
Appendix F

Fire Hazard Assessment

Fire and Fuel Modification Assessment

Talbert Regional Park Master Plan Project

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Table of Contents

SECTION	PAGE NO.
Acronyms and Abbreviations.....	iii
1 Introduction	1
1.1 Location	1
1.2 Environmental Setting.....	5
1.3 Project Description	5
2 Project Site Risk Analysis.....	8
2.1 Site Characteristics and Fire Environment	8
2.1.1 Topography.....	8
2.1.2 Climate	8
2.1.3 Vegetation and Fuels.....	9
2.1.4 Vegetative Fire Hazard	12
2.1.5 Vegetation Dynamics (Fuel Loads)	12
2.1.6 Fire History	13
2.1.7 Wildfire Types and Potential Fire Behavior	13
3 Anticipated Fire Behavior	18
3.1 Fire Behavior Modeling	18
3.2 Fire Model Classifications.....	18
3.3 Fire Behavior Modeling Results.....	20
3.4 Project Area Fire Risk Assessment.....	21
4 Fire Hazard Reduction and Suppression	22
4.1 Wildfire Ignition Reduction Recommendations	22
5 List of Preparers.....	28
6 References	30

TABLES

1 Vegetation Communities and Land Cover Types Within the Study Area	9
2 Fire Behavior Interpretation	14
3 Fuel Model Characteristics.....	19
4 Fuel Moisture and Wind Inputs.....	19
5 Modeled Fire Behavior 50 th Percentile Weather Conditions	20
6 Modeled Fire Behavior 97 th Percentile Weather Conditions	21

FIGURES

1 Project Location3
2 Fire History Map 16

Acronyms and Abbreviations

Acronym/Abbreviation	Definition
BTU	British Thermal Unit
CAL FIRE	California Department of Forestry and Fire Protection
CALTRANS	California Department of Transportation
F	Fahrenheit
FRAP	Fire and Resource Assessment Program
GIS	Geographic Information Systems
I-	Interstate
I&R	Institutional & Recreational
LRA	Local Responsibility Area
MPH	miles per hour
MSDS	material safety data sheet
OCFA	Orange County Fire Authority
OC Parks	Orange County Parks Department
OCPW	Orange County Public Works
SCE	Southern California Edison
FHSZ	Fire Hazard Severity Zone

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1 Introduction

The Talbert Regional Park Master Plan Project is proposed by the Orange County Parks Department (OC Parks) in conjunction with the Orange County Department of Public Works (OCPW) to restore an approximately 180-acre area (project site) located both north and south of Victoria Street in the City of Costa Mesa, California. These two areas of Talbert Regional Park, north and south Talbert, will collectively be referred to as the project site, or simply the Park.

This report describes the fire conditions of the project site. As part of the assessment, property location and its topography, surrounding combustible vegetation (fuel types), climatic conditions, fire history, and the proposed land use were all considered. This assessment provides recommendations for the types and methods of treatment that will reduce overall risk to the project site.

The following tasks were performed as part of the analysis conducted for this assessment:

- Gather site-specific climate, terrain, and fuel data;
- Process and analyze the data using the latest GIS technology;
- Predict fire behavior using scientifically based fire behavior models, comparisons with actual wildfires in similar terrain and fuels, and experienced judgment;
- Assess the risk associated with the Project and the Project site; and
- Prepare Fire Hazard Assessment report detailing recommendations to reduce fire risk within the Project site.

1.1 Location

The proposed project site is located in western Costa Mesa along the Santa Ana River, in western Orange County, (Figure 1, Project Location). Regional access is provided via State Route 55 and Interstate (I-) 405. Nearby cities include Huntington Beach, Fountain Valley, Santa Ana, Irvine, Newport Beach and unincorporated County. The 182-acre property consists of two areas divided horizontally by Victoria Street, and serves the cities of Huntington Beach, Costa Mesa, and Newport Beach.

The North Talbert parcel is bounded to the north and east by the city of Costa Mesa's Fairview Park, to the west by the Santa Ana River, and the south by Victoria Street. The Fairview Channel bisects the northernmost portion of the Park. South Talbert is bounded to the north by Victoria Street, to the east by Balboa Boulevard, to the west by the Santa Ana River, and to the south by the Banning Ranch property. The City of Costa Mesa operates three adjacent facilities: Canyon Park, Vista Park and Fairview Park. Canyon Park is east of South Talbert, adjacent to a residential area situated atop of a mesa. Vista Park is adjacent to Victoria Street at the southern tip of North Talbert. The entirety of Talbert Regional Park lies within the local responsibility area (LRA). The entirety of South Talbert is designated as a Moderate Fire Hazard Severity Zone(FHSZ) by California Department of Forestry and Fire Protection (CAL FIRE). The majority of North Talbert is designated as a High FHSZ, surrounded by moderate FHSZ. The southern tip of North Talbert is not designated as a FHSZ.

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1.2 Environmental Setting

The Park is designated as Public/Institutional in the City of Costa Mesa General Plan Land Use map and is zoned as Institutional & Recreational (I&R) (City of Costa Mesa 2016a; 2016b). Offering both passive and active recreation, the Park is used predominantly by hikers and joggers, nature watchers, casual bicyclists, and motocross bicyclists. North Talbert features a large grassy area, picnic areas, an equestrian corral and watering station, and restroom facilities. The trail system winding throughout North and South Talbert allows for observation of natural resources and linkage to other parks up and down stream along the Santa Ana River. Group use within the habitat areas is permitted, consisting of guided nature walks and individual use is facilitated by interpretive signage. The primary feature at South Talbert is Victoria Pond, a scenic natural resource visible from Victoria Avenue and available for fishing. The water body was expanded to the south in 1991 as a mitigation measure during construction of the Greenville-Banning Channel. A hydrographic survey conducted in 2014 found the maximum pond depth to be approximately 7.4 feet.

Currently, no on-site parking is available for Park visitors. Two City of Costa Mesa-owned areas accessible by foot near North Talbert provide parking along Placentia Avenue: Fairview Park and Vista Park. Limited street parking is available for South Talbert along Balboa Boulevard, and at the terminus of West 19th Street. Both North and South Talbert offer extensive public trail networks. Trails can be accessed by traversing through Fairview Park or Vista Park, and from Arbor Street by traversing through Canyon Park to South Talbert. Trails can also be accessed from Victoria Street or via the Santa Ana River Trail Footbridge connecting to the Banning Channel Bikeway. North Talbert trails consist of a mixture of decomposed granite near the grassy public use area, transitioning to dirt to the south, and asphalt to the north. South Talbert trails consist predominantly of natural earthen loamy soil that becomes slick and prone to collect water during the rainy season.

The only connection between North and South Talbert, is provided by the Banning Channel Bikeway, which passes under Victoria Street. A paved mixed-use trail atop the Santa Ana River flood control levee, the Bikeway is frequently used by pedestrians, joggers, and bicyclists. Other off-site pedestrian connections include a stairway within Fairview Park adjacent to the northeastern boundary in North Talbert. Canyon Park also includes a trail connection to South Talbert at the far side of Balboa Avenue.

Existing topography within the Park is generally flat, sloping gently from north to south, with elevations ranging from nearly twelve feet at the north boundary, to five feet at the southern end. The Park is bounded by bluffs rising approximately 80 feet above the site along the north and east boundaries. Notable topographic features within North Talbert include Placentia Drain, a linear channel at the base of the eastern bluffs providing drainage for Fairview Park as well as Talbert. South Talbert includes Victoria Pond near the staging area, and an internal BMX skill area referred to as “Sheephills”. A portion of the lower Greenville-Banning Channel crosses within the site boundary, and upland mesas are included along the southeastern boundary.

1.3 Project Description

The proposed project includes key improvements, infrastructure improvements, and habitat restoration as described below and are established by the Master Plan.

Proposed Key Improvements

Design concepts for the Park have evolved through a collaborative process with the regulatory agencies and surrounding communities. The proposed improvements began as concepts designed to be compatible with the surrounding context and provide a higher degree of function as well as recreational opportunities. The proposed key improvements are:

- Nature Center
- Balboa Boulevard Entrance
- Infrastructure Improvements

Nature Center

A new Nature Center is proposed within the northeastern corner of the North Talbert parcel at the location of the existing restrooms. The existing restrooms are provided in a small, circular building (approximately 250 square feet in size) located on a concrete slab/foundation and constructed of concrete masonry blocks. The Nature Center building would be approximately 500 square feet in size, and would be constructed of concrete with a stucco finish and metal roof with a low-reflectivity finish. The Nature Center may include a small classroom area, restrooms, and interpretive signage to serve as an educational center for park visitors.

Balboa Boulevard Entrance

Improvement of the existing Balboa Boulevard entrance to accommodate emergency and maintenance vehicles, bikes, and pedestrians. As proposed, the existing railroad-tie stairs providing park access from adjacent Balboa Boulevard and located near the intersection of Balboa Boulevard and Discovery Drive would be retained and supplemented with a new 15-foot-wide ADA-accessible ramp that would accommodate emergency vehicle access. The ramp would be constructed of compacted natural soil and would be firm, stable, and slip-resistant (a decomposed granite surface may be installed/specified during the preparation of construction documents for the project). A gate and rolled curb opening area is proposed at the ramp entrance off Balboa Boulevard. . Monument and wayfinding signage will be installed to direct visitors to the Park.

Proposed Infrastructure Improvements

Enhancements of the interior circulation system is proposed to provide improved multi-modal trails to enhance user experience. Improvements to existing access, trails, maintenance yard, and wayfinding systems are described below.

Trail Improvements

The bike and pedestrian trail system constitutes the primary visitor activity within the Park. The South Talbert pedestrian circulation route is to be improved as a raised, 15-foot wide trail. This improvement, that would entail raising the existing trail (approximately 8,350 feet in length) up to 18 inches from its current elevation (see Figure 4, Conceptual Trail Segments), would correct the existing drainage and ponding problem by reducing the occurrence of seasonal wet areas. Additionally, a new 4-foot-wide, 200-foot long, single-track trails (not raised) in North Talbert and a new, 15-foot wide, 2,020 foot long trail (raised) in South Talbert is proposed to enhance connections within the existing network by providing formalized access to the existing Victoria Pond and lateral, more direct access to the nearby Banning Channel Bikeway. A new access ramp connecting the new, east-west trail in South Talbert to

the Banning Channel Bikeway would also be constructed. This enhanced system would also accommodate requirements for both ADA and emergency access.

Maintenance Yard

Proposed improvements to the existing maintenance yard located in North Talbert consist of extending electrical service, as well as installing durable security fencing, a security camera, and lighting. The existing maintenance yard area consists of two mostly fenced areas (and associated storage trailers (shipping containers)) totaling approximately 4,750 square feet and surrounding disturbed and unvegetated lands. Electrical service would be extended from an existing buried line at the existing restrooms located in the northeastern corner of the North Talbert parcel. Trenching for electrical service between the restrooms building and the maintenance yard would occur within existing roads/areas of linear disturbance. During operations, lighting installed at the maintenance yard would only be turned on when needed by OC Parks staff or other authorized personnel.

Wayfinding

Wayfinding signage will be installed throughout the Park to announce arrival, strengthen branding identity as a part of the OC Parks system and provide clear direction. Proposed signage types include Arrival Signs, Directional Signs, Interpretive Signs, and Trail Markers. Generally, wayfinding signage would be installed via post/pole footings into small concrete foundations.

Habitat Restoration

The Park functions as a protected nature area within the urban fabric and is home to wildlife species that are dependent on the health of the larger ecosystem. The Master Plan calls for restoration through the removal of non-native vegetation throughout South Talbert, and at the Placentia Drain within North Talbert. Planting of native coastal sage and riparian tree species is planned within South Talbert to expand the existing mitigation/restoration areas. The Restoration Plan includes non-native plant removal and vegetation thinning both of which are described in more detail below.

Non-Native Plant Removal

Throughout the Park, removal of non-native vegetation is to be conducted on an on-going basis. Specifically, exotic tree species including Brazilian Pepper and Myoporum are to be removed in the area directly south of Victoria Pond. These trees are to be replaced by natives and the removal will create open areas where expansion of native habitat will be promoted.

Vegetative Thinning

To discourage the existing encampments within the Park, thinning of dense shrubs in selected areas is proposed. Current encampment areas are to be partially cleared to provide a higher level of visibility to promote public safety.

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2 Project Site Risk Analysis

2.1 Site Characteristics and Fire Environment

Fire environments are dynamic systems and include many types of environmental factors and site characteristics. Fires can occur in any environment where conditions are conducive to ignition and fire movement. Areas of naturally vegetated open space are typically comprised of conditions that may be favorable to wildfire spread. The three major components of the fire environment are topography, vegetation (fuels), and climate. The state of each of these components and their interactions with each other determines the potential characteristics and behavior of a fire at any given moment. Because the project site is adjacent to residential and commercial land uses, it is important to note that wildland fire may transition to urban fire if structures are receptive to ignition. Structure ignition depends on a variety of factors and can be prevented through a layered system of protective features including fire-resistive landscapes directly adjacent to the structure(s), application of known ignition resistive materials and methods, and suitable infrastructure for firefighting purposes. Understanding the existing wildland vegetation and urban fuel conditions on and adjacent to the Project site is necessary to understand the potential fire risk within and adjacent to the Project.

2.1.1 Topography

Existing topography within the Park is generally flat, sloping gently from north to south, with elevations ranging from nearly twelve feet at the north boundary, to five feet at the southern end. The Park is bounded by bluffs rising approximately 80 feet above the site along the north and east boundaries. Notable topographic features within North Talbert include Placentia Drain, a linear channel at the base of the eastern bluffs providing drainage for Fairview Park as well as Talbert. South Talbert includes Victoria Pond near the staging area, and an internal BMX skill area referred to as “Sheephills”. A portion of the lower Greenville-Banning Channel crosses within the site boundary, and upland mesas are included along the southeastern boundary.

2.1.2 Climate

The study area is located within the Peninsular Range, less than 1 mile from the Pacific Ocean. It is in a Mediterranean climate characterized by mild, dry summers and wet winters. Average temperatures near Newport Beach range from approximately 55° Fahrenheit (F) to 68°F, and the area generally receives an average rainfall of less than 11 inches per year (WRCC 2025).

Fire risk is typically greatest in fall during periods when there is a high pressure system in the Great Basin and a low-pressure trough along the southern California coast producing Santa Ana Winds that blow from east and northeast over the western slopes of the coastal mountains (Minnich 1983, Moritz 1997, Keeley and Fotheringham 2003, Keeley and Zedler 2009). Santa Ana winds often have speeds greater than 60 mi/h (100 km/h) and 10% (or lower) relative humidity for sustained periods (Keeley and Fotheringham 2003, Keeley and Zedler 2009). On the coastal side of mountains, differences in heating and cooling of valleys and slopes in relation to the land and the ocean creates complex wind patterns. During the day, onshore flows from the ocean can blow counter to the Santa Ana winds and lead to unpredictable fire behavior. During the night, Santa Ana winds often regain their strength with greatest speeds around day break. Santa Ana wind occurrence is greatest from September through

April with a peak during December. Fire danger is greatest when live fuel moisture is low, such as the fall and early winter before the rains have started (Dennison et al. 2008).

Another type of weather pattern that can produce high fire danger year-round occurs when a ridge or closed high¹ persists over the western portion of the United States. At the surface, this pattern produces very high temperatures, low humidity, and air-mass instability (Schroeder and Buck 1970).

2.1.3 Vegetation and Fuels

As detailed further in the project’s Biological Resources Technical Report (Dudek 2025), thirty-five vegetation communities and land covers (including disturbed forms) were mapped in the study area based on general physiognomy and species composition, including 28 native or naturalized vegetation types and 7 non-native land covers. The 35 vegetation communities and land cover types and acreages are presented in Table 1.

Table 1. Vegetation Communities and Land Cover Types Within the Study Area

Vegetation Community	Scientific Name	Vegetation Community Code	Project Site (Onsite) (Acres)	Study Area (Offsite) (Acres)
Forest and Woodland Alliances				
Arroyo Willow Association	<i>Salix lasiolepis</i>	SALLAS	5.81	0.0
Arroyo Willow/Mulefat Association	<i>Baccharis salicifolia</i>	SALLAS / BASCAL	2.60	1.39
Black Willow Association	<i>Salix gooddingii</i>	SALGOO	2.51	0.0
Black Willow/Mulefat	<i>Salix gooddingii/Baccharis salicifolia</i>	SALGOO / BACSAL	3.52	6.87
Black Willow Thickets	<i>Salix gooddingii</i>	BWT	3.42	0.46
Blue Elderberry/Toyon Association	<i>Sambucus nigra sp. caerulea/Heteromeles arbutifolia</i>	SAMNIG / HETARB	4.94	0.11
California Sycamore/Coast Live Oak Association*	<i>Platanus racemosa/Quercus agrifolia</i>	PLARAC / QUEGAR	3.88	0.11
Eucalyptus Groves	<i>Eucalyptus sp.</i>	EG	1.47	0.19
Mulefat thickets	<i>Baccharis salicifolia</i>	MFT	18.43	5.45
Mulefat/Blue Elderberry	<i>Baccharis salicifolia/Sambucus nigra sp. caerulea</i>	BACSAL / SAMNIG	29.35	14.86
Mulefat / Menzies’s goldenbush / Quailbush Association	<i>Baccharis salicifolia/Isocoma menziesii/Atriplex lentiformis</i>	BACSAL / ISOMEN / ATRLEN	7.20	0.0
White Alder / California Sycamore Association*	<i>Alnus rhombifolia /Platanus racemosa</i>	ALRHO / PLARAC	0.0	0.68

¹ Ridges form when the jet stream builds northward in an arc-like shape, and are associated with warm air, high pressure aloft, and a more stable atmosphere. This tends to result in dry, fair-weather conditions underneath the ridge. Sometimes, a closed circulation of high pressure develops under the center of the ridge with winds aloft blowing in a clockwise direction around the high-pressure center.

Table 1. Vegetation Communities and Land Cover Types Within the Study Area

Vegetation Community	Scientific Name	Vegetation Community Code	Project Site (Onsite) (Acres)	Study Area (Offsite) (Acres)
<i>Subtotal of Forest and Woodland Alliances and Stands</i>			83.13	30.12
Shrubland and Grassland Alliances				
Alkali heath / Salt grass Association	<i>Frankenia salina / Distichlis spicata</i>	FRASAL / DISSPI	0.12	2.71
American Bulrush Marsh*	<i>Schoenoplectus americanus</i>	ABM	0.64	0.18
Black Mustard / Ripgut Brome Association	<i>Brassica nigra / Bromus diandrus</i>	BM / RB	1.19	0.98
California brittlebush / California sagebrush / Black Sage / Coyote brush Association	<i>Encelia californica / Artemisia californica / Salvia mellifera / Baccharis pilularis</i>	ENCCAL / ARTCAL / SALMEL / BACPIL	12.38	1.31
Cattail Marshes	<i>Typha</i>	CM	0.0	0.45
Coyote Brush Scrub	<i>Baccharis pilularis</i>	CYS	15.78	0.98
Coyote Brush / California Sagebrush Association	<i>Baccharis pilularis / Artemisia californica</i>	BACPIL / ARTCAL	1.45	0.05
Ice Plant Mats	<i>Carpobrotus edulis</i>	IPM	2.07	0.0
Menzies's Goldenbush Scrub*	<i>Isocoma menziesii</i>	MGBS	2.91	14.67
Pickleweed Mats*	<i>Salicornia</i>	PM	1.72	0.0
Poison Hemlock / Fennel Patches	<i>Conium maculatum / Foeniculum vulgare</i>	PH / FP	0.11	1.43
Quailbush Scrub	<i>Atriplex lentiformis</i>	QS	1.95	0.34
Saltgrass / Pacific Swampfire Association	<i>Distichlis spicata / Sarcocornia pacifica</i>	DISSPI / SARPAC	15.35	1.11
Smartweed / Cocklebur Patches	<i>Persicaria / Xanthium strumarium</i>	S/CP	0.61	0.0
Tarplant fields*	<i>Centromadia parryi</i> sp. <i>australis</i>	TPF	0.50	0.0
Upland mustards	<i>Hirschfeldia incana</i>	UM	21.46	13.09
<i>Subtotal of Shrubland and Grassland Alliances</i>			75.33	37.30
Non-Natural Land Covers and Unvegetated Communities				
Fivehook Bassia	<i>Bassia hyssopifolia</i>	BASSIA	1.62	0.0
Myoporum / Black Willow	<i>Myoporum</i> sp. / <i>Salix gooddingii</i>	MP / SALGOO	3.08	0.0
Concrete Channel	-	CC	0.77	1.29
Disturbed Habitat	-	DH	16.05	12.32
Open Water	-	OW	3.23	85.36
Parks and Ornamental Plantings	-	ORN	3.67	31.47
Urban/Developed	-	DEV	2.23	83.13
<i>Subtotal of Non-Natural Land Covers and Unvegetated Communities</i>			27.57	216.65

Table 1. Vegetation Communities and Land Cover Types Within the Study Area

Vegetation Community	Scientific Name	Vegetation Community Code	Project Site (Onsite) (Acres)	Study Area (Offsite) (Acres)
Total			192.03	280.99

Source: Biological Resources Report, Dudek 2025

Note: *= Ranked by CDFW as Sensitive Vegetation Communities (S1-3).

2.1.3.1 Forest and Woodland

Riparian woodlands typically have a low fire hazard as their high moisture levels limit ignition potential and minimize the potential for wildfire spread. The vegetation within riparian woodlands responds slowly to changes in temperature and moisture, and significant surface shading from tree canopies limits fuel moisture loss. Surface fuels are relatively low in riparian woodlands; however, storm-related high water streamflow can deposit debris and contribute to fuel buildup as it dries out later in the season. During severe weather conditions, high fuel loads can result in high-intensity burning.

Coast live oak trees are very fire resistant, with fire adaptations including evergreen leaves, thick bark, and post-fire sprouting from surviving tissue. Fire intensity affects individual tree survival, with the amount and extent of trunk char and canopy consumption playing a critical role in survival and response (Plumb and Gomez 1983). Post-fire recovery of coast live oak woodlands is dependent on fire intensity and fall fire damage is typically more severe than that occurring earlier in the year (Plumb and Gomez 1983). While the thick bark of mature coast live oak trees minimizes the effects of heat exposure from wildfire, seedlings and acorns are much more susceptible to mortality, even following low-intensity fires (Lawson, Zedler and Sieger 1997).

Eucalyptus stands are composed of fuel structures ranging from fine to heavy and may include an understory of grass; brush; eucalyptus seedlings, saplings, and small trees; and eucalyptus leaf, twig, branch, and bark litter. Eucalyptus litter is generally moderately compacted with heavy to very heavy fuel loads; fuel loads in eucalyptus stands can reach between 45 and 100 tons per acre (Agee et al. 1973). Fuel buildup in blue gum eucalyptus stands is very rapid, exceeding that of other tree species, and its litter (dead leaves and debris) is especially flammable (Agee et al. 1973; NPS 2006; Wolf and DiTomaso 2016). Fuel reduction programs in eucalyptus stands are typically recommended to maintain low fuel load levels (USFS 2022).

2.1.3.2 Shrubland and Grassland

Grassland types may include scattered and widely spaced trees and/or shrubs, although grasses are the dominant cover type. 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 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 potential for a high rate of spread, rapid ignition, and facilitation of extreme fire behavior. Grasses are the vegetation type in the Plan Area with the highest risk for wildfire ignition. Their low overall fuel loads typically result in faster moving fires with lower flame lengths and heat output. Untreated grasses can help spread fire into other adjacent surface fuel types (e.g., shrubs) or facilitate surface to crown fire transition where they exist beneath tree canopies.

Coastal scrub is considered a moderately fine fuel that is loosely compacted with a moderate fuel load. Coastal scrub has a high surface-area-to-volume ratio, requiring less heat to remove fuel moisture and raise the fuel to ignition temperature. It is subject to early seasonal drying in the late spring and early summer but does not fully cure in the way that grasses do. Compared to chaparral, coastal scrub tends to have a lower content of volatile organic compounds. The live fuel moisture content reaches its low point in the late summer and early fall. Dead fuels consist mainly of 1-hour and 10-hour fuel sizes, or twigs and small stems ranging from 0.25 inches to 1 inch in diameter. Coastal scrub has the potential for a high rate of spread, rapid ignition, and extreme fire behavior.

2.1.4 Vegetative Fire Hazard

Hazardous fuels include live and dead vegetation that exists in a condition that readily ignites; transmits fire to adjacent structures or ground, surface, or overstory vegetation; and/or can support extreme fire behavior. All vegetation will burn; however, some plants exhibit characteristics that make them more flammable than others. Flammability can be defined as a combination of ignitability, combustibility, and sustainability, where ignitability is the ease of or the delay of ignition; combustibility is the rapidity with which a fire burns; and sustainability is a measure of how well a fire will continue to burn with or without an external heat source (White and Zipperer 2010). Flammability is influenced by several factors, which can be classified into two groups: physical structure (e.g., branch size, leaf size, leaf shape, surface-to-volume ratio, and/or retention of dead material) and physiological elements (e.g., volatile oils, resins, and/or moisture content) (Moritz and Svihra 1998; UCCE 2016; UCFPL 1997; White and Zipperer 2010). Plants that are less flammable have low surface-to-volume ratios, high moisture contents, and minimal dead material or debris, while those that are more flammable have high surface-to-volume ratios, exhibit low moisture contents, contain volatile oils, and have high levels of dead material or debris (Moritz and Svihra 1998; UCFPL 1997; UCCE 2016; White and Zipperer 2010). Plant condition and maintenance is also an important factor in flammability. Some plants that have more flammable characteristics can become less flammable if well maintained and irrigated but can also be explosively flammable when poorly maintained or situated on south-facing slopes, in windy areas, or poor soils (Moritz and Svihra 1998). In general, most vegetation within the project site is not regularly irrigated or maintained and exists in natural or open space settings.

Forest pests, such as insects, fungi, other microbes, and vertebrates, are a natural component of California forests and plant communities. Populations of pests are dynamic and fluctuate in response to climatic and environmental changes such as drought, stand density, fire, and other site disturbances. Healthy, vigorous trees are typically able to withstand pest attacks when pest populations are at endemic levels. When stressors exist in forests (e.g., overstocking, shading, drought), tree vigor is reduced and tree susceptibility to pest attacks and infestations increases. Diseases and pests can result in tree decline and mortality. These diseases/pests can contribute to wildfire hazards by increasing dead surface fuel loads.

2.1.5 Vegetation Dynamics (Fuel Loads)

The vegetation described above translates to fuel models used for fire behavior modeling, discussed in Section 3 of this Fire and Fuel Modification Assessment. Variations in vegetative cover type and species composition have a direct effect on fire behavior. Some plant communities and their associated plant species have increased flammability based on plant physiology (resin content), biological function (flowering, retention of dead plant material), physical structure (bark thickness, leaf size, branching patterns), and overall fuel loading. For example, the native shrub species that compose the plant communities onsite are considered to exhibit higher potential hazards (higher intensity heat and flame length) than grass-dominated plant communities (fast-moving, but lower

intensity) if ignition occurred. The corresponding fuel models for each of these vegetation types are designed to capture these differences.

As described, vegetation plays a significant role in fire behavior, and is an important component of the fire behavior models discussed in this report. A critical factor to consider is the dynamic nature of vegetation communities. Fire presence and absence at varying cycles or regimes disrupts plant succession, setting plant communities to an earlier state where less fuel is present for a period of time as the plant community begins its succession again. In summary, high-frequency fires tend to convert shrublands to grasslands or maintain grasslands, and fire exclusion tends to convert grasslands to shrublands over time as shrubs sprout back or establish and are not disturbed by repeated fires. In general, biomass and associated fuel loading will increase over time, if disturbance (e.g., fire, grazing, or farming) or fuel reduction efforts are not diligently implemented. It is possible to alter successional pathways for varying plant communities through manual alteration.

2.1.6 Fire History

Fire history data provides valuable information regarding fire spread, fire frequency, ignition sources, and vegetation/fuel mosaics across a given landscape. One important use for this information is as a tool for pre-planning. It is advantageous to know which areas may have burned recently and therefore may provide a tactical defense position, what type of fire burned on a site, and how a fire may spread. Fire history represented in this assessment uses the Fire and Resource Assessment Program (FRAP) database. FRAP summarizes fire perimeter data from as far back as the late 1800s to the present; however, the data only includes fires over 10 acres in size and has incomplete perimeter data, especially for the first half of the 20th century (Syphard and Keeley 2016). Regardless, the data does provide a summary of recorded fires and can be used to show whether large fires have occurred in the project area, which indicates whether fires may be possible in the future. According to available data from the CAL FIRE in the FRAP database, and illustrated in Figure 2, one (1) fire has burned within a 5-mile radius of the project site, which was onsite, since the beginning of the historical fire data record. The singular wildfire occurred in 2010 and burned approximately 7.5 acres in the southern portion of the project site.

2.1.7 Wildfire Types and Potential Fire Behavior

Several wildfire types exist, as summarized below.

- **Ground Fire:** A fire burning on the ground or through understory vegetation and not reaching into the canopy (NWCG 2022).
- **Surface Fire:** A surface burning fire with low flame lengths (usually less than 3 feet) that does not result in significant movement into understory or overstory vegetation (NWCG 2022).
- **Crown Fire:** A fire that has burned upward from the ground and into the tree canopy. There are three types of crown fires:
 - **Passive Crown Fire:** A crown fire in which individual or small groups of trees torch out, but solid flaming in the canopy cannot be maintained except for short periods. Passive crown fires encompass a wide range of crown fire behavior, from the occasional torching of an isolated tree to a nearly active crown fire. Also called torching (Scott and Reinhardt 2001).
 - **Active Crown Fire:** A crown fire in which the entire fuel complex becomes involved, but the crowning phase remains dependent on heat released from the surface fuels for continued spread. Also called running and continuous crown fire (Scott and Reinhardt 2001).

- **Independent Crown Fire:** A crown fire that spreads without the aid of a supporting surface fire (Scott and Reinhardt 2001).

Another component of fire behavior is spotting—the transfer of firebrands (embers) ahead of a fire front—which can ignite smaller vegetation fires (NWCG 2022). These smaller fires can burn independently or merge with the primary fire. Spotting can also result in structural ignitions when transported embers reach a receptive fuel bed (e.g., combustible roofing), especially in wind-driven fires, such as those occurring during Santa Ana wind events in the foothills of the San Gabriel mountains. Structure fires, as well as vegetation-fueled fires, can generate firebrands. Additionally, landscape features like ridges can dramatically affect fire behavior by changing prevailing wind patterns, funneling air, and increasing wind speeds, thereby intensifying fire behavior.

Each of the fire types mentioned above have the potential to occur within the project site. Fire behavior is how a wildland fire reacts to weather, fuels, and topography. The difficulty of controlling and suppressing a wildfire is typically determined by fire behavior characteristics, such as rate of spread, fireline intensity, torching, crowning, spotting, fire persistence, and resistance to control (NWCG 2022). Extreme fire behavior is that which precludes methods of direct control (e.g., flame lengths 8 feet and greater), behaves unpredictably and erratically, and typically involves high spread rates, crowning and spotting, the presence of fire whirls, and a strong convective column.

Fire behavior characteristics are an essential component in understanding fire risk. Flame length—the length of the flame of a spreading surface fire within the flaming front—is measured from midway in the active flaming combustion zone to the average tip of the flames (Andrews et al. 2008). Although it is a somewhat subjective and nonscientific measure of fire behavior, it is imperative to fireline personnel when evaluating fireline intensity and is worth considering as a vital wildfire variable (Rothermel 1993). Fireline intensity is a measure of heat output from the flaming front and affects the potential for a surface fire to transition to a crown fire. Table 2 presents an interpretation of flame length and its relationship to fire suppression efforts.

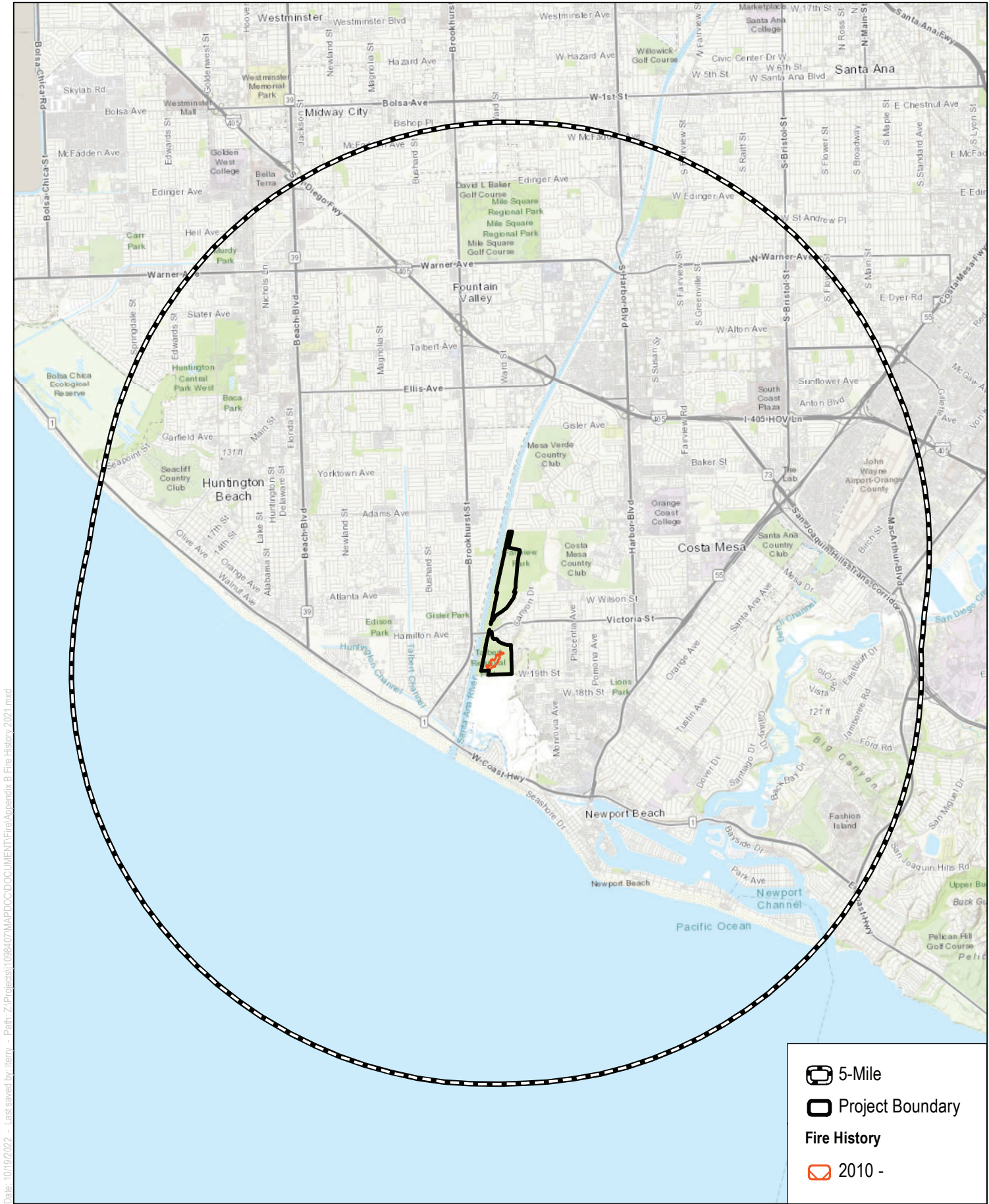
Table 2. Fire Behavior Interpretation

Flame Length	Fireline Intensity	Interpretations
Under 4 feet	Under 100 BTU/ft/s	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
4 feet to 8 feet	100–500 BTU/ft/s	Fires are too intense for a direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8 feet to 11 feet	500–1,000 BTU/ft/s	Fires may present serious control problems—torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
Over 11 feet	Over 1,000 BTU/ft/s	Crowning, spotting, and major fire runs are probable. Control efforts at the head of fire are ineffective.

Source: Roussopoulos and Johnson 1975.

Note: BTU/ft/s = British thermal units per foot per second.

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SOURCE: BASE MAP- ESRI MAPPING SERVICE; FIRE DATA-CAL FIRE 2021




 5-Mile
 Project Boundary
Fire History
 2010 -

FIGURE 2
Fire History Map
 Talbert Regional Park

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3 Anticipated Fire Behavior

3.1 Fire Behavior Modeling

In 2013, Dudek conducted extensive fire behavior modeling for the Nature Reserve of Orange County, which included the project site (Dudek 2013). Since the modeling was completed, there have been no fires on the project site and the vegetation onsite has not changed significantly since that time; therefore, for the purpose of this analysis, the modeling completed in 2013 will be utilized to determine fire risk and provide recommendations for vegetation management within the project site.

Fire behavior modeling was conducted to document the type and intensity of the fire that would be expected within the project site given characteristic features such as topography, vegetation, and weather. Dudek utilized BehavePlus for “point fire behavior modeling” in an effort to compare the effect of weather on expected fire behavior. Additionally, FlamMap software was used to graphically depict fire modeling results at a site-wide scale. FlamMap utilizes the same fire spread equations built into the BehavePlus software package, but allows for a geographical presentation of fire behavior outputs as it applies the calculations to each pixel in an associated Geographic Information Systems (GIS) landscape. For FlamMap modeling, extreme fall, offshore weather conditions (97th Percentile) were modeled to understand worst-case fire behavior on the project site. For the BehavePlus analysis, 50th percentile and 97th percentile weather conditions were modeled to evaluate the effect of weather on fire behavior.

3.2 Fire Model Classifications

The initial step in modeling potential fire behavior is the evaluation of vegetation and determination of appropriate fuel model assignments. In order to make reliable estimates of fire behavior, one must understand the relationship of fuels to the fire environment and be able to recognize the variations in these fuels. Natural fuels are made up of the various components of vegetation, both live and dead, that occur in a particular landscape. The type and quantity will depend upon soil, climate, geographic features, and fire history. The major fuel groups of grass, shrub, trees, and slash are defined by their constituent types and quantities of litter and duff layers, dead woody material, grasses and forbs, shrubs, regeneration, and trees. Fire behavior can be predicted largely by analyzing the characteristics of these fuels. Fire behavior is affected by seven principal fuel characteristics: fuel loading, size and shape, compactness, horizontal continuity, vertical arrangement, moisture content, and chemical properties.

The seven fuel characteristics help define the 13 standard fire behavior fuel models (Anderson 1982) and the more recent custom fuel models developed for Southern California (Weise and Regelbrugge 1997). According to the model classifications, fuel models used in BehavePlus have been classified into four groups, based upon fuel loading (tons/acre), fuel height, and surface-to-volume ratio. Observation of the fuels in the field (on site) determines which fuel models should be applied in modeling efforts. The following describes the distribution of fuel models among general vegetation types for the standard 13 fuel models and the custom Southern California fuel models:

- Grasses–Fuel Models 1 through 3
- Brush –Fuel Models 4 through 7, SCAL 14 through 18

- Timber–Fuel Models 8 through 10
- Logging slash–Fuel Models 11 through 13.

In addition, these fuel characteristics were utilized in the recent development of 40 new fire behavior fuel models (Scott and Burgan 2005) developed for use in the BehavePlus and FlamMap modeling systems. These new models attempt to improve the accuracy of the 13 standard fuel models outside of severe fire season conditions, and to allow for the simulation off fuel treatment prescriptions. The following describes the distribution of fuel models among general vegetation types for the 40 new fuel models:

- Non-burnable –Models NB1, NB2, NB3, NB8, NB9
- Grass–Models GR1 through GR9
- Grass shrub –Models GS1 through GS4
- Shrub –Models SH1 through SH9
- Timber understory –Models TU1 through TU5
- Timber litter–Models TL1 through TL9
- Slash blowdown –Models SB1 through SB4.

Any resource or fire management decision regarding the use of prescribed fire and/or wildland fire suppression tactic must be based upon authenticated fire behavior expectations and established fuel models. Table 3 contains descriptions of the two burnable fuel models found on the project site.

Table 3. Fuel Model Characteristics

Fuel Model	Description	Vegetation Type	Tons/acre; Btu/lb	Fuel Bed Depth (Feet)
1	Short grasses	Grassland, disturbed areas, agriculture, vernal pools	0.7 tons/acre; 8,000 Btu/lb	1.0 ft.
9	Hardwood litter	Riparian, woodland, and forest	3.5 tons/acre; 8,000 Btu/lb	0.2 ft.

Table 4 summarizes the weather and wind input variables used in the BehavePlus modeling process.

Table 4. Fuel Moisture and Wind Inputs

Model Variable	Summer Weather Condition (50 th Percentile)	Peak Fall Weather Condition (97 th Percentile)
1 hr. Moisture	8%	2%
10 hr. Moisture	10%	4%
100 hr. Moisture	17%	9%
Live Herbaceous Moisture	60%	30%
Live Woody Moisture	90%	59%
20-foot Wind Speed (mph)	9 mph	19 mph
Wind Directions from north (degrees)	225	45
Wind adjustment factor	0.2	0.2
Slope (uphill)	20%	20%

3.3 Fire Behavior Modeling Results

FLAM Map Fire Behavior Modeling Results

One output grid file was generated for each FlamMap run and includes representations of flame length (feet). The fire behavior analysis results for the project site vary depending on fuel type. As FlamMap utilizes site-specific digital terrain data (including slope, vegetation, aspect, and elevation data) slight variations in predicted flame length values can be observed based on fluctuations of these attributes across the landscape. As presented, wildfire behavior in each of the fuel types varies, based on differing weather conditions.

Given the climatic, vegetation, and topographic characteristics along with the fire behavior modeling results and fire history discussed herein, the project site is expected to be receptive to wildfire starting on, burning onto, or spotting onsite. Under extreme weather conditions, fire can move rapidly through the project site’s fuels. The most common type of fire anticipated is a fire burning onto the project site from one of several nearby highways or roadways and fanned by off shore Santa Ana winds. Worst-case modeled flame lengths were calculated at up to 11 feet within the project site.

It should be noted that the modeling results presented herein depict values based on inputs to the FlamMap software, which are held constant for each cell in the analysis landscape. Changes in wind, weather, or pockets of different fuel types are not accounted for in this analysis. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns.

BehavePlus Fire Behavior Modeling Results

Fire behavior during 50th percentile weather conditions was modeled with a 20-foot wind speed of 9 mph for both the project site and slope gradient of 20%. All other weather input variables are identified in Table 4. BehavePlus modeling evaluated the following fire behavior variables: spread rate (mph), fireline intensity (btu/feet/second), and flame length (feet). Table 5 summarizes the modeling results for 50th percentile weather conditions within the project site.

Table 5. Modeled Fire Behavior 50th Percentile Weather Conditions

Fuel Type	Fuel Model	Spread Rate (mph)	Fireline Intensity (btu/ft/s)	Flame Length (Feet)
Grass	1	0.24	29	2.1
Riparian/Woodland	9	0.03	15	1.6

Fire behavior during 97th percentile weather conditions was modeled with a 19 mph for the project site and a slope gradient of 20% as representing the typical conditions. All other weather input variables are identified in Table 2. BehavePlus modeling evaluated the following fire behavior variables: spread rate (mph), fireline intensity (btu/ft/s), and flame length (feet). Table 6 summarizes the modeling results for 97th percentile weather conditions within the Project site.

Table 6. Modeled Fire Behavior 97th Percentile Weather Conditions

Fuel Type	Fuel Model	Spread Rate (mph)	Fireline Intensity (btu/ft/s)	Flame Length (Feet)
Grass	1	1.15	196	5.1
Riparian/Woodland	9	0.12	87	3.5

3.4 Project Area Fire Risk Assessment

Wildland fires are a common natural hazard in most of southern California with a long and extensive history. Southern California landscapes include a diverse range of plant communities, including vast tracts of shrubland and grassland, like those found on and in the vicinity of the project site. Wildfire in this Mediterranean-type ecosystem ultimately affects the structure and functions of vegetation communities (Keeley 1984) and will continue to have a substantial and recurring role (Keeley and Fotheringham 2003). Supporting this are the facts that 1) native landscapes, from forest to grasslands, become highly flammable each fall and 2) the climate of southern California has been characterized by fire climatologists as the worst fire climate in the United States (Keeley 2004) with high winds (Santa Ana) occurring during autumn after a six-month drought period each year. Based on this research, the anticipated growing population expanding into WUI areas, and the regions' fire history, it can be anticipated that periodic wildfires may start on, burn onto, or spot onsite. The most common type of fire anticipated in the vicinity of the project area is a wind-driven fire from the north/northeast, moving through the grassland and shrubland on lands in the vicinity of the project site.

Given the climatic, vegetative, topographic characteristics, and local fire history of the area, the project site is determined to be subject to periodic wildfires that may start on, burn toward, or spot onsite. The potential for off-site wildfire encroaching on, or showering embers onsite is considered low.

4 Fire Hazard Reduction and Suppression

A high priority for reducing the effects of wildfire on the project site is reduction of human-caused ignitions. Reducing human-caused ignition rates would reduce the potential for wildfire encroachment and spread throughout the project site. Prioritizing management of ignitions is predicted to be more effective than widespread fuel reduction efforts in reducing the area burned by wildfire. A comparison of five landscape fire models in a standardized modeling experiment evaluated the importance of fuel management, ignition management, and weather on total area burned and the amount of burned edge area adjacent to a fire prone landscape (Cary et al. 2009). The researchers found weather and ignition management were more important than fuel management in determining the total area burned under each of the five landscape models. However, one model found that fuel management at the burned edge area was important. This analysis supports after fire assessments in Orange, San Diego, Los Angeles, and Riverside Counties, along with other California locations that indicate that fuel management strategies, particularly in shrublands, may not be effective at reducing risk in comparison to the effects of reducing ignitions, particularly under Red Flag Warning weather conditions. Other analyses have concluded that manipulating fuel loads in southern California shrublands is unlikely to be effective in preventing large wind driven wildfires since they burn through old and new fuels (Moritz et al. 2004, Keane et al. 2008, Keeley and Zedler 2009).

Because natural ignition sources (i.e., lightning) are relatively absent from the project site, the human-caused ignitions of all types are the highest risk. With the projected population growth in Orange County over the next 50 years, preventing human-caused ignitions of wildfire is considered the most important means of limiting wildfire and protecting the project site and surrounding communities. Further, the fire behavior modeling results presented herein, which are consistent with other large, extreme fire weather wildfire events (including the Santiago Fire), indicate that firefighting is limited in terms of available options and overall affect. This elevates the need to focus on preventing ignition and reducing fire spread during normal weather conditions.

4.1 Wildfire Ignition Reduction Recommendations

Successful long-term fire management requires pre-planning, consistent application of principles known to reduce fire hazard, and utilization of fire prevention techniques and strategies. Ignition sources and fire spread patterns are important components of understanding wildfire behavior and implementing practices aimed at preventing wildfires. In addition, high-value resource areas must be identified, and then appropriate wildfire ignition/wildfire spread reduction practices must be implemented and maintained. The highest risk for wildfire ignition within the project site is along roadways, areas adjacent to residential/urban areas, acts of arson, on site recreational activities, and powerlines. Recommendations for fuel reduction include:

Invasive Species Removal/Restoration

Targeted non-native plant removal focuses on high value habitats including waterways as well as areas adjacent fuel modification zones. Targeted non-native plant removal may include species such as arundo (*Arundo donax*), salt cedar (*Tamarix tamarix*), eucalyptus (*Eucalyptus* sp.), artichoke thistle (*Cynara cardunculus*), castor bean (*Ricinus communis*), amongst many others. The selection of the appropriate fuel reduction methodology should be determined with consideration of many variables, including the particular species, time of year, severity of fuel loading/exotic infestation, the presence of sensitive resources, the degree of intermixing of invasive species with sensitive native habitats, access, and proximity to surface water. The U.S. Army Corps of Engineers and USFWS

should be consulted regarding potential permitting requirements if invasive removal will occur in waterways or wetlands under their jurisdiction.

Additionally, non-native grasses, such as those found on the project site, are perpetuated by frequent fires as the fires remove the recovering shrub cover that develops overtime. In the absence of fire, grassland will proceed along successional pathways toward a climax condition of shrub cover in Southern California landscapes. However, the existence of non-native grasses, which readily populate a burned site, facilitate repeated fires due to their early season drying and flashy nature, that is, they are much easier to ignite than native shrubs. Because they are receptive to ignition for a longer period and are more readily ignited, the tendency for these areas to burn repeatedly is enhanced and the successional path remains disrupted and in an early successional period. Active restoring of non-native landscapes to shrub cover may be necessary in some areas and may need to be accomplished in conjunction with additional hazard reduction measures that help reduce the likelihood of ignition.

Roadside Fuel Modification

Studies (IRC 2008) indicate that roadways are one of the most significant sources of ignitions within WUI areas. As such, roadside vegetation management and maintenance is critical to reducing wildfires. Roadway fuel modification efforts occur on most of the public roadways throughout the County. This maintenance must continue to be performed through mowing operations that remove dry, non-native fuels during the spring annually. Sparks generated by dragged chains, overheated/failed brakes, exploding catalytic converters, tossed cigarette, or other roadway/vehicle related sources may be contained in the road shoulder area or first few feet off the road that usually includes no vegetation (on primary roadways) or they may bounce into the extended area adjacent roadways where vegetation occurs. Depending on the fuel bed that hot material lands, it may ignite a vegetation fire which could spread under the right conditions. Non-native fuels, primarily grasses, cure during the spring and early summer and are receptive to ignitions. Native fuels generally take longer to dry out and reach a point where they readily ignite. Removing the flashy grass fuels and other non-native species from the areas adjacent roadways provides significant reduction in ignitions. The existing maintenance area along roadways is roughly 10 to 20 feet wide. The area mowed should be as wide as 20 feet, where possible. Where 20 feet cannot be provided, due to terrain or existence of native, lower flammability shrub species, roadside fuel modification should be as wide as possible without impacting native vegetation unless it is dead, then it should be removed.

Red Flag Warning Days

The highest ranked potential hazard reduction measure is restricting access during Red Flag Warning weather. This measure is perceived to have a very low financial cost (keep gates locked, patrols monitor trail heads, erect signs indicating no use and potential for fines if unauthorized use occurs) and low cost in terms of lost recreational opportunities, especially considering it is unlikely to realize more than approximately 20 Red Flag Warning days per year. Due to the low cost and significant potential for removing potential ignition sources on days when fire ignition and spread is most likely, this measure is considered to include at least a moderate and likely a high leverage level. Removing normal recreational users during this period also makes it easier to identify and deter potential arsonists who may shy from the area due to patrols.

Additionally, during Red Flag Warning days, fire ignition potential dramatically increases, and the probability of a vegetation fire associated with any type of road or road right-of-way-project, including heat or spark sources (guard rail maintenance, road fuel modification maintenance, sign installations, paving, etc.) is enhanced. Research indicates that California Department of Transportation (CALTRANS) and the Transportation Corridor Agency currently include protocols for suspending potential fire producing activities during Red Flag Warning conditions.

However, there are other agencies who are responsible for roads, trails, and green spaces adjacent to the project site that do not include RFW weather protocols. One such identified agency in Orange County Public Works. It is recommended that all entities responsible for maintenance are educated on the importance of fire weather restrictions during Red Flag Warning days and the potential liabilities associated with fire ignitions.

Trail Head/Entry Fire Safety Signage

All trailheads within the project site should provide signage regarding fire prevention, fire safety, and the importance of avoiding activities that can lead to vegetation fires. There has not been a high incidence of wildland fires originating from the project site's recreational users, but there is a correlation with outdoor users and wildfires. For example, a visiting hiker not familiar with the potential for vegetation ignitions in dry grass may decide to smoke a cigarette in a vulnerable area that can lead to a wildfire. There are many other examples of humans causing fires in wildland areas, and these potential ignition sources can be positively affected with clear, consistent messages. It is recommended that language indicating the potential for firefighting cost recovery from the individual may occur for fire started by Park users.

Electrical Transmission Line Fire Prevention Measures

This potential hazard reduction measure focuses on reducing the potential ignition of vegetative fuels from electrical transmission lines. Electrical transmission lines and associated structures can start fires in a number of ways, including the following:

- Uncleared vegetation, especially trees, coming into contact with conductors;
- Sparks (from exploding hardware such as transformers and capacitors) coming into contact with vegetation;
- Wind-blown debris coming into contact with hardware such as transformers and conductors;
- Conductor-to-conductor contact;
- Wood transmission poles blown down by high winds;
- Dust or dirt buildup on power line hardware;
- Aircraft or helicopter, or attached features such as fire-fighting water buckets, coming into contact with power line hardware and support structures;
- Wildlife coming into contact with power line hardware or transmission line.

Southern California Edison (SCE) is responsible for electrical transmission lines on and adjacent to the project site. The NROC should coordinate with SCE on planned maintenance and upgrades/retrofits of equipment. Among the types of activities that should be considered high priority are replacement of wood poles with steel, replacing and/or repairing aging equipment on a more frequent timeline, providing raptor/bird protection retrofits, and increasing the number of patrols along the right-of-way to increase the probability that a potential issue is detected early.

SCE currently follows RFW restrictions, suspending all non-essential work in wildland areas during high fire hazard conditions. They also require construction related fire prevention activities including water truck on site, educational training, no smoking outside vehicle, etc., that is mandated for all contractors.

Vegetation line clearance occurs on an as-needed basis that is driven by species growth characteristics and size of distribution line. This primarily occurs outside of the project site, but vegetation ignitions could easily result in spread onto the project site. Coordination should focus initially on identifying all electrical infrastructure onsite and then

identifying where the highest priority maintenance needs are and implementing a program to mitigate these issues. Funding for this potential hazard reduction measure would be provided by SCE as part of their operating budget.

Mastication

Mastication is a term used to generally describe the process of using mechanical means, usually a skid-steer mounted drum, to cut and grind vegetation for fuel reduction purposes. Mastication is a relatively fast method of fuel reduction with roughly one treated acre per hour possible. The process leaves behind biomass as mulch on the ground and mastication can include selective removal of above ground components to bare earth or to any other desired height. This method of fuel reduction is best used where non-native shrubs and small trees require removal.

Targeted Herbicide Use for Fuel Reduction

Chemical means to control fuels/non-native plants is an effective method, but one that has a negative connotation, potential toxicity for humans and wildlife, and can affect water quality and environmental conditions. Focused chemical selection and application minimizes the detrimental effects and makes the use of chemicals, such as glyphosate and other selective chemicals, a feasible alternative. The application of herbicides to control target invasive species may be used on its own or as a secondary treatment following manual or mechanical removal for controlling sprout growth and regeneration. Herbicide application is recommended following removal of invasive tree species and other perennial species with the ability to regenerate from root fragments when removal of all plant material is not feasible. Herbicide use should be limited to localized applications rather than foliar applications to eliminate the possibility of drift and impacts to neighboring desirable species. A wide range of herbicides are available for such types of treatment. Herbicide labels and material safety data sheets (MSDS) list susceptible target plant species and provide proper direction in the use and handling of the products. Herbicides should be applied by state licensed applicators.

Tree Crown Raising

Crown raising is simply removing branches from the bottom of the crown of a tree to provide clearance for any of a variety of reasons including hikers (trailside trees), vehicles (maintenance or fire engines), or for increasing the distance between ground fire and the tree crown. Crown raising is commonly used within fuel modification areas as a means to protect the trees from fire laddering into the tree crown and producing intense heat, tall flames, and large quantities of embers. As a strategy, oaks, sycamores, and potentially Tecate cypress could be individually treated as part of an overall “point protection” measure aimed at reducing the likelihood that a typical fire (non wind-driven fire) would cause mortality. This method could be particularly useful for very high value trees/stands where wildfire is not desirable for stand health and maturation purposes.

Fire Adapted Communities Education Campaign

Private property owners in the interface or intermix (located adjacent to open space) should be encouraged to play an active role in reducing the potential fire hazard in the vicinity of the project site. As such, a concerted effort to reach property owners who are situated in locations that may be affected by wildfire adjacent to open space areas or whose properties and actions may serve as ignition sources. The Fire Adapted Communities Educational material can be customized for these homeowners to include discussion of the importance of managing fire in the project area. Additional information is available from Orange County Fire Authority (OCFA), the Firewise organization, CAL FIRE (<http://www.fire.ca.gov>), Fire Safe Councils (<http://www.fire safecouncil.org>) and other web sources.

The educational campaign should also include involvement in the “We Tip” program with signage indicating telephone numbers where citizens can report criminal activity, including arson. Neighborhood Watch programs also can help provide additional eyes and ears on the ground in neighborhoods surrounding the Park, potentially leading to a reduction in ignitions and associated burned acreages.

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