Water Supply and Demand Assessment Program
Napa River Watershed

State Water Board Staff

CALIFORNIA
Water Boards

Division of Water Rights

Meeting Agenda

- Background on Russian River Drought Response
- Water Supply & Demand Assessment Program Overview
- Napa River Watershed
- Model Specifics & Work Plan

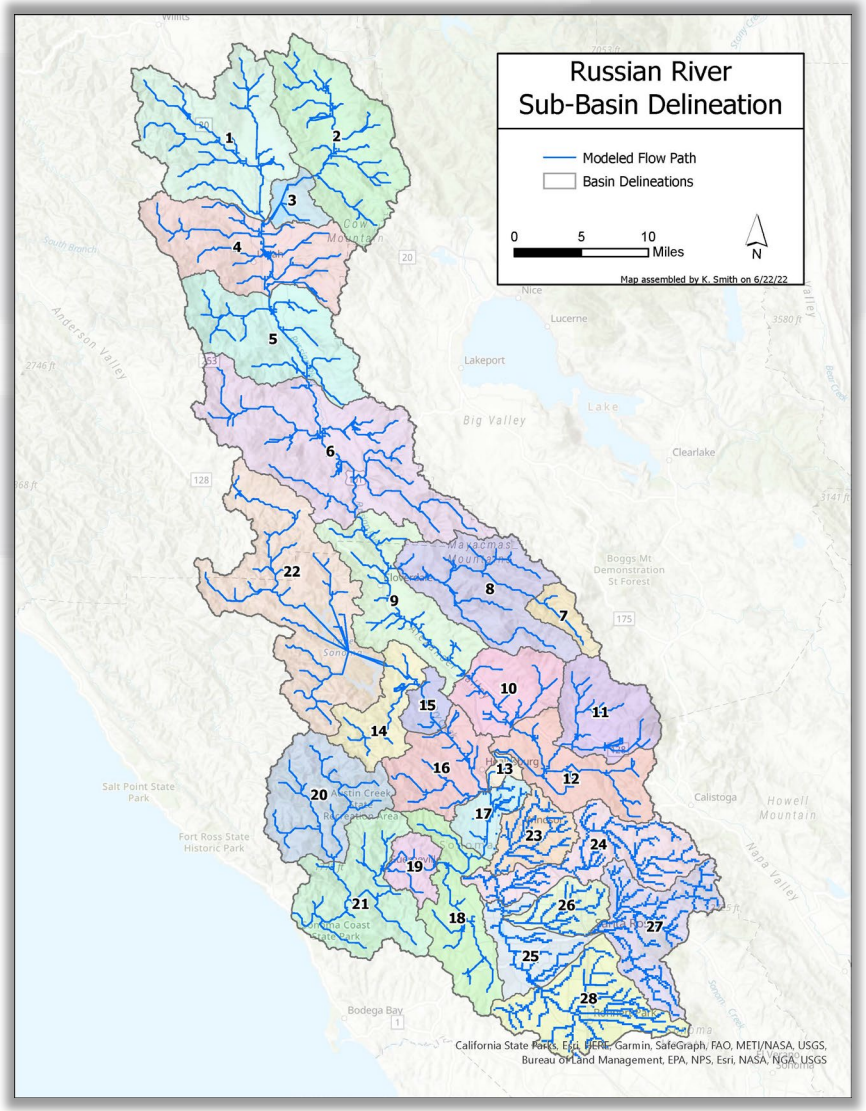
Background: Russian River Drought Response

- Emergency Regulations (2021-22)
  - Board adopted emergency regulations to prevent the unreasonable use of water and to require curtailments to protect senior water rights
  - Set specific exceptions to curtailment (Human Health & Safety Needs, Non-Consumptive Uses, etc.)
  - Established a methodology for determining water availability for diverters in the Russian River watershed, at their priority of right
- Curtailment
  - Month-by-month curtailment based on forecast models and water right priority
  - Voluntary Water Sharing Program was developed with local stakeholders as an alternative to curtailment

Russian River Drought Response

Water management using water allocation tool

- Observed and forecasted climate data are used to run hydrologic models that represent the “water supply” in watershed
- Division staff clean and process the diversion data (from annual water use reports) to develop a dataset that represents “water demand”
- Tool allocates available supply to water right holders based on the water right priority date, demand, and forecasted flow data on a monthly basis



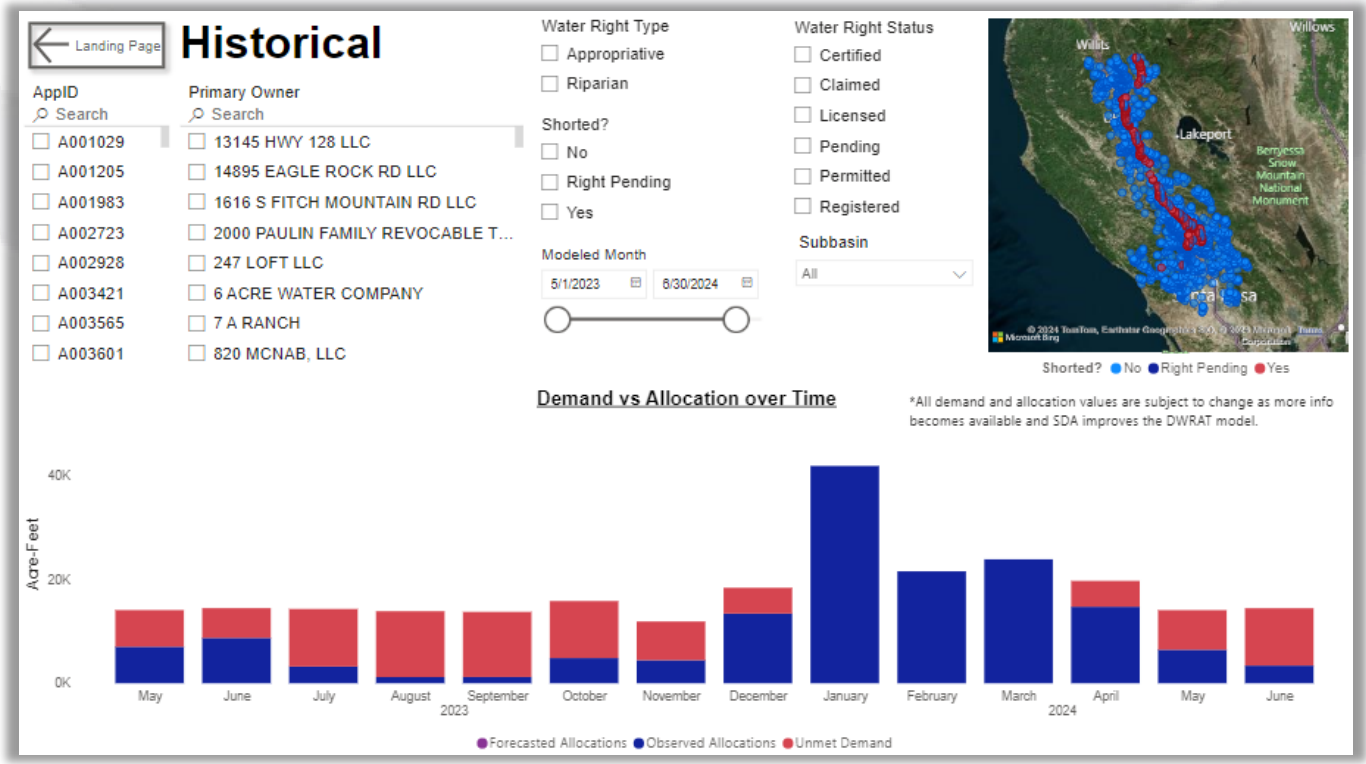
Supply & Demand Assessment Program

- Authorized in 2022, includes 9 positions building on Russian River drought response
- $15M modeling contract with Paradigm Environmental, Inc.
- **Goal:** Provide data and tools to inform better planning and decision-making during times of water shortage

Lake Mendocino, October 2021. CA DWR

Supply & Demand Assessment Program

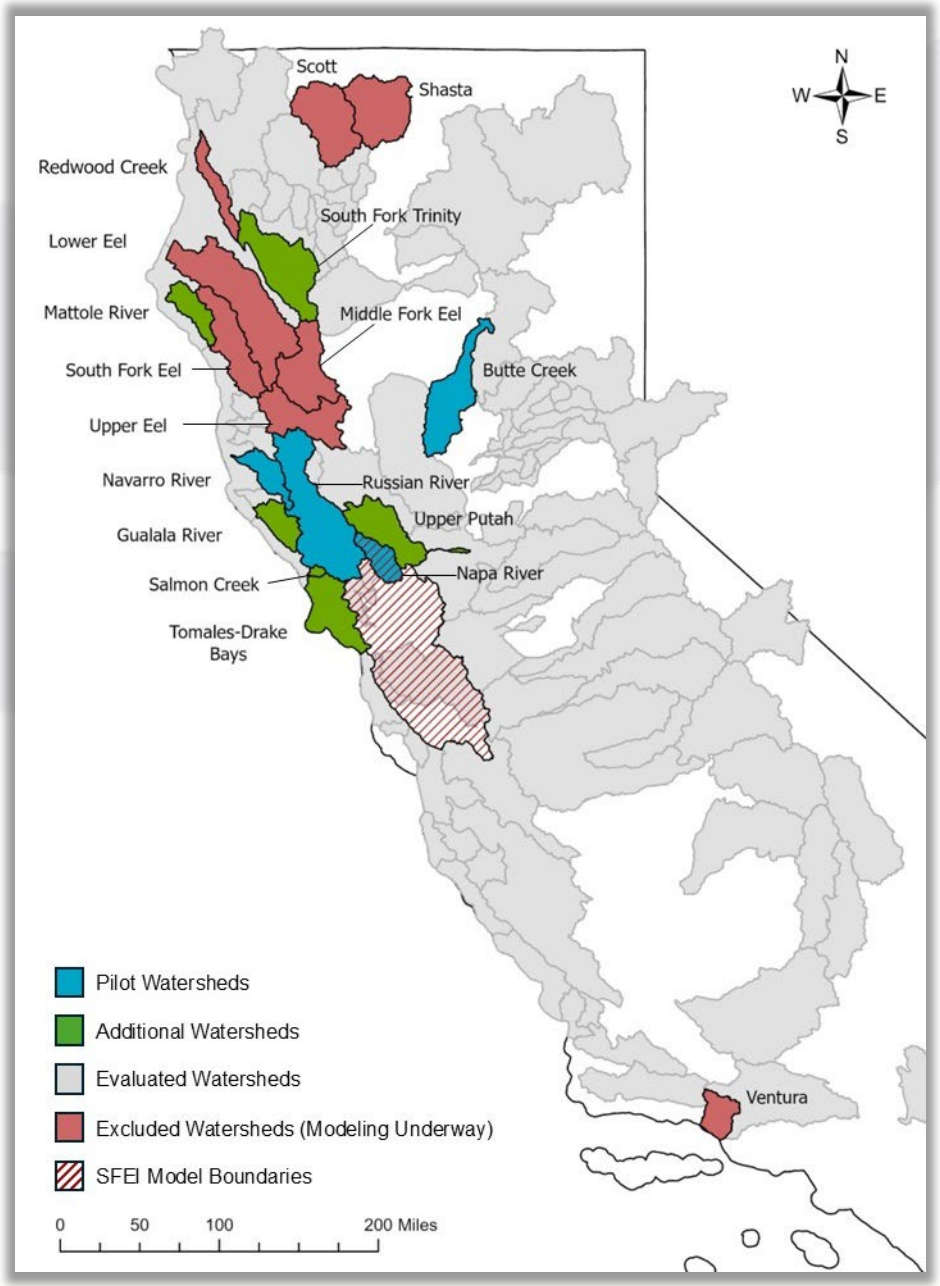
- Objective: Develop hydrologic models and tools to assess supply and demand in select watersheds throughout California to support local and Board efforts
    - All tools (supply models, demand datasets, and water allocation tools) open source and accessible to public



Power BI Data Visualization tool for the Russian River watershed
Available on the SDA Webpage: www.waterboards.ca.gov/sda

Selected Watersheds

- Pilot Watersheds
  - Butte Creek
  - Napa River
  - Navarro River
- Additional Watersheds
  - Gualala River
  - Mattole River
  - Salmon Creek
  - South Fork Trinity
  - Tomales-Drake Bays
  - Upper Putah



Selected Watershed Characteristics

- Driven by the presence of significant **surface water demand** (regions where analysis would likely be successful)
- Contain regions of **salmonid habitat** or other important fisheries with known flow concerns
- Targeting watersheds in the **North Coast**, **San Francisco Bay**, and **Central Coast** Regions, but not a formal requirement
- Be a region where the Division is **not already engaged** in other drought or flow assessment efforts unless modeling work at a sub watershed level would accelerate efforts

Assessing Water Demand

- Modeling framework incorporates self-reported water diversion data provided by diverters via annual water use reports
- 441 water rights in Napa River watershed
- Water use (demand) data applied in:
  - Water supply model:
    - To consider impact of diversions on streamflow
    - To better estimate evapotranspiration
  - Water allocation tool:
    - As a proxy for demand data to account for water demand of each catchment

Water Right Reporting: Background

- Annually, water rights holders (or agents) required to report amount of water diverted, stored, and used during each month
- Self-reported data often contains errors related to missing or duplicate reporting, unit conversions, or multiple owners
- Cleaned up data can be used to represent water demand for a watershed

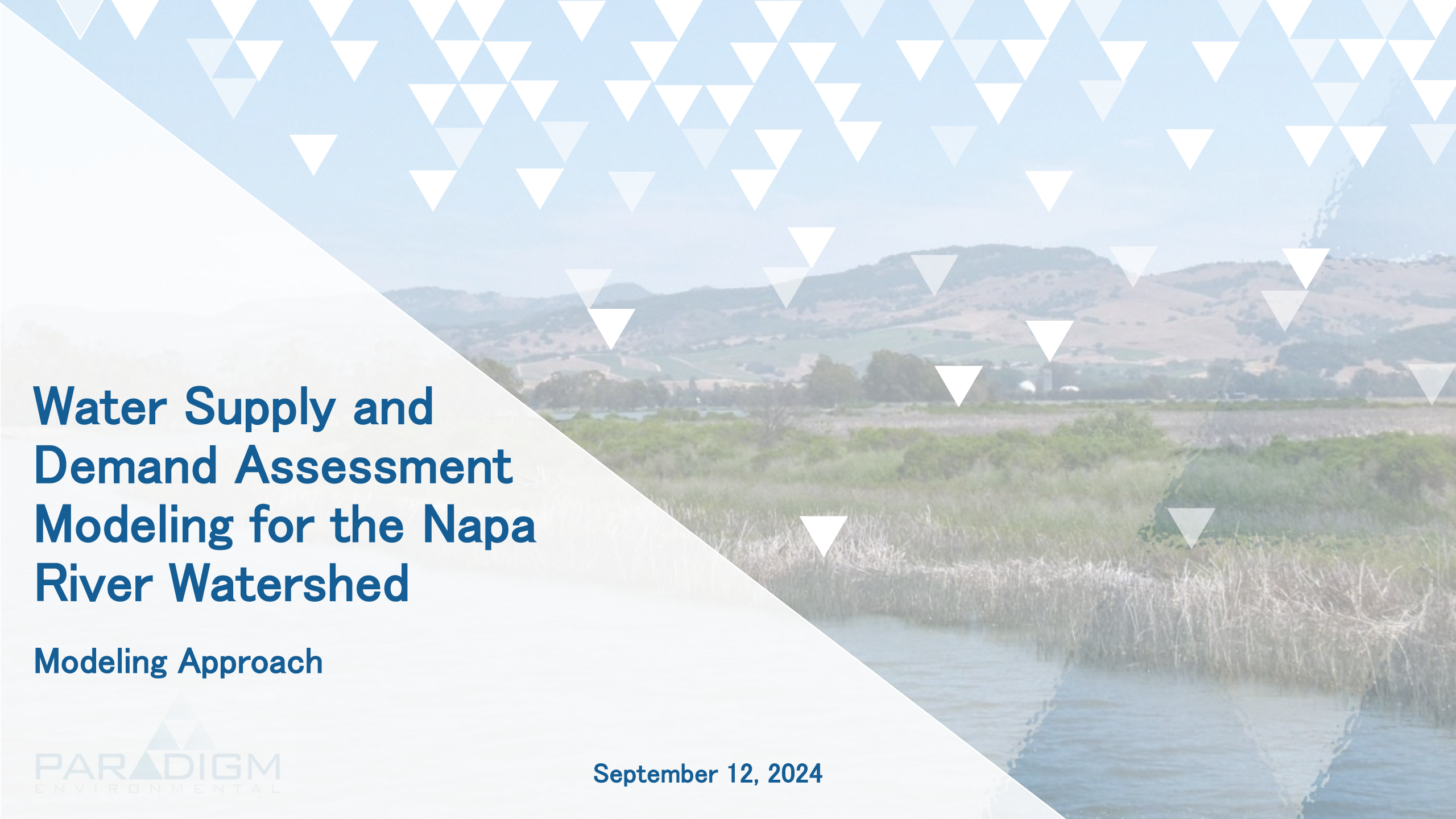
South Yuba River, June 2023. CA DWR.

Assessing Water Demand

- Self-reported water use data underwent Quality Assurance and Quality Control (QA/QC) before application in model
- QA/QC process included:
  - Assessing geolocational accuracy: ensuring points of diversion were plotted correctly and flowed into the watershed instead of neighboring watersheds
  - Correcting units (e.g., reporting in gallons instead of acre-feet)
  - Detecting duplicate reporting (e.g., when multiple water rights exist at a single point of diversion, it can lead to double or triple counting diversion amounts)

Next Steps

- Model will be validated with data not already included in calibration process
- Staff intend to use final model to evaluate scenarios involving:
  - Current hydrologic conditions
  - Water allocations
  - Changes in demand
  - Impact of extreme events such as drought on water allocation
- Collaboration with local agencies and organizations



Water Supply and Demand Assessment Modeling for the Napa River Watershed

Modeling Approach

PARADIGM ENVIRONMENTAL

September 12, 2024

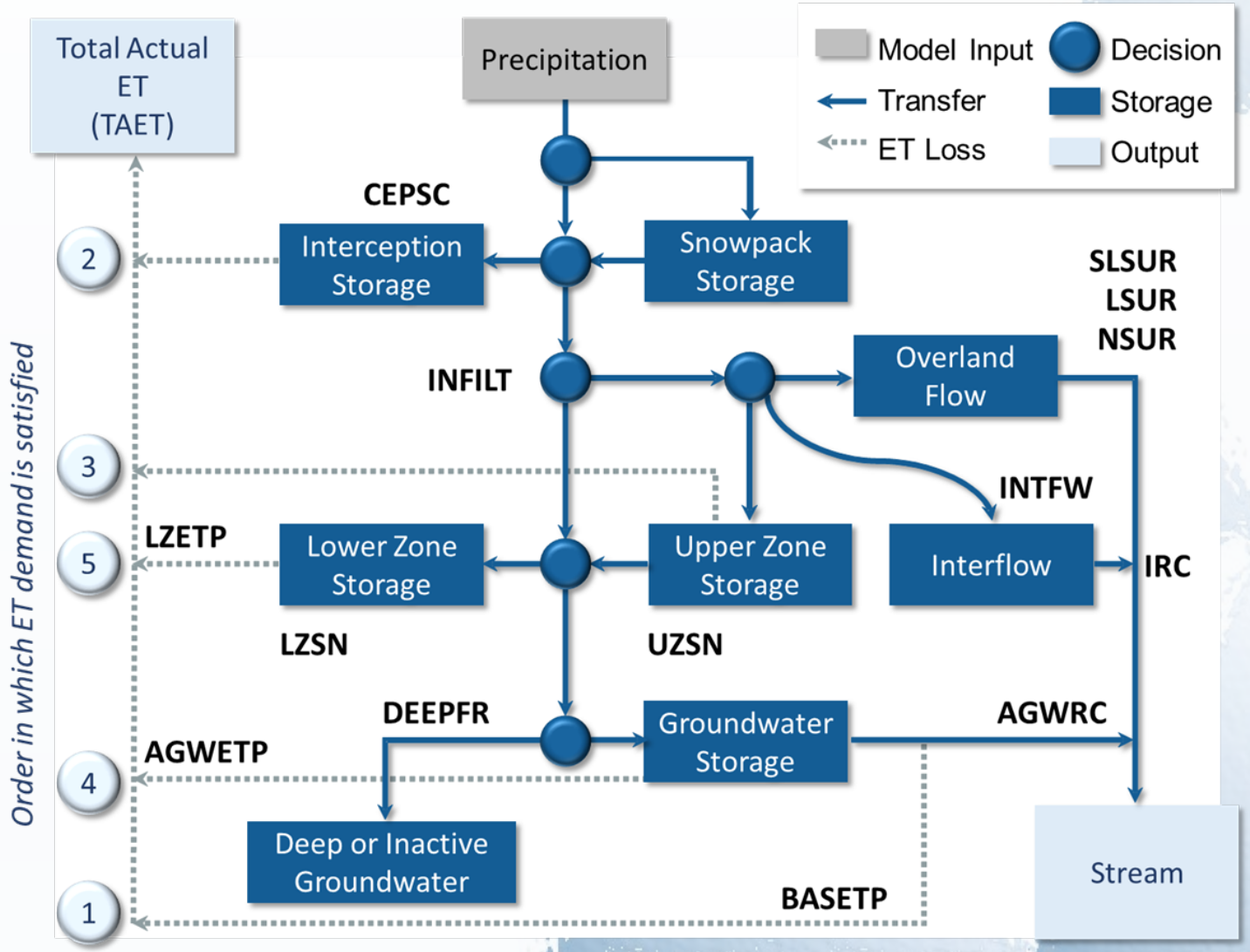
Agenda

- Watershed Model Introduction
- Model Development Steps and Data Used
- Demand Data Incorporation
- Model Calibration and Testing
- Q&A

Philary/Getty Images

Watershed Model (LSPC)

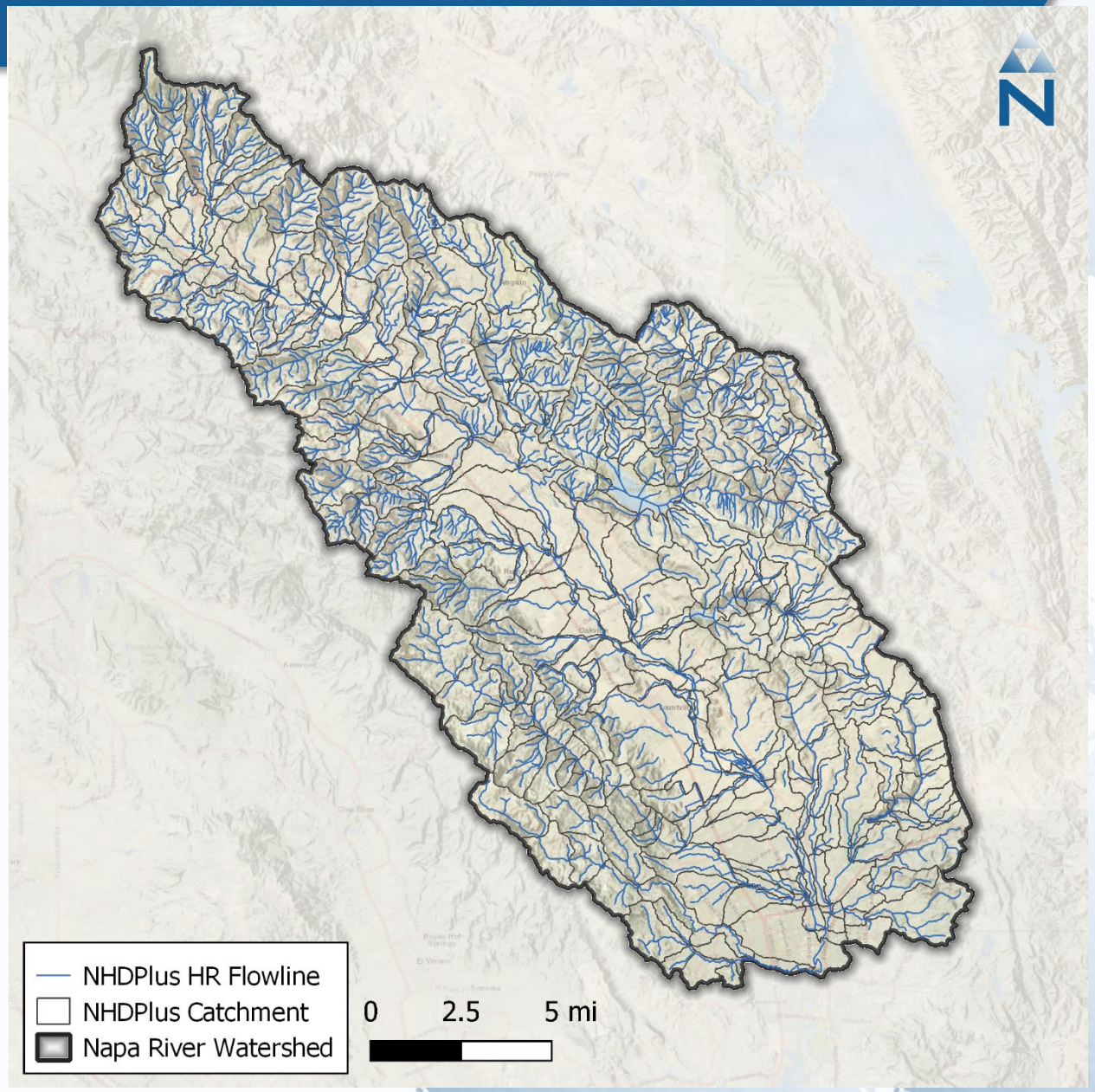
- Loading Simulation Program in C++
- Semi-distributed
- Physically-based
- Hydrology model based on Stanford Watershed Model
- Used extensively for modeling watershed hydrology and water quality
- An existing model for larger Bay Area received from SFEI



Model Segmentation

- Based on NHDPlus High-Resolution Delineations
- 346 catchments/reaches

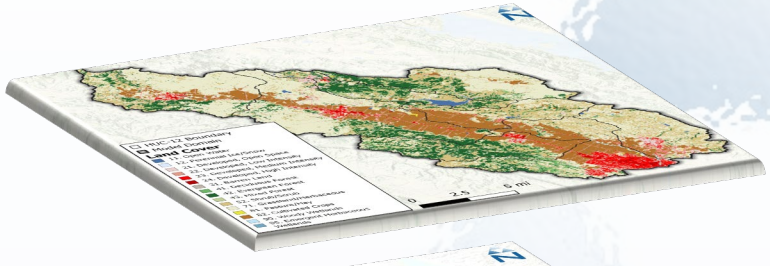
HUC-12	Catchment Count	Catchment Area (ac)			
		Minimum	Average	Maximum	Total
Chiles Creek	39	25.0	516	1,458	20,146
Lake Hennessy - Conn Creek	25	22.0	525	1,374	13,138
Rector Creek - Conn Creek	34	7.0	425	1,399	14,455
Upper Napa River	55	12.0	520	1,709	28,602
Middle Napa River	68	17.0	565	2,423	38,447
Dry Creek	31	38.0	595	3,529	18,471
Milliken Creek	44	10.0	431	1,948	18,999
Lower Napa River	50	0.8	575	2,279	28,748
Total Watershed	**346**	--	--	--	**181,008**



Model HRU Definition

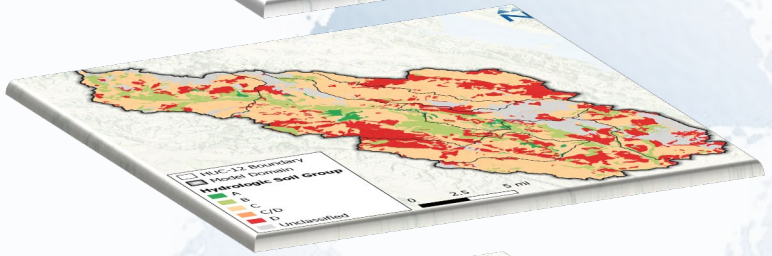
- Hydrologic Response Units (HRUs) represent areas of similar physical characteristics attributable to core hydrological processes
  - **Primary: land cover, soil, and slope**
  - **Secondary: land use, imperviousness, tree canopy, geology**
- HRU approach goal:
  - **Capturing the heterogeneity while maintaining computational efficiency**

Land Use
e.g., NLCD

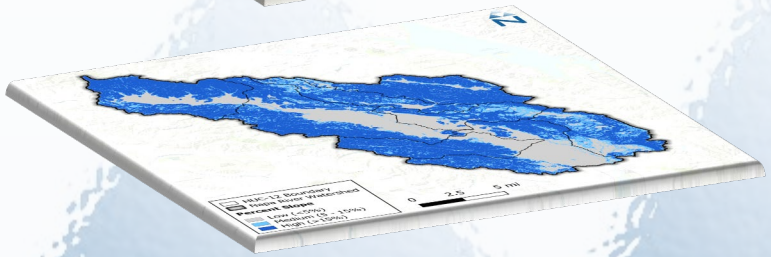


Land Cover
e.g., Imperviousness

Soils Group
e.g., SSURGO



Slope
e.g., DEM-derived

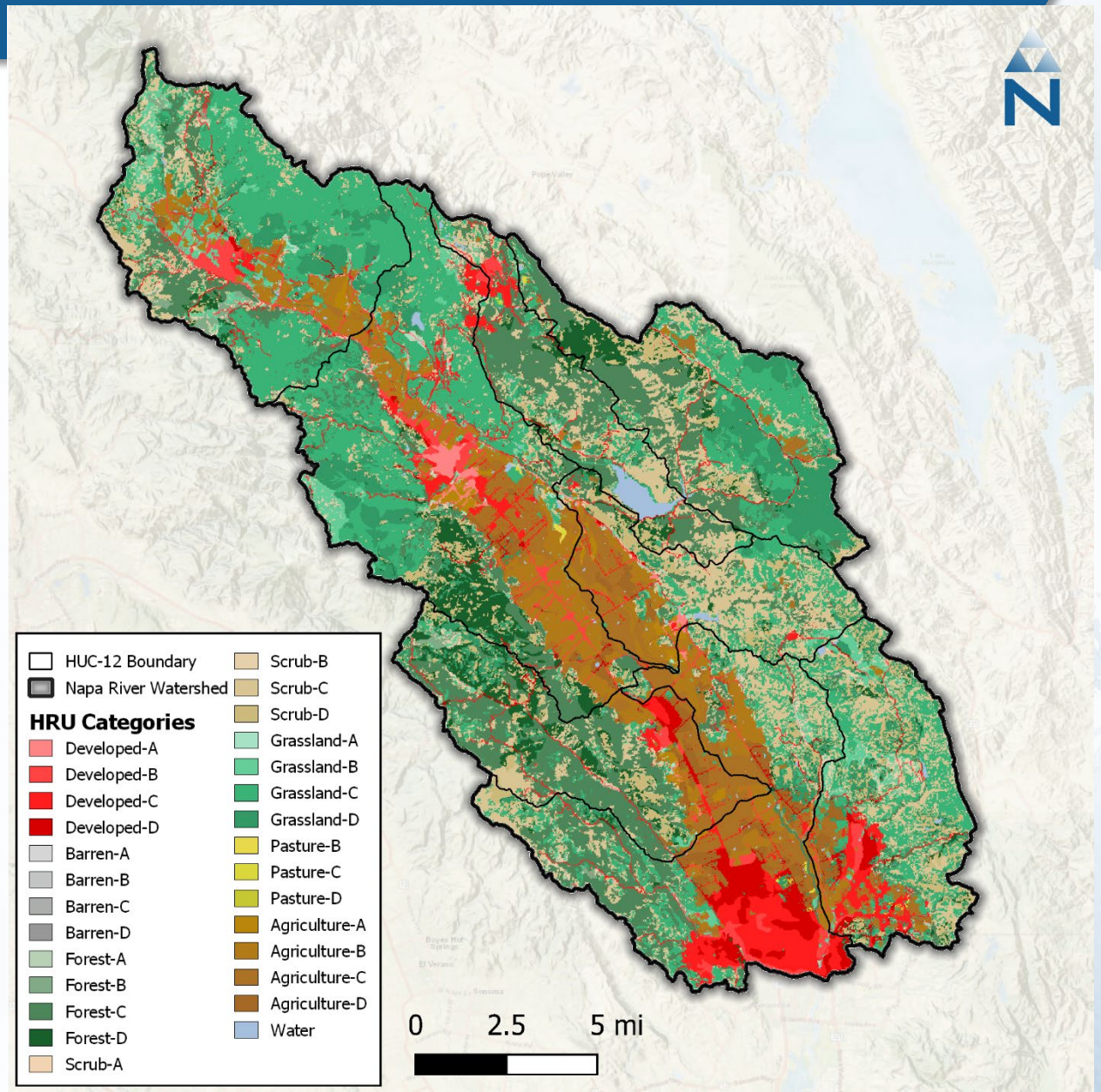


Model HRU Definition

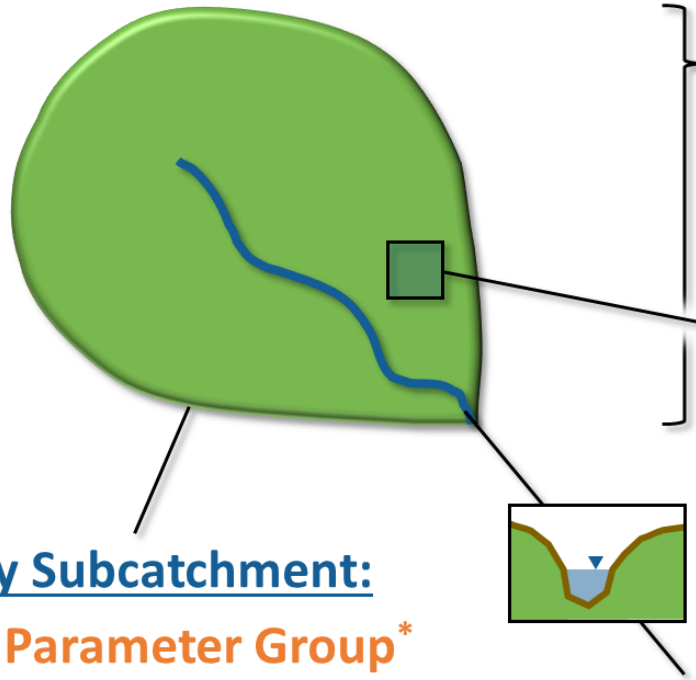
- 86 unique HRUs defined
  - **Forest/grassland/scrub: 78%**
  - **Agriculture: 15%**

LULC	Total Area (%)	Soil Group (% LULC Area)				Slope (% LULC Area)		
		A	B	C	D	0-5	5-15	>15
Developed_Low_Intensity	3.2%	5.9%	26.5%	46.4%	21.2%	68.8%	19.2%	12.0%
Developed_Medium_Intensity	2.9%	5.2%	18.2%	48.0%	28.6%	87.4%	9.6%	3.1%
Developed_High_Intensity	0.6%	6.9%	16.6%	50.3%	26.2%	93.2%	5.5%	1.2%
Developed_Open_Space	3.9%	2.9%	22.6%	57.2%	17.3%	38.9%	27.0%	34.1%
Barren	0.0%	1.6%	28.1%	40.5%	29.7%	53.5%	27.0%	19.5%
Forest	20.7%	0.1%	3.8%	75.1%	21.1%	2.9%	12.1%	85.0%
Scrub	19.6%	0.2%	6.0%	66.1%	27.7%	4.9%	21.0%	74.0%
Grassland	33.4%	0.4%	7.7%	66.5%	25.3%	8.3%	16.5%	75.2%
Pasture	0.1%	0.0%	25.0%	57.9%	17.1%	87.5%	11.7%	0.8%
Agriculture	14.9%	4.5%	42.2%	40.0%	13.3%	90.0%	7.9%	2.1%
Water	0.7%	0.3%	5.9%	91.2%	2.5%	88.0%	9.7%	2.3%
Total	**100.0%**	**1.4%**	**13.2%**	**62.8%**	**22.6%**	**25.2%**	**15.4%**	**59.4%**

Color gradients indicate more Watershed Area and an increasing percentage of Soil and Slope, respectively.



Model Hydrologic Processes



By HRU × Subcatchment (Physical):

- Slope of HRU
- Length of Overland Flow
- Imperviousness

By Individual HRU (Processes):

- Interception Storage Capacity
- Subsurface Storage Capacity
- All other Hydrological Parameters, Rates, and Constants

By Subcatchment:

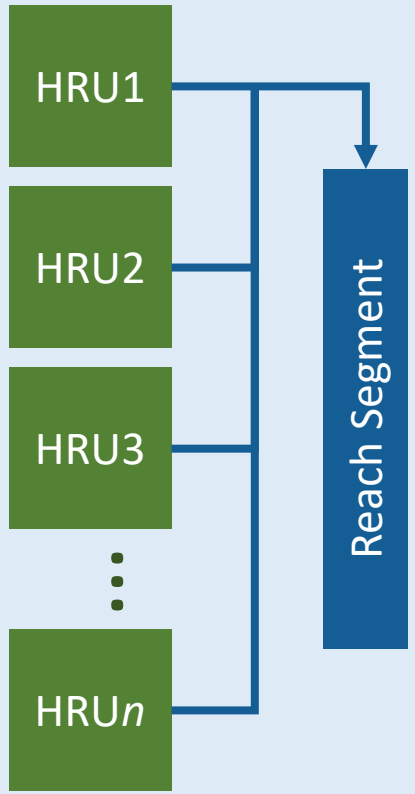
- **Parameter Group***
- HRU Area Distribution
- Weather Data
- Average Elevation
- Reach or Lake Segment

By Reach/Lake Segment:

- **Reach Group ***
- Geometry
- Transport Rates and Constants

* **Parameter/Reach Groups** can be used to differentiate features with distinct characteristics.

HRU Routing



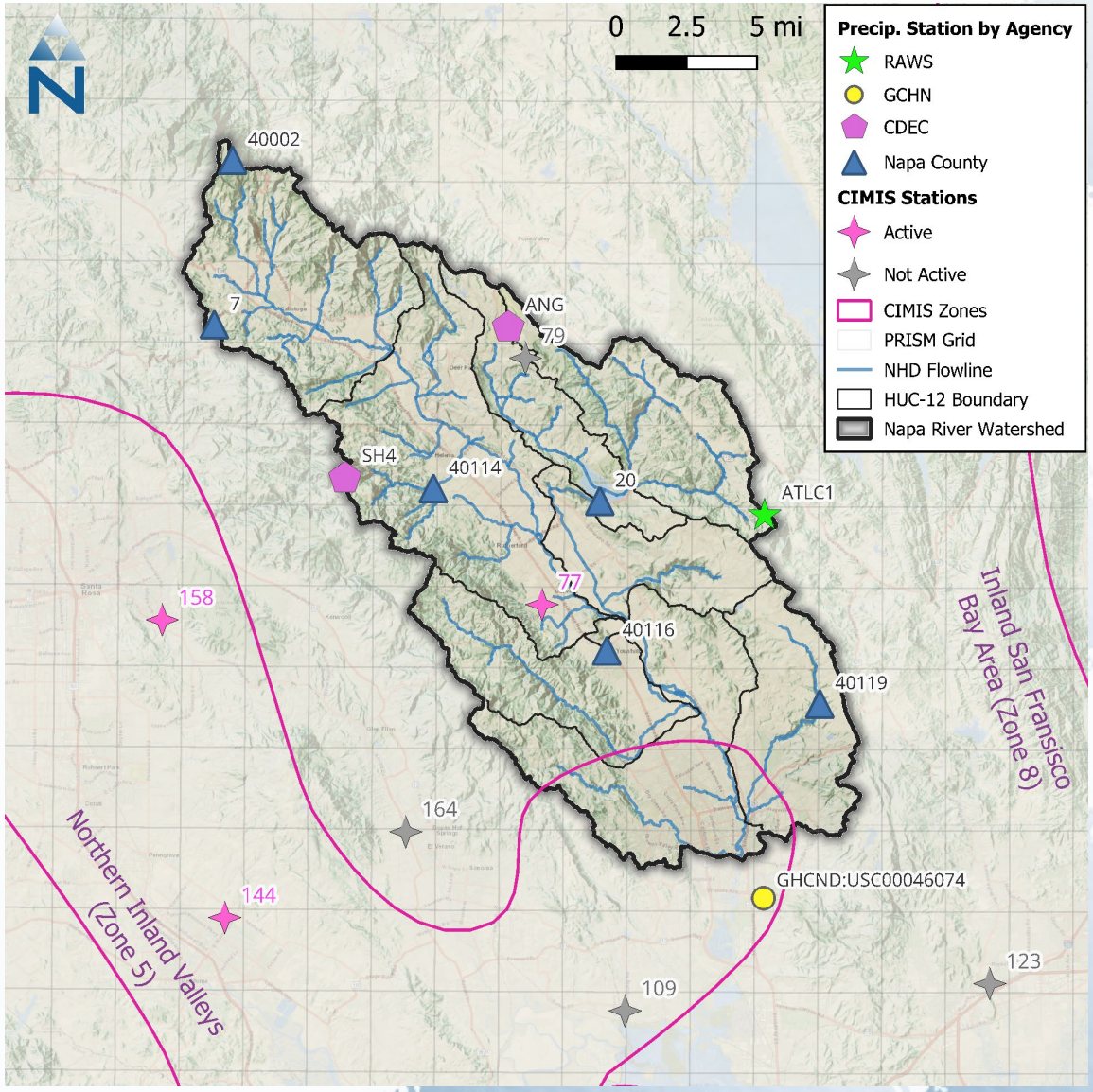
Model Climate Forcing Inputs

- Hourly time-step

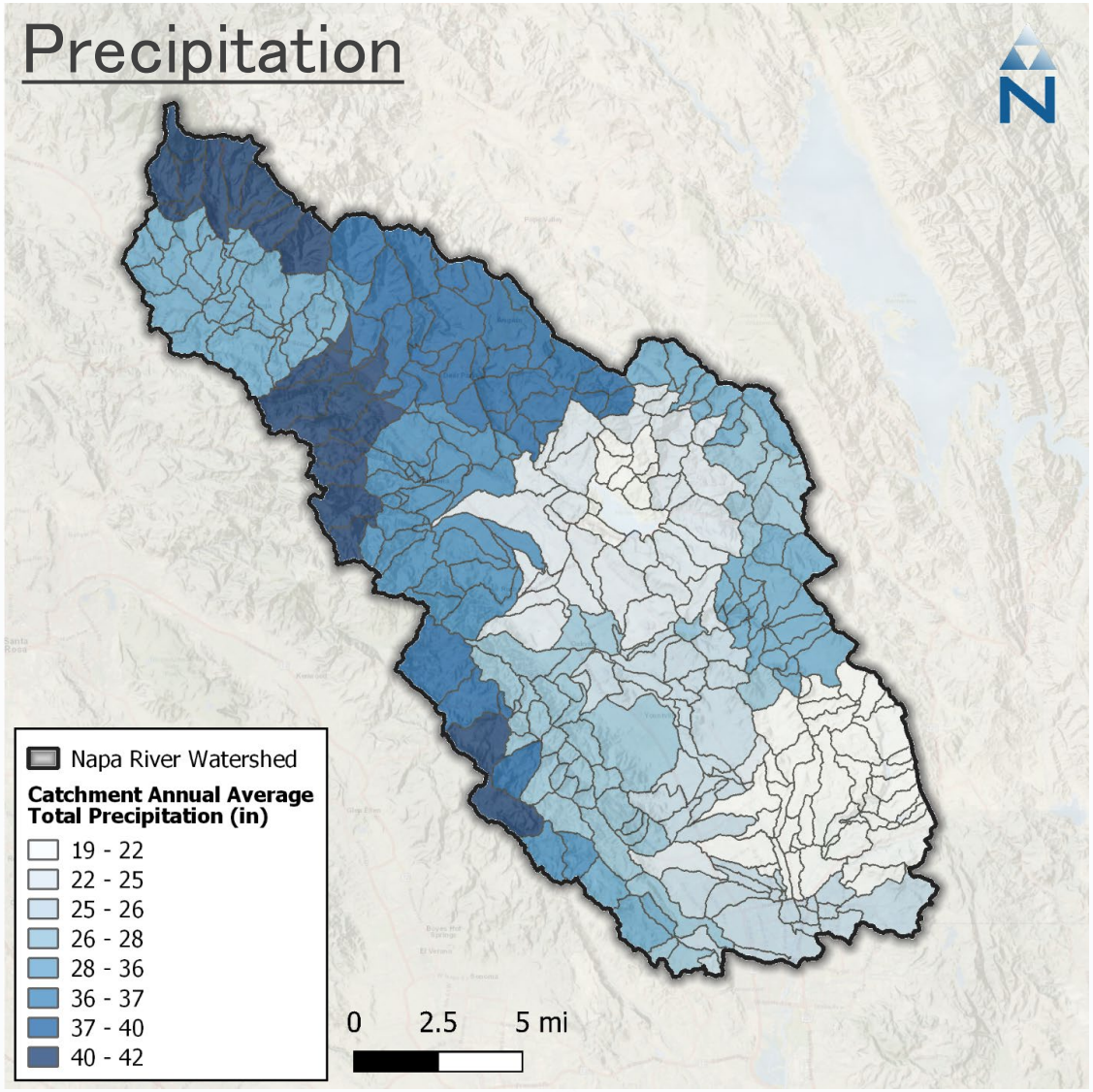
➢ Gage data
  - NOAA GHCN (1)
  - CDEC (2)
  - RAWS (1)
  - Napa County (6)

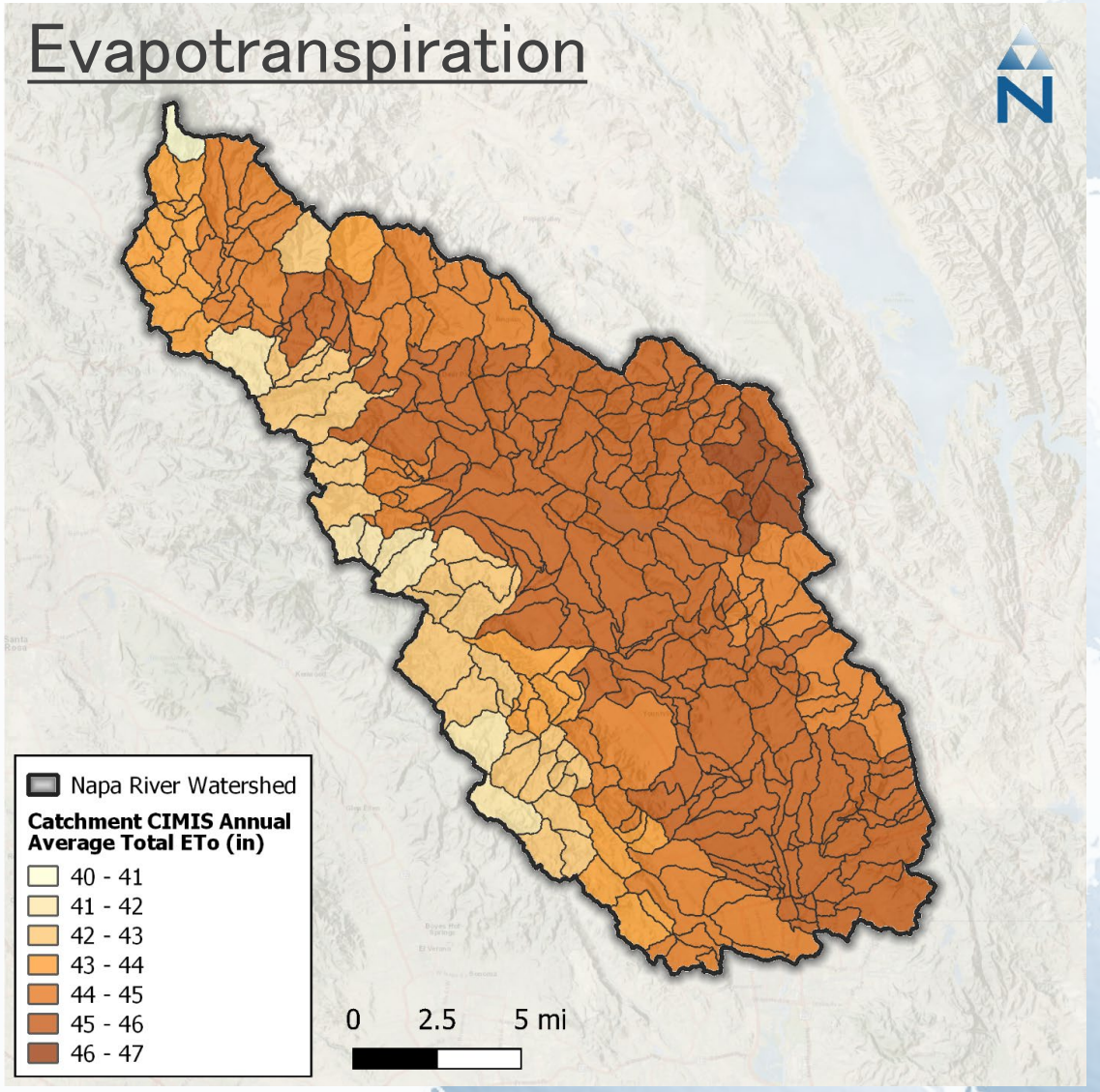
➢ Grid-based data
  - Monthly PRISM
  - Hourly NLDAS

- ET: Daily CIMIS downscaled to hourly with NLDAS
- Hybrid land-based/grid-based approach



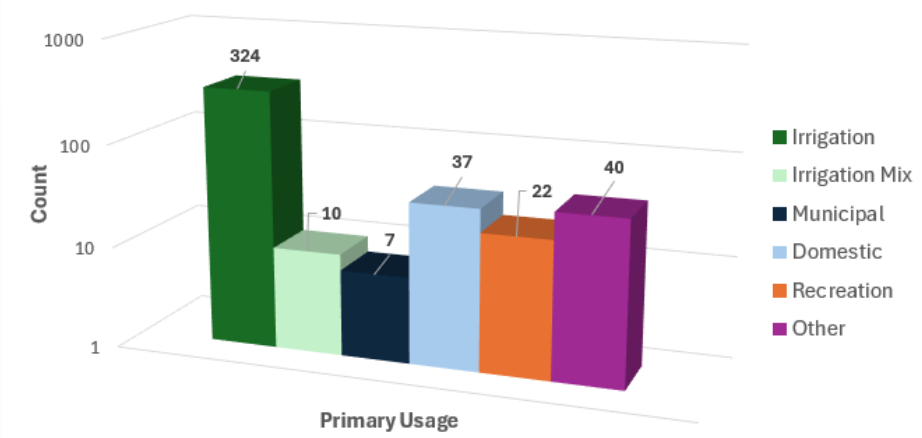
Model Climate Forcing Inputs

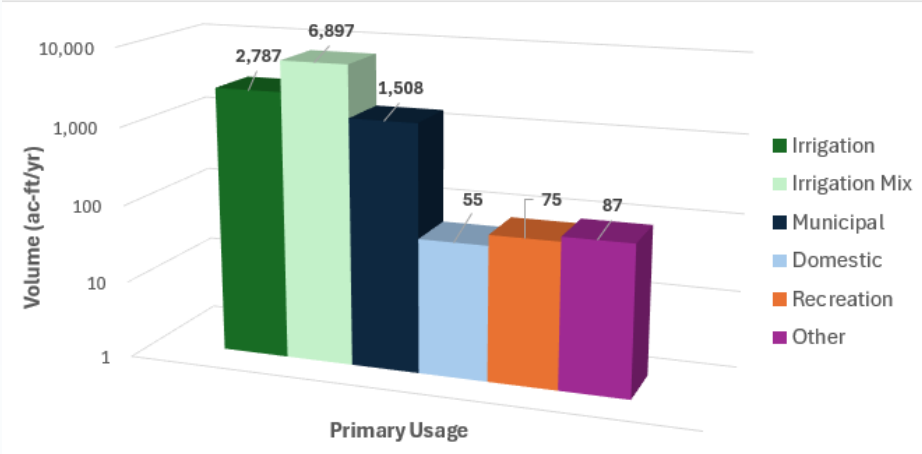


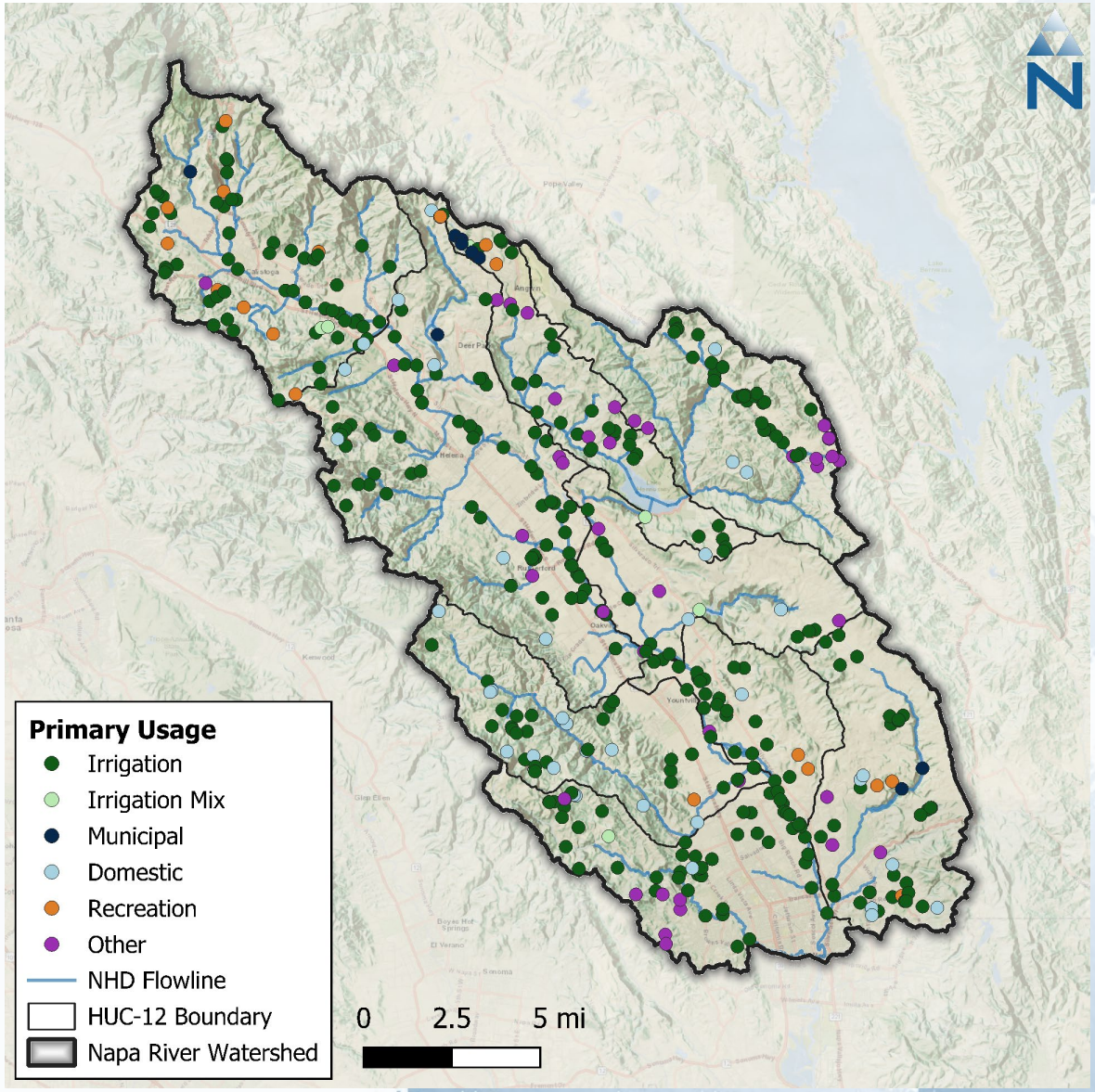


Representing Demand Data

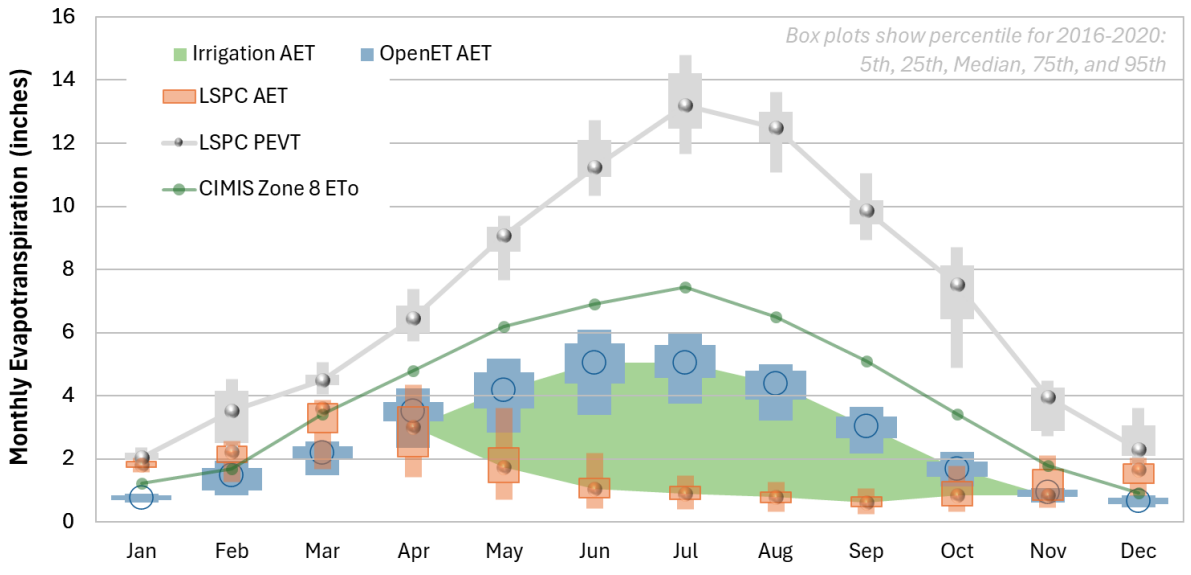
- Received demand for 441 water rights application IDs

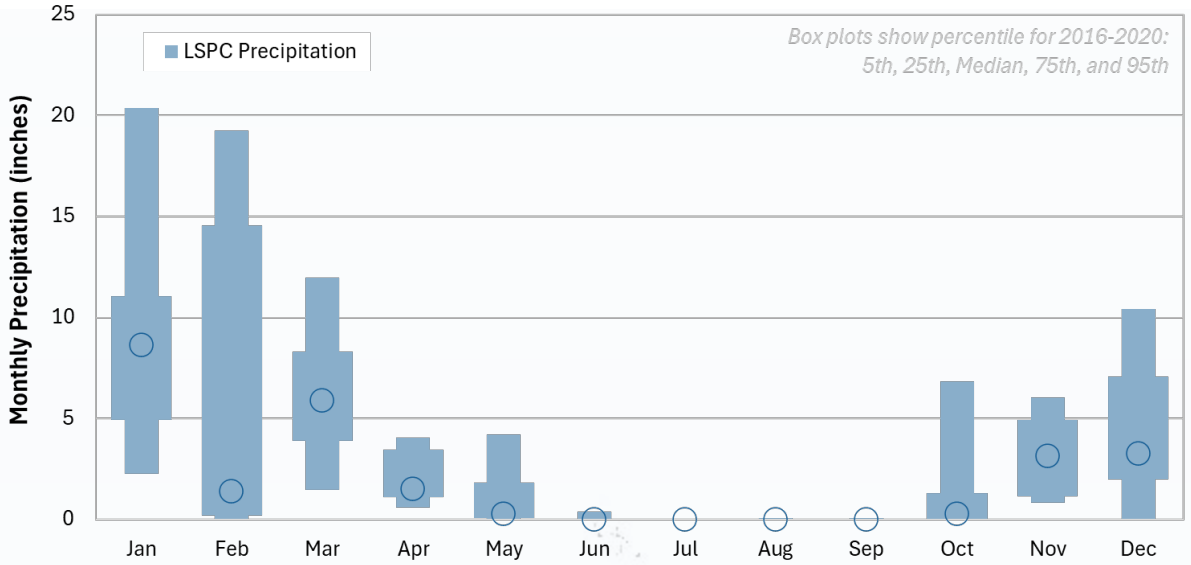


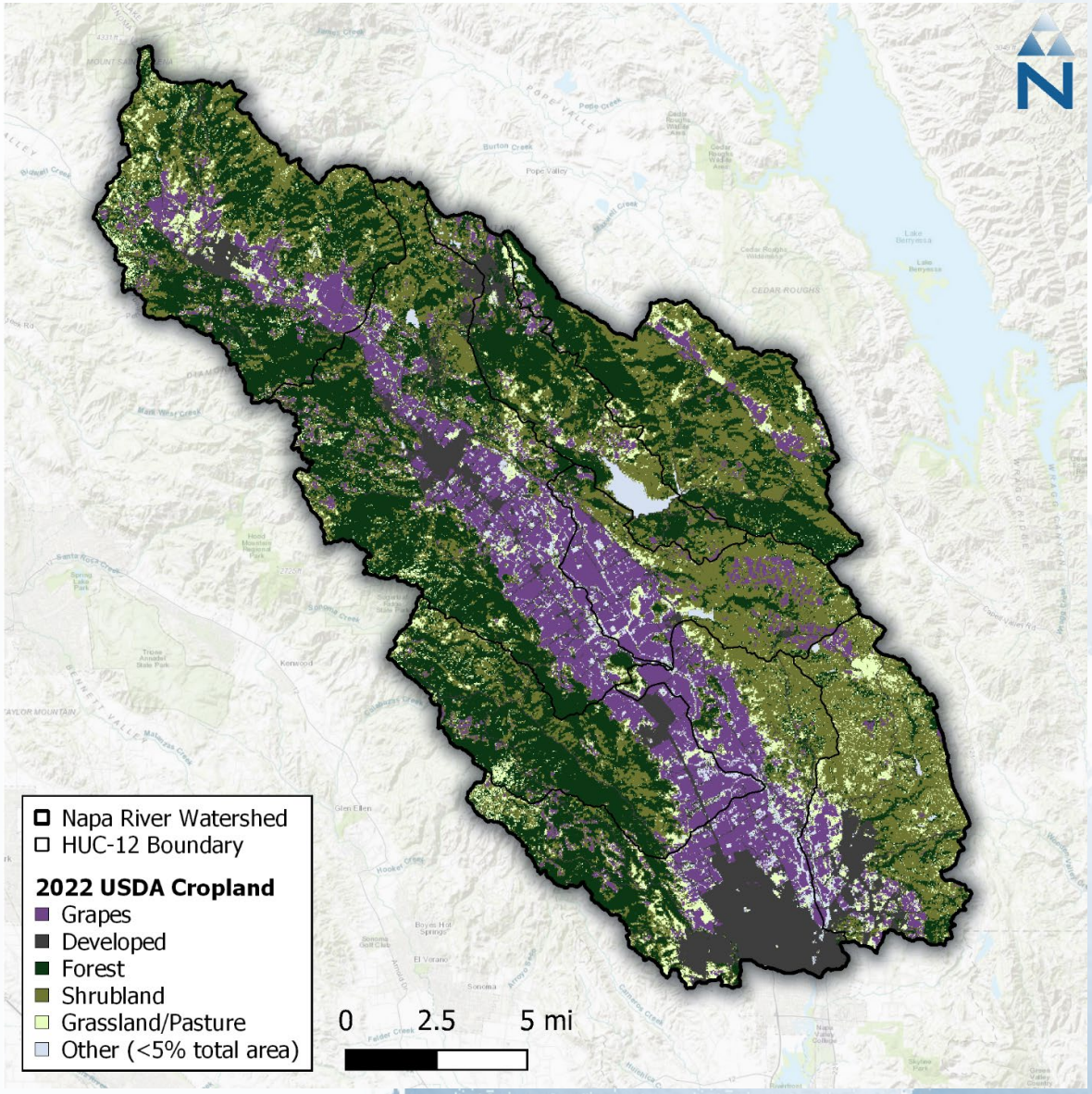




Representing Demand Data (Irrigation)



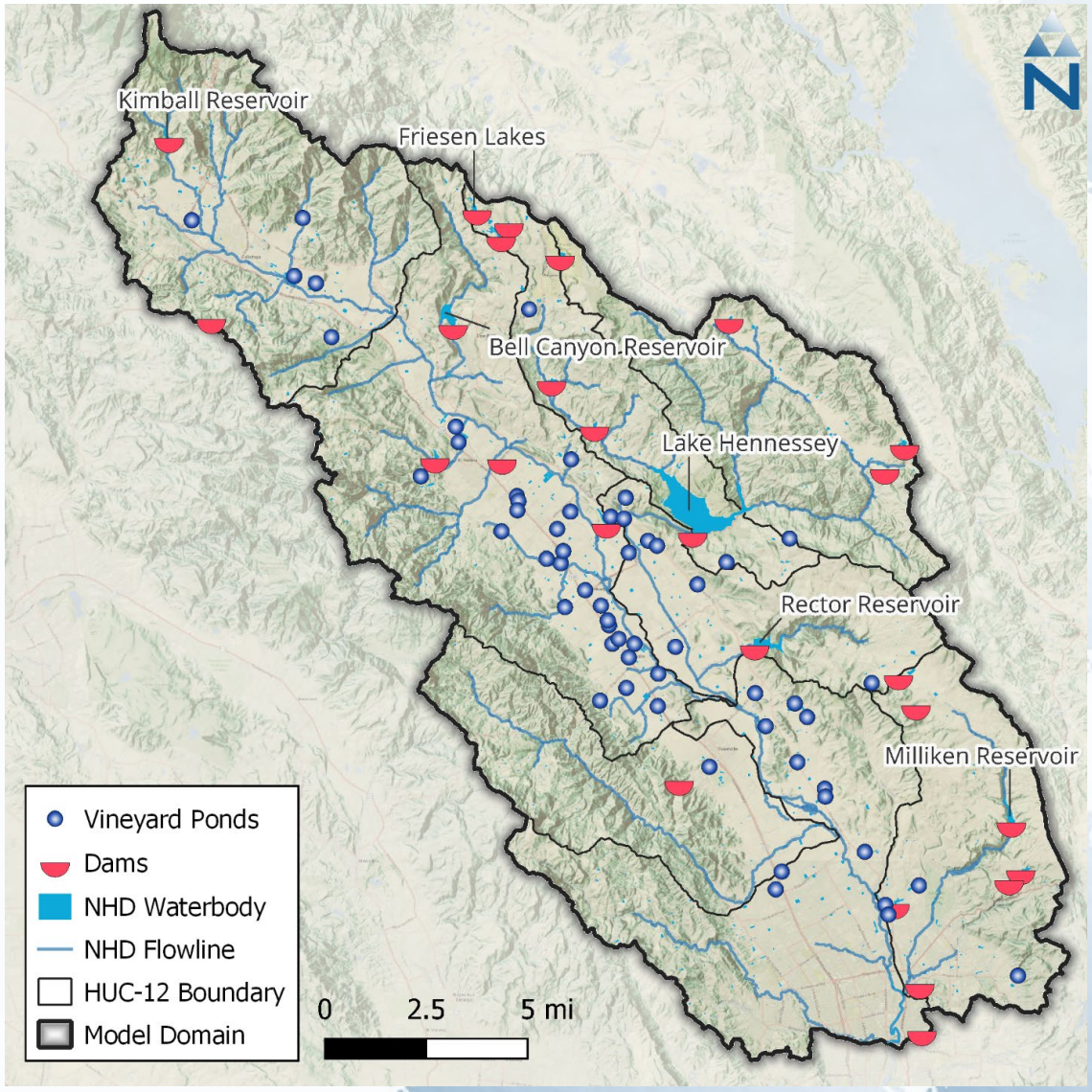




Representing Lake/Reservoir Operations

- Stage–Volume relationships
- Stage–area relationships
- Flow release rates

Reservoir/Lake	Surface Area (ac)	Storage (ac-ft)
Lake Hennessey	1000.0	31,000
Rector Reservoir	82.0	4,500
Bell Canyon Reservoir	84.0	2,500
Milliken Reservoir	33.0	1,390
Kimball Reservoir	16.0	312



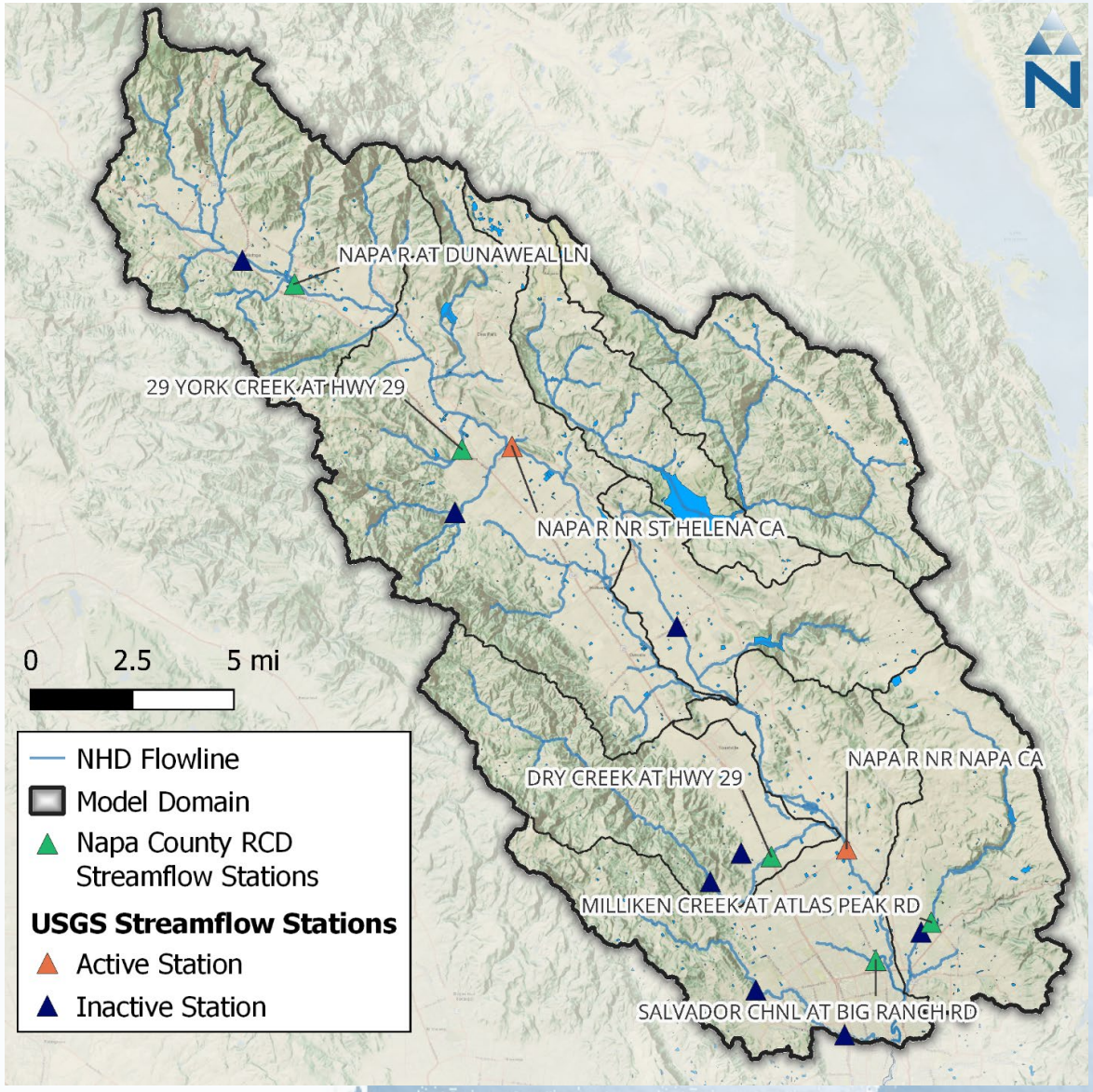
Model Calibration and Validation

USGS NWIS

Gage Description	Station ID	Drainage Area (mi^2)	Start Date	End Date	Active?
NAPA R NR NAPA CA	11458000	218	1929	Present	Yes
NAPA R NR ST HELENA CA	11456000	78.8	1929	Present	Yes

Napa County (FCWCD)

Gage Description	Station ID	Drainage Area (mi^2)	Start Date	End Date	Active?
Napa River at Dunaweal Ln	40142	30.51	2009	Present	Yes
York Creek at Hwy 29	40129	3.89	2015	Present	Yes
Dry Creek at Hwy 29	40115	23.53	1997	Present	Yes
Salvador Channel at Big Ranch Rd	40128	5.57	2008	Present	Yes
Milliken Creek at Atlas Peak Rd	40113	17.2	1997	Present	Yes



For further information and to subscribe to Supply and Demand Assessment Email List visit:

www.waterboards.ca.gov/sda

Questions?

Email: **DWR-SDA@waterboards.ca.gov**