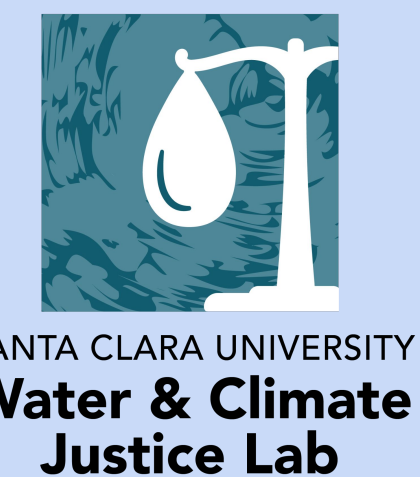




Tuolumne River Health Report Card

Evaluating Land Use Impacts on River Health

E. Mila Erceg, Aryn Kaul, Austin Kaneko, and Bianca Isabela Ricafort
Department of Environmental Studies and Sciences, Santa Clara University



1. Introduction

The **Tuolumne River** shaped settlement during the Gold Rush and continues to support surrounding communities and ecosystems. Today, the **watershed faces increasing pressure** from agricultural runoff, urban development, industrial activity, altered flow regimes, and rising temperatures. Building on the ESS Capstone of Eulate et al. (2025), this study evaluates the river's health using a **grading framework** to examine how **land use patterns**, including agriculture, industry, and the distribution of mobile home parks, influence environmental conditions along the river.

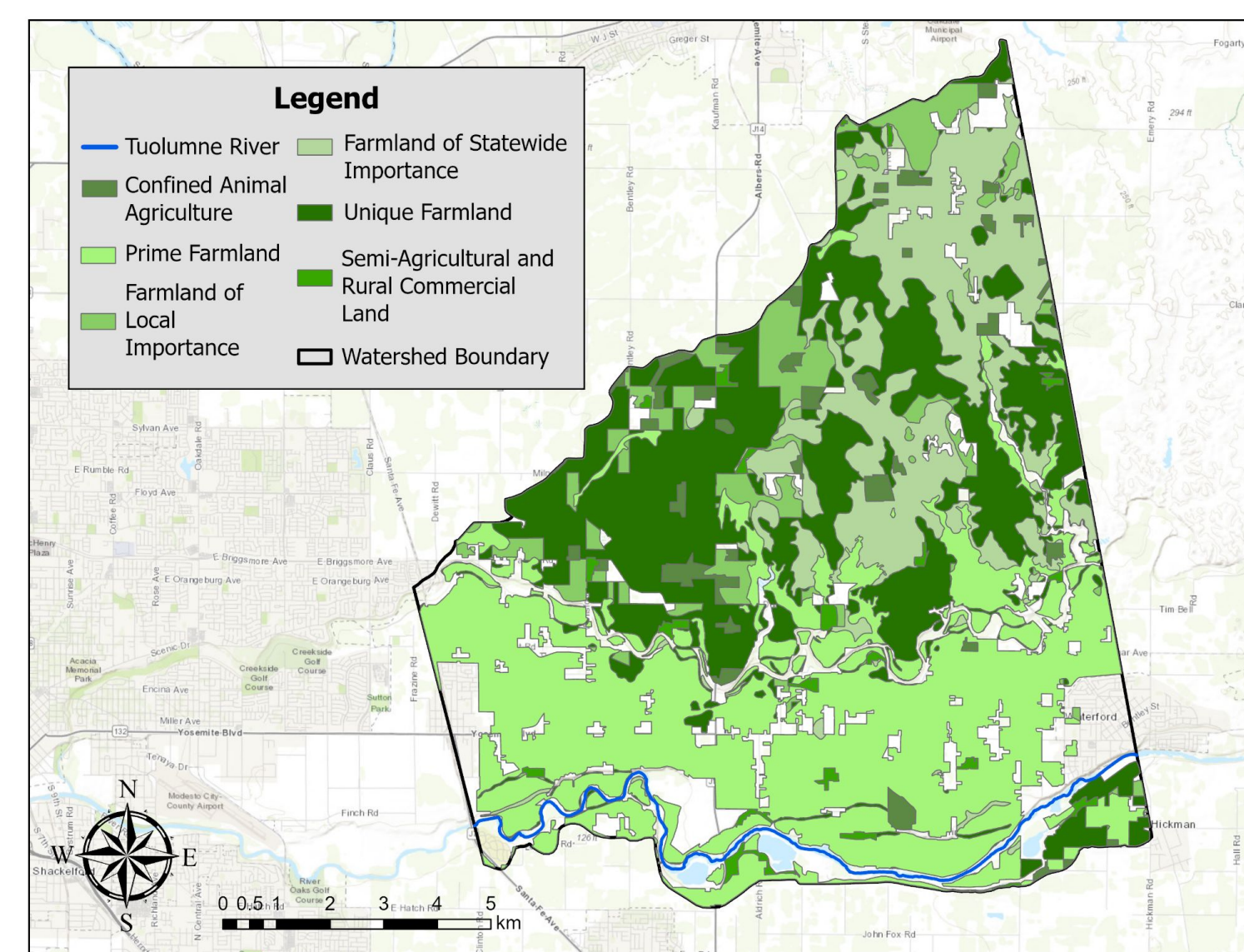


Figure 3. Map of Irrigated Farmlands within the Empire-Hickman watershed section

3. Methods

Topic	Metric	Measure	Grade	Individual Scores	Avg. Score	Avg. Scores by Metric	1	2	3	
I: Water Quality	Water Quality Testing	Nitrates (ag. runoff)	C	2.0	3.5	0.57	3.12	1.25	Overall Score for the Modesto-Empire Section: 2.63 (C+)	
		Conductivity	A	4.0						
		Dissolved O2	A	4.0						
		pH	A	4.0						
	Agricultural Land Cover	Percent of watershed area that is irrigated land	B	3.0	3.0	0.99				
	Industrial Presence	Percent area by food processing plants or wineries	B-	2.7	2.7	0.89				
		Number of auto repair shops	B-	2.7						
	Mobile Home Park Presence	Percent area covered by mobile home parks	A	4.0	4.0	0.66				
II: Water Flow	River Flow Data	% flow	B	3.0	3.0	NA	NA	0.7		
III: Land Management	Protected Areas	% protected area within 1 km of river	D	1.0	1.0	NA	NA	0.2		
IV: Ecosystem Status	Riparian Coverage	% Area within 1km of river	D+	1.3	2.4	NA	NA	0.49		
	Riparian Quality	Quality within 1km of river	B	3.0		NA				
	Invasive Species	Invasive Species Count	B	3.0		NA				

Figure 4. Table Showing Weighted Grade Calculations for the Modesto-Empire Section

¹ Combined Average Metric Scores

² Combined Avg. Metric Score * Topic Weight

³ Composite Score

2. Research Questions

1. How can we define what a “healthy” Tuolumne River looks like in a way that reflects both ecological science and what the local communities care about?
2. What’s the most effective way to communicate “river health” on an interactive map so that it’s clear to people who live near or depend on the river?
3. How will understanding historical and agricultural/pollution data on the Tuolumne help us in making accurate grades for the different parts of the river?

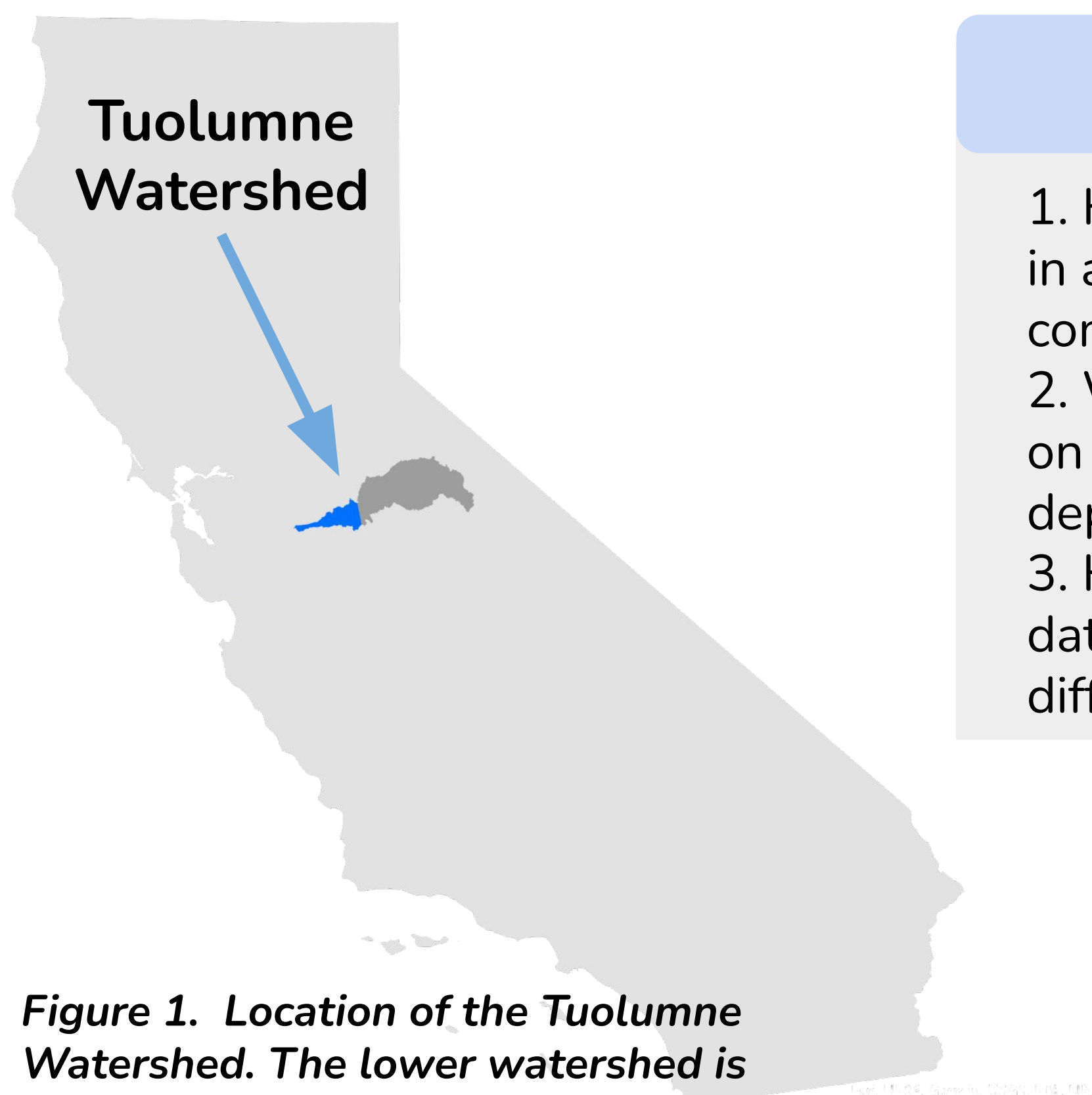


Figure 1. Location of the Tuolumne Watershed. The lower watershed is the scope of this work and marked in blue.

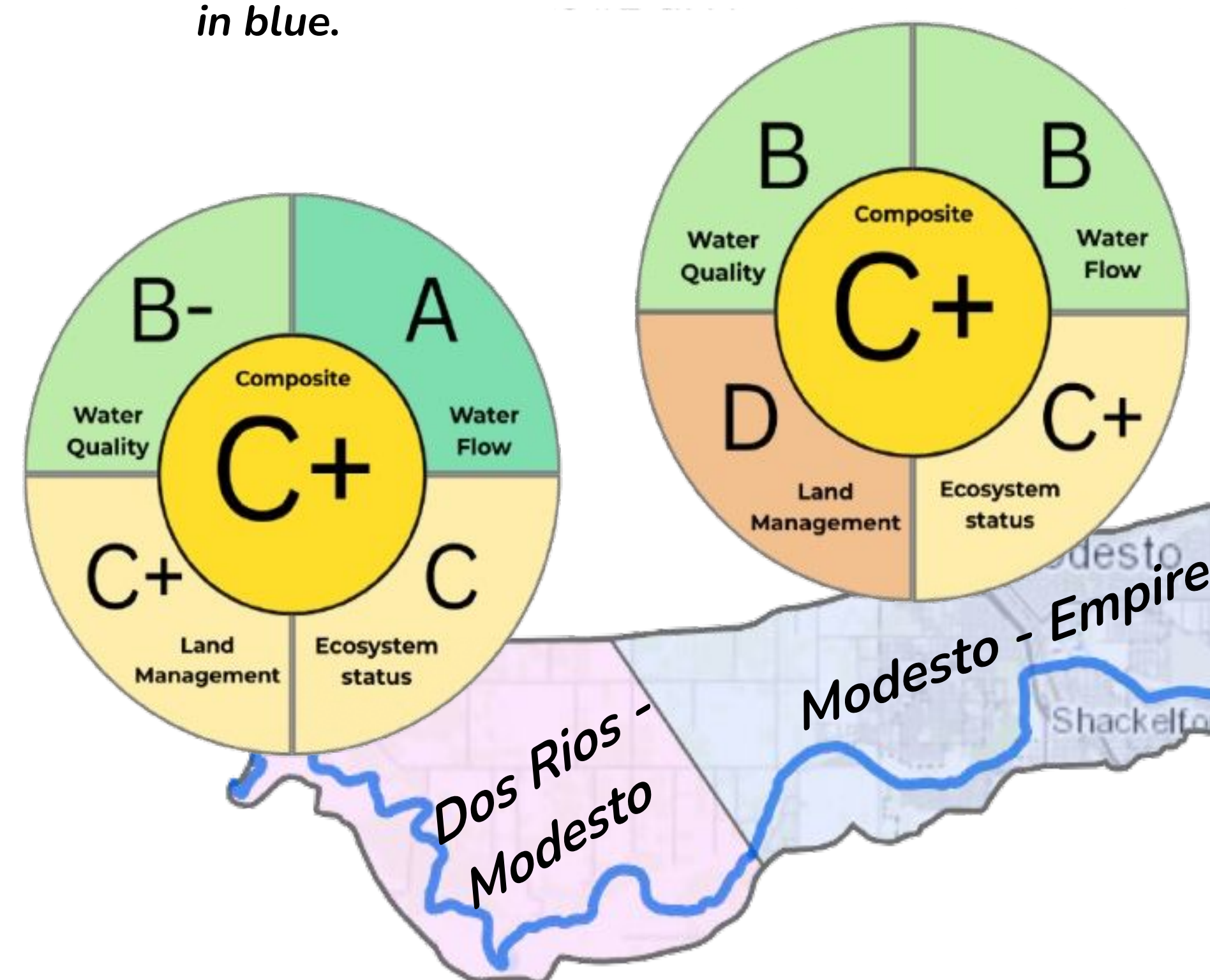


Figure 2. Map of the Tuolumne River Watershed Sections

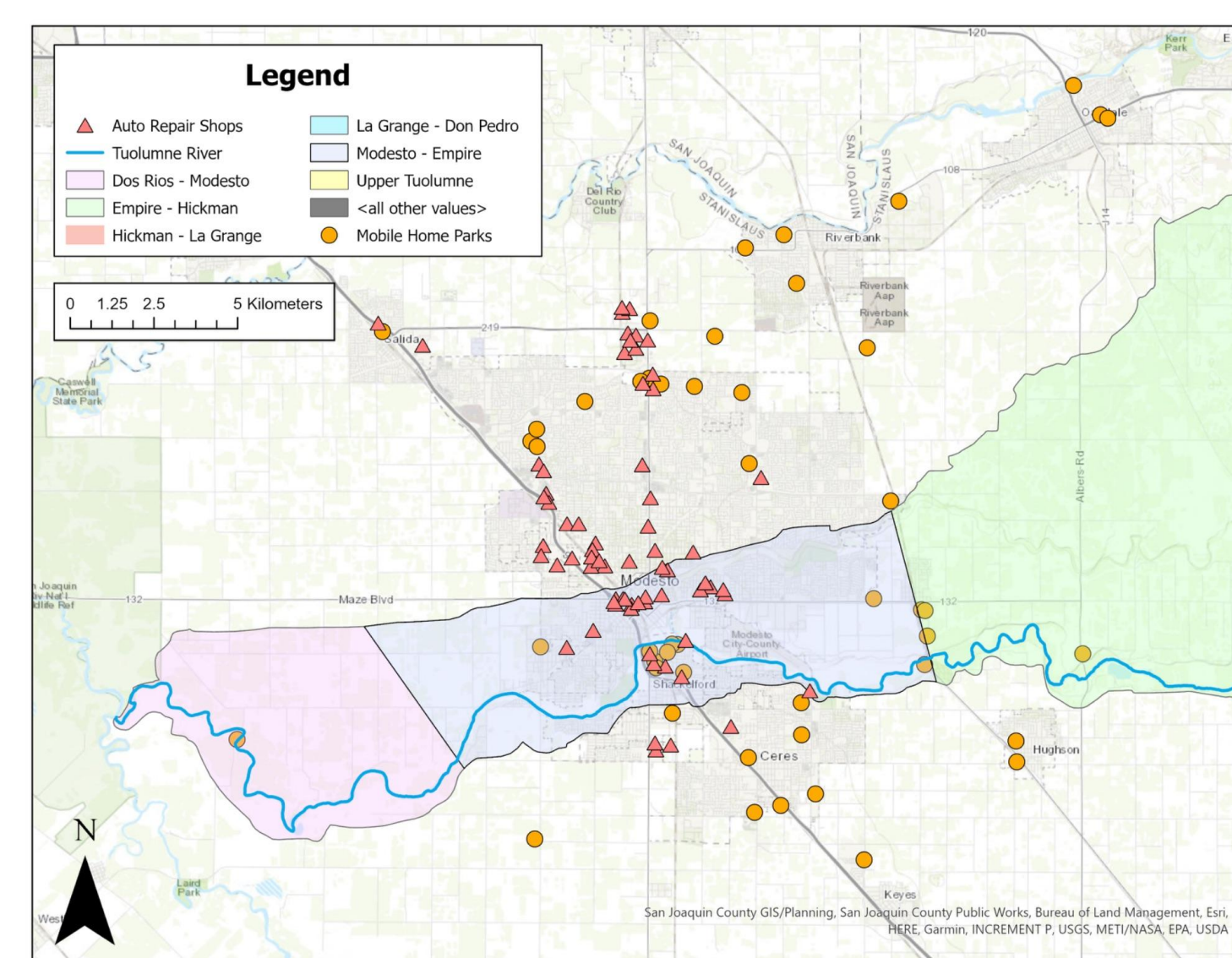
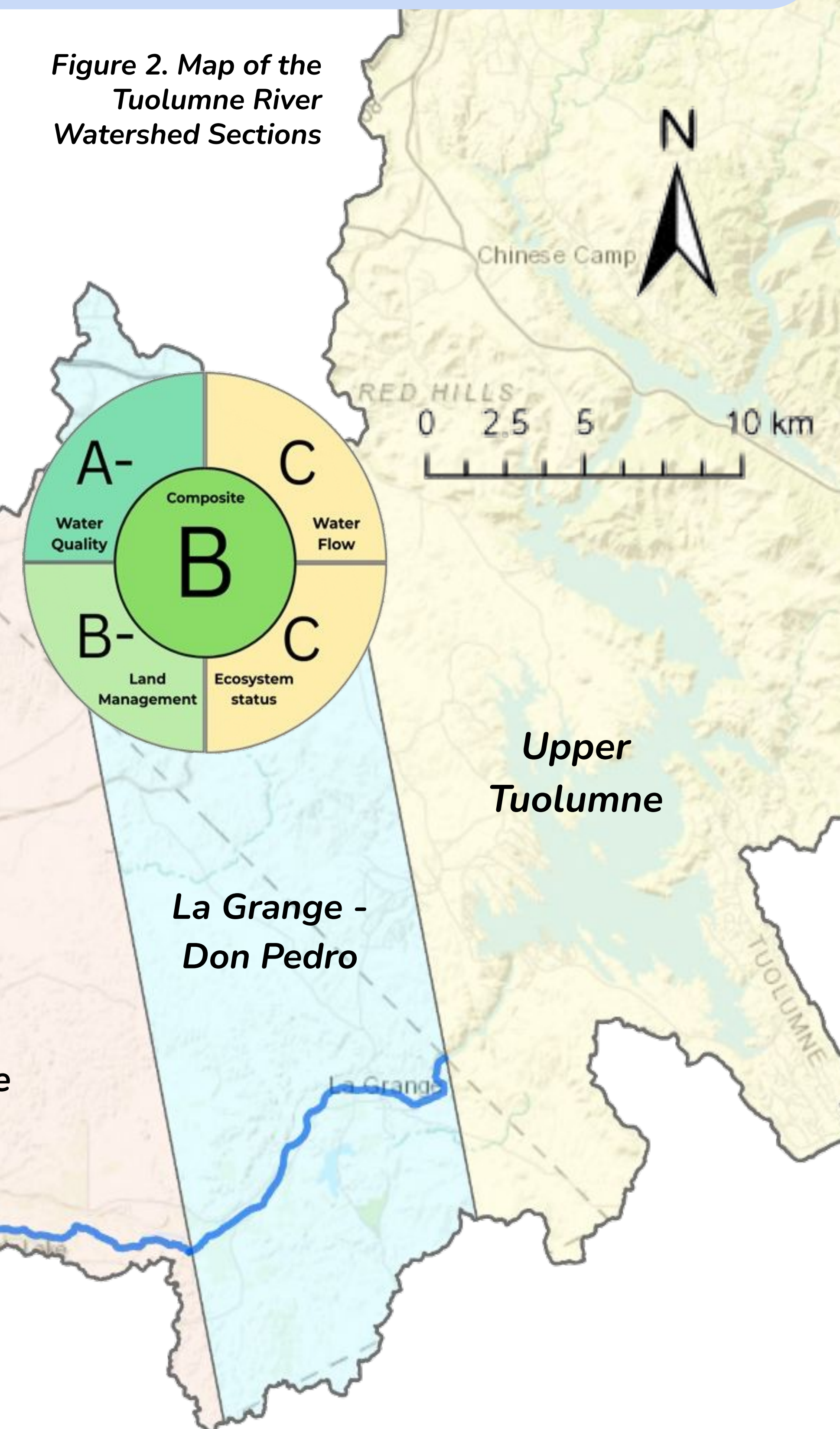


Figure 5. Auto Repair Shops and Mobile Home Parks in the Modesto-Empire watershed section

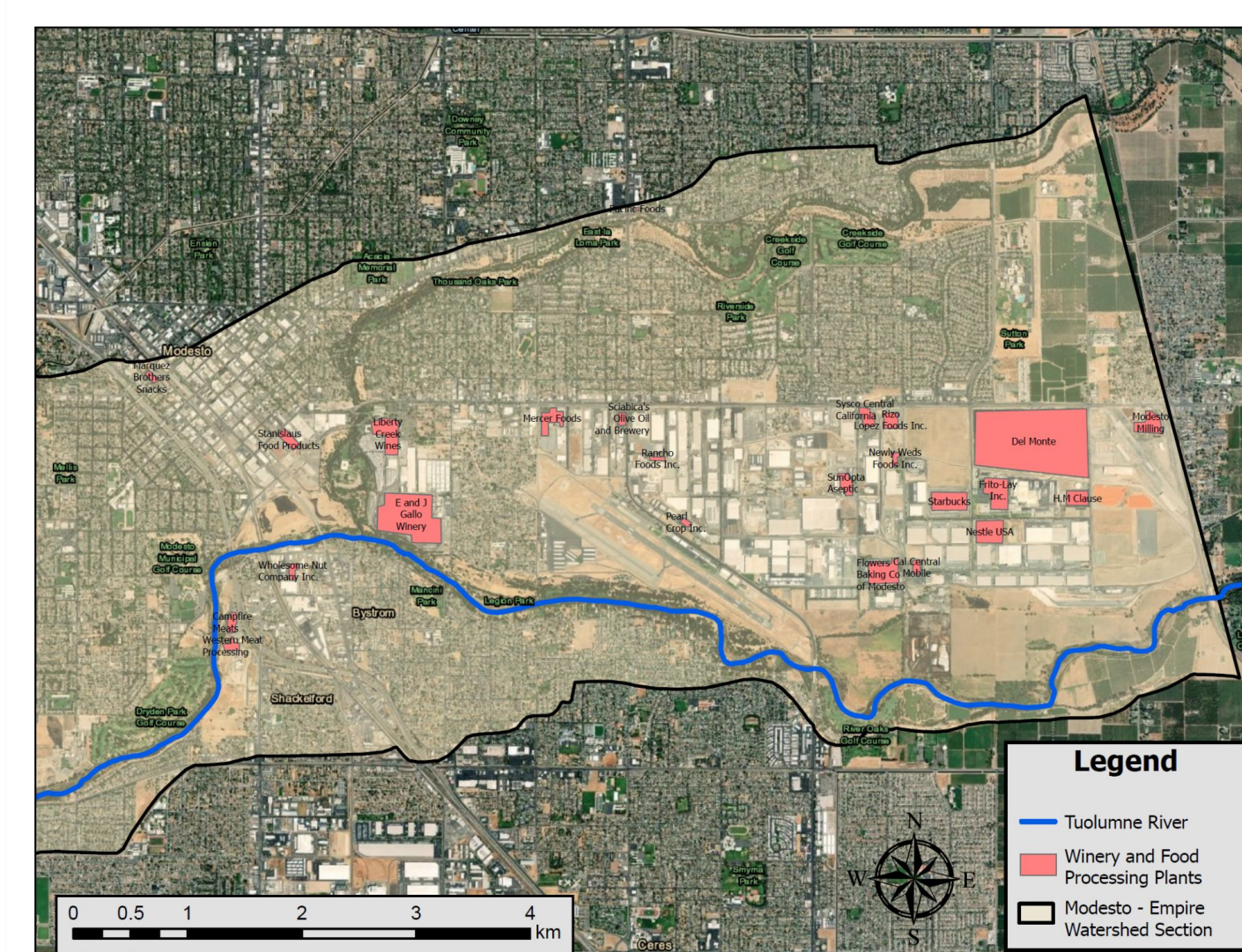


Figure 6. Wineries and Food Processing plants in the Modesto-Empire watershed section

4. Conclusions

- The watershed received an overall score of 2.46 (C+), indicating moderate health with significant variation between sections.
- In the Modesto-Empire section, point-source and urban-adjacent stressors become more important. Wineries, food-processing facilities, and auto repair shops are concentrated here.
- Mobile home parks located near the river corridor in the Modesto-Empire and Empire-Hickman sections raise potential environmental justice concerns because residents may be more exposed to nearby industrial activity.
- Watershed health generally declines moving downstream, where agricultural intensity and urban pressures increase.
- Section 5, just below Don Pedro Reservoir, stands out as one of the healthiest areas in the lower Tuolumne watershed.
- These findings will be presented through an interactive community map, allowing residents to explore watershed conditions and identify where environmental pressures are most concentrated.

Acknowledgements and References

Thank you to our advisors Iris Stewart-Frey, and Hillary Moak at the Yosemite Rivers Alliance for their guidance, support, and time.

