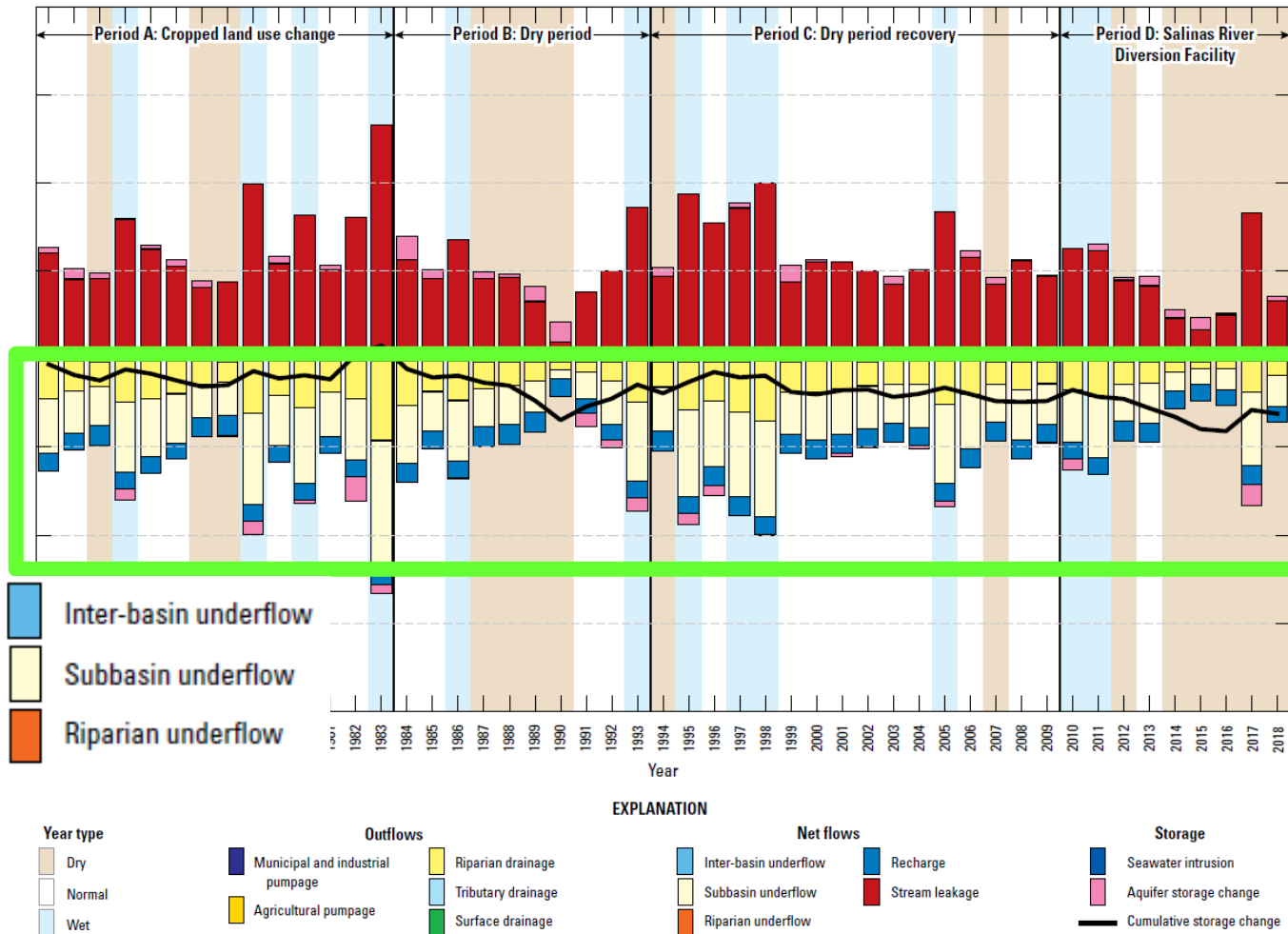
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RIPARIAN GROUNDWATER BUDGET



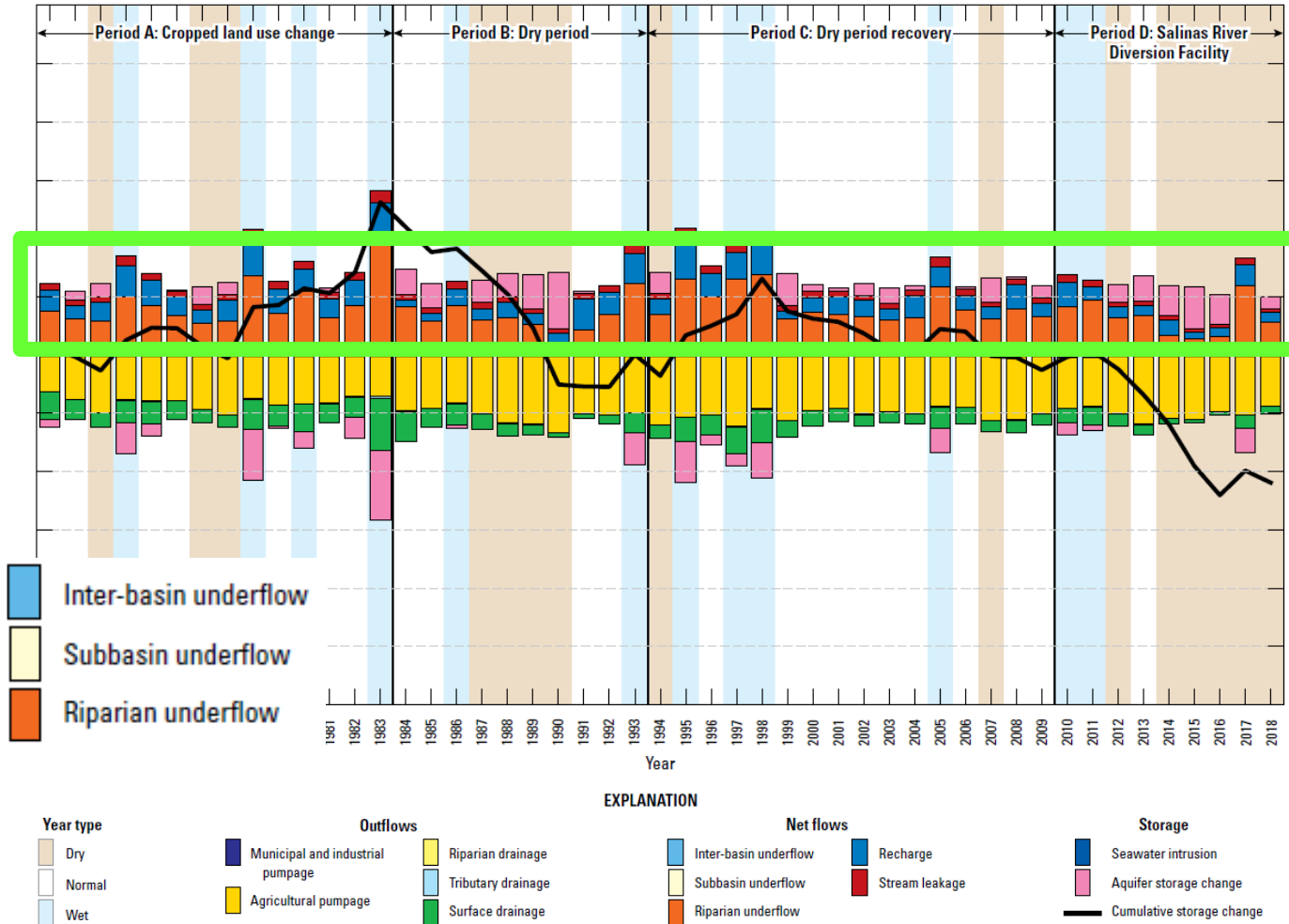
- Primary inflow is seepage
- Primary outflow is subbasin underflow
- Total magnitude of this budget is 3X groundwater subbasin budgets

Note:

Published model results. Y-axis values are not shown to avoid confusion; the underlying model has been refined, the updated model is not yet published, and only relative budget comparisons are relevant for this analysis.



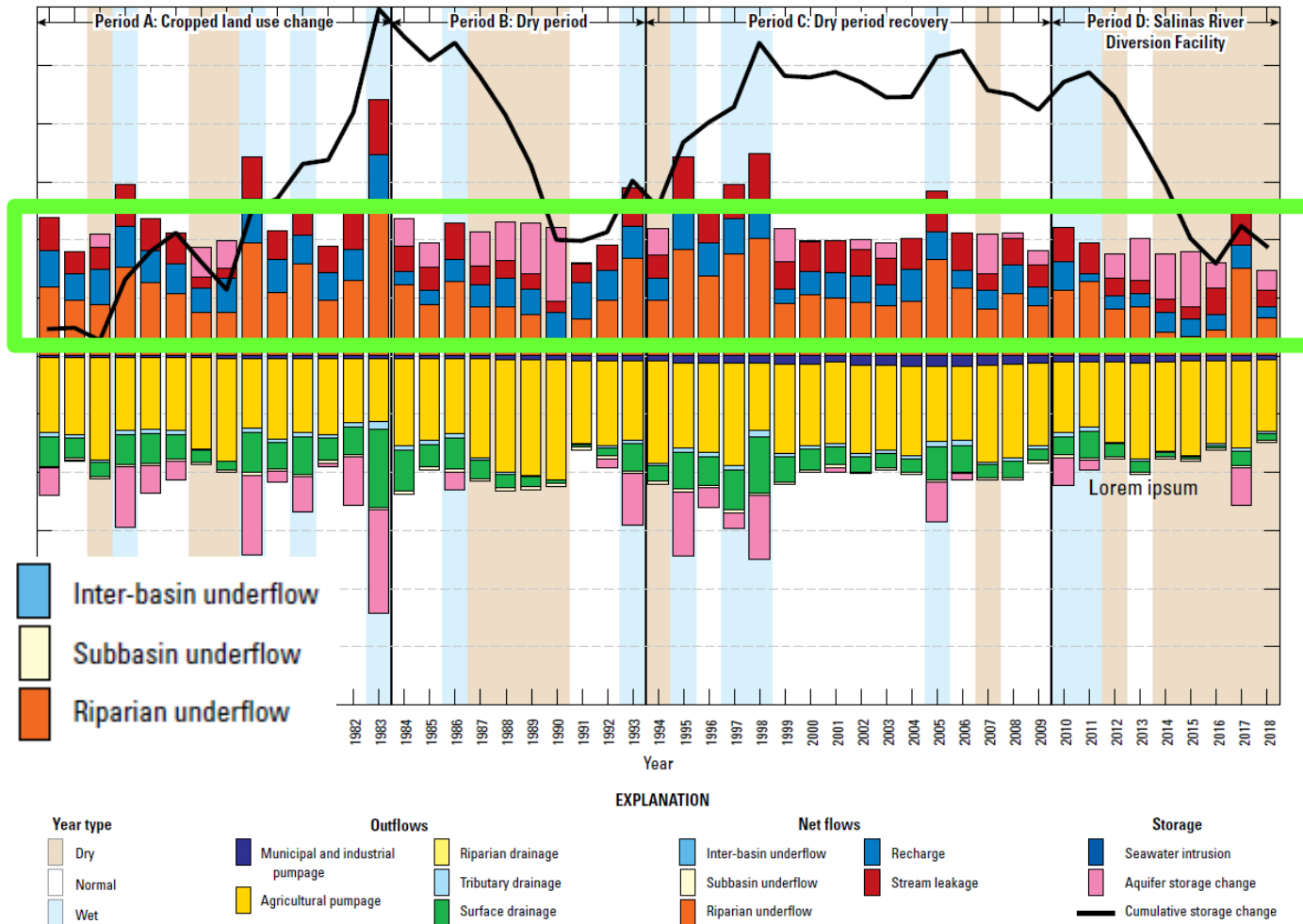
UPPER VALLEY GROUNDWATER BUDGET



- Riparian underflow is the most substantial inflow to this region
- Subbasin underflow is not substantial



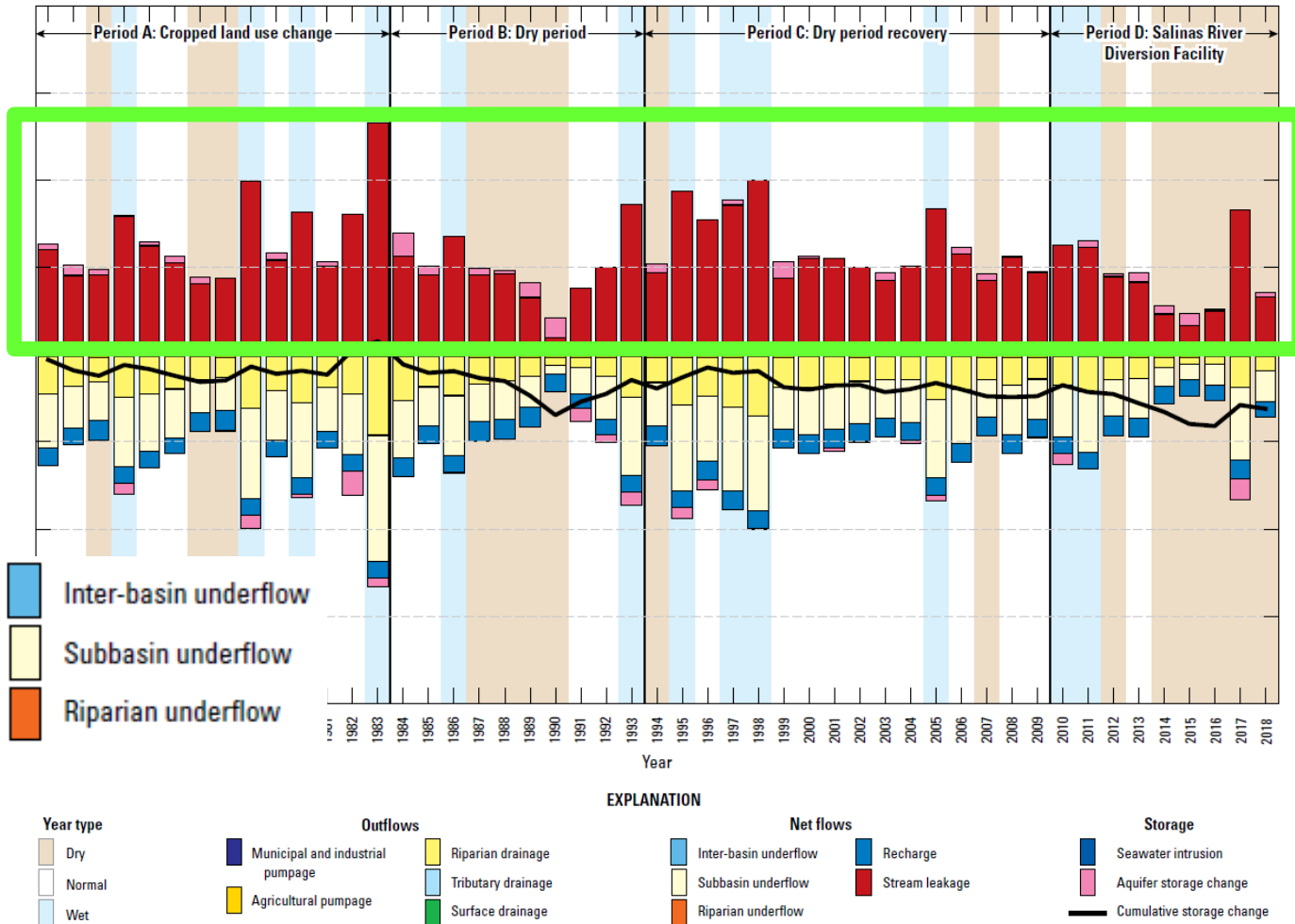
FOREBAY GROUNDWATER BUDGET



- Riparian underflow is the most substantial inflow to this region
- Magnitude of riparian underflow is second highest in this region.
- Subbasin underflow is not substantial



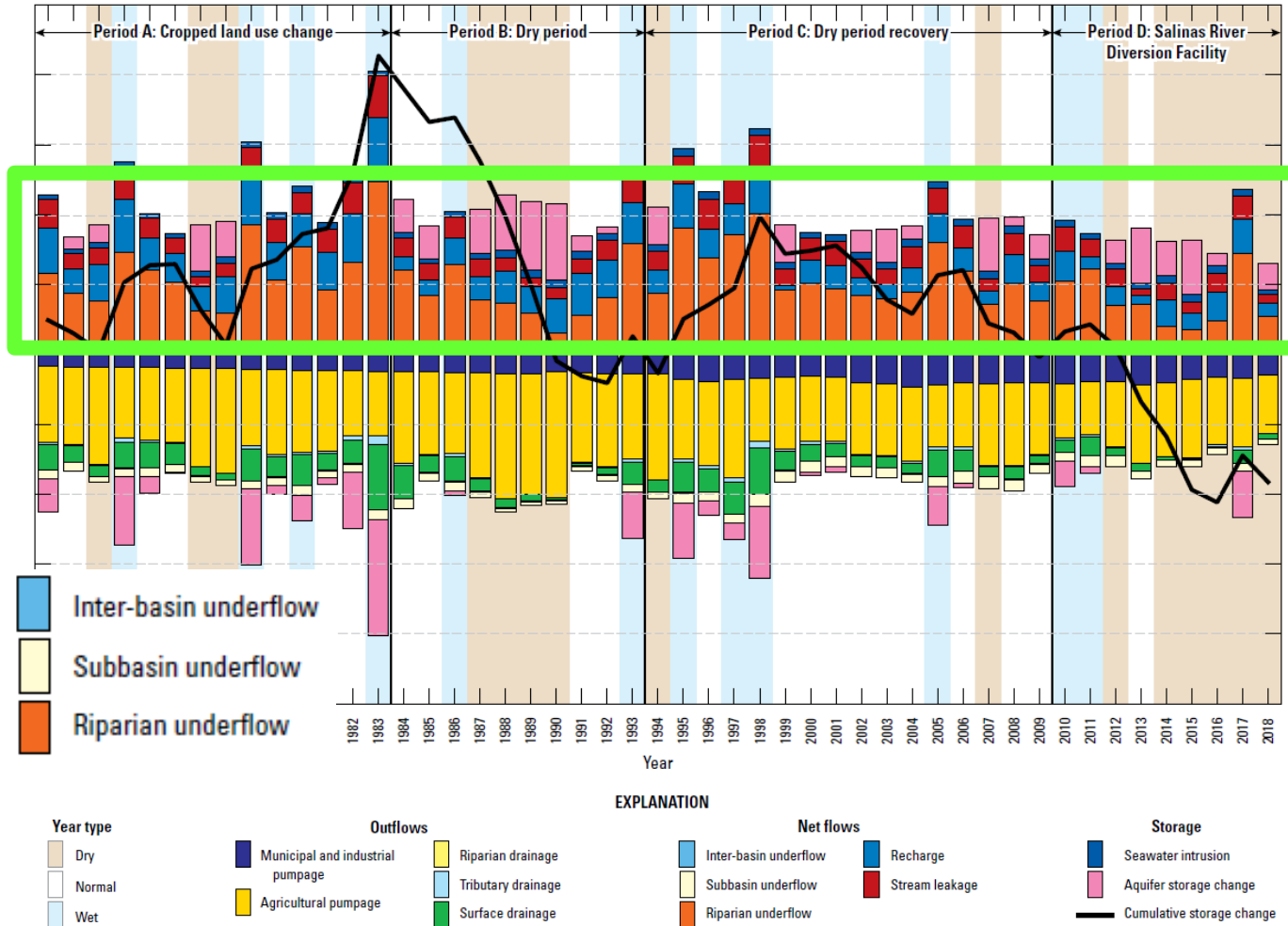
EASTSIDE-LANGLEY GROUNDWATER BUDGET



- Local stream leakage from channels sourced in the Gabilan Range is the most substantial inflow to this region
- Subbasin underflow to adjacent basins is the most substantial outflow



PRESSURE GROUNDWATER BUDGET



- Riparian underflow is the most substantial inflow to this region
- Magnitude of riparian underflow is highest in this region.
- Subbasin underflow to adjacent subbasins is highest of all regions but still low magnitude



WHERE IS THE WATER COMING FROM?

Pumpage-to-Recharge Fraction ¹							
Analysis Region	Entire Simulation 1970-2018	Analysis Period A 1970-1983	Analysis Period B 1984-1994	Analysis Period C 1995-2004	Analysis Period D 2010-2018	2010 High precipitation ²	2013 Low precipitation ³
Riparian	-	-	0.1	-	0.1	-	0.1
Pressure (A)	2.1	1.5	2.5	2.2	2.5	2.0	3.6
Forebay (B)	1.8	1.3	2.2	1.7	2.4	1.6	3.5
Eastside (C)	1.6	1.2	1.9	1.7	2.1	1.6	2.9
Upper Valley (D)	2.3	1.6	2.7	2.2	3.2	2.0	3.8
¹ Pumpage-to-Recharge Fraction = Absolute value of total pumpage / total areal recharge in non-riparian zone ² Highest total precipitation for entire active model domain after Salinas Valley Water Project implementation ³ Lowest total precipitation for entire active model domain after Salinas Valley Water Project implementation							

Across all regions, water demand exceeds areal recharge, underscoring the critical role of Salinas River underflow in supporting subbasin water supply.

TAKE-AWAYS



Salinas Valley Conjunctive Water Management is Complex

- Conveyance losses reduce surface water deliveries to agricultural areas
- Groundwater sustainability management adds additional constraints



Long term water management benefits from evaluation of the entire basin and river system.

- Regional coordination is vital to optimizing water supply while mitigating undesired conditions (seawater intrusion, fish habitat loss, groundwater storage depletion)
- Basin wide models like the SVIHM and SVOM help support this effort.



Evaluating Salinas River riparian area as a separate analysis region reveals some key information

- Subsurface groundwater flows from the riparian area are important in most groundwater subbasins.
- These flows supply a large portion of water demands