Lake Hennessey Community Evaluation

March 16, 2022

Table of Contents

A. Introduction

Fire hazard is a special concern in the Lake Hennessey area in central Napa County. The area is located in the interface between wildlands and developed areas where fires may spread from wildlands to the homes, possibly damaging structures or even threatening lives. Conversely, wildlands are subject to increased ignition potential from elevated levels of human activities. Most fires in the coastal mountains are human caused[1].

This evaluation serves as a platform for recommendations for projects to: minimize threat to life safety and damage from wildfire to homes and natural resources. It is based on a review of the terrain, weather, fuels, and fire history of the area, compared to the values at risk, and likely scenarios of fire ignition and spread.

The Lake Hennessey community boundary covers 16,834 acres in central Napa County. It is an organized Fire Safe Council (FSC) located between the Angwin FSC to the north, the St. Helena and Deer Park FSCs to the northwest, and the Hennessey Rector FSC to the south. The towns of Zinfandel and Rutherford are also nearby to the west. The Lake Hennessey FSC area of interest is bounded by Howell Mountain Road to the northwest, Silverado Trail to the west, Lower Chiles Valley Road to the east, and Lake Hennessey and Highway 128 (Sage Canyon Rd) to the south. Los Posadas State Forest is located close by to the north of the community. The northern boundary is a straight line in the west-east direction from the ridge west of Conn Creek to Lower Chiles Valley Rd.

Within this area, data records show approximately 58 households, 407 structures, and a population of 121 lie within the Lake Hennessy FSC. Elevation ranges from approximately 300 feet to slightly more than 1700 feet at northern on the northern boundary of the FSC, above and to the west of Moore Creek. The area is best characterized by steep and rolling terrain

While there are many rural residents within the Lake Hennessey community boundary, there are no incorporated or informally recognized cities or towns within its boundary. The City of St Helena is to the northwest and the town of Yountville is to the southwest. While the majority of the Lake Hennessey area is privately owned, it also includes lands owned by the following public or non-profit entities: the City of Napa (Hennessey Lake), and Napa County Regional Park District (eastern shore of Lake Hennessey and Moore Park area northeast of the lake).

More details on each will be presented in the following sections.

[1] https://www.nps.gov/articles/wildfire-causes-and-evaluation.htm

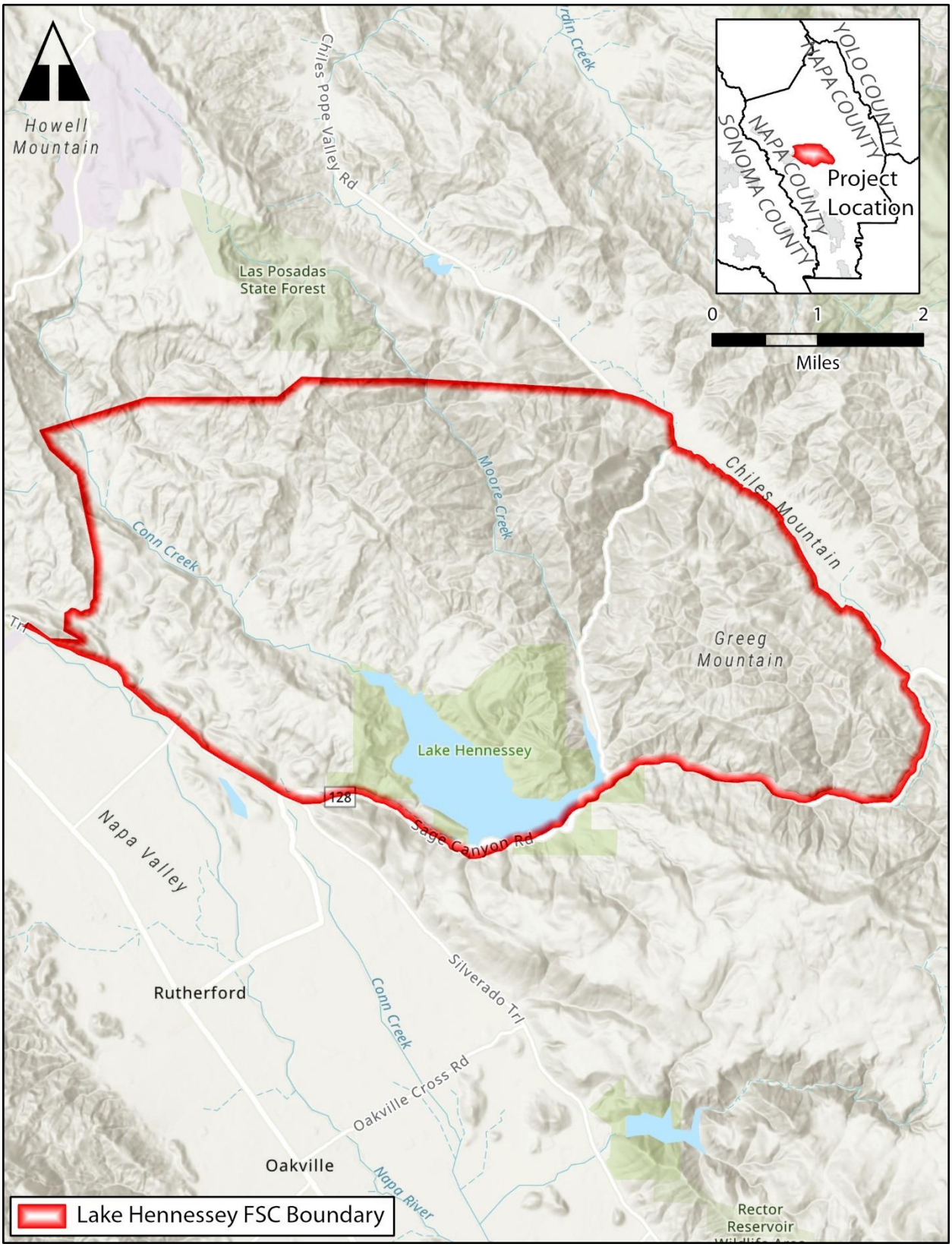

Figure 1. Area of Interest – Lake Hennessey FSC boundary (shown in red).

B. Values at Risk

The most important values at risk are life safety, then improvements to property (residential structures and vineyards), then natural resources. Because there is only on way in and out for most residents, and all the evacuation routes are long and involve poor road conditions, the threat to human life is significant.

Homes in the Lake Hennessey FSC area are at risk from wildfire for a number of reasons. While a few structures are a mix of older construction, dating before the requirement for ignition resistant construction, most structures are either newly constructed or newly remodeled, and are not prone to ignition. Most roofs are less flammable, and only a few have wood siding, decks. Unprotected vents that are part of most homes all make the buildings prone to ignition due to ember intrusion.

Homes: Residential structures are mostly made of wood because of their age. They have wood porches and decks, though wood fences are a rarity. The presence of ignition-resistant construction is closely related to the age of the structures; structures built after 1996 have features that prevent ignition such as non-flammable roofs, double-paned windows, and stucco siding. Many older structures have been remodeled and a few property owners have installed personal fire suppression systems involving various water sprinkler strategies.

Structures are located primarily off Silverado Trail and in the area north of the lake, with a few structures scattered in the Greeg Mountain area east of the lake.

Access points to existing structures include: Greenfield Road, Rossi Road, Rutherford Hill Road, Hennessy Ridge Road, Taplin Road, Lower Chiles Valley Road, Conn Valley Road, Chiles Pope Valley Road, Auberge Road, and Reserve Road. (See Fig 9 for access)

Most structures are located on the western side of the FSC, off Conn Valley Rd., Silverado Trail. Structures are widely scattered throughout the FSC. A smaller number of structures are situated on Greeg Mtn, access from the east by Lower Chiles Valley Rd and on the west by Chile-Pope Valley Rd.

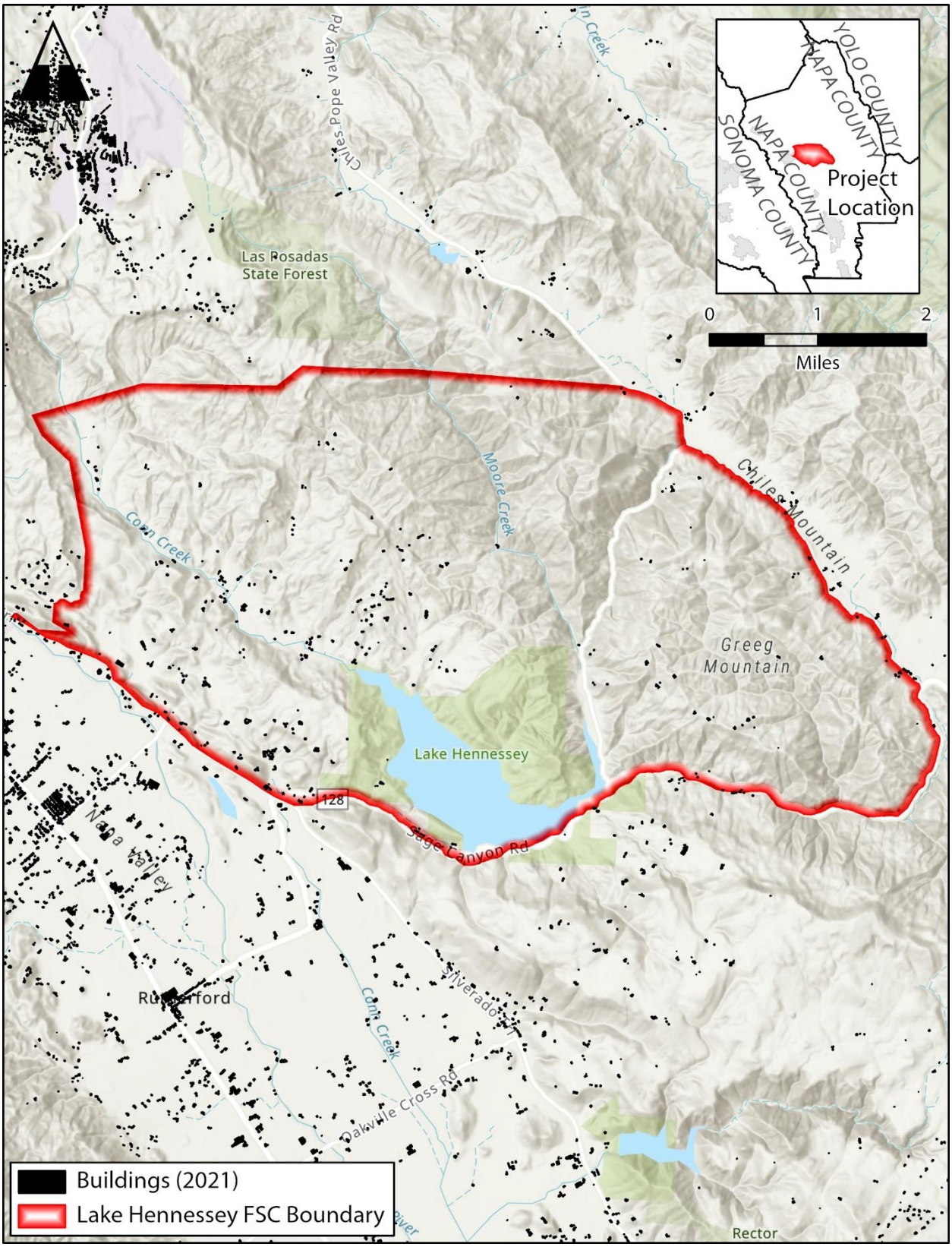

Figure 2. Structures (shown in black) within Lake Hennessey community boundary.

Land use: The Napa County parcel database shows that the Lake Hennessey FSC area is dominated by vacant lands, which account for more than half the lands within the area. This is mostly comprised by City of Napa property, which is located in the south-central part of the area on either side of Lake Hennessy. In fact, the City of Napa is the largest landowner in the FSC. The next largest land use is Agricultural (vineyards). Most of the agricultural lands are in the southwestern part of the area on the less steep hillsides. Interspersed among the vineyards and wineries are residences. Many of the vineyards also have residences.

Parcels categorized as residential account for 7% of the area and are made up mainly of larger lots (greater than 5 acres). Six percent of the parcels are designated as Commercial (which includes wineries).

Table 1. Number of parcels and county land use within the Lake Hennessey FSC area (Napa County GIS Open Data Portal, accessed in July 2021).

Category	Parcel Count	Acres
AGRICULTURAL	**48**	**3235.5**
CONTRACTS LAND-NON-VINEYARD	3	243
VINEYARD LAND >5 AC	10	1076.53
CONTRACT LAND-VINEYARD	3	394.6
CONTRACT VINEYARD W/1 RES	2	106.7
VINEYARD > 5 AC W/1 RES	15	488.79
VINEYARD LAND < 5 AC	1	1.5
CONTRACT VINEYARD W/2 SFRS	4	201.32
CONTRACT NON-VNYD W/MISC IMPS	1	22.49
VINEYARD LAND W/MISC IMPS	3	451.26
CONT VINE W/ WINERY W/1 RES	4	241.99
VINEYARD < 5 AC W/1 RES	2	7.32
COMMERCIAL	**14**	**610.8**
WINERY	2	42.81
WINERY/1 RES	1	7.93
WINERY WITH VINEYARD	7	254.94
WINERY/VINEYARD/1 RES	4	305.12
RESIDENTIAL	**30**	**627.4**
RURAL RES < 5 AC W/1 RES	10	21.42
RURAL RES > 5 AC W/1 RES	17	446.52
RURAL RES < 5 AC W/2 SFRS	1	2.7
RURAL RES > 5 AC W/2 SFRS	2	156.76
VACANT	**49**	**5163.49**
VACANT LAND RURAL	43	4145
VACANT LAND NON-TAXABLE	4	848.36

VACANT RURAL W/MISC IMPS	2	170.13
Grand Total	**141**	**9637.19**

C. Topography

Topographic features - such as slope and aspect (orientation with respect to sun and wind) and the overall form of the land - have a profound effect on fire behavior. Topography affects a wildfire's intensity, direction, and rate of spread. An area's topography also affects local winds, which are either "bent" or intensified by topographic features. Topographic features can also induce daily upslope and downslope winds. The speed, regularity, and direction of these winds (and other winds) directly influence the direction of wildfire spread and the shape of the flaming front.

For example, fires burning on flat or gently sloping areas tend to burn more slowly and to spread more horizontally than fires burning on steep slopes. This makes ridgetop positions more vulnerable than those at the bottom of a slope.

The area encompasses a broad range of slopes and aspects with almost equal representation of southwestern and northeastern facing slopes. Slopes range from zero at the bottom on Napa Valley and more than 100% along the ridgelines. There are no large peaks in the area, but the ridge off of Atlas Peak (to the southeast) extends into the area and forms Fir Canyon. There are numerous creeks and canyons that bisect the area in a roughly west to east direction. In the northeast of the area, small creeks run from the south to the north into Sage Canyon.

Lake Hennessy and Greeg Mtn define the landscape.

An un-named ridge connects Los Posadas Forest on the north to the tallest portion of the FSC are at the top of Greenfield Rd.

Greeg Mtn is an isolated topographic knob separated by Lower Chiles Valley Rd to the east, Sage Canyon Rd to the south and Moore Creek to the west.

The City-owned property northwest of Lake Hennessy rises from Silverado Trail and Conn Valley and is a distinct topographic feature.

Moore Creek is aligned with northerly winds and is likely to funnel airflow.

Conn Valley is protected from northerly winds

Parcels at higher elevations are subjected to strong winds and gaps between the peaks concentrate air flow.

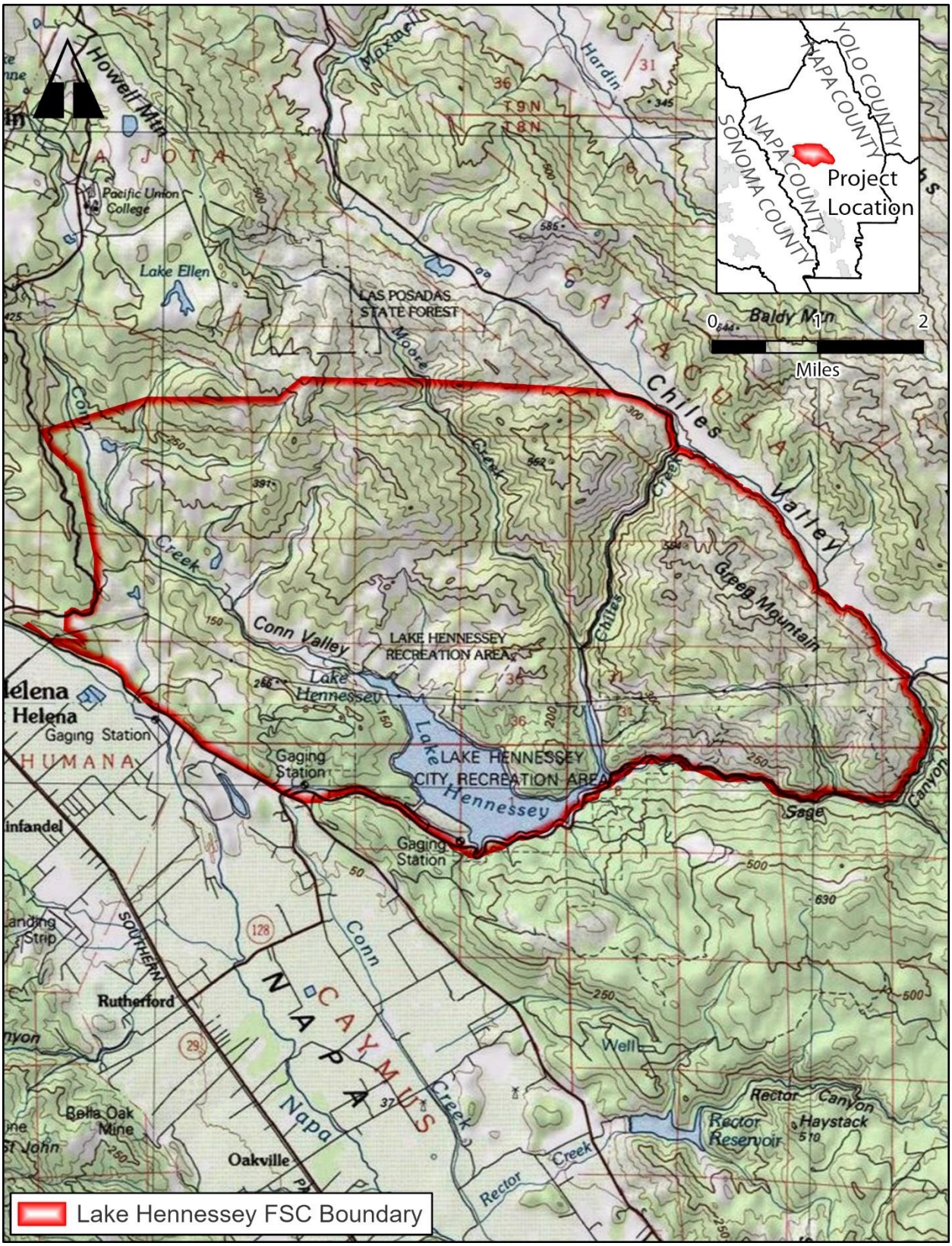

Figure 3. USGS Topographic map of the Lake Hennessey FSC area (boundary shown in red).

Watersheds and Orientation of Canyons

The Lake Hennessey FSC has several sub-watersheds in its boundary, a result of several prominent ridges that divide the waterflow into many different directions. Its entirety falls within the Napa River Sub-Area. The Greeg Mtn Super Planning Watershed contains 3 Planning watershed: the 5,761-acre Planning Watershed of Lake Hennessy, the 8,1985-acre Planning Watershed of Fir Canyon and the 7297 Planning Watershed of Conn Creek. The western portion of the FSC that bounds Silverado Trail lies within Super Planning Watersheds. Surprisingly, water in the northwestern extent of the FSC feeds into the Larkmead Super Planning Watershed, within a much larger (10,138 acres) Heath Canyon Planning Watershed. A small portion of the FSC, located further south along the Silverado Trail is located in the Lower Napa Super Planning Watershed, with water flowing to the much larger, 79,027-acre, Planning Watershed named the Mount of Napa Fiver.

Several creeks exist in the area. They include: Moore Creek, Conn Creek, Chiles Creek, and Sage Creek.

There are several well-defined canyons in the Lake Hennessy FSC.

- Moore Creek area: This canyon runs from the north central part of the FSC southeast and merges with Chiles Creek in the southernmost part of the area before running into the southeastern end of Lake Hennessey. Moore Creek Trail runs along Moore Creek. This is a canyon that is most closely aligned with northerly winds.
- Chiles Valley: This valley originates in the northeast and runs to the southeast, merging with Moore Creek to run into the southeastern end of Lake Hennessey. Chiles Pope Valley Road runs along Chiles Creek.
- Rossi Road area: Rossi Road follows an ephemeral creek in a canyon running from the center of the FSC southwest where it hits Conn Creek.
- Conn Valley area: This broad valley runs from the northwestern part of the FSC southeast to run into the northwestern end of Lake Hennessey.
- Sage Canyon: This well-defined, narrow canyon runs from the east on the southern boundary of Lake Hennessey FSC along Sage Canyon Road.

More details of the terrain follow in the discussion of weather.

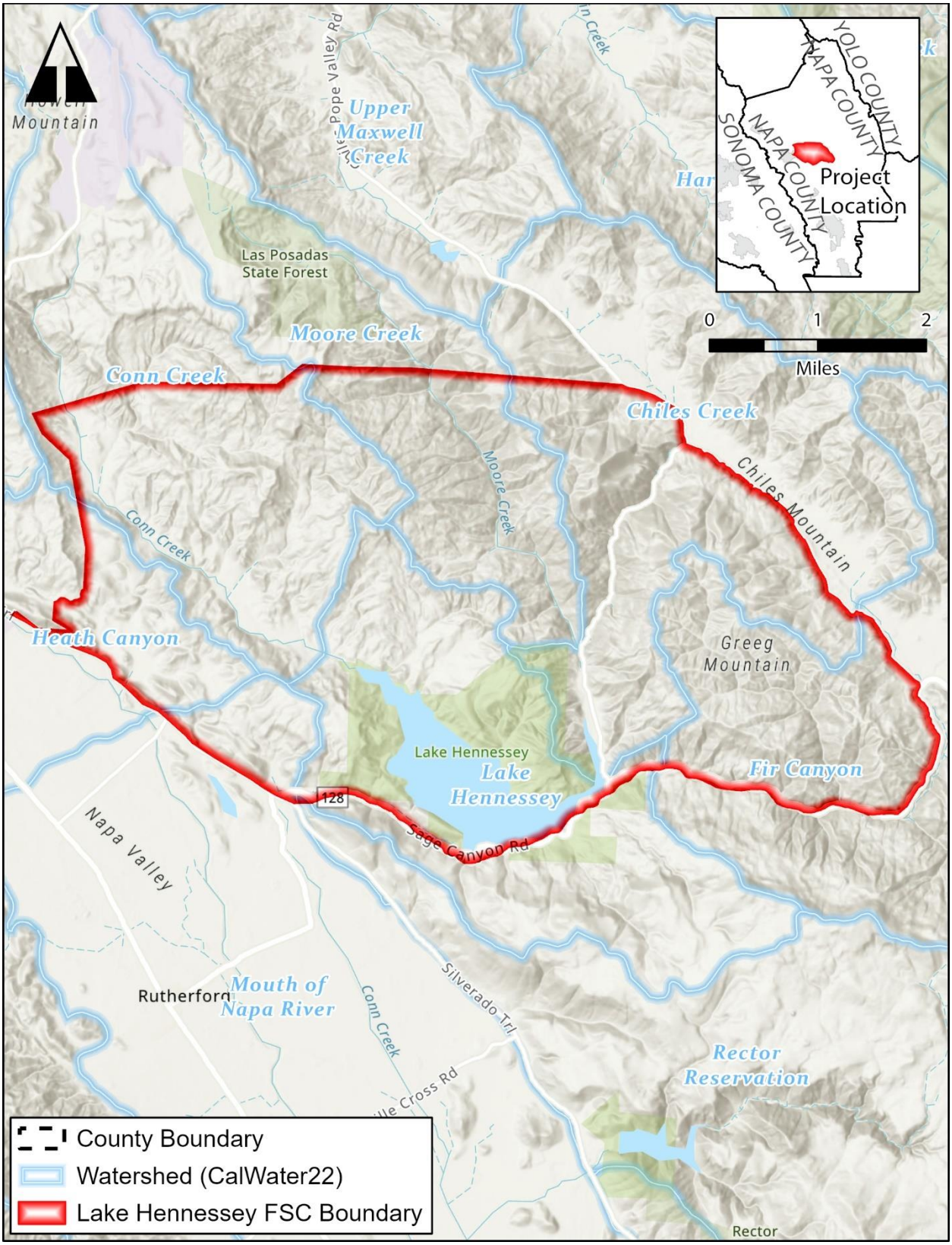

Figure 4. Watershed map of the Lake Hennessey area (boundary shown in red).

D. Weather

Weather conditions significantly impact both the potential for ignition and the rate, intensity, and direction in which fires burn. The most important weather factors used to predict fire behavior are wind, temperature, and humidity.

1. Temperatures and Humidities

Summer days are usually comfortable; temperatures normally range from lows in the 40's and to highs in the 90's, with an occasional high reaching a maximum of 105 degrees Fahrenheit. Humidities can drop to the single digits in the summer and fall.

Portions of the Lake Hennessey FSC of interest lie in a relatively protected area and would be subject to occasional episodes of several still, stagnant air formed by stationary highs during summer months. This overall weather pattern -- characterized by continuous high temperatures and low relative humidities -- enhances the possibilities of ignition, extreme fire behavior and extreme resistance to fire control.

2. Winds

The most important influence on fire behavior is wind. Wind can greatly affect the rate of fire's spread and the output of a fire. Wind increases the flammability of fuels both by removing moisture through evaporation and by angling the flames so that they heat the fuels in the fire's path. The direction and velocity of winds can also control the direction and rate of the fire's spread. Winds can carry embers and firebrands downwind that can ignite spot fires ahead of the primary front. Gusty winds cause a fire to burn erratically and make it more difficult to contain.

Wind will tend to follow the pattern of least resistance and is therefore frequently deflected and divided by landforms. Canyon slopes produce pronounced daily up-canyon and down-slope winds caused by differential heating and cooling of air during the day. This occurs region-wide and on a local scale. This daily movement of air up and down from the slopes are likely to be most pronounced in the drainages up and down Greenfield Rd and noticeable to residents on Greeg Mtn.

The winds that create the most severe fire danger typically blow from the north, usually in October. Winds from the east and north bring low humidities and elevated fire danger and can wreak havoc on the forested and chaparral covered areas, causing fire to spread to the south. These winds are the same ones that blew during the largest fires in Napa County; an unnamed fire in 1939 follows the pattern of larger fires influenced by these northeasterly winds. Those larger fires the Tubbs and Nuns fire in 2017 and the Glass fire in 2020 also followed this pattern and burned substantial parts of Napa County, very near the Lake Hennessey FSC as well as surrounding lands.

Regional southwesterly winds are slowed by the northwest-to-southeast aligned ridges that form the Lake Hennessey FSC area; however, strong winds from the northeast could produce strong up-slope and erratic winds, especially from the valley, with air flow following Moore Creek.

These northeasterly events generally last from 15 to 35 hours, but in 2000, 2003, 2005, 2017, 2018, 2019, and 2020 these events in October and November lasted for 5 to 14 days. This type of wind could “push” a fire from the upper eastern slopes of Napa Valley down across into the vineyards on the valley floor to the higher slopes to the west and beyond into Sonoma County.

E. Vegetation

The 2016 Vegetation Map of Napa County[2] (updated from the 2004 version) was used as reference for this evaluation. There are seven main vegetation categories within the Lake Hennessey area along with four non-veg types (rock outcrop, developed, aquatic, and unclassified). The major vegetation categories mapped are listed in Table 2.

Table 2. Vegetation acres by major vegetation categories within the Lake Hennessey FSC area (Vegetation Map of Napa County).

Vegetation Major Category	Acres	Percent
Agriculture	1,222.33	7%
Coniferous forest	1,540.45	9%
Developed	197.78	1%
Grassland	1,688.61	10%
Oak woodlands	7,740.11	46%
Other	17.91	0.1%
Riparian woodland	450.11	3%
Rock Outcrop	21.20	0.1%
Shrubland	3,095.94	18%
Streams and reservoirs	851.92	5%
Wetlands	18.34	0.1%

Along with the mapped vegetation is the landscaped environment surrounding buildings and homes.

Each vegetation type burns differently, based on the amount of biomass available to burn, the distribution of biomass in the vegetation, as well as the moisture and oil content of the foliage and dead material. A discussion on each major type follows the map on the next page.

Note: the tables and maps presented here reflect pre-2020 conditions.

[2] https://data-cdfw.opendata.arcgis.com/datasets/b9855bea85c14190ab030da86441301c_0/explore

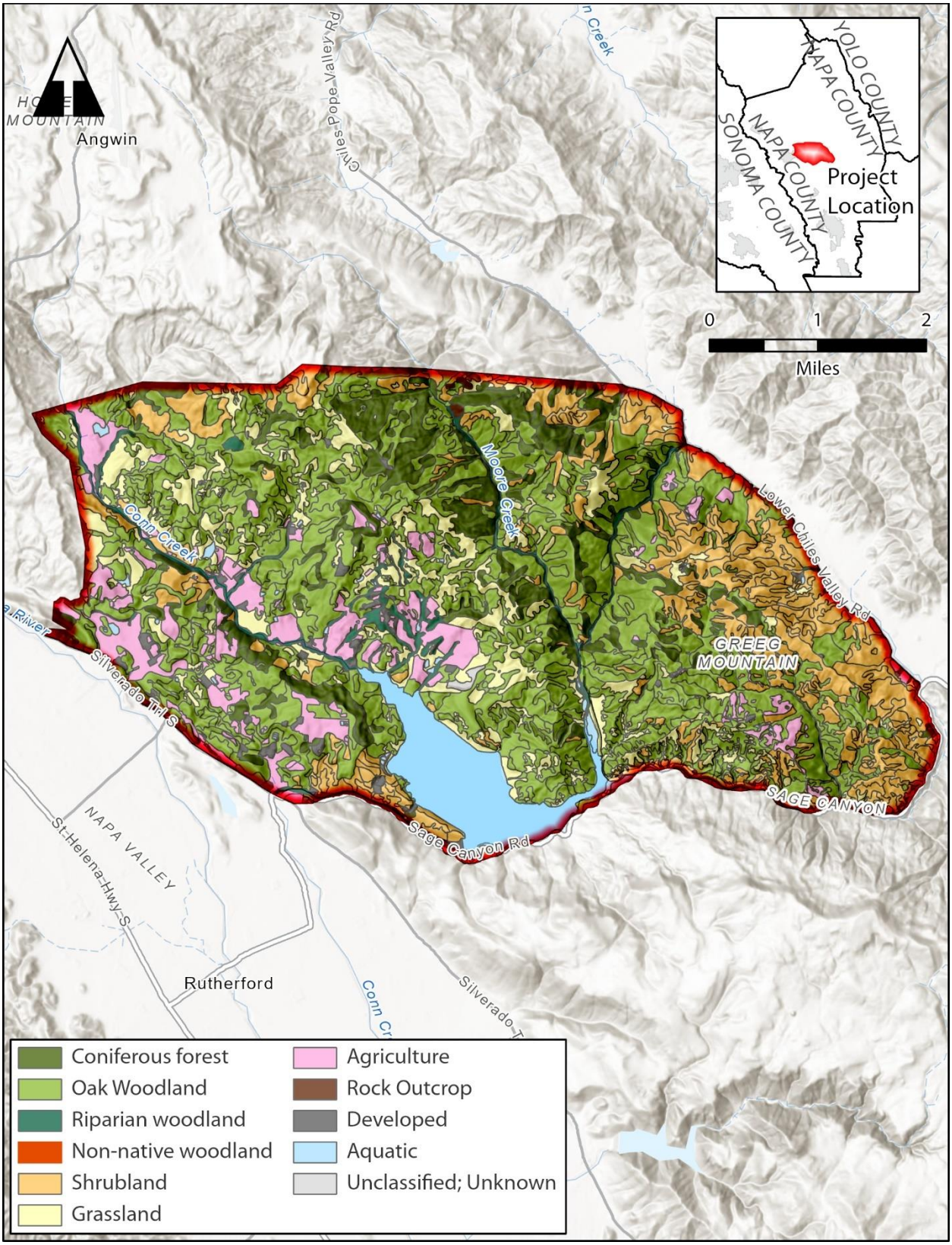

Figure 5. Vegetation map – Lake Hennessey FSC area (boundary shown in red) (Napa Vegetation Map, 2016).

Oak Woodland: 46% of the Lake Hennessey area is mapped as Oak Woodland, which occurs on the flanks of hillsides and ridgetops throughout the area. In most areas, dense canopies, with little or no grass or shrubs under the canopies, typify these oak woodlands. The tree canopy in the lower reaches of the drainages is dominated by Coast live oak, but also includes California bay, madrone, black oak, blue oak, valley oak, interior live oak, Douglas fir and occasional pines. In more exposed areas, where the canopy opens up, shrubs are abundant in the understory.

Fire intensity, flame lengths, and scorch heights are usually low in oak woodlands. Slow-burning surface fires (approximately two-feet per minute) are carried in the compact leaf litter layer. Low flame heights (less than one foot) are the rule. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards in this vegetation type. Leisurely spread rates, combined with the relatively short flame lengths of the predicted fire behavior produce a manageable, moderate fire hazard.

However, when shrubs are allowed to develop under the hardwoods, these fuels can pose fire hazards under severe weather conditions, e.g., those conditions involving high temperatures, low humidities, and high winds. If the shrubs develop under oaks, torching is likely to occur because of the ladder fuels that allow a fire to burn from the shrub to the tree crowns. Foliage of both bay and coast live oak can be very flammable when fire reaches the crowns.

Shrubland: The next largest mapped vegetation type occupies 18% of the Lake Hennessey area of interest and can be found mostly along the eastern side along Lower Chiles Valley Road and into the Greeg Mountain area. Some areas of shrubland also exist along the northern boundaries of the area. While these distinct areas were mapped as Shrubland, brush exists throughout and often contributes to other vegetation types described in this document. The specific mapped alliances include:

- California Bay - Leather Oak - (Rhamnus spp. (Foothill Pine)) Mesic Serpentine
- Chamise - Wedgeleaf Ceanothus
- Chamise Alliance
- Leather Oak - California Bay - Rhamnus spp. Mesic Serpentine Chaparral
- Leather Oak - White Leaf Manzanita - Chamise Xeric Serpentine
- Mixed Manzanita - (Interior Live Oak -California Bay - Chamise) West County
- Scrub Interior Live Oak - Scrub Oak - (California Bay - California Ash - Birch Leaf Mountain Mahogany - Toyon - California Buckeye) Mesic East County
- White Leaf Manzanita - Leather Oak - (Chamise - Ceanothus spp. (Foothill Pine)) Xeric Serpentine

Brush produces severe fire behavior, with flames longer than 20 feet in length. Intense, fast-spreading fires in chaparral burn the foliage as well as the live and dead fine woody material in

the brush crowns. The foliage is highly flammable and dead woody material in the stands significantly contribute to increased fire intensity.

This fuel type constitutes the highest hazard. Direct attack is not possible, and containment efforts would need to rely on backfiring or suppression strategies other than line building because the perimeter of the fire is likely to grow faster than a line could be built. In addition, spotting is likely in chaparral which will present even more challenges to suppression efforts.

Annual Grasslands (Herbaceous): Accounting for 10% of the Lake Hennessey FSC area, annual grasslands were mapped in small patches scattered throughout the central part of the western half of the area, especially on the slopes above the Silverado Trail. Fires spread through grasslands can be quick, however, they are easy to spot and quick to put out.

Agriculture (Cropland/Vineyards): 7% of the land in the Lake Hennessey area is mapped as agriculture. These agricultural areas are most concentrated in the western half, clustered near the northern tip of the lake, along Conn Creek, and between Conn Creek and Silverado Trail (the western boundary of the area of interest). Most of these agricultural areas are vineyards.

Fires are usually benign in croplands or vineyards. In the case of vineyards, biomass is concentrated in live vines, with a mowed or bare soil surface. A fire can spread quickly through the vineyard where there is a ground cover. However, this situation is rare. Vineyards were instrumental in stopping the Howell Mountain fire in 1983, and formed the edges of fires in the Tubbs, Nunns, and Kincade Fires, but were part of the contagion in the Cavedale Fire in Napa in 1996. Vineyards often have access roads on the perimeter and within the interior, further aiding containment. With all that said, however, in the LNU Lightning Complex, the Glass fire of 2020, many vineyards were burned through.

Conifer forest: These areas include mapped Douglas Fir (372 acres), a mix of Douglas Fire – Ponderosa Pine (1038 acres), and Foothill Pine (100 acres) and constitute 9% of the total area.

Conifer forests are often found on north-facing slopes, especially on the City lands south of Conn Valley Rd, and at the top of Greenfield Rd and the east-facing slopes leading from Moore Creek up to the highest portion of the FSC. These forests do not pose a significant fire hazard under normal conditions. However, when hot, dry weather occurs, these forests do offer a large fuel load to burn and can exhibit greater fire intensity. Of all the vegetation types in the Lake Hennessey area, dense, coniferous forests are most likely to burn as a crown fire. When a fire reaches tree crowns, embers are distributed throughout adjacent areas (including vulnerable residential areas). Dead material from dying oaks increases fire intensity.

Landscaping: Landscaped areas -- being closest to homes -- may make the greatest impact on survivability of a house during a fire arising in wildlands. Landscaped areas either (1) are moist,

thus will not likely burn; (2) contain large amounts of fuel which will burn with great intensity; or (3) are landscaped with fire resistant plants, and only burn slowly with little heat release.

While research results regarding fire resistance of landscape plants are meager, several important generalities have surfaced. First, the overall volume of biomass as well as the spacing and design of the garden is more critical than the species selected. Horizontal spaces between planting masses and the house are important components of a fire safe landscape. Similarly, vertical spacing between tree branches, shrubs, ground cover and the structure (particularly windows) are also part of a well-designed garden.

Maintenance of landscaped areas is necessary to remove dead material and to maintain vertical and horizontal spaces. Neglect of landscape maintenance can lead to a significant worsening of the fire hazard closest to the structure.

Landscaping in the Lake Hennessey FSC is generally consistent with fire safety principles. A few residences in each neighborhood have abundant vegetation that can endanger adjacent and nearby residents if they are within a few hundred feet of each other.

F. Predicted Fire Behavior

Lower flame lengths (shorter than 4 feet) are predicted over 37% of the area. However, flame lengths are expected to be high (over 12 feet) over 35% of the area, because of the combination of heavy fuels, especially in the conifer, mixed forest, and chaparral. Where a well-developed understory is present under the oak canopies, fires are also expected to burn with high intensity.

Fires can also be expected to burn fast when they are propelled by dry grass and chaparral. Vineyards can moderate both the fire intensity and fire spread but would not provide good suppression opportunities for safe evacuation because they are small in comparison to the tracts of uninterrupted vegetation. As mentioned previously, Douglas fir stands burn with high intensity under extreme conditions, and produce and distribute vast numbers of embers as a result of crown fires expected in this fuel typ.

The distribution within an area of expected flame lengths can be predicted using public-domain software and data. FlamMap[3] was used to model fire behavior using a county-wide dataset developed from the Napa County Vegetation Map[4].

[3] https://www.firelab.org/document/flammap-software
[4] https://ncff-cwpp-dms-usa.hub.arcgis.com/maps/b2de24b3562e4e27b0fbea2921e2c9e4/explore

1. Predicted Flame Lengths

Long flame lengths can be expected in coniferous and oak forests where understory is present. Vineyards and areas of well-maintained defensible space can be expected to burn with low intensity even under the most extreme conditions. Flame length most directly relates to the ability of a firefighter to safely attack a fire; flames longer than eight feet prevent safe, effective direct attack. Flame length is also most closely related to structural damage – the higher the flame length, the more likely a structure could be lost.

Flame lengths longer than eight feet account for 40% of the predicted fire behavior. Leaving about 60% of the area that is predicted to have less than 8-foot flame lengths. Of those areas, 37% is predicted to have less than 4-foot flame lengths.

Predicted flame lengths longer than 12 feet are mostly located along the boundaries of the FSC, and on the eastern side of Greeg Mountain. They generally correspond to places covered with shrublands. or oak woodlands and coniferous forests with abundant understory. The interior of the FSC is expected to burn with flames shorter than four feet with scattered small pockets of flames from 4-12 feet. The lower flame lengths are also in areas of lower slope steepness, in more sheltered locations and more importantly surrounding the vineyards (which no fire is predicted due to the limitations of the predictive software).

Note that the no predicted fire category accounts for agriculture and developed areas that may indeed burn – as evidenced in many of the recent fires in Napa County.

Table 3. Predicted flame length by category and area (in acres) within the Lake Hennessey FSC area (based on Napa Veg Map-based landscape version 2-2021 with a Northeast wind at 15mph with low fuel moistures).

Predicted Flame Length	Acres	Percent
No predicted fire	2,262.72	13%
Less than 4 feet	6,250.25	37%
4 - 8 feet	1,633.39	10%
8 - 12 feet	771.52	5%
Greater than 12 feet	5,916.00	35%

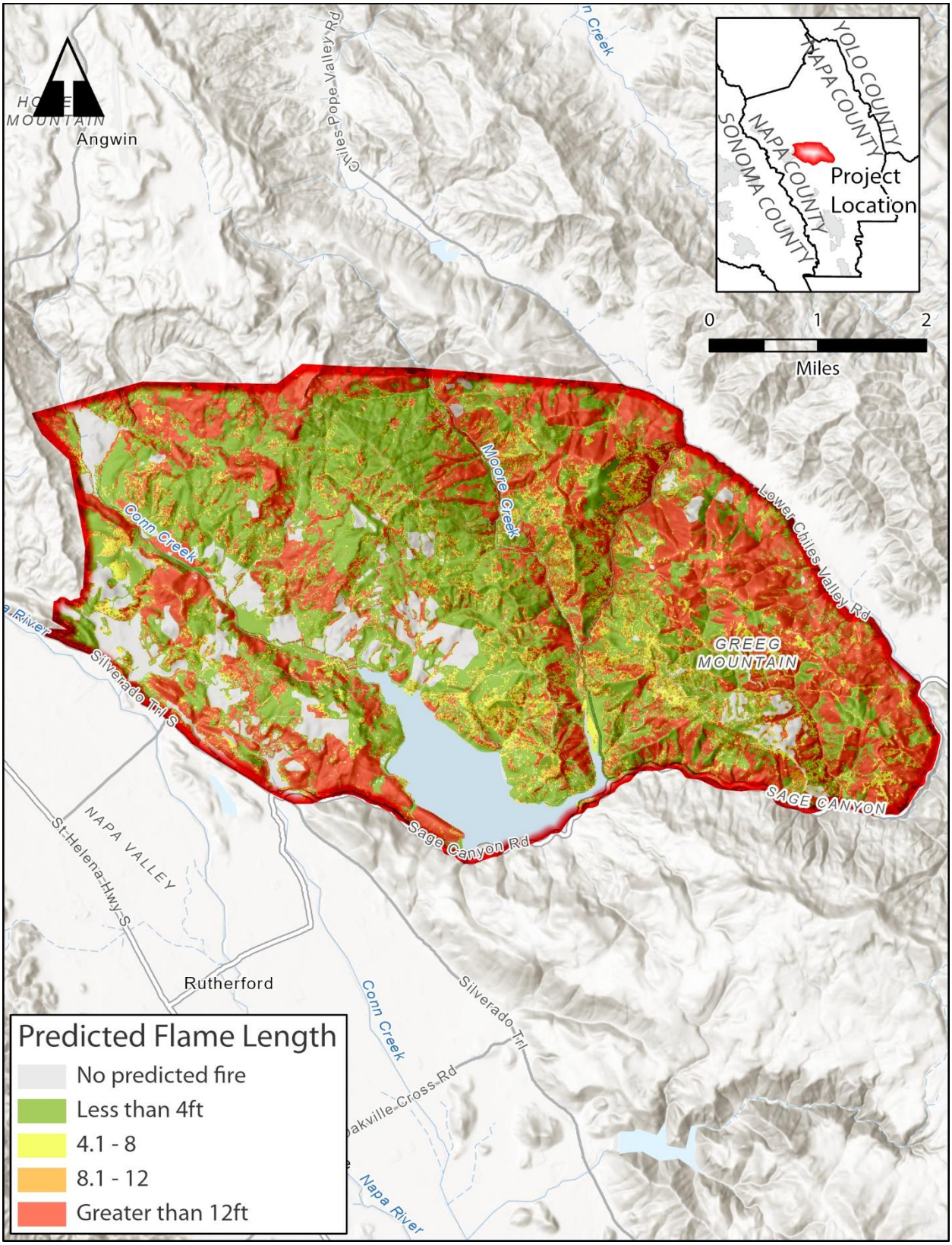

Figure 6. Predicted flame length (feet) map (based on Napa Veg Map-based landscape version 2-2021 with a Northeast wind at 15mph with low fuel moistures). Lake Hennessey FSC area boundary (shown in red).

2. Predicted Crown Fire Activity

While both the coniferous and oak forests can torch, hardwoods are less likely to have fire reach to the tree crowns, unless vegetation is burning underneath. Crowning potential is crucial. When fires spread into crowns, thousands of embers are produced and lofted into ignitable fuels, often overwhelming fire suppression personnel.

For the Lake Hennessey FSC, a very small area is predicted to have fire spread within the tree canopy (tree-to-tree or crown fire), which is actually pretty rare and virtually un-heard of in hardwoods. Areas with higher density of coniferous forests are most at risk to torching and to crown fires. These small areas are located scattered throughout the FSC and persist on the steepest slopes.

Table 4. Predicted crown fire activity (or fire type) by category and area (in acres) within the Lake Hennessey FSC area (based on Napa Veg Map-based landscape version 2-2021 with a Northeast wind at 15mph with low fuel moistures).

Crown Fire Activity	Acres	Percent
No predicted fire	2,262.72	13%
Surface fire canopy cover < 20%	2,192.17	13%
Surface fire with canopy > 20%	4,991.55	30%
Torching fire	6,967.28	41%
Crown fire	420.16	2%

The majority of the FSC is expected to either not burn at all or burn with a surface fire. These areas are concentrated in the agricultural fields, as well as in the central Greeg Mountain area.

Of the area predicted to have only a surface fire, we identified those areas with a higher canopy (over 20%) to highlight areas that do not torch but could, if longer flame lengths were produced. These areas accounted for 30% of the predicted surface fire. Areas where torching is predicted account for 41% of the area.

Torching can be expected in the locations where a combination of long flame lengths and tree canopies are found. These areas are predominately on mid-slopes and places where the vegetation is not protected from strong winds. They occur throughout the area, surrounding the vineyards and residential areas. These areas are located on City property southwest of Lake Hennessy, north-east facing slopes of Conn Valley and those following Moore Creek, and the northeast quarter of the FSC near Lower Chiles Valley Rd.

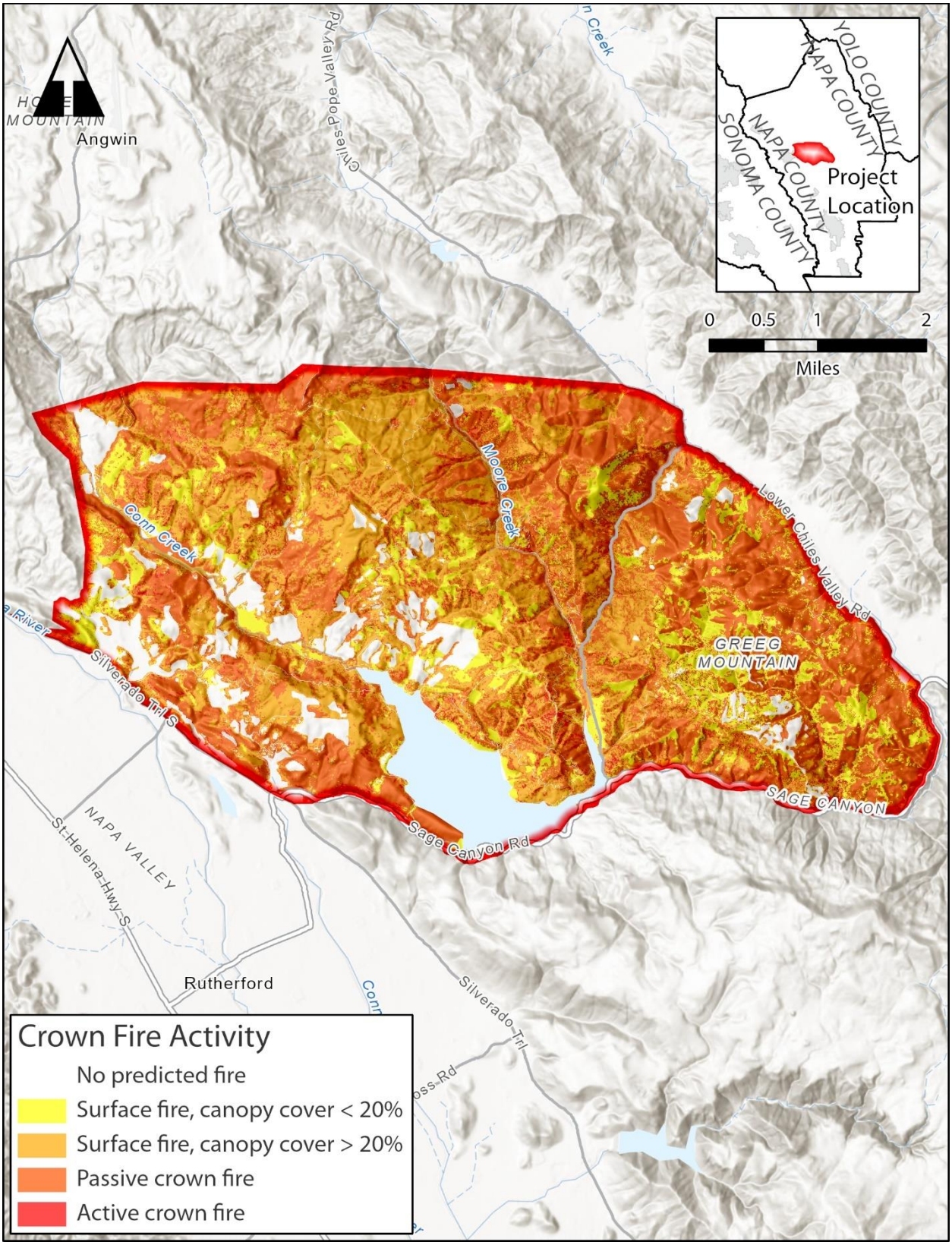

Figure 7. Predicted crown fire activity map (based on LANDFIRE landscape version 2.0 with a Northeast wind at 15mph with low fuel moistures). Lake Hennessey FSC area boundary (shown in red).

G. Fire History

In the recent decades, ten fires have been recorded occurring within or near the Lake Hennessey area, including the LNU Lightning Complex, which started within the FSC on Greeg Mountain. These include four fires that occurred in 2020: the large and wide-ranging Hennessey fire, the Glass fire, and two small fires (1 acre and 62 acres). Slightly further away, the Atlas fire and the Nuns fire occurred in 2017, and a small fire on the valley floor called the Silverado in 2013. A small fire called the Soda fire occurred in 2012, a tiny fire occurred in 2006 called the Sage fire, and a small fire called the Silverado occurred in 2003. In addition, a fire occurred in the area in 1995, in 1983, in 1981 (the larger Atlas fire), in 1964, in 1961, three in 1959, one in 1957, one in 1955, and two in 1954.

Despite the fact that the lightning strike that caused the LNU Complex (also called the Hennessy Fire) in 2020 was located on Greeg Mountain, large fires have not directly and indirectly impacted most of the area of interest. In fact, the fire history map shows that most of the FSC has not been visited by fire in the last 100 years. Important exceptions are that roughly the eastern half of Greeg Mountain burned in 2020, the 1983 Howell Mountain Fire burned the northeastern portion of the FSC. The 1964 PGE Fire #6 burned the area just south of the Greenfield Rd, where many residences are located. The 1954 De La Briandias #2Fire burned 552 acres between Moore Creek and Chiles Valley Rd. A portion of this area burned again in 1959 in the 309-acre Chiles Mill Fire. A larger fire, the Country Roadside Fire, burned both a portion of the FSC and more of Chiles Valley in 1954.

Immediately to the south of the FSC, nearly the entire Hennessy Rector FSC has burned in recent years.

Table 5. List of recorded fires within the Lake Hennessey FSC area (CAL FIRE, 2020).

YEAR	MONTH	DATE	FIRE NAME	CAUSE	ACRES
1954	June	6/20/1954	DE LA BRIANDIAS #2	Unknown / Unidentified	552
1954	July	7/27/1954	COUNTY ROADSIDE #19	Unknown / Unidentified	3,490
1955	August	8/2/1955	COUNTRY ROADSIDE #14	Unknown / Unidentified	853
1957	July	7/7/1957	J. STEGGE	Unknown / Unidentified	251
1959	October	10/30/1959	CHILES MILL	Unknown / Unidentified	307
1959	October	10/30/1959	C. KUHN	Unknown / Unidentified	1,816
1959	December	12/3/1959	R. WILSON	Unknown / Unidentified	3,504
1961	November	11/16/1961	DE LA BRIANDAIS	Unknown / Unidentified	387
1964	September	9/21/1964	P.G.&E. #6	Unknown / Unidentified	453
1981	June	6/22/1981	ATLAS PEAK	Arson	33,606
1983	August	8/28/1983	POPE	Equipment Use	226
1983		<Null>	HOWELL MTN. FIRE	Unknown / Unidentified	2,354
1995		<Null>	PRIEST FIRE	Unknown / Unidentified	5,113
2003	October	10/29/2003	SILVERADO	Powerline	69

2006	July	7/27/2006	SAGE	Unknown / Unidentified	3
2012	February	2/23/2012	SODA	Escaped Prescribed Burn	197
2013	April	4/30/2013	SILVERADO	Debris	60
2017	October	10/8/2017	NUNS	Unknown / Unidentified	55,798
2017	October	10/8/2017	ATLAS	Unknown / Unidentified	51,625
2020	July	7/26/2020	MOBILE	Equipment Use	1
2020	August	8/17/2020	HENNESSEY	Lightning	305,352
2020	September	9/27/2020	GLASS	Unknown / Unidentified	67,484
2020	October	10/23/2020	POPE	Vehicle	62

A recurring history of large fires (over 10,000 acres in size), which typically burn for several days, has been well established in Napa County. The typical period between such large fires is approximately 20-30 years. Like much of California, fires in Napa County are almost entirely caused by human-caused accidental ignitions. With that said, in 2020, several lightning-strike fires burned in Napa County and west into Sonoma County.

In the past, fires did not involve large numbers of structures because of the historic rural nature of Napa County; however, structure damage is now a common concern whenever wildland fires of any size occur.

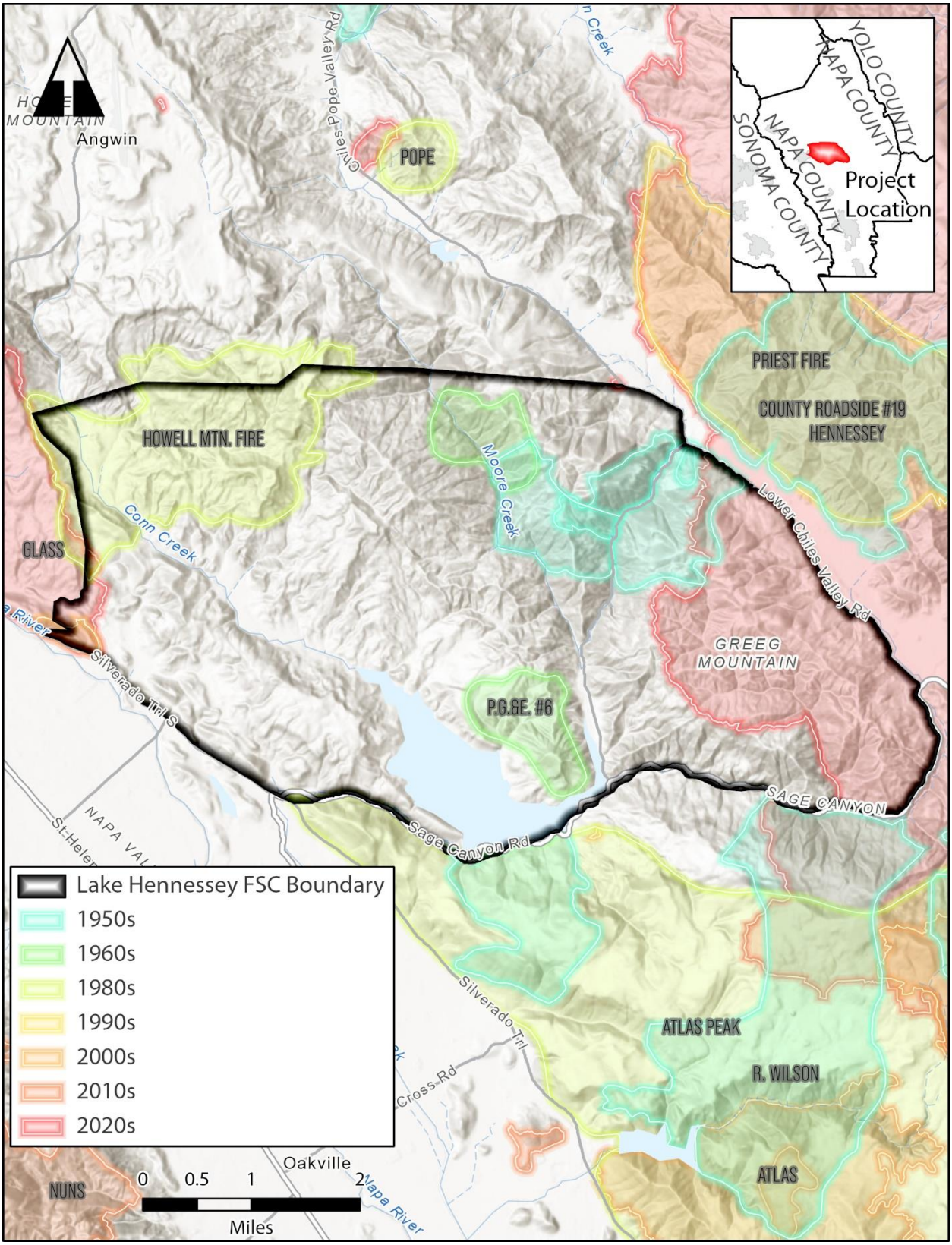

Figure 8. Fire perimeters/fire history map of Lake Hennessey FSC area (CALFIRE FRAP, 2019).

H. Access

In general, access to the central portion of the Lake Hennessey area is poor. Roads are narrow (barely two lanes), and windy. While Sage Canyon Road and Silverado Trail are well-paved and wide roads (sometimes with a limited shoulder), all other roads are barely two lanes with no shoulders. Pavement (road surface) is generally in good shape; some curves are simultaneously sharp and steep. Driveways are generally long. Some residences are served by long shared driveways behind locked gates. Locked gates are common and can further delay emergency response. Locked gates also discourage/prevent inspection by local fire authorities.

Regardless of the condition of the roadbed, access can be blocked by roadside vegetation. Trees can fall, blocking passage or vegetation can burn with such intensity that emergency response and evacuation cannot occur. Most roadsides have abundant roadside vegetation. This vegetation could block the road while burning, and after, as trees fall (a common event during a fire). Roadside vegetation has not been maintained on many of the roads or driveways within the Lake Hennessey FSC area and could prove significant in the event of a fire.

Driveways into in the interior of the region are dead ends. There are no other means of egress other than fire roads that may or may not be maintained. All residents from Rossi Rd., Greenfield Road and Conn Valley Road must use one exit point – Conn Valley Rd.

From Silverado Trail, one can access the northwestern part of the center via Conn Valley Road, leading to Rossi Road or Greenfield Road. Chiles Pope Valley Road allows access to the eastern part of the center, and the smaller Hennessey Ridge Road leads east toward the Greeg Mountain area. Other residences off Silverado Trail are accessed directly from or from driveways stemming from that road.

See map on next page.

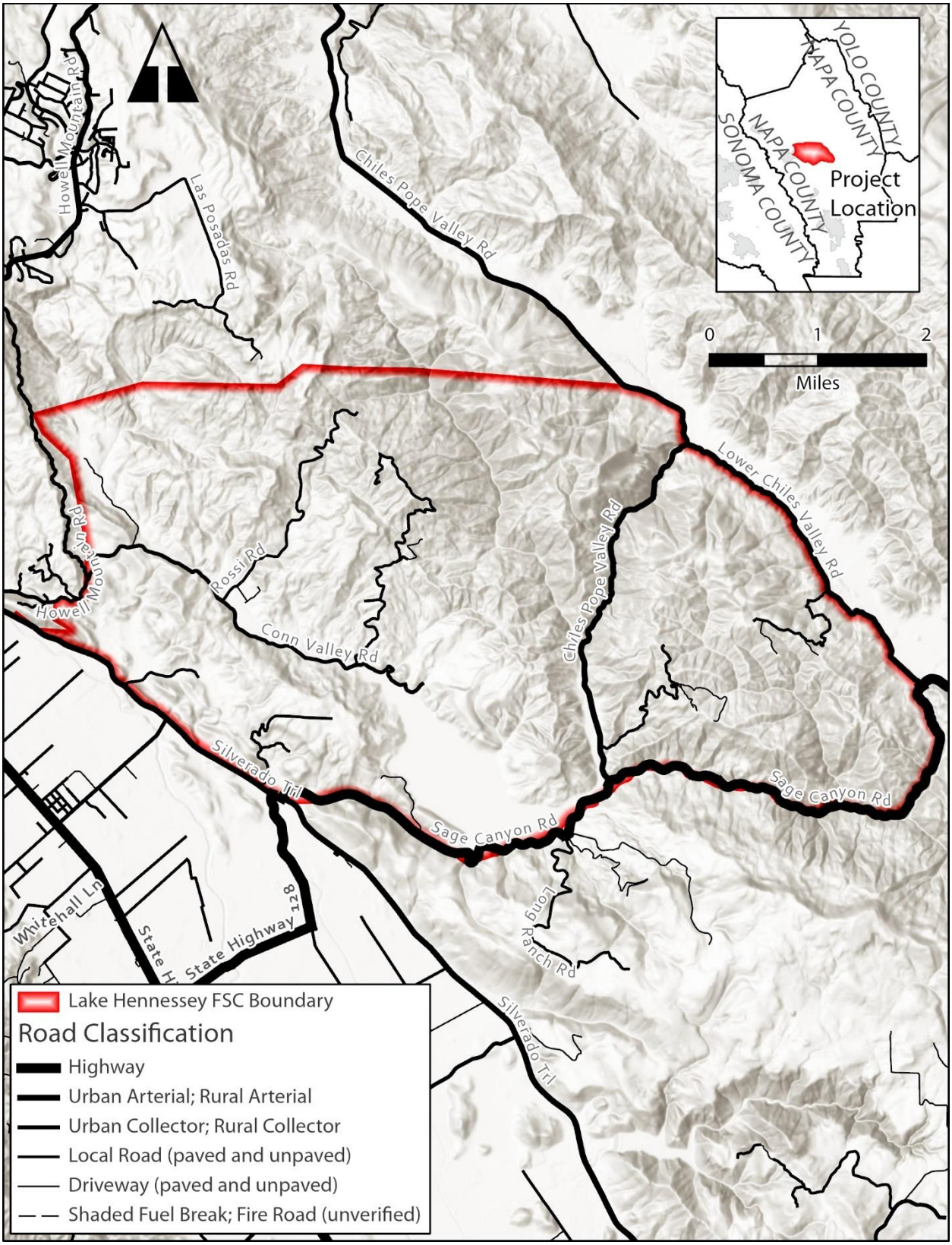

Figure 9. Access and street map of Lake Hennessey FSC area (shown with red outline).

I. Hazard Ranking

The entirety of the area is within CAL FIRE's State Responsibility Area (SRA). CAL FIRE has determined in a 2007 fire hazard assessment that 23% of the area is categorized as a **Very High Fire Hazard Severity Zone**, 46% is classified as High, and the remainder categorized as Moderate (30%).

The areas of Very High Fire Hazard Severity are located on the northeast portion of the FSC. The entire eastern half of Greeg Mountain was classified as Very High FHSZ, along with portions on the FSC on both sides of Moore Creek. The residential areas of Greenfield Rd and Rossi Rd., most of Conn Valley west to Silverado Trail are all classified as Moderate FHSZ, which is the lower possible designation. The middle swath of the FSC is categorized as High FHSZ.

Table 6. Fire hazard severity zone by area (acres) within Lake Hennessey area boundary (CAL FIRE, 2007 – current version).

FHSZ (SRA)	Acres	Percent
Moderate	5,073.07	30%
High	7,819.96	46%
Very High	3,938.62	23%

See map on next page.

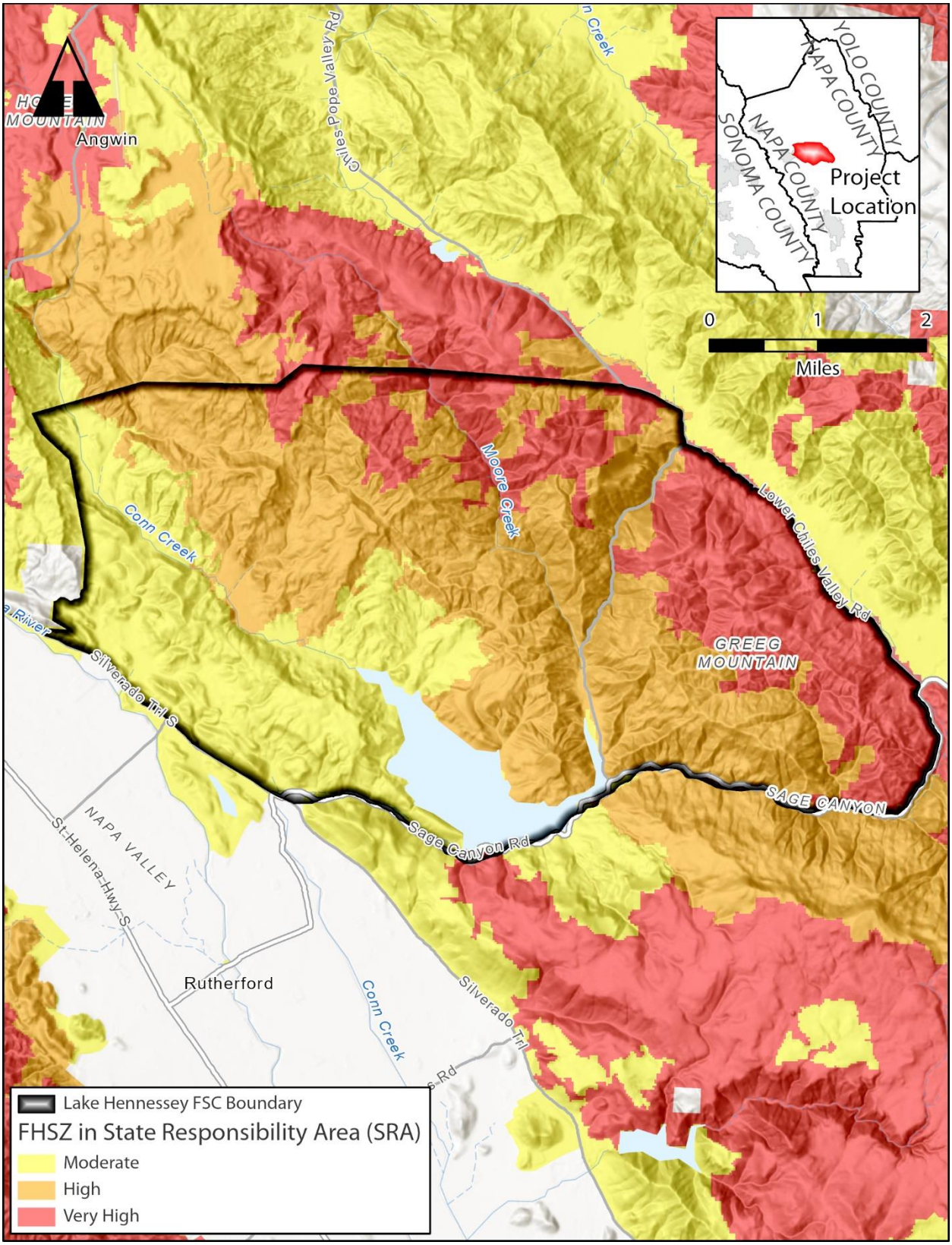

Figure 10. Distribution of Fire Hazard Severity Zones (CALFIRE, 2007).