



flameMapper



Prepared on Behalf of:

Nevada City, CA
"Goat Fund Me Campaign"
March 13, 2019

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*Our Focus is on
the Highest Value*

FlameMapper Products	Phase of Emergency Management			
	Mitigation	Preparedness	Response	Recovery
Fire Behavior Engine	•	•	•	
Fire Utility Engine	•	•	•	•
Mitigation Mapper	•	•	•	•
Evacuation Route Safety	•	•	•	
Cell Containment Mapping	•	•	•	

GOAT FUND ME CAMPAIGN C/O REINETTE SENUM:

FlameMapper is a California based technology company that provides real-time wildfire predictive analyses, landscape level mitigation modeling, and fuel break containment analysis. Emergency managers and first responders at heart, FlameMapper utilizes proprietary fire behavior and landscape modeling algorithms to serve customers at all stages of emergency management: mitigation, preparedness, response, and recovery. *It is our mission to limit the impact of wildfire, and subsequent disasters, on people and property.*

FlameMapper has invested in developing superior technical capabilities by partnering with subject matter experts who have domain expertise, including wildland firefighters and those experienced in emergency management systems integration.

The FlameMapper team has a passion for reducing structure loss by all means necessary, especially through landscape level mitigation. Through our advanced technology, we help build knowledge of new solutions that translate into statistically effective cost saving results.

We believe in supporting mitigation projects as the first phase of emergency management. We use **virtual fires** to understand the movement of fire and fire intensity over a landscape. This allows for targeted mitigation for **maximum impact** at the **lowest cost**.

Sincerely,

Shea Broussard & Tony Shafer, Co-Founders

REPRESENTATIONS AND WARRANTIES, LIMITATION OF LIABILITY, INDEMNIFICATION

FlameMapper is intended as a tool to assist firefighters, first responders and local governments with estimates of wildfire behavior, before, during, or after an event. It is not intended to replace or take priority over on-the-ground observations made by experienced fire behavior analysts supporting operations. Every effort has been made to provide accurate information based on scientifically supported formulas and knowledge of wildfire behavior gained from applied research and field observations from years of work conducted by wildfire professionals.

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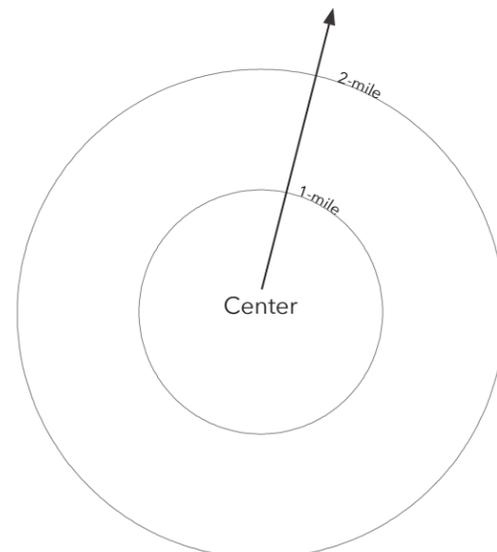
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Key Concepts

Reducing the amount of vegetation (i.e. fuel) and changing its arrangement before a wildfire starts will affect fire behavior.

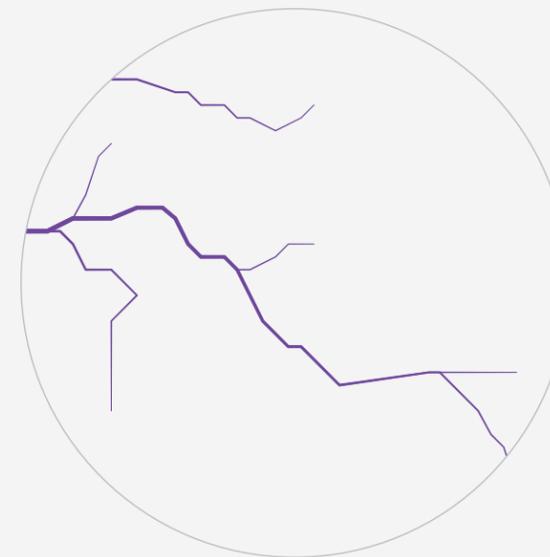
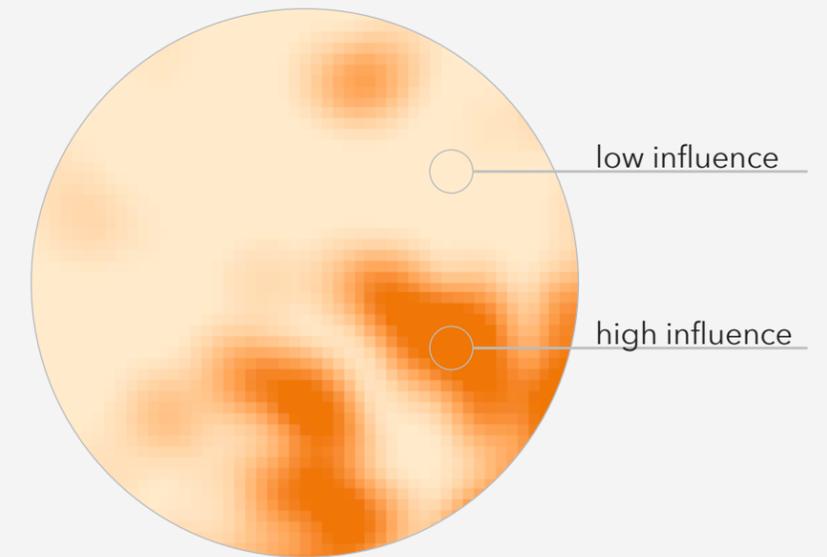
When fuels are reduced, fire intensity and severity are also reduced. Thus, removing or reducing fuels in strategic locations over a landscape can lower fire risk and help make a location more resistant to large-scale wildfire.



Generally, mitigation prioritization extends from the city center outward.

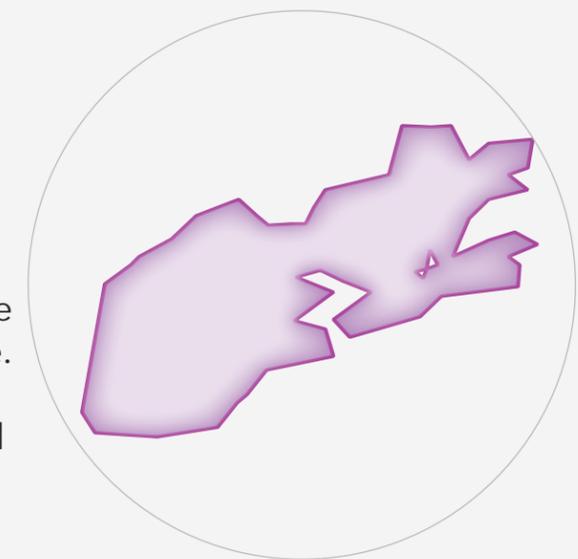
Intensity of fire spread.

Darker areas have greater influence on fire spread, therefore, should reflect higher mitigation priority.



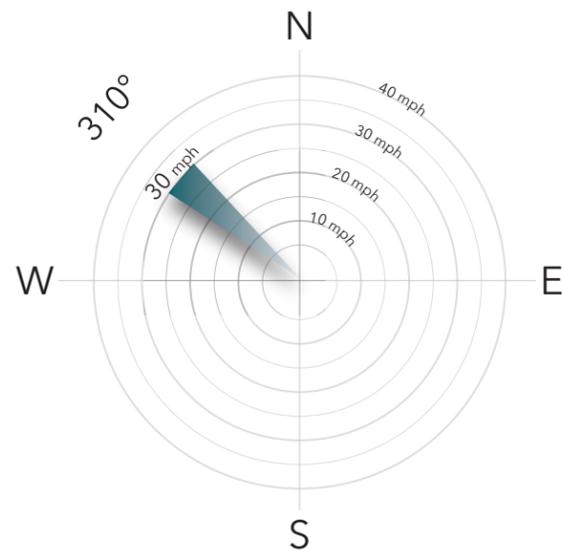
Fire Pathways represent the likely direction of fire progression based on modeled wind and topographic features.

Fire Perimeter is boundary of the fire spread after a period of time. Fire growth is not uniform but driven by wind, topography, and fuel.

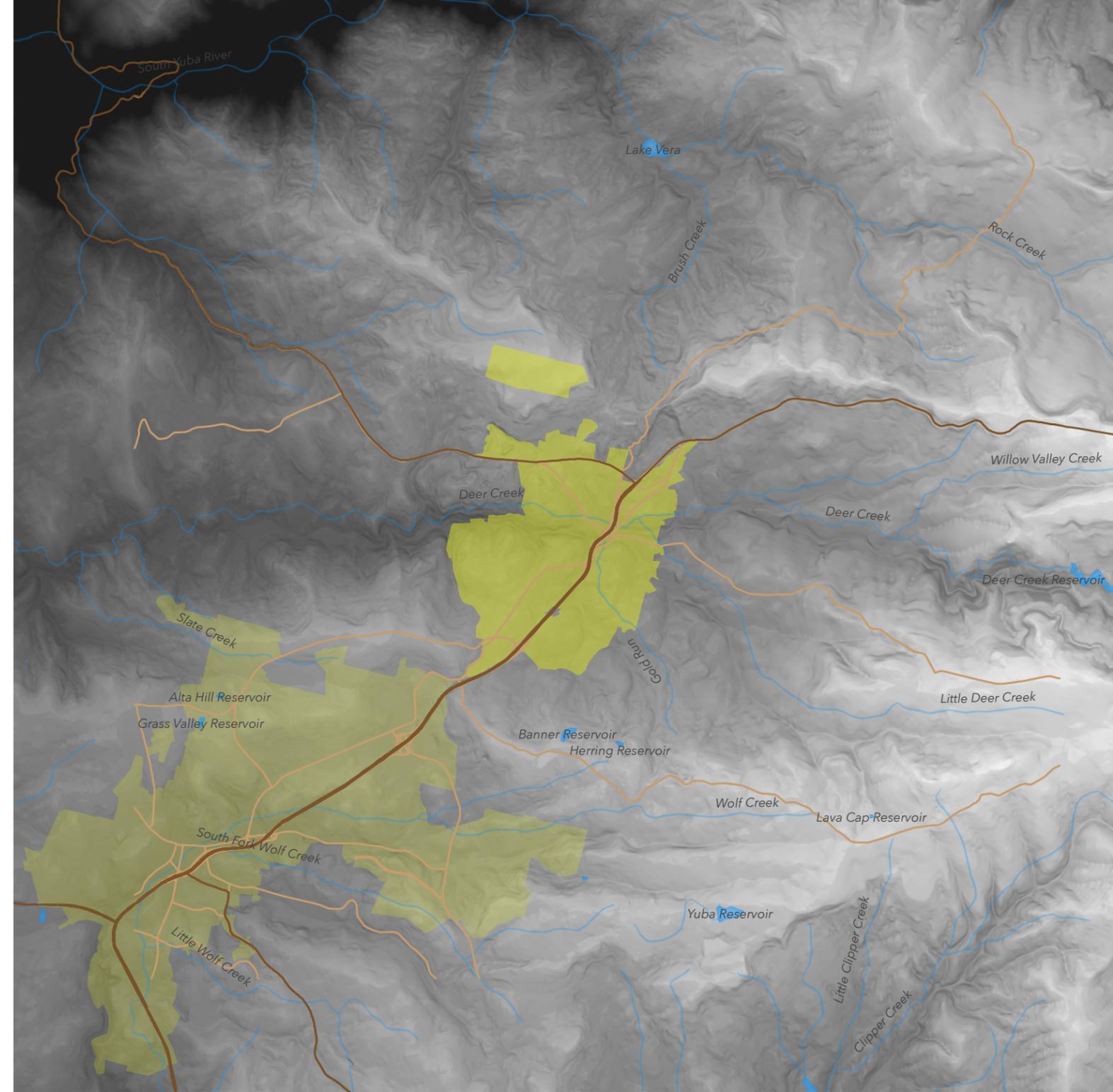


Local Topography

The following predictive analysis uses 30 mph Winds out of the West Northwest as indicated below. These wind conditions represent high fire spread and low fire suppression containment probability.



Wind parameters analyzed based on email communication with Chief Goodspeed (2/22/2019)

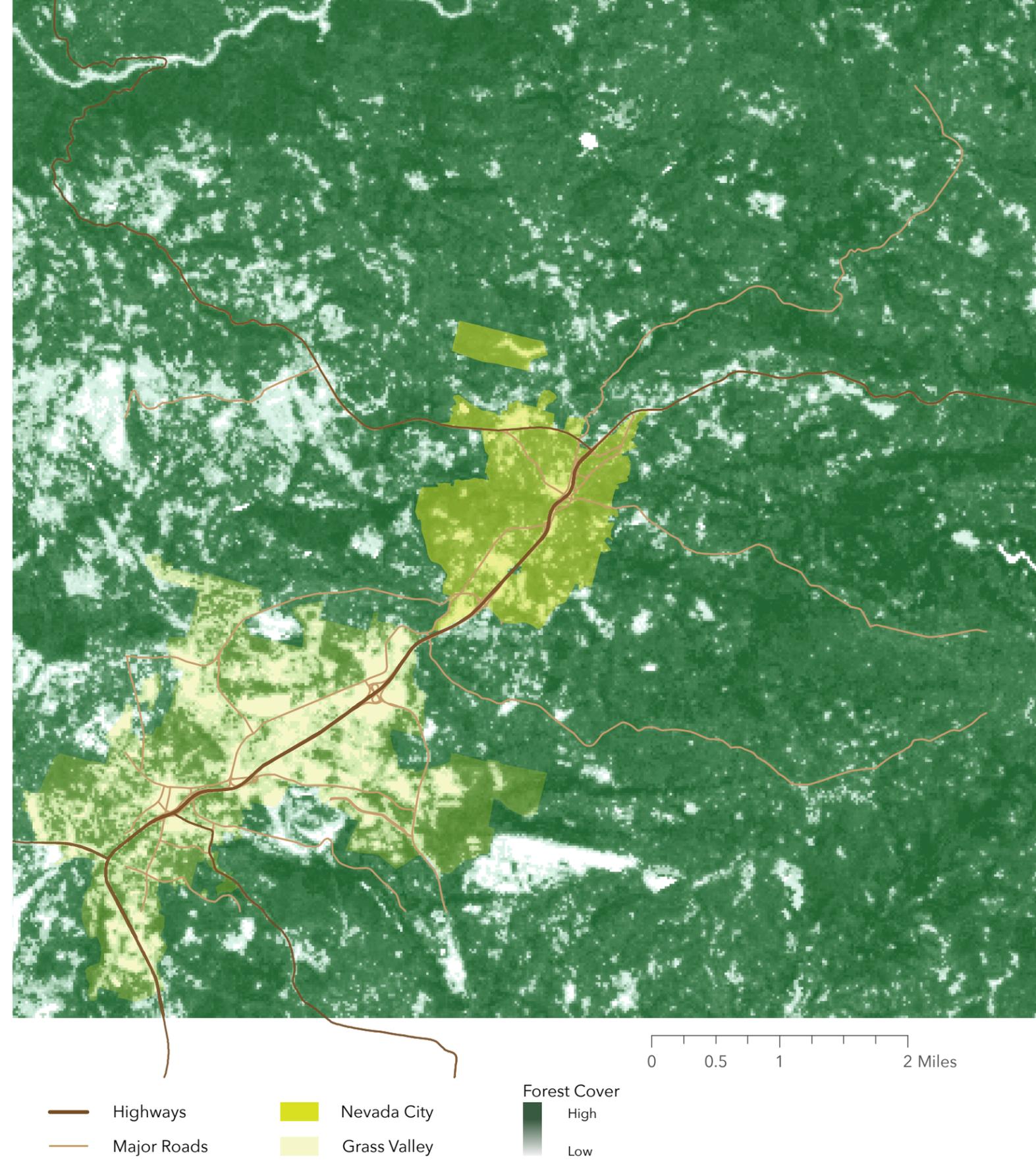


Forest Vegetation Overlay

According to the Local Hazard Mitigation Plan for Nevada County 2011-2016, "wildland fires endanger significant Grass Valley, Nevada City, and surrounding unincorporated Nevada County facilities and residents by direct fire involvement and/or fire brands or spot fires."

The current U.S. Geographic Survey land cover and fuel models confirm this fact. The following analysis uses U.S. Geographic Survey's LANDFIRE fuel models to estimate landscape conditions.

Nevada City and the surrounding area has dispersed vegetation with areas of high vegetation density. These factors suggest **strategies to maximize reductions in fire spread** such as thinning, grazing, and fuel breaks. The following information will help identify areas to deploy these tactics.



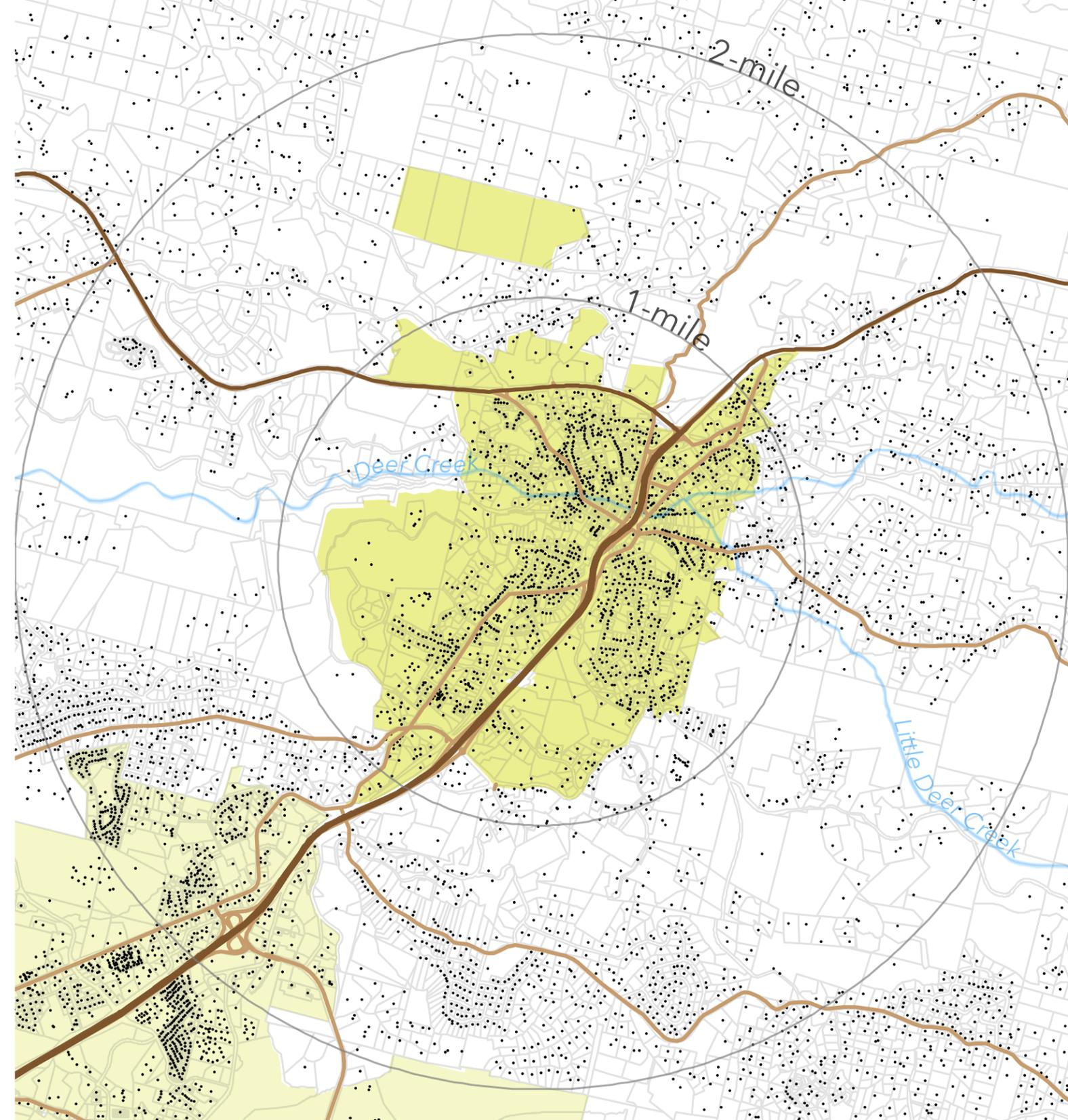
Population and Structure Distribution

The black points represent locations of structures with the 36 mile study area. Structure density is highest within Grass Valley and Nevada City limits.



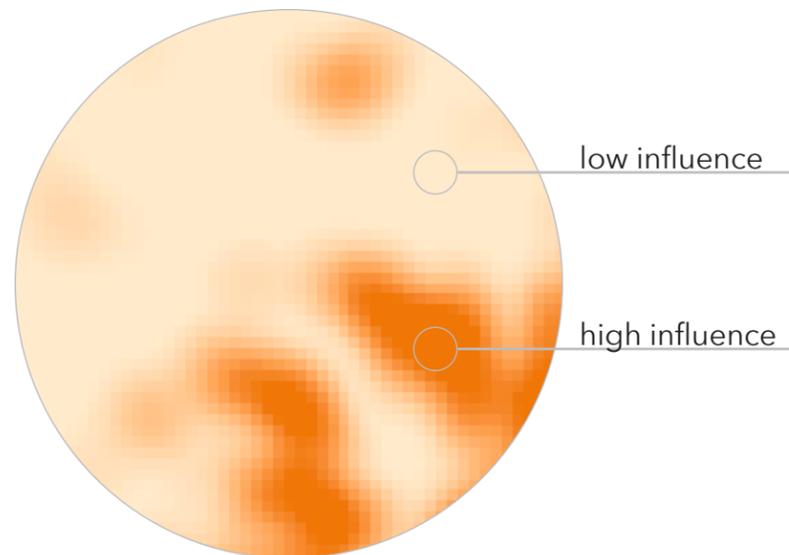
- Highways
- Major Roads
- Structure
- Nevada City
- Grass Valley

Nevada City Population Distribution

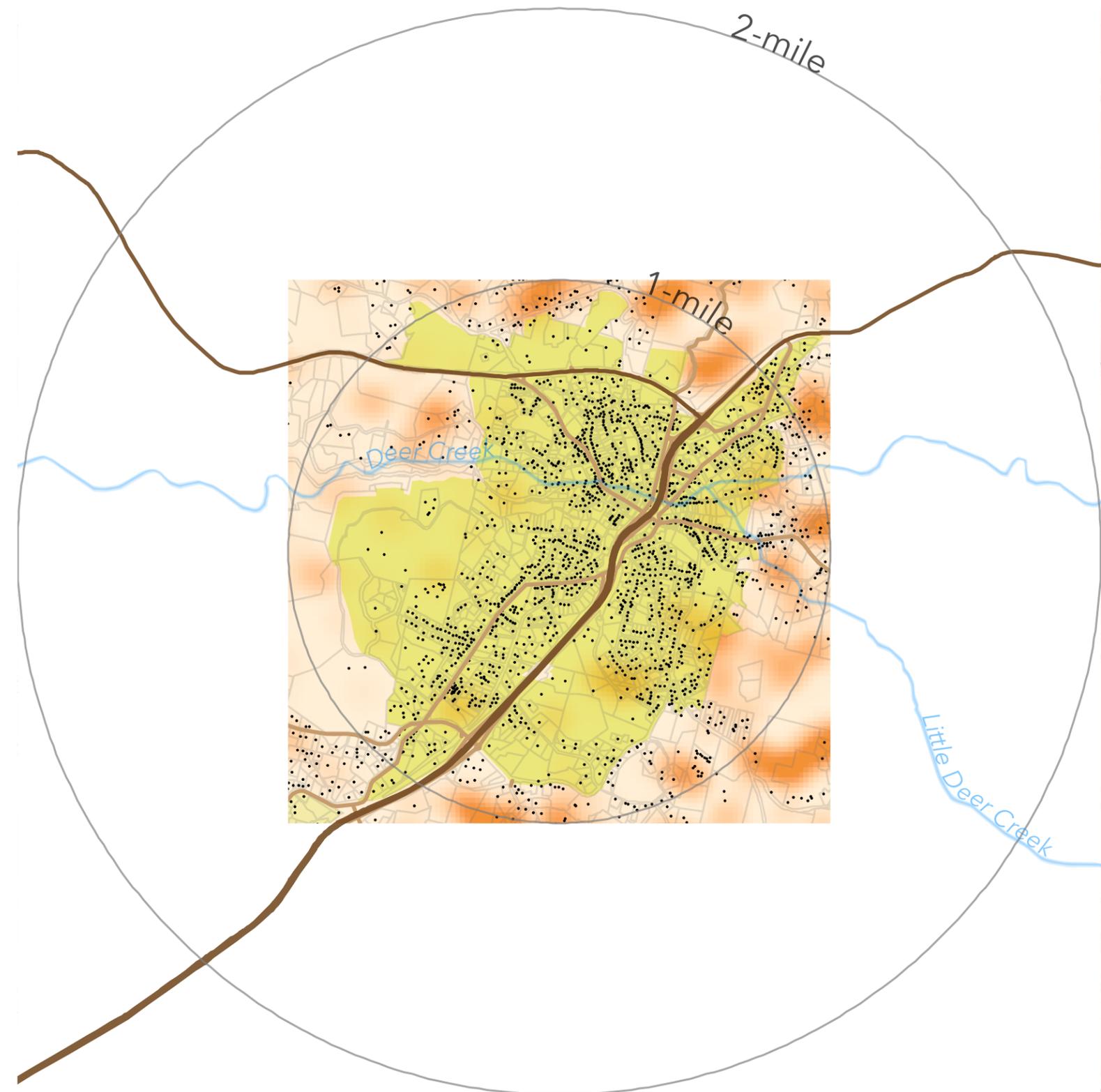


- Highways
- Major Roads
- Structure
- Nevada City
- Grass Valley

Targeted Mitigation Heatmap

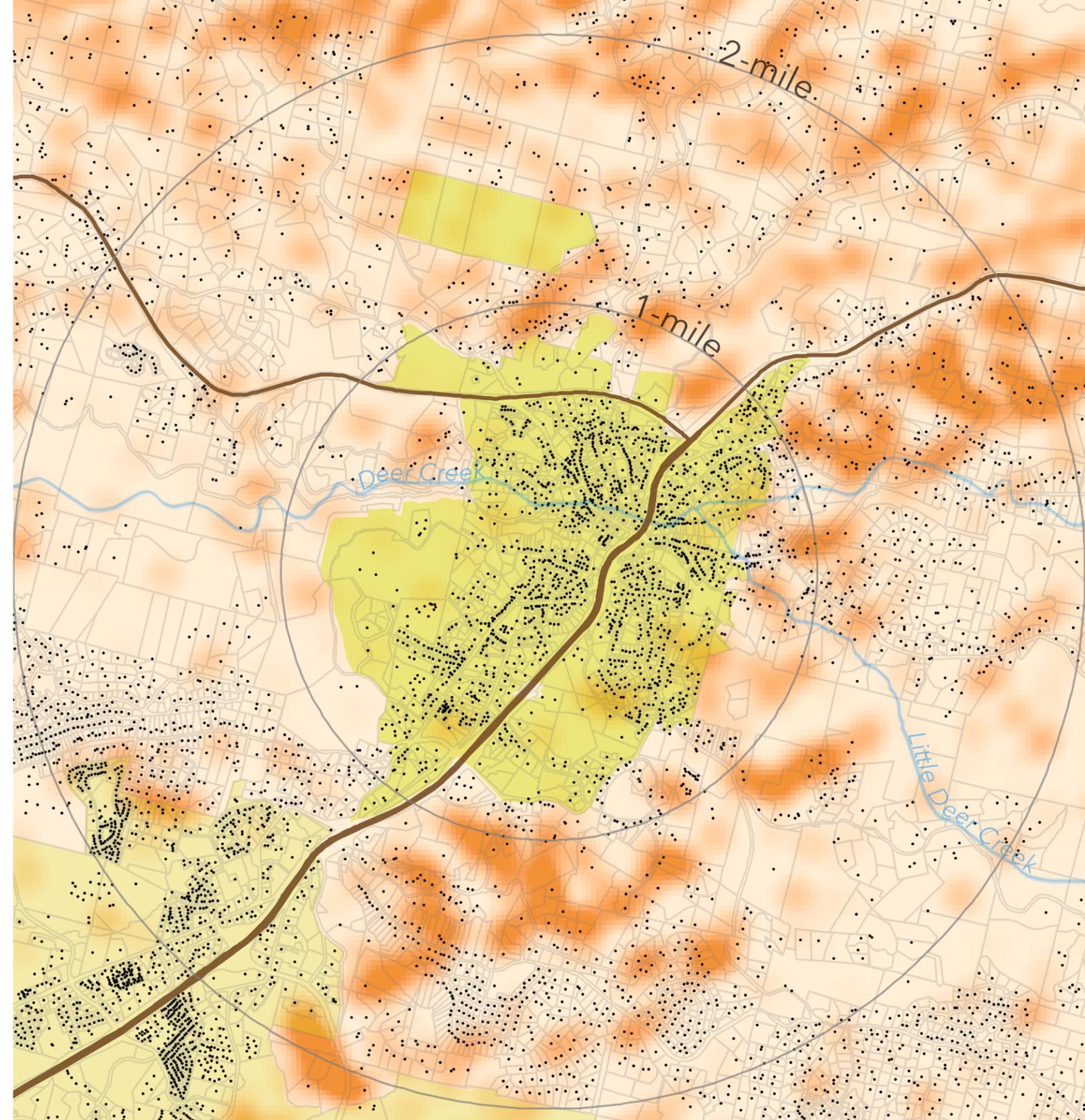


Intensity of fire spread.
 Darker areas have greater influence on fire spread, therefore, should reflect higher mitigation priority.



- | | | |
|-------------|--------------|------|
| Highways | Nevada City | High |
| Major Roads | Grass Valley | Low |
| Structure | | |

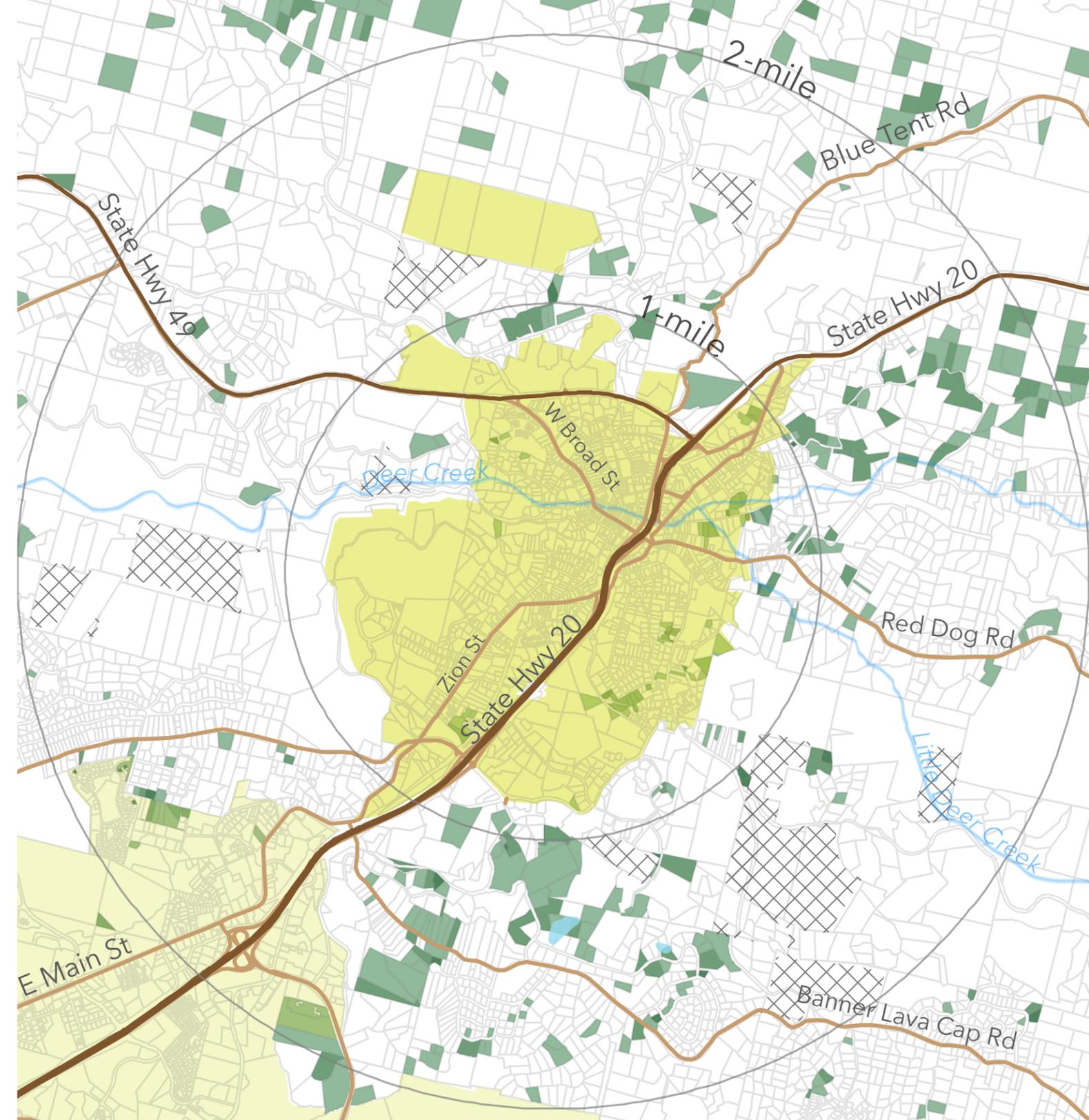
Zoomed Areas for Mitigation Consideration



Parcel Mitigation Priority

Highlighted parcels represent influential fuel loads, and therefore, should be targeted first for thinning and grazing.

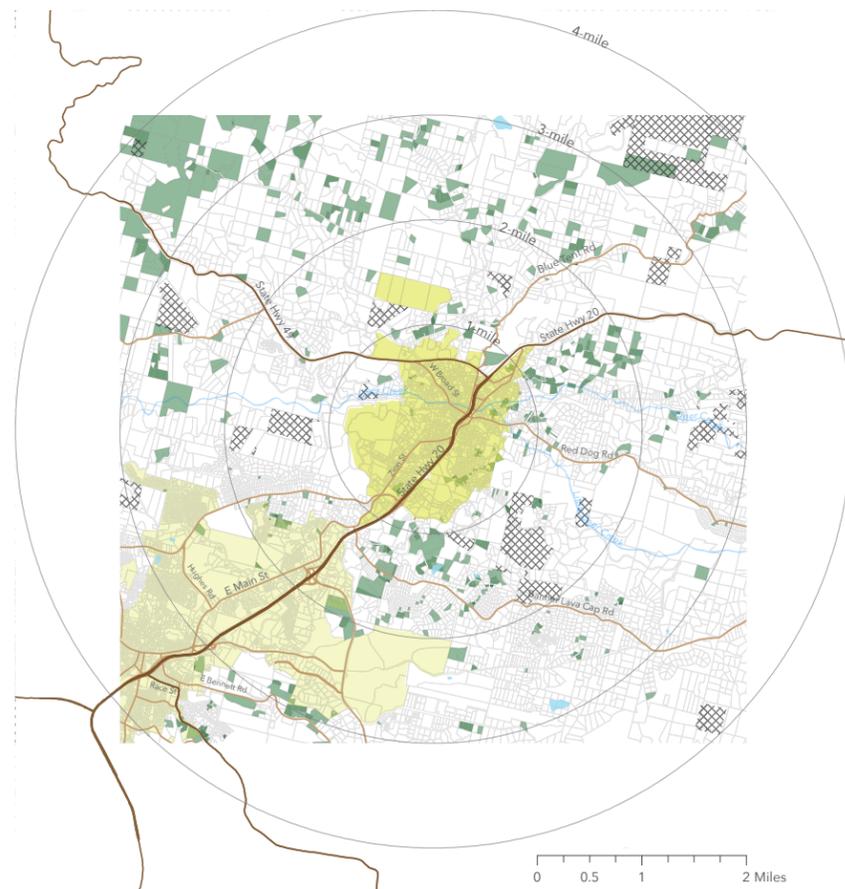
Additional prioritization is possible beyond this initial study.



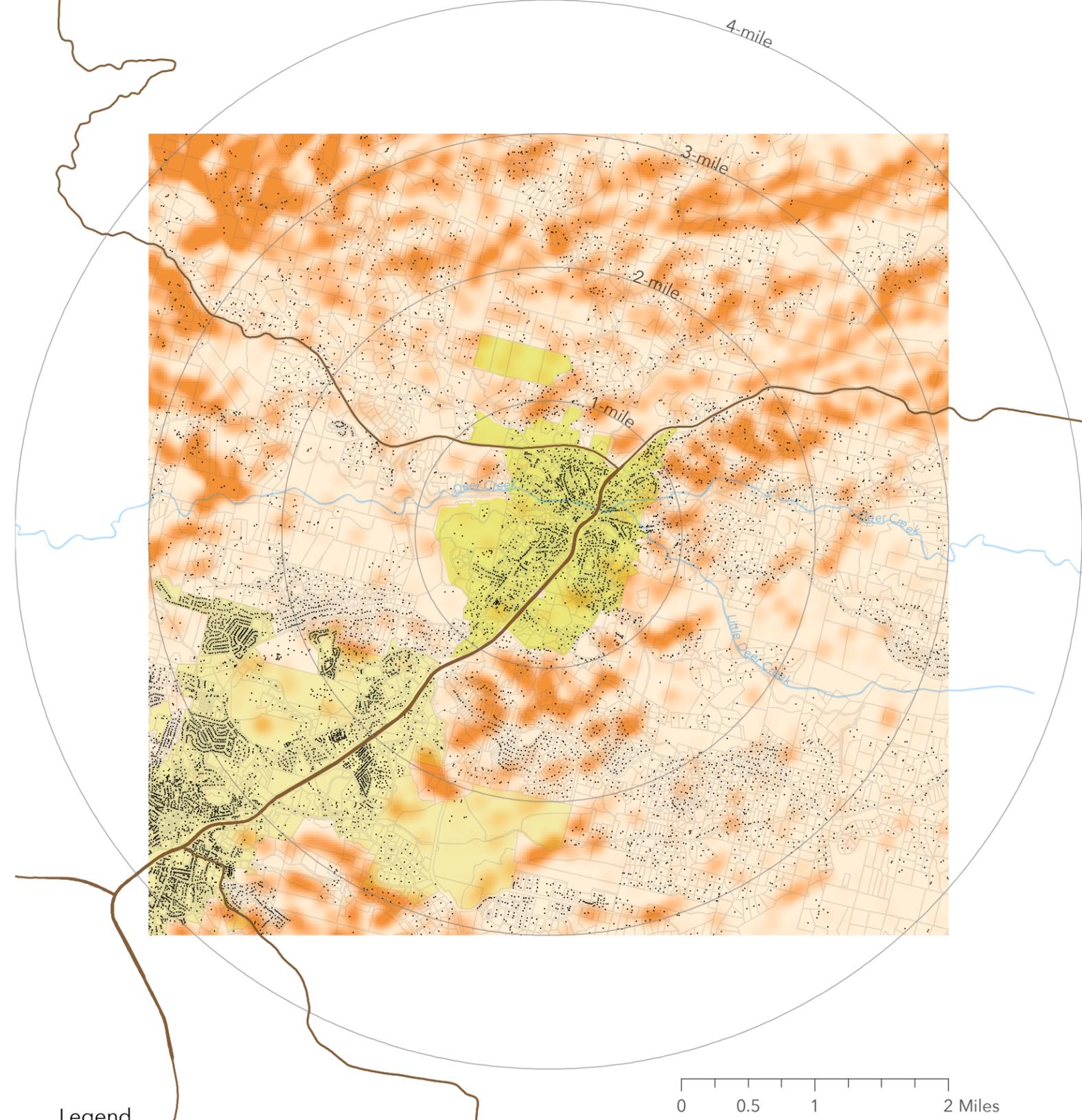
- Highways
- Major Roads
- Nevada City
- Grass Valley
- Bureau of Land Management
- Highest Priority Parcels
- High Priority
- Medium Priority

Analysis Area for Mitigation Consideration

Zooming out further provides better context for landscape scale mitigation projects relative to projects within Nevada City boundaries.



Highlighted parcels should be prioritized for vegetation reduction.



Legend

- Highways
- Major Roads
- Structure
- Nevada City
- Grass Valley

- Influence on Fire Spread**
- High
 - Low

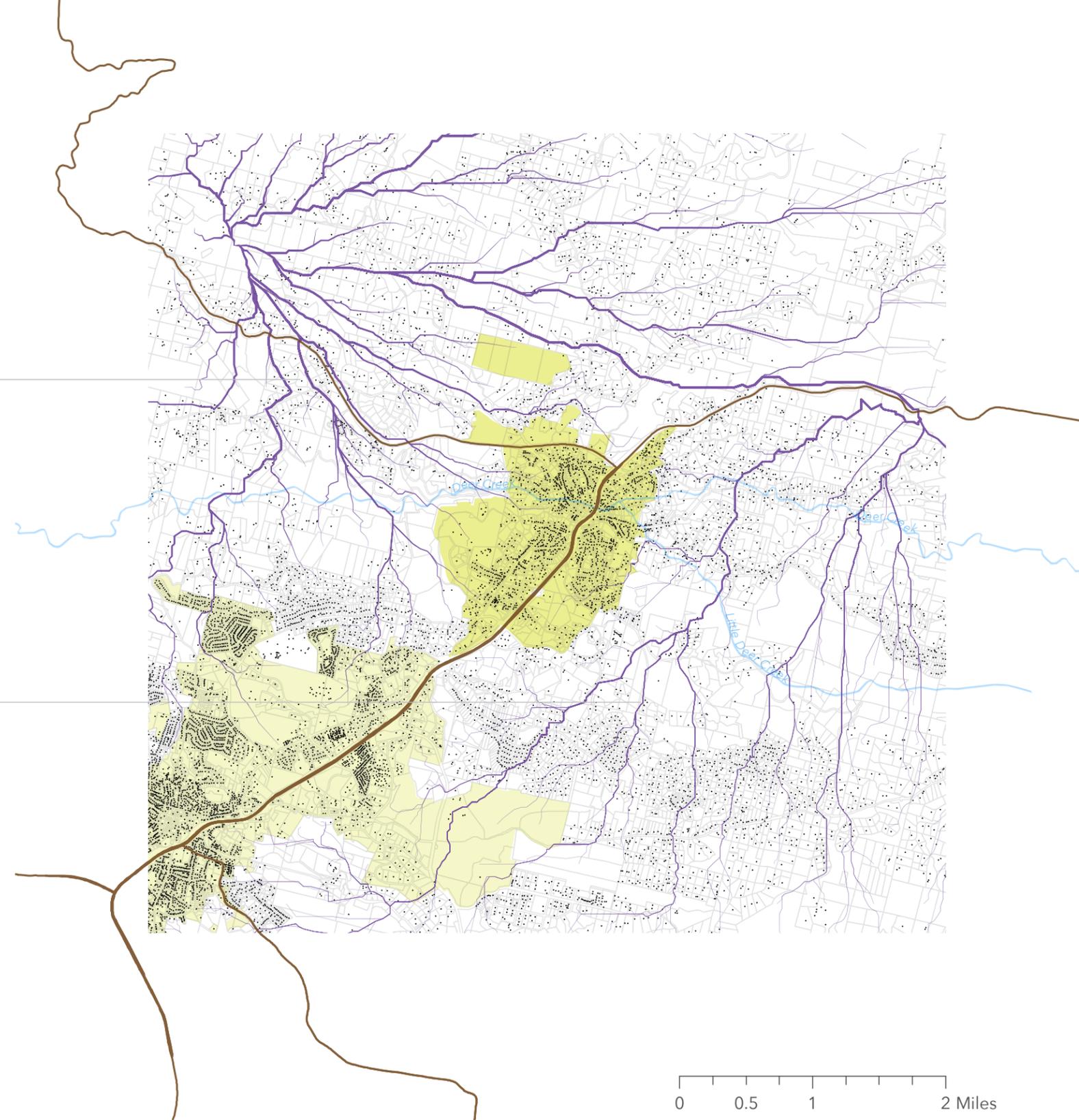
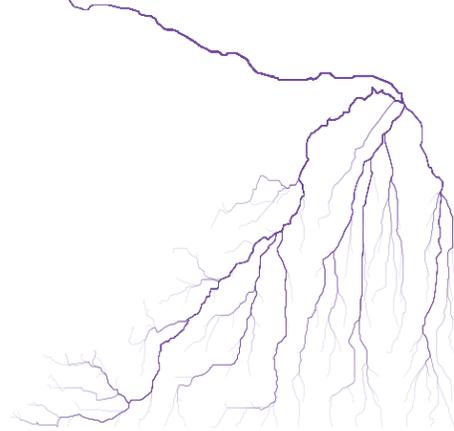


Fire Pathways

South & East Pathway



South & West Pathway



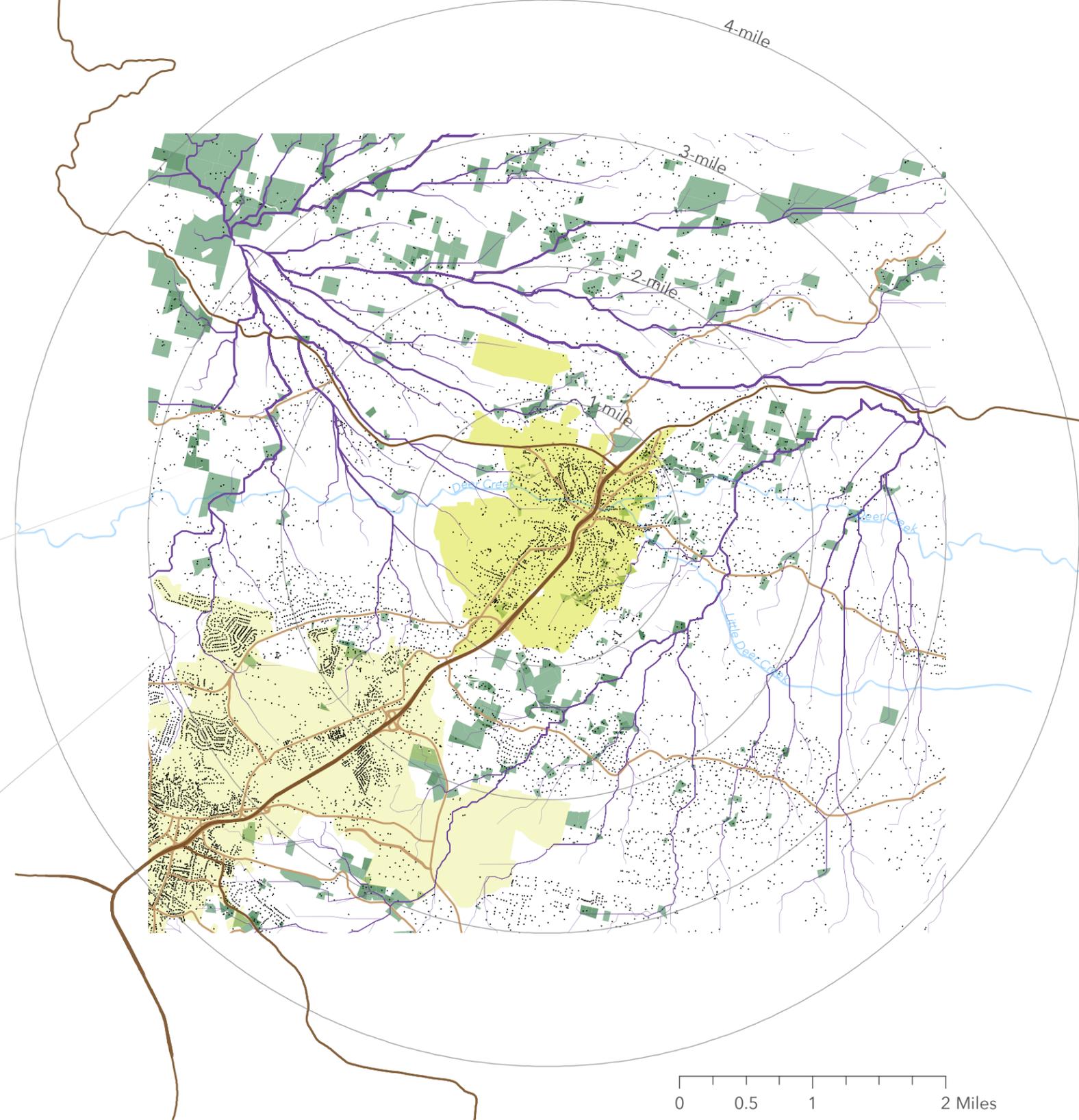
- Highways
- Major Roads
- Structure
- Nevada City
- Grass Valley
- Fire Pathways

Fire Pathways Affecting Communities

Mitigation to the west and south of Nevada City will provide direct benefit to Grass Valley.



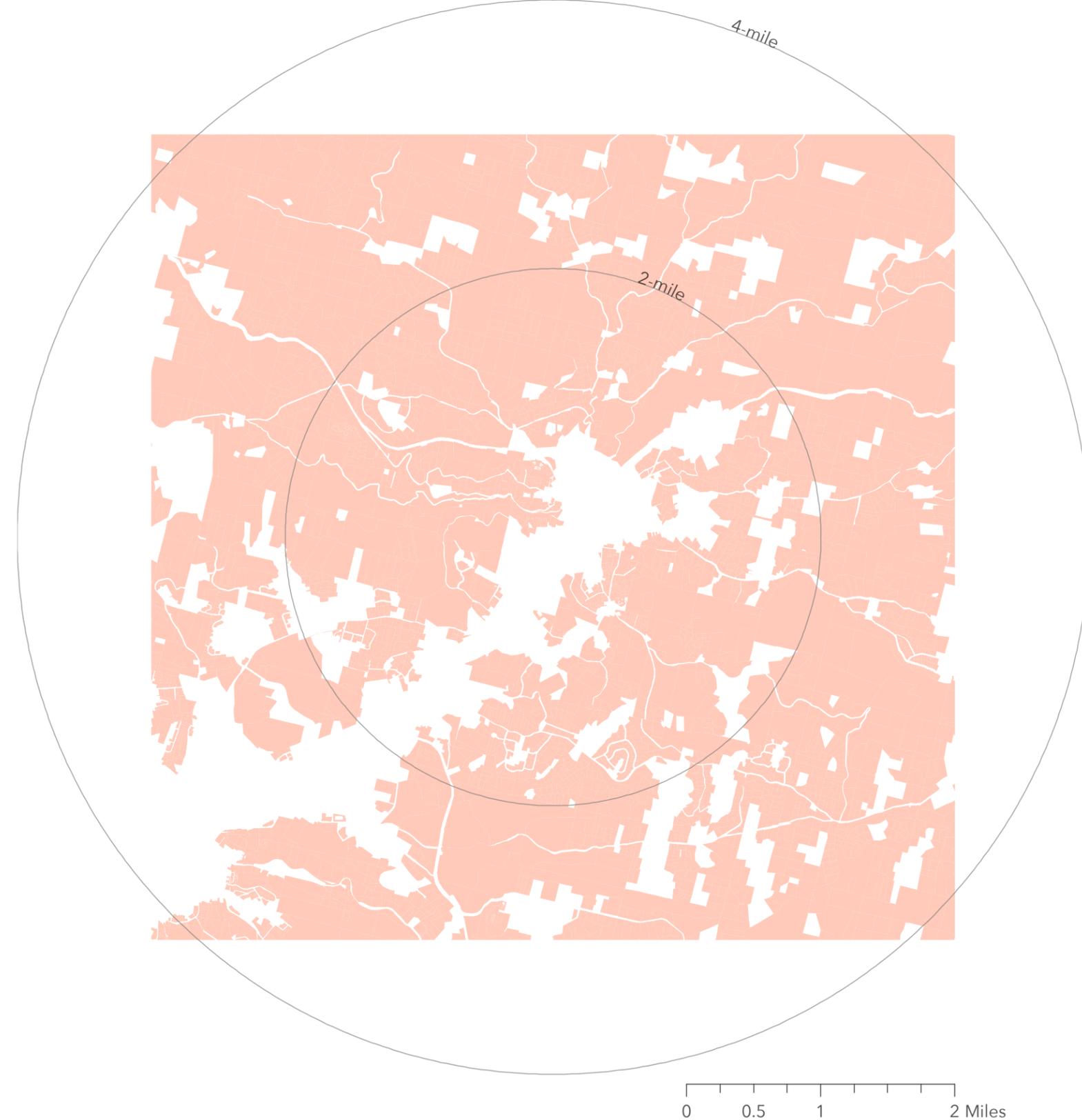
Areas of overlap between fire paths and high priority mitigation parcels should be targeted.



- Highways
- Major Roads
- Structure
- Nevada City
- Grass Valley
- Highest Priority Parcels
- High Priority
- Medium Priority
- Fire Pathways

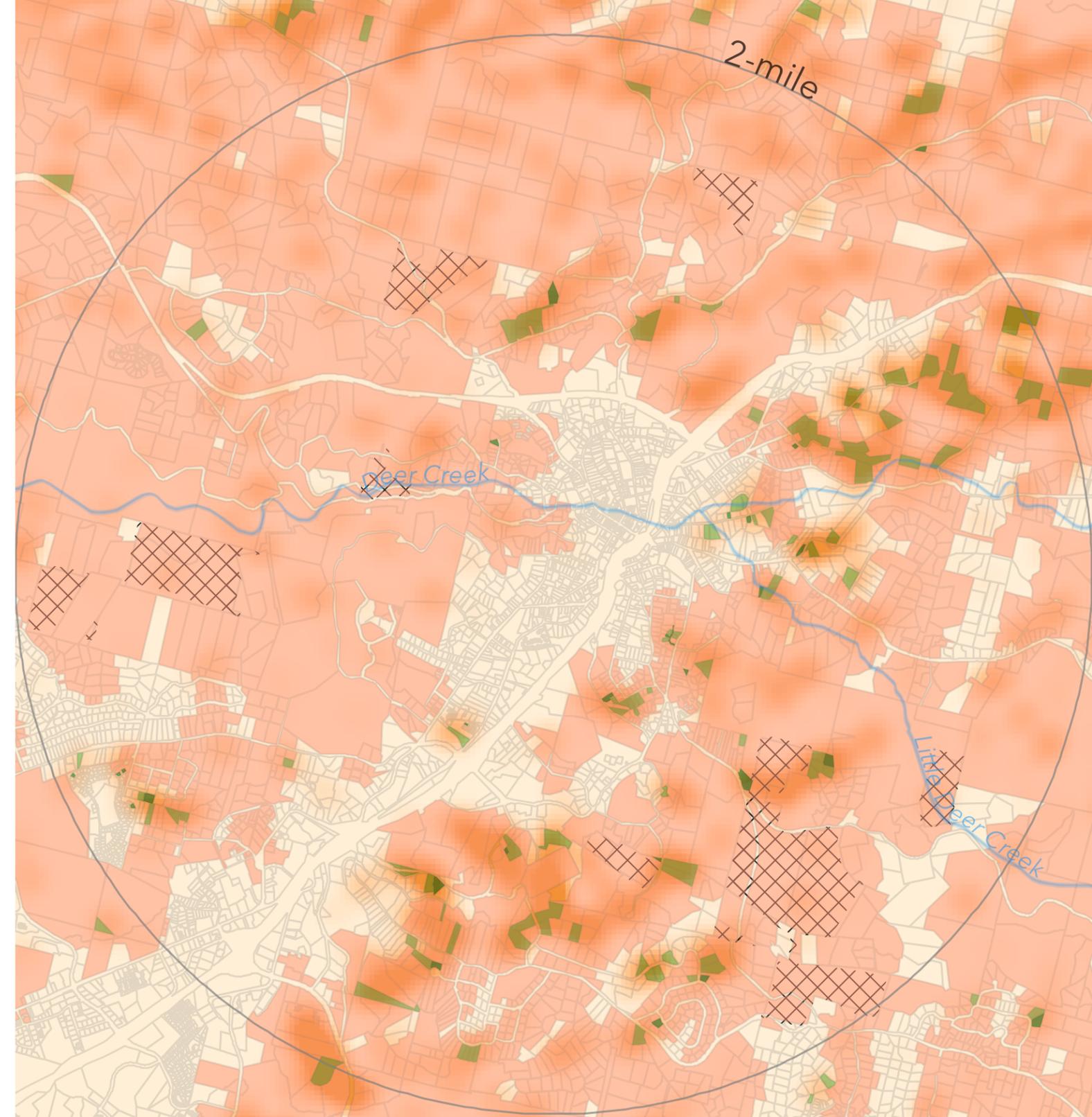
Fire Pathway Exposure

The map on the right shows the parcels within **100 meters** of a fire pathway. **41% of all parcels** and **nearly the entire area** has exposure to fire pathways from a 310° wind direction. Significant exposure to wildfire progression.



Nevada City Parcel Level Analysis

Green parcels represent the locations with a high influence on fire spread. These represent strategic locations for mitigation.

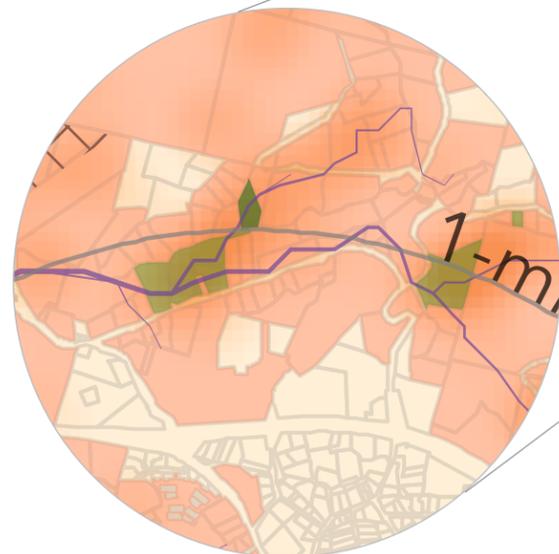


- Influence on Fire Spread
 - High
 - Low
- Parcels within 100m of Fire Pathway
- Highest Priority Parcels
- High Priority
- Fire Pathways
- Bureau of Land Management

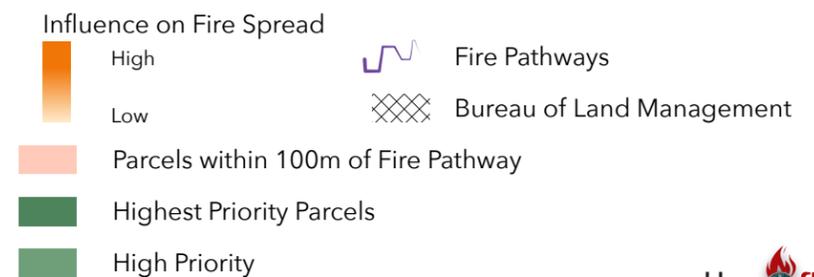
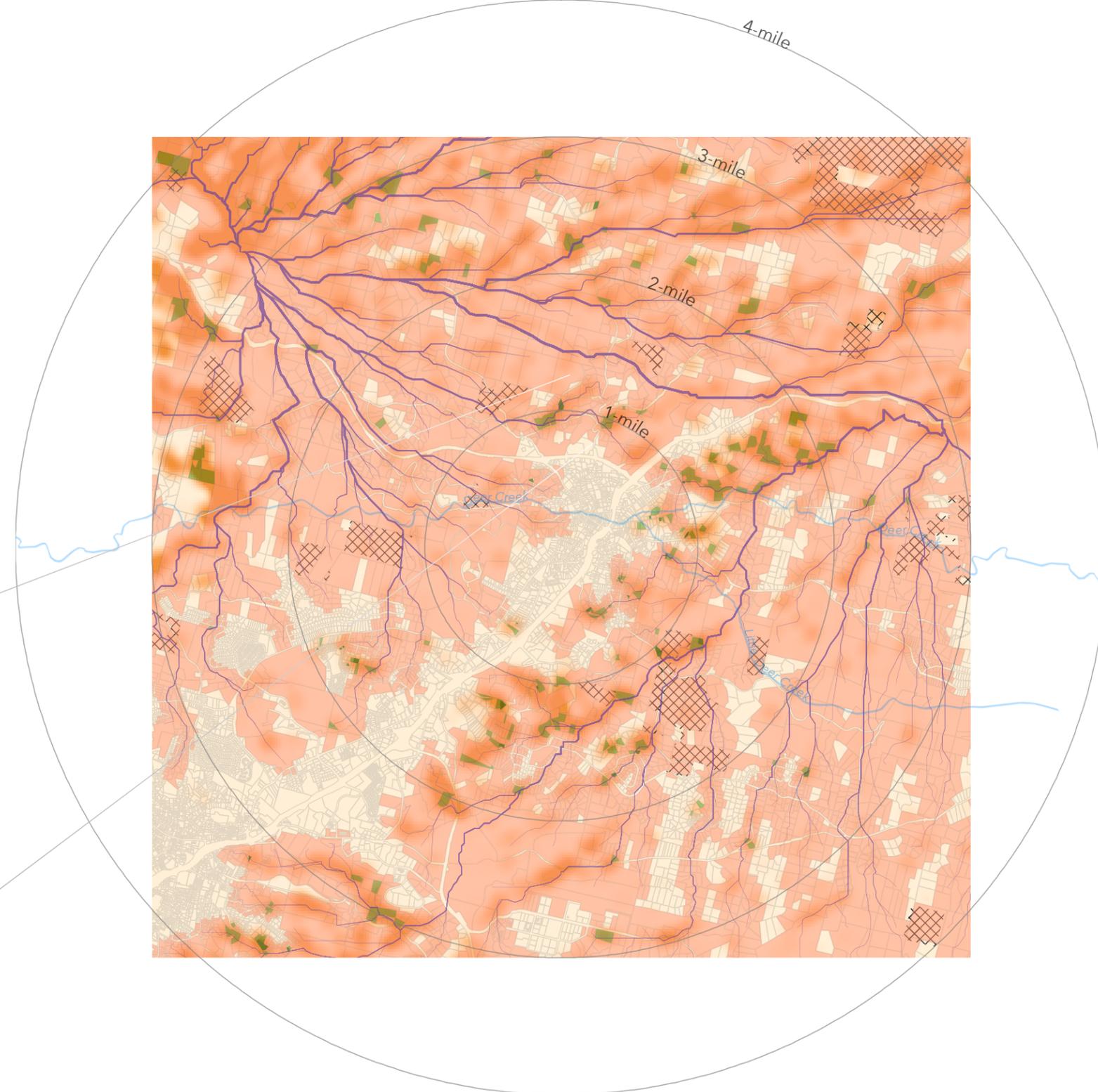
Study Area Parcel Level Analysis

Again, green parcels represent the locations with a high influence on fire spread. These represent strategic locations for mitigation.

Introducing fire pathways demonstrates the likely direction of fire spread. **Parcels with high fire spread influence located on fire pathways are top candidates for mitigation.**



Overlapping fire pathway, high priority parcel, and fire influence.



Ignition Points Deer Creek Detail

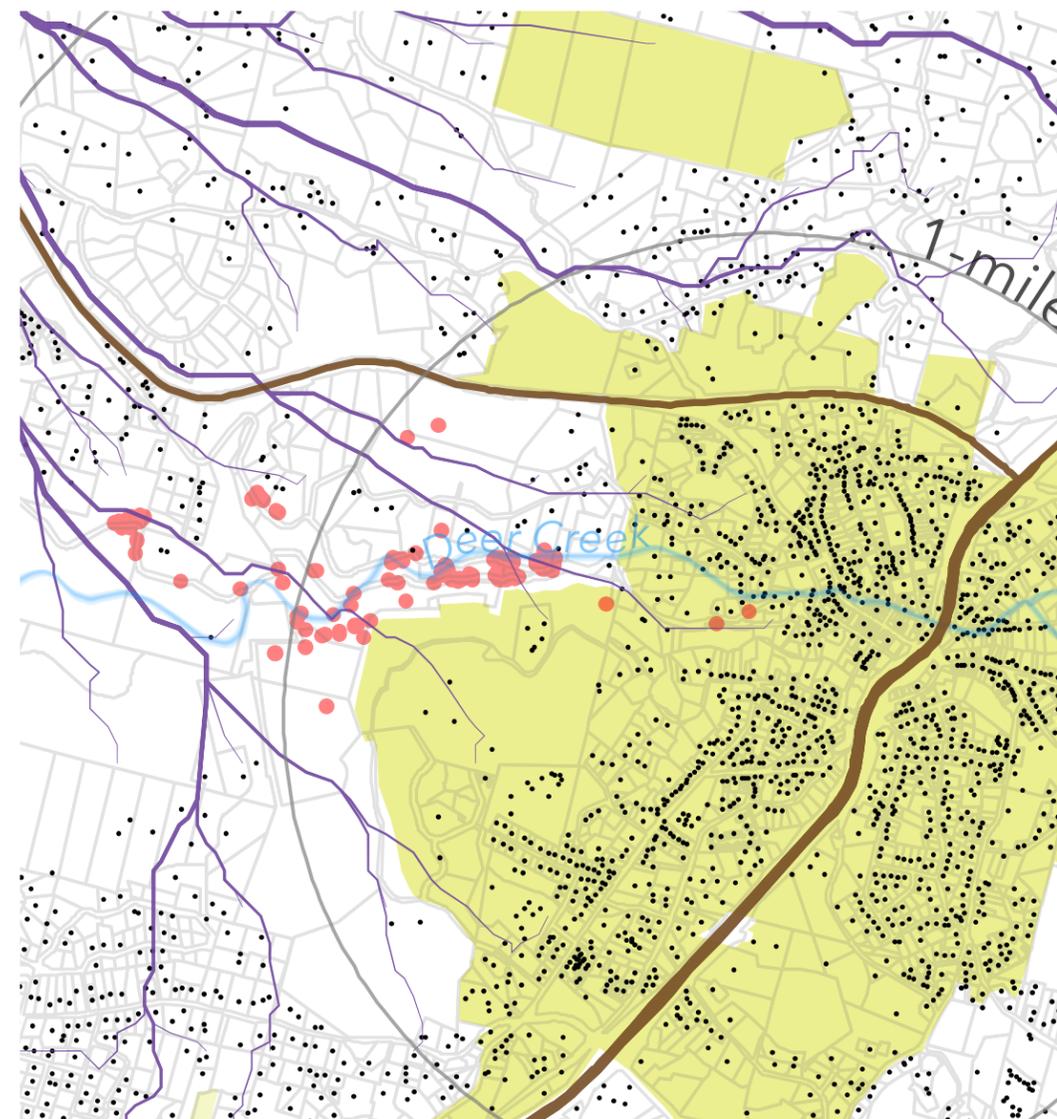


Ignition points received via email from Reinette S. (2/22/2019)

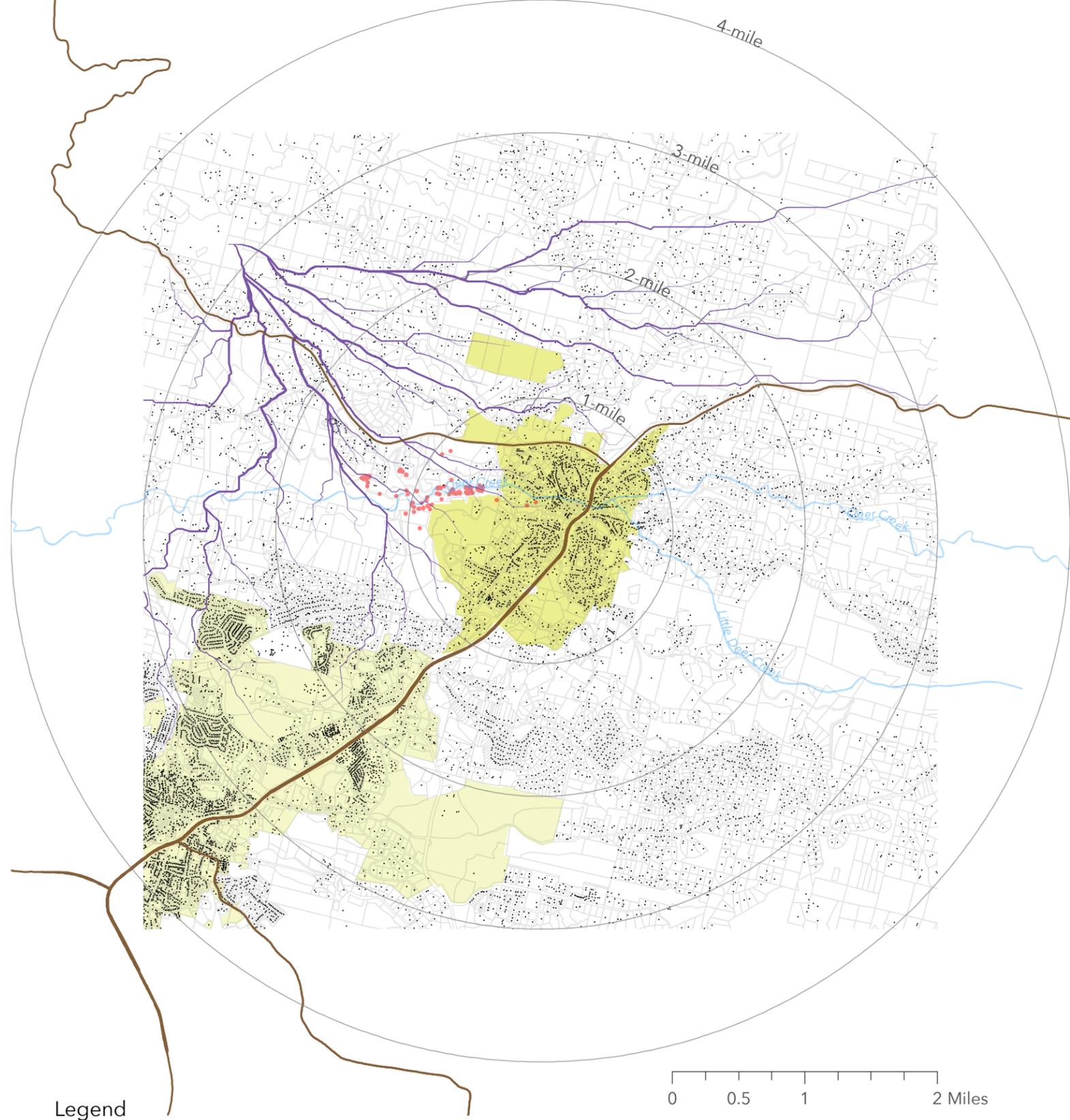


-  Highways
-  Major Roads
-  Structure
-  Ignition Points
-  Nevada City
-  Grass Valley

Prime Fire Pathways near Potential Ignition Points Detail



Ignition points received via email from Reinette S. (2/22/2019)



Legend

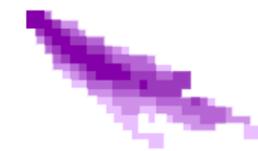
- Highways
- Major Roads
- Structure
- Nevada City
- Grass Valley
- Fire Pathways

0 0.5 1 2 Miles

2-Hour Fire Perimeter from Camp Location

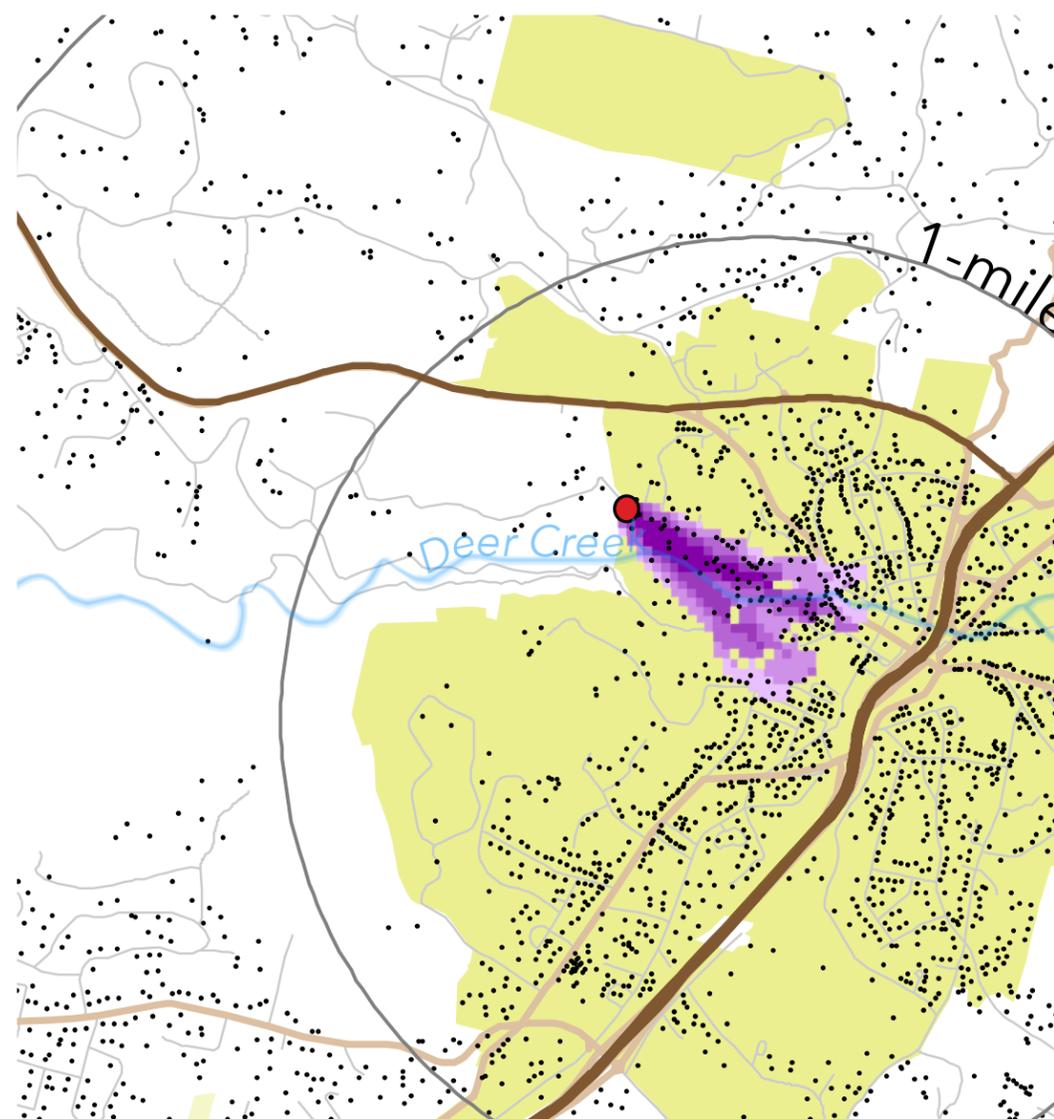


2-Hour Fire Perimeter with Thinning and Grazing

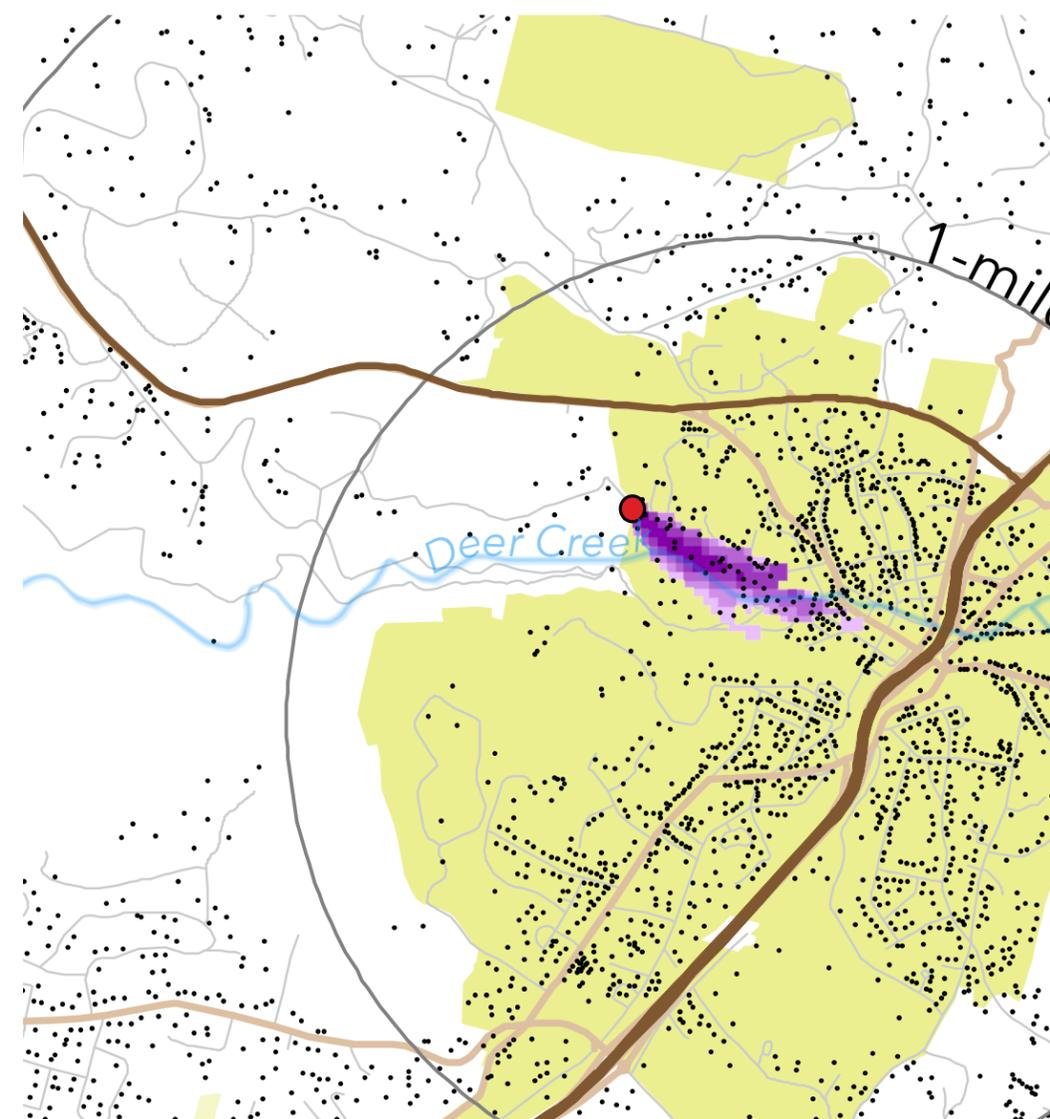


Smaller Fire Spread and
90% Reduction in Fire Intensity

2-Hour Fire Perimeter
from Ignition Point Location



2-Hour Fire Perimeter
After Thinning and Grazing



Smaller Fire Spread and
90% Reduction in Fire Intensity

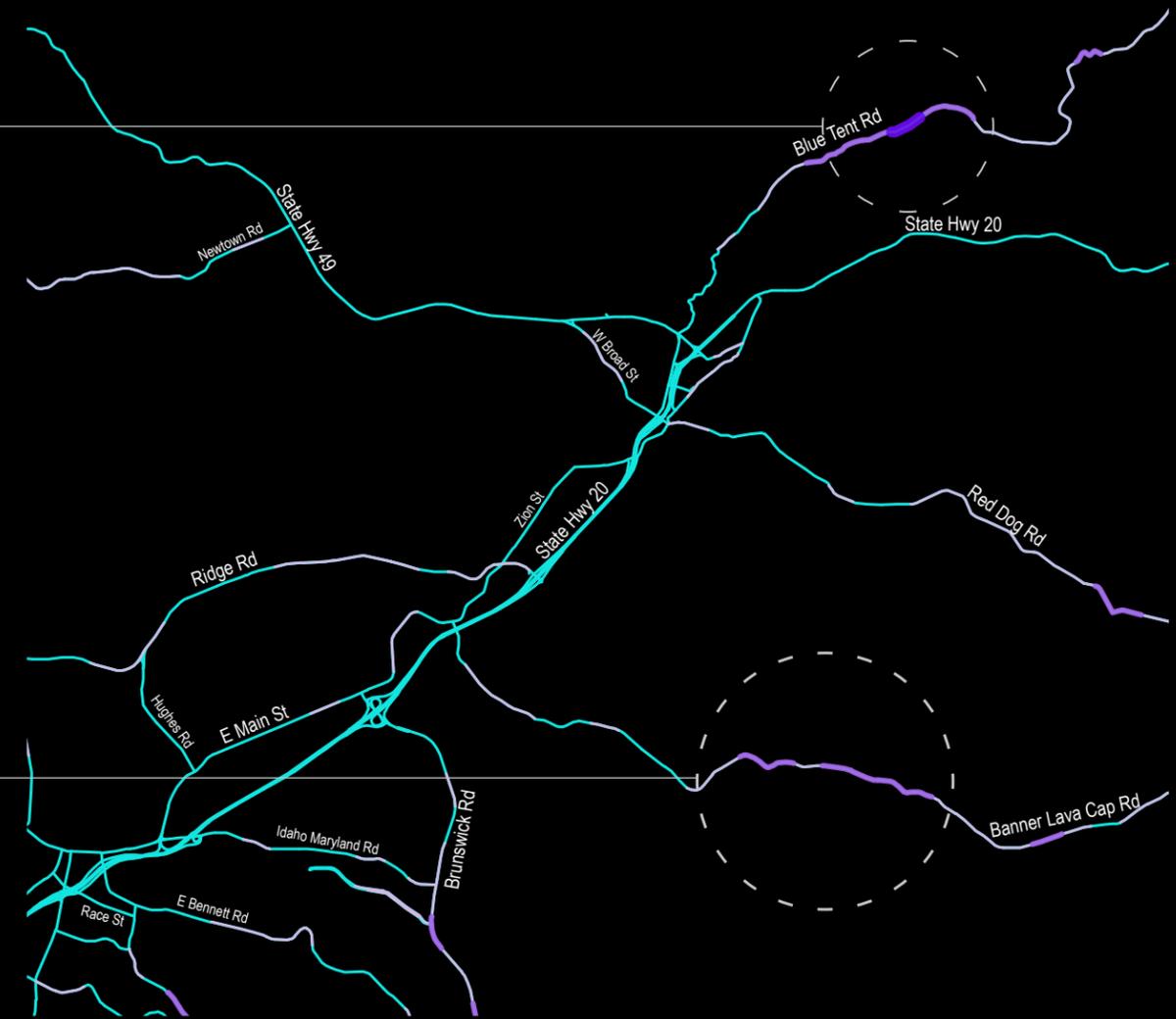
Evacuation Safety Analysis

Top Priority Location

This analysis identifies specific sections from **64 total miles** of highways and major roads where wildfire is most likely to impede safe passage. Therefore, roadside mitigation should prioritize these locations. The top priority section is a **1/6 mile segment representing 0.25%** of the entire network. The medium priority sections total **3.5 miles** or 5.5% of the total. Roadways with low vulnerability represent 16 miles or 25%.

Secondary Location

Additional analysis is possible on **smaller secondary roads** or other **known evacuation safety routes**.



Priority Locations for Roadside Mitigation to Enhance Evacuation Safety

- Primary Roads
- Highest Priority
- Medium Priority
- Lowest Priority



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Questions:
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