UPPER VENTURA RIVER GROUNDWATER AGENCY BOARD MEETING FEBRUARY 11, 2021

Upper Ventura River
GROUNDWATER AGENCY
SUSTAINABLE MANAGEMENT

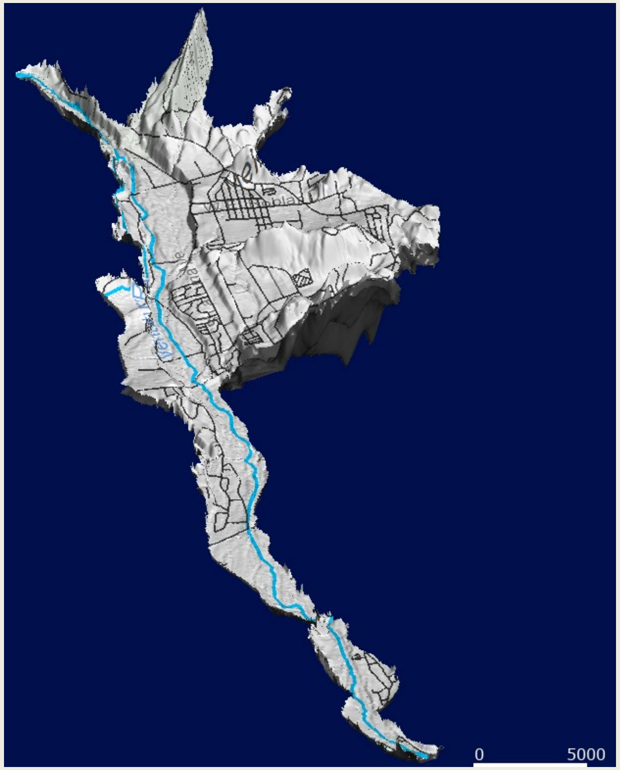
ITEM 10D GROUNDWATER MODEL UPDATE

ITEM PURPOSE

1. Explain what models are and how they support planning
2. Describe UVRGA model construction and calibration results
3. Describe next steps for modeling to support GSP development

WHAT IS A NUMERICAL FLOW MODEL?

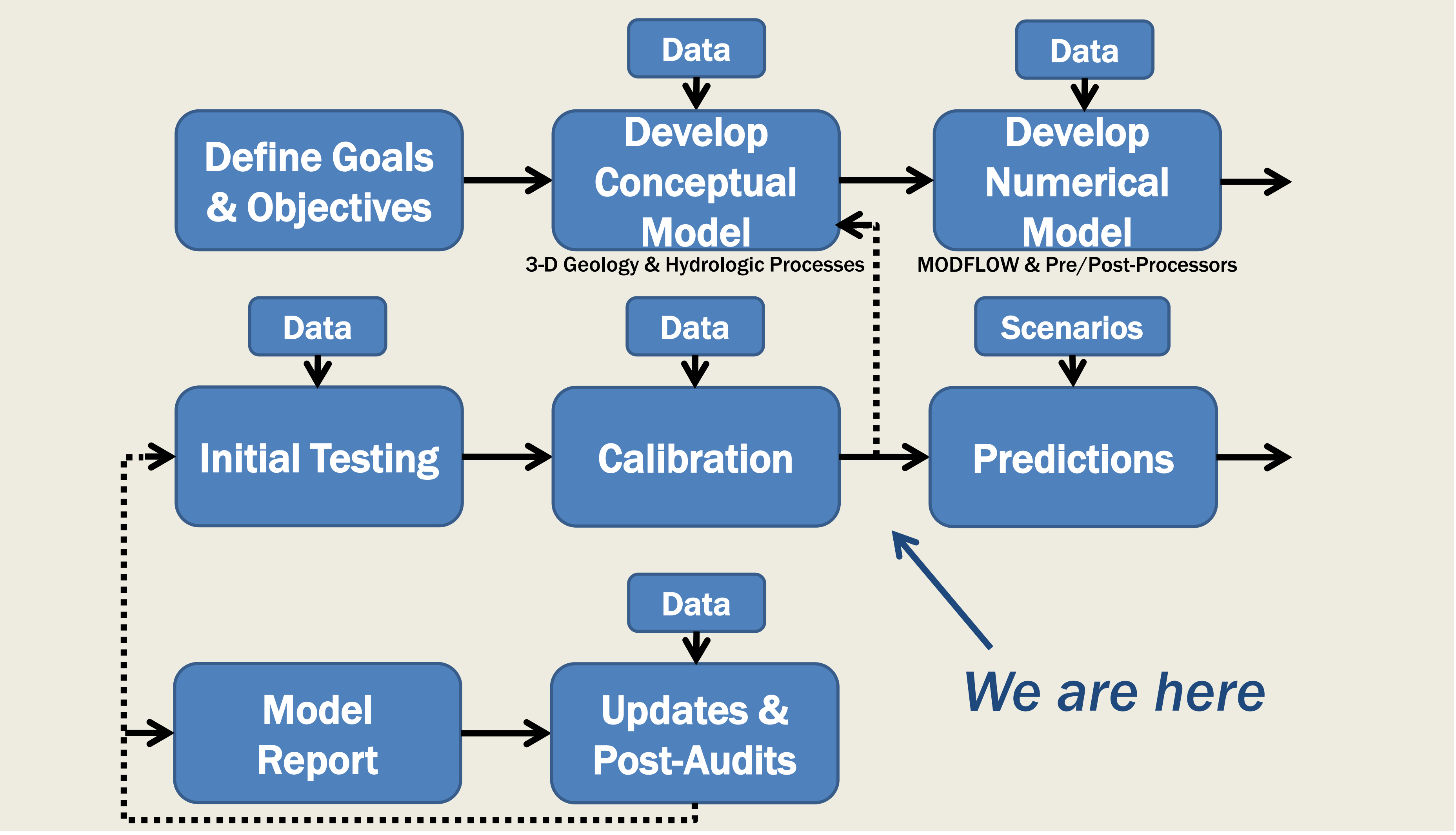
- Mathematical representation of the groundwater (GW) and surface water (SW) flow system
- Solves groundwater flow equation (GW level) and computes flows throughout the SW and GW systems
- A model is an approximation of the real system – only as good as the data upon which the model is based on



WHY DEVELOP A NUMERICAL FLOW MODEL?

- To make predictions and test unknowns:
  - Develop estimates of future groundwater conditions based on different assumptions
  - Estimate benefits of different projects or management actions (if needed)
  - Test hypotheses in areas with limited or no data
- To comply with SGMA
  - SGMA requires model or “equally effective tool” for:
    - Water budgets
    - Quantification of interconnected surface water depletion

GENERAL MODEL DEVELOPMENT PROCESS



Upper Ventura River
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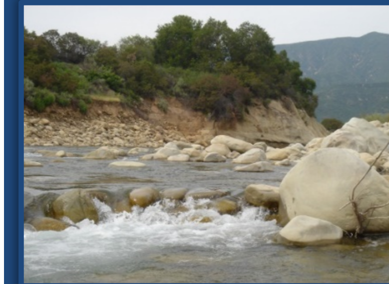
NUMERICAL FLOW MODEL PRESENTATION



CASITAS Municipal Water District

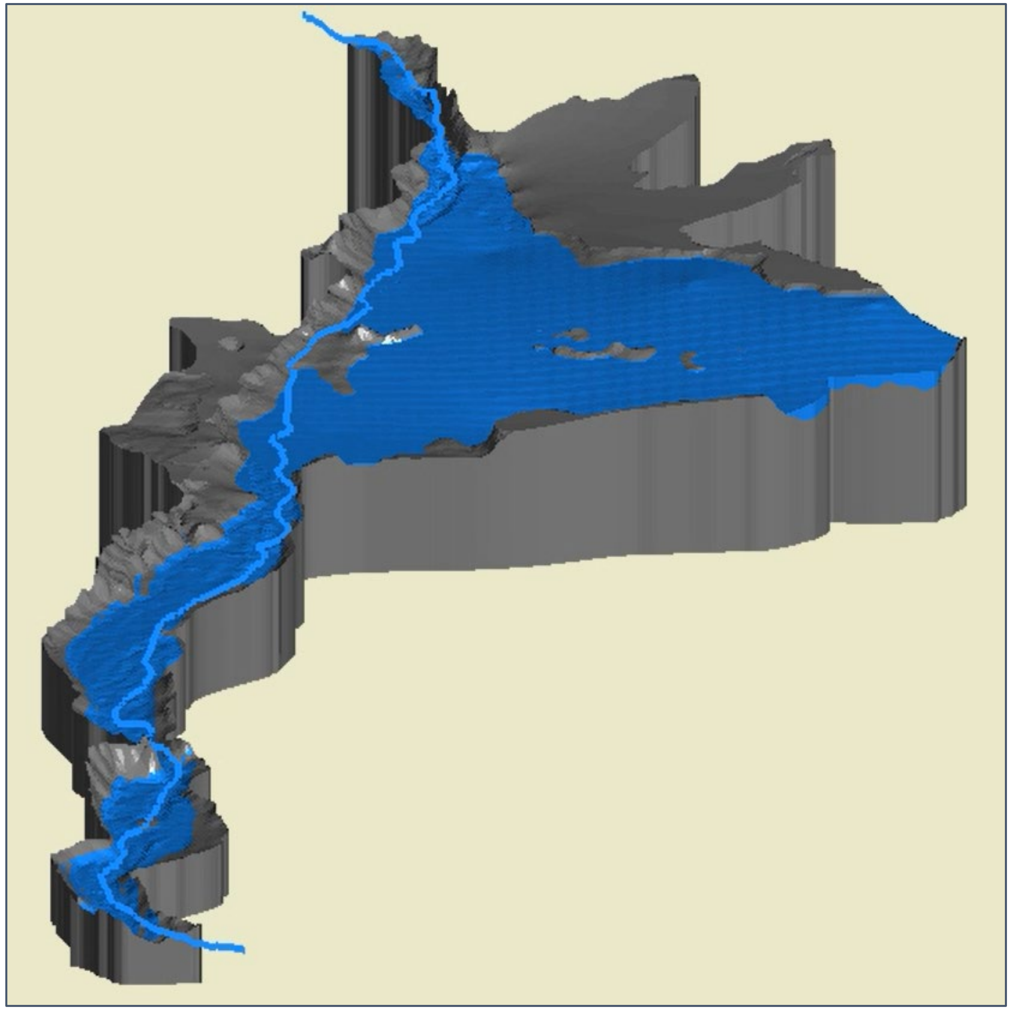
We Serve Water

MEINERS OAKS WATER DISTRICT
VENTURA COUNTY SINCE 1949

COUNTY OF VENTURA CALIFORNIA

VENTURA WATER

Groundwater Model of the Upper Ventura River Subbasin



Upper Ventura River
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INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

Feb 11, 2021

INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

1 Hydrogeologic Conceptual Model

- Basin consists of fluvial-origin alluvium derived from weathering/erosion from surrounding mountain
- Younger alluvium deposited within the river floodplain
- Older alluvium underlies young alluvium (in some areas) and tends to be less permeable
- Bedrock consists of older marine deposits, underlies and bounds much of the river floodplain
  - Key driver of groundwater/surface-water interactions
- Oldest alluvial units (Ojai Conglomerate) present in much of Mira Monte Area.
  - Very low permeability and behaves more like bedrock.
- UVRGA basin boundary (modified in 2016) includes mapped (older and younger) alluvium units

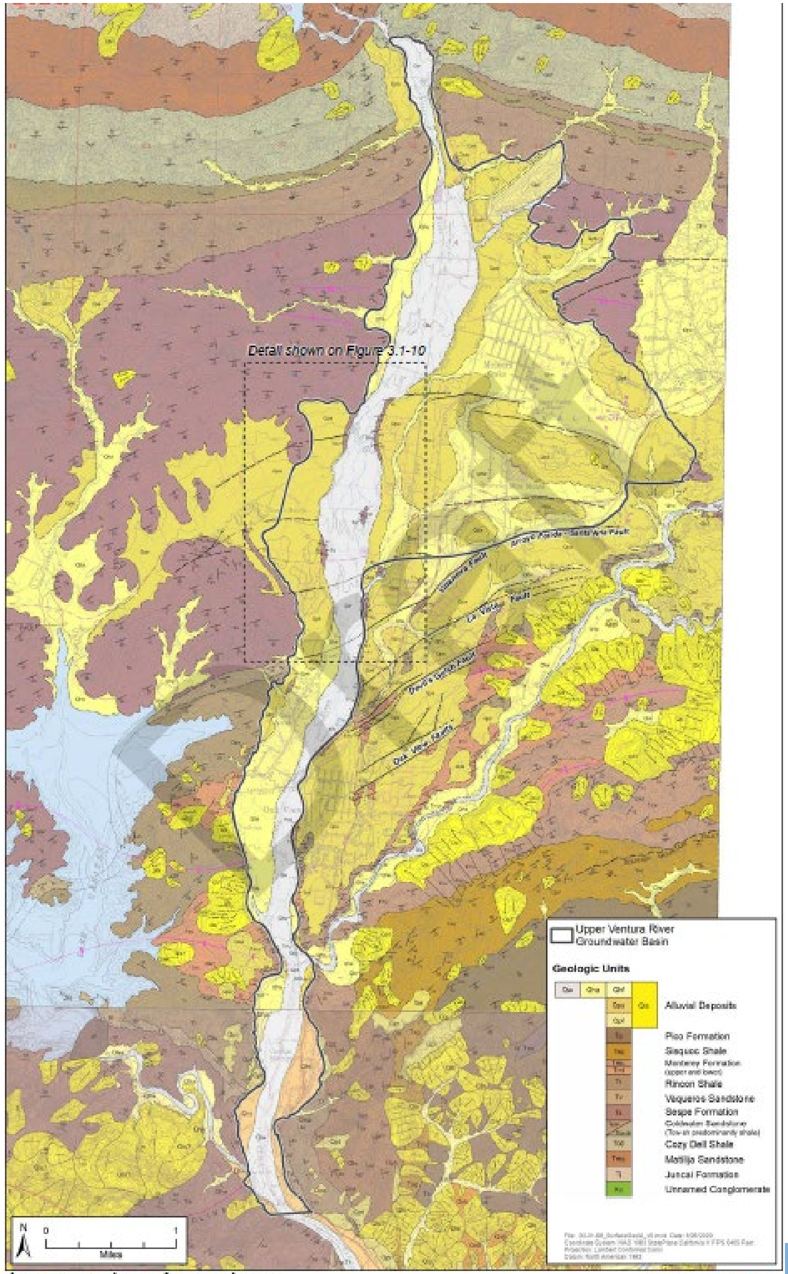
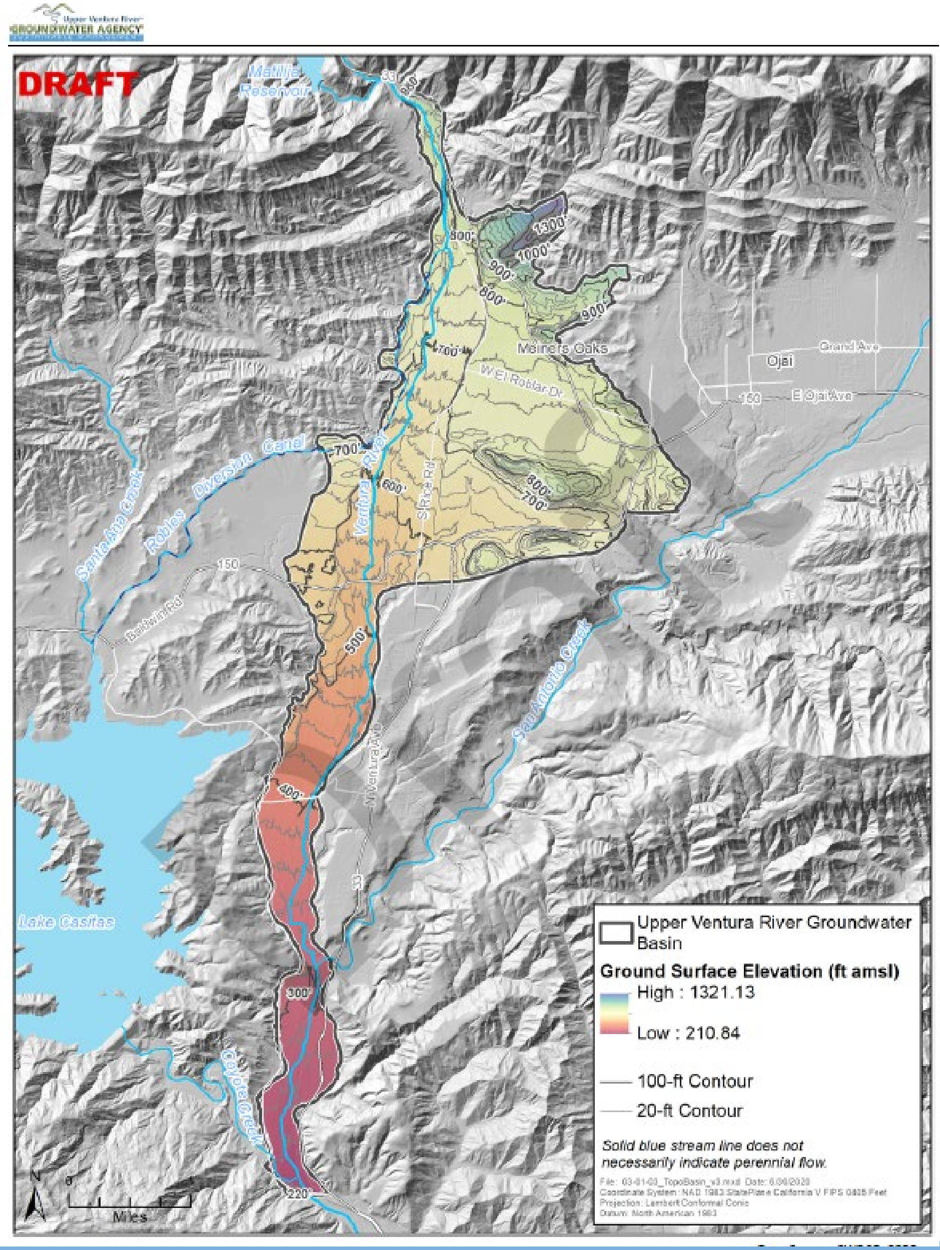


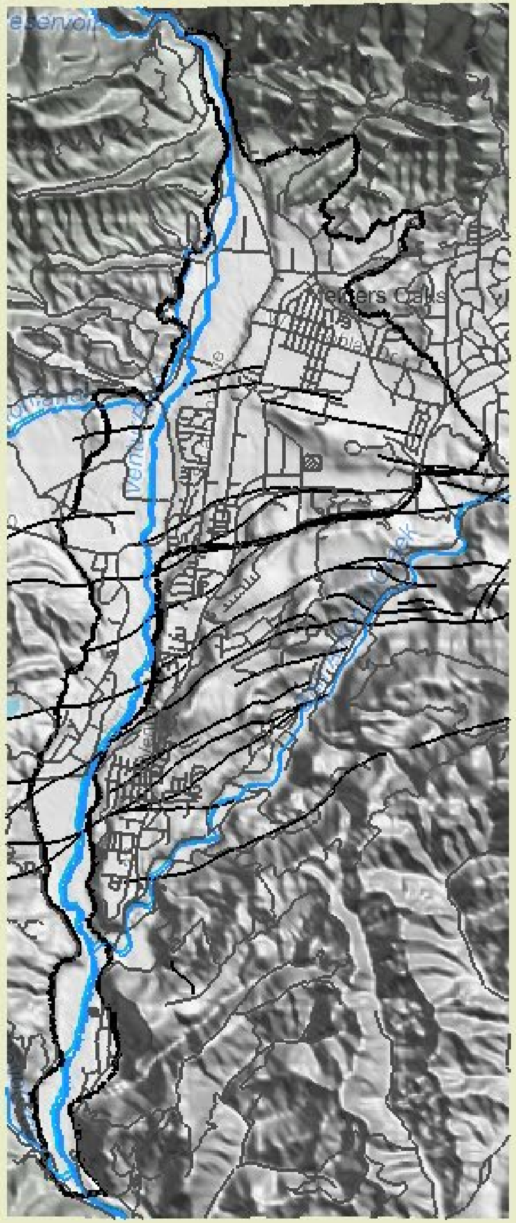
Figure 3.1-9 Regional Surface Geologic Map.

Data Source: USGS, 2003, 2006.

Hydrogeologic Conceptual Model

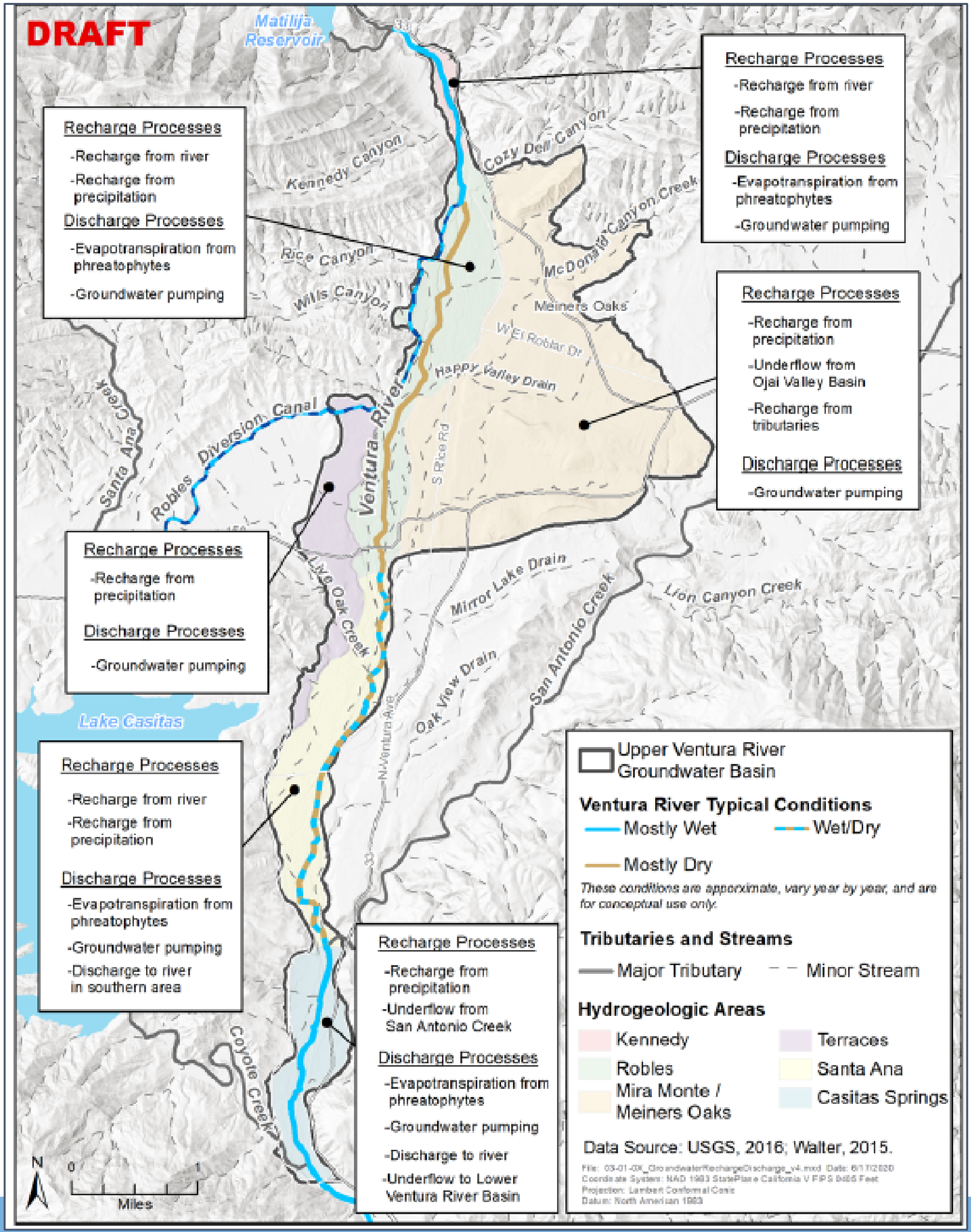
- Basin characterized by highly variable topography and stratigraphy
- Structure and hydrostratigraphy based on SWRCB surfaces
- Topography based on 10 ft Lidar data
- Refined stratigraphy based on review of well-boring logs, well construction records, surface geology maps, and published cross-sections





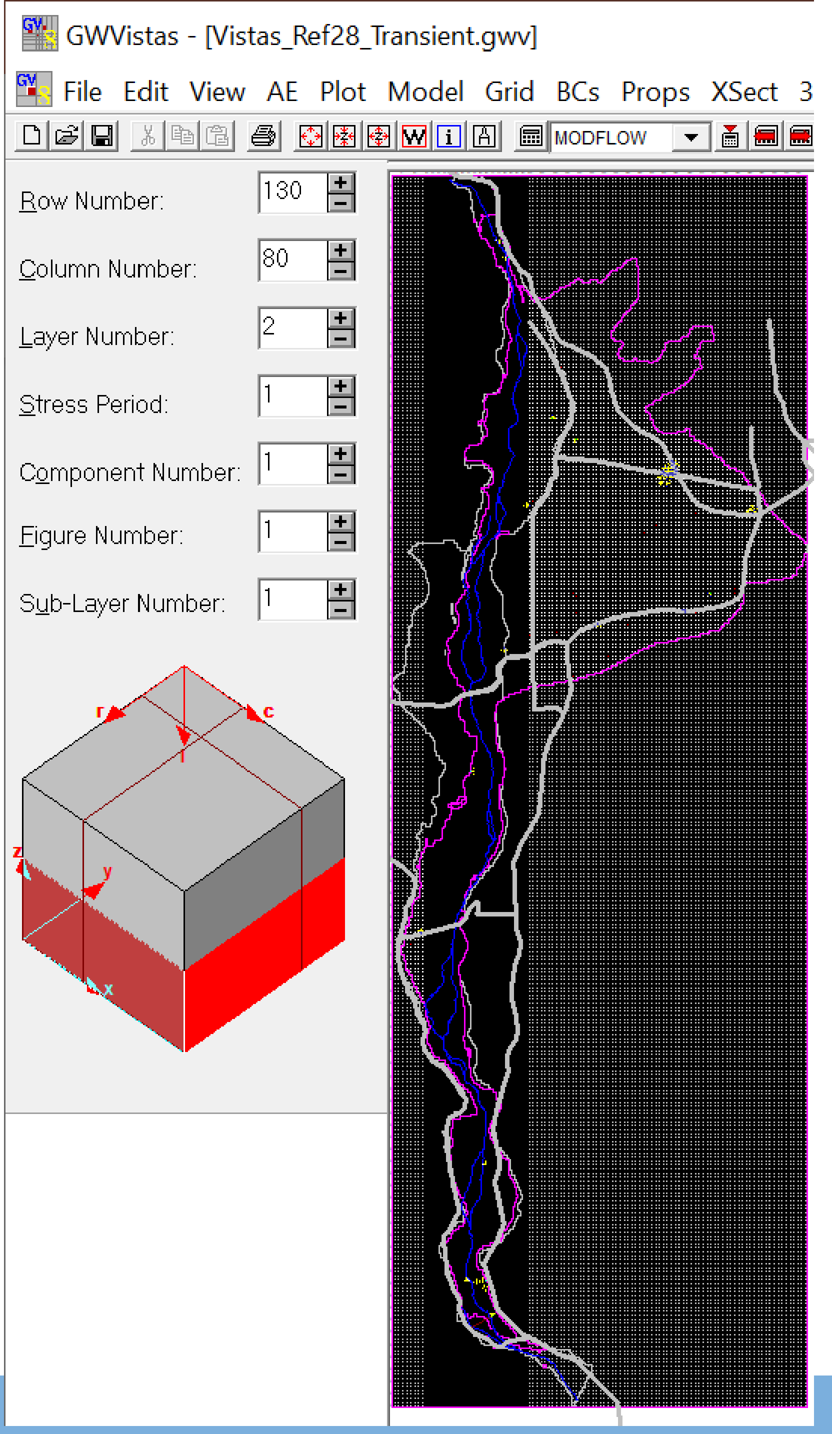
4 Key Recharge/Discharge Processes

- Primary inflow/outflow processes:
  - Flow to/from river
  - Precipitation-based recharge
  - Agricultural and M&I return flows
  - Pumping
  - Evapotranspiration
  - Underflows
- Spatial and temporal variability



Numerical Groundwater Model

- Finite-Difference Groundwater Model developed in USGS code MODFLOW-NWT (Niswonger et al., 2011)
- Model simulates conditions from 2005 – 2019
  - Daily stress-periods: Nov – Mar; Monthly: Apr - Oct
- Model grid ranges from 50x100 to 100x100 ft
  - 505 rows, 213 columns, 2 layers
  - 215,130 total model grid cells
  - 46,180 active model grid cells
- Simulates groundwater/surface-water interaction using MODFLOW SFR (Prudic et al., 2004) module
- Model development and calibration consistent with ASTM standards (D5447, D5609, D5981)



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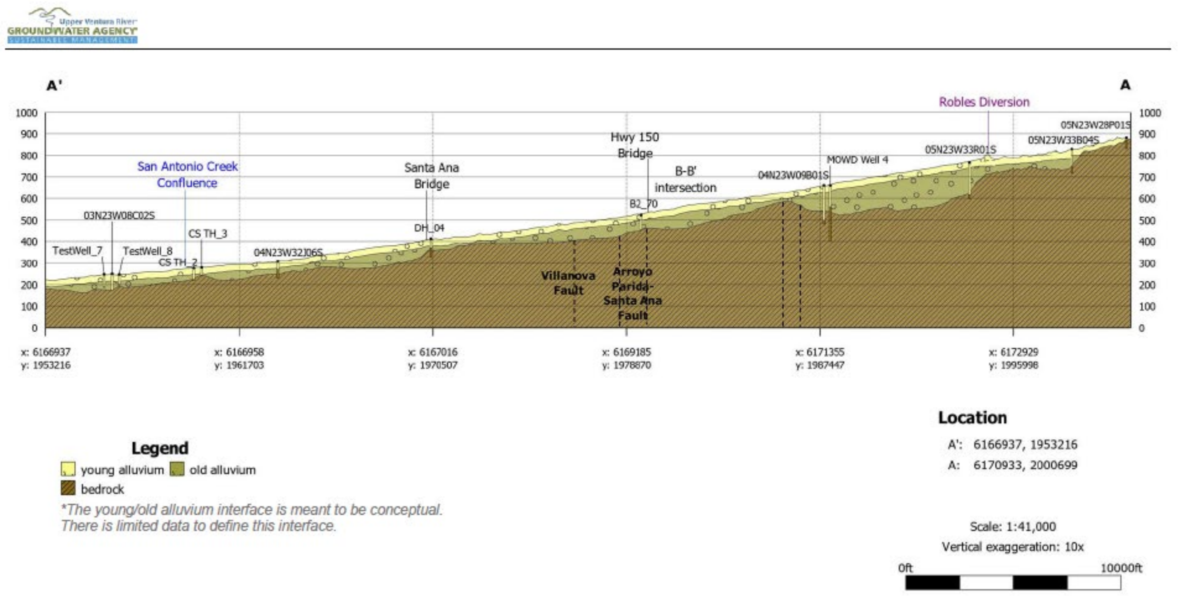
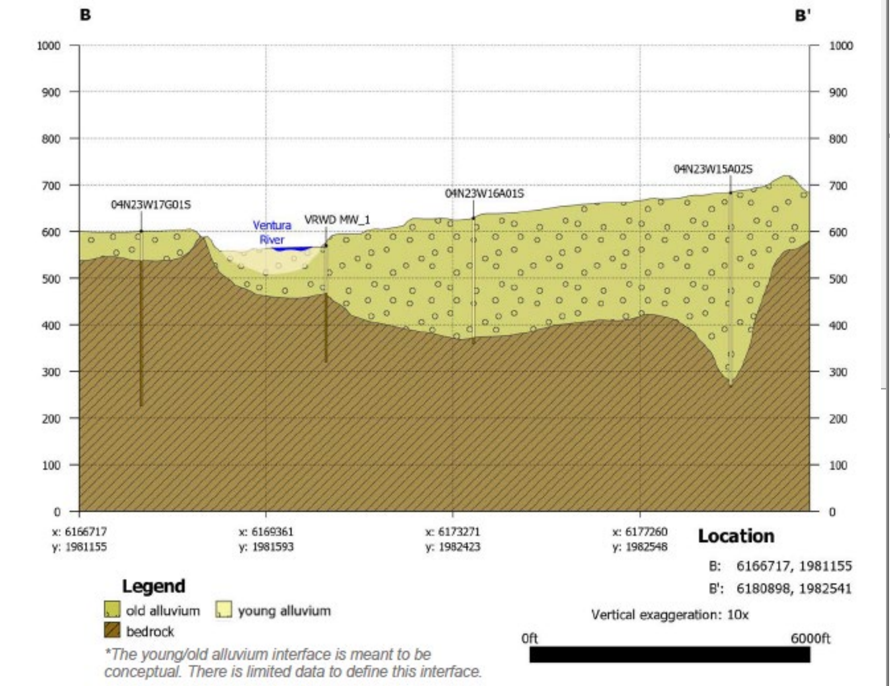
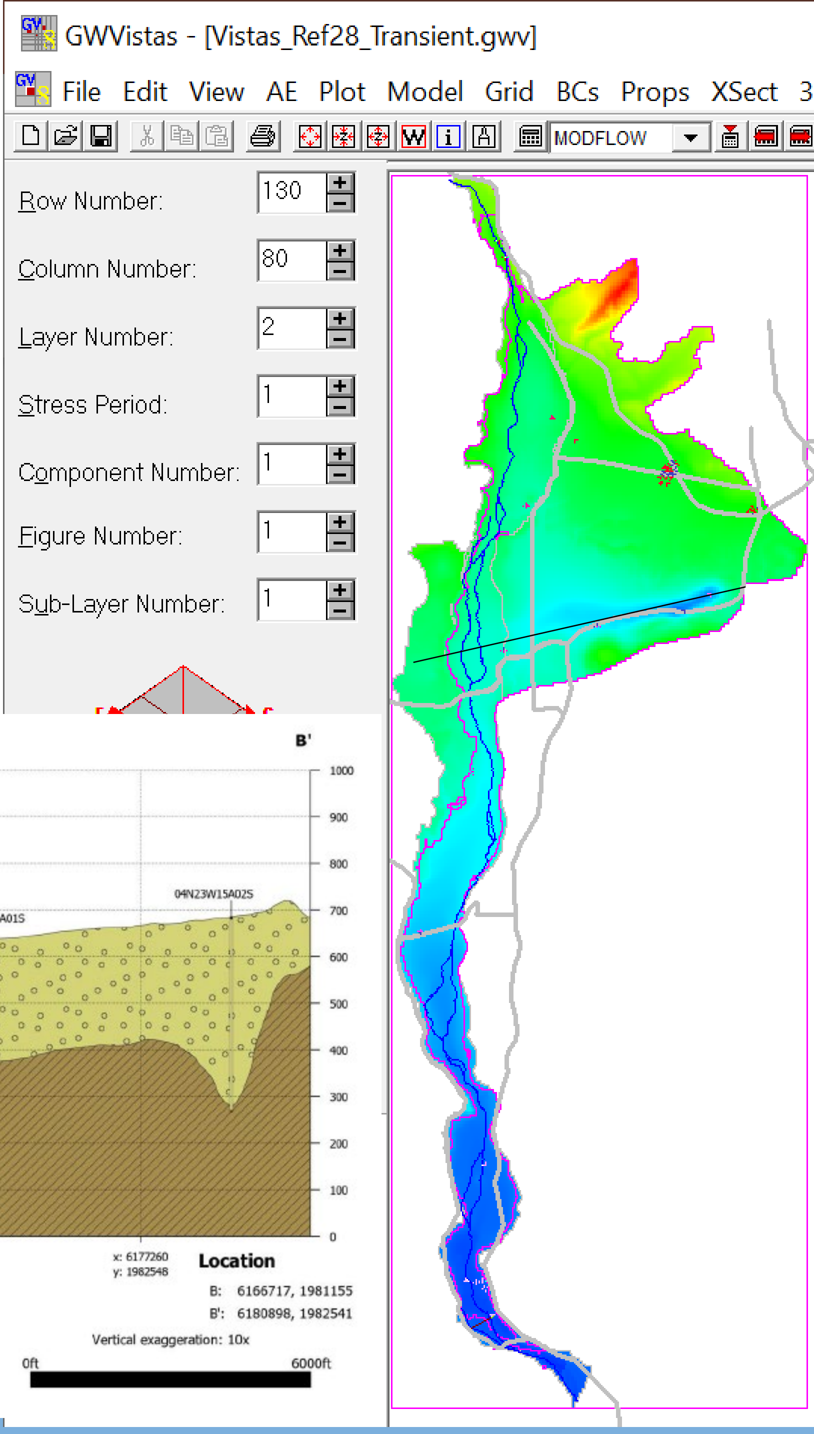
Numerical Groundwater Model - Structure

- Model structure based on 3D geologic model
- Depth to bedrock ranges from 200 – 1200 ft amsl
- Alluvium split into two layers
    - Younger alluvium in floodplain (<30 ft deep)
    - Older alluvium in the East and underlying the young alluvium in the floodplain

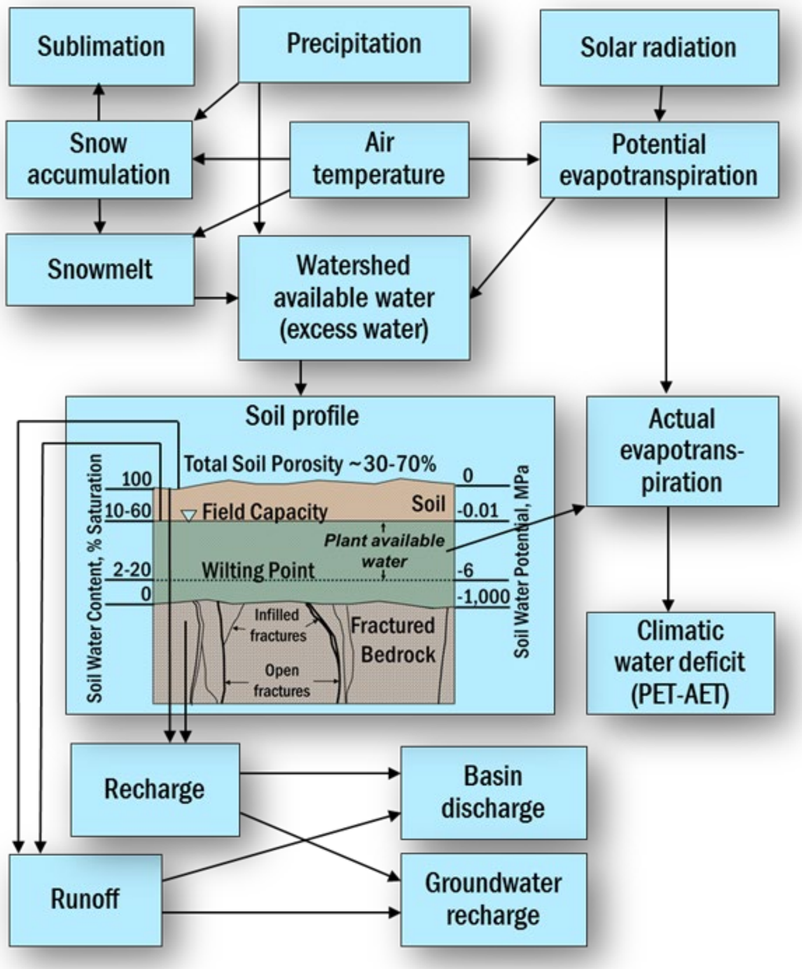






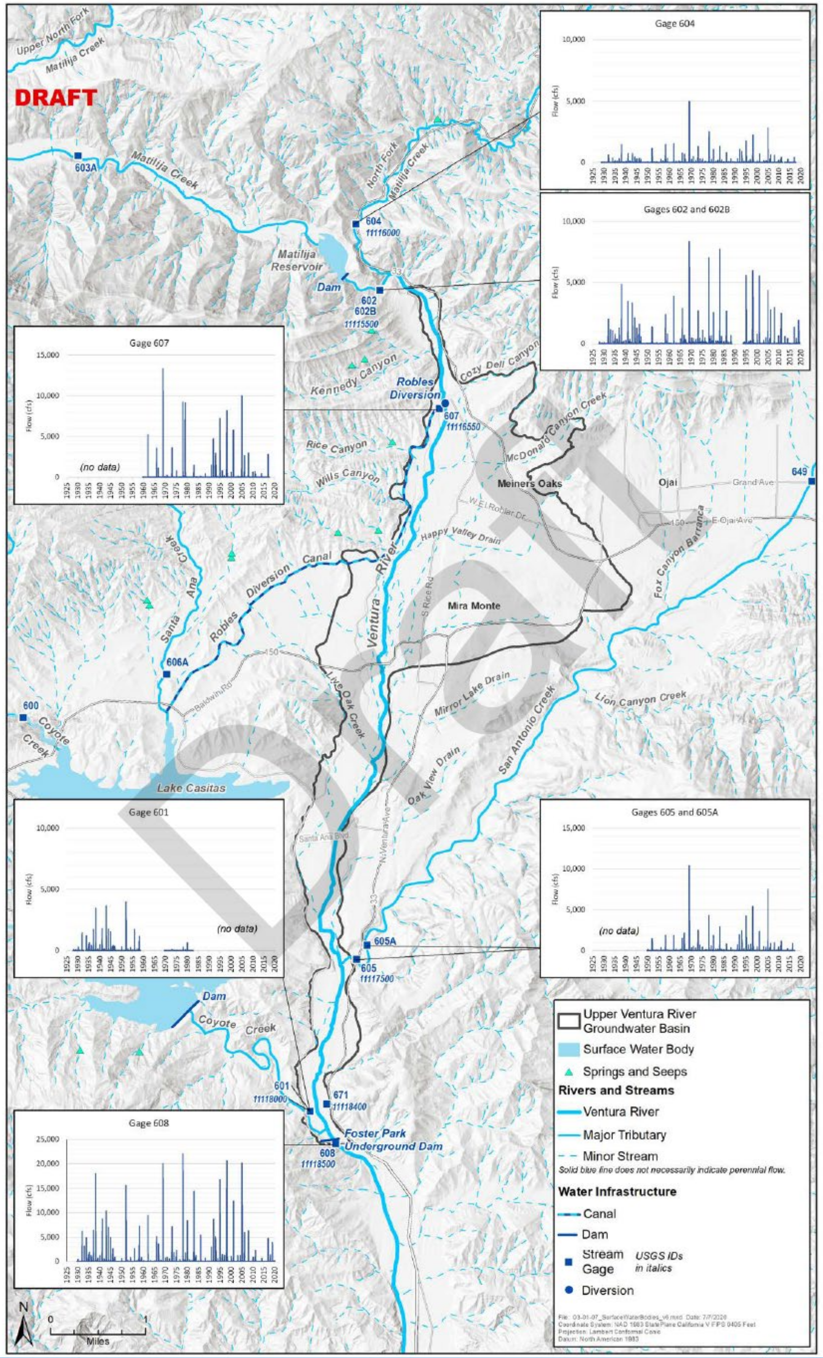
Numerical Groundwater Model - Recharge

- Monthly net recharge from precipitation calculated from California Basin Characterization Model (BCM) developed by USGS (Flints et al, 2013)
  - Regional-scale model incorporates rainfall, run-off, evapotranspiration in the surficial system
- Agricultural and M&I return flows estimated based on available data on water use



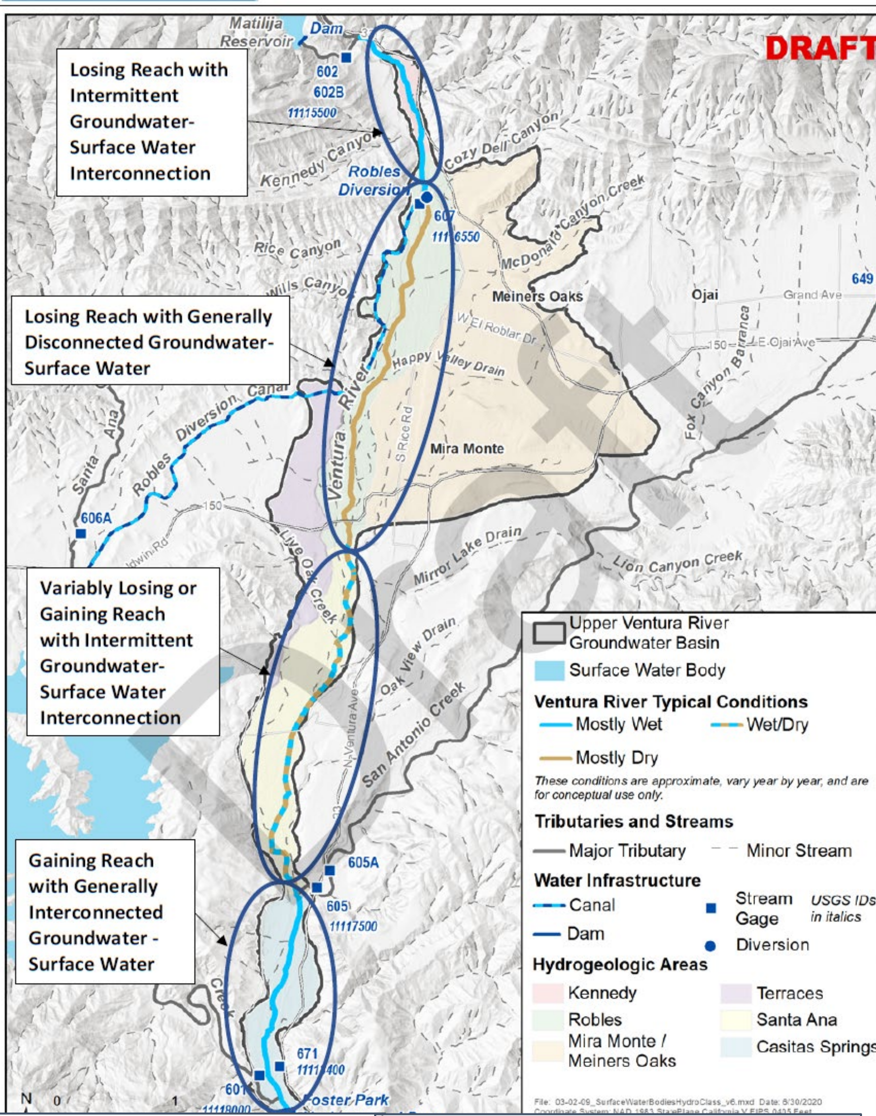
Numerical Groundwater Model - Streamflow

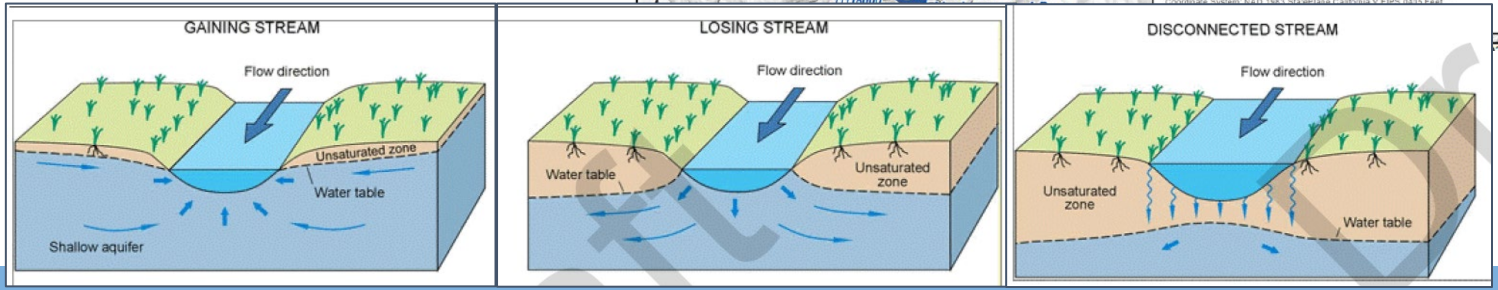
- River channel geometry based on areal imagery and Lidar data
  - Refined available NHD flowlines
  - Includes secondary braids
- Model routes gaged surface-flows from 602 (Matilija Creek) and 604 (North Fork Matilijia Creek)
- Robles Diversions based on daily data from CMWD
- Includes gaged tributary flows from San Antonio Creek and Coyote Creek
- Ungaged tributary flows estimated based on precipitation and size/characteristics of contributing catchment
- Outflow south of the Foster Park gage



Numerical Groundwater Model - Streamflow

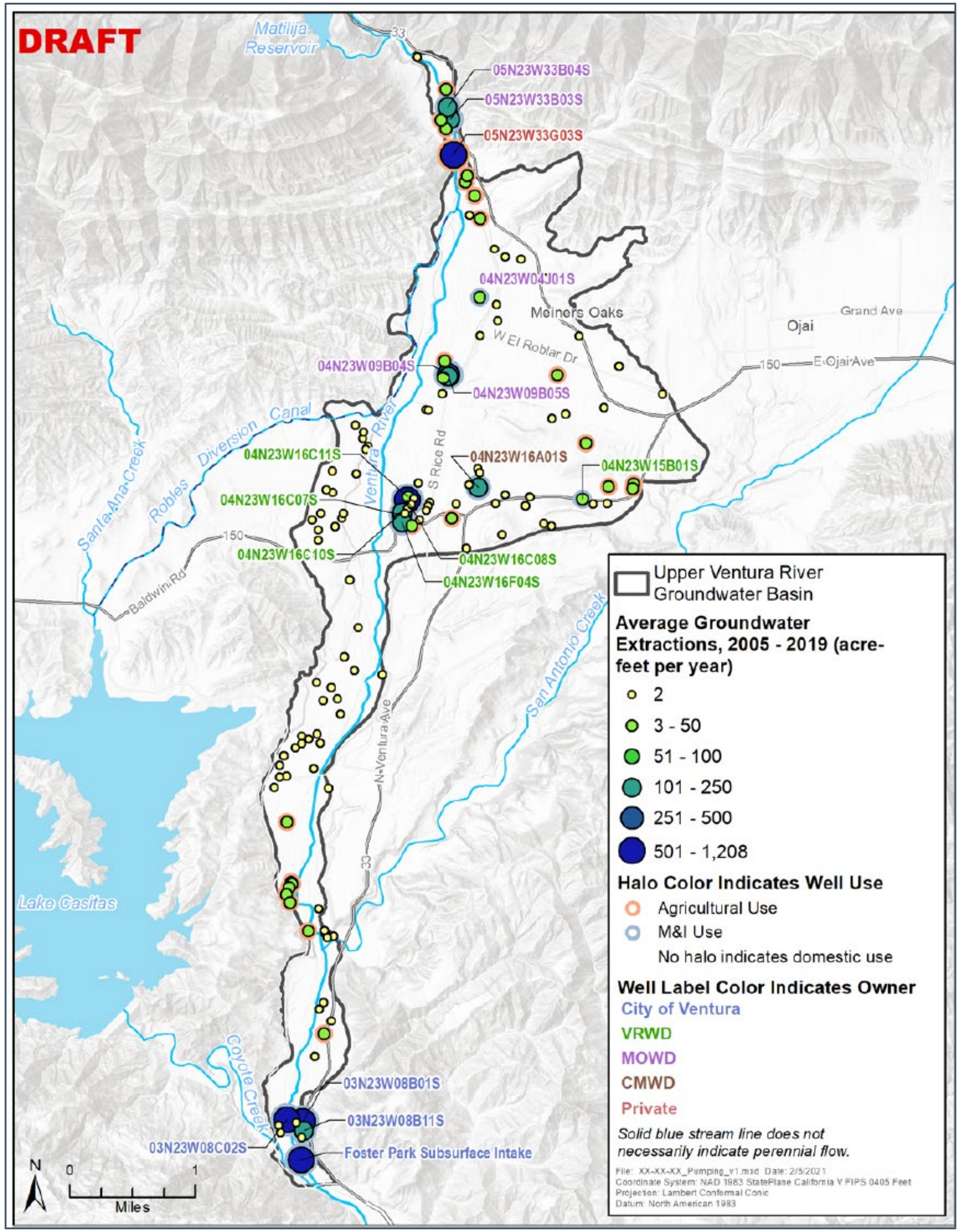
- River divided into 43 segments, with multiple reaches (total of 1462 reaches)
- SFR package routes surface-water along River channel
- Dynamically calculates GW/SW flows based on flow, stage, and width in River and groundwater table at model grid
- River can get disconnected from the water-table or dry up based on flow conditions and groundwater table
- Gaining/losing/intermittent reaches simulated by the model





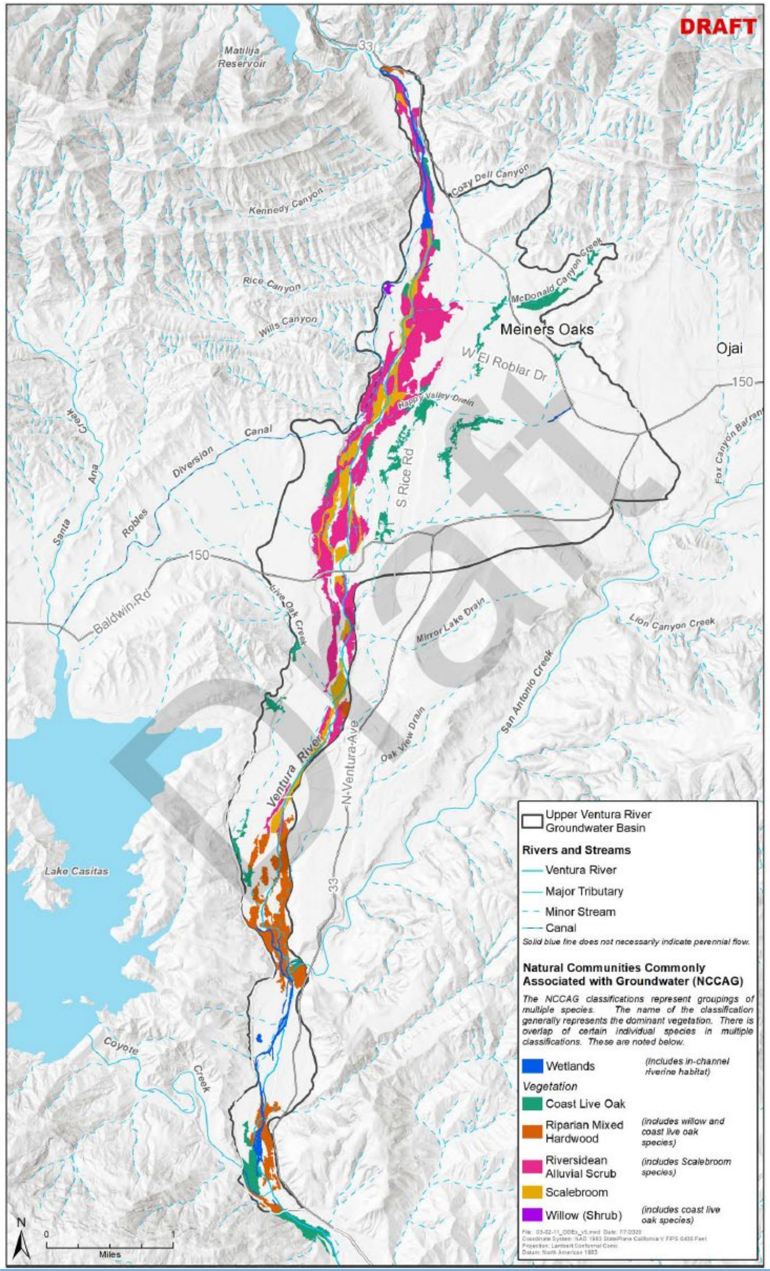
Numerical Groundwater Model - Pumping

- Model simulates all known groundwater pumping and subsurface intakes between 2005 – 2019
- Data for pumping based on:
  - M&I pumping based on reports and data received from City of Ventura, VRWD, CMWD, and MOWD
  - Ag pumping based on estimates provided by UVRGA Executive Director and Adhoc Committee
- Subsurface dam modeled as a 'hydraulic flow barrier'
- Subsurface intake modeled as series of wells along lateral intake



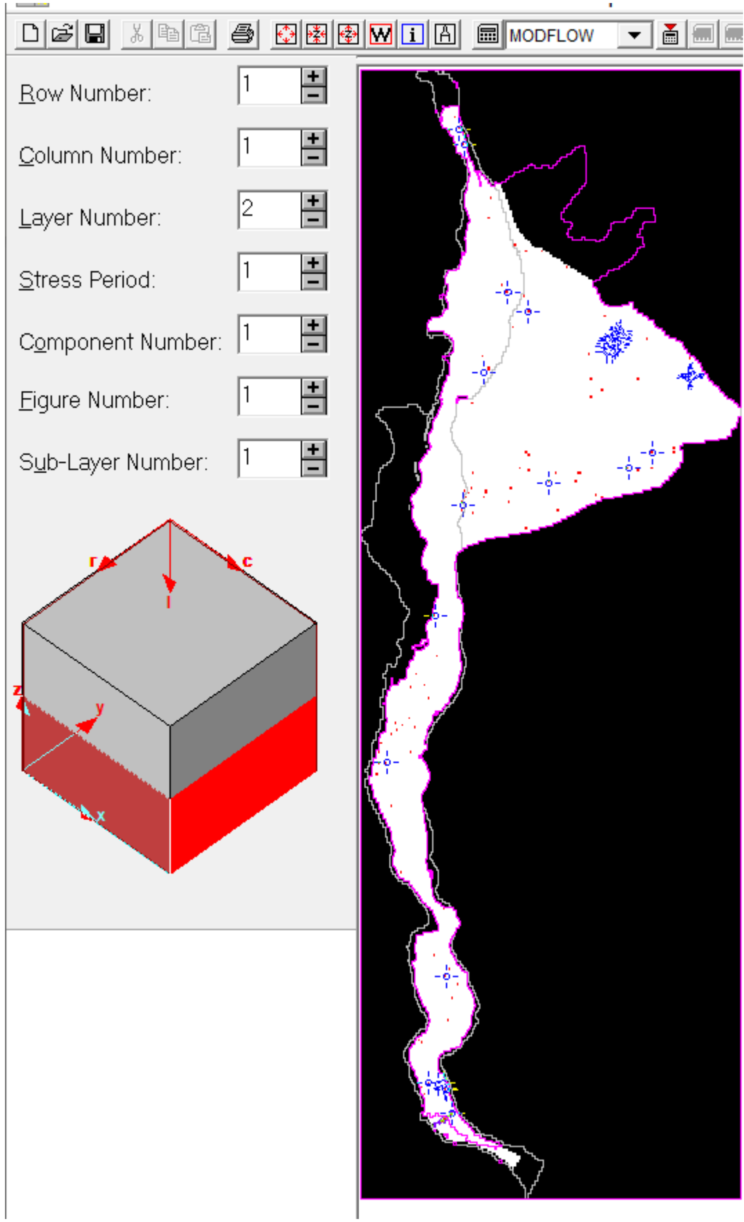
Numerical Groundwater Model
- Evapotranspiration

- Groundwater ET by riparian phreatophytes within the River floodplain modeled using the evapotranspiration (EVT) module
- Based on TNC GDE dataset
- Worked with Rincon to develop spatial distributed ET parameters based on type and density of vegetation
- Incorporated time-varying Arundo coverages provided by Rincon
- ET rates incorporate data from two CMWD ET stations

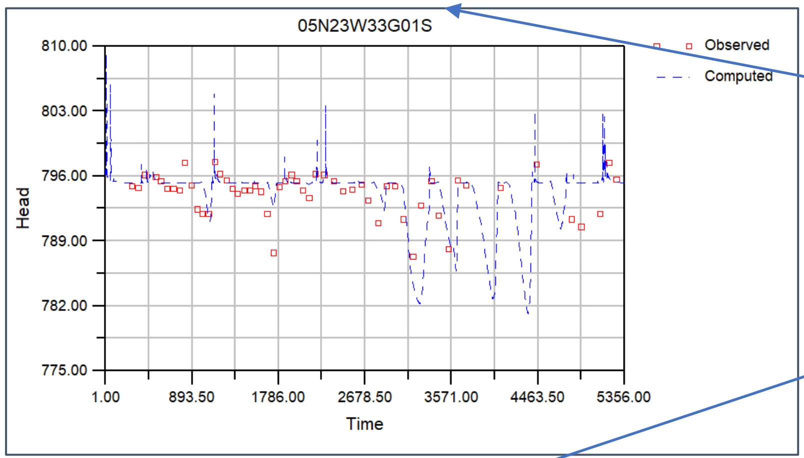


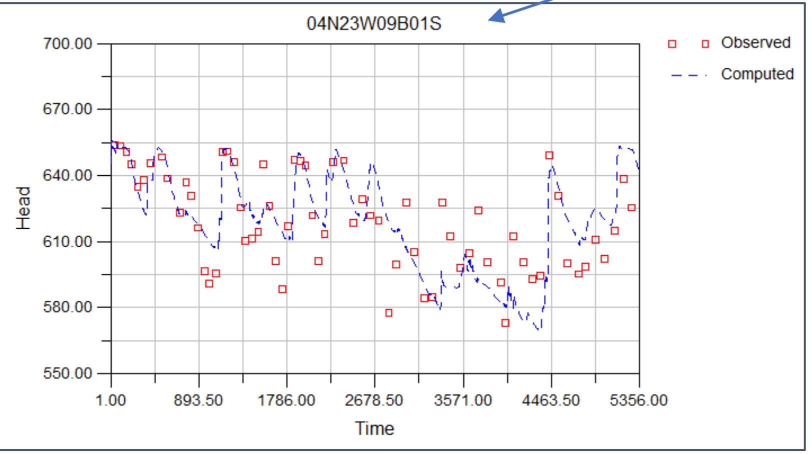
Numerical Groundwater Model - Calibration

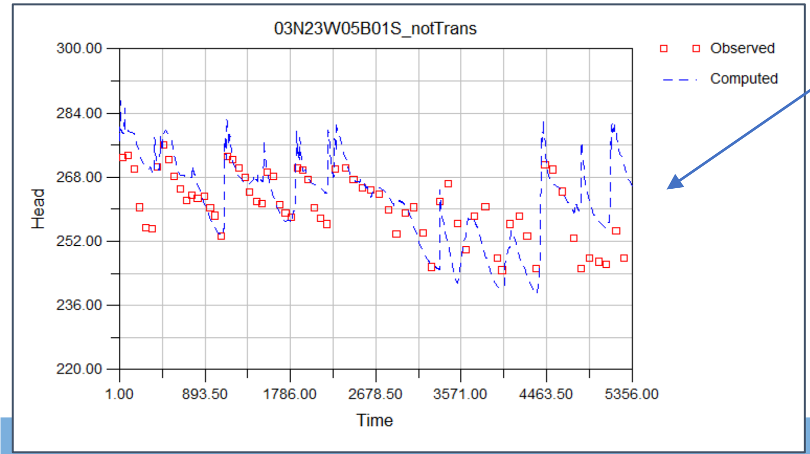
- Model calibrated to historical conditions (2005 – 2019)
- Groundwater model calibrated by varying aquifer hydraulic conductivities and storage properties to match observed groundwater levels
  - Root Mean Square Error = 2% of Range of Observations
  - Well within industry standard of 10%
- Surface-water flows calibrated by varying riverbed depth/conductance as well as groundwater parameters (conductivities and storage)
  - Match simulated and observed flows at Foster Park gauge and Robles Diversion gage
  - Match gaining/losing/intermittent reaches in different parts of the river

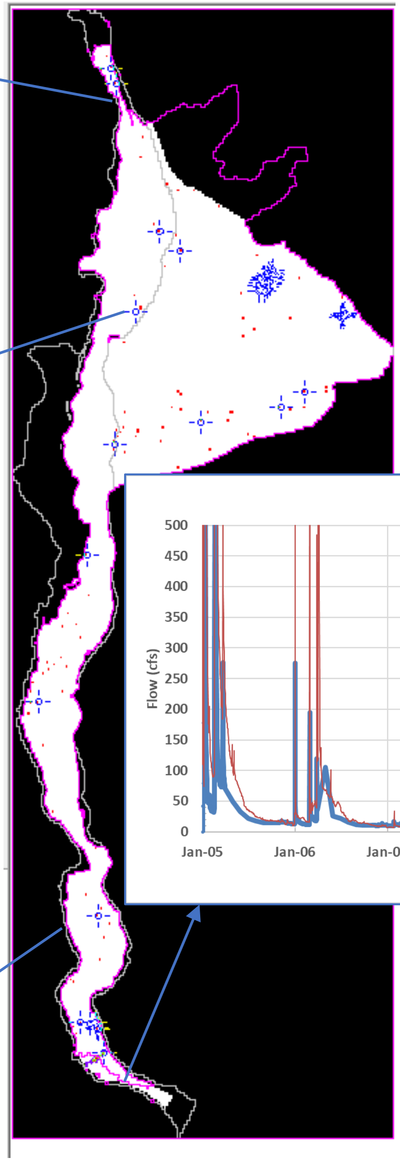


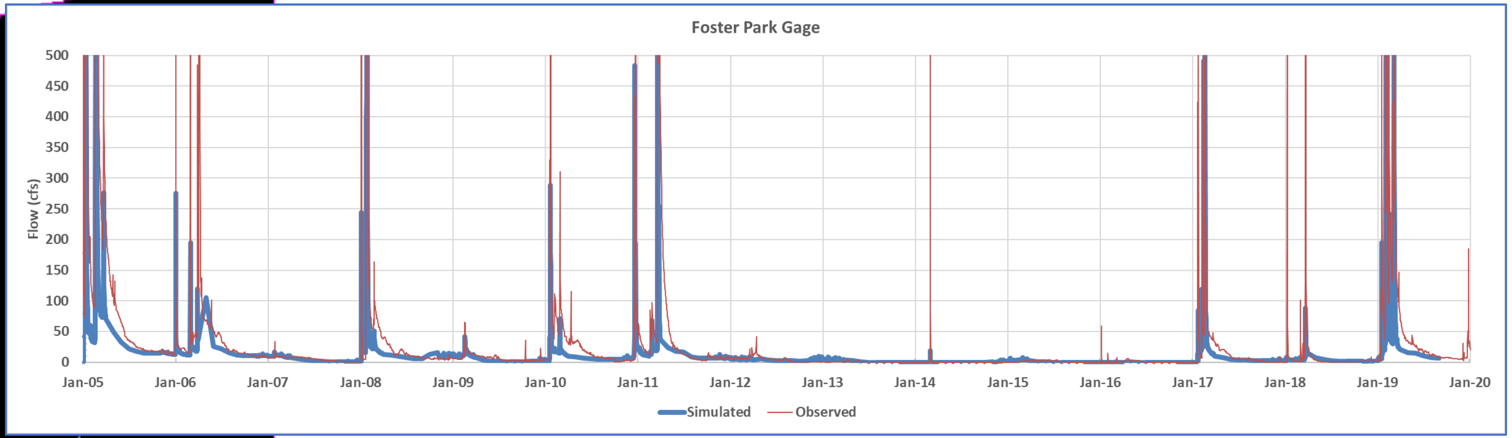
Numerical Groundwater Model - Calibration











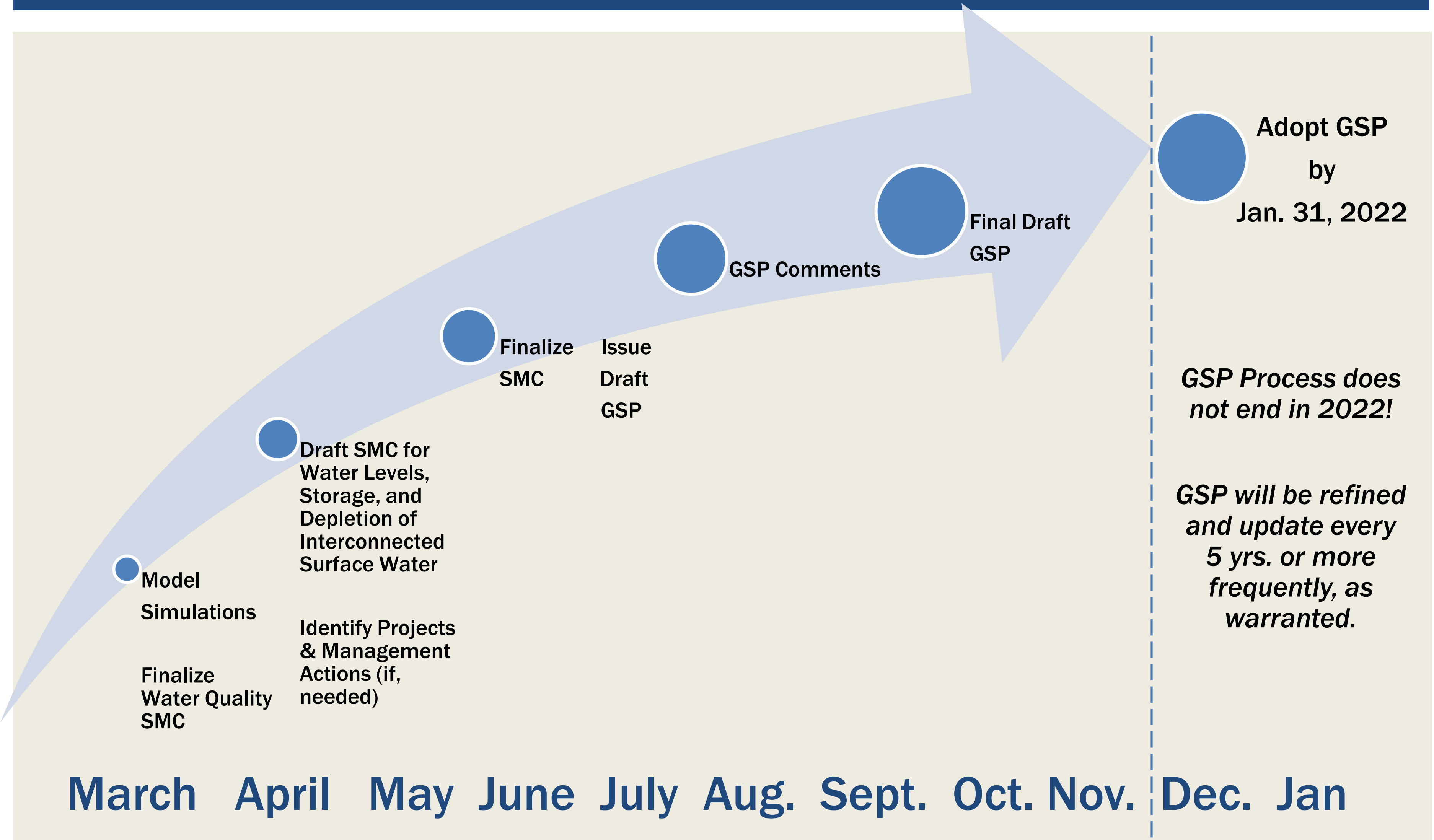
Model Use and Limitations

- Groundwater:
  - Model well calibrated to trends in groundwater elevations
  - Can be reliably used to estimate future trends in water levels, storage, and pumping impacts
  - Eastern area has limited area and complex structure – additional data would improve predictive capabilities
- Surface-water
  - Model matches low flows during summer/fall (within 1 cfs uncertainty)
  - Simulated spring baseflows lower than measured
  - Error/data-gaps in gage records impact model calibration
- Depth to bedrock is a key driver for groundwater levels and SW/GW interactions – additional geophysical/seismic data would help improve understanding
- Additional GW monitoring (near the river) and SW gages will reduce model uncertainty

Next Steps

- Finalize calibration and compile historical water budget information for GSP historical and "current" water budget requirements
- 50-year simulations for GSP future water budget projection requirements
- Simulations to evaluate depletion of interconnected surface water depletion sustainability indicator
- Model documentation TM – for GSP

NEXT STEPS



Adopt GSP
by
Jan. 31, 2022
Final Draft
GSP
GSP Comments
Finalize
SMC
Issue
Draft
GSP
Draft SMC for
Water Levels,
Storage, and
Depletion of
Interconnected
Surface Water
Identify Projects
& Management
Actions (if,
needed)
Model
Simulations
Finalize
Water Quality
SMC
GSP Process does
not end in 2022!
GSP will be refined
and update every
5 yrs. or more
frequently, as
warranted.
March
April
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan

QUESTIONS?