Office of the City Manager

SUPPLEMENTAL AGENDA MATERIAL

for Supplemental Packet 1

Meeting Date: **July 23, 2024**

Item Number: **01**

Item Description: **Zoning Ordinance and General Plan Amendments Relating to Middle Housing**

Submitted by: **City Manager via Jordan Klein**

No change to the staff report. This is a supplemental memo from the Fire Department elevating concerns with deviating from Staff's recommendation with regard to the application of middle housing in Fire Zone 2 and 3.

Department of Fire and Emergency Services
Office of the Fire Chief
David Sprague, Fire Chief

Date: July 16, 2024

To: Mayor and City Council

From: David Sprague, Fire Chief

Subject: **WILDFIRE RISK ASSOCIATED WITH ADDITIONAL DENSITY IN THE VERY HIGH FIRE DANGER SEVERITY ZONE**

Introduction

The Berkeley Fire Department (The Department) understands that proposed changes to the zoning ordinance are desirable to encourage the development of multi-family residential uses within certain zoning districts throughout the City. The Department is extremely concerned about any intensification of structures, population and vehicles in Berkeley's Very High Fire Hazard Severity Zones 2 and 3 ("Fire Zones") and urges caution before deviating from Staff's recommendation and including the Fire Zones in the modifications to the zoning ordinance.

Berkeley has a cyclic relationship with significant wildfires and has all of the conditions for future wildfires that could devastate not just the burned area, but a large portion of the city. These conditions include:

- steep topography and weather patterns that support the rapid spread of fire, and
- a surface street capacity that is undersized and will constrain both a large-scale evacuation of residents and the emergency response, and
- a landscape that has been transformed from an Oak Savanna to a dense urban forest,
- a dense network of tightly spaced structures that will exacerbate structure-to-structure ignition and fire spread during a wildfire, and
- many homes were constructed prior to 2008 when modern (wild)fire resistive building codes were put in place, and
- a network of linear features (auxiliary structures, fences, wood piles, decks and

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vehicles) that will easily transmit fire through a neighborhood, and
- a Department that lacks sufficient staffing and facilities to meet the current risk, let alone any increased risk.

Over the past two decades, wildfires in wildland-urban interface (WUI) areas have become more severe, causing significant damage to communities and the economy. The National Institute of Standards and Technology (NIST), California Department of Forestry and Fire Protection (CAL FIRE), and Insurance Institute for Business & Home Safety (IBHS) collaborated to create a Hazard Mitigation Methodology (HMM) to address this issue. Published as *NIST Technical Note 2205: WUI Structure / Parcel / Community Fire Hazard Mitigation Methodology*[i], the HMM focuses on assessing and mitigating fire and ember hazards by considering the spatial relationships between fuels (structures, fences, ADUs, sheds, etc.), exposures, and hardening at structure and parcel levels. The methodology is science-based, drawing from extensive field data and research, and assesses mitigation effectiveness at the parcel and community levels and is therefore referenced throughout this memo.

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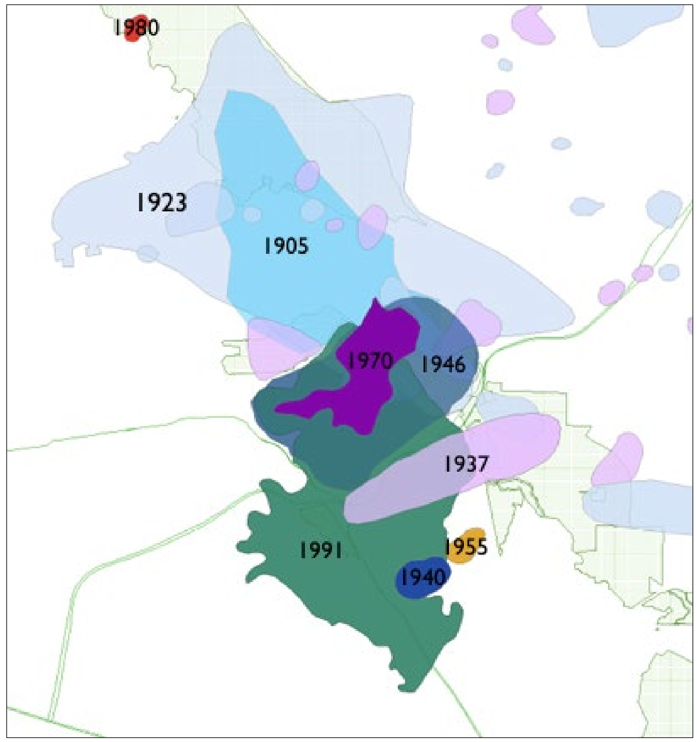
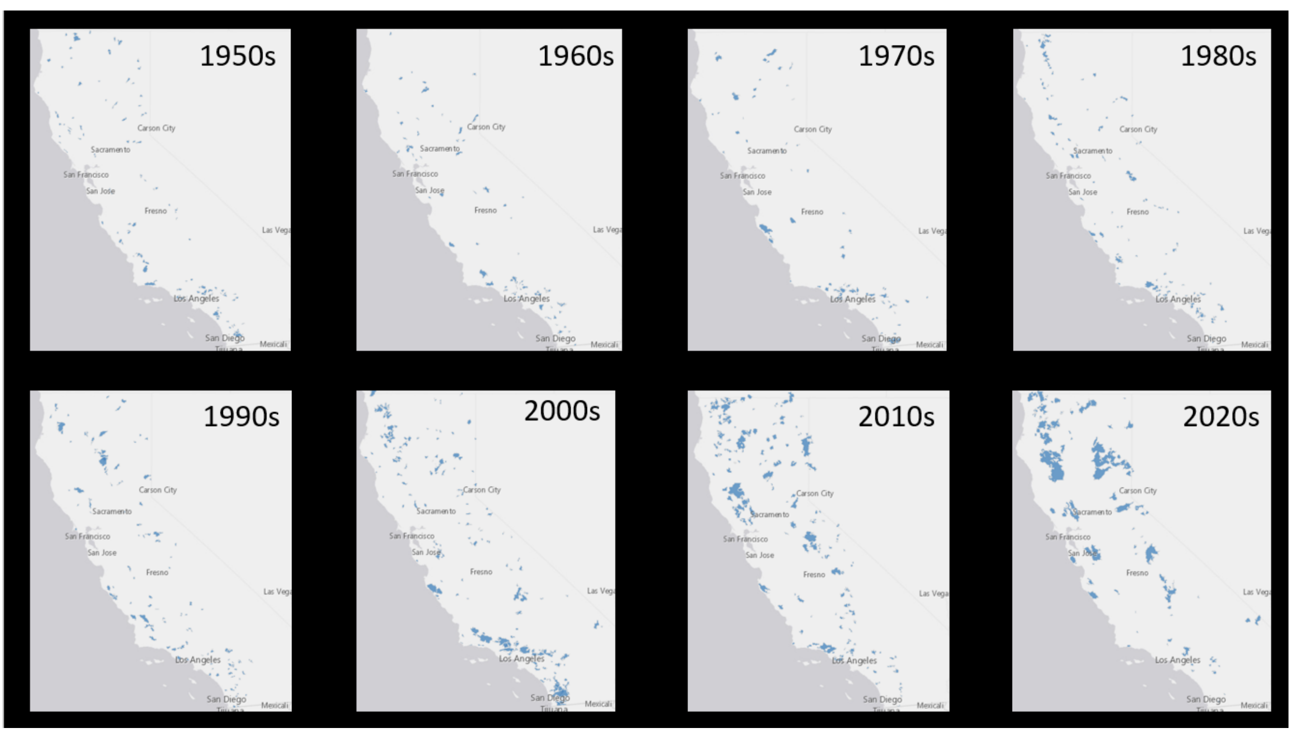
Berkeley's Cyclic Relationship with Wildfire



Berkeley and the region have long faced an elevated risk of wildfires, having faced significant wildfires in 1905, 1923, 1946, 1970, and 1991[ii]. The map shows the locations of these fires, which generally correspond with the City's Very High Fire Danger Severity Zones.

The maps below were created by CalFIRE and show the perimeters of California wildfires by decade from 1950 to present day. Far from receding with time, the risk of catastrophic wildfire is growing due to a confluence of factors including unusual drought and heat exacerbated by climate change, the accumulation of vegetative fuels as a result of 110+ years of fire exclusion, and rapid population growth along the edges of forests. These growing risks demand new approaches in risk management and careful consideration of any policy changes that impact density, especially in the Fire Zones.



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Challenges with Large Scale Evacuation of Berkeley

Because of the above-mentioned challenges, it is especially crucial that residents within Berkeley's Fire Zones be able to evacuate as quickly and efficiently as possible. A wind-driven wildfire can spread at extraordinary speeds and ember storms can ignite spot fires far ahead of the main flame front[iii]. During this type of weather, some normally-available firefighting tools can be ineffective or even unusable; for instance, planes and helicopters, which are ordinarily useful for firefighting, need to be grounded during high winds. When a fire builds to this magnitude and travels with extreme speed and force, firefighters' primary focus often shifts from firefighting to supporting evacuations.

We know from many of the contemporary wildfires that have impacted residential communities, from Paradise to Santa Rosa to Lahaina, that many people have died fleeing in their vehicles or on foot on limited evacuation routes. The Netflix documentary "Fire in Paradise" provides some visceral insight into the challenge of evacuation for a community that considered itself prepared for such an event. The narrow, winding roadways in the Berkeley Hills pose evacuation challenges in this respect. Video from the 1991 Oakland-Berkeley Hills Fire demonstrates how evacuating vehicles get backed up, forcing their occupants to choose between waiting in a line of cars or abandoning their vehicles and running for safety. Given the aging of Berkeley's population, the topography, the large number of people living in the City's Fire Zones, and the extremely limited opportunities for egress, a rapidly moving wildfire that causes a wind-driven, structure-to-structure urban conflagration in the Berkeley Hills has the potential to result in fatalities on the same magnitude, and potentially greater, than what has been seen in recent fires in Maui and Sonoma County.

We also know from recent fires that evacuation must occur *before* a fire starts. The fires that occurred in Lahaina, Maui in 2023 are the most recent example demonstrating that under fire conditions, waiting to evacuate until after the fire starts may not provide enough time to escape, especially when roadways are under-sized for the evacuating population. The Department is already aware that residents in Berkeley's WUI may not be able to evacuate as fast as a fire could spread, given both the extraordinarily fast spread of a wind-driven wildfire, as well as area's density and narrow, winding roads. Further density within this region would likely exacerbate the risk that some residents would not be able to evacuate quickly enough, leading to devastating loss of life. Said plainly, the encouragement of pre-evacuation is evidence of infrastructure ill-equipped to handle the load of the existing need, let alone the additional load of increased density.

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Weather Conditions, Topography, and Vegetation Pose Extreme Risks to People and Property

It is well-known that weather elements, including temperature, relative humidity, wind, and lightning, affect wildland fire potential and behavior. Wind can be the most significant weather factor influencing wildland fire behavior, with higher wind speeds increasing fire spread and intensity. High temperatures and low relative humidity also influence fire potential and behavior by drying out vegetative fuels, allowing such fuels to burn more readily and intensely. In Berkeley, weather conditions conducive to wildland fires primarily occur during the summer and fall months, as strong winds develop, producing higher temperatures and lower humidity.

The City's topography also contributes to the fire risk in Berkeley's WUI.[iv] The City's topography transitions from being sea level along the San Francisco Bay in the west, to steeper, sloped terrain approaching 1,000 feet in elevation in the Berkeley Hills along the City's eastern edge. The steeper, sloped terrain in the Hills can contribute to fire spread, because wildland fires tend to burn more intensely and spread faster when burning uphill and up-canyon. However, the hot, dry "Foehn" or "Diablo" winds from the northeast that occur especially during the spring and fall, and come from the northeast, can cause rapid downhill and down-canyon fire spread and were responsible for the fires in 1923 and 1991.

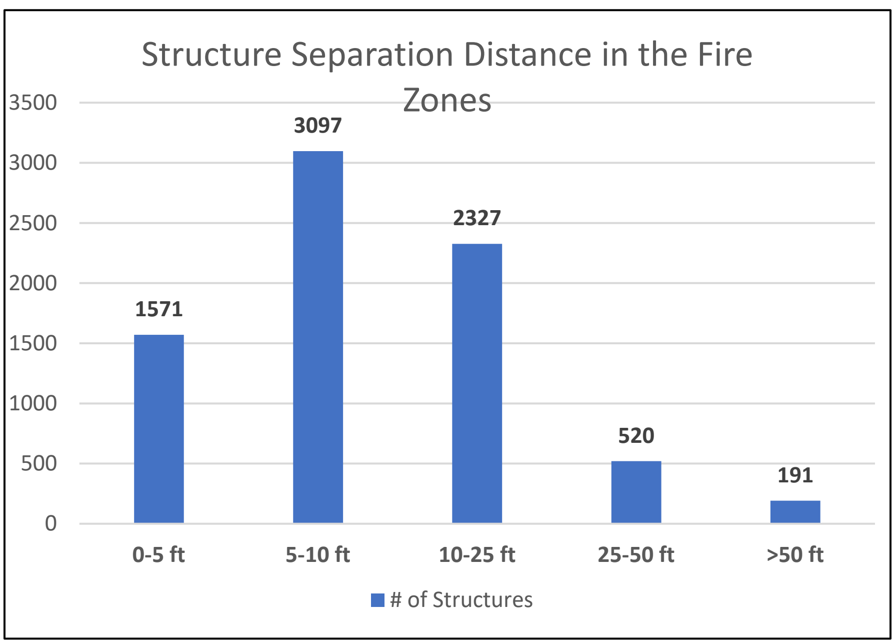
The vegetation within the WUI further contributes to fire risk. In addition to decorative landscape species, vegetative fuels within the Fire Zones consist of a mix of annual grasses and weeds, manzanita/knob cone, chaparral, deciduous, eucalyptus, cypress, and mixed conifer tree species. These types of vegetation can burn intensely and contribute to rapid fire spread under the right fuel, weather, and topographic conditions. Development has intensified these natural hazards over time. At the time of the 1923 Berkeley Fire, the Berkeley Hills were largely undeveloped, looking more like the Hills in the South Bay: open grassland/Oak Savanna. However, many trees were planted over the course of the 20th Century as the Hills became more developed. Some of these trees are invasive and/or more flammable during a wildfire, such as the Italian Cypress, Eucalyptus, Monterey Pine, and Acacia. Over time, these trees have altered Berkeley's natural landscape and dramatically increased the Hills' fire fuels.

Structure Separation Distance is Critical to Limiting Fire Spread in Berkeley

According to recognized industry practice, structure separation distance, or "SSD", is a key metric in mitigating the risk of structure-to-structure ignition during wildfires. This is due to the fact that *"…structures represent a significant density of fuels that impact fire spread and, in many cases, directly contribute to the ignition of additional structures, propagating fire throughout the community."* (Maranghides, et al., 2022) According to NIST 2205 there are three categories of SSD, summarized in the table below.

Category	SSD	Notes
Low Density	>50 ft	lower potential losses from individual structure ignitions, low potential for urban conflagration
Moderate Density	25 ft to 50 ft	greatest impact on structure ignition resistance by hardening for fire exposures from neighboring structures
High Density	< 25 ft	must not have any structures ignite, as risk of entire community loss is very high due to structure-to-structure fire spread

Many of the structures in Berkeley's Fire Zones have an SSD of < 25 feet (see table below and map[1] on the next page), which places the community in the highest risk category according to research. The Department recommends preserving or gaining every foot of SSD possible, as the more space between structures, the less likely structure-to-structure ignition will occur. Additional space also provides more access for firefighters to perform offensive or defensive firefighting activities such as deploying hose lines or cooling vertical and horizontal structural surfaces with water and foam/retardant.



The Department's residential Defensible Space Inspection program is focused on mitigating risk that was established prior to a

1 https://berkeley.maps.arcgis.com/home/item.html?id=28897f6849bf4514bd1d7cf93ee4ea53

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modern understanding of how wildfire spreads in a build environment. Existing structures cannot be moved, and inspections aim to mitigate existing risk where possible. However, it is important to note that this program cannot mitigate risk of additional density, which would be antithetical to both the science behind the inspections and enforcement of the fire code, as well as the intent of the program; additional density may nullify the work that is being done today to transition the Fire Zones to a more wildfire safe environment.

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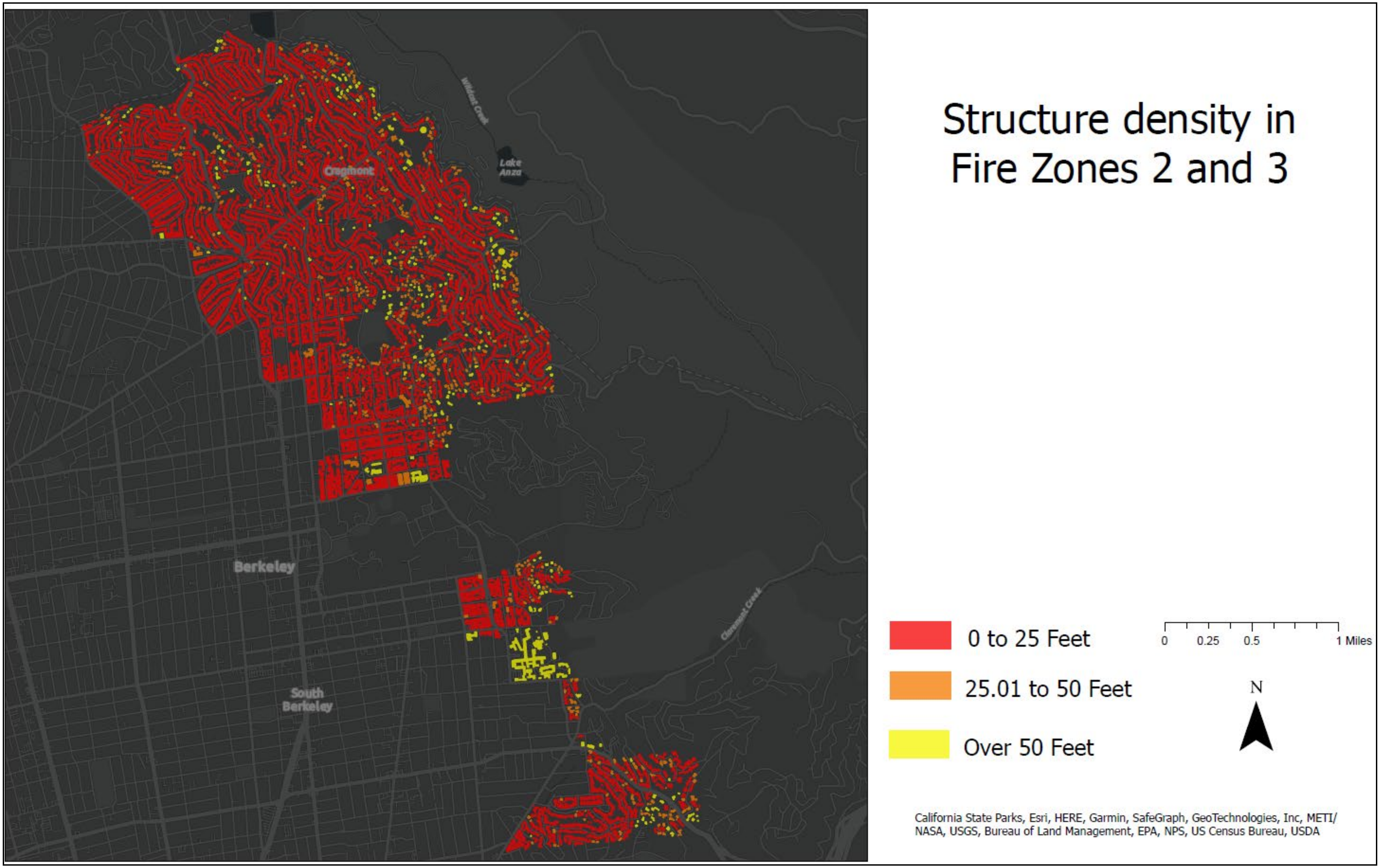

Structure density in Fire Zones 2 and 3
Cragmont
Lake Anza
Berkeley
South Berkeley
0 to 25 Feet
25.01 to 50 Feet
Over 50 Feet
0 0.25 0.5 1 Miles
N
California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA

Housing Units per Acre Impact Structure-to-Structure Fire Spread in Berkeley

The structural density of a Wildland Urban Interface is categorized into one of seven risk profiles with the highest-density communities having 8 housing units per acre (HU/ac). Almost the entire Fire Zone area is in the two highest risk categories with between 4 and 6 structures per acre (See the table below and the map[2] on the next page).

Type	WUI Type Name	Typical Housing Density (Hu/ac)
1	High Density Interface – Perimeter	2 to 8+
2	High Density Interface – Interior	2 to 8+
3	Medium Density Interface – Perimeter	<2
4	Medium Density Interface – Interior	<2
5	Medium Density Intermix	<2
6	Low Density Interface	<1
7	Low Density Intermix	<1

One factor exacerbating this problem further is that almost all homes were constructed prior to modern home hardening (fire resistive) codes were put in place, leaving homes vulnerable to ignition from embers, direct flame impingement, or radiated or convection heat.

2 https://berkeley.maps.arcgis.com/apps/mapviewer/index.html?layers=50439fabd95045fba6d7319173698609

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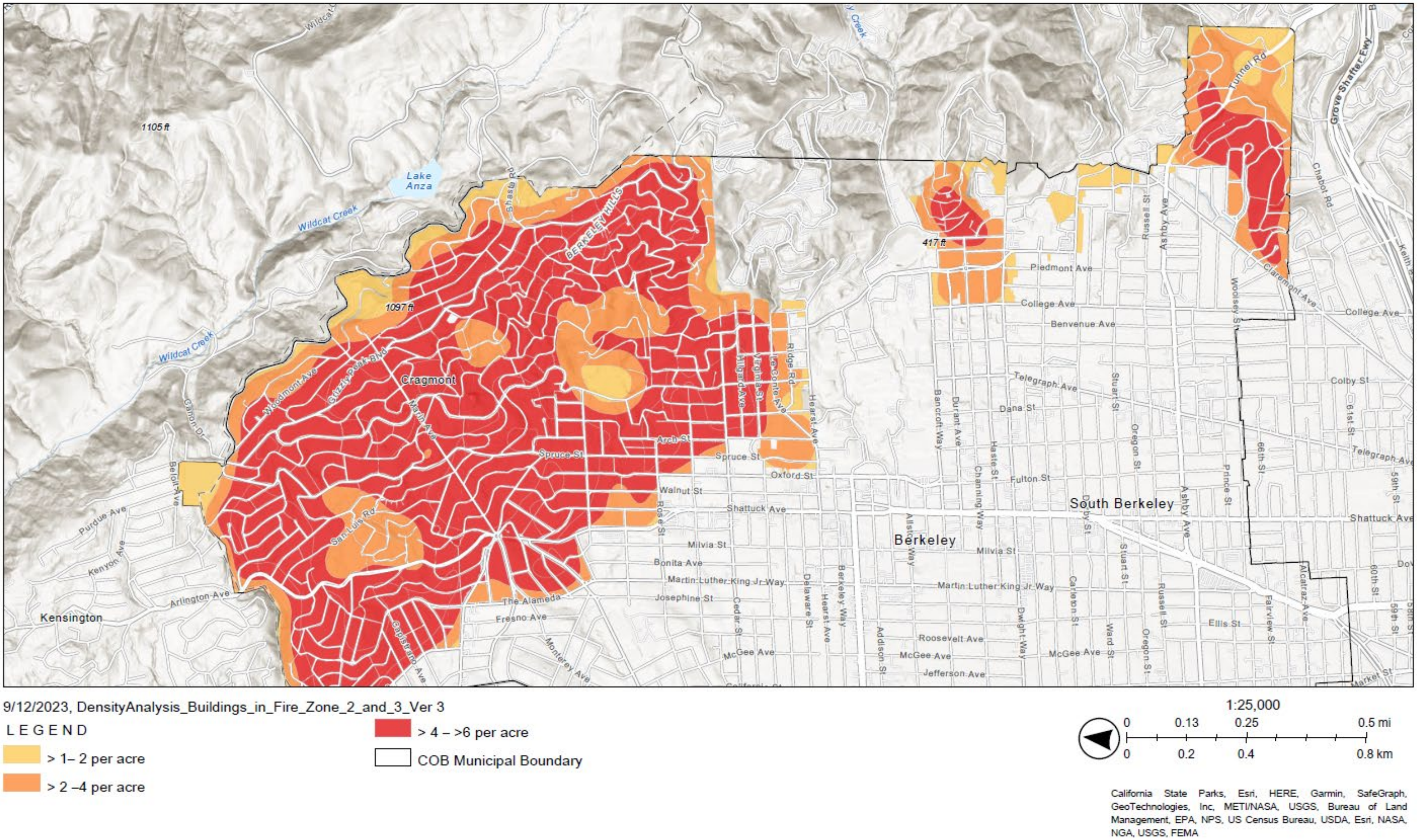
COB Fire Zone Structure Density



To illustrate the prior scientific findings and GIS information, we are including two images of Berkeley's Fire Zone which demonstrate existing conditions which can propagate rapid structure to structure fire spread.

This image of Fire Zone 2 shows a typical arrangement of structures with a SSD that is often less than 25 ft, an abundance of vegetation, and houses arranged along winding, narrow roadways – all of which create a high wildfire risk and potential for catastrophic structure-to-structure ignition.

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The Evolution of the California Fire Code: 2008 Modifications for Wildfire-Resistant Homes

California has a long history of devastating wildfires, prompting the state to continually enhance its building codes to improve the fire resistance of structures. The most substantial modifications came in 2008 when comprehensive building standards specifically aimed at reducing the risk of ignition from wildfires were introduced. These modifications apply to only to the construction of new buildings in Wildland-Urban Interface (WUI) areas – and of course most structures in Fire Zone 2 and 3 were build decades ago and have numerous ways in which they will pose a risk during a wildfire that enters the City. In 2008 the key objectives were to improve the resistance of homes to wildfire exposure from burning embers, radiant heat, and direct flame contact and included:

1. Roofing Materials: The code mandated the use of Class A fire-rated roofing materials in WUI areas. Class A roofs, such as fiberglass-based asphalt shingles, concrete or clay tiles, and metal roofing, are designed to withstand severe fire exposure and prevent roof ignition.
2. Exterior Wall Siding and Veneer: The code requires non-combustible siding materials like stucco, fiber-cement panels and siding, and masonry.
3. Ventilation: Vents must be designed to resist ember and flame intrusion, using metal mesh screens with a maximum of 1/8-inch openings or ember-resistant vents with baffle systems that block embers while allowing air flow.
4. Windows and Doors: Windows must have double pane tempered glass, which is more heat-resistant than regular glass. Exterior doors need to be non-combustible or have a specific fire-resistance rating, often meaning they must be solid core wood or steel.
5. Decking Materials: Decks should be made from ignition-resistant materials, such as composite decking products specifically designed for fire resistance or treated wood. Alternatives like metal decking and other non-combustible materials are also compliant.

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Linear Features

Fire can spread along features including primary structures, auxiliary structures, fences, wood piles, decks and vehicles. **This spread can occur both inter and intra parcel, easily transmitting fire through a neighborhood. As more open space on a parcel is filled with structures, this fuel agglomeration may have an impact on structure-to-structure fire spread during an urban, wind-driven conflagration.**

The figure below, courtesy of NIST 2205, *"illustrates how fire can burn along linear features to spread from a single ignition point to multiple lots and impact multiple residences. For example, following ignition and fire spread pathway B shows that a single ignition on a fence line can carry fire to 6 lots and destroy (directly or indirectly) 3 residences depicted within the extent of the figure. It is also important to note that even with a partial improvement, such as removing the fence's direct connection to Residence 3, the result is still 2 destroyed residences within the figure: Ignition B → shed → Structure 3 → Structure 4."*

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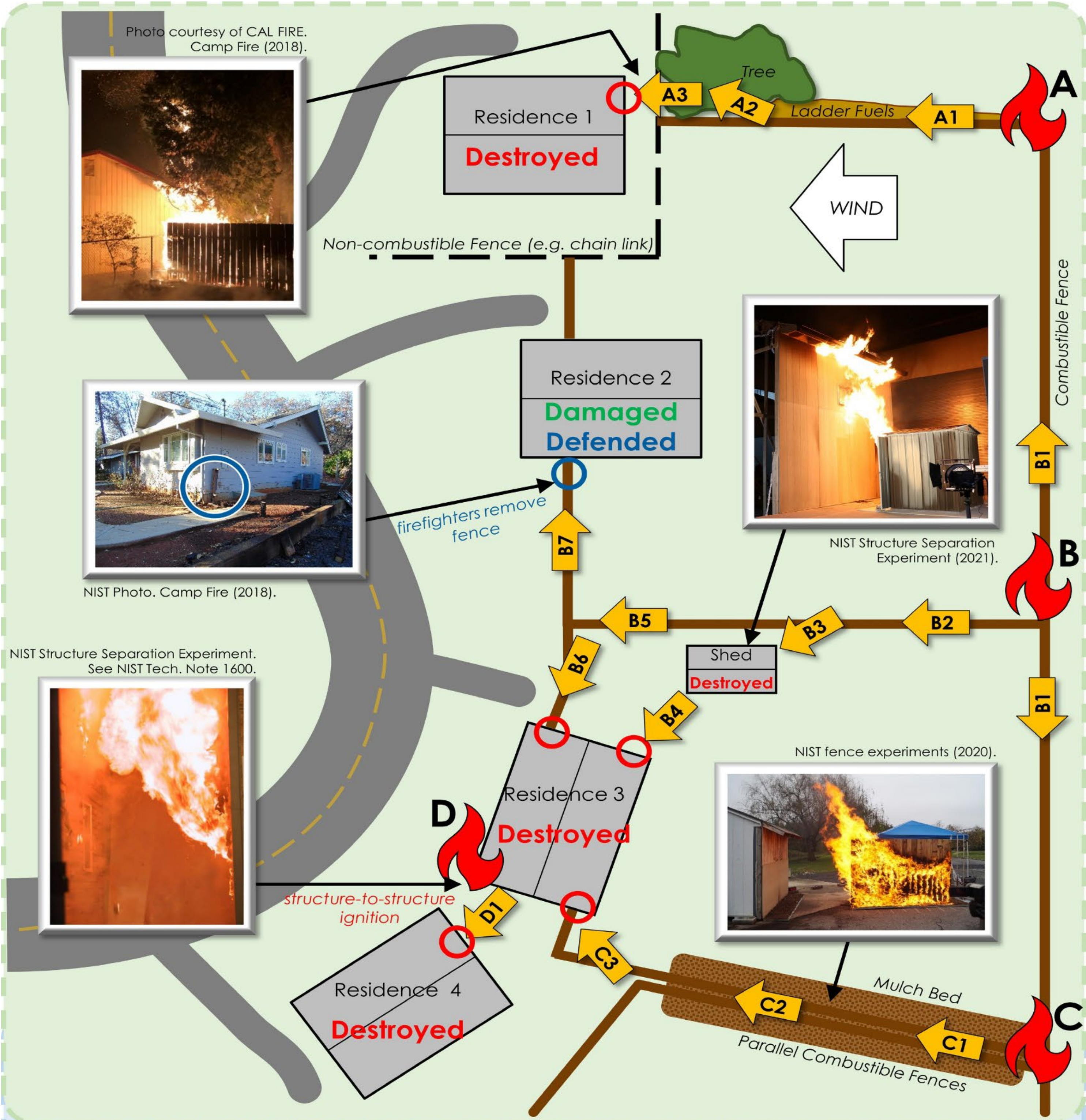

Embers can bring fire into communities. Once fire has started, fire spreads along multiple pathways:

A: Spot fire ignites fence, burning along ladder fuels (*A1*) to larger vegetation (*A2*), and ignites Residence 1 on adjacent parcel (*A3*).

B: Fence ignition propagates fire on multiple parcels (*B1, B2*). Fence ignites shed (*B3*). Exposures from shed and fence ignite Residence 3 (*B4, B6*).

Fence ignites Residence 2 (*B7*). Defensive actions save Residence 2.

C: Parallel fences on adjacent parcels exponentially intensify fire exposure (*C1, C2*) which ignites Residence 3 (*C3*).

D: The exposure from burning Residence 3 ignites Residence 4 (*D1*).

Berkeley Fire Department Resources Are Also Constrained, Demonstrating the Importance of Mitigating Fire Risk Through Planning Where Possible.[5]

The Berkeley Fire Department currently lacks adequate staffing to respond effectively to severe wildland urban interface fires entering the city. Historically, the department operated with over 180 firefighters across 12+ fire companies, each staffed with four firefighters. Today, only nine fire companies exist, each with three firefighters, totaling 116 personnel. Despite Berkeley's growing population, the reduction in force contrasts with other densely populated communities facing significant wildfire threats, such as Santa Ana & Torrance (Orange County Fire Authority), Anaheim, Long Beach, Los Angeles, Oakland, and San Jose, which maintain a four-person staffing model. The recent Standards of Coverage and Community Risk Assessment highlights the urgent need for additional firefighters to adequately staff engines and trucks for wildland and high-rise building fires. In a rapidly moving wildfire scenario, every firefighter makes a difference in moving residents to safety and protecting property.

> *"Citygate finds the Department's response apparatus types to be appropriate to protect against the hazards likely to impact the City. However, fire crew staffing of three per unit is insufficient to provide the necessary "weight" of response to serious fires—especially so in mid- and high-rise buildings* ***and for severe wildland fires that start in the hills.***
>
> *At a minimum, four-firefighter staffing should be provided:*
>
> - *On four engines: 1, 2, 5, and 6 and on trucks 2 and 5*
> - *Occasionally (on high-fire danger wildland fire days) on engines 3, 4, and 7."*

Fire Services are already strained[6]

The below study, conducted by CityGate, summarizes current response times for the Fire Department. The results demonstrate that the Department is under strain.

> *"The Department serves a diversity of populations, from residents to business employees and students. These populations, across a varied zoning pattern combined with topography and road design constraints, place significant restrictions on best practice-based fire and EMS response times."*

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Response Performance Summary – CY 20/21

Response Component	Best Practice		90th Percentile Performance	Performance Versus Best Practice and Current Goal
	Time	Reference		
Call Processing / Dispatch	1:30	NFPA	**2:29**	**+ 0:59**
Crew Turnout	2:00	Citygate	**2:05**	**+ 0:05**
First-Unit Travel	5:00	CityGate	**5:53**	**+ 0:53**
First-Unit Call to Arrival	8:30	Citygate	**10:27**	**+ 1:57**
ERF Call to Arrival	11:30	Citygate	**18:50**	**+ 7:20**

The first-unit travel performance is 53 seconds slower than the 5-minute best practice goal for urban areas due to factors like station location, terrain, and traffic congestion. CityGate noted that both the first-unit and effective response force (ERF) times are significantly slower than their best practice goals of 8:30 minutes and 11:30 minutes, respectively. To meet these goals, dispatch, turnout, and travel times need reductions of 59 seconds, 5 seconds, and 53 seconds, respectively, aiming for a total first-unit response time of 8:30 minutes.

These resource issues will only be intensified by further development, ***"the ongoing intensification of land uses, building heights, and population density will make several sections of the City very urban—typical of the largest metropolitan cities for building fire and rescue/EMS challenges. The cumulative effect of these projects around the City necessitates a shift in staffing and response models as well as an increase in the flexibility of emergency medical resources."***

The Fire Department is therefore already short-staffed and under-resourced, and any increase in density within high-fire risk areas could impose serious consequences for the City.

In summary, the Department would strongly suggest that encouraging further density within the City's Fire Zones, which already pose a high risk for structure-to-structure fire spread and are ill-equipped for evacuation, is unadvisable. The Fire Zones should be excluded from the middle housing zoning amendments as was originally recommended by Staff.

[i] NIST Technical Note 2205: https://doi.org/10.6028/NIST.TN.2205
[ii] Fire History in the East Bay Map, East Bay Regional Park District; https://www.ebparks.org/sites/default/files/history_all_fires.pdf
[iii] NIST Technical Note 2205: WUI Structure/Parcel/Community Fire Hazard Mitigation Methodology; https://doi.org/10.6028/NIST.TN.2205
[iv] [iv] City of Berkeley, Standards of Coverage and Community Risk Assessment, 2023, CityGate, LLC.
[5] City of Berkeley, Standards of Coverage and Community Risk Assessment, 2023, CityGate, LLC.
[6] City of Berkeley, Standards of Coverage and Community Risk Assessment, 2023, CityGate, LLC.

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