

Clear Lake Hitch Hydrology Study

Presentation to Lake County Board of Supervisors
March 2026

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Objectives

- Collect and analyze information about surface water, groundwater, stream geomorphology, and hitch (chi) spawning habitat in selected Clear Lake tributary streams
- Improve understanding of the status of hitch habitat & the effects of surface & groundwater use
- Evaluate water management strategies that can enhance instream flows focused on the spring spawning season

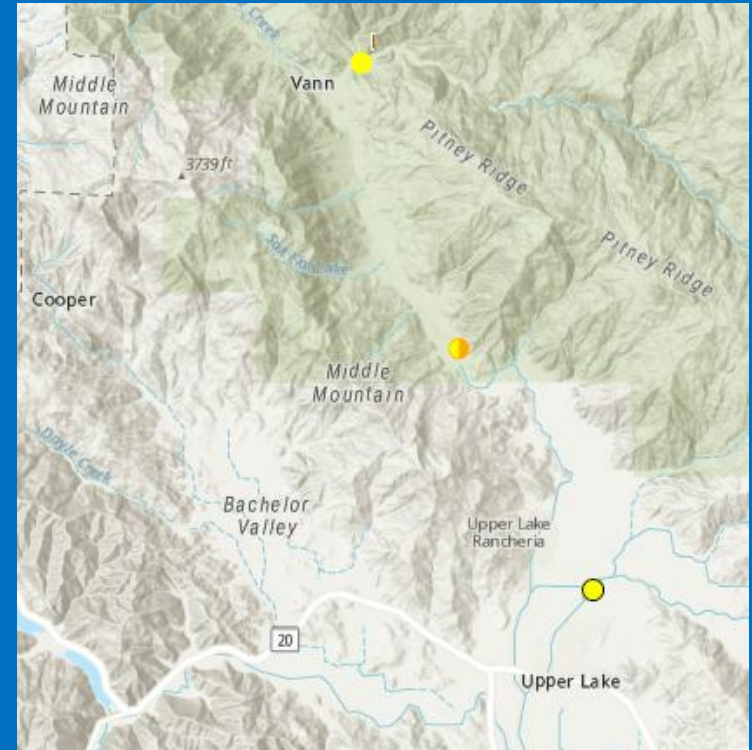
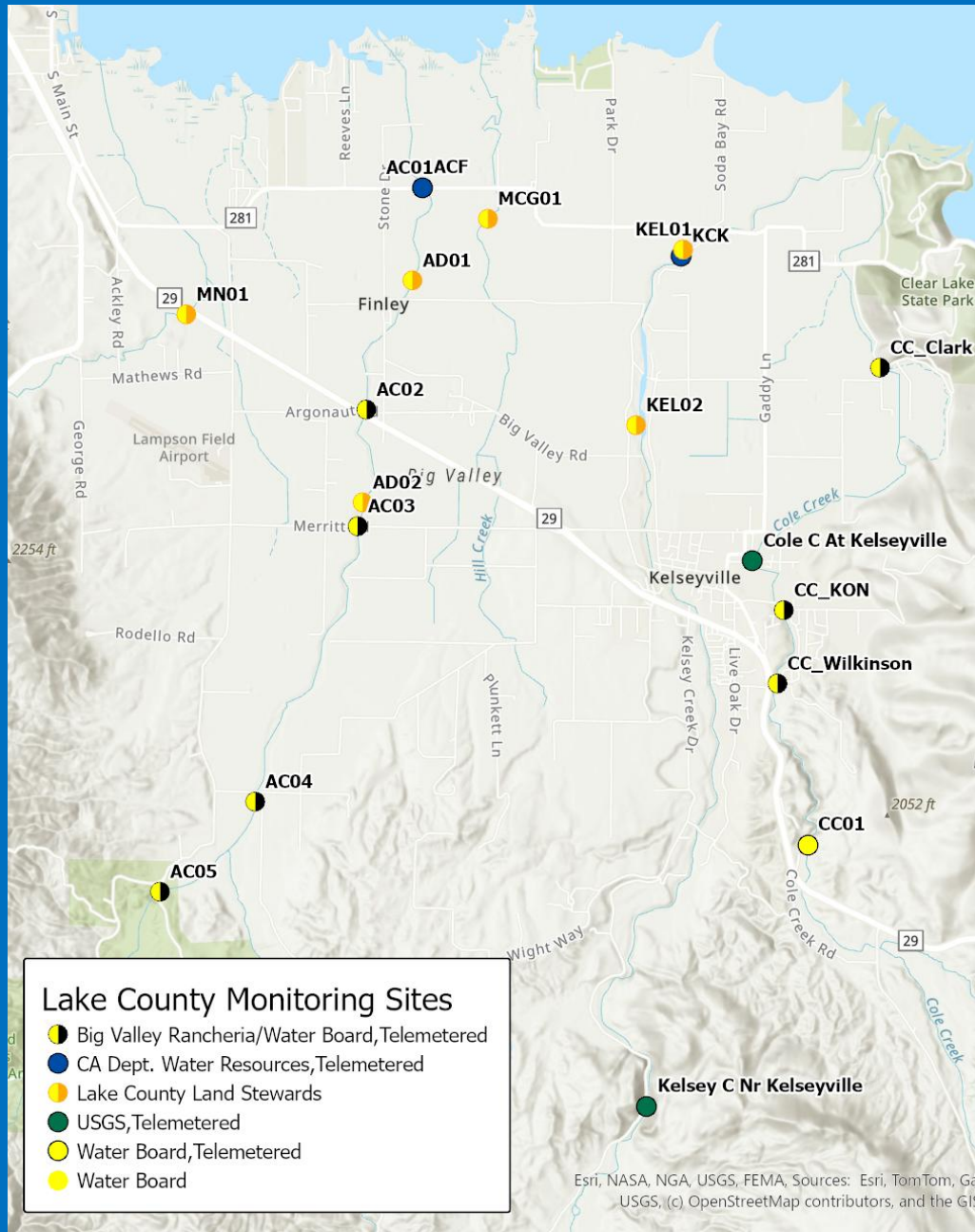
Study Components

- Monitoring & Data Collection (Summer 2023-Summer 2026)
 - streamflows, groundwater elevations, water depths for fish migration
 - compilation of a large volume of existing data & studies
- Hydrologic Analysis (Spring 2025-Spring 2027)
 - analysis & interpretation of field data
 - integrated hydrologic model (MIKE SHE)
- Coordination with Tribes, public agencies, NGOs, landowners, researchers
- Technical Assistance & Knowledge Transfer

Hydrologic Study Overview

- Numerical Hydrologic Model $\approx$ Decision Support Tool
 - Data synthesis and comprehensive description of hydrologic conditions and processes
- Utilize hydrologic simulation model to:
 - Predict location and quantity of surface flows relative to hitch requirements under different climate conditions
 - Evaluate cumulative effects of land and water use on stream flow
 - Prioritize reaches for restoration based on flow availability-based habitat indices
 - Predict effectiveness of strategies to maintain/enhance stream flow for hitch spawning

Streamflow Monitoring Network



Esri, NASA, NGA, USGS, FEMA, Sources: Esri, TomTom, Garmin, USGS, (c) OpenStreetMap contributors, and the GIS User Community

Other Monitoring

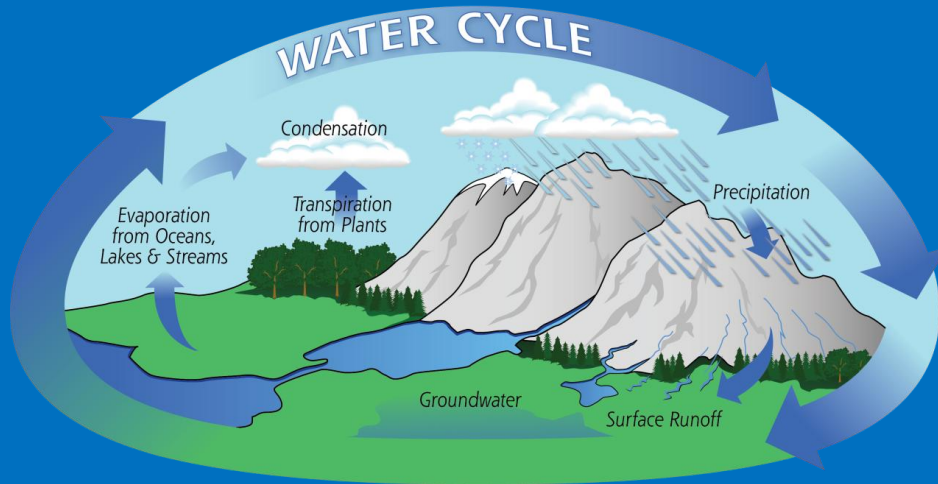
- Groundwater Elevations
 - six wells (OEI/SWB)
 - ~88 other wells in Big Valley (CASGEM, DWR)
- Seepage Runs
 - surface water/groundwater interaction
- Pump Tests
 - aquifer properties
- Fish Passage
 - critical riffle analysis & thalweg depths



Hydrologic Study Approach

Natural Processes

Precipitation
Evapotranspiration
Runoff
Soil Moisture
Groundwater
Streams

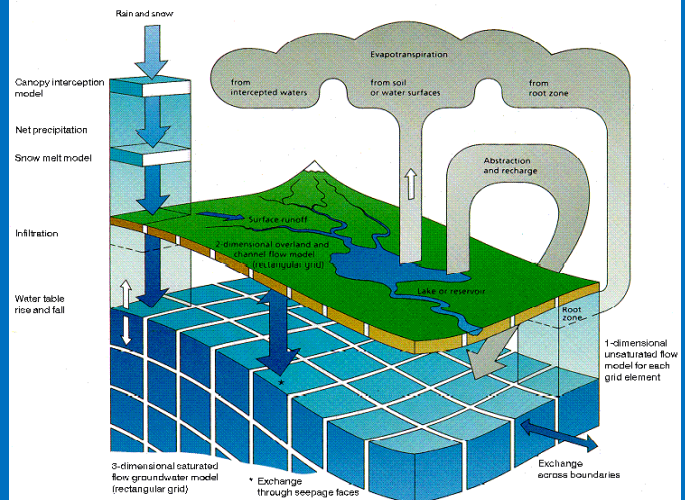


Man-made Influences

Irrigation
Wells
Ponds
Diversions

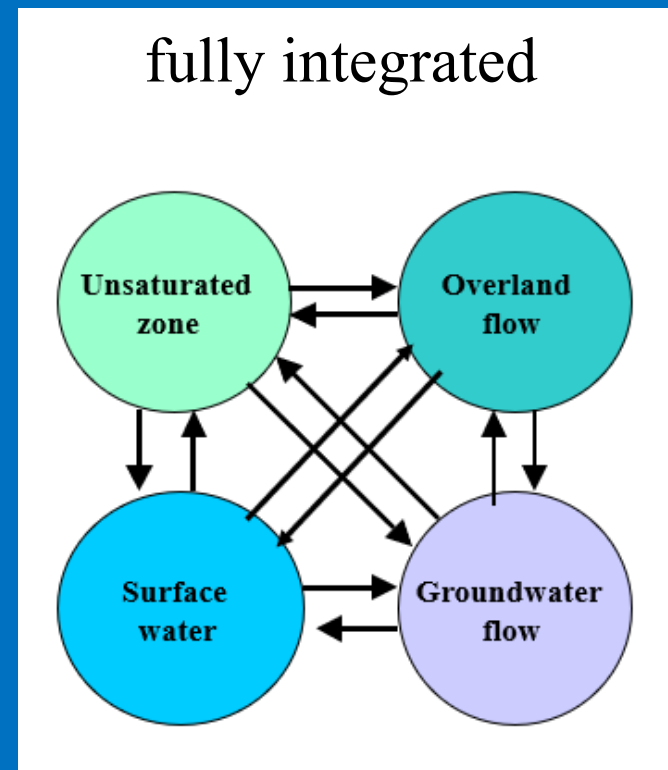
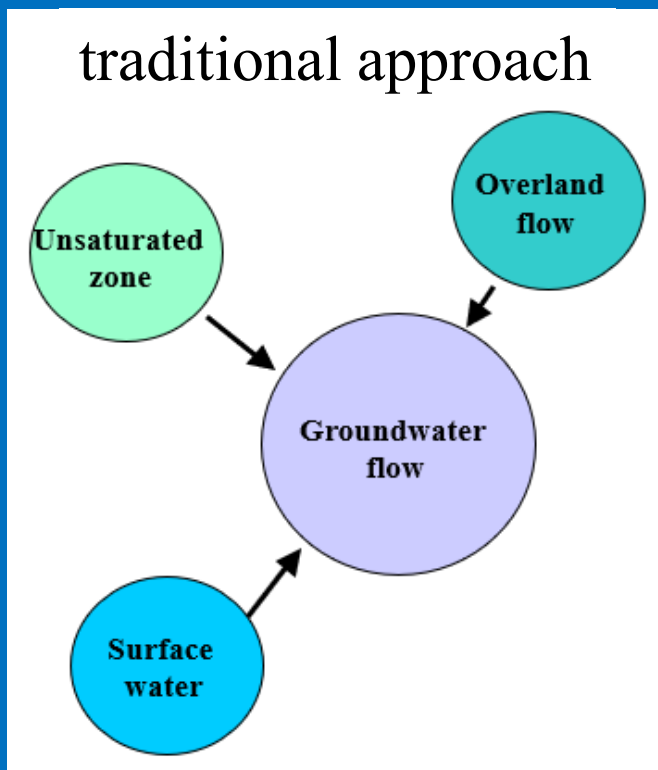
MIKE SHE

an Integrated Hydrological Modelling System



MIKE SHE Model Overview

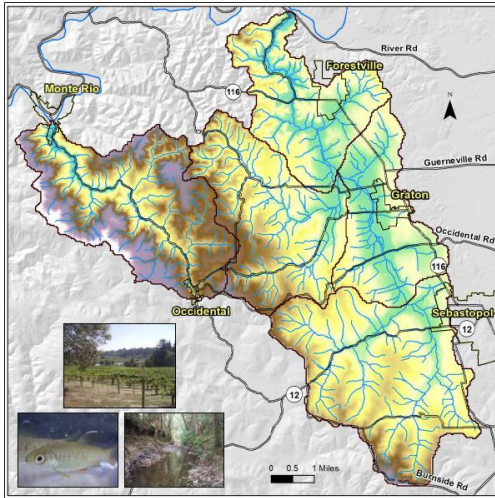
- Fully-distributed & Physically-based
- Mature Code
 - Originally developed in 1977 as an integrated code by the Institute of Hydrology (UK), SOGREAH (France), and DHI (Denmark)
 - Most widely applied integrated code worldwide



Existing Integrated Numerical Models

Integrated Surface and Groundwater Modeling and Flow Availability Analysis for Restoration Prioritization Planning:

Green Valley\Atascadero and Dutch Bill Creek Watersheds, Sonoma County, California



March 2016

Integrated Surface and Groundwater Modeling and Flow Availability Analysis for Restoration Prioritization Planning, Upper Mark West Creek Watershed, Sonoma County, CA



Wildlife Conservation Board Grant Agreement No. WC-1996AP
Project ID: 2020018

November 2020

Integrated Surface and Groundwater Modeling and Flow Availability Analysis for Restoration Prioritization Planning, Mill Creek Watershed, Sonoma County, CA



Wildlife Conservation Board Grant Agreement No. WC-1659EH
Project ID: 2017033

June 2021

River Research and Applications

RESEARCH ARTICLE

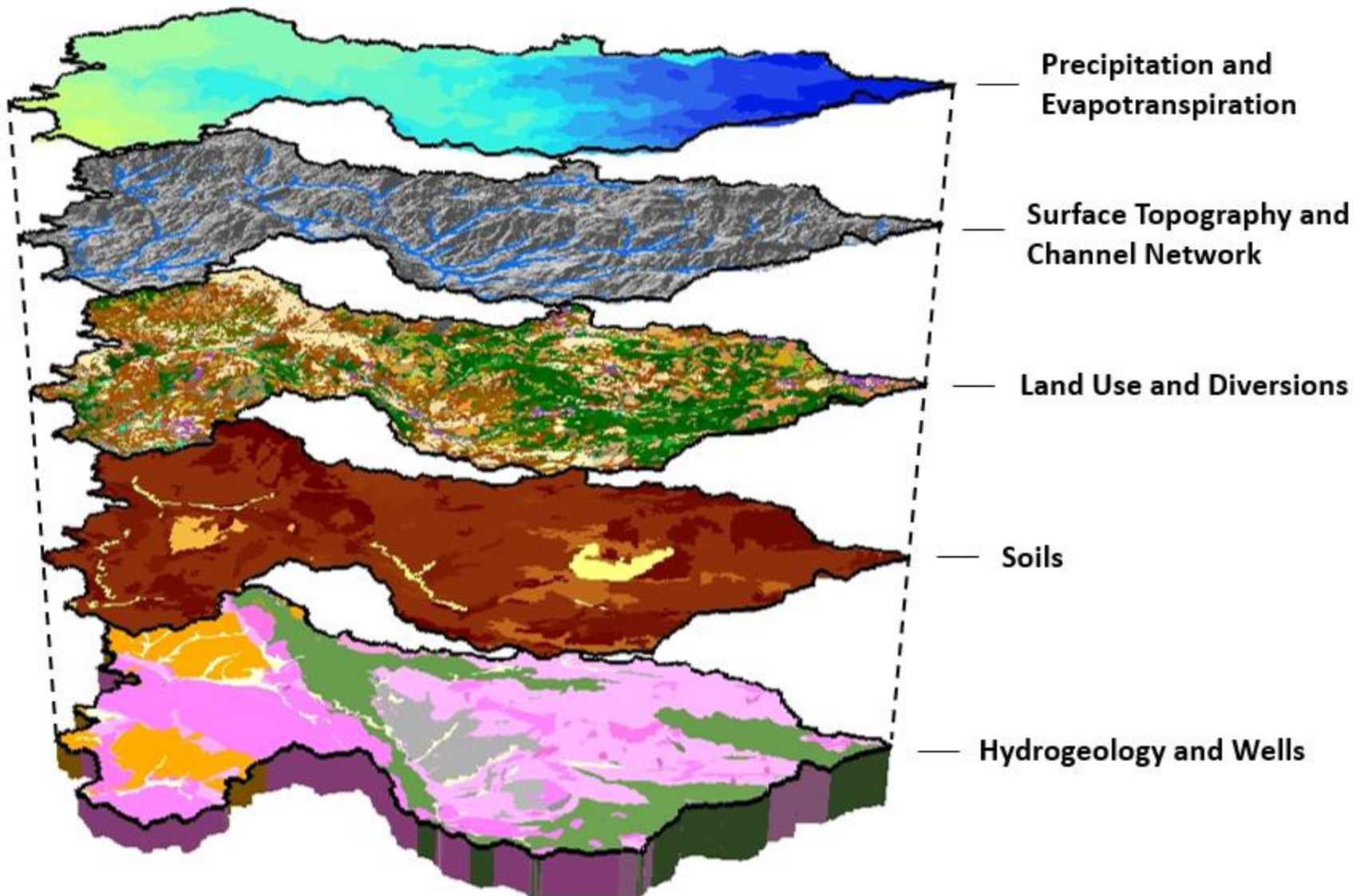
Developing Effective Flow Enhancement Strategies for Salmonid Recovery and Climate Change Adaptation in Central California's Coastal Watersheds

www.coastrangewater.org/projects

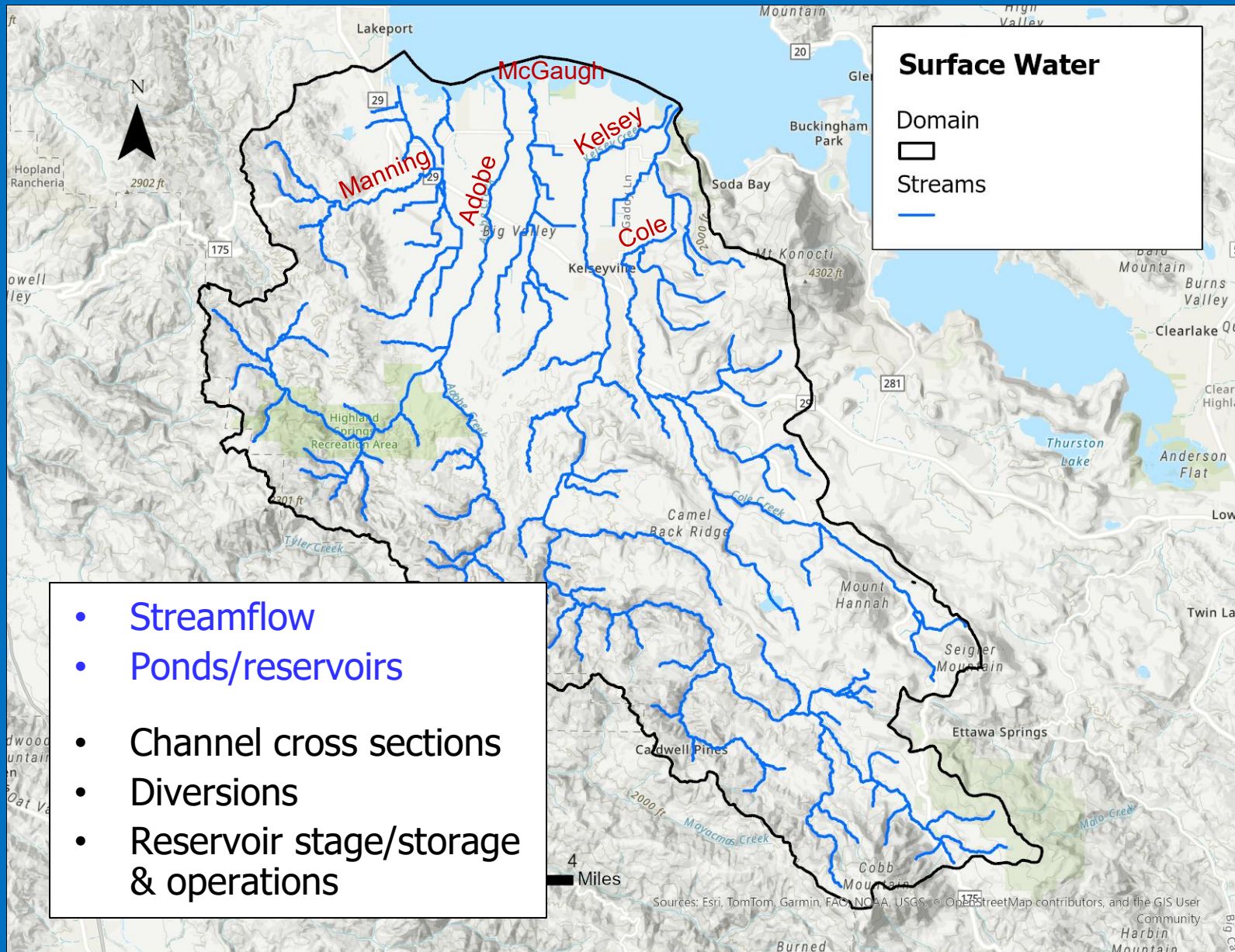
Model Overview

- Domain
 - Big Valley Groundwater Basin & contributing watersheds
- Resolution
 - 1.6-acre grid, stream cross sections every 250 ft
 - daily timestep (most processes), hourly (streamflow)
 - ~10-yr simulation of recent conditions (dry, average, & wet water years)

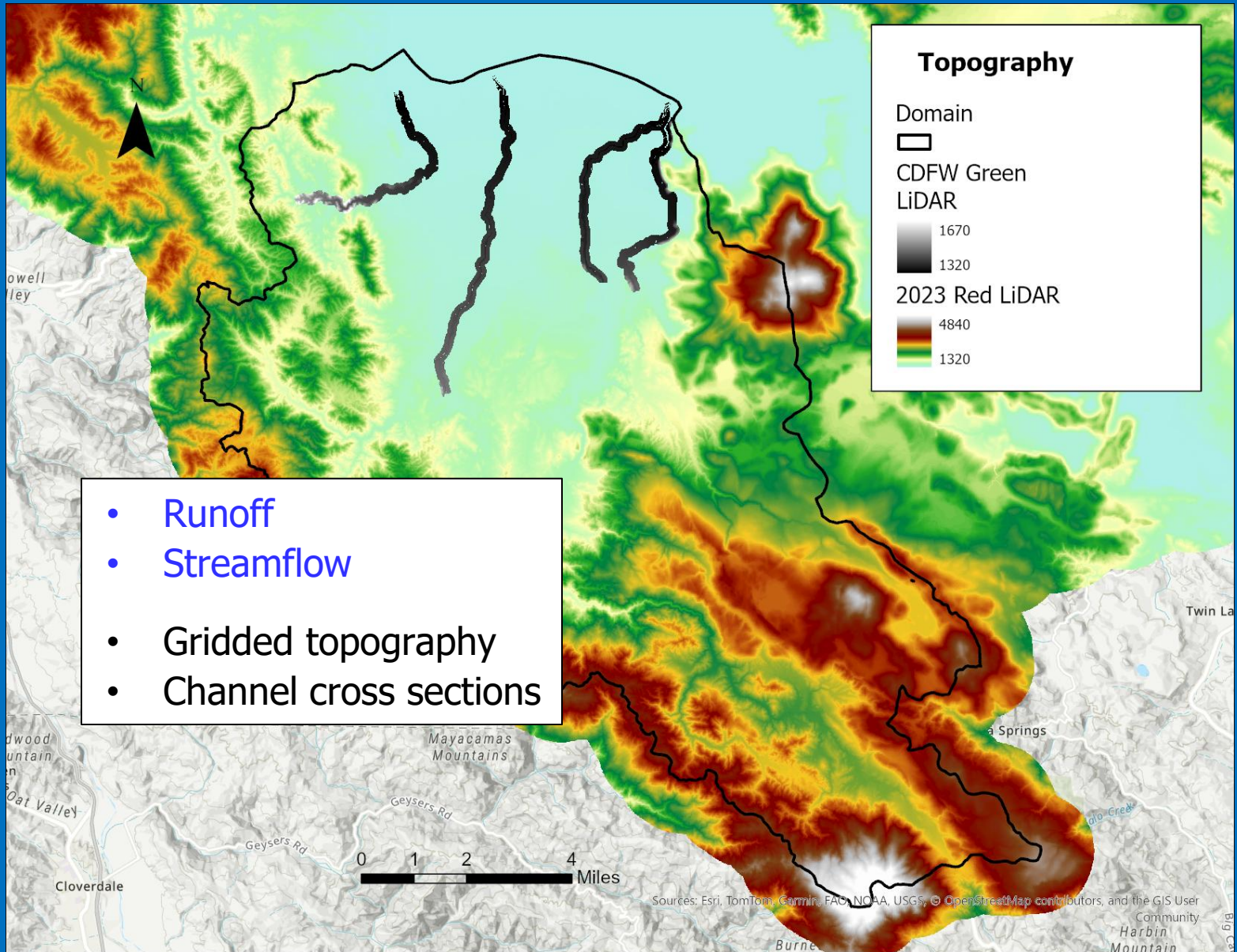
Model Input Data



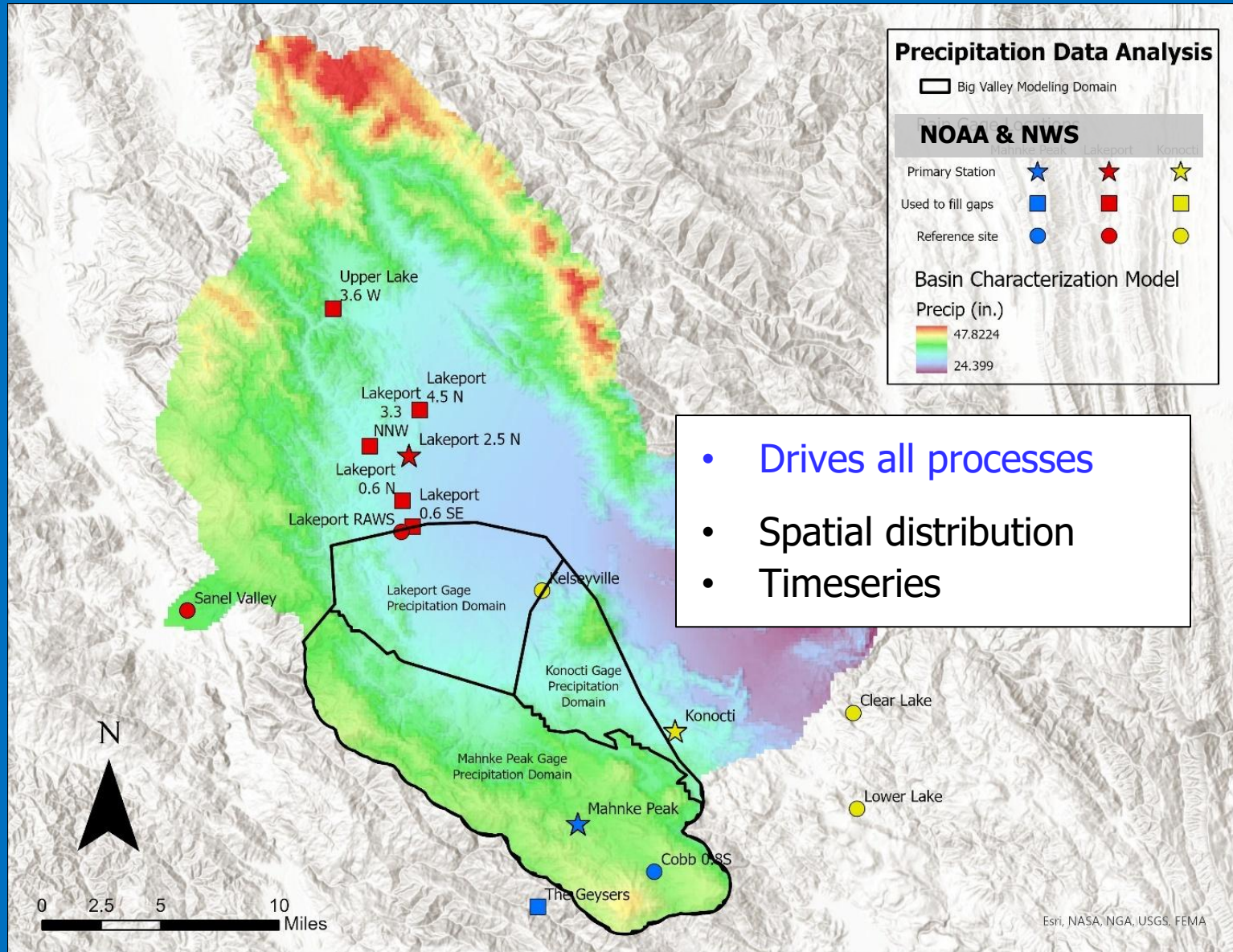
Surface Water



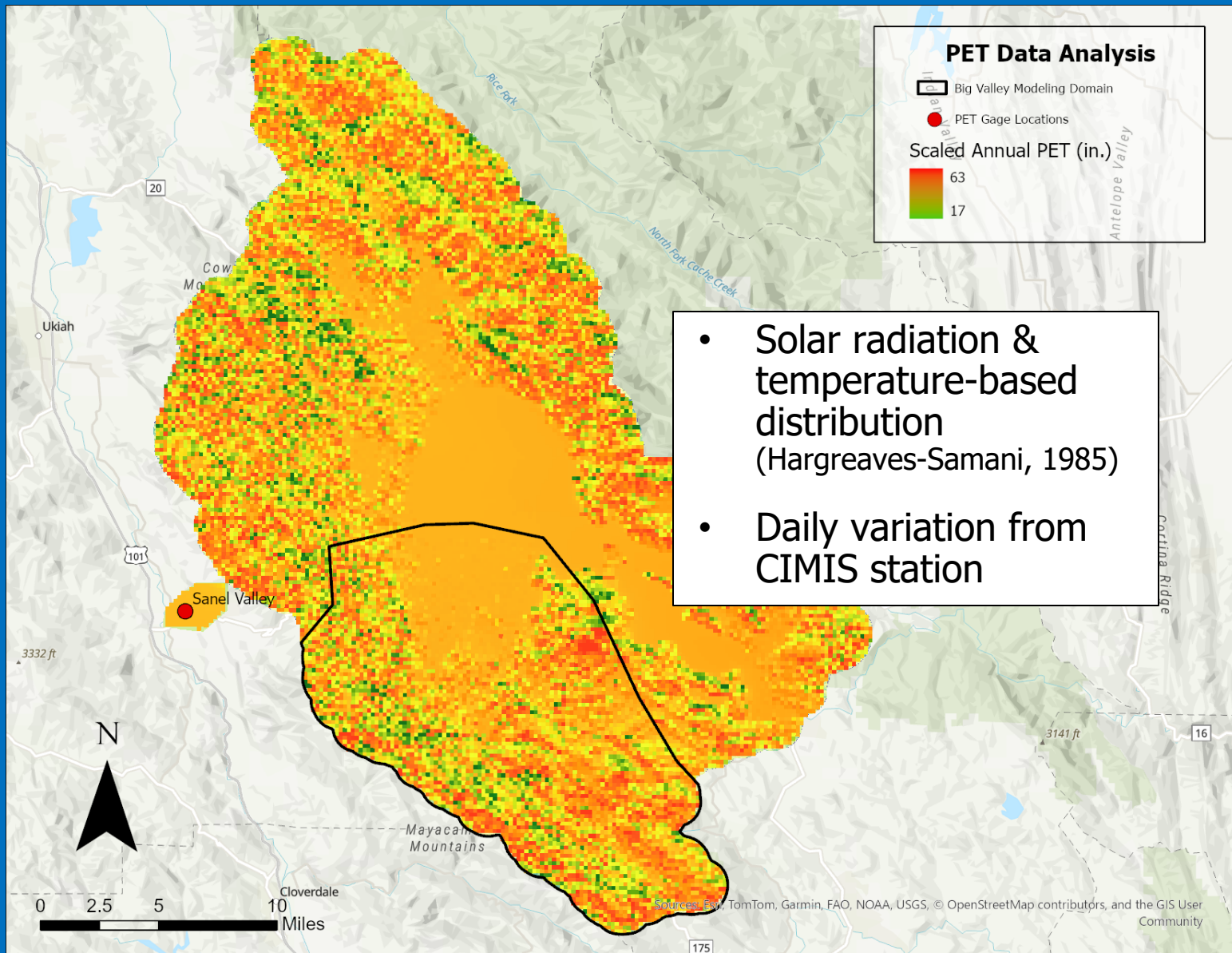
Topography



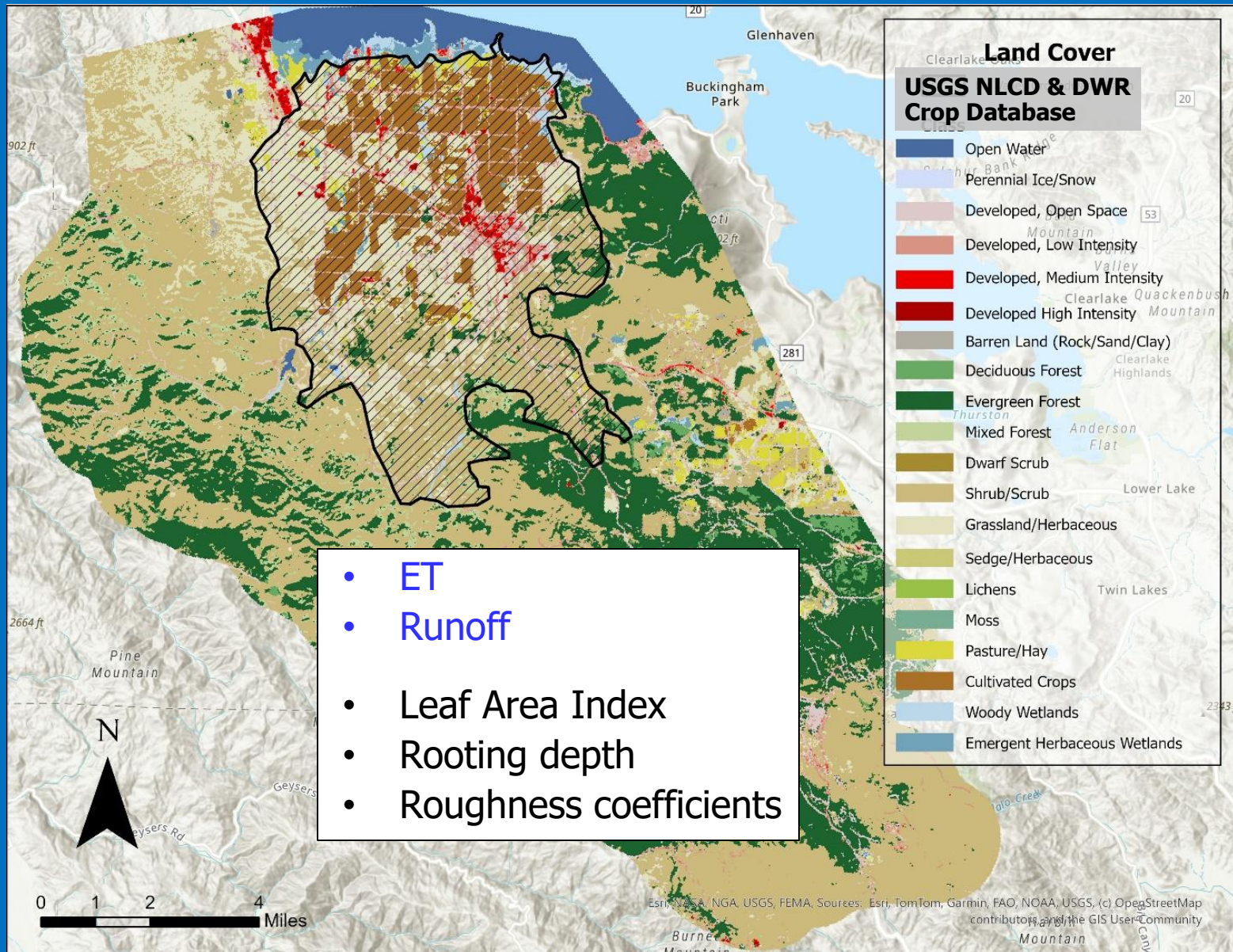
Precipitation



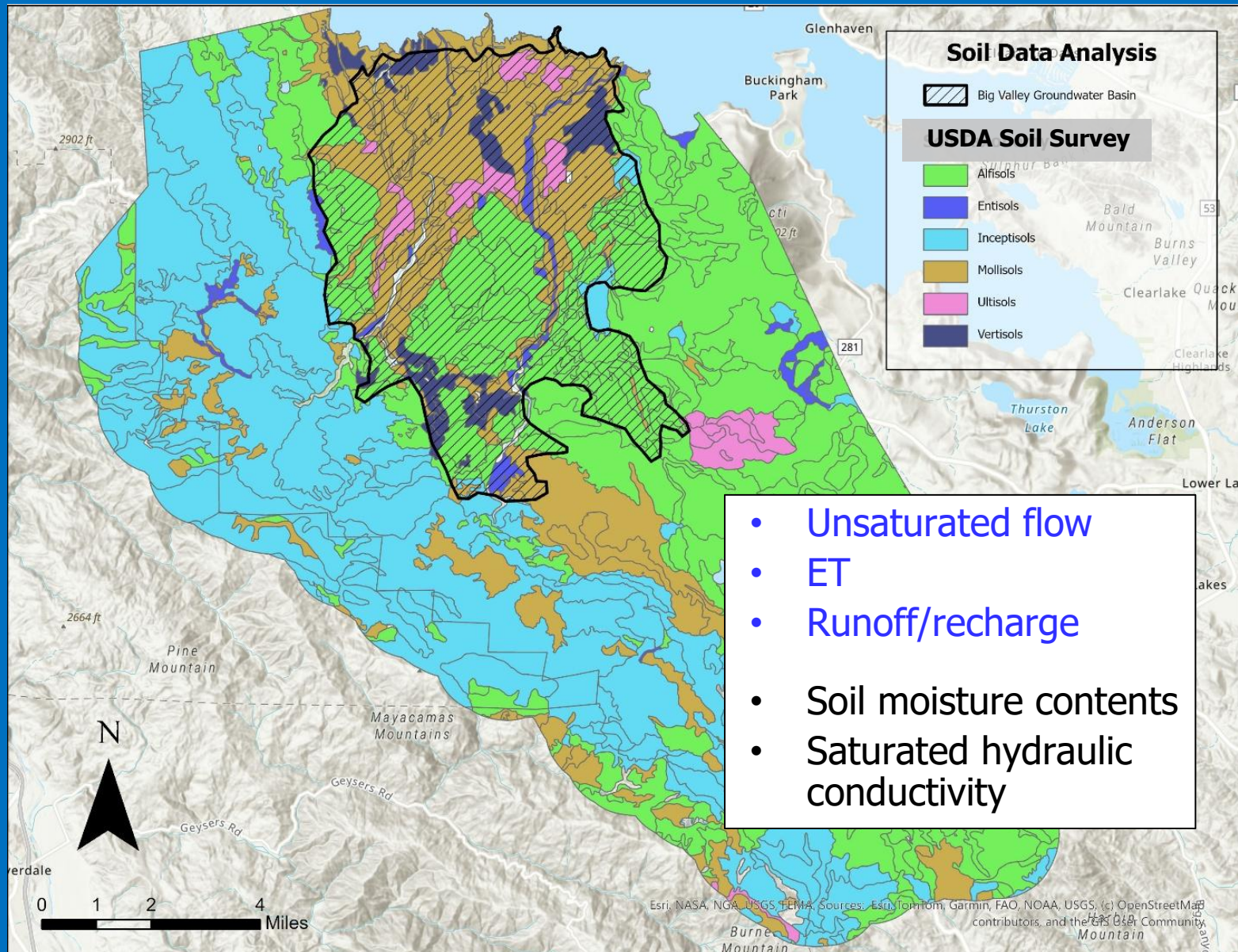
Potential Evapotranspiration



Landcover



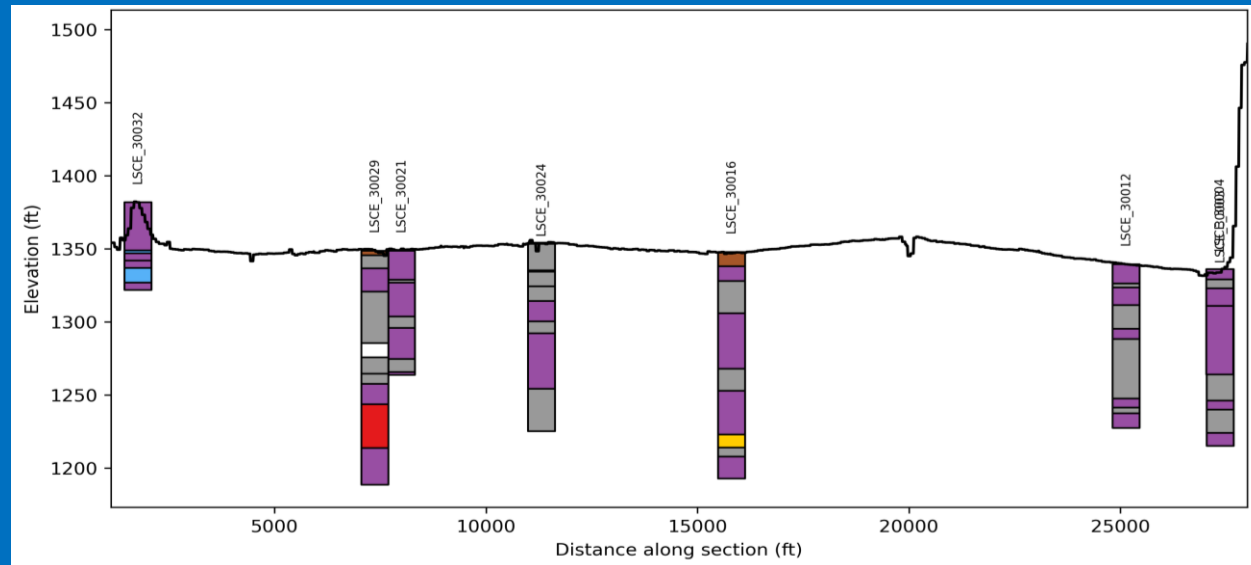
Soils



Hydrogeology

- Prior Studies
 - 1967 & 2003 Groundwater Recharge Reports
 - 2022 Groundwater Sustainability Plan
 - Hydrologic Model
- Distribution of materials
 - geologic maps & well completion reports
 - AEM surveys
- Aquifer properties
 - pump tests

- Groundwater flow
- Groundwater pumping
- Distribution of geologic materials
- Hydrogeologic properties (K , S , S_y)



Water Use

- Information Order
 - water sources, water uses, well details
 - CalWATRS/eWRIMS
 - surface water diversions
 - Census data & municipal use
 - domestic use
 - County permits
 - cannabis, wineries
 - DWR crop database
 - agricultural uses
- Diversions
 - Groundwater wells
 - Ponds
 - Irrigation & frost protection
 - Sources of water
 - Rates of use & application

Fish Habitat

- Guide interpretation of modeled management/water use effects
 - Relating simulated streamflows to habitat needs
- Optimal & minimum flows for hatch spawning habitat
 - Tribal studies
 - Adobe Creek Chi Habitat Suitability Assessment
 - Stream disconnection/fish rescue data
 - Other?
 - CDFW Instream Flow study
 - OEI riffle analysis

Schedule

- Monitoring
 - August 2023 – August 2026
- Hydrologic Model Development
 - March 2025 – March 2026
- Model Calibration
 - March 2026 – July 2026
- Scenario Analysis
 - August 2026 – December 2026
- Meetings at Key Milestones
 - Fall 2025
 - Fall 2026
 - Spring 2027



Thank You

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