PRESIDIO FIRE RISK ASSESSMENT AND MANAGEMENT PLAN

THE PRESIDIO TRUST

SAN FRANCISCO, CA

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PREPARED BY WILDLAND
RESOURCE MANAGEMENT
RENO, NV

Executive Summary

In 2018, the Presidio Trust (Trust) commissioned Wildland Resource Management, Inc. to analyze the Presidio's potential fire risk and develop a fire management plan. Based on the local weather patterns in the Presidio, and an analysis of fire behavior, our consultant determined that **the fire risk in the Presidio is low.**

The Trust is taking the following measures to further reduce and manage fire risk in the Presidio:

- Maintaining defensible space around structures. The Trust is in the process of implementing CALFIRE Defensible Space Guidelines along the park's boundary.
- Reducing vegetation around power lines. In 2019, we cleared the entire overheard powerline system of at-risk vegetation. We will continue to clear and protect powerlines on routine basis. We researched undergrounding power lines and determined it to be cost-prohibitive.
- Reducing ground fuels and ladder fuels by clearing underbrush in the forest. In 2019, we cleared three acres of ground and ladder fuels in targeted locations. In 2020, we cleared an additional four acres of ground and ladder fuels, and we reduced the density of six acres of trees and eliminated lower limbs to reduce ladder fuels.
- Requiring permits for all "hot work," whether done by contractors or Trust staff.
- Conducting annual fire inspections of structures and fire detection systems.

In addition to these important preventive measures, the Trust contracts for fire response services with the San Francisco Fire Department (SFFD), who have a fire station in the Presidio and have a mutual aid agreement with San Francisco. This means that the Presidio has access to the entire SFFD to respond to fire incidents. As a result, response time to incidents is less than 7 minutes in the park.

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I – SUMMARY

Safeguarding the Presidio of San Francisco from wildfire is essential. Many important values need protection. The most important of these are the employees and visitors on the site. Additional values within the Presidio include many unique and some historic facilities, important aesthetic values, and habitat for wildlife species. High-value residences adjacent to the Presidio create a need for wildland/urban interface fire management. Ultimately, the Wildland Fire Management plan's objective is to understand the Presidio's fire risk and develop actions and best practices, supported by evidence-based data, to effectively and efficiency reduce risk.

This Wildland Fire Management Plan considers the values at risk, while providing a framework for implementing a wildland fire program. This plan analyzes the level of risk posed by wildland fire and the range of potential fire behavior in order to provide recommendations regarding fire suppression. The plan also provides information about and the preparedness actions that can be taken to diminish the risk and consequences of wildland fires, including fuel reduction programs. This plan considers fire suppression activities as well as immediate post wildfire actions that are needed to minimize the threat to life and prevent unacceptable degradation to the natural and cultural resources at the Presidio.

II – INTRODUCTION

The Presidio of San Francisco is unique; a park on a former military post, which now combines opportunities for the public to explore history, culture and nature in the midst of a densely populated urban area. The interior of the park is managed by the Presidio Trust (Trust) which was created by Congress to preserve 1,168 acres of the Presidio (Area B); the National Park Service's Golden Gate National Recreation Area (GGNRA) manages the remainder of the area (Area A).

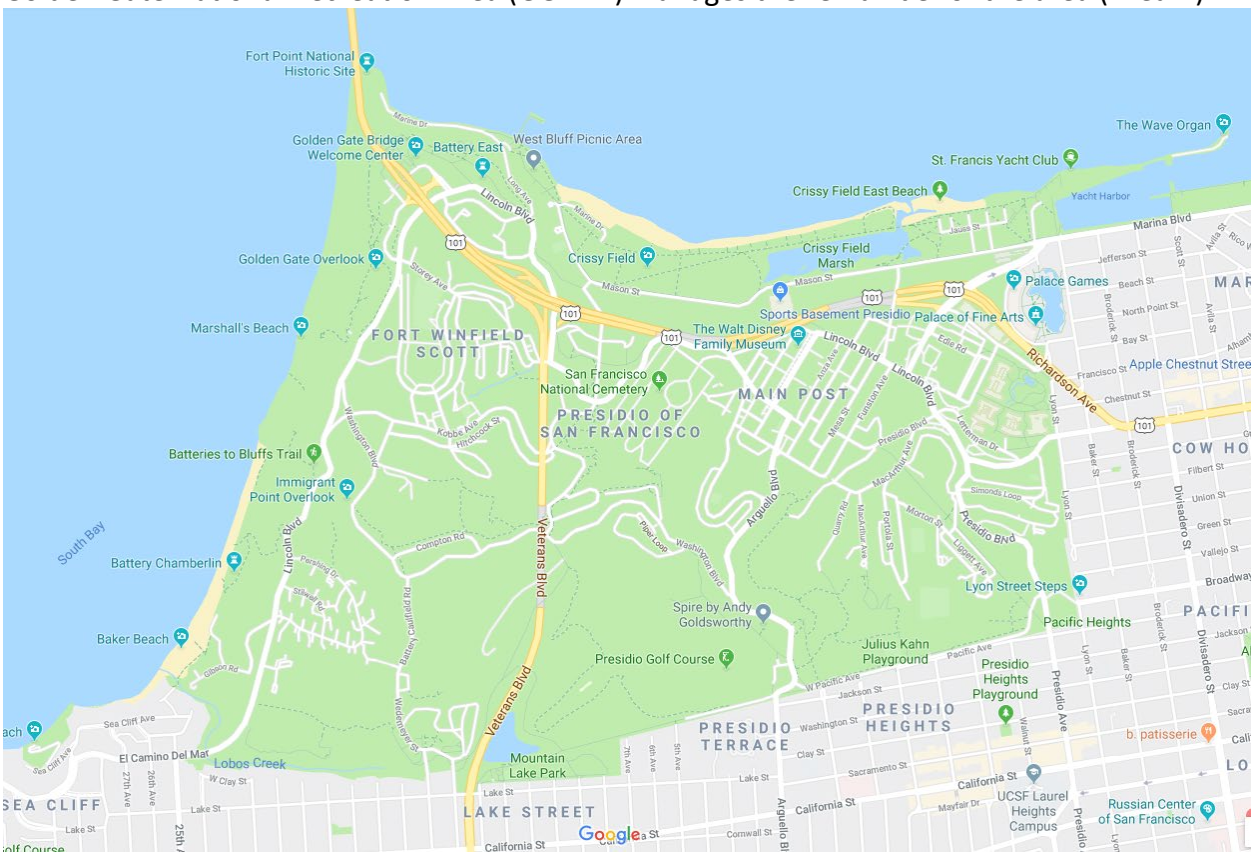

Figure 1. Location of the Presidio from https://www.google.com/maps/@37.800195,-122.4666159,15z

The open space of the Presidio is a mixture of natural and historic landscapes, bordered by costly homes. Minimizing the threat of wildfire to the natural and cultural resources of the Presidio, visitors to the park, and the adjacent community, is of concern. It is important to safeguard the Presidio's historic forest, which is a significant landscape characteristic and a haven for visitors: the eucalyptus stands in the historic forest are of particular interest because of fuel accumulation and their flammable characteristics. Also of importance is the protection of the many historic military buildings that contribute to the Presidio's status as a National Historic Landmark District, and the high-value residences adjacent to the Presidio which create a need for wildland/urban interface fire management.

PURPOSE OF THE PLAN

This Wildland Fire Management Plan (WFMP) was prepared by Wildland Res Mgt under contract to the Presidio Trust (Trust). The WFMP provides the justification and foundation of a fire management program for the Presidio. The plan's focus is to provide recommendations for minimizing the threat of wildfire on the interior 1168 acres managed by the Trust, and to outline a methodology for the implementation of these recommendations. It provides specific guidance, procedures, and protocols for the management of wildland fires on all Trust lands.

Wildland fires are a risk to human lives, natural resources, historical and cultural assets. However, wildfires have not been, and do not, present a significant concern at the Presidio due to the cool, humid climate of the area. This WFMP analyzes the level of risks and consequences of wildfire, now and in the future, in order to provide recommendations regarding fire suppression and fire hazard reduction measures. This plan includes an assessment of probable future wildland fire risks associated with climate change. The plan also addresses necessary pre-fire preparations, wildfire control methods, and coordination among multiple fire-fighting entities.

The requirement for a wildland fire management plan is established in the Federal Wildland Fire Management Policy by the statement, "Every area with burnable vegetation must have an approved Fire Management Plan. Fire Management Plans are strategic plans that define a program to manage wildland fires based on the area's approved land management plan."[1]

National Fire Protection Association (NFPA) 1143, Standard for Wildland Fire Management notes that, "The purpose of this standard is to specify management practices and policies necessary for a fire protection organization to develop a wildland fire management program."[2]

POLICY/ORDERS/CONTRACTS

The Federal Wildland Fire Management Policy relates fire management to land use policies: "The Land or Resource Management Plan will define and identify fire's role in the ecosystem. The response to an ignition is guided by the strategies and objectives outlined in the L/RMP and/or the Fire Management Plan."[3]

In addition, the Presidio Trust Act states, "As part of the Golden Gate National Recreation Area, the Presidio's significant natural, historic, scenic, cultural and recreational resources must be managed in a manner which is consistent with sound principles of land use planning and management, and which protects the Presidio from development and uses which would destroy

[1] Guidance for Implementation of Federal Wildland Fire Management Policy, 2009. pg 12.
[2] National Fire Protection Standard 1143, 2009. pg 4.
[3] Guidance for Implementation of Federal Wildland Fire Management Policy, 2009. pg 10.

the scenic beauty and historic and natural character of the area and cultural and recreational resources."[4]

AUTHORITIES

The Presidio Trust is a US Government Corporation. The Trust follows federal codes and statutes unless exclusion is permitted by means of the Presidio Trust enabling legislation (Public Law 104-333: https://www.govinfo.gov/content/pkg/PLAW-104publ333/html/PLAW-104publ333.htm). As a federal agency operating on federal lands, the Trust is not required to adopt or implement state or local codes. In certain cases, state statutes are voluntarily used when federal statute lacks corresponding statutes, such as elevator inspections and childcare facility licensing.

Figure 2. Natural features, restoration activities, and historic facilities in the Presidio Trust.

[4] Presidio Trust Act, as amended through December 28, 2001. per appendix A of the PTMP, pg. 169.

III – RELATIONSHIP TO LAND MANAGEMENT PLANNING AND WILDLAND FIRE POLICY

REFERENCE TO PLANNING AND DOCUMENTS

This section of the document establishes the linkage between higher level planning documents, legislation and policies and the actions described in the Wildland Fire Management Plan. This section identifies in broad programmatic terms the direction found in the land-use planning and management process, such as goals, objectives, and desired future conditions, as they pertain to wildland fire management activities.

THE PRESIDIO VEGETATION MANAGEMENT PLAN

The Presidio Vegetation Management Plan (VMP), published in 2001, is a collaboration between the National Park Service (NPS) and the TRUST, and guides the management of vegetation at the Presidio. Recommendations will be implemented under the VMP and associated Environmental Impact Statement, and in accordance with NEPA. The VMP prescribes that both natural and cultural resources at the Presidio be protected and managed sustainably.

The VMP notes:

> This plan has been developed to guide the NPS and the Trust in the management of vegetation resources at the Presidio. The vegetation resources have both natural and historical significance; both aspects will be protected and enhanced. Central to the plan is the development of sustainable and enduring vegetation that can be managed with less maintenance effort than is currently required, with increased resource sensitivity, and using natural processes whenever possible.[5]

According to the VMP, while fire danger at the Presidio is generally low due to the wet, maritime climate, there are short periods during late summer or fall, when warm, dry winds increase the fire danger.

The VMP further notes that fire hazard is higher in the Presidio's eucalyptus stands due to the fuel accumulation from the trees shedding oil-rich bark, leaves and branches and proposes mitigation for fire hazard by containing Eucalyptus and planting natives to replace Eucalyptus trees and thereby reduce fire hazard.[6]

The VMP specifically addresses fire suppression in the Presidio stating that, "The current practice of suppressing all human-caused fires will continue" and stipulates, "mutual aid agreements with local fire departments are also in place if firefighting needs exceed on-site capabilities. Fire

[5] Presidio Vegetation Management Plan, 2001, Summary, pg. 1.
[6] Ibid., 3.6.1 Existing Policies, pg. 75.

clearances, as recommended by the State of California, continue to be maintained around structures."[7]

The VMP for the Presidio specifies various fuel reduction practices including removing dead material and forest litter, pruning, and mowing. The VMP prescribes that fuel reduction focus on developed areas of the Presidio where fires are most likely to start. The VMP allows for the consideration of using prescribed burning as a management tool on TRUST land in suitable circumstances, including that, "Prescription burns are carefully planned and controlled to meet specific weather, fuel moisture, air quality, and vegetation management requirements. Any plans to use Prescription burning will be reviewed by the public, as well as cooperating agencies."[8]

LOCAL PLANS AND POLICIES THAT APPLY

The 2014 City and County of San Francisco Hazard Mitigation Plan (2014 HMP) states that:

> In 2007, pursuant to state law, CAL FIRE adopted Fire Hazard Severity Zone (FHSZ) maps for State Responsibility Areas (SRAs), the areas in California where the state is financially responsible for the prevention and suppression of wildfires. The maps use a fuel ranking assessment methodology that assigns a rank -- moderate, high, or very high -- based on expected fire behavior for unique combinations of topography and vegetative fuels under a given severe weather condition, including wind speed, humidity, and temperature. CAL FIRE has also developed FHSZ maps for Local Responsibility Areas (LRAs) within California. LRAs include incorporated cities such as San Francisco, where fire protection is typically provided by a city fire department. The LRA fire hazard zone maps developed by CAL FIRE use an extension of the SRA FHSZ model, which reflects flame and ember intrusion from adjacent wildlands and from flammable vegetation in urban areas.9

According to the 2014 HMP, CAL FIRE's current fire hazard map for the City and County of San Francisco (CCSF) shows that the area has no very high fire hazard severity zones and only one small high fire hazard area. The Presidio is designated as a moderate fire hazard zone by the CAL FIRE fire hazard map.[10]

The 2014 HMP concludes that, while probability of wildfire increases dramatically during the dryer times of year (late summer and early fall), "there is no historical record of a wildfire occurring in CCSF. Therefore, the probability of a future wildfire event within CCSF appears to be low to moderate."[11]

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[7] Presidio Vegetation Management Plan, 2001, 3.6.2 Proposed Management Actions, pg. 75.
[8] Ibid., pg. 76.
[9] 2014 City and County of San Francisco Hazard Mitigation Plan, Section 5, pg 56.
[10] Ibid, pg 56.
[11] Ibid, pg 57.

GOALS AND DESIRED CONDITIONS

This section describes site-wide desired condition, goals and objectives. The Federal Wildland Fire Management Policy sets forth the guiding principle that, "Fire Management Plans, programs, and activities support land and resource management plans and their implementation."[12]

The Presidio Trust Management Plan: Land Use Policies for Area B of the Presidio of San Francisco (PTMP) stipulates the following site-wide goals:

- The Presidio will remain an open space haven with its natural, historic, scenic, cultural, and recreational resources preserved for public use and enjoyment.
- Open space and natural habitats will be preserved, enhanced, and increased.
- Over time, the Presidio Trust will reduce the total building area in the park by 360,000 square feet or more, from the 5.96 million square feet that exist today to 5.6 million square feet or less.
- The historic forest will be rehabilitated, wetlands enhanced, and native plant and wildlife species protected.
- The Presidio's National Historic Landmark status will be preserved; any changes within the landmark district will comply with the National Historic Preservation Act and be compatible with the park's setting.
- Public uses will invite and engage visitors to the park; employee housing will perpetuate the historic sense of community.
- Construction will be limited to developed areas, and will be compatible with existing structures.
- The Presidio Trust will discourage automobile use by promoting walking, biking, public transit, and internal shuttle use.
- Public input will continue to be valued in ongoing planning for the Presidio's future.[13]

[12] Guidance for Implementation of Federal Wildland Fire Management Policy, 2009. pg 8.

[13] The Presidio Trust Management Plan: Land Use Policies for Area B of the Presidio of San Francisco (PTMP) Plan Summary, pg ii.

IV – WILDLAND FIRE MANAGEMENT STRATEGIES

All fires that burn natural vegetation on the Presidio Trust are defined as wildland fires. All fires will receive immediate fire suppression actions to minimize the area burned. All wildland fires will also receive suppression actions appropriate to the safety of firefighters; Presidio Trust employees and the public; the resources and values to be protected; the condition of fuels, current and predicted fire behavior; weather; and topography to accomplish the specific suppression objectives for that individual fire.

In addition to fire response, a crucial wildland fire management strategy will be to emphasize pre-fire actions: ignition prevention, attentive fuel management, and fire response preparedness.

GENERAL MANAGEMENT CONSIDERATIONS

This section describes how wildland fire is managed and identifies site-wide considerations, such as interagency partnerships, regional strategies, collaborators, and collaborative processes that are incorporated in wildland fire management strategies.

The primary goals of the Presidio Trust wildland fire management program are to protect human health and safety, protect Presidio Trust facilities, enhance community protection, diminish risk and consequences of wildland fires, and maintain the health of the ecosystem. To accomplish these goals, wildland fires will be managed through suppression strategies. The land management direction is for continued protection of the wildlands and the built facilities on the Presidio. The Presidio Trust will not use wildland fire for resource benefit because the benefit of wildland fire use to the resource is not obvious. Moreover, the use of wildland fire as a management tool is prohibited by the lack of fire management staff, the density of buildings inside the Presidio, and the wildland/urban interface in which the Presidio is situated.

The values to be protected, and their susceptibility to damage or loss by fire, are discussed in more depth in the description of the Fire Management Units.

SITE-WIDE VALUES AT RISK

Many important values need to be protected. The most important of these are the employees and visitors on the site. Additional values include many unique and some historic facilities, important aesthetic values, and habitat for wildlife species.

ADJACENT VALUES AT RISK

Adjacent values at risk reinforce the need for immediate fire containment. The Presidio sits next to an urban environment with areas of high-value residential structures, historic buildings, well-used recreational facilities, and more.

Figure 3. Adjacent residential/commercial values at risk from wildfire

Figure 4. Example of residential values adjacent to the Presidio Trust

Table 1. Examples of residential values at risk from wildfire

WILDLAND FIRE MANAGEMENT GOALS AND OBJECTIVES

The intent of this section is to develop and list wildland fire management goals. These goals provide the programmatic direction for the wildland fire program and should be stated within the context of the approved land-use planning and management process direction.

The wildland fire management goals provide the programmatic direction for the wildland fire program at the Presidio Trust. They are intended to provide safe and effective implementation of the fire management plan.

The goals are based on the site-wide considerations. Because the wildlands in the Presidio Trust site are situated in an urban setting, goals focus on wildland/urban interface fire management.

The goal of wildland fire management would be to protect and enhance the site's natural and visual resources, including native habitats, riparian areas, and mature tree stands, by focusing future development primarily within the already developed areas of the site.

The objectives of wildland/urban interface fire management are (1) to facilitate fire prevention and protection and minimize fire loss and damage to structures, other human development, and wildland resources; (2) to prevent a structure fire from spreading into wildland fuels; and (3) to encourage property owners and occupants to take an active role in establishing and maintaining their own fire prevention and safety measures in the wildland/urban interface. Figure 3 depicts the management area within the Presidio.

The strategy is to suppress the fire immediately and to manage fuels surrounding buildings, and infrastructure to limit ignition or structures and prevent ember production and distribution.

An additional strategy is to manage fuels to limit wildland fire intensity and spread. This strategy serves to protect lives and property when fires burn in the Presidio and when a fire burns in the near vicinity. The vegetative and structural fuels have been managed such that suppression can be achieved efficiently, minimal damage will occur, and production of embers will be prevented.

Several strategies have been established to reduce the fire hazard: reduce fuel volumes, reduce fuel flammability, establish/maintain fuel discontinuity, and reduce the possibility of fire traveling through tree crowns. All are goals for modifying fire behavior and are applied site-wide.

The following areas are highest in priority for treatment:

a) Areas next to buildings;
b) Major egress and emergency ingress routes; and
c) Areas of vegetative fuel accumulation.

Figure 5. Areas next to buildings is a high priority for treatment

V – WILDLAND FIRE PROGRAM COMPONENTS

The components of Presidio Trust's wildland fire program consist of elements that address ignition prevention, pre-fire preparedness, fire response, and recovery. The program includes a monitoring process that provides feedback for refinement.

GENERAL IMPLEMENTATION PROCEDURES

Implementation of the components of the wildland fire management program at the Presidio will be consistent with fire management capabilities and will consider the current and predicted conditions affecting fire behavior.

This section describes the range of fire behavior – which is generally benign – on the Presidio Trust lands. Activities that staff and the SFFD take on the Presidio to prepare for the fire season are presented. These include staff-training, interagency coordination, community education, detection, prevention, inspection and testing. The Presidio Trust has developed a prudent and considered approach to each of these elements. The process of fire suppression – from initial attack to extended actions – is detailed in this section. The Presidio Trust uses contract fire responders and participates in a robust mutual aid agreement to provide additional resources when needed.

WILDLAND FIRE SUPPRESSION

The Presidio Trust wildland fire management program covers ignition prevention, fuel management, fire preparedness and response, as well as rehabilitation of burned areas. Because the Presidio Trust is situated in the wildland urban interface, wildlands are seen in the context with structures and vital infrastructures.

RANGE OF POTENTIAL BEHAVIOR

Trust facilities are at risk from both on-site and off-site wildland fuels. The hazard from vegetative fuels takes several forms:

a) Fuels which produce enough heat to make firefighting untenable, shatter windows and/or ignite building exteriors
b) Embers (numbering thousands) which each potentially start new fires. These are lofted and land on ignitable grass and congregate in building crevices
c) Highly flammable ("flashy" fuels) such as dry grass, Eucalyptus litter, and French broom, which are the likely to start numerous new fires from embers and a vector of fire to less ignitable fuels

There are many ways to assess fire hazard. Most utilize the three main factors of fuels, weather and topography, with possible inclusions of elevation, or fire history. Fire behavior integrates the effects of fuels, weather, topography. Fire behavior predictions also denote where containment areas may be easiest, and where access may be precluded during a fire. Fire behavior outputs also can warn where natural resources may be unduly harmed by a wildfire and where it may be inconsequential to natural resources.

A fire behavior model called FlamMap was used for this wildfire hazard assessment. FlamMap is an updated version of the BEHAVE-type model outputs of the fire behavior prediction system to assess current relative hazard throughout the Presidio Trust.

FlamMap is a computerized fuel and fire behavior prediction model developed by the USDA Forest Service at the Intermountain Forest Fire Research Laboratory. The heat transfer formulas in FlamMap are based on the software program BEHAVE, used in wildfire behavior prediction since the 1970s. FlamMap allows prediction of fire behavior on a spatial basis, portraying the locations of various flame lengths, heat release, and rate of spreads along with type of fire (crown fire, surface fire, or a fire that torches trees).

The types of data FlamMap uses describe the terrain, weather, and fuels on the site. To model a fire a number of data themes must be developed for the FlamMap program. These include slope, elevation, aspect, fuel model, tree height, height to live tree canopy base, tree crown density, as well as weather and wind speed and direction.

Flame length is often correlated to the ability to control a fire. A flame length of eight feet is usually looked at as a cut-off point for strategic firefighting decisions on whether to attack the fire directly, or instead attempt control through indirect methods. Attacking the fire directly involves efforts to slow the flaming front at its head – where it is advancing fastest. Indirect attack involves fire control methods on the fire's flank or well ahead of the fire (using backfires or retardants).

High flame lengths are well correlated to structural damage. Fire intensity (a.k.a. flame length) was determined to be the most important factor in many studies of structural damage from fire. Flame lengths are often used as a proxy for fire intensity because they are highly correlated to fire intensity.

Crowning activity indicates locations where fire is expected to travel into and possibly consume the crowns. When a fire burns through tree crowns, countless embers are produced and are distributed, sometimes at long distances. These embers can start new fires, which can each grow and confound the finest fire suppression forces.

Hot fires create embers that loft ahead of the flaming front that ignite new fires called "spot fires". "Spotting potential" and "crowning potential" describe the propensity of vegetation to create and disburse embers that have the potential to start countless new fires well in advance of the main fire.

Wildland Fuels

A quantitative method for predicting fire behavior is based on mathematical models that require descriptions of fuel properties as inputs.

The VMP relates that the amount of fuel on the ground at the Presidio has increased over time. Fire threat is increasing in areas that have undergone less fuel modification.[14]

In 2018, Wildland Res Mgt mapped the wildland fuel characteristics and vegetation types. Wildland fuel characteristics include the Presidio site's surface fuel model and canopy fuel properties. Surface fuel models describe the vegetation in terms of fuels that might carry a fire near the ground and do not include foliage or other fuels in the tree canopy. The collections of fuel properties have become known as fuel models.

While the vegetation within the Presidio Trust has been mapped in a variety of ways, wildland fuel characteristics have not been mapped. The important characteristics are:

- surface fuel model
- canopy cover (absolute cover)
- crown density
- height to live crown
- tree height

Landfire, a nation-wide database that includes these characteristics did not accurately represent the condition on the Trust lands, so a variety of analyses were conducted to better portray the fuels.

Initial Data Layers Investigated

- Vegetation layers of The Presidio
    - City data – LiDAR based, very detailed boundaries but broad categorization
    - Jones and Stokes – accurate categorization, but gross boundaries
    - CalVeg – broad categories and gross boundaries
- LANDFIRE
    - Raster-based (pixelated)
    - Fuel models inaccurate in wildland-urban interface (WUI)

The best characterization resulted from using city data polygons and categorizing them into fuel models. The fuel models used LANDFIRE data as a guide.

[14] Ibid.

FBFM40	Acres	Percent	Description
NB1	334.4	22%	Urban
NB8	14.2	1%	Water
NB9	96.2	6%	Barren
GR1	421.5	28%	Short, sparse dry climate grass is short, naturally or heavy grazing, predicted rate of fire spread and flame length low
GS2	57.7	4%	Low load, dry climate grass-shrub shrub about 1 foot high, grass load low, spread rate moderate and flame length low
SH4	1.8	<1%	Moderate load, humid climate shrub, woody shrubs and shrub litter, possible pine overstory, fuelbed depth 2-3 feet, spread rate and flame low
SH5	41.9	3%	Low load, humid climate timber shrub, woody shrubs and shrub litter, low to moderate load, possible pine overstory, fuelbed depth about 3 feet, spread rate high and flame moderate
SH9	0.5	<1%	Very high load, humid climate shrub, woody shrubs and shrub litter, dense finely branched shrubs with fine dead fuel, 4-6 feet tall, herbaceous may be present, spread rate and flame high
TU1	19.7	1%	Low load dry climate timber grass shrub, low load of grass and/or shrub with litter, spread rate and flame low
TU2	215.8	14%	Moderate load, humid climate timber-shrub, moderate litter load with some shrub, spread rate moderate and flame low
TU3	33.7	2%	Moderate load, humid climate timber grass shrub, moderate forest litter with some grass and shrub, spread rate high and flame moderate
TL1	104.6	7%	Low load compact conifer litter, compact forest litter, light to moderate load, 1-2 inches deep, may represent a recent burn, spread rate and flame low
TL2	142.8	10%	Low load broadleaf litter, broadleaf, hardwood litter, spread rate and flame low
TL3	8.9	<1%	Moderate load conifer litter, moderate load conifer litter, light load of coarse fuels, spread rate and flame low

Table 2. Description of Vegetative fuels and acreage and percent of each.

Surface fuels along with canopy fuel characteristics (canopy cover, height to live crown base, and tree height) were mapped using

In late 2018, no recent vegetation or fuel model mapping had been done on The Presidio. However, three sources of vegetation were available as candidates to crosswalk to fuel models described in the technical report: *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model* (Scott & Burgan, 2005).

The first data layer considered was a data layer prepared by Jones and Stokes in the late 1990s. However, while the vegetation classification was accurate, the polygon boundaries were a gross approximation to the actual location. In addition, only specific tree groves and areas were mapped, leaving other areas on The Presidio unmapped.

The second data layer we considered was CalVeg. CalVeg is a set of U.S. Forest Service standards and procedures that have been established at the national and regional levels to classify vegetation. The Region 5 CALVEG classification system conforms to the upper levels of the National Vegetation Classification Standard (USNVC) hierarchy as it currently exists (USFS, 2019).

While this vegetation classification completely mapped The Presidio, the spatial resolution was quite large and the vegetation types too broad to be useful at the scale we were interested in. In addition, much of The Presidio was mapped as urban (light gray in image above).

The third data layer we considered was the Landcover layer derived from San Francisco's city-wide LiDAR[1]. While this layer has incredibly detailed and accurate landcover boundaries (including vegetation), no vegetation classification was employed, other than the initial tree, shrub, grass binning of LiDAR points. However, these boundaries would become the basis of our fuel model layer due to their accurate representation of vegetation boundaries.

Another additional layer we considered was the hazard tree inventory layer maintained by The Presidio staff. While this was only a point layer of select individual trees, it was thought it could help determine fuel model characteristics.

And finally, we downloaded the fuel model layer available through LANDFIRE. LANDFIRE is a nationwide program that provides geo-spatial layers such as vegetation and fuels in support of wildland fire management (USGS, 2019). The data from LANDFIRE heavily relies of CALVEG and similar data inputs. In addition, since we had finer scale data (the Landcover data derived from LiDAR), we did not want to limit our analysis to LANDFIRE's 30m resolution data. Therefore, we utilized this layer only as a guide to inform our classification decisions.

After our data investigation, we based our fuel model on the Landcover boundaries, initially assigning fuel models based on LANDFIRE data and tree data provided by The Presidio. In general, we used the following decision rules to assign fuel models and other canopy characteristics:

Broad Vegetation Type:	Decision Rule	Fuel Model	Percent Canopy	Stand Height	Canopy Base Height	Canopy Bulk Density
				meters*10	meters*10	kg/m3*100
Asphalt	none	91	0	0	0	0
Concrete	none	91	0	0	0	0
Water	none	98	0	0	0	0
Bare Soil	none	99	0	0	0	0
Grass	none	101	0	0	0	0
Scrub	If near grass	122	0	0	0	0
	If near trees	145	0	0	0	0
Trees	Eucalyptus	189	65	180	10	8
	Monterey Cypress	182	35	180	100	1
	Monterey Pine	183	65	180	10	16
	Mixed	187	55	180	8	11

Table 3. Modifications of fuel types

A draft was produced and field checked. Some changes were made to the shrub models based on field observations. Additional decision rules were as follows:

- East of Highway 1
  - If formerly 187, changed to 181
  - If formerly 189, changed to 182
- West of Highway 1
  - If formerly 189, changed to 162
  - If formerly 187, changed to 163
- Where restoration sites (plantation) have been identified, change to 161
- Assign the following to all 161: CC 40%, SH 120, CBH 8, CBD 20
- Willow patch assigned 149 – increased live herbaceous and live woody fuel moisture content

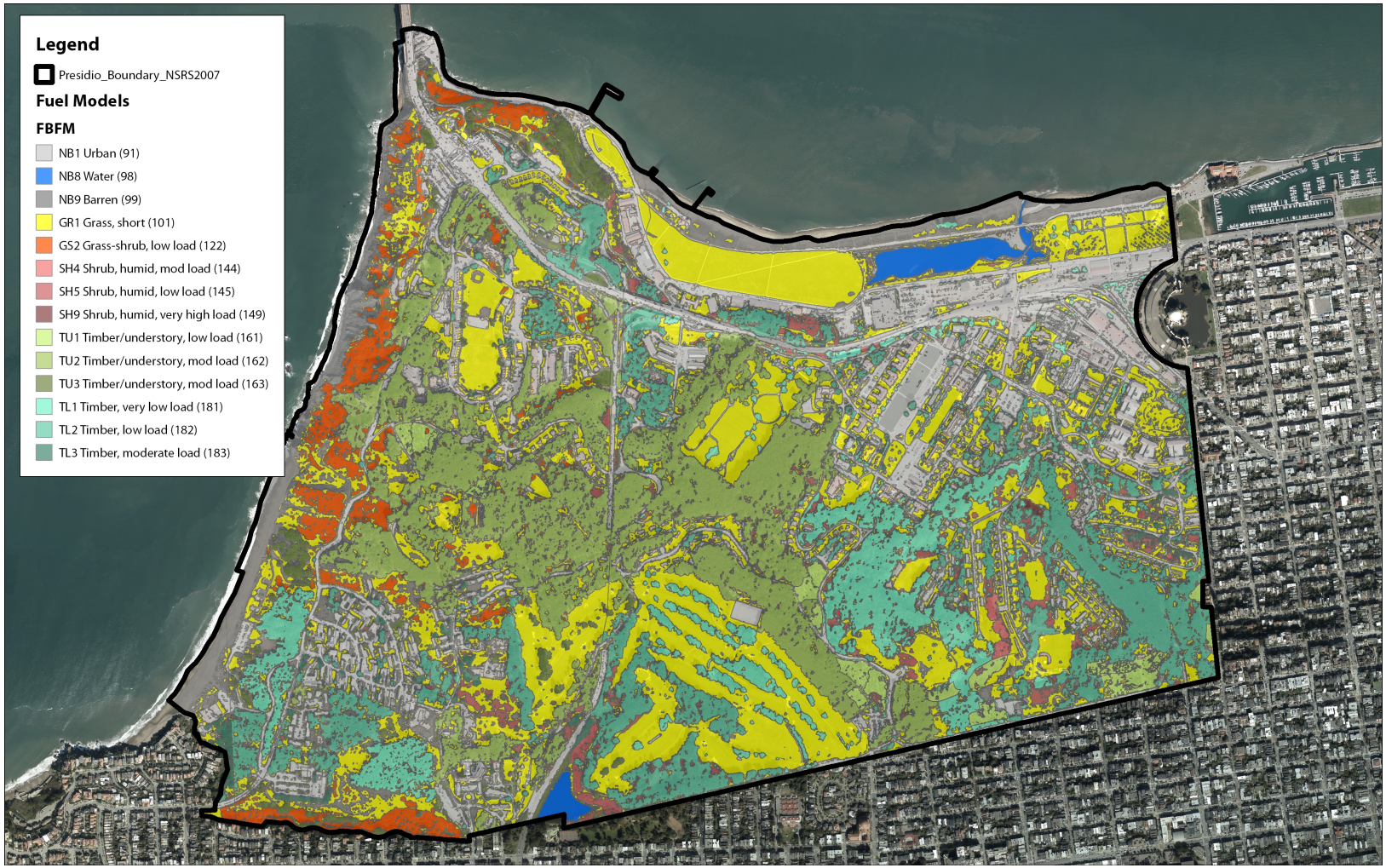

Figure 6. Map of surface fuel models in the Presidio Trust.

Additional modifications were made to further refine the fuel models:

- Changed shrub model around Mountain Lake from 145 (dry shrub, high fuel load) to 148 (humid shrub, high fuel load)

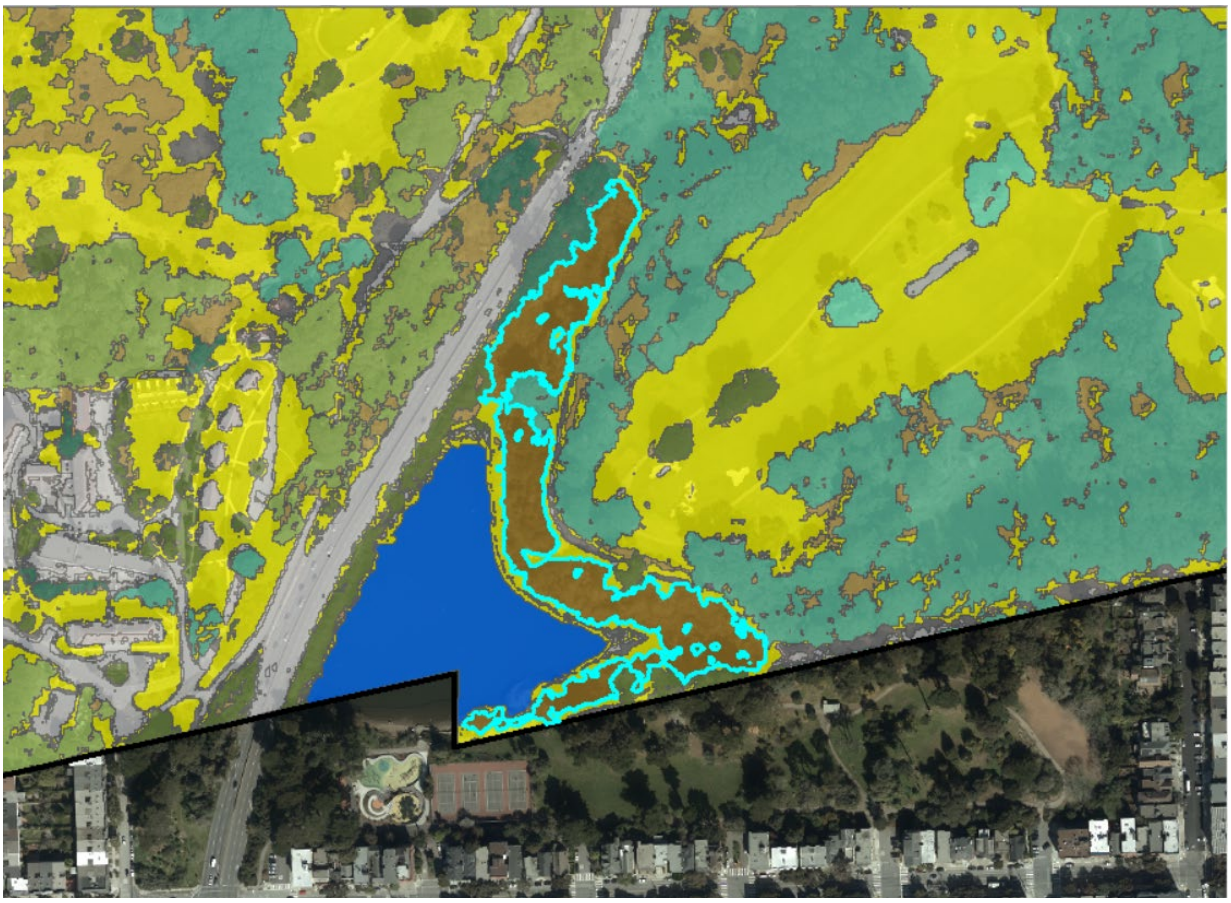

Figure 7. Refinement of fuel models to more the fuel map more accurate

Weather

The weather-related input necessary for fire behavior prediction comes in two forms: The weather during the simulation and the fuel moisture at the beginning of and during the simulation.

The value for these inputs were based on a weather analysis (see Appendix A).

The warmest months are in September and October, with the hottest temperature recorded being 87 degrees (on September, 2016). Ninety-five percent of all observed temperatures were cooler than 70 degrees Fahrenheit. while the

Diablo winds do not occur on the Presidio because it is surrounded by the ocean and Bay, and because it is not downslope form a mountain range. During the fire season, 90 percent of all observations were slower than 8 miles per hour. Average wind speeds from August to October were also less than 10 miles per hour.

Relative humidities were consistently high. The lowest recorded was 16%, which occurred in October.

Fuel Moisture

- Initial Fuel Moisture file (.fms) derived from on-site readings
- Adjusted using Spring Valley as an example
- Fuel moisture sampling and determination of inputs is shown in Appendix B

Refinements

New file based on lowest 10-hr fuel moisture recorded on the Presidio (10%)
All fuel models except willows and shrubs around Mountain Lake were set to the following:

- 1hr 9%
- 10 hr 10%
- 100 hr 11%
- Live herbaceous 100%
- Live woody 100%
- Shrubby areas of willows and Mountain Lake were set to the same as above except Live herbaceous and Live woody were increased to 150%

Fuel Category	Percent Fuel Moisture (wet, previous model)	Percent Fuel Moisture (dry, current model)
1hr	17	9
10hr	19	10
100hr	20	11
Live herb	150	100
Live woody	150	100

Table 4. Fuel moistures used in FlamMap fire behavior predictions.

- Only the fuel moisture file is used, no conditioning using weather or wind files
- Foliar moisture content set to 100%
- Outputs chosen include Rate of Spread, Flame Length, and Crown Fire Activity

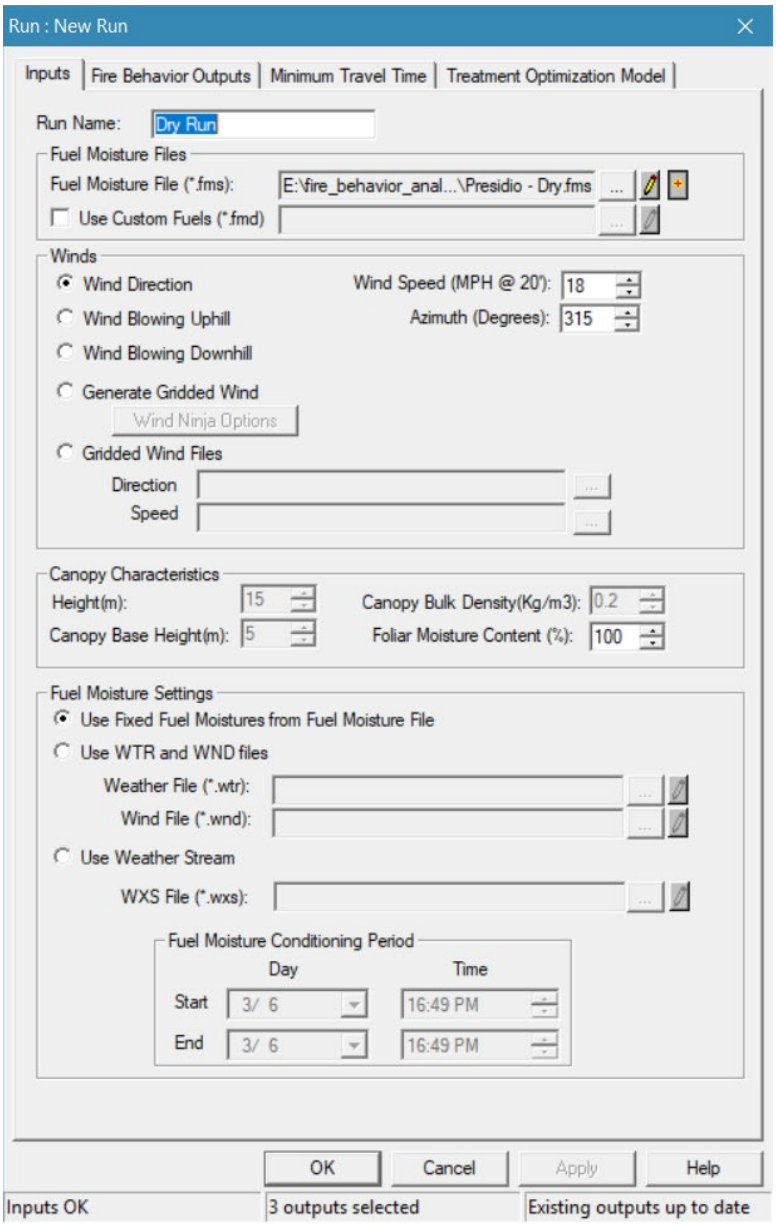

Figure 8. Weather used a basis of fire behavior predictions in FlamMap – Dry Run

Weather During Simulation

- Wind speed set to highest observed reading for the month of August (for all years) – 22 mph
- Wind direction set to dominate direction for the month of August (for all years) – North
- Weather (.wtr) and Wind (.wnd) files were generated from the FOSSEN weather station for August, September, and October (2016). These were used to condition the fuel moisture readings.

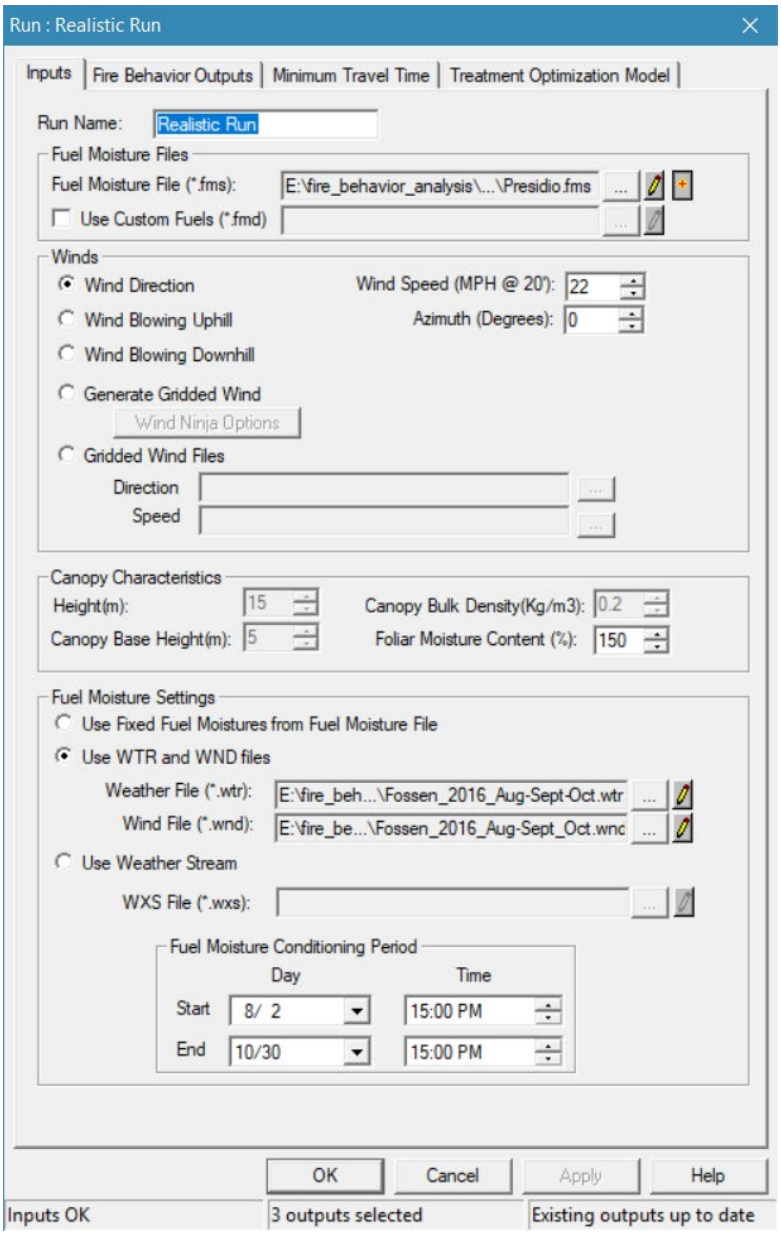

Figure 9. Weather used a basis of fire behavior predictions in FlamMap – Realistic Run

- Used the hottest temperature recorded on the Presidio (91°F on 9/25/2016 at 1330)
- Used the driest relative humidity recorded on the Presidio (12% on 10/5/2013 at 1530)
- Used the highest wind speed recorded on the Presidio (18mph on 11/30/2014 at 1100)
- Used the predominate wind direction recorded on the Presidio (NW)

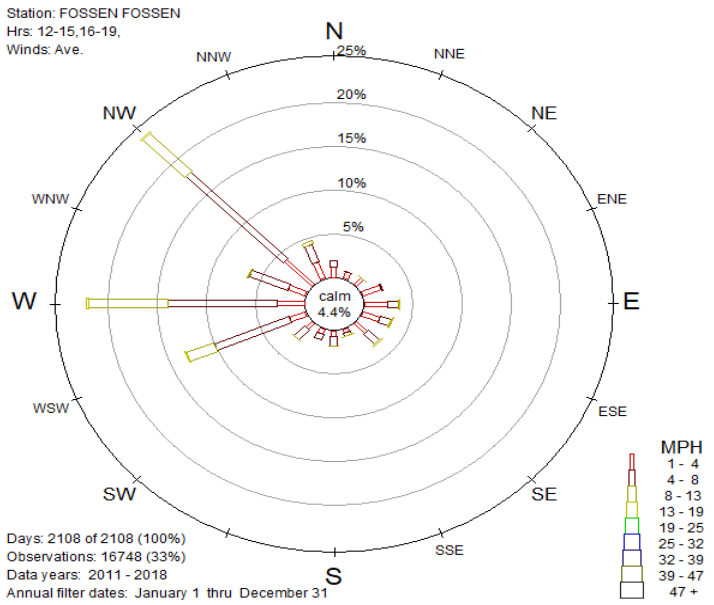

Figure 10. Distribution of wind directions

Expected Fire Behavior

Wildland fire is a rare occurrence on the Presidio.

Figure 8 is a map of the expected fire behavior for each of the fuel models represented on the Presidio Trust managed lands. This figure shows that vegetation fuel risks are generally well mitigated for asset survival. The wildland fire hazard assessment found that the overall level of wildland fire hazard is low, both as a result of a concentrated vegetation management program implemented over the last decade, and the cool moisture climate within the Presidio. Stands of trees have been thinned, lower branches have been pruned from trees, and shrubs have been removed. Grass is mowed or grazed annually. In specific locations, forestlands and shrublands have been restored, resulting in young, vibrant vegetation not prone to ignite.

Wildfires are expected to burn with low intensity even under the worst fire weather conditions observed. Small areas of longer flames can be expected in shrubby areas under extremely hot, dry weather but with very few exceptions, these locations are located well away from buildings.

Eucalyptus stands continue to pose some danger of burning with moderate intensity, and will continue to require maintenance. In addition, some small areas of shrubs intermixed with hardwoods, can be expected to burn with higher intensity. However, in both situations, these areas of potentially higher fire intensity would only spread into areas that would burn with more calm fire behavior. Therefore, any high intensity fire behavior would be isolated by areas of low intensity or unburnable areas. Such wildland fires are not likely to travel far before reaching barriers such as roads, parking lots, or mowed grass. In addition, any embers that might be

produced in these areas would fall into locations that are unburnable or that would burn with flames shorter than three feet, which can be extinguished quickly and easily.

Figure 11. Eucalyptus with litter that would be expected to burn with moderate intensity.

Initial FlamMap Run

Flame Length

- Flame length is important because it is what we observe on a fire and is directly linked to suppression tactics
- The lower the flame length, the easier it is to suppress a fire
- Predicted flame length on The Presidio is very low, less than 4 feet (shown in yellow)
- However, there are some pockets of higher activity (shown in orange) – mostly in shrub models 145 and 149
- Areas of grass and shrub burn with flames of 4-8 ft length
- Grass is assumed to be dry (extreme assumption)
- Few pockets of long flames

Rate of Fire Spread

- Similar to flame length, rate of spread is also easily observable on a fire and is directly linked to suppression tactics
- The lower the rate of spread, the easier it is to suppress a fire
- The predicted rate of spread on The Presidio ranges from 1 ft/min to over 44 ft/min.
- The lowest rates occur in fuel models 101 (wet grass) and 181 (closed canopy trees).
- The highest rates occur in fuel models 162 (shrub/tree) and 145 (shrubs)
- Fire in dry grass spreads quickly
- Shrubby areas spread extremely quickly, but are bounded by areas of slow spread rate

Figure 12. If aflame, fire in patches of shrubs can be expected to spread quickly

Crown Fire Potential

- Crown fire activity is an indication of spotting (fires starting from ember transfer) which is a key component to a fire's spread
- Due to the moist conditions found on The Presidio, crown fire activity is not predicted anywhere within the modeled area.
- No crown fire potential
- No long-distance ember-cast
- Treed areas are not high hazard

Figure 13. Because of high foliar moisture, crown fires are not expected.

Figure 14. The lack of fuels on and near the ground prevents crown fires

Refined Fire Behavior Runs

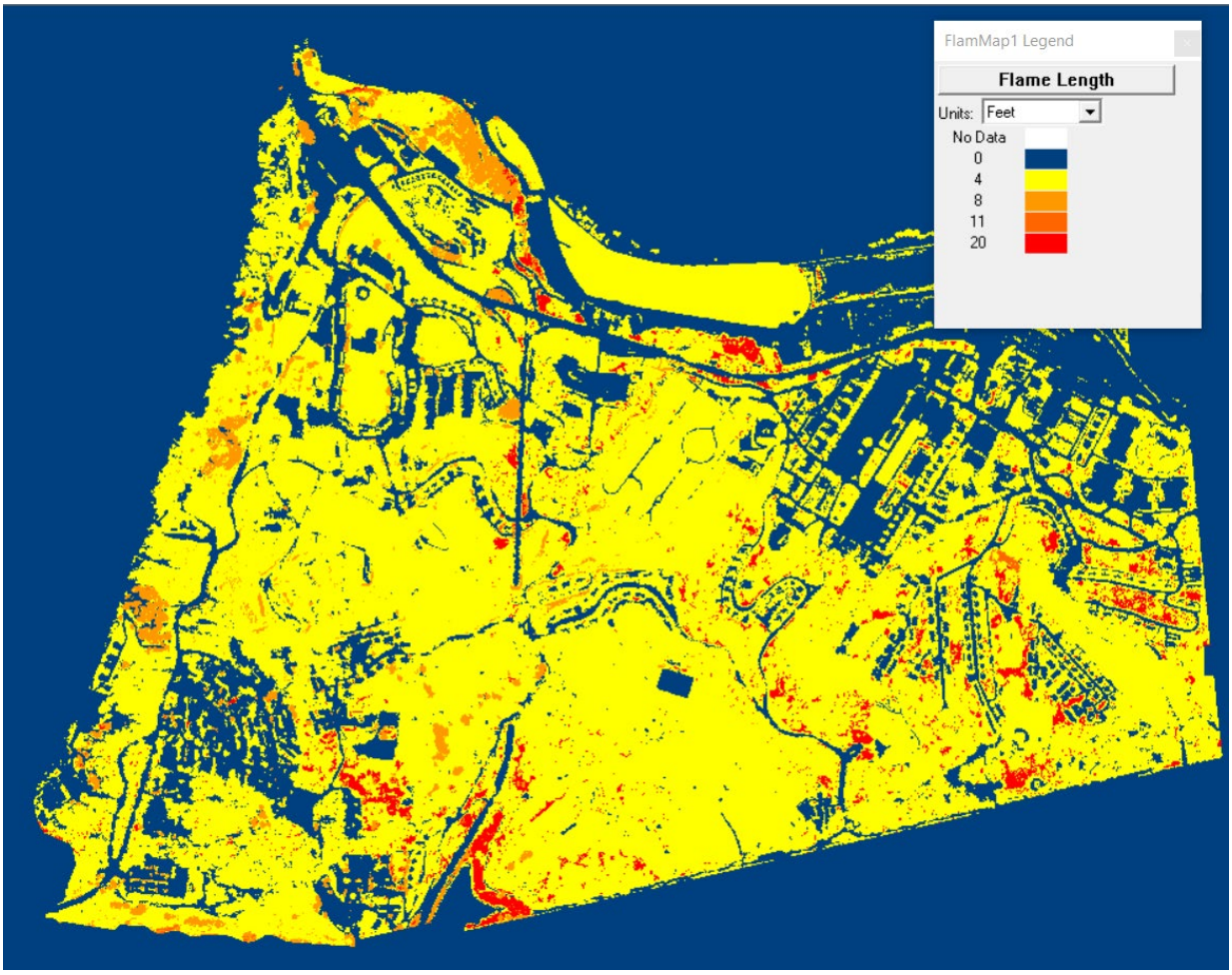

Figure 15. Flame Length under Dry Scenario.

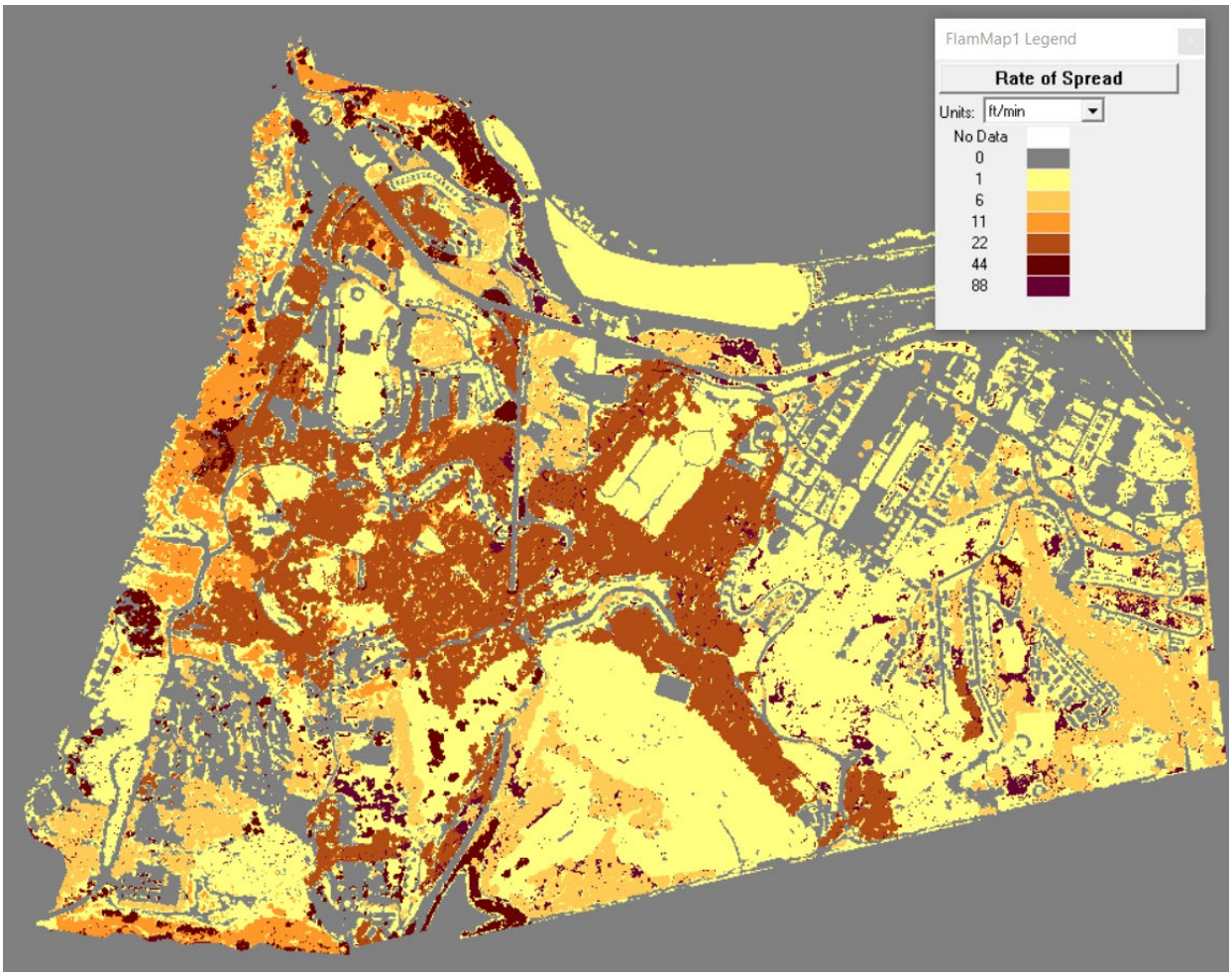

Figure 16. Rate of fire spread under Dry Scenario.

CONCLUSIONS REGARDING WILDLAND FIRE BEHAVIOR

Based on previous weather data analysis and this fire behavior analysis, fire risk and hazard on The Presidio is relatively low. However, despite moist conditions, some areas still burned at a rate that would exceed basic fire suppression tactics (hand crews). It is recommended that mitigation measures be done in these areas; primarily areas with shrub and tree/shrub fuels, especially near residential areas.

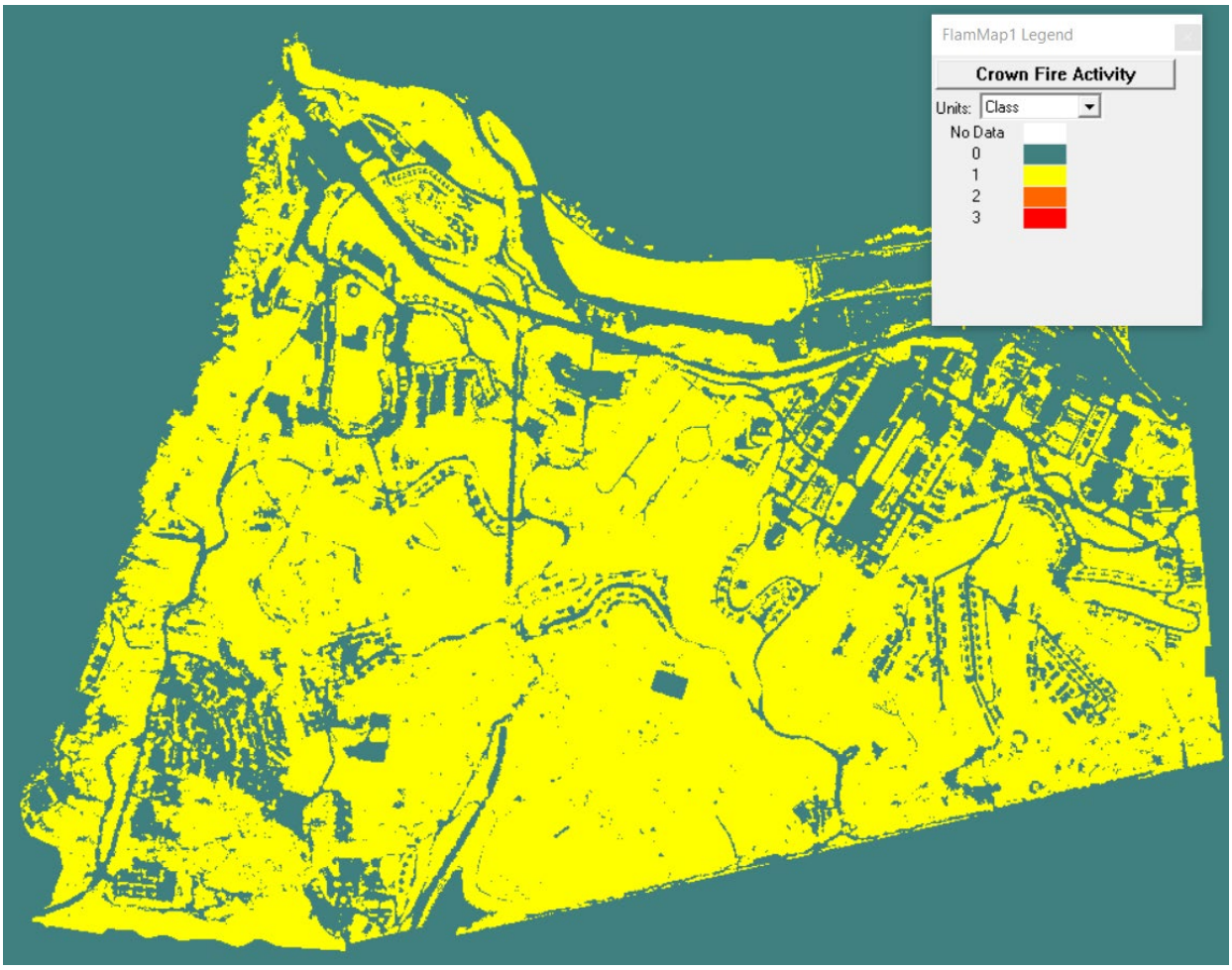

Figure 17. Crown Fire Potential Under Dry Scenario.

Predicted changes in wildland fire weather associated with climate change (Cal-Adapt)

Cal-Adapt is an online tool that provides a view of how climate change might affect California. It was developed by the Geospatial Innovation Facility at University of California, Berkeley with the California Energy Commission. Dr. LeRoy Westerling at the University of California, Merced, provided the projections for wildfire scenarios for, "based on statistical modeling from historical data of climate, vegetation, population density, and fire history. The fire modeling ran simulations on five variables on a monthly time step - Large fire presence/absence, Number of fires given presence, Area burned in a grid cell given a fire, High severity burned area given a fire and Emissions. The modeling used the LOCA climate projections as inputs and therefore is considered as secondary scenarios in the Fourth Assessment. Details are described in Westerling et al., forthcoming [4th Assessment report or white paper].[15]

[15] http://Cal-Adapt.org/tools/wildfire. Accessed June 21, 2019.

Figure 13 shows the Cal-Adapt modeled annual averages of area burned for the Presidio. The Annual Mean Hectares burned for the period from 1961-1990 is 2.7 hectares. The predicted Annual Mean Hectares for 2070-2099 is 3.7 hectares.

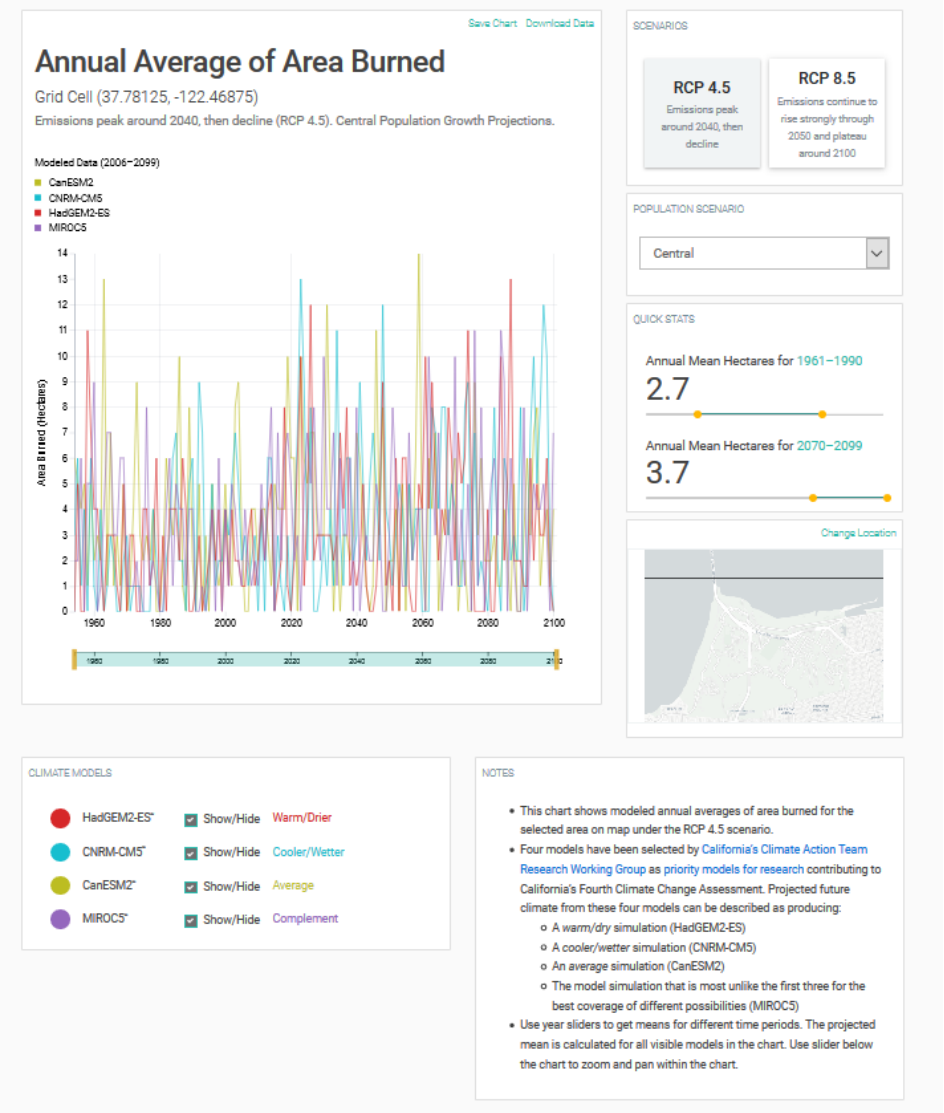

Figure 13. Cal-Adapt modeled annual averages of area burned for the Presidio.

Additional predicted future conditions further indicate relatively small changes in weather. The historical annual mean total precipitation between 1950 – 2005 was 24.2 inches, while the it is predicted to have 26.1 inches from 2020-2050. The historical annual mean maximum temperature for the same time period was 63.4 degrees Fahrenheit; the future condition is expected to be 66.3 degrees. Perhaps most relevant to wildland fire concerns is the number of extreme heat days. During the same period, there were 5 extreme heat days, while the same future time period is expected to have 6 days. All these values indicate a relatively similar

climate as in the past, so changes in fire behavior and ignition probability is not expected to change.

Structural Fuels

The Resource Management Plan designates districts that address the different characteristics of the area. The structural fuels in each of the seven districts are:

1. Main Post: Historic buildings and landscapes
2. Crissy Field (Area B): Historic buildings and bayfront park
3. Letterman: Office and residential buildings
4. Fort Scott: Historic buildings and landscapes
5. Public Health Service Hospital site: Residential and educational historic buildings
6. East Housing: Primarily residential buildings
7. South Hills: Non-historic housing

Fire clearances, as recommended by the State of California, continue to be maintained around structures[16].

Structure Risk from Wildland Fire

All new buildings are designed, located, and constructed to comply with applicable DOE Orders and Standards, the California Wildland-Urban Interface Code (WUI), and Chapters 7 and 7A of the California Building Code. The Presidio Trust follows NFPA 1143, NFPA 1144, and the Federal Wildland Fire Management Fire Policy (2009).

The Presidio Trust contains numerous historic buildings that limit the amount of retrofitting that can be done.

Using Google Street Map and two field visits, we assessed each building on the Presidio for structural vulnerability. Structural vulnerability was based on seven construction attributes, each rated based on whether it was constructed with Ignition Resistant Material (IRM) or not. For example, a building with siding made of stone, masonry, or stucco would get a rating of -5; whereas a building with siding made of anything else (i.e. wood) would get a rating of 10. The tables below detail the construction definition for IRM and their corresponding rating for siding, roofing, eaves, windows, vents, deck/balcony/patio, and underside of desk.

Based on this assessment, of the 1,069 identified structures on the Presidio, 89 were unrated due to insufficient access to the structure or lack of data. Of the remaining 980, 16 buildings (or 1.6%) were rated 65 (very high). These buildings have non-IRM siding, roofing, eaves, deck, and underside of deck, along with single-pane windows and unprotected vents. 8 buildings (or 0.8%) were rated -25. These buildings have IRM siding, roofing, eaves, deck, and underside of deck,

[16] VMB pg 75

along with double-pane windows and protected vents. The map below shows where the most vulnerable buildings on the Presidio.

PREPAREDNESS ACTIONS

"Preparedness" refers to activities that lead to a safe, efficient, and cost-effective fire management program in support of the mission and resource management objectives of the Presidio Trust through appropriate planning and coordination. The term "preparedness" here covers staffing and equipment available for initial attack as well as the cooperative agreements that provide for additional resources and extended engagements. Preparedness also includes training, qualifications, readiness and detection, all components that support fire response in advance of an actual ignition.

Fire Prevention, Community Education, Community Risk Assessment, and Other Community Assistance Activities (Firewise)

This section explains the overall wildland fire prevention and community education and assistance programs for the site. Human-caused wildland fire is a rare event in the Presidio, but regardless, many activities conducted by the Presidio Trust relate to wildland fire prevention.

Community Assistance Activities (Firewise)

The objective of wildland fire prevention is the cost-efficient reduction of fire suppression expenditures and damages from human-caused fires to levels commensurate with resource and mission management objectives and fire management direction.

Fire prevention is a major focus of the Emergency Services and Law Enforcement duties, especially during plans review, as well as conducting building and other site inspections. The Presidio Trust and SFFD use a number of strategies, including environmental education and interpretation, to reduce the occurrence of preventable wildland fire.

Site-wide Plans Review and Inspection

All work related to buildings and their infrastructures must be reviewed and approved by the Fire Marshal. While most construction is done in the interior of structures, and not a source of ignition for wildland fire, the same process applies to design and construction aspects that affect wildland fire hazards. Construction itself is a time of potential ignitions and thus the following is relevant.

During project construction, the Fire Marshal inspects the project periodically for the method and materials of construction of the building as related to fire and life safety and fire detection and suppression systems. The Fire Marshal generates a Construction Punch List and submits it to

the Facilities Project Manager (PM) for action. Upon construction completion, the Fire Marshal witnesses the testing and commissioning of the relevant building systems and fire protection systems. Any deficiencies found during the test are identified to the PM in writing. Upon completion and verification of all deficiencies, the Fire Marshal will then sign off on the Project. The various practices assure that the Fire Marshal is brought into the process for review or approval.

Site-wide review of wildlands should be done annually prior to the onset of the fire season. Compliance with defensible space regulations and observations of hazardous conditions should be noted. A procedure for ensuring these hazardous conditions be abated prior to fire season should be established. Funds for these treatments and inspections should be dedicated.

Fire Prevention Actions

The Presidio Trust is committed to preventing human-caused fires through information and education. Several actions will ameliorate the hazard and risk to the site:

1. On-going program to maintain 100-foot defensible zones around all structures
2. All hot work must be done under permit
3. Training on wildfire prevention and urban-interface protection concepts
4. Conduct of fire prevention programs aimed at Presidio Trust staff, visitors and neighbors. Incorporate fire prevention messages into information media (bulletin boards) during period of high fire danger
5. Conduct fire extinguisher training to the Presidio Trust staff
6. Conduct annual fire inspections of all fire extinguishers and structures
7. Inspect all fire detection systems
8. Strictly enforce all fire regulations

Community Assistance

The Presidio Trust's fire prevention and education program is implemented in conjunction with other fire management and public safety agencies to increase awareness of fire prevention, develop understanding of the dangers of fire, protect human life and property, and prevent damage to facilities and natural resources in the Presidio Trust managed lands.

Presidio Trust employees will be provided with information about fire prevention, the wildland/urban interface, the objectives of the fire management program, and the dangers of wildland fire. Employees will be kept informed about changes in the fire situation throughout the fire season. Visitor contacts, bulletin board materials, handouts and meetings with neighborhood associations have been used to increase staff and visitor awareness of fire hazards.

The Presidio Trust's staff work with the SFFD and other agencies with fire management and public safety responsibilities to establish common protocols and procedures, identify training needs, conduct joint training, and develop strategies for safer and more efficient fire management operations. These regional efforts provide a consistent message to the public, provide consistent training to many organizations in an efficient manner, and offer a consistent strategy that can be customized when needed.

Detection

Automatic fire alarm systems are located in site buildings consistent with Federal requirements and applicable codes. These fire alarm systems warn building occupants automatically as well as summon the Fire Department in the event of a fire. The Presidio does not have its own site-wide alarm system. San Francisco has a City-wide alerting system (the Outdoor Warning System). The Presidio has coverage provided by this system.

All occupied non-residential buildings and multi-residential buildings are protected by fire alarm systems. All fire alarm systems are designed and installed in accordance with National Fire Protection Association (NFPA) 72, the National Fire Alarm Signaling Code. NFPA 72 dictates the number and locations of manual pull stations. Additional means on reporting the location of a fire are calling 911 or the direct-dial emergency number 415-561-5656.

Wildland fires will be detected by employees and/or visitors. It is the general duty of all Presidio Trust personnel to take appropriate actions when unsafe conditions. These duties include, but are not limited to:

a) Calling 911 to report any life-threatening condition;
b) Taking appropriate actions to assure personnel safety;
c) Warning other personnel in the immediate area of an unsafe condition;
d) Taking actions to isolate the unsafe condition, if appropriate;
e) Assisting co-workers and other personnel with implementation of protective actions, especially those persons who need extra assistance, if necessary;
f) Following directions provided by emergency response personnel; and
g) Calling 415 561-5656 to report the incident when able to do so safely.

Every wildland fire will be reported through one of the many fire alarm system monitors, although it is expected that the manual pull-stations will be the type most frequently used. Incorporating a specific message about ways to report wildland fires would be an improvement to the detection and reporting process now in place.

Annual Prevention Program

There is meager record of human-caused wildland fires on the Presidio Trust lands. Regardless of the lack of ignitions, the Presidio Trust would develop programs to further enhance the previous fire prevention successes. The goals for the fire prevention program would be to evaluate the pattern and causes of ignitions that could involve wildland vegetation and to develop and/or refine current actions that would be effective prevention measures. A specific goal is be to develop site-specific messages aimed at Presidio Trust employees about ignition prevention and vegetation management. Two particular messages could increase awareness of warming fires and how to maintain fire safe defensible space.

Special Orders and Closures

In other locations site restrictions and closure are part of a fire prevention plan. Trust issues closures to the campground based on wind speed conditions. However, the entirety of Presidio Trust cannot be closed during times of high fire danger because of its daily use as a nationally recognized recreational facility and because of residential use and office rentals on-site.

Industrial Operations and Fire Precautions

Hot work encompasses welding and allied processes, heat treating, grinding, thawing pipe, power-driven fasteners, hot riveting, torch applied roofing, BBQ propane or charcoal and sternos, and similar operations producing a spark, flame, or heat. This constitutes an ignition source for adjacent wildland fuels.

Hot Work Permits are issued by the Department of Emergency Services & Law Enforcement, in accordance with NFPA 1. Trust employees are required to complete annual fire extinguisher training (live fire). Contractors are required to complete a general safety briefing provide by the Trust Occupational Safety and Health Manager. Hot Work Permits contain specific conditions and requirements.

Permits for hot work shall be requested no less than 24 hours in advance of the work to be done, or before 12:00 pm on the Friday before the weekend in which hot work is to be performed. Permits may extend to multiple days, up to two weeks and must be posted at the site before and during any hot work. The requestor must assure that all conditions of the permit are addressed before starting work and do not change as the work progresses. If the work or conditions change, the requestor must stop and contact the Fire Marshal or designee for a review/re-inspection and possible modification of the permit for reissuance. The area of the permit will be inspected daily.

A fire watch is required during the operation and for at least one-half hour after the operation ceases, as determined by the permit. The length of time the fire watch is required will be not only marked on the permit but also verbally communicated to the requestor.

The area of hot work will be non-combustible, fire-resistive construction, essentially free of combustibles and flammables, suitably segregated from adjacent areas, equipped with fire extinguishers, and inspected and approved by the Fire Marshal.

Future revisions to the fire safety permitting procedure should include a prohibition of any hot work, including outdoor cooking during red flag conditions, or other conditions of high fire danger, per the Operations Plan (Appendix C).

Sprinklers as a Prevention Method

Most occupied, non-residential buildings are protected by fire sprinkler systems, consistent with Federal requirements and applicable codes. These extinguishing systems help prevent fires from buildings advancing from buildings to ignite wildlands. Additional suppression systems have been provided where warranted by the hazard. These suppression systems include dry chemical, wet chemical, high-expansion foam, deluge, or aqueous-film-forming foam. Each building is also equipped with fire extinguishers. Depending on the type of hazards, appropriate types of fire extinguishers with an adequate extinguishing rating are placed in strategic locations to be used by trained occupants.

ANNUAL FIRE TRAINING ACTIVITIES

Annual training activities augment and reinforce the skills and knowledge base of emergency responders and Emergency Services and Law Enforcement Staff. For example, Trust employees are required to complete annual fire extinguisher training (live fire).

Staffing Qualifications

The SFFD is under subcontract for fire response to The Presidio Trust. Section 8.4 of the subcontract between the Presidio Trust and SFFD states that, "*SFFD shall assign only competent and qualified personnel to provide the services as set forth in this Contract and shall at all times be solely responsible for their work quality*."

All fire personnel involved in federal fire management activities must meet the fitness standards established by their agency. The SFFD Fire Department uses the National Fire Protection Association's *Standard 1500, Occupation Health and Safety Program*. This includes an annual physical and stress test.

Presidio Trust Employee Training

Training courses include fire extinguisher training, and extends to other areas that address wildfire detection, reporting, response and remediation. SFFD could design and conduct

educational and training programs and exercises regarding wildfire for Presidio Trust employees as requested. In addition, Presidio Trust staff should be trained to function in within the National Incident Management System so that s/he can be prepared to interact with Incident Command Officers from outside the area as well as those local to the Presidio, specifically, as a Resource Advisor.[17]

Annual Training

Because the fire responders are on-site and on duty all year, fire response personnel qualifications need to be maintained at all times. No additional training is conducted in advance of the wildland fire season.

Presidio Trust employees conduct drills regarding evacuation every year. The Emergency Services and Law Enforcement Staff and contract fire suppression staff should also participate in an annual wildland fire drill that practices initial attack assessment. This will also highlight the effectiveness or deficiencies in training as it pertains to wildland fire.

WILDLAND FIRE SEASON READINESS

Wildland Fire Season Readiness describes the work needed annually to ensure the readiness of equipment, personnel, and supplies.

Readiness: Testing and Inspection of Equipment

All fire detection and suppression systems are tested, inspected, and maintained as per the requirements of the applicable NFPA standards, unless the local or State of California statutory requirements are more stringent. The more stringent requirements will be enforced. SFFD is contractually required to comply with NFPA Standards, and the California Fire Code. Accordingly, SFFD inspects portable fire extinguishers, standpipe and hose systems, hydrants, and fire engines. Additionally, SFFD flow tests all hydrants annually.

Various other entities are responsible for inspection, testing, and maintenance of all fire detection and suppression systems, including the following:

- Diesel-engine-driven water supply pumping system, including the one within the Letterman Digital Arts Center Master Ground Lease area. This is inspected by LDAC staff.
- The Presidio reservoir, no other water storage tanks exist.
- Automatic sprinkler systems: inspected and tested to Title 19 standards every 5 years by authorized contractors. The waterflow switch activation is tested annually as part of fire alarm test

[17] This position within the Incident Command System can be filled by any qualified person within the Presidio Trust staff, and is not assigned to a specific position in the Presidio Trust.

- Pre-action sprinkler systems: inspected and tested to Title 19 standards every 5 years. Waterflow switch activation tested annually as part of fire alarm test
- Standpipe and Fire Department connections: inspected and tested to Title 19 standards every 5 years by authorized contractors
- Fire hydrants: tested every 10 years by Trust Water Department
- Dry-chemical systems (detection and annunciation only): inspected and tested annually by authorized contactors
- Heat detectors, smoke detectors, and building fire alarm systems: tested annually by Trust Fire Alarm Technician or authorized contactors

The testing program is not specific to wildland fire. The inspection and testing and maintenance is done year-round, and not in specific preparation to the wildfire season.

Annual Preparedness Reviews

Regarding annual preparations that are specific to wildland fire, a future recommended program to ensure readiness should include the following:

March 1: Complete annual wildland fire fighter safety refresher and fitness testing for red cards.
April 15: Document personnel qualifications.
May 30: Complete inventory of all fire equipment.
Fire tools and equipment are ready; chain saws operational.
Fresh fuel mixed and labeled.
August 20: Training requests for fire courses submitted.
November 15: Note equipment deficiencies and prepare requisitions for replacement equipment. Review and revise Fire Management Plan as needed.

Pre-Incident Plans

No pre-incident plans addressing wildland fire hazards have been submitted. Based on the wildland fire behavior analysis and common wildland fire causes, the Presidio Trust is rarely exposed to predictable wildland fire exposures, including threats from electric power transmission easements, multiple embers burning from an off-site fire, warming or camp fire escapes. It is recommended that the development of pre-incident plans address these scenarios.

One of the recommended pre-incident plans that focus on wildland fire near or adjacent to electric power transmission easements could include:

- Latitude and longitude of every pole/substation and tower footing
- Accessing information (cross roads, gate combinations, road conditions

- Nearest water source location
- Easement information (principle contact and phone number)

A pre-incident plan should also be developed for multiple embers burning throughout the site from a large wildland fire off-site.

A third pre-incident plan should address an escape from a warming or campfire. The information would include location of established campfire rings, and other information as in the electrical power transformer scenario.

WILDLAND FIRE WEATHER AND FIRE DANGER

CAL FIRE declares the start and stop of wildfire season. Typically, fire season starts in the first week of June and is closed after two "productive and wetting rains, usually during the first part of November." However, lack of rain may cause the season to be declared earlier and remain open later in the year.

An on-site weather station is located on Howard Rd. in the Presidio, where fire response staff, equipment and vehicles are located. The weather is checked daily to determine daily on-site conditions, and especially whether a red flag warning is in effect.

The observations from the Fossen weather station should continue to be collected and analyzed as part of the fire prevention plan and as part of fire season readiness. This data should be shared through the national fire weather database collection and storage program.

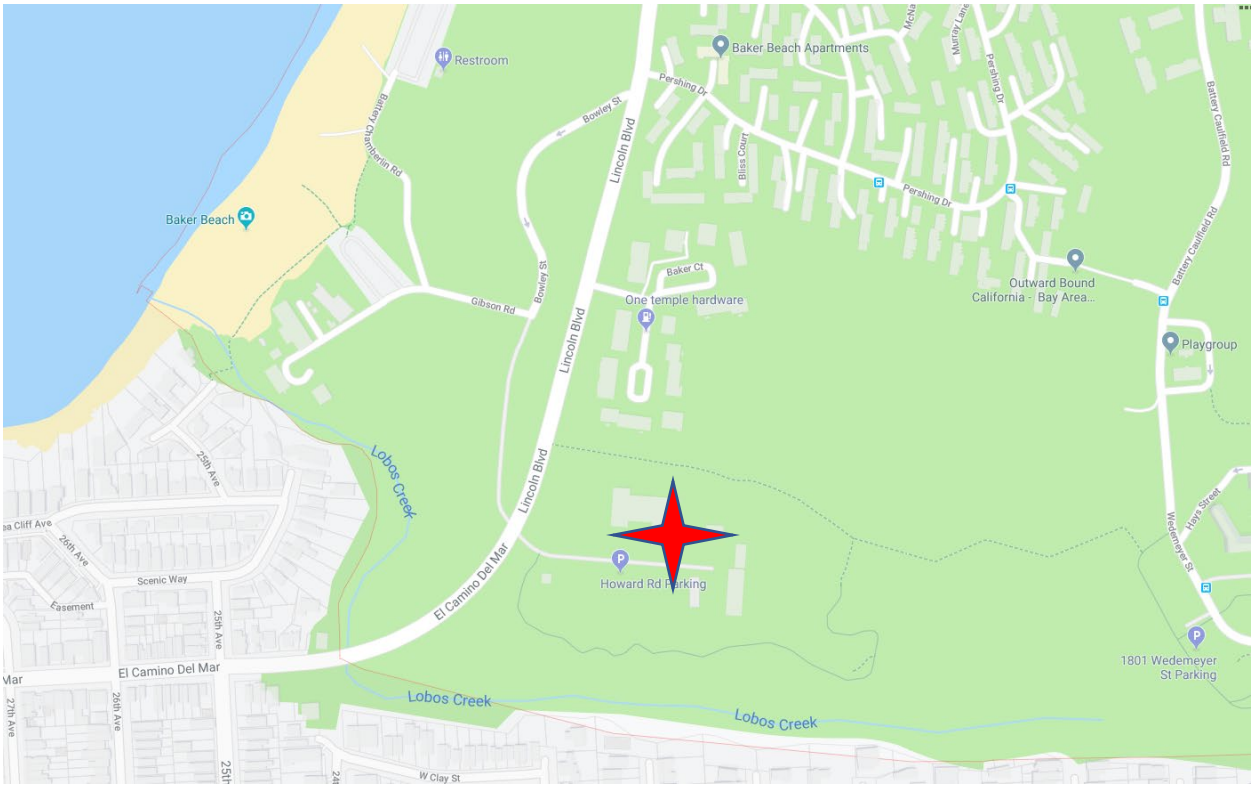

Figure 11. Location of weather station in the Presidio

NATIONAL FIRE DANGER RATING SYSTEM INDICES

Wildland fire danger thresholds are a key element, as they drive almost all wildland fire management actions on the ground. The National Fire Danger Rating System (NFDRS) is often used to develop thresholds used for prevention, initial response, large wildland fire actions, and prescribed fire activities. A specific index or indices are often used to monitor trends, however, NFDRS indices are not monitored because staffing is constant, and is not related to fire danger.

Similarly, initial attack is comprised of the same equipment and number of firefighters. The Presidio Trust is not considering prescribed burning at this time, and thus using NFDRS indices as a decision criteria is not appropriate.

However, on-site fire weather is monitored to determine the appropriateness of outdoor "hot work."

The regionally-accepted trigger for changes in staffing and operations is the determination of a "red flag warning." The National Weather Service/National Atmospheric Administration have established weather conditions that merit a "red flag warning" designation. The outlook and designation of a red flag warning can be found at two websites: http://gacc.nifc.gov/oncc/predictive/outlooks/index.htm and http://www.fire.ca.gov/communications/communications_firesafety_redflagwarning.php.

A red flag warning is issued when the combination of dry fuels and weather conditions support extreme fire danger. For example, the criteria for the Oakland-Berkeley Hills include:

- Daytime ten-hour fuel moisture less than 6% (as measured at 1300)
- Annual grasses are cured
- No wetting rain (greater than 0.10 inch in the previous 24 hours)
- Winds of speeds measured at 20-ft height sustained for at least eight hours of 6-30 miles per hour, depending on the daytime and night-time relative humidity per the following table.[18]

Relative Humidity	Sustained Wind 6-11 mph	Sustained Wind 12-20 mph	Sustained Wind 21-29 mph	Sustained Wind 30+ mph
Daytime Minimum RH 29-42% and/or Nighttime Maximum RH 60-80%				**Warning**
Daytime Minimum RH 19-28% and/or Nighttime Maximum RH 46-60%			**Warning**	**Warning**
Daytime Minimum RH 9-18% and/or Nighttime Maximum RH 31-45%		**Warning**	**Warning**	**Warning**
Daytime Minimum RH < 9% and/or Nighttime Maximum RH < 31%	**Warning**	**Warning**	**Warning**	**Warning**

Table 5. Red Flag Warning Criteria.

It is recommended that Presidio Trust officials monitor NOAA weather reports daily during fire season to determine if a red flag warning day has been declared. On such days employees and contractors are instructed to terminate any hot work and any work that could produce sparks and/or fire. This includes mowing, chain saw operations, excavation, and driving in grasslands. All outdoor hot work permits are cancelled.

It is further recommended that on red flag warning days that staff of Emergency Services and Law Enforcement be alerted, via email, to red flag conditions and that these staff members communicate to their employees and contractors the heightened danger of fire.

The red flag warning condition is rescinded when the National Weather Service cancels the warning.

[18] http://gacc.nifc.gov/oscc/predictive/weather/myfiles/Watches_and_Warnings_for_California.htm

INITIAL ATTACK

An initial attack is a response that does not exceed 24 hours' duration, threaten persons or property off site, or require additional forces from outside the Presidio Trust. Wildland fire response will be initiated by SFFD personnel and equipment located at the Presidio Trust and will dispatch additional personnel and equipment form either SFFD's stations or via mutual aid.

The SFFD is the lead on wildfire suppression. Fire safety falls under Presidio Trust Emergency Services and Law Enforcement, with fire operations contracted to the SFFD.

All initial attacks will be performed with one engine company and four firefighters.

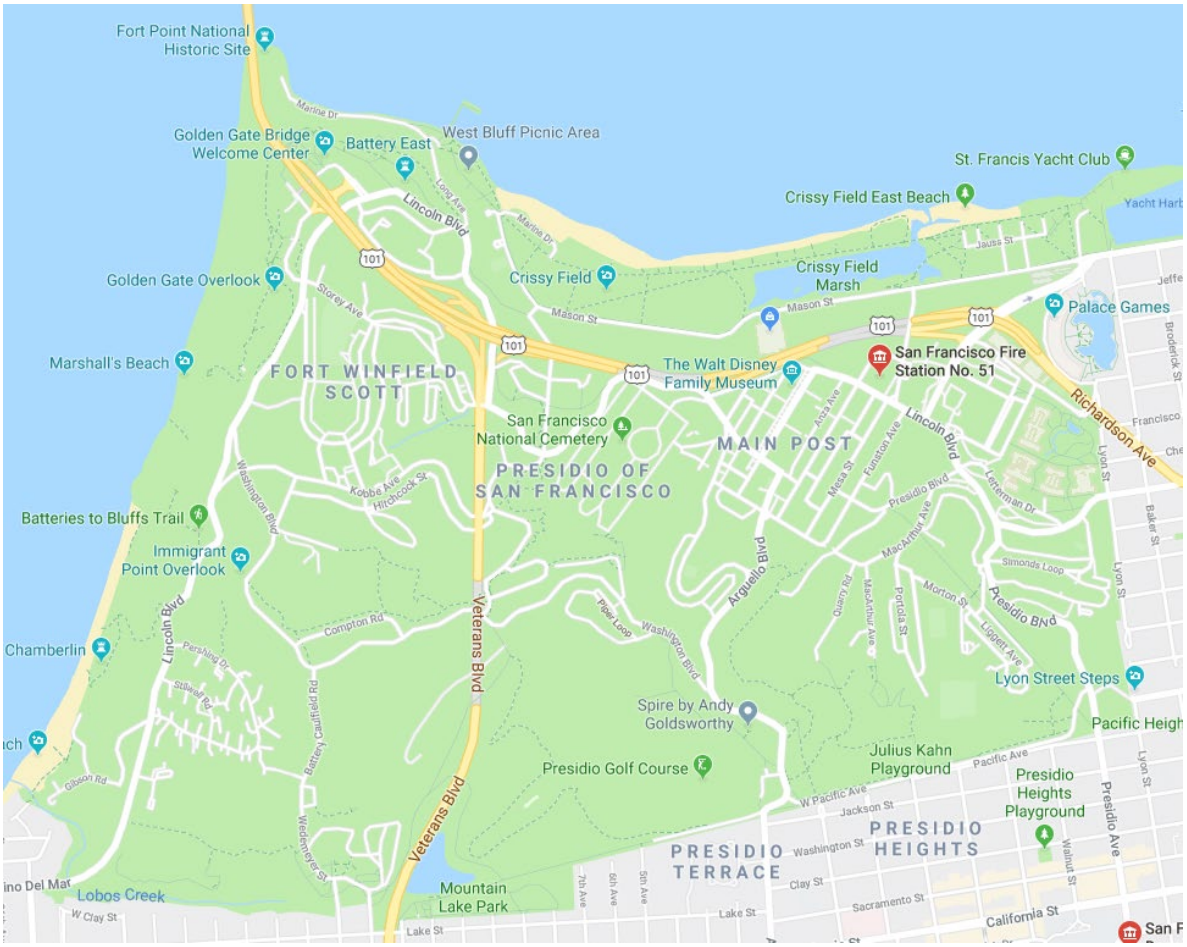

Figure 12. Location of Fire Station No. 51 in the Presidio.

The SFFD Fire Station is staffed 24 hours a day with a minimum of four firefighters (one captain, one engineer, and two fire fighters).

The Presidio Trust Emergency Services and Law Enforcement employees are responsible for fire safety, excluding fire operations. The Presidio Trust Emergency Services and Law Enforcement team staffs and manages associated operational activities including emergency response/access

planning and activities, evacuation management procedures and drills, and disaster damage assessment and recovery programs.

Initial Attack Priorities

All initial attacks will be performed with one engine company and four firefighters. Coupled with site-wide guidance, pre-incident plans serve to guide decisions regarding priorities for suppression*.*

Criteria for the Appropriate Initial Attack Response

Because of the extremely high values at risk and the sensitivity of those values to wildfire damage, every wildfire will be suppressed as quickly as possible. The appropriate response is generally aimed at effective and efficient suppression, prioritizing life safety and protection of buildings and research.

Extended Attack

An extended attack is required when a fire is likely to last longer than 24 hours, threatens adjacent public or private lands, or exceeds the capabilities of the SFFD assisted by on-site fire-trained personnel. All extended attacks will be managed under the National Incident Management System under a Unified Command. The appropriate response will be determined by the Incident Commander, under guidance from a Presidio Trust Resource Advisor.

Presidio Trust Emergency Services and Law personnel are notified upon extended attack actions, and may coordinate with appropriate the Incident Commander. Actions may include:

- Presidio Trust to request additional state and federal Completing a Delegation of Authority form if needed;
- Completing a Wildland Fire Situation Analysis (WFSA) and holding a daily review of that plan with the necessary parties; and
- Notifying resources

Resource Advisor

A Resource Advisor (RA) is a position within the National Incident Management System that is responsible for gathering and analyzing information concerning critical areas and natural resources that may be impacted by fire or fire suppression activities. The National Incident Management System allows anyone who is qualified to assume the role, regardless of the

position within the Trust organization. In an incident this position reports to the Planning Chief as a technical resource.[19]

This plan recommends that staff from the Presidio Trust be called upon as a Resource Advisor to provide consultation on technical and logistical assistance. This person is a crucial link between the fire suppression forces and the Trust. The priorities and considerations include the following:

a) Public and firefighter safety;
b) Protection of Presidio Trust facilities and private property;
c) Protection of cultural, historic and natural resources;
d) Available suppression resources and response times;
e) Fire behavior as determined by fuels, weather and topography;
f) Use aircraft and mechanized equipment where necessary to support above-listed criteria; and
g) Minimum fire-line construction and use of Minimum Impact Suppression Tactics (MIST).

During an extended attack outside the Presidio boundaries, the on-duty engine company is dedicated to the site and will remain on site to assist the Presidio Trust as needed. The Battalion Chief is subject to callback, if off-duty, during wildland fires. The Battalion Chief will service as the fire representative in the Emergency Operations Center when required.

Contracted SFFD personnel are designated as the Incident Commander on a wildfire. The Incident Commander has the authority to commit resources to carry out the response actions in a wildland fire.

Response Times

The response time for initial attack ground resources does not vary depending on the time of year. The overall average response time is seven minutes.

OTHER FIRE SUPPRESSION CONSIDERATIONS

The Presidio is a unique site, requiring specific management and operation other considerations related to wildland fire suppression. These include cultural resources, protected habitats, gas lines and utilities, and a variety of special hazards that span poison oak and hazardous wildlife.

[19] http://www.fema.gov/national-incident-management-system. Accessed September, 2014.

Cultural Resources

The Presidio Trust is subject to provisions of both the National Historic Preservation Act and the Archeological Resource Protection Act, which require it to "identify, evaluate and protect historical and archeological sites eligible for listing in the National Register of Historic Places."

The PTMP sets forth principles that will "guide future actions and decisions, protecting the Presidio's cultural resources and ensuring the long-term preservation of the National Historic Landmark District."[20]

Principle number 1 in the PTMP is to "Protect the historic character and integrity of the National Historic Landmark District while allowing changes that will maintain the site's vitality. Rehabilitate historic buildings compatibly for adaptive and feasible uses. Protect the Presidio's cultural landscape."[21]

Principle number 4 in the PTMP is to "Protect archeological resources for future research and interpretation," stating that:

> These sites are important because archeological remains can reveal information about past conditions, uses, and lives of the Presidio's inhabitants, and can tell the stories from periods in the Presidio's history that left little or no above-ground evidence. The Presidio Trust will evaluate identified archeological resources for significance and integrity and will document and manage these resources to allow for future research and interpretation. To locate additional sites, the Trust will use a variety of inventory methods, including remote sensing, predictive modeling, geomorphologic reconstruction, sensitivity mapping, surveys, and subsurface investigations such as coring, trenching, and archeological testing.[22]

Protected Habitats

Impacts to natural resources will be minimized through the use of a Resource Advisor. While the Incident Commander has the authority to commit resources and determine the suppression strategy and tactics, the Resource Advisor will inform the Incident Commander of sensitive habitats for protected species, erosive soils that may preclude the use of heavy equipment, and other considerations that can reduce the effects of fire suppression.

The VMP for the Presidio notes the following issues related to erosive soils and sensitive habitats:

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[20] The Presidio Trust Management Plan: Land Use Policies for Area B of the Presidio of San Francisco (PTMP), pg 18.
[21] The Presidio Trust Management Plan: Land Use Policies for Area B of the Presidio of San Francisco (PTMP), pg 20.
[22] Ibid.

Impacts to Physical Resources

Soil Erosion Is a Threat to Native Vegetation and the Historic Forest. Visitor foot traffic and improper drainage have resulted in erosion and gullying in several areas. In some forested areas, soil characteristics have changed such that dramatically less water infiltrates into normally porous sand, and rill and gully erosion have occurred. Corrective actions need to be identified and implemented to protect resources and maintain accessibility for urban visitors.

Impacts to Native Plant Communities

Existing Native Plant Communities in the Presidio Require Protection and Enhancement. Native plant communities, rare in San Francisco and found in small areas within the Presidio, are critically threatened by lack of habitat and must be protected.

Rare and Endangered Species Require Protection. Many small natural areas contain populations of rare and endangered species that must be protected and enhanced in order for the rare species to survive. [23]

The Presidio Trust is the site of several habitats of protected wildlife species, as shown on Table 6. During suppression as well as pre-fire activities, these habitats require special consideration:

Table 1
Special-Status Plant Species in the Presidio

Common Name	Scientific Name	Federal/State/CNPS Status
Coast rock cress	Arabis blepharophylla	--/--/4
Raven's manzanita	Arctostaphylos hookeri var. ravenii	E/CE/1B
San Francisco spineflower	Chorizanthe cuspidata	--/--/1B
Franciscan thistle	Cirsium andrewsii	--/--/proposed 1B
Presidio clarkia	Clarkia franciscana	E/CE/1B
San Francisco wallflower	Erysimum franciscanum	--/--/4
Dune gilia	Gilia capitata ssp. chamissonis	--/--/proposed 1B
San Francisco gumplant	Grindelia hirsutula var. maritima	--/--/1B
Marin dwarf flax	Hesperolinon congestum	T/CT/1B
San Francisco lessingia	Lessingia germanorum	E/CE/1B
San Francisco campion	Silene verecunda ssp. verecunda	--/--/1B
California sea blite	Suaeda californica	E/CE/1B
San Francisco owl's clover	Triphysaria floribunda	--/--/1B

Notes: Status definitions:

[23] Presidio Vegetation Management Plan, 2001, pg. 13.

-- = no listing status
Federal: *U.S. Fish and Wildlife Service (50 CFR 17.12, 61 FR 40:7596-7613, Feb. 28, 2000)*
E = listed as endangered under the federal Endangered Species Act
T = listed as threatened under the federal Endangered Species Act
Table 6. From page 34 of the Vegetation Management Plan

Riparian and Wetland Habitat.

A number of drainages exist on the main site. Some are ephemeral or intermittent, and others, like the Woods Lake, and their tributaries, are considered "jurisdictional" under the Clean Water Act and thus warrant special attention. According to the California Department of Fish and Game, these jurisdictional drainages, along with four freshwater seeps, support riparian habitat.

Special Hazards

The Presidio has numerous safety considerations. Most are common to wildland firefighting in the wildland urban interface. The Presidio has a particularly dense network of above-ground electrical utility conduits, and fences. Hazards include unstable terrain as well as poison oak and dangerous wildlife such as rattlesnakes. Poison oak is prevalent in locations remote from buildings.

Wildfire suppression activities are also limited by the following considerations:

a) Accessibility to certain areas by vehicles due to steep terrain
b) No impact to water resources may occur, such as run-off of toxins into waterways
c) Aerial and foam retardants will not be used within 300 feet of open water or waterways
d) Firelines must be rehabilitated to avoid unnecessary erosion and habitat fragmentation.

The following general constraints should apply to all fire operations unless specifically excepted:

a) Dozers and other soil moving heavy equipment will not be used without the expressed approval of Emergency Services and Law Enforcement.
b) Use of vehicles off established paved roads, fire roads/trails, and firebreaks will be subject to approval by the Chief of Emergency Services and Law Enforcement on a case-by-case basis.
c) Suppression actions, such as line construction will be conducted in such a way as to minimize long-term environmental impacts.
d) Sites impacted by fire suppression or by fire will be rehabilitated as necessary, based on an approved course of action for each incident.

MINIMUM IMPACT SUPPRESSION TACTICS (MIST) REQUIREMENTS

Minimum impact suppression tactics will be followed. The concept of Minimum Impact Suppression Tactics (MIST) is to use the minimum amount of forces necessary to effectively achieve the fire management protection objectives consistent with land and resource management objectives. It implies a greater sensitivity to the impacts of suppression tactics and their long-term effects when determining how to implement an appropriate suppression response. Individual determinations will be dependent on the specific situation and circumstances of each fire

PRE-WILDFIRE FUEL TREATMENTS

Fuel treatments are planned for and carried out by the Land and Building Stewardship Division of the Presidio Trust. In recent decades, the U.S. Army maintained the Presidio forest by removing downed material, mowing groundcover, removing hazardous fuel accumulations (such as fallen branches), and removing or pruning hazardous trees. [24]

According to the VBM, fire prevention practices will continue to focus on fuel reduction and removal near developed areas (along roads and around buildings) where fires are most likely to start. Fuel loads will be frequently inspected and altered when necessary by removing dead and fallen trees and branches, pruning trees to remove dead branches that can act as a fuel ladder, removing excessive forest litter, and in some cases, clearing or mowing understory vegetation in areas that are frequently visited.[25]

FUEL REDUCTION – DISKING AND MOWING

Currently the Presidio Trust implements its fuel reduction program using hand crew to cut grasses, trim shrubs and prune trees in locations near buildings. The fuel reduction work begins in the late spring after the last rains and after the majority of plant growth has stopped.

Particular attention is paid to areas that expose the Presidio Trust and the surrounding community to the greatest chance of fire and greatest potential damage. The treatments around buildings are considered part of general clean-up activities.

FUEL REDUCTION – TREE TRIMMING, BRUSH REMOVAL AND LEAF LITTER REMOVAL

There are several related vegetation reduction programs. These include: clearing of brush around hydrants, removal of “ladder fuels” from the landscaping materials and wildland vegetation within 100-feet of structures, trimming trees so that they do not add leaf litter to roof tops, clearing of leaf litter from roofs and drains; and trimming trees so that fire response vehicles have

[24] VBM pg 75
[25] Ibid

enough clearance to respond to fires. In addition, several trees are cut and removed each year because they are dead or have the potential to fall and create damage

Under this vegetation management program, the site is managed to minimize wildland fire damage to structures. This program provides for annual treatment of vegetation on the Presidio site such that ground fuels cannot produce flame heights in excess of 3 feet (and ground plantings within 10 feet of buildings and roadways produce even lower flame heights) at the wildland border and to further reduce risks as fire approach assets. Trees are "limbed up" so that flammable branches are at least 8 to 10 feet above the ground, and bushes that would allow ground-based fires to rise into tree canopies are removed.

The Presidio Trust's vegetation management program is designed to minimize wildland fire damage to structures by limiting the potential flame heights of ground cover vegetation to no more than 3 feet at the wildland border, and to further reduce risks as fires approach assets. The following vegetation management is conducted annually, generally before June 1:

- Cutting off tree limbs below a minimum of 6 to 8 feet from the ground, depending on species;
- Cutting grasses to a maximum height of 3 inches;
- Removing brush, except ornamental bushes (and similar plantings) which may be pruned or removed depending on risk; and
- Removing leaf litter, branches, twigs, and branches that accumulate on the ground to a depth greater than 2 inches.

The following standards for defensible space are recommended:

Standards for Defensible Space

1. Remove all dead plants and dry vegetation.
   a. Cut grass and weeds within 15-feet of the pavement edge and within 30-feet of a structure to less than 4 in. in height.
   b. Remove leaves, bark, and humus under trees and shrubs (including vines and semi-woody species) so that the buildup of leaves and humus will not exceed 2 in. in depth anywhere in a defensible space within a year. However, do not expose bare earth in over 50% of the site.
   c. Remove dead material that drapes over ground cover (including leaves, bark, and branches).
   d. From mature trees, remove all vines, loose papery bark, dead branches, and live branches smaller than 3 in. in diameter to a height of 8 ft above the ground.
   e. Remove all dead branches from within live ground covers, vines, shrubs (including semi-woody species), and immature trees.

2. Prune trees and large tree-form shrubs (e.g. elderberry or toyon) that are being retained.
   a. All lower tree branches, under 3 inches in diameter, shall be removed up to 8 feet above the ground, or on the lower third of trees, whichever is less (Figure 13). OR,

b. All lower tree branches, under 3 inches in diameter, shall be removed to provide vertical clearance of 3 times the height of the understory plants, or eight feet above understory plants, whichever is greater.

c. In young trees, remove the branches on the lower one-third of the height of the tree. Example: if a tree is 10 ft tall, prune the lower 3–4 ft and keep the understory plant material to less than 1 ft in height. As the tree grows to 24 ft in height, it can achieve the 8-ft distance from the ground, and the understory plant material can reach 2.5 ft in height.

d. All dead branches smaller than three inches in diameter shall be removed. All dead limbs greater than three inches in diameter should be retained.

e. Do not thin or prune the tree canopy, as this will promote more growth in the lower parts of the tree, and will result in increased risk that fire will spread to the tree canopy.

f. Sometimes small trees may need to be cut to the ground in order to achieve the separation of the ground level from another, larger, tree canopy, or because mowing equipment cannot avoid the small trees.

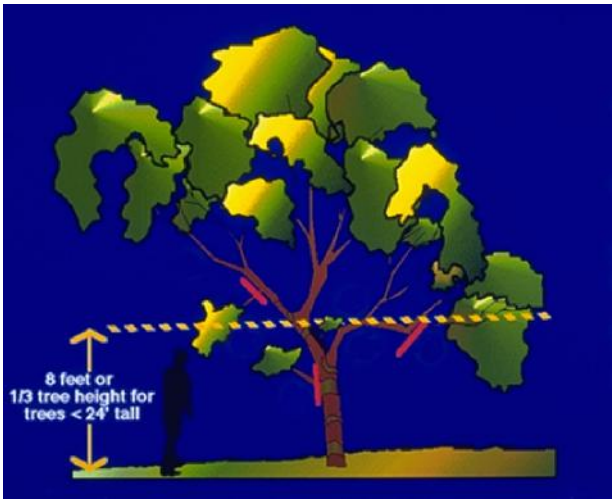

Figure 13 - Prune branches to a height of 8 ft above the ground. In young trees, prune branches on the lower one-third of the height of the tree. Do not disturb or thin the tree canopy. This promotes growth in the understory, which is more easily ignited.

3. Maintain 8 ft of vertical clearance between roof surfaces and overhanging portions of trees.

4. Manage individual plants or shrub masses to maintain adequate horizontal spacing. Design distinct groupings of shrubs (including vines, semi-woody species, all types of brush, and all chaparral species) to dampen the spread of fire. Make sure the plant groupings are small enough to provide adequate horizontal separation between groupings and to allow proper

maintenance; groupings should measure no wider than two times the grouping height, or 120 sq ft. The space between islands should be greater than three times the height of the shrubs (see Figure 14).

5. Remove and safely dispose of all cut vegetation and hazardous refuse. Material can be placed in a dense pile at a distance more than 100-ft from the structure, in a depression, remote from a tree canopy.

6. Chipped materials may remain on the site, provided the mulch layer is no greater than 2 in. in depth.

Figure 14. Shrub island spacing. Design groups of plants small enough to provide horizontal separation between groups. This allows proper maintenance and helps slow the spread of fire. Each shrub or group of plants should measure no wider than two times its height, or less than 120 sq. ft. (or 6 ft x 20 ft). The space between groups should be greater than three times the height of the shrubs.

ADDITIONAL STANDARDS FOR DEFENSIBLE SPACE ZONE

A two-to-five-foot wide zone Non-Combustible Zone nearest the structure should be kept free of all dead plants and combustible materials to prevent the ignition of materials by embers.

1. Keep the ground free of dead leaves, mulch, needles or other plant debris. The ground surface should be composed of inorganic material such as decomposed granite, pebbles, or rock/flagstone.
2. Vegetation in the non-combustible zone could be comprised of irrigated lawns, succulents, but would exclude woody plants.
3. Dead material that drapes over ground cover will need to be removed. This includes leaves, bark, and branches.

PRESCRIBED FIRE

A program of using prescribed fire is not considered in this plan.

EMERGENCY REHABILITATION AND RESTORATION

EMERGENCY STABILIZATION

A large wildfire may cause detrimental effects on the environment. Regardless immediate post wildfire actions may be needed to minimize the threat to life and health and prevent unacceptable degradation to natural and cultural resources.

BURNED AREA REHABILITATION

Similar to immediate post wildfire actions, applicable post-wildfire burned area rehabilitation actions may be needed to repair or improve wildfire damaged lands unlikely to recover naturally or minor facilities damaged by the fire

Recovery planning is event-specific and requires input from Land and Building Stewardship Division personnel for utility and infrastructure issues, as well as Emergency Services and Law Enforcement personnel for safety guidelines and potential air, land, water, and personnel monitoring if the event involved a hazardous materials release.

VI – ORGANIZATION

ORGANIZATION OF FUEL MANAGEMENT PERSONNEL AND FIRE SUPPRESSION

The Presidio Trust Emergency Services and Law Enforcement group is responsible for fire safety and response. Fire prevention and community education are also major focuses of Emergency Services and Law Enforcement.

The Presidio Trust Landscape Stewardship group is responsible for planning and undertaking vegetation management activities, including fuel reduction. This includes the Chief of Land and Building Stewardship and a Forester. The Director of Emergency Services and Law Enforcement works closely with the Landscape Management Team.

Both Emergency Services and Law Enforcement and Landscape Stewardship are part of the Land and Building Stewardship Division of the Presidio Trust as indicated in Figure 17.

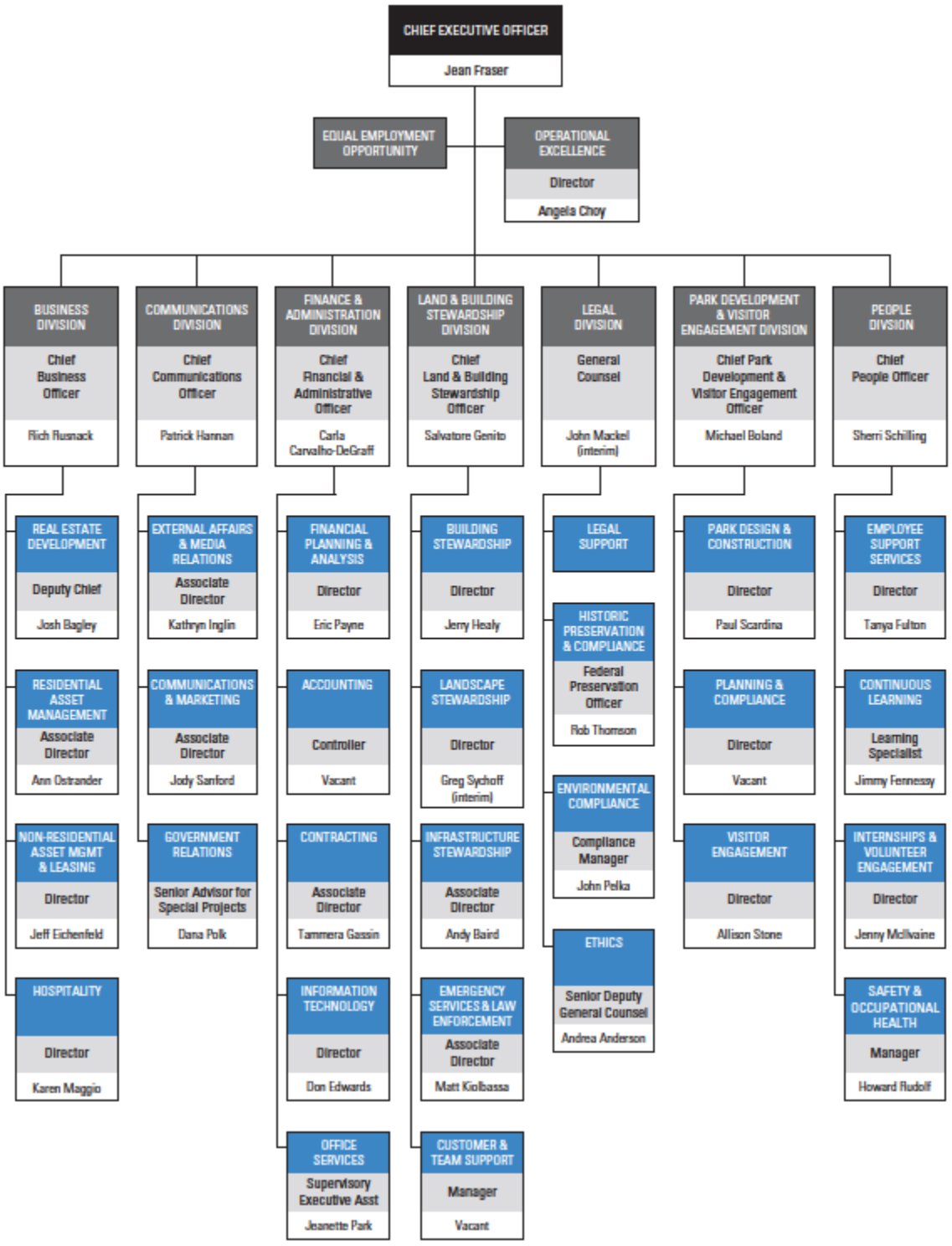

Figure 17. Organizational Chart of the Presidio Trust showing the structure of the organization and the relationships of its parts.

COOPERATIVE AGREEMENTS AND INTERAGENCY CONTACTS

COOPERATIVE AGREEMENTS

Through a mutual aid agreement with the Presidio Fire Department, the San Francisco Fire Department (SFFD) provides first response services to the Presidio. The Contract for Fire and Emergency Medical Services between the Presidio Fire Department and the SFFD states in Exhibit A, Scope of Services:

1. **Description of Services**
   SFFD will provide structure and wildfire firefighting, rescue, hazardous materials responses, and emergency medical services and emergency preparedness assistance for Area B. SFFD will provide these services at a level and with management oversight consistent with services provided by SFFD throughout San Francisco. At a minimum, SFFD will provide the following services within the described service performance parameters. The Scope of Services appears in its entirety as Appendix D.

VII – MONITORING AND EVALUATION

REPORTING OF WILDLAND FIRES

All staff and contractors should call 911 in case of a wildfire. Staff should then call the Director of Emergency Services and Law Enforcement.

MONITORING FUEL MANAGEMENT EFFECTS

Monitoring takes four forms:

1. Annual monitoring fire hazards, for compliance of local defensible space and weed abatement regulations, and to assess the effects of fire hazard reduction treatments. Formal sampling such as transects in the treatment areas, sampling plant species and volume, can be established so that vegetative diversity, presence of alien, invasive species, and fuel volume can be assessed. Ocular estimates and qualitative evaluation are also suitable.

2. Weather conditions to inform operations and possible restrictions thereof. During the fire season weather conditions should be noted at the start of each day when mowing or use of mechanized equipment is to take place.

3. Compliance with training and certification. This is done annually, for staff, and during administration of the contract between SFFD and the Presidio Trust.

4. Post-fire monitoring of fire effects to inform possible rehabilitation needs. Should a wildfire occur, the burned area should be assessed for fire effects, with increasing attention on fires larger than 1 acre, or where it abuts or is located in areas of high value (restoration areas, high-impact recreation sites or housing).

APPENDICES

DIGITAL MAPPING SOLUTIONS
INTEGRATING DATA TO CREATE SPATIAL KNOWLEDGE

TECHNICAL REPORT:

FOSSEN WEATHER STATION SUMMARY FOR THE PRESIDIO LAND TRUST

PREPARED FOR: WILDLAND RES MGT

PREPARED BY: DIGITAL MAPPING SOLUTIONS

JANUARY 7TH, 2019

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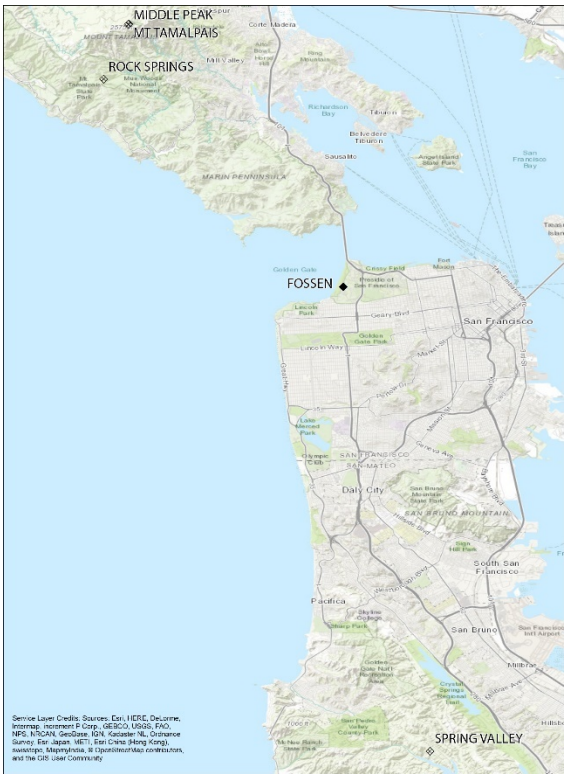
SECTION 1 – FOSSEN WEATHER STATION

The Fossen weather station is located at 37.7954498, -122.4792842 within the Presidio Trust boundary. It is maintained and operated by PLT's maintenance staff. Data from this weather station were acquired through Hans Barnaal, GIS Specialist with the Presidio Trust, via an unformatted text file. The text file was accompanied by a one-page document with some notes.

Technical specifications for the weather station are as follows:

- Temperature readings are in degrees Fahrenheit.
- Humidity is relative percent.
- Rain was measured in fractions of an inch.

SECTION 1.1 – LOCATION



The weather station is located south-west of The Presidio's maintenance yard. On the map to the right, it is labeled FOSSEN. It is roughly at 200 feet in elevation and sits on a flat spot on a south-west facing hillside. Vegetation in the general vicinity can be characterized as mix hardwood and conifer with some high-density residential and commercial buildings nearby. Access to the weather station is limited to park staff.

SECTION 1.2 – DATA CORRECTIONS/CHANGES

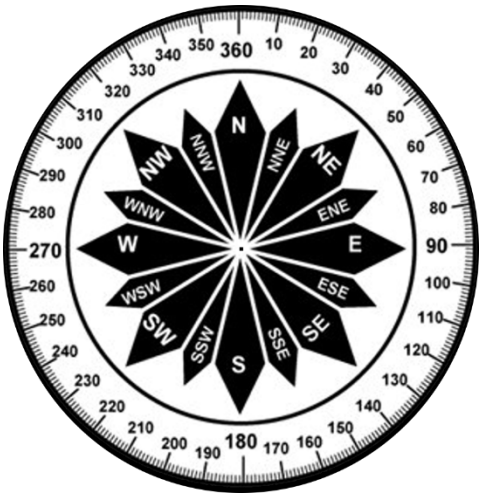
For the period of data used in this summary, some data corrections were applied to correct for weather station setup mistakes. Primarily, the wind anemometer had initially started at due west, rather than due north.

FIGURE 1 WEATHER STATION LOCATION

To correct for this, the following was done to all records:

1. Since wind direction was reported in cardinal direction, these were converted to azimuth degrees using the following table:

Wind Direction	Azimuth
N	0
NNE	22.5
NE	45
ENE	67.5
E	90
ESE	112.5
SE	135
SSE	157.5
S	180
SSW	202.5
SW	225
WSW	247.5
W	270
WNW	292.5
NW	315
NNW	337.5



2. Once converted to an azimuth, 90 degrees were added.

3. Any resulting 360 degree reading was changed to 0; for any resulting reading above 360, 360 was subtracted.

SECTION 2 – WEATHER STATION DATA STATISTICS

Weather data acquired from the Fossen weather station spans from October 26th, 2011 at 1 pm to September 11th, 2018 at 12:30pm. Readings were taken every half hour. At that rate, 120,528 readings should be expected in the file. However, only 98,637 readings were included. Presumably, the missing 21,891 readings (18%) were due to power outages.

Missing data include the following months/years (but is not limited to):

Year/Month	Note
2014-07	All days missing
2015-09	All days missing
2017-07 through 2017-09	All days missing
2018-06	All days missing

SECTION 2.1 – STATISTICS

YEARLY SUMMARY

	Average				Maximum			Minimum	
Year	Temp	RH	WS	WS Dir	Temp	RH	WS	Temp	RH
2011	51	80	2.4	233	75	100	16.0	38	15
2012	54	84	3.8	269	85	100	16.0	34	19
2013	54	80	3.2	274	87	96	16.0	32	12
2014	57	82	2.8	246	90	99	18.0	40	18
2015	55	80	3.4	224	80	98	16.0	35	17
2016	56	70	4.0	222	91	83	17.0	33	20
2017	54	74	4.0	213	76	89	17.0	34	19
2018	54	77	4.4	232	78	87	15.0	33	22

Temperature in Fahrenheit degrees, relative humidity in percent, wind speed in miles per hour, and wind direction in azimuth degrees.

Because

MONTHLY SUMMARY

	Average	Maximum	Minimum

Year/Month	Temp	RH	WS	WS Dir	Temp	RH	WS	Temp	RH
2011-10	56	85	2	271	71	98	6	46	32
2011-11	52	84	3	229	75	100	16	40	15
2011-12	49	76	2	230	68	99	11	38	16
2012-01	50	80	3	223	68	99	13	34	19
2012-02	50	81	3	249	68	100	13	37	27
2012-03	51	82	4	249	70	98	15	37	25
2012-04	53	84	4	284	65	98	15	38	30
2012-05	53	85	5	295	72	98	15	44	35
2012-06	56	85	5	299	69	100	13	45	48
2012-07	56	89	4	297	66	98	12	50	70
2012-08	56	91	5	300	67	97	11	51	68
2012-09	55	90	4	303	70	98	11	50	69
2012-10	59	85	3	287	85	96	11	48	27
2012-11	56	82	3	235	79	94	16	42	37
2012-12	51	82	3	224	64	93	12	38	37
2013-01	50	72	3	189	64	92	11	37	31
2013-02	50	79	3	281	72	92	11	38	28
2013-03	51	84	3	286	71	93	13	42	29
2013-04	53	81	4	297	72	93	16	43	22
2013-05	55	81	5	300	87	95	14	42	13
2013-06	57	85	4	295	70	93	13	48	65
2013-07	56	88	4	303	69	93	12	51	68
2013-08	59	88	4	303	71	94	10	52	74
2013-09	60	85	4	305	74	94	14	47	33
2013-10	56	77	2	288	85	96	16	46	12
2013-11	54	76	2	260	73	93	9	42	16
2013-12	50	68	2	182	66	93	12	32	21
2014-01	54	70	2	221	72	94	10	42	20
2014-02	52	86	3	263	68	94	17	40	38
2014-03	55	80	3	275	76	92	12	44	21
2014-04	55	80	3	297	88	92	13	44	26
2014-05	57	78	4	305	86	89	13	46	24
2014-06	53	86	3	234	59	89	8	50	80
2014-08	62	87	4	253	71	97	11	56	68
2014-09	62	87	4	249	74	97	11	55	59
2014-10	61	83	2	239	90	98	10	48	18
2014-11	57	83	1	191	75	98	18	47	28
2014-12	55	85	2	170	68	99	15	41	18
2015-01	53	79	1	133	69	98	6	39	26
2015-02	56	78	2	231	74	96	15	41	22

2015-03	56	82	3	240	77	96	12	44	27
2015-04	54	78	4	247	78	93	13	42	17
2015-05	54	85	6	253	61	95	12	50	75
2015-06	57	84	5	251	70	92	11	49	66
2015-07	61	82	5	252	78	90	13	55	49
2015-08	65	74	5	262	70	84	10	56	63
2015-10	61	82	3	263	80	85	11	49	48
2015-11	53	73	3	221	69	88	15	38	30
2015-12	50	76	3	182	62	83	16	35	36
2016-01	52	77	3	143	64	83	13	34	38
2016-02	55	73	2	197	76	82	14	40	29
2016-03	55	76	4	234	71	81	17	41	28
2016-04	56	74	5	249	86	80	15	44	28
2016-05	56	76	5	251	76	80	10	50	39
2016-06	57	77	5	234	69	80	15	50	60
2016-07	56	72	6	244	65	80	13	50	58
2016-08	58	67	5	258	67	72	12	52	58
2016-09	59	63	5	251	91	74	14	49	20
2016-10	59	60	3	224	81	73	10	48	27
2016-11	56	64	3	224	75	79	11	41	38
2016-12	50	68	3	177	63	83	13	33	34
2017-01	49	72	4	187	62	83	12	34	43
2017-02	53	71	4	206	68	84	17	37	38
2017-03	54	73	4	242	76	83	13	40	30
2017-04	55	74	4	242	69	83	14	41	29
2017-05	55	77	6	250	72	83	14	44	53
2017-06	57	77	6	243	76	83	14	48	56
2017-10	55	75	4	274	64	84	13	47	62
2017-11	56	78	2	193	71	85	12	42	44
2017-12	52	66	2	138	66	89	12	38	19
2018-01	53	77	2	171	66	86	9	40	51
2018-02	52	72	4	232	75	87	15	33	22
2018-03	52	75	3	219	78	86	15	38	31
2018-04	54	80	5	252	70	87	13	40	52
2018-05	55	82	6	260	65	87	14	45	63
2018-07	57	72	6	261	66	83	10	52	57
2018-08	58	76	5	251	71	84	11	51	48
2018-09	58	82	5	250	68	85	10	51	68

Month (across years) Summary

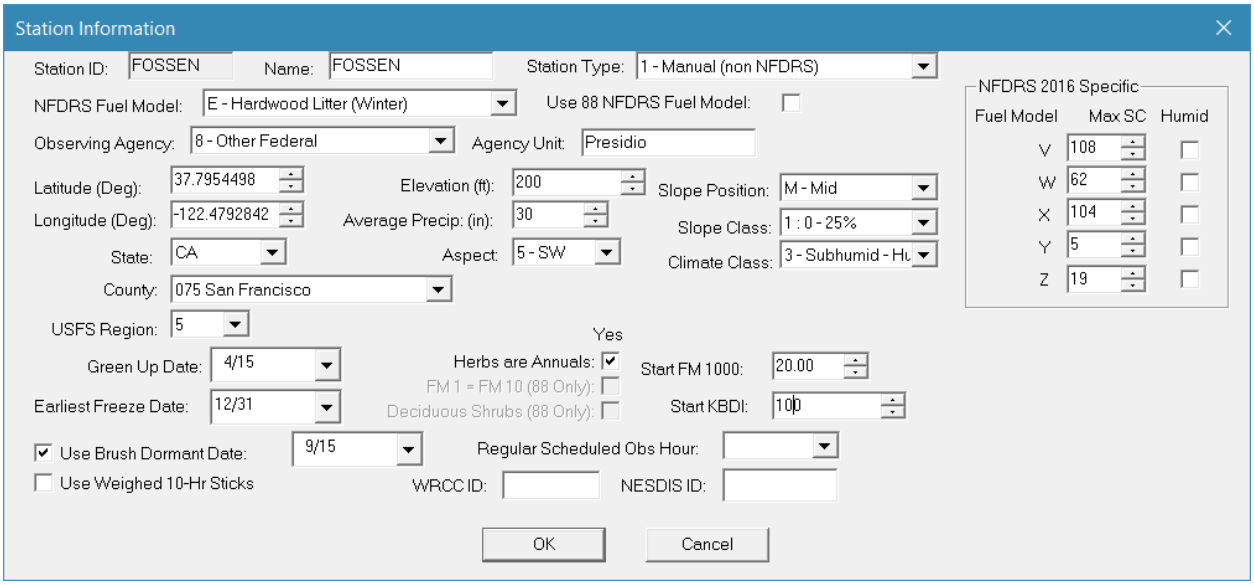
	Average				Maximum			Minimum	
Month	Temp	RH	WS	WS Dir	Temp	RH	WS	Temp	RH
1	51	75	3	182	72	99	13	34	19
2	52	77	3	237	76	100	17	33	22
3	53	79	3	249	78	98	17	37	21
4	54	79	4	267	88	98	16	38	17
5	55	81	5	279	87	98	15	42	13
6	57	82	5	267	76	100	15	45	48
7	57	82	5	273	78	98	13	50	49
8	58	81	5	275	71	97	12	51	48
9	60	80	4	271	91	98	14	47	20
10	59	77	3	261	90	98	16	46	12
11	55	77	2	222	79	100	18	38	15
12	51	74	3	186	68	99	16	32	16

From this preliminary review of the FOSSEN weather data, the warmest months on The Presidio are September and October, while the lowest relative humidity occur within the month of October (on average). Further analysis will focus on these months.

SECTION 2.2 – FIRE WEATHER (PERCENTILE DATA)

For further, detailed analysis, the FOSSEN weather data was formatted and imported into FireFamilyPlus (version 5)[26]. For this simple weather analysis for The Presidio, we used FireFamilyPlus for its robust weather and climatology tools.

[26] FireFamilyPlus supports the spectrum of fire weather/fire danger/fire climate/fire occurrence analysis tools required by fire managers to successfully use the National Fire Danger Rating System (NFDRS).



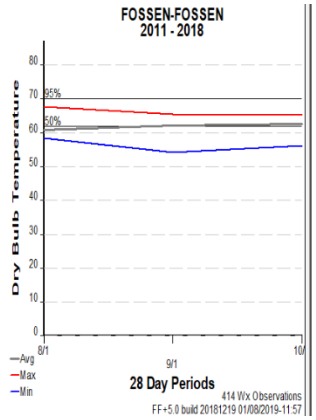
TEMPERATURE

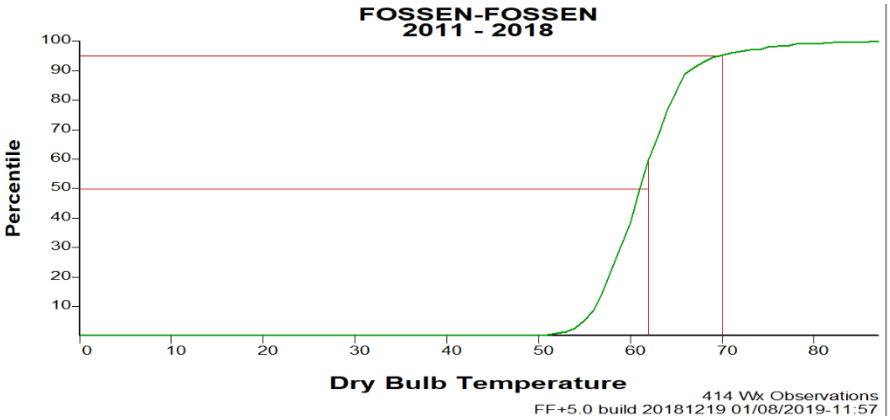
A statistical summary of temperature for the months of August, September and October was exported from FireFamilyPlus and are presented below.

```
FireFamily Plus Statistical Summary Report
   printed on: 01/08/2019   at  11:57:55 AM  (from run # 1)
   using database: E:\fire_behavior_analysis\Presidio\FFP\Presidio-Fossen v2

-----------------------------------------------------------
Active Working Set:
   Station: FOSSEN  - FOSSEN
   Data years:  2011 - 2018
   Analysis Period Length: 28 (Monthly) days
   Annual filter dates:  August 1  thru  October 31
-----------------------------------------------------------
Station Details:
   FOSSEN FOSSEN                Fuel model: E   (Use 88?: N)

   Slope class: 1   Climate class: 3   Greenup: 04/15   Freeze: 12/31
   Start KBDI: 100  Start FM1000:20   Avg. Precip: 30.00
   FM1 = FM10?  N   Herb Annual?   Y   Deciduous?  N
   Aspect:      5   Slope posit.:  M   Elevation:  200
   Latitude:   37.80   Longitude: -122.48
   Weighed Stick Moistures Used:   No
   Dormancy Date Used: 09/15
   SOW:       Use SR_SOW if SOW is Missing
   WetFlag:   Use SR_WetFlag if WetFlag is Missing
-----------------------------------------------------------

Variable: Dry Bulb Temperature
                                  Mean, Median, Standard Deviation and Extreme Values

        28-Day and Monthly Period Means                                  28-Day and Monthly Extreme Values

Period   No.          Std.  Critical Highest      Lowest     |              Avg.   Std  Median              Avg.   Std   Median Period
Begins  Years  Mean   Dev.  Pcntile  Avg, Year    Avg, Year  |  High, Year  High   Dev.  High    Low, Year  Low    Dev.    Low  Begins
-------------------------------------------------------------------------------------------------------------------------------------
 08/01     6   60.9    3.3   61.0    67.7  2015   58.4  2012      69.0  2014   67.3   2.0   68.0   54.0  2012   57.8    4.3   56.0  08/01
 09/01     5   62.1    7.3   62.0    65.4  2014   54.2  2012      87.0  2016   71.6   9.6   70.0    0.0  2012   46.2   26.0   55.0  09/01
 10/01     7   62.6    6.0   62.0    65.3  2014   56.2  2017      86.0  2014   75.4   8.7   78.0   51.0  2013   55.9    2.9   56.0  10/01

         No.          Std.          Highest      Lowest     |              Avg.   Std  Median              Avg.   Std   Median
Month   Years  Mean   Dev.          Avg, Year    Avg, Year  |  High, Year  High   Dev.  High    Low, Year  Low    Dev.    Low  Month
-------------------------------------------------------------------------------------------------------------------------------------
 AUG       6   60.9    3.3          67.7  2015   58.4  2012      69.0  2014   67.3   2.0   68.0   54.0  2012   57.8    4.3   56.0  AUG
 SEP       5   62.1    7.3          65.4  2014   54.2  2012      87.0  2016   71.6   9.6   70.0    0.0  2012   46.2   26.0   55.0  SEP
 OCT       7   62.6    6.0          65.3  2014   56.2  2017      86.0  2014   75.4   8.7   78.0   51.0  2013   55.9    2.9   56.0  OCT

414 weather observations used. 2109 records processed.
FF+5.0 build 20181219 01/08/2019-11:57
```

The table above shows that for all years available for analysis, the mean daily temperature did not exceed 63°F. While the maximum daily recorded for these months did hit above 80 degrees, the average high temperature only reached the mid-70s. The hottest temperature was recorded in September, 2016 at 87°F. On average, October is the hottest month.

For all months and years available, the highest temperature, 87°F, was recorded in September 2016.





The above graph shows the 50th and 95th percentile figures for all three months examined. Ninety five percent of all temperature readings fell beneath 70°F.

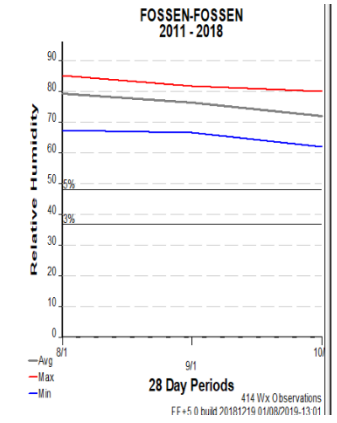
RELATIVE HUMIDITY

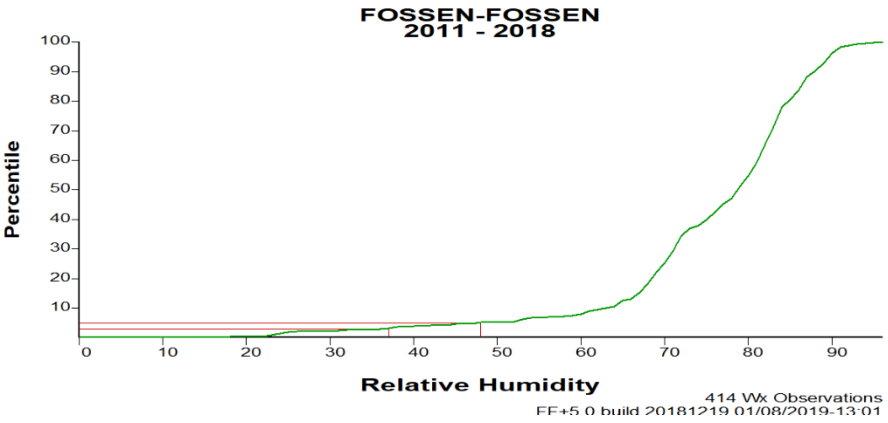
With its proximity to the Pacific Ocean, The Presidio experiences consistently high relative humidity as shown in the statistical summaries below.

```
FireFamily Plus Statistical Summary Report
   printed on: 01/08/2019   at  01:01:54 PM  (from run # 1)
   using database: E:\fire_behavior_analysis\Presidio\FFP\Presidio-Fossen v2

-----------------------------------------------------
Active Working Set:
   Station: FOSSEN  - FOSSEN
   Data years:  2011 - 2018
   Analysis Period Length: 28 (Monthly) days
   Annual filter dates:  August 1  thru  October 31
-----------------------------------------------------
Station Details:
   FOSSEN FOSSEN                Fuel model: E    (Use 88?: N)

   Slope class: 1   Climate class: 3   Greenup: 04/15   Freeze: 12/31
   Start KBDI: 100  Start FM1000:20   Avg. Precip: 30.00
   FM1 = FM10?  N   Herb Annual?   Y   Deciduous?  N
   Aspect:      5   Slope posit.:  M   Elevation:  200
   Latitude:   37.80   Longitude: -122.48
   Weighed Stick Moistures Used:   No
   Dormancy Date Used: 09/15
   SOW:       Use SR_SOW if SOW is Missing
   WetFlag:   Use SR_WetFlag if WetFlag is Missing
-----------------------------------------------------

Variable: Relative Humidity
                                    Mean, Median, Standard Deviation and Extreme Values

         28-Day and Monthly Period Means                                    28-Day and Monthly Extreme Values

Period   No.          Std.  Critical Highest      Lowest     |              Avg.    Std  Median              Avg.   Std   Median Period
Begins  Years  Mean   Dev.  Pcntile Avg, Year    Avg, Year  |  High, Year  High    Dev.  High    Low, Year  Low    Dev.    Low  Begins
-------------------------------------------------------------------------------------------------------------------------------------
 08/01     6   79.2    7.9    65.0   85.1  2012   67.3  2015     91.0  2013   83.3   8.8   84.0   62.0  2016   67.8    5.2   65.0   08/01
 09/01     5   76.5   11.9    64.0   81.6  2018   66.6  2016     96.0  2012   87.0   9.2   91.0    0.0  2012   46.2   32.8   65.0   09/01
 10/01     7   71.9   17.2    31.0   80.0  2015   62.0  2011     95.0  2012   86.3   7.9   87.0   18.0  2013   39.7   19.9   32.0   10/01

         No.          Std.          Highest      Lowest     |              Avg.    Std  Median              Avg.   Std   Median
Month   Years  Mean   Dev.          Avg, Year    Avg, Year  |  High, Year  High    Dev.  High    Low, Year  Low    Dev.    Low  Month
-------------------------------------------------------------------------------------------------------------------------------------
 AUG       6   79.2    7.9          85.1  2012   67.3  2015     91.0  2013   83.3   8.8   84.0   62.0  2016   67.8    5.2   65.0   AUG
 SEP       5   76.5   11.9          81.6  2018   66.6  2016     96.0  2012   87.0   9.2   91.0    0.0  2012   46.2   32.8   65.0   SEP
 OCT       7   71.9   17.2          80.0  2015   62.0  2011     95.0  2012   86.3   7.9   87.0   18.0  2013   39.7   19.9   32.0   OCT

414 weather observations used. 2109 records processed.
FF+5.0 build 20181219 01/08/2019-13:01
```

The table above shows the lowest relative humidity was recorded in September, 2012 at 0 percent. This is probably an error with the data collection sensor. Therefore, we will ignore the September data and concentrate on October since, on average, the relative humidity is lower in this month. A relative humidity of 18% was recorded in October, 2013.

For all months and years available, the lowest relative humidity, 16%, was recorded in May, 2013 and November, 2013.





The above percentile graph shows the 3 percentile (97) and 5 percentile (95) cutoffs for all readings recorded in August, September, and October. Ninety seven percent of the relative humidity recordings fell above 37% humidity. In other words, The Presidio rarely experiences low relative humidity.

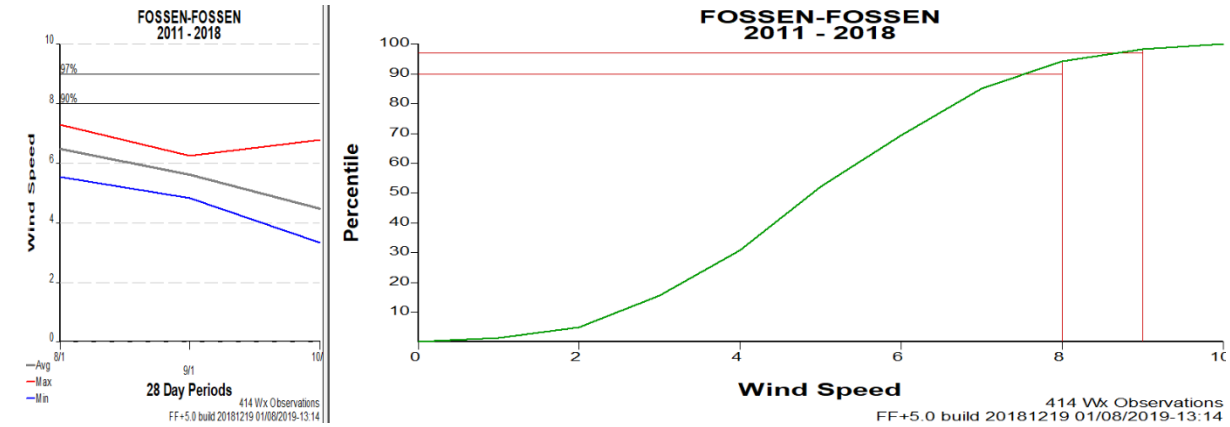
WIND SPEED/DIRECTION

The weather station is located at a sheltered part of The Presidio and does not experience the strong winds that come directly off the coastline. The table and graphs below show the full range of wind speed and direction experienced at the FOSSEN weather station during August, September, and October for the past five to seven years.

```
FireFamily Plus Statistical Summary Report
   printed on: 01/08/2019   at  01:14:05 PM  (from run # 1)
   using database: E:\fire_behavior_analysis\Presidio\FFP\Presidio-Fossen v2

-----------------------------------------------------
Active Working Set:
   Station: FOSSEN  - FOSSEN
   Data years:  2011 - 2018
   Analysis Period Length: 28 (Monthly) days
   Annual filter dates:  August 1  thru  October 31
-----------------------------------------------------
Station Details:
   FOSSEN FOSSEN                Fuel model: E   (Use 88?: N)

   Slope class: 1   Climate class: 3   Greenup: 04/15   Freeze: 12/31
   Start KBDI: 100  Start FM1000:20   Avg. Precip: 30.00
   FM1 = FM10?  N   Herb Annual?   Y   Deciduous?  N
   Aspect:      5   Slope posit.:  M   Elevation:  200
   Latitude:   37.80   Longitude: -122.48
   Weighed Stick Moistures Used:   No
   Dormancy Date Used: 09/15
   SOW:       Use SR_SOW if SOW is Missing
   WetFlag:   Use SR_WetFlag if WetFlag is Missing
-----------------------------------------------------

Variable: Wind Speed
                                  Mean, Median, Standard Deviation and Extreme Values

        28-Day and Monthly Period Means                                    28-Day and Monthly Extreme Values

Period   No.          Std.  Critical Highest      Lowest     |              Avg.   Std  Median             Avg.   Std   Median Period
Begins  Years  Mean   Dev.  Pcntile  Avg, Year    Avg, Year  |  High, Year  High   Dev.  High   Low, Year  Low    Dev.    Low  Begins
-------------------------------------------------------------------------------------------------------------------------------------
 08/01     6    6.5    1.5     8.0    7.3  2018    5.5  2013     10.0  2018    9.0   0.6    9.0   3.0  2012    4.0    1.1    3.0   08/01
 09/01     5    5.6    1.9     8.0    6.3  2016    4.8  2013     10.0  2013    9.2   0.8    9.0   1.0  2013    2.0    1.0    2.0   09/01
 10/01     7    4.5    1.7     6.0    6.8  2017    3.3  2011     10.0  2012    8.3   1.8    9.0   1.0  2014    2.1    1.5    2.0   10/01

        No.          Std.          Highest      Lowest     |              Avg.   Std  Median             Avg.   Std   Median
Month   Years  Mean   Dev.          Avg, Year    Avg, Year  |  High, Year  High   Dev.  High   Low, Year  Low    Dev.    Low   Month
-------------------------------------------------------------------------------------------------------------------------------------
 AUG       6    6.5    1.5          7.3  2018    5.5  2013     10.0  2018    9.0   0.6    9.0   3.0  2012    4.0    1.1    3.0    AUG
 SEP       5    5.6    1.9          6.3  2016    4.8  2013     10.0  2013    9.2   0.8    9.0   1.0  2013    2.0    1.0    2.0    SEP
 OCT       7    4.5    1.7          6.8  2017    3.3  2011     10.0  2012    8.3   1.8    9.0   1.0  2014    2.1    1.5    2.0    OCT

414 weather observations used. 2109 records processed.
FF+5.0 build 20181219 01/08/2019-13:14
```

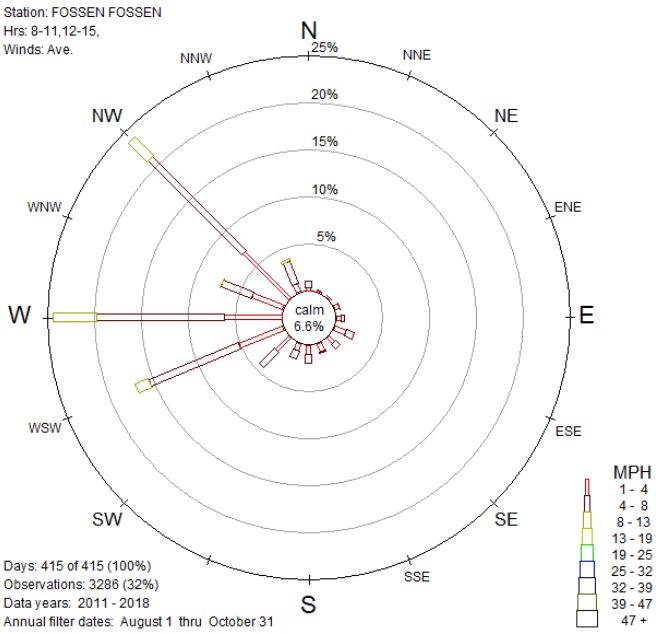
The average observed wind speeds for the examined months did not reach above 10 miles per hour (mph). However, all three months did experience a high of 10 mph at least once.

For all months and years available, the highest wind speed , 15 mph, was recorded in February 2014.



For the FOSSEN station, 90 percent of the data recorded did not exceed 8 mph.

For the months examined, winds during the day (8 am to 3 pm) were recorded at 0 (or calm) for 6.6 percent of the time, with the strongest winds from the West and North-west.



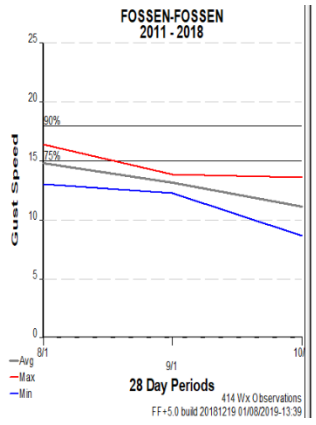
WIND **GUST** SPEED/DIRECTION

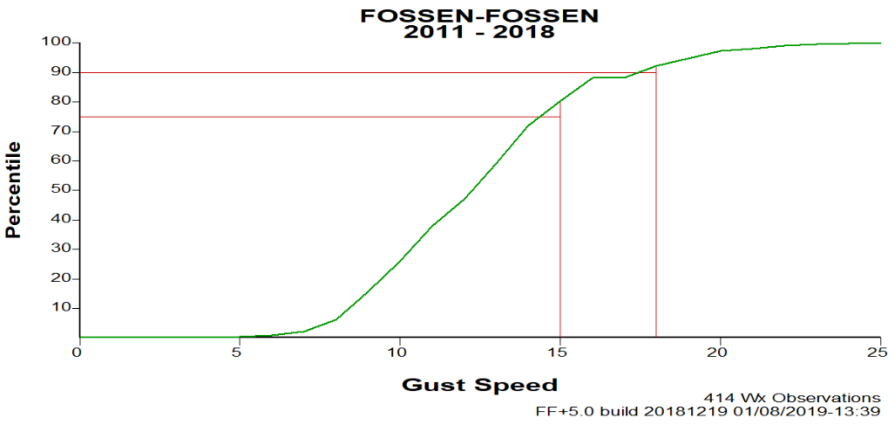
Wind gusts for each 30-minute recording period were also noted. A summary is provided below.

```
FireFamily Plus Statistical Summary Report
   printed on: 01/08/2019   at  01:39:12 PM  (from run # 1)
   using database: E:\fire_behavior_analysis\Presidio\FFP\Presidio-Fossen v2

-----------------------------------------------------------
Active Working Set:
   Station: FOSSEN  - FOSSEN
   Data years:  2011 - 2018
   Analysis Period Length: 28 (Monthly) days
   Annual filter dates:  August 1  thru  October 31
-----------------------------------------------------------
Station Details:
   FOSSEN FOSSEN                Fuel model: E    (Use 88?: N)

   Slope class: 1   Climate class: 3   Greenup: 04/15   Freeze: 12/31
   Start KBDI: 100  Start FM1000:20   Avg. Precip: 30.00
   FM1 = FM10?  N   Herb Annual?   Y   Deciduous?  N
   Aspect:      5   Slope posit.:  M   Elevation:  200
   Latitude:   37.80   Longitude: -122.48
   Weighed Stick Moistures Used:   No
   Dormancy Date Used: 09/15
   SOW:       Use SR_SOW if SOW is Missing
   WetFlag:   Use SR_WetFlag if WetFlag is Missing
-----------------------------------------------------------

Variable: Gust Speed
                                  Mean, Median, Standard Deviation and Extreme Values

        28-Day and Monthly Period Means                                    28-Day and Monthly Extreme Values

Period   No.          Std.  Critical Highest      Lowest     |              Avg.    Std  Median             Avg.   Std   Median Period
Begins  Years  Mean   Dev.  Pcntile  Avg, Year    Avg, Year  |  High, Year  High    Dev.  High    Low, Year  Low    Dev.    Low  Begins
-------------------------------------------------------------------------------------------------------------------------------------
 08/01     6   14.8    2.5    16.0   16.4  2018   13.0  2013     22.0  2018   19.5   2.0   20.0   9.0  2013   11.7   2.1   11.0   08/01
 09/01     5   13.1    3.4    14.0   13.8  2016   12.3  2012     25.0  2013   21.0   3.4   21.0   5.0  2018    7.8   1.9    8.0   09/01
 10/01     7   11.1    3.2    12.0   13.6  2017    8.7  2011     24.0  2012   19.4   4.6   20.0   5.0  2016    6.9   1.3    7.0   10/01

         No.          Std.          Highest      Lowest     |              Avg.    Std  Median             Avg.   Std   Median
Month   Years  Mean   Dev.          Avg, Year    Avg, Year  |  High, Year  High    Dev.  High    Low, Year  Low    Dev.    Low   Month
-------------------------------------------------------------------------------------------------------------------------------------
 AUG       6   14.8    2.5          16.4  2018   13.0  2013     22.0  2018   19.5   2.0   20.0   9.0  2013   11.7   2.1   11.0    AUG
 SEP       5   13.1    3.4          13.8  2016   12.3  2012     25.0  2013   21.0   3.4   21.0   5.0  2018    7.8   1.9    8.0    SEP
 OCT       7   11.1    3.2          13.6  2017    8.7  2011     24.0  2012   19.4   4.6   20.0   5.0  2016    6.9   1.3    7.0    OCT

414 weather observations used. 2109 records processed.
FF+5.0 build 20181219 01/08/2019-13:39
```

The average observed wind **gust** speeds for the examined months reached above 14 mph in the month of August. The absolute highs reached above 20 mph in all three months, with September experiencing the highest average wind **gust** speed of 21 mph.

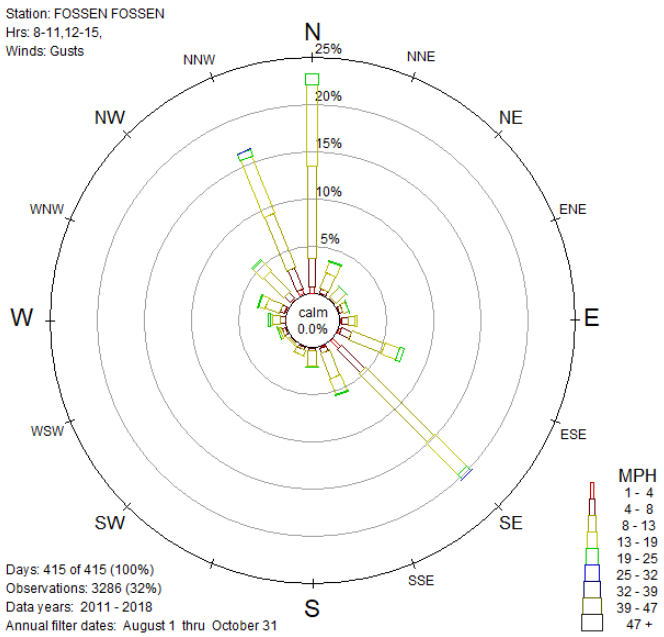
For all months and years available, the highest wind **gust** speed , 31 mph, was recorded in January, 2017.





In contrast to wind speed, the wind gust speed 75th percentile is 15 mph. However, 90% of the wind gusts recorded fell under 18 mph.

For the months examined, the strongest wind **gusts** came from the North and South-east.

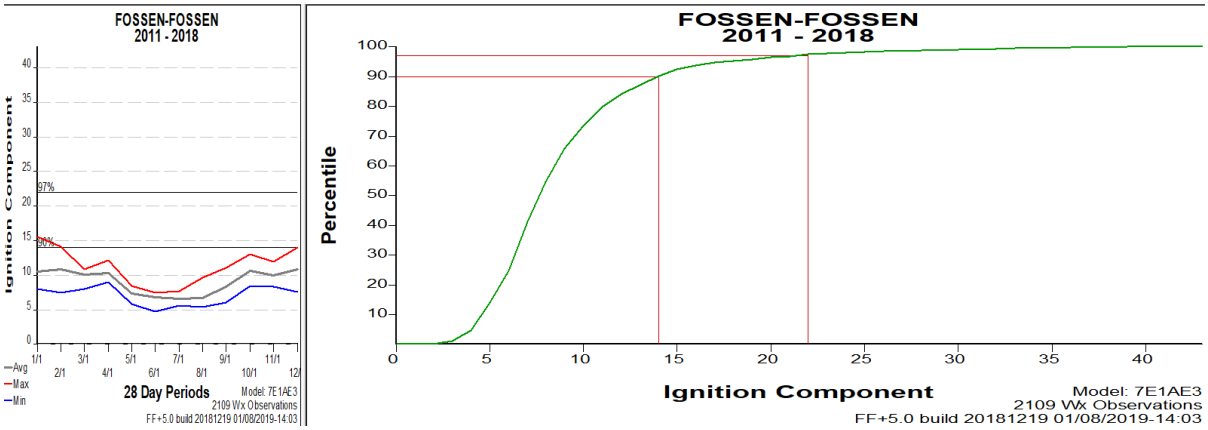


SECTION 2.3 – IGNITION, BURNING AND DROUGHT INDICES

As part of NFDRS, there are many indices developed to help determine the likelihood of fire ignition and spread based on weather conditions. We analyzed all the FOSSEN weather data and looked at only three indices: Ignition Component (IC), Burning Index (BI), and the Keetch-Byram Drought Index (KBDI). A brief explanation of each is presented below.

IGNITION COMPONENT INDEX

The Ignition Component is a rating of the probability that a firebrand will cause a fire requiring suppression action. Since it is expressed as a probability, it ranges on a scale of 0 to 100. An IC of 100 means that every firebrand will cause a fire requiring action if it contacts a receptive fuel. An IC of 0 would mean that no firebrand would cause a fire requiring suppression action under those conditions.

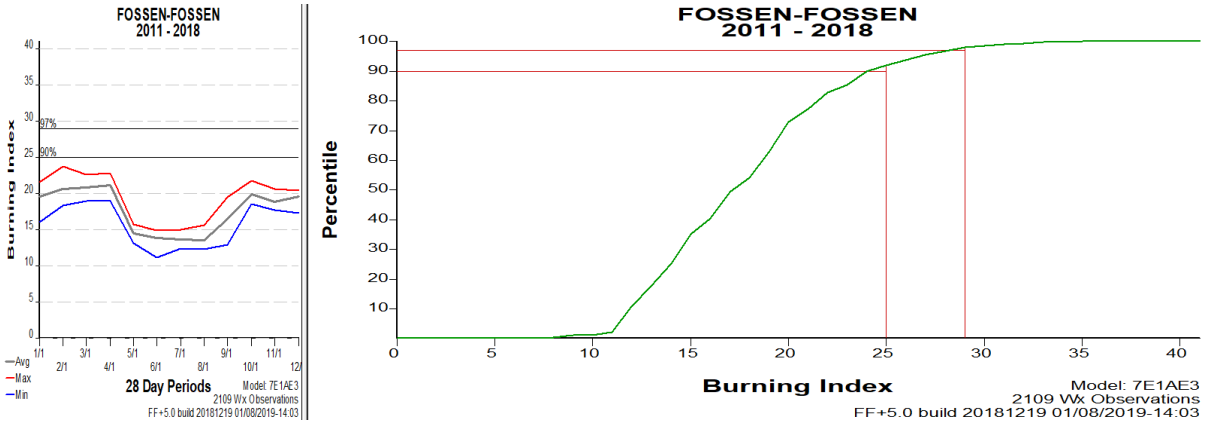


The FOSSEN weather station, IC is highest during the winter months (October to January), however it rarely goes above 15. In other words, at worst, a fire requiring action would occur less than 15 percent of the time on The Presidio.

BURNING INDEX

The Burning Index is a number related to the contribution of fire behavior to the effort of containing a fire. The BI (difficulty of control) is derived from a combination of Spread Component (how fast it will spread) and Energy Release Component (how much energy will be produced). The BI is an index that rates fire danger related to potential flame length over a fire danger rating area.

The BI is expressed as a numeric value related to potential flame length in feet multiplied by 10. The scale is open-ended which allows the range of numbers to adequately define fire problems, even during low to moderate fire danger.[27]

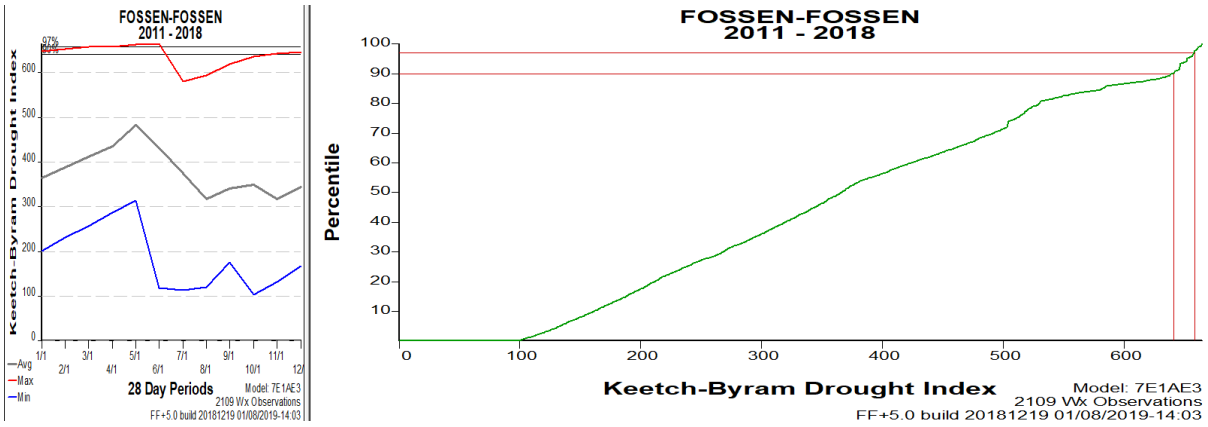


[27] Gaining an Understanding of the National Fire Danger Rating System, PMS 932, NFES 2665, July 2002.

The BI for the FOSSEN weather station is again highest during the winter and spring, and lowest during the summer. However, overall, it is very low, with 97% of all BI predictions under 29 (or 2.9 feet).

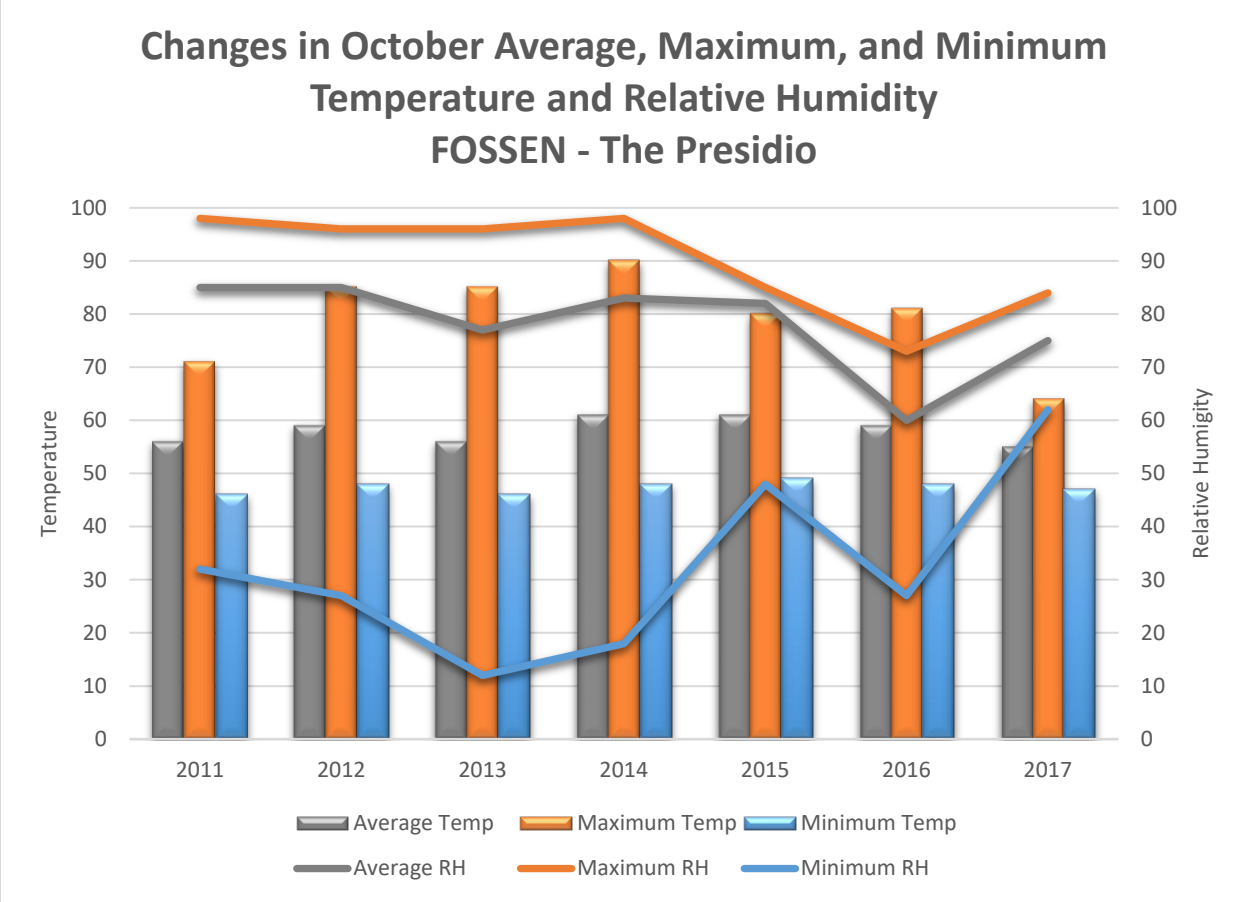
DROUGHT INDEX

Keetch-Byram Drought Index (KBDI) is a stand-alone index that can be used to measure the effects of seasonal drought on fire potential. The actual numeric value of the index is an estimate of the amount of precipitation (in 100ths of inches) needed to bring the soil back to saturation (a value of 0 is complete saturation of the soil). Since the index only deals with the top eight inches of the soil profile, the maximum KBDI value is 800 or 8.00 inches of precipitation would be needed to bring the soil back to saturation. The index's relationship to fire danger is that as the index value increases, the vegetation is subjected to increased stress due to moisture deficiency. At higher values, desiccation occurs, and live plant material is added to the dead fuel loading on the site. Also, an increasing portion of the duff/litter layer becomes available fuel at higher index values.



With a staring KBDI of 100 (or only 1 inch of water needed to fully saturate the soil), the model predicts a relatively low KBDI for the entire year. Only May would experience any significant soil drying with an average peak of 490 (or 4.9 inches needed to fully saturate the soil).

SECTION 3 – NOTES/OBSERVATIONS



Overall, the weather observed at the FOSSEN weather station is stable. While the regional drying trend is reflected in the data (lowering average relatively humidity, dark gray line above), the average temperature remains constant as is the minimum temperature.

With the weather data evaluated here, it is safe to predict an overall, low fire danger for The Presidio. However, if the drying trend continues into the future, a re-analysis of the data is recommended to ascertain future fire risk to The Presidio.

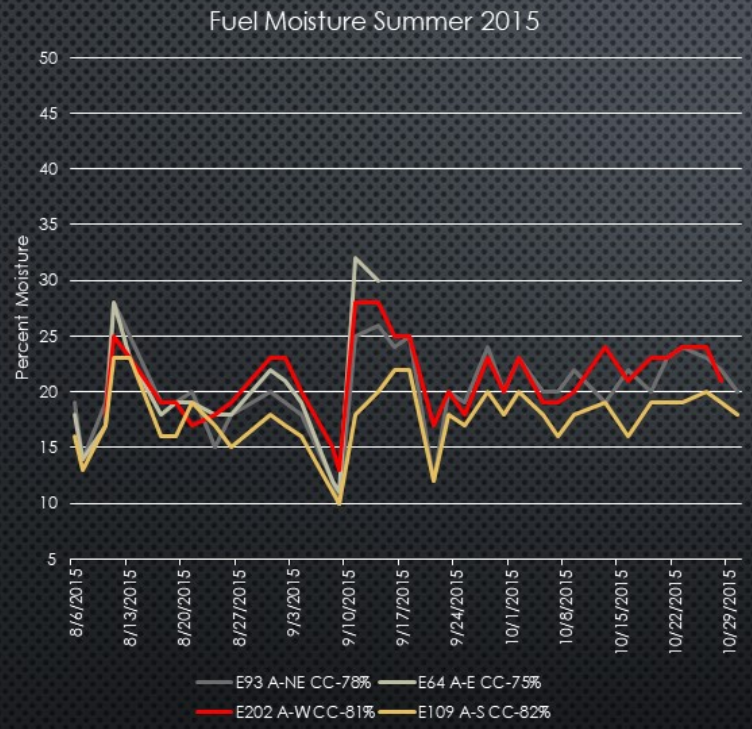
APPENDIX B FUEL MOISTURE INPUT DEVELOPEMENT

STEPS TO A CUSTOM FUEL MOISTURE FILE

Reviewed fuel moisture data collected on The Presidio

Reviewed Spring Valley measured fuel moisture data

Synthesized into a reasonable estimate for fuel moistures for all size classes



10-HOUR FUEL MOISTURE DATA COLLECTED ON THE PRESIDIO

- COLLECTED IN SUMMER OF 2015
- AUGUST, SEPTEMBER, AND OCTOBER
- FOUR SITES
- DATA SHOWN FOR ALL RECORDED READINGS
- LOWEST IS 10%, HIGHEST ABOVE 30%, AVERAGE FOR ALL READINGS IS 20%

FUEL MOISTURE DATA FROM SPRING VALLEY

- CLOSEST RAWS STATION TO THE PRESIDIO WITH FUEL MOISTURE DATA, SOUTH OF THE PRESIDIO IN SAN MATEO COUNTY
- SPORADIC DATA COLLECTION, NOT IN MONTHS WE ARE FOCUSING ON
- DOES HAVE READINGS FOR LIVE AND WOODY
- CAN BE USED AS A GUIDE
- DRIER SITE THAN THE PRESIDIO

043308 - 1-Hour Fuel Moisture - Statistics Table

WetFlag: Use SR_WetFlag if WetFlag is Missing

Variable: 1-Hour Fuel Moisture

Mean, Median, Standard Deviation and Extreme Values

28-Day and Monthly Period Means

28-Day and Monthly Extreme Values

Period Begins	No. Years	Mean	Std. Dev.	Critical Pcntile	Highest Avg, Year	Lowest Avg, Year	High, Year	Avg. High	Std Dev.	Median High	Low, Year	Avg. Low	Std Dev.	Median Low	Period Begins
01/01	0	NA													01/01
02/01	2	9.3	1.0	8.6	10.0 2014	8.6 2018	10.0 2014	9.3	1.0	8.6	8.6 2018	9.3	1.0	8.6	02/01
03/01	1	10.7	0.0	10.7	10.7 2016	10.7 2016	10.7 2016	10.7	0.0	10.7	10.7 2016	10.7	0.0	10.7	03/01
04/01	0	NA													04/01
05/01	1	10.2	2.6	5.9	10.2 2016	10.2 2016	13.6 2016	13.6	0.0	13.6	5.9 2016	5.9	0.0	5.9	05/01
06/01	2	11.2	3.0	5.1	12.1 2018	11.1 2012	14.4 2012	13.2	1.7	12.1	5.1 2012	8.6	4.9	5.1	06/01
07/01	1	15.8	3.9	11.7	15.8 2012	15.8 2012	19.9 2012	19.9	0.0	19.9	11.7 2012	11.7	0.0	11.7	07/01
08/01	0	NA													08/01
09/01	0	NA													09/01
10/01	0	NA													10/01
11/01	1	11.4	0.0	11.4	11.4 2017	11.4 2017	11.4 2017	11.4	0.0	11.4	11.4 2017	11.4	0.0	11.4	11/01
12/01	0	NA													12/01

Month	No. Years	Mean	Std. Dev.	Highest Avg, Year	Lowest Avg, Year	High, Year	Avg. High	Std Dev.	Median High	Low, Year	Avg. Low	Std Dev.	Median Low	Month
FEB	2	9.3	1.0	10.0 2014	8.6 2018	10.0 2014	9.3	1.0	8.6	8.6 2018	9.3	1.0	8.6	FEB
MAR	1	10.7	0.0	10.7 2016	10.7 2016	10.7 2016	10.7	0.0	10.7	10.7 2016	10.7	0.0	10.7	MAR
MAY	1	10.2	2.6	10.2 2016	10.2 2016	13.6 2016	13.6	0.0	13.6	5.9 2016	5.9	0.0	5.9	MAY
JUN	2	11.2	3.0	12.1 2018	11.1 2012	14.4 2012	13.2	1.7	12.1	5.1 2012	8.6	4.9	5.1	JUN
JUL	1	15.8	3.9	15.8 2012	15.8 2012	19.9 2012	19.9	0.0	19.9	11.7 2012	11.7	0.0	11.7	JUL
NOV	1	11.4	0.0	11.4 2017	11.4 2017	11.4 2017	11.4	0.0	11.4	11.4 2017	11.4	0.0	11.4	NOV

24 weather observations used. 24 records processed.
FF+4.2 build 24.19 01/09/2019-14:29

FUEL MOISTURE VALUES FOR THE PRESIDIO

- 1 HR FUEL MOISTURE WAS SET TO 17% FOR ALL FUEL MODELS ACROSS THE PRESIDIO. THIS IS 2 PERCENTAGE POINTS LOWER THAN THE AVERAGE RECORDED FUEL MOISTURE FOR THE 10 HR FUEL MOISTURE; THE DIFFERENCE CONSISTENT WITH WHAT WAS REPORTED FOR SPRING VALLEY.
- 10 HR FUEL MOISTURE WAS SET TO 19%. THIS IS THE AVERAGE FOR ALL AUGUST, 2015 RECORDED FUEL MOISTURE READINGS ON THE PRESIDIO.
- 100 HR FUEL MOISTURE WAS SET TO 20%. THIS IS 1 PERCENTAGE POINT HIGHER THAN THE AVERAGE RECORDED FUEL MOISTURE FOR THE 10 HR FUEL MOISTURE; THE DIFFERENCE CONSISTENT WITH WHAT WAS REPORTED FOR SPRING VALLEY.
- LIVE HERBECEOUS AND LIVE WOODY WAS SET TO 150% EACH, ASSUMING THAT IN AUGUST ALL VEGETATION WOULD BE IN MATURE.
- WEATHER AND WIND FILES WERE USED TO CONDITION THE FUELS AFTER THIS INITIAL FUEL MOISTURE STATE.

Moisture Content (%)	Stage of Vegetative Development
300%	Fresh foliage, annuals developing early in the growing cycle.
200%	Maturing foliage, still developing, with full turgor.
100%	Mature foliage, new growth complete and comparable to older perennial foliage.
50%	Entering dormancy, coloration starting, some leaves may have dropped from stem.
30%	Completely cured, treat as dead fuel.

APPENDIX C OPERATIONS PLAN – MOWING AND CUTTING

Inspection - All mowing equipment will be inspected by May 1 of each year for compliance with PRC Section 4442. Equipment not inspected shall not be used. The Trust will maintain records of maintenance and inspection for equipment; these records will be available for inspection.

Fire Prevention Equipment – String cutters, chain saws, small mowers and other internal combustion engine-powered must comply with PRC Section 4442, that requires it must be equipped with an approved spark arrestor (per US Forest Service standards in their Spark Arrestor Guide). Equipment powered by properly maintained exhaust-driven turbo-charged engines and those equipped with scrubbers with properly maintained water levels do not require spark arrestors. This does not include most motor vehicles it they are equipped with an approved muffler system, routed properly, as described in the Motor Vehicle Code.

AS A MINIMUM, the following fire suppression equipment must always be available at the work site (and on all mowers) per PRC Section 4427(b):

- 1 round-pointed shovel with overall length not less than 46 inches
- 1 5-gallon backpack water pump to serve as a fire extinguisher
- 1 fully charged fire extinguisher UL rated at 4 BC or more per truck, tractor, grader or other heavy equipment
- two-way radio or mobile telephone or pager, walkie-talkie to enable reporting of fires or emergencies from the scene, when in an area of potential ignition

Additional equipment may be required per the rules below:

- 100 gallon pumper equipped with Class A foam and proportioner

Operational Procedures - The following rules apply with operations are conducted within or adjacent to any grass, brush of forest areas:

	Very High/High	**Extreme**	**Shutdown RFW**
Weather Sampling	Hourly	Hourly	Hourly
Communications	2-way communication required	2-way communication required	2-way communication required
Permitted Activity	All	No grass cutting	None
Mitigation Required	None	Cessation of activities if: probability of ignition is >90% and 20-ft wind >15 mph OR if probability of ignition is 100% under any windspeed	Cessation of activities if: probability of ignition is >90% and 20-ft wind >15 mph OR if probability of ignition is 100% under any windspeed
Inspection	By operator	By operator, with follow-up confirmation by personnel from Emergency Services and Law Enforcement	By operator, with follow-up confirmation by personnel from Emergency Services and Law Enforcement

Summary of Operational Procedures -

- ✓ No grass cutting and pumper is needed if probability of ignition is >80% and the windspeed is >15 mph.
- ✓ All work stops if probability of ignition is >90% and the windspeed is >15 mph.
- ✓ All mowing stops during Red Flag Warning

Notification – Operators will check the weather at the beginning of the work period. It is the responsibility of the supervisors and crew members to communicate to the Trust staff at Emergency Response and Law Enforcement the as soon as the Red Flag Warning is known and when the above trigger points are reached. Plumber Supervisor must report fires occurring within limits of project. **This procedure will be attached to the contract of any vegetation management contractor.**

Patrol - The area of operation will be patrolled and directly monitored for 30 minutes **by the operator** following completion of the operation. The operator will contact Dispatch Center and Trust staff at Emergency Response and Law Enforcement upon completion of the operation, and patrol/monitoring period.

How to determine the operating procedures to be used on any day:

1. Determine the air temperature, relative humidity, and wind speed from the RAWS

2. Using *Table A*, the air temperature, and relative humidity, determine the reference fuel moisture. This is the fine fuel moisture.

3. From the table of *Probability of Ignition*, use air temperature and fine fuel moisture to determine the probability of ignition. Assume 0-10 percent shading.

4. Using the *Tables of Operations Procedures*, determine restrictions in place.

5. Example 1: Air temperature is 75 degrees F, relative humidity is 35%. Fine fuel moisture is 5%, and the corresponding probability of ignition is 60%. Operations are unrestricted.

6. Example 2: Air temperature is 80 degrees F, relative humidity is 20%. Fine fuel moisture is 3%, and the corresponding probability of ignition is 80%. Check the wind speed. Operations are restricted - grass cutting is prohibited if RAWS wind speed exceeds 10 mph.

Exhibit II-2.(con).

TABLE A

REFERENCE FUEL MOISTURE

DAY TIME 0800-1959

Dry Bulb Temperature (°F)	RELATIVE HUMIDITY (PERCENT)																				
	0 ↓ 4	5 ↓ 9	10 ↓ 14	15 ↓ 19	20 ↓ 24	25 ↓ 29	30 ↓ 34	35 ↓ 39	40 ↓ 44	45 ↓ 49	50 ↓ 54	55 ↓ 59	60 ↓ 64	65 ↓ 69	70 ↓ 74	75 ↓ 79	80 ↓ 84	85 ↓ 89	90 ↓ 94	95 ↓ 99	100
10 - 29	1	2	2	3	4	5	5	6	7	8	8	8	9	9	10	11	12	12	13	13	14
30 - 49	1	2	2	3	4	5	5	6	7	7	7	8	9	9	10	10	11	12	13	13	13
50 - 69	1	2	2	3	4	5	5	6	6	7	7	8	8	9	9	10	11	12	12	12	13
70 - 89	1	1	2	2	3	4	5	5	6	7	7	8	8	8	9	10	10	11	12	12	13
90-109	1	1	2	2	3	4	4	5	6	7	7	8	8	8	9	10	10	11	12	12	13
109+	1	1	2	2	3	4	4	5	6	7	7	8	8	8	9	10	10	11	12	12	12

GO TO TABLE B, C, or D FOR CORRECTIONS

TABLE B

DAYTIME 0800-1959

DEAD FUEL MOISTURE CONTENT CORRECTIONS

MAY JUNE JULY

		EXPOSED – LESS THAN 50% SHADING OF SURFACE FUELS																			
		0800 ➤			1000 ➤			1200 ➤			1400 ➤			1600 ➤			1800 ➤				
		B	L	A	B	L	A	B	L	A	B	L	A	B	L	A	B	L	A		
N	0-30%	2	3	4	1	1	1	0	0	1	0	0	1	1	1	1	2	3	4		
	31%+	3	4	4	1	2	2	1	1	2	1	1	2	1	2	2	3	4	4		
E	0-30%	2	2	3	1	1	1	0	0	1	0	0	1	1	1	2	3	4	4		
	31%+	1	2	2	0	0	1	0	0	1	1	1	2	2	3	4	4	5	6		
S	0-30%	2	3	3	1	1	1	0	0	1	0	0	1	1	1	1	2	3	3		
	31%+	2	3	3	1	1	2	0	1	1	0	1	1	1	1	2	2	3	3		
W	0-30%	2	3	4	1	1	2	0	0	1	0	0	1	0	1	1	2	3	3		
	31%+	4	5	6	2	3	4	1	1	2	0	0	1	0	0	1	1	2	2		
	SHADED – GREATER THAN OR EQUAL TO 50% SHADING OF SURFACE FUELS																				
N	0%+	4	5	5	3	4	5	3	3	4	3	3	4	3	4	5	4	5	5		
E	0%+	4	4	5	3	4	5	3	3	4	3	4	4	3	4	5	4	5	6		
S	0%+	4	4	5	3	4	5	3	3	4	3	3	4	3	4	5	4	5	5		
W	0%+	4	5	6	3	4	5	3	3	4	3	3	4	3	4	5	4	4	5		

NOTE: A = 1000'-2000' above site
L = ±1000' of site location
B = 1000'-2000' below site

Exhibit II-2.(con).

TABLE C

DAYTIME
0800-1959

DEAD FUEL MOISTURE CONTENT CORRECTIONS

FEBRUARY MARCH APRIL/AUGUST SEPTEMBER OCTOBER

		EXPOSED – LESS THAN 50% SHADING OF SURFACE FUELS																	
		0800 ➤			1000 ➤			1200 ➤			1400 ➤			1600 ➤			1800 ➤		
		B	L	A	B	L	A	B	L	A	B	L	A	B	L	A	B	L	A
N	0-30%	3	4	5	1	2	3	1	1	2	1	1	2	1	2	3	3	4	5
	31%+	3	4	5	3	3	4	2	3	4	2	3	4	3	3	4	3	4	5
E	0-30%	3	4	5	1	2	3	1	1	1	1	1	2	1	2	3	3	4	5
	31%+	3	3	4	1	1	1	1	1	1	1	2	3	3	4	5	4	5	6
S	0-30%	3	4	5	1	2	2	1	1	1	1	1	1	1	2	3	3	4	5
	31%+	3	4	5	1	2	2	0	1	1	0	1	1	1	2	2	3	4	5
W	0-30%	3	4	5	1	2	3	1	1	1	1	1	1	1	2	3	3	4	5
	31%+	4	5	6	3	4	5	1	2	3	1	1	1	1	1	1	3	3	4
	SHADED – GREATER THAN OR EQUAL TO 50% SHADING OF SURFACE FUELS																		
N	0%+	4	5	6	4	5	5	3	4	5	3	4	5	4	5	5	4	5	6
E	0%+	4	5	6	3	4	5	3	4	5	3	4	5	4	5	6	4	5	6
S	0%+	4	5	6	3	4	5	3	4	5	3	4	5	3	4	5	4	5	6
W	0%+	4	5	6	4	5	6	3	4	5	3	4	5	3	4	5	4	5	6

NOTE: A = 1000'-2000' above site
L = ±1000' of site location
B = 1000'-2000' below site

TABLE D

DAYTIME
0800-1959

DEAD FUEL MOISTURE CONTENT CORRECTIONS

NOVEMBER DECEMBER JANUARY

		EXPOSED – LESS THAN 50% SHADING OF SURFACE FUELS																	
		0800 ➤			1000 ➤			1200 ➤			1400 ➤			1600 ➤			1800 ➤		
		B	L	A	B	L	A	B	L	A	B	L	A	B	L	A	B	L	A
N	0-30%	4	5	6	3	4	5	2	3	4	2	3	4	3	4	5	4	5	6
	31%+	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6
E	0-30%	4	5	6	3	4	4	2	3	3	2	3	3	3	4	5	4	5	6
	31%+	4	5	6	2	3	4	2	2	3	3	4	4	4	5	6	4	5	6
S	0-30%	4	5	6	3	4	5	2	3	3	2	2	3	3	4	4	4	5	6
	31%+	4	5	6	2	3	3	1	1	2	1	1	2	2	3	3	4	5	6
W	0-30%	4	5	6	3	4	5	2	3	3	2	3	3	3	4	4	4	5	6
	31%+	4	5	6	4	5	6	3	4	4	2	2	3	2	3	4	4	5	6
	SHADED – GREATER THAN OR EQUAL TO 50% SHADING OF SURFACE FUELS																		
N	0%+	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6
E	0%+	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6
S	0%+	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6
W	0%+	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6

NOTE: A = 1000'-2000' above site
L = ±1000' of site location
B = 1000'-2000' below site

PROBABILITY OF IGNITION

When spotting is possible, the probability of ignition where the firebrand lands must also be considered. The method presented here was developed by Mark J. Schroeder (unpublished office report 2106–1, August 13, 1969), and adapted for FBO's by Pat Andrews. It is based on the amount of heat required to bring the fuel to ignition temperature. It assumes that the firebrand lands on **fine** fuel. The probability of ignition does not consider whether or not the resulting ignition will be sustained and therefore is different from ignition component.

Probability of ignition is obtained from table IV–4. The inputs needed are:

- fine fuel moisture.
- air temperature.
- percent shading of ground fuels due to either cloud cover or tree canopy.

A place for recording this information is given on the bottom of the spotting worksheet, exhibit IV–1.

Example: fine dead fuel moisture = 6%
shading due to tree canopy = 100%
air temperature under canopy = 75° F
from table IV–4: probability of ignition = 50%

Table IV–4.— Probability of ignition (Percent)

Shading	Dry bulb temp	Fine dead fuel moisture (percent)															
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Percent	°F																
0–10	110+	100	100	90	80	70	60	50	40	40	30	30	30	20	20	20	10
	100–109	100	90	80	70	60	60	50	40	40	30	30	20	20	20	10	10
	90– 99	100	90	80	70	60	50	50	40	30	30	30	20	20	20	10	10
	80– 89	100	90	80	70	60	50	40	40	30	30	20	20	20	20	10	10
	70– 79	100	80	70	60	60	50	40	40	30	30	20	20	20	10	10	10
	60– 69	90	80	70	60	50	50	40	30	30	30	20	20	20	10	10	10
	50– 59	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	40– 49	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	30– 39	90	70	60	60	50	40	40	30	30	20	20	20	10	10	10	10
10–50	110+	100	100	80	70	60	60	50	40	40	30	30	20	20	20	20	10
	100–109	100	90	80	70	60	50	50	40	40	30	30	20	20	20	10	10
	90– 99	100	90	80	70	60	50	40	40	30	30	30	20	20	20	10	10
	80– 89	100	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10
	70– 79	100	80	70	60	50	50	40	40	30	30	20	20	20	10	10	10
	60– 69	90	80	70	60	50	50	40	30	30	20	20	20	20	10	10	10
	50– 59	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	40– 49	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	30– 39	80	70	60	50	50	40	30	30	20	20	20	10	10	10	10	10
60–90	110+	100	90	80	70	60	50	50	40	40	30	30	20	20	20	10	10
	100–109	100	90	80	70	60	50	50	40	30	30	30	20	20	20	10	10
	90– 99	100	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10
	80– 89	100	80	70	60	60	50	40	40	30	30	20	20	20	10	10	10
	70– 79	90	80	70	60	50	50	40	30	30	30	20	20	20	10	10	10
	60– 69	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	50– 59	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	40– 49	90	70	60	50	50	40	30	30	20	20	20	20	10	10	10	10
	30– 39	80	70	60	50	50	40	30	30	20	20	20	10	10	10	10	10
100	110+	100	90	80	70	60	50	50	40	30	30	30	20	20	20	10	10
	100–109	100	90	80	70	60	50	40	40	30	30	20	20	20	20	10	10
	90– 99	100	80	70	60	60	50	40	40	30	30	20	20	20	10	10	10
	80– 89	90	80	70	60	50	50	40	30	30	30	20	20	20	10	10	10
	70– 79	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	60– 69	90	60	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	50– 59	90	70	60	60	50	40	40	30	30	20	20	20	10	10	10	10
	40– 49	80	70	60	50	50	40	30	30	20	20	20	10	10	10	10	10
	30– 39	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10	10

APPENDIX D
SAN FRANCISCO FIRE DEPARTMENT SCOPE OF SERVICES

EXHIBIT A

SCOPE OF SERVICES

1. Description of Services

SFFD will provide structure and wildfire firefighting, rescue, hazardous materials responses, and emergency medical services and emergency preparedness assistance for Area B. SFFD will provide these services at a level and with management oversight consistent with services provided by SFFD throughout San Francisco. At a minimum, SFFD will provide the following services within the described service performance parameters.

1.1 Service Elements:

Structure and wildfire firefighting, emergency medical services, technical rescue, including confined space rescue operations, and hazardous material incident response at both the first responder and hazardous materials team levels via:

- A four person Type 1 Advanced Life Support Engine Company located in Station 51 operating 24 hours per day, 365 days a year, and other SFFD stations located within the City as may be required to meet Service Performance Standards;
- The same level of Paramedic ambulance service as deployed throughout San Francisco neighborhoods. Coverage shall be provided 24 hours per day, 365 days a year and the ambulance shall be staffed and operated per San Francisco County EMS system policies;
- As appropriate, additional fire fighting, rescue and emergency medical support dispatched from fire stations and ambulance posts located outside Area B, consistent with SFFD's policies and procedures;
- Emergency incident command and daily supervision of units providing services under this Contract consistent with the levels provided citywide.

1.2 Service Performance Standards

1.2.1 SFFD will use all reasonable efforts to provide first-responder unit response on average at 5 minutes or less from response unit notification (or 4 minutes or less drive time), 90% of the time, for incidents within Area B.

1.2.2 SFFD will deploy to incidents in Area B the personnel, equipment, and resources at the same level normally dispatched within the City for similar incident types. When multiple units are needed, SFFD shall use all reasonable efforts to have the additional units on-scene within 9 minutes or less from response unit notification (or 8 minutes or less drive time) 90% of the time for incidents within Area B.