
Appendix J

Wildfire Hazard and Risk Assessment

Wildfire Hazard and Risk Assessment

City of Vista, California

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Executive Summary

The potential for damaging wildfire exists within the plan area (i.e., Vista, California), as highlighted through regional fire history; existing vegetation types and fuels composition; terrain; local climate; and the presence of the wildland/urban interface (WUI), which encompasses roughly 31% of the plan area. Vegetation conducive to ignition and wildfire spread exists in proximity to communities, presenting risks to human life, safety, and property. The potential for extreme wildfire behavior is exacerbated by the occurrence of Santa Ana wind events, which facilitate extreme fire weather in the plan area.

To assess the extent of potential wildfire impacts in the plan area, a Wildfire Hazard Assessment was conducted using the Interagency Fuel Treatment Decision Support System (IFTDSS) program. The assessment was conducted in two basic stages: the first stage modeled wildfire hazards, and the second stage modeled wildfire risk. Wildfire hazard represents the existing wildfire environment and potential wildfire behavior occurring in that environment. Sixteen percent of the plan area was identified as areas of middle, higher, or highest hazard. Wildfire risk is the intersection of wildfire hazard and identified highly valued resources and assets, and represents the potential impact of wildfire on these assets and resources. WUI communities were determined to experience the greatest risk from wildfire in the plan area, especially low-density intermix communities.

This summary of the Wildfire Hazard Assessment includes a discussion the fire environment, including terrain, vegetation and fuels, weather, and fire history, in addition to model inputs and model results. The model results map and identify regions experiencing high wildfire risk, highlighting areas for prioritized projects to reduce wildfire risk. A description of applicable wildfire risk reduction approaches is also provided.

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1 Plan Area Description

1.1 Location

The plan area encompasses 22,719 acres in northern San Diego County, California (Figure 1, Plan Area Location). The plan area includes the entirety of the City of Vista limits and the jurisdictional boundary of the Vista Fire Protection District, which extends beyond the City of Vista boundary in most areas and includes the communities of Buena and Twin Oaks. The Cities of Oceanside and Carlsbad border the plan area to the west and southwest, and the City of San Marcos occurs to the southeast. The northern extent of the plan area ends near the community of Bonsall. The San Marcos Mountains occur along the northeast portion of the plan area and extend south along the eastern edge to the Twin Oaks community. State Route 78 bisects the southern portion of the plan area.

1.2 Terrain

Terrain within the plan area varies greatly. The west and central portions of the plan area are characterized by gentle rolling hills and flat terrain with considerable development. Elevation in these portions of the plan area is mostly below 500 feet and gradually increases to the east toward the San Marcos Mountains, where elevation and slope steepness increase considerably over a relatively short distance. San Marcos Highpoint is the highest peak in the plan area at 1,671 feet. Notable canyons within the plan area include Gopher Canyon in the northeast and Los Monos Canyon in the southwest.

Terrain affects wildfire movement and spread. Steep terrain typically results in faster upslope fire spread due to the pre-heating of uphill vegetation. Flat areas typically result in slower fire spread when absent of windy conditions. Topographic features, such as saddles, canyons, and chimneys (land formations that collect and funnel heated air upward along a slope), may form unique circulation conditions that concentrate winds and funnel or accelerate fire spread. For example, fire generally moves slower downslope than upslope. Terrain may also buffer, shelter, or redirect winds away from some areas based on canyons or formations on the landscape. Saddles occurring at the top of drainages or ridgelines may facilitate the migration of wildfire from one canyon to the next. Various terrain features can also influence fire behavior, as summarized in Table 1.

Table 1. Effects of Topographic Features on Fire Behavior

Topographic Feature	Effect
Narrow Canyon	Surface winds follow canyon direction, which may differ from the prevailing wind; wind eddies/strong upslope air movement expected, which may cause erratic fire behavior; radiant heat transfer between slopes facilitates spotting/ignition on opposite canyon side.
Wide Canyon	Prevailing wind direction not significantly altered; aspect significant contributor to fire behavior. Wide canyons are not as susceptible to cross-canyon spotting except in high winds.
Box Canyon/ Chute	Air is drawn in from canyon bottom; strong upslope drafts. No gaps or prominent saddles to let heated air escape. Fires starting at the canyon bottom can move upslope very rapidly due to a chimney-like preheating of the higher-level fuels and upslope winds.

Table 1. Effects of Topographic Features on Fire Behavior

Topographic Feature	Effect
Ridge	Fires may change direction when reaching ridge/canyon edge; strong air flows likely at ridge point; possibility for different wind directions on different sides of the ridge. Ridges experience more wind. Fires gain speed and intensity moving toward a ridge. Fires burning at a ridge can exhibit erratic fire behavior. Strong air flows can cause a whirling motion by the fire. As the wind crosses a ridge it usually has a leeward eddy where the wind rolls around and comes up the leeward side.
Saddle	Potential for rapid rates of fire spread; fires push through saddles faster during upslope runs. Winds can increase when blowing through saddles due to the funneling effect of the constricted pass. On the other side, winds will slow, but erratic winds potentially occur at the saddle due to eddies.

Sources: NFPA 2011; Teie 1994

1.3 Vegetation and Fuels

Although most of the plan area is categorized as urban, large continuous areas of natural vegetation exist, most notably in the north, east, and southeast portions near Buena Vista Park. The plan area includes a variety of vegetation types that are common throughout northern-inland San Diego County (Table 2).

Table 2. Plan Area Vegetation Communities

Vegetation Community	Total Acreage	Percent of Plan Area
Urban	15,652	69%
Mixed Chaparral	1,958	9%
Annual Grassland	1,438	6%
Coastal Scrub	1,238	5%
Irrigated Row and Field Crops	713	3%
Valley Foothill Riparian	530	2%
Deciduous Orchard	393	2%
Coastal Oak Woodland	386	2%
Pasture	267	1%

Source: CAL FIRE 2021a

Vegetation type greatly influences wildfire hazard. Although all vegetation burns, some plants exhibit characteristics that make them more flammable than others. Age of fuels can also affect their vegetative fire hazard. In general, chaparral 30 years and older and sage scrub 15 years and older present greater hazard due to accumulation of dead material within shrub canopies. Fires in these older fuels tend to burn hotter and spread faster compared to fires burning in younger fuels. Shrub-dominated vegetation communities, including both mixed chaparral and coastal scrub, are the most prominent vegetation type within undeveloped portions of the plan area. Chaparral has a high surface-area-to-volume ratio, requiring less heat to remove fuel moisture and raise the fuel to ignition temperature. Chaparral is subject to early seasonal drying in the late spring and early summer, but does not fully cure in the way that grasses do. The fire regime of chaparral communities is mostly stand-replacing crown fires. Fire frequency interval is moderate and ranges depending on the dominant species. Fire return intervals can range from 33 to 125 years (USDA 2022a). Mature chaparral stands are more flammable compared to younger chaparral stands. Older chaparral stands are more flammable due to their ability to accumulate more dead material. Although

less likely to ignite compared to other vegetation types, such as grasses, wildfire in chaparral communities can move rapidly and consume fuel at rapid rates. Chaparral communities also exacerbate fire severity through the combustion of volatile organic compounds present within the plants that contributes to flammability and increases combustion rates. Although coastal shrub has similar characteristics to chaparral, coastal scrub tends to have a lower content of volatile organic compounds.

Grasslands are the second most prevalent vegetation type in the undeveloped portions of the plan area. Grasses are fine fuels that are loosely compacted with a low fuel load. Grasses have a high surface-area-to-volume ratio, requiring less heat to remove fuel moisture and raise the fuel to ignition temperature. They are also subject to early seasonal drying in late spring and early summer. Live fuel moisture content in grasses typically reaches its low point in early summer, and grasses begin to cure soon after. Due to these characteristics, grasses have the potential for a high rate of spread, rapid ignition, and facilitation of extreme fire behavior. Their low overall fuel loads typically result in faster-moving fires with lower flame lengths and heat output. Untreated grasses can spread a fire into other adjacent surface fuel types (e.g., shrubs) or facilitate surface-to-crown fire transition where grasses exist beneath tree canopies.

Urban vegetation can also contribute to wildfire spread. Fire burning in undeveloped areas can pass to urban areas through the presence of flammable or poorly maintained landscape or ornamental vegetation. The San Diego County Department of Planning and Land Use provides a list of recommended and non-recommended residential plant species, in addition to management practices to reduce wildfire risk in developed areas (County of San Diego 2021).

1.4 Weather

Northern San Diego County and the plan area are influenced by the Pacific Ocean and are frequently under the influence of a seasonal, migratory subtropical high-pressure cell known as the “Pacific High” (WRCC 2022). Wet winters and dry summers with mild seasonal changes characterize the Southern California climate. This climate pattern is occasionally interrupted by extreme periods of hot weather, winter storms, or dry, easterly Santa Ana winds (WRCC 2022). The average high temperature for the plan area is approximately 70°F, with average highs in the summer and early fall months (July–October) reaching 95°F. Precipitation typically occurs December through April, with annual rainfall ranging from 3.5 to 13.3 inches, with lower annual accumulation in recent years due to the current drought (WRCC 2022). The prevailing wind pattern is from the west (on-shore), but the presence of the Pacific Ocean causes a diurnal wind pattern known as the land/sea breeze system. During the day, winds are from the west–southwest (sea) and at night winds are from the northeast (land), averaging 2 miles per hour (mph). During the summer season, the diurnal winds may average slightly higher (approximately 16 mph) than the winds during the winter season due to greater pressure gradient forces. Surface winds can also be influenced locally by topography and slope variations. The highest wind velocities are associated with downslope, canyon, and Santa Ana winds.

The plan area’s climate has a large influence on fire risk because drying vegetation during the summer months becomes fuel available to advancing flames should an ignition be realized. Typically, the highest fire danger is produced by the high-pressure systems that occur in the Great Basin, which result in the Santa Ana winds of Southern California. Sustained wind speeds recorded during recent major fires in San Diego County exceeded 30 mph, and may exceed 50 mph during extreme conditions. The Santa Ana wind conditions are a reversal of the prevailing southwesterly winds that usually occur on a region-wide basis during late summer and early fall. Santa Ana winds are warm and dry winds that flow from the higher desert elevations in the north through the mountain passes and canyons. As they converge through the canyons, their velocities increase. Consequently, peak velocities are highest at the mouths of canyons and dissipate as they spread across valley floors. Canyons in the plan area that align with the direction of Santa Ana winds are likely to experience severe fire weather during Santa Ana wind events. Santa Ana winds generally coincide with the regional drought period and the period of highest fire danger.

1.5 Fire Hazard Severity Zones

Fire Hazard Severity Zones (FHSZs) are geographical areas designated pursuant to California Public Resources Code Sections 4201 through 4204; they are classified as Very High, High, or Moderate in State Responsibility Areas, or as Local Responsibility Area Very High FHSZ designated pursuant to California Government Code Sections 51175 through 51189. California Public Resources Code Sections 4201–4204 and Government Code Sections 51175–51189 direct the California Department of Forestry and Fire Protection (CAL FIRE) to map areas of significant fire hazard based on fuels, terrain, weather, and other relevant factors. The resulting FHSZs define the application of various mitigation strategies to reduce the risk associated with wildland fires (OSFM 2021). The model used to determine the extent of FHSZs is based on an analysis of potential fire behavior and fire probability predicated on the frequency of fire weather, ignition patterns, expected rate of spread, ember (brand) production, and past fire history (OSFM 2021). Structures built in FHSZs are subject to more stringent fire-hardening requirements than those that are not. The FHSZ classifications for State Responsibility Area and Local Responsibility Area lands in the plan area are provided in Figure 2, Fire Hazard Severity Zones, and Tables 3 and 4.

Table 3. FHSZ Classifications in State Responsibility Area of Plan Area

FHSZ Classification	Acres in Plan Area	Percent of Plan Area
Very High	5,717	25%
High	1,312	6%
Moderate	2,500	11%

Source: OSFM 2021

Notes: FHSZ = Fire Hazard Severity Zone

Table 4. FHSZ Classifications in Local Responsibility Area of Plan Area

FHSZ Classification	Acres in Plan Area	Percent of Plan Area
Very High	1,853	8%
High	636	3%
Moderate	782	3%

Source: OSFM 2021

Notes: FHSZ = Fire Hazard Severity Zone

1.6 Fire History

Fire history assists in understanding potential wildfire behavior based on previous wildfire occurrences. Known areas of historical wildfire identify areas and communities that may again be impacted by wildfire. The most recent wildfires within the plan area include the Assist #16 Fire, which burned 650 acres near Los Monos Canyon in 1982; the Gopher Fire, which burned 675 acres in 1985 near Gopher Canyon; and the Gopher #3 Fire, which burned 40 acres in 1984 less than 0.5 miles south of the Gopher Fire (Figure 3, Fire History). Wildfire has not occurred within the plan area in the past three decades (Table 5), although large wildfires have occurred in proximity to the plan area. The Lilac Fire in 2017 burned 4,000 acres just north of the plan area. The Witch Creek Fire burned roughly 6 miles from the plan area and burned 162,000 acres south and east of Escondido. The Cocos Fire occurred in 2014 just 3 miles from the southern edge of the plan area and burned roughly 2,000 acres south of San Marcos. The Harmony Fire of 1996 burned in a similar location and scorched 9,400 acres. In fall 2003, San Diego County experienced three large wildfires driven by extreme drought and extreme fire burning a total of 376,237 acres (13% of San Diego County). One of these fires, the Paradise Fire, burned close to the plan area. Although considerable historical wildfires have occurred in proximity to the plan area, the lack of historical wildfires

within the plan area suggests that the vegetation within undeveloped areas has likely matured and accumulated a significant amount of dead and dying material, which can increase fuel loads and contribute to a high-severity fire.

Table 5. Historical Wildfires within the Plan Area

Decade	Number of Fires	Acres Burned Within Plan Area
1970s	3	358
1980s	3	906
1990s	0	0
2000s	0	0
2010s	0	0
2020	0	0
Total	6	1,264

Source: CAL FIRE 2021b

1.7 Wildland/Urban Interface/Intermix

The pattern of development and land use within the plan area creates conditions that can be described as either a wildland/urban interface or a wildland/urban intermix. Urban areas are predominantly built-up environments with little or no exposure to vegetative fuels. Such areas are primarily in the central and western regions of the plan area where considerable continuous tracts of suburban development exist. The area where urban development abuts vegetative fuels is known as the wildland/urban interface (WUI). This condition exists commonly in the northeast, east, and southeast regions of the plan area where development abuts the San Marcos Mountains. A WUI area is also observed in the southwestern region of the plan area near Los Monos Canyon. Areas where the density of housing units and structures is lower and/or the space between structures consists of vegetative fuels capable of propagating fire are more typically characterized as a wildland urban intermix (intermix). This condition exists most commonly near the edges of the plan area in the far north, northeast, and east regions in the plan area, notably where smaller undeveloped lots consisting of vegetative fuels are situated between structures. Both conditions present advantages and disadvantages with respect to reducing wildfire risk, as described below.

1.7.1 Wildland/Urban Interface

WUI areas are those within the “vicinity” of wildland vegetation. The wildland fire risk associated with WUI areas includes propagation of fire via house-to-house fire spread, landscaping-to-house fire spread, or ember intrusion. Advantages and disadvantages associated with WUI areas are provided below.

WUI Advantages

- Community water supply systems in place
- Multiple homes accessed by a single road
- Emergency equipment protects multiple assets at once
- Houses usually only exposed to flammable fuels on one side

WUI Disadvantages

- High housing density
- Congested roads during emergencies
- Limited options if the community water systems fail

1.7.2 Wildland/Urban Intermix

Intermix areas are those where housing and vegetation intermingle. In an intermix area, wildland vegetation is continuous, and more than half of the land area is vegetated with combustible fuels. The wildland fire risk associated with intermix areas includes vegetation-to-house fire spread or ember intrusion. Advantages and disadvantages associated with intermix areas are provided below.

Intermix Advantages

- Low housing density
- Diversity in water supply systems

Intermix Disadvantages

- Increased risk to firefighters
- Emergency equipment can only protect single assets
- Delayed emergency equipment response times due to the following:
 - Rural roads (single lane, windy, heavy fuel loading)
 - Long driveways
- Congested roads during emergencies
- Diversity in water supply systems
- Houses surrounded by vegetation

CAL FIRE mapped three wildland/urban types representing the overall pattern of development in the plan area (CAL FIRE 2021c):

- **Wildland/Urban Interface:** Dense housing adjacent to vegetation that can burn in a wildfire
- **Wildland/Urban Intermix:** Housing development interspersed in an area dominated by wildland vegetation subject to wildfire
- **Wildfire Influence Zone:** Wildfire-susceptible vegetation up to 1.5 miles from WUI or intermix areas

Table 6 presents the acreage of land in each wildland/urban type for the plan area.

Table 6. Wildland/Urban Distribution in the Plan Area

Wildland/Urban Type	Acres in Plan Area	Percent of Plan Area
Interface	5,760	25%
Intermix	1,386	6%
Influence Zone	5,067	22%
Non-Wildland/Urban	10,505	46%

Source: CAL FIRE 2021c

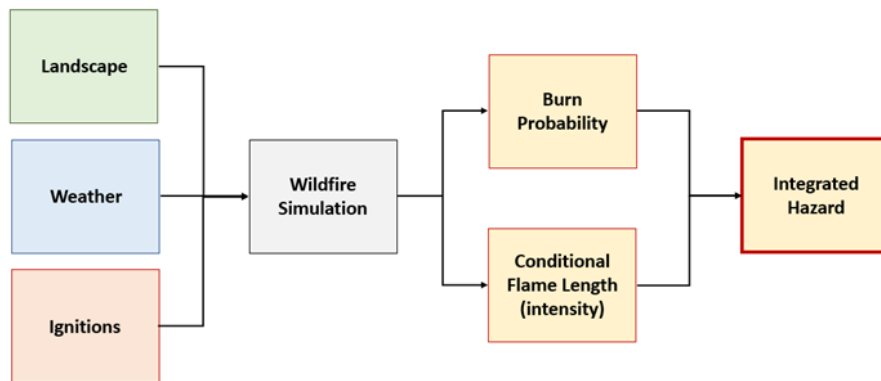
2 Quantitative Wildfire Risk Assessment

A Wildfire Risk Assessment was conducted for the plan area using the IFTDSS program. The assessment was conducted in two basic stages: the first stage modeled wildfire hazard and the second stage modeled wildfire risk. Wildfire hazard represents the existing wildfire environment and potential wildfire behavior. Wildfire risk is the intersection of wildfire hazard, identified assets and high-valued resources, and the resulting potential impact on those assets and resources. This section summarizes the Wildfire Risk Assessment and includes a discussion of data sets, assumptions, model inputs, and model results. The model results can be used to identify and prioritize projects intended to reduce wildfire risk.

2.1 Wildfire Hazard Assessment

A Landscape Burn Probability analysis was performed in the IFTDSS software application to evaluate wildfire hazard in the plan area. The final product of the hazard assessment is Integrated Hazard, which is produced by simulating a wildfire in each area under specific weather conditions to determine the intensity and burn probability of a fire.

The 2016 LANDFIRE data set (embedded in the IFTDSS software application) was used to represent the terrain (elevation, slope, and aspect) and the vegetation/fuel for the plan area. Landscape Burn Probability was run for the plan area under Santa Ana wind conditions to model the greatest potential wildfire hazard (see graphic below).



In the IFTDSS software application, wildfire hazard is represented by the Integrated Hazard output. Integrated Hazard is an analysis process that combines two important measures—burn probability and conditional flame length—into a single model output layer in a GIS/mapping format. The following summarizes the Integrated Hazard process (see also the graphic above):

- **Burn Probability** represents the likelihood that a given location would burn considering the model inputs used. Burn probability is related to the size of fires that occur on a given landscape, where larger fires produce higher burn probabilities than smaller fires and is a function of wildfire spread rate and wildfire duration. The modeling results for burn probability are displayed with seven distinct classes in the software.
- **Conditional Flame Length** is an estimate of the mean flame length for all the fires that burn a given point on the landscape during a model run. It is typically lower than traditional flame length value because it

accounts for heading, flanking, and backing fires, and is the mean of the three types of fires. The modeling results for conditional flame length are displayed with eight distinct classes in the software.

- **Integrated Hazard** is quantified and categorized in IFTDSS using the burn probability and the conditional flame length results for an analysis area. This model evaluates the results from the burn probability (probability of a fire occurring at a specific point under a specified set of conditions) and conditional flame length (intensity at a specific point if a fire occurs) analyses described above. Integrated Hazard is categorized into seven distinct classes in the software.

2.2 Wildfire Risk Assessment

Following the hazard assessment, a Quantitative Wildfire Risk Assessment (QWRA) was conducted to evaluate wildfire risk to communities in the plan area. A QWRA characterizes the predicted benefits and threats from a wildfire on values across a landscape. Results from a QWRA can be used to identify and prioritize potential vegetation treatment areas.

The QWRA considers both the threats and benefits of wildfire. Some resources may benefit from fire (e.g., fire-dependent plant species and landscapes that have departed from the historical fire regime) and others may be threatened by fire (e.g., communities). The QWRA first looks at the level of exposure of the high-value resources and assets (HVRAs) to wildfire by comparing the burn probability, conditional flame length, and Integrated Hazard outputs with the HVRAs across the analysis area. The analysis then calculates the likelihood of a fire occurring and the potential intensity of a fire to the susceptibility of the HVRA to determine risk. The QWRA was run for the entire plan area.

The first step of the QWRA is to conduct an Exposure Analysis of the HVRAs. The Exposure Analysis examines the intersection between wildfire hazard and the HVRA. The QWRA then combines the HVRAs with the Exposure Analysis and the Landscape Burn Probability outputs and results in two model outputs: the Conditional Weighted Net Value Change (CwNVC) and the Expected Weighted NVC (EwNVC), defined below:

- **CwNVC** is a product of fire intensity, susceptibility, and importance. It highlights the likely effects of fire on HVRAs, with the assumption that a fire will or has occurred. CwNVC aids in planning scenarios where the presence of fire is assumed, and the goal is to understand the anticipated threats and benefits from a fire.
- **EwNVC** analyzes the likelihood of a fire occurring and the effect on HVRAs. The expected weighted value is a product of the CwNVC and burn probability. It determines the risk to the HVRA by intersecting the wildfire hazard with the likelihood of occurrence and the potential impact on the HVRA. EwNVC is used for planning scenarios where the likelihood of a fire occurring needs to be considered (as opposed to CwNVC, which assumes a fire will occur).

Because EwNVC is a product of CwNVC and burn probability, it is best used for planning scenarios where the likelihood of a fire occurring needs to be considered. EwNVC can be used to determine where best to treat fuels or allow for unplanned ignitions, and was the model output evaluated for this assessment. EwNVC is calculated for every pixel in the analysis area. Positive values indicate that an HVRA is benefited by fire, and negative values indicate that an HVRA is threatened by fire (at risk).

The QWRA conducted for this assessment focused on communities as the sole HVRA. Protection of life and property is often the primary mission of fire management. This is especially true in the WUI. Communities data was accessed directly in the IFTDSS program (IFTDSS 2022) and included representations of low-density (0–27 people per square mile), medium-density (28–249 people per square mile), and high-density (250 people or greater per square mile) areas. The communities-based QWRA examined the potential negative impact a fire would have on existing communities within the plan area. The model results aid in identifying areas for implementing strategic wildfire risk reduction projects.

2.3 Model Inputs

To run Landscape Burn Probability in IFTDSS, model inputs are required for wind, weather, ignition, and model duration. Table 7 presents the required model inputs and values used in this assessment.

Table 7. Model Inputs Used for Wildfire Risk Assessment

Required Input	Value Chosen
Wind Type	Gridded
Wind Speed	26 miles per hour
Wind Direction	70 degrees
Crown Fire Method	Scott and Reinhardt (2001)
Foliar Moisture Content	100%
1-Hour Fuel Moisture	2%
10-Hour Fuel Moisture	3%
100-Hour Fuel Moisture	5%
Live Herbaceous Moisture	30%
Woody Fuel Moisture	60%
Fuel Moisture Conditioning	Not Conditioned
Ignitions	Random
Burn Period	10 Hours
Spotting Probability	20%

Weather and wind inputs for this assessment, and inputs presented in Table 7, used the guidelines and standards presented by the County of San Diego, Department of Planning and Land Use (County of San Diego 2010). These guidelines identify acceptable fire weather inputs for fire conditions during summer months and Santa Ana wind fire weather patterns. The County of San Diego analyzed and processed 44 years of fire weather data from fire stations and Remote Automated Weather Stations from April 15 through December 31 to represent the general limits of the fire season. Data provided by the County of San Diego's analysis included temperature, relative humidity, and sustained wind speed, and is categorized by weather zone, including Maritime, Coastal, Transitional, Interior, and Desert. The plan area exists in the Coastal weather zone. Therefore, the model inputs used in this wildfire risk assessment reflect the local climate of this region.

2.4 Model Results

The following sections provide a summary of the landscape burn probability, Integrated Hazard, and QWRA modeling results. The model results presented in this section include those for the entirety of the plan area. The resolution of model outputs layers is 30 meters.

2.4.1 Landscape Burn Probability

A 10-hour burn period was chosen to model landscape burn probability, which resulted in 30,635 total ignitions. Landscape burn probability outputs predict the likelihood of an area to burn over a 100-year period, with a maximum burn probability of 12% predicted within the plan area. Sixty percent of the plan area was classified as non-burnable.

These areas are often urbanized with conditions not conducive to ignitions and wildfire spread. The area classified as non-burnable is consistent throughout the subsequent Integrated Hazard and QWRA runs. Nineteen percent of the plan area is classified as middle, higher, or highest burn probability. The highest burn probabilities are located along the eastern edge of the plan area within the San Marcos Mountains. These areas possess large undisturbed fuel beds that are receptive to wildfire. Roadways passing through these areas expressing high burn probability are listed below:

- Little Gopher Canyon Road
- Gopher Canyon Road
- Spa Havens Way
- Vista Valley Drive
- Blue Bird Canyon Trail
- Panoramic Drive
- Hardell Lane
- Debb Court
- El Paso Alto
- Huntalas Lane
- Green Hills Way
- Elevado Road
- Disney Lane

Landscape burn probability modeling results are summarized in Table 8 and presented in Figure 4, Burn Probability.

Table 8. Landscape Burn Probability Results for the Plan Area

Burn Probability Classification	Acres	Percent of Plan Area
Non-Burnable	13,665	60%
Burnable but Not Burned	532	2%
Lowest Hazard (0–20% of maximum)	3,649	16%
Lower Hazard (20–40% of maximum)	478	2%
Middle Hazard (40–60% of maximum)	972	4%
Higher Hazard (60–80% of maximum)	1,696	7%
Highest Hazard (80–100%)	1,718	8%

2.4.2 Integrated Hazard

Model results for Integrated Hazard resemble a similar pattern to the results for landscape burn probability, while further identifying areas predicted to burn at high severity based on modeled conditional flame lengths. Sixteen percent of the plan area is classified as middle, higher, or highest Integrated Hazard. Areas classified as middle, higher, or highest hazard are consistent with those with higher burn probabilities and are located in the far north region of the plan area, in addition to the northeast and east regions of the plan area within the San Marcos Mountains. Integrated Hazard modeling results are summarized in Table 9 and presented in Figure 5, Integrated Hazard.

Table 9. Integrated Hazard Results for the Plan Area

Integrated Hazard Classification	Acres	Percent of Plan Area
Non-Burnable	13,365	60%
Burnable but Not Burned	532	2%
Lowest Hazard	3,080	14%
Lower Hazard	1,888	8%

Table 9. Integrated Hazard Results for the Plan Area

Integrated Hazard Classification	Acres	Percent of Plan Area
Middle Hazard	1,483	7%
Higher Hazard	1,876	8%
Highest Hazard	186	1%

2.4.3 Quantitative Wildfire Risk Assessment

QWRA model results for EwNVC predict risk to communities in the plan area as a result of the intersection between wildfire hazard, burn probability, and community location. EwNVC assesses the predicted impacts from wildfire on communities based on location relative to different Integrated Hazard classifications. Thirty-four percent of the plan area exhibits a middle, higher, or highest threat to communities classification. Such areas are in the following locations:

- Los Monos Canyon
- Buena Vista Park
- Canyon east of Melrose Drive and south of Park Center Drive
- Community of Buena near Loma Vista Way
- Sunset Park
- Sugarbrush Drive
- Lemonadeberry Lane
- Cleveland Trail
- Near the community of Twin Oaks near Buena Creek Road
- Bluebird Canyon Trail
- Buena Creek drainage
- Near Monte Vista Elementary
- Between Longmont Road and Palm Hill Drive
- Areas surrounding Catalira Heights Way and Hardell Lane
- East of Friendly Drive
- Between Camino Cantera and Las Lomas
- Throughout the areas of Gopher Canyon and Gopher Canyon Road
- South fork of Gopher Canyon
- Gopher Canyon Preserve extending north
- Areas surrounding Little Gopher Canyon Road
- Lands adjacent to Vista Valley Country Club
- San Luis Rey drainage
- Rancho Guajome Park
- Vista Sports Park

QWRA modeling results are summarized in Table 10 and presented in Figure 6, Risk to Communities.

Table 10. Community QWRA Results for the Plan Area

Expected Weighted NVC (EwNVC) Classification	Acres	Percent of Plan Area
Non-Burnable	13,665	60%
Burnable but Not Burned	532	2%
No Benefit/No Threat (0)	100	<1%
Lowest Threat (-0.001 to <0)	0	0
Lower Threat (-0.01 to -0.001)	814	4%
Middle Threat (-0.1 to -0.01)	1,292	6%
Higher Threat (-1 to -0.1)	1,061	5%

Table 10. Community QWRA Results for the Plan Area

Expected Weighted NVC (EwNVC) Classification	Acres	Percent of Plan Area
Highest Threat (<-1)	5,247	23%

Notes: QWRA = Quantitative Wildfire Risk Assessment; NVC = Net Value Change; EwNVC = Expected Weighted Net Value Change

Of the three different sub-classifications of communities (based on density), low-density communities (fewer than 28 people per square mile) experience the greatest wildfire threat. These communities resemble the wildland/urban intermix where wildland vegetation is dispersed between homes. Moderate-density communities (28 to 250 people per square mile) are also at high risk from wildfire, with an EwNVC of 87% of maximum. High-density communities are at the lowest risk from wildfire, with an EwNVC of 1% of maximum. QWRA results by sub-HVRA are summarized in Table 11.

Table 11. Community QWRA Results for Expected Weighted NVC Classification by Sub-HVRA

Sub-HVRA Classification	Threat (percent of maximum)
Low Density (0-27 people per square mile)	100%
Moderate Density (28-249 people per square mile)	87%
High Density (250 or greater people per square mile)	1%

Notes: QWRA = Quantitative Wildfire Risk Assessment; NVC = Net Value Change; HVRA = high-value resource and asset

2.4.4 Modeling Results Summary

Wildfire in the plan area and its corresponding risk is dynamic and influenced by multiple factors, such as terrain, vegetation and fuels, weather conditions, and community proximity to areas expressing high wildfire hazard. Although most of the plan area (60%) is urbanized and experiences low risk from wildfire, underdeveloped areas throughout the plan area present the opportunity for damaging wildfire due to the presence of vegetation communities conducive to ignition and wildfire spread. Historical wildfires also highlight the potential for large wildfires in the plan area. Model outputs from the Integrated Hazard assessment indicate that 16% of the plan area is classified as either middle, higher, or highest hazard. Communities existing within the WUI or Intermix, collectively 31% of the plan area, experience the greatest risk from wildfire due to their proximity to areas more likely to experience wildfire. Results from the QWRA indicate low- and moderate-density communities within the plan area to be at the greatest risk from wildfire.

2.5 Field Assessment

Dudek conducted a field assessment of the project site on October 21, 2022 to confirm/acquire site information, document existing site conditions, evaluate areas identified as high wildfire hazard, verify assumptions, and to determine potential actions for addressing the protection of the project's structures. While on site, a Dudek Fire Planner assessed areas identified as high wildfire risk. Field assessment included an evaluation of factors influencing wildfire hazard including topography, natural vegetation, fuel loading, surrounding land use and general susceptibility to wildfire, in addition to an assessment of community risk factors including construction vulnerability, and residential vegetation maintenance. Among the field tasks that were completed are:

- Vegetation maintenance evaluation
- Fuel load analysis
- Topographic features documentation

- Photograph documentation
- Confirmation/verification of hazard assumptions

Field observations were utilized to confirm the wildfire risk assessment and to formulate the risk reduction approaches provided in this report. A photolog for the field assessment is provided in Appendix A.

2.5.1 Field Assessment Results

Observations from the field assessment highlighted multiple factors influencing wildfire hazard and risks to communities in the Plan Area. Strong variability was observed in construction methods, vegetation maintenance, and community types (Wildland Urban Interface/Intermix). Newer developments in the Plan Area express enhanced wildfire resilience due to modern construction methods in alignment with Chapter 7A of the California Building Code and community wide ignition resistant landscaping. Older communities expressed greater variability in wildfire resilience yet were generally at greater risk due to undermaintained residential vegetation, a lack of defensible space around structures, and limited home hardening due to older construction methods. Intermix communities commonly expressed dense residential vegetation between homes with a high proportion of flammable species. This increases the capacity for wildlife to move quickly through intermix communities in the Plan Area and limits the capacity for structure protection efforts during a wildfire.

The general absence of wildfire in the Plan Area in recent decades has led to the accumulation of shrub and chaparral fuels in underdeveloped areas. Generally, vegetation communities were observed to have high fuel loads with a large proportion of dead material. These conditions contribute to increased wildfire hazard in the Plan Area. Maintenance of Fuel Modification Zones adjacent to WUI developments is needed to mitigate risks to assets adjacent to underdeveloped lands in the Plan Area. Riparian areas were also observed to demonstrate high fuel loads, resulting in higher fire hazard during prolonged periods of drought. Many roadways throughout the Plan Area were observed to be inundated by undermaintained roadside vegetation. These conditions increase the potential for roadside ignitions while also limiting the capacity for safe evacuations during a wildfire.

Field assessment confirmed the findings from the quantitative wildfire risk assessment (QWRA) in most cases. However, the area of Bonsall Farms was not found to be a high hazard area as identified from the QWRA. Irrigated vegetation and low fuel loads observed during the field assessment do not align with a high wildfire hazard classification for this area.

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3 Potential Wildfire Risk Reduction Approaches

The following sections describe a variety of methods for reducing wildfire risk. It is important to note that wildfires in California and portions of Vista will continue to occur in natural areas. However, it is primarily unprepared communities with older, vulnerable homes that lack adequate defensible space in close proximity to areas designated as high or very high fire hazard severity zones, will be threatened. It is very important however to understand that there is a difference between a hazard designation and the potential risk to a building or community. High hazard does not result in high risk if the building or community mitigates the hazard.

While portions of Vista are located in designated Very High FHSZs, which occur in a patchy network of varying and non-fire hazard severity zones (agriculture and other development), newer communities will have significantly lower potential of actual loss than older communities and older structures. This reasoning is based upon the distinction between HAZARD (which the State categorizes in its fire hazard severity zone classifications) and RISK (which the State does not quantify).

HAZARD is a property of the potential fire behavior (flame length, crown fire occurrence, capacity to generate embers) in the likely mature vegetation of a given area. RISK, however, is the potential for structural loss from said fire. Thus, even if there is potential low fire hazard in a given area (expected low flame lengths), a given structure might be at high risk of ignition if the physical characteristics of the property would facilitate structural ignition (e.g., flammable vegetation next to a building with wood siding).

Conversely, a structure might be in a high-hazard area (potential exposure to high flame lengths and ember generation), but may actually be at low risk of ignition if the structure is built with ignition-resistant construction materials and the owner has created adequate defensible space. This is especially true in planned communities where fuel modification can be provided over large areas and includes a perimeter zone. Syphard, et. al. (2013)¹ research indicates that scenarios with lower housing density, large lots (ranchettes) and larger numbers of small, isolated clusters of development resulted in higher predicted fire risk.

The recommendations that follow are intended to be considered for application within the areas identified in this analysis that represent the highest potential hazard. Where the modeling and site assessments confirm that burn probability is high in given areas, Gopher Canyon for example, it would be appropriate for public outreach and ongoing efforts to address potential fire hazards in these areas so that the risk can be lowered to acceptable levels.

3.1 Reducing Structural Ignitability

Terrain, vegetation, and climatic conditions in the plan area combine to create a unique situation capable of supporting large-scale, high-intensity, and sometimes damaging wildfires. There are two main components to reducing structural ignitability: structural hardening and defensible space.

¹ Syphard AD, Bar Massada A, Butsic V, Keeley JE (2013) Land Use Planning and Wildfire: Development Policies Influence Future Probability of Housing Loss. PLoS ONE 8(8): e71708. doi:10.1371/journal.pone.0071708

- **Structural Hardening.** Although fire-resistant construction standards are mandatory for new buildings in the plan area, hardening of existing structures is voluntary. Hardening of homes and other structures to enhance survivability during a wildfire includes retrofitting the most vulnerable home features, including roofs, vents, eaves and soffits, windows, walls, decks, rain gutters, patio covers, chimneys, garages, and fences.
- **Defensible Space.** Reducing structure exposure to wildfire is also achieved via vegetation management in defensible space areas. The following zones are identified for defensible space areas:
 - **Zone 0 (0–5 feet):** Zone 0, sometimes referred to as the “Ember-Resistant Zone,” is the area nearest the house and includes the surfaces of the structure itself, vegetation, equipment, outdoor furniture, toys, and anything else that can be ignited by embers. No vegetation or combustible items are recommended within this zone to avoid ignitions from windblown embers landing on or near the structure. Soil, rocks, gravel, or concrete should be used instead of landscape mulch or wood chips. This area is especially crucial because research from the Insurance Institute for Business and Home Safety shows that the first 0 to 5 feet around the house has the greatest impact on reducing the risk of losing a home to wildfire (IBHS 2022).
 - **Zone 1 (5–30 feet):** Zone 1, sometimes referred to as the “Home Protection Zone,” extends from 5 feet from the structure to 30 feet. This zone should be designed to create and maintain a landscape that, if ignited, will not transmit fire to the home. This includes having a minimum planting zone with low-density planting to medium-density planting moving farther away from the structure. Depending on the type of wildland vegetation in the area and the steepness of the slope, this zone should have an area at least 30 feet wide (50 feet for slopes above 20%) that is lean, clean, and green. Trees should be spaced to allow a minimum 10-foot clearance to the structure at full maturity.
 - **Zone 2 (30 feet–Varies):** Zone 2, sometimes referred to as the “Reduced Fuel/Thinning Zone,” extends from 30 feet to at least 100 feet. This zone also serves as a connection to the natural environment in promoting habitat restoration while eliminating continuous, dense vegetation to decrease the energy and speed of a wildfire. To help with this function, vegetation should not be removed to the bare soil, and use of heavy equipment on hillsides should be avoided because they can cause soil erosion and mudslides. More defensible space may be required depending on site-specific characteristics such as topography, building construction, and vegetation types.

3.2 Vegetation Management

Vegetation management actions outside of defensible space/fuel modification areas may be conducted by fire and land management agencies for the purposes of wildfire risk reduction. A list of recommended vegetation management practices is provided below.

- **Grazing.** Grazing is a method of using livestock to reduce fine fuel loading of live herbaceous growth, shrubs, and new growth of trees. Livestock, such as cattle, goats, or sheep, browse on grasses, forbs, shrubs, and fresh growth of young trees, thereby removing vegetation from the overall fine fuel load of the site. Grazing is effective in managing fine fuels and preventing the expansion of brush into grasslands. Livestock have different grazing habits, and not all livestock are ideally suited for grazing treatments. Most livestock, with the exception of goats, do not consume live or dead, tough, woody plant material in significant quantity because this material is generally unpalatable. Additionally, livestock does not effectively create fuel breaks, but is well-suited to maintain new annual growth.

- **Manual Treatments.** Manual techniques involve pruning, cutting, or removing trees or other forest vegetation by hand or manual equipment. Manual treatments involve removing dead wood, piling material, lopping and scattering, and spreading chips/mulch. Lopping and scattering is the process of breaking down vegetative material into smaller pieces, usually with a chainsaw, and scattering (as opposed to concentrating) the material across the treatment area. Manual treatment is most effective in small treatment areas or areas with difficult access where using heavy equipment is infeasible. Manual treatment also allows for selective management or targeted vegetation removal, and is typically used in conjunction with other techniques. Proper hand crew training and supervision is necessary to reduce danger to workers using sharp tools on steep and/or unstable terrain, or where other environmental hazards exist. Hand tools include chain saws, shovels, Pulaski hoes, McLeod fire tools, line trimmers, weed wrenches, pruning shears, and loppers. Personal protection equipment typically includes long pants and long-sleeved shirts, gloves, safety goggles, hard hats, chaps, and sturdy boots.
- **Mechanical Treatments.** Mechanical practices include all methods employing motorized heavy equipment to remove or alter vegetation. Mechanical practices rearrange vegetation structures; compact or chip material; and move material to landings, staging areas, or burn piles. Mechanical equipment typically uses rubber tires or tracks, although skids and cables are also used. In some instances, two or more pieces of equipment work in concert to achieve a management standard. Mechanical equipment includes masticators, tractors, skid-steers, chippers, mowers, grinders, crushers, and skidders. Mechanical treatments are commonly used to create fuel breaks, which are wide strips of land where vegetation management has occurred so that wildfires burning into them can be more easily controlled. Fuel breaks are not intended to stop fire spread, especially where embers can be transported via strong winds over the fuel break, but rather to modify fire behavior and enhance firefighting capabilities.
- **Prescribed Fire.** Although not likely to be a viable treatment within the City of Vista unless specific conditions are met, prescribed fires reduce fuel volume through combustion and are permitted under specific regulations when conditions permit adequate combustion and fire control. Prescribed fires use planned activities with low- to moderate-intensity fire and defined goals. Prescribed fires are performed in conjunction with specific land management objectives, such as reducing fuel loads, increasing overall forest or habitat health, and/or protecting communities from wildfire (USDA 2022b). Prescribed fires can accomplish land management objectives to control undesirable vegetation, prepare sites for harvesting/seeding, control plant pathogens and pests, improve wildlife habitat, improve plant production or quality, remove debris, restore ecological sites, and maintain native plant diversity and composition. Prescribed fires can occur in small, designated areas or over larger expanses. Two types of prescribed fire, pile burning and broadcast burning, are often implemented in conjunction with manual treatment and mechanical treatment methods as a means of treating vegetative debris, or to enhance effectiveness in advance of an herbicide treatment.
- **Chemical Techniques.** Chemical applications use herbicides to kill vegetation or prevent growth and are typically used in combination with other fuel reduction treatments. Herbicides do not remove vegetation from treatment areas; therefore, dead plant material remains without further treatment (except in cases where pre-emergent herbicides are used to control annual plants). Herbicide application is typically performed by hand and may include sponging, spraying, or dusting chemicals onto undesirable vegetation. Hand application provides flexibility and is ideally suited for small treatment areas. Roadside herbicide application may employ a boom affixed to or towed behind a vehicle. Herbicide application requires specific storage, training, and licensing to ensure safe use.

3.3 Community Outreach and Education

Community outreach and education is an important component in community wildfire hazard reduction efforts. Such efforts increase the community's knowledge and awareness of wildland fire, can assist in prevention and preparedness efforts, and are an important component in planning and implementing vegetation management projects. Following are examples of community outreach programs:

- **“Ready! Set! Go!”** “Ready! Set! Go!”, which the City promotes for resident emergency readiness, was designed to provide communities with information about creating defensible space around homes, retrofitting homes with fire-resistive materials, and preparing the community to safely evacuate well ahead of a wildfire. The “Ready! Set! Go!” Action Plan provides a three-step process that teaches homeowners to create their own action plan of preparedness, have situational awareness, and leave early in the event of a fire.²
- **Alert San Diego County Community Notification System.** The Alert San Diego County Community Notification System is an emergency notification system used by the Sheriff's Communications Center that allows the County of San Diego to alert individuals, schools, and businesses of existing or potential emergencies and necessary actions associated with that emergency. Through Alert San Diego County, the County of San Diego can alert individuals by landline, cell phone, and email. Individuals can register for emergency alerts.³
- **Community Emergency Response Team.** The Community Emergency Response Team (CERT) educates people about disaster preparedness for hazards that may impact their area, and trains people in basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations. Using the training learned in the classroom and during exercises, CERT members can assist others in their neighborhood or workplace following an event when professional responders are not immediately available to help. CERT members also are encouraged to support emergency response agencies by taking a more active role in emergency preparedness projects in their community. More information on the CERT program managed by San Diego County Fire can be found in the footnote link.⁴
- **Red Flag Warnings.** A Red Flag Warning means that critical fire weather conditions are either occurring now or will shortly. A combination of strong winds, low relative humidity, and warm temperatures can create extreme fire behavior. The National Weather Service provides daily fire weather forecasts in coordination with local fire agencies. The Red Flag Warning program enables firefighting agencies to manage critical resources and prepare appropriate suppression responses for protecting life and property. Red Flag Warnings are typically issued within 24 hours of an impending critical fire weather event. Residents can sign up for Red Flag Warning text alerts by texting the word “redflag” to 888777.
- **Firewise Communities.** The Firewise USA recognition program,⁵ administered by the National Fire Protection Association, promotes collaboration within communities to organize and improve the ignition resistance of homes and communities. Communities can receive a Firewise Community designation through the California Office of the State Fire Marshal's Community Wildfire and Preparedness and Mitigation Division. In addition to financial support for conducting risk reduction projects, homeowners living within a Firewise Community are qualified to receive insurance discounts with the California Fair Plan.

² <https://www.readyforwildfire.org/prepare-for-wildfire/ready-set-go/>

³ <https://www.readysandiego.org/alertsandiego/>

⁴ <https://www.sandiegocounty.gov/content/sdc/sdcfa/crr/cert>

⁵ <https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA>

3.4 Additional Wildfire Risk Reduction Approaches

The following techniques may minimize ignition potential, reduce risks to plan area assets and resources, and/or alter vegetation conditions within suitable areas identified in this plan as demonstrating high fire probability:

- **Reforestation/Tree Planting:** Planting trees or shrubs to achieve management goals may include restoration of degraded areas, wind flow alteration, ember defense, and increased ground surface shading.
- **Invasive Species Removal:** Removal and treatment of invasive plants that displace native species and/or increase fire hazards via high fuel loading rates or increased ignitability and flammability.
- **Fire Road Maintenance:** Minor grading or natural material resurfacing to ensure fire agency apparatus can drive on existing fire access roads.
- **Roadside fuel management:** vegetation management along key roadways that may be needed during evacuations and are exposed to natural fuel beds should be treated to reduce the potential that the roadway is compromised by fire. Thinning and selective plan removal, from 50 to 100 feet wide on both edges of key evacuation routes in high fire burn probability areas is prudent.
- **Ignition and Spread Prevention:** Modifications including flashy fuel treatment, restoration, ignition-resistant mat installation, and use restrictions (e.g., no parking).
- **Structural Hardening:** Efforts to reduce structure ignition via radiant heat, direct flame impingement, or ember intrusion (e.g., installation of dual-pane windows, replacement of combustible roof materials, installation of ember-resistant attic vents).
- **Community Outreach:** Public education and engagement to raise wildfire risk awareness and encourage wildfire risk reduction efforts (e.g., maintenance of defensible space, participation in chipper programs).
- **Utility Hardening/Undergrounding:** Moving overhead powerlines below ground, or retrofitting overhead power line networks to minimize arcing, conductor contact, and other hazards.
- **Patrols:** Patrolling fire hazard areas to deter, detect, and report fire starts.
- **Inspection/Monitoring:** Conducting defensible space or structural hardening inspections or monitoring open space areas for trespass or fire activity.
- **Chipper Program:** Providing chippers to incentivize fuels reduction and defensible space maintenance work on residential properties.
- **Infrastructure:** Equipment purchase, installation, permitting, and maintenance intended to alert the communities about wildfires (e.g., fire detection cameras), or provide data to fire managers (e.g., remote automated weather stations).

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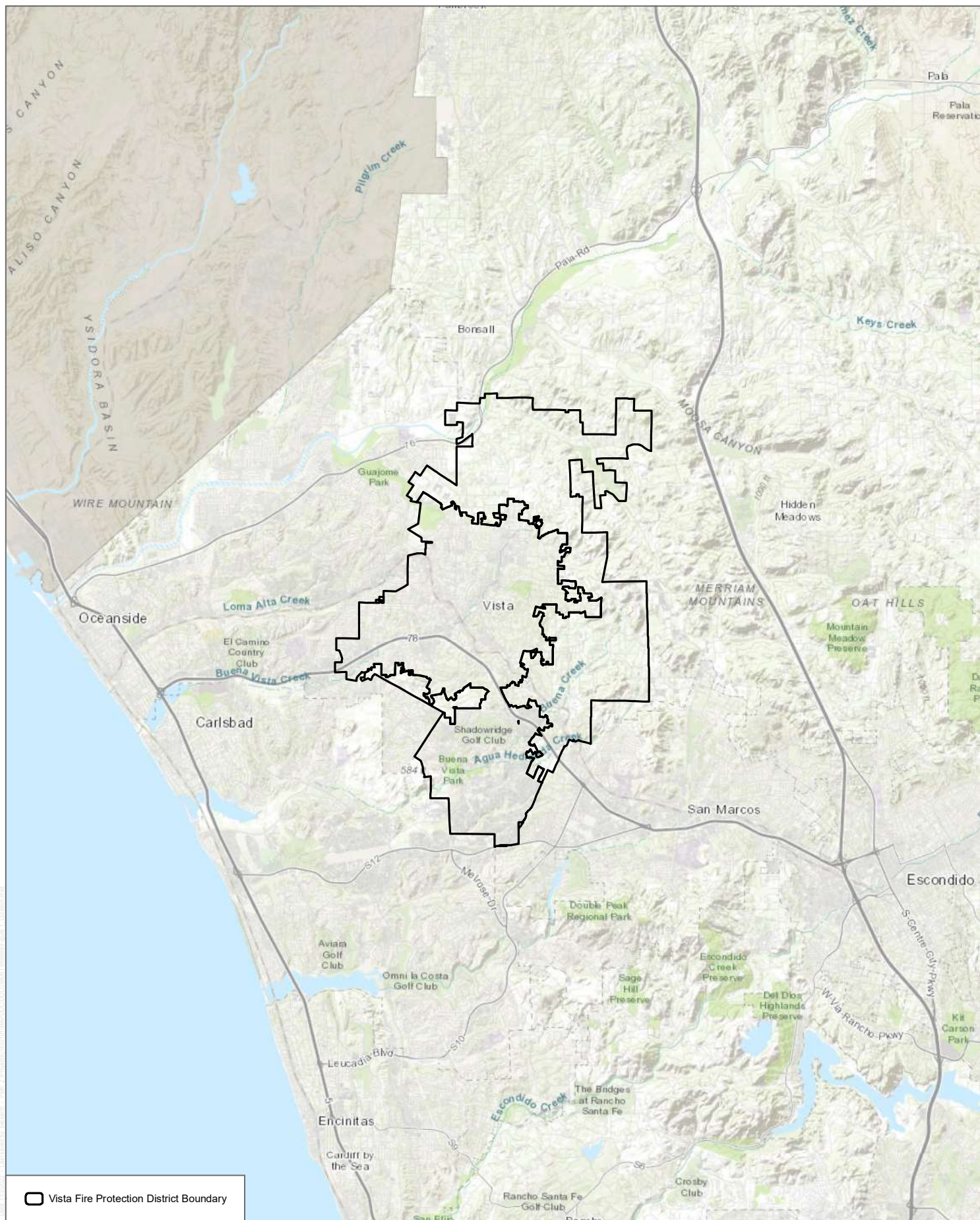
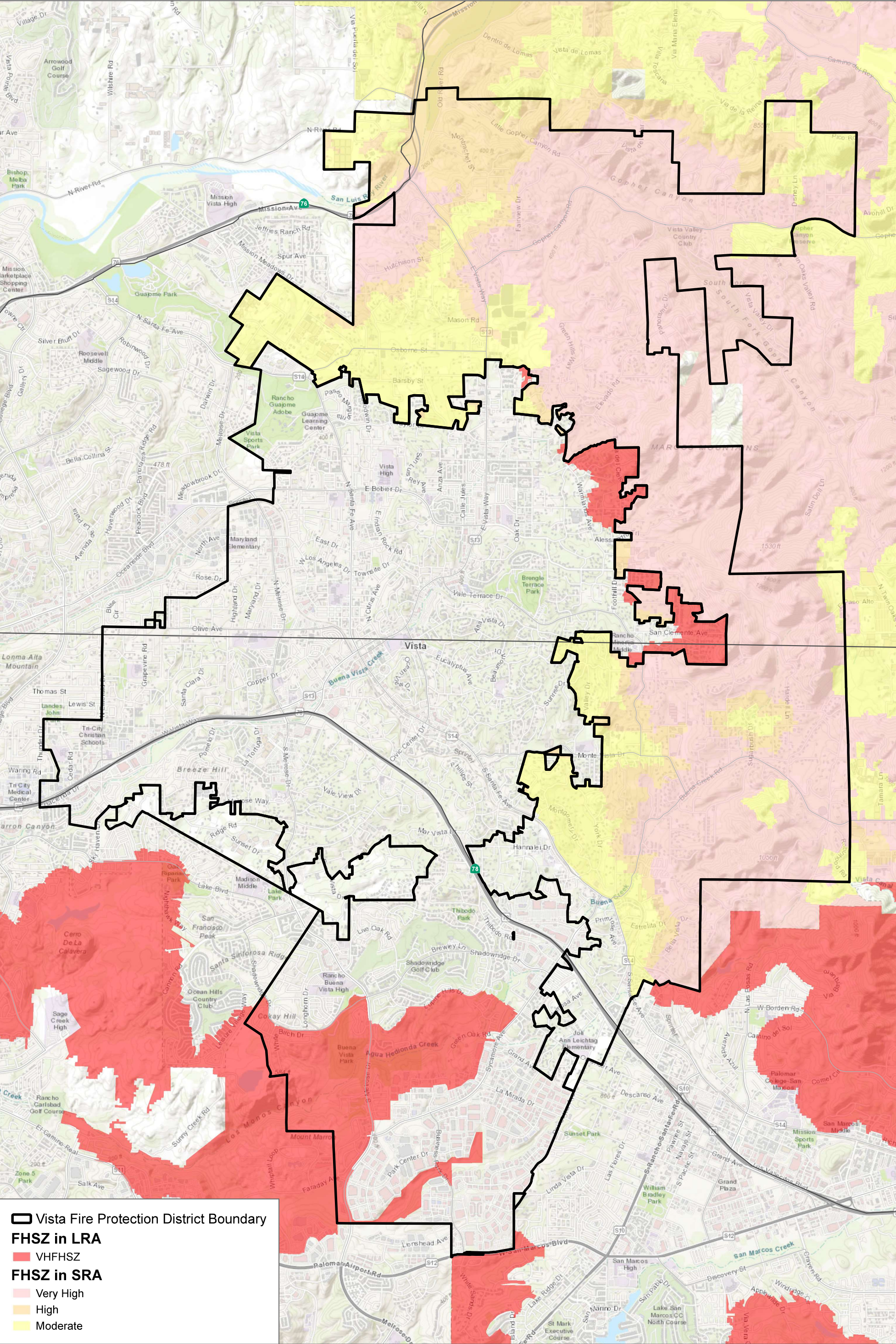


FIGURE 1

Plan Area Location

Vista Wildfire Hazard and Risk Assessment

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SOURCE: ESRI 2022, CAL FIRE 2022

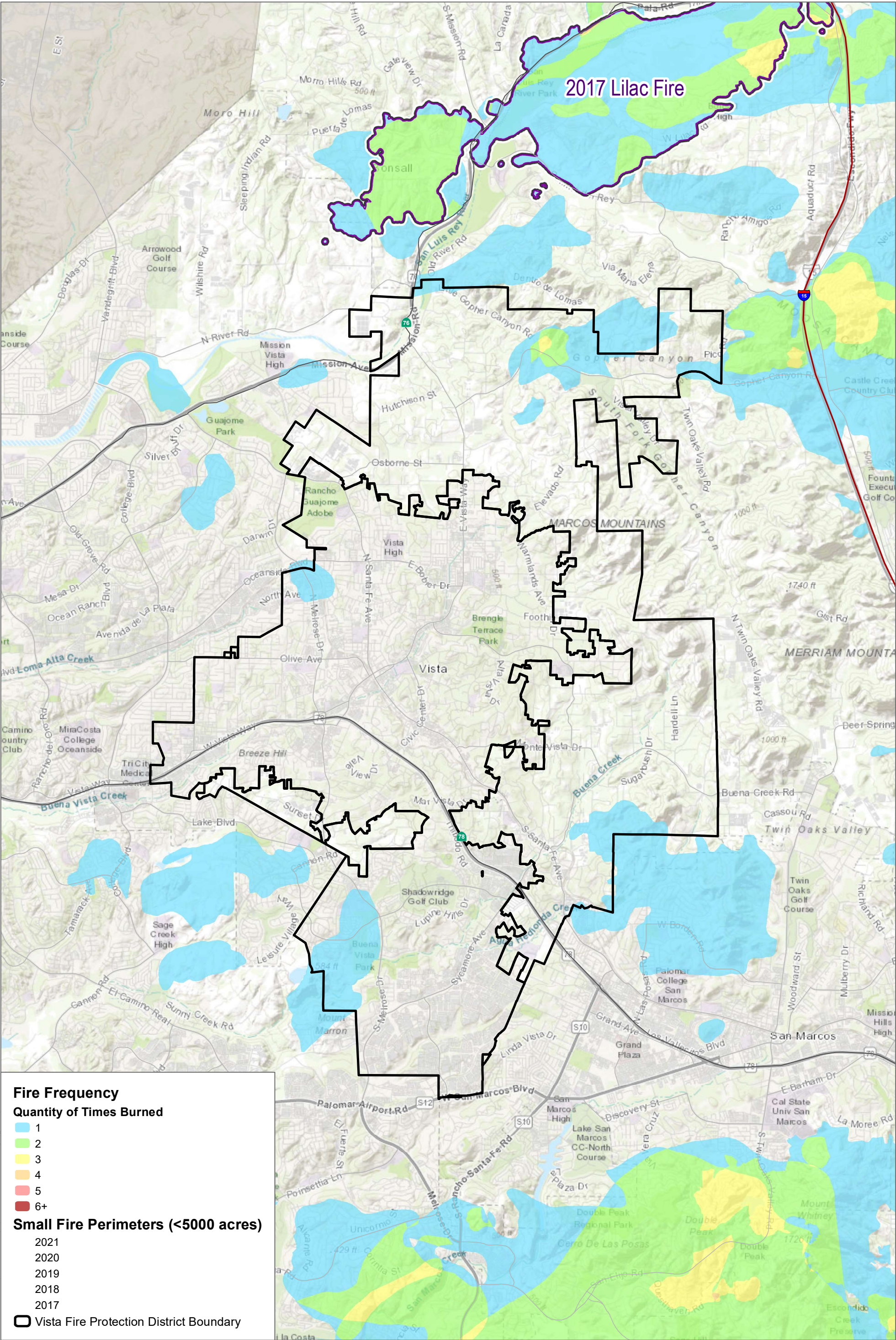
DUDEK



0 2,000 4,000
Feet

Figure 2
Fire Hazard Severity Zones (FHSZ)

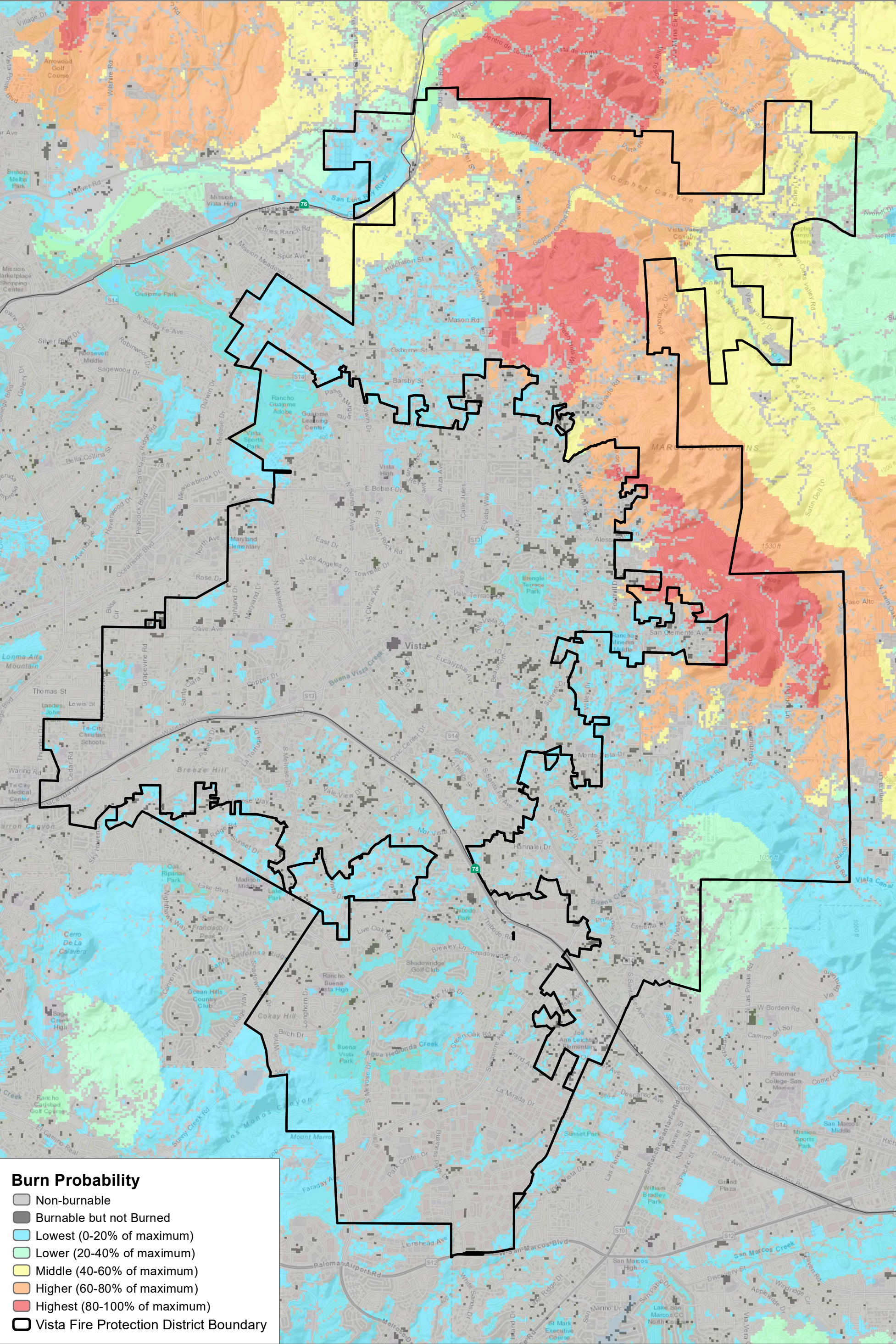
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SOURCE: ESRI 2022, CAL FIRE 2022

FIGURE 3
Fire History

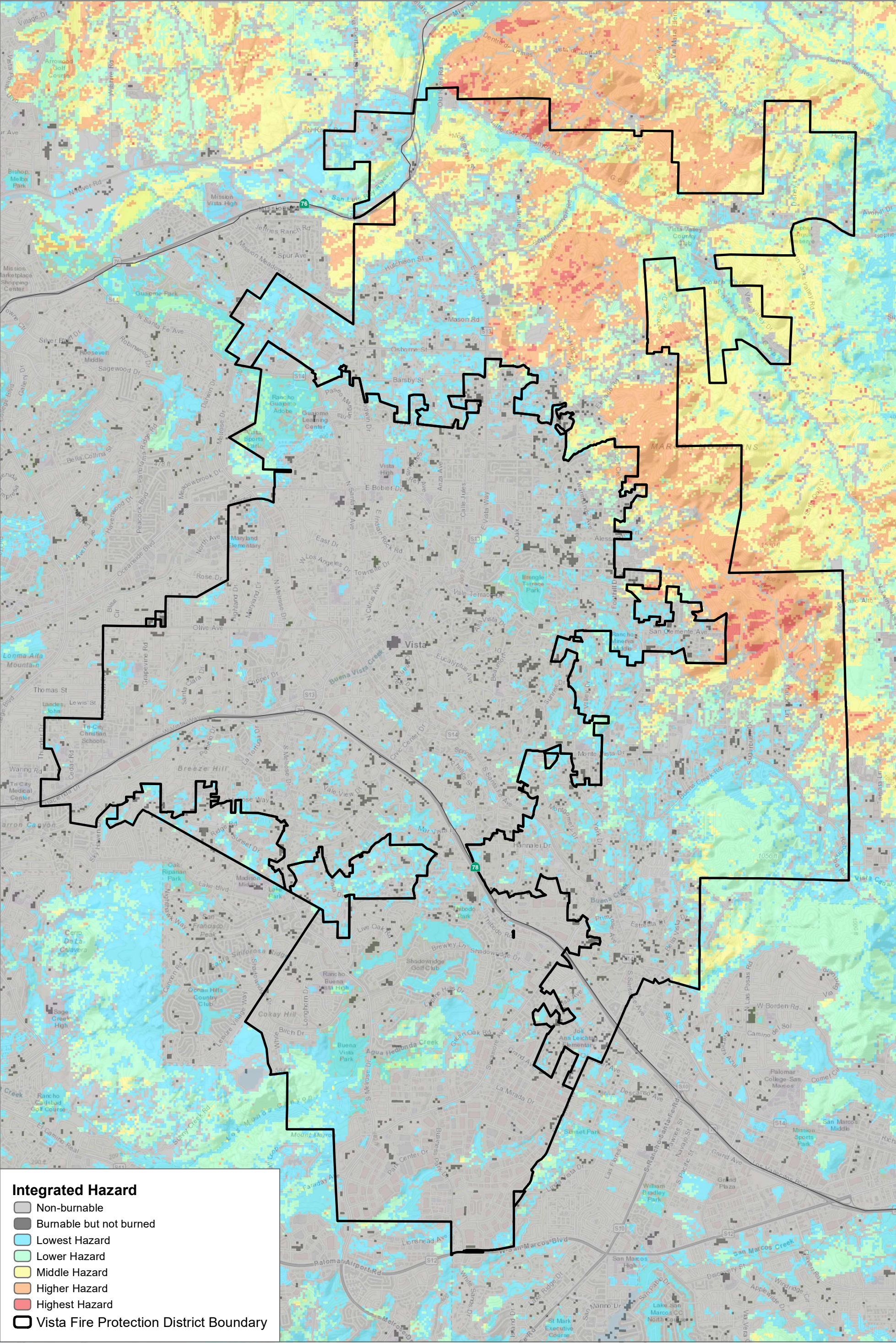
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SOURCE: ESRI 2022

FIGURE 4
Burn Probability

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SOURCE: ESRI 2022

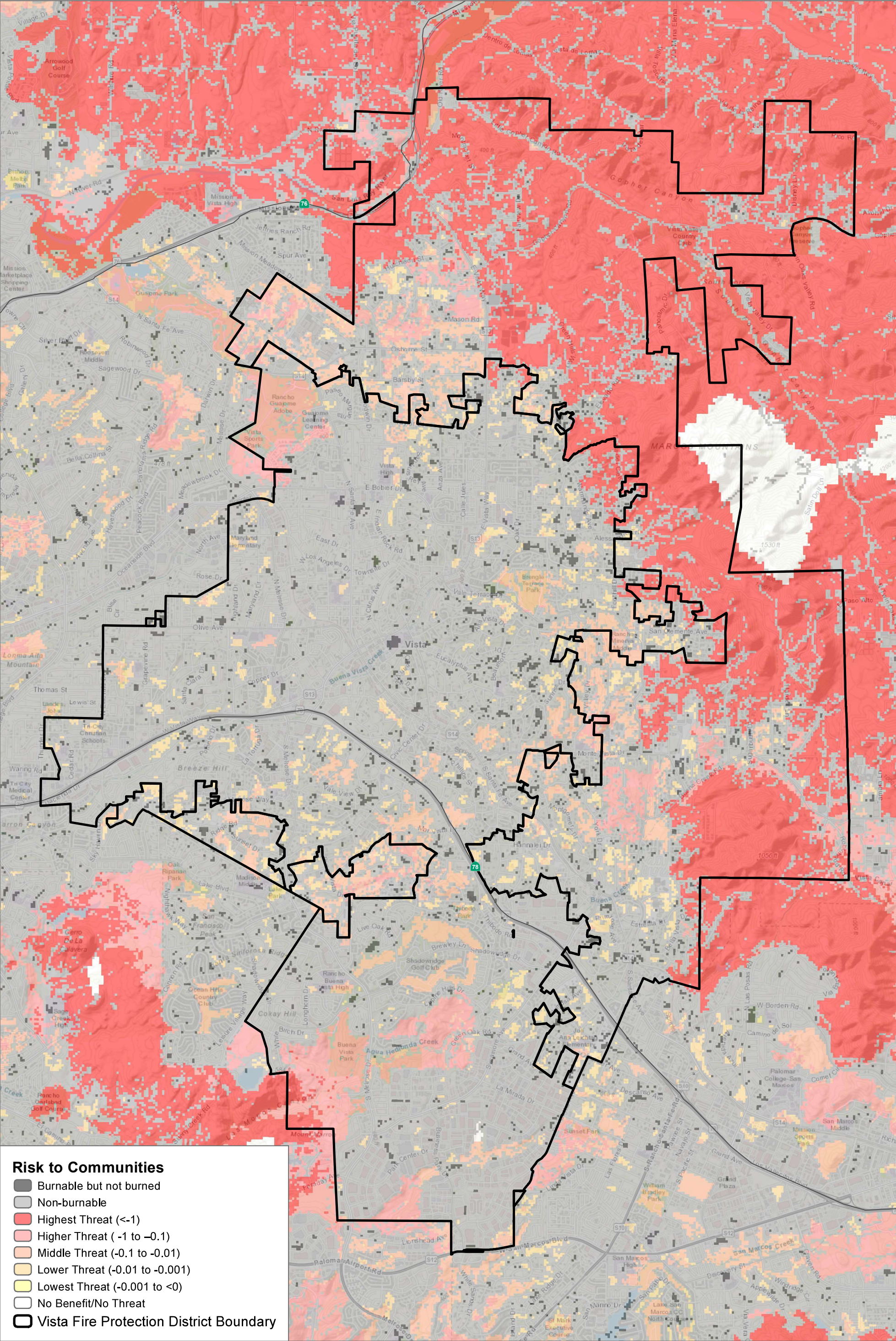
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0 2,000 4,000 Feet

FIGURE 5
Integrated Hazard

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SOURCE: ESRI 2022

DUDEK



0 2,000 4,000 Feet

FIGURE 6
Risk to Communities

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Appendix A

Photograph Log



Photograph 1: Photograph taken near the intersection of Green Oak Road and Sycamore Avenue looking southwest towards Buena Creek and dense riparian vegetation. While riparian areas often express greater fuel moistures, prolonged periods of drought can increase the flammability of riparian fuels and pose risks to adjacent developments.



Photograph 2: Photograph taken near the intersection of Green Oak Road and Sycamore Avenue looking west across a community designated within the Wildland Urban Interface. Dense vegetation with high fuel continuity adjacent to this home increases the likelihood of structural ignition during a wildfire and limits the capacity for successful structure protection.



Photograph 3: Photograph taken along Green Oak Road looking south. High fuel loading adjacent to the roadside increases the potential for roadside ignitions and threatens a safe evacuation during a wildfire in the area. This area would benefit from roadside fuels reduction.



Photograph 4: Photograph taken behind manufacturing building at Engineer Street and La Mirada Drive looking north towards a Wildland Urban Interface development. The pictured high load shrubs and chaparral with intermixed oak woodland is expected to exacerbate wildfire severity in this area as highlighted from the results of wildfire behavior modelling.



Photograph 5: Photograph taken near the intersection of Green Oak Road and South Melrose Drive looking east at the Fuel Modification Zone of a Wildland Urban Interface community identified as high risk. Vegetation is undermaintained and capable of facilitating wildfire spread.



Photograph 6: Photograph taken neat Vista Fire Department Station 5 looking west at open space featuring disturbed areas and natural vegetation including shrubs, chaparral, and oak woodlands. Communities adjacent to this open space are identified as experiencing high wildfire risk.



Photograph 7: Photograph taken from Buena Vista Park looking west to adjacent communities and hillslopes with shrub and chaparral fuels. Homes positioned at the top of slopes such as those pictured are generally at greater risk than homes in flat areas or at the toe of a slope.



Photograph 8: Photograph taken from Buena Vista Park looking east towards a Wildland Urban Interface community near Green Oak Road.



Photograph 9: Residential vegetation near the Oak Creek community. While generally less susceptible to wildfire when compared to natural vegetation, undermaintained vegetation and certain plant species can facilitate wildfire spread through communities. Palm trees like those pictured have been found to ignite from ember cast during previous wildfires in vicinity to the Plan Area.



Photograph 10: Photograph taken near Sugarbush Drive and Lemonadeberry Lane looking southeast towards open space dominated by high load chaparral with a large proportion of dead material. Chaparral is likely to burn at greater severity when it is mature as pictured.



Photograph 11: Newly constructed home on Lemonadeberry Lane showing Chapter 7A construction methods. Structural ignitability could be further reduced by removing the flammable landscaped vegetation directly adjacent to the home.



Photograph 12: Photograph taken from Vista Grande Drive looking southeast. The pictured home is at higher risk for structural ignition to due an absence of defensible space and flammable plant species directly adjacent to the home.



Photograph 13: Photograph taken near Camino Loma Verde and Grandview Road looking southeast towards an intermix community. Adjacent open space and dense residential vegetation increase risks for this community.



Photograph 14: Photograph taken from Cottontail Drive showing a home adjacent to open space with high load shrubs and chaparral. Wood siding and attached wood fence increase the potential for structural ignitions during a wildfire.



Photograph 15: Photograph taken from East Vista Way looking east across Bonsall Farms. This area was identified as high hazard after modelling efforts; however, field assessment identified the presence of irrigated landscapes with insignificant fuel loads. This area is best classified as low fire hazard following field assessment.



Photograph 16: Photograph taken from Gopher Canyon Road traveling east towards I-15. This roadway travels adjacent to areas with high fuel loads. Roadside fuels reduction, in some cases to 50 or 100 feet wide, would be beneficial along this corridor to improve evacuation safety.



Photograph 17: Photograph taken from Edgehill Road looking east. The righthand roadside expresses fire resistant landscaping, while the lefthand roadside possesses unmaintained shrub vegetation resulting in reduced fire safety.



Photograph 18: Photograph taken from Edgehill Road looking west showing flammable roadside shrub vegetation.



Photograph 19: Photograph taken from Grandview and Elevado Road looking south at intermix homes. Proximity to shrublands and dense residential vegetation increase wildfire risk in this area. Structural ignition risks are exacerbated by wooden home construction materials as pictured.