CITY OF
FLAGSTAFF

Community Risk Assessment & Standards of Cover Analysis

Final Report

22 November 2022

Northern Arizona Healthcare

FACETS CONSULTING

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EXECUTIVE SUMMARY

The City of Flagstaff is currently experiencing significant development activity across its southern zones. Based on information gleaned from the *Flagstaff Regional Plan Vision 2030: Place Matters*, and discussions with local officials, the present condition is a harbinger of the future, with ongoing growth expected in multiple areas of the City during the coming years.

Local fire and emergency medical services (EMS) agencies in growing communities often must provide additional resources and/or higher levels of service to effectively address changes in their community's overall dynamic risk profile; this is the current situation facing the Flagstaff Fire Department (FFD). As the City continues to grow and face 21st-Century challenges, it has reached a point where the demand for all-hazards emergency response services cannot be met without additional FFD resources.

Although growth is occurring throughout the City of Flagstaff, two new development areas are causing immediate pressure on the FFD's existing response system.

The proposed Northern Arizona Healthcare (NAH) Health Village in the southwestern corner of the City—including a high-rise hospital tower and mixed-use development with 315 planned residential units—will create additional fire-EMS demand in an area where there is currently almost none.

Substantial development along the J.W. Powell (JWP) Corridor in the southeast quadrant of the City is already underway, with road and infrastructure construction progressing daily. This area is expected to contain 3,000-4,000 residential units (plus commercial and retail) at buildout, likely causing meaningful fire-EMS demand in what is largely a pine forest today.

The peripheral locations and character of the ongoing JWP and impending NAH development(s) will immediately stress the FFD's existing fire-EMS response system beyond the point where current service levels can be maintained throughout the City of Flagstaff.

Even with limited mutual-aid support from the adjacent Summit Fire & Medical District (SFMD), additional resources are sorely needed to provide fire-EMS response consistently and effectively across the Flagstaff Fire Department's service area—now and in the future.

KEY FINDINGS

Over the course of this project, FACETS identified several key findings that are summarized in this section and detailed in the balance of this report.

- The Flagstaff Fire Department (FFD) does not meet the minimum staffing requirements of relevant national standards and best practices; given the City of Flagstaff's risk profile, regional importance, and limited surrounding mutual-aid resources, the FFD should work toward full compliance with the NFPA 1710 Standard.
- Based on the increasing density and risks posed by future development, the FFD should immediately provide full-time, dedicated staffing on at least one of its two ladder trucks to ensure 24x7x365 availability and effectiveness to perform vital fireground support functions.
- Based on near-term development activity, the FFD requires an additional fire-EMS station along the JWP Corridor; the exact location/siting and number/type of response units staffed at this facility will depend on the ultimate density/character of the built environment in the JWP area, including an expected 3,000-4,000 new homes.

- While the proposed NAH Health Village is currently planned for 315 residential units at medium density, its peripheral location and the relatively high(er) risk of the healthcare facilities requires additional resources in Flagstaff fire stations (existing/renovated, relocated, and/or new).
- Leveraging contemporary building and fire codes to engineer safety into new structures from inception is a vital component of any strategy to reduce life, property, and environmental risk from fires; both the NAH and JWP developments will benefit from using state-of-the-art codes/standards throughout their buildings' lifecycles.
- Development along the JWP Corridor, and in the NAH Health Village, creates additional risk of wildland urban interface (WUI) fires; additional wildfire mitigation and response resources should be considered for both areas.
- Anticipated (and unrelated) development to the northwest of the NAH Health Village will likely create additional fire-EMS demand; given uncertainty around the ultimate character and timing of potential development activity in that area, FACETS is unable to forecast the expected resources needed in the future.

BACKGROUND

The City of Flagstaff is the employment, education, commercial, transportation, and healthcare hub of northern Arizona.

Northern Arizona University (NAU) is the City's largest employer and enrolls a student population of almost 30,000, the majority of whom reside in Flagstaff proper. NAU's presence in the City forms the core of a scientific and technical industry cluster that includes multiple private-sector firms and support sector employers.

Flagstaff is also visited by an estimated 5 million visitors/year, making tourism an important facet of the City's overall economy.

The heavily-trafficked Burlington Northern Santa Fe (BNSF) Railway through Flagstaff's downtown is that carrier's southern transcontinental mainline from Chicago to California, a critical link in the national economy, and one of the busiest rail corridors in North America.

Similarly, Interstate 40 from North Carolina to California runs through the middle of Flagstaff, intersecting with Interstate 17 to Phoenix and carrying all manner of commodities—including hazardous materials.

The City of Flagstaff is currently experiencing significant development activity across its southern zones. Based on information gleaned from the *Flagstaff Regional Plan Vision 2030: Place Matters* (see Appendix D), and discussions with local officials, the present condition is a harbinger of the future, with ongoing growth expected in multiple areas of the City during the coming years.

Development along the J.W. Powell (JWP) Corridor in the southeast quadrant of the City is already underway, with road and infrastructure construction progressing daily. This area is expected to contain a minimum of 3,000-4,000 residential units (plus commercial and retail) at buildout.

Northern Arizona Healthcare (NAH) is one of the City's largest employers; it is currently seeking to consolidate and expand its facilities in a new "NAH Health Village" located near the southwestern boundary of Flagstaff.

INTRODUCTION

In September 2022, FACETS Consulting, LLP, was engaged by Northern Arizona Healthcare and the City of Flagstaff to conduct a community risk assessment (CRA) and standards of cover (SOC) analysis for the Flagstaff Fire Department (FFD).

An Arizona corporation, FACETS has performed fire-EMS management studies, CRAs, and SOC analyses across the United States—in communities large and small—from Anchorage to Baltimore, Sacramento to Boston, and many places in-between.

Growing population, increasing population density, and expanding the built environment can all place pressure on local jurisdictions to maintain existing public fire protection and emergency medical services (EMS). Additionally, local fire-EMS agencies in growing communities often must provide higher levels of service to effectively address changes in their community's overall dynamic risk profile.

Development activity in peripheral areas, and the concomitant increase in demand for fire-rescue service, will—absent additional resources—pull existing front-line response units from their existing first-due coverage areas into the areas of new growth. While this effect is predictable, its order of magnitude will depend on the ultimate character and profile of the new areas.

Infill development also affects fire-EMS demand, as density and call volume increase in previously un-/under-developed areas; overlapping coverage from multiple adjacent fire stations can sometimes accommodate the increased frequency of incidents arising from this type of growth—to a point.

In either case, the effects of increased demand, with the same supply of front-line response units, means that response times will increase, and service quality will decrease, for all users of the fire-EMS system; this is the situation facing the FFD right now, even with limited mutual-aid support from the neighboring Summit Fire & Medical District (SFMD).

This report will assess Flagstaff's overall community risk and evaluate the ability of the FFD to provide the appropriate fire-EMS coverage across the entire City, with special emphasis on impacts from the JWP and proposed NAH developments.

Requested analyses of FFD: ladder company locations; existing FFD Station 4 siting; and a notional "clean slate" scenario for ideal fire-EMS station locations are in the Appendices.

METHODOLOGY

FACETS has more than 16 years of experience performing CRAs and SOC analyses across the United States. Over that time, we have developed a proven methodology based on national standards and best practices for the fire and emergency services, coupled with mixed methods research and analytics. Our approach is focused on equitable service delivery, and always with a human-centered perspective.

During this engagement, FACETS attended or facilitated meetings with various stakeholders, including:

- Flagstaff Fire Department
- Flagstaff Community Development
- Flagstaff Public Works
- Northern Arizona Healthcare

FACETS consultants attended a City Council retreat where the proposed NAH Health Village was discussed in detail; we also toured the NAH and JWP development areas with the FFD and independently.

With guidance from the reference standards identified below, FACETS gathered data from multiple sources to perform extensive geographic information system (GIS) analyses using actual data from the FFD, City of Flagstaff, NAH, Census Bureau, and other organizations.

- NFPA 1300 Standard on Community Risk Assessment and Community Risk Reduction Plan Development
- Center for Public Safety Excellence (CPSE), Commission on Fire Accreditation International (CFAI), 10th Edition: Quality Improvement for the Fire and Emergency Services
- NFPA 1710 Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments

FACETS also performed a literature review for related research applicable to the Flagstaff CRA and SOC; available in the References section of this report.

Given the in-progress character of the specific developments examined for this study, the results should be viewed as dynamic, with changes to the development plans potentially changing the analyses presented in the balance of this report.

COMMUNITY RISK ASSESSMENT

FACETS uses several different national- and state-level risk assessment products for initial calibration of our work.

Federal Emergency Management Agency

National Risk Index for Natural Hazards (NRI)
https://www.fema.gov/flood-maps/products-tools/national-risk-index

The Federal Emergency Management Agency (FEMA) National Risk Index for Natural Hazards (NRI) is a relatively new product that is focused on U.S. communities' risk from the 18 natural hazards identified below in Table 1.

Table 1. Natural Hazards Included in FEMA National Risk Index for Natural Hazards (NRI)

Avalanche	Landslide
Coastal Flooding	Lightning
Cold Wave	Riverine Flooding
Drought	Strong Wind
Earthquake	Tornado
Hail	Tsunami
Heat Wave	Volcanic Activity
Hurricane	Wildfire
Ice Storm	Winter Weather

Using an extensive methodology that included multiple working groups, a comprehensive literature review, and data from a wide range of sources, FEMA developed a risk equation that incorporates a community's social vulnerability, as depicted in Figure 1.

Figure 1. FEMA NRI Risk Equation

			1
Risk =	Expected Annual Loss X	Social Vulnerability X	----------
			Community Resilience

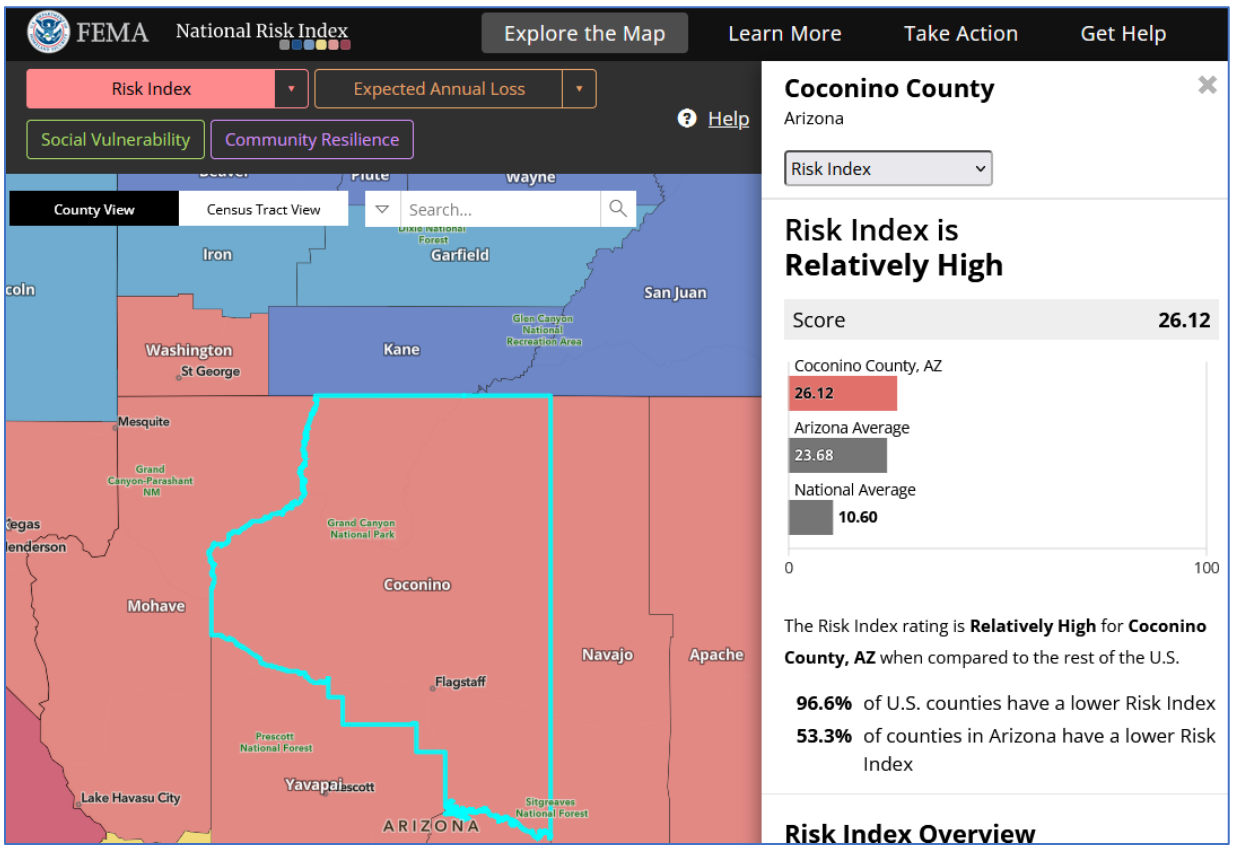
In its *National Risk Index Primer*, a companion document to the online NRI, FEMA notes:

> "An overall composite Risk Index score and individual hazard Risk Index scores are calculated for each county and Census tract included in the NRI. All scores are relative as each Census tract or county's score is evaluated in comparison with all other Census tracts or counties."

As the largest city in northern Arizona, and the most populous in Coconino County, the City of Flagstaff presents the largest risk exposure in the northern part of the state.

Figure 2 presents the overall NRI ratings for Coconino County, including the City of Flagstaff, relative to the other communities assessed by FEMA in the NRI.

Figure 2. FEMA National Risk Index Rating for Coconino County (November 2022)



Additional data from the NRI are used in the Community Risk Analysis section of this report.

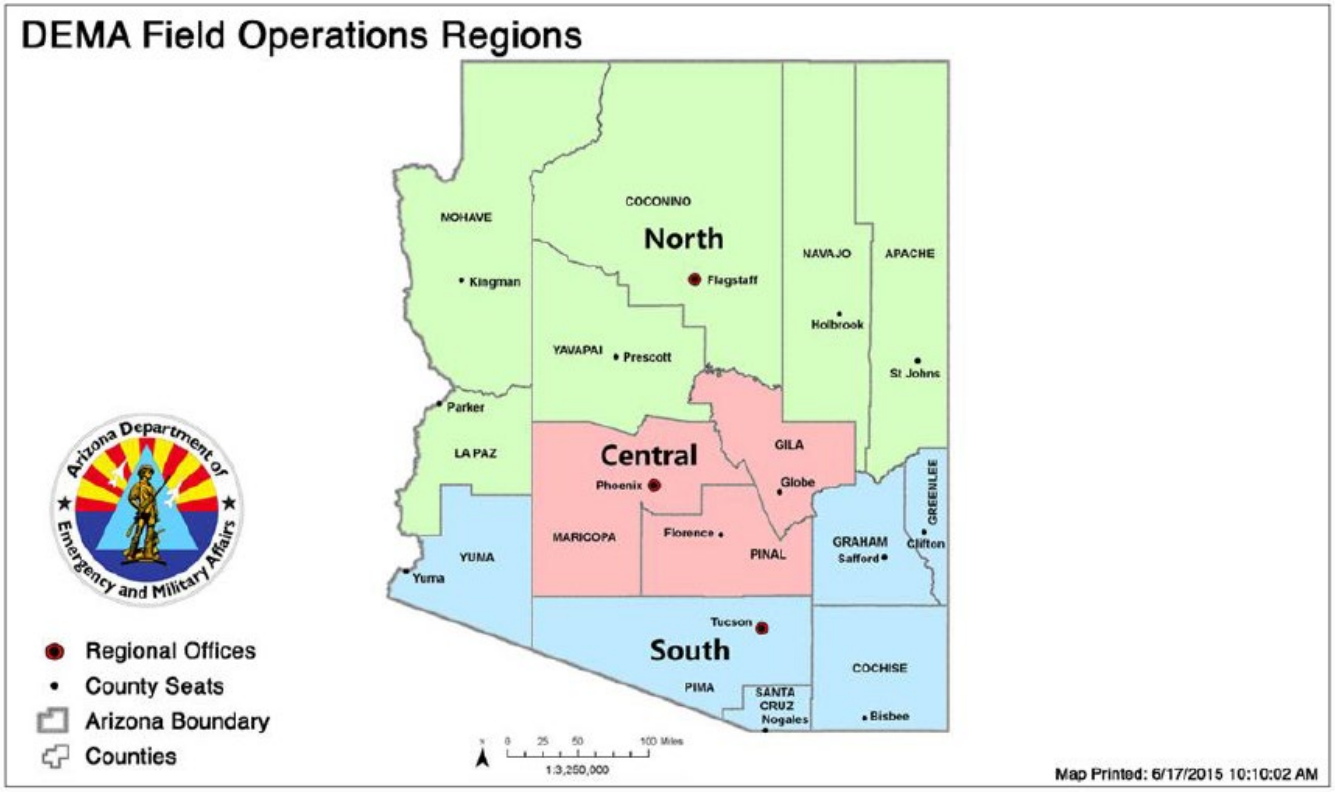
Arizona Department of Emergency and Military Affairs

State of Arizona Hazard Mitigation Plan, 2018
https://dema.az.gov/sites/default/files/publications/EM-PLN_State_Mit_Plan_2018.pdf

In 2018, the Arizona Department of Emergency and Military Affairs (DEMA) conducted a detailed, statewide process to identify hazards and recommend mitigation actions; this resulted in publication of the State of Arizona Hazard Mitigation Plan (HMP), 2018.

According to DEMA's 2018 HMP, Coconino County, including the City of Flagstaff, is assessed as part of the state's "North Region," as displayed in Figure 3.

Figure 3. DEMA Field Operations Regions, 2018 State of Arizona HMP

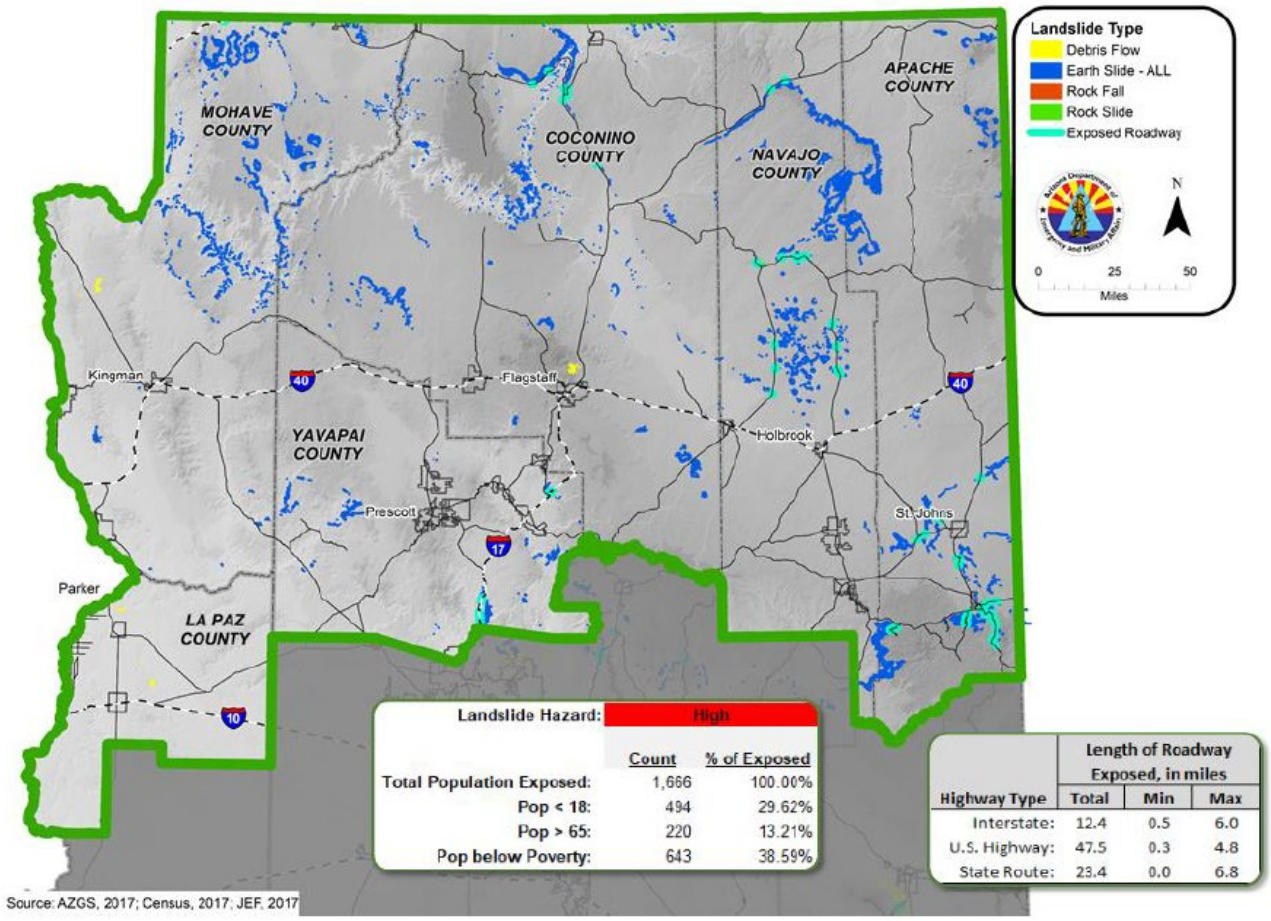


Relative to the Central and South regions of the state, the North Region's vulnerability for all the hazards DEMA selected for analysis is summarized in Table 2.

Table 2. Summary of DEMA 2018 HMP Vulnerability Rankings for the North Region of Arizona

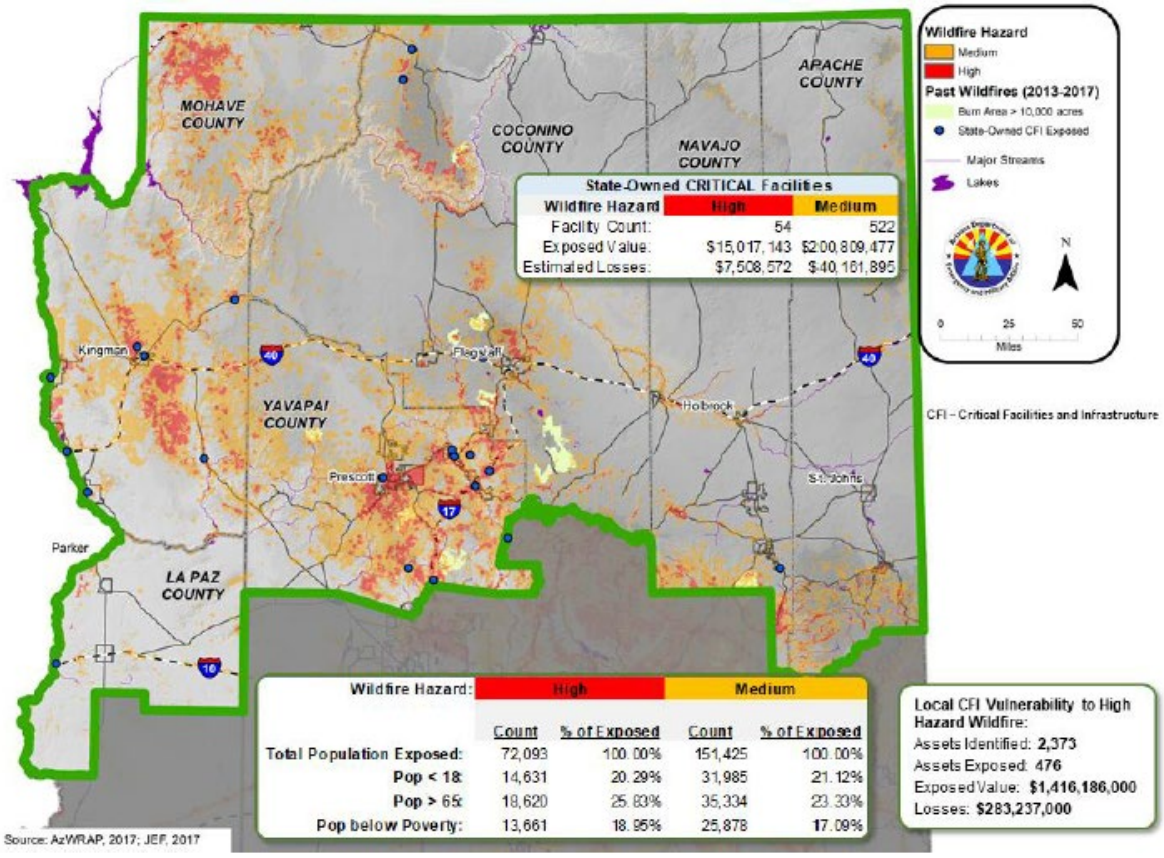
Hazard	Most Vulnerable	Second Most Vulnerable	Least Vulnerable
Dam Failure			
Drought			
Earthquake			
Extreme Heat			
Fissure			
Flooding			
Hazardous Materials			
Infectious Disease			
Landslide			
Levee Failure			
Severe Wind			
Subsidence			
Terrorism			
Wildfire			

Figure 4. Landslide Hazard in North Region of Arizona, DEMA 2018 HMP



While landslides may present a risk of harm across the DEMA-defined Northern Region of Arizona, they appear to present a relatively low risk to the City of Flagstaff.

Figure 5. Wildfire Hazard in North Region of Arizona, DEMA 2018 HMP



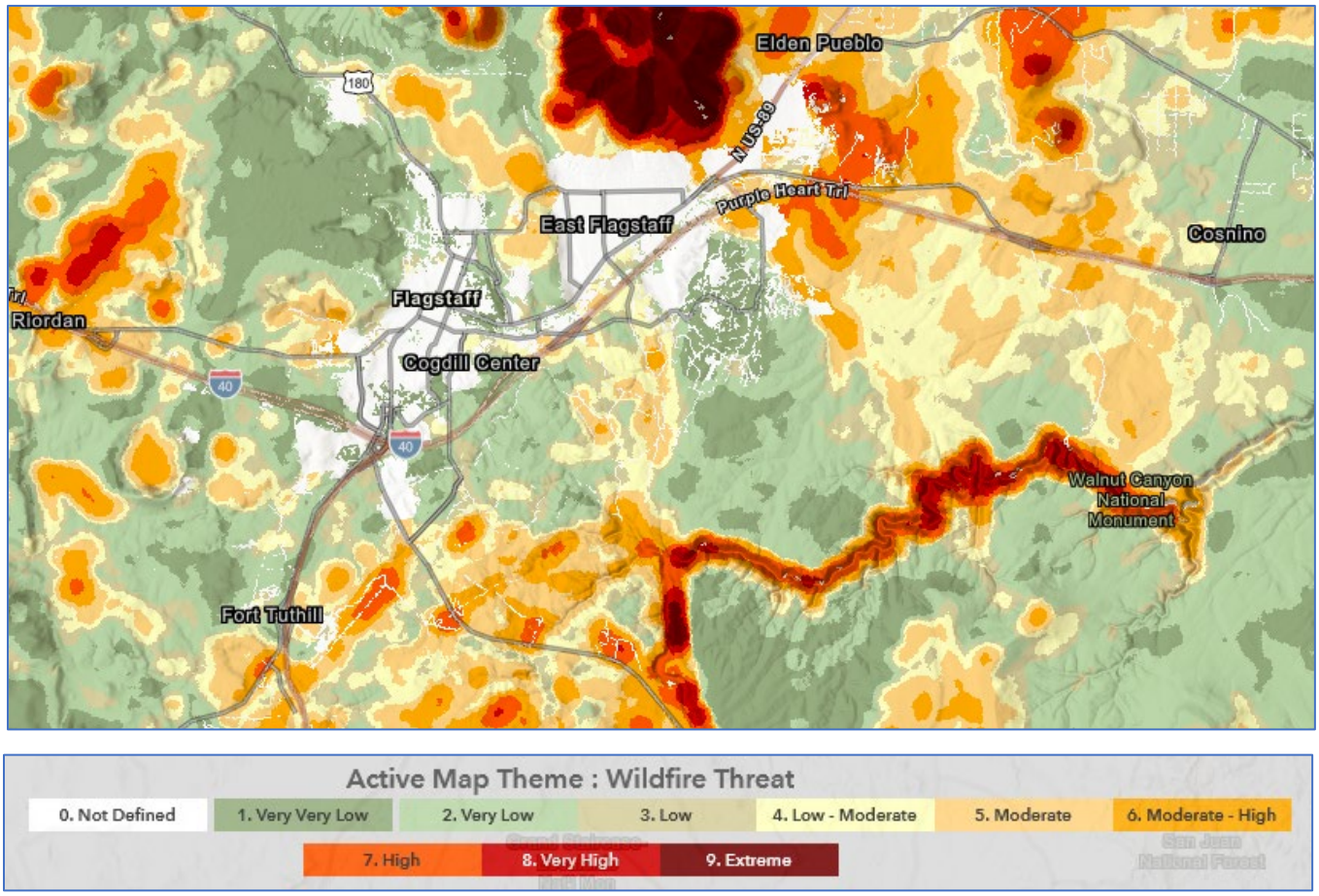
Perhaps unsurprisingly, the City of Flagstaff is at a relatively high risk for wildfire impacts. As growth and development move into areas of the City and adjacent lands, the risk of wildland-urban interface (WUI) fires will continue to grow.

ARIZONA DEPARTMENT OF FORESTRY AND FIRE MANAGEMENT

Wildfire Risk Assessment Portal
https://dffm.az.gov/arizona-wildfire-risk-assessment-portal

Overall, the City of Flagstaff and surrounding region is at relatively high risk for wildfire and wildland-urban interface (WUI) fires. The State of Arizona, through its Department of Forestry and Fire Management, maintains a Wildfire Risk Assessment Portal (WRAP) that allows public access to that department's current analyses of wildfire risk across Arizona. Figure 6 displays a high-level overview of the City's wildfire risk, according to the WRAP.

Figure 6. Arizona Wildfire Risk Assessment Portal, City of Flagstaff overview (November 2022)



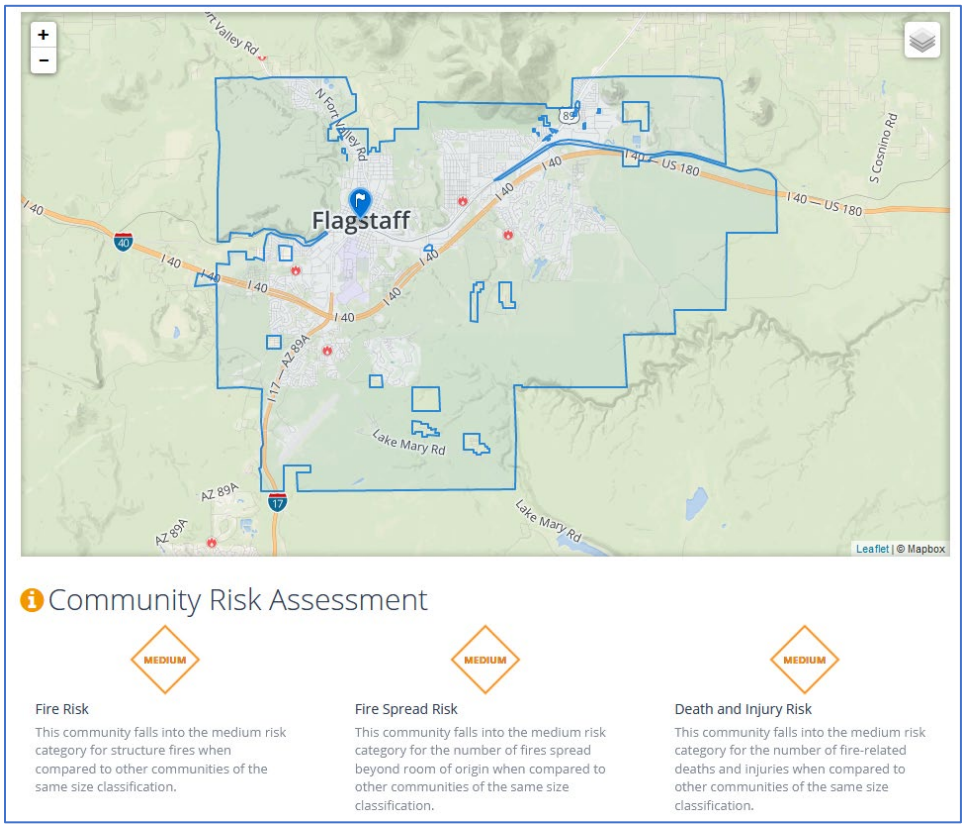
International Public Safety Data Institute

Fire-Community Assessment Response Evaluation System (FireCARES)
https://firecares.org/

Developed over the past decade by a consortium of partners including, among others—the National Institute of Standards and Technology (NIST), The Urban Institute, the United States Fire Administration (USFA), the International Association of Fire Fighters (IAFF), Underwriter's Laboratories (UL) Fire Safety Research Institute (FSRI), and the International Association of Fire Chiefs (IAFC)—FireCARES, maintained by the International Public Safety Data Institute (IPSDI), quantifies the relative risk of structure fires and fire-related deaths/injuries in thousands of local jurisdictions across the United States.

IPSDI uses state-of-the-art data science techniques, coupled with research performed by its many partners, to analyze "big data" sets from a wide range of sources. The results of these analyses are depicted visually in FireCARES and made available to fire chiefs and other community stakeholders. Figure 7 displays the top-line FireCARES community risk assessment for the Flagstaff Fire Department.

Figure 7. IPSDI FireCARES Rating for the Flagstaff Fire Department (November 2022)



Insurance Services Office (ISO)

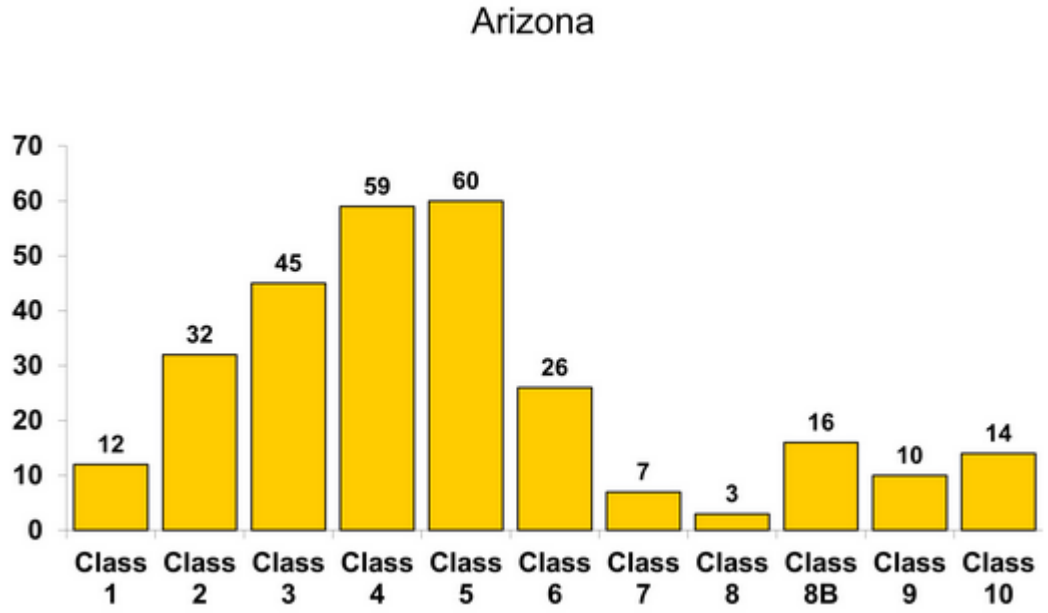
Public Protection Classification (PPC) Service
https://www.verisk.com/insurance/products/location-fire-protection/

The origins of fire protection in the United States trace back to the development of the insurance industry and its continued concerns about the provision of effective fire protection in both urban and rural areas. The Insurance Services Office (ISO), a business unit of Verisk, Inc., maintains a Public Protection Classification (PPC) rating system for local fire departments in communities nationwide.

Local fire departments' "ISO (PPC) Ratings" are used to establish insurance rates for homeowners and businesses in the area serviced by that department. All other things being equal, insurance policyholders protected by fire departments with lower ISO ratings should pay less in annual premiums than their counterparts in areas with higher ISO ratings.

The Flagstaff Fire Department is currently rated an ISO Class 2/10. (This "split" rating indicates that properties within 5 miles of a fire station will be Class 2; those beyond 5 miles will be rated Class 10.) FFD leadership is very attuned to ISO ratings and has an ongoing relationship with a skilled ISO rating consultant to regularly assess development and other system impacts on the department's ISO PPC rating. Figure 8 displays the current distribution of ISO PPC ratings across the State of Arizona.

Figure 8. ISO PPC Distribution for Arizona (November 2022)



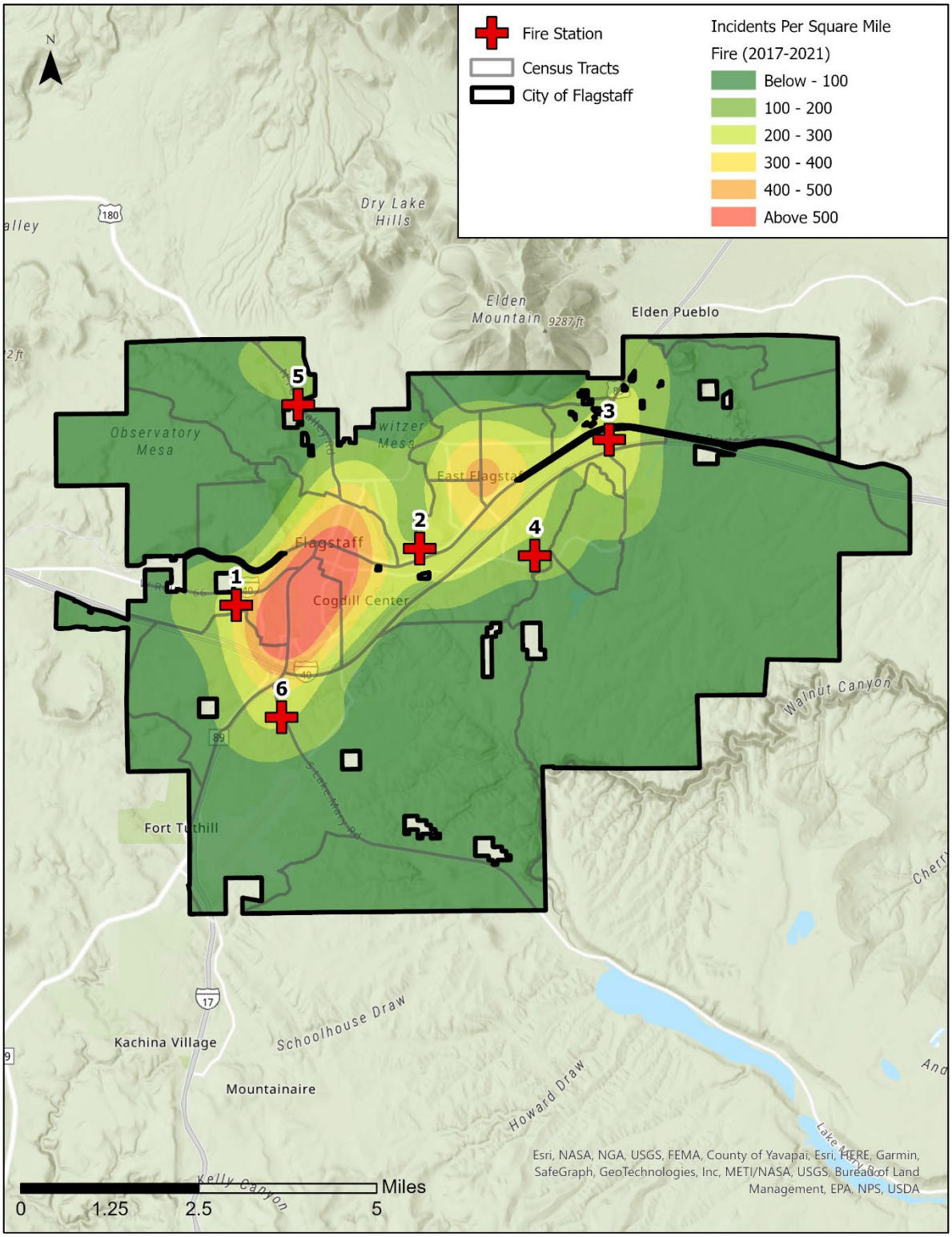
Community Risk Analysis

For a more in-depth analysis of community risk in the City of Flagstaff, FACETS gathered data from a wide range of sources and performed a series of geographic information system (GIS) analyses on multiple combinations of variables that contemporary research suggests influence fire risk in U.S. communities.

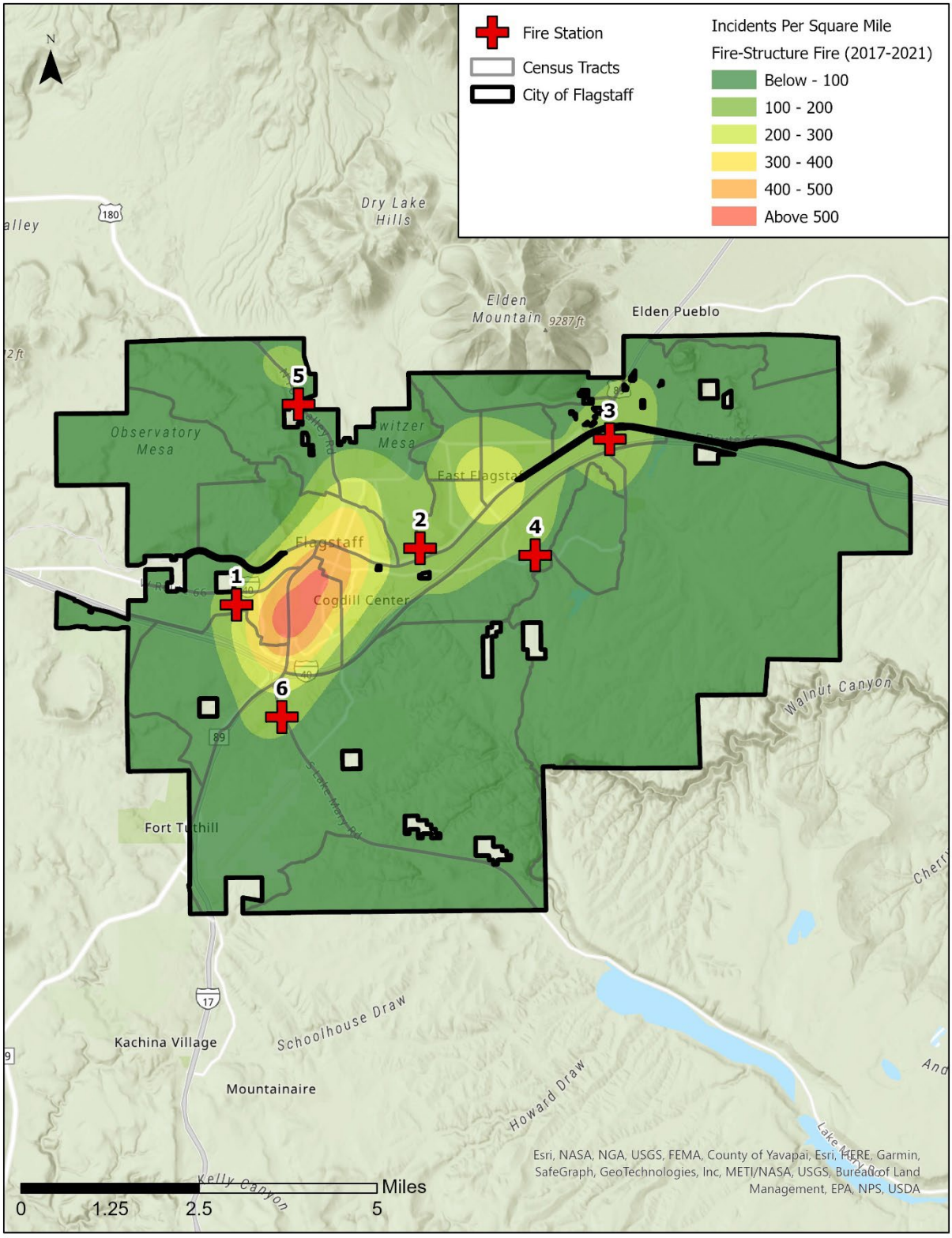
Risk in the built environment is typically a function of the probability of an event occurring, by its consequences.

Fire departments are—first and foremost—concerned with reducing the potential for human consequences of emergency incidents, so community risk assessments tend to prioritize social vulnerability and the effects of emergencies on a community's residents. At the same time, fires can also have severe economic (i.e., business interruption, loss, etc.) and environmental impacts on communities.

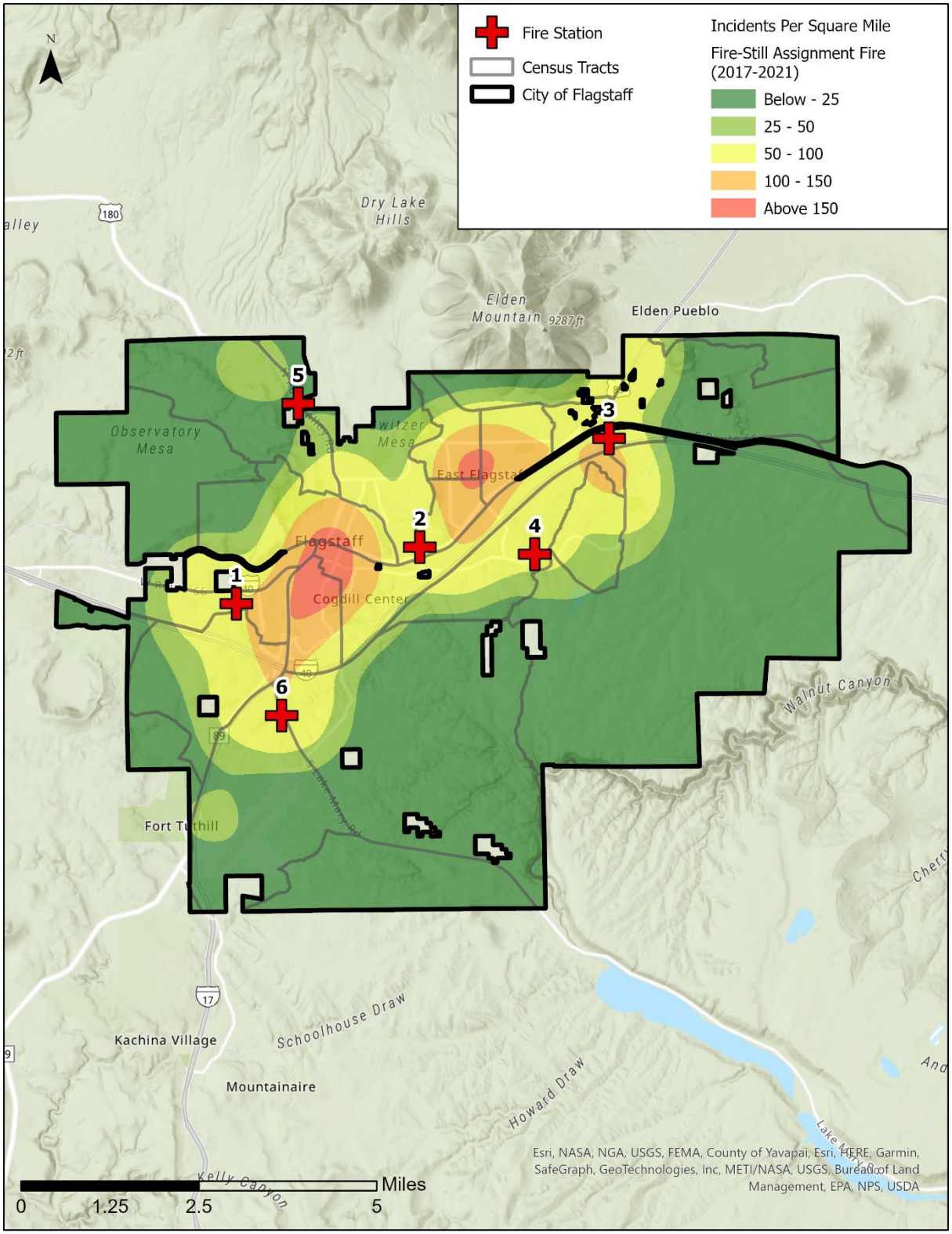
All other things set equal, the demographic aspects of human vulnerability to fire impacts are similar to other factors influencing social vulnerability overall. Appendix E contains detailed profiles of social vulnerability across the City of Flagstaff, by Census tract.



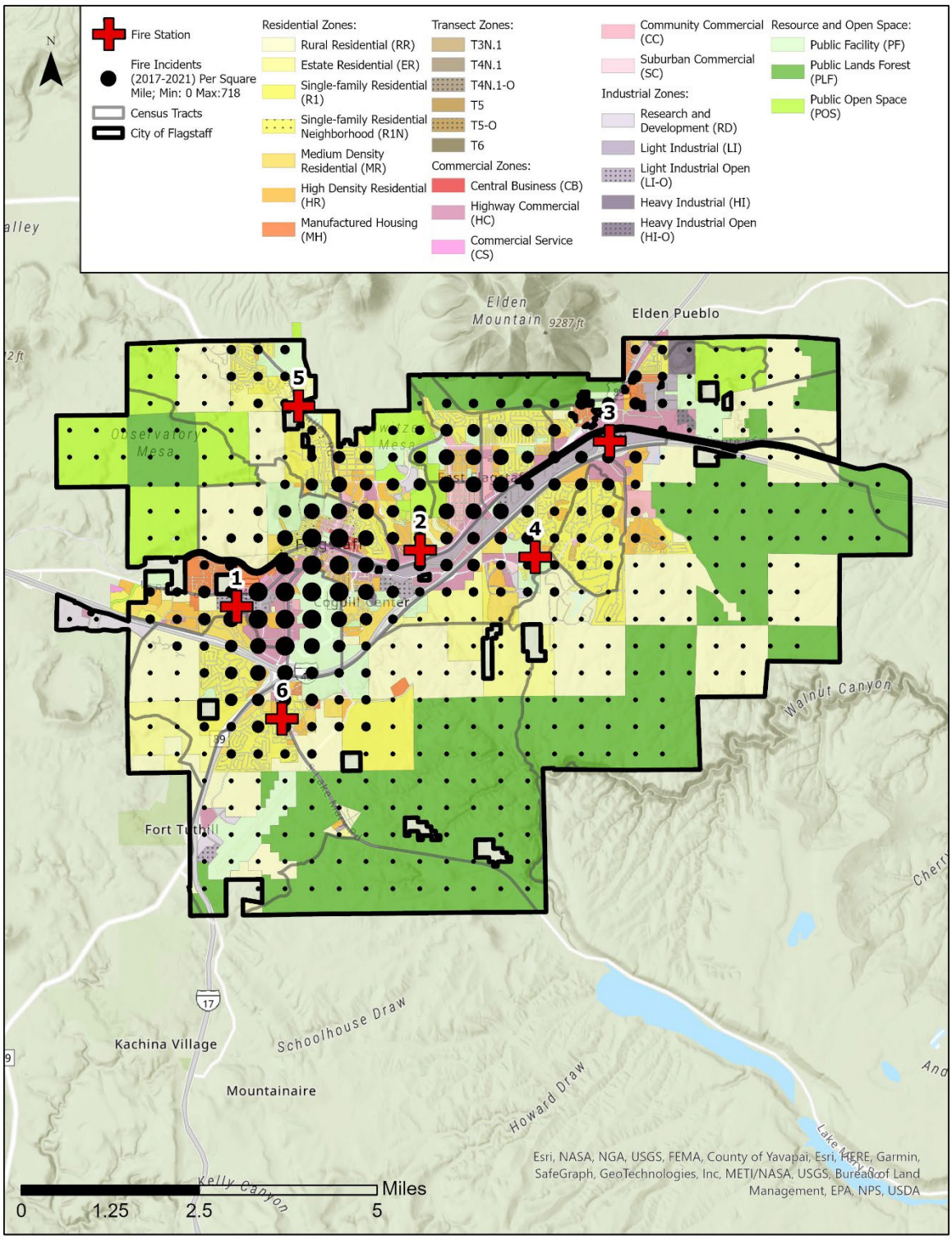
This map displays fire-related incidents City-wide, of all types (e.g., alarm activations, good intent calls, actual/reported structure fires, etc.).



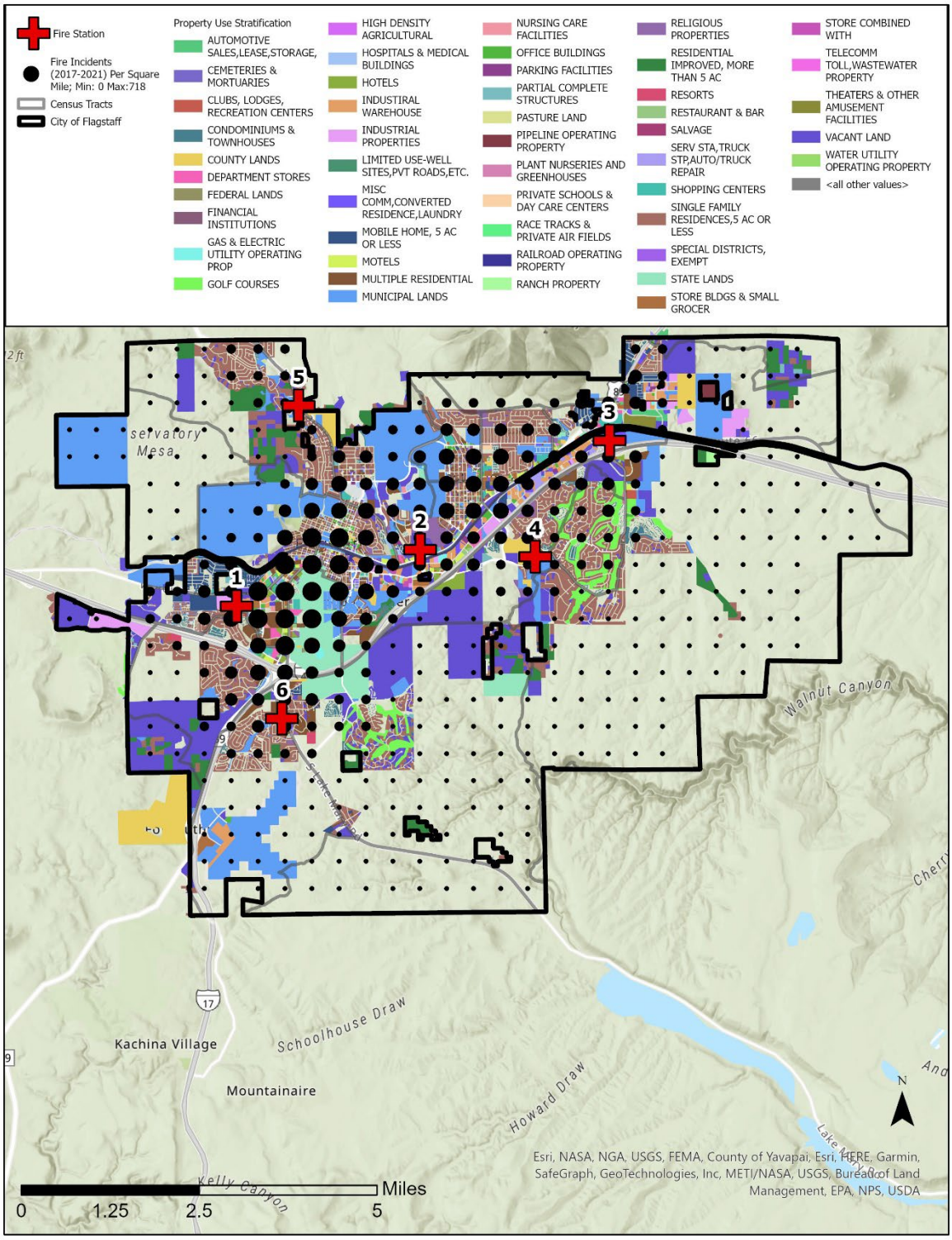
This map displays actual structure fires across the City of Flagstaff.



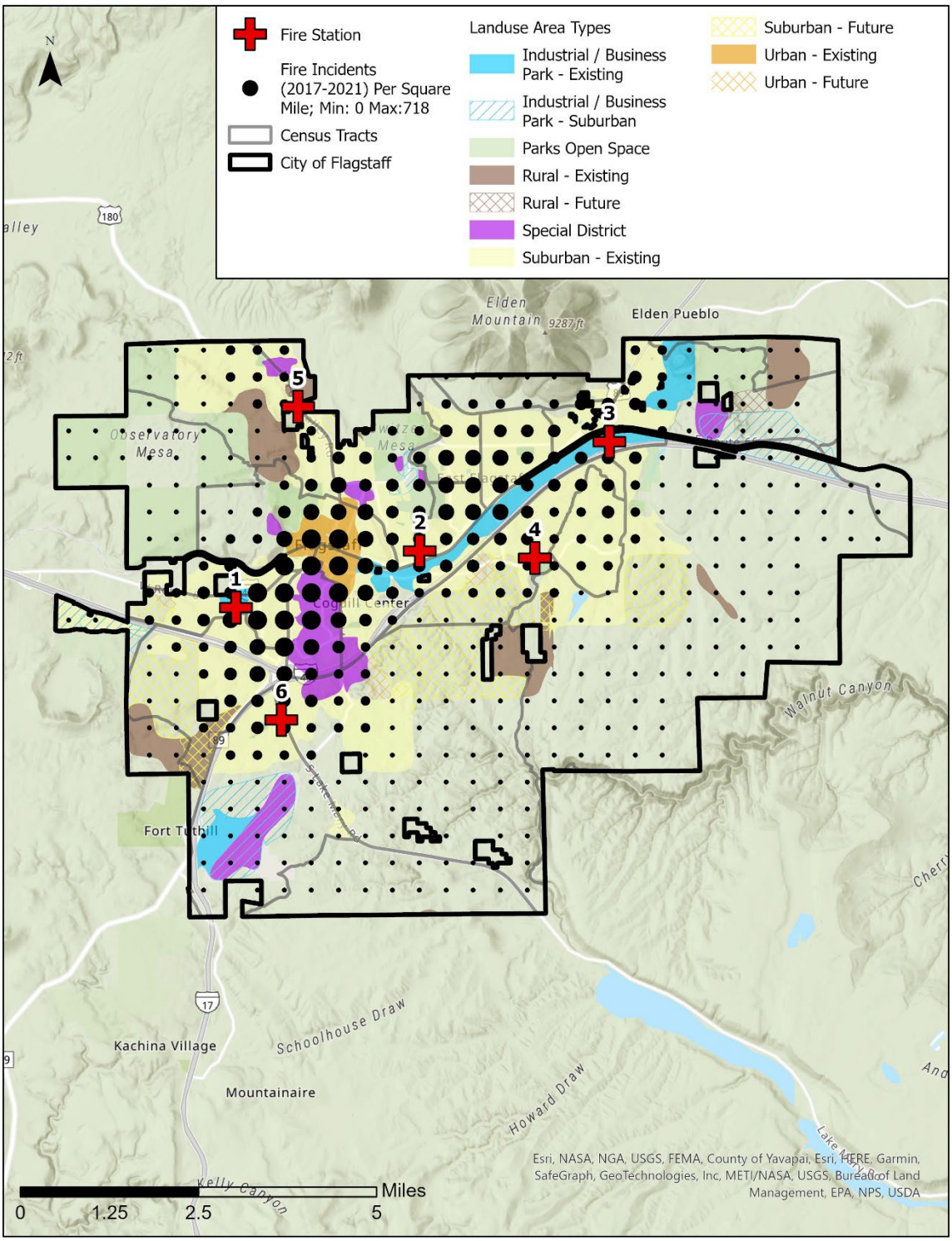
This map displays reported structure fires ("still assignments") City-wide.



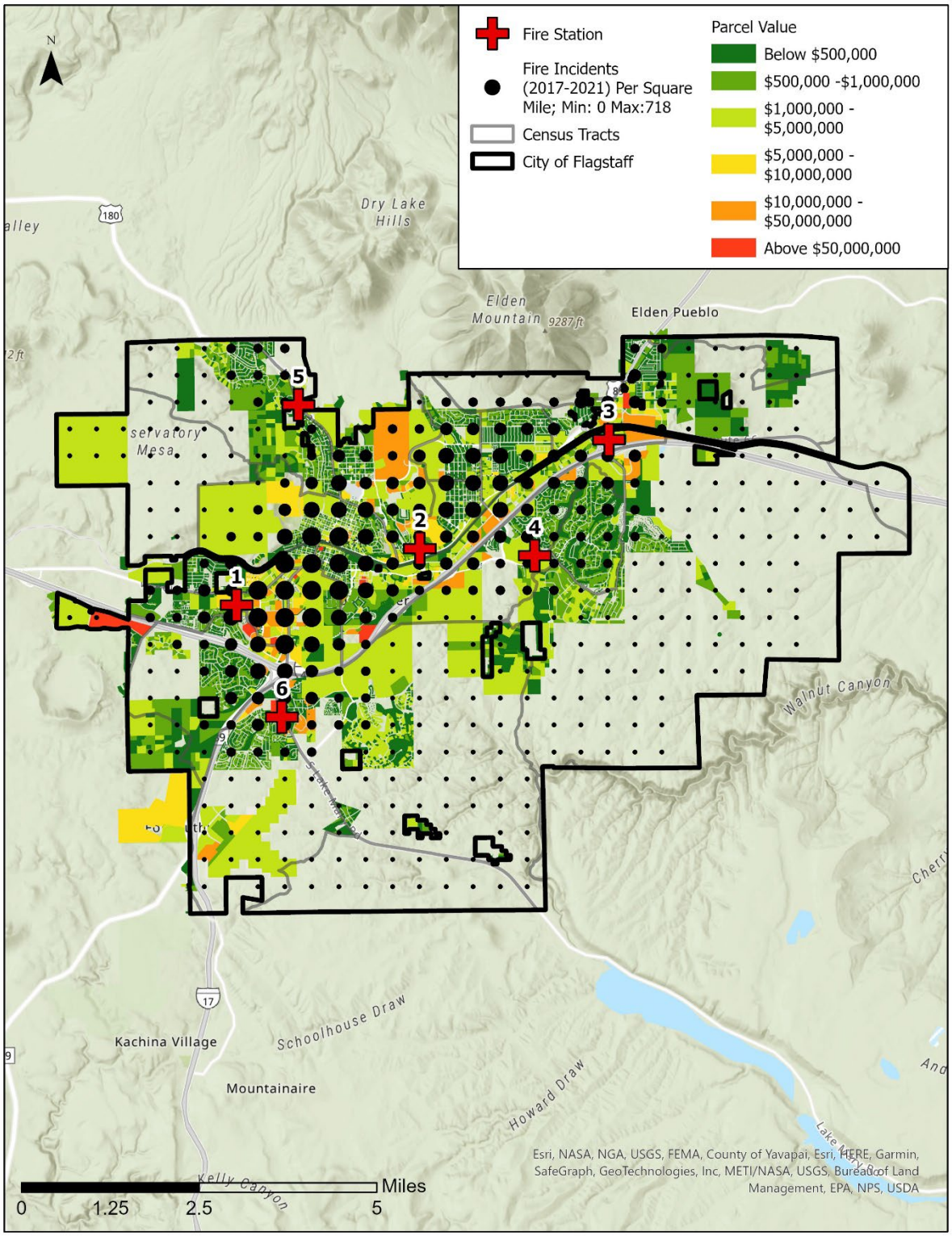
This map displays all fire-related incidents by current City of Flagstaff zoning categories.



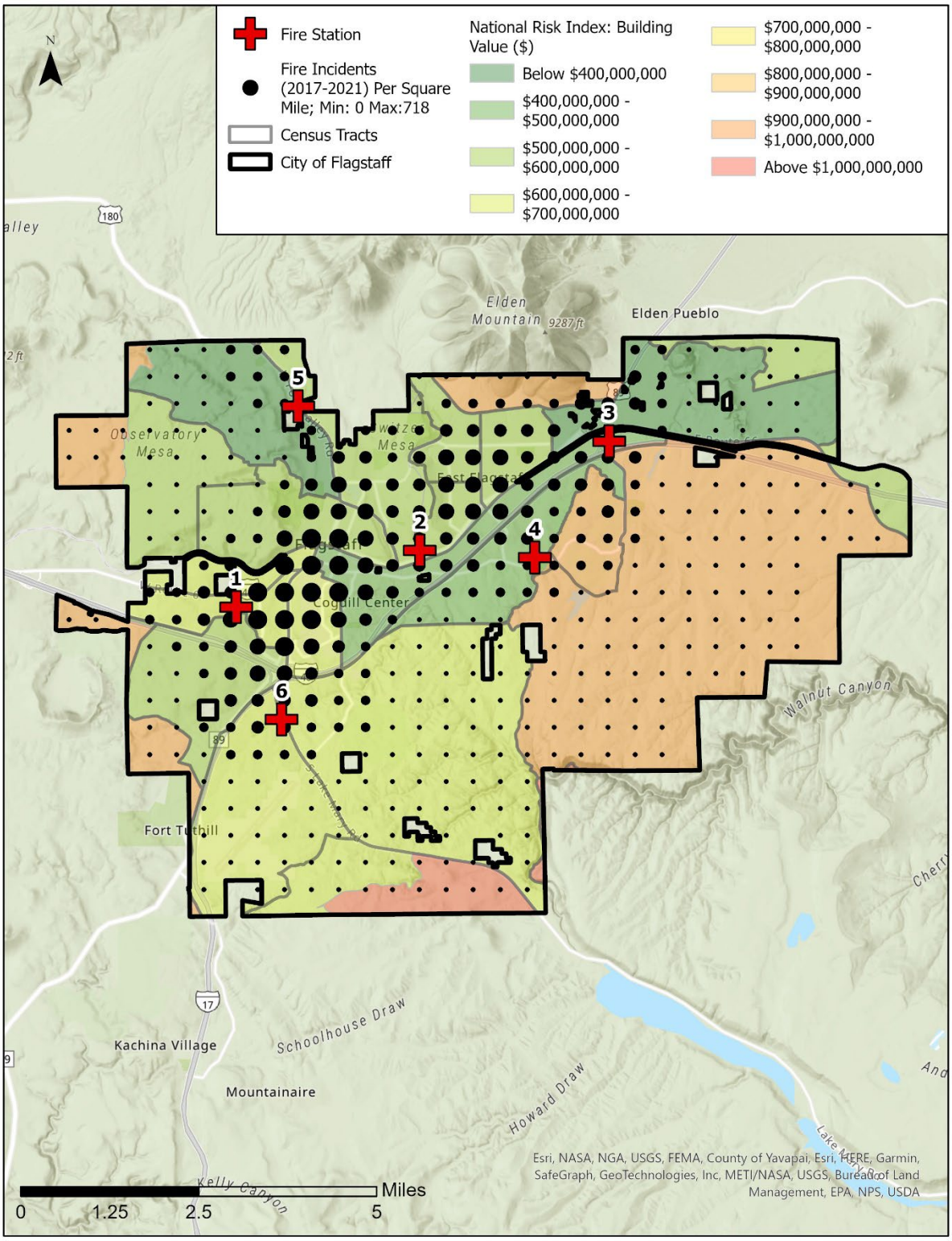
This map displays all fire-related incidents by property use classification.



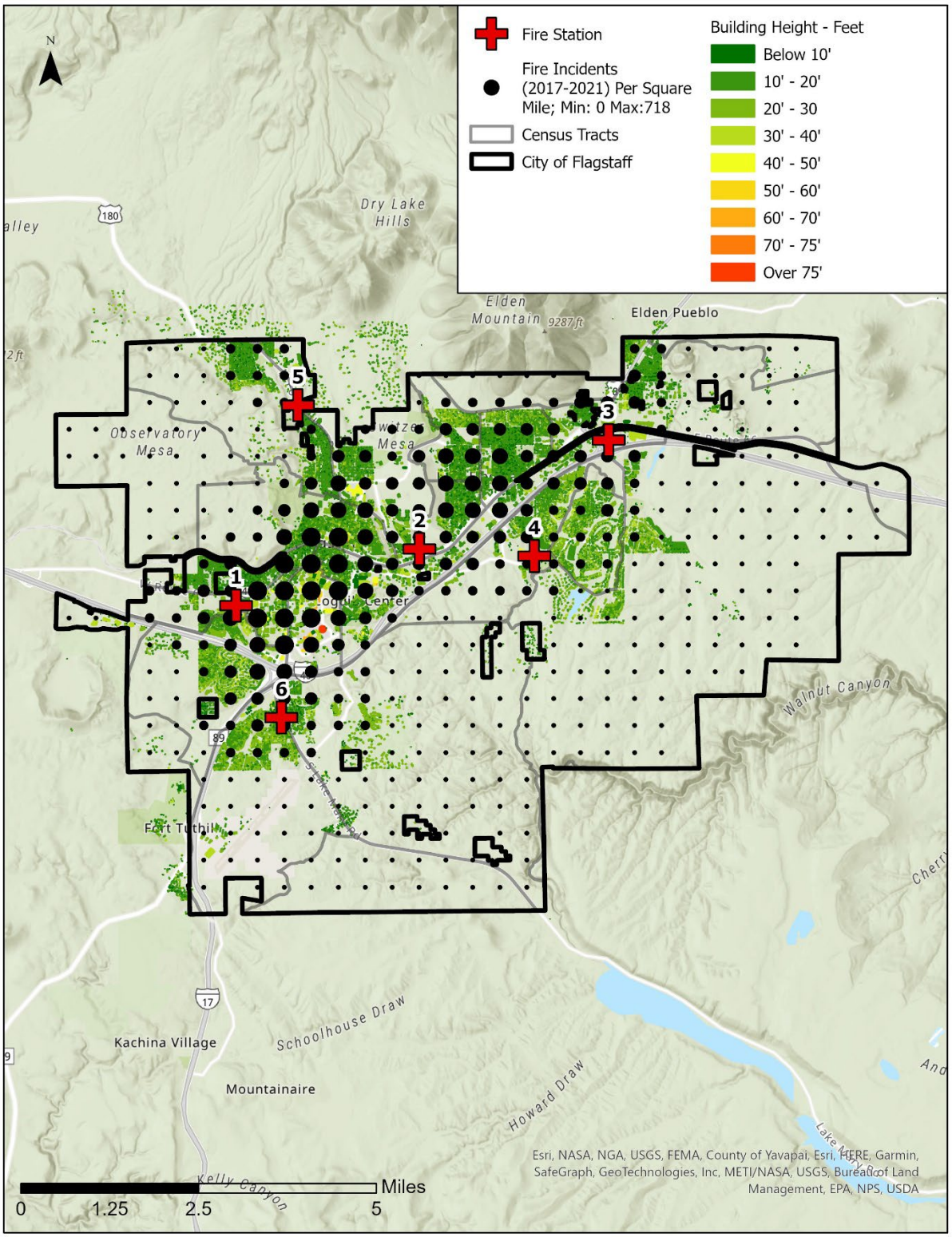
This map displays all fire-related incidents by land use.



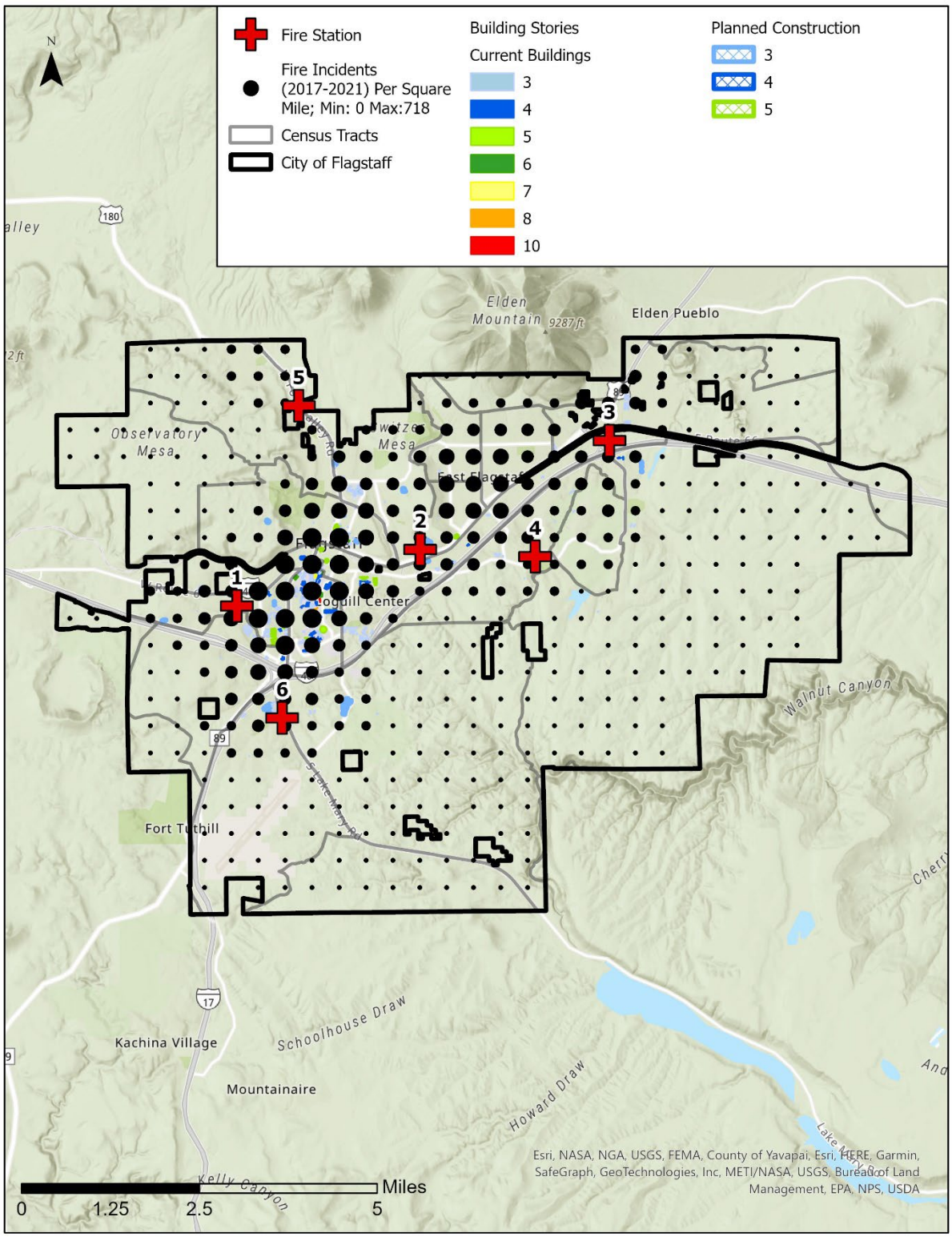
This map displays all fire-related incidents by parcel value.



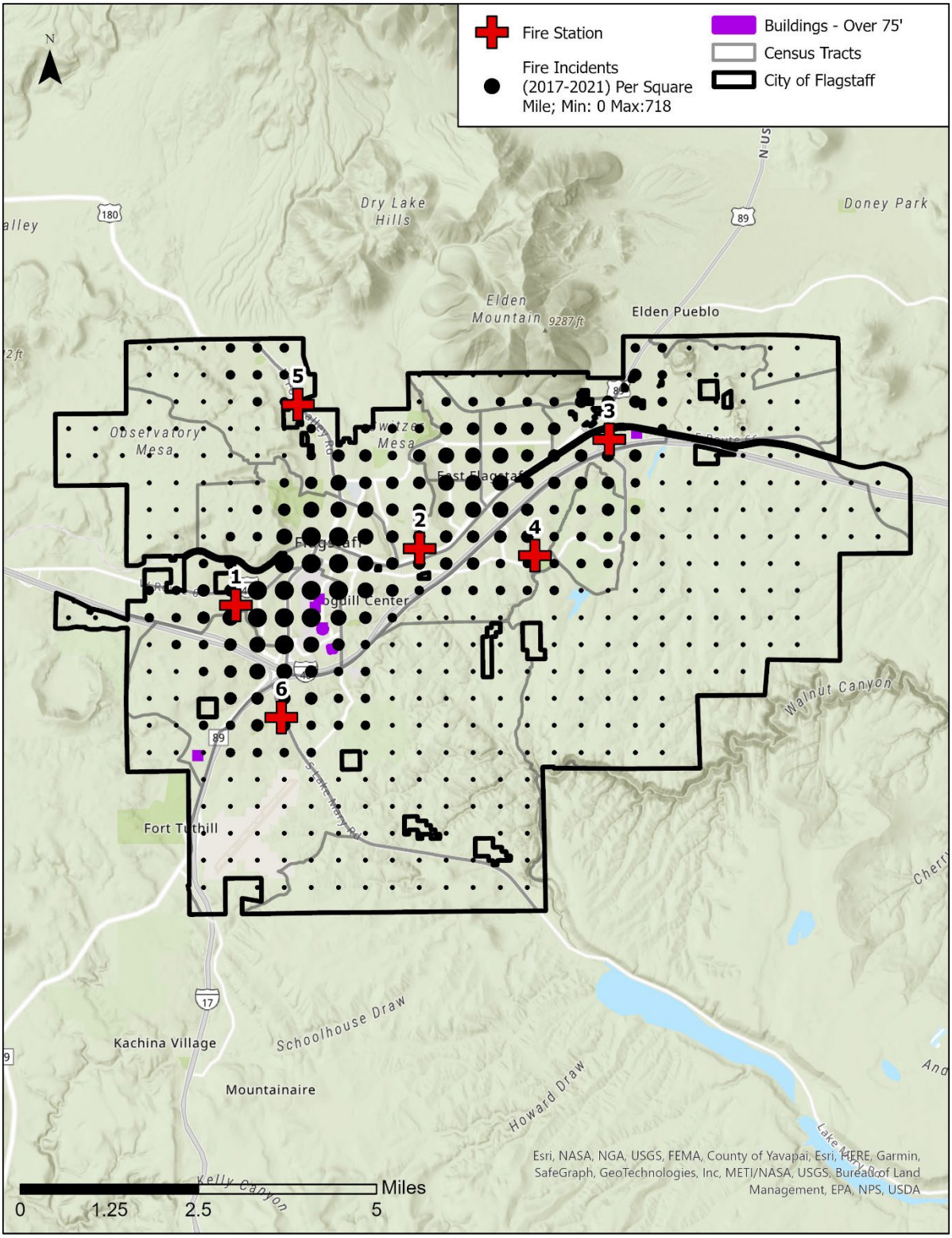
This map displays all fire-related incidents by NRI building value.



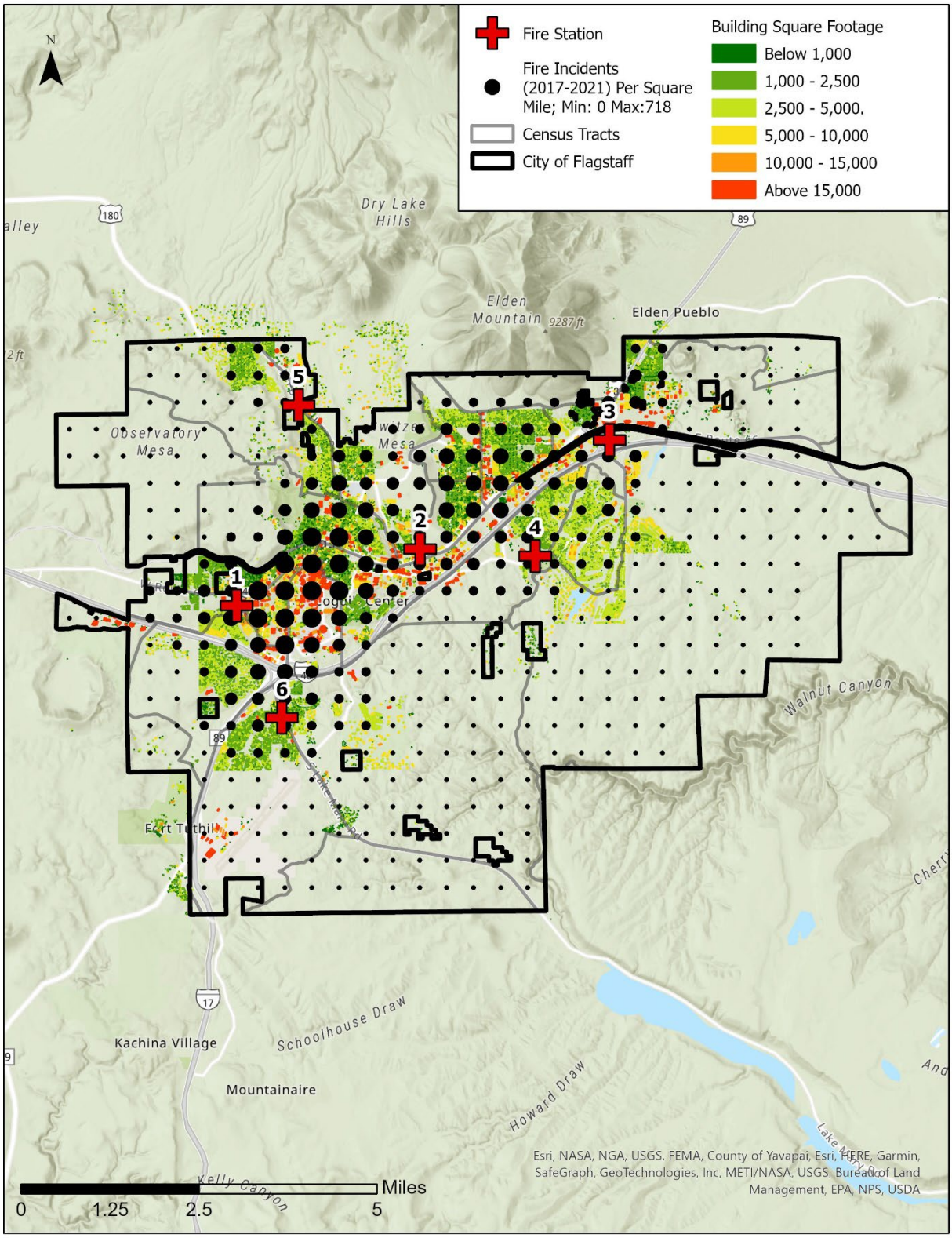
This map displays all fire-related incidents by building height.



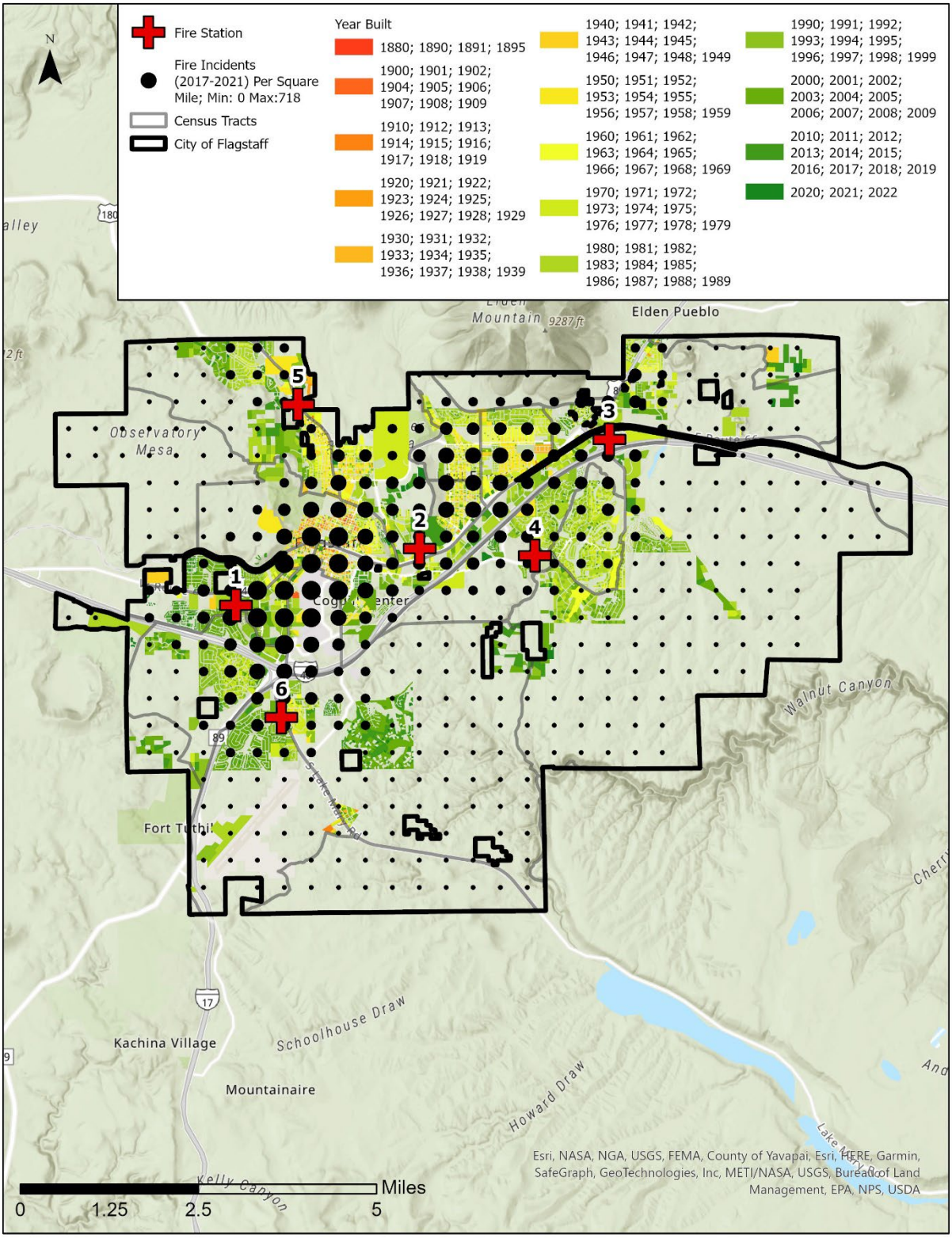
This map displays all fire-related incidents by building stories.



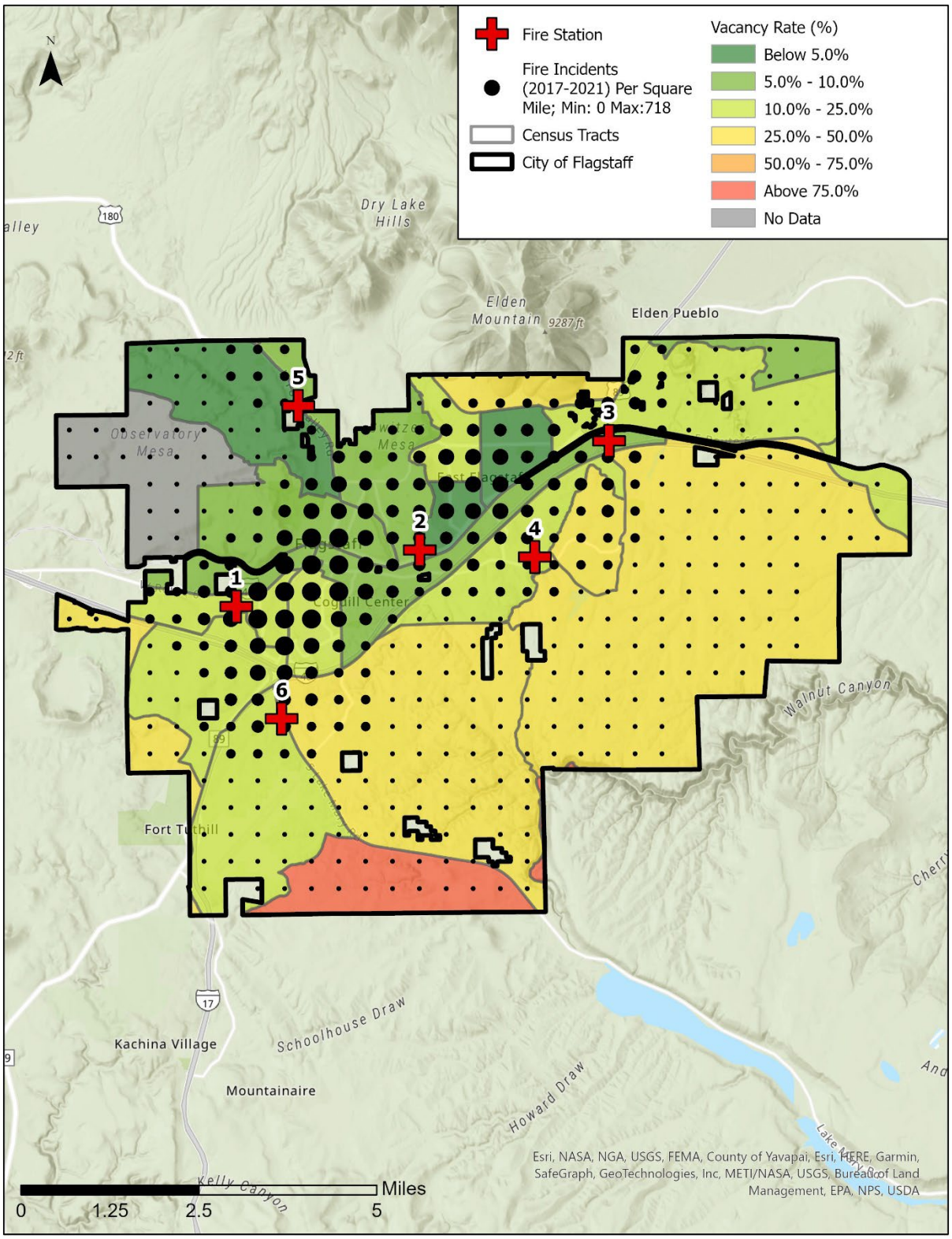
This map displays all fire-related incidents by building height over 75' (i.e., high-rise structures). Current high-rises are located on the NAU Campus and Nestle Purina facility; the high-rise hospital tower at the proposed NAH Health Village is also shown.



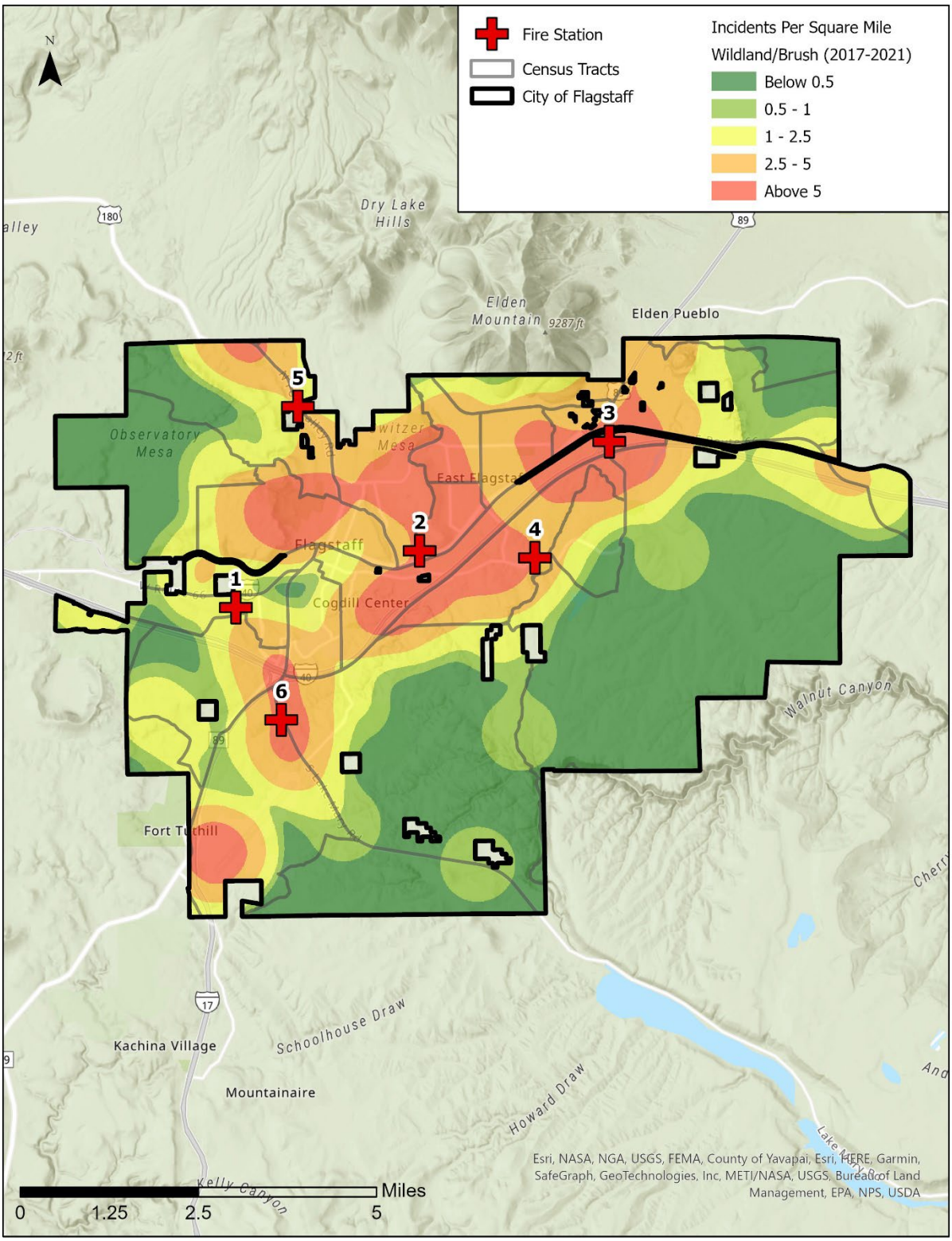
This map displays all fire-related incidents by building area.



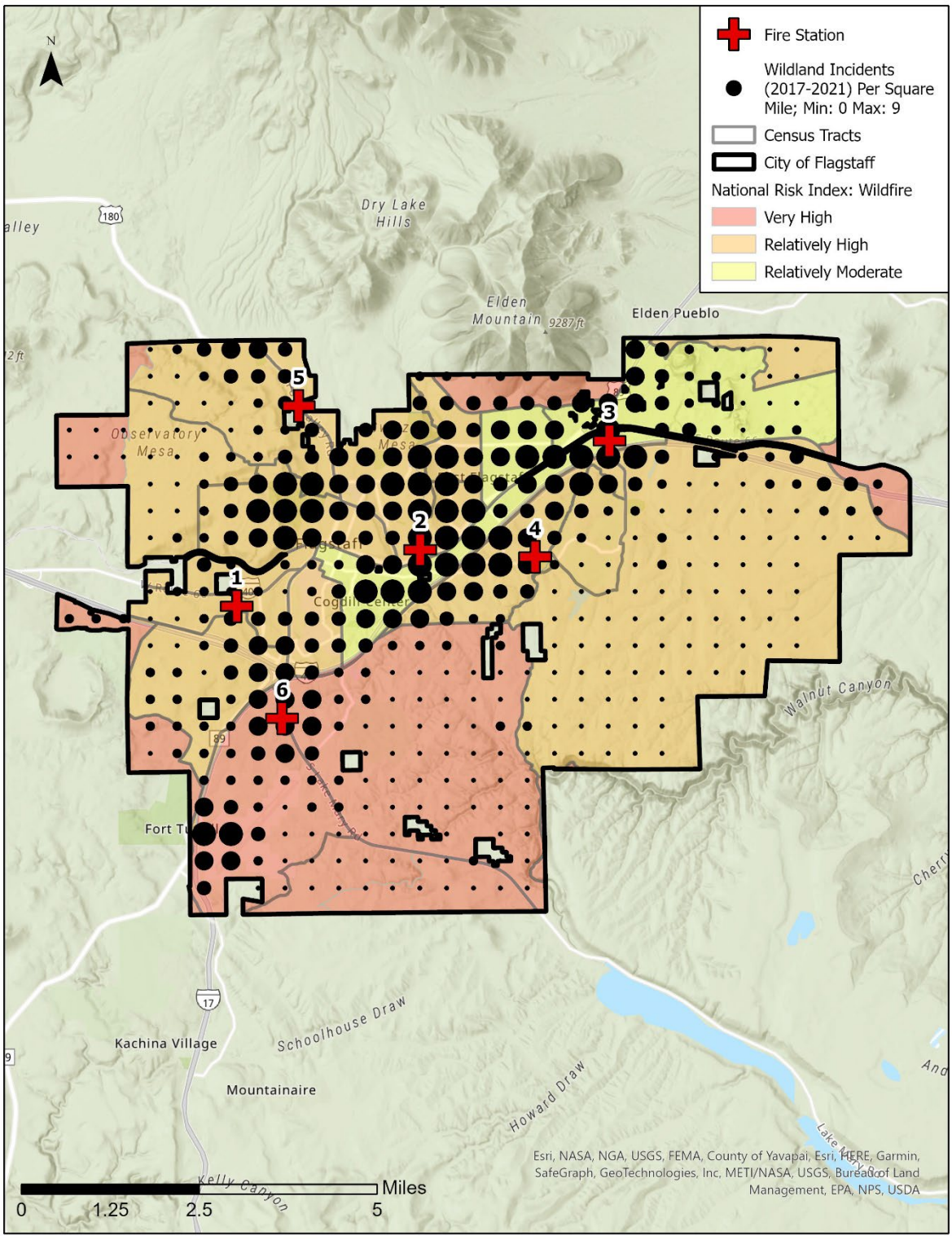
This map displays all fire-related incidents by building age.



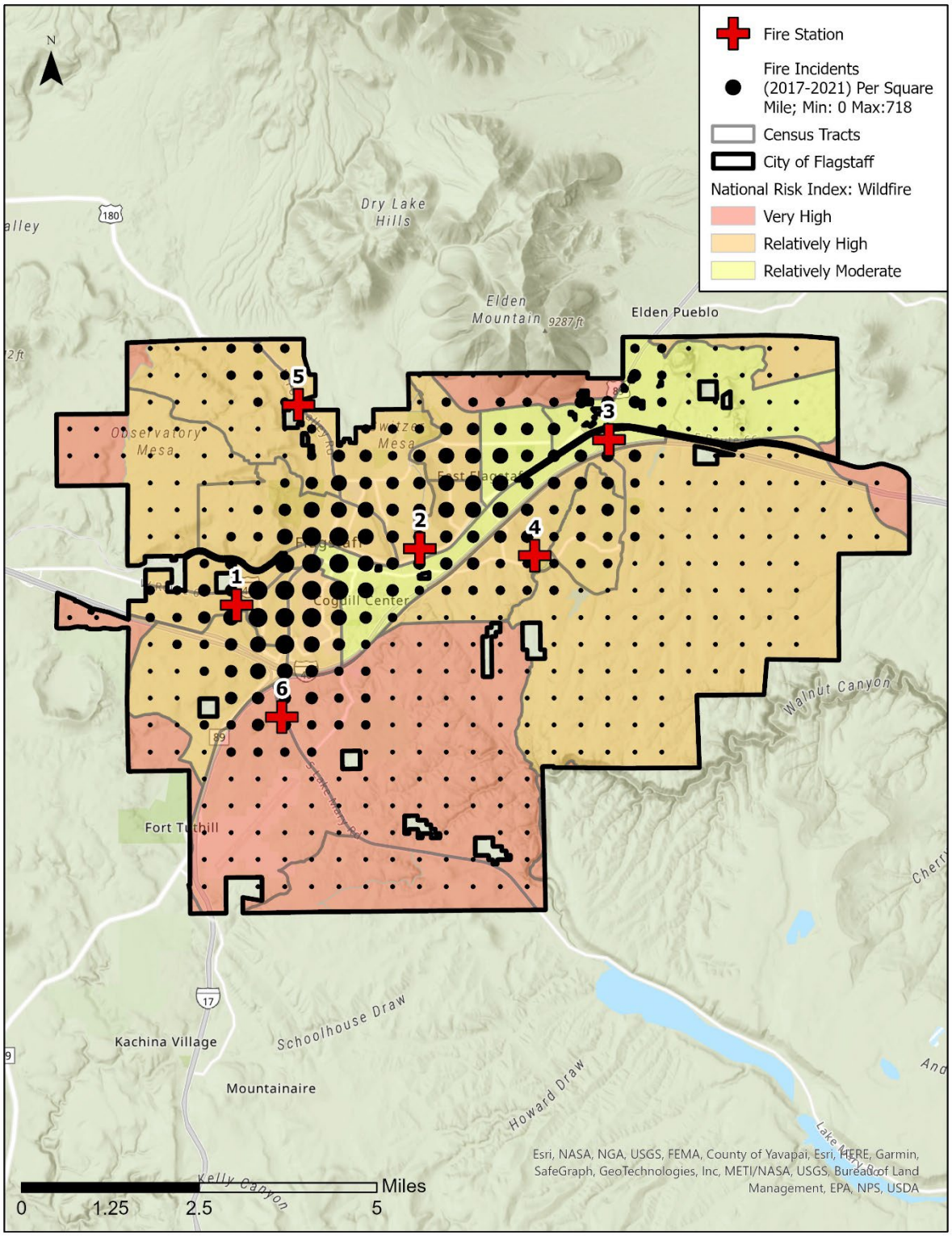
This map displays all fire-related incidents by vacancy rate.



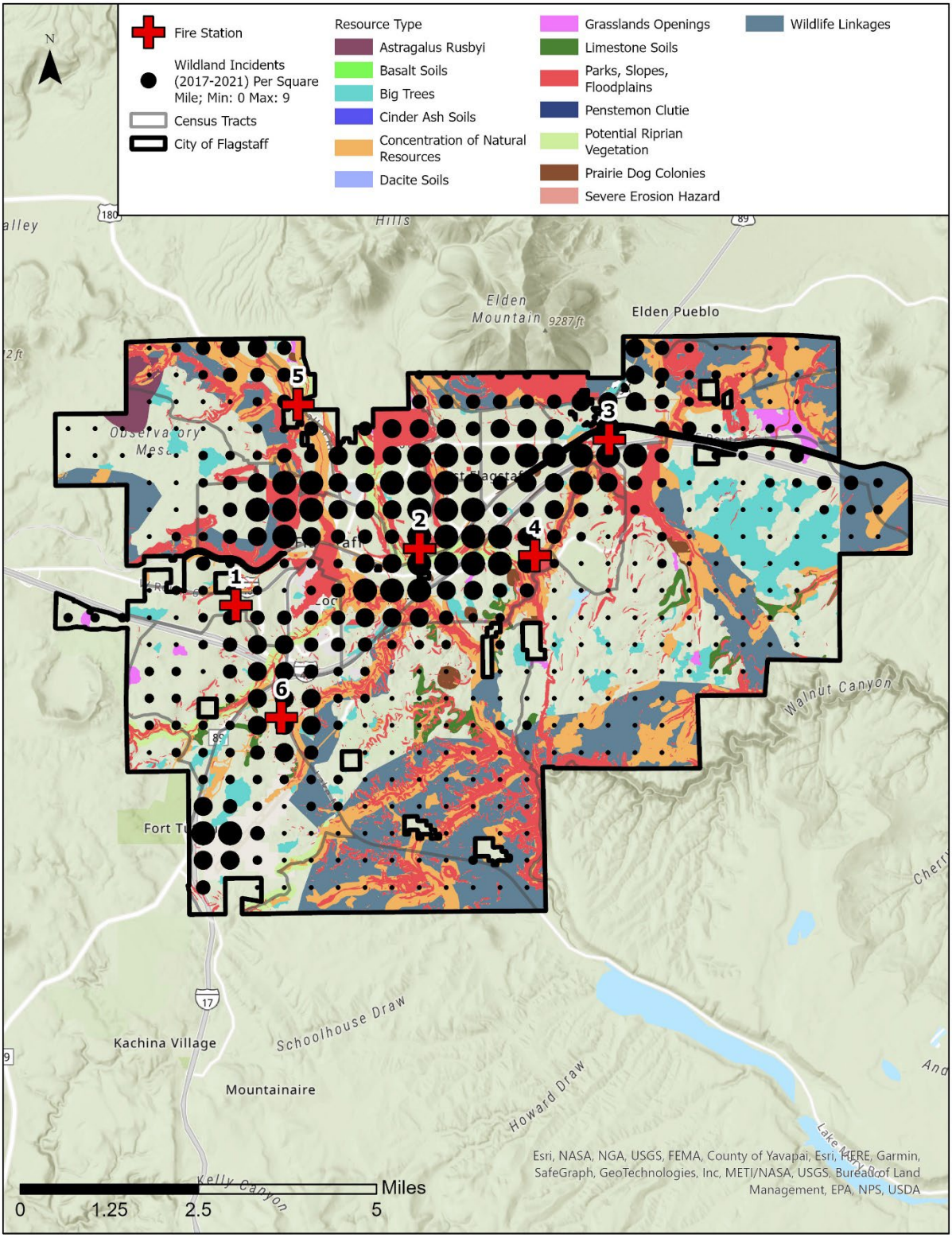
This map displays wildland/brush fire incidents across the City of Flagstaff.



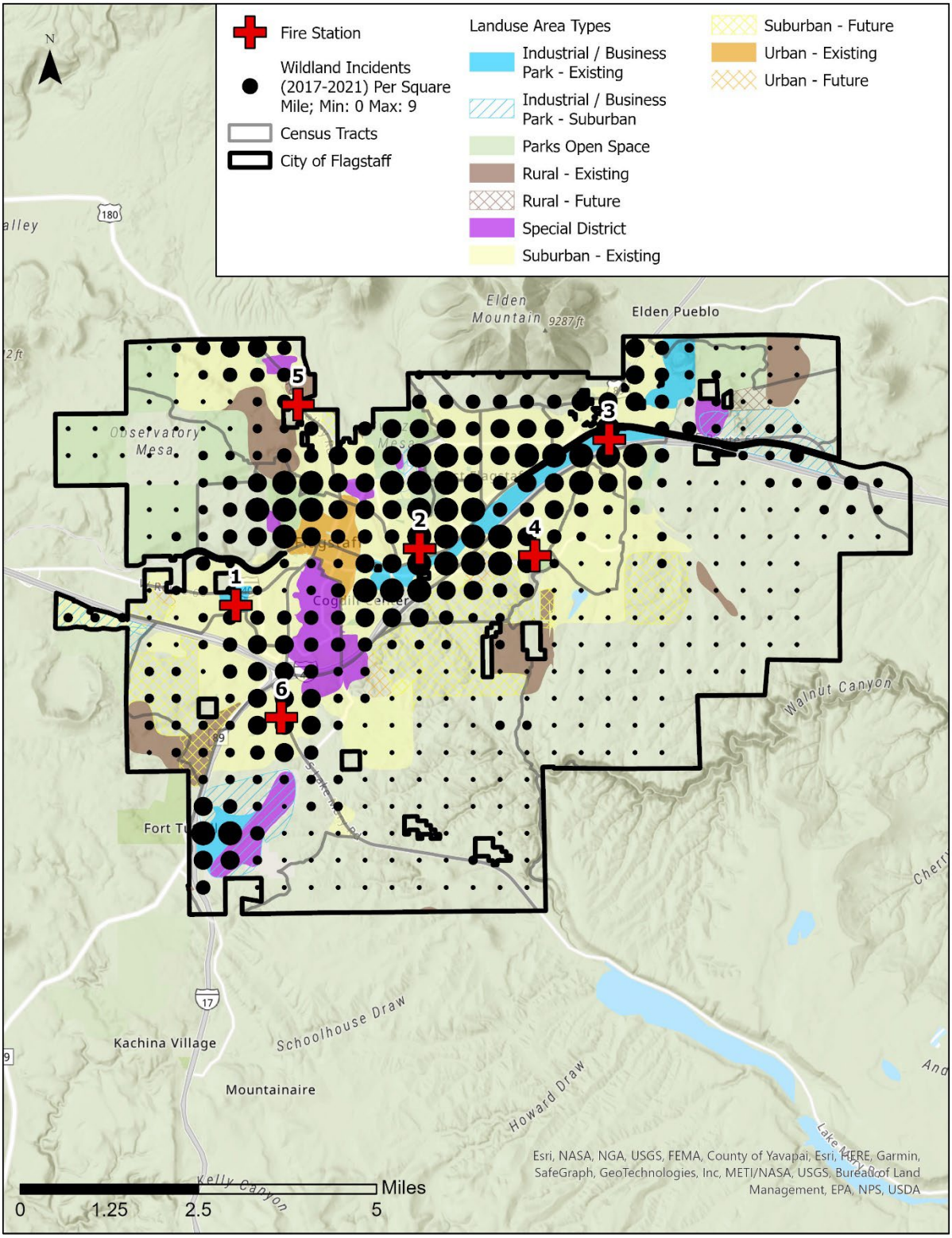
This map displays wildland/brush fire incidents by NRI Wildfire risk across Flagstaff.



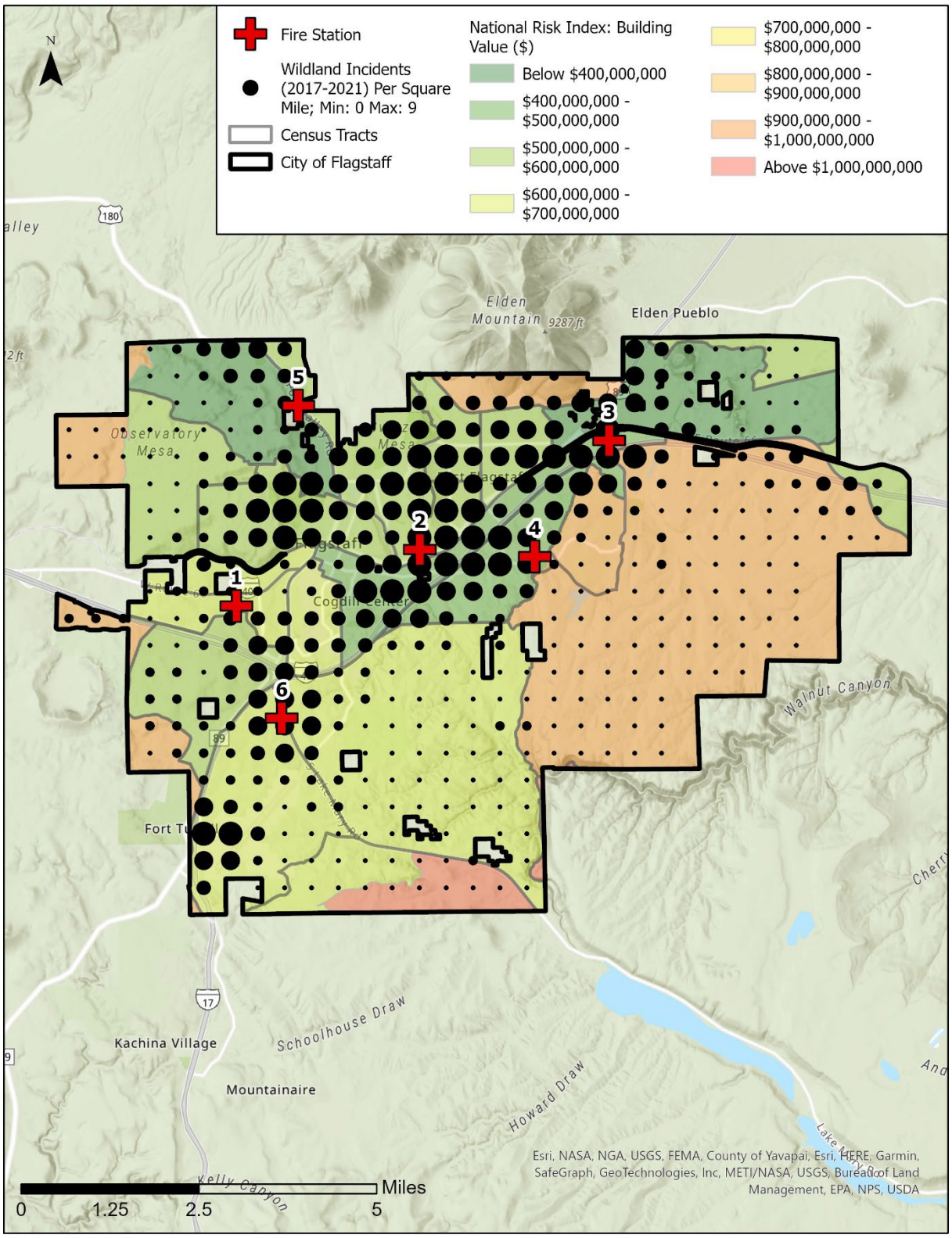
This map displays all fire-related incidents by NRI Wildfire risk across Flagstaff. Even relatively small fire-related incidents in wildfire-prone areas can spark major WUI fires.



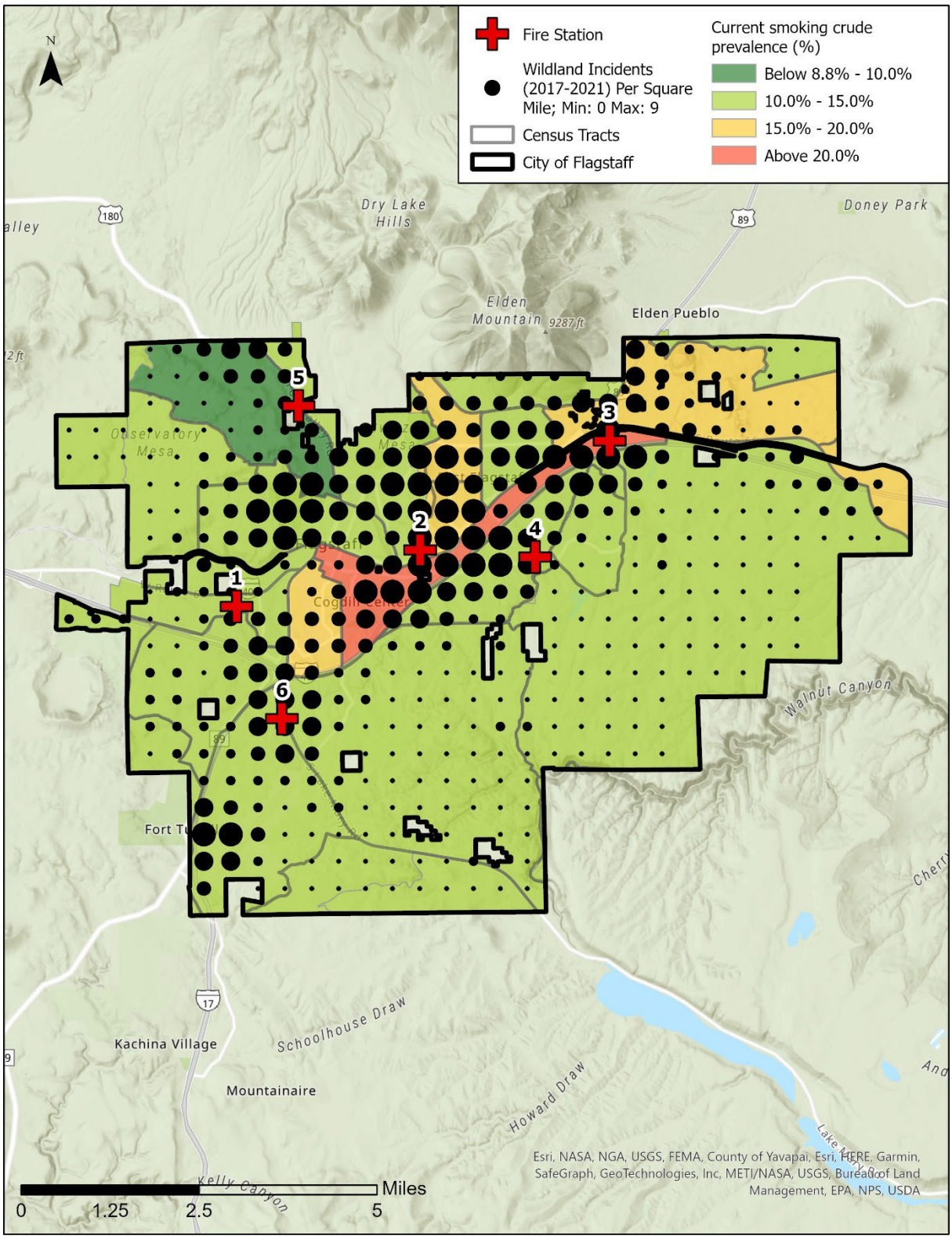
This map displays wildland/brush fire incidents by natural resource types.



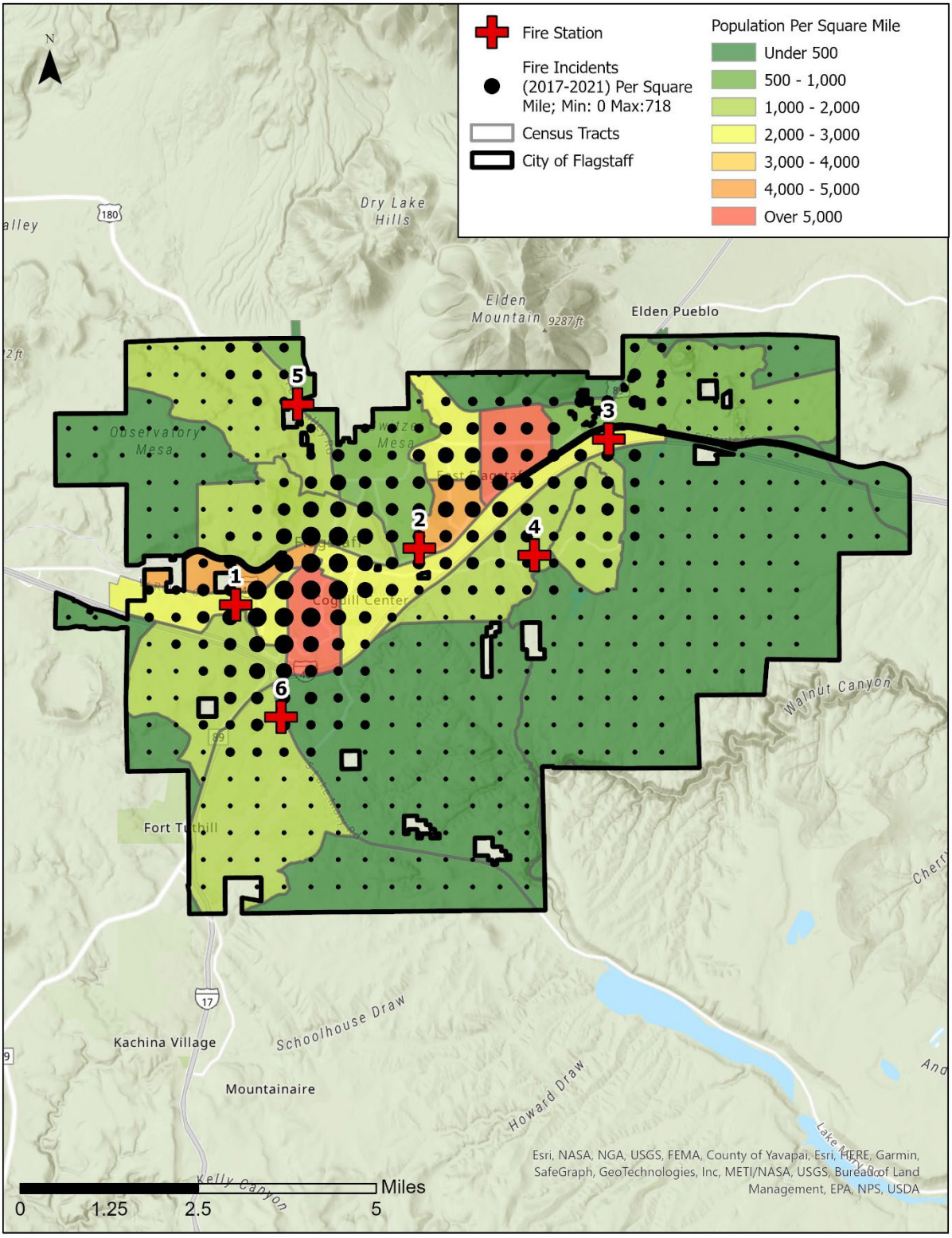
This map displays wildland/brush fire incidents by land use types.



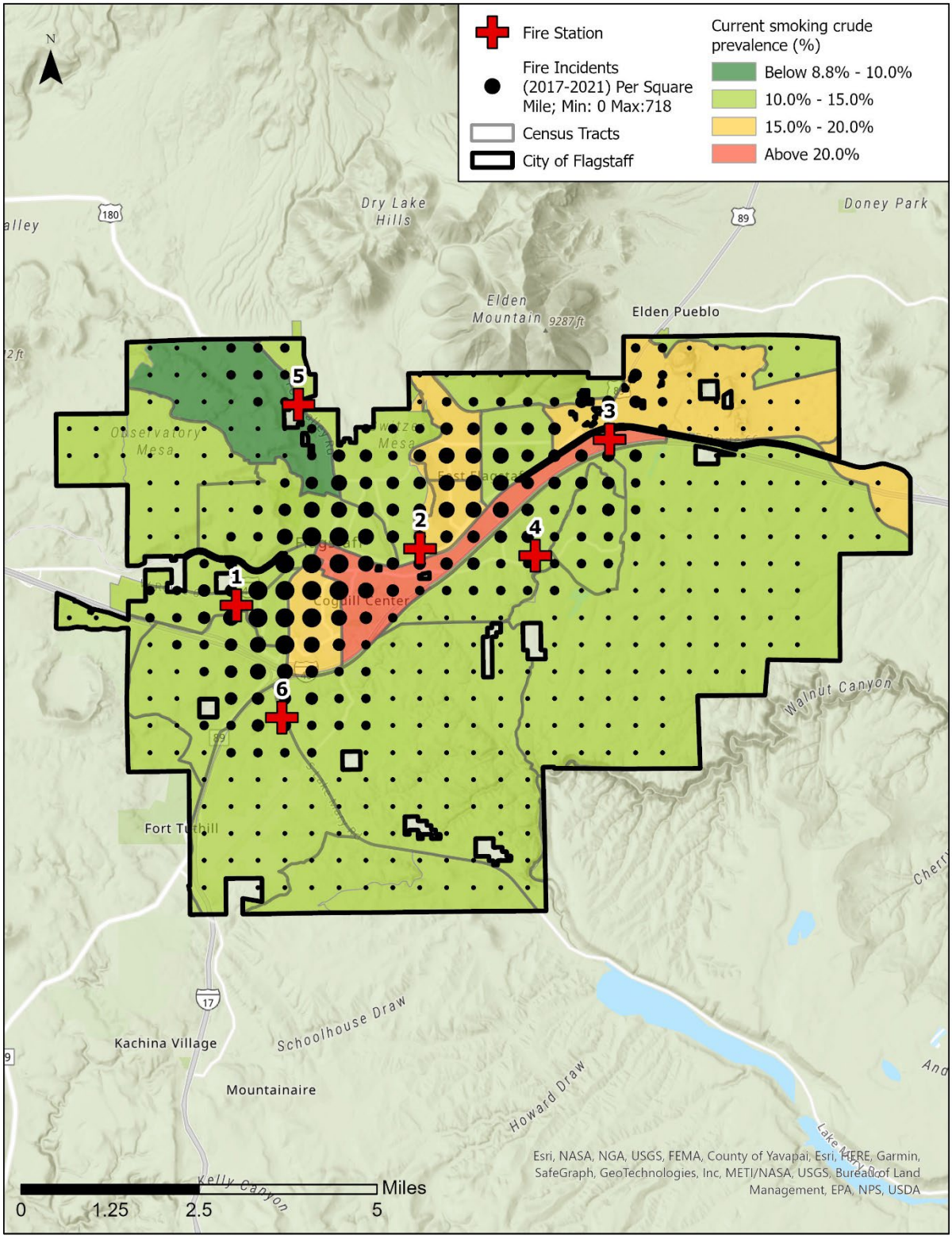
This map displays wildland/brush fire incidents by NRI Building Value.



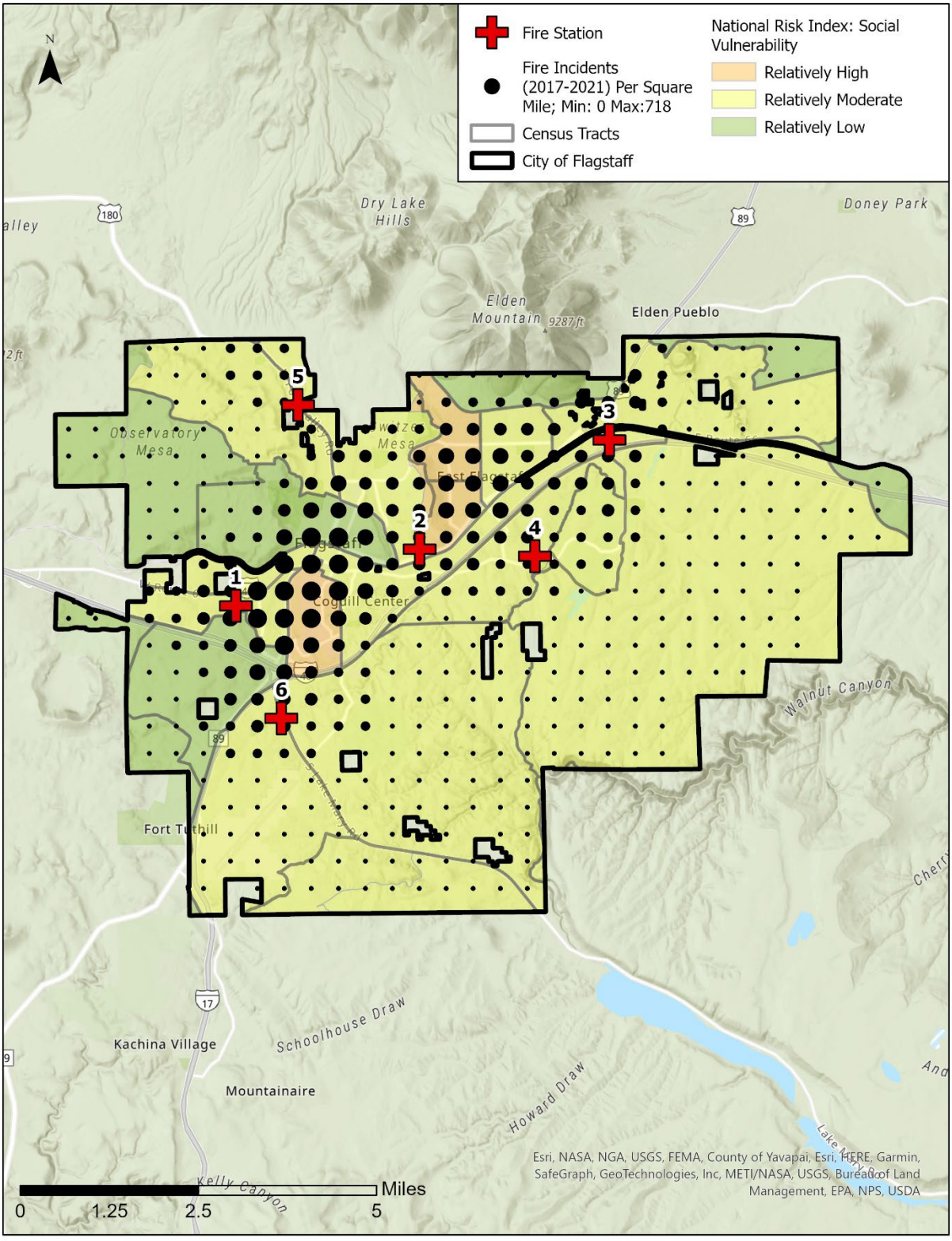
This map displays wildland/brush fire incidents by smoking prevalence.



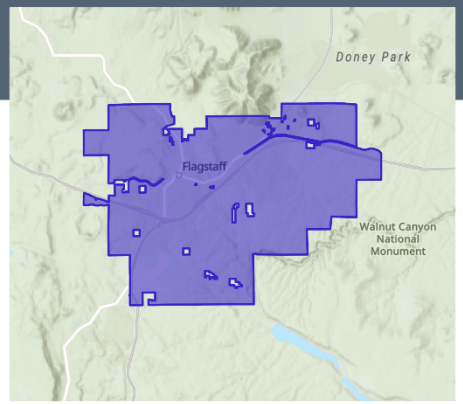
This map displays all fire-related incidents by population density across the City of Flagstaff.



This map displays all fire-related incidents by smoking prevalence City-wide.



This map displays all fire-related incidents by NRI Social Vulnerability.



AT RISK POPULATION PROFILE

City of Flagstaff

esri

Area: 65.84 square miles

78,632	27,606	2.45	28.2	$64,920	$380,098	77	83	69
Population	Households	Avg Size Household	Median Age	Median Household Income	Median Home Value	Wealth Index	Housing Affordability	Diversity Index

AT RISK POPULATION

5,280	8,072	1,195
Households With Disability	Population 65+	Households Without Vehicle

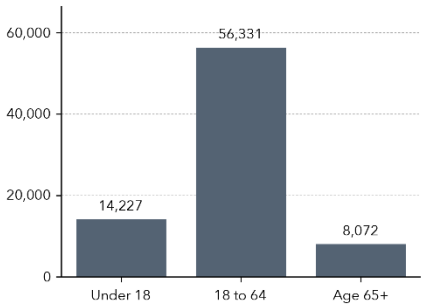
POVERTY AND LANGUAGE

18%	4,352	1
Households Below the Poverty Level	Households Below the Poverty Level	Pop 65+ Speak Spanish & No English

POPULATION AND BUSINESSES

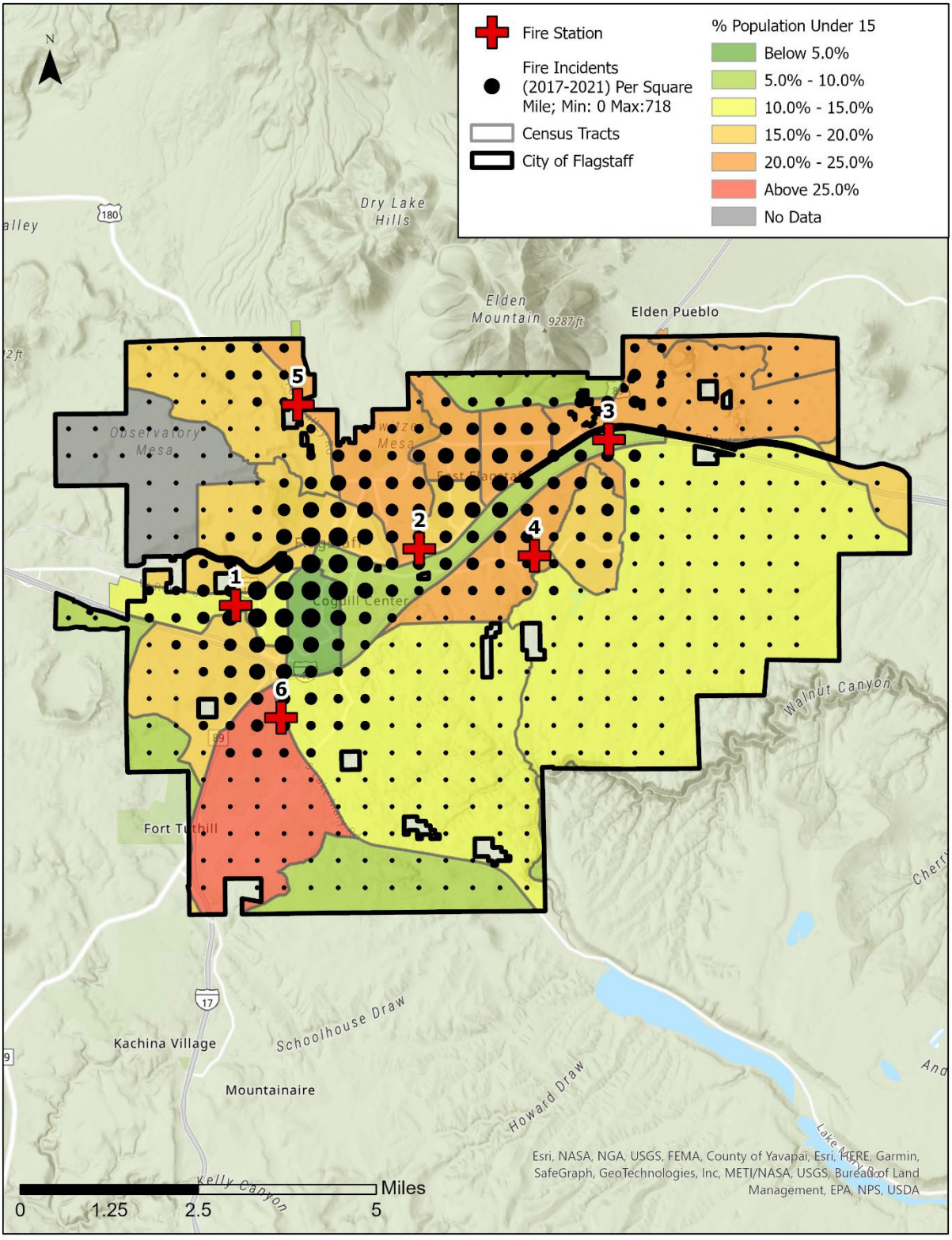
81,176	3,224	42,999
Daytime Population	Total Businesses	Total Employees

POPULATION BY AGE

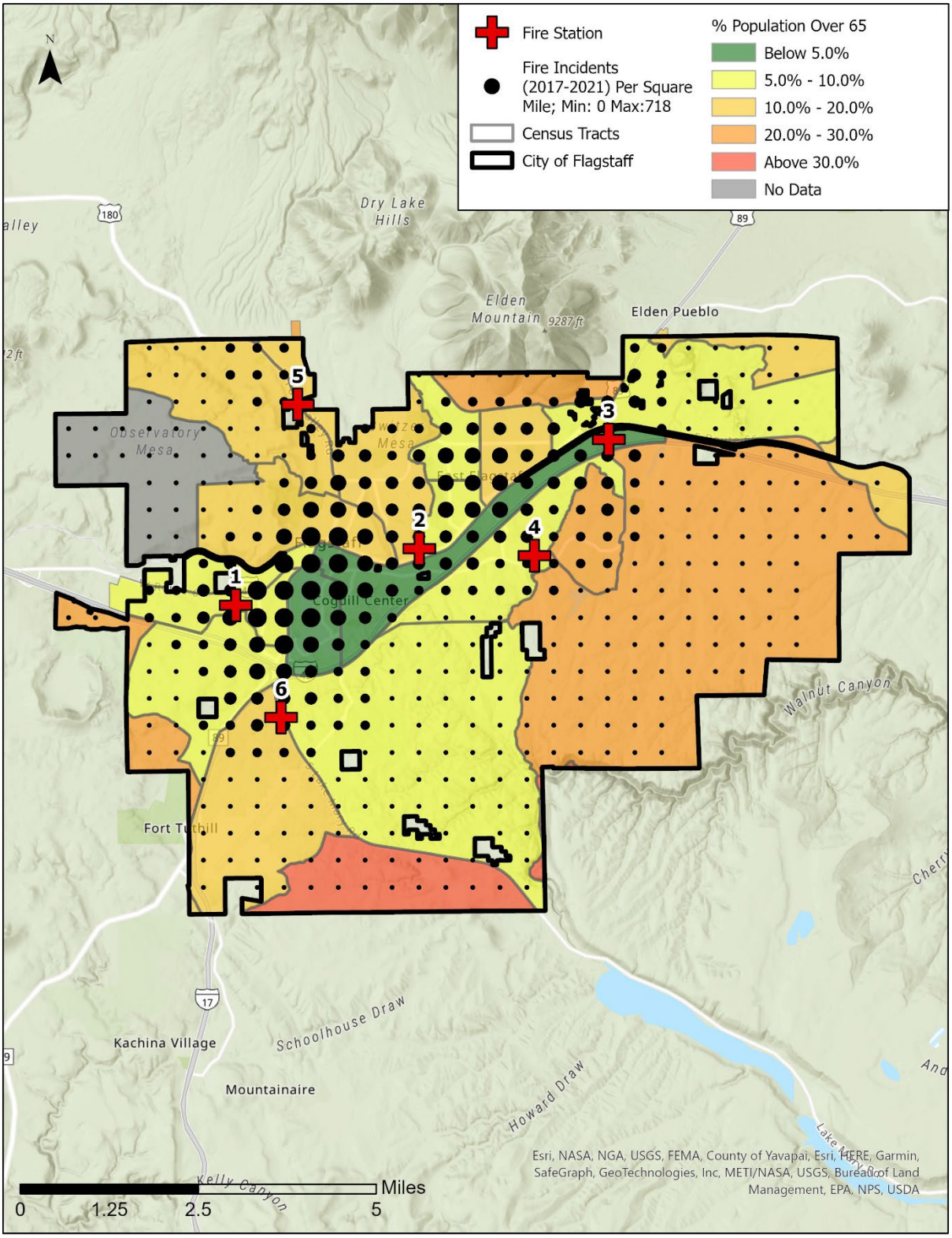


Language Spoken (ACS)	Age 5-17	18-64	Age 65+	Total
English Only	**7,811**	**44,872**	**5,654**	**58,337**
Spanish	**1,322**	**4,425**	**542**	**6,289**
Spanish & English Well	1,260	3,921	514	5,695
Spanish & English Not Well	62	465	27	554
Spanish & No English	0	40	1	41
Indo-European	**258**	**1,087**	**40**	**1,385**
Indo-European & English Well	258	999	34	1,291
Indo-European & English Not Well	0	56	6	62
Indo-European & No English	0	32	0	32
Asian-Pacific Island	**90**	**949**	**56**	**1,095**
Asian-Pacific Isl & English Well	90	870	13	973
Asian-Pacific Isl & English Not Well	0	79	43	122
Asian-Pacific Isl & No English	0	0	0	0
Other Language	**564**	**2,029**	**132**	**2,725**
Other Language & English Well	378	1,889	81	2,348
Other Language & English Not Well	186	139	14	339
Other Language & No English	0	0	37	37

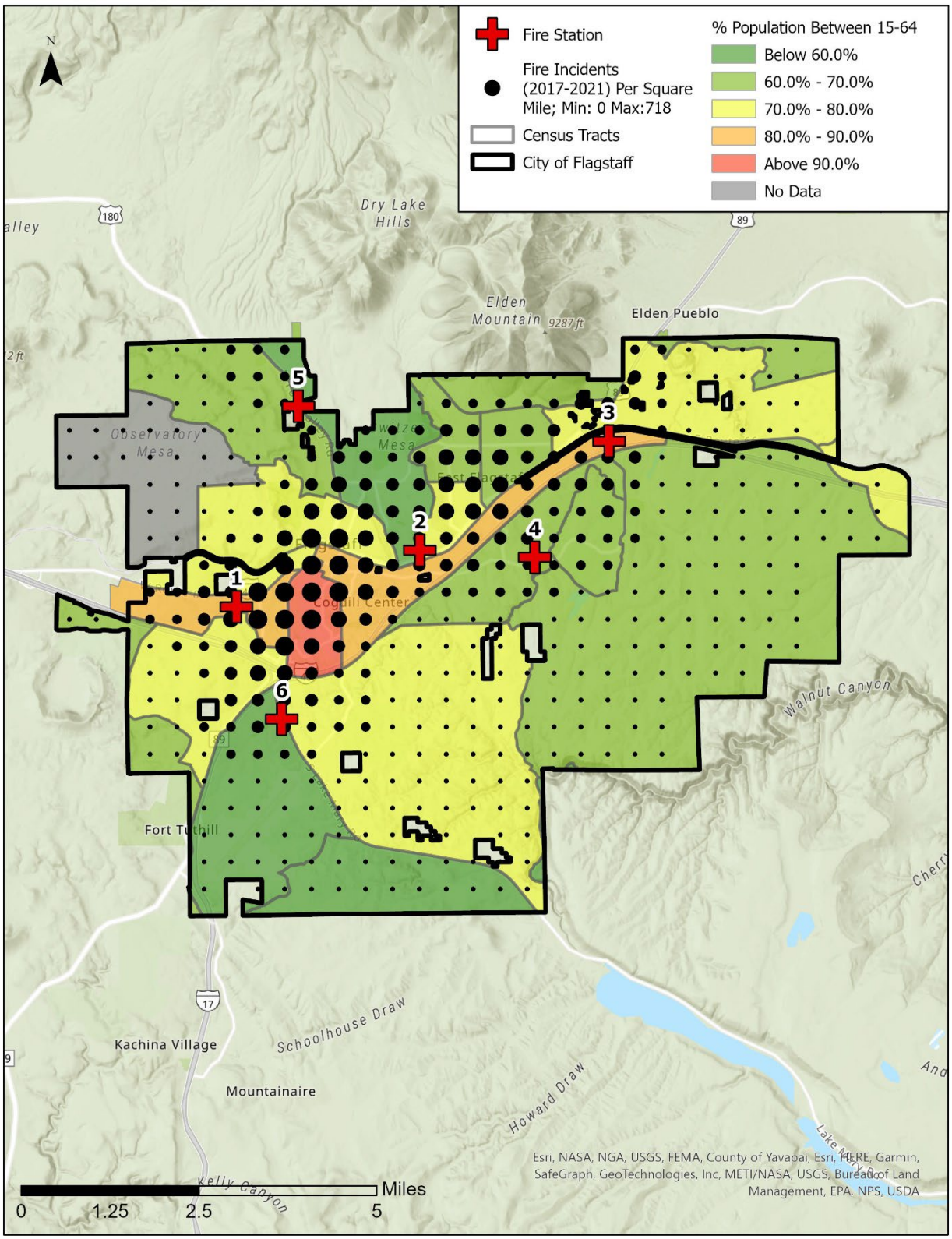
Source: Esri, ACS, Esri-Data Axle, Esri forecasts for 2022, 2027, 2016-2020.



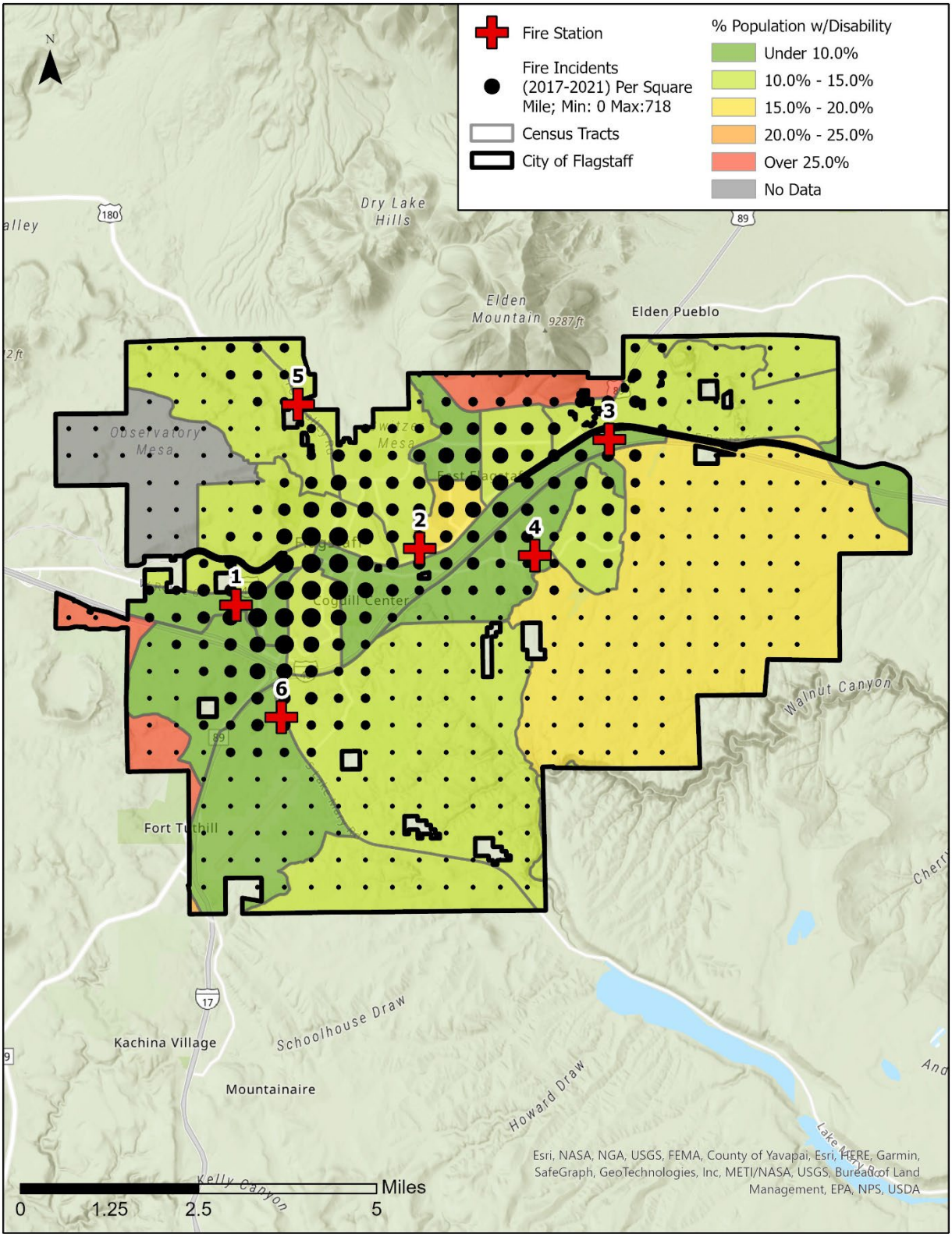
This map displays all fire-related incidents by percent of population <15 years old.



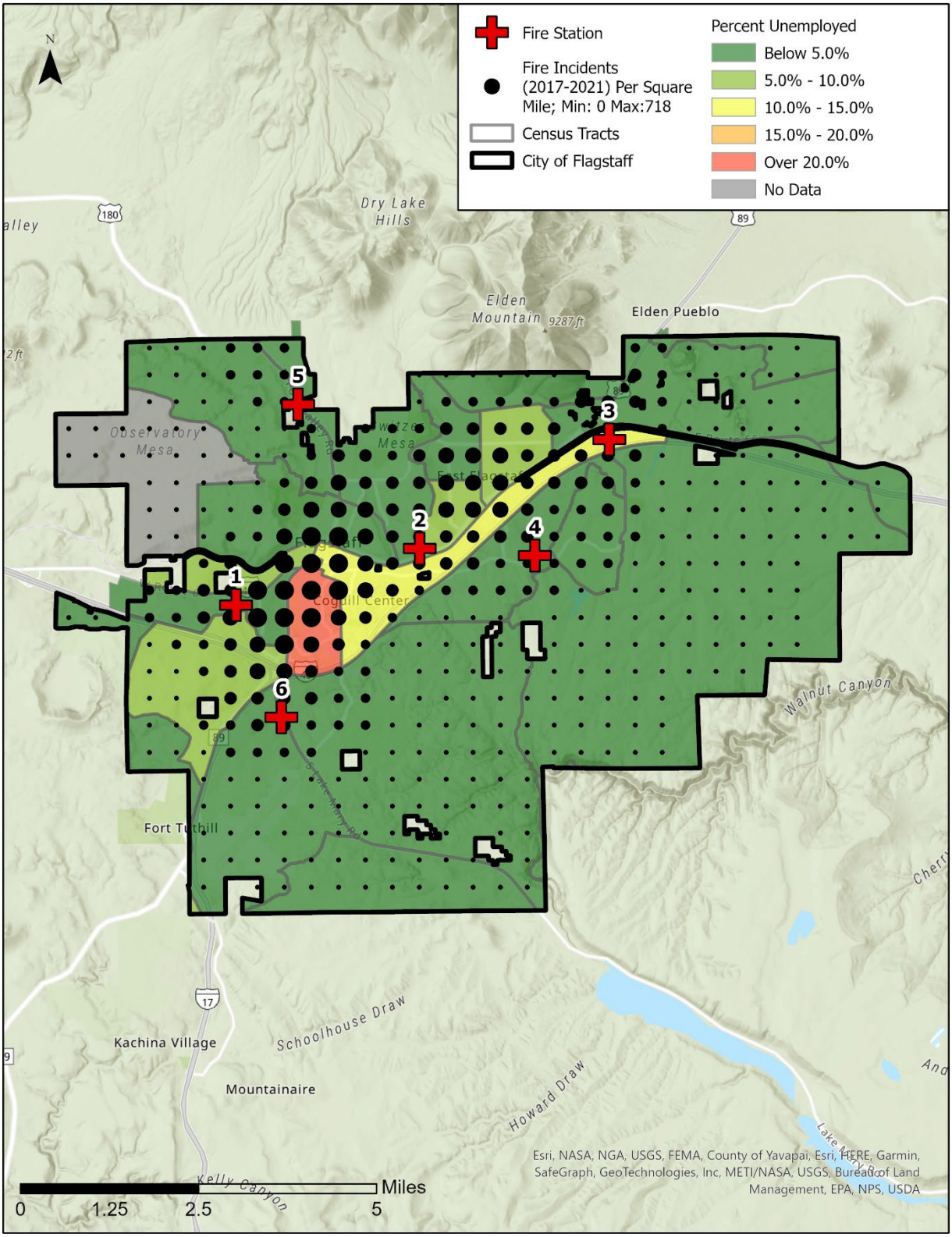
This map displays all fire-related incidents by percent of population >65 years old.



This map displays all fire-related incidents by percent of population between ages 15 and 64.



This map displays all fire-related incidents by percent of population reporting a disability.



This map displays all fire-related incidents by percent unemployed.