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MEMORANDUM

To:	Justin Gipson, Fire Division Chief: Director of Fire Prevention and Support Services, Chula Vista Fire Department
From:	Noah Stamm, Dudek Fire Protection Planner Michael Huff, Principal Fire Protection Planner
Subject:	Otay Ranch Village 7 Fire Protection Plan Addendum and Figures updates
Date:	April 2024
Attachment (s):	Figure 1 – Property Ownership Map Figure 2 - Proposed Amendment Scope: Areas of Change Maps Attachment 1 – Updated Photograph Log Attachment 2 – Updated Overall Conceptual Plan Attachment 3 – Revised Land Use Map - R-3, R-4, R-8, MU-1, and TS-1 Attachment 4 – Updated Fire History Map Attachment 5 – Updated Fire behavior Analysis

Background

The Otay Ranch Village 7 Fire Protection Plan (FPP) prepared by Hunt Research Corporation was originally drafted and approved by the City of Chula Vista and the Chula Vista Fire Department (CVFD) in June 2005. The Village Seven SPA plan was adopted in 2004. The SPA Plan for Village Seven allows for a mix of single-family and multi-family residential development, a middle elementary school and high school, trail connections, and a village core area containing mixed-use development, community purpose facilities, a town-square, and a neighborhood park. Baldwin & Sons (the applicant) proposes revisions to the Village Seven land use plan in order to increase multi-family residential and town center uses by changing land use designations for single family residential uses. This would not result in an increase to the overall approved number of residential units within Village Seven. Amendments to the Chula Vista General Plan, Otay Ranch General Development Plan (GDP), and Village Seven SPA Plan are necessary to implement the proposed changes.

The approved land use plan for Village Seven SPA allows for the maximum construction of 1,456 residential units (949 single-family and 507 multiple-family units; to date, 1,120 units have been constructed); a high school; a trail connection through the village connecting Wolf Canyon to the west and Eastern Urban Center in Planning Area 12 to the east; and a village core area that contains commercial uses in a mixed use setting, public and community purpose facilities, a transit stop, an elementary school, multi-family residences, a Town Square/Village Green/Main

Street area, affordable housing, and a Neighborhood Park.

The majority of Village Seven has already undergone construction. Single-family homes are constructed in the northern half of the SPA area, the All Seasons and Wolf Canyon Parks constructed within the middle of Village Seven, multi-family homes constructed along the eastern boundary of Village Seven, and both the Wolf Canyon Elementary School and the Olympian High School constructed within the southeastern portion of Village Seven. Primary internal roadways have been constructed and paved. These roadways include Birch Road, Magdalena Avenue, Santa Luna Street, and Wolf Canyon loop.

The remaining land in Village Seven that is currently unimproved is under two different ownerships: Baldwin & Sons and the Federal Aviation Administration (FAA) (Figure 1). The FAA's property is approximately 52 acres and is currently used to operate an aviation navigation facility (known as VORTAC) from the site. The facility is planned for eventual relocation outside of Village Seven, whereafter the property would be sold to private ownership for its ultimate buildout. The VORTAC site is planned to serve as the heart of the village with a future Town Square, a 3.4-acre neighborhood-serving mixed-use commercial anchor, a transit stop, community purpose facilities, residential uses, and open space. Baldwin & Sons owns three triangular-shaped parcels on three sides of the VORTAC site:

- an approximately 12.6-acre portion of neighborhood R-3 to the west the VORTAC site, along La Media Road,
- an approximately 3-acre portion of neighborhood R-3 on the east of the VORTAC site, along Magdalena Avenue, and
- an approximately 3-acre neighborhood R-4 south of Santa Luna Road.

The 12.6-acre portion of neighborhood R-3 and the 3-acre neighborhood R-4 are the subject of the proposed SPA Plan amendment.

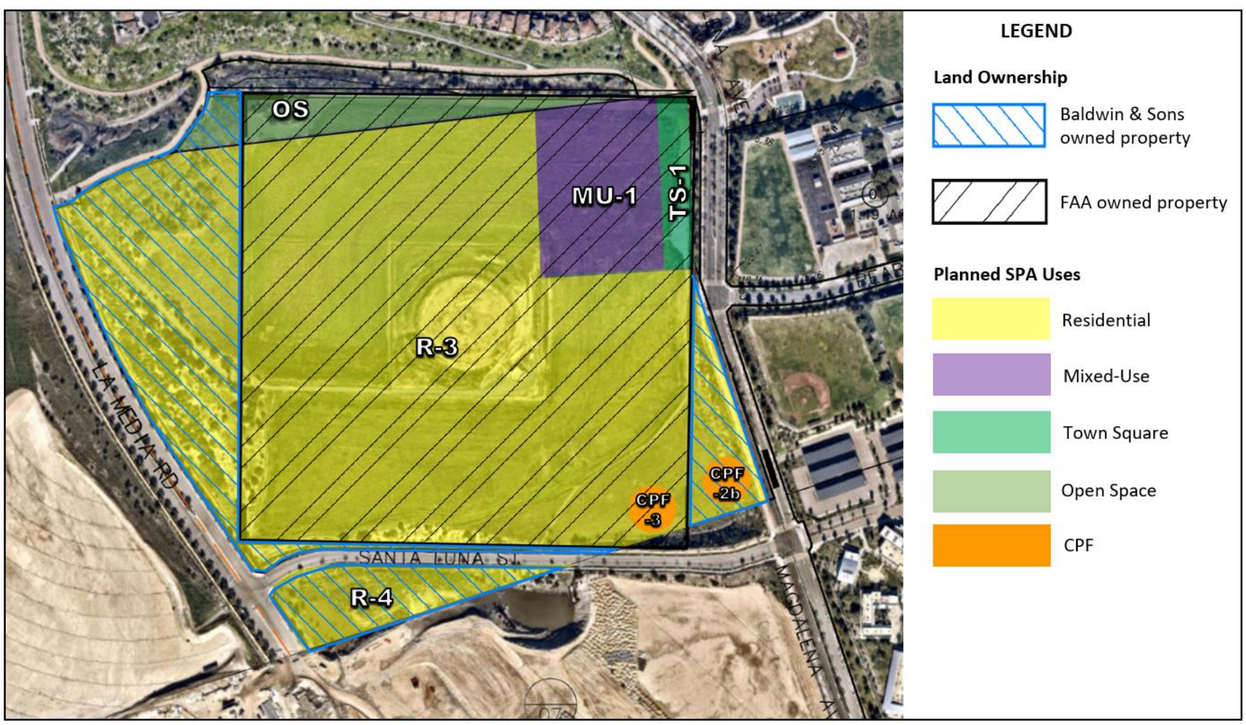


Figure 1. Property Ownership Map

Item 1. Approved 2005 Fire Protection Plan ADDENDUM – PROPOSED AMENDMENTS AND LAND USE CHANGES.

The proposed modifications to the approved project are as follows:

a) Chula Vista General Plan Amendment

- Update the Chula Vista General Plan land use maps and tables to change the land uses for a 12.6-acre portion of R-3 along La Media Road from Low-Medium Residential (LM) to Medium (M) Residential, and R-4 from Low-Medium Residential (LM) to Town Center (TC).

b) Otay Ranch GDP Amendment

- Update the Otay Ranch GDP land use maps and tables to change the land uses for a 12.6-acre portion of R-3 along La Media Road from Low-Medium Village (LMV) Density Residential to Medium (M) Density Residential, and R-4 from Low-Medium Village (LMV) Density Residential to Town Center (TC).

c) Village Seven SPA Plan Amendment

- Change the land use designation of the western portion of the neighborhood R-3 from Single Family Three (SF3) to Residential Multi-Family One (RM1)
- Change the land use designation in neighborhood R-4 from Single Family Four (SF4) to Town Center (RM2).
- Change the boundary of the existing neighborhood R-3, create a new neighborhood R-8 from the rezoned portion of R-3, and transfer units between neighborhoods R-3, R-4 and R-8.
- Update SPA Plan text, tables, and exhibits to reflect the proposed land use changes.
- Update SPA Appendices – Planned Community District Regulations, Village Seven Design Plan, Air Quality Improvement Plan, Water Conservation Plan, Non-Renewable Energy Conservation Plan, and technical studies to reflect the SPA Amendment.

Proposed Land Use Plan:

The proposed modifications are summarized as follows:

- Change to parcels designated "Single Family Three" to "Residential Multi-Family One" (SF3 to RM1) within western portion of the neighborhood R-3;
- Change the parcel designated as R-4 from "Single Family Four" to "Residential Multi-Family Two" (SF3 to RM2);
- Change the boundary of the R-3 neighborhood, and create a new neighborhood "R-8" using the amended portion of R-3.
- Reallocate 184 residential units out of the remaining 336 units from the single-family residential use category to the multi-family use category as follows:
  - Reduce single-family units in neighborhood R-3 from 228 to 44
  - Increase residential units in neighborhood R-4 from 59 single-family to 120 multi-family units
  - Allocate 123 multi-family residential units to the newly created neighborhood R-8

The proposed modifications do not result in an overall increase of the residential units in Village Seven beyond the 1,456 units that are currently approved in the Village Seven SPA Plan and what was studied in the Village Seven FEIR and the approved Fire Protection Plan. The proposed modifications redistribute the existing dwelling units between neighborhoods R-3, R-4 and the newly created neighborhood R-8 (what is currently the westernmost portion of R-3). The change in residential density will allow for housing types that are more appropriate for their specific location based on the existing surrounded development that has been completed and the changes in the adjacent land uses that have occurred over the past eighteen years since Village Seven village concept was initially conceived and approved. The proposed modifications would not require an expansion of the development footprint from that studied in the Village Seven FEIR.

PROPOSED VILLAGE 7 SITE UTILIZATION TABLE;

LEGEND	
R-1 – R-8	Residential Neighborhoods
MU-1	Mixed Use Neighborhood
TS-1	Town Square
P-1	Public Park
S-1	High School
S-3	Elementary School
OS	Open Space
CPF	Community Purpose Facility
	Village Core District

RESIDENTIAL				
Neighborhood	*Land Use*	*Acres*	*DU*	*du/ac*
R-1	SDF	50.7	346	6.8
R-2	SDF	50.5	375	7.4
R-3		30.4	44	1.4
Sub-Total SFD:		*131.6*	*765*	*5.8*
R-4	MF	3.11	120	38.6
R-5	MF/SF Cluster	17.4	132	7.6
R-6	MF/SF Cluster	12.5	193	15.4
R-7	MF	8.0	123	15.4
R-8	MF	12.6	123	9.8
Sub-Total MF:		*53.6*	*691*	*12.9*
Total Residential		**185.2**	**1,456**	**7.9**

NON-RESIDENTIAL		
Neighborhood	*Land Use*	*Acres*
P-1	Public Park	7.6
TS-1	Town Square	1.9
CPF-1	CPF (HOA Park)	1.1
CPF-2a	CPF (HOA Park)	0.7
CPF-2b	CPF	1.0
CPF-3	CPF	1.1
S-1	High School	53.9
S-3	Elem. School	11.5
MU-1	Mixed Use	3.7
OS	Open Space	60.5
Cir	Circulation	62.9
Total Non-Residential		**205.9**
VILLAGE TOTAL		**391.1**

Item 2. Fire Protection Plan ADDENDUM – CURRENT CODES.

The approved FPP (June 2005) shall include the application of the 2022 California Fire Code and Chapter 7A of the 2022 California Building Code for all new buildings constructed in the southwest portion of Village 7 (parcels R-4 and R-8) after approval of this addendum.

Item 3. Fire Protection Plan ADDENDUM – FUEL MODIFICATION ZONES.

Fuel Modification Zones will remain the same throughout Otay Ranch, Village 7, parcels R-4 and R-8 with the exception of the addition of a Zone "0", which will be located on all sides of and directly adjacent to all structures. Zone 0 extends 5 feet from buildings, structures, decks. Below are the Zone 0 requirements:

Zone 0

The Zone "0" ember-resistant zone is currently not required by law, but science has proven it to be the most important of all the defensible space zones. This zone includes the area under and around all attached decks, and requires the most stringent wildfire fuel reduction. The ember-resistant zone is designed to keep fire or embers from igniting materials that can spread the fire to a home. The following provides guidance for this zone, which may change based on the regulation developed by the Board of Forestry and Fire Protection.

- Use hardscape like gravel, pavers, concrete and other noncombustible mulch materials. No combustible bark or mulch
- Remove all dead and dying weeds, grass, plants, shrubs, trees, branches and vegetative debris (leaves, needles, cones, bark, etc.); Check and clear roofs, gutters, decks, porches, stairways, etc.
- Remove all branches within 10 feet of any chimney or stovepipe outlet
- Limit plants in this area to low growing, nonwoody, properly maintained plants
- Limit combustible items (outdoor furniture, planters, etc.) on top of decks
- Relocate firewood and lumber at least 30-feet from structures
- Vegetation limited to no more than 6" to 18" in height
- Vegetation shall be irrigated
- Replace combustible fencing, gates, and arbors attach to the home with noncombustible alternatives
- Consider relocating garbage and recycling containers outside this zone
- Consider relocating boats, RVs, vehicles and other combustible items outside this zone

Zone 1, 2, and 3 Fuel modification and fire safety standards will follow the recommendations of Section 6 of the Project's approved FPP. Zone 1, 2, and 3 will all be irrigated, per the Project's FPP (dated June 2005). FMZ consistent landscape or hardscape is allowable and consistent with the intent of a 90 to 100-foot wide FMZ. Based upon the review of the approved FPP (2005), a site risk and on site assessment, review updated Fire History in the area (See

Attachment 3), and updated Fire Behavior Analysis results (see Attachment 4), the approved Fuel Modification Zones are still valid.

Item 4. Fire Protection Plan ADDENDUM – ACCESS ROADS AND FIREFIGHTER WALKWAYS (Section 7):

Access to parcels R-4 and R-8 of Village 7 shall be consistent with the information provided within Section 7 of the approved FPP, as well as with the requirements outlined in Section 503 of the 2022 California Fire Code. Fire Access Road must be in compliance with the Chula Vista Fire Department Auto-Turn detail and requirements as adopted by the Chula Vista Municipal Code.

Item 5. Fire Protection Plan ADDENDUM – WATER SUPPLY AND FIRE FLOW (Section 8):

Water supply and fire flow to parcels R-4 and R-8 of Village 7 shall be consistent with the information provided within Section 8 of the approved FPP, as well as with the requirements in Section 507 of the 2022 California Fire Code. Water supply and Fire Flow must be in compliance with the Chula Vista Fire Department Fire Flow requirements as adopted by the Chula vista Municipal Code.

Item 6. Fire Protection Plan ADDENDUM – FIRE PROTECTION SYSTEMS AND EQUIPMENT (Section 9):

Water supply and fire flow to parcels R-4 and R-8 of Village 7 shall be consistent with the information provided within Section 9 of the approved FPP, as well as with the requirements in Chapter 9 of the 2022 California Fire Code, including Section 903 – Automatic Sprinkler Systems, Section 905 – Standpipe Systems, Section 906 – Portable Fire Extinguishers, and Section 907 – Fire Alarm and Detection Systems. Fire Protection Systems and Equipment must be in compliance with the Chula Vista Fire Department requirements as adopted by the Chula Vista Municipal Code.

Item 7. Fire Protection Plan ADDENDUM – IGNITION RESISTANT CONSTRUCTION REQUIREMENTS (Section 10):

The Ignition Resistant Construction requirements for Parcels R-4 and R-8 of Village 7 shall be consistent with the information provided within Section 10 of the approved FPP, as well as with the requirements in Chapter 49 of the 2022 California Fire Code, including Section 4905. The ignition resistant building construction for the development must be in compliance with the Chula Vista Fire Department requirements as adopted by the Chula Vista Municipal Code.

Please feel free to contact Noah Stamm at (760) 642-8379 or Michael Huff at (619) 992-9161, if you have any questions or require any additional information.

Attachment 1

Updated Photograph Log

Photograph 1: Photograph looking west along the north property boundary of the Otay Ranch Village 7 South Project site. Photograph taken standing along Magdalena Ave. Note the strip of riparian/coast live oak habitat area separating the northern portion of the project site and the existing residential community to the north.

Photograph 2: Photograph looking southwest across the north portion of the Otay Ranch Village 7 South Project site. Photograph taken standing along Magdalena Ave. Note the existing vegetation onsite includes bare soil and low-load non-native grasses.

Photograph 3: Photograph looking west along the north property boundary of the Otay Ranch Village 7 South Project site. Photograph taken standing along Magdalena Ave. Note the strip of riparian/coast live oak habitat area separating the northern portion of the project site and the existing residential community to the north.

Photograph 4: Photograph looking east/southeast along the north property boundary of the Otay Ranch Village 7 South Project site. Photograph taken standing along a walking trail to access the existing residential community to the north.

Photograph 5: Photograph looking south across the north property boundary towards the center of the Otay Ranch Village 7 South Project site. Photograph taken standing along a walking trail to access the existing residential community to the north.

Photograph 6: Photograph looking southwest across the north property boundary towards the center of the Otay Ranch Village 7 South Project site. Photograph taken standing along a walking trail to access the existing residential community to the north.

Photograph 7: Photograph looking west/southwest across the north property boundary towards the center of the Otay Ranch Village 7 South Project site. Photograph taken standing along a walking trail to access the existing residential community to the north.

Photograph 8: Photograph of the existing 'All Seasons Park' directly east/northeast of the Otay Ranch Village 7 South Project site. Photograph taken facing east standing near the northeast corner of the Project site along Magdalena Ave.

Photograph 9: Photograph of the existing Wolf Canyon Elementary School directly east of the Otay Ranch Village 7 South Project site. Photograph taken facing east/northeast standing at the intersection of Wolf Canyon Loop and Magdalena Ave.

Photograph 10: Photograph of the existing Olympian High School directly east of the Otay Ranch Village 7 South Project site. Photograph taken facing east/southeast standing at the intersection of Wolf Canyon Loop and Magdalena Ave.

Photograph 11: Photograph looking northwest across the eastern portion of the Otay Ranch Village 7 South Project site. Photograph taken standing along Magdalena Ave. Note the existing vegetation onsite includes bare soil and low-load non-native grasses.

Photograph 12: Photograph looking west across the eastern portion of the Otay Ranch Village 7 South Project site towards the center of the site. Photograph taken standing along Magdalena Ave. Note the existing vegetation onsite includes bare soil and low-load non-native grasses.

Photograph 13: Photograph looking southwest across the southern portion of the Otay Ranch Village 7 South Project site. Photograph taken standing along Magdalena Ave. Note the existing vegetation onsite includes bare soil and low-load non-native grasses.

Photograph 14: Photograph looking west/northwest across the eastern portion of the Otay Ranch Village 7 South Project site towards the existing Brown's Field Air Traffic Control property in the center of the property.

Photograph 15: Photograph looking north across the southern portion of the Otay Ranch Village 7 South Project site. Photograph taken standing along Santa Luna Street, near the intersection of Santa Luna St. and Magdalena Ave. Note the existing vegetation onsite includes bare soil and low-load non-native grasses.

Photograph 16: Photograph looking west along the southern property boundary of the Otay Ranch Village 7 South Project site. Photograph taken standing along Santa Luna Street, near the intersection of Santa Luna St. and Magdalena Ave.

Photograph 17: Photograph looking south along the western property boundary of the Otay Ranch Village 7 South Project site. Photograph taken standing above La Media Road, near the existing entrance into the project site. Note the existing construction taking further south of the project site.

Photograph 18: Photograph looking south towards construction currently taking place south of the Project site. Photograph taken standing along Santa Luna Street, near the intersection of Santa Luna St. and Magdalena Ave.

Photograph 19: Photograph looking east across the western portion of the Otay Ranch Village 7 South Project site. Photograph taken standing above La Media Road, near an existing entrance into the project site.

Photograph 20: Photograph looking north along the western property boundary of the Otay Ranch Village 7 South Project site. Photograph taken standing above La Media Road, near the existing entrance into the project site. Note the existing residential community further north of the project site.

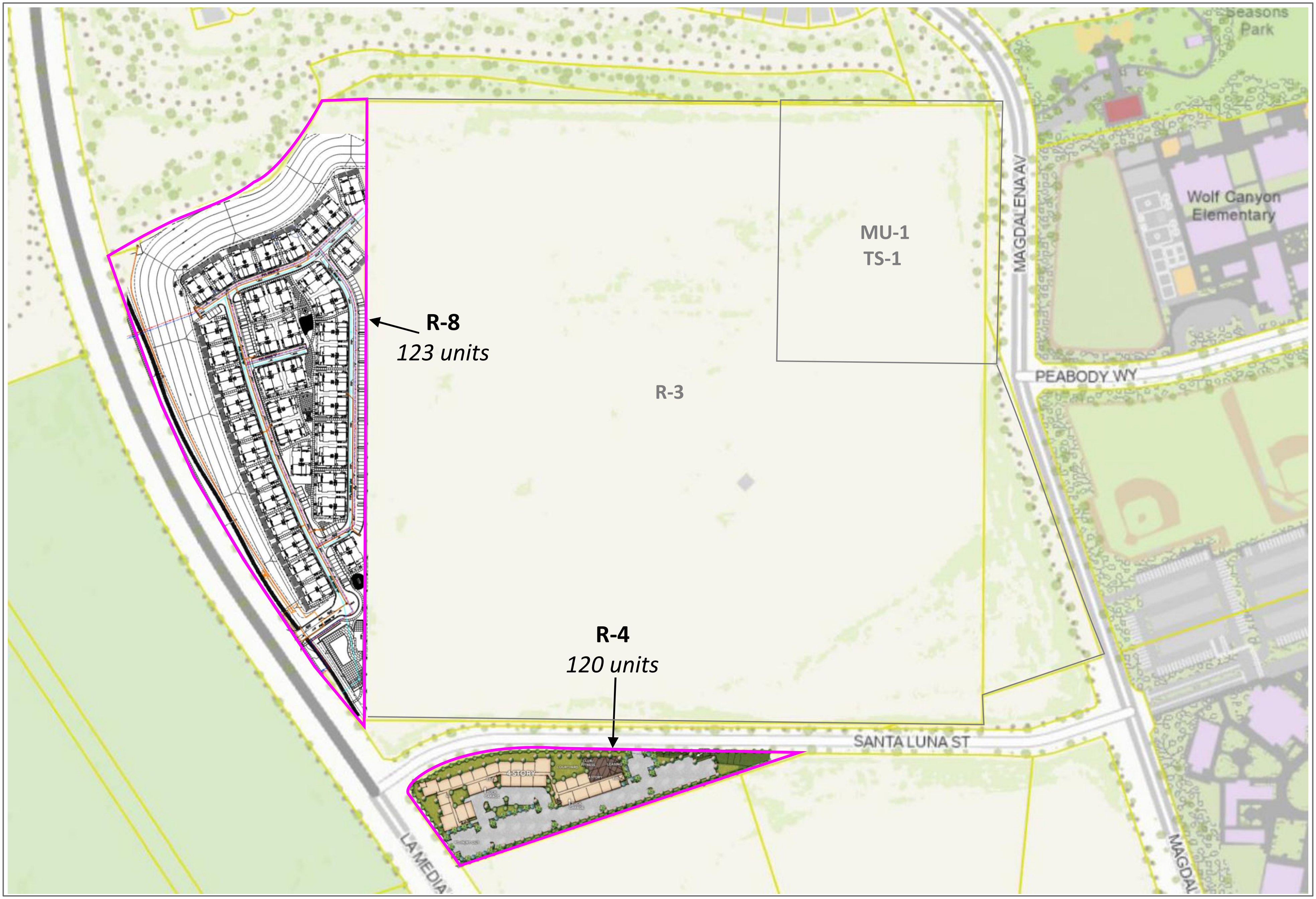
Photograph 21: Photograph looking up towards the northwest corner of the Otay Ranch Village 7 South Project site. Photograph taken standing along La Media Road.

Photograph 22: Photograph looking west/northwest towards the existing land uses west of the project site across La Media Road.

Photograph 23: Photograph looking northwest towards the existing residential community northwest of the project site across La Media Road.

Attachment 2

Revised Land Use Map - R-3, R-4, R-8, MU-1, and TS-1



SOURCE: Baldwin & Sons, 2022

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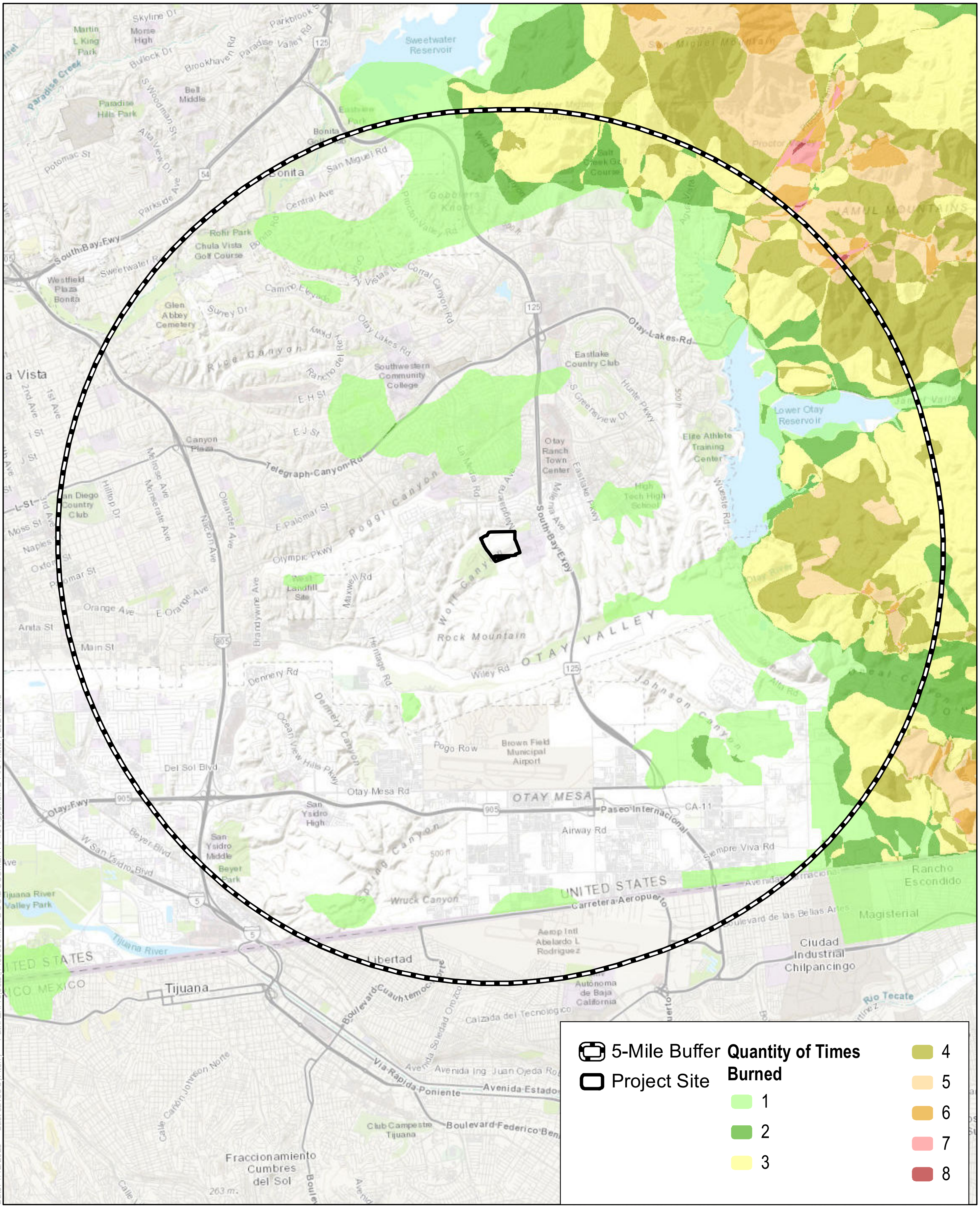
ATTACHMENT 2

Revised Land Use Map - R-3, R-4, R-8. MU1, and TS-1

Fire Protection Plan Addendum for the Otay Ranch Village 7 Project

Attachment 3

Updated Fire History Map



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

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ATTACHMENT 3

Fire History Map

Fire Protection Plan for Otay Ranch Village 7 Project

Attachment 4

Updated Fire behavior Analysis

FIRE BEHAVIOR MODELING SUMMARY OTAY RANCH VILLAGE 7 FPP UPDATE, CHULA VISTA, CALIFORNIA

1 BehavePlus Fire Behavior Modeling History

Fire behavior modeling has been used by researchers for approximately 50+ years to predict how a fire will move through a given landscape (Linn 2003). The models have had varied complexities and applications throughout the years. One model has become the most widely used as the industry standard for predicting fire behavior on a given landscape. That model, known as "BEHAVE", was developed by the U. S. Government (USDA Forest Service, Rocky Mountain Research Station) and has been in use since 1984. Since that time, it has undergone continued research, improvements, and refinement. The current version, BehavePlus 6.0, includes the latest updates incorporating years of research and testing. Numerous studies have been completed testing the validity of the fire behavior models' ability to predict fire behavior given site specific inputs. One of the most successful ways the model has been improved has been through post-wildfire modeling (Brown 1972, Lawson 1972, Sneeuwjagt and Frandsen 1977, Andrews 1980, Brown 1982, Rothermel and Rinehart 1983, Bushey 1985, McAlpine and Xanthopoulos 1989, Grabner, et. al. 1994, Marsden-Smedley and Catchpole 1995, Grabner 1996, Alexander 1998, Grabner et al. 2001, Arca et al. 2005). In this type of study, Behave is used to model fire behavior based on pre-fire conditions in an area that recently burned. Real-world fire behavior, documented during the wildfire, can then be compared to the prediction results of Behave and refinements to the fuel models incorporated, retested, and so on.

Fire behavior modeling conducted on this site includes a relatively high-level of detail and analysis which results in reasonably accurate representations of how wildfire may move through available fuels on and adjacent the property. Fire behavior calculations are based on site-specific fuel characteristics supported by fire science research that analyzes heat transfer related to specific fire behavior. To objectively predict flame lengths, spread rates, and fireline intensities, this analysis incorporated predominant fuel characteristics, slope percentages, and representative fuel models observed on site. The BehavePlus fire behavior modeling system was used to analyze anticipated fire behavior within and adjacent to key areas just outside of the proposed lots. Predicting wildland fire behavior is not an exact science. As such, the movement of a fire will likely never be fully predictable, especially considering the variations in weather and the limits of weather forecasting. Nevertheless, practiced and experienced judgment, coupled with a validated fire behavior modeling system, results in useful and accurate fire prevention planning information. To be used effectively, the basic assumptions and limitations of BehavePlus must be understood.

- First, it must be realized that the fire model describes fire behavior only in the flaming front. The primary driving force in the predictive calculations is dead fuels less than one-quarter inch in diameter. These are the fine fuels that carry fire. Fuels greater than one inch have little effect while fuels greater than three inches have no effect on fire behavior.
- Second, the model bases calculations and descriptions on a wildfire spreading through surface fuels that are within six feet of the ground and contiguous to the ground. Surface fuels are often classified as grass, brush, litter, or slash.
- Third, the software assumes that weather and topography are uniform. However, because wildfires almost always burn under non-uniform conditions, length of projection period and choice of fuel model must be carefully considered to obtain useful predictions.

- Fourth, the BehavePlus fire behavior computer modeling system was not intended for determining sufficient fuel modification zone/defensible space widths. However, it does provide the average length of the flames, which is a key element for determining "defensible space" distances for minimizing structure ignition.

Although BehavePlus has some limitations, it can still provide valuable fire behavior predictions which can be used as a tool in the decision-making process. 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 on a site. The type and quantity will depend upon the soil, climate, geographic features, and the fire history of the site. 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[1] and the five custom fuel models developed for Southern California[2]. 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 BehavePlus. 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, the aforementioned fuel characteristics were utilized in the recent development of 40 new fire behavior fuel models[3] developed for use in BehavePlus modeling efforts. These new models attempt to improve the accuracy of the standard 13 fuel models outside of severe fire season conditions, and to allow for the simulation of fuel treatment prescriptions. The following describes the distribution of fuel models among general vegetation types for the new 40 fuel models:

- Non-Burnable — Models NB1 through NB 4
- Grass — Models GR1 through GR9
- Grass-shrub — Models GS1 through GS4

1 Anderson, Hal E. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. USDA Forest Service Gen. Tech. Report INT-122. Intermountain Forest and Range Experiment Station, Ogden, UT.

2 Weise, D.R. and J. Regelbrugge. 1997. Recent chaparral fuel modeling efforts. Prescribed Fire and Effects Research Unit, Riverside Fire Laboratory, Pacific Southwest Research Station. 5p.

3 Scott, Joe H. and Robert E. Burgan. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

- Shrub Models SH1 through SH9
- Timber-understory Models TU1 through TU5
- Timber litter Models TL1 through TL9
- Slash blowdown Models SB1 through SB4

BehavePlus software was used in the development of the Otay Ranch Village 7 South (Proposed Project) Fire Protection Plan (FPP) Report in order to evaluate potential fire behavior for the Project site. Existing site conditions were evaluated, and local weather data was incorporated into the BehavePlus modeling runs.

2 Fuel Models

Dudek utilized the BehavePlus software package to analyze fire behavior potential for the Proposed Project site in Hemet, California. As is customary for this type of analysis, four fire scenarios were evaluated, including two summer, onshore weather condition (west/southwest and northwest of the Project Site) and two extreme fall, offshore weather condition (north/northeast and south/southeast of the Project Site). The Project site is currently vacant and is surrounded by a variety of land uses including existing single-family residential communities to the north, east, and further west; additional residential communities/commercial development sites that are currently under development and/or have been graded for future development (Village 3, Village 4 to the west, Village 8 west and 8 east to the south, and Village 9 further southeast); native and non-native grassland areas further to the south; and State Route 125 (SR-125) runs along the eastern property boundary of the Village 7 project site. With that said, based on the existing land uses the fuels and terrain within and adjacent to the Project development area could possibly produce flying embers that may affect the Project (although unlikely), but defenses have been built into the new single-family and multi-family residential structures to prevent ember penetration and to extinguish fires that may result from ember penetration. It is the fuels directly adjacent to and within the proposed fuel modification zones that would have the potential to affect the Project's structures from a radiant and convective heat perspective as well as from direct flame impingement. The BehavePlus software requires site-specific variables for surface fire spread analysis, including fuel type, fuel moisture, wind speed, and slope data. The output variables used in this analysis include flame length (feet), rate of spread (feet/minute), fireline intensity (BTU/feet/second), and spotting distance (miles). The following provides a description of the input variables used in processing the BehavePlus models for the Proposed Project site. In addition, data sources are cited, and any assumptions made during the modeling process are described.

2.1 Vegetation (Fuels)

To support the fire behavior modeling efforts conducted for the Otay Ranch Village 7 FPP Project, the different vegetation types observed within the Project areas and adjacent to the Project site were classified into the aforementioned numeric fuel models. As is customary for this type of analysis, the terrain and fuels within and adjacent to the project area were used for determining flame lengths and fire spread. It is these fuels that would have the potential to affect the Project's structure from a radiant and convective heat perspective as well as from direct flame impingement. Fuel beds, including non-burnable areas where adjacent communities are being graded/under construction, sparse- to- moderate load grass fuels (Fuel Models Gr1 and Gr4) located west and south the Project development, as well as moderate- to- high-load shrub and grass-shrub fuels (Fuel Models Gs2, Sh2, and Sh5) found in the adjacent areas surrounding the project development area. These fuel types can produce flying embers that may affect the project, but defenses have been built into the structures to prevent ember penetration. Table 1 provides a description of the six existing fuel models observed in the vicinity of the site that were subsequently used in the analysis for this Project. A total of four fire modeling scenarios were completed for the Project area. These modeling scenario locations were selected based on the low probability of a fire approaching from these directions during a Santa Ana wind-driven fire event (fire scenarios 1 and 2) and an on-shore weather pattern (fire scenarios 3 and 4). Dudek also conducted modeling of the site for post-Fuel Modification Zones' (FMZ) recommendations for this project (Refer to Table 2 for post-FMZ fuel model descriptions). Fuel modification includes establishment of irrigated and thinned zones on the periphery of the new residential structure. For modeling the post-FMZ treatment condition, fuel model assignments were re-classified for the FMZs 0 and 1 (Fuel Model FM8) and FMZ 2 (Fuel Models Gs1).

Table 1. Existing Fuel Model Characteristics

Fuel Model Assignment	Vegetation Description	Location	Fuel Bed Depth (Feet)
Gr1	Sparse-load, Dry climate grasses	Represents the graded areas south/southeast of the Project area.	<1.0 ft.
Gr4	Moderate-load, Dry climate grasses	Represents the maintained grass areas west and throughout the Project area.	<2.0 ft.
Gs2	Moderate-load, Dry climate grass-shrubs	Represents the grass-shrub vegetation located throughout the adjacent areas to the west and northwest without maintenance.	<3.0 ft.
Sh2	Moderate-load, Dry Climate Shrubs	Represents the shrubs/chaparral vegetation located west and along the northern boundary of the development without maintenance.	<3.0 ft.
Sh5	High-load, Dry Climate Shrubs	Represents the shrubs/chaparral vegetation located along the northern boundary of the development without maintenance.	>4.0 ft.
NB	Non-burnable	Represents the graded areas and areas under construction to the south and further west	0.0 ft.

Table 2. Post-development Fuel Model Characteristics

Fuel Model Assignment	Vegetation Description	Location	Fuel Bed Depth (Feet)
FM8	Irrigated landscae	Fuel Modification Zones 0 and 1: irrigated landscape throughout the Project site	<1.0 ft.
Gs1	Low load, dry climate grass-shrubs	Fuel Modification Zone 2: 50% thinning of brush around the perimeter of the structures	<2.0 ft.

2.2 Topography

Slope is a measure of angle in degrees from horizontal and can be presented in units of degrees or percent. Slope is important in fire behavior analysis as it affects the exposure of fuel beds. Additionally, fire burning uphill spreads faster than those burning on flat terrain or downhill as uphill vegetation is pre-heated and dried in advance of the flaming front, resulting in faster ignition rates. Existing manufactured and natural slope values adjacent to the development ranging from approximately 3% to 10% were measured around the perimeter of the Project area from U.S. Geological Survey (USGS) topographic maps.

2.3 Weather Analysis

Historical weather data for the southern San Diego County region was utilized in determining appropriate fire behavior modeling inputs for the Project area. 50th and 97th percentile moisture values were derived from Remote Automated Weather Station (RAWS) and utilized in the fire behavior modeling efforts conducted in support of this report. Weather data sets from the San Miguel RAWS (ID number 045737) were utilized in the fire modeling runs.

RAWS fuel moisture and wind speed data were processed utilizing the Fire Family Plus software package to determine atypical (97th percentile) and typical (50th percentile) weather conditions. Data from the RAWS was evaluated from August 1 through November 30 for each year between 2002 and 2021 (extent of available data record) for 97th percentile weather conditions and from June 1 through September 30 for each year between 2002 and 2021 for 50th percentile weather conditions.

Following analysis in Fire Family Plus, fuel moisture information was incorporated into the Initial Fuel Moisture file used as an input in BehavePlus. Wind speed data resulting from the Fire Family Plus analysis was also determined. Initial wind direction and wind speed values for the two BehavePlus runs were manually entered during the data input phase. The input wind speed and direction is roughly an average surface wind at 20 feet above the vegetation over the analysis area. Table 3 summarizes the wind and weather input variables used in the Fire BehavePlus modeling efforts.

Table 3: Variables Used for Fire Behavior Modeling

Model Variable	Summer Weather (50th Percentile)	Peak Weather (97th Percentile)
Fuel Models	Gr4, Gs2, Sh2, and Sh5	Gr1, Sh2, and Sh5
1 h fuel moisture	8%	1%
10 h fuel moisture	9%	2%
100 h fuel moisture	15%	5%
Live herbaceous moisture	59%	30%
Live woody moisture	118%	60%
20 ft. wind speed	12 mph (sustained winds)	16 mph (sustained winds); wind gusts of 50 mph
Wind Directions from north (degrees)	250 and 310	40 and 130
Wind adjustment factor	0.4	0.4
Slope (uphill)	4% to 10%	3% to 4%

3 Fire Behavior Modeling Efforts

As mentioned, the BehavePlus fire behavior modeling software package was utilized in evaluating anticipated fire behavior adjacent to the Proposed Project site. Four focused analyses were completed for both the existing project site conditions and the post project conditions, each assuming worst-case fire weather conditions for a fire approaching the project site from the northwest, northeast, southeast, south, and southwest. The results of the modeling effort included anticipated values for surface fires flame length (feet), rate of spread (mph), fireline intensity (Btu/ft/s), and spotting distance (miles). The aforementioned fire behavior variables are an important component in understanding fire risk and fire agency response capabilities. 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, Bevins, and Seli 2008). Fireline intensity is a measure of heat output from the flaming front, and also affects the potential for a surface fire to transition to a crown fire. Fire spread rate represents the speed at which the fire progresses through surface fuels and is another important variable in initial attack and fire suppression efforts (Rothermel and Rinehart 1983). Spotting distance is the distance a firebrand or ember can travel down wind and ignite receptive fuel beds. Three fire modeling scenario locations were selected to better understand the different fire behavior that may be experienced on or adjacent the site based on slope and fuel conditions; these fire scenarios are explained in more detail below:

Fire Scenario Locations and Descriptions:

- **Scenario 1:** A fall, off-shore fire (97th percentile weather condition) burning through moderate- to- high-load shrub/chaparral dominated vegetation within the manufactured slopes and drainage along the northern property boundary. The terrain is flat (approximately 4% slope) with potential ignition sources (although highly unlikely given the surrounding residential communities) from a car and/or structure fire originating within the existing residential communities to the north.
- **Scenario 2:** A fall, off-shore fire (97th percentile weather condition) burning through non-burnable or sparse grass dominated vegetation southeast of the property within the graded areas of Village 8 east. The terrain is flat (approximately 3% slope) with potential ignition sources from a car fire originating on SR-125 or a wildland fire originating within the native wildland areas further south of the Project site.
- **Scenario 3:** A summer, on-shore fire (50th percentile weather condition) burning through moderate-load grass and grass-shrub/chaparral dominated vegetation within the soon to be graded areas west of the village 7 project site. The terrain is relatively flat-sloped (approximately 10% slope) with potential ignition sources from a car and/or structure fire originating within the existing residential communities further to the west/northwest.
- **Scenario 4:** A summer, on-shore fire (50th percentile weather condition) burning through moderate- to-high-load grass-shrub/chaparral dominated vegetation within the manufactured slopes and drainage along the northern property boundary. The terrain is flat (approximately 4% slope) with potential ignition sources (although highly unlikely given the surrounding residential communities) from a car and/or structure fire originating within the existing residential communities to the north/northwest.

4 Fire Behavior Modeling Results

The results presented in Tables 4 and 5 depict values based on inputs to the BehavePlus software and are not intended to capture changing fire behavior as it moves across a landscape. Changes in slope, weather, or pockets of different fuel types are not accounted for in this analysis. For planning purposes, the averaged worst-case fire behavior is the most useful information for conservative fuel modification design. 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.

As presented in Table 4, a worst-case fire under gusty Santa Ana winds and low fuel moistures adjacent to the Project site is expected to be primarily of moderate intensity through the moderate- to- high-load grass-shrub/chaparral dominated vegetation within the manufactured slopes and drainage along the northern property boundary. Please note that the areas surrounding this portion of Village 7 include irrigated manufactured slopes and highly fire resistive single-family residential homes, so the likelihood of a fire originating in this area is very low, however, when modeled, worst-case fire behavior under peak weather conditions (represented by Fall Weather, Scenario 1) is anticipated to be a wind-driven fire from the north/east/southeast during the fall. Under such conditions, modeled surface flame length have the potential to reach approximately 41 feet during wind speeds of 50+ mph. Under this scenario, fireline intensities have the potential to reach 18,341 BTU/feet/second with moderate spread rates of 6.2 mph and could have a spotting distance up to 2.3 miles away.

Furthermore, wildfire behavior through the moderate- to- high-load grass-shrub/chaparral dominated vegetation within the manufactured slopes and drainage along the northern property boundary being fanned by 12 mph sustained winds, from the west/northwest, pushed by on-shore ocean breezes typically exhibit less severe fire behavior due to lower wind speeds and higher humidity. Under typical onshore weather conditions, a surface vegetation fire could have potential flame lengths between approximately 3 feet and 11 feet in height and spread rates between 0.2 and 0.5 mph. Spotting distances, where airborne embers can ignite new fires downwind of the initial fire, range from 0.1 to 0.4 miles.

As depicted in Table 5, post development fire behavior expected in the irrigated and replanted with plants that are acceptable with the Chula Vista Fire Department (FMZ Zones 0 and 1 – FM8), as well as in an area with manufactured slope areas (FMZ Zone 2 – Gs1) under peak weather conditions experience a significant reduction in flame length and intensity. Fuel modification would result in approximately 12 feet at the outer edges of the FMZ (Zone 2) and to approximately 3 feet by the time the inner portions of the FMZ (Zones 0 and 1) are reached. During on-shore weather conditions, a fire approaching from the west/northwest towards the development footprint would have low fire intensity and spotting distances due to the higher live and dead fuel moisture contents. These reduction of flame lengths and intensities are assumed to occur within the fuel modification that is achieved on site. Therefore, the FMZs proposed for the Project are approximately 2.5-times the flame length of the worst-case fire scenario under peak weather conditions in the moderate- to- high-load grass-shrub/chaparral dominated vegetation within the manufactured slopes and drainage along the northern property boundary and approximately 8 to 10 times the flame lengths within the development footprint and would provide adequate defensible space to augment a wildfire approaching the perimeter of the Project site.

Table 4: RAWS BehavePlus Fire Behavior Model Results – Existing Conditions

Fire Scenarios	Flame Length[1] (feet)	Fireline Intensity[1] (BTU/feet/second)	Spread Rate[1] (mph[2])	Spotting Distance[1] (miles)
Scenario 1: 4% slope; Fall Santa Ana winds (97th percentile) – Pre-FMZ (N/NE of Project site)				
Moderate-load shrubs (Sh2)	7.4' (15.1')[3]	447 (2,075)	0.2 (0.9)	0.3 (1.1)
High-load shrubs (Sh5)	22.3' (41.2')	4,832 (18,341)	1.6 (6.2)	0.7 (2.3)
Scenario 2: 3% slope; Fall Santa Ana winds (97th percentile) – Pre-FMZ (SE of Project site)				
Sparse-load grasses (Gr1)	3.1' (3.1')[3]	67 (67)	0.5 (0.5)	0.2 (0.4)
Scenario 3: 10% slope; Summer on-shore winds (50th percentile) – Pre-FMZ (W/SW of Project site)				
Moderate-load grasses (Gr4)	7.9'	514	0.8	0.3
Moderate-load shrubs (Sh2)	1.3'	11	0.0	0.1
Moderate-load grass-shrub (Gs2)	3.2'	73	0.2	0.1
Scenario 4: 4% slope; Summer on-shore winds (50th percentile) – Pre-FMZ (NW of Project site)				
Moderate-load shrubs (Sh2)	1.4'	11	0.0	0.1
High-load shrubs (Sh5)	11.5'	1,154	0.5	0.4
Moderate-load grass-shrub (Gs2)	3.3'	74	0.2	0.1

Note:
1. Wind-driven surface fire.
2. MPH=miles per hour.
3. Spotting distance from a wind driven surface fire; it should be noted that the wind mph in parenthesis represent peak gusts of 50 mph

Table 5: RAWS BehavePlus Fire Behavior Model Results – Post Project Conditions

Fire Scenarios	Flame Length[1] (feet)	Fireline Intensity[1] (BTU/feet/second)	Spread Rate[1] (mph[2])	Spotting Distance[1] (miles)
Scenario 1: 4% slope; Fall Santa Ana winds (97th percentile) – Pre-FMZ (N/NE of Project site)				
Fuel modification zones 0 and 1 (FM8)	1.7' (2.6')	19 (46)	0.1 (0.1)	0.1 (0.3)
Fuel modification zone 2 (Gs1)	6.1' (12.1')[3]	291 (1,283)	0.5 (2.4)	0.3 (1.0)
Scenario 2: 3% slope; Fall Santa Ana winds (97th percentile) – Pre-FMZ (SE of Project site)				
Fuel modification zones 0 and 1 (FM8)	1.7' (2.6')	19 (46)	0.1 (0.1)	0.1 (0.3)
Fuel modification zone 2 (Gs1)	3.1' (3.1')[3]	67 (67)	0.5 (0.5)	0.2 (0.4)
Scenario 3: 10% slope; Summer on-shore winds (50th percentile) – Pre-FMZ (W/SW of Project site)				
Fuel modification zones 0 and 1 (FM8)	1.0'	5	0.0	0.1
Fuel modification zone 2 (Gs1)	1.3'	11	0.1	0.1
Scenario 4: 4% slope; Summer on-shore winds (50th percentile) – Pre-FMZ (NW of Project site)				
Fuel modification zones 0 and 1 (FM8)	1.0'	5	0.0	0.1
Fuel modification zone 2 (Gs1)	1.3'	11	0.1	0.1

Note:
1. Wind-driven surface fire.
2. MPH=miles per hour.
3. Spotting distance from a wind driven surface fire; it should be noted that the wind mph in parenthesis represent peak gusts of 50 mph

The following describes the fire behavior variables (Heisch and Andrews 2010) as presented in Tables 4 and 5:

Surface Fire:

- Flame Length (feet): The flame length 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.
- Fireline Intensity (Btu/ft/s): Fireline intensity is the heat energy release per unit time from a one-foot wide section of the fuel bed extending from the front to the rear of the flaming zone. Fireline intensity is a function of rate of spread and heat per unit area, and is directly related to flame length. Fireline intensity and the flame length are related to the heat felt by a person standing next to the flames.
- Surface Rate of Spread (mph): Surface rate of spread is the "speed" the fire travels through the surface fuels. Surface fuels include the litter, grass, brush and other dead and live vegetation within about 6 feet of the ground.

The information in Table 6 presents an interpretation of the outputs for five fire behavior variables as related to fire suppression efforts. The results of fire behavior modeling efforts are presented in Tables 4 and 5.

Table 6: Fire Suppression Interpretation

Flame Length (ft)	Fireline Intensity (Btu/ft/s)	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 to 8 feet	100-500 BTU/ft/s	Fires are too intense for 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 to 11 feet	500-1000 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 1000 BTU/ft/s	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

SOURCE: Google Aerial Map, 2022

DUDEK

BehavePlus Fire Behavior Analysis Map

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