Integrated Groundwater and Surface Water Study of the Green Valley/Atascadero & Dutch Bill Creek Watersheds

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  - CDFW
  - NMFS
  - CEMAR
  - UCCE

Background

- Summer stream flow - can be a limiting factor for coho salmon survival
- Complexity - many natural and man-made factors affect surface water and groundwater availability
- Habitat restoration efforts by RCD, Coho Partnership and others include:
  - monitoring stream flow at selected locations
  - actively seeking to augment summer stream flow
- Knowledge of spatial and temporal variations in hydrologic conditions remains incomplete
- Challenges - increasing water demands, ongoing drought, climate change…

Approach

- Gather information describing the watersheds
  - Climate, Topography, Land use, Soils, Geology, Streams, Wells, Diversions, Irrigation
- Develop a computer model to:
  - Predict locations and quantities of stream flow under different climate conditions (e.g. "normal" v. drought)
  - Predict effectiveness of strategies to maintain or augment summer stream flow
- Relate stream flow conditions to coho habitat to:
  - Classify stream reaches based on flow conditions
  - Make recommendations for the most effective restoration actions to pursue in each stream reach

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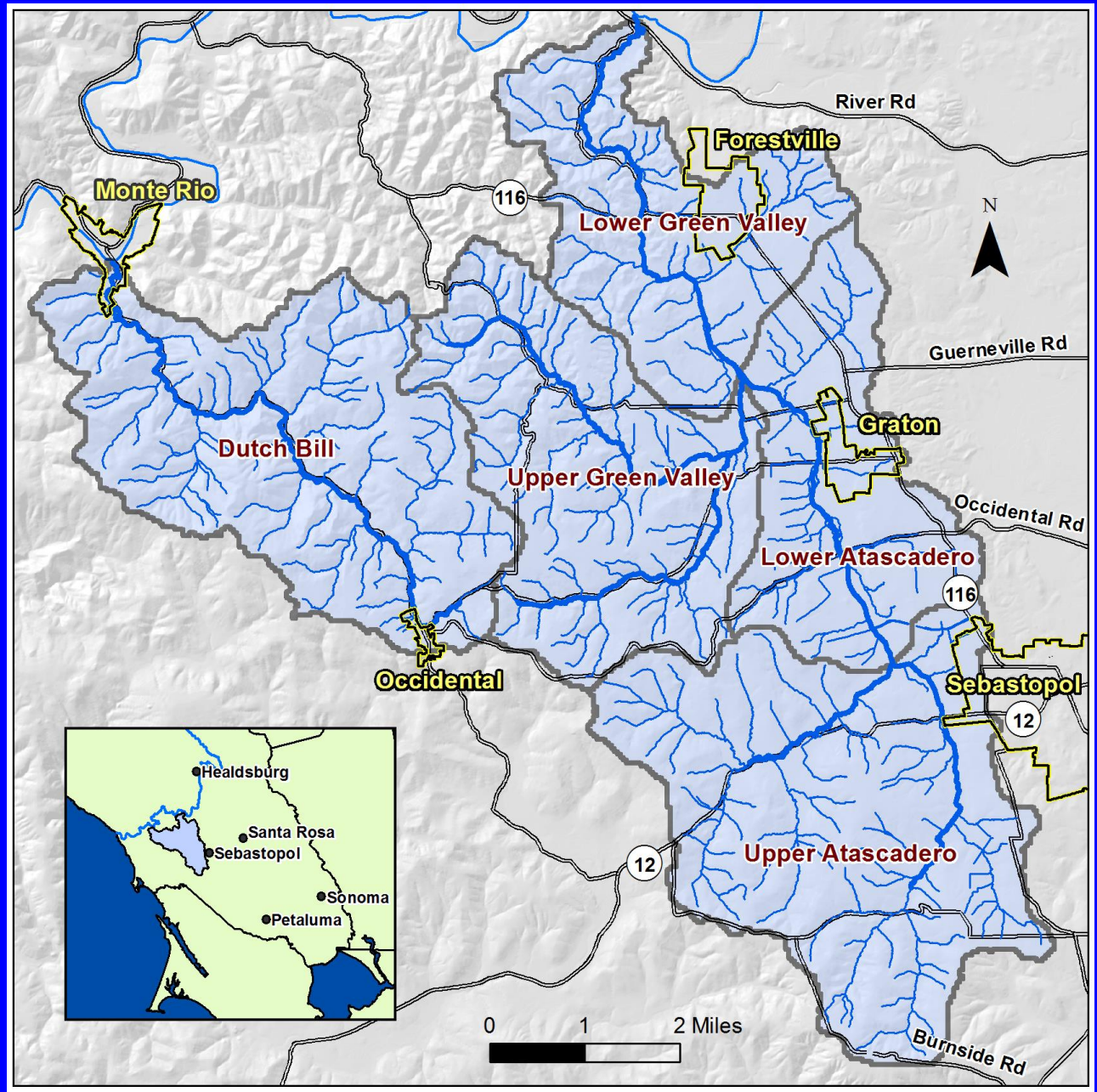
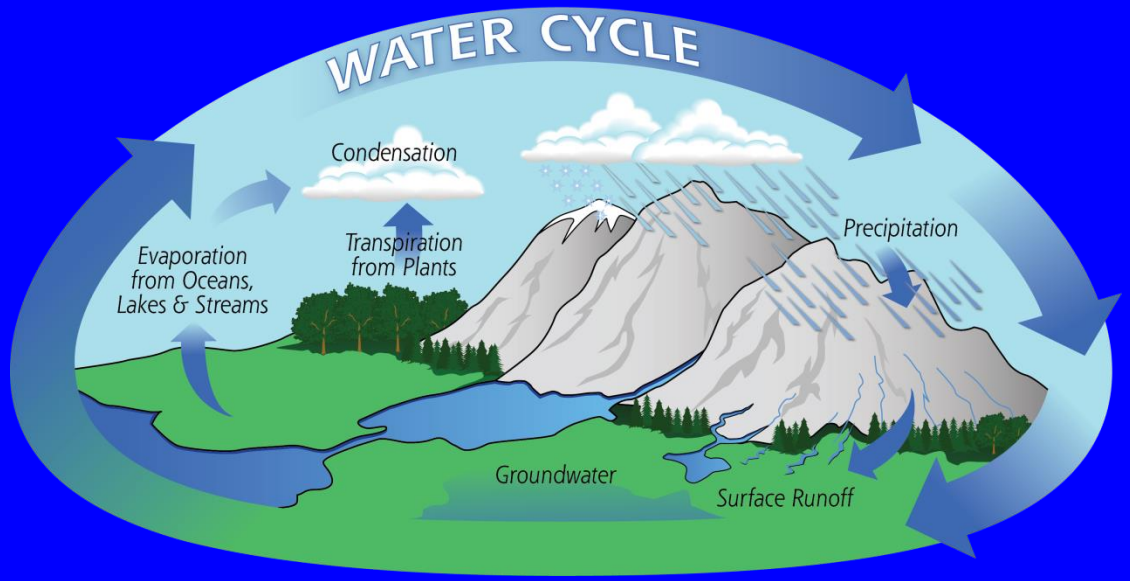
Study Area: Two Watersheds



Model Overview



Precipitation

Evapotranspiration

Runoff

Soil Water

Groundwater

Streams and Ponds

Irrigation, Wells, Diversions

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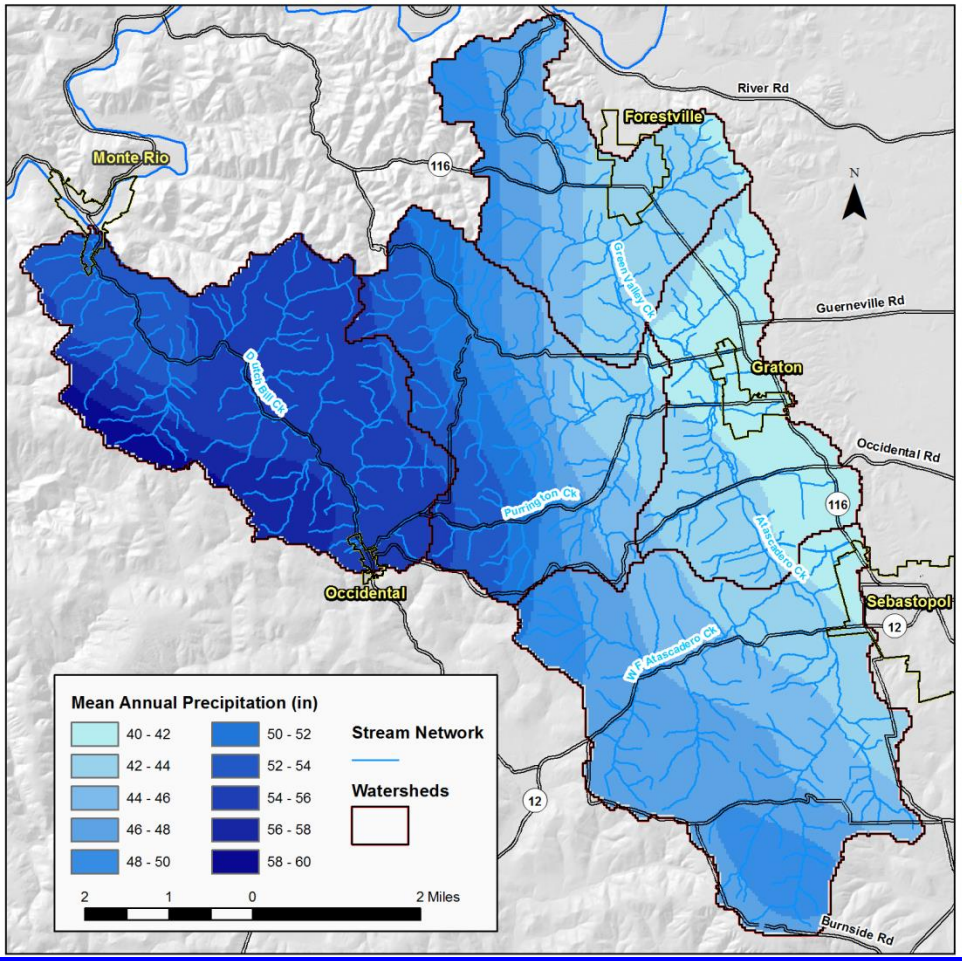
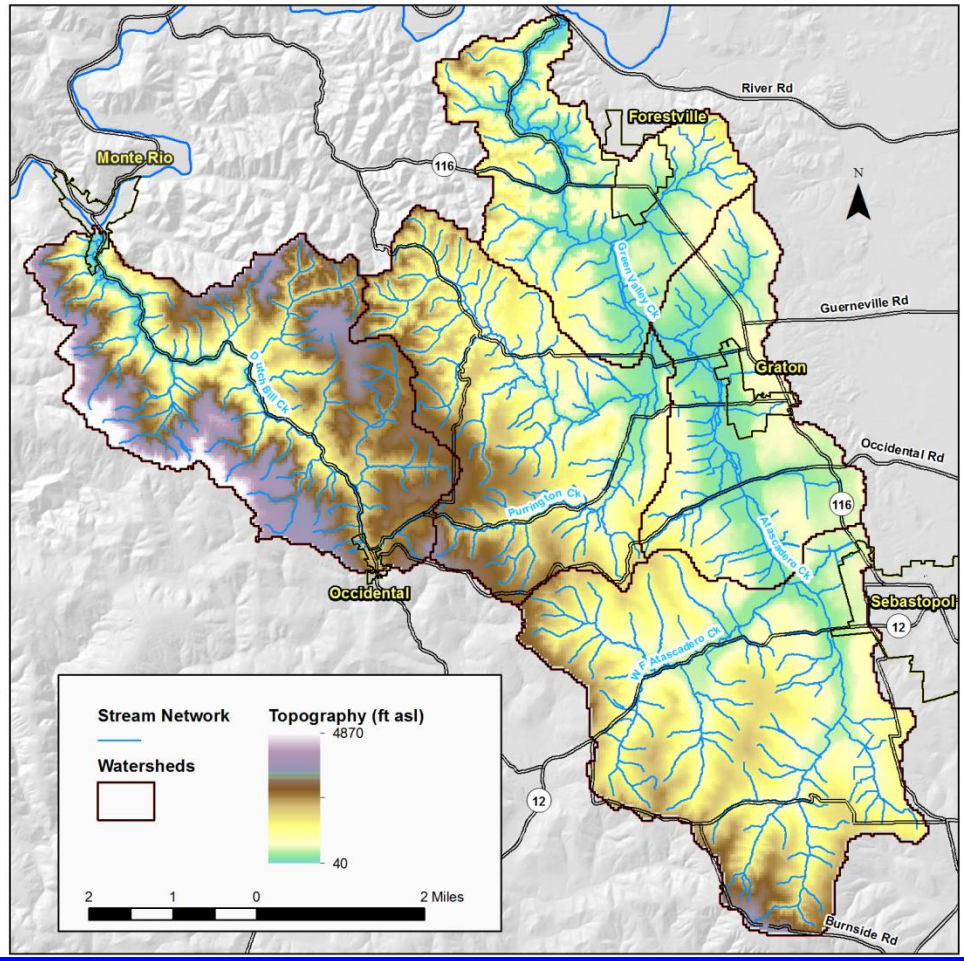
Climate

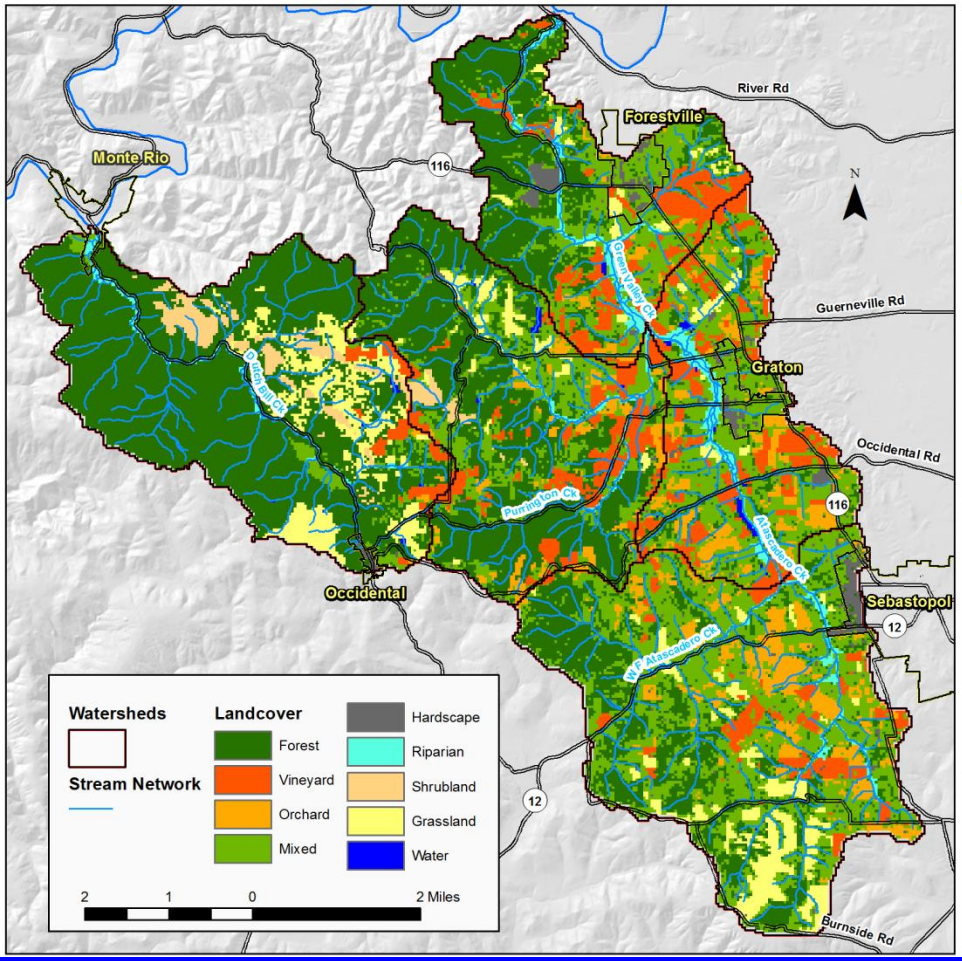


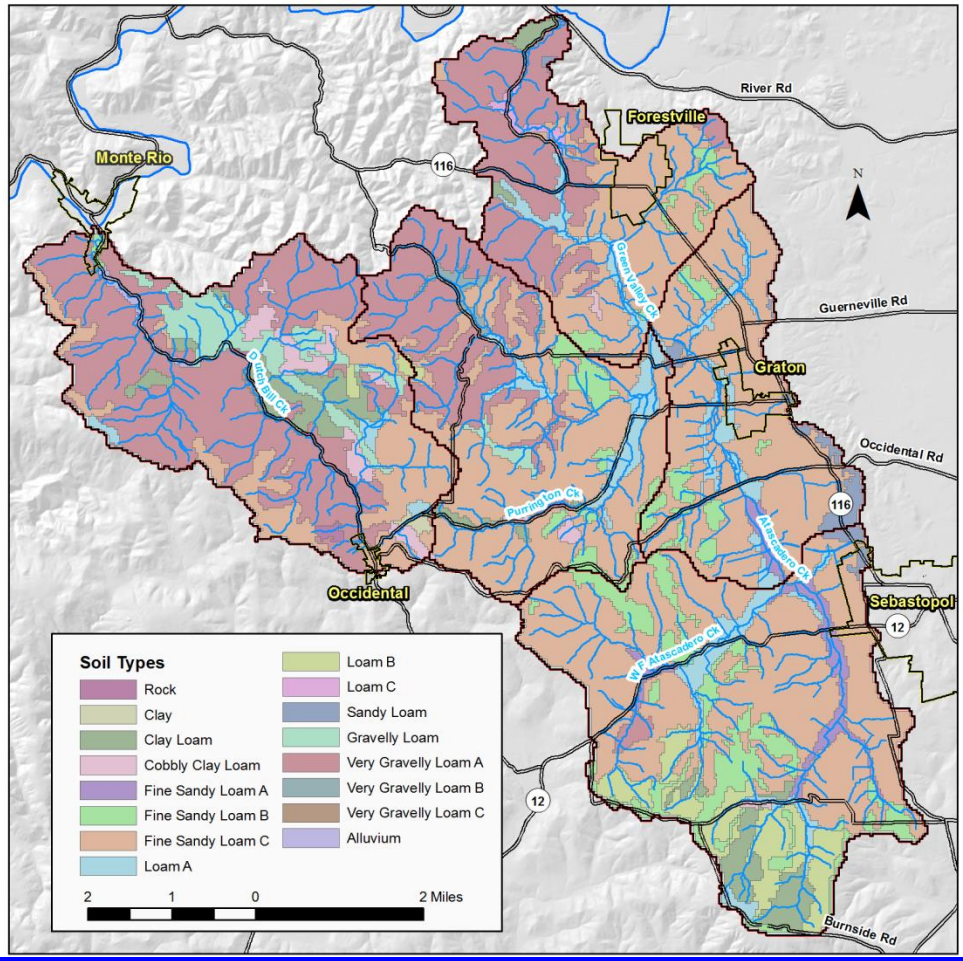
Topography



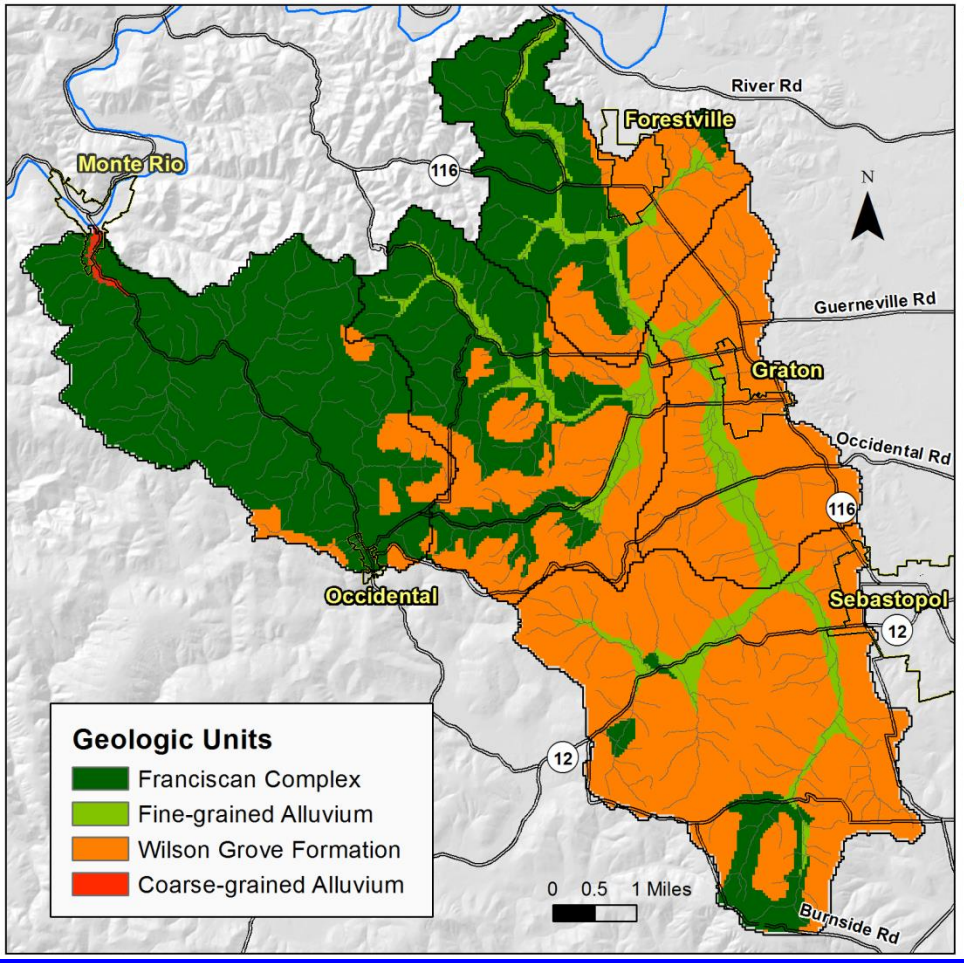
Land Cover

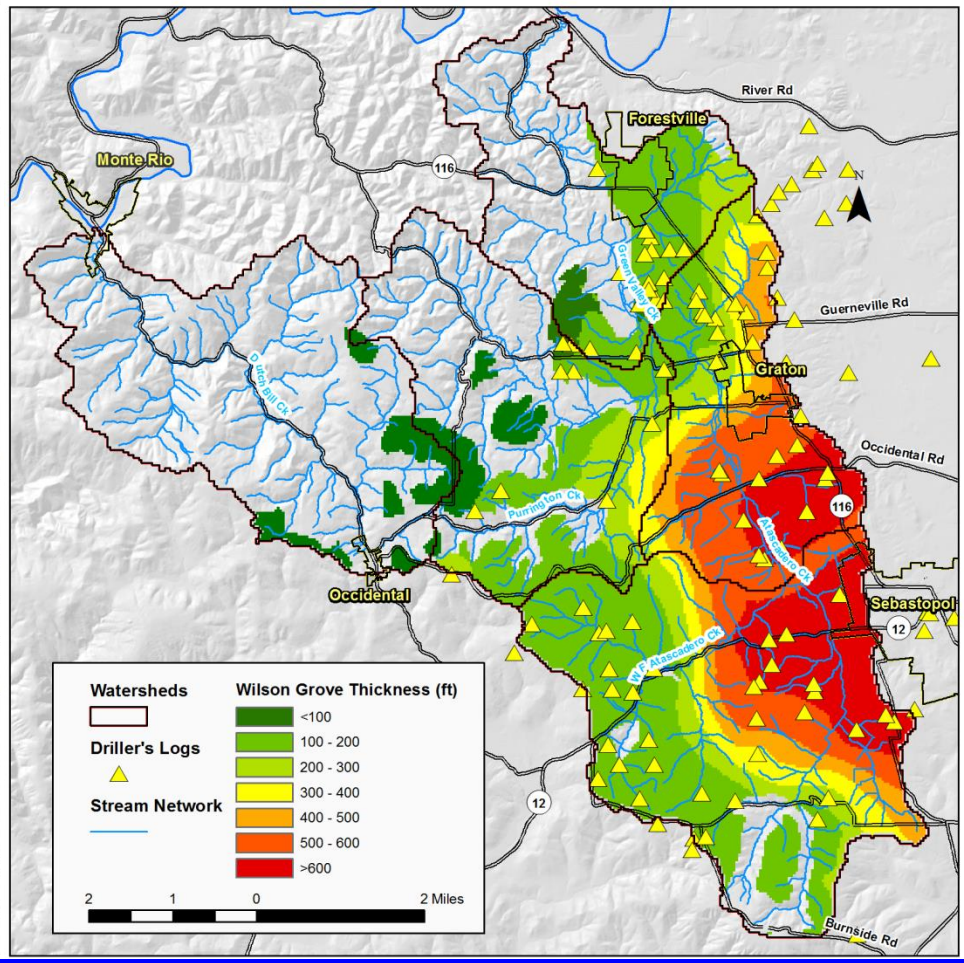
Soils





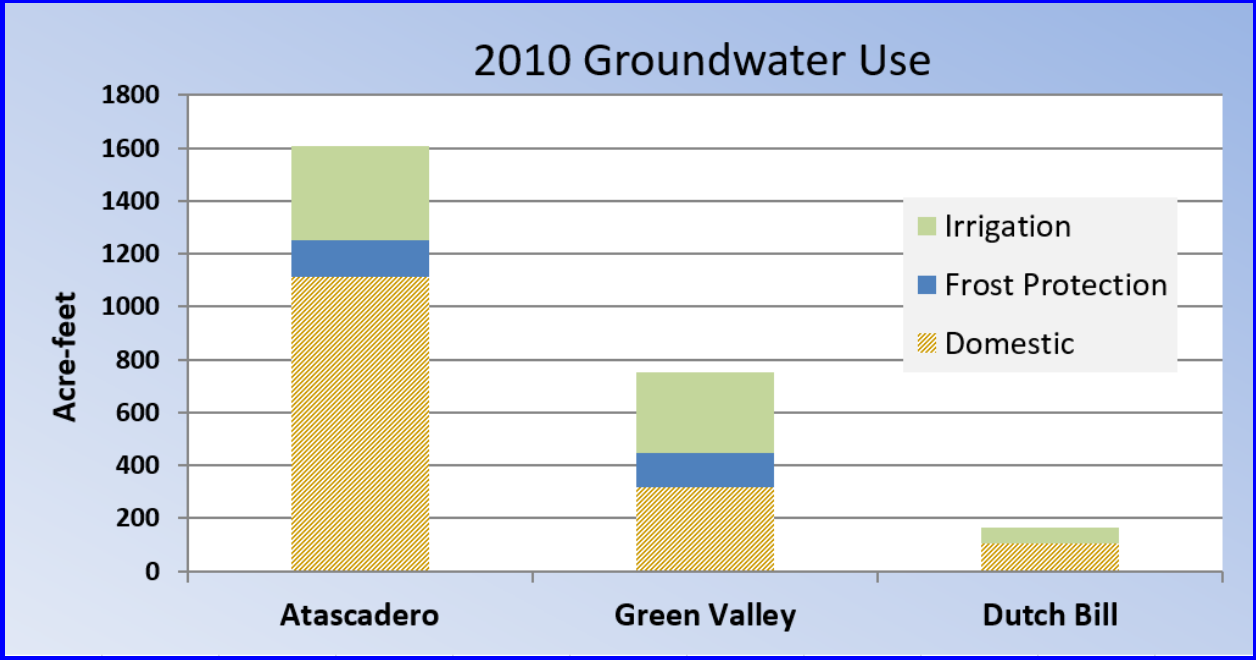
Hydrogeology



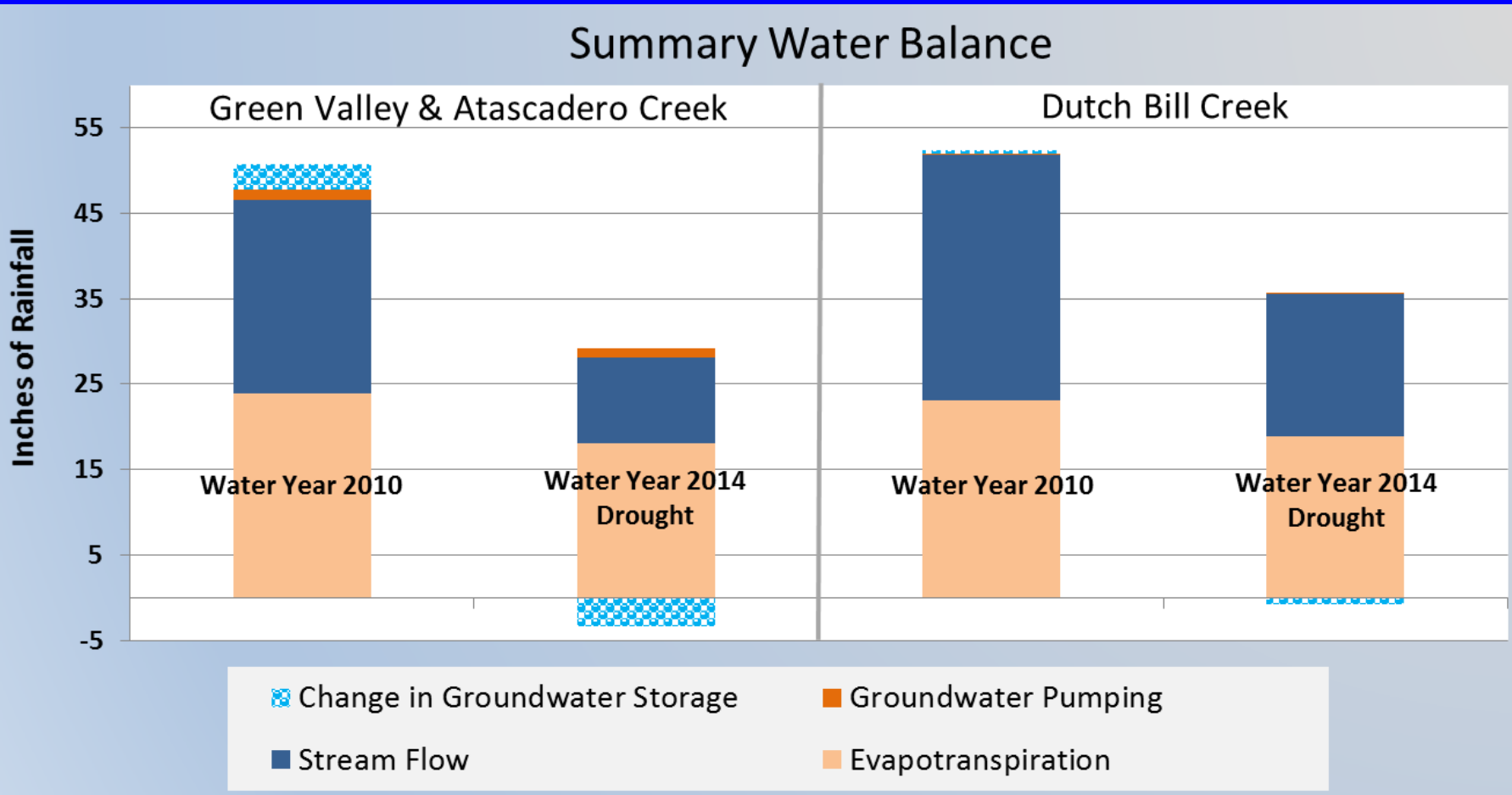


Water Use

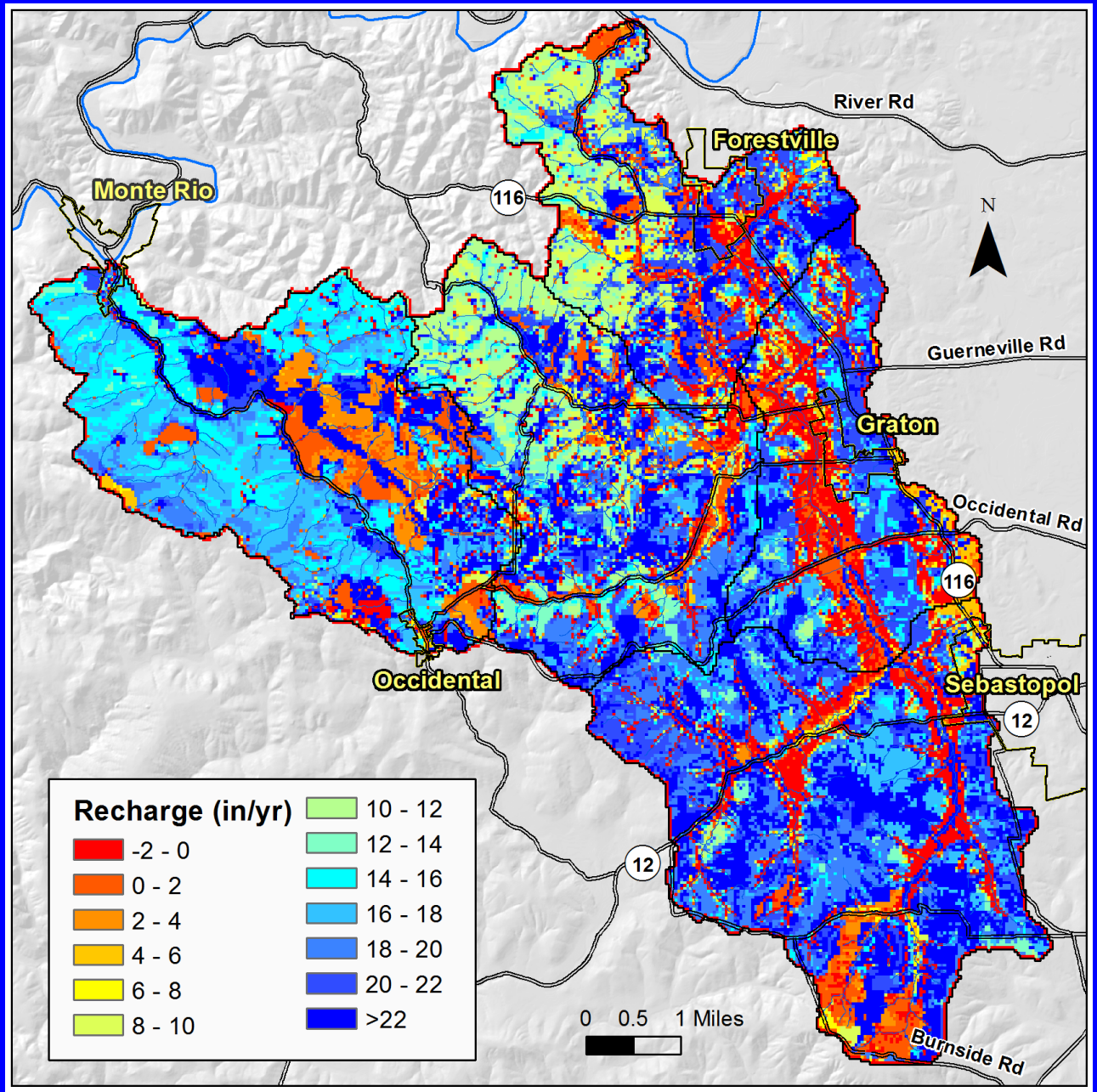
Watershed	Drainage Area (acres)	Population Served by Wells	Vineyard Acres Served by Wells	2010 Groundwater Use (acre-feet)			Surface Water Diversions Reported to SWRCB (acre-feet)
				Irrigation	Frost	Domestic	
Atascadero	12,961	7,660	1,187	359	138	1,112	85
Green Valley	11,361	2,261	1,013	306	131	328	130
Dutch Bill	7,654	730	201	61	0	106	115
Total	31,976	10,651	2,401	726	289	1,546	330



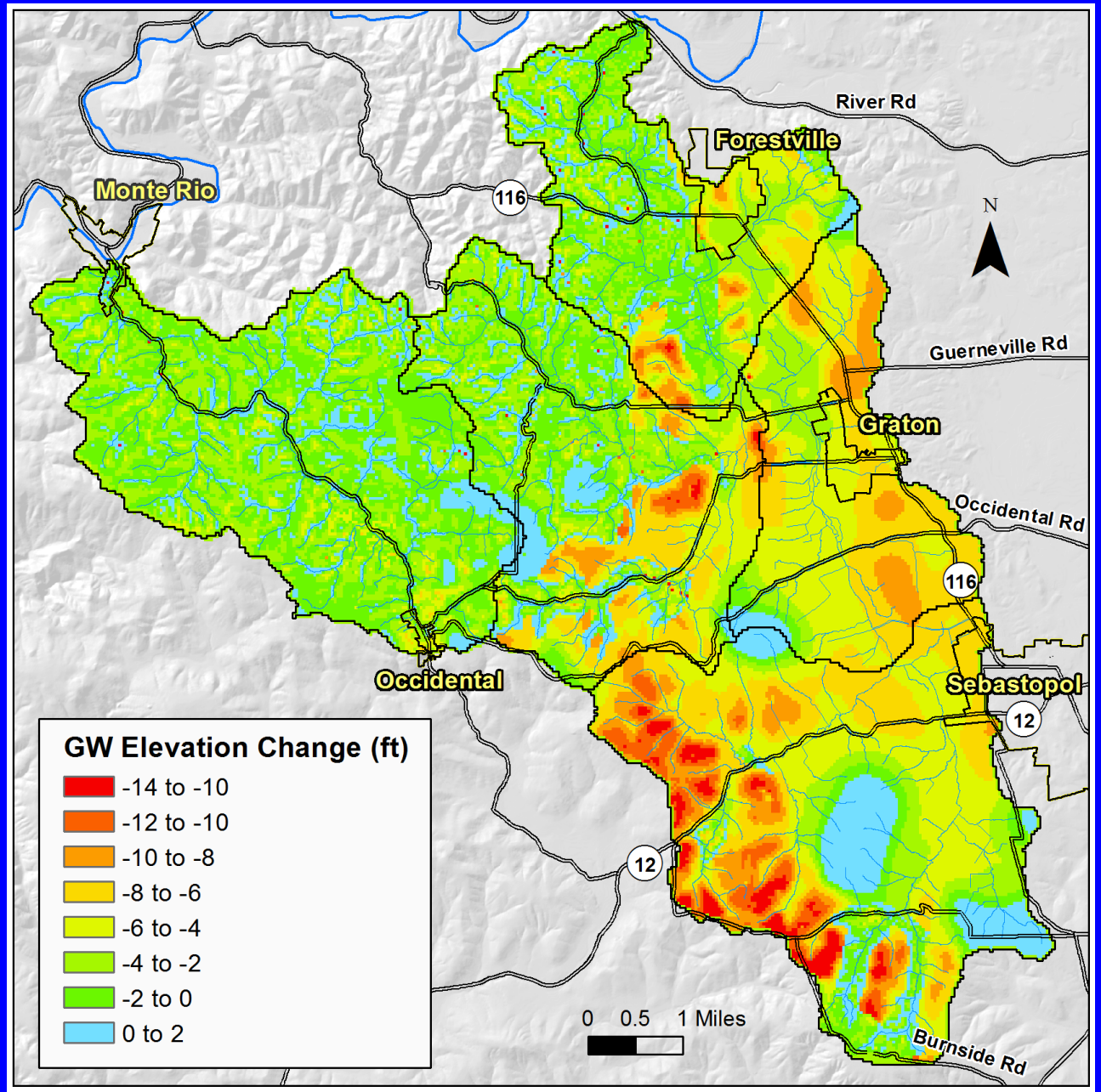
Annual Water Balance



Groundwater Recharge

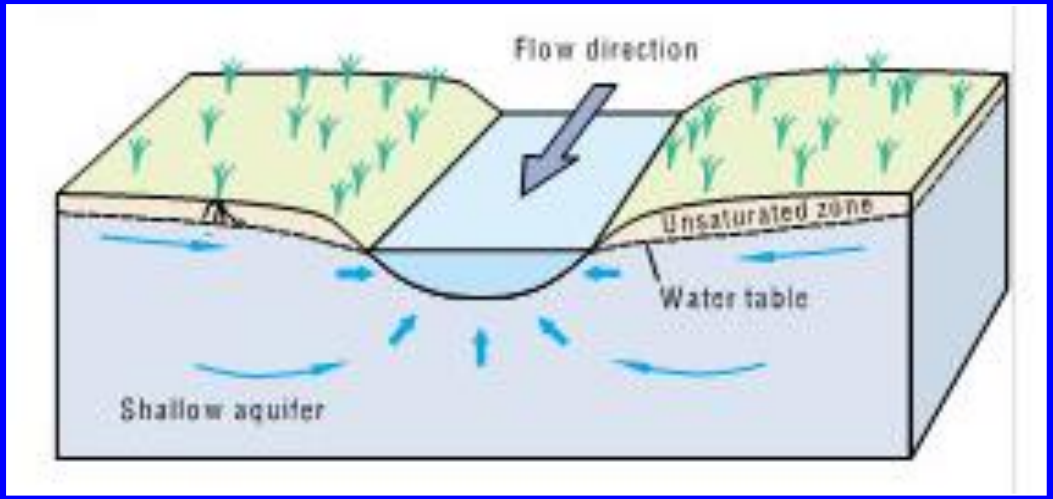


Groundwater Elevations

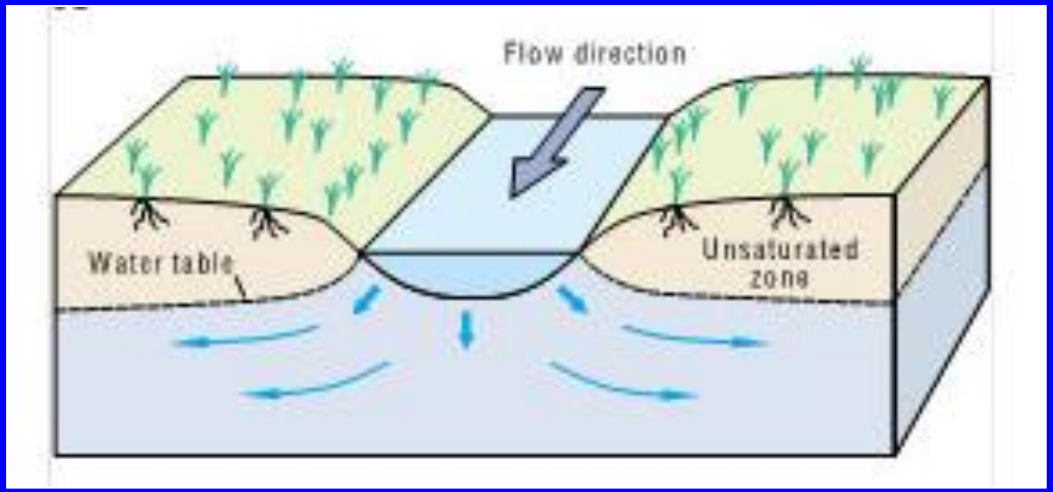


Surface water/Groundwater Exchange

Gaining Stream



Losing Stream



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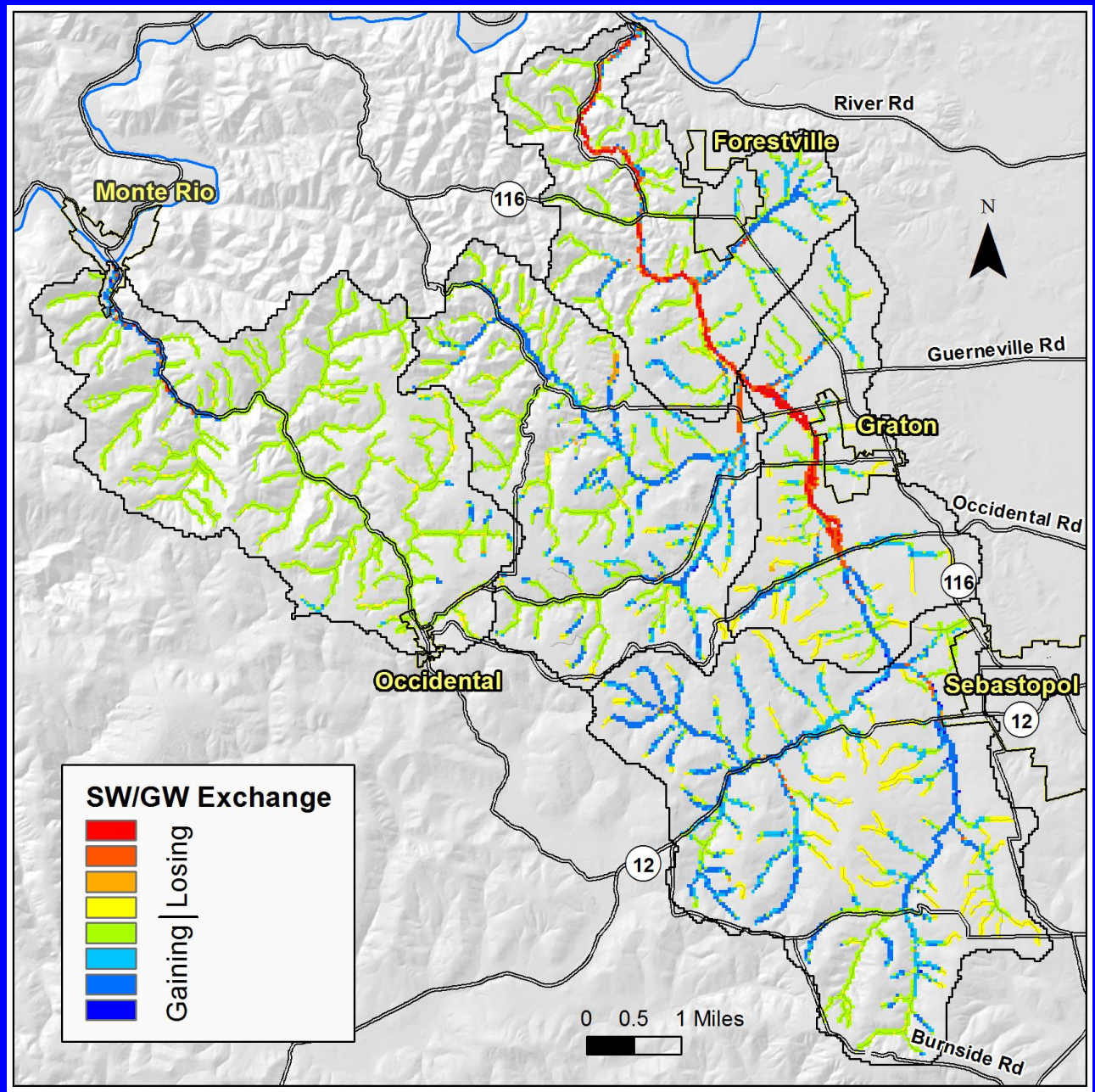
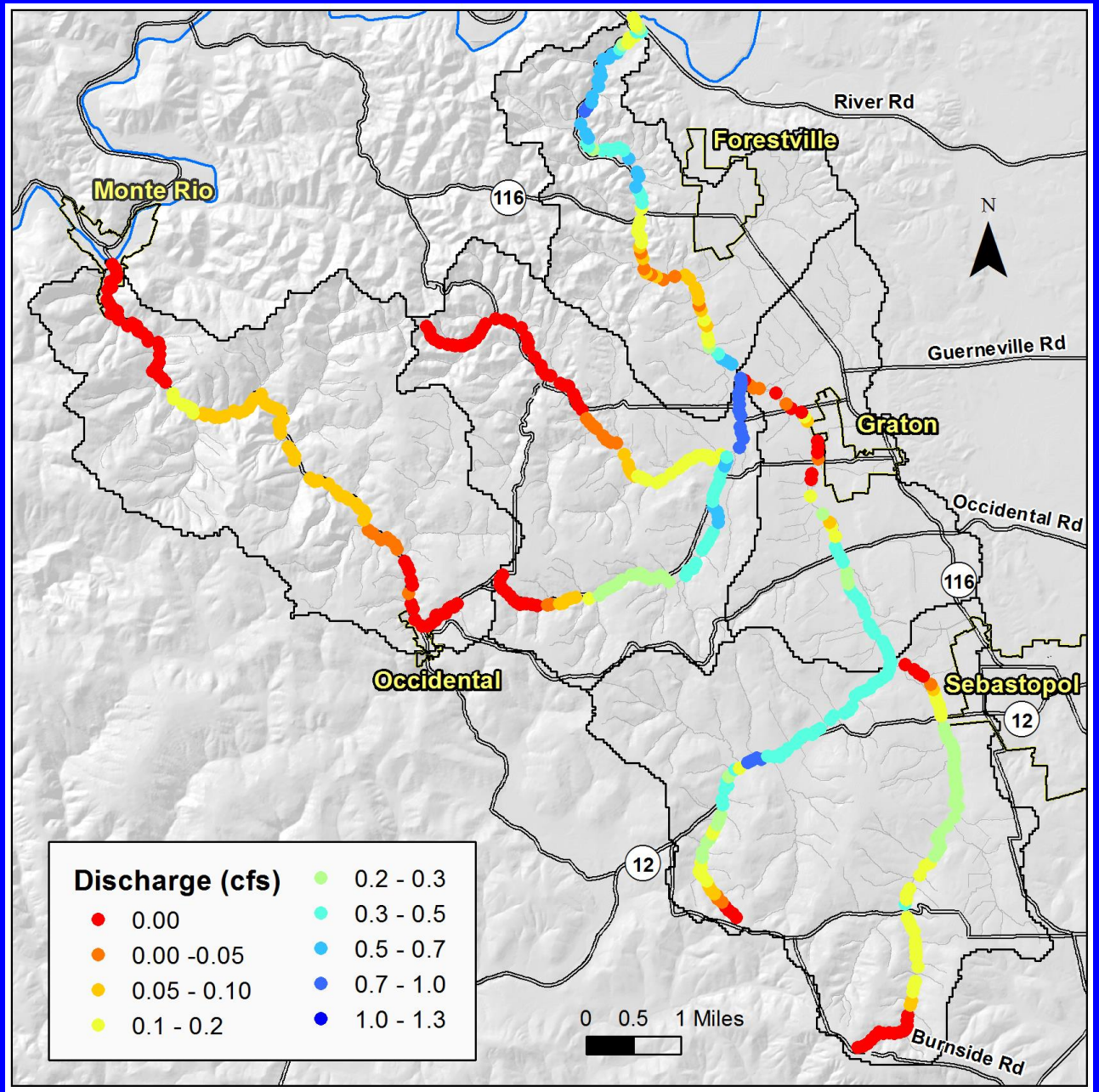
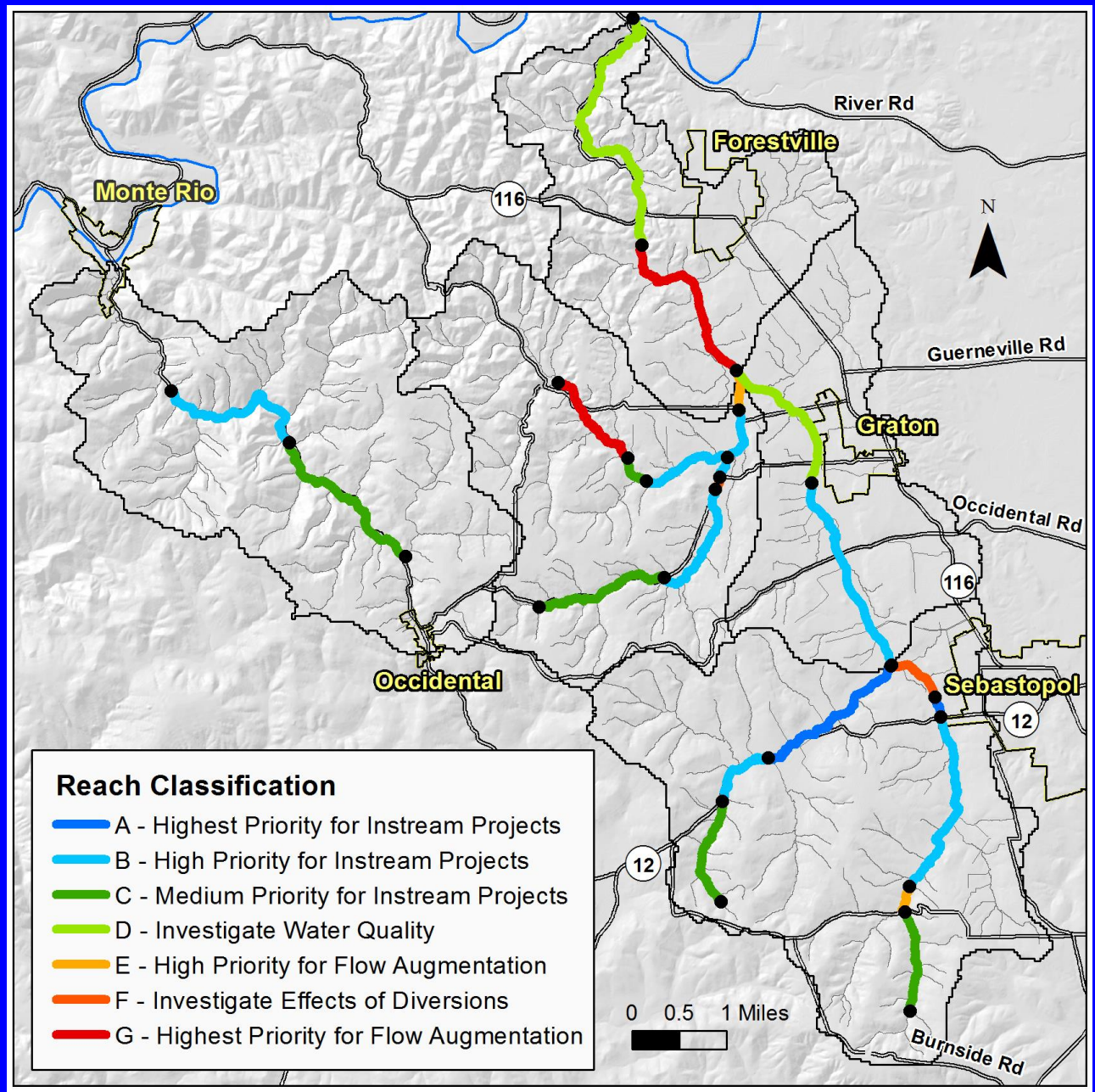


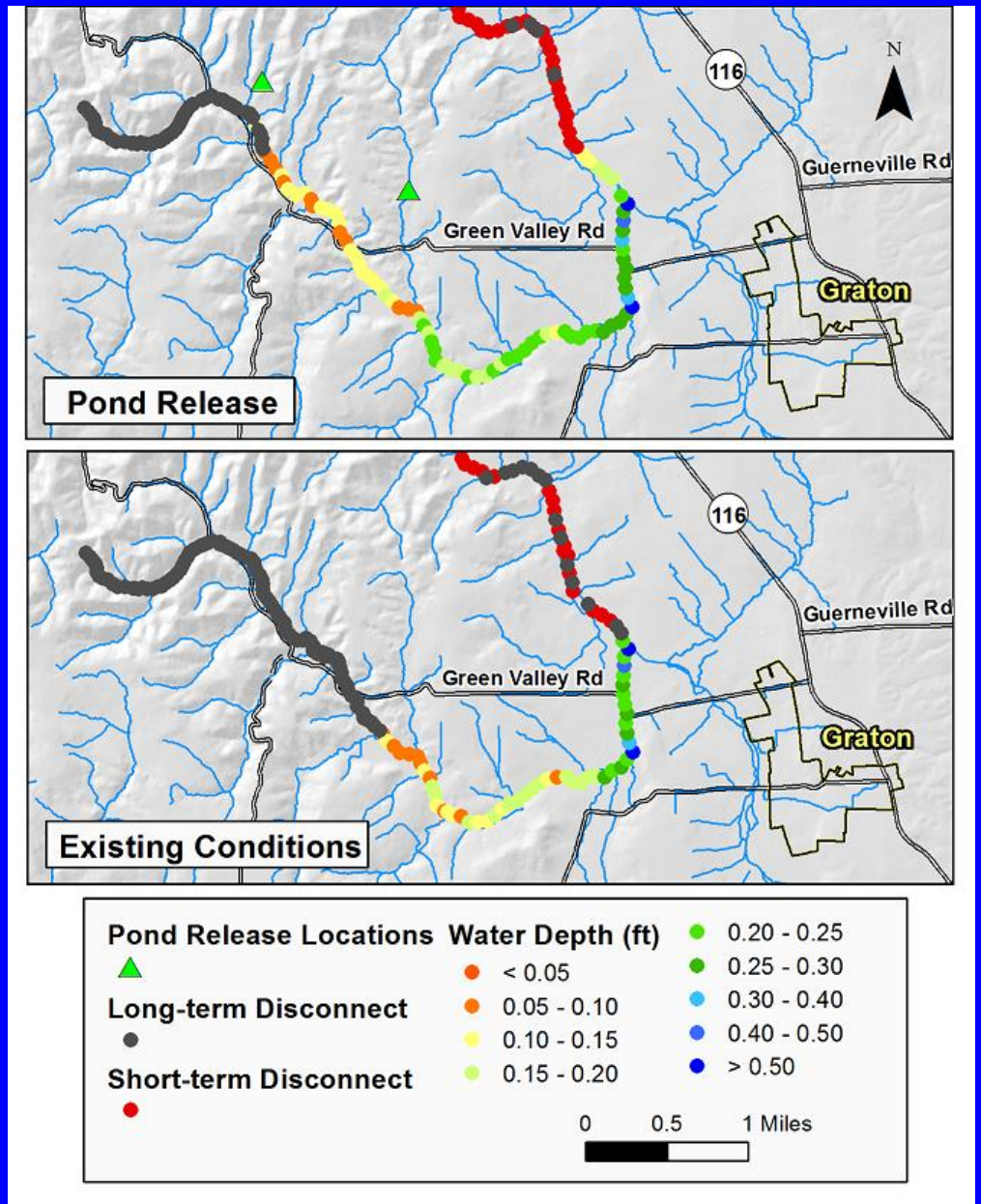
Minimum Stream Flow



Restoration Recommendations



Stream Flow Augmentation



Key Findings - Habitat

- Minimum flows drop below optimum conditions for coho rearing habitat throughout the study area
- Green Valley, Purrington, and Dutch Bill provide 16.2 river miles of perennial suitable (not optimal) habitat during average water year conditions
    - Upper Green Valley - 3.4 miles
    - Lower Green Valley - 5.7 miles
    - Purrington - 2.8 miles
    - Dutch Bill - 4.3 miles

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Key Findings - Drought

Drought Effects

- 2014 groundwater recharge was only 20% of "normal"
- In 2014, the extent of reaches with suitable coho habitat decreased from 16.1 to 12.8 river miles
- Variable stream flow responses – a portion of Dutch Bill Creek and Purrington Creek are more resilient to drought conditions than Green Valley

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Key Findings - Restoration

Flow Augmentation

- Targeted flow augmentation could be a very effective means of increasing habitat availability
- Identified highest priority reaches

Atascadero Creek

- 8+ miles of Upper Atascadero have suitable flow conditions
- Conditions in the lowest 2 miles of Atascadero may be limiting – further investigation needed

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Next Steps

- Refine model with more detailed diversion and well data to evaluate potential for improving stream flows by modifying water use patterns
- Actively use the model as a management tool
  - Proposed flow augmentation projects can be simulated and optimized
  - Develop strategies to manage rainfall, runoff, soils and vegetation to maintain and enhance groundwater recharge
  - Forecast potential changes in stream flow resulting from anticipated changes in land- and water-use and resulting from climate change

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