



2022 – 2027 BOULDER HAZARD MITIGATION PLAN

Abstract

Boulder County experiences natural hazards frequently and the Boulder Hazard Mitigation Plan provides detailed information about each hazard. The plan also contains information by community about hazards, risk, and vulnerabilities along with mitigation strategies and projects.



Boulder OEM

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- D City of Longmont
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- F Town of Erie
- G Town of Lyons
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Appendix B: Meeting 2 Documentation, Goals and Community Engagement

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1.0 Introduction

1.1 Purpose

In 2008 the Boulder Office of Emergency Management (OEM), together with the communities of Erie, Jamestown, Lafayette, Longmont, Louisville, Lyons, Superior, Ward, and the Boulder Valley and St. Vrain School Districts, prepared the first Boulder County Multi-Hazard Mitigation Plan to better protect people and property from the hazards that threaten our County. By completing the plan, our County became eligible for certain federal disaster assistance including the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Grant Program and the Pre-Disaster Mitigation program. Our County also earned credits for the National Flood Insurance Program's Community Rating System.

In 2016 Boulder County received approval from FEMA and established another 5-year hazard mitigation plan and program. The organizations participating in the 2016-2022 Boulder County Hazard Mitigation Plan participated in yearly updates and accomplished significant and steady progress on projects. The Board of County Commissioners reviewed yearly updates and approved the Hazard Mitigation Program Progress summary as provided each year by the Boulder OEM.

The 2016 Hazard Mitigation Plan built off the 2008 plan's mitigation goals and continued project planning within that framework. In the 2022 Hazard Mitigation Plan there are new goals created from a community desire to refresh the plan's goals and create a new framework and direction within this planning effort and projects to address hazards.

The update of the 2016 Hazard Mitigation Plan began in 2019 and included most planning partners from the 2016 planning team with new members from departments within the municipalities represented. The planning process had a renewed vigor and vitality from previous planning efforts. The planning group placed an emphasis on significantly updating the mitigation goals, assessing the effects of climate change on hazards, vulnerabilities, and risk.

As with any civic effort, the process to revise and update our hazard mitigation plan works best when it is as inclusive as possible. The OEM reached out to stakeholders, partners, and residents to educate, inform, and generate unprecedented levels of participation. In 2016, Boulder County Office of Emergency Management (BOEM) launched a virtual planning process using social media to broaden the dialogue to include those members of our communities that in the past have been underrepresented in the planning process. This activity was continued in the 2022 plan and a community survey was utilized to incorporate community input.

Through an inclusive revision process focused on the mitigation goals of our communities we have developed a revised plan that will help enable our communities to protect their critical facilities, reduce their liability exposure, minimize the impact and disruption caused by hazards, and reduce the costs of disaster response and recovery.

1.2 Background and Scope

Our communities within Boulder County are very familiar with the threats of fire and flood. Yet we face other hazards as well, including tornadoes, drought, hailstorms, and even earthquakes. Each hazard threatens in some way our economy, our property, and our lives. The good news is that we are not powerless against these threats. Through mitigation, we can reduce or even eliminate much of the damage caused by the hazards we face.

FEMA defines hazard mitigation as any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard. A Congressional study found that, on average, each dollar spent on mitigation saves \$6 in future losses. Even more importantly, those savings pale in comparison to the lives

we can save through mitigation.

This revised and updated plan improves upon the 2008 & 2016 plan and identifies new opportunities and strategies to reduce vulnerabilities and increase resiliency and sustainability in our communities. Boulder County's Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that geographically covers everything within Boulder County's jurisdictional boundaries. Unincorporated Boulder County, the municipalities of Boulder, Erie, Lafayette, Longmont, Louisville, Lyons, Nederland, and Superior, along with the Four Mile Fire Protection District participated in the planning process and are seeking FEMA approval of this plan.

This plan continues to meet the requirements of the Disaster Mitigation Act of 2000 (PL 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002 (44 CFR §201.6) and finalized on October 31, 2007. By meeting these requirements, the County and participating jurisdictions will remain eligible for federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (PL 93-288). Access to these resources will be critical to enabling residents of Boulder County to mitigate against and recover from disaster.

The goals of the mitigation plan are summarized here and detailed further in Chapter 5.

Goal 1: Reduce the Loss of Life and Personal Injuries from Hazard Events

Goal 2: Reduce Impacts of Hazard Events on Property, Critical Facilities/Infrastructure, and the Environment

Goal 3: Strengthen Intergovernmental Coordination, Communication, and Capabilities Regarding Mitigating Hazard Impacts

Goal 4: Improve Public Awareness and Preparedness Regarding Hazard Vulnerability and Mitigation

Goal 5: Address Hazard Identification in the Context of Climate Change

1.3 Boulder County Hazard Mitigation Update Report 2017-2020

For credit under the Community Rating System, this report must be distributed to the media and be made available to the public. Notification of the availability of the report will be sent to the media that cover Boulder County via a press release. Copies of this report and the 2016 Plan Update are available for review at the Boulder OEM or on the website (BoulderOEM.com).

The original hazard mitigation planning process was managed by the Boulder OEM and included representatives from communities throughout Boulder County, non-profit agencies, Boulder County departments, members from the Colorado Division of Homeland Security and Emergency Management's Mitigation Section and FEMA Region 8. The plan was adopted officially on April 4, 2016, and covers the following communities, Boulder County; the Cities of Longmont and Louisville; the Towns of Erie, Gold Hill, Jamestown, Lyons, Nederland, and Superior; and the Fire Protection Districts of Fourmile and Sunshine. The update process occurred in 2020-2022.

Tables with implementation status of county projects from the 2017-2020 report can be found in Appendices E, F & G. Status updates for each jurisdiction's mitigation projects can be found in each of the jurisdictional annexes.

1.4 City of Boulder County Hazard Mitigation Update Report 2019

For credit under the Community Rating System, this report must be distributed to the media and be made available to the public. Notification of the availability of the report will be sent to the media that cover the City of Boulder via a press release. Copies of this report and the 2018 Plan Update are available for review at the Boulder OEM or on the website (BoulderOEM.com).

The original hazard mitigation planning process was managed by The City of Boulder Public Works Department and included representatives from communities throughout the City of Boulder, Boulder County, non-profit agencies, Boulder County departments, members from the Colorado Division of Homeland Security and Emergency Management's Mitigation Section and FEMA Region 8. The plan was adopted officially in March 2018 and the plan will expire in 2023. Currently, the plan is being integrated with the Boulder County Hazard Mitigation Plan update process to increase whole community mitigation projects. The update process is being managed by the Boulder OEM and it will be submitted to FEMA for adoption in 2022.

1.5 Climate Change and Equity Considerations in the County Hazard Mitigation Plan Update 2021-2022

The Boulder County 2021-2022 Hazard Mitigation Plan update is focused on shifting from a reactive structure to a more proactive approach. Boulder County recognizes that climate change is real and that our planet is rapidly warming at a pace never experienced by humans. We can no longer use past hazard events as a good indicator for future hazard impacts. Although there is value in using our previous data and assessing trend lines, the County has made a commitment to integrating climate change into the 2021-2026 HMP.

Boulder County also recognizes that hazards do not impact members of our community equally. We recognize that the root causes of climate change, environmental injustice, and racial inequity are the same and are due to colonization and extraction of natural and human resources to the benefit of a few. In order to effectively reduce vulnerability of people, property, and the environment, we must acknowledge the true history of our country and identify solutions that prioritize the needs of the most marginalized.

Finally, Boulder County understands that humans are part of the ecosystem and that we are deeply connected to and reliant on the natural environment. For decades we have neglected to respect the environment and that has led to air, water and soil quality issues and environmental degradation.

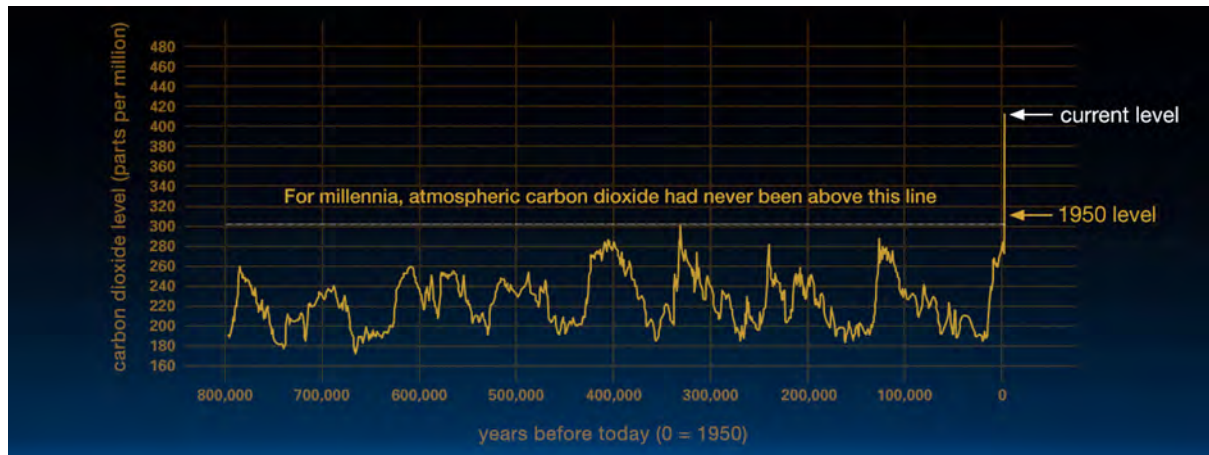
In the 2021 Hazard Mitigation Plan Update, Boulder County will continue to use the successful structure and strategies identified in our 2016 plan and incorporate climate change, social equity and ecological considerations into the risk assessment and mitigation strategies. Additionally, we will restructure elements of the plan to ensure connectivity to other implementation partners for a more holistic and proactive approach. This includes structure inclusive of social, ecological, and technological/infrastructure actions.

Climate Change

Global Context

The Earth is warming at an unprecedented rate. Since 1880, the global average surface temperature has increased by two degrees Fahrenheit (NASA). Increasing air and ocean temperatures affect the planet's weather and climate systems leading to increases in extreme weather events and natural disasters. Although the planet has been through several cycles of heating and cooling, human activities that increase carbon dioxide and other emissions into the atmosphere have led to record warming over the past 40 years, and with it, record-setting extreme weather events. All but one of the 16 hottest years in NASA's 134-year record have occurred since the year 2000.

To date, scientists have been able to document precipitation (rain and snowfall) variability globally, with increased average precipitation in some areas contrasting severe drought in other areas; ice sheets and mountain glaciers melting which reduces the Earth's ability to reflect sunlight; shifts in wildlife habitats including altered migration patterns, the loss of several species, and the thriving of disease carriers such as mosquitoes and ticks (NASA).

Figure 1-1 Global Carbon Dioxide Levels over Time

Climate.nasa.gov. This graph, based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, provides evidence that atmospheric CO₂ has increased since the Industrial Revolution. (Credit: Luthi, D., et al. 2008; Etheridge, D.M., et al. 2010; Vostok ice core data/J.R. Petit et al.; NOAA Mauna Loa CO₂ record.)

The Intergovernmental Panel on Climate Change (IPCC) is made up of over 1300 scientists from around the world. Utilizing best available data, these scientists believe average global temperatures will continue to rise between 2.5- and 10-degrees Fahrenheit by the end of this century (IPCC). Impacts from a two-degree rise have already led to increased extreme heat days, precipitation variability, bigger hurricanes and storm events, increased likelihood of wildfires, and sea level rise. If trends continue, there will be catastrophic impacts to the economic, social, and environmental systems we all rely on.

National Context

The Fourth National Climate Assessment (NCA4) states that in the coming decades the United States will experience “high temperature extremes, heavy precipitation events, and high tide flooding events along the U.S. coastline,” among other effects. With these changes will also come “more frequent and intense extreme weather and climate-related events, as well as changes in average climate conditions”. As experienced and observed in recent years, these extreme hazard events disrupt lives and local economies, strain social services, damage infrastructure, and cause harm to ecosystems. Effects of climate change are impacting our communities today. Daily stresses are compounded when one or more of these climate-related impacts occurs.

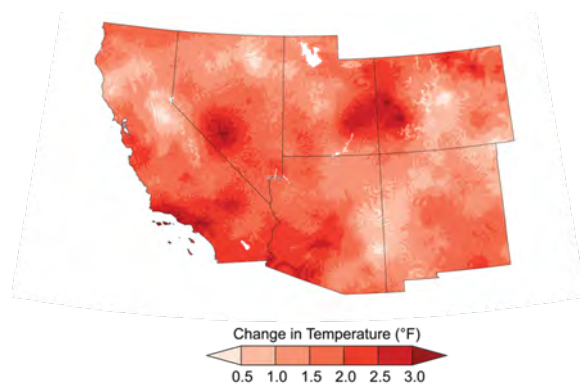
Recent trends in annual average temperature variability will not only persist but also accelerate in the coming decades. According to NCA4, “annual average temperature over the contiguous United States has increased by 1.2°F for the period 1986-2016 relative to 1901-1960”. In the future, the annual average temperature of the contiguous United States is expected to increase by about twice as much (2.5°F) by 2050, as compared to the average from 1976-2005, and even larger increases are expected to occur by the end of the 21st century.

Daily extreme temperatures are also expected to increase, with the largest increases effecting the coldest temperatures of the year, especially in the northern half of the country. Changes in the warmest daily temperatures of the year will be more uniform across the contiguous United States. However, overall average temperatures will continue to increase leading to more frequent and intense heatwave and extreme heat events. In addition to temperature changes, heavy precipitation events are also likely to continue increasing in frequency and intensity leading to more flash flooding.

Regional Context

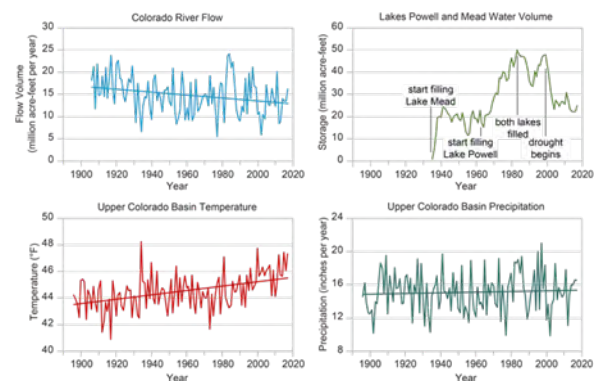
The southwest is incredibly vulnerable to the impacts from climate change. The region is made up of an assortment of ecosystems ranging from coastal land and deserts to mountains and high elevation forests. Even with a variety of ecosystems, the region is collectively experiencing rapid changes in average temperatures and precipitation variability.

Figure 1-2 Change in Temperature in the Southwest



Source: NCA 2018 Chapter 25

Figure 1-3 Drought Impacts in the Southwest



Source: PRISM Climate

Group, Oregon State University

The climate of the Intermountain West is mimicking trends seen at the global and national scale. Over the past 30 years, the average temperature in the Intermountain West has increased by nearly two degrees Fahrenheit; a rapid pace that is unlike other periods of warming. This region is expected to continue warming. Similar to global and national projections, the Intermountain West is projected to warm by 2 to 6.5 degrees by mid-century (WWA).

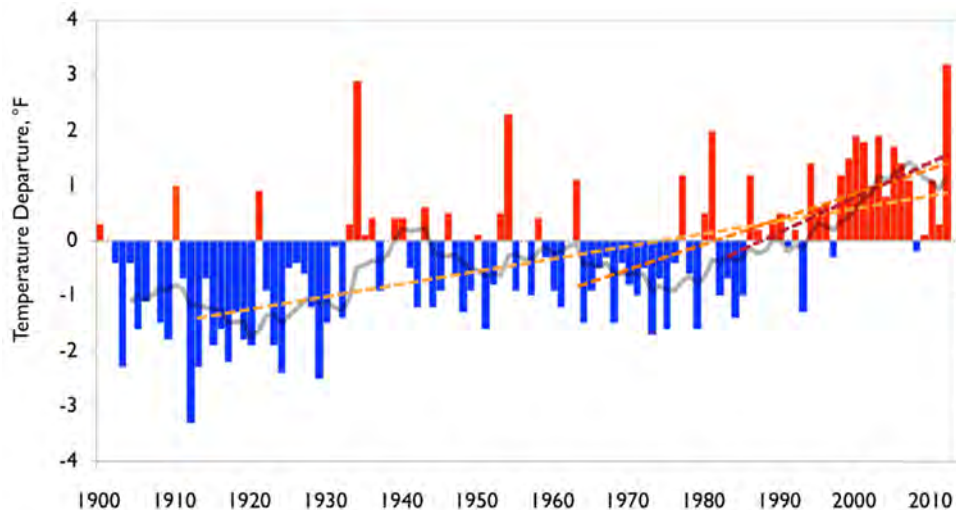
Local Context

Climate models for Colorado show potential for both increased and decreased precipitation, but models are in overall agreement that the hottest recorded summer temperatures in the state will become the new normal; spring snowpack will decrease between 5% and 20%; and streamflows will decrease by up to 30% by 2050 (WWA 2018). In Boulder County, climate data show that the number of 95-degree days has already doubled from 5 to 11 between 2000-2017. Projections indicate that this number will grow to 38 days above 95 degrees by 2050, and 70 days above 95 degrees by the end of the century (Rocky Mountain Climate Organization 2016). Climate change models exhibit a much wider variation in projecting precipitation events, but the models agree that the number of large or heavy storms, with precipitation over ½ inch, will increase in both quantity and intensity. Storms creating over one-inch of precipitation are likely to increase by 50% by the end of the century (Rocky Mountain Climate Organization 2016). While the mountains will see an increase in large storm events, there will also likely be a reduction in overall precipitation at high elevations, including up to a 5% reduction in precipitation during the summer months by the end of the century (Rocky Mountain Climate Organization 2016).

Accompanying the changes in temperature, the number of drought months will nearly double compared to their historic occurrence, and drought events will be classed as “severe” and “extreme” according to the Palmer Drought Severity Index (Resilient Analytics 2018). The combination of increased drought and higher temperatures will further reduce moisture availability within soils, making drought impacts on vegetation more severe and impacting road and infrastructure foundations (Resilient Analytics 2018). Water availability

in Boulder County will be impacted by the earlier snow melt, 5%-20% reduction in snowpack, and 30% reduction in stream flow that is projected for the state as a whole by the end of the century (WWA 2018).

Figure 1-4 Colorado Statewide Annual Temperature 1900-2012



Source: NOAA/National Centers for Environmental Information (NCEI)

Social Equity

Black Indigenous People of Color (BIPOC), immigrants and low-income people, known as frontline communities, have intentionally been made more vulnerable to the impacts of natural hazards and climate change due to decades of prejudice policies and practices, inequitable power distribution and withholding of assets and resources. Institutionalized racism, theft of land and water rights, and class bias began with colonization of the United States and have been foundational pillars that continue to create deep divisions within the country. Unjust systems have created higher levels of poverty and limited access to jobs, resources, transportation, and education for frontline communities.

Prior to colonization by White Europeans in the 15th century, the lands occupied by the United States were home to many Indigenous Tribes and intricate and productive ecosystems that were intertwined with human livelihoods. Despite the rich history of Native Americans, they have also been subject to intense violence, persecution, and swindling at the hands of White colonizers, which has resulted in massive disparities in income, land, and home ownership in addition to inequities in basic public health, bodily safety, and civil rights. Much of the current land possession within the United States, state boundaries, city plans, housing developments, and land rights are implicitly records of White supremacy and that preserve the assets and historical records of White populations at the expense of the rights of native peoples. Native Americans are now one of the populations most vulnerable to climate change due to higher exposure to hazard impacts and lower adaptive capacity due to historical and current disenfranchisement. Over the period of colonization in the United States, Tribes have been forcibly restricted to lands with limited resources and struggled to have rights of ownership recognized by state and federal governments. The impacts of this on communities are exacerbated by climate change as sovereign lands of many Tribes are becoming increasingly dry, and the scant water rights afforded to Indigenous Americans are insufficient for their needs.

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Home Ownership, Insurance, and Reinsurance

In addition to marginalizing and stifling the growth of communities of color, the practice of redlining and its continued effects have exacerbated the impact of hazards, reduced resource access, and ensured highly finite and fragile mechanisms of resilience within BIPOC communities. The impacts of systemic racism within the housing market are so stark, that Black homeownership has lagged far behind White homeownership for decades. Estimates on the overall equity gap that these policies contribute to indicate that it would take Black families over 200 years to accumulate the same amount of wealth that White people possess, and this

disparity is only increased by the impacts of natural hazards. In Houston after Hurricane Harvey, reporting found that White, wealthier homeowners were provided with more resources for recovery than Black, poor families. This pattern holds true across the United States, whereby the wealthy, and the White get more federal aid after a disaster, while minorities and the poor, receive less (NPR 2019). The cycle of poverty increased by homeownership policies is also visible on Native American reservations, where the lack of addresses on homes that are legible to White bureaucracy has prevented distribution of aid for years. A series of flooding events on the Oglala Sioux Pine Ridge reservation from 2015 forward showcased the haphazard approach that FEMA had in distributing aid to Native American Tribes, as assistance was distributed only in piecemeal fashion because of the burden of proof laid on homeowners for deeds to their homes and maintenance reports. In subsequent years, including 2019, no disaster declaration was granted to the Tribe even though major disaster declarations were given to neighboring states.

This lack of bureaucratic recognition and stifling of aid distribution contributes to ongoing poverty and increased income disparities during recovery. Other ways in which income disparities are exacerbated and inhibit community recovery include lack of insurance for BIPOC and low-income communities. Data on damage estimates and disaster impact is created through insurance reporting. For underinsured communities, lack of reporting means lack of recognition in recovery resources and may result in exclusion from rebuilding and resilience efforts.

Local Context

The communities of Boulder County live with highly differentiated risk exposure due to the diverse influences of geography, culture, economic opportunity, and racial and social inequities. These different groups exhibit various capacities to respond to and recover from hazard impacts. Racial inequities in Boulder County are reflective of the history of Colorado as a whole, in that White majorities were created and maintained rather than happened naturally. Early disputes over Black voting rights in the 1860s sparked racial tensions, with Congress bypassing White voters in the territory to grant Black residents suffrage before admitting Colorado to the Union (Newsom 2017). In the early 1900s, the African American population in Denver created a thriving community known as the “Harlem of the West,” but the power of the local branch of the Ku Klux Klan meant that the population was restricted within certain neighborhoods in Denver (Newsom 2017). If Black homeowners moved outside of the area, they were threatened with violence, including drive by bombings. Because of the racist restrictions on Black activities and incipient violence, eventually the thriving neighborhood of Five Points lost its entertainment venues and economic viability (Newsom 2017).

The largest non-White group in Boulder County is the Latinx population, which makes up approximately 14% of the County residents (TRENDS 2019). There is a long history of Latinx residents in the area, as many arrived in the 1920s and 30s to farm sugarbeets and mine coal, coming north from Trinidad, Colorado to follow economic opportunity (McIntosh 2016). Throughout the 1900s the Ku Klux Klan tormented people of color in Boulder County, ensuring that Latinx populations only lived in certain areas in the eastern part of the County (TRENDS 2019). More subtly, environmental racism has a long history in Boulder County, where the myth of untouched, virgin open space has been used to romanticize the history of Native Americans in the area, and to restrict the availability of affordable housing (Hickcox 2007). This trend continues through 2020, as residents of the County are least willing to donate to causes that will benefit minorities, immigrants, and refugees (TRENDS 2019). The impacts of systemic racism can be seen in the chronic disparities between Whites and non-Whites in Boulder County. For the Latinx population, this means a higher occurrence of health issues such as diabetes, and child obesity compared to Whites as well as comprising 37% of COVID-19 cases and 48% of COVID-19 deaths (POS 2020); a 86% graduation rate after four years in high school compared to a 93% graduation rate for Whites in Boulder Valley School District (TRENDS 2019); and a median income level of \$46,388 for Latinx vs \$75,802 for Whites (POS 2020).

Income levels impact recovery from all disasters, but the effects of institutional racism have been also seen in problems with Latinx access to resources after the 2013 floods, and in lack of warning systems in Spanish. There are a number of ongoing efforts to combat the impacts of racism within Boulder County government, but this plan acknowledges that existing inequities increase hazard vulnerabilities for people of color. Other areas of significant vulnerability in Boulder County include the 60% of the population over 65 that has a mental or physical disability, the 27% of residents that do not earn enough to cover basic needs, and the lack of affordable housing that increases commute times and places heavy reliance on working roadways, such as the 50,000 people that commute into the City of Boulder to work every day (TRENDS 2019). Problems with underinsurance are prevalent throughout the mountain communities, as many homeowners do not have enough to cover their wildfire risk. In manufactured home parks, and for monolingual Spanish speakers, recovery in Boulder County has been made more difficult by lack of access to resources and the lack of comprehensive data collection on needs and culturally appropriate disaster preparedness. These gaps in services indicate a need for a more robustly supported cultural broker network and the creation of community-led after action reports that will assist in improving and adjusting mitigation plans and actions.

Ecological

Natural hazards are part of geophysical processes that are constantly at work across the Earth. Movements of tectonic plates, alterations in water availability, precipitation, wind, lightning, etc. are all-natural processes that both create and destroy natural resources. Human activities have affected landscape processes and resource availability for millennia. Throughout North America, this has included indigenous practices of prescribed burns in forests and grasslands, rotational agriculture, hunting, and fishing, etc. With colonization of the United States, exploitation of natural resources and disruption to natural systems accelerated, and practices such as overlogging of forests, fire suppression, cattle ranching, and mining reduced the availability and resiliency of intact ecological systems. These exploitative practices have at times increased the occurrence and severity of hazards, including events such as the Peshtigo fire in 1871. No impact, however, has caused so much disruption as climate change, which has accelerated rapidly since the beginning of the Industrial Revolution around 1750. The advent of fossil fuel powered machines has been shown to have begun warming parts of the world as early as 1830. The increase in greenhouse gas emissions and warming global temperatures are disrupting ecological systems on both large and small scale. Coupled with increased development, clear cutting of forests, and the destruction of habitat around the world and throughout the United States, including for continued oil and gas development, the world is staring at an ecological crisis. This includes rapid temperature swings that stress plant life and reduce soil health; loss of ocean current strength with an accompanying collapse of aquatic food chains; loss of pollinators that would maintain viability of crops and flowering plant life; and many other damaging consequences that threaten human life as well as the robustness of the built environment.

Ecological systems provide the foundation for human technologies and community construction, and ecological health is a fundamental driver of human life and economic viability. Nationally, the United States is unprepared for the ecological impacts of climate change on nearly all points. The hazards that arise from geophysical processes will become more extreme and more difficult to predict as climate change effects increase in strength. Natural resources will become scarcer, and economic sectors that are entirely dependent on the environment, such as tourism, will provide less income and fewer jobs. Climate change will also disrupt supply chains, transportation systems, and trade networks. These economic impacts in addition to hazard impacts will increase strain on government resources and reduce community capacities for resilience and recovery.

Boulder County's ecological systems are diverse and cover a wide range of ecotones as the County topography rises quickly from the plains to alpine environments. Straddling this transition zone, Boulder County includes shortgrass prairie environments as well as alpine tundra, subalpine and montane forests,

with lodgepole pine, and mixed Ponderosa and Douglas fir forests as well as pockets of quaking aspen. The foothills display mountain mahogany shrublands while grasslands, wetlands, and riparian areas are scattered throughout the rest of the County. Boulder County exhibits the most condensed transition from plains to mountains of all the Front Range communities in Colorado, with only 15 miles of transition between the two environments (CNHP 2008). This increases the landslide risk for certain parts of the County, but also creates a large diversity of plant and animal species. The mountains in Boulder County include some of the oldest rock in Colorado, with Precambrian elements that date from 1,800-900 million years ago. Intricate fault lines and magma intrusions weave throughout these formations, and the uplift of the Rocky Mountains injected them with mineral rich ore that enticed White settlers into the area and contributed to a long tradition of extractive mining in the area.

Besides precious metals, the ecological systems in Boulder County have provided resources to the Indigenous Tribes in the area, agricultural viability for early farmers, and now power a large tourism industry that includes hiking, camping, leaf watching, cycling, and skiing.

1.5.1 Social, Ecological, Technological Systems (SETS) Framework

Natural hazards such as earthquakes, winter storms, wildfires, and even zoonotic diseases do not impact one jurisdiction, community, or sector in isolation. Hazard impacts are wide ranging and felt at many scales, and response and recovery take many forms and require a variety of resources. Recognizing the diverse nature of hazard impacts across human, natural, and built environments, this document uses a social, ecological, and technological systems (SETS) framework to explore interconnections and identify co-existing risks and vulnerabilities within these systems. This framework is based on the understanding that past efforts to harden infrastructure and create robust systems have depended on an ability to control or prevent any level of disruption on infrastructure/technological systems from hazards. With increasing volatility from climate change and the inability to predict hazard occurrence or scales of return with confidence, hardening infrastructure and relying on engineered control has become maladaptive. In situations where technology is considered as the only system, engineered solutions can lock communities into fragile infrastructure design that cannot adapt to new hazards and risks. A glaring example of this is Houston. As the city has massively increased the amount of impervious surface coverage without regard for ecological systems, FEMA floodplain maps failed to account for 75% of insured losses between the years 1999 and 2009.

In order to increase system flexibility, adaptive capacity, and long-term solutions creation, the SETs framework considers the intertwined nature of human, natural environment, and infrastructure systems. Examining the impacts that these systems have on one another and the ways in which they interact leads to increased ability to meet the demands of changing climate and increasing hazard impacts. This document uses the SETs framework throughout Section 4.0 in order to better analyze hazard profiles and functionally address the risks and vulnerabilities that community members, ecological systems, and the built environment have and will experience within Boulder County. For each hazard profile, consideration of social, ecological, and technological systems is included in each hazard profile. Likewise, vulnerability and risk assessments consider how interactions between these systems result in increased risk for certain populations.

2.0 Community Profile

2.1 Geography and Climate

Our unique geography and climate help shape the hazards we face in Boulder County. We live in environments ranging from the rolling prairies in the eastern part of the County to the rugged mountains and alpine forests in the western regions. We live at elevations climbing from 5,000 feet on the high plains to more than 12,000 feet at the Continental Divide which forms our western border.

Our climate is as varied as our topography. In winter we endure frequent snowstorms and temperatures as low as minus 30 degrees Fahrenheit. But, as those of us who live here know snow today does not mean temperatures in the 60s tomorrow. With gusts of 120 miles per hour or more, we also experience some of the strongest winds in the continental United States. Summer typically brings us temperatures reaching the upper 90s and low levels of humidity. We receive an average of 18.17 inches of moisture each year which means that we enjoy at least some sunshine most days.

2.2 Population

At the 2010 census our County had a population of 294,571. According to the State Demography Office, population estimates as of 2020 for Boulder County is 330,860 residents. Below are additional population statistics from the 2020 U.S. Census.

Table 2-1 Boulder County Population by Jurisdiction

Jurisdiction	2020 Population
Unincorporated Boulder County	43,368
City of Boulder	108,860
Town of Erie	12,791
Town of Jamestown	255
City of Lafayette	30,377
City of Longmont	97,833
City of Louisville	21,171
Town of Lyons	2,202
Town of Nederland	1,481
Town of Superior	13,099
Town of Ward	129

Source: Colorado State Demography Office U.S. Census Bureau 2020 Census

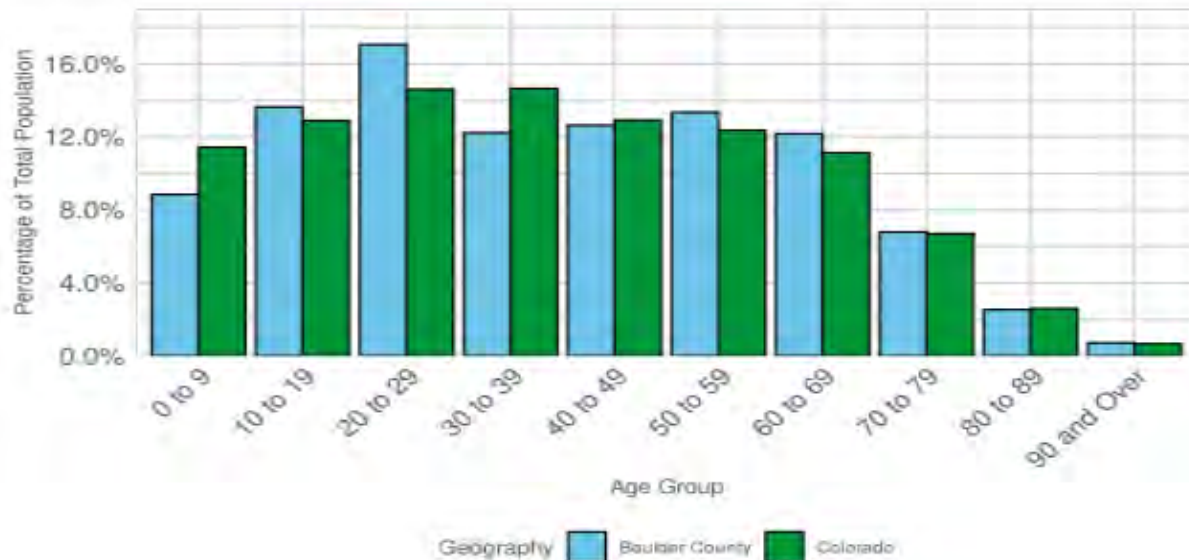
Table 2-2 Boulder County Population by Race

Race	2020 Census	% of total county population
White	261,253	79
African American	4,378	1.3
Asian	18,069	5.5
American Indian/Alaska Native	1,577	0.5

Race	2020 Census	% of total county population
Hispanic/Latino Origin	45,583	13.8.6

Source: Colorado State Demography Office U.S. Census Bureau 2020 Census

Figure 2-1 Boulder County Population by Age Compared to State of Colorado



Source: Colorado State Demography Office, U.S. Census Bureau 2020 Census

2.3 History

Native Americans were the first inhabitants of the area that would become Boulder County. The Southern Arapahoe Tribe had a village here and the Utes, Cheyenne, Comanche, and Sioux also frequented the area.

Gold seekers established the first non-native settlement in 1858. Boulder became an important supply base for miners working in the mountains. At the creation of the Colorado Territory in 1861, Boulder County was one of the 17 original counties represented in the first territorial assembly. In 1873 the railroad connected Boulder to Denver as well as eastern locations to the mining camps to the west. In 1874 Boulder became the home of the University of Colorado spurring more growth.

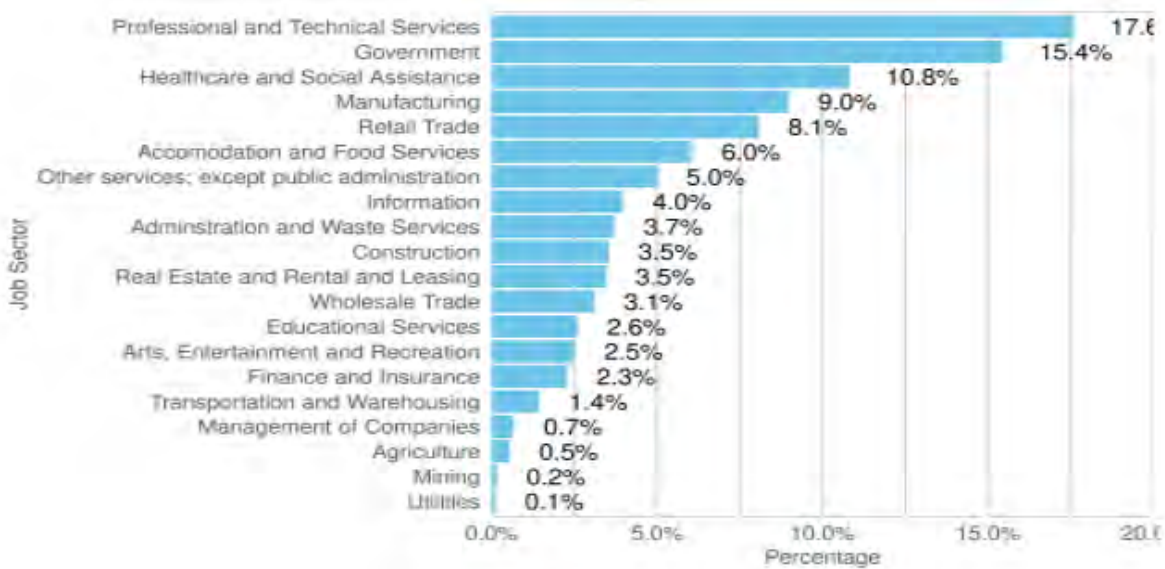
Throughout the 20th century the University and a boom in tourism would continue to drive and shape the development of our area and attract new industries such as the National Bureau of Standards (now the National Institute of Standards and Technology) which located here in 1952.

The hazards of flood and fire have been a part of the history of our County. In 1894 a flood destroyed every bridge in Boulder Canyon and covered the flood plain in eight feet of water. In 1913 a flood destroyed roads and cutoff the community of Jamestown for two weeks. In 1941 the St. Vrain creek flooded causing damage to homes, businesses, and farms. Notable recent wildfires include the Black Tiger Fire of 1989, the Old Stage fire in 1990, the Overland fire of 2003, Fourmile fire of 2010, the Cal-Wood Fire of 2020, and the Marshall Fire of 2021.

2.4 Economy

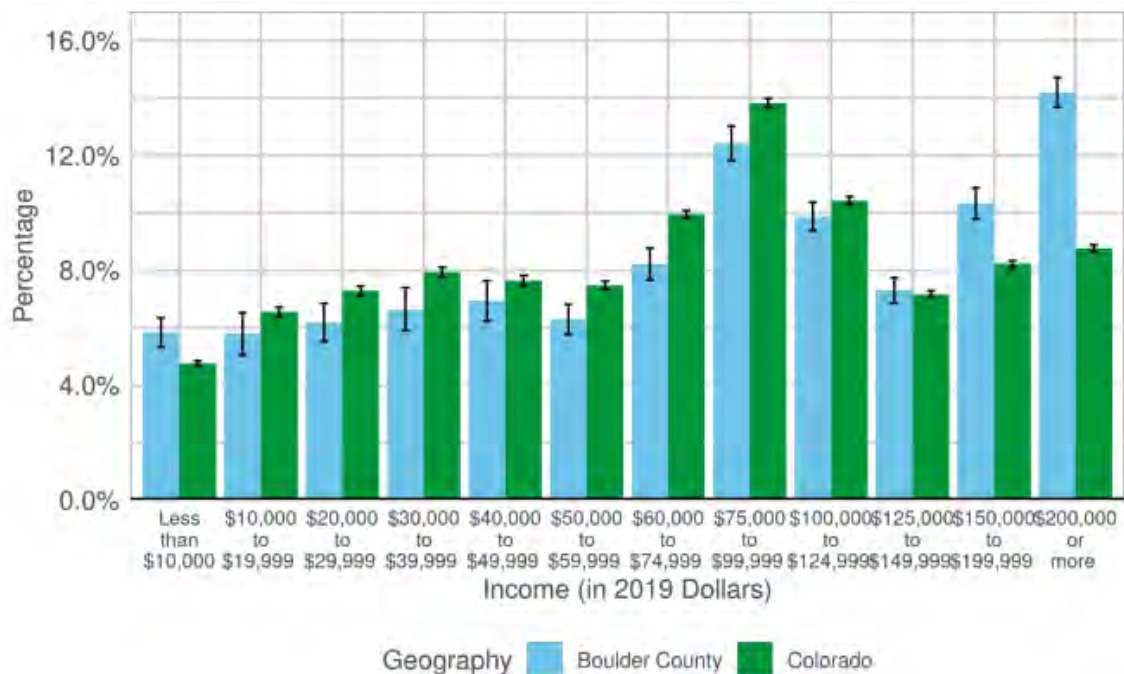
According to the U.S. Census Bureau's 2019 American Community Survey most of Boulder County's labor force is employed in the professional, scientific, and management, and administrative and waste management services industry. The median household income in our County is \$83,019. The per capita income is \$46,826.

Figure 2-2 Boulder County Employment by Industry



Source: Colorado State Demography Office, U.S. Census Bureau, 2015-2019 American Community Survey

Figure 2-3 Boulder County Household Income Distribution Compared to Colorado



Source: Colorado State Demography Office, U.S. Census Bureau, 2015-2019 American Community Survey

3.0 Planning Process

3.1 Planning Process

44 CFR Requirement 201.6(c) (1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

As a requirement under the Disaster Mitigation Act of 2000, local jurisdictions are responsible for revising their Hazard Mitigation Plans every five years. This plan is an update to the County's 2016 – 2021 Hazard Mitigation Plan that was approved in April 2016 under this requirement. All sections of the plan were analyzed and revised where appropriate as part of the update process. At the time of the update a global pandemic and significant wildfires (2020 Cal-Wood and the 2021 Marshall Fire) occurred, disrupting the update of the 2016-2021 plan. One challenge was the ability to hold community meetings as part of the plan. Social media and interactive periods of public comment were made during this update. The opportunity to comment on the plan spanned many months rather than one or two meetings as sponsored in a traditional planning effort.

Wood Environment & Infrastructure Solutions, Inc (Wood) was procured following in the fall of 2021 to assist with finalizing the plan update and address initial review comments from the Colorado Department of Homeland Security and Emergency Management (DHSEM).

3.1.1 Importance of This Plan

Being a participant in the hazard mitigation planning process qualifies communities and some organizations to apply for pre- disaster and post- disaster mitigation grant funding for projects that decrease or remove the impacts of natural hazards. In addition, having an approved plan assists in qualifying for recovery programs, relief assistance and public assistance under a federal disaster declaration.

3.1.2 Outcome of the Planning Process

A Hazard Mitigation Plan should bring together a community to identify hazards, assess the risks and develop pre- and post-disaster mitigation programs. The previous Boulder County Hazard Mitigation Plan received approval by FEMA in 2016. That plan was designed with a life span of 5 years. The Boulder County Natural Hazards Mitigation Planning process of 2021-2022 is fulfilling the required update to that plan and is expected to receive approval by FEMA in 2022.

This plan builds off previous planning efforts, including the original plan in 2008 and the 2016 update and is aligned with the Disaster Mitigation Act (DMA) planning regulations.

FEMA requires local mitigation planning to meet the intent of regulation 44 CFR §201.6 to qualify for the above-mentioned programs. In accordance with the regulation, the updating of this plan includes the following activities (1) planning process overview, (2) hazard identification and risk assessment, (3) mitigation strategy, (4) plan review, evaluation, and implementation, and (5) plan adoption.

3.1.3 Hazard Mitigation Planning Committee

A multi-jurisdictional Hazard Mitigation Planning Committee (HMPC) guided the development of the plan. The HMPC is comprised of staff members with broad areas of expertise from the municipalities included in the plan as well as other public stakeholders. Please see Table 3-1 for a list of the members of the HMPC.

3.2 Multi-Jurisdictional Participation

44 CFR Requirement §201.6(B)(2): multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan.

The planning regulations and guidance of the DMA of 2000 stress that each local government seeking FEMA approval of its mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the HMPC
- Detail areas within the planning area where the risk differs from that facing the entire area
- Identify specific projects to be eligible for funding, and have the governing board formally adopt the plan

Table 3-1 Multi-Hazard Mitigation Planning Committee

Committee Members	Representative 1	Title	Other Representatives	Title
Boulder County Assessor	Cynthia Braddock	County Assessor		
Boulder County Attorney	Melanie Lewis	Senior Assistant		
Boulder County BOCC	Jana Petersen	County Administrator	Michelle Krezek	Chief of Staff to BOCC
Boulder County Community Services and Housing & Human Services	Joycelyn Fankhauser	Emergency Management Coordinator		
Boulder County Firefighter's Association	Chris O'Brien	Fire Chief		
Boulder County GIS	Mark Mullane	GIS Program Manager		
Boulder County Community Planning	Dale Case	Director	Jim Webster	Wildfire Partners Program Coordinator
Boulder County OEM	Mike Chard	Director	Andrew Notbohm	Deputy Director
Boulder County Parks and Open Space	Stefan Reinold	Resource Management Division Manager	Justin Atherton-Wood	Senior Planner
Boulder County Public Works	Mike Thomas	County Engineer	Kristine Obendorf	Division Manager
Boulder County Community Planning & Permitting	Stacey Proctor	Communications Specialist	Virginia Gazzetti	Floodplain Program Planner
	Kelly Watson	Floodplain Program Planner		
Boulder County Office of Sustainability, Climate Action & Resilience	Garry Sanfacon	Disaster Recovery Manager		
Boulder County Public Health	Joe Malinowski	Environmental Health Division Manager	Chris Campbell	Emergency Management Coordinator
Boulder Mountain Fire	John Benson	Chief		
Boulder Rural Fire Rescue	Greg Schwab	Chief		
Boulder Valley School District	Brendan Sullivan	Director of Safety, Security	Rob Price	Executive, Assistant Superintendent of Operations

Committee Members	Representative 1	Title	Other Representatives	Title
		and Emergency Services		
City of Boulder	Kate Dunlap	Water Quality Project Manager	Christin Shepherd	Flood & Wetland Administrator
	Bret KenCairn	Senior Sustainability & Resilience Policy Advisor		
City of Boulder Public Works	Joe Taddeucci	Director of Utilities	Ed Stafford	Development Review Manager
Colorado Dam Safety	Bill McCormick	Chief, Dam Safety Branch	Kallie Bauer	Dam Safety Engineer
City of Lafayette	Jeff Arthur	Public Works Director	Brian Rosipajila	Deputy Chief, Police
City of Louisville	Dave Hayes	Police Chief	Megan Davis	Deputy City Manager
	Emily Hogan	Assistant City Manager		
City of Longmont	Shannon McVaney	Emergency Manager Coordinator	Monica Bortolini	Floodplain Administrator
	Peter Gibbons	Emergency Manager Coordinator		
Colorado Division of Homeland Security & Emergency Management	Mark Thompson	State Hazard Mitigation Officer	Patricia Gavelda	Program Manager
FEMA	Nicole Aimone	Deputy Director, Mitigation Planning Program		
Four Mile Fire Protection District	Bret Gibson	Chief	Maya MacHamer	Watershed Coordinator
Mile High Flood District	Kevin Stewart	Flood Warning Services Manager		
National Weather Service	Greg Hansen	Warning Coordination Meteorologist	Treste Huse	Senior Hydrologist
Town of Erie	Kim Stewart	Police Chief		
Town of Lyons	Victoria Simonsen	Town Administrator		
Town of Nederland	Miranda Fisher	Town & Zoning Administrator		
St. Vrain Valley School District	Richard Peebles	Executive Director of Safety and Security		
Town of Superior	Matt Magley	Town Manager	Emily Clapper	Management Analyst

Committee Members	Representative 1	Title	Other Representatives	Title
University of Colorado	Garry Dejong	Director, Events and Emergency Management Division	Deon Phenning	Program Manager, Emergency Preparedness

For the HMPC, “participation” meant:

Attending and participating in the HMPC meetings, providing available data as requested by the HMPC members, reviewing, and providing comments on the plan drafts, Advertising, coordinating, and participating in the public input process, and coordinating the formal adoption of the plan by the governing boards.

Boulder County’s Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that geographically covers everything within Boulder County’s jurisdictional boundaries. Unincorporated Boulder County, the municipalities of Boulder, Erie, Lafayette, Longmont, Louisville, Lyons, Nederland, and Superior, along with Four Mile Fire Protection District participated in the planning process and are seeking FEMA approval of this plan. The City of Boulder was previously covered by its own separate multi-hazard mitigation plan but decided to join the County plan in the 2020-2022 planning process. The municipalities of Jamestown, Ward, and Gold Hill and the Sunshine and Lefthand fire protection districts opted not to participate in the 2020-2022 plan update process due to limited resources.

3.3 The 10 Step Planning Process-201.6(C) (1):

The Boulder OEM established the planning process for the update of this plan using FEMA’s associated guidance information. This guidance is structured around a four-phase process:

- 1) Organize Resources
- 2) Assess Risks
- 3) Develop the Mitigation Plan
- 4) Implement the Plan and Monitor Progress

This four-phase process also contains the more detailed 10-step planning process used for FEMA’s CRS and Flood Mitigation Assistance programs. Thus, the process used for this plan meets the requirements of six major programs: FEMA’s Hazard Mitigation Assistance Grant Program, Building Resilient Environments (BRIC), CRS, Flood Mitigation Assistance Program, and new flood control projects authorized by the U.S. Army Corps of Engineers. The County and cities of Longmont and Louisville all participate in the CRS and have earned planning credits from the development of this plan and by continuing in the update process.

Table 3-2 shows how the modified 10-step process fits into FEMA’s four-phase process.

Table 3-2 FEMA’s 4-Phase Process and the 10-Step CRS Process Used to Develop Boulder County’s Local Hazard Mitigation Plan

FEMA’s 4-Phase DMA Process	Modified 10-Step CRS Process
1) Organize Resources	
201.6(c)(1)	1) Organize the Planning Effort
201.6(b)(1)	2) Involve the Public
201.6(b)(2) and (3)	3) Coordinate with Other Departments and Agencies

FEMA's 4-Phase DMA Process	Modified 10-Step CRS Process
2) Assess Risks	
201.6(c)(2)(i)	4) Identify the Hazards
201.6(c)(2)(ii)	5) Assess the Risks
3) Develop the Mitigation Plan	
201.6(c)(3)(i)	6) Set Goals
201.6(c)(3)(ii)	7) Review Possible Activities
201.6(c)(3)(iii)	8) Draft an Action Plan
4) Implement the Plan and Monitor Progress	
201.6(c)(5)	9) Adopt the Plan
201.6(c)(4)	10) Implement, Evaluate, and Revise the Plan

3.3.1 Phase 1: Organize Resources

Step 1: Organize the Planning Effort

The Boulder OEM established the framework and organization for the development of this plan update. OEM identified the key county, municipal, other local government, and initial stakeholder representatives. Letters were mailed to invite them to participate as a member of the HMPC and to attend a kick-off meeting. Table 3-3 lists the County departments and municipalities that participated on the HMPC and assisted in the development of the plan.

Table 3-3 Boulder County Hazard Mitigation Planning Committee Framework

Boulder County	City of Boulder	Municipalities	Districts
Emergency Management	OSMP	Erie	Boulder County Fire Chiefs Assoc.
Sheriff	Fire Dept.	Jamestown	Boulder Fire Chiefs Assoc.
Community Planning	Utilities	Lafayette	Four Mile Fire Protection District
Assessor's Office	City Manager	Longmont	
Building	Open Space and Mountain Parks	Louisville	
Commissioners' Office		Lyons	
Public Health		Superior	
Information Technology/GIS			
Public Works			
Parks and Open Space			

A list of all HMPC representatives is included in Table 3-1.

During the planning process, the HMPC communicated with a combination of face-to-face meetings, phone interviews, email correspondence, and an ftp (file transfer protocol) site. Four planning meetings with the HMPC were held during the plan's development between April 2019 and December 2021. The meeting schedule and topics are listed in the following table. The sign-in sheets and agendas for each of the meetings are on file with Boulder OEM.

Table 3-4 Schedule of HMPC Meetings & Events

HMPC Meeting	Meeting Topic	Meeting Date
1	Introduction to Natural Hazard Mitigation Plan (NHMP) Planning/Kick-off Meeting Overall Plan Goals, Hazard analysis	April 12, 2019
2	Social media blitz begins	November 2019
3	Hazard Mitigation Goal Setting	July 15, 2019
4	Hazard Mitigation engagement and update meeting	February 19, 2020
5	Hazards, Risk & Vulnerability assessment, review mitigation strategies and community capabilities	July 12, 2020
6	HMP Draft Version 1 completed and sent through social media outlets to stakeholders and the community	September 9, 2020
7	Posted to Website and remained for public viewing and comment	September 10, 2020
8	Call for mitigation projects and community profiles with stakeholders	September 11, 2020
9	HMP Draft Version 2 completed and sent through social media outlets to stakeholders and the community	October 10, 2020
10	HMP Draft final version completed and sent through social media outlets to stakeholders and the community	October 31, 2020
11	Community Website Virtual Engagement	November 12, 2020
12	Final Draft Established on BOEM Website	January 28, 2021
13	Submitted to CO DHSEM for review and begin addressing comments from state.	March 2021
14	Procure consultants Wood to help address DHSEM comments and resubmit to state.	December 2021
15	HMP Participant follow up/plan finalization meeting to complete DHSEM required revisions.	December 13, 2021
16	Resubmitted to State for Review	April 2022
17	FEMA Submittal	April 2022
18	Submit for Final Approval From FEMA	May-June 2022

Step 2: Public Involvement & Community Engagement

44 CFR Requirement 201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

FEMA requires community engagement in the process in order for the plan to be approved. The requirements set forth by FEMA are found in the requirements of §201.6(b) and §201.6(c). An open public

involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

- 1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
- 2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and non-profit interests to be involved in the planning process;
- 3) Partners and stakeholders' engagement in developing and implementing mitigation strategies is critical to successful plan adoption and operational application of mitigation projects;
- 4) Opportunities for community engagement throughout the planning process using social media outlets and tools; and
- 5) [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Our engagement of the community has been our strength. This process began with the kick-off meeting and continued throughout the entire process in one form or another. Community engagement initially began with social media, press releases and scheduled meetings. Each community participating in the Natural Hazards Mitigation Plan had a responsibility to carry the message and engage their community in the process. The Boulder OEM created and will maintain social media sites, programs and community group facilitation as needed.

On March 11, 2020, just as community meetings were being scheduled the COVID-19 Pandemic hit the world. Since that time public gatherings have been challenging as Public Health Orders have prohibited public gatherings. Boulder OEM utilized social media to conduct community risk analysis and review versions of the plan. The feedback was incorporated into the plan changes as each version was published. See also section 3.3.3 Step 8 for how public feedback was solicited before finalizing the plan.

Public Survey Results

In late 2019 a public survey was conducted and launched on the Boulder OEM website and Facebook page. Over 1700 views occurred and 334 residents took the survey. The survey contains 13 questions designed to identify communities represented, identify the most significant hazards and gain insight about what the community has done to prepare and wants done to mitigate hazards.

The majority of respondents in the survey had not participated the 2016 hazard mitigation planning efforts (Yes 18% No 82% in 2008 & Yes 12 % and No 88%). All questions that solicited responses used "Word Cloud" formatting to represent the range and weight of responses. The following results summarize the data collected over the three-month period of time.

The number of people taking the survey by community.

City of Boulder	37.01%	124
Town of Erie	5.67%	19
Town of Jamestown	0.00%	0
City of Lafayette	7.16%	24
City of Longmont	31.34%	105
City of Louisville	5.67%	19
Town of Lyons	2.39%	8
Town of Nederland	4.48%	15
Town of Superior	3.58%	12
Town of Ward	0.90%	3
Allenspark	0.30%	1
Caribou	0.30%	1
Coal Creek	0.60%	2
Eldora	0.90%	3
Eldorado Springs	0.60%	2
Gold Hill	1.49%	5
Gunbarrel	2.09%	7
Hygiene	0.90%	3
Niwot	2.69%	9
Unincorporated Boulder County	18.21%	61

The survey results identifying the most concerning hazards in Boulder County were wildfire, flood, and drought. Severe weather related to hail and winter storm also were significantly represented but, in the comments, stressors and human-caused or technological hazards were also represented.

Avalanche	0.37%	1
Dam and Levee Failure	10.45%	28
Drought	35.07%	94
Earthquake	1.87%	5
Expansive Soils	4.10%	11
Extreme Temperatures	10.07%	27
Flood	58.96%	158
Hailstorm	21.64%	58
Landslide/Mud and Debris Flow/Rockfall	10.82%	29
Lightening	5.22%	14
Pandemic Flu	14.55%	39
Severe Winter Storm	32.46%	87
Subsidence	1.12%	3
Tornado	7.09%	19
West Nile Virus	10.82%	29
Wildfire	56.34%	151
Windstorm	19.03%	51

What additional hazards do you believe the Hazard Mitigation Planning Committee should consider?

Traffic Air pollution explosion due failure water
climate change planning Fracking disease
hazards roads gas Air quality outbreak

Of all the hazards you have identified which do you consider to be the greatest threat to you and your community?

hailstorm winter storm Hail storm Fire Windstorm Flood tornado
Wildfire Flu Drought wind Severe winter storm
Dam Levee failure West Nile Virus extreme temperatures

If the greatest threat to you and your community occurred in your neighborhood today, what would be the likely impact to you and your family?

Devastating Depends severity homeless Possible loss Wildfire without belongings leave
destruction possessions community extreme loss property electricity possibly
Drought 2013 Major Damage home affected life enough evacuation
move property possible loss home Loss home loss life
house power Loss due home displacement damage
Loss residence flooding area water safety live temperatures
impacts Increased property damage potential lose home also
possible food work destroyed death expense High likely significant lose everything heat
financial loss roads Potential loss home lose

If you answered YES to Question 10, please describe the actions you or your community have taken to reduce or eliminate the impact of this hazard?

roof around home home also clearing year flood mitigation maintain
reduce needs fire keep city brush fire mitigation
participated property wildfires mitigation cut water
mitigate trees believe work metal roof flood Planted
Wildfire Partners debris community town house aware
Boulder city Longmont around Resilient St Vrain Wildfire mitigation

What actions do you believe your local government or Boulder County can take to help reduce or eliminate the impact of these hazards?

flood high risk community Fracking wildfire area city Good
fire Boulder thank make work flood plan people
priority plan

Are there any other comments, questions, or concerns you would like the Hazard Mitigation Planning Committee to consider?

infrastructure preparation homeowners possible really limits drainage drought make sure north
take access control Enforce Boulder less houses many maintain wildfires fund use
Reduce plantings support hazards none known increase keep building illegal
property Keep public informed neighborhood dead trees
flood mitigation much residents natural people threat trees
require sure creek education home plans mitigate
water parks areas ditches fire including mitigation ways
Continue land flood safety fire mitigation water conservation
Better don't know think remove need call public available forest educating
emergency information Protect Offer Make happen efforts Higher open space along
work burns training manage provide Conduct Boulder County streets Improve alternative Put
thinning places Encourage fuel find

Step 3 Coordinate with other Departments and Agencies

Neighboring Jurisdictions: The Boulder Hazard Mitigation Plan was sent to Jefferson County Office of Emergency Management, Larimer County Office of Emergency Management, Gilpin County Emergency Management, Broomfield County and Weld County Emergency Management for comments and feedback prior to its finalization in 2022; no feedback was received.

Agency Involvement and other government stakeholders: At each of the planned meetings, invitations were sent out to all sectors of the community. Government, non-profit, private sector, and academia were directly targeted or open sourced to attend the meetings. Meetings were communicated via email, social media, and traditional media postings. The following agencies were invited to be involved in the plan update process:

- Boulder County Firefighter's Association
- Colorado Division of Homeland Security & Emergency Management
- Denver Water
- FEMA
- Mile High Flood District
- National Weather Service
- Boulder Valley School District
- St. Vrain School District
- University of Colorado

Additional agencies invited to comment on the plan include Colorado Division of Fire Prevention and Control, CDOT and the Colorado Water Conservation Board. No feedback was received.

Incorporating plans and studies: Numerous data sources were used in the development of this plan. Existing studies from the Mile High Flood District, weather models from the National Weather Service (NWS) and FEMA flood plain studies also were used. The Boulder Valley Comprehensive plan and the Boulder Climate Adaptation plan were also consulted. Refer to Table 3-5 for a high-level summary of key plans, studies and reports reviewed and incorporated where applicable.

Table 3-5 Summary of Review of Key Plans, Studies, and Reports

Plan, Study, Report Name	How Plan informed LHMP
Boulder Valley Comprehensive Plan (2020)	Provided background information on the county including some information related to jurisdictions. Informed the Community Profile in Chapter 1 and the jurisdictional annexes.
Boulder County Comprehensive Plan (2018)	Informed the Boulder County Annex, capability assessment
Boulder Climate Adaptation Plan	Informed the risk assessment and the City of Boulder annex, capability assessment
Mile High Flood District studies	Informed the flood section of the risk assessment in the base plan and in the applicable annexes.
National Weather Service weather models	Informed the Community Profile, Geography and Climate section and the weather-related hazards in the risk assessment
Boulder County Hazard Mitigation Plan (2016)	Informed the updated risk assessment.
City of Boulder Hazard Mitigation Plan (2018)	Informed the updated risk assessment and portions of the City of Boulder annex (vulnerability assessment and mitigation actions)
Colorado State Hazard Mitigation Plan (2018)	Informed the HIRA (Chapter 3) with risk information specific to Boulder County and hazard profile information for each of the hazards.
Colorado State Demography Office. 2020 Census Data	Informed the Community Profile and each of the incorporated jurisdictional annexes.
Census Bureau American Community Survey 2015-2019 estimates	Informed the Community Profile and each of the incorporated jurisdictional annexes.
Boulder County Flood Insurance Study (2019)	Reviewed for information on past floods and flood problems to inform risk assessment (Chapter 3) Utilized Digital Flood Insurance Rate Maps to update maps and flood risk assessment in Chapter 3.
Boulder County Community Wildfire Protection Plan (2011)	Informed the hazard profile and vulnerability assessment for the Wildfire section and in the jurisdictional annexes.
Colorado State Forest Service - 2018 Report of The Health of Colorado's Forests	Informed the pest infestation, specifically to forest pests hazard profile and risk assessment. Provided background information on successful wildfire mitigation before the Buffalo Mountain Fire.
History of Colorado Avalanche Accidents 1859-2006	Informed the avalanche hazard profile in Chapter 3 risk assessment.
Colorado State Drought Response and Mitigation Plan (2018)	Informed the drought hazard profile and vulnerability assessment in Chapter 3 risk assessment.
Colorado Department of Labor and Employment 2019 data	Informed the Economic Assets sections of the jurisdictional annexes
Colorado Water Conservation Board – Colorado Water Availability Study (2018)	Informed the drought hazard vulnerability assessment in Chapter 3 risk assessment.
Boulder County Land Use and Development Code	Informed the County's capabilities assessment.

Plan, Study, Report Name	How Plan informed LHMP
City of Lafayette Community Profile (2018)	Informed the discussion on economic assets and top employers in the City of Lafayette annex.
Colorado State Register of Historic Properties	Informed the community profiles of the jurisdictional annexes. Each annex has a table of historic properties listed in the register.
City of Lafayette Register of Historic Places	Informed the Historic and Cultural Resources section of the City of Lafayette annex.
2013 Technical Update to the Lafayette Comprehensive Plan	Informed the capability assessment of the City of Lafayette annex.
City of Longmont Sustainability Plan (2016)	Informed the City of Longmont's annex, capability assessment section.
City of Longmont Land Development Code Update (2018)	
Envision Longmont Multimodal and Comprehensive Plan (2016)	
Longmont Open Space Master Plan (2018)	
Longmont Wildlife Management Plan (2019)	
City of Longmont Emergency Operations Plan (2020)	
Town of Erie Comprehensive Plan (2015)	Informed the community profile, capability assessment, and vulnerability assessment of the Town of Erie Annex.
City of Louisville Comprehensive Plan (2013)	Informed Economic Assets and Capability assessment sections of the Louisville annex
Louisville Municipal Code	Informed the City of Louisville's annex, capability assessment section.
Denver Regional Council of Governments Nederland profile	Informed Economic Assets section of the Nederland annex
Town of Nederland Comprehensive Plan (2013)	Informed Natural, Cultural, and Historic resources section of the Nederland annex
OnTheMap Census Bureau	Informed Economic Assets section of the Nederland annex
Town of Superior Comprehensive Plan with 2012 Amendment	Informed the Town of Superior annex, capability assessment section.
Superior Municipal Code and Superior Development Code	
Coal Creek and Rock Creek Master Drainageway Plan (2014)	
Weld County HMP (2021)	Used to cross reference capability assessment for Town of Erie
Lyons Land Use and Management Plan for Deed Restricted Buy-Out Properties (2017)	Informed Town of Lyons annex
Lyons HIRA (2017)	Informed vulnerability assessment for Town of Lyons annex

Plan Visibility: Throughout the planning process various versions or drafts of the plan were authored. With each version the plan was sent out to the participating agencies for feedback and approval. Community members were also allowed to publicly comment on the draft versions.

3.3.2 Phase 2 Assess Risk

Step 4 Identify Hazards

During the kick-off meeting, the HMPC discussed past events, impacts, and future probability for each of the hazards required by FEMA for consideration in a local hazard mitigation plan. A profile of each hazard was then developed with the help of County- GIS staff in developing GIS layers to display the information. The HMPC discussed the rankings as determined by the scores associated with each of the factors, i.e., occurrences, probability of future occurrences, magnitude, and severity. The committee concurred with the scoring and the ratings of hazards as either high, medium, or low hazards. The committee then determined the areas affected by the top three hazards and GIS mapped out the areas using a subjective boundary.

Step 5 Assess Risks

After profiling the hazards that could impact Boulder County, the Boulder OEM staff collected information to describe the likely impacts of future hazard events in the participating jurisdictions. This step involved two parts: a vulnerability assessment and a capability assessment.

The vulnerability assessment involves an inventory of assets at risk to natural hazards and in particular wildfires, flooding, and rock fall/landslides. These assets included total number and value of structures; critical facilities and infrastructure; natural, historic, and cultural assets; and economic assets. Boulder OEM staff supported the efforts of each community to complete a detailed analysis for the revision of the plan. The analysis was used to determine the proportion of value of buildings in the hazard areas that were identified by the HMPC or community planning effort. The County GIS system was used by first selecting parcels from the assessor's data that have their center within the City or Town limits and then making a sub-selection of parcels that have their center within the defined hazard area. Structure value is based on the actual value of improvements.

A similar process was completed for each jurisdiction to understand the affected population. This analysis used census tract data. The capability assessment consists of identifying the existing mitigation capabilities of participating jurisdictions. This includes government programs, policies, regulations, ordinances, and plans that mitigate or could be used to mitigate risk to disasters. Participating jurisdictions collected information on their regulatory, personnel, fiscal, and technical capabilities as well as ongoing initiatives related to interagency coordination and public outreach.

3.3.3 Phase 3 Develop the Mitigation Plan

Step 6 Set Goals

On April 12, 2019, the kick-off meeting occurred and one of the meeting objectives was to set the goals of the new HMP effort. A multi-agency group selected four goals as defined in Section 5.0 of the plan.

- **Goal 1:** reduce the loss of life and personal injuries from hazard events
- **Goal 2:** Reduce impacts of hazard events on property, critical facilities / infrastructure, and the environment
- **Goal 3:** Strengthen Intergovernmental coordination, communication, and capabilities in regard to mitigation hazard impacts
- **Goal 4:** Improve public awareness regarding hazard vulnerability and mitigation

Step 7 Review Possible Activities

At the third committee meeting, the HMPC identified and prioritized mitigation actions. The HMPC conducted a brainstorming session in which each committee member identified at least one mitigation action to address each of the plan's goals. In addition, each community was asked to complete a capabilities worksheet for any additional mitigation actions throughout the remaining planning process.

As with each priority, there is a responsible agency to ensure the project is completed. The HMPC identified the responsible agency for implementing each action. The responsible agency then completed the Mitigation Project Description Worksheet. These worksheets allow the HMPC to document background information, ideas for implementation, alternatives, responsible agency, partners, potential funding, cost estimates, benefits, and timeline for each identified action. Alternatives, responsible agency, partners, potential funding, cost estimates, benefits, and timeline for each identified action.

Step 8: Draft the Plan

A draft of the revised Boulder County Multi-Hazard Mitigation Plan was developed by the Boulder OEM staff and submitted to the HMPC for internal review. Once the committee's comments were incorporated, a complete draft of the plan was made available online for review and comment by the public and other agencies and interested stakeholders. There were two public review periods. The first review period was from September 2020 to February 2021. The second public review period occurred with a revised draft that was made available in May 2022. Public comments were integrated into a final draft for submittal to the Colorado OEM and FEMA Region VIII. The plan will be left online for continual public comment as outlined in Section 7.2.5.

A total of 11 comments were received from members of the public during the May 2022 review and documented in Appendix F. These comments generally ranged in topics regarding hazards and perceptions of risk, with six comments concerning wildfire. These involved suggestions for mitigation actions to reduce wildfire risk such as firebreaks, better fuels management practices, and improved notification procedures for evacuations in the event of a fire. The HMPC felt that the on-topic comments have already been addressed throughout the plan, including in the identified mitigation actions for the County and for specific jurisdictions such as Superior and Louisville. Other comments requested that the County consider man-made hazards and cyber security threats. These hazards will be considered by the HMPC for inclusion in future updates of the HMP. A few other comments received concerned topics which are outside of the scope of this plan, such as legislation concerning hazardous materials, crime, and drugs.

3.3.4 Phase 4 Implementation of the Plan

Step 9 Adopt the Plan

To implement the plan, the governing bodies of each participating jurisdiction adopted the plan with a formal resolution. Scanned copies of resolutions of adoption are included in the appendices of the plan.

Step 10: Implement, Evaluate, and Revise the Plan

The HMPC developed and agreed upon an overall strategy for plan implementation and for monitoring and maintaining the plan over time. This strategy is further described in the plan implementation section.

4.0 Risk Assessment

Requirement §201.6(c) (2): [The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

The traditional risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. Boulder County's process builds off the traditional risk assessment and improves our understanding of risk by integrating social equity considerations and projected impacts due to climate change. Expanding the information considered in the risk assessment allows for a better understanding of the County's role in creating disenfranchised communities through prejudice policies and practices and connecting that information to why a community's potential risk to natural hazards is currently higher and will continue to be worse as impacts from climate change increase the frequency and intensity of natural hazard events. This more comprehensive risk assessment provides a framework for developing and prioritizing mitigation actions that take inequities into account while also reducing risk from future hazard events by integrating the best available science and considering trend lines.

The following sections are organized to align with the methodology and four-step process described in the FEMA publication Understanding Your Risks—Identifying Hazards and Estimating Losses. However, Boulder County recognizes the need to integrate social and ecological elements into this plan to better assess risk holistically and proactively address systems connectivity. The following sections will also build off that guidance to ensure social, ecological and infrastructure elements are considered and incorporated.

- 1) Hazard Identification identifies the hazards that threaten the planning area and describes why some hazards have been omitted from further consideration.
- 2) Hazard Profiles discusses the threat to the planning area and describes previous occurrences of hazard events. Profiles include increased frequency and intensity of hazard events and integrates anticipated impacts utilizing the best climate science to determine the likelihood of future occurrences. Social, ecological and infrastructure considerations will all be included in the profiles.
- 3) Identify Community Assets and Analyze Risk will build off the hazard profiles and identify which social, ecological, and technical/infrastructure assets and systems are at risk.
- 4) Vulnerability Assessment assesses the County's total exposure to natural hazards, considering assets at risk, critical facilities, disenfranchised communities, human health discrepancies and ecosystem services and evaluates where risks vary by jurisdiction within the planning area accounting for future development trends. Preventing disaster losses and improving human quality of life in Boulder County requires a more comprehensive approach to understanding the natural hazards that pose a risk to our communities. The following terms will be utilized throughout the Plan and are critical to understand and consider when designing mitigation strategies.
 - **Hazard:** An event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss (FEMA 1997, xxi).
 - **Risk:** The probability of a specific hazards occurrence and its consequences including the impact to people, facilities, services, and structures.
 - **Vulnerability:** FEMA defines vulnerability as the susceptibility of people, property, industry, resources, ecosystems, or historical buildings and artifacts to the negative impact of a disaster. According to the Centers for Disease Control and Prevention (CDC), social vulnerability refers to the

potential negative effects on communities caused by external stresses on human health. For the purposes of this document, vulnerability is the inability of people, assets, resources, ecosystems, organizations, industry, or businesses to withstand adverse impacts from natural or human-caused disasters, or disease outbreaks including social, economic, and environmental impacts and intersections.

- **Climate Change:** changes in average weather conditions that persist over multiple decades or longer. This includes increases and decreases in temperature, as well as shifts in precipitation, changing risk of certain types of severe weather events and changes to other features of the climate system (NCA, 2018).
- **Social Equity:** Policy Link defines equity as “just and fair inclusion into a society in which all can participate, prosper, and reach their full potential. Unlocking the promise of the nation by unleashing the promise in us all.” Social equity includes all people having what we need to survive or succeed including access to opportunity, networks, resources, and supports—based on where we are and where we want to go. Equitable policies actively mitigate the disproportionate harm faced by certain communities.
- **Discrimination:** The unequal allocation of goods, resources, and services, and the limitation of access to full participation in society based on individual membership in a particular social group; reinforced by law, policy, and cultural norms that allow for differential treatment on the basis of identity.

4.1 Hazard Identification

Requirement §201.6(c) (2) (i): [The risk assessment shall include a] description of the type...of all natural hazards that can affect the jurisdiction.

This risk assessment evaluates risk by considering probability and likelihood of a hazard event occurring, exposure of people, property and infrastructure to the hazard, and the cascading consequences of that exposure. Historically, the HMPC used a “multi-hazard” approach for the 2008 HMP. They agreed upon a list of hazards that could affect Boulder County by using existing hazards data, plans from participating jurisdictions, and input gained through planning and public meetings. In 2013, the HMPC determined that the updated mitigation planning process would focus on natural hazards. They then reviewed the hazard events that have occurred since 2007, and developed a list of hazards, listed alphabetically to be included in the HMP. For this update, the Multi-Hazard Mitigation Planning Team (MHMPC) reviewed the 2013 list of hazards and felt that the hazard profile list is appropriate and recommended no changes. However, the MHMPC concluded that climate change needs to be incorporated into the 2021 plan and thus, air quality has been added as a hazard and climate change considerations will be integrated throughout the risk assessment. Additionally, to address climate change it was determined that the County must consider social equity and ecological impacts. Thus, we have added social considerations and ecological considerations to the assessment of each hazard.

For this risk assessment, hazards evaluated include those that have already occurred historically or have the potential to cause significant social, ecological and/or infrastructural losses in the future. Historical hazards data from FEMA, the Colorado DHSEM (including the 2018-2023 Colorado Hazard Mitigation Plan), the National Oceanic and Atmospheric Administration, the Spatial Hazard Events and Losses Database for the United States (SHELDUS), the Colorado Geological Survey (CGS), the Colorado Dam Safety Branch (DSB), the United States Geological Survey (USGS) and many other sources were examined to assess the significance of these hazards to the planning area. Additionally, social data was assessed from the Centers for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI), Boulder County Cultural Brokers Resilience Program, Boulder Community Foundation’s Trends Report, Colorado Department of Public Health and Environment, Boulder County Regional Housing Partnership, Boulder County Mobility for All

Needs Assessment and Action Plan, Census and American Community Survey Data, and Headwater Economics Neighborhoods at Risk.

The historical data, potential for catastrophic impacts to humans and the systems they rely on, and the probability and potential of future occurrences were all utilized to determine the list of hazards, listed alphabetically to be included in the Natural Hazard Mitigation Plan.

- | | |
|--|--|
| 1) Air Quality | 9) Flood |
| 2) Avalanche | 10) Hailstorm |
| 3) Communicable/Zoonotic Disease Outbreak* | 11) Landslide/Mud and Debris Flow/Rockfall |
| 4) Dam and Levee Failure | 12) Lightning |
| 5) Drought | 13) Subsidence |
| 6) Earthquake | 14) Tornado |
| 7) Expansive Soils | 15) Wildfire |
| 8) Extreme Heat | 16) Windstorm |
| | 17) Winter Storm (Severe) |

** This includes Pandemic Flu and West Nile Virus. The World Health Organization (WHO) states “there is much evidence of associations between climatic conditions and infectious diseases.... changes in infectious disease transmission patterns are a likely major consequence of climate change.” Thus, Communicable/Zoonotic Disease Outbreak falls within the list of hazards that are connected to nature and influenced by climate change.*

In 2019 the Multi-Hazard Mitigation Planning Committee (MHMPC) reviewed the hazards and felt that the hazard profile list is appropriate however, the MHMPC concluded that climate change needs to be incorporated into the 2021 plan and thus, the addition of air quality as a hazard is listed above. Additionally, the team added climate change as a consideration for determining hazard significance.

Table 4-1 provides overall hazard significance based on geographic extent, probability of occurrence and the likely magnitude and severity of the hazard. The significance ratings are based on data from the hazard analysis in the following sections in addition to input from all the participating jurisdictions. Only the more significant hazards (high or medium) have a more detailed hazard profile and are analyzed further in the Vulnerability Assessment section (to the extent possible). Note that the significance of the hazard may vary from jurisdiction to jurisdiction (see the Jurisdictional Annexes for notes on how the significance varies for each jurisdiction). Some modifications were made to the original HMPC input based on the results of this risk assessment.

Table 4-1 Boulder County Hazards Significance Identification Worksheet

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Air Quality	Extensive	Highly Likely	Critical	Moderate	Medium
Avalanche	Limited	Highly Likely	Limited	Low	Low
Communicable Disease	Extensive	Occasional*	Critical	Substantial	Medium

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Dam and Levee Failure	Significant	Unlikely	Catastrophic	Moderate	High
Drought	Extensive	Likely	Catastrophic	Substantial	High
Earthquake	Extensive	Occasional	Catastrophic	Low	Medium
Expansive Soils	Significant	Highly Likely	Limited	Substantial	Low
Extreme Heat	Extensive	Likely	Critical	Severe	Low
Flood	Significant	Highly Likely	Critical	Severe	High
Hailstorm	Extensive	Likely	Limited	Moderate	Limited
Landslide	Limited	Occasional	Limited	Substantial	High
Lightning	Extensive	Likely	Limited	Moderate	Medium
Subsidence	Significant	Likely	Limited	Moderate	Medium
Tornado	Significant	Likely	Limited	Low	Medium
Wildfire	Significant	Highly Likely	Critical	Severe	High
Windstorm	Extensive	Highly Likely	Critical	Moderate	High
Winter Storm (Severe)	Extensive	Highly Likely	Catastrophic	Substantial	High
Geographic Extent <ul style="list-style-type: none"> Limited: Less than 10% of planning area Significant: 10-50% of planning area Extensive: 50-100% of planning area Increase Threat from Climate Change <ul style="list-style-type: none"> Low- unlikely to become more of a threat due to climate change. Moderate – possibly will become more of a threat due to climate change. Substantial- likely to become more of a threat due to climate change. 		Probability of Future Occurrences <ul style="list-style-type: none"> Highly Likely: Near 100% chance of occurrence in next year or happens every year. Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less. Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years. Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years. Magnitude/Severity <ul style="list-style-type: none"> Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability. Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability. 			

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
<ul style="list-style-type: none"> Severe- highly likely to become more of a threat due to climate change 		<ul style="list-style-type: none"> Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid <p>Significance</p> <ul style="list-style-type: none"> Low: minimal potential impact Medium: moderate potential impact High: widespread potential impact 			

**Based on occurring anywhere in the United States*

4.1.1 Disaster Declaration History

Identification of hazards to consider and address in this plan are based on previous plans and on research of past events that triggered federal and/or state emergency or disaster declarations. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. The Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. §§ 5121-5206, was enacted in 1988 to address when a disaster is so severe that both the local and state governments' capacities are exceeded. When a federal emergency or disaster declaration is issued, this allows for the provision of federal assistance. The disaster assistance that is granted through either of these declarations is supplemental and sequential.

Figure 4-1 Number of Disaster Declarations for the State of Colorado since 1953



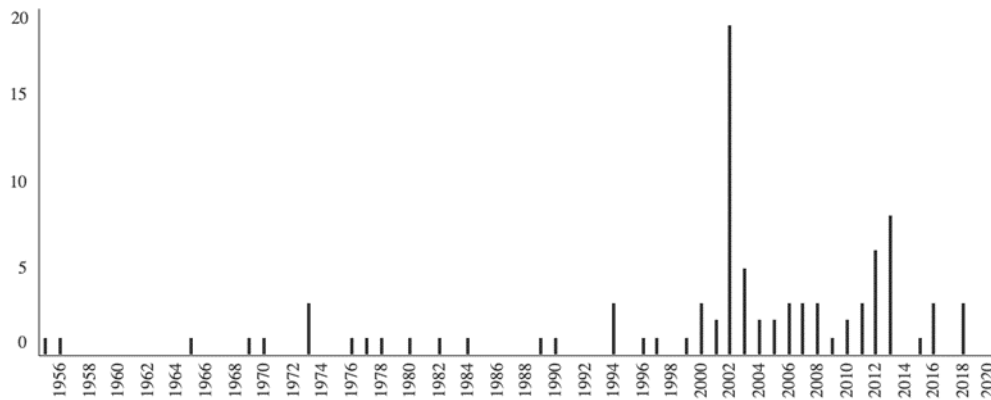
Source: FEMA

The figure above is a graphical representation of FEMA recognized federal disaster and emergency declarations that have occurred in Colorado since 1953. The numbers represented on the right are specific to Boulder County. Note that the unusual coastal storm consideration was related to evacuations related to Hurricane Katrina in 2005.

Above the state level, there are a few agencies which can authorize a disaster declaration. The federal government may issue a disaster declaration through the FEMA, the U.S. Department of Agriculture (USDA),

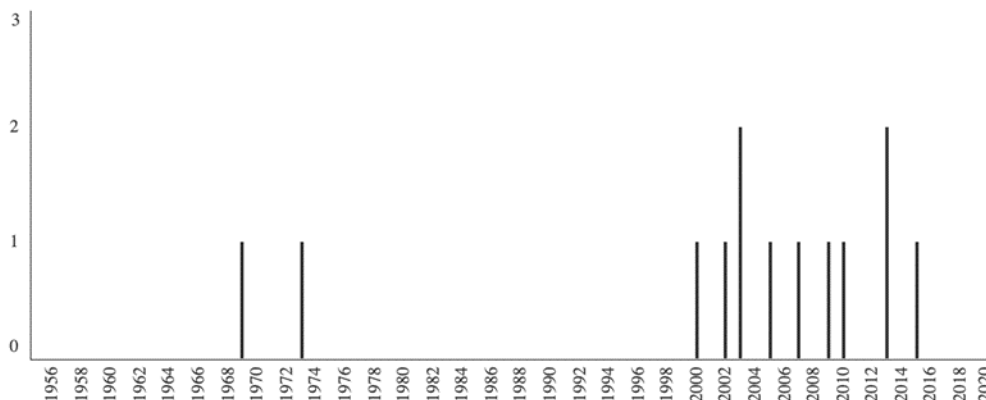
and/or the Small Business Administration (SBA). As a side note, FEMA also issues emergency declarations. These are different from ‘disaster declarations’ in that they are more limited in scope and without the long-term federal recovery programs. It is the quantity and types of damage that are the determining factors between an ‘emergency declaration’ vs. a ‘disaster declaration’.

Figure 4-2 Disaster Declarations for the State of Colorado since 1953 by Year



Source: FEMA

Figure 4-3 Disaster Declarations for Boulder County since 1953 by Year



Source: FEMA

A USDA declaration will result in the implementation of the Emergency Loan Program through the Farm Services Agency. This program enables eligible farmers and ranchers in the affected county as well as contiguous counties to apply for low interest loans. A USDA declaration will automatically follow a major disaster declaration for counties designated major disaster areas. Counties that are contiguous to the declared counties, including those that are across state lines will also qualify for benefits. As part of an agreement with the USDA, the SBA offers low interest loans for eligible businesses that suffer economic losses. These loans are referred to as Economic Injury Disaster Loans. Businesses in Counties who received a disaster declaration and those contiguous to them may apply.

Table 4-2 provides information on natural disasters declared in Boulder County between 1953 and December 2021.

Table 4-2 Boulder County Disaster and Emergency Declarations, 1953-2021

Year of Declaration	Type of Declaration	Disaster Type
1969	Federal	Severe Storms and Flooding
1973	Federal	Heavy Rains, Snowmelt, Flooding
1989	Local	Wildfire
1990	Local	Wildfire
1994	Local	Flooding
1995	State	Flooding
1998	Local	Wildfire
2000	USDA Federal	Drought Wildfire- Eldorado Fire
2001	State	Severe Weather
2002	Federal USDA	Wildfire Drought
2003	Federal Federal	Snow Wildfire- Overland Fire
2005	Federal	Hurricane Katrina Evacuation
2006	USDA Federal	Heat, High Winds, Ongoing Drought Snow
2007	Federal	Snow
2009	Federal	Wildfire- Olde Stage Fire
2010	Federal	Wildfire
2011	Local	Flooding
2012	Federal	Wildfire
2013	Federal	Flood
2015	Federal	Severe Storms, Tornadoes, Flooding, Landslides, and Mudslides
2016	Federal	Wildfire
2017	Federal	Wildfire
2020	Federal	Pandemic- COVID-19 Pandemic

Year of Declaration	Type of Declaration	Disaster Type
2020	Federal	Wildfire
2021	Federal	Wildfire
2021	Federal	Wildfires and Straight-Line Winds

Source: 2018-2023 Colorado Hazard Mitigation Plan; FEMA, PERI Presidential Disaster Declaration Site. U.S. Department of Agriculture

Hazards Not Included

Other hazards were discussed by the MHPC, but ultimately not included in this plan. Thunderstorm is not identified as an individual hazard, but thunderstorms are recognized for their role in the flood, lightning, and windstorm hazards, and is addressed accordingly in those hazard profiles. Erosion/deposition had not been identified previously for inclusion. However, after the September 2013 rain and flood events it is important to recognize the unique and different impacts these phenomena present. Further mitigation efforts and planning will need to occur and should be included in future updates to this plan. Fog, and volcanoes were considered but removed from the list due to minor occurrences and/or impacts. Coastal erosion, coastal storm, hurricane, and tsunami were excluded because they are not experienced in Boulder County.

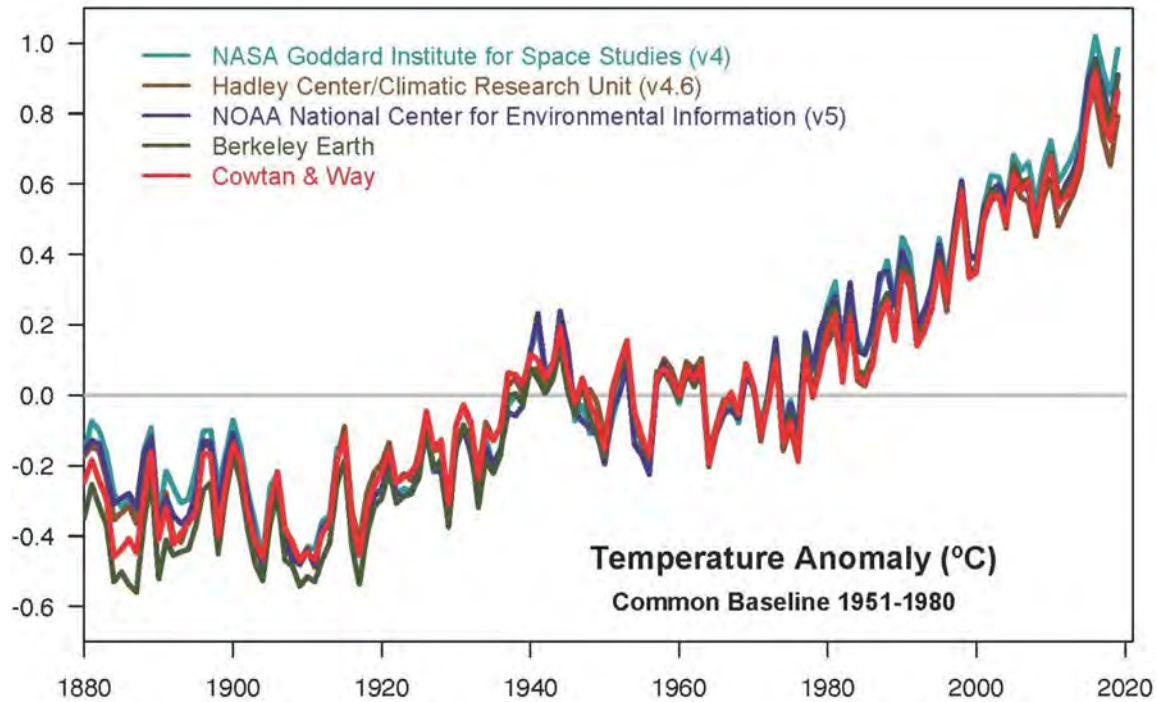
4.2 Climate, Social, Ecological Considerations

4.2.1 Climate Change

Climate change is real. Evidence from direct measurements of ocean and air temperatures unequivocally demonstrates that the Earth's climate is rapidly warming due to human activities. In fact, the Earth is warming faster today than ever before in recorded history. Climate refers to patterns of weather that includes variations in precipitation, wind, temperature, and humidity. Weather refers to short-term changes in the atmosphere whereas climate refers to averages over a longer period of time. Scientists believe that global temperatures will continue to rise for decades to come due to irreversible consequences from human action.

Climate change exacerbates existing vulnerabilities while generating new risks. Changes in global climate patterns are already having visible impacts on social, ecological, and technical systems in Colorado. The State is and will continue to experience more intense and frequent hazard events leading to increased loss of life, ecosystem services, and vulnerabilities. As population increases, these losses will be further magnified along with severe economic disruption.

Figure 4-4 Scientific Consensus: Earth's Climate is Warming



Temperature data showing rapid warming in the past few decades, the latest data going up to 2019. According to NASA data, 2016 was the warmest year since 1880, continuing a long-term trend of rising global temperatures. The ten warmest years in the 140-year record all have occurred since 2005, with the six warmest years being the six most recent years. Credit: NASA/NOAA

The U.S. Global Change Research Program (USGCRP) is the national authority on climate change in the United States. In 2018, the USGCRP released the Fourth National Climate Assessment (NCA4) which confirms that climate change is impacting every region of the United States and provides peer reviewed data and information about how impacts are expected to become worst as average global temperatures continue to rise. The report breaks the country into regions in which Colorado is part of the southwest region.

The southwest region is one of the quickest warming areas in the nation, greater than the global average. Over the past 30 years, there has been a 2°F increase in average surface temperatures which, despite the regions variable weather, is unprecedented. Warmer temperatures are expected to increase summer temperatures more than winter temperatures leading to increased risk of heat stress, outbreaks of infectious disease, water supply issues and infrastructure failure.

Over the past 40 years, Colorado had a tremendous increase in natural disasters making it the number one state in the country in the rate of increase for natural disruptions. The rapid increase in average temperatures has already begun to increase the number of natural hazard events such as wildfires, drought, and heavy precipitation. Higher temperatures impact soil, water, and air quality leading to direct impacts on human health, livestock, crop yields and wildlife. Additionally, climate impacts effect population groups differently. BIPOC, age-advanced, youth, and less able-bodied people are impacted disproportionately due to the combination of prejudice systems and structures with more frequent and intense hazard events.

The following information comes from NASA's Global Climate Change, Vital Signs of the Planet website and provides a brief summary of expected impacts from climate change in this area. According to NASA, the southwest region will experience increased heat, drought, and insect outbreaks along with increased wildfires, declining water supplies, reduced agricultural yields and more severe flooding. Less winter and

spring precipitation is projected in the southwest however, precipitation patterns are likely to change leading to more intense precipitation events and increasing unpredictability. Summer temperatures will continue to rise exacerbating heat waves, reducing soil moisture, increasing disease outbreaks and wildfires while also leading to more human health impacts.

4.2.2 Social and Ecological Considerations

Social Considerations

Communities of Color, specifically BIPOC, are disproportionately impacted by climate change due to centuries of discriminatory policies and practices. The United States is founded on extraction of people and natural resources to enable the seeds of capitalism to grow. Race is the nation's greatest disparity. When assessing vulnerability, it is critical to assess impacts of racism and prejudice against BIPOC communities first and to integrate a targeted universalism approach to solutions.

Other vulnerable people include children, the elderly, those with health conditions and lower income; however, in all of these categories, race is still the greatest disparity and BIPOC people have lower capacity to anticipate, accommodate and cope with hazard events. Hazard events intensify existing social stressors such as lack of access to resources and transportation, lack of affordable housing, living paycheck-to-paycheck, economic hardship, health issues, etc.

Boulder County recognizes the need to take a 'targeted universalism' approach to hazard mitigation by ensuring that resources, capacity, and action are prioritized in BIPOC communities with high vulnerability and risk. This approach will ensure that those with the most need are recognized, heard, and valued while also improving human health, infrastructure and quality of life. This aligns with recent guidelines developed by FEMA including the FEMA guide on expanding mitigation and making the equity connection identified 13 population groups that are likely to be disproportionately impacted by natural disasters. These groups include:

- People of Color
- Tribal and First Nation communities
- Underserved communities with a low socioeconomic status
- Women
- Members of the lesbian, gay, bisexual, transgender, and queer persons (LGBTQ+) community
- Individuals experiencing homelessness or displacement
- Rural communities
- Elderly and youth populations
- Populations with limited English proficiency
- Service workers and migrant laborers
- Populations with limited cognitive or physical abilities
- Institutionalized populations such as those in prisons and nursing homes
- Renters

FEMA moves on to acknowledge the negative impacts of government policies that make it harder for BIPOC and low-income people to prepare for, anticipate, withstand, and recovery from hazard impacts. Centuries of discrimination (which still exists today) have led to inequitable impacts leading to higher incidences of heart disease, respiratory illness, high blood pressure, diabetes, and other health issues that when combined with lack of access to resources and support led to higher likelihood of impact from natural hazards.

Ecological Considerations

Ecological dimensions are the elements of nonhuman nature that connect throughout the County. They include elements such as tree growth, soil formation, habitat formation, and hydrologic processes. All elements of the natural environment are subject to a range of impacts from climate change, including an inability to adapt to the rapid fluctuations in temperature and extreme changes to the hydrologic cycle.

Alterations to ecological systems will make hazard events less predictable and may increase hazard impacts.

Extreme hazard events will increase damage to property and infrastructure while also disrupting productivity and accessibility. Boulder County's economy is highly dependent on the health and resources generated by ecological systems and disruptions to the natural environment will have repercussions for all sectors, from agriculture to technology. In addition to local impacts, climate change is a global issue and hazard events will impact global and national systems with repercussions for supply chains and businesses with operations outside of county borders. As average global temperatures continue to rise, Boulder County must proactively anticipate these disruptions and build adaptability into hazard mitigation projects and strategies.

4.3 Hazard Profiles

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the ...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events. 32

Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. The description shall include an overall summary of each hazard and its impact on the community.

The hazards identified in the Hazard Identification section are profiled individually in this section. Much of the profile information came from the same sources used to initially identify the hazards however additional sources were utilized when developing the climate change, social equity, and ecological sections. Those sources are cited throughout the document.

Profile Methodology

Each hazard is profiled in a similar format that is described below.

- Hazard Description

This subsection gives a generic description of the hazard and associated problems, followed by details on the hazard specific to Boulder County.

- Geographic Extent

This subsection discusses which areas of the County are most likely to be affected by a hazard event. For clarification, 'planning area' refers to Boulder County.

- **Limited:** Less than 10 percent of planning area
- **Significant:** 10-50 percent of planning area
- **Extensive:** 50-100 percent of planning area

Previous Occurrences

This subsection contains information on historic incidents, including impacts where known. The extent or location of the hazard within or near the Boulder County planning area is also included here. Information for the previous occurrences of these hazards was provided by the HMPC along with information from other data sources.

Probability of Future Occurrences

The frequency of past events is used in this subsection to gauge the likelihood of future occurrences. Based on historical data, the likelihood of future occurrences is categorized into one of the following classifications:

- **Highly Likely:** Near 100 percent chance of occurrence in next year or happens every year.
- **Likely:** Between 10 and 100 percent chance of occurrence in next year or has a recurrence interval of 10 years or less.

- **Occasional:** Between 1 and 10 percent chance of occurrence in the next year or has a recurrence interval of 11 to 100 years.
- **Unlikely:** Less than 1 percent chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years

The frequency, or chance of occurrence, was calculated where possible based on existing data. Frequency was determined by dividing the number of events observed by the number of years and multiplying by 100. This gives the percent chance of the event happening in any given year. Example: Three droughts over a 30-year period equates to 10 percent chance of that hazard occurring in any given year.

Magnitude/Severity

This subsection summarizes the magnitude and severity of a hazard event based largely on previous occurrences and specific aspects of risk as it relates to the planning area. Magnitude and severity are classified in the following manner:

- **Catastrophic:** More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
- **Critical:** 25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability.
- **Limited:** 10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
- **Negligible:** Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Increased Threat from Climate Change

The IPCC states that “warming of the climate system is unequivocal, and since the 1950’s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and oceans have warmed, the amounts of snow and ice have diminished, and sea level has risen.” Human emissions of greenhouse gases trap heat near the surface of the Earth leading to increase in average global surface temperatures. This subsection summarizes the likelihood of a hazard becoming an increased threat due to climate change.

- **Low:** unlikely to become more of a threat due to climate change
- **Moderate:** possibly will become more of a threat due to climate change
- **Substantial:** likely to become more of a threat due to climate change
- **Severe:** highly likely to become more of a threat due to climate change

Overall Hazard Significance

Overall vulnerability and potential impact of each hazard is summarized in this subsection, based on probability of future occurrence, magnitude of previous occurrences, and assessments of public safety risk and threat to property and infrastructure.

Social Considerations

Hazards do not impact all people equally. Climate change is a result of extraction, extraction of natural resources but also of people. The United States is built on the acceptability of extracting from Black and Indigenous people for the benefit of White male landowners including theft of land, slavery, and genocide. BIPOC have faced centuries of racism and discrimination that has been institutionalized into policies and practices at all levels of government and into our economic system. Social considerations are critical when assessing hazard impacts and identifying mitigation strategies that acknowledge inequities and shift towards a targeted universalism approach.

Ecological Considerations

The ecosystems that benefit human quality of life are the same systems that are being impacted by climate change. Elements like clean air and water have benefits for crop pollination, fishing, hunting, tourism, and human health. Ecological considerations are critical when assessing hazards and determining mitigation strategies. The entire web of life and the inner connectivity and interactions are important to understand and evaluate in order to design solutions that will be sustainable and able to withstand increased frequency and intensity of natural hazards. Within this hazard assessment, ecological connectivity and opportunities will be evaluated to ensure more holistic mitigation strategies are prioritized.

4.3.1 Air Quality

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Air Quality	Extensive	Highly Likely	Critical	Moderate	Medium

Description

Air quality is a measure of how polluted or clean the air is. It is critical to human health, agriculture, and vegetation and is impacted by weather, climate, and human activities. Ground-level ozone and particulate matter (PM) are two very common air pollutants that negatively impact human health and ecological systems. Unlike the protective ozone in the upper stratosphere, ground-level ozone is formed in the atmosphere and is impacted by emissions from human actions, ecological systems such as forests, and weather conditions. Ozone pollution is a serious hazard for the Denver Metro/North Front Range region and the nine air quality monitors in the region often exceed Environmental Protection Agency (EPA) air quality standards.

Poor air quality can have significant social, ecological, and economic impacts. Although impacts to human health are most documented, poor air quality can also have negative effects on vegetation, crops, and forests leading to loss of environmental and economic benefits. Colorado's complex topography and variable weather patterns can significantly impact differences in air quality from point to point.

Air quality is measured by air quality monitors and the Air Quality Index (AQI) which is a system utilized to warn the public when there are dangerous levels of air pollution. The AQI categorizes air pollution into five levels based on a scale of 0 to 500. Each level is provided with an associated color to make it easier to communicate poor air quality days with the public.

Air Quality Index	Value	Ozone	Particulate Matter
Good	0-50	No major concerns.	No major concerns.
Moderate	51-100	Unusually sensitive individuals may experience respiratory symptoms.	Respiratory symptoms possible in unusually sensitive individuals, possible aggravation of heart or lung disease in people with cardiopulmonary disease and older adults.
Unhealthy for Sensitive Groups	101-150	Increasing likelihood of respiratory symptoms and breathing discomfort in active children and adults and people with lung disease, such as asthma.	Increasing likelihood of respiratory symptoms in sensitive individuals, aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease and older adults.
Unhealthy	151-200	Greater likelihood of respiratory symptoms and breathing difficulty in active children and adults and people with lung disease, such as asthma; possible respiratory effects in general population.	Increased aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease and older adults; increased respiratory effects in general population.
Very Unhealthy	201-300	Increasingly severe symptoms and impaired breathing likely in active children and adults and people with lung disease, such as asthma; increasing	Significant aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease and older adults; significant

Air Quality Index	Value	Ozone	Particulate Matter
		likelihood of respiratory effects in general population.	increase in respiratory effects in general population.
Hazardous	301-500	Severe respiratory effects and impaired breathing likely in children and adults and people with lung disease, such as asthma; increasingly severe respiratory effects likely in general population.	Serious aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease and older adults; serious risk of respiratory effects in general population.

Table based on information from the American Lung Association AQI and Colorado Department of Public Health and Environment

Although indoor air quality is critical to human health and it is important to consider when developing housing, building and floodplain policies and codes, the specific elements around indoor air quality are outside the scope of the HMP and will only be referenced as having co-benefits in the mitigation strategies identified in Section 5.0.

Social Considerations

According to the Colorado Health Institute, every two years more people than the entire population of Colorado are prematurely killed globally due to effects of air pollution. Air pollution impacts BIPOC members of the community disproportionately due to discriminatory policies that lead to “undesirable uses” such as processing plants, industrial sites, highways, and other high polluters being located in BIPOC communities. Decades of exposure to pollution creates adverse impacts to human health and can lead to respiratory illness, asthma, premature death, lost wages for outdoor workers and more school days missed for young people.

People with increased vulnerability are even at risk from short-term changes in air quality. Data shows that when air pollution levels increase, so do health issues such as respiratory illnesses, strokes, and heart attacks, having negative impacts on emergency services, emergency rooms and healthcare facilities. Air quality also interacts and exacerbates other hazards such as zoonotic diseases. A study by Harvard University was able to document higher death rates from COVID-19 occurred in areas where people live with long-term air pollution issues.

Geographic Extent

A combination of unique topography, geography, and weather increase Boulder County’s vulnerability to air quality. Ozone levels are highest in dense urban areas such as the Front Range and when there is considerable sunlight and warm temperatures. Ground-level ozone pollution and PM come from neighboring states and surrounding counties making it difficult to effectively decrease without regional collaboration. Generally, Boulder County experiences the same poor air quality as the entire nine-county North Front Range and when the region experiences very unhealthy or hazardous air quality days, there is a strain on regional emergency services and hospitals.

Previous Occurrences

According to the Center for Technology in Government, Colorado’s Front Range communities had the most air quality issues in the winter months when both urban and rural areas were in nonattainment for different air quality metrics. In fact, authors of the Air Quality Data Use, Issues and Value in Colorado state that “until the mid-1980’s, carbon monoxide pollution was so severe in Colorado that levels sometimes surpass those in the Los Angeles basin”.

The previous two decades have seen small improvements however, the Front Range has failed to meet

federal air quality standards set in 2008 and continues to be out of compliance for the old federal standards even though stricter ones were set in 2015. In 2020, the American Lung Association gave Boulder County an “F” due to high levels of ozone.

Probability of Future Occurrences

Probability of future poor air quality occurrence is considered **highly likely**, with multiple events of varying magnitude occurring on an annual basis. Poor air quality is likely to result in fatalities that will occur on a more frequent scale over time. The region is likely to continue to experience poor air quality days that increase from higher heat days, longer consecutive high heat days, and increased wildfires due to climate change.

Magnitude/Severity

Based on the definitions established for this plan, magnitude and severity of air quality is considered **critical**, with relatively threats to agricultural and ecological assets and serious risk to the public safety.

Climate Considerations

According to the National Climate Assessment (NCA4), due to an increase in average global surface temperatures, there will be an increase in existing air pollution levels. Ozone pollution and climate change have a cyclical relationship; increases in ground-level ozone lead to faster warming of the planet and thus, accelerates the pace of climate change, which in turn, exacerbates ozone pollution.

Air quality impacts and is impacted by other natural hazards. For example, more air pollution leads to more extreme heat events including heat waves which impact infrastructure and increase mortality. Air quality will continue to deteriorate as impacts from climate change become more frequent and intense. This will result in increased damage and disruption to human health, ecosystems, agriculture, and infrastructure. According to the NAACP’s 2012 “Coal-Blooded” study, communities of color are more likely to breathe in polluted air, in fact the air they breathe is 40 percent more polluted than White communities across the United States.

Ecological Considerations

Air pollution can have considerable impacts on agriculture, vegetation, and forest ecosystems. When air quality is mildly poor, impacts may include changes to soil chemistry, loss of more vulnerable plant species, and plant tissue damage. However, when air quality is significantly bad for longer periods of time, soil chemistry may be permanently altered and there is greater risk of animal and vegetation loss. Ozone pollution is likely to damage both crops and plant and forest ecosystems by reducing photosynthesis

Overall Hazard Significance

The overall hazard significance for air quality is **medium**, with a growing impact relative to other disasters. This assessment considers a high overall probability and high probability of life-threatening occurrences but limited magnitude of property damage and/or limited shutdown of facilities.

4.3.2 Avalanche

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Avalanche	Limited	Highly Likely	Limited	Low	Low

Description

Avalanche hazards occur predominantly in the mountainous regions of Colorado above 8,000 feet. The vast majority of avalanches occur during and shortly after winter storms. Avalanches occur when loading of new snow increases stress at a rate faster than strength develops, and the slope fails. Critical stresses develop more quickly on steeper slopes and where deposition of wind-transported snow is common.

The combination of steep slopes, abundant snow, weather, snowpack, and an impetus to cause movement all create an avalanching episode. According to the Colorado Avalanche Information Center (CAIC), about 90 percent of all avalanches start on slopes of 30-45 degrees; about 98 percent of all avalanches occur on slopes of 25-50 degrees. Avalanches release most often on slopes above timberline that face away from prevailing winds (leeward slopes collect snow blowing from the windward sides of ridges). Avalanches can run, however, on small slopes well below timberline, such as gullies, road cuts, and small openings in the trees. Very dense trees can anchor the snow to steep slopes and prevent avalanches from starting; however, avalanches can release and travel through a moderately dense forest. An average-sized avalanche travels around 80 mph; the typical range of impact pressure from an avalanche is from 0.5 to 5.0 tons per foot.

Historically in Colorado, avalanches have occurred during the winter and spring months between November and April. The avalanche danger increases with major snowstorms and periods of thaw. About 2,300 avalanches are reported to the CAIC in an average winter. More than 80 percent of these fall during or just after large snowstorms. The most avalanche-prone months are, in order, February, March, and January. Avalanches caused by thaw occur most often in April.

Social Considerations

This hazard generally affects a small number of people, such as snowboarders, backcountry skiers, and climbers who venture into backcountry areas during or after winter storms. Motorists along highways are also at risk of injury and death due to avalanches. Road and highway closures, damaged structures, and destruction of forests are also a direct result of avalanches. Recognizing areas prone to avalanches is critical in determining the nature and type of development allowed in a given area however, most avalanches occur in remote locations and thus, have lower risk of personal injury.

Geographic Extent

Based on the definitions set forth previously, the geographic extent of avalanche hazard is considered **limited**, with less than 10 percent of the planning area affected. In general, avalanche hazard is highest in areas of steep slopes at high elevation where contributing conditions described above are present. This includes the alpine region of western Boulder County. More specifically, the access road to the Eldora Ski Area is an identified avalanche risk area as well as unincorporated sections of western Boulder County.

Previous Occurrences

Avalanches occur annually in western Boulder County, typically following significant snowstorms. Some of these have resulted in fatalities in Boulder County, mostly to persons recreating in the backcountry. According to the CAIC, between the winters of 1950/51 and 2021/2022, four avalanche fatalities occurred in Boulder County. Specific cases include an occurrence on December 18, 1999, on South Arapaho Peak, when two hikers were caught in an avalanche resulting in one fatality. Other notable occurrences include

the closure of the Eldora Ski Area access road due to the avalanche hazard and the stranding of skiers during the March 2003 blizzard.

- **March 2003:** Colorado's Great Blizzard of 2003 caused an avalanche that closed Eldora Ski Area. The three-day storm that dumped from two to seven feet of snow across central Colorado and the "Front Range" of the Rocky Mountains -- the urban corridor stretching from Cheyenne, Wyo., to Denver and Colorado Springs -- spawned hundreds of avalanches in the mountains and foothills. One of them swept past the slopes of the Eldora Mountain Resort near Boulder, closing all the ski runs and trapping some 300 skiers in the base lodge for two days and nights.
- **March 2019 Colorado Avalanche Season:** 1,000 avalanches during the month of March 2019 throughout Colorado being the worst experience in the past 20 years.

Probability of Future Occurrences

Probability of future avalanche occurrence is considered highly likely, with multiple events of varying magnitude occurring on an annual basis. Avalanches that result in property damage or fatalities occur on a less frequent scale, and the recurrence interval for avalanche fatalities for the period 1950-2022 is approximately one every 18 years.

Magnitude/Severity

Based on the definitions established for this plan, magnitude and severity of avalanche is considered **limited**, with relatively minor threat to property inventories but serious risk to the public safety.

Climate Change Considerations

Climate change will make avalanches more unpredictable, bigger, and able to travel longer distances making them altogether more dangerous. Colorado is already experiencing an increase in observed avalanches, most of which are wet snow and wet slab avalanches connected to warmer temperatures. Warmer temperatures from climate change make snow layers less stable and more likely to collapse and then slide. This is from more rain-on-snow events and greater fluctuations in temperatures. Additionally, more moisture in the atmosphere can lead to more extreme winter snow events which are likely to increase the scale of avalanches.

Boulder County is not alone in seeing these changes. In other mountainous areas such as the Canadian Rockies or the Himalayas, the same trends are occurring and avalanches are bigger, cover a greater area and are happening more often.

Ecological Considerations

Similar to wildfires and windstorms, avalanches are natural ecological disturbances. They do have the potential to kill wildlife and destroy trees and vegetation, however they also lead to new life and enrichment of the soil through decomposition. Although destructive, the natural environment is equipped to handle avalanches and provide opportunities for new habitats to appear.

Overall Hazard Significance

The overall hazard significance for avalanche is **low**, with relatively limited impact relative to other disasters. This assessment considers a high overall probability but a low probability of life-threatening occurrences and limited magnitude of property damage and/or limited shutdown of facilities.

4.3.3 Communicable / Zoonotic Disease Outbreak

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Communicable/ Zoonotic Disease	Extensive	Occasional	Critical	Substantial	Medium

Description

The impact to human health that communicable disease outbreaks can have on an area can be substantial.

Communicable Diseases: Diseases such as Human Immunodeficiency Virus (HIV)/acquired immunodeficiency syndrome (AIDS) and the simple head cold are communicable, or easily passed person to person through direct contact or contamination of inanimate objects or food. Hand washing and adequate personal hygiene practices can help prevent the spread of many communicable diseases.

- COVID-19 is a respiratory disease that has a zoonotic source and was most likely was transmitted by a horseshoe bat to humans although the intermediate host that was the source of the outbreak remains to be determined. Since the transfer of the virus to humans, human-to-human transmission from respiratory tract via droplets and on high-touch surfaces has helped spread COVID-19 globally.
- HIV is another disease with a zoonotic source, chimpanzees. HIV is a virus that attacks the body's immune system and if not treated, can lead to AIDS. Although a few cases were documented in the 1970's, the 1980's is when HIV/AIDS infections accelerated. By the end of the 1990's, the WHO released that AIDS was the fourth biggest cause of death worldwide and over 14 million people had died from the virus since the start of the epidemic. Today, many diagnosed with HIV receive antiretroviral treatment and are able to successfully live with infection.

Zoonotic Diseases: Zoonotic diseases are transmitted from animal to human. Examples include the Swine Flu and West Nile Virus. Zoonotic diseases can be caused by fungi, bacteria, parasites, or viruses that are transmitted through insects or animals. Zoonotic diseases are a significant hazard to both Boulder County's human population and livestock. Table 4-3 provides a list of reportable diseases in Boulder County in the last decade. The most common zoonotic diseases include hantavirus, plague, rabies, tularemia, West Nile Virus (WNV) and other mosquito-borne diseases, and tick-borne diseases.

- Hantavirus Pulmonary Syndrome (HPS) is a respiratory disease spread through contact with urine, feces, and saliva of the deer mouse. Hantavirus cases occur year-round, but prevalence is higher from May to July.
- Plague (bubonic, septicemic, and pneumonic) is a disease caused by bacteria that spreads through flea bites or direct contact from animals to humans. Since the early 1970's, human plague cases in Colorado have been on the rise. Although Boulder County has had no positive cases, it is a disease that is likely to increase in prevalence Statewide as humans have more direct contact with animals.
- Swine Flu is a respiratory illness that causes influenza in pigs. Human infections can happen from interactions with pigs and in 2012 there was an increase in the number of swine flu cases in humans.
- Tularemia is another bacteria-caused disease that transfers from rabbits or other wild rodents to humans through animal tissues or ticks.
- WNV is the most common arboviral disease in Colorado and is spread most often by an infected mosquito bite. Birds are the primary host of WNV although other animals such as horses are easily infected. WNV is most common in summer months (June-August).

Safe food and animal handling practices as well as protection of natural spaces and reforestation are some of the best ways to prevent the onset of these zoonotic types of disease.

Boulder County Public Health is the primary agency which handles these types of outbreaks. Further information and resources can be found at: <https://www.bouldercounty.org/families/disease/> or <https://www.bouldercounty.org/departments/public-health/communicable-disease-and-emergency-management-division/>

Other resources can be found at:

Communicable Disease Control: 303-413-7500 or 303-413-7517 (after hours)

Boulder County Public Health: 3482 Broadway Boulder, CO 80304

Social Considerations

Race, income, education, and employment status can impact exposure to infectious diseases. Often people who are living paycheck-to-paycheck must continue to work through illness increasing risk of exposure to others and thus, increasing their risk of contracting a virus. Additionally, BIPOC and lower-income individuals often have pre-existing medical conditions that lead to increased risk of contracting a virus and more harmful impacts due to underlying health issues. Additionally, inequities exist in the ability of individuals, communities, regions and even countries in the capacity, accessibility, and finances to identify, monitor and contain infectious diseases.

Geographic Extent

The geographic extent of communicable and zoonotic diseases is classified as **extensive**, with 50-100 percent of the planning area affected. As the world becomes more connected through globalization, the likelihood and extent of infectious disease spread increases dramatically. Although Boulder County Public Health Department is structured to provide education and testing for disease outbreaks, coordinated regional, state, and national efforts will be most effective.

Previous Occurrences

Communicable and zoonotic diseases have the potential to impact a large number of people as well as have severe economic and ecological impacts. Although disease outbreaks can happen on their own, they may also come as a secondary impact from other hazard events such as a flood or extreme heat. The Colorado Division of Disease Control and Environmental Epidemiology collect reportable disease data for the entire state of Colorado and disseminates this data by year and by County. Below is the list of reportable diseases for Boulder County from 2010- 2018.

Table 4-3 Colorado Reportable Disease Statistics for Boulder County, 2013-2018

Disease	2013	2014	2015	2016	2017	2018	Total
Campylobacter	62	47	61	105	115	113	503
Carbapenem-Resistant Enterobacteriaceae (CRE)	n/a	n/a	n/a	n/a	17	21	38
Carbapenem-Resistant Pseudomonas Aeruginosa (CRPA)	n/a	n/a	n/a	n/a	70	45	115
Cryptosporidiosis	11	3	26	29	16	29	114
Giardiasis	33	52	38	62	49	46	280
Haemophilus Influenzae	3	1	1	6	3	4	18
Hepatitis B, Chronic	22	15	19	33	19	27	135
Hepatitis C, Chronic	79	118	107	166	191	220	881
Influenza-Hospitalized	57	106	64	81	230	207	745
Meningitis Aseptic/Viral	15	8	0	0	0	1	24
Pertussis	215	92	46	61	42	63	519

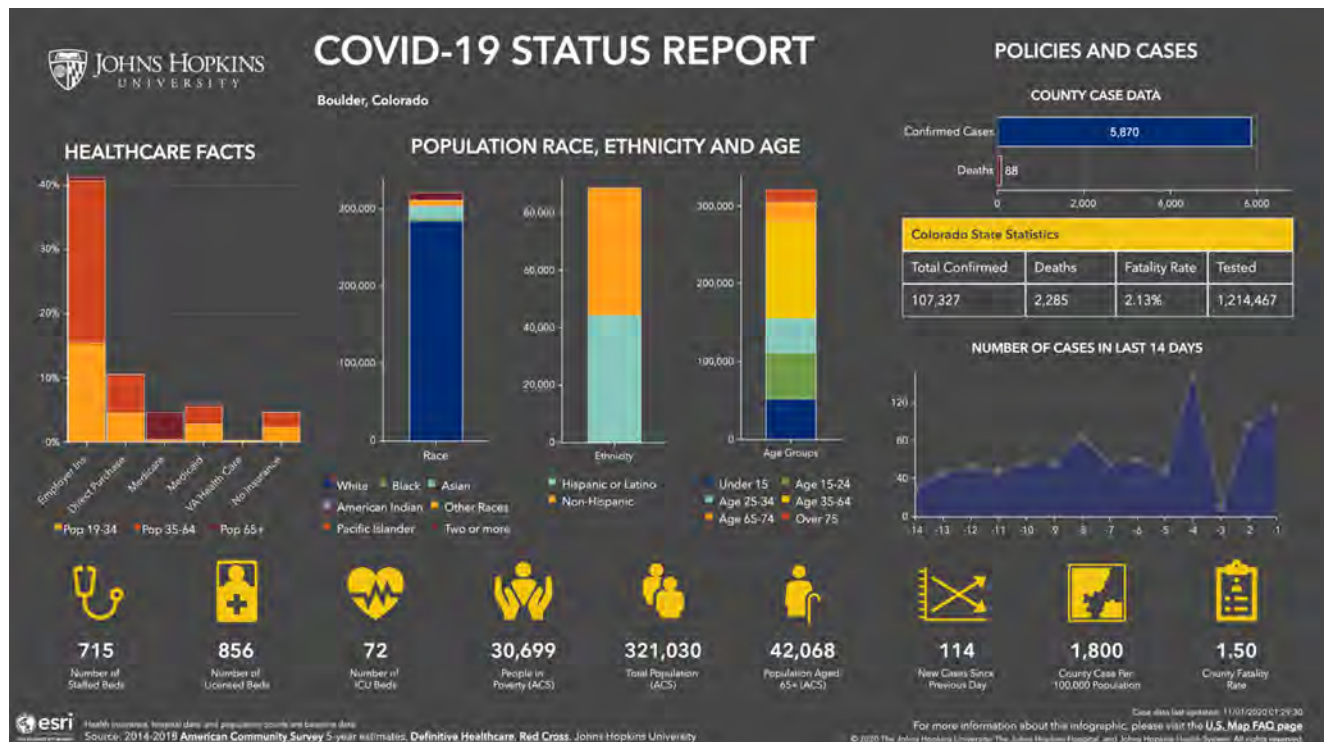
Disease	2013	2014	2015	2016	2017	2018	Total
Salmonellosis	32	35	45	46	51	39	248
Shigellosis	14	4	3	14	13	18	66
STEC (Shiga Toxin Producing E.coli)	12	6	10	12	21	31	92
Strep Pneumo Invasive	18	17	15	20	26	19	115
Varicella (Chicken Pox)	36	27	28	31	13	23	158
West Nile Virus	n/a	n/a	n/a	0	9	11	20
Total	609	531	463	666	885	917	4071

Source: Division of Disease Control and Environmental Epidemiology
<https://www.colorado.gov/pacific/cdphe/colorado-reportable-disease-data>

Pandemics

According to the Centers for Disease Control and Prevention, there have been five global pandemics since the early 1900's:

- **1918-1919 Influenza Pandemic:** Otherwise known as the Spanish Flu, this was the most severe pandemic in recent history. Over one-third of the world's population was infected and nearly 50 million people died worldwide. In the United States, 675,000 people, primarily young healthy adults, died from the virus which made it very unique. In the Denver area, nearly 13,000 influenza cases resulted in over 1,200 deaths.
- **1957-1958 Pandemic (H2N2):** Known as the Asian Flu, this pandemic originated from an avian influenza A virus. The estimated number of deaths was 1.1 million worldwide with 116,000 of those deaths in the United States.
- **1968-1969 Pandemic (H3N2):** Dubbed the Hong Kong Flu, over one million people are estimated to have died worldwide and nearly 100,000 in the United States. People over 65 years of age were most impacted by this pandemic. In Colorado, 50,317 cases and 955 deaths were counted by the end of 1968.
- **2009-2010 Pandemic:** The Swine Flu
- **2019- Ongoing COVID-19 Pandemic:** As of November 1, 2020, the number of confirmed global cases of COVID-19 totaled 46,196,087 cases and over 1,197,000 deaths. Since January 21, 2020, the United States has over nine million confirmed COVID-19 cases and nearly 230,000 deaths. Boulder County has had 5,870 cases and 88 deaths.



Source: Johns Hopkins University

Probability of Future Occurrences

Based on patterns of previous occurrence, future probability is considered likely, with a 10-100 percent chance of occurrence in the next year. See Climate Considerations below for additional information about the likelihood of future occurrences.

Magnitude/Severity

The severity of outbreaks is expected to change from year to year depending on variables such as weather patterns, the mosquito population, the bird population, and immunity in humans. Overall magnitude and severity of this hazard is classified as **limited**, with the majority of illnesses treatable and not resulting in permanent disability. The magnitude and severity of infectious disease depend on how aggressive a disease is, how easily it is transmitted and whether or not advances have been made in development of vaccines or herd immunity has been established. With epidemics and pandemics, high levels of illness and, in some cases death, can lead to economic losses, social disruptions and interruption of supply chains as demand for certain goods and services increases or decreases.

Climate Considerations

According to the WHO, "today, worldwide, there is an apparent increase in many infectious diseases, including some newly circulating ones (HIV/AIDS, hantavirus, hepatitis C, SARS, etc.). This reflects the combined impacts of rapid demographic, environmental, social, technological, and other changes in our ways of living. Climate change will also affect infectious disease occurrence". Climate change will create warmer global temperatures. As average winter temperatures decrease, reproduction periods will last longer increasing likelihood of new pests and transmission of diseases. This will allow certain agricultural pests to persist year-round and increase the prevalence of parasites and diseases that affect livestock leading to increased economic and social impacts. Additionally, climate change is likely to have impacts on aquatic ecosystems which may lead to increased spread of non-native species and disease.

Ecological Considerations

Activities such as human driven deforestation, resource extraction, and removal of biodiversity is leading to increasing encroachment into wild spaces elevating interaction with disease carriers and providing more opportunities for viruses to jump to humans. Lee Hannah, a climate scientist for Conservation International said “deforestation is a prime driver of pandemics”. As deforestation continues, pandemics are likely to emerge more often and spread more rapidly, leading to more deaths and economic hardship. Reforestation and protection of natural spaces is a critical method for reducing probability of future occurrences.

Overall Hazard Significance

Based on assessments of probability, geographic extent and magnitude/severity, the overall hazard significance of communicable and zoonotic diseases is classified as **medium**, with moderate potential impact.

4.3.4 Dam and Levee Failure

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Dam and Levee Failure	Significant	Unlikely	Catastrophic	Moderate	High

Description

Dams are structures built for a variety of uses, including flood protection, power, agriculture, water supply, and recreation. Dams typically are constructed of earth, rock, concrete, or mine tailings. Two factors that influence the potential severity of a full or partial dam failure are the amount of water impounded and the density, type, and value of development and infrastructure located downstream.

Dam failures can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding, which result in overtopping
- Earthquake/seismic activity
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage or piping or rodent activity
- Improper design
- Improper maintenance Negligent operation
- Failure of upstream dams on the same waterway

Overtopping is the primary cause of earthen dam failure. Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Associated water quality and health concerns could also be an issue.

The Colorado DSB recently developed a tool that attempts to increase public awareness, preparedness, and response around high hazard dams in Colorado. The tool focuses on flood release and operational functions and provides an assessment of each dam. The Colorado DSB requires owners and managers of both high and significant hazard dams to develop and maintain Emergency Actions Plans (EAP) to help mitigate impacts.

Social Considerations

As population in Boulder County continues to grow, risk to human life from dam or levee failure grows along with it. Dam and levee breaks have the potential to cause catastrophic damage including loss of entire communities. Increasingly, social impact assessments are being utilized as part of risk assessments to consider factors such as cultural and/or indigenous sites and business investment. If failure occurs, even if not catastrophic, or controlled releases can lead to flooding downstream and have a tremendous impact on people with fewer resources, especially if water impacts their homes or personal assets. Although floods are often treated as solely infrastructure problems, they impact other social factors such as social cohesion, sense of security, sanitation, and cultural spaces. Similar to other flooding events, lower-income people and those intentionally located in 'high-risk' or 'undesirable' areas are likely to be impacted worse by small dam or levee failures or releases.

Mental health and trauma are important social care elements to integrate into engagement around dam safety and into all response and recovery materials. Having one's home, property or source of income inundated or completely wiped out by dam failure is psychologically damaging however very few resources

and materials are provided to support people through that traumatic experience. Additionally, it is important to recognize the increased cascading impact of water-based illnesses that can also increase and impact people's quality of life after an event.

Geographic Extent

In general, the geographic extent of dam and levee failure hazard is **significant**, with 10-50 percent of the planning area potentially affected by inundation and directly related impacts. More specifically, HAZUS-MH contains a database of dams based on the National Inventory of Dams (NID). This database lists 73 dams in the County and classifies dams based on the potential hazard to the downstream area resulting from failure or poor operation of the dam or facilities:

- High Hazard Potential: Probable loss of life (one or more)
- Significant Hazard Potential: No probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns; often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure
- Low Hazard Potential: No probable loss of human life and low economic and/or environmental losses; losses are principally limited to the owner's property

Based on these classifications, there are 23 high hazard dams and 18 significant hazard dams in Boulder County. These dams are listed in Table 4-4 and illustrated on the map of Boulder County dams in Figure 4-5. The dams are listed by hazard potential, alphabetically.

Table 4-4 High and Significant Hazard Dams in Boulder County

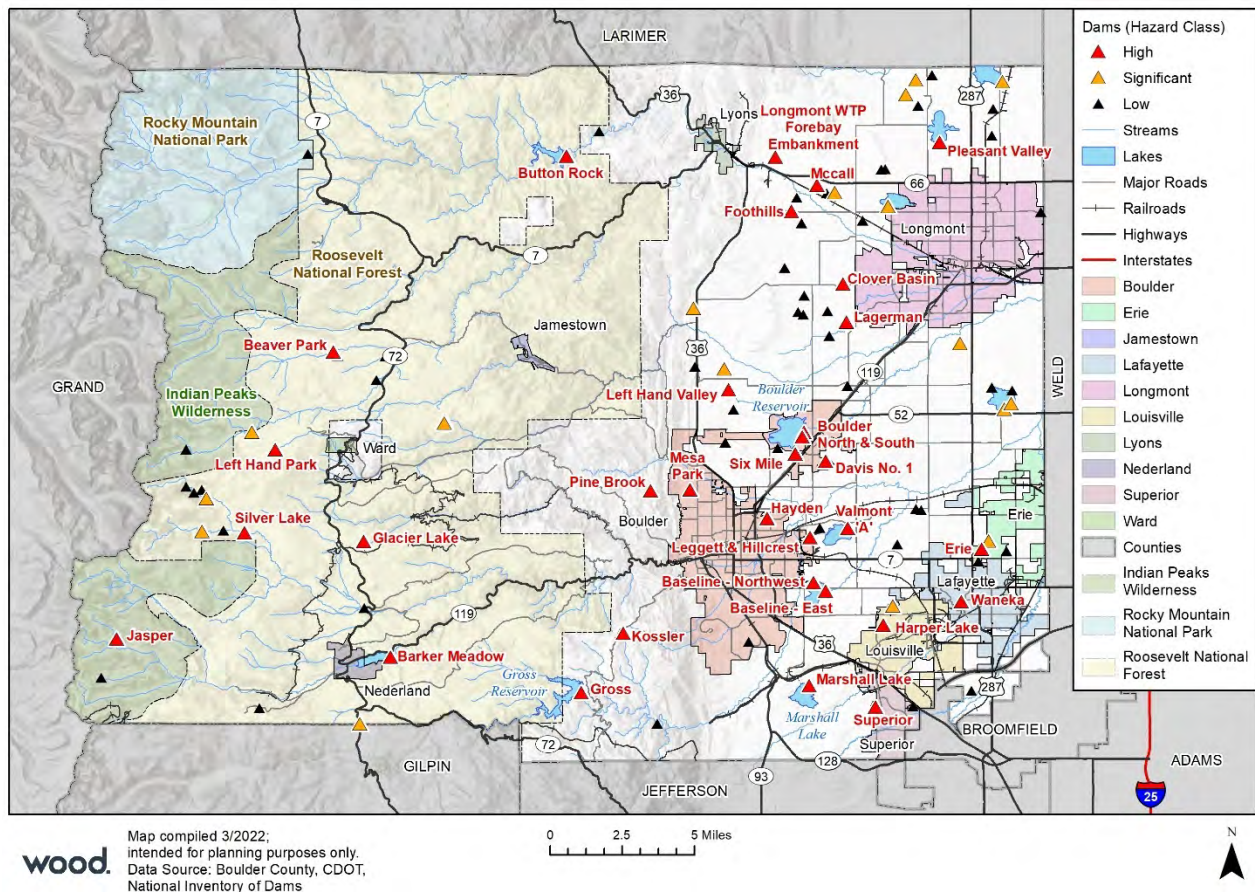
Name	River	Near City	Max Storage (acre ft.)	Hazard	Downstream Communities	Relative Downstream Impacts
Glacier Lake	Pennsylvania Gulch	Boulder	329	H	Unincorporated	Medium
Longmont Wtp Forebay Embankment	St Vrain Creek-Os	Hygiene	129	H	Unincorporated and Longmont	Medium
Pine Brook	Two Mile Creek	Boulder	140	H	Boulder	High
Barker	Middle Boulder Creek	Boulder	12,400	H	Boulder, Unincorporated	High
Baseline	Dry Creek	Boulder	6,592	H	Unincorporated	Medium
Beaver Park	Beaver Creek	Longmont	2,731	H	Lyons, Longmont	Medium
Boulder	Dry Creek	Boulder	17,700	H	Unincorporated	Medium
Button Rock	N. Fork St. Vrain Creek	Longmont	20,400	H	Lyons, Longmont, Unincorporated	High
Clover Basin	Dry Creek-Tr	Longmont	984	H	Longmont	Low
Foothills	St. Vrain Creek	Longmont	4,767	H	Longmont, Unincorporated	Medium
Gross	South Boulder Creek	Eldorado Springs	47,500	H	Boulder, Eldorado Springs, Unincorporated	High
Harper Lake	Coal Creek- Tr	Louisville	843	H	Louisville	Low
Hayden	Boulder Creek-Os	Boulder	765	H	Boulder	Low

Name	River	Near City	Max Storage (acre ft.)	Hazard	Downstream Communities	Relative Downstream Impacts
Jasper	Jasper Creek	Eldora	426	H	Unincorporated, El Dora	Low
Lagerman	Dry Creek-Tr	Longmont	1,832	H	Longmont	Medium
Lefthand Park	Left Hand Creek	Longmont	2,075	H	Ward, Unincorporated	Medium
Lefthand Valley	Dry Creek-Tr	Boulder	5,274	H	Boulder, Unincorporated	Medium
Leggett & Hillcrest	South Boulder Creek-Tr	Boulder	15,950	H	Boulder, Unincorporated	Medium
Marshall Lake	South Boulder Creek-Tr	Marshall	12,878	H	Louisville	Medium
Mc Call	St. Vrain Creek	Longmont	722	H	Longmont, Unincorporated	Low
Pleasant Valley	St. Vrain Creek	Longmont	4,562	H	Longmont	Medium
Silver Lake	North Boulder Creek	Boulder	4,819	H	Boulder, Unincorporated	Medium/High
Six Mile	Little Dry Creek-Tr	Boulder	2,186	H	Boulder, Unincorporated	Medium
Superior	Coal Creek- Os	Superior	500	H	Superior	Low
Valmont "A"	Boulder Creek-Tr	Boulder	15,950	H	Unincorporated	Medium
Waneka	Coal Creek- Os	Lafayette	838	H	Lafayette	Low
Albion Lake	North Boulder Creek	Boulder	700	S	Unincorporated, Boulder	Low
Allen Lake	Left Hand Creek	Longmont	784	S	Unincorporated, Boulder	Low
Brainard Lake	South St Vrain Creek		160	S	Unincorporated	Low
Davis No. 1	Dry Creek- Os	Boulder	185	S	Boulder, Unincorporated	Low
Erie	Boulder Creek-Os	Erie	360	S	Erie	Low
Gaynor	Boulder Creek	Longmont	754	S	Longmont, Unincorporated	Medium
Gold Lake	Bell Gulch	Longmont	648	S	Unincorporated	Low
Goose Lake	North Boulder Creek-Tr	Boulder	1,170	S	Unincorporated, Boulder	Medium
Highland #2	Little Thompson River-Tr	Longmont	4,613	S	Unincorporated	Medium
Ish #3 (East Dam)	Little Thompson River-Os	Milliken	9,065	S	rural Berthoud	Low
Los Lagos No. 3	Beaver Creek-Tr	Pinecliffe	60	S	Pinecliffe, Unincorporated	Low
Louisville No. 1	Bullhead Gulch-Tr	Louisville	212	S	Louisville	Low
Margaret Spurgeon #1	Dry Creek-Tr	Boulder	450	S	Boulder, Unincorporated	Low
McIntosh	St. Vrain Creek	Longmont	2,986	S	Longmont	Medium

Name	River	Near City	Max Storage (acre ft.)	Hazard	Downstream Communities	Relative Downstream Impacts
Mesa Park	Fourmile Canyon Creek-Tr	Boulder	260	S	Boulder	Low
Oligarchy #1	St. Vrain Creek	Longmont	2,161	S	Longmont, Unincorporated	Medium
Panama No. 1	Boulder Creek-Os	Evans	7,539	S	Erie, Unincorporated	Medium

Source: NID; <http://cruncj.tec.army.mil/nidpublic/webpages/nid.cfm> and Division of Water Resources

Figure 4-5 Dam Locations, Boulder County



Areas that would be significantly impacted by a dam failure include the City of Boulder, unincorporated Boulder County along Boulder Creek and South Boulder Creek, and Lyons, Longmont, and unincorporated areas along St. Vrain Creek.

Levees in Boulder County are not as widespread as dams. Most of these are located in or around the City of Boulder. Some of the known flood levees are located at: The Canyon Centre between 6th and 9th Street; the Roche Chemical Plant (2075 55th St), and the City of Boulder Wastewater Treatment Plant. Another levee is located at Harrison Ave. along the Bear Canyon Creek and behind the Syntex property along Boulder Creek between Goose Creek and Foothills Pkwy. There are several levee/floodwall structures along Boulder Creek protecting properties that have been documented in a 2008 Boulder Creek floodplain restudy project.

According to a memo by the Colorado Water Conservation Board dated January 22-23, 2008, "FY 04/03

COUNTIES: All of the Boulder County levees have been identified; FEMA and the State have met with the City of Boulder and County to determine the interest in a PAL (Provisionally Accredited Levee) agreement and/or certification."

Previous Occurrences

Colorado has a history of dam failure, with at least 130 recorded occurrences since 1890 (Source: Flood Hazard Mitigation Plan for Colorado, 2004). The Lawn Lake Disaster of 1982 caused four deaths and over \$31 million in property damage when a privately-owned dam failed on Forest Service Property above the Town of Estes Park in neighboring Larimer County.

According to historical data, to date, there have been no dam failures in Boulder County. Two dams were listed as unsafe at one time but have since been repaired and the unsafe rating removed.

Probability of Future Occurrences

Due to a lack of previous occurrences within the planning area, the recurrence interval for dam failure specific to the County cannot be calculated. The possibility for future dam failure remains, but the likelihood as a result of natural hazards is estimated to be extremely low, or **unlikely**, with less than a 1% chance of occurrence in next 100 years.

Magnitude/Severity

According to the information in this hazard profile, a dam failure's potential impact on the County is **catastrophic**, with shutdown of facilities for more than 30 days and/or multiple deaths.

Climate Considerations

Most dams and levees were constructed based on historic conditions and the climate of their time rather than including consideration of climate change. The mechanisms to deal with precipitation variability and extremes have often not been put in place making dams and levees infrastructure at high risk to the impacts of climate change. Climate change increases air temperatures resulting in increased moisture in the atmosphere and thus, increased precipitation during extreme storms. Extreme precipitation events put more stress on dam and levee infrastructure and increase the likelihood of the need for slow release or strategic flooding to prevent dam failure. Additionally, dams are likely to suffer from increase drought conditions impacting storage and dam effectiveness.

Furthermore, dams with bigger surface area will be impacted by increasing temperatures which increases the rate of evaporation. Increased evaporation in the region can result in a change in moisture content in the air leading to increased heavy precipitation events. This makes dams a factor in climate change and creates a regional concern since dams with larger surface areas outside of Boulder County can impact and increase heavy precipitation events within the County.

Ecological Considerations

There are a range of ecological impacts of dams. Many of the documented ecological impacts are from dams being newly constructed and damaging ecosystems. Typically issues around new dams include downstream impacts to ecosystem services, loss of vegetation and wildlife and impacts to existing species. However, existing dams are also an ecological threat. Dam failures have the potential to wipe out entire areas harming wildlife that depend on those spaces for survival and vegetation. Although nature tends to recover over time, climate change will make that recovery harder and impacts to soil nutrients and water quality are likely to be long-term impacting flora and fauna. Additionally, lack of vegetation and vegetative growth can lead to erosion and soil destabilization while trapped nutrients upstream can lead to harmful algae blooms.

Overall Hazard Significance

The overall hazard significance for dam failure is **high**. This assessment considers a relatively low probability but potentially catastrophic magnitude and widespread impacts to infrastructure, property, and public safety in the dam inundation zone.

4.3.5 Drought

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Drought	Extensive	Likely	Catastrophic	Substantial	High

Description

Drought is a gradual phenomenon. Although droughts are sometimes characterized as emergencies, they differ from typical emergency events. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends.

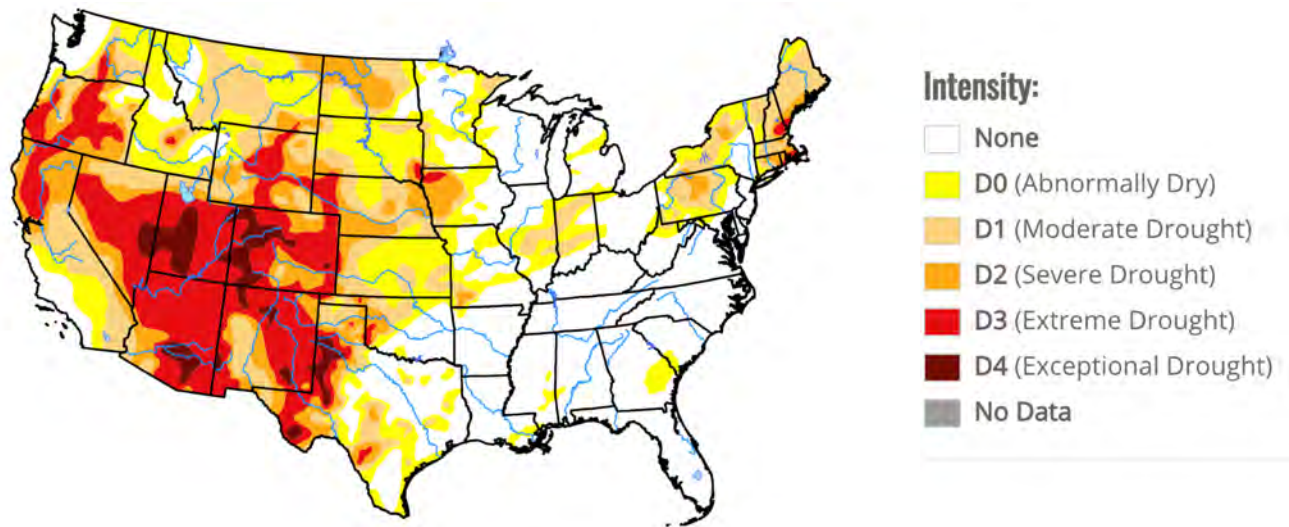
Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area’s usual water-consuming activities. Drought can often be defined regionally based on its effects:

- **Meteorological drought** is usually defined by a period of below average water supply.
- **Agricultural drought** occurs when there is an inadequate water supply to meet the needs of the state’s crops and other agricultural operations such as livestock.
- **Hydrological drought** is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels.
- **Socioeconomic drought** occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

With its semiarid conditions, drought is a natural but unpredictable occurrence in Colorado. Due to natural variations in climate and precipitation sources, it is rare for all of Colorado to be deficient in moisture at the same time. However, single season droughts over some portions of the state are quite common. Defining when a drought begins is a function of drought impacts to water users. Hydrologic conditions constituting a drought for water users in one location may not constitute a drought for water users elsewhere, or for water users that have a different water supply. Individual water suppliers may use criteria, such as rainfall/runoff, amount of water in storage, or expected supply from a water wholesaler, to define their water supply conditions. The drought issue is further compounded by water rights specific to a state or region. Water is a commodity possessed under a variety of legal doctrines.

Drought impacts are wide-reaching and may be economic, environmental, and/or societal. The most significant impacts associated with drought in Colorado are those related to water-intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. A reduction of electric power generation and water quality deterioration are also potential problems. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding. An ongoing drought may also leave an area more prone to beetle kill and associated wildfires. Drought impacts increase with the length of a drought, as carryover supplies in reservoirs are depleted and water levels in groundwater basins decline.

Figure 4-6 U.S. Drought October 2020



Social Considerations

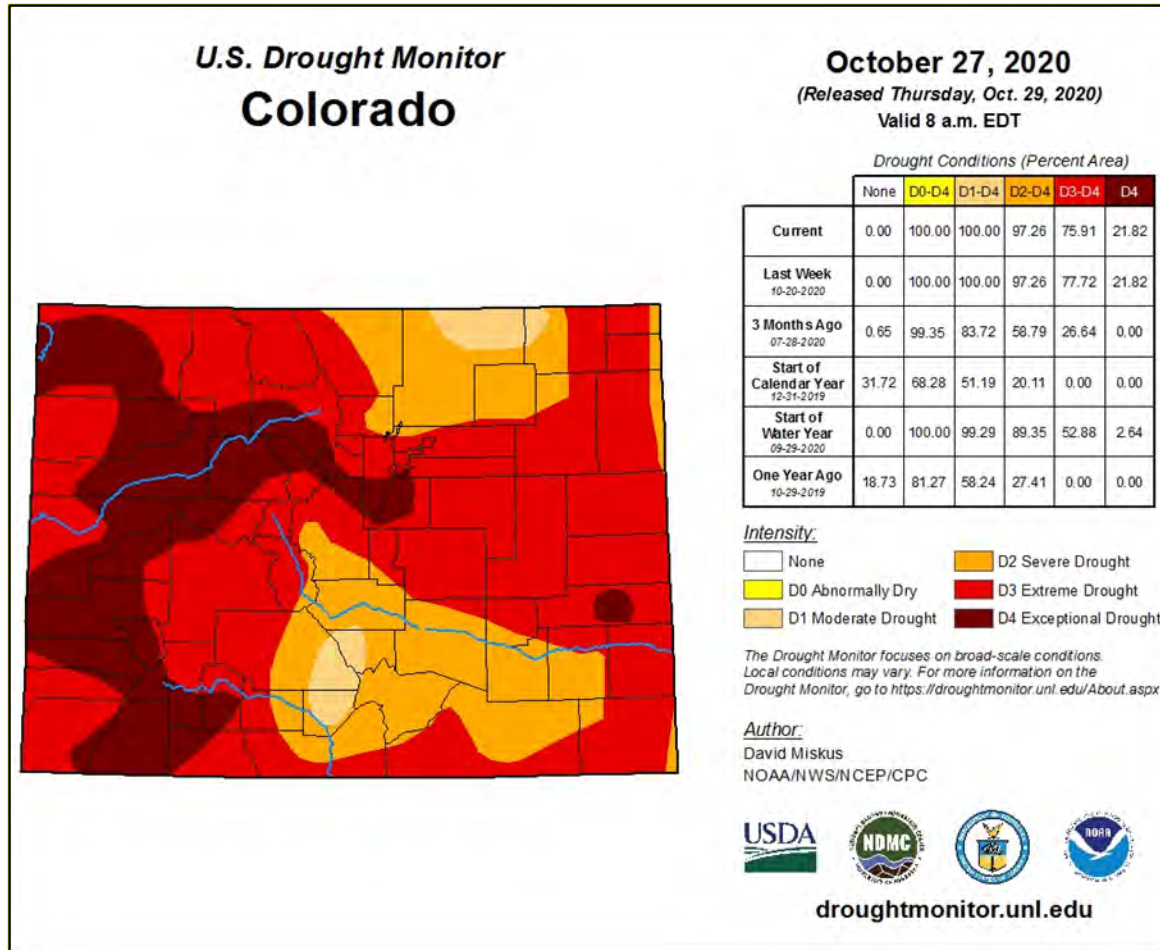
Food injustice and food insecurity disproportionately impacts BIPOC and low-income communities. For communities already experiencing difficulty accessing fresh and healthy food, drought will increase those challenges as the likelihood of crop loss increases. Additionally, BIPOC and low-income communities also tend to suffer from more respiratory illnesses and health conditions. Drought increases dust levels and dryness which can exacerbate respiratory problems and lead to other health conditions.

Water also plays a major role in the economy and supporting livelihoods. Access to water and use of water is inequitable. Often wealthier communities use more water and have a difficult time reducing water use in the event of a drought. Additionally, the agriculture sector relies heavily on water availability and both farmers and farm workers experience financial hardship and social strain related to ongoing drought conditions.

Geographic Extent

As a regional phenomenon, drought affects all areas of the planning area with roughly the same frequency and severity. Data from NOAA NCEI and Co Division 2 Data show, long-term droughts (consisting of three or more years of below average rainfall) tend to occur every 10-30 years without a defined pattern.

Figure 4-7 Example of Drought Extent in Colorado in 2020



Previous Occurrences

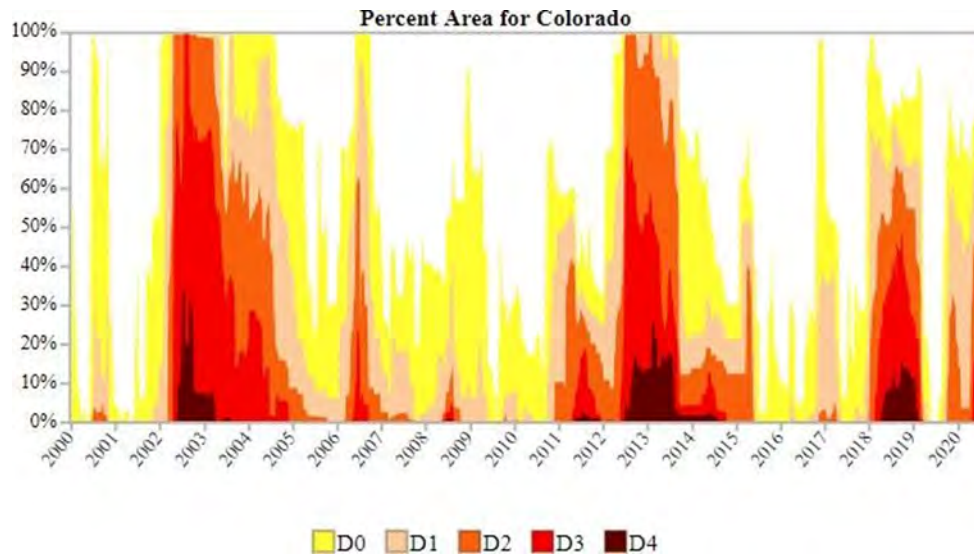
According to the 2007 Drought and Water Supply Assessment Update, Colorado has experienced multiple severe droughts. 2002 is still considered the driest year on record for the region. In 2006 and 2007, six basins in Colorado had below 80% of average snowpack, and recovered water supplies slowly as a result. Since 2006, the County has been slowly returning to non-drought conditions due to increased precipitation levels. Table 4-5 details the most significant drought periods in Colorado.

Table 4-5 Significant Colorado Drought Periods of the Modern Instrumented Era

Years	Worst Years	Major State Impact Areas
1890-1894	1890 and 1894	Severe drought east of mountains
1898-1904	1902-1904	Very severe drought over southwestern Colorado
1930-1940	1931-1934, 1939	Widespread, severe, and long-lasting drought in Colorado
1950-1956	1950, 1954-1956	Statewide, worse than the 1930s in the Front Range
1974-1978	1976-1977	Statewide, driest winter in recorded history for Colorado's high country and Western Slope
1980-1981	Winter 1980-1981	Mountains and West Slope; stimulated writing of the Colorado Drought Response Plan and the formation of the Water Availability Task Force

Years	Worst Years	Major State Impact Areas
2000-2006	2001-2002	Significant multi-year statewide drought, with many areas experiencing most severe conditions in Colorado in instrumented history
2011-2012	2011-2012	Southern part of the state was impacted the worst from the drought while Northern Colorado remained relatively above average

Source: *Drought and Water Supply Assessment, 2004*,
http://cwcb.state.co.us/Conservation/Drought/Drought_Water/index_DWSA.html



The HMPC identified the following as drought events of significance in Boulder County:

- **1930-1937:** The drought of the 1930s had the greatest impact on the agricultural industry. Poor farming techniques, low market prices, and a depressed economy compounded the problem.
- **1951-1957:** Similar to the drought of the 1930s, the drought of the 1950s once again impacted the agricultural industry. Improvements in irrigation and farming techniques mitigated the effects.
- **1976-1977:** This drought was characterized as a winter event, limited in duration. It was the driest winter in recorded history for much of Colorado's high country and western slope, severely impacting the ski industry.
- **1980-1981:** This drought, beginning in the fall of 1980 and lasting until the summer of 1981, also had costly impacts to the ski industry. According to the Colorado Drought Mitigation and Response Plan, this was considered to be the last severe and widespread drought to affect Colorado.
- **1994:** This growing season drought that impacted northeast Colorado was considered to be one of the driest years on record. Significant impacts included increased wildfires statewide, winter wheat crop losses, difficulties with livestock feeding, and declines in the state's fisheries.
- **1996:** On July 29, 1996, the Colorado governor issued a drought disaster emergency declaration. Fifteen southwestern counties were included in a request for U.S. Department of Agriculture (USDA) assistance. Boulder County was not one of the 15. Fall and winter precipitation alleviated further drought concerns.
- **2000:** Strong La Niña conditions created below average precipitation and above average temperatures for most months in 2000. Statewide, snowpack started out well below average but recovered to near average in March. However, an early snowmelt resulted in low stream flows, and by June, drought conditions began to affect most of the state. Conditions were most severe in the northeastern plains and the Rio Grande and San Juan/Dolores basins in the southwest. Wildfire conditions were extreme, and several fires were reported statewide. Agriculture also suffered. Dryland farming and ranching was affected the most. As of October 2000, 17 Colorado counties and 29 contiguous counties were eligible for assistance as a result of a USDA secretarial disaster designation. Boulder County was eligible for aid

as a contiguous county. By fall, weather patterns returned to near normal with average precipitation and below average temperatures.

- **May 2002:** The Colorado governor, for the first time in state history, asked the federal government to declare all of Colorado a drought disaster area. With an average temperature of 52.4 degrees, 2001 was the warmest year since 1986. The drought started in late 1999 and was compounded by scarce snowfall in 2001. 2002 was the driest year on record for the Denver region and much of the state. Total precipitation for 2002 was 7.48 inches. According to the Orodell gauge on Boulder Creek, 2002 was the worst single year on record for flow deficit.
- **2002-2006:** Damage to trees as a result of early twenty-first century drought conditions resulted in pruning and removal costs for both parks and streets estimated at approximately \$122,660.
- **2011-2012:** Even though 2011 was very wet across northern Colorado, the extreme drought during this time in Texas, New Mexico and Oklahoma was also felt in the Rio Grande and Arkansas Basins in Colorado. This trend continued in those basins as 2012 began, but also increased in breadth across the rest of Colorado. Based on the U.S. Drought Monitor, approximately 50% of Colorado was already under drought conditions at the beginning of 2012. Drought conditions and a period of extremely hot temperatures in June 2012 contributed to very dry forests, contributing to the conditions that led to the High Park fire in northern Colorado and the Waldo Canyon fire near Colorado Springs, two of Colorado's most destructive wildfires. Drought conditions also exacerbated the Lower North Fork fire in Jefferson County in March of 2012. Reservoir levels in many portions of the State helped abate some of the drought impacts seen in 2011-2013. Had the reservoir levels not been at levels sufficient for carryover storage into 2012 (due to record-breaking high snowpack in 2011) in many river basins, many of the impacts discussed above may have been worse.

The longest duration of drought (D1-D4) in Colorado lasted 395 weeks beginning on October 30, 2001, and ending on May 19, 2009. The most intense period of drought occurred the week of July 16, 2002, where D4 affected 34.37% of Colorado land. The Drought Impact Reporter contains information on 80 drought impacts from droughts that affected Boulder County between 1990 and 2007. The list is not comprehensive. Most of the impacts, 30, were classified as "agriculture." Other impacts include "fire" (16), "social" (14), "water/energy" (11), "environment" (7), and "other" (2). These categories are described as follows:

- **Agriculture:** Impacts associated with agriculture, farming, and ranching. Examples include damage to crop quality, income loss for farmers due to reduced crop yields, reduced productivity of cropland, insect infestation, plant disease, increased irrigation costs, cost of new or supplemental water resource development, reduced productivity of rangeland, forced reduction of foundation stock, closure/limitation of public lands to grazing, high cost/unavailability of water for livestock, and range fires.
- **Water/Energy:** Impacts associated with surface or subsurface water supplies (i.e., reservoirs or aquifers), stream levels or stream flow, hydropower generation, or navigation. Examples include lower water levels in reservoirs, lakes, and ponds; reduced flow from springs; reduced streamflow; loss of wetlands; estuarine impacts; increased groundwater depletion, land subsidence, reduced recharge; water quality effects; revenue shortfalls and/or windfall profits; cost of water transport or transfer; cost of new or supplemental water resource development; and loss from impaired navigability of streams, rivers, and canals.
- **Environment:** Impacts associated with wildlife, fisheries, forests, and other fauna. Examples include loss of biodiversity of plants or wildlife; loss of trees from urban landscapes, shelterbelts, wooded conservation areas; reduction and degradation of fish and wildlife habitat; lack of feed and drinking water; greater mortality due to increased contact with agricultural producers, as animals seek food from farms and producers are less tolerant of the intrusion; disease; increased vulnerability to predation; migration and concentration; and increased stress to endangered species.

- **Fire:** Impacts associated with forest and range fires that occur during drought events. The relationship between fires and droughts is very complex. Not all fires are caused by droughts and serious fires can result when droughts are not taking place.
- **Social:** Impacts associated with the public, or the recreation/tourism sector. Examples include health-related low-flow problems (e.g., cross-connection contamination, diminished sewage flows, increased pollutant concentrations, reduced firefighting capability, etc.), loss of human life (e.g., from heat stress, suicides), public safety from forest and range fires, increased respiratory ailments; increased disease caused by wildlife concentrations, population migrations, loss of aesthetic values; reduction or modification of recreational activities, losses to manufacturers and sellers of recreational equipment, and losses related to curtailed activities.
- **Other:** Drought impacts that do not easily fit into any of the above categories.

Probability of Future Occurrences

Based on patterns of previous occurrence, future probability is considered **likely**, with 10-100 percent chance of occurrence in the next year.

Magnitude/Severity

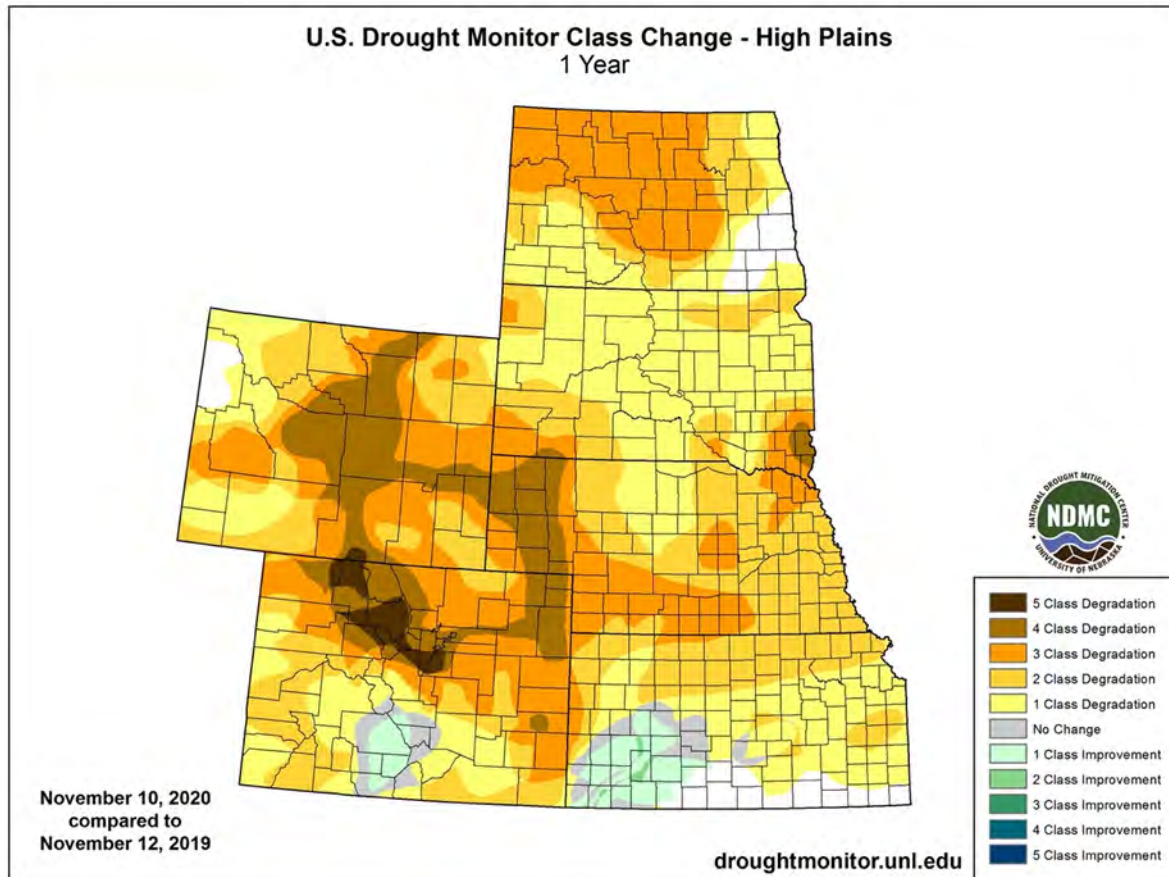
Based on assessments of potential damage to property and disruptions to commerce and day-to-day life, the magnitude and severity of drought in Boulder County is considered **catastrophic**, with the potential shutdown of facilities for 30 or more days and widespread agricultural and resource damage.

Climate Considerations

Increasing global surface temperatures and precipitation variability create conditions that make droughts more likely and persistent in the near future. Droughts have cascading impacts that increase the likelihood of other hazard events. For example, prolonged drought-like conditions dry out vegetation and reduce water supply. This creates the optimal conditions for wildfires while also making it harder to fight those wildfires. Drought conditions also impact trees and forests, increasing tree mortality and leading to more dead vegetation that is perfect for starting and spreading wildfires quickly.

Another secondary impact of drought is land subsidence which is caused from groundwater pumping. Groundwater pumping occurs in both drought and non-drought times; however, demands for water during droughts often increases to keep crops alive and support urban and rural spaces. Water demand leads to increased pumping at the subsurface which can lead to the Earth's surface slightly sinking and can have much larger long-term impacts such as permanent damage to underground aquifers.

Figure 4-8 Drought Monitor Map



Ecological Considerations

Drought conditions, especially for a long period of time, have negative impacts on biodiversity. Wildlife including reptile, bird, mammal, and amphibian populations all depend on water availability from marshes, streams, rivers, and other water bodies. Drought conditions not only impact the amount of water available to wildlife and vegetation, but also the quality of water. Drought often results in lower water quality and increased water pathogens which impact wildlife

Overall Hazard Significance

The overall hazard significance for drought is **high**. This assessment is based on relatively high probability, potentially catastrophic magnitude and widespread impacts to municipal and rural water supplies, agriculture, forests and increased fire risk.

4.3.6 Earthquake

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Earthquake	Extensive	Occasional	Catastrophic	Low	Medium

Description

An earthquake is caused by a sudden slip on a fault. Stresses in the Earth's outer layer push the sides of the fault together. Stress builds up and the rocks slip suddenly, releasing energy in waves that travel through the Earth's crust and cause the shaking that is felt during an earthquake. The amount of energy released during an earthquake is usually expressed as a Richter magnitude and is measured directly from the earthquake as recorded on seismographs. Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface as felt by humans and defined in the Modified Mercalli scale (see Table 4-6). Seismic shaking is typically the greatest cause of losses to structures during earthquakes.

Table 4-6 Modified Mercalli Intensity (MMI) Scale

MMI	Felt Intensity
I	Not felt except by a very few people under special conditions. Detected mostly by instruments.
II	Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing.
III	Felt noticeably indoors. Standing automobiles may rock slightly.
IV	Felt by many people indoors, by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle.
V	Felt by nearly everyone. Many people are awakened. Some dishes and windows are broken. Unstable objects are overturned.
VI	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls.
VII	Most people are alarmed and run outside. Damage is negligible in buildings of good construction, considerable in buildings of poor construction.
VIII	Damage is slight in specially designed structures, considerable in ordinary buildings, great in poorly built structures. Heavy furniture is overturned.
IX	Damage is considerable in specially designed buildings. Buildings shift from their foundations and partly collapse. Underground pipes are broken.
X	Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked. Considerable landslides occur on steep slopes.
XI	Few, if any, masonry structures remain standing. Rails are bent. Broad fissures appear in the ground.
XII	Virtually total destruction. Waves are seen on the ground surface. Objects are thrown in the air.

Source: Multi-Hazard Identification and Risk Assessment, FEMA 1997

Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, communication, and transportation lines. Other damage-causing effects of earthquakes include surface rupture, fissuring, settlement, and permanent horizontal and vertical shifting of the ground. Secondary impacts can include landslides, seiches, liquefaction, fires, and dam failure.

Colorado is considered a region of minor earthquake activity. Geologic studies indicate there are about 90 potentially active faults in Colorado with documented movement within the last 1.6 million years. Active faults, which represent the highest earthquake hazard, are those that have ruptured to the ground surface during the Holocene period (about the last 15,000 years).

Social Considerations

Junia Howell from Rice University conducted a study documenting the impact of natural disasters on different social groups. Howell found that when White Americans that go through a disaster, they have the highest wealth accumulation post-disaster whereas Black Americans have an overall loss of wealth. Earthquakes can cause tremendous damage. Most BIPOC people have been unable to acquire enough disposable income to purchase insurance or save money for a “rainy day”. Howell’s study found that there are three main factors that improve individual’s ability to recovery from a disaster: advanced education, assets such as home ownership, and savings in the bank. Three factors that institutional racism have kept BIPOC people from attaining. According to the New York Times, for every \$100 in White family wealth, Black families have \$5.04.

Earthquakes cause building damage, infrastructure damage and reduce access to resources. Not only are low-income, elderly, youth and BIPOC individuals impacted inequitably in the disruption due to lack of adequate housing and already scarce access to resources, but the aftermath has much more long-term consequences.

Geographic Extent

Geological research indicates that faults capable of producing earthquakes are prevalent in Colorado. There are about 90 potentially active faults in Colorado with documented movement within the last 1.6 million years. The map in Figure 4-9 indicates that potentially active faults exist in the vicinity of Boulder County that are capable of producing damaging earthquakes.

Figure 4-9 Colorado Major Fault Map



Source: State of Colorado NHMP, 2007

Faults have been classified based on the geologic time frame of their latest suspected movement (in order of activity occurrence, most recent is listed first):

- **H:** Holocene (within past 15,000 years)
- **LQ:** Late Quaternary (15,000-130,000 years)
- **MLQ:** Middle to Late Quaternary (130,000 - 750,000 years)
- **Q:** Quaternary (approximately past 2 million years)

Known faults in Boulder County include the Rock Creek (Q) and Vailmont (MLQ) faults. Other faults that

could affect Boulder County (e.g., other faults that were analyzed by the state for their potential impact on the County) are Frontal (LQ), Golden (Q), Mosquito (LQ), Ute Pass (MLQ), Valmont (MLQ), Walnut Creek (Q), Williams Fork (H) (see the Vulnerability Assessment section for the results of the state's analysis). The Golden, Ute Pass, and Walnut Creek faults, which could affect Boulder County, are three of the state's five potentially most damaging faults.

Based on the definitions set forth in the Hazard Profiles section, the geographic extent of earthquake hazard is considered **extensive**, with 50-100 percent of the planning area potentially impacted.

Previous Occurrences

According to the U.S. Geological Survey (USGS), eastern Colorado is nearly aseismic, with just a few epicenters in the Arkansas and Platte River valleys. Most shocks in the history of Colorado have been centered west of the Rocky Mountain Front Range. The first seismographs in Colorado of sufficient quality to monitor earthquake activity were installed in 1962. Newspaper accounts are the primary source of published data for earthquake events before that time.

The following is a summary of known earthquake activity in Colorado with a focus on the Boulder County region.

- **Since 1867:** More than 400 earthquake tremors of magnitude 2.5 or greater have been recorded in Colorado.
- **November 7, 1882:** On this day, the largest recorded earthquake in the state and the first to cause damage in Denver occurred. The epicenter is thought to have been located in the Front Range near Rocky Mountain National Park; the magnitude was estimated to be about 6.2 on the Richter scale. In Boulder County, the walls of the train depot cracked, and plaster fell from walls at the University at Colorado. The earthquake was felt as far away as Salina, Kansas, and Salt Lake City, Utah.
- **1962-1967:** A series of earthquakes occurred in the Denver-Boulder County area from 1962-1967. The earthquakes were felt by cities and towns within a 100-mile radius of Denver. Some people attribute this earthquake activity to deep- well injections conducted at the Rocky Mountain Arsenal starting in 1962. A few notable occurrences are detailed below.
- **1965:** Shocks on February 16, September 29, and November 20 caused intensity VI damage in the Commerce City area.
- **January 4, 1966:** A magnitude 5.0, intensity V earthquake occurred northeast of Denver.
- **April 10, 1967:** The Colorado School of Mines rated this earthquake of magnitude 5.0. The earthquake broke 118 windowpanes in buildings at the Rocky Mountain Arsenal, cracked an asphalt parking lot in the Derby area, and caused school officials in Boulder County to dismiss schools because of cracked walls. Legislators quickly moved from beneath chandeliers in the Denver Capitol Building, fearing they might fall.
- **April 27, 1967:** Minor damage was caused to walls and acoustical tile ceilings as a result of this magnitude 4.4 earthquake.
- **August 9, 1967:** Located northeast of Denver, this magnitude 5.2, intensity VI earthquake caused more than \$1 million in damage and is considered the most economically damaging earthquake in Colorado history.
- **November 27, 1967:** A magnitude 5.1, intensity VI earthquake occurred northeast of Denver.

Since 1971, there have been 12 to 15 earthquakes located north and northeast of Denver that were large enough to be felt in Boulder County.

Probability of Future Occurrences

Seismic hazard zone maps and earthquake fault zone maps are used to identify where such hazards are more likely to occur based on analyses of faults, soils, topography, groundwater, and the potential for

earthquake shaking that can trigger landslide and liquefaction. Typically, significant earthquake damage occurs when accelerations are greater than 30 percent of gravity.

The data show peak horizontal ground acceleration, including the shaking level that has a 10 percent chance of being exceeded over a period of 50 years. Boulder County lies in the range of 3-4 percent peak acceleration. In a worst-case scenario, Boulder County lies in the range of 10-12 percent peak acceleration. Thus, probability for an earthquake producing minor shaking is considered occasional and an earthquake causing significant damage is **unlikely**, with less than a 1 percent chance of occurrence over the next 100-year period.

Magnitude/Severity

Considering a worst-case scenario, the potential magnitude of earthquakes is catastrophic, with more than 50 percent of property severely damaged, shutdown of facilities for more than 30 days and/or multiple fatalities.

Climate Considerations

According to the U.S. Geological Survey, "the only correlation that's been noted between earthquakes and weather is that large changes in atmospheric pressure caused by major storms like hurricanes have been shown to occasionally trigger what are known as slow earthquakes, which release energy over comparatively long periods of time and do not result in ground shaking like traditional earthquakes do". There is not enough information at this time to connect climate change to increase or decrease in earthquake activity.

Ecological Considerations

Earthquakes have secondary earthquake environmental effects (EEE). These are typically landslides and liquefaction in areas like Boulder County. Large earthquake events can lead to destruction of infrastructure that carry hazardous waste, sewage, chemicals, and other toxins. In the event of a major earthquake, damages to human infrastructure and leaking of toxic substances into the surrounding environment is likely to have harmful long-term impacts to biodiversity, soil, water, and other species.

Overall Hazard Significance

The overall hazard significance for earthquake is **medium**. This assessment is based on low probability but potentially catastrophic magnitude and widespread impacts to public safety, property, and infrastructure.

4.3.7 Expansive Soils

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Expansive Soils	Significant	Highly Likely	Limited	Substantial	Low

Description

Expansive (swelling) soils or soft bedrock are those that increase in volume as they get wet and shrink as they dry. Expansive soils are also known as expansive clays and shrink-swell soils. Commonly, they are known as bentonite, expansive, or montmorillinitic soils. Swelling soils contain high percentages of certain kinds of clay particles that are capable of absorbing large quantities of water and expanding up to 10 percent or more as the clay becomes wet. The force of expansion is capable of exerting pressures of 20,000 pounds per square foot or greater on foundations, slabs, and other confining structures.

In Colorado, swelling soils tend to be at a constant moisture content in their natural state and are usually relatively dry prior to any construction disturbance. Exposure to water sources during or after development generally results in swelling. Colorado, with its arid or semiarid areas and seasonal changes in soil moisture, experiences a much higher frequency of swelling problems than eastern states that have higher rainfall and more constant soil moisture. Rocks that contain swelling clay are generally softer and less resistant to weathering and erosion than other rocks; therefore, expansive soil events occur more often along the sides of mountain valleys and on the plains than in the mountains.

Swelling soils are one of the nation's most prevalent causes of damage to buildings. Annual losses are estimated in the range of \$2 billion. In Colorado, the cost is estimated at \$16 million annually. Damage can include severe structural damage; cracked driveways, sidewalks, and basement floors; heaving of roads and highway structures; condemnation of buildings; and disruption of pipelines and other utilities. Destructive forces may be upward, horizontal, or both. Buildings designed with lightly loaded foundations and floor systems often incur the greatest damage and costly repairs from expansive soils. Building in and on swelling soils can be done successfully, although more expensively, as long as appropriate construction design and mitigation measures are followed.

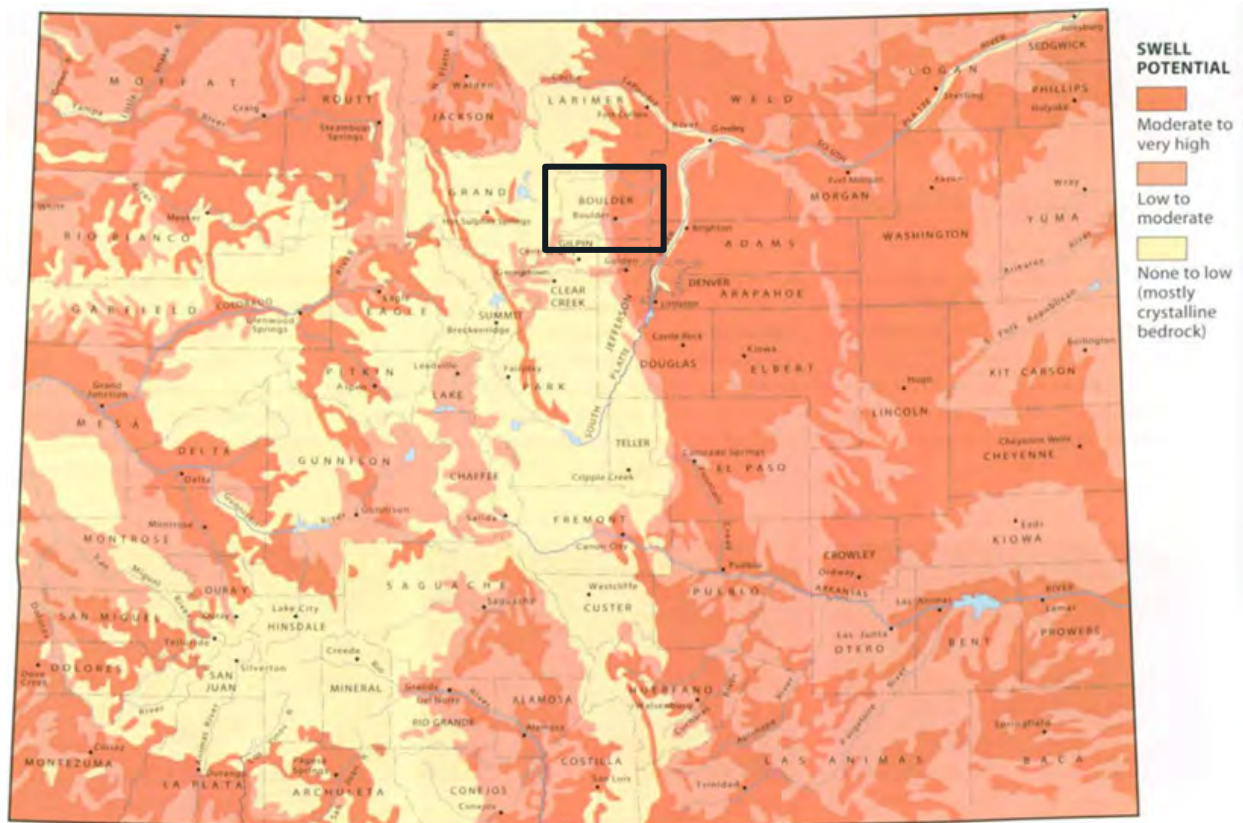
Social Considerations

Expansive soils cause damage to buildings and infrastructure. Most homeowner's insurance does not cover damage from expansive soils thus the burden is on the homeowner when damage does occur. In low-income areas people are less likely to have homeowners or renter's insurance to cover damage associated with impacts from expansive soils and are also less likely to have the funds to take proactive action. Damage from expansive soils usually takes place slowly and impacts driveways, sidewalks, and floors. When this damage goes unrepaired it can turn into additional issues such as flooding, mold and mildew growth, and structural damage. Although the American Society of Civil Engineers estimates that one in four homes in the United States will experience damage from expansive soils, low-income individuals are more likely to experience impacts due to inability to afford contractors, testing, and the continuous investment it takes to prevent damage.

Geographic Extent

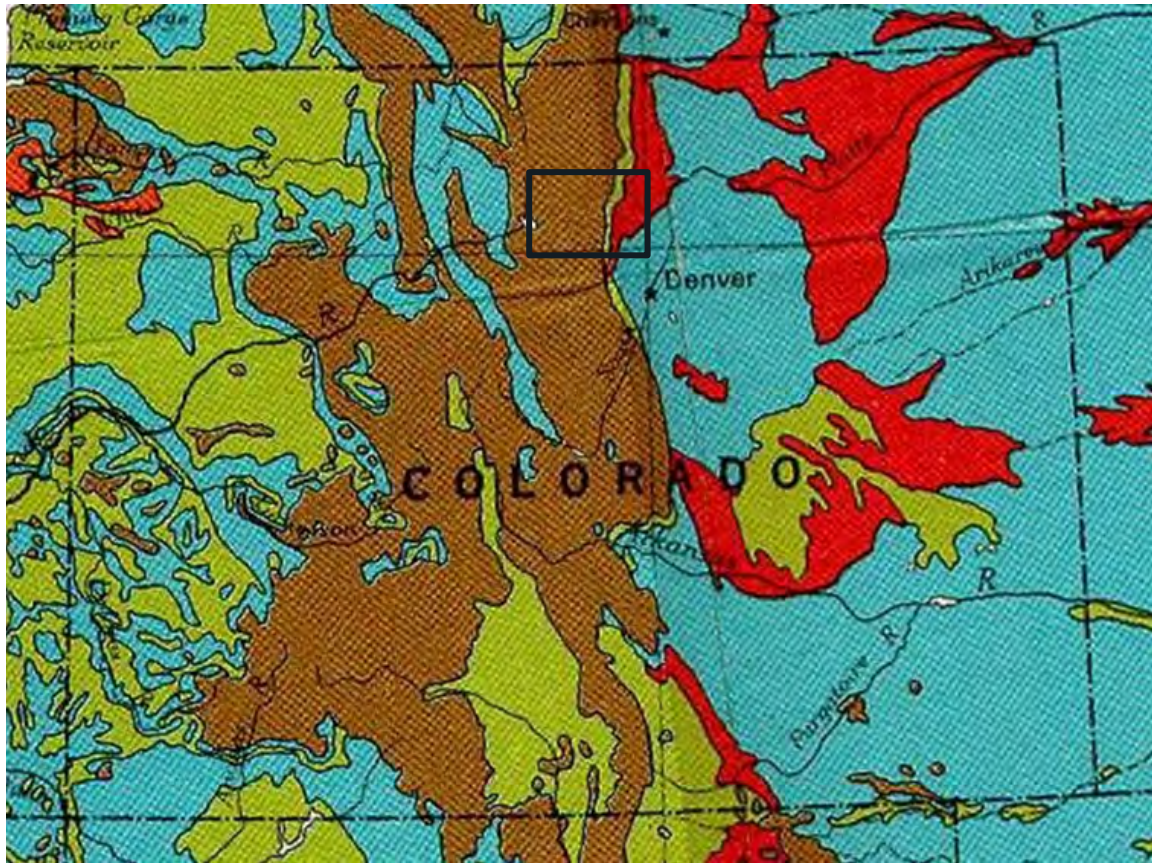
Figure 4-10 on the following page shows a large area of Boulder County consisting of soils with high swelling potential. The approximate location of Boulder County is indicated by the black box. Expansive soils tend to be most concentrated in the eastern sections of the planning area whereas the western sections of the County have significantly less occurrence of soils susceptible to swelling. Overall geographic extent is **significant**, with 10-50 percent of the planning area affected by concentrations of expansive soils.

Figure 4-10 Soil Map of Colorado- Swell Potential



This is a generalized map. The swell potential of soils at any specific location can only be determined by site-specific testing.
Map modified from "Shrink-Swell Potential" map, Colorado Land Use Commission, 1973.

Figure 4-11 Swelling Clays Map of Colorado



Source: U.S. Geological Survey publication "Swelling Clays Map of The Conterminous United States"; 1989;
http://arcvoid.com/surevoid_web/soil_maps/ks.html

Map Legend	
Red	Unit contains abundant clay having high swelling potential
Blue	Part of unit (generally less than 50%) consists of clay having high swelling potential
Orange	Unit contains abundant clay having slight to moderate swelling potential
Green	Part of unit (generally less than 50%) consists of clay having slight to moderate swelling potential
Brown	Unit contains little or no swelling clay
Yellow	Data insufficient to indicate clay content of unit and/or swelling potential of clay (Shown in westernmost states only)

Note: Black rectangle represents approximate location of Boulder County

Previous Occurrences

Damage of varying degrees of severity occurs on an ongoing and seasonal basis. The frequency of damage from expansive soils can be associated with the cycles of drought and heavy rainfall and also reflect changes in moisture content based on typical seasonal patterns. Published data summarizing damages specific to Boulder County is not available, but it is acknowledged that a certain degree of damage to property and infrastructure occurs annually.

Probability of Future Occurrences

Based on patterns of previous occurrences, probability of future occurrence is **highly likely**, with multiple

occurrences on an annual basis.

Magnitude/Severity

The magnitude of expansive soils is considered **limited**, based on the definitions established previously, with 10-25 percent of property severely damaged. This assessment considers that damage of severe magnitude does not occur in a single shrink-swell cycle, but rather over much longer time periods to the effect that building foundations, underground pipes and streets and highways must be replaced over shorter timeframes.

Climate Considerations

Climate change is likely to have significant impacts on expansive soils due to changes in the freeze-thaw cycles and the amount that soils shrink and swell. These changes will impact infrastructure such as roads, bridges, culverts, and sidewalks which will require more frequent replacement and maintenance. These same factors are likely to have significant impacts on residential and commercial buildings that are constructed on expansive soils leading to increases in damage to basements and building settlement, cracks in foundations and walls, damage to utilities and pipelines and movement in retaining walls.

State of Colorado law mandates that builders make homeowners aware if expansive soils are present and provide information about how expansive soils may impact their home. The same is true when a house is resold; the homeowner must disclose expansive soil conditions to the potential home buyer. However, most homeowners and purchasers are unaware of what that information means and how much worse soil swell will likely get with climate change.

Ecological Considerations

Expansive soils are different from other soils because of their tendency to shrink and swell due to interaction with water. In dry seasons, expansive soils shrink and cause cracks. In wet seasons, these soils swell leading to upheaval. Expansive soils are a natural environmental process and most of the ecological impacts are from actions taken to stabilize soils such as insertion of moisture barriers, engineering fills and chemical treatments. Treatments impact soil quality and soil pH levels. Expansive soils also have the potential to cause damages to natural landscapes and cultural resources.

Overall Hazard Significance

The overall hazard significance for expansive soils is **medium**. This assessment is based on high probability but relatively low potential public safety impacts and moderate impacts to property and infrastructure.

4.3.8 Extreme Temperatures

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Extreme Temperatures	Extensive	Likely	Critical	Severe	Medium

Description

Extreme Heat

According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Heat kills by taxing the human body beyond its abilities. According to the EPA “more than 1,300 deaths per year in the United States are due to extreme heat.... extreme heat contributes to far more deaths than the official death certificates might suggest”. According to the NWS, among natural hazards, only the cold of winter—not lightning, hurricanes, tornadoes, floods, or earthquakes—takes a greater toll. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the heat wave of 1980, more than 1,250 people died.

Heat disorders generally have to do with a reduction or collapse of the body’s ability to shed heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds the level the body can remove, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body’s inner core begins to rise, and heat-related illness may develop. Elderly persons, small children, chronic invalids, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions, especially during heat waves in areas where moderate climate usually prevails.

The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for the issuance of excessive heat alerts is when the maximum daytime high is expected to equal or exceed 105°F and a night-time minimum high of 80°F or above is expected for two or more consecutive days.

Extreme Cold

Extreme cold often accompanies a winter storm or is left in its wake. It is most likely to occur in the winter months of December, January, and February. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold can disrupt or impair communications facilities.

In 2001, the NWS implemented an updated Wind Chill Temperature index. This index was developed to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Social Considerations

Extreme temperatures are silent killers. High temperatures combined with humidity can take a significant toll on the human body leading to directly to heat-related illnesses and indirectly exacerbating pre-existing conditions. People with medical conditions often use medications that prevent the body from regulating temperature or can be in situations that make it difficult to movement into cooler or warmer spaces. Although heat-related deaths are often preventable, pre-existing medical conditions, social isolation,

poverty, educational attainment, age, and job type all play a role in increased vulnerability.

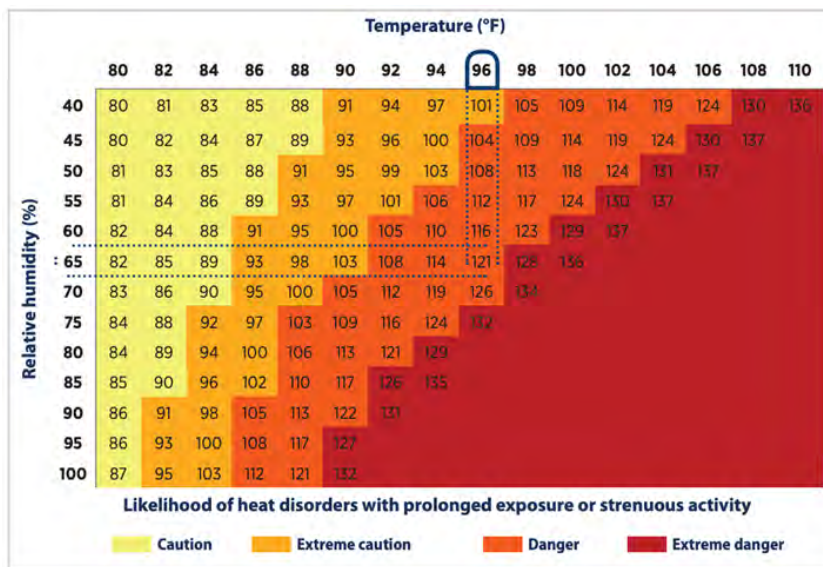
Due to centuries of discriminatory policies and practices, BIPOC communities have had less access to resources, wealth, insurance, and healthcare leading to increase vulnerability to extreme temperatures. Individuals who lack financial means to install temperature-regulating equipment or live in poor housing conditions with lack of insulation are more likely to succumb to extreme temperatures; especially if they lack housing entirely. There is a particular intersection with the COVID-19 Pandemic and extreme temperatures. As more people are unable to gather inside to access heating or cooling from common spaces such as movie theatres, malls or faith-based spaces, their bodies are exposed to extreme temperatures consistently and unable to regulate.

Additionally, children, those of advanced age, homeless, disabled, pregnant women, immigrants and low-income individuals are all populations more vulnerable to extreme temperatures. With heat, infants and small children lose water in their bodies at a faster rate than adults and without the ability to read their bodies well, children can end up with heatstroke, kidney issues and may even die. Additionally, elderly people's bodies often struggle to regulate temperature and are more likely to have pre-existing conditions that are exacerbated by extreme temperatures.

Centers for Disease Control and Prevention (CDC) data consistently shows that extreme cold poses a greater threat to human life than extreme heat. Although extreme heat data is often documented improperly and heat-related deaths are attributed to other factors, the important element to note is that "Weather-related death rates were 2 to 7 times as high in low-income communities as in high-income communities".

Outdoor workers are also at elevated risk from extreme temperatures. Landscapers, postal workers, farmworkers, and construction workers are a few examples of professions where risk is already high and is likely to increase. Agricultural workers often are immigrants. In the U.S., immigrant workers are three times more likely to die from heat than American citizens, especially from extreme heat events where the combination of exposure to the sun, fewer breaks, lack of adequate medical services and health insurance all play a factor.

Figure 4-12 NOAA's National Weather Service Heat Index Chart



Source: NOAA NWS

The NWS combines relative humidity and temperature to produce a heat index. The heat index is what

temperatures feel like to the human body and is utilized to provide warnings on excessive heat days. The heat index chart provides general guidance for when conditions can be dangerous however, dangerous conditions for some may be deadly conditions for others, especially if they lack resources and proper housing or are working in high exposure conditions.

The NWS utilizes wind chill charts and freeze warnings to alert people about extreme cold temperatures. The chart below provides air temperature and wind speed information and estimates the amount of time it will take for frostbite to set in if one was exposed to those conditions.

Figure 4-13 Wind Chill Chart

		AIR TEMPERATURE (F)																		
		50	45	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
WIND SPEED (mph)	5	48	42	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57
	10	46	40	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66
	15	45	38	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71
	20	44	37	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74
	25	43	36	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78
	30	42	35	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80
	35	41	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82
	40	41	34	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84
	45	40	33	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86
	50	40	33	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88
	55	40	32	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89
	60	39	32	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91
	65	39	32	24	17	10	2	-5	-12	-19	-27	-34	-41	-49	-56	-63	-70	-78	-85	-92
	70	38	31	24	16	9	2	-6	-13	-20	-27	-35	-42	-49	-57	-64	-71	-79	-86	-93
75	38	31	23	16	9	1	-6	-13	-21	-28	-36	-43	-50	-58	-65	-72	-80	-87	-95	
80	38	30	23	16	8	1	-7	-14	-21	-29	-36	-44	-51	-59	-66	-73	-81	-88	-96	
85	38	30	23	15	8	0	-7	-15	-22	-30	-37	-44	-52	-59	-67	-74	-82	-89	-97	
90	37	30	22	15	7	0	-8	-15	-23	-30	-38	-45	-53	-60	-68	-75	-83	-90	-98	
95	37	29	22	14	7	-1	-8	-16	-23	-31	-38	-46	-53	-61	-68	-76	-84	-91	-99	
100	37	29	22	14	6	-1	-9	-16	-24	-31	-39	-47	-54	-62	-69	-77	-84	-92	-100	
Approx frostbite times		30 min			10 min			5 min												

Source: Source: Colorado State University

Geographic Extent

In general, extreme temperatures affect broad regions that include all parts of Boulder County, and therefore the geographic extent is **extensive**, with 50-100 percent of the planning area affected. However, extreme heat tends to affect areas of lowest elevation in the eastern portion of the County with the greatest severity and areas of higher elevation experience extreme low temperatures with greater frequency and severity.

Previous Occurrences

For the eastern sections of Boulder County over the period 1948-2022, monthly average maximum temperatures in the summer months (June, July, and August) were in the low to mid-80s. The highest recorded temperature in eastern Boulder County was recorded in Longmont at 106°F on June 27, 1994, and July 7, 1973. On average, 33 days exceed 90°F each year.

Temperature patterns for the western sections of Boulder County were retrieved from two different monitoring stations in order to provide a more comprehensive time range for the climate data. The Nederland 2 NNE station had climate data available over the time period 1970-1988 and the Niwot station located just north of the CU Mountain Research Station had climate data available from 1989-2022. Between 1970 and 1988 the monthly average maximum temperatures in the summer months (June, July, and August) ranged from 69 to 75 degrees. The highest temperature recorded during this time period was 89 degrees on September 1, 1975. From 1989-2022 the average summer temperature was between 64 and 69 degrees,

and the record high was 94 degrees on June 15, 2006.

Probability of Future Occurrences

The probability of future extreme cold conditions and/or extreme heat is considered **likely**, with a 10-100 percent chance of occurrence in any given year. With Boulder County average daily temperatures project to increase and number of days over 95 degrees also likely to increase, extreme heat is **extremely likely** to occur.

Figure 4-14 Boulder County Average Daily Temp (Observed and Projected)

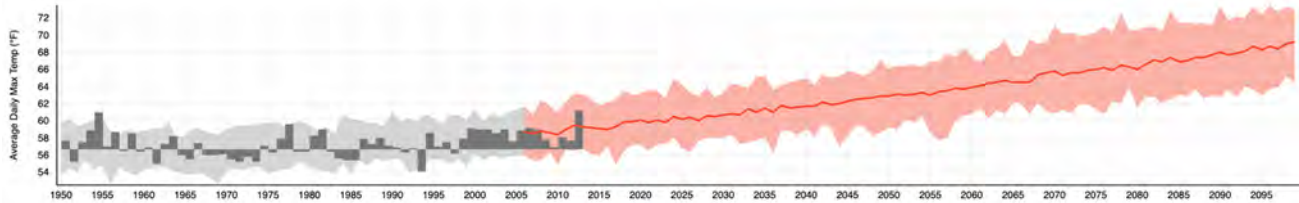


Figure 4-15 Boulder County Days Over 95 F (Observed and Projected)

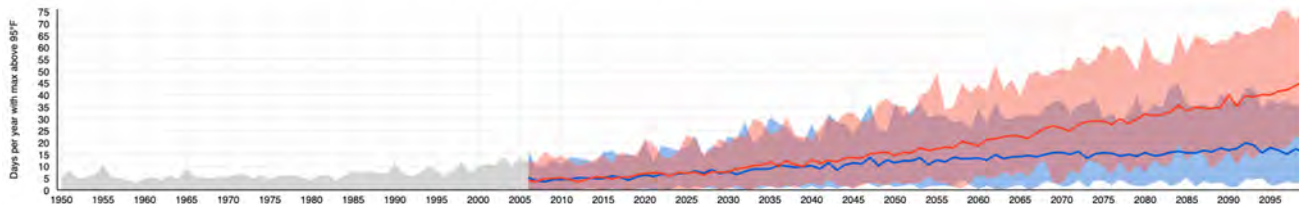


Chart Source: U.S. Climate Toolkit, The Climate Explorer

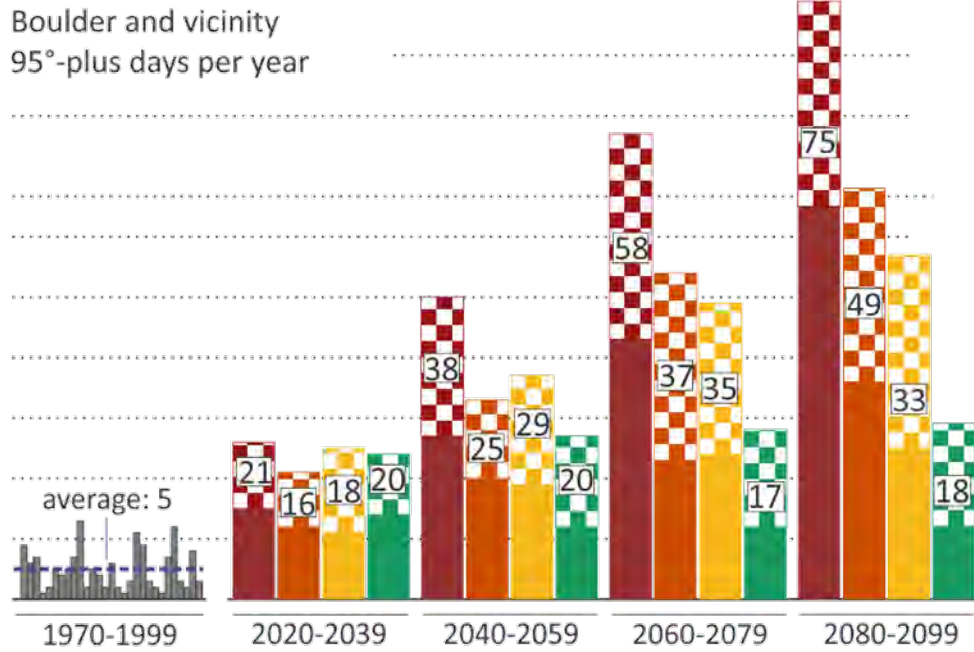
Magnitude/Severity

The magnitude and severity of extreme temperatures is classified as **critical**, with 25-50 percent of property or infrastructure severely damaged, and/or shutdown of facilities for two weeks or more, and/or injuries that result in fatality or permanent disability

Climate Considerations

Due to human actions, the planet is warming at an unprecedented rate. Warming conditions are already creating more severe extreme heat events. Within in the next 30 years, heat wave days are projected to increase from ten events per year to nearly 50 events per year. In addition to average temperatures increasing, dewpoint temperatures are also expected to rise leading to muggier summers. In Boulder County, there is likely to be an increase in the frequency and the extent of extreme heat events leading to more record-setting high heat days for prolonged periods of time.

Figure 4-16 Future 95 Degree+ Days in Boulder County



The figure above shows how the number of days 95° or hotter in Boulder could go from an average of five per year late in the last century to 75 per year late in this century. For future periods, the figure shows the range of the middle 80 percent of projections from multiple climate models (the checkered portions of the columns) and the medians (the numerals), for four possible levels of future heat-trapping emissions.

Ecological Considerations

Urbanization and increased amount of man-made landscape can lead to urban spaces being significantly warmer than surrounding natural areas. Concrete and asphalt absorb more of the sun's energy making landscape a factor in impacts from extreme temperatures. Natural spaces and ecosystems are impacted by the amount of impervious surface.

Water is one of the most impacted ecological elements from extreme temperatures. In high heat events, the demand for water increases to cool both people and infrastructure. This can reduce water supply, impact water quality and organisms in the water ecosystem. Additionally, high temperatures tend to increase the likelihood of algae growth which can impact fish and mammals.

Extreme temperatures can heavily impact ecological systems since temperature impacts both growth and distribution of a species. This includes plants and animals. High temperatures often lead to prolonged dry seasons, droughts and wildfires impacting accessibility to water and ability to migrate; even breeding patterns can be impacted.

Overall Hazard Significance

The overall hazard significance for extreme temperatures is **medium**. This assessment is based on high probability, moderate potential public safety impacts and moderate impacts to property and infrastructure.

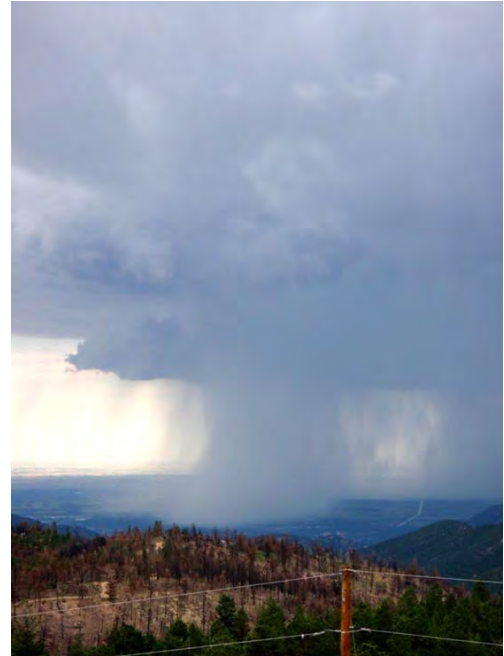
4.3.9 Flood

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Flood	Significant	Highly Likely	Critical	Severe	High

Description

Floods can be among the most frequent and costly natural disaster in terms of human hardship and economic loss and can be caused by a number of different weather events. Floods can cause injuries and deaths and substantial damage to structures, landscapes, and utilities. Certain health hazards are also common to flood events. Standing water and wet materials in structures can become a breeding ground for microorganisms such as bacteria, mold, and viruses. This can cause disease, trigger allergic reactions, and damage materials long after the flood. Direct impacts such as drowning can be limited with adequate warning and public education about what to do during floods. Where flooding occurs in populated areas, warning and evacuation will be critical to reduce life and safety impacts.

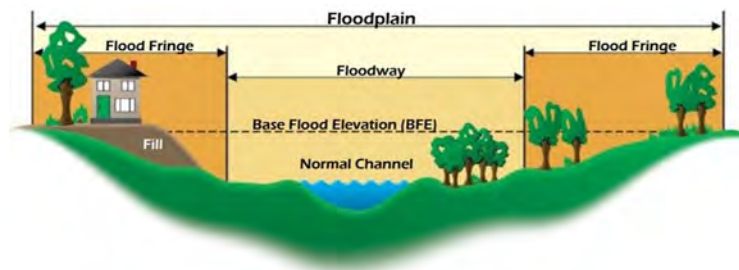
Risk of flooding in Boulder County is increased as a result of the burn scars such as that left by the Fourmile Canyon Fire in September of 2010. Heavy rainfall, especially in the form of cloudbursts, is alone capable of causing flooding, even more so if it occurs over the burn areas where vegetation has largely been lost. Floods caused by rainstorms can peak within a few minutes or hours of the rainfall, leaving little time for evacuation.



Floodplain Basics

The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a 1% chance in any given year of being equaled or exceeded. The 100-year flood is the federal minimum standard to which communities regulate their floodplains through the NFIP.

Figure 4-17 Floodplain Basics



Source: FEMA NFIP Guidebook, 2009

The potential for flooding can change and increase as a result of land use changes and changes to land

surface that change the floodplain. A change in environment can create localized flooding problems in and out of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity.

Types of Flooding in Boulder County

Communities in Boulder County are susceptible to various types of flood events as described below.

Riverine or Overbank Flooding

This type of flooding is defined as when a watercourse exceeds its “bank-full” capacity and is usually the most common type of flood event. Riverine flooding generally occurs as a result of prolonged rainfall, or rainfall that is combined with soils or drainage systems that are already saturated or overloaded from previous rain events. The duration of riverine floods may vary from a few hours to several days.

Factors that directly affect the amount of flood runoff include precipitation amount, intensity, and spatial and temporal distribution; the amount of soil moisture; seasonal variation in vegetation; snow depth; and the water resistance of the surface due to urbanization. The largest watersheds extend as far west as the Continental Divide and snowmelt in these watersheds dominates streamflow in late spring and early summer. Heavy rainfall on top of the snowpack can increase the rate of snowmelt and the extra runoff can produce significant flooding downstream. Other factors, such as debris blocking a waterway or channel, can further aggravate a flood event. In portions of Boulder County, development has altered the natural environment, changing and interrupting some of the natural drainage ways. As a result, drainage systems can become overloaded more frequently.

The most serious overbank flooding occurs during flash floods that result from intense rainstorms or following a dam failure. The term “flash flood” describes localized floods of great peak flow and magnitude and short duration. In contrast to riverine flooding, this type of flood usually results from a heavy rainfall on a relatively small drainage area. Flash floods by definition occur very quickly and may occur with little or no warning. Flash flood risk can be greatly increased when drainages are cleared of foliage that normally absorbs and slows the rate of runoff.

Irrigation Ditch/Canal Flooding

The eastern portion of Boulder County has more than 100 irrigation ditches and canals used to convey water collected in the mountain reservoirs to downstream users. Ditches convey irrigation water along hillsides, following contours and, as a result, cut across the natural drainage pattern of stormwater runoff flowing down hillsides. Although efforts are made to separate stormwater runoff and irrigation water, excessive runoff can flow into an irrigation ditch causing overbank flooding or a collapse of the ditch itself. Similar to flash floods, there is often little warning for these types of events.

Urban or Street Flood Events

These events occur due to the conversion of land from fields to roads and parking lots, which cause the land to lose its ability to absorb rainfall. Urbanization increases runoff two to six times over what would occur on natural terrain. Except at underpasses, street flooding and yard ponding usually do not exceed more than a foot or two and are often viewed more as a nuisance than a major hazard. However, during periods of urban flooding, high velocity flows can occur in streets, even in areas with only shallow flooding.

Until recently, the Lefthand Creek floodplain was devoted entirely to agriculture. Now, because of expanding population and industrialization, urban development has begun at both ends and in the middle of the study reach.

Development in the Floodplain

Development in narrow mountain canyons presents a unique flooding problem as the floodplain and floodway occupy essentially the entire canyon floor. Historically the mountain canyons were developed extensively with infrastructure, private residences, and small amounts of commercial and industrial property. Much of this development occurred along stream banks within the canyon floodways presenting a flooding hazard to those properties as well as debris hazards for downstream stream reaches. Since floodplain management regulations were incorporated into the Boulder County Land Use Code, new development is no longer allowed within the mountain canyon floodways which causes rise in Base Flood Elevation (BFE) and cannot get a CLOMR.

The county's flood mitigation efforts have been in place for many years. Codes and ordinances have been adopted prohibiting or controlling building in floodplains. Mitigation efforts, such as channelization and detention ponds, have been built and some high-risk buildings located in floodplains have been removed. A flood warning system, made up of stream and rain gauges, is in drainages. These gauges are monitored by the Boulder OEM during high-risk rain events and automatically transmit data to a computer in the Boulder Communications Center that sounds an alarm when significant amounts of rainfall occur and when rising stream levels are detected. A flood warning plan has been developed for Boulder County, which is exercised and updated annually. The southeast portion of the County is served by the Mile High Flood Control District. The following communities participate in the NFIP: unincorporated Boulder County, City of Boulder, Erie, Lafayette, Longmont, Louisville, Jamestown, Lyons, Nederland, and Superior. Boulder County and the cities of Boulder, Longmont, and Louisville participate in the NFIP's CRS, which provides flood insurance discounts to communities that implement floodplain management activities above and beyond the minimum standards.

Levees

For flood protection from Boulder Creek, a levee was constructed around the 75th Street Wastewater Treatment Plant. The levee was found to provide protection from the 1-percent annual chance flood, and it meets all of the requirements set forth in Section 65.10 of the NFIP regulations. If this levee were breached, damage to the wastewater treatment plant could result in release of untreated wastewater to the creek. A floodwall protects the Boulder County Justice Center, which was certified to provide 1% annual chance flood protection in recent years.

The University of Colorado South Campus Levee provides protection from the 1-percent annual chance flood event. If this levee were breached, no development beyond CU Boulder's tennis complex would suffer damage.

Flood protection measures along Coal Creek in the Town of Erie include channelization and the construction of levees from approximately 5,700 feet downstream to approximately 600 feet upstream of the Union Pacific Railroad. As a result of this project, the base flood and floodway are contained within the channel from approximately 2,750 feet down stream to the UPRR. The flooding associated with the Coal Creek West Line Overflow through the town has been eliminated. If this levee were to breach to the west, the flooding threat would be to the historic Briggs Street neighborhood in Erie. This area is outside of Boulder County but included here because it is within the municipal boundaries of Erie, one of the participating communities on the HMPC.

Other Flood Issues

All communities in Boulder County, both incorporated and unincorporated are experiencing population growth and resulting development. While a small portion of new development is occurring in the sparsely developed mountainous area of western Boulder County, the expected development in this area is unlikely to significantly affect the County's watersheds' hydrology and hydraulics related to runoff in Boulder County

streams. The bulk of new development in the County is expected to occur in the high plains areas to the east of the Front Range Foothills. Increased development will likely include all typical types of land uses including residential, commercial, and industrial. Where development occurs outside of established floodplains, it will contribute to increased stormwater runoff flowing to streams due to inevitable increases in impervious surfaces from new roads and buildings. The result will be an increase in potential for urban flooding as a result of a reduced capacity of the land to absorb precipitation.

Projections and land use plans suggest that an increase in population within previously developed portions of regulatory floodplains is expected in Boulder County. It is unlikely that floodwater conveyance would be significantly affected through these previously developed areas as building footprints and other urban infrastructure will remain relatively unchanged. The Boulder County Land Use Code also allows structures to be developed in the flood fringe portion of the base floodplain. However, the Boulder County Comprehensive plan requires that development be concentrated within the municipalities. While new structures in previously undeveloped portions of the floodplain will likely represent a small fraction of development within the floodplain, any new structures will present small, localized impediments to floodwaters. This type of flood fringe development is likely to occur in rural residential and agricultural areas in unincorporated portions of the high plains east of the Front Range Foothills.



Social Considerations

BIPOC and lower-income members of the community are often at most risk of flooding and flash flooding. Discriminatory lending and housing policies created structural inequity placing BIPOC families and those with lower incomes in high-risk areas that receive less investment in infrastructure and from private groups. Their homes are often in floodplains or are more susceptible to damage. This has led to the effects from floods not impacting all people equally.

Post-flood, these same individuals are being disproportionately affected due to insufficient aid and support programs. Federal disaster and recovery programs are slow and often make inequities worse by prioritizing those with insurance, those with the ability to translate lengthy flood documentation forms, and those with the ability to hire legal teams. NFIP, HUD and FEMA programs utilize traditional cost-benefit assessments when assessing and prioritizing flood recovery efforts. For renters and low-income individuals, the value of their property is assessed and compared to wealthy areas with higher property values, thus leading to recovery money being allocated in higher income areas first. Additionally, flood insurance is typically expensive and for people living paycheck-to-paycheck, it is often unobtainable.

Geographic Extent

Boulder County has multiple creeks, tributaries, and associated floodplains that comprise the geographic extent of flooding throughout the planning area. Based on the definitions set forth previously, this extent is considered **significant**, constituting roughly 10-50 percent of the planning area. Refer to the map of flood hazards in Section 4.5.6.

Much of the floodplain is used for agriculture, thus the most common flooding impact is crop losses and damage to irrigation equipment and rural roads and bridges. There are also undefined, localized zones of flow-velocity hazard throughout the monitored section of Lefthand Creek. Generally, these zones are in the channel and near bridges.

All stream reaches east of the foothills, except for those on Fourmile Canyon Creek, are located within urbanized areas with occasional open space and park areas. The terrain of these sub-basins consists of mild

slopes with topsoil in the B and C hydrologic soils group with some D soils. Vegetation for most of the stream reaches is characteristic of urban areas. Fourmile Canyon Creek is located in sparsely developed agricultural areas. Vegetation along Fourmile Canyon Creek and the downstream reaches of Bear, Skunk, Goose, and Wonderland Creeks consists of natural grasses and weeds.

Previous Occurrences

The flood season in Boulder County is typically April 1 through September 30, but floods can happen at any time. The most dangerous flooding in Boulder County tends to occur from mid-July through early September due to heavy precipitation from thunderstorms and monsoonal rains. Creeks with mountainous, upstream watersheds are subject to flash floods as are urban streams and drainage ways. A flood event would most likely result from a heavy rainstorm that stalls over any of the creek basins with increased risk if it stalled over the Fourmile burn area. It could rain for as little as 20-30 minutes in the foothills before the water starts overflowing stream banks.

The state of Colorado's worst flash flood occurred on July 31, 1976, in the Big Thompson Canyon west of Loveland, claiming over 400 houses and 144 lives. Another catastrophic event occurred at Ft. Collins in 1997, when 14.5 inches of rain led to flooding that claimed five lives and caused \$200 million in damages.

The state of Colorado's second worst flooding event occurred on September 11, 2013. Three days of rain occurred prior to September 11, 2013, saturating the ground. Rainfall was continuous on the 11th and by 10 p.m. widespread flooding occurred, and the rain would not stop until late on September 14th, 2013. The rainfall during this period totaled 17 inches to the northern and southern areas of the County and eight inches of rain over the plains and foothills. Over 750 landslides occurred during this event. Extreme precipitation also caused numerous dams in the Front Range to fail, which added to the devastating nature of the flooding. Over 1700 homes were completely destroyed, ten deaths and damages exceeded \$2.5 billion. Boulder County had over 10,000 residences affected by flooding, over 800 homes destroyed, 150 miles of road wash out and four deaths. Major flooding events recorded within Boulder County include the following detailed by area/drainage:

Boulder Creek

- **May 23, 1876:** A general storm over the Boulder Creek basin created flooding on the plains of Boulder County up to one and a half miles wide.
- **May 29 to June 2, 1894:** This flood, caused by a downpour, washed away much of the City of Boulder's downtown district. Mountain rainfall, combined with snowmelt runoff, produced the greatest flood known in Boulder County and inundated the valley. Bridges, buildings, roads, and railroads were washed away. Every bridge in Boulder Canyon was swept away destroying the highway and railroads as far up the canyon as Fourmile Canyon Creek. Buildings were destroyed at Crisman, Sunset, and Copper creeks. The town was isolated from other Colorado communities for five days. Only one person was killed.

Records indicate that the floodplain was inundated by water over an area as much as one-mile wide for several days. Floodwater covered the entire area between Canyon Boulevard (previously Water Street) and University Hill to depths as great as eight feet. The rainfall amount has been estimated at 5.5 inches. Computations made 18 years later produced estimates of the peak discharge ranging from 9,000 cubic feet per second (cfs) to 13,600 cfs. This was considered a slow-rising flood and designated as a 100-year event. Agricultural damage included loss of livestock, crops, pastures, fences, and roads, and the deposition of sand and silt on floodplain lands. Although damage was extensive, a dollar amount was not estimated at that time.

- **July 8, 1906:** Heavy rains over Sunshine Canyon (an estimated 2.8 inches Saturday night through Sunday) led to extensive flooding. The water spread out at the point where the dry gulch comes into

Pearl Street, rushed down through gardens at the corner of Third Street, through Pearl, and down into Walnut and Railroad streets. Vast quantities of sand and debris were deposited on lawns and gardens. Water stood two feet deep on the platform at the Colorado and Southern passenger depot and the yards were so flooded that the tracks were not visible. By building a temporary wall at Third Street, people were able to direct the water in its natural channel across Pearl and down into Boulder Creek. The flooding did considerable damage to the Silver Lake ditch, which broke and contributed a considerable quantity of water to the flood and affected the west part of town.

- **June 1-2, 1914:** The peak discharge on the creek was estimated at 5,000 cfs. Numerous bridges were washed out between Colburn Mill and Boulder Falls. A portion of the main line for City of Boulder water system was destroyed.
- **June 2-7, 1921:** Rainfall totaled 3.36 inches in Boulder County. A peak discharge of 2,500 cfs was recorded on June 6, 1921.
- **September 4, 1938:** Maximum discharge of 4,410 cfs occurred near the mouth of Boulder Creek. Numerous bridges were destroyed.
- **May 6-8, 1969:** This flood was the result of a combination of snowmelt in the mountains and four days of continuous rainfall. Total precipitation for the storm amounted to 7.6 inches in Boulder County and 9.3 inches at the hydroelectric plant in Boulder Canyon. Bear Canyon Creek, Skunk Creek, and Two Mile Canyon Creek overflowed their banks. Damage from this storm was estimated at \$325,000. Schools were closed. The gauging records show that floods the size of the May 1969 flood occur on an average of about once every five years on Boulder Creek.
- **July 13, 2011:** The Fourmile Canyon Fire on Sept. 6, 2010, heavily damaged the canyon area. The wildfire destroyed 169 homes and severely burned over 6000 acres of land. On July 13, 2011, a thunderstorm released over $\frac{3}{4}$ inch of rain in an hour resulting in a flow of over 1800 cfs. This caused debris and mudslides in the Fourmile Canyon area and low impact flooding along Boulder Creek.
- **September 11, 2013:** Three days of rain saturated the ground prior to September 11, 2013, causing high surface runoff and landslides/ debris flows throughout Boulder County. The rainfall totals during this event delivered 17 inches causing widespread flooding. Boulder Creek drainage had eight inches of rain over this period and sustained approximately 5500 cfs causing localized flooding along the creek and student housing on CU Campus. The City of Boulder Water Treatment Center was impacted causing sewer backups and flood waters overtopped many roads to the east.

South Boulder Creek

- **September 2, 1938:** In the mountains west of Eldorado Springs, six inches of rain fell resulting in flooding that destroyed many buildings in the Eldorado Springs community and exceeded previous flood records dating back to 1895. Eldorado Springs recorded 4.4 inches of rainfall. This resulted in a peak discharge of 7,390 cfs, which is the highest recorded flood on South Boulder Creek. The picture in Figure 4-18 shows the destroyed dancehall at the Eldorado Springs Resort.

Figure 4-18 Damage to Eldorado Springs Resort, 1938 Flood



- **September 11, 2013:** Three days of rain saturated the ground prior to September 11, 2013, causing high surface runoff and landslides/ debris flows throughout Boulder County. The rainfall totals during this event delivered 17 inches causing widespread flooding. South Boulder Creek drainage had 17 inches of rain over this period. Boulder Creek had peak stream flows estimated at 5,200 cfs. While this was less than half the stream flow rate observed during the 1894 Boulder flood, it is worth noting that the average mid-September stream flow for Boulder Creek is approximately 100 cfs.

Boulder County also identifies the following flood events at South Boulder Creek with peak discharges in excess of 1,000 cfs:

- June 3, 1895—1,130 cfs
- May 9, 1900—1,100 cfs
- June 20, 1909—1,340 cfs
- May 24, 1914—1,240 cfs
- June 6, 1921—1,440 cfs
- September 2, 1938—7,390 cfs
- June 21, 1947—1,290 cfs
- June 6, 1949—1,430 cfs
- June 18, 1951—2,370 cfs
- June 4, 1952—1,080 cfs
- May 7, 1969—1,690 cfs
- September 11, 2013 – 2,100cfs

Four Mile Canyon Creek

Fourmile Canyon Creek experiences occasional flooding with notable events occurring in 1916, 1941, and 1951. Railroad bridges were washed out in 1916 and 1941. Localized flooding along the lower reaches of Fourmile Canyon Creek occurs frequently. Damage and losses have generally been low because the area is somewhat undeveloped. However, this threat has increased significantly since the Fourmile Canyon Fire in September 2010.

- **July 23, 1909:** Heavy rains caused two injuries and two deaths as flash flooding occurred in Twomile Canyon and Fourmile Canyon creeks. Damage to bridges and pipelines also resulted. Boulder Creek was not highly affected.
- **July 30, 1916:** Heavy rain (one to three inches) centered over Fourmile Canyon caused a brief but strong flash flood causing flooding of farms and damage to roads, railroad, bridges, and irrigation ditches. Though the Folsom Street (then 26th Street) bridge crossing was covered with three feet of water, it was not damaged by the flood. The flood water was from 10 to 12 feet deep on the Terry

ranch. Damage was estimated at several thousand dollars (1916).

- **July 2-7, 1921:** Flooding in Coal Creek and Fourmile canyons occurred destroying numerous structures, injuring and killing livestock, and damaging bridges. The maximum recorded rainfall was 5.3 inches, and the greatest recorded rainfall intensity was 4.3 inches in six hours at Longmont. This flood was produced by a combination of rainfall and snowmelt.
- **July 13, 2011:** 1.18 inches of rain in a short period of time fell over the area, resulting in over 1200 cfs in Fourmile Canyon Creek. Water and debris flow damaged homes, but no injuries or deaths were reported.

Fourmile Creek

- **July 13, 2011:** 3/4" of rain in a short period of time fell over the area, resulting in over 700 cfs in Fourmile Creek. Water and debris flow damaged homes, but no injuries or deaths were reported.
- **September 11, 2013:** Three days of rain saturated the ground prior to September 11, 2013, causing high surface runoff and landslides/ debris flows throughout Boulder County. The rainfall totals during this event delivered 17 inches causing widespread flooding. In Four Mile Creek 8 inches of rain over this period and sustained approximately 1000 cfs causing localized flooding along the creek washing out roads and flooding homes.

Goose Creek

Significant flooding occurred in September 1951 and July 1954. The 1954 event damaged an addition to the community hospital that was under construction.

- **September 11, 2013:** Three days of rain saturated the ground prior to September 11, 2013, causing high surface runoff and landslides/ debris flows throughout Boulder County. The rainfall totals during this event delivered 17 inches causing widespread flooding. Goose Creek flooded homes and overtopped roads in the area.

Lefthand Creek

Significant flooding on Lefthand Creek occurred in 1864, 1876, 1894, 1896, 1918, 1921, 1938, 1949, 1951, 1963, 1969, 1973 and 2013. Details of some of these events follow:

- **June 1894:** Heavy rains combined with high spring runoff caused extensive flooding throughout Boulder County. Damage was extensive along Lefthand Creek, and bridges and roads were washed out. Buildings in Ward, Rowena, Glendale, and all the towns along James Creek (a tributary of Lefthand Creek) sustained heavy damage or were swept away. Damage to nearby mines was also extensive. Trees were uprooted, roads and railroads were destroyed, and ten families lost homes. James Creek grew to a width of 250 feet at some locations. 8.5 inches of rain from May 30 through June 1 was reported in Ward.
- **August 1913:** Jamestown suffered extensive flood damage in August 1913. Flooding damaged or destroyed most of the houses along the creek. All wagon and footbridges were destroyed, and Jamestown was isolated for two weeks when the access road washed out.
- **June 2-6, 1921:** The maximum recorded rainfall was 5.3 inches, and the greatest recorded rainfall intensity was 4.3 inches in six hours at Longmont. The storm lasted for five days. This flood was produced by a combination of rainfall and snowmelt. Although this storm caused overbank flooding, neither discharges nor damage were recorded.
- **September 3, 1938:** During this storm, showers were generally over the Lefthand Creek basin accompanied by isolated cloud bursts along the foothills and the lower elevations. A maximum peak discharge of 812 cfs was recorded at U.S. Highway 287 near Longmont.
- **June 4, 1949:** Heavy and prolonged rainfall, accompanied by runoff from snowmelt, caused overbank flooding on Lefthand Creek during May and early June. The high flow caused minor damage to

irrigation headworks, bridges, and farmlands. The peak discharge was 1,140 cfs.

- **August 3, 1951:** A heavy rainstorm occurred over the Front Range and foothills east of the Continental Divide from Boulder County to near Fort Collins, a distance of approximately 50 miles. One of the storm centers was on Lefthand Creek near the town of Niwot. At this storm center, total precipitation was unofficially reported to have been over six inches. Overbank flows occurred along most of the length of Lefthand Creek. Bridges, roads, crops, and irrigation structures were damaged.
- **May 7-8, 1969:** Three days of heavy snow and rain along with spring runoff caused a flood that damaged houses and businesses in Jamestown and caused major erosion damage to roads and bridges along James Creek. Peak discharge measurement on James Creek was 1,970 cfs. Precipitation totals of approximately eight inches were recorded in the James Creek Basin. The primary damage was done to the South Pratt Parkway Bridge, which was ultimately destroyed by the floodwater.
- **September 11, 2013:** Three days of rain saturated the ground prior to September 11, 2013, causing high surface runoff and landslides/ debris flows throughout Boulder County. The rainfall totals during this event delivered 17 inches causing widespread flooding. In Lefthand Creek over ten inches of rain fell over this period and sustained approximately 8500 cfs causing flooding to homes, damage to the Lefthand Water District infrastructure and washing out roads. One person died in their home when a debris flow caused by the ground saturation and rainfall.

St. Vrain Creek

St. Vrain Creek flood history dates back to 1844. Flooding also occurred in 1864, 1876, 1894, 1914, 1919, 1921, 1938, 1941, 1949, 1951, 1957, 1969, 1973, 1976 and 2013. Over the course of 100 years, floods along the St. Vrain Creek have destroyed farmland, roads, and bridges.

- **May 1876:** The flood was severe, and much valley farmland was flooded.
- **May 31, 1894:** All of the lower parts of Lyons were washed away, and 20 houses were destroyed or ruined. The St. Vrain Valley looked like a lake three miles wide. Peak discharge was estimated at 9,800 cfs, which made it greater than a 50- year event.
- **August 2, 1919:** Bridges on the North St. Vrain for about a ten-mile stretch were destroyed. Longmont and Lyons water mains up the canyon were torn out in many places. People living on the lowlands along the banks of the St. Vrain were flooded out. Peak discharge was estimated at 9,400 cfs.
- **June 2, 1921:** North and South St. Vrain creeks carried large volumes of water. Damage was done to bridges, sheds, and barns. The peak discharge at Lyons of 2,020 cfs was not indicative of conditions at Longmont because of heavy rain downstream from Lyons. Longmont recorded 5.9 inches. No estimate of the discharge at Longmont is available.
- **September 1-4, 1938:** Precipitation for the three-day period totaled 4.5 inches at Longmont. The peak discharge at Lyons was only 1,650 cfs, while it was estimated to be 8,360 cfs near the mouth of the St. Vrain Creek. Highways were underwater, some bridges were washed out, and many residents near the creek were forced from their homes.
- **June 2, 1941:** Overbank flooding as a result of four inches of rain in the Longmont area caused damage or destruction of homes, businesses, bridges, roads, water lines, crops, livestock, and irrigation structures. The peak discharge was 10,500 cfs.
- **June 4, 1949:** All bridges between Longmont and Lyons were impassable when the St. Vrain peaked at 6,700 cfs. A total of 16 bridges were damaged. Two were completely destroyed. Irrigation headworks were extensively damaged. In Longmont, ten homes and five businesses were flooded.
- **August 3, 1951:** Lyons received 6.3 inches of rain from a cloudburst, causing flooding from Lyons to the mouth of St. Vrain Creek. The peak discharge was 3,700 cfs at Lyons and 6,200 cfs at a point seven miles east of Longmont. Railroad and highway bridges near Longmont were severely damaged. The flood lasted for less than 12 hours. Severe damage resulted to Colorado Highway 7 along South St. Vrain Creek. In the rural areas downstream from Lyons, many grain stocks were washed from the fields.

- **May 8-9, 1957:** Three to five inches of rain fell over the entire St. Vrain basin, peaking at 3,060 cfs in Lyons. Irrigation works and bridges between Lyons and Longmont were damaged or destroyed.
- **May 4-8, 1969:** Three days of heavy snow and rain along with spring snow melt / runoff caused flooding which damaged two bridges in Lyons, 14 bridges outside of town, numerous town streets and other property. Highways 7 and 36 were closed. Roads and bridges along streams were damaged, stream banks were eroded, and farmlands were flooded. The peak discharge at Lyons was 2,900 cfs on May 7 and 10,300 cfs on May 8.
- **June 15-21, 1969:** Roads and bridges along the stream were extensively damaged, stream banks were eroded, and farmlands were flooded.
- **August 10, 1994:** approximately three inches of rain fell in a period of 30 minutes in Lyons. An urban flash flood resulted when the drainage system was unable to manage the large amounts of water. Damage to streets alone was \$65,000. There were no reported deaths or injuries. The property damage was estimated at \$213,000 and other damage to streets was \$65,000. Highways 7 and 36 were closed as a result.
- **September 11, 2013:** Three days of rain saturated the ground prior to September 11, 2013, causing high surface runoff and landslides/ debris flows throughout Boulder County. The rainfall totals during this event delivered 17 inches causing widespread flooding. In the Saint Vrain Basin 17 inches of rain fell over this period and sustained approximately 25,000 cfs causing flooding to the Town of Lyons, Hygiene, and Longmont. One person died while evacuating their home.

Twomile Canyon Creek

The worst flood on Twomile Canyon Creek occurred in September 1933. Other flooding events occurred in 1909 (see Fourmile event above), 1941, 1942, 1949, and 1965.

- **September 11, 2013:** Three days of rain saturated the ground prior to September 11, 2013, causing high surface runoff and landslides/ debris flows throughout Boulder County. The rainfall totals during this event delivered 17 inches causing widespread flooding. In Twomile Canyon Creek, approximately 6-8 inches of rain fell over this period. Homes were damaged by flooding and landslides in the area, roads washed out and two people died when their car was washed away in the flood waters.

Miscellaneous

- **May 30, 1896:** Flooding occurred in Marshall and Boulder County caused by locally heavy thunderstorms. Estimated rainfall was 4.6 inches. Large hail was also present during the storm.
- **August 19, 1896:** A cloudburst over Magnolia tore up the road beyond Salina and made Fourmile Canyon Creek impassable. Considerable damage was done to property in Salina. According to reports,

"Boulder has not had such a dashing rainstorm as that of yesterday afternoon for a long time." The lightning burned out the telephone of the Daily Camera office. The rise of the creek in the south part of town was so rapid and of such threatening proportions as to cause great anxiety for two or three hours to the people living in that section.

- **July 31, 1929:** Nearly five inches of rain fell causing flooding in Fourmile Creek, Boulder Creek, and South Boulder Creek. Water ran in streams down Boulder County streets and across University Hill lawns and sidewalks. Damage was estimated at \$4,000 to roads, bridges, and culverts. Principal damage was on 10th Street from Chautauqua to University

Avenue and 12th Street from University Avenue to Arapahoe. A large section of the Armstrong Bridge in Gregory Canyon was washed out and 150 feet of Baseline Road in front of the Chautauqua golf course was covered with rock and gravel. A cement sidewalk across Gregory ditch on Marine Street was washed out.



- **June 22, 1941:** Heavy rains caused flooding in areas of Fourmile Canyon Creek, St. Vrain Creek, Twomile Canyon Creek, and Boulder Creek. Flash floods swept a Longmont man to his death. The storm dropped one inch of rain and more to the north and west of the County. Roads, gullies, and some structures were damaged in several areas. Damage estimates were in the thousands of dollars (1941). The storm was centered over Sugarloaf Mountain and primarily affected Fourmile and St. Vrain canyons. Numerous roads were partially or completely destroyed.
- **August 20, 1982:** An estimated 2.1 inches fell in Rollinsville, a considerable amount for such high elevation at 9,370 feet above mean sea level.
- **May of 1995:** Boulder County received record rainfall (9.4 inches) that combined with above average snowfall in the mountains and caused flooding throughout Boulder County. St. Vrain Creek in Lyons and Longmont as well as lesser streams throughout the County overflowed. Boulder Creek ran at its highest level of the year but did not overtop its banks within the city limits. The biggest threat was a related mudslide at the base of Flagstaff Road that threatened six homes.
- **July 30, 1997:** Heavy rain and hail triggered a flash flood that sent a wall of water through the window of the financial aid office at the University of Colorado (CU). A pipe draining rainwater at the Coors Event Center broke and damaged ceiling tiles, carpets, and dressing rooms. In all, 10 CU buildings received water damage estimated at a total of \$100,000.
- **August 4, 1999:** Flooding and flash flooding problems developed over portions of the Front Range urban corridor as slow-moving thunderstorms dumped from 2 to 3.5 inches of rain in approximately three hours. Widespread flooding was reported in Boulder County as was damage to the University Memorial Center at CU.

Probability of Future Occurrences

Since the County has a significant history of flooding, it is clear the potential exists for more flooding in the future. According to the NCEI database maintained by NOAA, there have been 37 reported incidents of flooding or flash flooding in the County since 1997. Some of these include the same event but reported for

multiple cities, such as in the 2013 floods. However, this results in an average of approximately 1.5 flood events occurring somewhere in the County every year. Given this rate, the probability of future flooding occurrence is **likely**, considering the entirety of the planning area.

Magnitude/Severity

The magnitude and severity of floods is classified as **critical**, with significant threat to public safety, 25-50 percent of property severely damaged and the potential shutdown of facilities for at least two weeks. Severity of a flood event is determined by topography, precipitation, recent soil moisture conditions, degree of vegetation and impacts to people and property. These factors are then impacted by flood duration, depth, and flow-velocity rate. The greater the depth, the longer the duration and the higher flow-velocity rate, the increased likelihood of significant damages and loss of life.

Climate Considerations

In Colorado, half of the annual rainfall occurs in a short period of time; around 12 days of the year. With climate change, rainfall is expected to increasingly fall in a few concentrated days leading to more severe flooding. Drought and wildfires play a role in the impact of flood events. As the planet continues to warm, drought events will harden the soil and more frequent wildfires will remove water absorbers such as trees and vegetation. In turn, this will lead to more extreme flood events- especially as rainfall patterns become more variable. Cloudbursts are becoming more common as the climate changes. Warmer air means that more moisture can be held in the clouds which, in turn, leads to more rain. These extreme precipitation events quickly dump large amounts of water on smaller areas of land and are likely to lead to flash flood events.

Stratus Consulting produced the *Boulder County Climate Change Report* in 2012 and provided a general outlook on the expected effects of climate change on local natural systems and processes including those related to runoff and flooding. The report documented a seasonal shift in precipitation patterns with an increase in precipitation expected to fall between December through March and a decrease in precipitation in spring months of April and May. The report cites studies that suggest an increase in late winter and spring heavy precipitation events with two-year recurrence intervals and a decrease in events of similar recurrence intervals in the summer months. However, another study cited in the report suggests that precipitation events in the Front Range area with recurrence intervals of three years and greater will likely increase in intensity. The report summarizes the expected change in precipitation patterns by stating that research indicates a general decrease in event frequency but an increase in event intensity. It may be expected then, that more intense events will have the potential to affect areas beyond the acknowledged and regulated floodplains.

Ecological Considerations

Flooding can have both positive and negative impacts on the environment and ecosystems. On the positive side, floods are natural and aid in biological productivity and replenishing of rivers, streams, and lakes. Ecological systems can also benefit communities and help to reduce flooding. For example, wetlands are valuable natural areas that protect wildlife and provide natural floodplain protection. They help to reduce flow rates and capture water and then slowly release it while also removing sediment brought in by floodwaters.

On the negative side, floods can lead to environmental degradation, erosion, and sedimentation. Flash floods produce fast moving water that erodes away riverbanks and can bring pollutants and other debris into riverbeds, creating sediment deposits, polluting the water, and potentially leading to huge debris removal efforts. Flash floods can also have negative impacts on small animals and those that burrow who are unable to escape quickly. They may bring human waste and litter into waterways, negatively impacting fish and other parts of the riverine ecosystem.

Overall Hazard Significance

Based on assessments of probability, risk to public safety and property, the overall hazard significance for flooding is **high**.

4.3.10 Hailstorm

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Hailstorm	Extensive	Likely	Limited	Moderate	Low

Description

Hail is associated with thunderstorms that can also bring high winds and tornadoes. It forms when updrafts carry raindrops into extremely cold areas of the atmosphere where they freeze into ice. Hail falls when it becomes heavy enough to overcome the strength of the updraft and is pulled by gravity towards the Earth.

Hailstorms occur throughout the spring, summer, and fall in the County, but are more frequent in late spring and early summer. Hailstones are usually less than two inches in diameter and can fall at speeds of 120 mph.

Severe hailstorms can be quite destructive. In the United States, hail causes more than \$1 billion in damage to property and crops each year. In 2005, hail and wind damage made up 45 percent of homeowners' insurance losses. Much of the damage inflicted by hail is to crops. Even relatively small hail can shred plants to ribbons in a matter of minutes.

Vehicles, roofs of buildings and homes, and landscaping are the other things most commonly damaged by hail. Hail has been known to cause injury to humans, and occasionally has been fatal.

Hail is a major cause of property damage in the plains just east of the Rockies. The past 30 years have brought one catastrophic hailstorm after another to the Front Range. One of these large storms occurred on July 11, 1990, when Denver took a direct hit by hail during a severe thunderstorm. Damage totals close to \$600 million were reported—the greatest property losses from hail ever reported from one storm up to that time and one of the most expensive natural disasters to affect Colorado.

Colorado's Front Range is located in a region known as "hail alley" encompassing land from Texas up to North Dakota. This region is known for the highest amount of large hail in North America and as population continues to grow in Boulder County, so does the potential for more costly impacts from hailstorms. From 2017-2019, Colorado was ranked as the state with the second highest number of hail loss claims, just behind Texas.

Social Considerations

Hail causes significant damage to homes and vehicles. For low-income individuals, the quality of housing is often insufficient to handle a hailstorm. Cheaper construction materials such as vinyl siding are often used on mobile homes or in low-income housing. Although they help improve affordability, siding is easily damaged by hail and severe hailstorms can leave homes with siding and weak roofs looking like Swiss cheese. Currently, Coloradans have the third fastest-rising homeowners insurance rates in the country.

Additionally, low-income vehicle-owners, homeowners and renters are often unable to afford insurance which can assist with repair from hail damage. As hailstorms are often difficult to predict, they are also difficult to avoid and very few alternative options are available to low-income members of the community.

Hailstorms also impact the agricultural sector. Local farms can go from having a field nearly ready to harvest to a field of completely destroyed crops in a matter of minutes. Hailstorms impact crops and hurt livestock leading to loss in revenue for local farms and impacting livelihoods of farmers and agricultural workers.

Geographic Extent

Hailstorms can occur across broad regions that includes all sections of Boulder County. The geographic

extent is **extensive**, with 50-100 percent of the planning area exposed to hailstorm impacts.

Previous Occurrences

A study conducted in 1994 by the state climatologist looked at recorded hail statistics from 1973 to 1985 and from 1986 to 1993. The data used for this study is limited as systematic observations of hail are taken only at a small number of weather stations. Therefore, this study relied on point weather station data from a small number of sites in and near Colorado along with statewide data on severe hailstorms obtained from the national publication, Storm Data. Further, since hail occurs only briefly and tends to be very localized, many storms go undetected by the official weather stations. Regardless, by analyzing the existing data, this study uncovered the following statistics regarding hailstorms in Colorado:

- The hail season in Colorado begins in March and ends in October
- There has been an average of more than 130 reported severe hailstorms each year since 1986
- Overall, June has the highest frequency of days with hail with slightly more than ten on average
- Hail in Colorado is primarily an afternoon or evening phenomenon; 90 percent of all severe hailstorms reported between 1986 and 1993 occurred between 1:00 and 9:00 p.m.
- Hail usually only falls for a few minutes. Hail that continues for more than 15 minutes is unusual
- A study of 60 Fort Collins hail events showed the median duration to be six minutes
- The vast majority of hailstones that fall in Colorado are ½ inch in diameter or smaller
- The most common size range for damaging hail in Colorado is 1 to 1.5 inches in diameter
- Six percent of the reported severe hailstorms had maximum hailstone diameters of 2.5 inches or greater
- The maximum hailstone size reported in this study was 4.5 inches
- Hail frequency can be very variable. For example, there were only 25 severe hail days in 1988 compared with 51 in 1993
- Severe hail is not a statewide problem. It is limited to eastern Colorado beginning in the eastern foothills and extending across the eastern plains

Table 4-7 Colorado's Most Costly Hailstorms

Date	Location	Cost When Occurred (Millions)	2020 Dollars (Millions)*
May 8, 2017	Denver Metro	\$2.3 Billion	\$2.4 Billion
July 20, 2009	Denver Metro	\$767.6	\$923.5
July 11, 1990	Denver Metro	\$625.0	\$1.23 Billion
June 6-15, 2009	Denver Metro	\$353.3	\$425
July 28, 2016	Colorado Springs	\$352.8	\$379.4
June 6-7, 2012	CO Front Range	\$321.1	\$360.9
June 13-14, 1984	Denver Metro	\$276.7	\$687.3
June 18-19, 2018	North Denver and Denver Metro	\$276.4	\$284
July 29, 2009	Pueblo	\$323.8	\$280
October 1, 1994	Denver Metro	\$225.0	\$391.8
September 29, 2014	Denver Metro	\$213.3	\$232.5
May 22, 2008	Windsor	\$193.5	\$231.9

Source: Rocky Mountain Insurance Information Association

Data from the NCEI and SHELDUS identified 109 hail events in Boulder County between January 1, 1955, and November 30, 2014, with hailstones at least one inch in diameter 65 times. Of these, the following hail events resulted in reported damage to people or property:

- **August 2, 1986:** Hailstones of 1.75 inches caused six injuries.

- **July 1989:** A storm caused hail damage in the City of Boulder and Lafayette.
- **July 1990:** A severe hailstorm caused massive hail damage, localized flooding, and rockslides on Highway 119 at the mouth of Boulder Canyon.
- **September 17, 1993:** Hailstones of 0.75 inches (in Lafayette) caused \$5,000 in property damage.
- **July 12, 1996:** Hailstones of 1.25 inches (in Broomfield) caused \$1 million in property damage. Large hail, strong winds, and heavy rain caused substantial damage to property in portions of Boulder County and northern Jefferson County. Damage estimates in the Broomfield area alone were approximately \$1 million.
- **June 28, 2013:** Severe thunderstorms developed over the Front Range Foothill of Boulder, Larimer, and Gilpin Counties; then spread east into the urban corridor and adjacent plains. Large hail, ranging from quarter to golf ball size, was reported. In addition, damaging thunderstorm winds snapped large branches and knocked down power lines.
- **May 2017:** Colorado was hit with its costliest hailstorm in history, a battery that triggered 267,000 claims in the Denver region and caused \$2.3 billion in damages, according to the Rocky Mountain Insurance Information Association (RMIIA).
- **2018:** Colorado surpassed Texas as the costliest state for hail damage to homes and vehicles as reported by State Farm.
- **June 18, 2018:** Severe thunderstorm hit Boulder County with 1.25-inch hail causing 1.3 million dollars in agricultural losses and personal property beyond reported losses.
- **July 07, 2019:** A severe thunderstorm was located five miles northeast of sunshine, or 30 miles northwest of Denver, moving east at 10 mph (radar indicated). Hazards include quarter size hail. Damage to vehicles is expected. Locations impacted include northern Boulder and Niwot.

Probability of Future Occurrences

Probability of future occurrence is classified as **likely**, with 10-100 percent chance of occurrence within a range of severity in the next year.

Magnitude/Severity

Based on the definitions established for this plan, magnitude and severity is classified as **limited**, with 10-25 percent of property, agricultural crops, and natural resources potentially damaged and a limited history of public safety impacts.

Climate Considerations

Hailstorms are increasing in frequency in the United States. Currently, hailstorms account for 70 percent of insured loss from severe storms, mostly for roof and siding replacements. One reason insurance claims are increasing is that population is increasing thus, providing more buildings and infrastructure as targets. Climate change is likely to impact thunderstorm clouds which, in turn, will likely impact hailstone formation. Warmer temperatures are likely to impact the strength of updrafts leading to the development of storms that can create larger hailstones. In lower laying areas, warmer temperatures may help to melt hailstones before they can cause damage however, in Boulder County and the rest of the Front Range, the combination of high altitude and dry air makes it more likely that hailstorms will increase in size and impact as average global surface temperatures continue to climb.

In addition to likelihood of more hailstorms, hailstone sizes have also been increasing. In 2018, there were hundreds of reports of hail larger than 2 inches in diameter, primarily from states in "hail alley". As the Boulder County region becomes warmer and moister with climate change, storms will have more moisture availability which is likely to lead to increase in average hail diameter along with increase occurrences.

Figure 4-19 Increase in Size of Hailstones

More big hailstones

Between 2000 and 2017, about 8.8 percent of U.S. severe hail reports included hail larger than two inches in diameter.

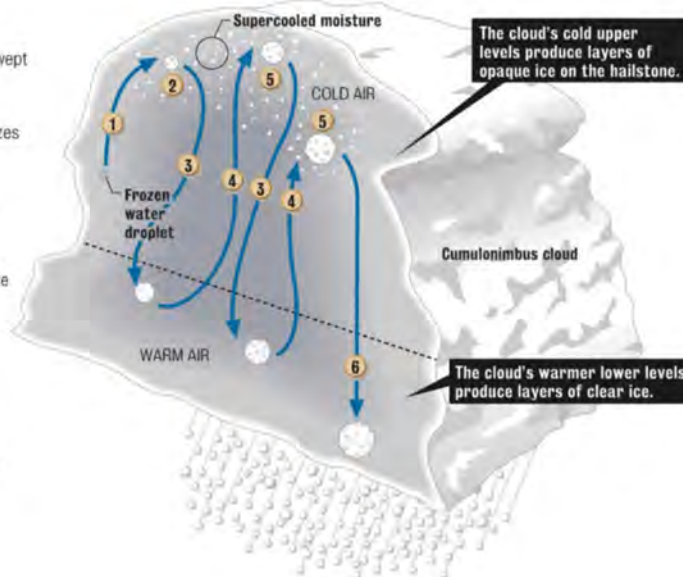
2 in. to 2.99 in. 3 in. or more



Source: Storm Prediction Center. Chart Colorado State CC-BY-ND

HOW A HAILSTONE FORMS

- 1 A frozen water droplet is swept up by currents within a thundercloud.
- 2 Supercooled moisture freezes onto the droplet's surface forming a layer of ice.
- 3 As it gets heavier, gravity pulls it downward.
- 4 Then it's sucked back up by strong updrafts. Golf-ball-size hailstones need 60 mph updrafts of air to form.
- 5 As the process continues, thick layers of ice accumulate on the hailstone's surface.
- 6 Eventually, gravity pulls the hail through the warm, wet cloud base and finally to the ground.



Source: National Severe Storms Laboratory (NSSL)

Ecological Considerations

Hailstorms can harm animals, birds, plants, trees, and crops. Storms that produce hail tend to damage trees and vegetation that are unprotected from the intense impact. However, once hail melts, it has similar impacts as rainwater and is good for the soil, streams, and water bodies.

Overall Hazard Significance

Based on assessments of probability, risk to public safety and property, the overall hazard significance for hailstorms is **high/medium**.

4.3.11 Landslide/Mud and Debris Flow/Rockfall

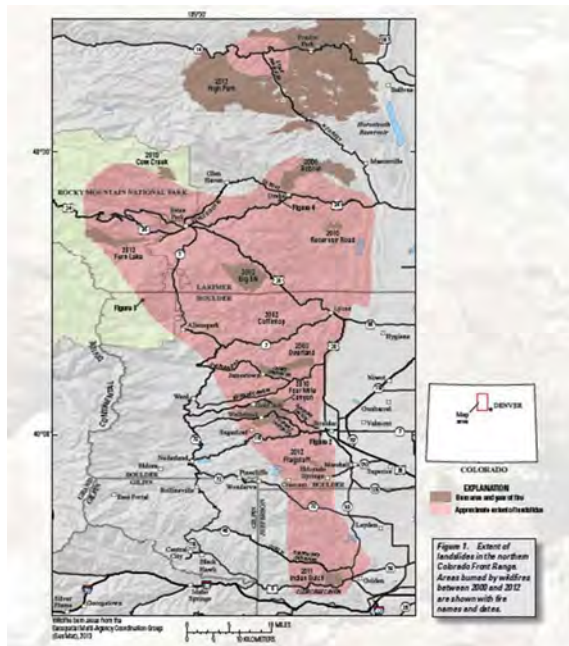
Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Landslide	Limited	Occasional	Limited	Substantial	High

Description

Landslide

A landslide is a general term for a variety of mass-movement processes that generate a downslope movement of soil, rock, and vegetation under gravitational influence. Some of the natural causes of ground instability are stream and lakeshore erosion, heavy rainfall, and poor-quality natural materials. In addition, many human activities tend to make the Earth materials less stable and, thus, increase the chance of ground failure. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation. Landslides typically have a slower onset and can be predicted to some extent by monitoring soil moisture levels and ground cracking or slumping in areas of previous landslide activity.

Figure 4-20 Extent of Landslides in CO Front Range



Mud and Debris Flow

According to the CGS, a mudslide is a mass of water and fine-grained earth materials that flows down a stream, ravine, canyon, arroyo, or gulch. If more than half of the solids in the mass are larger than sand grains—rocks, stones, boulders—the event is called a debris flow. A debris fan is a conical landform produced by successive mud and debris flow deposits, and the likely spot for a future event.

The mud and debris flow problem can be exacerbated by wildfires that remove vegetation that serves to stabilize soil from erosion. Heavy rains on the denuded landscape can lead to rapid development of destructive mudflows.

Rockfall

A rockfall is the falling of a detached mass of rock from a cliff or down a very steep slope. Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Rockfalls are caused by the loss of support from underneath through erosion or triggered by ice wedging, root growth, or ground shaking. Changes to an area or slope such as cutting and filling activities can also increase the risk of a rockfall. Rocks in a rockfall can be of any dimension, from the size of baseballs to houses. Rockfall occurs most frequently in mountains or other steep areas during the early spring when there is abundant moisture and repeated freezing and thawing. Rockfalls are a serious geological hazard that can threaten human life, impact transportation corridors and communication systems and result in other property damage. Due to the Fourmile Canyon Fire in 2010, there is an increased risk of debris flows in Fourmile Canyon.

Spring is typically the landslide/rockfall season in Colorado as snow melts and saturates soils and temperatures enter into freeze/thaw cycles. Rockfall and landslides are influenced by seasonal patterns, precipitation, and temperature patterns. Earthquakes could trigger rockfalls and landslides too.

Social Considerations

Similar to flooding, landslides and mudslides are natural disasters that are covered by flood insurance policies from the NFIP. Minimizing impacts from landslides and mudslides requires investments in land stabilization and infrastructure. Although most heavily populated areas in Boulder County are not at high risk of landslides and rockfall, insurance and proactive mitigation on personal property are expenses that low-income people are unable to afford.

Geographic Extent

This hazard is most prevalent in the foothills of western Boulder County, particularly in the canyons that dissect the region, most of which have County roads or State highways running through them, and some residential development. Developed areas with rockfall potential include Eldorado Springs and sections of Boulder Canyon. Areas of recent wildfire burns are susceptible to debris flow. These areas include the Black Tiger Fire burn area in Boulder Canyon and the Overland Fire area near Jamestown. Rock fall and debris flows can impact foothills transportation corridors from Lyons to Allenspark, Boulder to Nederland, and Ward to Jamestown, and along the Peak to Peak highway (Highways 7, 72, 36, 119, and 72).

The Colorado Landslide Hazard Mitigation Plan, developed in 1988 and updated in 2002, identified 49 areas in Colorado where landslides could have the “most serious or immediate potential impact on communities, transportation corridors, lifelines, or the economy.” One area in Boulder County was identified from the Black Tiger wildfire in 1989. The Fourmile Canyon Fire burn area from September 2010 is also a high-risk area for debris flows, rockfalls and erosion. The wildfire leaves the potential for debris flows, rockfalls and extreme erosion in the area around the fire. Minor landslides will likely continue in susceptible areas as a result of post-fire conditions or when heavy precipitation occurs.

The underlying geology in the steeper slopes of western Boulder County is generally granitic bedrock, and thus resistant to landslide issues, but can be prone to rockfall. Based on assessments of the potential area affected by landslide, debris flow and rockfall, geographic extent is considered **limited**, with less than 10 percent of the planning area prone to occurrence. It should be noted however that when this hazard causes road closures, the overall area affected indirectly can be much larger than the slide area itself.

Previous Occurrences

On September 11, 2013, 1 person died due to debris flow /landslide caused by ground saturation and rainfall over the burn scar above Jamestown. During the 2013 flood over 800 landslides occurred in Boulder County alone. Damage to structures, infrastructure and highways occurred as a result of landslides. In

addition, landslides during inundation events also exacerbates flash flooding due to damming of canyons holding back large creeks creating devastating hydraulic forces. Development in areas vulnerable to landslides increases the potential for destructive landslides and rockfalls. Most historical landslides that have occurred in Boulder County were a secondary impact associated with wildfires and/or heavy rains. For instance, the highway in Boulder Canyon below Sugarloaf Mountain was closed at least six times during the months following the Black Tiger Fire in July 1989 after mud, boulders, and other debris slid down onto the highway.



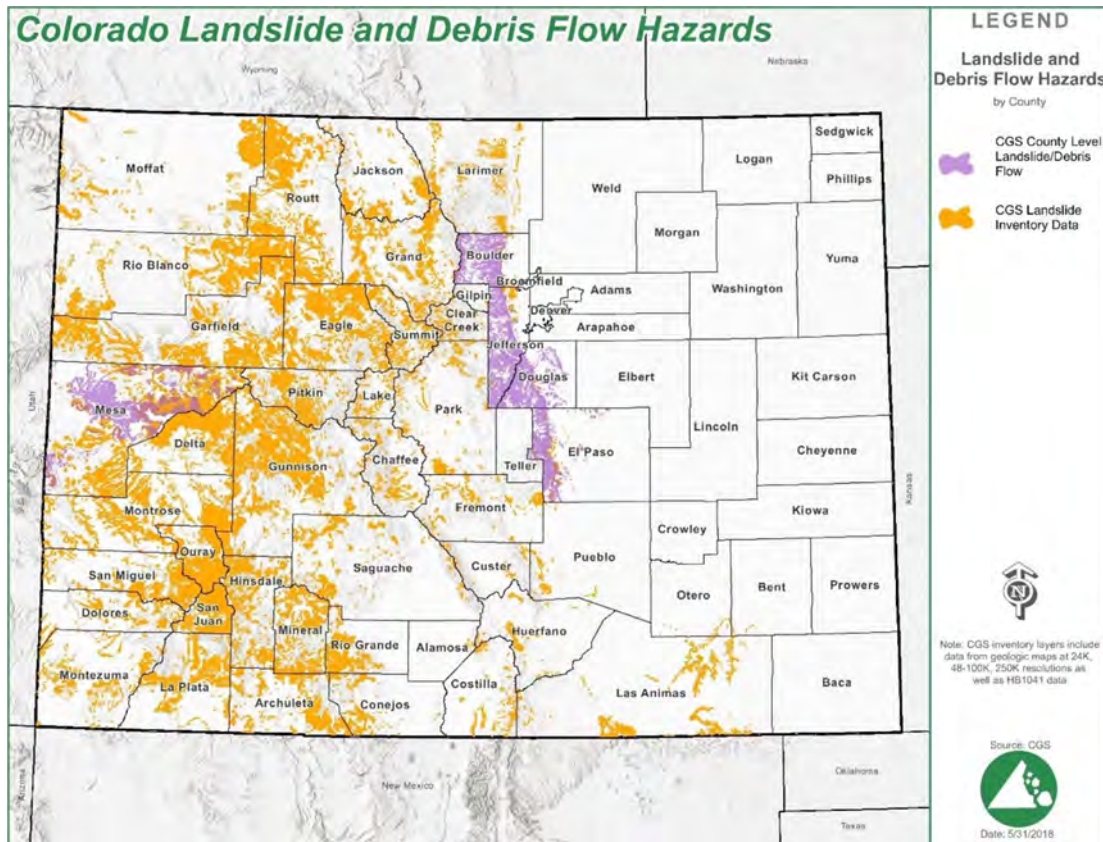
One home was destroyed, and two others were damaged. A mudslide also occurred at the base of Flagstaff Road during a period of heavy rains in May and June of 1995. Approximately six homes were threatened by the slide.

According to an HMPC team member from the Town of Jamestown, multiple landslides occurred as a result of unstable soil in a burn area from the Overland fire. The landslides occurred between the burn area and James Creek on June 23, 2004, July 23, 2004, July 29, 2004, July 25, 2005, and July 20, 2006. County Road 94 was closed due to the mudslides. The damage to culverts and channels could exceed \$150,000 before the soil stabilizes. Mudslides are expected to continue over the next 5 to 10 years. Property damage mitigation costs have been \$80,000 to \$100,000 to date.

According to a newspaper article from the Daily Camera in the mid-1990's (exact date unknown) a boulder the size of a Volkswagen impacted a home in the unincorporated community of Eldorado Springs. No one was injured in the incident.

In July 1990, a severe hailstorm caused massive hail damage, localized flooding, and rockslides on Highway 119 at the mouth of Boulder Canyon. Most recently, on July 20, 2006, heavy rain in the Overland burn area caused minor flash flooding in Jamestown. The roads behind the Jamestown Fire Hall were washed out when a culvert became blocked with debris. A rockslide was also reported in the town.

Figure 4-21 Colorado Landslide and Debris Flow Hazards



Source: State of Colorado Hazard Mitigation Plan

Probability of Future Occurrences

Based on patterns of previous occurrences, future probability of landslide/debris flow/rockfall occurrence is classified as **occasional**, with a 1-10 percent chance of occurrence in the next year. However, with population increases, the State of Colorado Hazard Mitigation Plan recently classified Boulder County growth risk rating for landslides as **severe**.

Magnitude/Severity

Based on the definitions established for this plan, magnitude and severity is considered **limited**, with 10-25 percent of property severely damaged and/or shutdown of facilities for more than one week. Landslide severity is often determined by the amount of soil, debris and rocks that are transferred and where that transfer stops (e.g., on a transportation route versus a natural space). Landslides and mudslides are hard to predict and often occur without warning. They tend to have long-term impacts that impact access, utilities, and mobility due to difficulty in debris removal along impacted areas.

Climate Considerations

Landslides often result from intense rainfall events that cause runoff. Climate change is expected to increase the intensity of heavy precipitation events leading to a potential increase in landslide frequency. The combination of drier and warmer days which increase the likelihood of wildfires and drought along with more extreme rainfall events is an unfortunate recipe for more landslides and mudslides.

The impact of climate change on the wildfire season means Boulder County is likely to experience more

frequent and larger wildfires. Wildfires remove soil stabilizing vegetation and burn soil surfaces which leads to more rainfall runoff. Wildfires are also likely to create more debris which will be carried into Boulder County communities and transportation routes from landslides and mudslides.

Ecological Considerations

Landslides and rockfall are natural environmental occurrences. Many of Colorado's landslides occur in remote areas impacting the natural ecosystems. These impacts are often difficult to measure and document however, in most cases landslides contribute to biodiversity and play a role in sediment transfer; although they wipe out entire areas, this is an essential for ecosystem services.

However, even landslides in remote areas can have negative impacts to Boulder County and the natural resources the County depends on. Landslides can pollute waterbodies with sediment while also having the potential to dam up streams and rivers. Landslides and mudslides can also wipe out entire tracts of land impacting forests, soils and killing wildlife habitat. As humans continue to alter the landscape and the state continues to warm, landslides are likely to occur more often which can lead to the inability of natural systems to regenerate.

Overall Hazard Significance

Based on assessments of probability, public safety risk and the potential for property and/or infrastructure damage, the overall hazard significance for landslide/debris flow/rockfall is **high/medium**.

4.3.12 Lightning

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Lightning	Extensive	Likely	Limited	Moderate	Medium

Description

Lightning is an electrical discharge between positive and negative regions of a thunderstorm. A lightning flash is composed of a series of strokes with an average of about four. The length and duration of each lightning stroke vary, but typically average about 30 microseconds.

Lightning is one of the more dangerous weather hazards in the United States and in Colorado. Each year, lightning is responsible for deaths, injuries, and millions of dollars in property damage, including damage to buildings, communications systems, power lines, and electrical systems. Lightning also causes forest and brush fires and deaths and injuries to livestock and other animals. According to the National Lightning Safety Institute, lightning causes more than 26,000 fires in the United States each year. The institute estimates property damage, increased operating costs, production delays, and lost revenue from lightning and secondary effects to be in excess of \$6 billion per year. Impacts can be direct or indirect. People or objects can be directly struck, or damage can occur indirectly when the current passes through or near it.

Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually, it takes place inside the cloud and looks from the outside of the cloud like a diffuse brightening that flickers. However, the flash may exit the boundary of the cloud, and a bright channel, similar to a cloud-to-ground flash, can be visible for many miles.



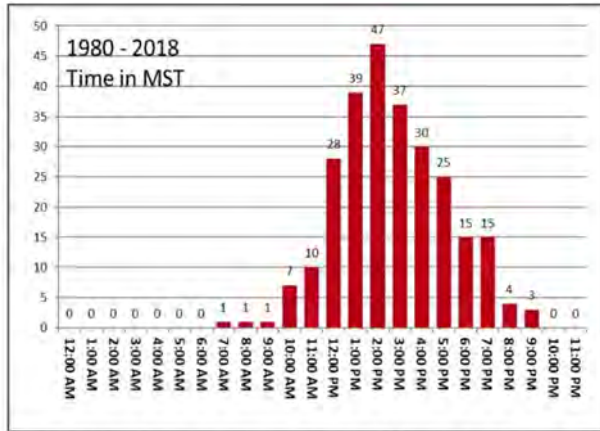
Although not as common, cloud-to-ground lightning is the most damaging and dangerous form of lightning. Most flashes originate near the lower-negative charge center and deliver negative charge to Earth. However, a large minority of flashes carry positive charge to Earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat. Positive lightning also has a longer duration, so fires are more easily ignited. And, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

The ratio of cloud-to-ground and intra-cloud lightning can vary significantly from storm to storm. Depending upon cloud height above ground and changes in electric field strength between cloud and earth, the discharge stays within the cloud or makes direct contact with the earth. If the field strength is highest in the lower regions of the cloud, a downward flash may occur from cloud to earth. Using a network of lightning detection systems, the United States monitors an average of 25 million strokes of lightning from the cloud-to-ground every year.

Boulder County implemented the use of lightning software to monitor lightning occurrences in the County.

All Fire Departments and Districts were trained in July 2012 on the use of the software and provided a username and password to access it. This enables Fire Departments and Districts to monitor cloud-to-ground strike within their jurisdictions and respond as they see appropriate, given the fire conditions.

Social Considerations



The chart above shows the time when lightning casualties occurred in the state of Colorado. Data since 1980.

Lightning does not necessarily impact one group of people more than others however, there are a few elements to consider regarding social equity and lightning. First, certain members of the population rely on constant power for their health and well-being. This is especially true of the elderly population and people with disabilities who may rely on respirators or special equipment and would be disproportionately impacted from prolonged power outages.

Second, BIPOC and low-income families are more likely to live in lower quality housing conditions. Although there are retrofits and measures that

people can take to reduce impact from lightning strikes on their homes, these alterations require licensed contractors and funds. Home protection systems range from installing small things like surge protectors to large items like highly conductive copper and lightning rods. Impacts on property from lightning are often covered by homeowners and renter's insurance however insurance is often too costly for low-income residents. Additionally, mobile homes, where many low-income residents reside, can be more dangerous places to be in lightning storms.

Lastly, lightning strikes to humans are rare however, if struck, those who survive often suffer from lasting impacts such as dizziness, memory loss, numb limbs, and weakness. Cardiac arrest and severe burns are other outcomes from humans being struck by lightning.

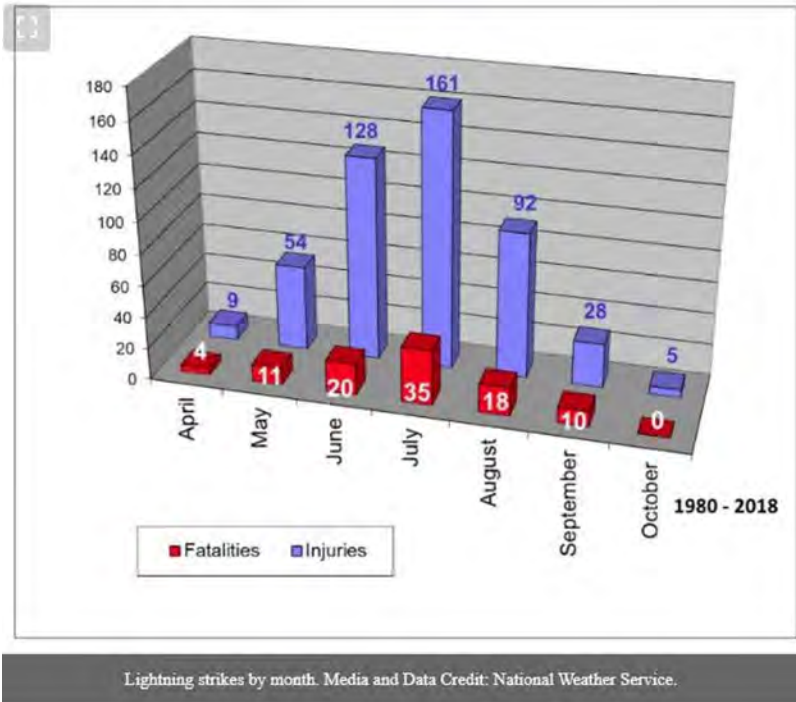
Geographic Extent

Lightning can potentially impact any portion of Boulder County, though isolated peaks and other points of high elevation relative to their surroundings are at increased probability of direct impact. It should also be noted that power outages caused by lightning strikes can affect a much broader region beyond the location of the lightning strike or storm.

Therefore, geographic extent is classified as extensive, with 50-100 percent of the planning area at risk from lightning and its affects.

Previous Occurrences

Data from the National Lightning Detection Network ranks Colorado 31st in the nation (excluding Alaska and Hawaii) with respect to the number of cloud-to-ground lightning flashes with an average number of 517,217 flashes per year (based on data collected between 1996 and 2005). Boulder County has an average of 3,500 flashes per year. According to the NWS, an average of 62 people are killed each year by lightning in the United States. In 2012, only one person was injured by lightning in Colorado. In an average year, three people in the Centennial State are killed by lightning and 13 are injured (1980-2012 data). The true injury number is likely higher than this, because many people do not seek help, and not all lightning-related injuries are reported as such by doctors.



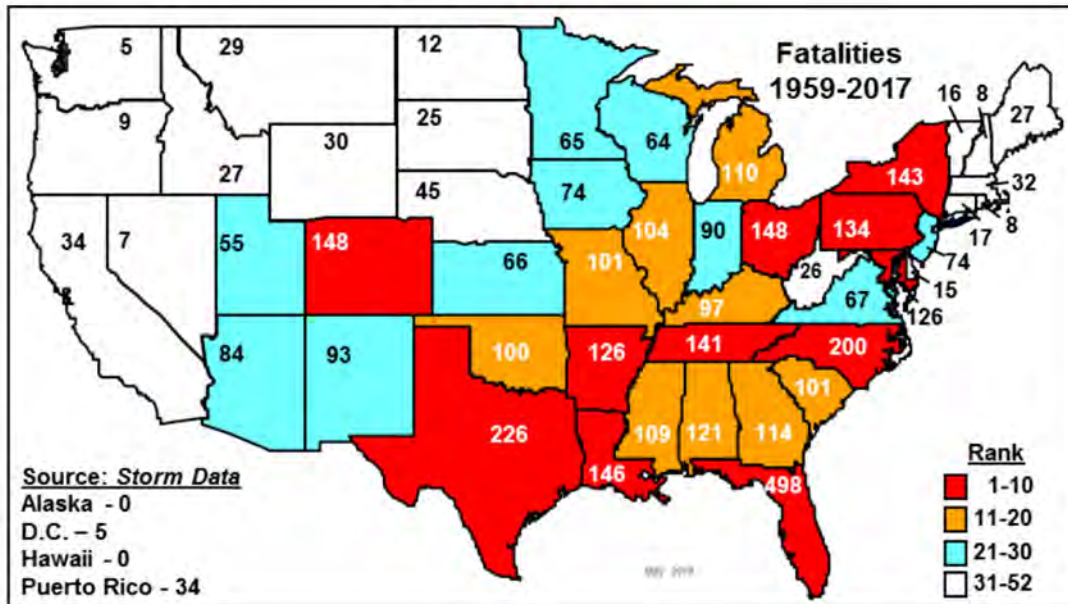
U.S. lightning statistics compiled by the National Oceanic and Atmospheric Administration between 1959 and 1994 indicate that most lightning incidents occur during the summer months of June, July, and August and during the afternoon hours from between 2 and 6 p.m. Figure 4-23 shows state-by-state lightning deaths between 1959 and 2017. Colorado ranks in the top ten percentile with 148 deaths.

Table 4-8 National Weather Service Lightning Activity Level Scale

Lightning Activity Level	
LAL 1	No thunderstorms.
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud-to-ground strikes in a five-minute period.
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud-to-ground strikes in a five-minute period.
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud-to-ground strikes in a five-minute period.
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud-to-ground strikes in a five-minute period.
LAL 6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag warning.

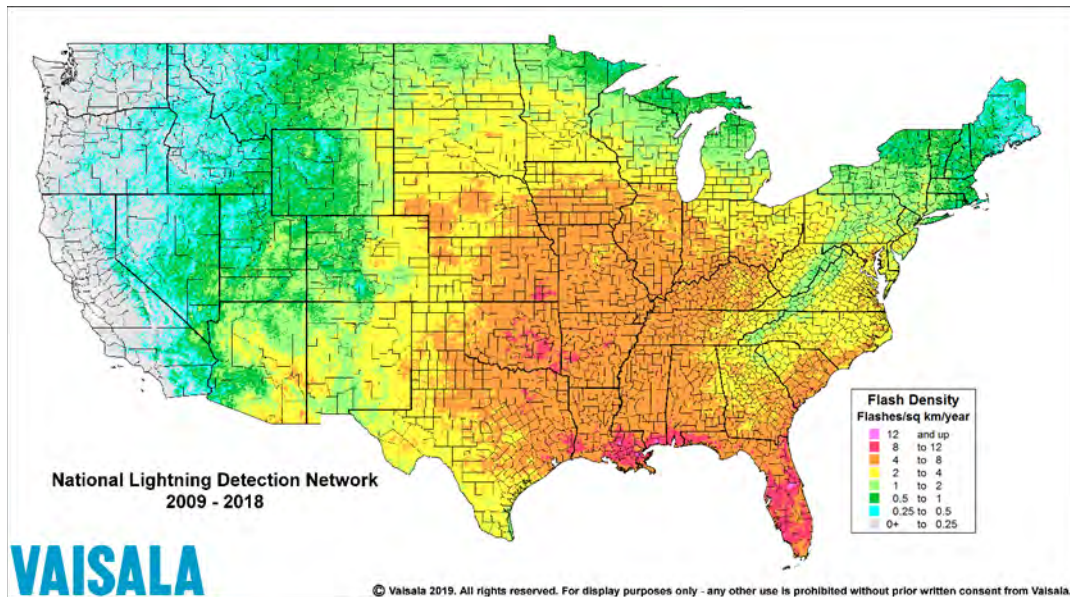
Source: NWS

Figure 4-22 Lightning Fatalities by State, 1959 - 2017



Source: NWS, http://www.lightningsafety.noaa.gov/stats/03-12_deaths_by_state.pdf

Figure 4-23 Average Lightning Flash Density in the United States



Source: <https://www.weather.gov/pub/lightningFlashDensityMaps>

Table 4-9 contains information from the NWS on lightning casualties in Boulder County:

Table 4-9 Lightning Casualties in Boulder County, 1980-2019

Date	Time	Killed	Injured
June 27, 1980	2:12 p.m.	0	4

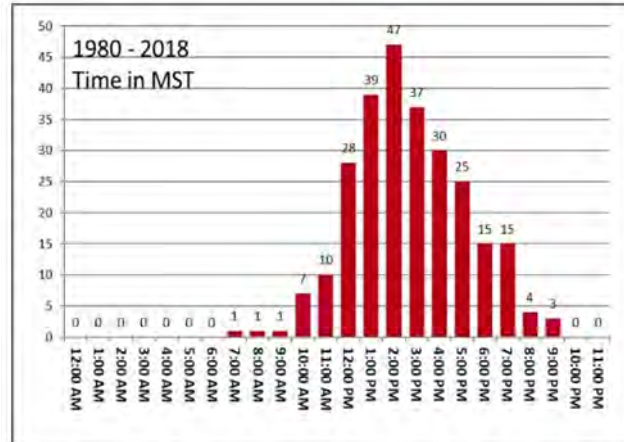
Date	Time	Killed	Injured
June 3, 1981	12:00 p.m.	1	2
August 22, 1981	Morning	0	2
August 5, 1983	Evening	0	1
July 2, 1987	5:34 p.m.	0	4
August 7, 1987	7:30 p.m.	0	1
June 25, 1988	3:30 p.m.	1	1
August 19, 1989	12:35 p.m.	1	1
June 13, 1991	2:00 p.m.	0	1
August 30, 1992	11:30 a.m.	0	1
June 27, 1995	3:30 p.m.	0	1
June 5, 1997	2:00 p.m.	0	1
June 7, 1997	12:00 p.m.	0	1
June 19, 1997	2:04 p.m.	0	1
July 10, 2000	3:40 p.m.	0	3
July 12, 2000	2:00 p.m.	1	0
July 24, 2000	3:00 p.m.	0	2
August 3, 2009	12:00 p.m.	0	1
August 3, 2010	3:00 p.m.	0	1
July 7, 2018	1:30 p.m.	1	
July 14, 2019	1200		1
Totals		5	31

Source: NWS, http://www.crj.noaa.gov/pub/?n=/ltg/county_stats_1.php

According to the State of Colorado Natural Hazards Mitigation Plan, a study determined that one out of 52 lightning flashes results in an insurance claim. Data from the NCEI and SHELUDS identified 40+ lightning events in Boulder County between January 1, 1993, and November 30, 2014 (note: since this data is from a different source, it does not track exactly with the incidents reported in Table 4-9). The 17 lightning events that resulted in death/injury and/or property damage are detailed below:

- **May 15, 1993, 4:00 p.m.:** Lightning resulted in property damage of \$5,000.
- **May 27, 1993, 2:55 p.m.:** Lightning resulted in property damage of \$5,000 (Lyons).
- **May 31, 1994, 6:00 p.m.:** Lightning resulted in property damage of \$1,000 (Louisville).
- **July 27, 1994, 4:00 p.m.:** Lightning resulted in property damage of \$5 million. (The damage occurred when lightning struck a furniture store in Boulder, igniting a fire which caused damage to building and contents).
- **June 2, 1995, 11:10 a.m.:** Lightning resulted in property damage of \$5,000 (Nederland).
- **June 2, 1995, 5:30 p.m.:** Lightning resulted in property damage of \$20,000.
- **June 27, 1995, 3:30 p.m.:** Lightning resulted in one injury (Longmont).
- **September 14, 1996, 5:00 p.m.:** Lightning resulted in property damage of \$7,000 (West Longmont).
- **June 5, 1997, 2:00 p.m.:** Lightning resulted in one injury (Nederland).
- **June 7, 1997, 12:00 p.m.:** Lightning resulted in one injury (Ward).
- **June 19, 1997, 2:04 p.m.:** Lightning resulted in one injury (Broomfield).
- **July 10, 2000, 3:40 p.m.:** Lightning resulted in three injuries.
- **July 12, 2000, 2:00 p.m.:** Lightning resulted in one death (Allenspark). (A climber was struck and killed by lightning as he and a companion were ascending a sheer rock face near the summit of Longs Peak).

- **July 24, 2000, 3:00 p.m.:** Lightning resulted in two injuries (Longmont).
- **June 19, 2002, 5:30 p.m.:** Lightning resulted in property damage of \$25,000.
- **August 5, 2002, 2:00 p.m.:** Lightning resulted in one injury.
- **June 22, 2006:** Lightning kills a motorcyclist on Highway 36
- **May 21, 2007, 2:00 p.m.:** Lightning resulted property damage of \$5,000. The 15,000-gallon fuel tank, which stored diesel gas for farm equipment, was also struck. The explosion shot the tank an estimated 150 feet in the air, and it landed approximately 400 feet from its original location.
- **June 26, 2012:** Flagstaff Fire – Lightning caused a fire that threatened residences and the City of Boulder. Total cost to fight the blaze was 1.9 million.
- **July 7, 2018:** 1 person injured from a lightning strike while camping off the Peak to Peak Hwy.
- **July 17, 2019:** person was killed and one injured from a lightning strike while hiking on Bear Peak West Ridge Trail.



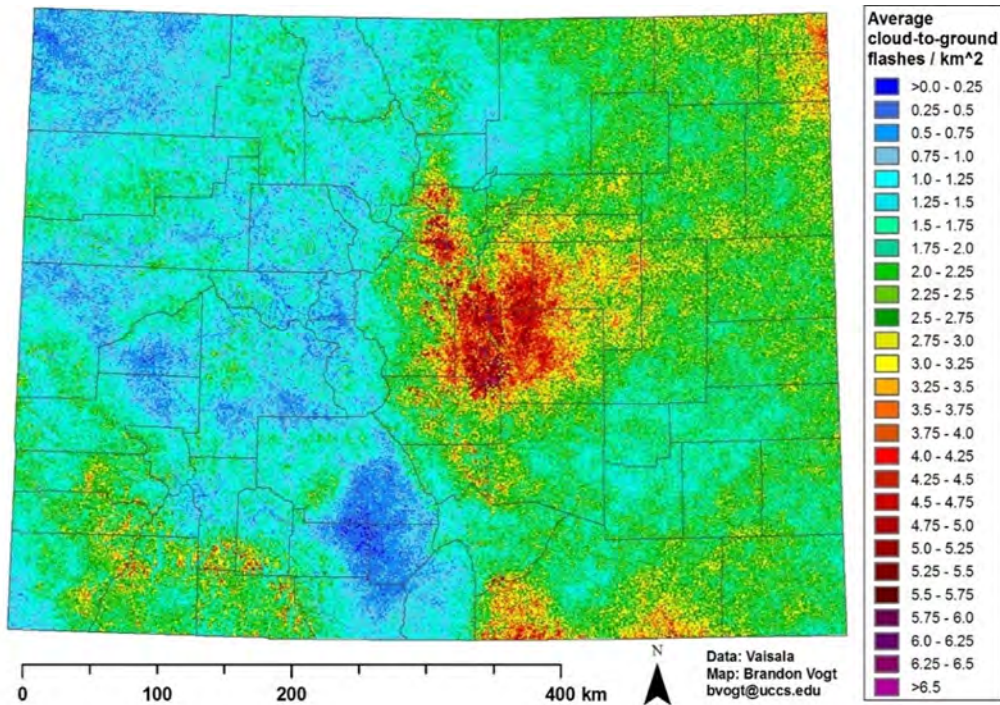
The chart above shows the time when lightning casualties occurred in the state of Colorado. Data since 1980.

Also, according to an HMPC team member from Lyons, lightning caused a three-hour electric power outage on August 10, 1994, in Lyons. This was in conjunction with heavy rain and high winds.

Probability of Future Occurrences

Based on patterns of previous occurrences, the future probability for damaging lightning strikes is classified as **likely**, with a 10-100 percent chance of occurrence in the next year.

Figure 4-24 Colorado Lightning Flash Density Map



Source: NWS Denver

Magnitude/Severity

Based on the definitions set forth in previously, the magnitude and severity of lightning is classified as **limited**, with 10- 25 percent of property severely damaged and/or shutdown of facilities for more than one week.

Climate Considerations

According to Colin Price, author of *Thunderstorms, Lightning, and Climate Change*, "The distribution of lightning around the planet is directly linked to the Earth's climate". In his book, Price identifies that climate change is likely to increase the number of intense thunderstorms which will lead to an "increase in the amount of lightning by 10% for every one-degree global warming". Scientists have started to document changes in lightning frequency as the climate changes. As average global surface temperatures increase, it is likely that there will be more intense thunderstorms, more frequent lightning strikes, and more wildfires ignited by lightning strikes.

Another key component to keep in mind is that lightning plays more than one role in climate change. Lightning produces nitrogen oxides which are strong greenhouse gases. As lightning strikes increase so will the production of greenhouse gases, further impacting the rate of warming on the planet and impacting air quality.

Ecological Considerations

Lightning is a natural environmental process. It leads to wildfires and other environmental impacts such as vaporizing water inside a tree that can blow it apart. It has not been proven to have severe negative impacts on ecological systems and in some cases has been shown to help to dissolve unusable nitrogen in water which does create natural fertilizer for plants.

Overall Hazard Significance

Overall hazard significance is considered **medium**, due to risk to public safety, threat to facilities, power outages and property and natural resource damage caused by fire ignitions or direct strike.

4.3.13 Subsidence

Hazard	Geographic Extent	Probability/ Frequency	Magnitude/ Severity	Increased Threat (Climate Change)	Overall Significance
Subsidence	Significant	Likely	Limited	Moderate	Medium

Description

The CGS defines land subsidence as the sinking of the land over manmade or natural underground voids. In Boulder County, the type of subsidence of greatest concern is the settling of the ground over abandoned mine workings. Past coal and clay mining activities have created surface subsidence in some areas and created the potential for subsidence in other areas.

Subsidence can result in serious structural damage to buildings, roads, irrigation ditches, underground utilities, and pipelines. It can disrupt and alter the flow of surface or underground water. Weight, including surface developments such as roads, reservoirs, and buildings and manmade vibrations from such activities as blasting or heavy truck or train traffic can accelerate the natural processes of subsidence. Fluctuations in the level of underground water caused by pumping or by injecting fluids into the Earth can initiate sinking to fill the empty space previously occupied by water or soluble minerals. The consequences of improper use of land subject to ground subsidence can be excessive economic losses, including the high costs of repair and maintenance for buildings, irrigation works, highways, utilities, and other structures. This results in direct economic losses to citizens as well as indirect economic losses through increased taxes and decreased property values.

Room and pillar mining was the mining technique used almost exclusively in early Colorado mining. In the room and pillar technique, a shaft or adit was driven or dug to the layer of coal. Passageways were excavated in the coal seam and openings, or rooms of coal were dug out on either wide of the tunnel. Between the rooms, pillars of coal were left in place to support the roof of the mine. When the coal be “ran out”, the miner’s started to “pull pillars” at the back of the mine. Ideally, pillars were removed until the roof started to cave in and settle. In reality, pillars were not always removed in a systematic manner and many pillars were left to support the roof.

In some cases, coal was “poached” or more coal was removed from an area than would be noted on the mine map. Also, many mines were dislocated relative to surface features due to surveying errors. Consequently, the precise location and extent of underground mines can be difficult to determine. The possible inaccuracies in mining records and the ability to determine present mine conditions combine to make subsidence resulting from room and pillar mining unplanned and unpredictable.

Social Considerations

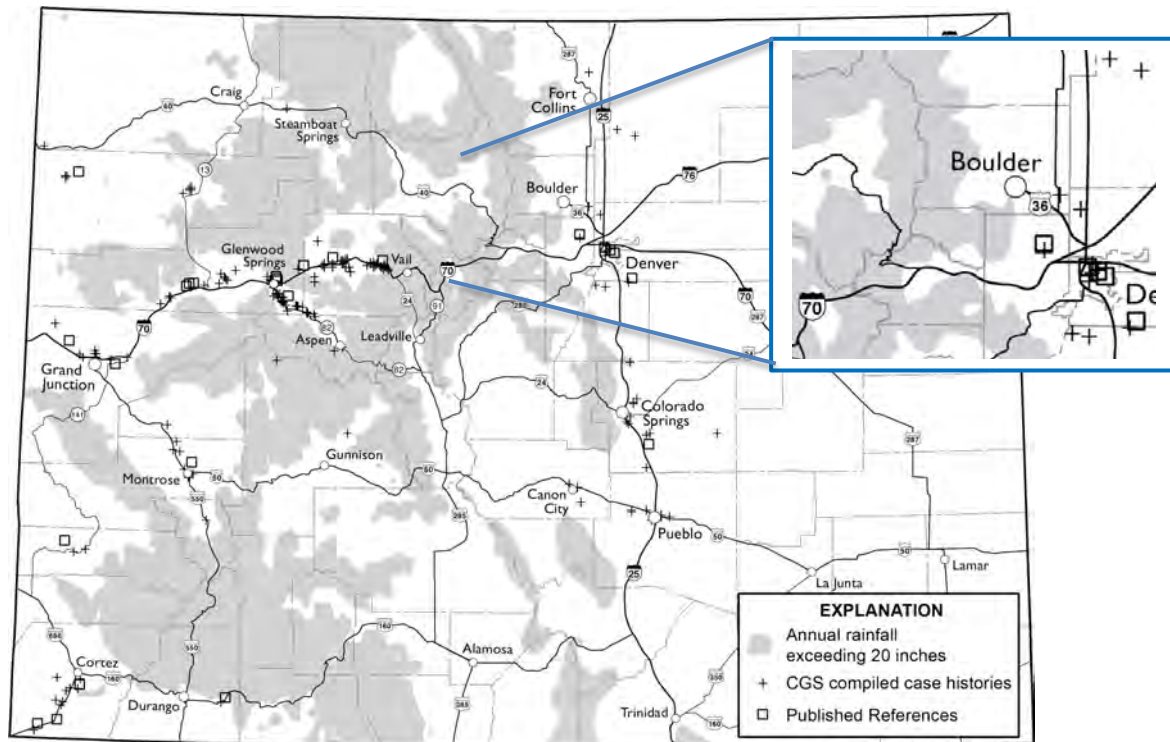
Land subsidence is typically caused by human activities such as removal of subsurface water and underground mining. Subsidence has serious consequences from small sinkholes to entire sections of land disappearing. Subsidence has the ability to weaken, damage or even destroy structures and infrastructure. In BIPOC and low-income neighborhoods, infrastructure and buildings tend to be in worse shape and suffer from years of neglect and lack of maintenance. Impacts from land subsidence are threats to human safety and well-being but the most likely impact is the damage to already weak infrastructure and buildings in underinvested areas. The impact of not having sewer, power, and water services for a period of time or not having the money to repair a home or elements on personal property is how land subsidence inequitable impacts low-income and BIPOC communities.

Geographic Extent

Based on information included in the state hazard mitigation plan, a substantial area within Boulder County

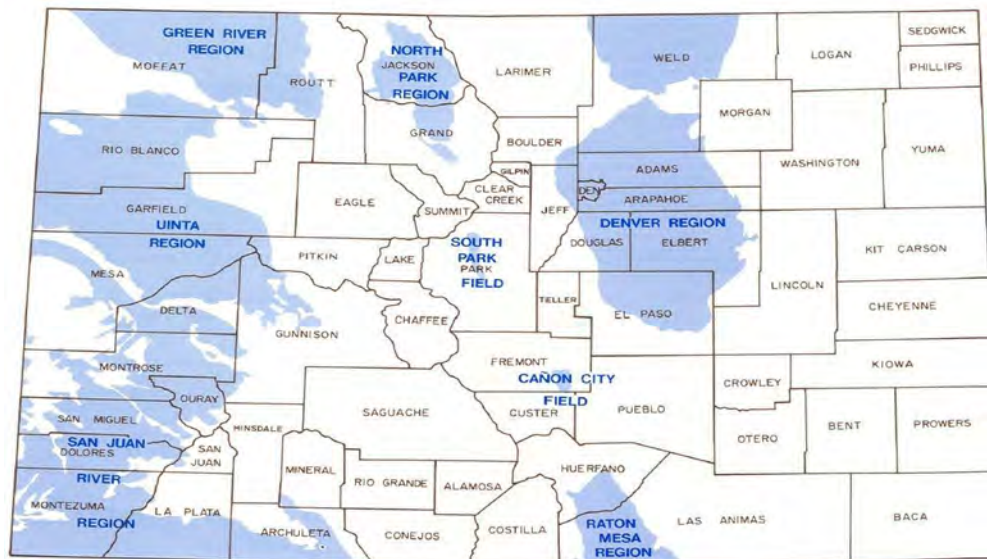
is a major mining district and a portion of the southeastern county is a coal region. As previously noted, there is a direct correlation with areas of current or previous coal production and land subsidence. Specifically, Figure 4-25 and Figure 4-26 below indicate an area in the southeast section of the County where coal deposits and/or abandoned coal mines are located. Based on the size of these areas relative to the County overall, the geographic extent of land subsidence is considered **significant**, with 10-50 percent of the planning area affected.

Figure 4-25 Collapsible Soil Event in Colorado



Source: CGS

Figure 4-26 Coal Deposits by Region, State of Colorado



Source: Subsidence above Inactive Coal Mines

Figure 4-27 Locations of Inactive Coal Mines, State of Colorado



Source: Subsidence above Inactive Coal Mines

These maps display the Boulder-Weld Coal Field in the southeastern area of Boulder County and identify the land most at risk of mine subsidence.

Previous Occurrences

Records of previous subsidence occurrences are difficult to track, as there is no coordinating or monitoring agencies for this hazard. The CGS manages the Colorado Mine Subsidence Information Center (MSIC) which houses maps and data about abandoned coal mines throughout the state however, there is not monitoring conducted at this time. A recent event in fall of 2007 involved the closure of a sunken road due to a coal mine collapse near the town of Erie. A 1986 study on land subsidence in southeastern Boulder County

conducted by the State of Colorado Department of Natural Resources Mined Land Reclamation Division found evidence of 595 subsidence occurrences across a 50 square mile study area. The report also found extensive evidence of wall and foundation damage in a survey of homes in the Lafayette and Louisville area, directly attributed to undermining from abandoned coal shafts.

Boulder County is second in the state in terms of number of abandoned mines with 183 abandoned coal mines and 3,600 abandoned mines of other types. In Lafayette in 1974, an abandoned coal mine created a sinkhole in a trailer park area that expanded to 25 feet deep and 25 feet in diameter in about a 24-hour period.

Probability of Future Occurrences

Based on patterns of previous occurrence and the numerous locations of abandoned coal mines in the planning area, probability of future occurrence is considered **likely**, with a recurrence interval of significant impacts estimated at 10 years or less.

Magnitude/Severity

Magnitude and severity of land subsidence is classified as **limited**, with 10-25 percent of property at risk of severe damage.

Climate Considerations

More intense rainfall and drought events from climate change are likely to have an impact on land subsidence. Subsidence related to groundwater withdrawal is more common in areas with a mix of dense urban space, oil and gas extraction, mining, and agricultural uses. In Boulder County, most subsidence is likely to be related to more intense rainfall and population growth in high-risk areas.

Ecological Considerations

Sinkhole subsidence is more likely to have negative environmental impacts. As subsidence is due to the extraction of minerals from underground mines, much of the environmental degradation is related to the initial extraction. However, subsidence can impact hydrogeology, vegetation and animals, water and streams and agriculture. Dangerous gases may leak from mines impacting the roots of trees and plants as well as soils quality. Leaking of the underlying strata also can impact surface water bodies and water systems leading to contamination of streams, rivers, and lakes.

Overall Hazard Significance

Based on assessments of probability, geographic extent and magnitude/severity, the overall hazard significance of land subsidence is considered **medium**, with moderate potential impact.

4.3.14 Tornado

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Tornado	Significant	Likely	Limited	Low	Medium

DESCRIPTION

Tornadoes form when cool, dry air sits on top of warm, moist air. In the plains areas of Colorado, this most often happens in the spring and early summer (i.e., May, June, and July) when cool, dry mountain air rolls east over the warm, moist air of the plains.

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist. They can have the same pressure differential that fuels 300-mile-wide hurricanes across a path less than 300 yards wide. Closely associated with tornadoes are funnel clouds, which are rotating columns of air and condensed water droplets that unlike tornadoes, do not make contact with the ground.

Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita Scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis, better correlation between damage and wind speed. It is also more precise because it takes into account the materials affected and the construction of structures damaged by a tornado. Table 4-10 shows the wind speeds associated with the original Fujita scale ratings and the damage that could result at different levels of intensity. Table 4-11 shows the wind speeds associated with the Enhanced Fujita Scale ratings. The Enhanced Fujita Scale's damage indicators and degrees of damage can be found online at www.spc.noaa.gov/efscale/ef-scale.html.

Table 4-10 Original Fujita Scale

Fujita (F) Scale	Fujita Scale Wind Estimate (mph)	Typical Damage
F0	< 73	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
F1	73-112	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113-157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
F3	158-206	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207-260	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown, and large missiles generated.
F5	261-318	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

Source: National Oceanic and Atmospheric Administration Storm Prediction Center; www.spc.noaa.gov/faq/tornado/f-scale.html

Table 4-11 Enhanced Fujita Scale

Enhanced Fujita (EF) Scale		
Category	Wind Speed (mph)	Potential Damage
EF0	65-85	Light damage: Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	86-110	Moderate damage: Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	Considerable damage: Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165	Severe damage: Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	Devastating damage: Well-constructed houses and whole frame houses completely leveled; cars thrown, and small missiles generated.
EF5	>200	Incredible damage: Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yds.); high-rise buildings have significant structural deformation; incredible phenomena will occur.

Source: National Oceanic and Atmospheric Administration Storm Prediction Center

Tornadoes can cause damage to property and loss of life. While most tornado damage is caused by violent winds, most injuries and deaths result from flying debris. Property damage can include damage to buildings, fallen trees and power lines, broken gas lines, broken sewer and water mains, and the outbreak of fires. Agricultural crops and industries may also be damaged or destroyed. Access roads and streets may be blocked by debris, delaying necessary emergency response.

Social Considerations

In a 2017 study published in *Regional Science and Urban Economics*, researchers found that social inequity and poverty increase the likelihood of people being killed by a tornado. Lower-income people are more likely to be impacted by tornadoes due to the fact that many live in manufactured homes and lack tornado shelters or basements. The death rate of people living in manufactured homes is nearly 20 times higher than site-built homes. Additionally, tornado warnings typically provide very little time for people to prepare and evacuate. For families without access to their own modes of transportation or for less able-bodied individuals, the likelihood of enduring a tornado event at home is much more likely.

Geographic Extent

While the potential for tornado occurrence is present throughout the planning area, probability is significantly higher for the eastern sections of the County. Based on this the geographic extent of tornadoes is classified as **significant**, with 10- 50 percent of the planning area potentially affected.

Previous Occurrences

According to the Denver Museum of Nature and Science, Colorado's tornado activity rivals that of Tornado Alley. Nevertheless, Colorado tornadoes tend to be small, short-lived, and relatively weak as compared with tornadoes in the plains states. Statistics indicate that Colorado tornadoes last only a few minutes, are generally only about 100 yards in diameter at the surface and have an average path length of 1½ miles. Wind speeds appear to average 100 mph or less.

According to the NCEI, Colorado ranks seventh among all U.S. states for the frequency of tornadoes, with an average of 53 per year. Tornadoes in Boulder County are rare and usually only affect the lower elevations in the eastern portion of Boulder County. The NCEI documents 11 incidents of tornadoes in Boulder County between January 1, 1950, and December 30, 2021. Information on these events is detailed below:

- **September 17, 1953, 3:00 p.m.:** Magnitude F1, property damage of \$3,000
- **May 12, 1955, 4:30 p.m.:** Magnitude F1, property damage of \$3,000
- **May 17, 1978, 3:45 p.m.:** Magnitude F1, property damage of \$3,000
- **April 30, 1980, 11:00 a.m.:** Magnitude F1, no property damage
- **October 15, 1980, 6:22 p.m.:** Magnitude F2, property damage of \$25,000 (roof at Vo-Tech on East Arapahoe)
- **June 5, 1988, 3:25 p.m.:** Magnitude F2, property damage of \$250,000
- **June 1, 1990, 5:03 p.m.:** Magnitude F0, no property damage
- **June 16, 1996, 4:35 p.m.:** Magnitude F1, no property damage recorded
- **July 12, 1996, 7:40 p.m.:** Magnitude F0, no property damage recorded
- **June 6, 1997, 1:15 p.m.:** Magnitude F1, no property damage (Other sources indicate a home was damaged in the vicinity of Baseline Reservoir during this event.)
- **June 5, 2015, 6:59 p.m.:** Tornado EF1 – EF3 (Longmont Berthoud), 25 homes damaged
- **June 7, 2021, 5:00 p.m.:** Tornado EF1-EF2, near east Longmont. Light property damage was recorded, and no deaths or injuries resulted.

Probability of Future Occurrences

Based on patterns of previous occurrences, future probability is considered **likely**, with a 10-100 percent chance of occurrence in the next year.

Magnitude/Severity

Based on assessment of impacts from previous occurrences, magnitude and severity is classified as **limited**, with 10-25 percent of property severely damaged and/or shutdown of facilities for more than one week.

Climate Considerations

To date, there is not enough evidence to show a direct correlation between tornadoes and climate change. Scientists have been unable to document an observable increase in the number of tornadoes or the severity of tornadoes as average global temperatures warm. Although there has been evidence of tornadoes becoming more clustered together and outbreaks including multiple tornadoes, the total number per year has not shifted significantly enough to tie tornado action to climate change. According to the 2018 Fourth National Climate Assessment, tornadoes are exhibiting changes that may be related to climate change, but scientific understanding is not confident enough to project the likelihood of future conditions.

Ecological Considerations

Tornadoes destroy almost everything in their path. They can have impacts on natural systems by uprooting trees and vegetation, damaging wildlife, and negatively impacting soils. Tornadoes can also lead to environmental contamination by bringing raw sewage, asbestos, dioxides and other debris into water

supplies and soil. Although nature is often able to recover from a tornado, it can often take years for soil and water systems to recover fully.

Overall Hazard Significance

Based on assessments of probability, geographic extent and magnitude/severity, overall hazard significance of tornadoes is considered **medium**.

4.3.15 Wildfire

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Wildfire	Significant	Highly Likely	Critical	Severe	High

Description

Wildfire and urban wildfire are an ongoing concern for Boulder County residents, businesses, and government as well as the state of Colorado. Historically, the fire season extends from spring to late fall. With the increase in average global surface temperatures, “earlier springs and hotter summers are projected throughout the state, with more frequent and severe heat waves” which has led to year-long fire seasons. Fire conditions arise from a combination of hot weather, an accumulation of vegetation, and low moisture content in air and fuel. These conditions, especially when combined with high winds and years of drought, increase the potential for wildfire to occur. Wildfire risk is predominantly associated with the wildland-urban interface, areas where development is interspersed or adjacent to landscapes that support wildland fire. A fire along this wildland-urban interface can result in major losses of property and structures as well as negatively impact human health and well-being. Significant wildfires can also occur in heavily populated areas leading to more extensive social and economic impacts and exacerbating existing inequities. Rangeland and grassland fires are a concern in the eastern portion of Boulder County, including urbanized areas, due to increased residential development in the urban-wildland interface.

Generally, there are three major factors that sustain wildfires and predict a given area’s potential to burn. These factors are fuel, topography, and weather.

Fuel: Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree needles and leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Also, to be considered as a fuel source are manmade structures, such as homes and associated combustibles. The



type of prevalent fuel directly influences the behavior of wildfire. Light fuels such as grasses burn quickly and serve as a catalyst for fire spread. In addition, “ladder fuels” can spread a ground fire up through brush and into trees, leading to a devastating crown fire that burns in the upper canopy and cannot be controlled. The volume of available fuel is described in terms of fuel loading. Certain areas in and surrounding Boulder County are extremely vulnerable to fires as a result of dense vegetation combined with a growing number of structures being built near and within rural lands. The presence of fine fuels, 1,000-hour fuels, and needle cast combined with the cumulative effects of previous drought years, vegetation mortality, tree mortality, and blowdown across Boulder County has added to the fuel loading in the area. Fuel is the only factor that is under human control however, drought conditions and vegetation mortality will continue to increase due



to our rapidly warming climate requiring increased capacity and funding to proactively control fuel sources.

Topography: Boulder County's terrain and land slopes affect its susceptibility to wildfire spread. Both fire intensity and rate of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. The arrangement of vegetation throughout a hillside can also contribute to increased fire activity on slopes.

Weather: Weather components such as temperature, relative humidity, wind, and

lightning also affect the potential for wildfire. Weather and climate are addressed together later in this section since weather is short-term changes in the atmosphere and climate is trends in weather over a longer period of time. Since climate is changing so rapidly, these two elements are highlighted below.

Social Considerations

Smoke and air pollution from wildfires can be a severe health hazard and are likely to impact frontline communities first and worst. Due to decades of discriminatory policies and practices, BIPOC members of the community are more likely to experience negative impacts due to pre-existing conditions, lack of access to healthcare, and inability to access resources to protect themselves proactively. Additional social damages from wildfires include evacuations, physical injuries, impacts to air quality and water quality, and loss of human life all of which are likely to become more frequent as the magnitude and severity of wildfires grows in the region. Similar to other hazards, wildfires can lead to loss of electricity, mobility, and hinder communication all of which are more difficult for lower-income people to recover from.

Geographic Extent

Most of the County is susceptible to wildland fires, with highest risk areas located in the Front Range Foothills in the central portions of Boulder County. The Colorado Forest Atlas, formerly known as the Colorado Wildfire Risk Assessment Project (CO-WRAP) is an initiative led by the Colorado State Forest Service to provide information to the public and wildfire professionals to identify areas in need of wildfire planning, disseminate information, encourage collaboration, plan response actions, and prioritize fuels treatments in the state.

The Colorado Forest Atlas calculates a composite risk rating, defined as the possibility of loss or harm occurring from a wildfire. It identifies areas with the greatest potential impacts from a wildfire – i.e. those areas most at risk - considering all values and assets combined together – wildland urban interface (WUI) Risk, Drinking Water Risk, Forest Assets Risk and Riparian Areas Risk. This risk index has been calculated consistently for all areas in Colorado, allowing for comparison and ordination of areas across the entire state. The Wildfire Risk Classes for Boulder County are shown in Figure 4-28.

The areas of greatest concern for wildfire risk are in the WUI, where development is interspersed or adjacent to landscapes that support wildland fire. While traditionally associated with forested mountain areas, WUI areas are also present in grasslands, prairies, valleys, or in any area where a sustained wildfire may occur and impact developed areas. Fires in the WUI may result in major losses of property and structures, threaten greater numbers of human lives, and incur larger financial costs. In addition, WUI fires may be more dangerous than wildfires that do not threaten developed areas, as firefighters may continue to work on more dangerous conditions in order to protect structures such as businesses and homes. Increased

development in WUI areas puts more people and structures potentially at risk. Figure 4-29 shows WUI areas within Boulder County as determined by the Colorado Forest Atlas. CO-WRAP defines the WUI using housing density data to delineate where people and structures meet and intermix with wildland fuels.

Within Colorado, Boulder County has the highest number of residential structures within 500m of public wildland and ranks tenth overall in the west in terms of existing wildfire risk. Based on this assessment the geographic extent is classified as **significant**, with 10-50 percent of the planning area potentially affected

Figure 4-28 Wildfire Hazard, Boulder County

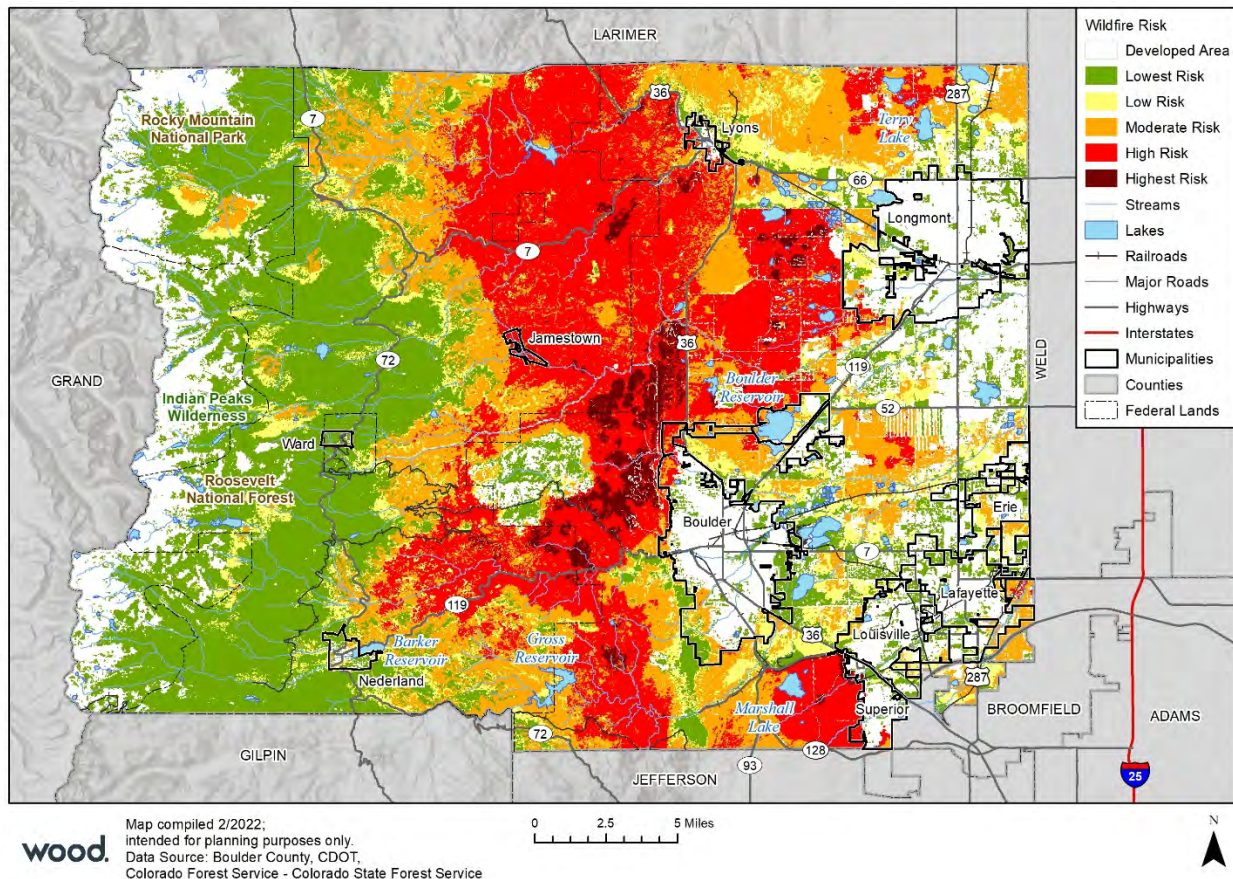
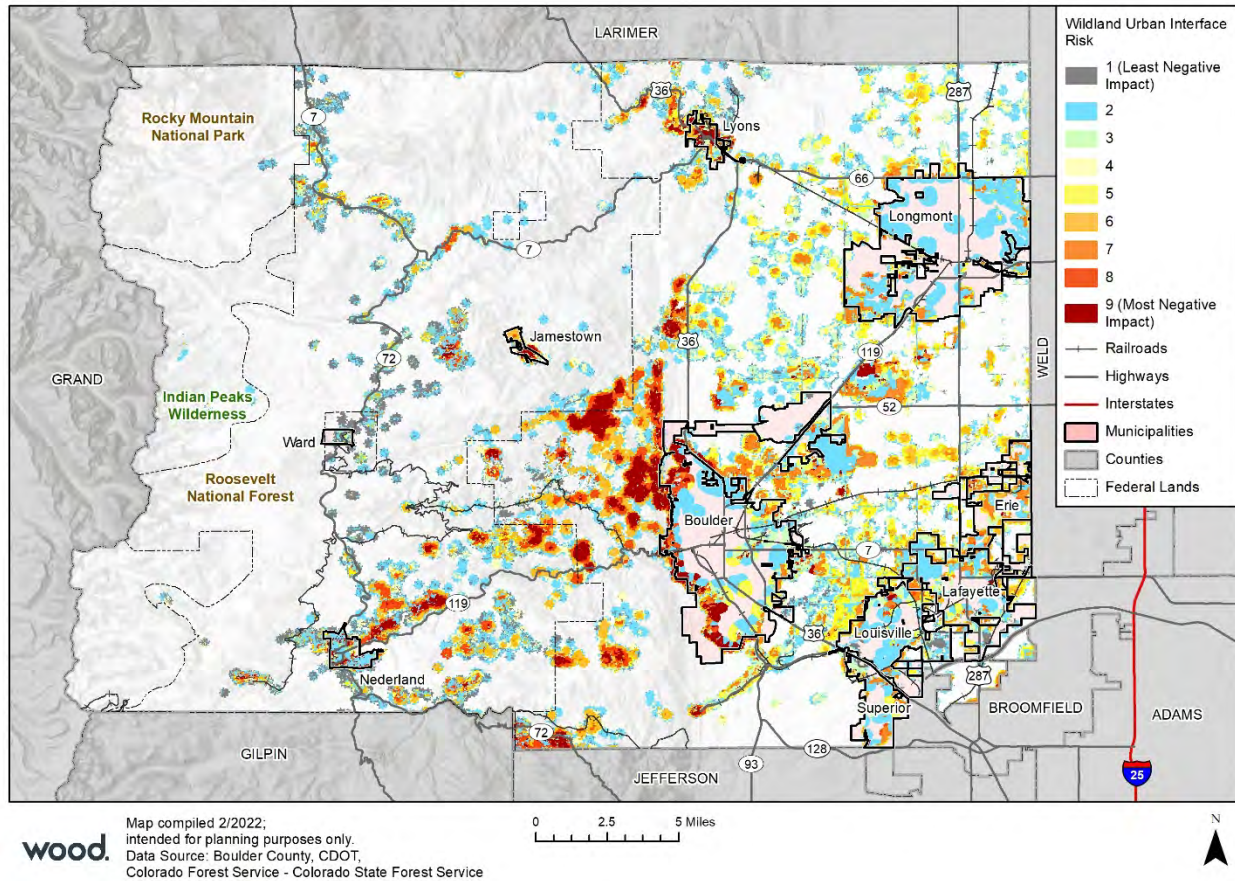


Figure 4-29 Boulder County Wildland Urban Interface (WUI) Areas



Previous Occurrences

According to the Colorado State Forest Service, vegetation fires occur on an annual basis; most are controlled and contained early with limited damage. For those ignitions that are not readily contained and become wildfires, damage can be extensive. Climate change is likely to increase the frequency and size of wildfires in the region leading to more severe damage and impacts to quality of life. Climate change is just one human-caused element making wildfires more likely and deadly. Additionally, human decision-making error attributed to activities such as smoking, uncontrolled campfires, equipment use, and arson are also contributors.

The 2002 wildfire season was the worst in Colorado history however as global temperatures continue to rise, so does the likelihood that record will soon be broken. Recent wildfire history in Colorado is summarized in Table 4-12 and Figure 4-30 below.

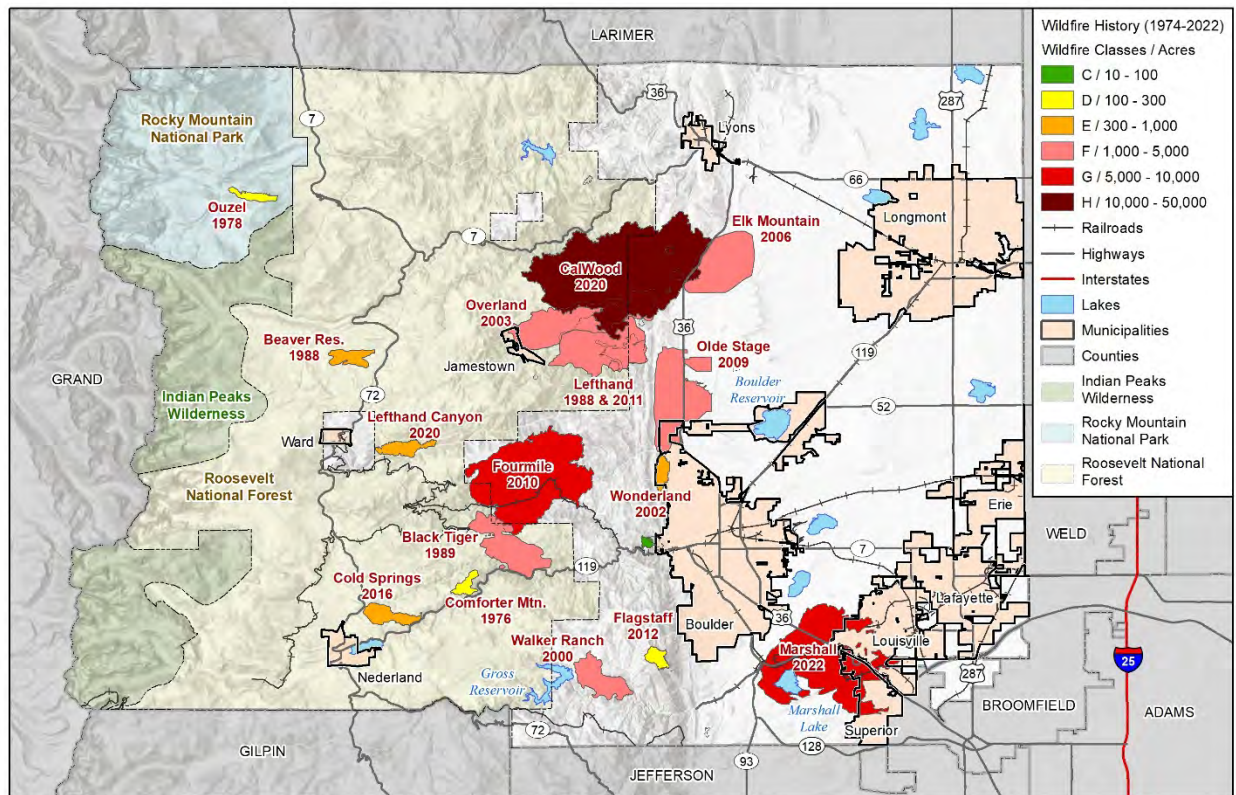
Table 4-12 Recent Colorado Wildfire History

Year	Number of Wildfires	Number of Acres Burned
2021	1,017	48,195
2020	1,080	625,357
2013	1,176	195,145
2012	1,498	246,445
2011	1,286	161,167
2010	1,076	40,788

Year	Number of Wildfires	Number of Acres Burned
2009	1,190	50,456
2008	1,133	141,966
2007	1,351	20,739
2006	2,025	94,484
2005	1,364	27,390
2004	1,290	24,996
2003	2,027	27,655
2002	3,067	926,502

Source: National Interagency Fire Center

Figure 4-30 Wildfire History, Boulder County



wood.
Map compiled 2/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
Colorado Forest Service - Colorado State Forest Service

Boulder County has experienced numerous wildfires dating back to June 29, 1916. Details are provided below.

- **June 29, 1916:** 1,000 acres burned around Bear Mountain.
- **July 5, 1924:** 1,600 acres burned near Nederland.
- **August 9, 1978:** Fire caused by lightning burned more than 1,000 acres in the northwestern portion of Boulder County in Rocky Mountain National Park.
- **October 6, 1980:** A fire caused by an arsonist burned 150 acres in the Pine Brook Hills subdivision, destroying a \$150,000 home.
- **September 1988:** The Lefthand Canyon fire (1,500 acres) and Beaver Lake fire (700 acres) occurred in the canyon above Buckingham Park and close to Beaver Lake near Ward. Houses were threatened, but no structures were lost. Both were thought to be human-caused fires.

- **July 9, 1989:** The Black Tiger Fire destroyed 44 homes on Sugarloaf Mountain, 14 miles southwest of Lyons, and burned over 2,100 acres. Hot temperatures, low humidity, and gusty winds contributed to this human-caused fire. Costs were estimated at \$10 million.
- **November 24, 1990:** Olde Stage Road fire, considered the fourth major wildfire in Boulder County, started when a man threw a burning mattress out his front door. Wind gusts up to 80 mph fanned the fire out of control. Ten homes, five outbuildings, and approximately 3,000 acres were burned in the fire.
- **September 15, 2000:** Walker Ranch/Eldorado fire, likely a human-caused fire, burned approximately 1,061 acres. No structures were lost; but over 250 homes were threatened. Firefighting costs were estimated at \$1.5 million. A FEMA fire management assistance declaration was made to help cover firefighting costs. This area had previously undergone fuels treatment, which mitigated the severity of the fire. The fire is suspected to be human-caused.
- **June 19, 2002:** All but five Colorado Counties are part of a federal disaster declaration (DR-1421) as a result of an extended period of wildfire activity.
- **October 29, 2003:** The Overland fire likely started when the top half of a tree that was sheared off by 60 mph winds fell onto a power line on or near the Burlington Mine cleanup site in northwest Jamestown. High winds and dry weather conditions existed. 3,500 acres were burned; 12 residences and several outbuildings were destroyed. Firefighting costs were approximately \$400,000. FEMA approved a request from the governor for federal fire management assistance. Property damage was estimated in excess of \$8 million but no infrastructure damage was reported. The town was evacuated, and roads and schools were closed for 24 hours.
- **February 14, 2006:** The Elk Mountain fire consumed an estimated 600 acres of brush and grassland. The fire originated in a pile of fireplace ashes that had been dumped outside of a mobile home. The gusting winds spread the hot ash, igniting nearby grasses that were tinder-dry after a prolonged period of dry, hot weather. Winds pushed the fire into a blaze that expanded rapidly, threatening at least three homes. No structures were lost, and damage was largely limited to fences, an apple orchard, and two old farm trucks.
- **September 6-16, 2010:** The Fourmile Canyon Fire burned 6200 acres and destroyed 169 structures. The fire started when a resident did not fully extinguish a fire in a fire pit. High winds fanned the embers and the subsequent fire grew rapidly. The fire started in Emerson Gulch and impacted the communities of Four Mile, Sunshine, and Gold Hill.
- **July 9, 2016:** The Cold Springs Fire was first reported on July 9, 2016, two miles northeast of Nederland, Colorado. Started by a campfire on private property that had not been properly extinguished, the fire quickly spread to more than 500 acres. More than 1,900 residents were evacuated with one thousand homes directly threatened. Due to the valiant efforts of firefighters, only eight homes were lost. There were no casualties. All home within the fire's perimeter that were part of the Wildfire Partners Program survived.
- **March 19, 2017:** Sunshine Fire 62 acres, 426 homes evacuated, no structures damaged or lives lost.
- **October 17, 2020:** The Cal-Wood Fire began near Jamestown on the afternoon of October 17, 2020. Due to dry conditions and high westerly winds the fire rapidly grew in size and did not reach 100% containment until November 14th, 2020. The Cal-Wood Fire ultimately burned 10,113 acres and 26 structures were lost or damaged.
- **December 30, 2021:** The Marshall Fire ignited on the morning of December 30, 2021 and rapidly grew into a fast-moving grassland fire near Marshall Lake in unincorporated Boulder County. Dry conditions and very high winds gusting up to 115 mph drove the fire east towards suburban communities in Superior and Louisville. Evacuation orders were issued for tens of thousands of residents in the town of Superior and the cities of Louisville, Broomfield, and unincorporated Boulder County. The fire was eventually contained with a combination of extensive response by firefighters and heavy snowfall the

following evening. From December 30-31, approximately 6,026 acres were burned, 1,084 buildings destroyed, and approximately \$513 million in damages. One person was confirmed dead as a result of the fire, and another is missing and presumed dead. Within 12 hours of igniting the Marshall Fire had already become the most destructive fire in Colorado state history in terms of structures lost.

Other notable fires (greater than 50 acres in size) in Boulder County include the following:

- **November 1, 1964**—Near Eldorado Springs (100 acres)
- **May 28, 1974:** Near Gold Hill (160 acres) June 1976—Comforter Mountain (256 acres)
- **August 1979:** Coal Creek Canyon (50 acres)
- **September 21, 1984:** U.S. Forest Service land near Lyons (60 acres)
- **August 1, 1987:** Between Boulder and Lyons (50 acres)
- **November 4, 1987:** Southwest of Highway 36 (100 acres)
- **February 21, 1988:** Sunshine Canyon (200 acres)
- **September 7, 1988:** North of Ward (160 acres)
- **July 15, 1991:** West of Boulder Hills subdivision, (135 acres)
- **July 14, 1994:** Near Ward (50 acres)
- **September 3, 1996:** Rabbit Mountain, Lyons (50 acres)
- **September 1, 2005:** North Foothills fire, Foothills Ranch subdivision above Mt. Ridge/Lake of the Pines area (55 acres)
- **October 2010:** The Dome Fire to the west of the City of Boulder and was 800 acres and threatened homes
- **June 26, 2013:** Flagstaff Fire was started by lightning causing home evacuations, but no structures were lost. The fire was 300 acres in size
- **July 9, 2016:** Cold Springs Wildfire occurred two miles Northwest of Nederland and burned 500 acres. There were no casualties and more than 1,900 residents were evacuated. The fire was started by a campfire on private property
- **March 19, 2017:** The Sunshine Fire burned 62 acres west of Boulder and caused 426 homes to evacuate and put 20,000 residents on stand-by evacuation status. The fire did cause any damage to homes but did cost \$800,000 to control. The fire was human-caused and due to an unattended fire at a campsite

Probability of Future Occurrences

Based on historical data, Boulder County experienced at least 23 significant (>50 acres) fires since 1916. This relates to a four-year recurrence interval or a 25 percent chance of wildfire in any given year. Smaller wildfires occur on an annual basis, either in forests or in grasslands within the planning area. Based on these assessments, future probability is classified as **highly likely**, with a near 100 percent chance of occurrence in a given year.

Magnitude/Severity

Based on the definitions established for this plan, magnitude and severity of wildfire is considered **critical**, with 25-50 percent of property severely damaged and/or the potential shutdown of facilities for at least two weeks.

Climate Considerations

Weather and Climate: Weather components such as temperature, relative humidity, wind, and lightning affect the potential for wildfire. There is also a strong connection between climate change and wildfires.

- High temperatures and low relative humidity dry out the fuels that feed the wildfire creating a situation where fuel will more readily ignite and burn more intensely. Colorado has already observed increases in average temperatures and drier soils from increased evaporation which contribute to surges in

wildfire activity. Increased temperatures also lead to longer breeding seasons for bark beetles which destroy forests leading to increased fuel.

- Wind is the most treacherous weather factor. The greater the wind, the faster a fire will spread, and the more intense it will be. In addition to wind speed, wind shifts can occur suddenly due to temperature changes or the interaction of wind with topographical features such as slopes or steep hillsides. As climate change increases the number of extreme weather events, it is likely that extreme winds will increase and play a role in spreading fires faster.
- Lightning also ignites wildfires, which are often in terrain that is difficult for firefighters to reach. An article in the journal Science, estimates that we can expect to see a 12% increase in lightning activity for every 1.8oF of global warming, translating to a potential increases of 50% in strikes by the turn of the century.
- Drought conditions contribute to concerns about wildfire vulnerability. During periods of drought, the threat of wildfire increases. Colorado is experiencing more multi-year droughts and variability in precipitation due to climate change. This trend is likely to continue leading to increased vulnerability.

Potential losses from wildfire include human life; structures and other improvements; natural and cultural resources; quality and quantity of the water supply; assets such as timber, range and crop land, and recreational opportunities; and economic losses. In addition, catastrophic wildfire can lead to secondary impacts or losses, such as future flooding and landslides during heavy rains.

Ecological Considerations

Wildfires have both positive and negative impacts on the natural environment. They impact air quality, water quality, and vegetation. Small fires can help an ecosystem regenerate and increase biodiversity however large wildfires can impact the ability of an ecosystem to recover and have the potential to permanently damage native vegetation and species.

- **Air Quality:** Wildfires generate smoke which is made up of gases, water vapor and microscopic particles. The small particles are referred to as PM which impacts air quality tremendously and has a range of negative impacts on the human body including difficulty breathing, heart stress and irritation to eyes. Smoke from fires can travel long distances and will impact humans and animals.
- **Water Quality:** Wildfires can have impacts on water quality for years and even decades. Wildfires increase stormwater runoff through reduction in vegetation and degradation of soil. Without vegetation to slow the flow of water down, runoff water transports sediment and debris into nearby water bodies. This impacts nutrient levels and can also result in algal blooms that impact downstream waterbodies.
- **Vegetation and Biodiversity:** Trees and vegetation are important for wildfire management and human health. Diverse vegetation and promotion of ecosystem resilience will help to improve biodiversity and reduce fire risk.

Overall Hazard Significance

Based on assessments of probability, geographic extent and magnitude/severity, the overall hazard significance of wildfire is classified as **high**, with widespread potential impact.

4.3.16 Windstorm

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Windstorm	Extensive	Highly Likely	Critical	Moderate	High

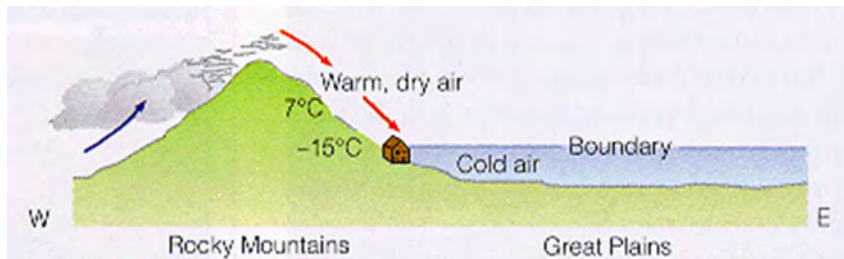
Description

High winds can result in property damage and injury and are a frequent occurrence throughout the region that includes Boulder County. Strong wind gusts can rip roofs from buildings, snap power lines, shatter windows, down trees, and sandblast paint from cars. Other associated hazards include utility outages, arcing power lines, debris blocking streets, dust storms, and occasional structure fires. Windstorm types that are prevalent in Boulder County include the following:

Chinook Winds

Downslope winds in the region of Colorado that includes Boulder County are referred to as Chinook winds, after the Native American Tribe of the Pacific Northwest. These downslope winds can occur with violent intensity in areas where mountains stand in the path of strong air currents. These warm and dry winds occur when the winds blow across the Continental Divide from the west and descend from the foothills and out onto the plains (see Figure 4-31). They are caused by high pressure conditions west of Boulder County, low pressure over and/or east of the County, and strong westerly winds in the mountains.

Figure 4-31 Chinook Wind Pattern



Source: University of Colorado at Boulder Atmospheric and Oceanic Services (ATOC) Weather Lab

Bora Winds

In general, Bora winds are downslope winds that replace relatively warm light wind conditions with cold temperatures and strong wind gusts. The specific Bora winds that affect Boulder County are relatively dry and cold and blow from the west. While their pattern onset is similar to Chinook winds, they are comprised of cold air, whereas a Chinook brings warmer and drier air. Generally, but with certain notable exceptions, Bora winds are less extreme than winds generated during Chinook events.

Damaging winds are measured using the Beaufort Wind Scale.

Table 4-13 Beaufort Wind Scale

Beaufort Rank	Description	Windspeed (MPH)	Land Conditions
0	Calm	<1	Calm. Smoke rises vertically.
1	Light air	1 – 3	Wind motion visible in smoke.
2	Light breeze	3 – 7	Wind felt on exposed skin. Leaves rustle.

Beaufort Rank	Description	Windspeed (MPH)	Land Conditions
3	Gentle breeze	8 – 12	Leaves and smaller twigs in constant motion.
4	Moderate breeze	13 – 17	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	18 – 24	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	25 – 30	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	31 – 38	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	39 – 46	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	47 – 54	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	55 – 63	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	64 – 72	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 73	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Source: National Oceanographic and Atmospheric Association, <http://www.spc.noaa.gov/faq/tornado/beaufort.html>

Social Considerations

Windstorms can severely impact human health. Direct impacts such as flying debris or falling trees can lead to severe injury or even death. Indirect impacts may include exacerbation of chronic illnesses or power outages leading to issues with mobility, access to resources, and medical care. Windstorms can also have an inequitable impact on outdoor workers who are at more risk of being impacted by debris. Additionally, windstorms can severely damage property which, as noted in social considerations for many hazards, low-income people are unable to afford to repair.

Geographic Extent

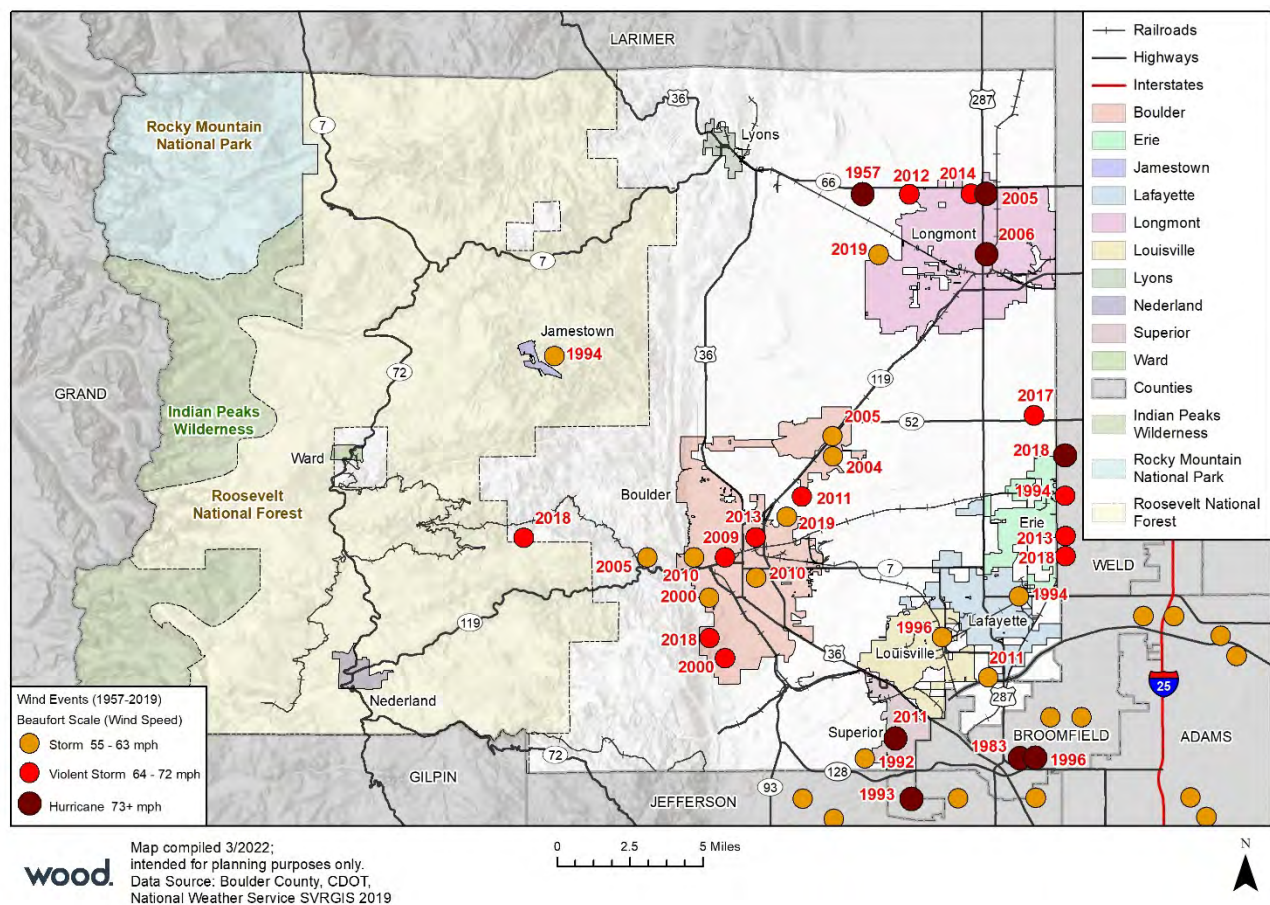
The geographic extent of windstorm is considered **extensive**, with 50-100 percent of the planning area affected. While the entire county can be affected by strong winds, the western county foothills and communities located at the base of the foothills experience the highest winds speeds. High alpine areas of the County are also subject to high winds but the impact in these locations is limited mostly to resource damage due to lower density of development. The Colorado Front Range Gust Map and Snow Load Design Data for Colorado provided by the Boulder County Land Use Department indicates general patterns of wind intensity through the prescription of more stringent wind shear design standards in western sections of the County.

Previous Occurrences

High wind events are one of the most notable natural hazards affecting Boulder County. According to NOAA's Climate Diagnostics Center, the County experiences some of the highest peak winds in the United States. Locations within the planning area experience wind gusts in excess of 100 mph with nearly annual frequency. Gusts have been measured as high as 147 mph. The National Center for Atmospheric Research (NCAR) reports that a severe windstorm in January 1982, comparable to the landfall of a Category 2-3 hurricane, resulted in more than \$17 million in damages and extensive structural impacts in Boulder County.

The peak of the wind season is December and January, but downslope windstorms have been recorded in every month except July. The map in Figure 4-32 shows notable wind occurrences throughout Boulder County between 1957 and 2019 based off data from the NWS Storm Prediction Center.

Figure 4-32 Boulder County Wind Events, 1957-2019



Historical windstorm events are summarized below:

Since 2007 there has been 105 days with winds above 39 knots in Boulder County. According to the NCEI, between January 1, 1955, and December 31, 2021, Boulder County experienced 414 wind events that reached wind speeds of at least 50 knots (57.6 mph). This number includes instances of the same wind event reported at multiple locations throughout the County, as the NCEI further clarifies that these events occurred across 263 individual days throughout this same time period.

Of these wind events, three deaths, 12 injuries, and approximately \$22,358,000 in property or crop damage were reported. Information on selected events provided by the NCEI from this period is detailed below.

Note that costs may include damages across a multiple county region are not necessarily specific to Boulder County:

- **February 24, 1994**—High winds, 96 knots (~110 mph), property damage of \$500,000
- **March 23, 1994**—High winds, 67 knots (~80 mph), property damage of \$5,000
- **October 29, 1996**—High winds, 88 knots (~103 mph), one death, five injuries, property damage of \$5.2 million
- **February 2, 1999**—High winds, 110 knots (~127 mph), property damage of \$3 million
- **April 8, 1999**—High winds, 100 knots (~115 mph), property damage of \$7.2 million
- **April 9, 1999**—High winds, 85 knots (~98 mph), property damage of \$13.8 million.
- **May 20, 2001**—High winds, 72 knots (~82 mph), 6 injuries, property damage of \$3.4 million
- **October 29, 2003**—High winds, 70 knots (~81 mph), property damage of \$979,000
- **December 20, 2004**—High winds, 88 knots (~102 mph), 3 injuries, property damage of \$3,400,000
- **December 5, 2005**—High winds, 85 knots (~98 mph), high winds reportedly broke windows and caused roof damage, winds downed trees and power lines throughout Boulder County
- **January 8, 2007**- Peak wind gusts included: 115 mph at the National Wind Technology Center near Eldorado Springs, 89 mph; seven miles west-northwest of Berthoud, 78 mph at Lafayette, with 77 mph; three miles west-southwest of Boulder.
- **December 12, 2009**- Very strong Chinook winds blasted areas in and near the Front Range Foothills of Larimer, Boulder and Jefferson Counties. The wind blew down trees and power poles, downed electrical lines and fences, and damaged homes and vehicles. Scattered power outages were reported all along the Front Range. In Metropolitan Denver alone, 24,000 Xcel customers were affected by the outages. Strong crosswinds also blew over some semi-trailers along Interstate 25, near the Wyoming state line. In Larimer County, two small wildfires were sparked by downed power lines in Rist Canyon and near the Laporte/Bellevue areas. Four planes were damaged at the Vance Brand Municipal Airport in Longmont; one was wrecked. Insurance companies estimated up to \$7 million in damage along the Front Range and adjacent plains, making it the fourth costliest windstorm to hit Colorado. Peak wind gusts included: 111 mph, 3 miles north of Masonville; 98 mph at Carter Lake; 87 mph at the National Wind Technology Center; 86 mph, 2 miles north of Longmont and at Pinewood Lake; 81 mph, 3 miles east of Gold Hill; 78 mph, 2 miles west-southwest of Broomfield; 77 mph at Erie; 76 mph, 21 miles north of New Raymer and 75 mph at Lafayette.
- **December 31, 2011**- A fast moving upper-level storm system, along with a deep low-pressure system over Nebraska and high pressure building over Utah, combined to create a powerful windstorm across Northeast and North Central Colorado. In the mountains and foothills, several locations recorded wind gusts in excess of 100 mph. Numerous trees were knocked down throughout Arapahoe National Forest. One man was killed when he was impaled by a falling tree limb while driving along U.S. Highway 36, north of Boulder.
- **January 18, 2012**- Damaging winds developed in and near the Front Range. A peak wind gust to 104 mph was recorded in the foothills of Boulder County. In Boulder, the high winds knocked down several trees, power poles and electrical lines. Some of the fallen trees damaged homes and automobiles. A semi-trailer was blown on its side along State Highway 93 near Marshall. In Loveland, the strong winds downed power lines and caused scattered electrical outages, which affected approximately 150 residents. In the mountains, the combination light to moderate snow driven by high winds, produced blizzard conditions above timberline. Storm totals generally ranged from 3 to 8 inches.
- **February 10, 2017** - Hurricane force winds toppled trees and knocked over several semis in and near the Front Range Mountains and Foothills. Nearly four thousand residents in Boulder County were left without power. The temperature in Denver reached 80 degrees. It was the first 80-degree temperature recorded in the month of February and established the all-time record for the month. The high wind and extremely warm temperatures helped to spread three grassfires in Boulder and Larimer Counties;

however, no homes were damaged or lost. Intense wind gusts on the 10th caused power outages and damage to trees, fences, and power lines across Boulder County.

Other significant wind events identified by the HMPC include the following:

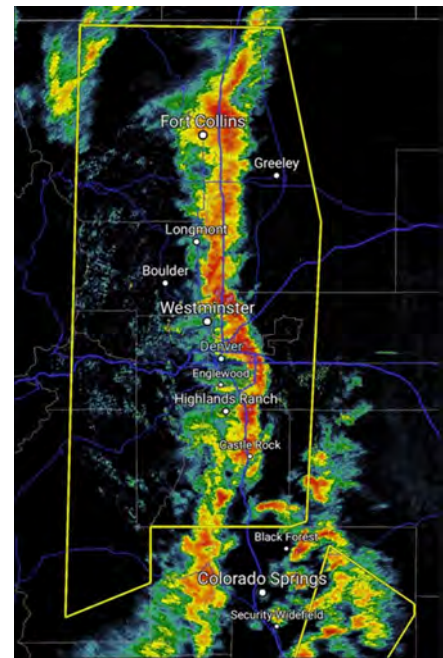
- **January 11, 1972:** Winds gusting to 97 mph damaged 40 trailers at Boulder Valley Village, including three that burned. Damage was estimated near \$3 million.
- **January 17, 1982:** In one of the most devastating windstorms in Boulder County, winds were clocked at 137 mph at NCAR. Twenty gusts in excess of 120 mph were measured during a 45-minute period. The southern section of the City of Boulder was the hardest hit area of the County. At least 15 people were treated for cuts and bruises at Boulder Community Hospital after being struck with flying debris and glass. Trees were uprooted, power lines toppled, roofs blown off, houses torn apart, and cars damaged. Damage totaled approximately \$17 million.

Previous occurrences of wind events resulting in fatalities in Boulder County include the following:

- **March 18, 1920:** Three people were killed when a fire truck responding to a fire collided with a car.
- **January 7, 1969:** One-half of all the houses in the city were damaged by wind. Winds clocked at 96 mph downtown and 130 mph at NCAR. One person died when he was blown off a Cherryvale fire department truck that was responding to a grass fire near the Boulder Airport.
- **June 1969:** A University of Colorado at Boulder student died while sailing under a parachute in 80 mph winds.
- **January 10, 1990:** One person was killed in a three-car accident on the Boulder Turnpike two miles west of Broomfield. Winds gusting to 107 mph caused poor visibility.
- **October 29, 1996:** A Boulder County man died as he was trying to secure his pop-up camper trailer during winds in excess of 100 mph. The trailer blew over on top of him. Trees were downed and cars and property damaged.
- **February 3, 1999:** Downed power poles and tree limbs cut power to over 10,000 homes. The peak gust of 127 mph was recorded at Sugarloaf. 80 mph winds were recorded at Nederland, 98 mph winds in the City of Boulder, 120 mph winds in the town of Lafayette, 100 mph winds in Longmont, and 119 mph winds were recorded in Wondervu. Nearly a dozen power poles were toppled between Baseline Road and Arapahoe on 95th street near Lafayette. The roof of the Boulder County Jail sustained approximately \$150,000 in damage. Damage across the Front Range region was estimated at \$3 million.
- **April 8-10, 1999:** High winds hit Boulder County on April 8, 1999, and then again on April 10 with 120 mph winds recorded at Sugarloaf, 100 mph winds recorded in southern sections of the City of Boulder, and 90 mph in Longmont. Trees were uprooted and semi-trailers overturned.
- **March 6, 2004:** Tree cleanup costs were estimated at \$5,000.
- **June 2004:** Tree cleanup costs were estimated at \$2,000.
- **June 6, 2007:** Intense wind conditions occurred along the North Central Mountains, Front Range Foothills and Urban Corridor. 92 mph wind gusts were recorded at the City of Boulder. Several trees were uprooted across the urban corridor. Xcel Energy reported service outages in Boulder, Denver, Lakewood, Longmont, and Windsor.
- **October 19, 2007:** Strong winds developed in the Front Range Foothills and portions of the Northeast Plains. Peak wind gusts included: 78 mph at Georgetown, 70 mph at Estes Park, 62 mph; three miles east of Amherst, and 61 mph; three miles northeast of Wiggins.
- **April 17, 2018:** A woman in Louisville died after she was struck by a falling tree branch. She stopped to rest under a tree when a large branch broke off and struck her in the head.

Other significant storms with wind velocities above 90 mph or where damage occurred include the following:

- **October 1949:** 85 mph, 300-ton crane toppled Valmont Plant
- **January 15, 1967:** 125 mph, NCAR
- **June 25, 1969:** 123 mph, NCAR
- **January 24, 1970:** 122 mph, NCAR
- **January 25, 1971:** 147 mph, NCAR
- **December 11, 1973:** 120 mph, Marshall Mesa
- **November 26, 1977:** 119 mph, Davidson Mesa
- **December 4, 1978:** 148 mph, one death
- **January 24, 1982:** 140 mph, Wondervu
- **December 25, 1984:** 112 mph, \$100,000 damage
- **September 24, 1986:** 131 mph, \$100,000 damage
- **January 23, 1988:** 90 mph, damaged bridge on Highway 157
- **February 9, 1988:** 96 mph, 1,600 homes without power
- **May 7, 1988:** 110 mph, 12,000 residents without power; annual Boulder Kinetics event canceled
- **January 8, 1990:** 110 mph, minor damage
- **December 14, 1990:** 120 mph, roof, trees, and cars damaged
- **January 24, 1992:** 143 mph, NCAR, minor damage
- **January 3, 1995:** 104 mph, Boulder Airport
- **December 4, 1995:** 95 mph, NCAR, minor damage
- **November 13, 1995:** 124 mph, NCAR, power outages in Nederland, a downed power line started a wildfire in Pine Brook Hills
- **January 1, 2007:** 100kts
- **December 29, 2008:** 96kts
- **January 7, 2009:** 93kts
- **November 12, 2011:** 100kts
- **December 31, 2011:** 101kts
- **December 31, 2011:** 109kts
- **January 18, 2012:** 90 kts
- **January 9, 2017:** High winds developed in and near the Front Range Foothills. Peak wind gusts included: 90, 3 miles north-northeast of Pleasant View; 88, 3 miles west-southwest of Louisville; 87, 2 miles south of Gold Hill; 79 at the NCAR Mesa Laboratory; 76 at Glen Haven; 60 in Littleton and 58 in Arvada. Scattered outages affected approximately 2,400 customers in Boulder and Jefferson Counties. In Berthoud, strong winds destroyed a barn
- **June 6, 2020:** First Recorded Derecho. A derecho is a straight-line wind event with sustained gusts connected to a long line of thunderstorms. Derechos are not common in Colorado with the last one being documented in 1994. The derecho on June 6th was a low dewpoint derecho that sped across the Rocky Mountains at 75 MPJ. Strong winds uprooted trees and disrupted power to more than 100,000 residents in the metro area. The severe wind from the derecho extended nearly 700 miles from eastern Utah across the state and into North Dakota
- **December 30, 2021-January 1, 2022:** High sustained winds with gusts recorded up to 115 mph were a driving factor in the rapid spread and destructive nature of the Marshall Fire, which



burned over 6,000 acres and upwards of 1,000 structures; several mobile homes were damaged by the wind according to the HMPC.

Probability of Future Occurrences

Based on the frequency of previous occurrences and the definitions established for this plan, future probability of occurrence is classified as **highly likely**, with nearly a 100 percent chance of occurrence in the next year.

Magnitude/Severity

Based on assessments of the typical impacts of windstorms, magnitude and severity is considered **critical**, with 25-50 percent of property severely damaged and/or shutdown of facilities for at least two weeks.

Climate Considerations

A study published in the journal Nature Climate Change found that winds have been getting faster and more intense since 2010. The increase in average global wind speed over the past decade has gone from 7mph on average to 7.4 mph on average. The research team found that climate patterns are influencing wind speeds. Due to temperature differences between regions, wind speeds will either pick up or slow down. With average global surface temperatures increasing, wind speeds could continue to pick up however there is not conclusive evidence.

Ecological Considerations

Windstorms can lead to significant environmental impacts. Severe wind events are capable of uprooting trees, destroying wildlife habitat, and providing opportunities for invasive species to establish themselves. Invasive species make it more difficult for forests and native vegetation to recover. Loss of native trees and vegetation can impact ability to sequester carbon and biodiversity.

Overall Hazard Significance

Based on assessments of probability, geographic extent and magnitude/severity, the overall hazard significance of windstorm is classified as **high**, with widespread potential impact.

4.3.17 Winter Storms (Severe)

Hazard	Geographic Extent	Probability/Frequency	Magnitude/Severity	Increased Threat (Climate Change)	Overall Significance
Winter Storm (Severe)	Extensive	Highly Likely	Catastrophic	Substantial	High

Description

Winter storms can include heavy snow, ice, and blizzard conditions. Heavy snow can immobilize a region, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse roofs and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of snow removal, damage repair, and business losses can have a tremendous impact on cities and towns.

Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days until damage can be repaired. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

Some winter storms are accompanied by strong winds, creating blizzard conditions with blinding wind-driven snow, severe drifting, and dangerous wind chills. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. Blowing snow can reduce visibilities to only a few feet in areas where there are no trees or buildings. Serious vehicle accidents can result with injuries and deaths.

Winter storms in Boulder County, including strong winds and blizzard conditions, can result in localized power and phone outages and closures of streets, highways, schools, businesses, and nonessential government operations. People can also become isolated from essential services in their homes and vehicles. A winter storm can escalate, creating life-threatening situations when emergency response is limited by severe winter conditions. Other issues associated with severe winter weather include the threat of physical overexertion that may lead to heart attacks or strokes. Snow removal costs can also impact budgets significantly. Heavy snowfall during winter can also lead to flooding or landslides during the spring if the area snowpack melts too quickly.

The NWS defines winter watches, warnings and advisories including:

- **Ice Storm Warning** is issued when a period of freezing rain is expected to produce ice accumulations of 1/4" or greater or cause significant disruptions to travel or utilities.
- **Heavy Sleet Warning** is issued when a period of sleet is expected to produce ice accumulations of 1" or greater or cause significant disruptions to travel or utilities.
- **Heavy Snow Warning** is issued when snow is expected to accumulate four inches or more in 12 hours, or six inches or more in 24 hours.
- **Winter Storm Warning** is issued for a winter weather event in which there is more than one hazard present, and one of the warning criteria listed above is expected to be met.
- **Blizzard Warning** is issued for sustained wind or frequent gusts greater than or equal to 35 mph accompanied by falling and/or blowing snow, frequently reducing visibility to less than 1/4 mile for three hours or more. Watches are issued when conditions may be met 12 to 48 hours in the future.
- **Winter Weather Advisory** is issued when wintry weather is expected, and caution should be exercised. Light amounts of wintry precipitation of patchy blowing snow will cause slick conditions and could affect travel if precautions are not taken

Social Considerations

Winter storms have impacts to several of the systems we rely on daily. For low-income families, winter storm events can shut down schools and require parents or caretakers to take time off of work. On tight budgets, this can be a tremendous impact, especially if children receive one or more free or reduced meals at school.

Winter storm events can also reduce mobility and disrupt public transportation services which impact the ability for many to get to work. Public buses can be significantly delayed or even stuck which hinders the ability of many to get resources they need or to get to their place of employment.

Additionally, winter storms are often accompanied by cold weather which impacts heating costs. For low-income families that spend a larger percentage of their income on heating their home, this can quickly become unaffordable.

Geographic Extent

The geographic extent of severe winter storms is classified as **extensive**, with 50-100 percent of the planning area potentially affected. While certain sections of Boulder County have a significantly higher probability of impact from winter storms, all areas can potentially be affected by blizzard conditions, snow drifts, ice, wind, and downed power lines. The highest point in the County is 14,255 feet and the lowest is 4,986 feet. Over 50 percent of the County is 6,000 feet or above in elevation and therefore located in areas with significant risk of winter storm impacts in any given year. The Colorado Front Range Gust Map and Snow Load Design Data for Colorado (available through the Boulder County Land Use Department) indicates a pattern of more intense of winter storms in western Boulder County correlating with increases in elevation. While this map does not represent direct observations for wind intensity and snow depth, it does indicate the need for more robust building design standards to the west and as elevation increases.

Previous Occurrences

Both the western and eastern portions of Boulder County receive snowfall on a regular seasonal basis, predominantly from October through April; however, the western portion of the County receives substantially more snow than the eastern portion. The following summarizes the effects of snow in the County of Boulder based on data from the Western Regional Climate Center.

- **Seasonally, December to February:** Regular winter snowstorms
- **April 13, 2020:** The record "coldest maximum" was also set on Monday when the high temperature for the day never reached above 25 degrees. It had never stayed so cold on April 13 in Denver's recorded history. In addition to the cold, most areas along the Front Range measured significant snow Wednesday night into Thursday this week. The biggest snow total was in Jamestown which is located in the foothills west of Boulder. Jamestown measured 30 inches while Fort Collins received 14 inches. Boulder received 16.9 inches of snow which brings their total for the season to a record 151.2 inches. Meanwhile Denver's official total was only 1.3 inches measured at DIA.
- **November 26, 2019:** A powerful snowstorm delivered significant accumulation west of the Interstate 25 corridor. Boulder received 20.7 inches of snow, making it the third-snowiest day ever recorded in the

10-year snowfall averages in Boulder, 2010 to 2019

Days		Inches	Centimetres
6.0	January	14.5	36.8
5.0	February	14.6	37.1
4.0	March	16.2	41.1
4.0	April	10.2	25.9
2.0	May	7.4	18.8
0.0	September	0.0	0.0
6.0	October	26.4	67.1
4.0	November	29.5	74.9
1.0	December	3.4	8.6
21.4	Year	96.1	244.0

city. The first was Oct. 25, 1997; the second was Nov. 20, 1979. The 20.7-inch total also set a new daily snowfall record for Nov. 26, smashing the old record for the date of 13.0 inches set in 1959. Additionally, the 22.3-inch two-day total (Nov. 25-26) is the third biggest for a November snowstorm. Only Nov. 20-21, 1979, and Nov. 3-4, 1946 had higher totals, according to the Colorado Climate Center.

- **March 25, 2016:** A monster snowstorm dumped a record-breaking 16.4 inches of snow on Boulder on Wednesday while crippling cities all along the Front Range and stranding would-be spring break travelers. That Boulder snowfall, as reported by meteorologist Matt Kelsch, shattered the record for snowfall on March 23, which was 10.6 inches set in 2013. In fact, Wednesday's dump exactly equaled Boulder's average March snowfall for the past 30 years and comes on top of last week's 15-inch snowfall.
- **March 2003:** A winter snowstorm dumped up to 60 inches of snow. The town was without electricity and phone service for three days. Significant storms over the past few years include March 2003 (over six feet of snow), March 1992 (20 inches), March 1990 (24 inches), December 1982 (24 inches), and December 1987 (over 24 inches). Boulder County was included in both the 2003 and 2006 Presidential Emergency declarations for snowfall.

Data from the NCEI and SHELDUS identified 190 winter storm events between January 1, 1993, and November 30, 2007, which impacted Boulder County or its major forecast zones (Z035 and Z039). Of these, the following events resulted in reported injuries and/or property damage:

- **February 11, 1994:** Heavy snow, two injuries, property damage of \$50,000. Moist upslope winds and an upper-level system produced heavy snow over portions of the Front Range. Amounts ranged from 6 to 12 inches.
- **January 28, 1995:** Heavy snow, two deaths, property damage of \$25,000. All mountains, northeast Front Range. A strong, very moist, and slow-moving winter storm system struck Colorado. In the high country, all mountain ranges received at least three feet of snow with some locations in the Elk Mountains collecting six to eight feet. Two people were killed by avalanches during the week. Road closures were common in the high country due to poor visibilities and avalanches. Interstate 70 was closed when an avalanche crossed the westbound lanes west of the Eisenhower Tunnel. At lower elevations, including the foothills and northern Front Range, the snow started falling the morning of the 10th. Most of the snow fell during the 24-hour period after onset. Locations in and near the foothills received the most snow as they collected between 10 and 15 inches. Golden and south sections of Boulder County collected 15 and 14 inches, respectively.
- **February 8, 1995:** Blizzard, property damage of \$3.1 million. The storm that moved into eastern Colorado developed into a blizzard across the northeast plains as an intense surface cyclone formed. The combination of freezing rain followed by heavy snow and damaging winds led to widespread electrical outages. Snowfall totals generally ranged from 6 to 18 inches. The heaviest snow occurred near the Front Range Foothills; the Palmer Divide; in the area from just south of Denver, east and northeast into northern Lincoln and Washington counties; and near the Nebraska state line.



Sustained winds from 35 to 58 mph with gusts to around 75 mph were recorded. Denver International

Airport was completely shut down for the first time in its brief history. Power surges and outages constantly crippled the airport's massive computer system. The airport was closed at 5:00 a.m. and did not reopen until mid- afternoon. Power outages affected nearly all of northeast Colorado. Some areas only had scattered outages for a few hours, while more remote areas were blacked out for over a week. As a result, most businesses were closed, and school classes canceled. The only businesses that remained open during the storm were those using backup generators. Overall, 220,000 Xcel Energy customers were affected, making it the worst outage in the company's history.

- **March 17, 2003:** Blizzard, property damage of \$62 million. A very moist, intense, and slow-moving Pacific storm system made its way across the Four Corners area and into southeastern Colorado from March 17-19, allowing for a deep easterly upslope flow to form along the Front Range. The storm dumped 31.8 inches of snow at the former Stapleton International Airport, enough for second place in the Denver weather history record book. The storm also placed March 2003 in first place for the snowiest March in Denver history and fifth place for the wettest March on record. In addition, the storm broke a 19-month streak of below normal precipitation in Denver. The heavy wet snow caused roofs of homes and businesses to collapse across the urban corridor. The snow also downed trees, branches, and power lines. Up to 135,000 people lost power at some point during the storms, and it took several days in some areas to restore power. Avalanches in the mountains and foothills closed many roadways, including Interstate 70 in both directions, stranding hundreds of skiers and travelers. Denver International Airport was also closed, stranding approximately 4,000 travelers. In all, the estimated cost of the damage to property alone (not including large commercial buildings) was \$93 million, making it easily the costliest snowstorm ever in Colorado. According to this NCEI report, the second costliest snowstorm was the 1997 blizzard, where damage totaled \$10.5 million (see description in the following grouping of events). The areas hardest hit by heavy snow were the northern mountains east of the Continental Divide, the Front Range Foothills, and Palmer Divide, where snowfall totals ranged from three feet to more than seven feet. Boulder County received 22.5 inches of snow. Tree cleanup costs for this storm and a subsequent storm in May were estimated at \$3,000.
- **December 20, 2006:** This storm resulted in a presidential emergency declaration. Some of the largest snowfall totals during this event ranged from 21 inches in Fort Collins to 42 inches at Conifer, southwest of Denver. Meteorologists at the NWS office in Boulder measured 19 inches of snowfall. This blizzard forced the closure of interstates, businesses, schools, and airports, stranding thousands of holiday travelers. This storm resulted in a presidential snow emergency declaration. Eligible snow removal reimbursement costs in Boulder County totaled \$279,044 federal share, and \$93,014 local share, for \$372,058 total. The St. Vrain Valley School District reported that 20 employees, six visitors and 59 students reported injuries. The employee injury costs were \$97,736. Snow removal expenses amounted to \$32,846 and the disaster relief funding from FEMA was \$23,679.29. There was also a report of some vehicle damages as well as school and road closures.
- **January 7, 2007:** Strong winds associated with an intense upper-level jet, and a very strong surface pressure gradient, developed in and near the Front Range Foothills. Peak wind gusts ranged from 77 mph to 115 mph. The strong winds coupled with freshly fallen snow resulted in whiteout conditions and several highway closures due to blowing and drifting snow. Road closures included: State Highway 93, between the cities of Golden and Boulder; and State Highway 36, from the Boulder Turnpike, in



Broomfield, to South Boulder Road; More than 100 people were stranded in their cars between Golden and Boulder as blowing and drifting snow made the highway impassable. Snow drifts along State Highway 93 were over six feet in depth. Up to twenty cars were also abandoned along the Diagonal Highway, between Boulder and Longmont. Thirty vehicles were stranded along State Highway 128. The high winds also caused intermittent power outages in Boulder County.

- **February 16, 2007:** A strong upper-level jet stream over northern Colorado, coupled with a passing weather disturbance, brought a one-two punch of heavy snow and strong winds to areas in and near the Front Range. At the National Wind Technology Center, the peak wind gust topped out at 101 mph. In and near the Front Range Foothills, the wind stirred up intense ground blizzards which resulted in several road closures. State Highway 93, between Golden and the City of Boulder was closed for much of the day.



Other winter storm events identified by the HMPC include the following:

- **May 1978:** The spring storm of 1978 dropped 30 inches of snow on Boulder County and was responsible for at least one death and a serious injury. It also collapsed an old hotel building (the Arnett Hotel) on Pearl Street across from the Daily Camera. The snow started before dawn on Friday, May 5, accumulating about eight inches in town and 26 in the foothills by later that day. It snowed all day Saturday and into Sunday.
- **Christmas storm of 1982:** The storm began on Christmas Eve, lasting through Christmas Day. Winds created large drifts, closing roads and stranding travelers.
- **December 24-29, 1987:** 20 inches of snow fell over a period of a few days. Countywide snow removal operations were estimated at \$280,000.
- **March 6, 1990:** More than two feet of wet snow dumped in the foothills, paralyzing traffic, stranding travelers, preventing mail delivery, and causing hundreds of accidents and power outages in Boulder County. Winds of 37 mph qualified the storm as a blizzard.
- **November 17, 1991:** The October 1991 freeze ("Halloween Freeze") saw temperature extremes from 60°F to below 0°F. This snowstorm combined with a freeze the previous month caused \$51,250 in tree damage.
- **March 9, 1992:** Twenty inches of snow fell in Boulder County. The storm began early in the afternoon with spring-like thunder and lightning and turned winter-like in about one hour. More than 25,000 residents were without electricity when wet, wind-driven snow toppled power lines. Many cars were stranded on Highway 36 between the City of Boulder and Denver, and on Highway 93 between Boulder and Golden. The storm caused \$32,045 in tree damage (an additional \$20,000 was spent on pruning and \$23,600 on removal).
- **September 20, 1995:** This storm damaged 80-90 percent of the tree population in the City of Boulder. Total damage and associated costs equaled \$363,710.
- **April 24, 1997:** A snowstorm dumped over 16 inches of snow in Boulder County; mountain areas received around 30 inches.
- **October 24, 1997:** During this "Blizzard of 1997," Boulder County received 30 inches of snow in 48 hours. A total of 51 inches fell in Coal Creek Canyon. Power outages were sporadic and tree breakage was minimal. Areas south and east of Boulder County were impacted more by the storm than Boulder County due to high winds that created blizzard conditions. The storm resulted in five deaths, two

injuries, and significant dollar losses. This storm was the largest October storm in county history and ranked as the fourth largest snowstorm on record. Snow totals made the 1997 calendar year the snowiest on record with a total of approximately 130 inches. Estimated tree cleanup costs were \$7,000.

- **Fall 2000:** Tree cleanup costs were estimated at \$2,000.
- **December 28, 2006:** This large storm arrived a mere week after another winter storm of significance (see above).
- **December 12, 2012:** Damaging winds developed in and near the Front Range. A peak wind gust to 104 mph was recorded in the foothills of Boulder County. In Boulder, the high winds knocked down several trees, power poles and electrical lines. Some of the fallen trees damaged homes and automobiles. In the mountains, the combination of light to moderate snow driven by high winds, produced blizzard conditions above timberline. Storm totals generally ranged from 3 to 8 inches.

Peak wind gusts included: 104 mph in south Boulder; 98 mph, 3 miles southwest of Pinecliffe; 95 mph, 2 miles northwest of Rocky Flats; 92 mph, along State Highway 93 near Marshall; 87 mph atop Berthoud Pass and in Boulder Canyon; 80 mph, 5 miles west-northwest of Boulder; 83 mph at NCAR Mesa Lab; 78 mph, 8 miles northeast of Four Corners; 79 mph at the National Wind Technology Center; 76 mph at Wondervu; 75 mph atop Loveland Pass and the NCAR Foothills Lab in Boulder; 74 mph at Blue Mountain, Boulder Municipal Airport, 9 miles east of Dillon and 1 mile northwest of Lyons; 73 mph, 4 miles east-northeast of Nederland; 72 mph at the Junction of State Highways 72 and 93.

- **September 8-9, 2020:** The second earliest recorded snowfall since 9/3/1961 occurred in the Denver Metro Area and it was the earliest recorded snow fall for the City of Boulder since 1948. This storm also set a record in the widest temperature swing over a 24-hour period going from the high 90s to freezing the next day. Impacts from this storm mainly were downed tree lines and power outages across the County.

Other storms with measurable snowfall include the following:

- **December 4-5, 1913:** 43 inches
- **November 2-5, 1946:** 31 inches
- **January 23-27, 1948:** 21 inches
- **April 7-11, 1959:** 26 inches
- **March 29-31, 1970:** 26 inches
- **September 17-18, 1971:** 21 inches
- **May 5-6, 1978:** 31 inches
- **November 20, 1979:** 22 inches
- **November 26-27, 1983:** 23 inches
- **January 5, 2007:** 17 inches
- **May 3-5, 2007:** 14.5 inches
- **December 12, 2007:** 11 inches
- **January 12, 2009:** 9 inches
- **April 18, 2009:** 2 feet
- **October 29, 2009:** 20 -46 inches in the mountains and 12-26 inches in the urban corridor

Seasonal Snowfall Last 10 Years:

Season	Snowfall (inches)
2019-2020	57.6
2018-2019	48.1
2017-2018	25.7
2016-2017	21.8
2015-2016	72.8
2014-2015	57.8
2013-2014	38.4
2012-2013	78.4
2011-2012	55.6
2010-2011	22.8

- **April 03, 2011:** 16 inches
- **February 12, 2012:** 4 feet mountains and 12 inches in the urban corridor
- **January 3, 2014:** 2 feet

Probability of Future Occurrences

Based on patterns of previous occurrences, future probability is considered **highly likely**, with impacts attributed to severe winter storms occurring on an annual basis at locations within the planning area.

Magnitude/Severity

Based on the definitions set forth in previously, the magnitude and severity of severe winter storms in

Boulder County is considered **catastrophic**, with more than 50 percent of property severely damaged and/or shutdown of facilities for more than 30 days and/or multiple fatalities.

Climate Considerations

Climate change is likely to increase the severity and intensity of severe winter storms. Although warming temperatures have already led to decreased snowpack and earlier melting, precipitation events are predicted to become more extreme leading to heavy amounts of snow and rapid melting. As the planet warms, Boulder County will continue to experience severe winter storms however these storms will be fewer and farther between. Additionally, the winter season will decrease in number of days leading to more spring flooding and erosion. Snow is already melting on average 2-4 weeks earlier than a half century ago.

Ecological Considerations

Winter storms tend to help the natural ecosystem by ending reproduction for pine beetles and insects. As temperatures warm and conditions fluctuate between heavy snow events and warm temperatures, insects and invasive species are likely to have longer breeding and growing seasons leading to significant impacts to native tree species and biodiversity.

Overall Hazard Significance

Based on assessments of probability, geographic extent and magnitude/severity, the overall hazard significance of severe winter storms is considered **high**.

4.4 Vulnerability Assessment

Requirement § 201.6(C)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

Requirement §201.6 (C)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

This vulnerability assessment identifies the assets and systems at risk to natural hazards and then estimates potential losses for specific hazards. Following the hazard profile methodology, the vulnerability assessment considers social, environmental, and technological vulnerabilities that will impact Boulder County, and the impact that significant hazards would have on the populations and assets in Boulder County.

This vulnerability assessment followed the methodology described in the FEMA publication Understanding Your Risks— Identifying Hazards and Estimating Losses. The vulnerability assessment first describes the total vulnerability and systems at risk and then discusses vulnerability by hazard.

4.4.1 Methodology

This assessment is an attempt to identify how social, ecological, and technological systems within Boulder County are affected by hazard impacts, to quantify assets at risk, by sector and jurisdiction where possible, and to identify opportunities for the whole community to participate in mitigation now and into the future. Note that this assessment was limited to the hazards that were considered medium or high in planning significance, based on HMPC input and the hazard profiles. This assessment is also limited by the data available for the high or moderate ranked hazards. The methods of analysis vary by hazard type and data available and are discussed further in the Future Development section under each hazard analyzed. It is important to note that the various analyses are data driven, and that potential errors or omissions may exist in the data. In some cases, these specific data limitations are noted, where known. The information presented is for planning level assessments only.

The avalanche and expansive soils hazards are omitted from this vulnerability assessment. Generally, these hazards were omitted because they were either low significance, research did not discover noteworthy damage in the past, or data did not support quantifying future losses.

Data to support the vulnerability assessment was collected and compiled from the following sources:

- County and municipal GIS data (hazards, base layers, critical facilities, and assessor's data)
- Housing and Urban Development reports (2018 and 2020) and EPA datasets
- Colorado Department of Public Health and Environment data and assessment tools
- Written descriptions of inventory and risks provided by participating jurisdictions
- Census and American Community Survey data
- Boulder Community Foundation TRENDS Report
- Existing plans and studies from County departments
- Personal interviews with planning team members, hazard experts, and County and municipal staff

The scope of the vulnerability assessment is to describe the risks to the County as a whole. The vulnerability assessment breaks down the social, ecological, and technological systems within the County by sector, including transportation, critical facilities and infrastructure systems, housing, public health, community, economy, and the natural environment. Development trends, including population growth and land status,

are analyzed through the lens of each sector. Next, where data was available, hazards of high and medium significance are evaluated in more detail and potential losses are estimated. Data from each jurisdiction was also evaluated and is integrated here and noted where the risk varies for a particular jurisdiction from the rest of the planning area.

4.4.2 Critical Facilities

Critical facilities provide services and functions that are essential for the whole community, especially during hazard response and recovery. The diversity of communities in Boulder County mean that critical facilities vary by geography and function; what is critical for Latinx community members in Longmont may be different than critical facilities for elderly residents in Nederland. In order to reflect the various needs of communities throughout Boulder County, examples of critical facilities and other facilities of importance to the HMPC are included for each sector below. Critical facilities are also included in the vulnerability assessments by hazard to identify specific impacts as appropriate.

Boulder County and certain municipalities have GIS databases of critical facilities and infrastructure. The data layer themes and their source are noted in Table 4-14 below. The best available data was used, but some limitations include lack of complete or comprehensive data and values such as replacement costs. Each critical facility was further categorized by the FEMA Community Lifeline category into which it falls. FEMA defines community lifelines as the most fundamental services in the community that, when stabilized, enable all other aspects of society. Essentially, these are the most important elements to the proper function of society and delivery of essential services, and as such it is vital to understand the community's vulnerabilities to these facilities.

Table 4-14 Summary of Critical Facilities by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Boulder	26	9	44	73	45	212	85	494
Erie	-	-	2	-	2	14	4	22
Jamestown	1	-	-	1	-	3	2	7
Lafayette	6	-	8	5	19	65	17	120
Longmont	-	-	7	17	38	150	47	259
Louisville	6	-	6	2	8	43	4	69
Lyons	3	-	1	1	-	10	6	21
Nederland	3	-	3	2	1	14	2	25
Superior	2	-	2	-	-	19	8	31
Ward	-	-	-	-	-	3	-	3
Unincorporated	16	14	149	94	2	127	143	545
Total	63	23	222	195	115	660	318	1,596

Source: Boulder County, Boulder OEM, City of Boulder, HIFLD, NID, National Bridge Inventory, CDPHE, EPA, Wildfire DSS

4.4.3 Community Assets

An asset is a “resource of value requiring protection.” Assets may be tangible or intangible and may provide value at different phases of the emergency management cycle. Boulder County communities occupy different geographic and climatic areas and maintain different demographic profiles, and so live with diverse exposures to various natural hazards. All communities have a variety of social and physical assets which they use to mitigate, respond to, and recover from these hazard impacts. Likewise, all community members differ in the systems, resources, and capacities to which they have access.

For all Boulder County communities, both the access to and health of social, ecological, and technological systems around them influence their risk profiles. This includes physical and financial capacities, cultural literacy, housing, education, etc. Access to these systems has immense repercussions for the resilience of the whole community. Many individuals are not prepared to respond to hazard events, and even less equipped to deal with recovery. As a result, communities have developed highly individualized safety nets that depend on a variety of localized solutions and are often not codified or legible to outside government or other representatives. It is vital to consider these community safety nets and diverse asset pools when assessing the vulnerability of communities. While they may not directly impact the County’s official systems of emergency response, it is important to build partnerships that will aid in identifying, mitigating, and preparing community assets in order to maintain existing safety nets. If communities are cut off from government services, as happened during the 2013 flood, local safety nets are vital for supporting vulnerable populations and assisting with the transition into recovery. If unprepared, the loss of safety net-supporting community assets will be devastating for some of the most vulnerable populations in Boulder County communities.

4.4.4 Social Systems

Social systems are not divorced from technological and ecological systems, but instead take a specific focus on human focused systems, the hazard outcomes for those systems, and community members’ interactions with them. These systems are analyzed firstly in order to identify critical facilities and current and future vulnerabilities that may impact the health and safety of Boulder County community members, but will not be identified through a focus on individual hazards; and secondarily to surface opportunities for mitigation partnerships with other County departments and whole community partners. Social system vulnerabilities for Boulder County focus on the interactions and outcomes with Public Health, Community, and Economy.

Public Health

Background

Public health assets are both tangible and intangible, including hospitals and clinics, as well as access to services. Major hazard events will increase the burden on public health systems and may require longer term assistance for residents. This includes but is not limited to health impacts such as mold growth and waterborne diseases from flooding, toxic runoff from pollutants in the flood plain; poor air quality from fires and drought; and exposure to extreme heat or cold.

Critical Facilities

- Hospitals
- Pharmacies
- Mental Health Centers
- Nursing Homes

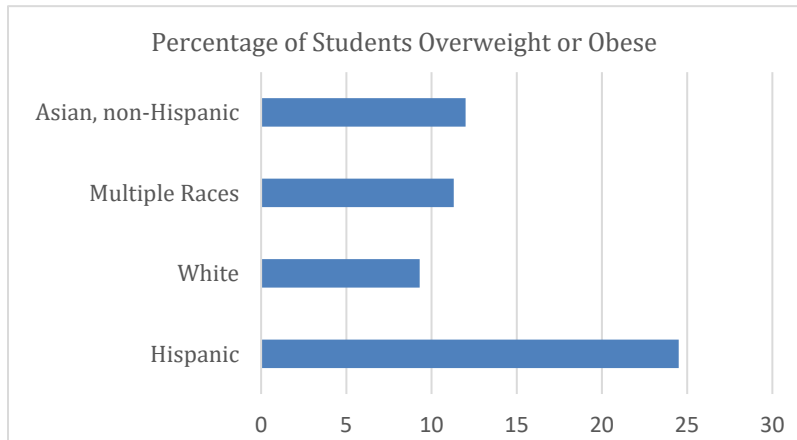
Other key facilities identified by the HMPC

- Avista

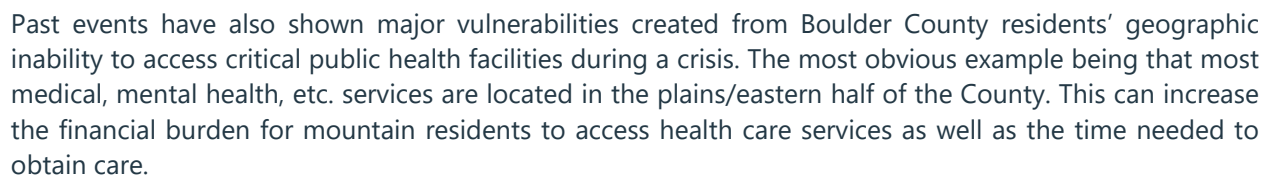
- Boulder Community Health System
- Good Samaritan Hospital
- Longmont United Hospital
- UC Health Longs Peak Hospital
- Centennial Peaks
- Wardenburg Health Center
- Clinica Medical Center
- Boulder Women's Clinic
- Foothills Medical Center

Equity

The history of systemic racism in Boulder County has left its mark in a myriad of ways, including in public health. Institutional barriers to preventive medical care, healthy food, clean air, and secure housing have contributed to higher instances of chronic disease in minority populations. In Boulder County this has contributed to large health disparities especially for the Latinx community. In October 2019, Boulder County declared a



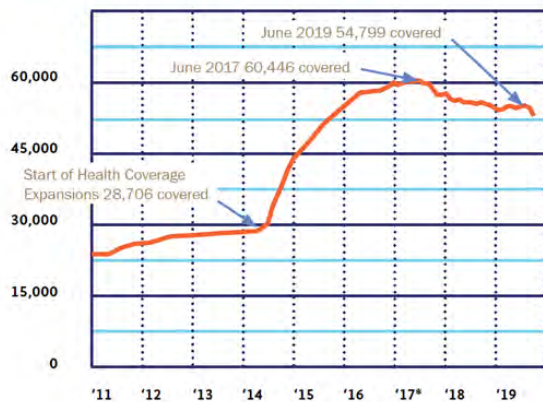
childhood obesity epidemic (Boulder County Public Health 2019); an epidemic which disproportionately impacts Hispanic children and can contribute to longer term health problems. These health issues also manifest an increased vulnerability to hazard related health impacts. This has contributed to the current health disparities during COVID-19 Pandemic, where Latinx patients represented 24% of cases in April 2020 and 31.9% of those hospitalized (Boulder County Public Health 2020) even though they are only approximately 14% of the total population of Boulder County (American Community Survey 2019). These pre-existing conditions are combined with a lower income for Latinx families than for Whites. Additional inequities for low-income families may include lack of internet service or cell phone coverage, which reduces the ability to access public health warnings and services.



Future Development

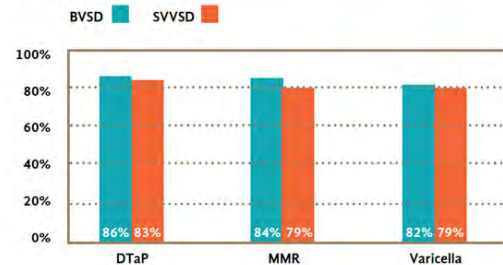
Current public health trends show that the rate of Medicaid enrolment has decreased since 2017, meaning that fewer vulnerable community members have health insurance (TRENDS 2019). Boulder County also has low rates of child vaccination, suggesting that the area is more likely to experience an outbreak of diseases such as pertussis, the measles, etc. (TRENDS 2019). The median age of County residents also continues to increase, and 60% of residents over 65 have a disability. As the median age increases, this will create greater demand for assets such as accessible housing and assistance with transportation, and increased strain on hospitals and nursing homes.

BOULDER COUNTY ENROLLMENT IN MEDICAID AND CHP+



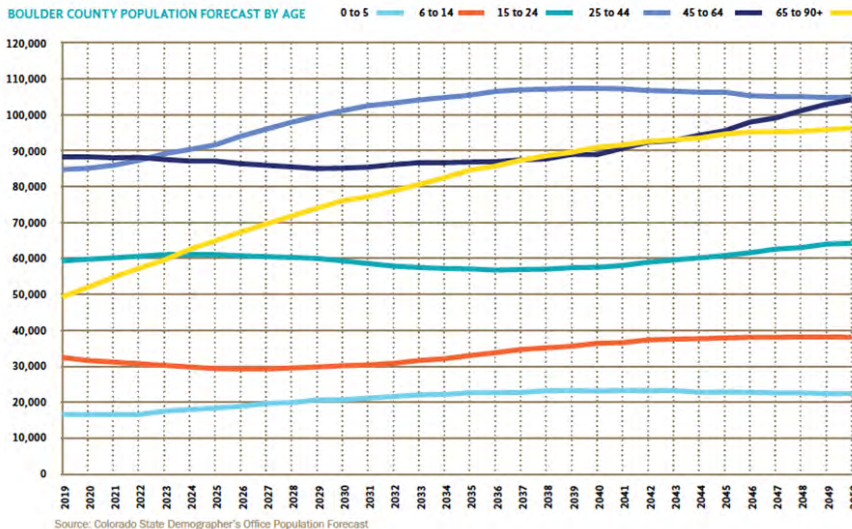
Source: Boulder County Housing and Human Services

KINDERGARTEN STUDENT VACCINATION RATES, BVSD AND SVVSD, 2017/2018 SCHOOL YEAR



Source: The Status of Children in Boulder County, 2018

As climate change stresses natural systems, new diseases will emerge, and air quality is likely to worsen. These trends will increase the burden of care, especially for those with pre-existing conditions and low-income families. Further public health impacts from climate change will include mental health consequences such as post-traumatic stress disorder after hazard events, which is likely to impact already vulnerable populations such as children and the elderly, as well as first responders. The rising age of the population in combination with climate change projections indicates that more residents will be susceptible to the impacts of hazards such as extreme heat, cold, and winter storms. For more detail on individual hazard impacts, see the relevant sections below.



Source: Colorado State Demographer's Office Population Forecast

4.4.5 Community Services

Background

Community assets include intangibles such as existing capacities for preparedness and response, as well as structures and resources such as schools and food banks, emergency services, and cultural and historical landmarks. The occurrence of a hazard may strain community assets, but preserving these services will assist residents in transitioning from response into recovery. Hazard impacts to community facilities may have major impacts on life safety during response and may destroy important cultural or historic artifacts. Recognizing their location and community importance before a disaster will aid in restoring or protecting them during a hazard event.

More information about the Boulder County historic preservation program can be found under the Property & Land Department. A list of Designated Historic Properties is available on their website and maintained in County GIS database:

<https://www.bouldercounty.org/property-and-land/land-use/historic-preservation/designated-historic-sites/>

The National Register of Historic Places is the Nation's official list of cultural resources worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archaeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and culture. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior.

The Colorado State Register of Historic Properties is a listing of the state's significant cultural resources worthy of preservation for the future education and enjoyment of Colorado's residents and visitors. Properties listed in the Colorado State Register include individual buildings, structures, objects, districts, and historic and archaeological sites. The Colorado State Register program is administered by the Office of Archaeology and Historic Preservation within the Colorado Historical Society. Properties listed in the National Register of Historic Places are automatically placed in the Colorado State Register.

It should be noted that as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

Critical Facilities:

- Food banks
- Shelters
- Schools
- Day care centers
- Main government buildings
- Domestic violence shelters
- Sexual assault hotlines
- Police Stations
- Fire Stations
- Emergency Operations Centers

Other key facilities identified by the HMPC:

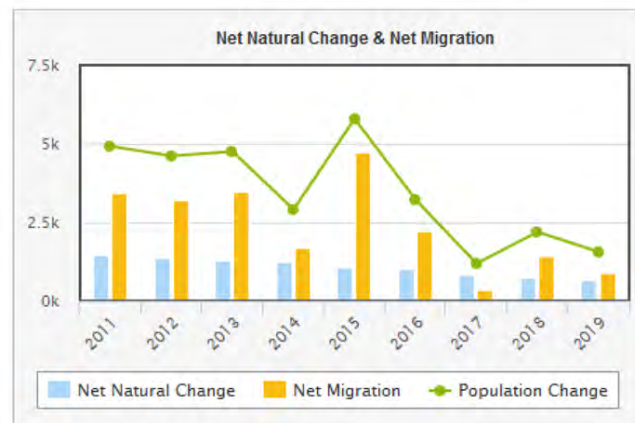
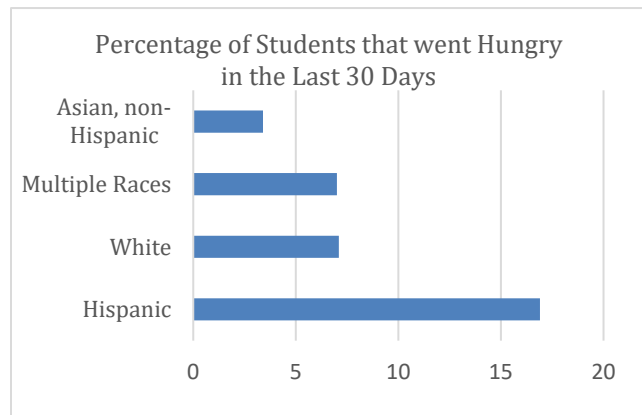
- Criminal Justice Center
- Municipal Building
- Army Reserve
- National Guard
- Public Safety Building
- Courthouse
- Jail
- Public Safety and Justice Center (Longmont)
- Pridemark
- Boulder County Paramedics

Equity community capacities are diverse throughout the County and have developed different coping mechanisms to handle hazard impacts. Despite many existing community strengths, disparities in income, racial equity, and lack of resource access create disproportionate vulnerabilities for some populations. In terms of disaster preparedness, low-income families are less likely to be able to afford to stockpile food let alone expensive insurance payments for natural hazards. Systemic racism plays a part as well, as Latinx children are more than twice as likely to go hungry as White students in Boulder County (Healthy Kids Colorado Survey 2019). This indicates Latinx families are less able to purchase and store food in the event of a disaster and underscores the importance of local food banks as critical facilities.

In addition, the list of historic and cultural places has been largely confined to places that celebrate White history, while disenfranchising the contributions, culture, and historic monuments of the Indigenous and Latinx populations that also inhabit Boulder County. This includes the Valmont mill site, which has been the location of a public battle between the City of Boulder and the Arapaho and Cheyenne Tribes that originally occupied the area now known as Boulder County.

4.4.6 Future Development

Population along Colorado's Front Range is expected to continue rising throughout the century, putting increased strain on community services, transportation systems, and natural resources. Income inequality is rising as is the median age of the population. All of these factors will reduce the resources that low-income and vulnerable populations have to put towards hazard response and recovery. Additionally, the majority of the population growth is through in-migration, indicating an increase in the segment of the population that is not aware of existing hazards or connected to resource networks. The racial composition of the County is also diversifying, with new cultural mores and languages arriving. This will require agile response in communication systems and may put more strain on cultural broker networks, which are already stressed by lack of services for Latinx populations in the County (Mosaics Report 2019).



Data Source: U.S. Census Bureau Population Estimates

4.4.7 Economy

Background

Economic assets include businesses, agriculture, tourism, jobs, and economic diversity. Impacts to economic assets will reduce the whole community's ability to recover. After a disaster, economic vitality is the engine that drives recovery. Every community has a specific set of economic drivers, which are important to understand when planning ahead to reduce long-term disaster impacts to the economy.

Table 4-15 Top Employers in Boulder County

Name	Address	City
10,000+ Employees		
University of CO - Boulder	Boulder	Boulder
5,000-9,999 Employees		
IBM	Diagonal Hwy	Boulder
1,000-4,999 Employees		
University of Boulder	Marine St	Boulder
Boulder Community Hospital	Balsam Ave	Boulder
Boulder Community Hospital	Mapleton Ave	Boulder
Boulder Valley School District	Various	Boulder
Covidien	Gunbarrel Ave	Boulder
Covidien	Longbow Dr	Boulder
Exempla Good Samaritan Med Ctr	Exempla Cir	Lafayette
Seagate Technology	Disc Dr	Longmont
IBM Business Continuity	Diagonal Hwy	Boulder
Longmont United Hospital	Mountain View Ave	Longmont
Office of Oceanic & Atmospheric	Broadway St	Boulder
500-999 Employees		
Digital Globe Inc	Dry Creek Dr # 260	Longmont
Emerson Process Management	Winchester Cir	Boulder
Eess Operations Manager	Broadway St	Boulder
Intrado Inc	Dry Creek Dr # 250	Longmont
Agilent Technologies Inc	Airport Blvd # 1	Boulder
Avista Adventist Hospital	Health Park Dr	Louisville
Boulder Valley School District	Arapahoe Rd	Boulder
Education Center	Arapahoe Rd	Boulder
Mental Health Boulder County	Iris Ave	Boulder
University Corp-Atmospheric	Table Mesa Dr	Boulder
250-499 Employees		
Epsilon	Crescent Dr	Lafayette
Markit On Demand	Central Ave	Boulder
Trans First	Centennial Pkwy	Louisville

Source: Colorado Department of Labor and Employment

Critical Facilities

- Banks
- Major Employers

Other Facilities Identified by HMPC:

- NIST

- NOAA
- NCAR
- CU
- IBM
- Hauser
- Amgen
- Lexmark
- StorageTek
- Roche
- Ball

Equity

Increasing economic disparities and ongoing struggles with systemic racism in Boulder County have created high variability in how hazards impact different populations around the County. Boulder County has slightly higher income inequality than the rest of Colorado, with the top 1% of earners making 26.5 times more than the entire remaining 99% (TRENDS 2019). This is slightly more than the U.S., and much more than the rest of the state. At the same time, according to Bank on Boulder County, approximately 5,000 families in Boulder County are unbanked, and 15,000 are underbanked (Bank on Boulder). This, combined with the rising number of residents that pay more than 30% of their earnings on housing, indicates that many county residents are economically unprepared to deal with hazard impacts. A survey by Out Boulder indicated large disparities in economic opportunities for genderqueer or trans men, as they reported an 8% unemployment rate compared to 3-4% for other LGBTQIA+ residents of the County (TRENDS 2019). Additionally, women continue to not only earn less in Boulder County than they do in the rest of the United States as a whole, but to also experience greater pay disparities with men. When combined with the 76% increase in the cost of childcare since 2000 (TRENDS 2019), this could pose a significant barrier to recovery for certain members of the population.

WOMEN'S MEDIAN EARNINGS BY EDUCATIONAL ATTAINMENT 2017		
	Boulder County	U.S.
Less than high school graduate	\$24,063	\$17,391
High school graduate	\$26,548	\$24,159
Some college or associate's degree	\$29,109	\$30,512
Bachelor's degree	\$42,422	\$45,233
Graduate or professional degree	\$55,585	\$60,691

Source: American Community Survey, 1-year data

Future Development

Climate change will create unpredictable stresses on and increase costs for residents, major employers, and the economy as a whole in Boulder County. Under the most extreme scenarios, climate impacts are projected to cost taxpayers over \$100 million in Boulder County alone (Boulder County Sustainability Plan 2018). Government is currently one of the largest job sectors in Boulder County, representing 20% of the non-farm payroll (HUD 2020). This includes 17 federal research labs that combined created a \$1.1 billion economic impact in 2016 (HUD 2020). Government shutdowns, loss of sales, and property taxes have already reduced the budgets for this employment sector in Boulder County. These types of stresses and unpredictable costs from events such as the COVID-19 Pandemic are likely to continue as climate change alters natural systems and increases strain on existing supply chains and markets.

In addition to affecting major employers, the negative impacts of climate change on natural environments will decrease the amount of revenue and overall stability of tourism in Boulder County (Resilient Analytics 2018). This may have larger impacts on mountain areas, where hazard occurrence can drive down tourism.

Impacts to winter snowpack will also reduce employment and tourist revenue associated with ski resorts and winter recreation. Other employment sectors in Boulder County will experience local, regional, national, and global impacts of climate change in areas such as supply chains, natural hazard impacts, and workforce availability. Locally, this will have outsize repercussions for low-income households, where economic instability will make disaster preparedness and recovery more difficult.

4.4.8 Ecological Systems

Ecological systems interact closely with technological and social systems, creating, connecting with, and shaping many pieces of the built and cultural environment. Ecological systems take a specific focus on natural systems, and the benefits from and hazard outcomes for those systems. These systems are analyzed to identify current and future vulnerabilities that may impact the health and safety of Boulder County community members, but will not be identified through a focus on individual hazards; and also, to identify opportunities for mitigation partnerships with other County departments and whole community partners. Ecological vulnerabilities for Boulder County focus on natural areas, endangered species, and wetland areas in Boulder County.

Natural Systems and Watersheds

Background

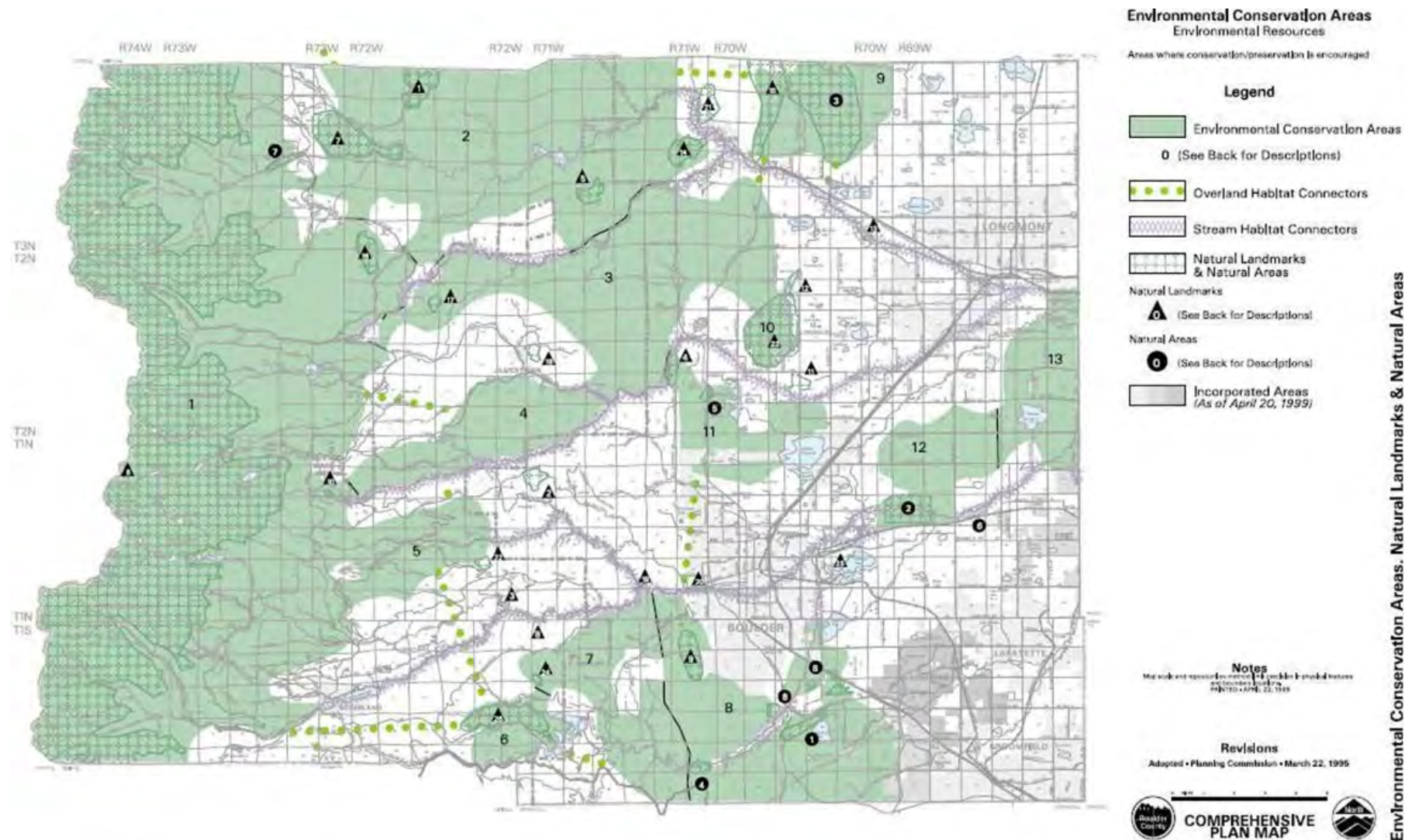
Natural environment and watershed assets include clean water and air, soil health, and ecosystem services. Hazard effects on natural assets may result in the loss of drinking water, reductions in air quality, or the occurrence of related hazards such as landslides following heavy precipitation or floods following wildfires. Awareness of natural assets can lead to opportunities for meeting multiple objectives. For instance, protecting wetlands areas protects sensitive habitat as well as attenuates and stores floodwaters.

Boulder County contains a unique combination of prairie, forest, and tundra environments. The County recognizes three types of valuable natural resources worthy of protection: environmental conservation areas, natural landmarks, and natural areas. These areas are described below and mapped in Figure 4-29.

Environmental conservation areas are so designated because of the value they provide in the perpetuation of those species, biological communities, and ecological processes that function over large geographic areas and require a high degree of naturalness. Natural landmarks are defined as prominent landscape features that distinguish a specific locality in Boulder County and are important because of the views they afford, their value as scenic vistas and backdrops, and the intrinsic value they hold as wildlife or plant habitats, natural areas, park and open space preserves, and open land areas.

Natural areas are physical or biological areas that either retain or have reestablished their natural characters, although they need not be completely undisturbed, and that typify native vegetation and associated biological and geological features or provide habitat for rare or endangered animal or plant species or include geologic or other natural features of scientific or educational value.

Figure 4-34 Boulder County Environmental Conservation Areas, Natural Landmarks, and Natural Areas

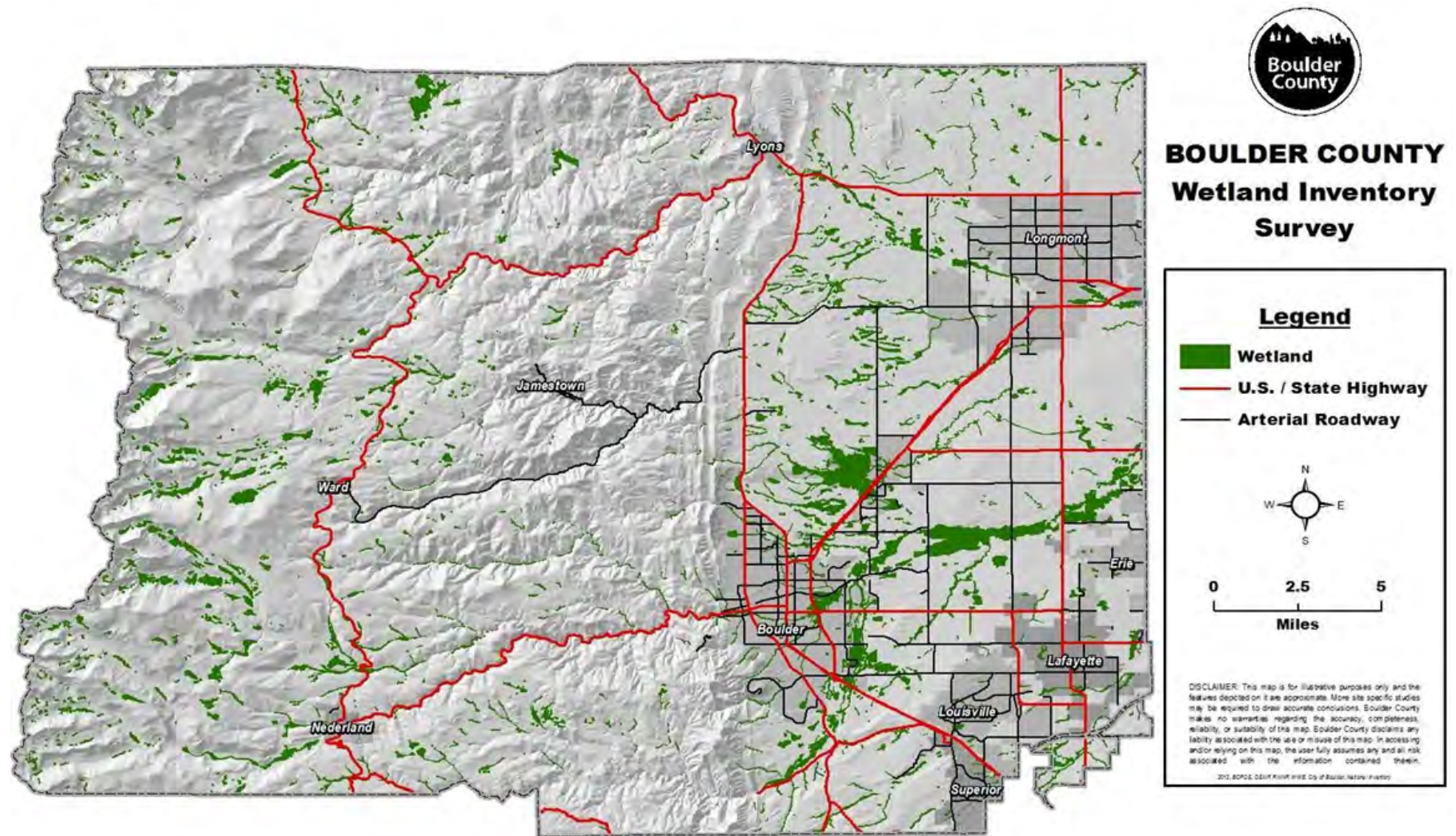


Environmental Conservation Areas	Natural Landmarks	Natural Areas
1 Indian Peaks Size - 1,000,000 Acres Lifezones - Montane/Subalpine/Alpine	1 Big Elk Park	1 Marshall Mesa
2 North St. Vrain Size - 34,500 Acres Lifezones - Montane/Foothills	2 Bighorn Mountain	2 White Rocks
3 South St. Vrain/Foothills Size - 21,800 Acres Lifezones - Montane/Foothills	3 Boulder Falls	3 Rabbit Mountain
4 Walker Mountain Size - 7,500 Acres Lifezones - Montane	4 Buckingham Park Hogback	4 Eldorado Springs Canyon
5 Fourmile Creek/Bald Mountain Size - 6,700 Acres Lifezones - Montane	5 Coffintop Mountain	5 Sixmile Fold
6 Wniger Ridge Size - 3,000 Acres Lifezones - Montane	6 Continental Divide	6 Heron Rookery
7 Hawkln Gulch/Walker Ranch/ Upper Eldorado Canyon Size - 9,500 Acres Lifezones - Foothills/Plains	7 Deer Ridge	7 Copeland Willow Carr
8 Boulder Mountain Park/South Boulder Size - 17,500 Acres Lifezones - Foothills/Plains	8 Eagle Rock	8 Tallgrass Prairie
9 Rabbit Mountain Size - 7,500 Acres Lifezones - Foothills/Plains	9 Flatirons	
10 Table Mountain Size - 7,500 Acres Lifezones - Plains	10 Grassy Top Mountain	
11 Boulder Valley Ranch/ Beech Open Space Size - 5,500 Acres Lifezones - Plains	11 Haystack Mountain	
12 White Rocks/Gunbarrel Hill Size - 6,200 Acres Lifezones - Plains	12 Hygiene Hogback	
13 East County Size - 7,300 Acres Lifezones - Plains	13 Hygiene Plains Cottonwood	
	14 Indian Lookout Mountain	
	15 Indian Mountain	
	16 Ironclads	
	17 Miller Rock	
	18 Porphyry Mountain	
	19 Profile Rock	
	20 Red Rocks	
	21 Steamboat Mountain	
	22 Sugarloaf Mountain	
	23 Table Mountain	
	24 Twin Sisters Peak	
	25 Valmont Dike	
	26 Wniger Ridge	

Wetlands

Wetlands are a valuable natural resource for communities, due to their benefits to water quality, wildlife protection, recreation, and education, and play an important role in hazard mitigation. Wetlands reduce flood peaks and slowly release floodwaters to downstream areas. When surface runoff is dampened, the erosive powers of the water are greatly diminished. Furthermore, the reduction in the velocity of inflowing water as it passes through a wetland helps remove sediment being transported by the water. They also provide drought relief in water-scarce areas where the relationship between water storage and streamflow regulation are vital. Figure 4-35 illustrates the location of wetland areas in Boulder County.

Figure 4-35 Boulder County Wetland Inventory Survey



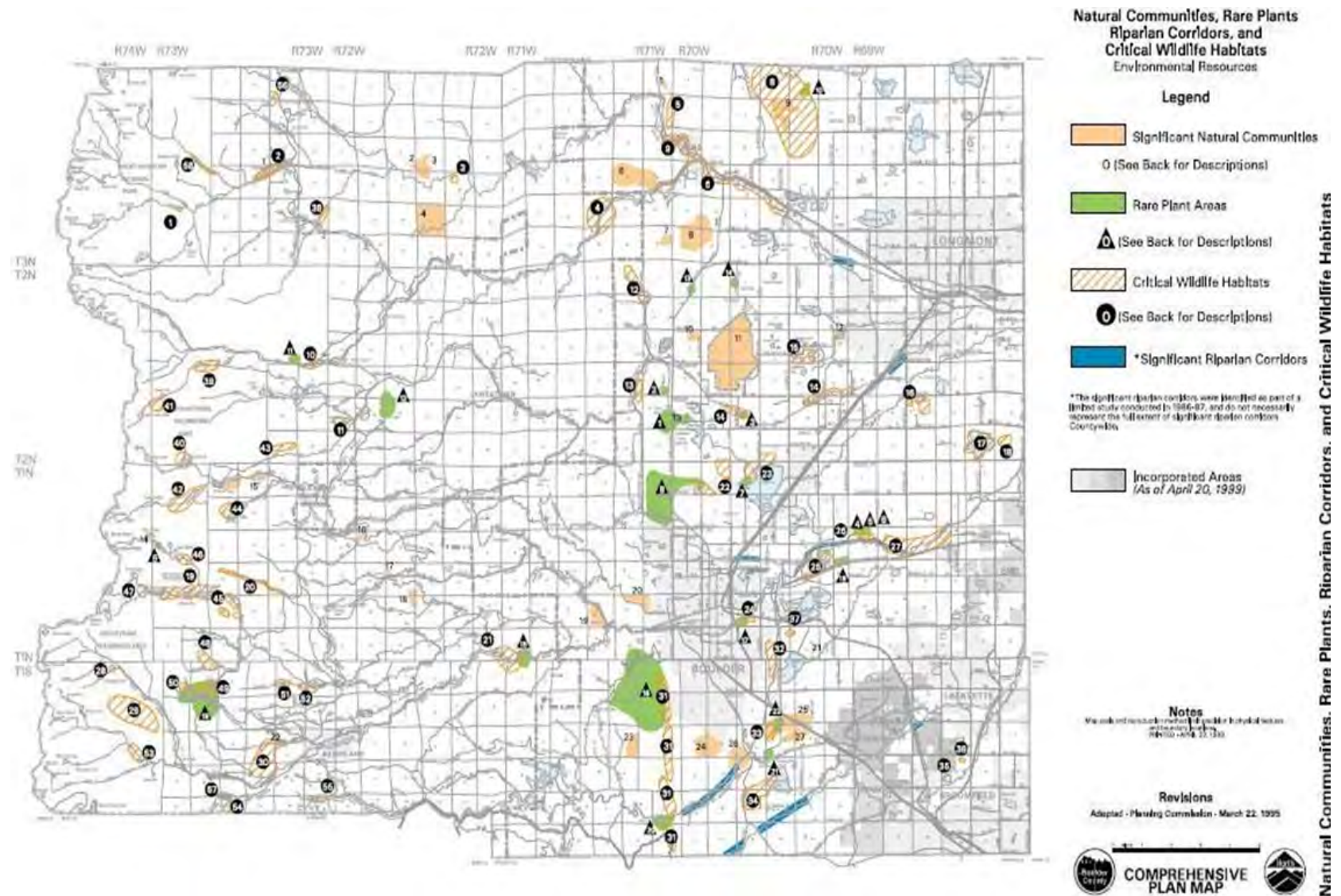
Endangered Species and Imperiled Natural Plant Communities

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at risk species (i.e., endangered species) in the planning area. An endangered species is any species of fish, plant life, or wildlife that is in danger of extinction throughout all or most of its range. A threatened species is a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Both endangered and threatened species are protected by law and any future hazard mitigation projects are subject to these laws. Candidate species are plants and animals that have been proposed as endangered or threatened but are not currently listed.

According to the U.S. Fish and Wildlife Service, as of March 2022, there were 16 federally endangered, threatened, candidate, or species of concern in Boulder County. For a list of those species along with state listed species (excluding those identified in the County as extirpated or casual/accidental) visit the following link: <https://ecos.fws.gov/ecp/>

According to the Colorado Natural Heritage Program, there are also a number of natural plant communities in Boulder County that have been identified as critically imperiled, imperiled, or rare/uncommon. These communities can be found in Section 4.2, Some of these communities, as well as critical wildlife habitat that support endangered species within the County are mapped in Figure 4-36.

Figure 4-36 Boulder County Natural Communities, Rare Plants, Riparian Corridors, and Critical Wildlife Habitats



Significant Natural Communities	Rare Plant Areas	Critical Wildlife Habitats	
1 Montane Willow Carr	1 <i>Physaria bellii</i>	1 Ouzel Falls	30 Arapaho Ranch - Tucker Homestead (+ wetlands)
2 Foothills Ponderosa Pine Scrub Woodland (Purshia)	2 <i>Physaria bellii</i>	2 Copeland Willow Carr (+ wetlands)	31 Boulder Mountain Parks - Eldorado Mountain
3 Mixed Foothills Shrubland (Purshia)	3 <i>Physaria bellii</i>	3 South Sheep Mountain	32 South Boulder Creek (+ wetlands)
4 Foothills Ponderosa Pine Savanna	4 <i>Aristida basynacea</i>	4 Deadman Gulch and South St. Vrain	33 Tallgrass Prairie
5 Mixed Foothills Shrubland (Cercocarpus)	5 <i>Apocynum androsaemifolium</i>	4 Steamboat Mountain	34 Marshall Mesa
6 Xeric Tallgrass Prairie	6 <i>Asplenium adnigrum-nigrum</i>	6 St. Vrain Creek (+ wetlands)	35 Stearns Lake (+ wetlands)
7 Foothills Ponderosa Pine Scrub Woodland (Cercocarpus)	7 <i>Physaria bellii</i>	7 St. Vrain Corridor (+ wetlands)	36 Carolyn Holmberg Preserve at Rock Creek Farm
8 Foothills Ponderosa Pine Scrub Woodland (Cercocarpus)	8 <i>Physaria bellii</i>	8 Rabbit Mountain	37 Sombbrero Marsh (+ wetlands)
9 Foothills Ponderosa Pine Scrub Woodland (Cercocarpus)	9 <i>Phacelia elaeagnifolia</i>	9 Old Apple Valley	38 Lazy H, Ranch Willow Carr (+ wetlands)
10 Great Plains Mixed Grass Prairie (Stipa comata)	10 <i>Physaria bellii</i>	10 Middle St. Vrain Willow Carr (+ wetlands)	39 Coney Flats Willow Carr (+ wetlands)
11 Great Plains Mixed Grass Prairie (Stipa neomexicana)	11 <i>Listera convallarioides</i>	11 Tumbleton Lake (+ wetlands)	40 Mitchell Lake Willow Carr (+ wetlands)
12 Great Plains Salt Meadow	12 <i>Eriogonum grande</i>	12 Marlette Canyon	41 Coney Lake Willow Carr (+ wetlands)
13 Great Plains mixed Grass Prairie (Stipa comata)	13 <i>Physaria bellii</i>	13 Lefthand Palisades	42 Long Lake Willow Carr (+ wetlands)
14 Alpine Wetlands	14 <i>Physaria bellii</i>	14 Lefthand Creek Cottonwood Groves (+ wetlands)	43 South St. Vrain Willow Carr (+ wetlands)
15 Montane Wet Willow Carr	15 <i>Selaginella selaginella</i>	15 Lagerman Reservoir (+ wetlands)	44 Lefthand Reservoir Willow Carr (+ wetlands)
16 Montane Grasslands	16 <i>Amorpha nana</i> , <i>Benedia papyrifera</i> , <i>Carex saximontana</i> , <i>Listera convallarioides</i> , <i>Malva brachypoda</i> , <i>Pyrola picta</i> , <i>Selaginella selaginella</i>	16 Gaynor Lakes (+ wetlands)	45 Boulder Watershed Willow Carr (+ wetlands)
17 Foothills Ponderosa Pine Savanna		17 Panama Reservoir (+ wetlands)	46 Lake Albion Willow Carr (+ wetlands)
18 Montane Grasslands		18 B-J Acres Ranch	47 Triple Lakes Willow Carr (+ wetlands)
19 Foothills Ponderosa Pine Savanna		19 City of Boulder Watershed (Special Consideration)	48 Horseshoe Creek Willow Carr (+ wetlands)
20 Xeric Tallgrass Prairie	17 <i>sensitive species</i>	20 Como Creek (Special Consideration)	49 Caribou Park Willow Carr (+ wetlands)
21 Great Plains Mixed Grass Prairie	18 <i>Eriogonum grande</i>	21 Boulder Falls area	50 Upper Caribou Park Willow Carr (+ wetlands)
22 Montane Willow Carr	19 <i>Botrychium echo</i> , <i>Botrychium hesperium</i> , <i>Botrychium lanceolatum</i> , <i>Botrychium pallidum</i> , <i>Listera convallarioides</i> , <i>Botrychium missouriense</i>	22 Boulder Valley Ranch (+ wetlands)	51 Delonde Creek Willow Carr (+ wetlands)
23 Montane Grasslands		23 Boulder Reservoir (+ wetlands)	52 Caribou Ranch Willow Carr (+ wetlands)
24 Wet Prairie		24 Cottonwood Grove on Boulder Creek (+ wetlands)	53 Woodland Flats Willow Carr (+ wetlands)
25 Wet Prairie	20 <i>Selaginella selaginella</i>	25 Walden and Sawhill Ponds (+ wetlands)	54 Buckeye Basin Willow Carr (+ wetlands)
26 Wet Prairie	21 <i>Amorpha nana</i>	26 White Rocks (+ wetlands)	55 Los Lagos Willow Carr (+ wetlands)
27 Xeric Tallgrass Prairie	22 <i>Amorpha nana</i>	27 Cottonwood Grove & Heron Rookery (+ wetlands)	56 Roaring Fork Willow Carr (+ wetlands)
		28 Diamond Lake Outlet	57 Peterson Lake (+ wetlands)
		29 Chittenden Meadows (+ wetlands)	58 Hunter's Creek

Source: Colorado Natural Heritage Program, www.cnhp.colostate.edu/

Critical Facilities

- Trailheads
- Environmental Conservation Areas

Other Facilities identified by the HMPC:

- USFS Campgrounds

Future Development

Natural systems and watersheds will continue to be heavily impacted by climate change. Various emissions scenarios and projections sampled down to the County level indicate that there will be an increase in hotter days, more extreme and variable precipitation events, and reduction in water resources. In addition to these changes, many species are simply unable to cope with the extreme variability in temperatures and moisture availability. As population increases in Boulder County, more houses and people are likely to occupy the WUI. This will put further strain on firefighting and emergency response resources and create further costs for environmental restoration.

Damage to natural systems will result in impacts to the economy, especially for mountain towns and areas dependent on tourism. It will also have a more intangible impact on mental health and will reduce resources available to populations around the County.

4.4.9 Technological Systems

Technological systems can both facilitate and prevent access to social and ecological systems. Specific focus on human focused systems, the hazard outcomes for those systems, and community members interactions with them. These systems are analyzed firstly in order to identify critical facilities and current and future vulnerabilities that may impact the health and safety of Boulder County community members, but will not be identified through a focus on individual hazards; and secondarily to surface opportunities for mitigation partnerships with other County departments and whole community partners. Technological system vulnerabilities for Boulder County focus on Housing and Infrastructure.

Housing

Background

Housing assets include affordable housing, access to structures, and safe spaces. Hazard impacts to housing cause severe shock to community members, as well as ripple effects in the economy, reductions to public safety, population loss, etc.

Total Exposure of Population and Structures

Table 4-16 shows the estimated total population. There were 135,409 housing units in Boulder County with a vacancy rate of 5.9% in 2020 according to the U.S. Census Bureau.

Table 4-16 Estimated Total Population

Jurisdiction	2020 Population
City of Boulder	108,154
Town of Erie*	12,791
Town of Jamestown	255
City of Lafayette	30,377
City of Longmont*	97,833
City of Louisville	21,171
Town of Lyons	2,202

Jurisdiction	2020 Population
Town of Nederland	1,481
Town of Superior	13,099
Town of Ward	129
Unincorporated Boulder County	23,368
Total County	330,860

Source: U.S. Census Bureau, 2020 Census and 2018 estimates for Town of Ward
*Partial estimate for Boulder County only

Assessments in this plan are based on two building inventories: one from Boulder County's Assessor's Office and the other from FEMA's HAZUS-MH. Table 4-17 shows the property inventory from the Assessor's Office for the entire county, organized by jurisdiction and property type. The parcel layer and Assessor Data Table were obtained from Boulder County in early 2022. The accounts in the assessor data undergo a full assessment in May of every odd year. Hence, actual values of the data are current as of May 2021. The only exception to this is when major improvements are made on a property. According to the assessor's data, the sum of the value of improvements in the County is \$61.5 billion (building exposure only, not including land value).

Table 4-17 Boulder County Property Inventory by Jurisdiction and Property Type

Jurisdiction	Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
Boulder	Agricultural	6	53	\$27,267,100	\$27,267,100	\$54,534,200
	Commercial	1,437	1,296	\$2,679,277,149	\$2,679,277,149	\$5,358,554,298
	Exempt	735	1,315	\$2,600,750,622	\$2,600,750,622	\$5,201,501,244
	Industrial	309	304	\$929,081,250	\$1,393,621,875	\$2,322,703,125
	Mixed Use	83	187	\$314,016,168	\$314,016,168	\$628,032,336
	Residential	31,523	26,925	\$16,575,234,102	\$8,287,617,051	\$24,862,851,153
	Vacant	1	7	\$7,800	\$7,800	\$15,600
	Total	34,094	30,087	\$23,125,634,191	\$15,302,557,765	\$38,428,191,956
Erie	Agricultural	6	9	\$2,763,400	\$2,763,400	\$5,526,800
	Commercial	11	17	\$15,255,400	\$15,255,400	\$30,510,800
	Exempt	20	34	\$25,158,621	\$25,158,621	\$50,317,242
	Industrial	4	5	\$5,033,400	\$7,550,100	\$12,583,500
	Mixed Use	4	29	\$11,297,600	\$11,297,600	\$22,595,200
	Residential	4,478	4,513	\$1,849,076,559	\$924,538,280	\$2,773,614,839
	Total	4,523	4,607	\$1,908,584,980	\$986,563,401	\$2,895,148,381
Jamestown	Commercial	1	1	\$50,000	\$50,000	\$100,000
	Exempt	25	29	\$970,900	\$970,900	\$1,941,800
	Mixed Use	2	2	\$492,800	\$492,800	\$985,600
	Residential	121	157	\$44,864,776	\$22,432,388	\$67,297,164
	Total	149	189	\$46,378,476	\$23,946,088	\$70,324,564
Lafayette	Agricultural	4	13	\$2,263,500	\$2,263,500	\$4,527,000
	Commercial	296	317	\$350,497,615	\$350,497,615	\$700,995,230
	Exempt	206	280	\$288,637,394	\$288,637,394	\$577,274,788
	Industrial	84	99	\$136,223,730	\$204,335,595	\$340,559,325

Jurisdiction	Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
	Mixed Use	20	52	\$29,404,800	\$29,404,800	\$58,809,600
	Residential	10,283	10,464	\$3,926,237,876	\$1,963,118,938	\$5,889,356,814
	Vacant	1	1	\$8,700	\$8,700	\$17,400
	Total	10,894	11,226	\$4,733,273,615	\$2,838,266,542	\$7,571,540,157
Longmont	Agricultural	10	30	\$2,916,700	\$2,916,700	\$5,833,400
	Commercial	1,072	958	\$854,929,370	\$854,929,370	\$1,709,858,740
	Exempt	432	777	\$633,312,850	\$633,312,850	\$1,266,625,700
	Industrial	195	271	\$489,665,660	\$734,498,490	\$1,224,164,150
	Mixed Use	111	215	\$118,634,626	\$118,634,626	\$237,269,252
	Residential	29,473	31,946	\$11,279,145,691	\$5,639,572,846	\$16,918,718,537
	Vacant	10	18	\$1,209,367	\$1,209,367	\$2,418,734
	Total	31,303	34,215	\$13,379,814,264	\$7,985,074,249	\$21,364,888,513
Louisville	Agricultural	3	6	\$728,800	\$728,800	\$1,457,600
	Commercial	251	245	\$433,063,223	\$433,063,223	\$866,126,446
	Exempt	88	158	\$165,149,034	\$165,149,034	\$330,298,068
	Industrial	148	117	\$501,166,046	\$751,749,069	\$1,252,915,115
	Mixed Use	9	22	\$16,367,500	\$16,367,500	\$32,735,000
	Residential	7,325	7,201	\$2,872,098,425	\$1,436,049,213	\$4,308,147,638
	Vacant	2	2	\$699,500	\$699,500	\$1,399,000
	Total	7,826	7,751	\$3,989,272,528	\$2,803,806,339	\$6,793,078,867
Lyons	Agricultural	2	6	\$863,500	\$863,500	\$1,727,000
	Commercial	42	55	\$15,447,800	\$15,447,800	\$30,895,600
	Exempt	48	61	\$6,924,600	\$6,924,600	\$13,849,200
	Industrial	7	4	\$189,000	\$283,500	\$472,500
	Mixed Use	17	41	\$7,100,300	\$7,100,300	\$14,200,600
	Residential	831	940	\$457,921,997	\$228,960,999	\$686,882,996
	Total	947	1,107	\$488,447,197	\$259,580,699	\$748,027,896
Nederland	Commercial	45	51	\$17,156,126	\$17,156,126	\$34,312,252
	Exempt	39	44	\$7,300,800	\$7,300,800	\$14,601,600
	Industrial	1	1	\$160,000	\$240,000	\$400,000
	Mixed Use	14	15	\$4,268,200	\$4,268,200	\$8,536,400
	Residential	706	807	\$288,663,998	\$144,331,999	\$432,995,997
	Vacant	1	1	\$10,900	\$10,900	\$21,800
	Total	806	919	\$317,560,024	\$173,308,025	\$490,868,049
Superior	Commercial	32	49	\$162,963,009	\$162,963,009	\$325,926,018
	Exempt	28	52	\$13,671,675	\$13,671,675	\$27,343,350
	Mixed Use	1	13	\$3,110,000	\$3,110,000	\$6,220,000
	Residential	3,925	3,973	\$2,052,115,131	\$1,026,057,566	\$3,078,172,697
	Total	3,986	4,087	\$2,231,859,815	\$1,205,802,250	\$3,437,662,065
Ward	Exempt	16	16	\$74,500	\$74,500	\$149,000

Jurisdiction	Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
Unincorporated	Mixed Use	3	3	\$407,200	\$407,200	\$814,400
	Residential	96	109	\$17,764,107	\$8,882,054	\$26,646,161
	Total	115	128	\$18,245,807	\$9,363,754	\$27,609,561
	Agricultural	1,072	3,331	\$684,114,839	\$684,114,839	\$1,368,229,678
	Commercial	154	350	\$105,066,942	\$105,066,942	\$210,133,884
	Exempt	1,003	1,680	\$126,659,625	\$126,659,625	\$253,319,250
	Industrial	67	123	\$122,016,480	\$183,024,720	\$305,041,200
	Mixed Use	65	234	\$35,097,200	\$35,097,200	\$70,194,400
	Residential	18,703	24,184	\$10,220,467,349	\$5,110,233,675	\$15,330,701,024
	Vacant	19	25	\$1,775,783	\$1,775,783	\$3,551,566
	Total	21,083	29,927	\$11,295,198,218	\$6,245,972,784	\$17,541,171,002
	Grand Total	115,726	124,243	\$61,534,269,115	\$37,834,241,893	\$99,368,511,008

Source: Boulder County Assessor's Office

Equity

Affordable housing continues to be a crisis of its own in Boulder County. Occupancy rates were affected by the 2013 flood and have only recently risen back to the 5% that indicates a balanced market (HUD 2020). However, housing prices in the major cities in Boulder County rose between 39% and 71% between 2008 and 2017 and continue to climb. Between 2000 and 2017, price inflation moved over 30,000 homes out of achievable reach for low to middle income earners (Boulder County Regional Housing Strategy 2017). More than 60% of Boulder County residents do not earn enough to buy a home in the County (TRENDS 2019).

Housing is a critical need during and after hazard events. If large numbers of homes are removed from the housing stock as happened during the 2013 flood, this could have a devastating impact on the ability of communities to recover. Loss of housing has a disproportionate impact on low-income families, especially mobile homeowners, as there are no affordable places to go if their original home is lost. As seen in prior disasters, people were priced out of Boulder County and unable to return (CoLab 2019). People with disabilities were likewise unable to find accessible housing due to very low occupancy limits in towns and cities throughout the County.

Future Development

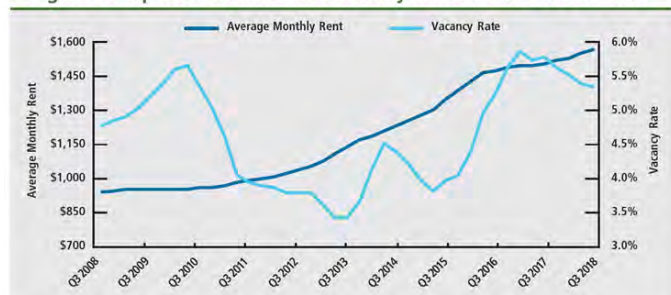
Climate change is projected to increase the number of hot days as well as the intensity of precipitation events (RMCO 2016). This will have major impacts on low-income households, as they will incur more heating and cooling costs, as well as maintenance costs to cope with the shortened lifespan of building materials in extreme temperatures. Wildfire mitigation alone for existing housing stock is projected to cost over \$20 million (Resilient Analytics 2018).

Infrastructure

Background

Infrastructure assets include transportation, green infrastructure, water, wastewater, solid waste, energy, and communications facilities.

Figure 15. Apartment Rents and Vacancy Rates in the Boulder HMA



Source: Apartment Insights

Hazard impacts to infrastructure may cause impacts to life safety during disaster response and can also be prohibitive to recovery. This may include but is not limited to impacts such as road or bridge washout from flooding; loss of potable water; and loss of communications systems to deliver warnings or information.

Critical Facilities

- Highways, bridges, and tunnels
- Railroads and facilities
- Airports
- Water treatment facilities
- Natural gas and oil facilities and pipelines
- Communications facilities
- Internet/Cellular data access

Other Facilities identified by the HMPC:

- Gross Dam
- Barker Dam
- Boulder Water Shed
- Button Rock Dam
- Betasso Water Treatment
- 63rd Street Water Treatment
- Longmont Treatment
- Nederland Treatment
- Lyons Treatment
- Superior Treatment
- Lafayette Treatment
- Louisville Treatment
- Public Service—63rd
- Longmont Gas and Electric
- Boulder Hydros
- Daily Camera
- AT&T Cable
- Channel 8
- KGNU

Equity

The digital divide has shrunk since 2015, but 17% of residents making under \$20,000 per year lack access to any internet service, even on their phones, as do nearly 10% of those making between \$20,000 and \$75,000 per year. This indicates a curtailed access to early warning systems and reduced access to public health warnings and information. The lack of digital devices also impacts elderly residents' ability to access services such as transportation assistance (Nelson/Nygaard). Low-income families also experience more difficulty accessing transportation systems (Nelson/Nygaard) as do elderly residents in mountain communities.

Is transportation a challenge in the life of you or your family?					
No	# of respondents	%	Yes	# of respondents	%
	27	35%		50	65%
Under \$15,000	10	13%	Under \$15,000	35	45%
\$15,000-\$24,999	4	5%	\$15,000-\$24,999	7	9%
\$25,000-\$34,999	3	4%	\$25,000-\$34,999	5	6%
\$35,000-\$49,000	1	1%	\$35,000-\$49,000	0	0%
\$50,000-\$74,999	1	1%	\$50,000-\$74,999	2	3%
\$75,000 or more	8	10%	\$75,000 or more	1	1%

Future Development

Future adaptation costs to mitigate the impacts of climate change on infrastructure are projected to be upwards of \$157 million across Boulder County. This does not include increased cooling costs for buildings or urban drainage improvements, which are conservatively projected to add another \$20 million in costs (Resilient Analytics, 2018). These costs do not include accounting for costs of installing heating or cooling systems in homes where they do not already exist, increasing water availability for droughts, removing dead trees from wildfires or pine beetle infestations, or rising health care costs for increased diseases and hospitalizations (Resilient Analytics, 2018).

4.4.10 Growth and Development Trends

Table 4-18 illustrates how Boulder County has grown in terms of population and number of housing units between 2005 and 2020.

Table 4-18 Boulder County's Change in Estimated Population and Housing Units, 2005-2020

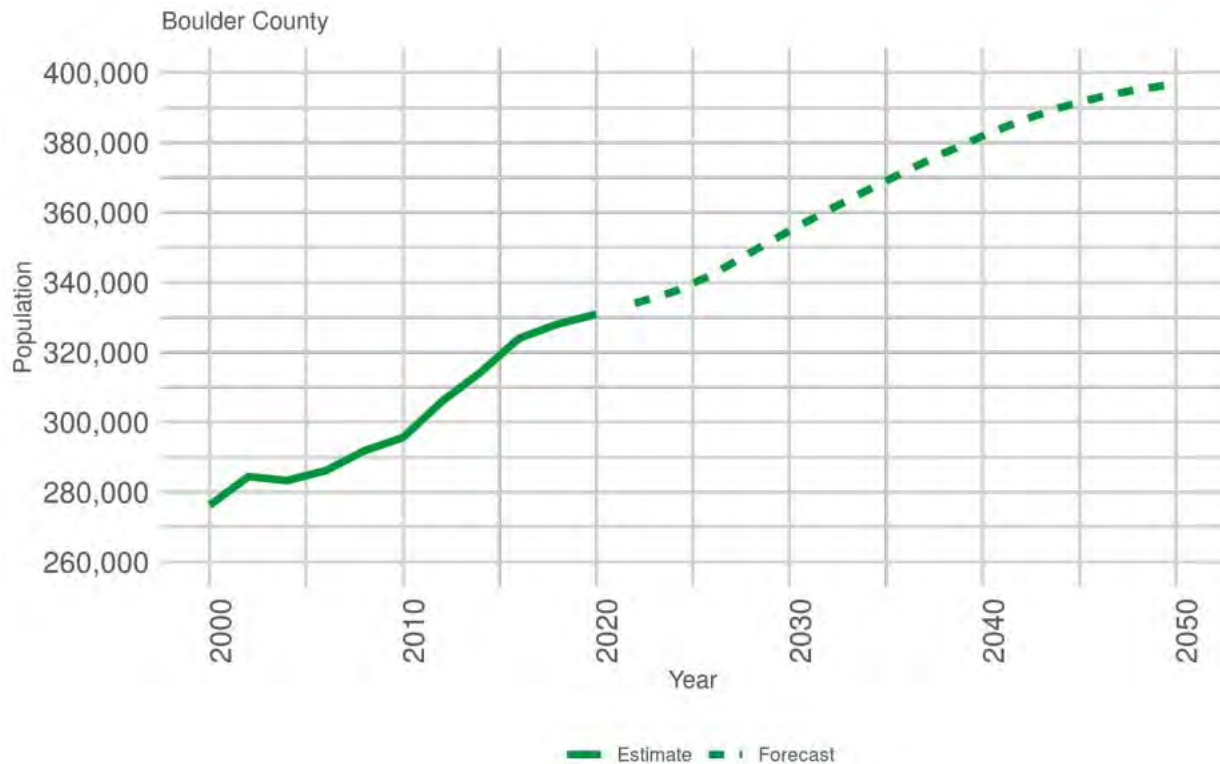
Jurisdiction	2005 Population Estimate	2020 Population	Percent Change 2005-2020	2005 # of Housing Units Estimate	2020 # of Housing Units	Percent Change 2005-2020
City of Boulder	95,088	108,250	12.16%	42,946	46,371	7.39%
Unincorporated Areas	43,261	42,263	-2.36%	20,751	20,973	1.06%
Erie (part)*	6,932	12,652	45.21%	2,500	4,221	40.77%
Jamestown	284	202	-40.59%	139	113	-23.01%

Jurisdiction	2005 Population Estimate	2020 Population	Percent Change 2005-2020	2005 # of Housing Units Estimate	2020 # of Housing Units	Percent Change 2005-2020
Lafayette	23,444	30,411	22.91%	9,714	12,482	22.18%
Longmont	81,415	98,885	17.67%	33,297	41,252	19.28%
Louisville	18,045	21,226	14.99%	7,631	8,934	14.58%
Lyons	1,642	2,126	22.77%	744	909	18.15%
Nederland	1,416	1,497	5.41%	735	772	4.79%
Superior	11,223	13,094	14.29%	4,573	5,043	9.32%
Ward	160	152	-5.26%	94	101	6.93%
Total County	282,910	330,758	14.47%	123,124	141,171	12.78%

Source: Colorado DOLA, State Demography Office
*Part of these municipalities are in another county.

As indicated above, Boulder County has grown significantly in recent years, and growth is projected to continue through 2050. According to the Colorado Department of Local Affairs, the population of Boulder County is forecast to reach 381,850 by 2040. Overall, the growth rate for Boulder County is expected to decrease between 2020 and 2040, however growth is projected to remain positive through the mid-21st Century.

Figure 4-37 Population Projections for Boulder County, 2000-2050



Source: Colorado DOLA

4.4.11 Sets Vulnerability Mitigation Opportunities

The use of a combined social, ecological, and technological systems (SETs) framework allows for the identification of mitigation partners, projects, and strategies that will reduce fragility and increase flexibility and adaptive capacity throughout all systems. Examples of overarching mitigation strategies that can be used to increase system cohesion and capacity within Boulder County include the following:

- 1) Identify community critical facilities and put them in GIS database for future mitigation and adaptation.
- 2) Adapt first responder agencies for climate change.
- 3) Ensure warning systems and alerts are accessible for people with disabilities and limited English proficiency.
- 4) Ensure a variety of mental health services and therapies are available for all communities.
- 5) Provide preparedness and hazard education materials in culturally appropriate ways for people experiencing homelessness, recent incarceration, income challenges or limited English proficiency.
- 6) Create opportunities for community-led after-action reports.
- 7) Educate homeowners on green infrastructure, swales, etc. and encourage investment in permeable paving to reduce urban flooding.
- 8) Provide climate adaptation assistance for low-income families and homeowners.
- 9) Ensure continuity of operations planning includes climate adaptation.

4.5 Estimating Potential Losses

4.5.1 Air Quality

Background

Boulder County's air quality continues to suffer from high ozone levels and has recently been impacted by smoke from major fires across the western United States.

Community Impacts

Poor air quality impacts those with pre-existing conditions, children, and the elderly as well as sectors of the workforce that work in the outdoors.

Future Development

Climate change will contribute to air pollution in a variety of ways. Higher temperatures increase the production of ozone (LGC). The projected increase in wildfires and droughts will reduce ecosystem services that mitigate air pollution while increasing PM and ozone levels that are damaging to human health. Current estimates indicate 20,000 premature deaths per year due to chronic wildfire smoke exposure. That figure could double by the end of the year (LGC 2020).

Indoor radon pollution is also an ongoing concern in Colorado. Rising population numbers will increase the number of homes that require mitigation, and education about radon will be necessary for new residents.

4.5.2 Dam and Levee Failure

Background

Based on the information in the hazard profile the impacts to existing development from a dam failure in Boulder County could be catastrophic. Specific inundation maps and risk information is included with

specific dam emergency action plans with the Boulder County OEM. Due to the sensitive nature of this information, it is not included in this plan. The impacts to the County and its municipalities from a dam failure will be similar in some cases to those associated with flood events (see the flood hazard vulnerability analysis and discussion). The biggest difference is that a catastrophic dam failure has the potential to result in a much greater loss of life and destruction to property and infrastructure due to the potential speed of onset and greater depth, extent, and velocity of flooding. Another difference is that dam failures could flood areas outside of mapped floodplains.

Community Impacts

The areas that could be significantly impacted by a dam failure include the City of Boulder, unincorporated Boulder County along Boulder Creek and South Boulder Creek, and Lyons, Longmont, and unincorporated area along St Vrain Creek. The reservoirs located in the foothills and Rocky Mountains could have the greatest potential impacts if they were to fail. These include the large reservoirs of Gross, Barker, and Button Rock. The overall dam inundation exposure of population, building counts, and estimated property value is broken out by jurisdiction in Table 4-19, and critical facility exposure is detailed in Table 4-20 below.

Table 4-19 Dam Inundation Hazard by Jurisdiction and Property Type

Jurisdiction	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Boulder	11,568	8,639	\$9,657,092,858	\$7,349,518,219	\$17,006,611,077	14,480
Erie	94	123	\$43,053,269	\$22,458,685	\$65,511,954	321
Jamestown	15	15	\$5,061,899	\$2,530,950	\$7,592,849	25
Lafayette	2,883	2,926	\$939,349,102	\$597,138,104	\$1,536,487,206	6,933
Longmont	4,609	5,531	\$2,120,134,833	\$1,494,255,178	\$3,614,390,011	11,616
Louisville	198	286	\$128,837,857	\$96,158,196	\$224,996,053	491
Lyons	291	351	\$129,982,369	\$69,494,685	\$199,477,054	721
Nederland	-	-	-	-	-	-
Superior	651	363	\$236,850,400	\$118,596,100	\$355,446,500	966
Ward	-	-	-	-	-	-
Unincorporated	2,893	4,236	\$1,349,532,323	\$778,007,684	\$2,127,540,007	7,645
Total	23,202	22,470	\$14,609,894,910	\$10,528,157,798	\$25,138,052,708	43,198

Source: Boulder County Assessor's Office, NID

Table 4-20 Critical Facilities with Dam Inundation Risk by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Boulder	13	1	17	45	22	106	51	255
Erie	-	-	1	-	-	-	2	3
Jamestown	1	-	-	-	-	1	1	3
Lafayette	1	-	3	2	8	15	3	32
Longmont	-	-	2	12	14	31	22	81
Louisville	1	-	1	-	-	5	2	9
Lyons	1	-	1	-	-	4	6	12
Nederland	-	-	-	-	-	-	-	0

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Superior	-	-	1	-	-	1	-	2
Ward	-	-	-	-	-	-	-	0
Unincorporated	4	11	49	22	1	29	62	178
Total	21	12	75	81	45	192	149	575

Source: NID, Boulder OEM, HIFLD, National Bridge Inventory

Losses from a dam failure will vary based on the dam involved, warning time, warning accessibility and time of day. However, the potential exists for property losses into the billions and multiple deaths and injuries. Impacts to critical facilities would be similar to those identified in the flood vulnerability analysis.

There are few levees within the County, mainly within the City of Boulder. While technically not a levee, a floodwall protects the Boulder County Justice Center (located within the City of Boulder) from flooding on Boulder Creek. This floodwall is designed to provide 100-year event protection and the structure has been mapped as providing 100-year protection.

Future Development

It is important that the County keeps the dam failure hazard in mind when permitting new development, particularly downstream of the high and significant hazard dams present in the County. There are currently 32 low hazard dams in the County. These could become significant or high hazard dams if development occurs below or downstream of them. Climate change is projected to increase the likelihood of dam failure due to increased variability in water availability, and more extreme temperature shifts that will strain infrastructure. In particular, precipitation events are projected to increase in variability and become more intense in the winter, while rising summer temperatures will increase evaporative potential (RMCO 2016). These fluctuations will strain the health and viability of existing infrastructure and may increase the possibility of dam failure.

4.5.3 Drought

Background

Based on Boulder County's recent multi-year droughts and Colorado's drought history, it is evident that all of Boulder County is vulnerable to drought. However, the impacts of future droughts will vary by region. The agricultural industry of the County will experience hardships, including agricultural losses, and livestock feeding expenses and deaths. The County will see an increase in dry fuels, beetle kill, and associated wildfires and some loss of tourism revenue. Water supply issues for municipal, industrial, and domestic needs will be a concern for the entire County during droughts. Most of Boulder County's water comes from snow melt runoff in the high country of the western County that is captured in reservoir storage. Vulnerability increases with consecutive winters of below average snowpack.

While widespread, the losses associated with drought are often the most difficult to track or quantify. While FEMA requires the potential losses to structures to be analyzed, drought does not normally have a structural impact. Drought can indirectly lead to property losses as a result of it contributing to extreme wildfire conditions (see discussion on wildfire vulnerability). This combined with the potential for significant impacts to water-intensive activities such as agriculture, wildfire suppression, municipal usage, commerce, tourism, and wildlife preservation, can lead to widespread economic ramifications.

Community Impact

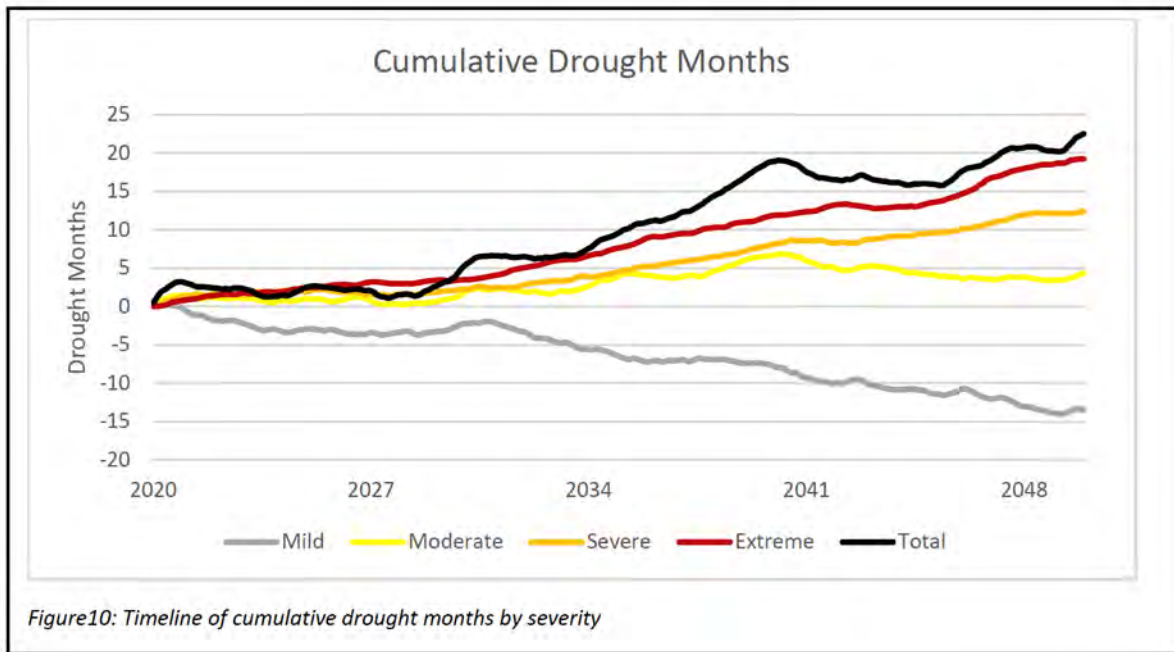
Many residents in unincorporated Boulder County are vulnerable to the direct impacts of drought reducing the availability of groundwater and increasing pollutant levels in well water. This threat is exacerbated by the increased likelihood of wildfire that accompanies more numerous droughts. Paying for well improvements was a financial hardship for homeowners after the 2013 flood, and may price people out of the mountains if they must participate in successive recoveries from drought, landslide, wildfire, etc.

Drought has also been shown to negatively impact air quality. In addition to increased risk of wildfire, prolonged drought reduces the ability of trees to absorb pollutants and clean the air, causing increasing levels of ozone. Boulder County already has some of the highest ozone levels in the United States, and future droughts may contribute to its effects. Poor air quality has a larger effect on those with jobs in the outdoors, as well as those with pre-existing health conditions. In Boulder County, the Latinx population are subject to higher percentages of pre-existing conditions such as diabetes (POS 2020). Poor air quality will also impact recreational opportunities, which has repercussions for mental health as well as tourist-based economies, such as ski-towns in the mountains. Regions that are dependent on tourism often have a majority low-income population and loss of business will increase overall hardship and the ability to recover from the impacts of other hazards.

Future Development

Drought vulnerability will increase with future development as there will be increased demands for limited water resources. Future growth in the unincorporated areas will mean more wells and more demands on groundwater resources. Potential costs associated with this include monitoring drawdowns from local aquifers and springs to ensure long-term water availability. In Boulder County, models project that the number of drought months will increase sharply after 2030, and that the number of drought months characterized as “severe” and “extreme” will nearly double between 2020-2049 compared to historical events (Resilient Analytics, 2018). This will contribute to a variety of increased costs, including obtaining water supplies, compensating the agricultural industry for reducing water-intensive crops and incentivizing homeowners to choose drought resistant landscaping and perform fire mitigation (Resilient Analytics, 2018). Throughout the whole County, drought will increase vulnerability through increases in dry fuels, beetle kill, and associated wildfires and as well as loss of tourism revenue. Water supply issues for municipal, industrial, and domestic needs and air quality will also be concerns for the entire County during droughts.

Figure 4-38 Projections of Future Drought Months by Severity



4.5.4 Earthquake

Background

Earthquakes represent a low probability, high consequence hazard for Boulder County. Colorado has a relatively short historic record of earthquakes, which makes for a limited data set when making assumptions based on past events. A lot of unknowns remain about the earthquake potential in Boulder County and Colorado in general.

Based on the fact that there have been earthquake epicenters as well as potentially active faults inside the County boundaries, as well as in neighboring counties, earthquakes will likely occur in the future. Based on historic events, these will likely be in the range of Magnitude 5.5 or lower, which is strong enough to be felt and potentially cause damage.

According to the USGS, damage usually occurs with earthquakes in the Magnitude 4-5 range, but many variables affect damage such as building age, soil type, distance from the epicenter, etc. Older, historic buildings could suffer structural damage from a moderate sized event, but most impacts would likely be to non-structural items within the buildings such as light fixtures, toppling of shelves, cracked walls and chimneys. Falling items within buildings will likely pose the greatest risk to life safety.

The CGS has utilized HAZUS-MH, FEMA's loss estimation software, to model earthquake risk from various faults in every county in the state. This information is included in Section 7.0 of the earthquake hazard identification and risk assessment chapter in the 2018 Colorado State Hazard Mitigation plan.

The CGS ran a series of deterministic scenarios for selected Colorado faults using HAZUS-MH to assess potential economic and social losses due to earthquake activity in Colorado. Deterministic analyses provide "what if" scenarios (e.g., determines what would happen if an earthquake of a certain magnitude occurred on a particular fault). The earthquake magnitudes used for each fault were the "maximum credible earthquake" as determined by the U.S. Geological Survey. The faults analyzed for Boulder County were Frontal, Golden, Mosquito, Ute Pass, Valmont, Walnut Creek, and Williams Fork (see Figure 4-9 in Subsection

4.2). Table 4-21 summarizes the results for Boulder County.

Table 4-21 Potential Earthquake Losses in Boulder County by Fault

Fault/Magnitude	Fatalities at 2pm	Total Economic Loss (in millions)*	Loss Ratio (%)**
Frontal M7.0	0	56 Million	0.15%
Golden M6.5	20	1.27 Billion	3.78%
Mosquito M7.0	0	20 Million	0.04%
Ute Pass M7.0	0	45 Million	0.12%
Valmont M5	2	582 Million	1.92%
Walnut Creek M6.5	98	2.9 Billion	9.01%
Williams Fork M6.75	0	21 Million	0.05%

Source: HAZUS-MH models with depth of 2 km, attenuation function of West U.S. Extension 2008

*Direct and indirect losses

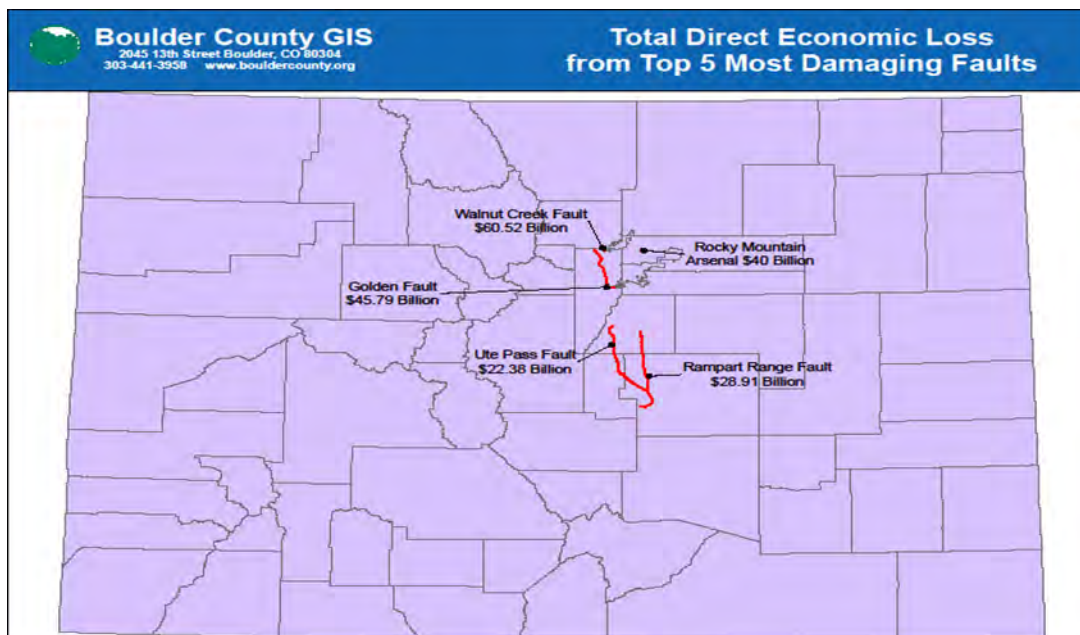
**Percentage of the total building stock value damaged; the higher this ratio, the more difficult it is to restore a community to viability (loss ratios 10 percent or greater are considered by FEMA to be critical.)

Note: County HAZUS-MH Inventory (HAZUS-MH 2000, including Broomfield): \$25.46 billion

According to the CGS report, the Golden, Ute Pass, and Walnut Creek faults are considered among the top five potentially most damaging faults in the state (includes damage to other counties in the Denver Metropolitan Area). The top five, in order, are listed below and illustrated in Figure 4-39.

- 1) Rocky Mountain Arsenal
- 2) Golden
- 3) Rampart Range
- 4) Ute Pass
- 5) Walnut Creek

Figure 4-39 Total Direct Economic Loss from Top five Most Damaging Faults



During the development of this plan in 2022, a HAZUS-MH probabilistic earthquake scenario was run with

the latest version of HAZUS-MH. This scenario involves a 2,500-year probabilistic 7.25 magnitude event occurring in Boulder County. The 2,500-year return period analyzes ground shaking estimates with a 2 percent probability of being exceeded in 50 years, from the various seismic sources in the area. The International Building Code uses this level of ground shaking for building design in seismic areas. Table 4-22 summarizes the results of the 2,500-year HAZUS-MH scenario. The total economic losses could exceed \$824 million. Over 4 percent of the total number of buildings in the County will be at least moderately damaged.

Table 4-22 HAZUS-MH Earthquake Loss Estimation 2,500-Year Scenario Results

Type of Impact	Impacts to County
Total Buildings Damaged	Slight: 9,907 Moderate: 3,706 Extensive: 576 Complete: 24
Building and Income Related Losses	\$606 million 61% of damage related to residential structures 17% of loss due to business interruption
Total Economic Losses (Includes building, income, and lifeline losses)	\$824 million
Casualties (based on 2 a.m. time of occurrence)	Without requiring hospitalization: 59 Requiring hospitalization: 7 Life threatening: 0 Fatalities: 1
Casualties (based on 2 p.m. time of occurrence)	Without requiring hospitalization: 98 Requiring hospitalization: 13 Life threatening: 1 Fatalities: 2
Casualties (based on 5 p.m. time of occurrence)	Without requiring hospitalization: 75 Requiring hospitalization: 10 Life threatening: 1 Fatalities: 1
Displaced Households	230
Shelter Requirements	135

Source: HAZUS Global Probabilistic 2,500 Year model

Community Impacts

Given the lack of earthquake occurrence within the County, it is difficult to predict what the impact on key assets would be. Ensuring that community centers are built or retrofitted to withstand shocks will ensure that community services continue. This will be more difficult for low-income homeowners. It is also important to ensure that communications infrastructure can withstand earthquakes, including Spanish language services, and that warnings are accessible by disabled and limited English-speaking populations. Cultural resources built prior to modern building codes are more at risk for damage or destruction.

Future Development

Any new construction built to modern building codes in the County should generally be able to withstand earthquakes. That said, the potential for non-structural damage will increase with new development. Continued growth of population in the County could potentially expose more persons to earthquakes and their related hazards.

4.5.5 Extreme Temperatures

Background

Extreme temperatures have not been considered for inclusion in the estimated losses section before. But with the increasing impacts of climate change, this hazard is projected to have a much more severe impact on residents and infrastructure within the County. Many homes in Colorado were built without cooling systems and it will be prohibitively expensive for many homeowners. The cost of adaptation and lack of preparedness may increase the impact of heat events across the County.

Community Impacts

Elderly populations, children, and those with pre-existing conditions are especially vulnerable to the impacts of extreme temperatures. Low-income families are less likely to be able to afford heating and cooling services and will be forced to rely on public institutions and services to escape extreme temperature events. Extreme temperatures will also preclude many from accessing the outdoors and will impact those that rely on the tourism sector for income.

Future Development

Extreme heat events are projected to become more common by the end of the century as climate change impacts intensify (RMCO 2016). In some models this would indicate that Boulder County's environment will come to resemble that of Phoenix, AZ by the end of the century. The County's infrastructure and homes require substantial mitigation costs to ensure that buildings can protect the population from extreme temperature impacts. As the median age of the population is rising, and as climate change impacts worsen, this hazard will create more substantial impacts in the County and throughout the region.

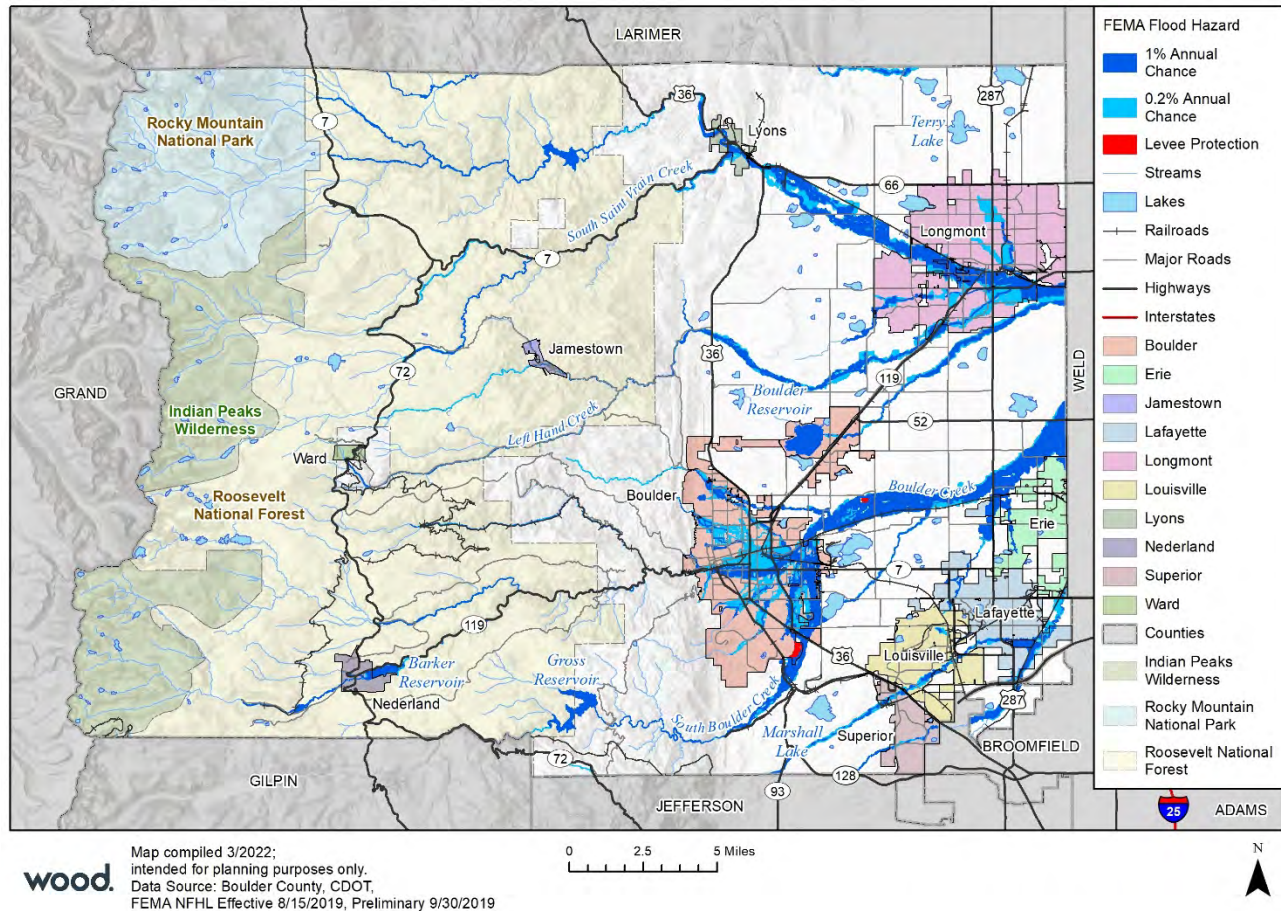
4.5.6 Flood

Background

Flooding and floodplain management are significant issues in Boulder County and some of the incorporated areas. The significance of this hazard, the requirements for Flood Mitigation Assistance plans, and the availability of digital hazard data in GIS drove the development of a detailed vulnerability assessment that is discussed in the following pages. The extent of the FEMA 1% and 0.2% Annual Chance Floodplains, as well as levee protected areas, are shown below in Figure 4-40.

It only takes three inches of rain over a few hours to trigger a 100-year flood. Those conditions are worsened by the lack of rain absorption caused by the Fourmile Canyon Fire in September 2010. Because of its large population and location at the mouth of the narrow Boulder Canyon, the City of Boulder has the greatest potential for loss of life from a flash flood of any community in Colorado. An estimated 6,000 people live and work in the floodplain of Boulder Creek, which runs through the heart of the City

Figure 4-40 Boulder County FEMA Flood Hazard



Methodology

The HMPC used GIS to quantify the potential flood losses to the County and cities within the mapped floodplain areas. The first step was to identify what is exposed to the various flood hazards. This entailed overlaying a countywide GIS layer of the 100- and 500-year floodplains (digitized by the City of Boulder based on the FEMA FIRM's) on parcels that contained data on structures. The flood layer for City of Boulder was determined to be the best available data countywide. The layer does not include changes associated with the recent restudy of South Boulder Creek. A separate countywide flood layer used for zoning purposes was not utilized because it did not differentiate between 100- and 500- year floodplains. A DFIRM is completed for the County.

Utilizing GIS, a hazard analysis was conducted on a 2020 pictometry building footprint layer provided by Boulder County. A separate parcel analysis was also conducted, where the parcel was used to create a centroid, or point, representing the center of each parcel polygon, in order to get the number of improved parcels, property types, and improved values. These two data sets were then merged together based on their property type and the jurisdiction in which they were located. This data was then analyzed in respect to the floodplain layer to find any parcel which intersected the floodplain, which in turn was assumed to be flooded. Another assumption with this model is that every parcel with an improved value greater than zero was assumed to be developed in some way. Only improved parcels, and the value of those improvements, were analyzed and aggregated by property type and flood zone. The parcels were segregated and analyzed for the unincorporated areas along with the following incorporated cities of Boulder, Erie, Jamestown, Lafayette, Longmont, Louisville, Lyons, Nederland, Superior and Ward.

The next step was to estimate potential losses to the properties located within a floodplain. The result of the exposure analysis summarizes the total values at risk in the floodplain. When a flood occurs, seldom does the event cause total destruction of an area. Potential losses from flooding are related to a variety of factors including flood depth, flood velocity, building type, and construction. Based on FEMA flood depth-damage curves, the percent of damage is directly related to the flood depth. FEMA's flood benefit-cost module uses this simplified approach to model flood damage based on building type and flood depth of two feet. A damage estimation of 25 percent of the total value of the flooded property was used. This model does not account for structures within the 100-year floodplain that may be elevated above base flood elevation in accordance with local floodplain development requirements. While there are several limitations to this model, it does present a methodology to estimate potential damages.

In order to calculate potential losses, the improved property values were used to calculate content value based on FEMA formulas for building content value based on property type. For agricultural, commercial, exempt, and mixed-use properties the content value is estimated to be 100 percent of the improved value. For industrial properties, the contents are valued at 150 percent of the improved value, and residential contents are valued at 50 percent of the improved value. The total value is then calculated by adding the improved value and content value.

The results of the vulnerability analysis are summarized in Table 4-23 and Table 4-24 showing loss by jurisdiction to the 100 year and 500-year events. A further \$94.9 million in total property value is located in areas protected by levees in the City of Boulder. Table 4-25 contains an estimate of the population affected in each jurisdiction, by applying the 2020 Census average household size of each jurisdiction to the total count of residential structures affected in that jurisdiction.

Table 4-23 Boulder County 1% Annual Chance FEMA Flood Hazard by Jurisdiction and Property Type

Jurisdiction	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss
Boulder	2,228	2,481	\$1,960,658,384	\$1,406,373,770	\$3,367,032,154	\$841,758,039
Erie	7	8	\$2,926,890	\$1,742,895	\$4,669,785	\$1,167,446
Jamestown	22	32	\$6,739,319	\$3,369,660	\$10,108,979	\$2,527,245
Lafayette	74	76	\$33,836,921	\$37,116,511	\$70,953,432	\$17,738,358
Longmont*	487	716	\$194,598,433	\$187,621,443	\$382,219,876	\$95,554,969
Louisville	16	16	\$5,897,600	\$2,948,800	\$8,846,400	\$2,211,600
Lyons	101	142	\$31,828,315	\$16,643,158	\$48,471,473	\$12,117,868
Nederland	17	28	\$5,018,550	\$3,268,725	\$8,287,275	\$2,071,819
Superior	4	3	\$481,227	\$302,551	\$783,778	\$195,945
Ward	-	-	-	-	-	-
Unincorporated	652	1,279	\$279,282,924	\$167,996,856	\$447,279,780	\$111,819,945
Total	3,608	4,781	\$2,521,268,563	\$1,827,384,367	\$4,348,652,930	\$1,087,163,233

*Source: Boulder County Assessor's Office, FEMA NFHL; *includes Boulder County portion only; see Longmont Annex for inclusion of Weld County.*

Table 4-24 Boulder County 0.2% Annual Chance FEMA Flood Hazard by Jurisdiction and Property Type

Jurisdiction	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss
Boulder	5,689	4,060	\$4,746,013,537	\$3,432,192,563	\$8,178,206,100	\$2,044,551,525
Erie	-	-	-	-	-	-
Jamestown	6	16	\$1,227,000	\$949,150	\$2,176,150	\$544,038
Lafayette	39	30	\$7,213,020	\$5,849,970	\$13,062,990	\$3,265,748
Longmont*	2,110	2,722	\$956,811,845	\$712,376,282	\$1,669,188,127	\$417,297,032
Louisville	101	125	\$41,275,687	\$25,306,586	\$66,582,273	\$16,645,568
Lyons	95	114	\$38,939,594	\$23,326,697	\$62,266,291	\$15,566,573
Nederland	-	-	-	-	-	-
Superior	27	43	\$8,846,369	\$4,548,635	\$13,395,004	\$3,348,751
Ward	-	-	-	-	-	-
Unincorporated	312	534	\$130,770,936	\$76,142,968	\$206,913,904	\$51,728,476
Total	8,379	7,644	\$5,931,097,988	\$4,280,692,850	\$10,211,790,838	\$2,552,947,709

Source: Boulder County Assessor's Office, FEMA NFHL; ; *includes Boulder County portion only; see Longmont Annex for inclusion of Weld County.

Table 4-25 Boulder County Population Affected by Flood

Location	Population Est. 100-year Flood	Population Est. 500-year Flood
Boulder	4,041	7,220
Erie	21	-
Jamestown	59	32
Lafayette	83	38
Longmont*	1,069	5,764
Louisville	39	281
Lyons	261	215
Nederland	48	-
Superior	3	103
Ward	-	-
Unincorporated	2,092	918
Total	7,714	14,569

Source: U.S. Census Bureau, Boulder County Assessor's Office, FEMA NFHL; ; *includes Boulder County portion only; see Longmont Annex for inclusion of Weld County.

The results show an estimate of what the flood losses to structures would be if a 100-year or 500-year flood was to occur in any of the municipalities and unincorporated county.

Besides the City of Boulder, the highest losses to flood would be in Longmont, unincorporated areas, and Lafayette. However, the potential losses for Lyons and Jamestown are extremely high relative to their total building inventory and values. The analysis indicates that a 500-year flood in Longmont would be considerably more damaging than a 100-year event.

Critical Facilities

To estimate the potential impact of floods on critical facilities a GIS overlay was performed on the flood hazard layer to examine where it intersected with critical facility locations. The results are shown in Table 4-26 and Table 4-27. Any jurisdictions not included in the tables below do not have critical facilities located within the floodplain.

Table 4-26 Critical Facilities in within the FEMA 1% Annual Chance Flood Hazard by Jurisdiction

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Boulder	4	-	6	8	9	30	26	83
Erie	2	-	-	-	-	-	-	2
Jamestown	1	-	-	-	-	1	2	4
Lafayette	-	-	-	-	-	-	6	6
Longmont	-	-	1	9	-	6	17	33
Louisville	-	-	-	-	-	1	1	2
Lyons	-	-	-	-	-	-	3	3
Nederland	-	-	1	-	-	-	1	2
Superior	-	-	-	-	-	-	2	2
Unincorporated	2	-	6	7	1	1	52	69
Total	9	0	14	24	10	39	110	206

Source: FEMA NFHL, Boulder OEM, HIFLD, National Bridge Inventory

Table 4-27 Critical Facilities in within the FEMA 0.2% Annual Chance Flood Hazard by Jurisdiction

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Boulder	4	1	6	16	7	47	22	103
Lafayette	-	-	1	-	-	-	1	2
Longmont	-	-	2	1	3	19	6	31
Louisville	-	-	-	-	-	2	-	2
Lyons	1	-	1	-	-	-	3	5
Unincorporated	2	-	7	-	-	3	17	29
Total	7	1	17	17	10	71	49	172

Source: FEMA NFHL, Boulder OEM, HIFLD, National Bridge Inventory

Replacement values were not available with this data; thus, an estimate of potential monetary losses to critical facilities could not be performed. Impacts to any of these facilities could have wide ranging ramifications, in addition to property damage.

Life, Safety, Health, Procedures for Warning and Evacuation

Flooding has the potential to affect road conditions to the point where evacuation routes are disrupted, and first responder access is cut off from specific locations. This can be exacerbated in areas of the County where alternate routes are limited, most notably the roads in the mountain canyons. These roads generally serve as the only thoroughfare up and down the canyons which are poorly interconnected. As demonstrated by the September 2013 flood event, roads in the canyons built immediately adjacent to creek channels are subject to partial or complete local washouts. During this event, road washouts stranded significant portions of the mountain communities in their homes waiting for evacuation by helicopter.

Warning and evacuation procedures are vital to ensure life safety but are not delivered comprehensively or made accessible to all populations within Boulder County. Information about flood safety has failed to reach Spanish speakers within the County in the past.

Natural Floodplain Function

58% of the regulatory floodplain in Boulder County is protected as open space, thus, new development is not a threat to the natural floodplain functions within this area. Beyond these protected lands development of new structures within the flood fringe is possible on private property, but Boulder County Land Use Code places restrictions on total building footprint area on those properties. Together, the County's land use process and floodplain management regulations will minimize the effect of development on the natural functions of the floodplain.

National Flood Insurance Program/Community Rating System §201.6(C)(3)(ii)

The NFIP is a federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses. A jurisdiction's eligibility to participate is premised on their adoption and enforcement of state and community floodplain management regulations intended to prevent unsafe development in the floodplain, thereby reducing future flood damages. Thus, participation in the NFIP is based on an agreement between communities and the federal government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new construction in floodplains, the federal government will make flood insurance available within the community as a financial protection against flood losses.

The CRS was created in 1990 to recognize communities whose floodplain management activities go above and beyond the NFIP's minimum requirements. Under the CRS, if a community implements certain program activities, such as public information, mapping, regulatory, loss reduction, and/or flood preparedness activities, then its residents can qualify for a flood insurance premium rate reduction. Communities can have a classification of 1 through 10 with discounts of 45 percent discount to 0, respectively.

Table 4-28 provides detailed information on NFIP participation in NFIP participating communities in Boulder County.

Table 4-28 Community Participation in the NFIP and Community Rating System

Jurisdiction	Date Joined	Effective FIRM Date	Policies in Force 3/3/2022	Insurance in Force (\$)	Number of Claims since 1978	Claims Totals (\$)	Community Rating System Rating
Boulder County	2/1/1979	8/15/2019	631	185,872,800	434	15,461,284	5
City of Boulder	7/17/1978	8/15/2019	3,612	930,782,600	1,145	23,153,425	5
Town of Erie*	10/17/1978	8/15/2019	49	13,056,200	6	20,152	n/a
Town of Jamestown	7/18/1983	8/15/2019	12	3,300,700	16	1,809,791	n/a
City of Lafayette	3/18/1980	8/15/2019	69	22,456,300	6	4,716	n/a
City of Longmont	7/5/1977	8/15/2019	336	118,541,300	64	4,581,108	5
City of Louisville	5/4/1973	8/15/2019	58	17,504,900	4	123,189	6
Town of Lyons	8/1/1980	8/15/2019	71	18,602,400	81	4,447,267	n/a
Town of Nederland	8/1/1979	8/15/2019	12	3,421,700	2	7,463	n/a
Town of Superior	9/28/1979	8/15/2019	16	5,012,000	5	98,052	n/a

Source: Watershed and Flood Protection Section of the Colorado Water Conservation Board, Department of Natural Resources

*Includes Weld County

According to data from the Colorado Water Conservation Board, as of January 2021 there were 14 repetitive loss properties in Boulder County. According to the data, three of the properties were mitigated. Seven of the properties are located in the City of Boulder, one in Erie, one possibly in Nederland, and five in the unincorporated County. Most are single family structures, but two in the City of Boulder are business-non residential. There are no severe repetitive loss structures.

Community Impacts

The highly variable terrain in Boulder County means that many communities are at risk of being isolated during large flood events. During the 2013 flood, the Town of Lyons was separated into six islands, and the Town of Jamestown required major air evacuation. This has resulted in piecemeal safety nets being developed through community liaisons and networks. These are dependent on a few community leaders and subject to disruption if individual community members drop out or move away. During the 2013 flood, food banks were especially important in the mountains, with the Old Gallery in Allenspark and food pantry in Nederland, for example, providing crucial food supplies for mountain residents. Without support for these lifeline services in situ, areas cut off from supplies in the plains for long periods of time will suffer. Without community engagement it will be impossible to successfully identify and mitigate facilities that are critical for local health and safety.

Other areas of community vulnerability in the mountains include difficulties in giving and receiving updates, including evacuation warnings; economic impacts from loss of transportation routes both from tourism and because major employment centers are located in the eastern half of the County; and ongoing impacts from debris cleanup and removal.

For the eastern half of the County, manufactured home parks remain a concern as many of them were built within the flood plain because land was cheaper. This population experienced an immense amount of difficulty recovering from the 2013 flood and were often unable to access assistance from FEMA due to claims of deferred maintenance on their homes. Other vulnerabilities throughout floodplains include a lack of income and knowledge to ensure positive drainage; homes which lack sump pumps and are not secured against groundwater flooding also increases risk. This has resulted in urban flooding and sewage backup into basements, which negatively impacts resident health and can put further pressure on available housing stock. Other income related vulnerabilities include lack of homeowners' insurance, and lack of assistance for older housing stock. Many reported that FEMA would not provide them with individual assistance because their homes were older and, during the damage assessment, they could not prove that damage was due to the flood and not deferred maintenance. Elderly homeowners have also struggled with debris removal from within their home, and mold growth.

Future Development

Any new construction in mapped flood hazard areas built in accordance with local floodplain management ordinances should be elevated at least one foot above the 100-year flood, at a minimum. Thus, vulnerability to flooding is not considered to be increasing with development. However, there are areas that are not mapped that could still be flood prone.

As a result of exacerbated urban flooding due to development in floodplains, the potential impact will include possible injury to individuals; damage to private property such as automobiles and residential, commercial, or industrial buildings; and degradation of natural floodplain functions due to excessive pollution from urban runoff.

Higher population density within the floodplain will put more individuals at risk of being affected by flooding. That risk could manifest itself as disrupted building access, disrupted services like electricity or plumbing, or even economic hardship due to disruption of local commerce. As a part of Boulder County's floodplain management regulatory policies, no new development within the floodplain will be permitted if it would cause a rise in base flood elevation for any other insurable structures. As such, the only impact to anthropogenic development within the floodplain beyond that which exists currently will be to those structures built anew. It should be noted, however, that these management restrictions do not cover all jurisdictions, and people may still be subject to flooding from their neighbors upstream, especially where county borders overlap with other municipalities. In 2013, neighbors in the area of North Boulder where the

city and county meet, caused major flooding impacts to each other with building along dry creek beds with no regard for hydrologic processes.

Climate change impacts are projected to include larger precipitation events interspersed with periods of severe drought. These will likely impose greater stress on people, property, and natural floodplain functions. With more intense events, private property and natural areas within the floodplain will suffer greater damage. Flood impacts will continue to be unpredictable as they are exacerbated by an accompanying increase in wildfires, erosion, and landslides. In addition to floodplain inundation, 62% of models project an increase in rainfall intensity during major storms. This will overwhelm storm drainage systems and cause urban flooding. Adaptive costs to meet EPA guidelines to limit runoff is estimated to be \$16.25 million for the County as a whole (Resilient Analytics 2018).

Fluctuation in groundwater tables can also create unpredictable urban flooding, as seen during the 2013 flood. This poses a threat of inadequate recovery time, especially for the beneficial functions afforded by natural areas within floodplains, as well as increased stress on utility grids, transportation systems, and community assets. During the 2013 flood, many homeowner insurance policies were shown to be inadequate, as the definitions for flooding, mudslides, and landslides are confusing to homeowners and were written for coastal and not mountain hazards. Damages from heavy rain, landslides, and groundwater rise were often not covered.

It is difficult to estimate the amount of precipitation and runoff that will impact current bridge infrastructure, but best estimates include an average cost of roughly \$478,000 to adapt vulnerable bridges for climate change (Resilient Analytics 2018). The cost of replacing private bridges after the flood in 2013 was eventually covered by Community Development Block Grant for Disaster Recovery funding from the federal government. It is questionable whether homeowners throughout the canyons will have the means to pay for bridge adaptation. This means that people will be forced to move elsewhere or live with reduced access to their homes for themselves and emergency services.

Larger precipitation events will likely impose greater stress on people, property, and natural floodplain functions. With more intense events, private property and natural areas within the floodplain will suffer greater damage. This poses a threat of inadequate recovery time, especially for the beneficial functions afforded by natural areas within floodplains. The goals, objectives, and action plan presented in this plan are in part meant to accommodate this expected shift in the dynamic flood hazard in Boulder County.

4.5.7 Landslide/Debris Flow/Rockfall

Background

Research in the hazard profile for Landslide/Debris Flow/Rockfall revealed sporadic impacts in western portions of the County, and repetitive debris flow issues in Jamestown and other areas that have had recent wildfire burns. Future property losses would likely be minor, based on patterns of previous events. Rockfall impacts on western Boulder County highways and county roads have the potential to cause significant indirect economic loss, in addition to the potential for serious injury or death. The most significant road that could be impacted by rockfall and related road closures is Highway 119 in Boulder County between Nederland and Boulder. Economic losses from this road closure and resulting detours could be estimated with traffic counts and detour mileage.

Critical facilities at risk include the Jamestown Fire Department which has been impacted by debris flows.

Community Impacts

Homeowners in the western half of the County will continue to be susceptible to landslides and debris flow. This is of high economic concern for the affordability of living in canyon areas in particular both for safety of housing stock as well as the transportation lifelines. During the 2013 flood, Boulder County set a new

record for landslides within the interior United States (USGS 2014). This not only destroyed homes, but also highlighted gaps in insurance policies that created severe financial hardship for both renters and homeowners. Additionally, long delays in road repairs meant that canyon and mountain residents were forced to increase commute times by up to two hours in order to reach their place of employment. This created significant financial burdens and reduced economic recovery times for the County. Residents require stronger safety nets closer to their homes in case transportation is reduced.

Future Development

Steep slope regulations should limit problems from these hazards in the future, thus the exposure to this hazard is not anticipated to grow. Climate change is, however, likely to increase the occurrence of landslides, as fluctuations between wet and dry periods increase. As precipitation events become more intense, and wildfires also increase, rains will wash more soil downstream and may destabilize slopes. As foresters in Colorado have already noted, tree regrowth in Ponderosa pine forests has all but ceased in areas burned after the year 2000. These areas are converting into grasslands, which have higher erosion potential. If large wildfires occur within the canyons and tree regrowth does not occur, landslides and debris flow will increase and could threaten water availability and quality as well as the homes of residents. This will also impact open space access and reduce recreation activities.

4.5.8 Lightning

Existing Development

It is difficult to quantify where specific losses will occur due to the random nature of this hazard. Given the lightning statistics for Colorado and Boulder County, the County remains at risk and is vulnerable to the effects of lightning. Persons recreating or working outdoors during the months of April through September will be most at risk to lightning strikes. It is difficult to quantify future deaths and injuries due to lightning.

Critical facilities and infrastructure will have the greatest consequences if damaged by a lightning strike. The greatest losses from lightning could result from secondary hazards, such as wildfire.

Future Development

New critical facilities such as communications towers should be built with lightning protection measures. Community assets should also be assessed for lightning safety.

4.5.9 Communicable and Zoonotic Diseases

Background

Communicable (person to person diseases such as the flu) and Zoonotic (animal to human diseases such as West Nile Virus) diseases could result in serious human and economic losses.

The total County population of 330, 860 could potentially be exposed to various communicable and zoonotic disease outbreaks. Viruses/fungi/bacteria will be present in Colorado into the future, but the severity changes from year to year, depending on variables such as weather patterns, the mosquito population, the bird population, and immunity in humans. In a severe outbreak, approximately 30 percent of the state's overall population, 20 percent among working adults, and 40 percent among school-age children can be affected. Employee absenteeism, due to illness, the need to care for ill family members, and fear of infection, may cause government operations to be reduced by 30-49 percent of normal.

Community Impacts

The number of hospitalizations and deaths will depend on the virulence of the virus/fungi/bacteria. Risk groups cannot be predicted with certainty, but certain populations have higher vulnerability. During the annual influenza season, infants, the elderly, the chronically ill, and pregnant women are usually at higher

risk. But, in contrast, in the 1918 pandemic, most deaths occurred among young, previously healthy adults. Despite these variabilities, certain populations within Boulder County continue to be more at risk for any outbreak. The availability of protective measures is not guaranteed for all populations as clean water access may be intermittent or inaccessible for low-income households.

The population of Boulder County has a high rate of health care coverage compared to the rest of the state, but 10% of the population is still not insured and could suffer financial as well as health impacts from an outbreak (CDPHE 2018). During the 2013 flood, residents in Lyons had problems getting prescriptions filled, and lack of transportation or a co-occurring hazard such as wildfire or flood could increase areas that are already underserved by health services such as communities along the Peak to Peak Highway. The digital divide within the County will also impact the accessibility of distributing public health information and warnings. Community partners and programs such as the Community Health Department's cultural broker outreach are important resources for increasing community self-sufficiency.

Future Development

As population trends continue to increase, more persons will be exposed to the communicable and zoonotic diseases, therefore increasing risk as well as pressure on local medical and emergency services. Climate change will also increase the number of disease outbreaks and introduce new diseases that may have a disproportionate impact on populations with pre-existing conditions.

4.5.10 Subsidence

Background

A 1986 study on land subsidence in southeastern Boulder County conducted by the State of Colorado Department of Natural Resources Mined Land Reclamation Division found that the major period of subsidence occurred within 30 to 40 years after the mining was completed. Since that time (around 1950), subsidence events have occurred on an erratic basis. It is not possible to predict the exact location where future subsidence may occur or the magnitude of subsidence events in terms of size or disturbance. This study found that subsidence-related damage to homes in the Louisville and Lafayette area was within a range of \$700 to \$2,900 per home (\$1,549 to \$6,438 in 20122 dollars). Losses from future subsidence events are predicted to be sporadic and relatively minor. Impacts to critical facilities are anticipated to be minor.

Future Development

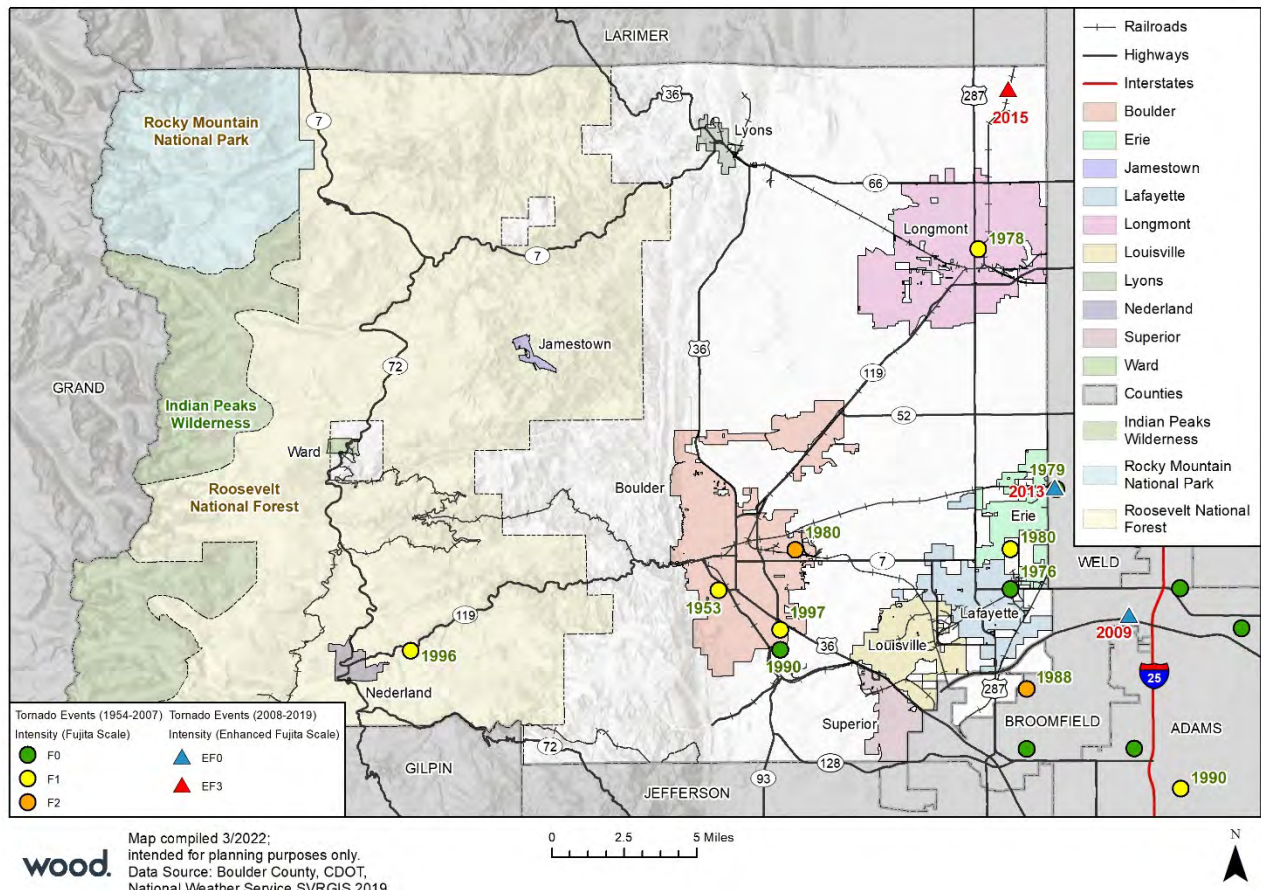
Land use and development controls should limit impacts to future development from subsidence. Lafayette's Comprehensive Plan recommends that no building occur on high hazard zones, and that pre-construction design considerations occur regardless of the hazard zone involved. Erie subdivision regulations have similar controls. The 1986 report recommends that utility lines installed in high hazard zones have special construction to minimize possible adverse effects of subsidence.

4.5.11 Tornado

Background

According to NOAA's Storm Prediction Center, based on national state-level tornado data from 1989 to 2019, Colorado averaged 49 tornadoes per year. This places Colorado 10th in the list of states with the most tornadoes per year. During a 71-year period (1950-2021), 11 tornadoes occurred in Boulder County, which equates to one tornado every 6.4 years, on average. Of these 11 tornadoes, two were magnitude F0, six were F1, two were F2, and one was EF3.

Figure 4-41 Boulder County Tornado Events, 1954-2019



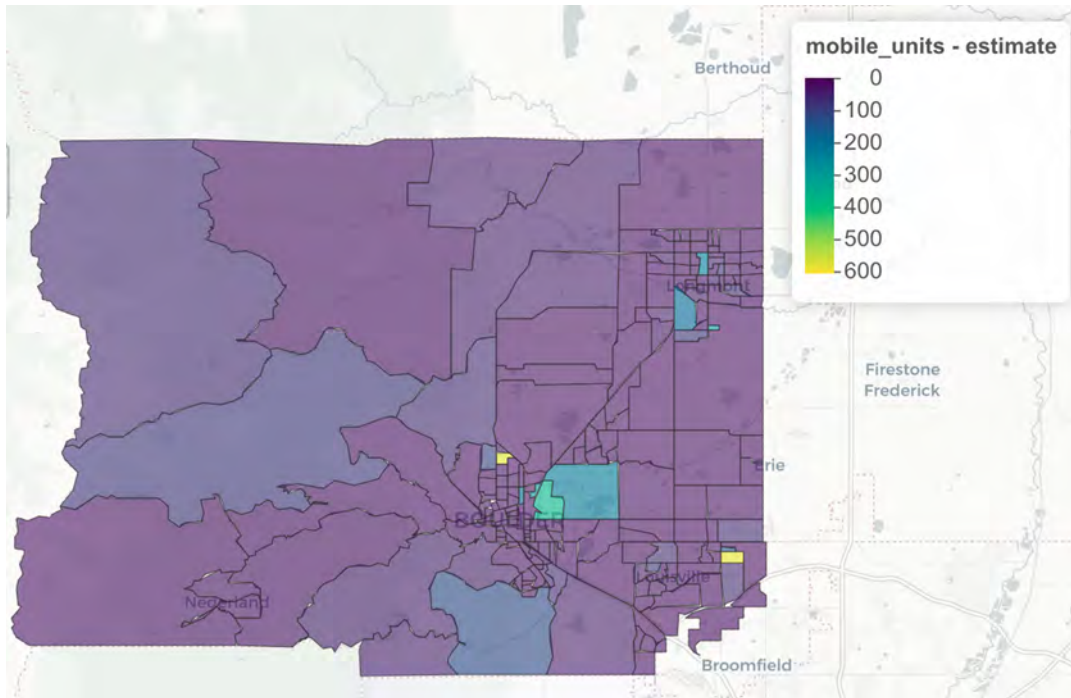
While tornadoes can occur anywhere, the likelihood of damaging tornadoes is highest in eastern Boulder County since it is further away from the foothills and closest to the eastern plains. The eastern Boulder County communities of Longmont and Erie have a higher risk than other communities in the planning area. The Weld County tornado in May 2008 occurred just east of Boulder County, damaging over 200 homes along a 10-mile path, and was an EF 3, so a damaging tornado is possible. Due to the random nature of tornadoes, it is difficult to quantify losses further or try to estimate impacts to critical facilities.

Community Impacts

Mobile home parks are especially vulnerable to the impacts of tornadoes, and many of these parks are clustered in Longmont and Boulder. Clear messaging on where and when to evacuate is critical, as are accessible shelters and education on where and how to shelter. This should include accommodations for low English proficiency households, as well as households without cars. Elderly residents represent a larger share of riders using public transportation and may need assistance in evacuating if necessary.

Future Development

Eastern unincorporated Boulder County, Erie, and Longmont are all experiencing population growth and associated residential and commercial development. This increase in population will expose more residents to tornado hazards. The scientific link between climate change and tornado activity has not yet been established and is difficult to quantify. There is some slight evidence that tornadoes may be appearing in more clusters and with slightly more force, but that has not yet been proven.



4.5.12 Wildfire

Background

Wildfire has the potential to cause widespread damage and loss of life in Boulder County. The significance of this hazard and the availability of digital hazard data in GIS drove the development of a detailed vulnerability assessment that is discussed in the following pages.

Methodology

The HMPC used GIS to quantify the potential wildfire losses to the County and cities within the mapped wildfire hazard areas. The first step was to identify what is exposed to the wildfire hazard. This entailed overlaying a countywide GIS layer of the wildfire hazard on parcels that contained data on structures. The hazard layer utilized was obtained from the Colorado State Forest Service. This layer was determined to be the best available wildfire hazard data countywide.

Boulder County's parcel layer was used as the basis for the inventory of developed parcels. GIS was used to create a centroid, or point, representing the center of each parcel polygon, upon which the wildfire layer was overlaid. In some cases, there are parcels in multiple wildfire hazard zones. For the purposes of this analysis, the wildfire hazard zone that intersected the centroid was assigned as the hazard zone for the entire parcel. Another assumption with this model is that every parcel with an improved value greater than zero was assumed to be developed in some way. Only improved parcels, and the value of those improvements, were analyzed and aggregated by property type and wildfire threat zone. Those parcels intersecting areas of moderate, high, or very high hazard were analyzed and aggregated by municipality. The analysis shows that wildfire risk is not limited to western Boulder County and the foothills and mountain communities of Boulder, Nederland, Jamestown, Lyons, and Ward. Recent events and shifting fire regimes indicate that eastern Boulder County is at a much greater risk to fire than previously considered. Fast moving grassland fires, such as the Marshall Fire in late 2021, could rapidly impact developed areas adjacent to plains and open spaces, such as Louisville, Lafayette, and Superior.

The results of the analysis are displayed in Table 4-29 through Table 4-31 displaying the value of residential

structures, estimated contents value, and population exposed to the moderate, high, and highest wildfire risk hazard areas. Additional data on lower wildfire risk areas and the WUI can be found in the respective community annexes. This analysis does not account for urban conflagration or for structures that were already impacted by the Marshall Fire.

Based on observations in WUI fires, structures and contents are often completely destroyed; thus the estimated total value also represents potential dollar losses. Note: a wildfire is not likely to burn all the WUI areas in Boulder County at once.

Table 4-29 Residential Structures and Population in Highest Wildfire Risk Hazard by Jurisdiction

Jurisdiction	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Boulder	3	126	\$4,985,000	\$2,492,500	\$7,477,500	273
Erie	-	-	-	-	-	-
Jamestown	32	150	\$8,984,130	\$4,658,665	\$13,642,795	303
Lafayette	-	-	-	-	-	-
Longmont*	-	-	-	-	-	-
Louisville	1	1	\$322,500	\$322,500	\$645,000	-
Lyons	9	67	\$5,753,900	\$2,876,950	\$8,630,850	159
Nederland	-	-	-	-	-	-
Superior	82	86	\$58,352,091	\$38,019,877	\$96,371,968	199
Ward	-	-	-	-	-	-
Unincorporated	1,333	5,078	\$927,522,851	\$480,100,966	\$1,407,623,817	9,406
Total	1,460	5,508	\$1,005,920,472	\$528,471,457	\$1,534,391,929	10,340

*Source: Colorado State Forest Service, Boulder County Assessor's Office, U.S. Census Bureau; ; *includes Boulder County portion only; see Longmont Annex for inclusion of Weld County.*

Table 4-30 Residential Structures and Population in High Wildfire Risk Hazard by Jurisdiction

Jurisdiction	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Boulder	76	4	\$78,051,955	\$39,025,978	\$117,077,933	7
Erie	-	-	-	-	-	-
Jamestown	109	22	\$33,829,926	\$17,505,213	\$51,335,139	18
Lafayette	-	-	-	-	-	-
Longmont	386*	57	\$246,400,086	\$129,589,966	\$375,990,052	126
Louisville	-	-	-	-	-	-
Lyons	43	42	\$24,278,290	\$12,544,695	\$36,822,985	104
Nederland	-	-	-	-	-	-
Superior	30	30	\$14,673,380	\$7,450,440	\$22,123,820	76
Ward	-	-	-	-	-	-
Unincorporated	2,709	239	\$1,630,289,817	\$912,593,903	\$2,542,883,720	170
Total	3,353	394	\$2,027,523,454	\$1,118,710,195	\$3,146,233,649	501

*Source: Colorado State Forest Service, Boulder County Assessor's Office, U.S. Census Bureau; ; *includes Boulder County portion only; see Longmont Annex for inclusion of Weld County.*

Table 4-31 Residential Structures and Population in High Wildfire Risk Hazard by Jurisdiction

Jurisdiction	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Boulder	253	394	\$203,203,616	\$203,203,616	\$406,407,232	794
Erie	411	494	\$220,281,926	\$220,281,926	\$440,563,852	1,476
Jamestown	8	9	\$3,564,420	\$3,564,420	\$7,128,840	20
Lafayette	45	112	\$95,845,550	\$95,845,550	\$191,691,100	190
Longmont*	292	286	\$205,726,667	\$205,726,667	\$411,453,334	684
Louisville	13	34	\$38,206,081	\$38,206,081	\$76,412,162	44
Lyons	41	55	\$22,254,835	\$22,254,835	\$44,509,670	114
Nederland	28	37	\$8,808,500	\$8,808,500	\$17,617,000	78
Superior	-	-	-	-	-	-
Ward	-	-	-	-	-	-
Unincorporated	2,656	4,895	\$1,435,346,347	\$1,435,346,347	\$2,870,692,694	8,581
Total	3,747	6,316	\$2,233,237,942	\$2,233,237,942	\$4,466,475,884	11,982

Source: Colorado State Forest Service, Boulder County Assessor's Office, US Census Bureau; ; *includes Boulder County portion only; see Longmont Annex for inclusion of Weld County.

To estimate the potential impact of wildfires on critical facilities a similar GIS overlay was performed of the wildfire hazard layer on existing critical facilities point locations. The results are shown in Table 4-32. Communities not listed had no critical facilities exposed to wildfire hazard. Bridges are included because wooden bridges could burn in a wildfire and result in a life safety issue both for evacuation and responders. A number of wastewater treatment facilities are potentially at risk. No replacement values are available, so a further estimate of potential losses was not possible. The critical facility layers provided were the best available, but may not be complete, especially for the mountain towns. Nederland, Ward, Jamestown, and Lyons more than likely have fire departments, water treatment plants, and government buildings but they were not represented in the available data.

Table 4-32 Critical Facilities Located in Highest Wildfire Hazard Areas, by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Superior	-	-	1	-	-	-	-	1
Unincorporated	-	-	1	1	-	3	4	9
Total	0	0	2	1	0	3	4	10

Source: Colorado State Forest Service, Boulder OEM, HIFLD, National Bridge Inventory

Table 4-33 Critical Facilities Located in High Wildfire Hazard Areas, by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Jamestown	1	-	-	1	-	3	2	7
Unincorporated	-	3	12	22	-	13	17	67
Total	1	3	12	23	0	16	19	74

Source: Colorado State Forest Service, Boulder OEM, HIFLD, National Bridge Inventory

Table 4-34 Critical Facilities Located in Highest Wildfire Hazard Areas, by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Boulder	-	2	2	1	-	1	-	6
Erie	-	-	-	-	-	3	1	4
Longmont	-	-	-	-	2	1	-	3
Louisville	-	-	-	-	-	1	-	1
Unincorporated	2	1	19	14	-	15	13	64
Total	2	3	21	15	2	21	14	78

Source: Colorado State Forest Service, Boulder OEM, HIFLD, National Bridge Inventory

Community Impacts

The impacts to communities can be wide-reaching and severe. Wildfires, both nearby and further throughout the state and Western U.S., can negatively impact air quality in Boulder County, impacting the health of residents. Wildfires can drive up the cost of home insurance premiums. In addition to infrastructure costs, residents may experience loss of water supplies throughout Boulder County or increased costs due to wildfires. This includes impacts to well water viability. Septic systems should be considered as these critical utilities will be impacted by water quality and wildfire activity. New residents in the WUI are often not educated about community resources or safety precautions, and fire mitigation is still optional. The Wildfire Partners program provides important community outreach in mitigation, and the Parks and Open Space Department actively educates visitors as well. A remaining area of concern for community vulnerability includes warnings for non-English speaking populations and houseless populations that camp in the mountains. Transient populations are drawn to mountains during the summer months because there is often more space and privacy than at the homeless shelter in Boulder. Lack of knowledge of local fire danger, weather, and geography can increase individual and community vulnerability.

Future Development

Growth in the WUI has been significant in the past twenty years in Boulder County. While this growth has recently slowed, there still remains potential for development of primary and secondary residences in wildfire hazard areas in the unincorporated County. Wildfire risk to future development in these areas will be tempered by the County's land use regulations.

In all climate change projections, the number of wildfires and acres burned in the County will increase through the next century, potentially up to a 48% increase over the historical average. The current cost to mitigate homes in wildfire areas is around \$3,399. This indicates costs could be up to \$20.25 million to mitigate vulnerable homes within the County (Resilient Analytics 2018).

Rising temperatures are also increasing the populations of mountain pine beetles in Boulder County. The combination of increased drought conditions and higher minimum temperatures in the spring and fall mean that trees will be more stressed and pine beetle larvae more robust. This may lead to populations of pine beetles reaching epidemic proportions (Resilient Analytics 2018). This will increase fuels for fires and reduce air quality as well.

4.5.13 Windstorm

Background

Based on the hazard profile in Subsection 4.2, windstorms will continue to cause property damage annually in Boulder County. Due to the random and widespread nature of the hazard it is difficult to estimate future

losses and where they will occur. Based on the NCEI data alone (see the windstorm profile in Section 4.0) between 1994 and 2005 the average annualized loss from wind is in the vicinity of \$3.4 million. While that figure may include other losses from neighboring counties, it is likely to be a reasonable estimate. Communities in and along the base of the foothills are most susceptible to the hazard, including the City of Boulder, Louisville, Superior, Lyons, Jamestown, Nederland, and Ward, but high winds can damage communities in eastern Boulder County as well.

Windstorms can and will cause injury and even death in Boulder County. The highest risk demographic is to first responders who are dealing with emergency situations resulting from the windstorm. Those working or recreating outdoors will be susceptible to injury from wind borne debris. Winds can also be hazardous to hikers in areas of beetle or fire killed trees. This situation killed a hiker in Rocky Mountain National Park in 2007.

Impacts to critical facilities are difficult to estimate, but buildings could be susceptible to roof and window damage, as was witnessed at the Boulder County Jail in February of 1999. Backup power systems in critical facilities could help mitigate impacts from power outages associated with windstorms.

Future Development

Construction sites can be particularly vulnerable to windstorms. Wind borne construction materials can become hazards to life and property. New construction designed in accordance with the Boulder County wind load map should be able to withstand wind damage, if properly constructed.

4.5.14 Winter Storms (Severe)

Background

The threat to public safety is typically the greatest concern when it comes to impacts of winter storms. But these storms can also impact the local economy by disrupting transportation and commercial activities. Winter storms are occasionally severe enough to overwhelm snow removal efforts, transportation, livestock management, and business and commercial activities. Travelers on highways in Boulder County, particularly along remote stretches of road, can become stranded, requiring search and rescue assistance and shelter provisions. The County can experience high winds and drifting snow during winter storms that can occasionally isolate individuals and entire communities and lead to serious damage to livestock populations and crops. Winter storms contribute directly to other hazards in this plan: extreme temperatures (cold).

Research presented in Subsection 4.3.17 Severe Winter Storms yielded significant impacts from this hazard in the past. Structural losses to buildings are possible and structural damage from winter storms in Colorado has resulted from severe snow loads on rooftops. Older buildings are more at risk, as are buildings with large flat rooftops (often found in public buildings such as schools).

Community Impacts

The County's elderly population is a potentially vulnerable demographic during severe winter storms, especially considering that 60% of 65 and older individuals experience mental or physical disabilities compared with 7.8% of those under 65 (TRENDS 2019). The commuting population is another demographic potentially at risk during winter storm events. About half the workforce in the City of Boulder lives outside the County borders and causes heavy traffic during morning and afternoon commutes (TRENDS 2019). Mountain communities also have above average commute times as the major employment centers are located in the plains.

For those with low-income, or in manufactured homes, extreme temperatures and snow loads will cause problems if utilities are compromised through lack of payment or extra weight to unmaintained structures.

Smaller mountain communities such as Ward and Jamestown may become isolated during winter storm

events, in addition to individuals living the foothills of unincorporated Boulder County. Persons that choose to live in these areas are generally self-sufficient, or should be, as government and emergency services may be limited during a severe winter storm.

Future Development

Future residential or commercial buildings built to code should be able to withstand snow loads from severe winter storms. Population and commercial growth in the County will increase the potential for complications with traffic and commerce interruptions associated winter storms. As building and population trends continue to increase, more persons will be exposed to winter storm hazards, therefore increasing pressure on local government snow removal and emergency services.

Climate change is projected to increase the variability and intensity of winter storms, with most years seeing more intense precipitation events within a shorter period of time (RMCO 2016). The increase in heavy precipitation will increase the burden on low-income households as houses will need to be maintained or retrofitted to accommodate heavier snow loads, and there may be increased day-to-day costs for warmer clothes, higher utility bills, and loss of revenue from business closures. Another major cost from heavy winter storms is likely to be childcare. If heavier precipitation events cause school closures, parents may be forced to miss work or pay for childcare, which will increase impacts on low-income populations.

5.0 Mitigation Strategy

44 CFR Requirement §201.6(c)(3); The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

This section describes the mitigation strategy process and mitigation action plan for the Boulder County Multi-Hazard Mitigation Plan. This section describes how the County accomplished Phase 3 of FEMA's 4-phase guidance—develop the mitigation plan.

5.1 Goals and Objectives

Up to this point in the planning process, the HMPC has organized resources, assessed natural hazards and risks, and documented mitigation capabilities. A profile of the County's vulnerability to natural hazards resulted from this effort, which is documented in the preceding section. The resulting goals, objectives, and mitigation actions were developed based on this profile. In 2008, the HMPC developed this aspect of the plan based on a series of meetings and worksheets designed to achieve a collaborative mitigation planning effort as described further in this section. In the 2013 update, a second series of meetings and workshops was conducted to reevaluate and modify the goals of the plan as needed.

For the purpose of this mitigation plan, goals were defined as broad-based public policy statements that:

- Represent basic desires of the community.
- Encompass all aspects of community, public and private.
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome.
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals were defined before considering how to accomplish them so that the goals are not dependent on the means of achievement. Thus, implementation cost, schedule, and means are not considered in the goal statements which form the basis for objectives and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable. During the 2022 plan update process, the HMPC reviewed the 2016 goals and objectives and concluded that the goals previously identified needed to be changed. A significant goal setting meeting developed new goals and the highlight is adding a climate change goal to the plan (Goal 5). The 2022 goals and objectives identified by the HMPC are listed below. The City of Boulder decided to keep their 2018 hazard mitigation goals, shown after the overall goals below and in the City's annex.

Goal 1: Reduce the Loss of Life and Personal Injuries from Hazard Events.

- Continue to manage development in areas, including property acquisitions to remove development from hazardous locations, pursuing relocation/elevation actions for flood- at risk properties, and providing enforcement measures following disasters to ensure that all redevelopment and recovery activities follow existing development codes. Continue programs to further identify hazards including incorporating future uncertain climate predictions.
- Continue programs to further identify hazards including but not limited to, flood after fire erosion, wildfire, wind, drought, debris flows, rock fall, etc. and assess risk associated. Provide timely notification and direction to the public of imminent and potential hazards.
- Provide timely notification and direction to the public of imminent and potential hazards, including installing rain gauges, soil saturation sensors and stream monitoring systems for early warning identification of pending flooding situations and debris flows. Continue public education programs to improve resident's ability to make informed decisions based on their hazard risks.
- Continue to manage development and mitigation efforts in hazard-prone areas.

- Add Inclusivity and Affordable Housing, list such areas, identify and prepare for impacts, and enhancing early warning systems.
- Add resiliency component and expand beyond flooding situations i.e. tornado and differentiate between detections versus warning.

Goal 2: Reduce Impacts of Hazard Events on Property, Critical Facilities/Infrastructure, and the Environment

- Continue to manage development and placement of structures in hazard-prone areas, including applying land use regulations to minimize exposure to potential hazards and expanding current wildfire mitigation and defensible space programs on both public and private lands. Create incentives and continue to provide assistance for the public to mitigate hazards on their own property.
- Protect existing property to the extent possible through regulations, codes, education, cooperative agreements, hazard reduction projects, and other means. Continue to manage development and protect existing properties in hazard-prone areas through regulations to minimize exposure to potential hazards.
- Protect infrastructure and critical facilities to minimize loss of services following a hazard event including installation of backup generators and other vital infrastructure at critical county facilities.
- Create incentives for the public to mitigate hazards on their own property through education, cooperative land acquisitions, Elevation and relocation programs, Community Wildfire Protection Plans, TDRs and TDCs, and other means as they become available or are created. Restore natural function of environmental processes. Or restore natural function of environmental process.
- Continue to reduce flood losses through compliance with NFIP requirements; continue to comply with CRS requirements, where applicable (i.e., Boulder County, City of Boulder Longmont, and Louisville). NFIP is mandatory and CRS is not. Monitor progress and implement adaptive management as needed to incorporate new and improved best practices including those resulting from future uncertain climate predictions.

Goal 3: Strengthen Intergovernmental Coordination, Communication, and Capabilities Regarding Mitigating Hazard Impacts

- Promote planning efforts that foster cooperation and coordination among jurisdictions, agencies, and organizations involved in hazard mitigation.
- Establish and maintain processes and resources to incorporate mitigation and resiliency into recovery efforts following a hazard event.

Goal 4: Improve Public Awareness and Preparedness Regarding Hazard Vulnerability and Mitigation

- Enhance public education efforts regarding hazards and risk in Boulder County and the role of the public in mitigation.
- Continue engaging the public in hazard mitigation planning and implementation.
- Combine mitigation education efforts with existing governmental and nongovernmental outreach programs.
- Incorporate the most up to date climate predictions with all whole community mitigation programs and projects.

Goal 5: Address Hazard Identification in the Context of Climate Change

- Strive to identify and address common issues related to hazard mitigation and climate changes.
- Monitor the ever-changing environment and continue to identify new or changing hazards.
- Address hazard identification in the context of climate change.

5.1.1 City of Boulder Hazard Mitigation Goals

Goal 1: Increase Community Awareness of Boulder's Vulnerability to Natural Hazards

- Objective 1.1: Inform and educate the community about the types of hazards the City of Boulder is exposed to, where they occur, and recommended responses.

Goal 2: Reduce Vulnerability of People, Property, and the Environment to Natural Hazards

- Objective 2.1: Reduce impacts of hazards on residents and vulnerable populations in the community.
- Objective 2.2: Reduce impacts to critical facilities and services.
- Objective 2.3: Reduce impacts to existing buildings and infrastructure to the extent possible
- Objective 2.4: Reduce impacts to future development and infrastructure to the extent possible
- Objective 2.5: Reduce impacts to the city's natural and historic resources.
- Objective 2.6: Reduce impacts to public health.

Goal 3: Increase Interagency Capabilities and Coordination to Reduce the Impacts of Natural Hazards and Increase Community Resiliency

- Objective 3.1: Continue to collaborate and coordinate with other agencies on planning, projects, hazard response, and funding opportunities.
- Objective 3.2: Minimize economic impacts of natural hazards

5.2 Identification and Analysis of Mitigation Actions

44 CFR Requirement §201.6(c)(3)(ii): The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

This version of the Boulder County Hazard Mitigation Plan has two distinct points of focus. The first, is the update on the mitigation projects from the 2016 HMP plan as an indication of progress and revising to indicate current hazard mitigation priorities. The second, is the explanation of the new projects added to the revised plan during 2021-2022.

In order to identify and select mitigation measures to support the mitigation goals, each hazard identified in Section 4.0: Risk Assessment was evaluated. Only those hazards that pose a significant threat to the community were considered further in the development of hazard specific mitigation measures. Once it was determined which hazards warranted the development of specific mitigation measures, the HMPC analyzed the previous set of viable mitigation options and alternatives identified in 2015/16. The status of those actions was categorized as completed, deferred, ongoing, or in progress (which included projects with some work started as well as those not yet begun). Additional mitigation actions were also developed and are incorporated into this plan's jurisdictional annexes where appropriate.

5.3 Progress on Mitigation Actions

Based on the review of mitigation action progress it is clear that the County and participating jurisdictions are building resiliency through the implementation of specific mitigation actions or projects. The following table shows a count of actions completed, deleted, or continuing in 2022 and new actions for each jurisdiction. Refer to the status notes in each jurisdictional annex's mitigation action strategy and Appendix G3 for status notes specific to the County's actions. The table below summarizes 32 completed actions since this plan was last updated in 2016, indicative that the overall goals of the plan are being achieved over time.

Table 5-1 Mitigation Action Summary by Jurisdiction

Jurisdiction	Completed	Deleted or Deferred	Continuing	New	Total Actions in 2022
Boulder County	8	1	29	3	32
City of Boulder	2	2	21	3	24
City of Lafayette	2	1	1	6	7
City of Longmont	0	0	8	12	20
City of Louisville	7	1	6	6	12
Town of Erie	4	0	2	11	13
Town of Lyons	8	0	13	9	22
Town of Nederland	0	0	4	1	5
Town of Superior	1	0	0	7	7
Four Mile Fire Protection District	0	0	2	7	9
Total	32	5	86	62	151

5.4 Prioritization Process

All participating agencies were involved in the first phase of hazard identification risk assessments based on an overall assessment of Boulder County. Using this data communities developed mitigation projects based on the updated 2021-2022 HMP goals. Each jurisdictional annex summarizes hazard significance to identify the local hazards and prioritize them from occurrence to impact. The assessment is then used to determine which hazard type is the most significant and likely to occur which then can be used to guide mitigation project creation and their relevance and priority. Communities assessed values at risk based on life, structures, and dollar loss. Once all the mitigation actions were identified, the HMPC members were asked to rank as high, medium, or low their mitigation actions related to their impact on reducing vulnerabilities to the communities' highest risks. In addition, prioritization of mitigation projects were based on considerations that include social, technical, administrative, political, legal, environmental and economic (cost effectiveness), using the guidelines recommended by FEMA that were used in the original development of this plan and subsequent updates.

5.5 Mitigation Action Plan

44 CFR Requirement §201.6(c)(3)(iv): The mitigation strategy shall include an action strategy describing how the actions identified in paragraph (c)(2)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefits review of the proposed projects and their associated costs.

This section outlines the development of the final mitigation implementation action plan. The action plan consists of the specific projects, or actions, designed to meet the plan's goals. Over time the implementation of these projects will be tracked as a measure of demonstrated progress on meeting the plan's goals. Each jurisdictional annex consists of their individual action plans.

Annex A contains the County's updated mitigation action strategy. Appendix G includes the yearly updates from the County for the 2016-2022 Hazard Mitigation Plan and at the end of each community annex hazard mitigation projects are listed in detail. Each project contains more detail about activities, actions, the entity responsible for implementation, any other alternatives considered, cost estimate, and a schedule for implementation.

6.0 Plan Adoption

Requirement §201.6(c)(4): The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

The purpose of formally adopting this plan is to secure buy-in from Boulder County and participating jurisdictions, raise awareness of the plan, and formalize the plan's implementation. This section is part one in part how the County accomplished Phase 4 of FEMA's 4-phase guidance—Step 9: Implement the Plan and Monitor Progress. Section 7.0: Plan Implementation and Maintenance is part two and will conclude the remainder of Phase 4. The governing board for each participating jurisdiction will need to adopt this local hazard mitigation plan by passing a resolution. A copy of the adoption resolution is provided in Appendix H.

7.0 Plan Implementation and Maintenance

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This section outlines how this plan will be implemented and updated and is the final conclusion of Phase 4 of FEMA’s 4-phase guidance—Implement the Plan and Monitor Progress.

Step 10: Implementation §201.6(c)(3)(vi) & §201.6(c)(3)(iii)

Once adopted, the plan faces the truest test of its worth: implementation. While this plan contains many worthwhile projects, the HMPC will need to decide which action(s) to undertake first. Two factors will help with making that decision. First, the priority assigned the actions in the planning process and funding availability. Second, Low or no-cost projects most easily demonstrate progress toward successful plan implementation.

Implementation will be accomplished by adhering to the schedules identified for each action and through constant, pervasive, and energetic efforts to network and highlight the multi-objective, win-win benefits of each project to the Boulder community and its stakeholders. These efforts include the routine actions of monitoring agendas, attending meetings, and promoting a safe, sustainable community. The three main components of implementation are:

- **IMPLEMENT** the action plan recommendations of this plan.
- **UTILIZE** existing rules, regulations, policies, and procedures already in existence; and
- **COMMUNICATE** the hazard information collected and analyzed through this planning process so that the community better understands what can happen where, and what they can do themselves to be better prepared. Also, publicize the “success stories” that are achieved through the HMPC’s ongoing efforts.

Simultaneously to the above-mentioned efforts, the HMPC will constantly monitor funding opportunities that could be leveraged to implement some of the more costly actions. This will include creating and maintaining a bank of ideas on how to meet required local match or participation requirements. When funding does become available, the HMPC will be in a position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, special district budgeted funds, state and federal earmarked funds, and other grant programs, including those that can serve or support multi-objective applications.

7.1 Role of Hazard Mitigation Planning Committee in Implementation and Maintenance §201.6(d)(3)

With adoption of this plan, the HMPC will be tasked with plan implementation and maintenance. The HMPC will be led by the Boulder OEM. The HMPC will act as an advisory body. Its primary duty is to see the plan successfully carried out and to report to the community governing boards and the public on the status of plan implementation and mitigation opportunities. The HMPC performed and will continue to perform the following duties:

- Act as a forum for hazard mitigation issues.
- Disseminate hazard mitigation ideas and activities to all participants.
- Pursue the implementation of high-priority, low/no-cost recommended actions.
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters.
- Maintain a vigilant monitoring of multi-objective cost-share opportunities to help the community implement the plan’s recommended actions for which no current funding exists.
- Monitor and assist in implementation and update of this plan.

- Report on plan progress and recommended changes to the Boulder Board of County Commissioners; and inform and solicit input from the public.
- Revise the plan to reflect changes in priorities as identified in mitigation actions / projects identified in the HMP.

Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on the County website and local newspapers.

7.2 Maintenance/Monitoring §201.6(C)(4)(ii)

Plan maintenance implies an ongoing effort to monitor and evaluate plan implementation and to update the plan as required or as progress, roadblocks, or changing circumstances are recognized.

7.2.1 Maintenance/Monitoring Schedule

In order to track progress and update the mitigation strategies identified in the action plan, the HMPC will revisit this plan annually or after a significant hazard event or disaster declaration.

Boulder OEM is responsible for initiating this review and convening members of the HMPC on yearly basis, or more frequently as needed. The annual review will be held in February, prior to the traditional flood and wildfire season.

In addition to the annual review, this plan will be updated, approved, and adopted within a five-year cycle as per Requirement §201.6(c)(4)(i) of the DMA of 2000. When the HMPC reconvenes for the update, they will coordinate with all stakeholders participating in the planning process—including those that joined the committee since the planning process began—to update and revise the plan. With the initial approval of this plan occurring in June 2022, the plan will need to be updated, re-approved by FEMA Region VIII and re-adopted by all participating jurisdictions by no later than June 2027. The County maintains the options of submitting a planning grant application to the Colorado DHSEM/FEMA for funds to assist with the update. This grant should be submitted by 2024, as there is a three-year performance period to expend the funds, plus there is no guarantee that the grant will be awarded when initially submitted. This allows time to resubmit the grant in 2024 or 2025 if needed. Updates to this plan will follow the most current FEMA and DHSEM planning guidance.

7.2.2 List of Communities Adopting Boulder County's Plan Monitoring & Maintenance Schedule

Boulder County	Boulder County will schedule, conduct, and record plan monitoring, revision, and maintenance schedules for all HMPC members. The Boulder OEM will be the lead agency.
City of Boulder	The City of Boulder will be the lead agency support by Boulder OEM.
Erie	The Town of Erie will follow Boulder County's schedule for plan monitoring, revision, and maintenance.
Lafayette	The City of Lafayette will follow Boulder County's schedule for plan monitoring, revision, and maintenance.
Longmont	City of Longmont will continue to partner with Boulder County and work with their schedule on the monitoring, revision, and maintenance of the plan.
Louisville	The City of Louisville will follow Boulder County's schedule for plan monitoring, revision, and maintenance.
Lyons	The Town of Lyons will follow Boulder County's schedule for plan monitoring, revision, and maintenance.
Nederland	The Town of Nederland will follow Boulder County's schedule for plan monitoring, revision, and maintenance.
Superior	The Town of Superior will follow Boulder County's schedule for plan monitoring, revision, and maintenance.

Four Mile FPD	The Four Mile Fire Protection District will follow Boulder County's schedule for plan monitoring, revision, and maintenance.
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7.2.3 Maintenance Evaluation Process

44 CFR Requirement 201.6(c)(4): The plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Updates to this plan will follow the latest FEMA and DHSEM planning guidance. Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability because of implementing recommended actions,
- Increased vulnerability because of failed or ineffective mitigation actions, and/or
- Increased vulnerability because of new development (and/or annexation).

The HMPC will use the following process to evaluate progress and any changes in vulnerability because of plan implementation: §201.6(d)(3)

- Yearly HMP update meeting and process on existing projects will be facilitated and managed by the Boulder OEM.
- A representative from the responsible entity identified in each mitigation measure will be responsible for tracking and reporting on an annual basis to the HMPC on project status and provide input on whether the project as implemented meets the defined objectives and is likely to be successful in reducing vulnerabilities.
- If the project does not meet identified objectives, the HMPC will determine what alternate projects may be implemented.
- New projects identified will require an individual assigned to be responsible for defining the project scope, implementing the project, and monitoring success of the project.
- Projects that were not ranked high priority but were identified as potential mitigation strategies will be reviewed as well during the monitoring and update of this plan to determine feasibility of future implementation.
- Changes will be made to the plan to accommodate for projects that have failed or are not considered feasible after a review for their consistency with established criteria, the time frame, priorities, and/or funding resources.
- All updates and changes will be communicated and distributed to the HMPC members.

Updates to This Plan Will: §201.6(d)(3)

- Consider changes in vulnerability due to project implementation,
- Document success stories where mitigation efforts have proven effective,
- Document areas where mitigation actions were not effective,
- Document any new hazards or increased hazard risk that may arise or were previously overlooked,
- Document hazard events and impacts that occurred within the five-year period,
- Incorporate new data or studies on hazards and risks,
- Incorporate new capabilities or changes in capabilities,
- Incorporate documentation of continued public involvement,
- Incorporate documentation to update the planning process that may include new or additional stakeholder involvement,
- Incorporate growth and development-related changes to building inventories,
- Incorporate new project recommendations or changes in project prioritization,

- Include a public involvement process to receive public comment on the updated plan prior to submitting the updated plan to DHSEM/FEMA, and
- Include re-adoption by all participating entities following DHSEM/FEMA approval.

7.2.4 Incorporation into Existing Planning Mechanisms §201.6(C)(3)

Another important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into other County and City plans and mechanisms. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. Implementation through existing plans and/or programs is recommended, where possible. The County and participating entities already have existing policies and programs to reduce losses to life and property from natural hazards. These are summarized in this plan's capability assessment. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing projects, where possible, through these other program mechanisms. These existing mechanisms include:

- County Comprehensive Plan
- County Land Use Code
- County Capital Improvements Plan
- County Emergency Operations Plan
- Boulder Multiple Agency Coordinating System
- City of Boulder Comprehensive Plan
- Boulder Code of Ordinances
- Lafayette Comprehensive Plan
- Lafayette Code of Ordinances
- Longmont Area Comprehensive Plan
- Longmont Water Supply and Drought Management Plan
- Longmont Water Conservation Draft Master Plan
- Louisville Comprehensive Plan
- Louisville Municipal Code
- Lyons Comprehensive Plan
- Lyons Municipal Code
- Superior Comprehensive Plan
- Superior Municipal Code
- Four Mile Fire Protection District Plans

HMPC members involved in the updates to these mechanisms will be responsible for integrating the findings and recommendations of this plan with these other plans, as appropriate. Examples would be the Boulder Climate Adaptation Plan or the Boulder Community Wildfire Plan, and specifically linking duties of these types of plans with this plan.

7.2.5 Continued Public Involvement

44 CFR Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

Continued public involvement is also imperative to the overall success of this plan's implementation. The update process provides an opportunity to publicize success stories from the plan implementation and seek additional public comment. A public engagement process to receive public comment on plan maintenance and updating will be held during the next update period. The plan maintenance and update process will include continued public and stakeholder involvement and input through attendance at designated committee meetings, web postings, and press releases to local media.

Social Media Strategy

Introduction

As with any civic effort, the process to revise and update the Boulder Multi-Hazard Mitigation Plan will benefit from broad public participation. The Boulder OEM will launch a virtual planning process to engage the community using social media and broaden the dialogue to include those members of our communities that, in the past, have been underrepresented in the planning process.

Goals

- Raise community awareness of the Boulder County Multi-Hazard Mitigation Plan revision process.
- Increase public participation in the revision process resulting in an increase the incorporation of public input and comments into the development of the Multi-Hazard Mitigation Plan.
- Increase engagement between the public and the Boulder OEM.
- Build relationships between the Boulder OEM and target audiences.

Target Audiences

All residents of Boulder County are our audience. However, to reach as broad an audience as possible we will actively engage several target audiences that can assist in pushing our message out to their constituencies and all residents of Boulder County.

- “Opinion leaders” (local journalists and traditional media, social media sites and the blogosphere, political/social activists)
- Business leaders (business owners, trade groups)
- Community organizations and leaders (churches, service clubs, chamber of commerce)
- Civic organizations and leaders that regularly engage with target constituencies (elected and government officials, schools and universities, service agencies)

Platforms

The Boulder OEM already maintains a presence on the following platforms. A separate Facebook page dedicated to the multi-hazard mitigation plan (MHMP) will be established. It will serve as the main platform for engagement and traffic will be directed there via the OEM website, twitter, and the general Facebook page.

- Facebook
- Twitter
- YouTube

We may utilize other platforms if we determine a need or potential benefit.

Strategies

- Target social media outreach to key “opinion leaders” to familiarize this group with the MHMP revision process and our goals of increasing public awareness and participation. Encourage this group to push our message through their outlets (re-tweets, link our site to their pages, shares on Facebook, etc.). This could have an added benefit of generating earned media if news sites, papers, radio, and TV pick up the content which will also reach our target audiences.
- Develop content aimed at interests of specific target audiences, i.e. “why small businesses in Boulder should participate in the MHMP revision process” etc. Push this content through key contacts in our target audiences.
- Engage target audiences through an active online presence (aggressively monitor social media sites, participate in online forums/conversations, share relevant content online).

Tactics

Increase our number of followers:

- Include links to OEM social media sites on all electronic correspondence, press releases, and on our static web presence with a tag line.
- "Like" and "Follow" key members of our target audiences, this encourages them to "Like" and "Follow" us.
- Comment on, reply to, link to, and re-tweet relevant content generated by key target audience members. This helps establish our presence and encourages them to follow us.

Engage Target Audiences

- Adopt the 70/20/10 rule:
 - 70% of the content we push will be information of significant interest and value to our target audiences (articles & stories that communicate our message of the value of the MHMP and its revision process and the importance of public participation)
 - 20% of the content we push will be through online interaction/conversation with our target audiences. Many people now expect to interact with organizations this way, relationships are built online. (Respond to and converse with commenters in a way that addresses their needs and communicates our message)
 - 10% of our content can be blatant promotion i.e. "Like us on Facebook!" or "Comment on the MHMP today!"

Observe and Analyze Social Media Activity

- Observation should guide any changes in the overall social media strategy.
- Keep basic records on who is talking about the OEM and the MHMP? What are they saying? Which platforms are they using? What content resonates generates interest and reaction? Have any new "opinion leaders" emerged with whom we should engage?
- Is our content/message pushing beyond our circles? i.e. have we generated any earned media?

Evaluation and Measures

- To measure the impact of our social media presence we will track the following metrics:
 - Number of comments per week
 - Number of followers on Twitter
 - Number of "Likes" on Facebook
 - Number of re-tweets
 - Number of click throughs on links posted on Twitter, Facebook, and other sites
- Compare levels of social media participation to levels of public participation in original MHMP planning process and traditional public meetings.
- Compare the quality of participation in virtual and traditional public participation using the following metrics:
 - Number of questions/comments per participant
 - Length and/or complexity of questions/comments
 - Length and/or complexity of discussion, i.e., number of follow up questions, number of back and forth with staff and public, number of additional outside comments/questions generated by the original
 - Satisfaction of staff and public that interaction was valuable and productive: this may require a survey at the conclusion of the process.

Annex A: Boulder County

Annex A Boulder County

A.1 Community Profile

See Base Plan Section 2.0 Community Profile.

A.2 Hazard Identification and Summary

See Base Plan Section 4.0 Risk Assessment/Hazard Identification

A.3 Asset Inventory

See Base Plan Section 4.0 Risk Assessment - Vulnerability Assessment subsection.

A.4 Growth and Development

See Base Plan Section 4.0 Risk Assessment - Vulnerability Assessment subsection.

A.5 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment summarizes the Unincorporated County's regulatory mitigation capabilities, administrative and technical mitigation capabilities, and fiscal mitigation capabilities and then discusses these capabilities in further detail along with other mitigation efforts as they pertain to the National Flood Insurance Program's Community Rating System (CRS). Although the CRS is flood-focused, this discussion also incorporates activities related to other hazards into the categories established by the CRS.

A.5.1 Mitigation Capabilities Summary

Table A-1 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Boulder County.

Table A-1 Boulder County's Regulatory Mitigation Capabilities Regulatory Tool (ordinances, codes, plans)

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Comprehensive plan	Yes	Boulder County Comprehensive Plan, 1999, plus subsequent amendments (2018). Plan has elements covering Geology, Natural Hazards, Environmental Resources and Fire Protection.
Zoning ordinance	Yes	Article 4 of the Land Use Code
Subdivision ordinance	Yes	Article 5 of the Land Use Code
Site plan review requirements	Yes	Article 4-800 of the Land Use Code
Growth management ordinance	Yes	Boulder County Intergovernmental Agreements sets growth boundaries for communities in the County

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Floodplain Management Plan and Floodplain Ordinance	Yes	Article 4-400 of the Land Use Code
Other special purpose ordinance (stormwater, steep slope, wildfire)	Yes	Land Use Code regulations include natural hazard evaluation for wildfire, stormwater management, access, etc. Article 19, Procedures Following Disasters, defining Hazard Mitigation Review.
BCEGS Rating	Yes	Last evaluation in 2020. Rating is current as of 3/21
Building code	Yes	International Building Code 2015, wind and snow load design standards
Fire department ISO rating	Yes	In place for most fire protection districts in the County, varies
Erosion or sediment control program	Yes	Article 7-903 of the Land Use Code
Stormwater management program	Yes	Article 7-904 of the Land Use Code
Capital improvements plan	Yes	Seven-year program; Mile High Flood District has a five-year plan for bridge replacements
Economic development plan	Yes	Economic Element to Boulder County Comprehensive Plan
Local emergency operations plan	Yes	Emergency Operations Plan Boulder County-City of Boulder, 1998, in the process of being updated
Participate in the National Flood Insurance Program	Yes	Joined 2/1/1979
Elevation Certificates	Yes	Maintained at the Community Planning & Permitting Department
Participate in the Community Rating System	Yes	CRS Class 5

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
(CRS)		
Other special plans	Yes	Several fire protection districts have community wildfire protection plans
Flood insurance study or other engineering study for streams	Yes	FEMA FIS, December 18, 2012; hard copies of all stream/flood studies on file with the Community Planning & Permitting Department

Table A-2 identifies the personnel responsible for mitigation and loss prevention activities as well as related data and systems in Boulder County.

Table A-2 Boulder County's Administrative and Technical Mitigation Capabilities

Administrative and Technical Capabilities	Yes/No	Department/Position	Comments
Planner/engineer with knowledge of land development/land management practices	Yes	Community Planning & Permitting, Planning Division	12 planners
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Community Planning & Permitting, Building Division; Administrative Services, Architects' Division; Administrative Services, Facilities' Division; Public Works, County Engineer	4 plan examiners (Community Planning & Permitting); 3 licensed architects, 1 licensed contractor, 1 master electrician, 11 electricians, 2 infrastructure project managers, construction crews 7 engineers (Engineering and County Engineer)
Planner/engineer/scientist with an understanding of natural hazards	Yes	Parks & Open Space	2 foresters, 1 hydrologist, 1 water engineer, and 5 planners
Transportation Planner	Yes	Community Planning & Permitting Dept. – Multimodal Transportation Planning Division	
Resiliency Planner	Yes	Department of Resiliency and Recovery	
Personnel skilled in GIS	Yes	Community Planning & Permitting; Assessor; Parks & Open Space; Sheriff's Office; Information Technology; Public Works,	20+ staff total

Administrative and Technical Capabilities	Yes/No	Department/Position	Comments
		Road Maintenance; Public Health	
Full-time building official	Yes	Community Planning & Permitting, Building Division	1 chief building official; 4 plans examiners; 5 inspectors
Floodplain manager	Yes	Community Planning & Permitting	2 certified floodplain managers
Emergency manager	Yes	Sheriff's Office	Office of Emergency Management
Grant writer	Yes	Various	Several staff have this as part of their job descriptions; one grants coordinator in Finance
Other personnel	Yes	Community Planning & Permitting; Public Works;	2 wildfire mitigation coordinators (Land Use); 55 equipment operators (Public Works); FEMA-trained public information staff (commissioners); various trades and administrative/communications staff throughout the County
GIS Data – Hazard areas	Yes	Community Planning & Permitting, GIS division	Wildfire and geology layers, Flood Hazard areas
GIS Data – Critical facilities	Yes	Public Works, Road Maintenance; Public Health	Critical transportation/evacuation routes/structures in roadway infrastructure layers (Public Works); nursing homes and assisted living centers within the floodplain (Public Health)
GIS Data – Building footprints	Yes		
GIS Data – Land use	Yes	Community Planning & Permitting, GIS division	Zoning, etc.
GIS Data – Links to assessor's data	Yes	Assessor's Office	
Warning systems/services (Reverse 9-11, cable override, outdoor warning signals)	Yes	Generally, Sheriff	Reverse 911; cable override at Public Safety Building; sirens throughout the County; emergency paging system for County staff
Other	Yes	Various	Close coordination with partner agencies throughout Boulder

Administrative and Technical Capabilities	Yes/No	Department/Position	Comments
			County, such as BCARES, CERT volunteers, RTD, Special Transit, School districts, CU-Ability to rapidly assess health needs following a disaster and develop and communicate health information to prevent further injuries/casualties following a disaster (Public Health)

Table A-3 identifies financial tools or resources that Boulder County could potentially use to help fund mitigation activities.

Table A-3 Boulder County's Fiscal Mitigation Capabilities Financial Resources

Financial Tools	Accessible/Eligible to Use (Yes/No)	Comments
Community Development Block Grants	Yes	CDBG-DR eligible during 2013 flood recovery
Capital improvements project funding	Yes	Subject to annual appropriation by the County commissioners
Authority to levy taxes for specific purposes	Yes	With voter approval
Fees for water, sewer, gas, or electric services	Some	Only in Eldorado Springs, where a sewer utility is provided; the County does not provide these services elsewhere
Comments Impact fees for new development	No	Possible under state law, but not something County has done before
Incur debt through general obligation bonds	Yes	With voter approval
Incur debt through special tax bonds	Yes	With voter approval
Incur debt through private activities	No	Possible under state law, but not something County has done before
Withhold spending in hazard-prone areas	Yes	Allocations are at the commissioners' discretion; however, County tends to do the opposite, spending more on mitigating hazards in these areas
Stormwater Service Fees	Yes	
Other	Yes	TABOR (state law) restricts the County to a 3 percent contingency fund (currently \$3.3 million) to address disasters; voter approval is required for any taxing/debt

Financial Tools	Accessible/Eligible to Use (Yes/No)	Comments
		authority, including restoration of the contingency fund after it has been spent.

Since the 2013 floods, Boulder County and subgrantees have received over \$20 million (federal share) in Hazard Mitigation Assistance (HMA) grants through FEMA's Hazard Mitigation Grant Program. The county and local subgrantees have contributed approximately \$8 million in local match to these grants, demonstrating the ability to fund mitigation with cash or in-kind resources. Table A-4 provides details on the previous mitigation grants received.

Table A-4 FEMA HMA Grants Received in Boulder County

Project Type	Disaster Number	Date Approved	Sub Applicant	Federal Share	Total Cost
100.1: Public Awareness and Education (Brochures, Workshops, Videos, etc.); 300.2: Vegetation Management - Wildfire; 700.1: Management Costs - Salaries		6/28/2013	Boulder County Land Use Department	\$630,234	\$840,312
202.1: Elevation of Private Structures - Riverine	4145	2014	Jamestown, Town Of	\$25,825	\$34,433
300.2: Vegetation Management - Wildfire	4145	2014	Boulder County	\$1,100,381	\$1,467,175
601.1: Generators	4145	5/16/2014	Boulder County	\$422,418	\$969,822
300.2: Vegetation Management - Wildfire	4145	5/16/2014	Boulder County	\$216,415	\$480,921
302.1: Landslide Stabilization - Structural		5/16/2014	Boulder County	\$2,680,824	\$3,574,432
91.5: Local Multijurisdictional Multi-Hazard Mitigation Plan - UPDATE	5378	5/16/2014	Boulder County	\$31,029	\$41,372
601.1: Generators	4145	5/16/2014	Sunshine Fire Protection District	\$11,217	\$14,956

Project Type	Disaster Number	Date Approved	Sub Applicant	Federal Share	Total Cost
904.2: Advance Assistance (FMA and PDMC)		5/16/2014	Boulder County Transportation Dept.	\$197,822	\$263,762
405.1: Other Minor Flood Control	4145	5/16/2014	University Of Colorado	\$720,694	\$960,925
200.1: Acquisition of Private Real Property (Structures and Land) - Riverine	4145	5/16/2014	Jamestown, Town Of	\$1,174,396	\$1,565,861
402.1: Infrastructure Protective Measures (Roads and Bridges)	4145	5/16/2014	University Of Colorado	\$2,690,510	\$3,587,347
90.4: Mitigation Plan - Local Multi-Hazard Mitigation Plan	9420	5/16/2014	Boulder County	\$78,425	\$104,567
200.1: Acquisition of Private Real Property (Structures and Land) - Riverine	4145	5/16/2014	Boulder County	\$6,848,369	\$9,131,159
904.1: Advanced Assistance		5/16/2014	Boulder County	\$73,961	\$194,481
601.1: Generators	4145	5/16/2014	Sunshine Fire Protection District	\$12,106	\$16,141
601.1: Generators	4145	5/16/2014	Boulder	\$34,275	\$45,700
403.1: Stormwater Management - Culverts	4145	5/16/2014	Jamestown, Town Of	\$1,206,016	\$1,608,022
300.2: Vegetation Management - Wildfire		5/16/2014	Boulder County Land Use Department	\$1,215,631	\$1,621,366
600.1: Warning Systems (as a Component of a Planned, Adopted, and Exercised Risk Reduction Plan)	4145	5/16/2014	Jamestown, Town Of	\$78,139	\$104,185
405.1: Other Minor Flood Control		5/16/2014	Jamestown, Town Of	\$45,099	\$60,132
405.1: Other Minor Flood Control		5/16/2014	Jamestown, Town Of	\$16,500	\$22,000
104.1: Developing, Implementing and Enforcing Codes, Standards, Ordinances and Regulations	4145	12/7/2016	Boulder County	\$93,410	\$124,547
601.1: Generators	4145	1/24/2018	Boulder	\$35,610	\$47,480

Project Type	Disaster Number	Date Approved	Sub Applicant	Federal Share	Total Cost
300.2: Vegetation Management - Wildfire	4145	12/12/2018	Boulder County	\$600,647	\$825,745
300.2: Vegetation Management - Wildfire		4/10/2019	Boulder County	\$960,000	\$1,280,000
Total				\$20,569,717	\$28,146,531

Source: OpenFEMA, OpenFEMA Dataset: Hazard Mitigation Assistance Projects

Table A-5 identifies existing education and outreach capabilities that Boulder County uses to inform the public about hazards and risks in the community.

Table A-5 Boulder County's Education and Outreach Capabilities

Capability/Program	Yes/No (Briefly Describe)
Local Citizen Groups That Communicate Hazard Risks	Inter Mountain Alliance: work with communities west of US 36. ESF 23 in the County EOP when activated conducts community engagement by leveraging existing communications through connections with community brokers and groups that work with non-English speakers
Firewise	Yes. Carriage Hills Estates, Foothills Ranch HOA, Lake of the Pines, Lefthand Fire Protection District, Sunshine Fire Protection District, Town of Jamestown
StormReady	Yes
Other?	Wildfire Partners; Annual Floodplain Outreach: The county sends annual notices to all owners of properties within the county's regulatory floodplain to notify residents of flood risk and provide information on flood emergency preparedness

A.5.2 Opportunities for Capability Enhancement and Improvement

The plan update process provided the County an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- Continue to integrate new or updated risk assessment information into future updates to the County's Comprehensive Plan (See Action Worksheet in Section A.6 *Integration of Land use and Mitigation Plans*) and Land Use Code.
- Expand the scope of projects in the County CWPP.

A.5.3 Community Rating System Activities (All Hazards)

Boulder County (unincorporated areas) joined the National Flood Insurance Program (NFIP) on February 1, 1979, and the Community Rating System (CRS) on October 1, 1991. The NFIP allows private property owners to purchase affordable flood insurance and enables the community to retain its eligibility to receive certain federally backed monies and disaster relief funds. The CRS is a voluntary program for NFIP-participating communities. It provides flood insurance discounts to policyholders in communities that provide extra measures of flood above the minimum NFIP requirements. Unincorporated Boulder County currently has

a CRS class rating of 5 (on a scale of 1-10, 1 being the best). This rating provides a 25 percent discount for policyholders within a special flood hazard area (SFHA) and a 10 percent discount for those outside of an SFHA.

NFIP insurance data indicates that as of 2018, there were 631 policies in force in the unincorporated County, resulting in \$185,872,800 of flood insurance coverage. Of these, and 260 were in A zone (special flood hazard areas). At the time of this plan update FEMA was technical difficulties with their reporting system and was unable to provide updated numbers for 2022.

In unincorporated Boulder County, there have been 434 historical claims for flood losses totaling \$15,461,284. As of December 2020, there are five repetitive loss structures in the unincorporated areas of the county, three of which are unmitigated. All five properties are single family structures.

Community Rating System Categories

The Community Rating System (CRS) categorizes hazard mitigation activities into six categories. These categories, and applicable County all-hazards mitigation activities, are described below. Note: some of the activities are appropriate to multiple categories. For purposes of simplicity, they are only included in the category deemed most appropriate based on the definitions and examples provided in the CRS Coordinator's Manual.

Preventive

Preventive activities keep problems from getting worse. The use and development of hazard-prone areas is limited through planning, land acquisition, or regulation. They are usually administered by building, zoning, planning, and/or code enforcement offices.

Boulder County Comprehensive Plan, 2020

The Boulder County Comprehensive Plan was updated in 2019 and readopted on July 15, 2020. The plan has a Natural Hazards Element which lists policies and implementation measures related to natural hazards and is reevaluated every five years when the County's Hazard Mitigation Plan is updated. The purpose of the Element, "is to avoid or reduce risk an acceptable level" (Boulder County 2020). In addition to the listed policies in the table below, the Natural Hazards Element also has the following three goals:

Natural Hazards/Geologic
NH 2.01.01 (Also Policy GE 1.01) The county shall strongly discourage development in Geologic Hazard and Constraint areas.
NH 2.01.04 (Also Policy GE 1.05) The county shall require the evaluation of all geologic hazards and constraints as appropriate to reflect conditions that may change following natural disasters. Such evaluations shall be conducted by a qualified Colorado Professional Geologist with knowledge and experience with the geology and geologic hazard conditions of Boulder County. Such evaluations should incorporate analytical methods representing current, generally accepted, professional principles and practice. Additionally, evaluations will be reviewed by the Colorado Geological Survey or an independent qualified professional geologist and/or an independent qualified geotechnical engineer.
Natural Hazards/Erosion
NH 3.01 Minimization of Erosion. Erosion from development and other land use activities should be minimized and disturbed or exposed areas should be promptly restored to a stable, natural, and/or vegetated condition using native plants and natural materials.
NH 3.02 Drainage and Erosion. Drainage from development or any alterations to historic drainage patterns shall not increase erosion either on site or on adjacent properties.
Natural Hazards/Flooding

NH 4.01 Limits to Development in Floodplains. The county should strongly discourage and strictly control land use development from locating in designated floodplains, as identified in the Boulder County Zoning Maps.

NH 4.02 Limits to Development below Dams, Spillways, and Levees. The county should strongly discourage and strictly control land use development from locating in areas below dams, spillways, and levees that would require the State Engineer to upgrade the classification of these structures.

NH 4.03 Location of Critical Facilities. Critical facilities (schools, churches, hospitals, and other facilities as defined by the Federal Emergency Management Agency, FEMA) should be sited outside the delineated floodplain areas.

NH 4.04 Acquiring and/or Relocation Existing Structures. The county, either individually or in partnership with others, should examine alternatives for acquiring and/or relocating existing structures prone to flooding.

NH 4.05 Pre-Disaster Flood Mitigation Plan. The county should continue to develop and refine the countywide Pre-Disaster Flood Mitigation Plan.

NH 4.06 Community Rating System. The county will continue to participate and implement the Community Rating System program as part of the National Flood Insurance Program.

Natural Hazards/Wildfire

NH 5.01 Elevated Risk in Wildland Urban Interface. The county recognizes the wildland urban interface as an area particularly at risk to wildland fires or wildfires.

NH 5.02 Fire-Dependent Ecosystem. Fire should be recognized as a natural and/or human-caused occurrence with certain benefits to the ecosystem. The county should strive towards balancing the natural processes of the ecosystem with development concerns so that residents may co-exist in a fire-dependent ecosystem.

NJ. 5.03 Wildfires and Development. Development/site plan reviews in areas identified to be at risk of wildfires should address site location, building construction and design, landscaping/defensible space/fuel management, access and water availability. These factors should be analyzed from the standpoint that wildfires may present a hazard to development and or development may present an ignition hazard to the forest.

NH 5.04 Interjurisdictional and Interagency Cooperation. Boulder County should continue to encourage interjurisdictional and interagency cooperation to further the goals of protection of life and property from wildfires. The Boulder County Wildfire Mitigation Group should continue to work cooperatively to develop and implement programs to reduce the hazard of wildfire. This should include the following subject areas: public education and awareness, fuel reduction and prescribed burn programs, ecosystem/vegetation management, Wildfire Hazard Identification and Mitigation System, (WHIMS), codes and regulations, and pre-suppression.

NH 5.05 Wildfire Hazard Identification & Mitigation System. Boulder County should be surveyed and mapped to locate the extent of wildfire hazards and areas at risk using the Wildfire Hazard Identification and Mitigation System (WHIMS).

NH 5.06 Reduction of Wildfire Risk to Low or Moderate Rating. Accepted methods of forest land ecosystem management should be used to reduce all severe wildfire hazard areas to a low or moderate rating, particularly in those areas inhabited with human development as defined by WHIMS.

NH 5.07 Forest Management. The county should encourage private and public landowners to manage their forests to preserve the forests' ecosystem processes by developing and maintaining a diversity of species, ages, and stand densities to serve as a natural deterrent to pest and fire outbreaks. The county should implement measures to guard against the danger of fire in developments within and adjacent to forests or grasslands.

NH 5.08 Improvement of Fire Protection Services. The county should continue to work in partnership with the local fire protection districts and departments in improving fire protection services to address the increasing concerns of wildfire and the increase in development in the mountainous areas of the county.

Natural Hazards/Seismicity

NH 7.01 New Siting and Building Standards Regarding Seismic Events. Efforts should be made to keep apprised of new siting and building standards that are predicated on potential impacts from seismic events such as earthquakes.

Natural Hazards/Extreme Weather Conditions

NH 8.01 New Siting and Building Standards Regarding Extreme Weather. Efforts should be made to keep apprised of new siting and building standards that are predicated on potential impacts from extreme weather conditions such as high winds, heavy snows/hail, lightning, and occasional and irregular temperature extremes.

In addition to the policies listed above from the Natural Hazards Element, there is also a Fire Protection Element of the Comprehensive Plan. These policies, listed in the table below were developed jointly with the County and local fire department representatives working through the Boulder County Firefighters' Association.

Policies from the Fire Protection Element	
FP 1.01 Fire Codes.	The county shall encourage fire protection districts in Boulder County to adopt, implement and enforce similar fire codes.
FP 1.02 Fire Coordinator.	The county shall encourage the provision of a fire coordinator to offer technical assistance concerning fire code and related matters to fire departments and county departments upon request.
FP 1.03 Level and Type of Service.	The county shall encourage each fire department to clearly define the level and type of service which it provides and to move toward development and adoption of a fire protection master plan as described in policy FP 1.04.
FP 1.04 Fire Protection Master Plans.	The county shall support the development of fire protection master plans by individual departments, and, where appropriate, by geographically related groups of fire departments for the purpose of defining and potentially improving the level of service provided, eliminating unnecessary duplication, fragmentation, or competing services, and encouraging the consolidation of fire departments or districts.
FP 1.05 Evaluation of Impact of Development Proposals.	The Boulder County Land Use Code shall require development proposals to include an evaluation of the impact of the proposal upon the capability of the affected fire department to maintain its appropriate level of service to existing development in its response area or district and to adequately serve the proposed new development.
FP 1.06 Design and Development Standards and Requirements.	The county shall incorporate into the Boulder County Land Use Code, in so far as possible, design and development standards and requirements which will result in the future provision of fire protection that is efficient and of an appropriate level.
FP 1.07 Information for Fire Protection Planning.	The county shall support the acquisition, development and maintenance, and utilization of accurate information for fire protection planning purposes, e.g., response time and fire protection category maps, wildfire hazard and risk data, land use patterns, and departmental capabilities, etc.
FP 1.08 Volunteer Departments.	Recognizing the value of fire protection districts in providing fire prevention inspection and investigative functions in the unincorporated areas of the county, the county shall encourage volunteer departments to consider reorganizing as fire districts or annexing their territorial area into existing fire protection districts.
FP 1.09 Efficient Use of Resources.	The county shall encourage cooperation and the development of agreements between all levels of government and the various agencies providing fire protection services for the purpose of most efficiently utilizing the resources of each entity.
FP 1.10 Organizations as Resources.	The county shall recognize the value of organizations such as the Boulder County Firefighters' Association as resources for guidance and referral on fire protection and emergency services issues, for facilitating cooperation between fire departments, emergency service agencies, other units of government, and the public.

Boulder County Land Use Code

The Boulder County Land Use Code was adopted in 1994 as a comprehensive regulatory document that applies to all land within the unincorporated areas of Boulder County. Its purpose is to protect and promote the health, safety, and general welfare of the present and future inhabitants of Boulder County and to guide

future growth, development, and distribution of land uses within Boulder County. The code defines zoning districts where uses and their intensities are defined. In addition, it establishes the process for subdivisions, site plan review, special use review, development standards, and other land use procedures. Among the regulations are the following, which directly mitigate natural hazards.

- **Article 4-400 Floodplain Overlay District:** This regulation establishes an overlay district that limits development, encroachment, use, or alteration in the floodway and the flood fringe; determines when a floodplain development permit is needed and application requirements; sets standards for permit review; establishes requirements for flood proofing and elevation; and designates the Boulder County engineer as the administrator of these requirements (i.e., floodplain manager). The location and boundaries of the district are designated by a number of reports, which are listed in the code.
- **Article 4-800 Site Plan Review:** This regulation calls for the administrative review for certain proposed developments that are considered likely to significantly impact important ecosystems, agricultural lands, surrounding land uses and neighborhoods, and infrastructure needs and demands, and which may be unsafe due to natural hazards. Such a review will allow significant adverse impacts to be identified, evaluated, and avoided or acceptably mitigated through the imposition of reasonable conditions.
- **Article 4-600 Uses Permitted by Special Review and Limited Impact Special Review:** This regulation reviews those uses where the level of intensity of the use requires evaluation to determine if the site is appropriate for the proposed use. Among other things, the review includes an evaluation of hazards and uses may be denied based on this evaluation or approvals may require hazard mitigation.
- **Article 7-200 Development Design:** This regulation requires development design to eliminate or mitigate the potential effects of hazardous site conditions, lots to be laid out to provide positive drainage away from all buildings, individual lot drainage to be coordinated with the general storm drainage pattern for the area, and drainage to be designed to avoid concentration of storm drainage from any lot to an adjacent lot. Guidelines that should be followed to the greatest extent possible include designing development to preserve the natural terrain, drainage, existing topsoil, and vegetation; to maintain stands of trees or other vegetative cover to reduce the effects of winds on buildings; to include xeriscaping instead of traditional landscaping; and to coordinate with the stormwater drainage and flood control systems.
- **Article 7-900 Drainage:** This regulation establishes requirements for storm drainage systems, drainage easements, and areas of high ground water, soil erosion and sedimentation control plans, and stormwater management.
- **Article 7-1100 Fire Protection:** This regulation sets standards for the provision of fire protection services. It recognizes the potential need for additional fire precaution measures in identified fire hazard areas.
- **Article 8-200 Regulation for Areas and Activities of State Interest:** Among the purposes of these regulations are to ensure that development in natural hazard areas minimizes significant hazards to public health or safety or to property or the environment and to protect the public health, safety, welfare, and the environment.
- **Article 19-300 Procedures Following Disasters, Front Range Extreme Rain and Flood Event (September 2013):** Among the purposes of these regulations are to ensure that there is an appropriate balance between citizens being able to rebuild their homes and businesses and resume their post-disaster lives, while assuring that the ongoing recovery effort is well planned in anticipation of the possibility of history repeating or exceeding itself.

As with the Boulder County Comprehensive Plan, a number of the land use regulations also indirectly mitigate hazards. These include the planned development district regulations, which promote the more

efficient use of land so as to preserve and enhance the natural characteristics and unique features of a property (e.g., using conservation easements to protect valuable natural resources from development), among other things.

Floodplain Management Regulatory / Current & Future Conditions

Floodplain management regulations must be sufficient for current and future conditions. These measures must account for changes in hydrology and hydraulics due to changing conditions within the watershed including climate change.

Flood Studies for Major Drainages

An element of Boulder County's long-term flood recovery response to the event of September 2013 is an evaluation through the Master Plans of the need for updated flood studies. All of the major drainages in the county have flood studies that are adopted by the County, the State of Colorado, and FEMA. The drainages with studies currently adopted by the county include South Boulder Creek, Boulder Creek, Fourmile Creek, Lefthand Creek, James Creek, St. Vrain Creek, Little Thompson River and a collection of significant drainages that flow through the City of Boulder. Most of the studies were completed in the late 1970s and early 1980s.

The drastic changes to the physiography of the watersheds brought about by the September 2013 flood have been a significant motivator behind the planning efforts for updated flood studies. Updated flood studies are also necessary due to natural, gradual changes in the climate, hydrology, and geomorphology of the region and the local watersheds. As of December 2020, the following Watershed Master Plans have been completed

- Boulder Creek
- Fourmile Canyon Creek
- Left Hand Creek and James Creek
- Little Thompson River
- St. Vrain Creek
- Upper Coal Creek
- Coal Creek
- Rock Creek

The watershed master plans identify risks, flood impacts, and recommendations for restoration project. Many of the projects identified in the plans have been completed.

Storm Drainage Criteria Manual

During the September 2013 flood, many mountain stream crossings (both public and private) were washed out, eliminating access to many properties in Boulder County. In the year following the flood, rebuilding presented a significant challenge, in part due to impossible and in some cases ambiguous requirements in the Boulder County Storm Drainage Criteria Manual (SDCM) which was prepared in 1984.

Boulder County Transportation Department retained the services of the engineering and emergency management consulting firm, Dewberry, to assist with revisions to the SDCM. The suggested changes detailed in Dewberry's report will result in more resilient private access design and are designed to maintain the same level of safety as the current criteria, but in a way that is more feasible for mountain environments. The revisions to the SDCM were adopted on November 20, 2014.

A.5.4 Boulder County Parks and Open Space Management and Parcel Acquisitions

Boulder County Parks and Open Space strives to acquire lands that meet the following criteria:

- Land threatened by development that is near or adjacent to existing open space.
- Prime agricultural land.
- Wildlife habitat.
- Riparian and scenic corridors.
- Land that could provide trail connections.

While lands within riparian and scenic corridors is called out as a specific category of properties sought by the Open Space Acquisitions program, the other four categories can include properties within flood hazard zones as well. Therefore, keeping flood hazard zones free of development by acquiring more properties for open space use may be accomplished through the multifaceted objectives of the program.

In October 2012, Boulder County Parks and Open Space published the Boulder County Parks and Open Space 2015 Vision Statements. Of the seven stated goals, the first is, "To preserve rural land." Of the two objectives therein, the first is to: "Preserve 1,500 additional acres and associated water rights, focusing on key/strategic parcels, trail corridors/connections (including regional), riparian corridors and wildlife habitat." As of November 2014, only a report of the 2013 calendar year was available. In 2013, a total of 603.33 acres of new open space either by direct purchase or Conservation Easement, 251.63 acres of which protect riparian habitat. As Boulder County Parks and Open Space continues to work toward its goal of a total of 1,500 acres of new open space preservation by 2015, it is clear that riparian habitat and other lands within flood hazard zones will continue to be preserved as well.

A.5.5 Other

Boulder County is party to a number of intergovernmental agreements (IGAs), contracts between two or more jurisdictions promising to follow a jointly developed growth plan. These IGAs usually identify areas where growth can best be accommodated and, conversely, where it would be counterproductive to Boulder County's goals and policies as set forth in the Boulder County Comprehensive Plan.

Boulder County's Storm Drainage Criteria Manual regulates storm drainage design in unincorporated Boulder County. It provides minimum design and technical criteria for the analysis and design of storm drainage facilities and requires that all subdivision, resubdivision, planned unit development, or any other proposed construction shall include adequate storm drainage analysis and appropriate system design.

The Boulder County Wildfire Mitigation Group facilitates communication between all parties with an interest in wildfire mitigation; coordinates actions among the parties that could help minimize loss of life and property from future wildfires; and acts cooperatively in addressing the issues by working together in effective partnerships.

The Boulder County Wildfire Mitigation Group assists in land use reviews and wildland-urban interface code development to encourage Firewise development.

Boulder County Public Health has a West Nile virus prevention plan.

Boulder County Public Health Emergency Preparedness Program is working with other public health officials, local leaders, and emergency management to develop and practice plans for the protection of the community from pandemic flu.

Property Protection

Property protection activities are usually undertaken by property owners on a building-by-building or parcel basis.

- The Boulder County Community Planning & Permitting Department maintains elevation certificates, which are used to provide elevation information necessary to ensure compliance with community floodplain management ordinances, to determine the proper insurance premium rate, and to support

requests for letters of map amendment or revision. FEMA elevation certificates are required to be completed for all improvements in a floodplain (approved under a floodplain development permit) that are classified as new construction or a substantial improvement.

- The Boulder County Wildfire Mitigation Group developed mitigation grants to assist homeowner associations and fire districts with their fire mitigation efforts.
- The Boulder County Wildfire Mitigation Group created the Boulder County Chipping Reimbursement Program to subsidize costs of chipping and to aid in slash collection and disposal.

Natural Resource Protection

Natural protection activities preserve or restore natural areas or their natural functions. They are usually implemented by parks, recreation, or conservation agencies or organizations.

- Over 65 percent of land in Boulder County is protected from development by Boulder County and federal, state, and local agencies, either through conservation easements or land ownership. Boulder County Parks and Open Space acquires land in a variety of different ways using a variety of funding sources to shape and buffer urban areas; preserve critical ecosystems, cultural resources, and scenic vistas; provide access to lakes, streams; and other public lands; conserve forests, agricultural land, and water resources; and protect areas of environmental concern. The Environmental Resources Element update to the Boulder County Comprehensive Plan adopted in November 2014 identifies resources and natural functions that exist and also that are at risk within the County.
- The Boulder County Wildfire Mitigation Group coordinates prescribed fire programs among the various fire management entities within Boulder County.
- The Boulder County Wildfire Mitigation Group supports fuel reduction work through the use of fire mitigation crews and youth corps crews.
- The Boulder County Parks and Open Space Forestry Division uses a variety of management techniques, such as thinning, prescribed burns, insect and disease treatment, and other techniques to mitigate wildfire.

Emergency Services

Emergency services measures are taken during an emergency to minimize its impacts. These measures are the responsibility of city or county emergency management staff and the owners or operators of major or critical facilities.

- The Boulder County Sheriff's Communications Center is responsible for the all-hazards warning siren system used to alert citizens to potential danger. There are approximately 30 outdoor warning sirens in place throughout Boulder County. System warning tests are conducted on the first Monday of each month from April through August and are intended to ensure that all systems and procedures are working properly during the season of peak flood danger. Some sirens have voice capability and the voice message will immediately follow the siren signal to inform the public of the situation and what actions should be taken.
- Boulder County has a flood warning and detection system. This system includes a flood forecasting and warning system comprised of a series of real time rain gauges monitored on a 24/7 basis, in coordination with the Mile High Flood District. These gauges automatically transmit data to a computer in the Boulder Communications Center that sounds an alarm when significant amounts of rainfall occur and when rising stream levels are detected. A flood warning plan has been developed for the Boulder Creek drainage basin, which is exercised and updated annually.
- The Citizens Alert System is a 24-hour alert and warning system toned with a voice warning message from the Boulder Regional Communications Center. This system is currently in many nursing homes, businesses, and homes and in all Boulder Valley and St. Vrain Schools and administrative offices. It is

used to alert and warn of any natural or manmade disaster.

- The Metropolitan Emergency Telephone System (METS) is a specially designed telephone system for alerting law enforcement, other response agencies, and Denver media of emergency situations. The particular value of METS to the Boulder Regional Communications Center is the ability to instantly notify all Denver media of any life-threatening situations in Boulder County that can be immediately broadcast on all Denver radio and television stations. Since many Boulder County residents watch Denver television and listen to Denver radio stations, this is a very valuable warning system for Boulder County and its municipalities.
- Cable television programming on all television channels can be immediately interrupted for any emergency that has a significant effect on public safety or for any unusual situation that requires evacuation. The screen can be blanked out and the emergency message transmitted.
- In January of 1997, the Federal Communications Commission (FCC) replaced the Emergency Broadcast System (EBS) with the Emergency Alert System (EAS). This digital system works with both new and established communications technologies, including satellite, broadcast, and cable systems. The EAS helps to make the disaster warning system more effective by emphasizing speed, reliability, and efficiency. It is designed to reduce property damage, injuries, and deaths resulting from natural and manmade disasters. There are eight Boulder County EAS stations according to the Denver Metro–Local Area 3 plan. The EAS can be activated locally by the emergency management director, Boulder County sheriff, and the manager of the Boulder Regional Communications Center. EAS messages can be broadcast through speakerphones in all County buildings to alert staff and the public that may be present of any emergency or need to evacuate. In addition, the County posts these alerts on the County web site and distributes them via email.
- NOAA Weather Radio All Hazards is a service of the National Oceanic and Atmospheric Administration (NOAA). During severe weather, National Weather Service forecasters can interrupt the routine weather broadcasts and substitute special warning messages. Special weather radio receivers are available for purchase at local electronics stores. Although NOAA classifies coverage in Boulder as reliable, the signal cannot be received in the canyon areas.
- The National Warning System consists of private line voice circuits. The detection systems of the North American Air Defense Command (NORAD), and other sources, provide the information from which NORAD commanders determine the probability or imminence of attack. At the present time, it is used mostly by the National Weather Service in Denver to disseminate weather-related warnings to warning points in Colorado.
- The Boulder County Office of Emergency Management is responsible for the Emergency Operations Plan, which delineates task assignments and responsibilities for the operational actions that will be taken prior to, during, and following an emergency or disaster to alleviate suffering, save lives, and protect property.
- The Multiple Agency Coordinating System (MACS) is an information and resource service intended to facilitate the effective use of limited resources between jurisdictions. MACS will be activated for any emergency or disaster that requires the use of resources beyond those available to the affected jurisdiction. The MACS concept operates separately from ICS and is not involved in the control of an incident. The MACS group meets on a monthly basis.
- The Boulder County Office of Emergency Management conducts citizen emergency response team training.
- The Boulder County Wildfire Mitigation Group installs and maintains fire danger rating signs at the entrance of major canyons.
- The Boulder County Public Health Communicable Disease Division issues West Nile virus alerts.
- The Boulder County Public Health Environmental Health Division’s Vector Control Program aims to prevent the spread of disease from vectors to humans. Among other things, it monitors wildlife and

mosquitoes to detect the presence of West Nile virus.

- The Boulder County Mosquito Control District uses an integrated pest management approach to safely and effectively reduce mosquito populations for the purposes of protecting residents from the health risks, annoyance, and discomfort associated with mosquitoes.
- The Boulder County Public Health Emergency Preparedness Program was originally established to develop and implement a response plan for natural disasters such as floods and wildfires. It consists of a diverse team of staff, representing different department programs, to ensure that essential public health services are continuously provided in the face of disaster. The program is coordinated with other local first-responder organizations, including fire, law enforcement, emergency medical services, hospitals, and community health centers as well as other local and state agencies.
- The Boulder County Housing Authority administers the Longs Peak Energy Conservation Weatherization and Home Rehab Programs, which assist low and moderate-income homeowners in Boulder County with home health and safety retrofits.
- Emergency generators were recently installed at main Boulder County facilities.

Structural Projects

Structural projects keep hazards away from an area (e.g., levees, reservoirs, other flood control measures). They are usually designed by engineers and managed or maintained by public works staff.

- Floodwall at the Boulder County Justice Center
- Levee at the City of Boulder Wastewater Treatment Plant
- Levee at the University of Colorado South Campus

Public Information

Public information activities advise property owners, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of natural resources (e.g., local floodplains). They are usually implemented by a public information office.

- The Boulder County Office of Emergency Management has produced an all-hazard symposium to educate the public about hazards in the County and help them prepare for emergencies.
- The Boulder County Community Planning & Permitting Department conducts annual outreach to properties in the unincorporated county that are also in a Special Flood Hazard Area. Outreach materials include online resources and mailed letters informing residents of flood hazards and what the public can do before, during, and after a flood to protect themselves and minimize losses.
- The Boulder County Community Planning & Permitting Department prepares and maintains a map of 100-year flood event emergency access routes.
- The Boulder County Community Planning & Permitting Department provides floodplain information, upon request, for properties in unincorporated Boulder County.
- Boulder County prepares and maintains a wildfire evacuation map.
- The Boulder County Wildfire Mitigation Group developed the Wildfire Hazard Identification and Mitigation System (WHIMS) for mapping fire hazards.
- The Boulder County Wildfire Mitigation Group creates education and outreach programs, including sponsoring Student Conservation Association Fire Education Corps Teams.
- The Boulder County Wildfire Mitigation Group develops brochures and information videos and has displays at the Boulder County Fair and other events.
- Add language around wildfire Partners Program
- A new forest health initiative is aimed at wildfire mitigation in western Boulder County.
- The Boulder County Public Health Communicable Disease Division provides educational materials on West Nile virus online, at events, in newspapers, and through mailings (statement stuffers).

The Boulder County Public Health provides pandemic flu preparedness checklists for healthcare providers, businesses, individuals.

A.6 Boulder County Mitigation Projects

The following are the continued and new Boulder County mitigation actions. Refer to Appendices G for more details on the implementation progress for each action between 2017 and 2021. A summary of progress (number of actions completed) on previously identified actions can be referenced in Chapter 5 (Section 5.3) of the base plan HMP.

Name of Action: Mechanical Treatment of Boulder County Parks and Open Space Forests

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goal 2

Issue/Background: In Boulder County, forests have been altered due to human settlement activities including suppression of natural fire; wildlife herbivory such as over grazing of aspen; and the introduction of cattle grazing, mining, and logging. The impacts of these activities include altered stand density, diversity, and structure. This has led to an overall increase in fire severity and decrease in frequency of natural fire events. Additionally, insect outbreaks and disease are more severe in these forests types when they are stressed due to drought, and when stand densities are higher and more homogenous than under natural conditions. Reducing hazardous fuels is a key part of wildfire mitigation strategies.

Other Alternatives: Use of hand crews or no active management.

Action Status: In progress/Ongoing.

Responsible Office: Parks and Open Space (POS)

Priority (High, Medium, Low): High

Cost Estimate: \$173,000 annually and using 5 employees.

Existing or Potential Funding: Existing funding comes from POS budget. \$23,000 from operating budget and \$150,000 from grants and POS Capital and Stewardship funding.

Benefits (avoided losses): There are numerous benefits associated with hazardous fuel reduction treatments. Properly designed fuel treatments can increase wildfire resiliency and resistance in dry forests and change the behavior of subsequent wildfires. Broad-scale fuel reductions can reduce the likelihood and severity of uncharacteristic wildland fire.

The dollar value of the benefits provided by Boulder County forests has not been estimated. These benefits include watershed services (water quantity and quality), soil stabilization and erosion control, air quality, climate regulation and carbon sequestration, biological diversity, recreation and tourism, forest products, cultural values, and aesthetic and passive use values.

Schedule: Annual Implementation

Name of Action: Restoration of Fire as an Ecological Process within Boulder County Parks and Open Space Forest

Hazards Addressed: Flood, Debris Flows, Wildfire

Mitigation Goal or Objective Addressed: Goal 2

Issue/Background: Fire is an essential ecological process in many fire-dependent ecosystems. In large areas of the country, fire exclusion from these ecosystems has led to unhealthy forest, woodland, and rangeland conditions. These areas are at risk of intense, severe wildfires that threaten communities and cause significant damage to key ecological components. As one component of fire management, prescribed fire is used to alter, maintain, or restore vegetative communities; achieve desired resource conditions; and to protect life, property, and values that would be degraded and/or destroyed by wildfire.

Other Alternatives: No use of prescribed fire

Action Status: In progress/Ongoing.

Responsible Office: Sheriff's Office and Parks and Open Space

Priority (High, Medium, Low): Medium

Cost Estimate: \$60,000 per year

Existing or Potential Funding: Funding comes from POS operating budget. \$10,000 is for operating expenses and \$50,000 is for implementation from the Capital and Stewardship Project funding.

Benefits (avoided losses): The value of the benefits provided by Boulder County forests has not been estimated. These benefits include watershed services (water quantity and quality), soil stabilization and erosion control, air quality, climate regulation and carbon sequestration, biological diversity, recreation and tourism, forest products, cultural values, and aesthetic and passive use values. The use of prescribed fire enhances all of these benefits associated with healthy forests.

Schedule: Annual Implementation

Name of Action: Fire Management within the Boulder County Parks and Open Space (BCPOS) System

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goal 2

Issue/Background: The Boulder County Fire Management Plan seeks to increase public and firefighter safety by creating appropriate response plans, clarifying fireline roles, responsibilities, communication plans, and procedures. Boulder County Fire Management seeks to reintroduce disturbance that is within historical ranges in each life zone and forest cover type. Multiple objectives fire management, the act of employing a modified containment strategy in order to garner some ecological benefits from a naturally occurring fire, is one of the best options we have for maintaining forest health. All properties with the BCPOS system have been identified as candidates for multiple objectives suppression management, given a set of conditions and indices are met and/or present at the time of a natural, unplanned ignition.

Other Alternatives: None

Action Status: In progress.

Responsible Office: Sheriff's Office and Parks and Open Space

Priority (High, Medium, Low): Medium

Cost Estimate: \$100,000 +

Existing or Potential Funding: Existing \$100,000 goes directly from Parks and Open Space operating budget to the Sheriff's Office fire staffing.

Benefits (avoided losses): The value of the benefits provided by Boulder County forests has not been estimated. These benefits include watershed services (water quantity and quality), soil stabilization and erosion control, air quality, climate regulation and carbon sequestration, biological diversity, recreation and tourism, forest products, cultural values, and aesthetic and passive use values.

Schedule: Annual Implementation

Name of Action: Landscape Restoration and Climate Change Adaptation

Hazards Addressed: All Hazards

Mitigation Goal or Objective Addressed: Goal 2

Issue/Background: A combination of factors can contribute to increases in pest outbreaks under climate change. Higher temperatures can contribute to increased survival and productivity of pests, while drought and heat stress caused by climate change can make forests more vulnerable to insect outbreaks. These dynamics can affect wildfire dynamics and also provide positive feedback to climate change. Seasonality of average and extreme temperatures and precipitation has a significant impact on wildfire timing, frequency, and magnitude. If climate change leads to warming, as anticipated, and possibly to drier conditions, this could affect the severity and frequency of wildfires, requiring alterations in fuels treatments and fire management practices.

In responses to these issues identified in Boulder County's Climate Change Preparedness Plan, Boulder County will work to restore forests on a landscape scale, across jurisdictional boundaries, from plains to peaks.

Other Alternatives: Manage forests property by property

Action Status: In progress **Responsible Office:** Parks and Open Space

Priority (High, Medium, Low): Medium

Cost Estimate: 50-100 acres are targeted every other year for about \$150,000 to \$300,000.

Existing or Potential Funding: Potential funding from grants such as BRIC HMGP, COSWAP, FRWRM, and other federal and state funding. Funding is also matched with cash from internal Capital and Stewardship funding.

Benefits (avoided losses): Changes in temperature and precipitation patterns and extremes can lead to the local extinction of species if key physiological thresholds are exceeded. In response to warming, many species are expected to shift their ranges northward and upward in elevation. Climate change also is likely to alter the timing of key events in species or ecosystems. Changes include earlier bud burst, flowering, emergence from hibernation, migration, and breeding. When these phenological changes affect co-occurring species, they can disrupt species interactions, including predator-prey and plant-pollinator relationships. As with native plant species, weeds are likely to be affected by climate change, but it is difficult to predict whether any given invasive species will do better or worse under elevated CO₂ and climate change.

Schedule: 2023 and then every other year on a continuous basis.

Name of Action: Research and Monitoring the Health and Resiliency of Boulder County Parks and Open Space (POS) Forest and the impact of POS Management

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goal 2

Issue/Background: In Boulder County, forests have been altered due to human settlement activities including suppression of natural fire; wildlife herbivory such as over grazing of aspen; and the introduction of cattle grazing, mining, and logging. The impacts of these activities include altered stand density, diversity, and structure. This has led to an overall increase in fire severity and decrease in frequency of natural fire events. Additionally, insect outbreaks and disease are more severe in these forests types when they are stressed due to drought, and when stand densities are higher and more homogenous than under natural conditions. Reducing hazardous fuels is a key part of wildfire mitigation strategies.

Other Alternatives: None

Action Status: In progress/Ongoing.

Responsible Office: Parks and Open Space

Priority (High, Medium, Low): Medium

Cost Estimate: Staff Time. This work is complete by in house staff. 5 FTE.

Existing or Potential Funding: Existing from POS operating budget, already addressed in values above, no set amount, more staff time.

Benefits (avoided losses): The value of the benefits provided by Boulder County forests has not been estimated. These benefits include watershed services (water quantity and quality), soil stabilization and erosion control, air quality, climate regulation and carbon sequestration, biological diversity, recreation and tourism, forest products, cultural values, and aesthetic and passive use values.

Schedule: Annual Implementation

Name of Action: Boulder County Wildfire Mitigation Requirements for New Homes and Remodels

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1, 2, and 4

Issue/Background: In Boulder County, the Community Planning & Permitting Department includes wildfire mitigation measures in the planning review and building permit processes. As part of the requirements for new development or remodeling of existing homes in wildfire prone areas, landowners are required to implement an approved Wildfire Mitigation Plan (WMP). This plan includes effective defensible space, ignition-resistant construction, adequate emergency access, and sufficient water supply. Boulder County programs also encourage, but do not require, residents of existing homes to create and maintain a safe home ignition zone. When building a new home, residents go through a SPR (Site Plan Review) process. This process looks at the location of the home and ensures the effective implementation of all aspects of the WMP. Boulder County adopted key regulations on the following dates: all new roofs in fire zone 1 to be class A fire retardant (1990), required a wildfire mitigation plan be approved before issuing a building permit in this zone (1993), adopted residential sprinkler requirements (1995), and required sprinklers for all new homes (2013).

Other Alternatives: No active management

Action Status: In progress.

Responsible Office: Boulder County Community Planning & Permitting, Wildfire Partners

Priority (High, Medium, Low): Medium

Cost Estimate: \$180,000 per year for 2 full-time FTEs to implement program (program also requires support from 20 staff positions)

Existing or Potential Funding: Boulder County General Funds to staff the program (homeowners pay the cost of mitigation and ignition resistant construction).

Benefits (avoided losses): In the Fourmile Canyon Fire, there were 474 homes within, or adjacent to, the final perimeter of the fire: 168 of these homes were destroyed (35%); 306 homes survived (65%). Fourmile Fire homes that did not go through SPR process for WUI building code regulations (268 out of 428 homes survived; 63%). Fourmile Fire homes that did go through SPR for WUI building code regulations (38 out of 46 homes survived; 83%). Of the homes that did go through SPR for WUI building code regulations, they were approved in the following years: 1993-1994: 9 of 12 homes survived (75%), 1995-1999: 20 of 25 homes survived (80%), 2000-2010: 9 of 9 homes survived (100%). If all 474 had been through SPR and survived at an 83% rate, 87 fewer homes would have been lost saving over \$100 million dollars in insured losses.

Schedule: Annual Implementation

Name of Action: Boulder County Wildfire Partners and Defensible Space

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1, 2, and 4

Issue/Background: In September 2013, Boulder County received a wildfire risk reduction grant for its Wildfire Partners program. Wildfire Partners is a program for homeowners who are willing to perform recommended mitigation measures and take necessary steps to prepare for wildfire. The program engages leaders and early adopters who want to do the right thing and serve as models for others to follow. Participants learn the science of home ignition and mitigation, and they receive recognition and financial incentives from the grant for their leadership and action. The Wildfire Partners program will include an application process, on-site wildfire assessments (audits) with homeowners, site specific lists of recommended mitigation measures, follow-up inspections, and a sophisticated tracking and reporting system. The program includes a marketing and public awareness campaign. The program has focused on the foothills and mountains but is expanding to include grassland systems on the plains.

Other Alternatives: No active management

Action Status: In progress.

Responsible Office: Boulder County Community Planning & Permitting

Priority (High, Medium, Low): High

Cost Estimate: \$1,500,000 per year

Existing or Potential Funding: County general funds, FEMA HMGP grant (\$1.125 million), CO DNR Forest Restoration and Wildfire Risk Mitigation (FRWRM) grant program (\$1.5 million), and contributions from homeowners (majority of funding) FEMA PDM grant (\$1.621), FRWRM grant (\$327,500).

Benefits (avoided losses): Effective mitigation will lead to more homes surviving wildfires and substantial avoided losses. Achieving a 75% home survival rate would save approximately \$65 million using the Fourmile Fire scenario.

Potential or current subject matter expertise: Current

Schedule: Annual Implementation

Name of Action: Boulder County Wildfire Partners and Grinder

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1, 2, and 4

Issue/Background: In Boulder County, forests have been altered due to human settlement activities including suppression of natural fire; wildlife herbivory such as over grazing of aspen; and the introduction of cattle grazing, mining, and logging. The impacts of these activities include altered stand density, diversity, and structure. This has led to an overall increase in fire severity and decrease in frequency of natural fire events. Additionally, insect outbreaks and disease are more severe in these forest types when they are stressed due to drought, and when stand densities are higher and more homogenous than under natural conditions. Reducing hazardous fuels is a key part of wildfire mitigation strategies.

Other Alternatives: No active management

Action Status: Ongoing/In progress.

Responsible Office: Boulder County Parks and Open Space and Community Planning & Permitting Departments

Priority (High, Medium, Low): Medium

Cost Estimate: Grinder will cost an estimated \$350,000. It will be purchased through DNR wildfire risk reduction grant.

Existing or Potential Funding: County general funds and CO DNR grant

Benefits (avoided losses): The value of the benefits provided by Boulder County forests has not been estimated. These benefits include watershed services (water quantity and quality), soil stabilization and erosion control, air quality, climate regulation and carbon sequestration, biological diversity, recreation and tourism, forest products, cultural values, and aesthetic and passive use values.

Schedule: Annual Implementation. Purchase of grinder and development of community program took place in 2014. Work continues yearly with multiple (3-5) community grinding events each year.

Name of Action: Boulder County Forest Health Education and Outreach Program

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1, and 4

Issue/Background: Boulder County's Forest Health program promotes forest sustainability through outreach and education with private landowners. We believe working with individuals and communities to encourage healthy forests is important to making a positive impact on our natural ecosystems and helping landowners achieve their specific land management goals.

Other Alternatives: Rely on Colorado State Forest Service programs

Action Status: In progress.

Responsible Office: Boulder County Community Planning & Permitting

Priority (High, Medium, Low): Medium

Cost Estimate: \$2,000 per year plus staff time

Existing or Potential Funding: County general funding

Benefits (avoided losses): The value of the benefits provided by Boulder County forests has not been estimated. These benefits include watershed services (water quantity and quality), soil stabilization and erosion control, air quality, climate regulation and carbon sequestration, biological diversity, recreation and tourism, forest products, cultural values, and aesthetic and passive use values.

Schedule: Annual Implementation

Name of Action: May Wildfire Awareness Month

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1, 2, 3, and 4

Issue/Background: In the wake of the Fourmile Canyon Fire, Boulder County declared October Wildfire Awareness Month in 2011. Six additional Colorado counties designated October as Wildfire Awareness Month in 2012. (Since then, the state declared May as Wildfire Awareness Month and the county switched its activities from October to May.) The idea for Wildfire Awareness Month came from the Citizen Advisory Team for our Community Wildfire Protection Plan. The month serves many purposes for Boulder County:

- Initially established to help heal from the impacts of the Fourmile Canyon Fire by honoring the hard work that our residents and firefighters do to prepare, suppress and recover from wildfires;
- To educate and engage our residents by giving them opportunities and tools to complete wildfire mitigation and defensible space work on their lands;
- To recognize that wildfires are a fact of living in the west, but there are things that we can do to decrease the severity of these fires and their impact to humans and the environment;
- To build upon National Fire Prevention Week, which also is in October.
- Continue to support all communities effected by more recent wildfires such as CalWood and Marshall Fires.

Fire awareness and preparedness is a year-round endeavor, but this initiative established an annual, dedicated time period for Boulder County to focus our attention and resources around wildfire awareness. The month includes a long list of community projects and educational events, including regional workshops, volunteer projects, educational tours and hikes, community chipping events, and a wildfire mitigation challenge.

Other Alternatives: No action

Action Status: Ongoing/In progress.

Responsible Office: Boulder County Community Planning & Permitting

Priority (High, Medium, Low): Medium

Cost Estimate: \$3,000/year plus staff time

Existing or Potential Funding: County general funding

Benefits (avoided losses): Projects to create defensible space will help reduce future home loss.

Schedule: Annual Implementation

Name of Action: Boulder County Community Chipping Program

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1, and 4

Issue/Background: Boulder County initiated its community chipping program in 1993.

Boulder County encourages all residents to perform effective wildfire mitigation on their land. One of the biggest obstacles homeowners face performing mitigation is disposing of slash. This chipping program helps address the problem of slash disposal. Homeowners participating in Wildfire Partners receive free chipping if they build their own slash piles. This service supports the on-going maintenance of defensible space—a critical strategy to help ensure mitigation is effective over the long-term.

Other Alternatives: No county program to support chipping projects

Action Status: Ongoing/In progress.

Responsible Office: Boulder County Community Planning & Permitting

Priority (High, Medium, Low): High

Cost Estimate: \$75,000 per year

Existing or Potential Funding: County general funding

Benefits (avoided losses): Chipping projects to create defensible space will help reduce future home loss.

Schedule: Annual Implementation

Name of Action: Acquisition of Flood-prone Properties

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 1, and 2,

Issue/Background: One of the best ways to prevent repetitive loss is to remove development from hazardous locations. The purpose of the property acquisition program is to purchase properties, remove structures and other improvements, and return the property to its natural state. Depending on the location and site characteristics, some properties may be used as parks, picnic areas, or trailheads in the future while other properties may remain vacant open space.

Other Alternatives: None.

Action Status: In progress.

Responsible Office: Boulder County Community Planning & Permitting

Priority (High, Medium, Low): Medium

Cost Estimate: The cost will vary based on the number of eligible properties identified for each funding opportunity. For HMGP from the 2013 extreme rain and flooding disaster, Boulder County has identified approximately \$17,000,000 in eligible acquisition projects. County will pursue developing a long term acquisition strategy to reduce risk as properties become available.

Existing or Potential Funding: Possible funding sources include FEMA's Hazard Mitigation Grant Program (HMGP), FEMA's Building Resilient Infrastructure and Communities (BRIC), Community Development Block Grant-Disaster Recovery (CDBG-DR), Mile High Flood District, and/or budgeting money into the Boulder County annual budget for regular acquisitions of properties in hazardous locations.

Benefits (avoided losses): Benefits include preventing future loss to life and property by removing structures from hazardous locations. There will also be a cost savings to NFIP for removing insurable structures from the floodplains.

Schedule: Annual Implementation

Name of Action: Elevation of Flood-prone Structures

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 1, and 2,

Issue/Background: Another way to prevent repetitive loss is to elevate vulnerable structures above the base flood elevation. The purpose of the property elevation program is to assist property owners with the expense of retrofitting an existing structure to comply with floodplain regulations. Boulder County's regulations requires a structure be elevated at least two feet above the base flood elevation in order to be considered compliant with the floodplain regulations in Article 4 of the Land Use Code. Elevating structures doesn't alleviate the risk, particularly to first responders, however, it can result in more resilient communities. In addition, homeowners may find significant savings to flood insurance premiums if their house is compliant with local regulations.

Other Alternatives: None.

Action Status: In progress.

Responsible Office: Boulder County Community Planning & Permitting

Priority (High, Medium, Low): Medium

Cost Estimate: The cost will vary based on the number of eligible properties identified. Estimate cost of \$60,000-\$150,000 per structure.

Existing or Potential Funding: Possible funding sources include FEMA's Hazard Mitigation Grant Program (HMGP), FEMA's Building Resilient Infrastructure and Communities (BRIC) and/or Community Development Block Grant-Disaster Recovery (CDBG-DR) funding.

Benefits (avoided losses): Benefits include preventing future loss to property by elevating the first flood of habitable structures at least two feet above the base flood elevation. There will also be a cost savings to NFIP for removing insurable structures from the floodplains.

Schedule: Annual Implementation

Name of Action: Integration of Land Use and Mitigation Plans

Hazards Addressed: Flood, Wildfire, Landslides and other Geologic Hazards

Mitigation Goal or Objective Addressed: Goals 1, 2, 3, and 4

Issue/Background: Utilize updated data, technical expertise and community input to update and integrate County's Comprehensive Plan, Land Use Code, and Hazard Mitigation Plan. Assure linkages and policy consistency and forge a stronger tie between Land Use decisions and policies and the Hazard Mitigation Plan. Identify short- and long-term policies and programs to meet integrated goals. Recognize and address potential environmental impacts of mitigation measures so ecological health is maintained.

Other Alternatives: No Action

Action Status: Ongoing

Responsible Office: Boulder County Community Planning & Permitting and Office of Emergency Management

Priority (High, Medium, Low): Medium

Cost Estimate: Estimated cost \$200,000. The cost will be determined based on scope and timing of future work. The nature of this project is scalable and can be done as money allows to address discreet issues or

if funds are available on a broad more inclusive level.

Existing or Potential Funding: Possible funding sources include FEMA’s Hazard Mitigation Grant Program (HMGP), FEMA’s Building Resilient Infrastructure and Communities (BRIC), Community Development Block Grant-Disaster Recovery (CDBG-DR), and/or budgeting money into the Boulder County annual budget and work plan.

Benefits (avoided losses): Boulder County has a strong record of successful land use planning and hazard mitigation and response programs. Stronger integration between plans and regulatory documents will allow for more effective mitigation measures to be identified and implemented. Developing a program which will capture best available information in identifying and prioritizing potential hazards and which reviews and develops land use policies to avoid or successfully mitigate hazards. Program will ensure consistency and linkage across disciplines, plans and codes. Programs for fire safety, flood mitigation, building codes, water and natural resource planning will be linked and guide land use policies and capital improvement expenditures. Recovery and response will improve as hazards are avoided or mitigated lessening impacts from disasters. Linking the land use planning and emergency managers will foster ongoing relationships and community building.

Schedule: 2030. Will continued to be reviewed each time the County updates the Comprehensive Plan, (10-30 years).

Name of Action: Debris Flow / Landslide Early Detection and Warning System

Hazards Addressed: Landslides and Debris Flows

Mitigation Goal or Objective Addressed: Goals 1-5

Issue/Background: During the 2013 flood it became apparent that most of the front-range is a high hazard landslide area. Once the soil became saturated the instability of the landscape became apparent as Boulder County experienced over 800 scarps or land movement events. Secondly, after a major wildfire the instability of the burn area causes immediate risk for debris flows and flooding. When a debris flow occurs it immediately puts lives, property and infrastructure at risk. If this project is completed it will for the first time allow for public warning and also take actions to minimize impacts by adjusting operational posture at vulnerable sites thus reducing potential community impacts. The project involves local government agencies, the USGS, CGS and NRCS. The goal of this project is to develop and implement a county wide early warning landslide detection system that would measure soil saturation levels and once thresholds are reached initiate emergency notifications to dispatch centers, OEM and local fire and police departments to initiate a response and public warning.

Having an early warning detection system would put data as the driving force behind public warning, operational decision making and also assist with monitoring high risk areas and deploy mitigation measures to stabilize the landscape or move critical infrastructure out of areas that cannot be mitigated.

As wildfires increase, storm intensity and variations to our monsoonal season landslide risks go along with them. Wildfires create burn scars and this creates debris flows and increase landslide risks. In many of our greatest Colorado floods inundation events are precursors to the actual flood and the saturated ground causes landslides that dam canyon creeks exacerbating the flood and its eventual damage to residences and communities.

There is not a landslide early warning plan in existence nationally. A solid plan would include soil saturation sensors to allow for anticipating when debris flows or landslides might occur, Drainage assessments to determine debris loading and volumes, USGS or CGS high hazard area engineering assessments and pre and post event LIDAR data.

Other Alternatives: No other alternatives. This is in an experimental stage right now and there is not a technology/ system or proprietary system to purchase to address this issue.

Action Status: In Progress. Currently the USGS, CGS, Fourmile Watershed, BOEM and NRCS are deploying experimental systems on the Fourmile burn scar and Calwood Burn scar to test the landslide early warning detection system.

Responsible Office: Boulder OEM. The current landslide detection system being deployed involves subject matter experts from the Colorado School of Mines, USGS, CSGS

Priority (High, Medium, Low): High

Cost Estimate: \$2.5 million

Existing or Potential Funding: County General Fund, State Budget Office through Legislative action, & Federal source such as USGS, USFS grants.

Benefits (avoided losses): Human life that reside in the USGS designated high-hazard landslide area which is the entire front-range of Boulder County. Future impacts to lives and property can be achieved by incorporating data from the system into future planning efforts and growth efforts. Existing critical infrastructure can also benefit from the system by knowing when the landslide risk is increased to a warning level and adjusting operations to avoid failures or impacts to infrastructure.

Schedule: 2027. The beta sites for the early warning system are being deployed currently in Calwood Burn Scar area. Once tested and the concept proven then the focus would be to obtain funding to create a system county wide in each canyon of Boulder County and along the foothills that front dense urban centers. The second element of this project is to develop a rapid deployment system for burn scars immediately following the fire to provide early warning landslide detection immediately after the fire.

Name of Action: Implementation of Watershed Master Plan Projects

Hazards Addressed: Flood

Mitigation Goal or Objective Addressed: Goals 1, 2, 3, and 4

Issue/Background:

Watershed master plans have been developed and will be continued to be developed in the County for St. Vrain Creek, Left Hand Creek, Fourmile Creek, Little Thompson River, Fourmile Canyon Creek, lower Boulder Creek upper Coal Creek and Rock Creek. The master plans identify restoration projects needed within the watersheds to stabilize the creeks, restore in-stream and riparian area habitat, and reduce flood risk to life, property, and infrastructure due to flood and post-flood conditions.

Other Alternatives: No action

Action Status: In progress/Ongoing

Responsible Office: Parks and Open Space, Transportation, Community Planning and Permitting

Priority (High, Medium, Low): High

Cost Estimate: \$165 million for all top priority projects in St. Vrain Creek, Left Hand Creek, and Fourmile Creek: \$200 million for priority projects in all seven plans.

Existing or Potential Funding: Community Development Block Grant- Disaster Recovery (CDBG-DR) Planning Resilience grants; CDBG-DR Watershed Resilience grants; Natural Resource Conservation Service (NRCS) Emergency Watershed Protection (EWP) program, phase 2; Colorado Water Conservation Board (CWCB) Stream Restoration and Debris Removal grants; US Army Corps of Engineers (USACE) restoration

programs.

Benefits (avoided losses): The benefits of the projects identified in the watershed master plans are increased stability of the watersheds, in-stream habitat and riparian area restoration, and reduced flood risk to life, property and infrastructure.

Schedule: 2022-2025

Name of Action: Boulder County Community Forestry Sort Yards

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1, 2, and 4

Issue/Background: The two Community Forestry Sort Yards (CFSY) are run by Boulder County Parks and Open Space to collect woody debris collected from private landowners. This material is then processed and utilized rather than ending up in landfills. Material is removed by private landowners and/or their hired contractor and brought to the CFSYs currently free of charge. Most of the material is removed in order to decrease fire hazards on the properties and improve the overall defensible space. Detailed data is collected to identify the reasons for removal, what is being removed, and how much is being removed.

Other Alternatives: Slash goes to landfill, don't mitigate property, burn slash (don't utilize).

Action Status: In progress/Ongoing

Responsible Office: Boulder County Parks and Open Space

Priority (High, Medium, Low): Medium

Cost Estimate: \$90-110,000 per year plus staff time

Existing or Potential Funding: County General Fund

Benefits (avoided losses): The benefits have not been estimated, however roughly 1500 tons per year are collected by the CFSY program, removing this fuel from around homes and diverting it from the landfill.

Schedule: Annual Implementation

Name of Action: Boulder County Youth Corps Forestry and Fire

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1 and 2

Issue/Background: Utilize Youth Corps to assist with the completion of forestry projects. The work helps decrease fire hazards and fuels build-up, while also putting the finishing touches on prior forestry work contracts.

Other Alternatives: Complete with staff time only

Action Status: In progress/Ongoing

Responsible Office: Boulder County Parks and Open Space

Priority (High, Medium, Low): Low

Cost Estimate: \$36,000 cost for one team per year

Existing or Potential Funding: County General Fund

Benefits (avoided losses): The benefits have not been estimated; however, these projects help complete projects in areas where it is difficult to extract material from the forest. Youth Corps works to pile slash that

is then burned by Parks and Open Space staff.

Schedule: Annual Implementation

Name of Action: Flood Hazard Studies and Flood Hazard Mapping

Hazards Addressed: Flooding, Landslide/Mud and Debris Flow/Rock Fall, Subsidence

Mitigation Goal or Objective Addressed: Goals 1, 2, and 5

Issue/Background: In 2017 and 2018, Boulder County adopted new flood hazard maps covering the majority of the county's regulatory floodplain. However, flood hazards change as rivers evolve naturally and floodplains are developed. Maintaining current flood hazard maps is critical to mitigation planning, development decisions, and risk assessments. Boulder County has committed to partnering with FEMA, the Colorado Water Conservation Board, the Mile-High Flood District, and neighboring communities to ensure that county flood hazard maps remain accurate by supporting new hydraulic surveys, hydrologic studies, and map revisions.

In addition to updates to the FEMA Flood Insurance Rate Maps (FIRMs), the county is also committed to incorporating additional flood hazard maps, such as those that target fluvial hazards (erosion, deposition, and debris) and pluvial flooding, into its planning and regulatory programs. Additional flood hazard data will be integrated as it becomes available.

Other Alternatives: No Action

Action Status: In progress. As of 2022, the county is working with FEMA to complete FEMA's adoption of 220 miles of re-mapped floodplain. The county is also actively integrating new Fluvial Hazard Zone data from the Colorado Water Conservation Board into its review of proposed development, flood hazard outreach/education, and mitigation project planning.

Responsible Office: County Community Planning & Permitting

Priority (High, Medium, Low): Medium

Cost Estimate: Estimated average cost is \$50,000 per map revision/incorporation. Cost depends on funding availability and revision needs,

Existing or Potential Funding: Potential funding sources include FEMA's Hazard Mitigation Grant Program (HMGP), FEMA's Building Resilient Infrastructure and Communities (BRIC), Community Development Block Grant-Disaster Recovery (CDBG-DR), Mile High Flood District, Colorado Water Conservation Board, and/or Boulder County General Funds.

Benefits (avoided losses): Benefits include preventing future loss to life and property by accurately identifying the flood risk to existing and future development.

Schedule: Annual implementation. Revisions and new map adoptions will be episodic and ongoing as floodplains change, new development occurs, and new hydrologic, hydraulic, and terrain data become available.

Name of Action: Floodplain Management Program Updates and Flood Education/Outreach

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 3, 4 and 5

Issue/Background: The Floodplain Management Program initiated HUD-funded Floodplain Program and Transportation Resiliency Study (F&TRS) in 2018. The study concluded a year with a series of recommended

actions. These actions included targeted flood/education outreach strategies, regulatory measures to enhance floodplain resiliency, and other programmatic improvements, such as developing incentives for voluntary flood protection measures for new development. The purpose of this project is to identify, target, and implement the most needed actions.

Other Alternatives: No Action

Action Status: In progress/Ongoing

Responsible Office: Community Planning & Permitting Department

Priority (High, Medium, Low): Medium

Cost Estimate: \$100,000

Existing or Potential Funding: Potential funding sources include FEMA's Hazard Mitigation Grant Program (HMGP), FEMA's Building Resilient Infrastructure and Communities (BRIC), Community Development Block Grant-Disaster Recovery (CDBG-DR), Mile High Flood District, Colorado Water Conservation Board, and/or the Boulder County General Fund.

Benefits (avoided losses): Benefits include preventing future loss to life and property through enhanced flood risk education, stronger regulatory flood protection measures, and enhanced participation in flood risk mitigation.

Schedule: Annual Implementation

Name of Action: Incorporate identified resiliency actions including projects, policies, and programs into transportation plans, codes, or standards

Hazards Addressed: All Hazards: Flood, Wildfire, Dam Failure, Geologic Hazards, Atmospheric Hazards

Mitigation Goal or Objective Addressed: Goals 1,2,3,4

Issue/Background: Resiliency is best achieved through the integration of related policies, projects and programs through various County initiatives. As part of this effort, the county initiated a HUD funded Floodplain Program and Transportation Resiliency Study (F&TRS) as well as a county funded transportation master plan (TMP) update with an integrated resiliency component. The study and plan will identify and recommend priority projects related to the transportation lifeline and increase resiliency at a countywide level.

Other Alternatives: No action

Action Status: In progress

Responsible Office: Boulder County Public Works and Community Planning and Permitting

Priority (High, Medium, Low): High

Cost Estimate: \$50,000

Existing or Potential Funding: HUD, Boulder County General Fund

Benefits (avoided losses): The development of a resiliency study and transportation master plan will help avoid future losses to county transportation infrastructure.

Schedule: 2030

Name of Action: Replace or Upsize Structures to Improve Resilience

Hazards Addressed: Flood, Dam Failure

Mitigation Goal or Objective Addressed: Goal 2

Issue/Background: Replace and/ or upsize structures at the locations below to improve infrastructure resiliency by increasing conveyance of flood waters due to excessive rain or dam failure.

- 55th at Boulder/Whiterock Ditch
- N 61st at Fourmile Canyon Creek
- Overland Rd at South St. Vrain Creek
- Replace minor structure at Baseline Rd over Dry Creek #3
- Replace Bridges on N. 61st St. and N 75th St over Boulder Creek
- Replace Bridge on East County Line Road over Boulder Creek
- Replace Bridge on N. 95th St. over Boulder Creek.

Other Alternatives: No Action

Action Status: In progress – Work to be completed in 2022

Responsible Office: Boulder County Public Works

Priority (High, Medium, Low): High

Cost Estimate: \$1,000,000

Existing or Potential Funding: Federal Highway Administration through CDOT, MHFD, Boulder County Road and Bridge Funds

Benefits (avoided losses): Avoid damages to transportation infrastructure and economic losses due to possible road closures.

Schedule: 2022-2032

Name of Action: Sugarloaf Rd improvements

Hazards Addressed: Landslide

Mitigation Goal or Objective Addressed: Goal 2

Issue/Background: Improvements to Sugarloaf Road 2,000 ft. above intersection with SH 119 to lessen potential for landslide related road closure.

Other Alternatives: No action

Action Status: In Progress

Responsible Office: Boulder County Public Works

Priority (High, Medium, Low): High

Cost Estimate: \$1,000,000

Existing or Potential Funding: County Road and Bridge Funds, FEMA BRIC grants

Benefits (avoided losses): Avoid losses to transportation infrastructure and economic losses that could be experience from road closures.

Schedule: 2023

Name of Action: Continue Involvement in Climate Adaptation Planning Process

Hazards Addressed: All Hazards

Mitigation Goal or Objective Addressed: Goals 1,4,5

Issue/Background: Identify opportunities for climate change information to be integrated into existing planning mechanisms. Climate Change information has been integrated into the County Hazard Mitigation Plan in 2016 and in 2022. With every update of the plan a review of new climate change information will be evaluated and integrated into the plan where appropriate.

Other Alternatives: No action

Action Status: In progress/Ongoing

Responsible Office: Boulder OEM / BOCC

Priority (High, Medium, Low): Medium

Cost Estimate: Little to no cost

Existing or Potential Funding: Staff Time, Dept. Budget, County General Fund

Benefits (avoided losses):

Schedule: 2027/Annual Implementation

Name of Action: Community Hazards Education and Preparedness Plan

Hazards Addressed: All Hazards

Mitigation Goal or Objective Addressed: Goals 1,3,4

Issue/Background: Develop a public outreach strategy plan related to the Better Together Program to communicate and educate members of the public on the hazards that pose a risk to the community and what can be done in terms of preparedness at the community member level. Use information from hazard mitigation plan risk assessment and review opportunities to update the outreach plan every 5 years when the hazard mitigation plan is updated.

Other Alternatives: No action

Action Status: In progress/Ongoing

Responsible Office: Boulder OEM

Priority (High, Medium, Low):

Cost Estimate: Little to no cost

Existing or Potential Funding: Staff time, Dept. Budget, County General Fund

Benefits (avoided losses): Informed population on what risks and vulnerabilities exist for the community and what can be done at the individual level.

Schedule: Annual Implementation

Name of Action: Wildfire Partners – Eastern County Expansion Program

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1-5

Issue/Background: Boulder County is ranked among the top 10 most-at-risk areas from wildfire in the

USDA Forest Service's Rocky Mountain Region. Since 1989, wildfires in the county have claimed 1,346 homes and structures, burned nearly 32,000 acres, and threatened the lives and property of thousands of residents. Residents of Boulder County are also impacted by wildfires that cause air and water quality degradation as well as impacts to mountain recreation assets.

Boulder County, with over 30 partner organizations, launched Wildfire Partners in 2013 and 2014. Following the Marshall Fire, we are expanding the program to include the eastern portion of the county (grasslands/plains). In the past, the program only operated in with western portion of the county (forest/foothills and mountains). Because of this expansion, we have listed this as a "New Mitigation Action."

This new mitigation action includes several potential components: public awareness/education, defensible space, structure protection through ignition-resistant construction, a chipping program, and community grinding projects. Wildfire Partners certification is incorporated into Boulder County's building code, so this new action also covers wildfire mitigation efforts for new homes and additions as required by code.

Other Alternatives: Do not expand mitigation efforts to the eastern portion of the county.

Action Status: New in 2022

Responsible Office: Boulder County Community Planning and Permitting

Priority (High, Medium, Low): High

Cost Estimate: \$1-10 million per year

Existing or Potential Funding: Boulder County General Funds (existing); BRIC and post disaster Hazard Mitigation funding (potential)

Benefits (avoided losses): Effective mitigation will lead to more homes surviving wildfires and substantial avoided losses. Achieving a 75% home survival rate would save approximately \$65 million using the Fourmile Fire scenario.

Schedule: Annual Implementation—50+ years to complete.

Name of Action: Prince Lake No. 1 Dam Rehabilitation

Hazards Addressed: Dam Failure

Mitigation Goal or Objective Addressed: Goals 1 and 2

Issue/Background: Hazard class of dam increased by Dam Safety Office in 2017 from Low Hazard to Significant Hazard (i.e., significant damage, but no life loss expected from dam failure. Significant damage is to structures where people live, work, or recreate, and results in structures being uninhabitable or inoperable).

2017 breach modeling indicates 14 residential structures flooded, with 4 of these having significant damage, in addition to threats to public roads

2022 overtopping breach modeling indicates significant hydrologic hazard with potential impact to about 200 people that live in the breach flow path, primarily in the Flatirons Meadows development downstream of the dam

Project would follow state of the art dam safety/engineering practices regarding spillway, outlet, and embankment configuration to address risks that could lead to dam failure and impacts cited above.

The Prince Lake No. 1 dam is an earthen dam originally constructed in 1879. Prior to its acquisition by Boulder County in 2003, only informal, incremental work occurred to maintain its flood retention, public safety, and agricultural functions.

In 2017, Boulder County was notified by the Dam Safety Office that dam inundation mapping of the area updated to account for existing, new, and planned suburban development demonstrated a need to increase the dam's hazard class from Low to Significant Hazard. This change is due to the increased amount of development downstream property threatened by overtopping or dam failure which is further exacerbated by increased expected flood flows into the reservoir as a result of reduced permeability of upstream lands due to development.

The purpose of this project is to construct the modifications required to come into compliance with Colorado's Dam Safety Regulations for the increased hazard class. Planned modifications include:

- constructing a larger, more-modern emergency spillway
- adding a service spillway tower,
- replacing the corroding outlet pipe with a concrete-encased PVC pipe
- replacing concrete rubble embankment protection with specified riprap
- and, most significantly, raising the height of the dam embankment either by capping the existing embankment and/or reconstructing some or all of the embankment to ensure adequate stability, composition, and capacity.

Modernization of the dam structure to meet state of practice dam safety regulations and standards will significantly mitigate risk to downstream structures and greatly improve public safety.

Other Alternatives: One alternative would be to remove the dam. While this would remove the threat of dam failure, it would do so at the cost of the use of the stored water in agricultural production. Additionally, this would remove the flood attenuation function provided by the reservoir that currently benefits public safety (i.e., attenuation provides that opportunity to alert downstream occupants of immediate flood risk) either from a storm event or from failure of Erie Reservoir located immediately upgradient.

Another alternative would be to completely reconstruct and/or reconfigure the dam. For example, this could involve passing large flood flows more directly to the downstream conveyance channel using pipelines and/or box culverts. However, the increased costs of such improvements do not appear to yield an equal benefit.

Action Status: New in 2022

Responsible Office: Boulder County Parks & Open Space (owner) Partner: Dam Safety Branch, Division of Water Resources, Department of Natural Resources, State of Colorado

Priority (High, Medium, Low): High

Cost Estimate: \$2,200,000

Existing or Potential Funding: FEMA PA Alternate Project Funding (2013 Flood, DR-4145); HMGP (2022 HMGP grant application); Boulder County

Benefits (avoided losses): Below is a summary of impacts/losses that are at greater risk without implementing the proposed mitigations. Failure of the dam would also impact the ability to store and utilize the perfected water right.

Structure Type	Population at Risk per Structure	# Structures Impacted	Total Population Impacted
Home	3	64	192
Main Local Road	2	3	6

Structure Type	Population at Risk per Structure	# Structures Impacted	Total Population Impacted
State Highway	4	1	4

Schedule: 1 year. 100% Design complete by end of 2022; Construct in 2023.

Name of Action: Off-Channel Water Body Hazard Mitigation and Resiliency Measures on Open Space

Hazards Addressed: Flooding and Erosion

Mitigation Goal or Objective Addressed: Goal 2

Issue/Background: Many publicly owned open space properties in Boulder County were mined for aggregate leaving a legacy of lined and unlined water bodies. Reclamation may not have adequately prepared for the effects of large storm events. During the 2013 Flood, water bodies on multiple properties located off-channel were eroded and breached by spatially varied flow outside the main channel. Park facilities were damaged and public safety closures lasted many years. During the recovery, many facilities were repaired, and mitigation measures were incorporated into the repairs. Since many of the dam structures are under the jurisdiction of the State Dam Safety Office, their rules and regulations applied to much of the activity. Similar mitigations should be considered for both park and agricultural facilities to provide for public safety and limit impacts from flood events. In addition, some water bodies are lined and used for water storage. Having reservoirs out of commission for an extended length of time impacts the viability of agricultural operations dependent on that source of irrigation.

Mitigation measures since the 2013 Flood have been implemented on the following open spaces: Pella Ponds, Walden Ponds, Western Mobile/Braly Open Space effecting 13 water bodies.

Implementation of this action will create a defined and armored flowpath in and out of the water bodies so that spatially varied flow in the floodplain during large events will not have the ability for evulsion and/or breaching.

Other Alternatives: No action. Taking no action could lead to most costly impacts from future floods to both the water bodies and the surrounding public and private lands.

Action Status: New in 2022

Responsible Office: Boulder County Parks & Open Space, municipalities and special districts with similar facilities, State Dam Safety Office, and Mile High Flood District. Other county departments are partners esp., Public Works and Community Planning & Permitting.

Priority (High, Medium, Low): Medium

Cost Estimate: Total costs on the above recovery projects were approximately \$18 million. Costs to rehabilitate a dam and include mitigation measures typically ranges between \$1m to \$2M.

Existing or Potential Funding: Hazard Mitigation Assistance grants, funding, State and Federal. Bureau of Reclamation. Colorado Water Conservation Board. Department of Agriculture.

Benefits (avoided losses): Improve public safety downstream; increase resilience of dams and surrounding open space for ecosystem benefits and public recreation benefits; reduce cost to repair because flood flows are conveyed in a controlled manner.

Schedule: 2042

Annex B: City of Boulder

Annex B City of Boulder

B.1 Community Profile

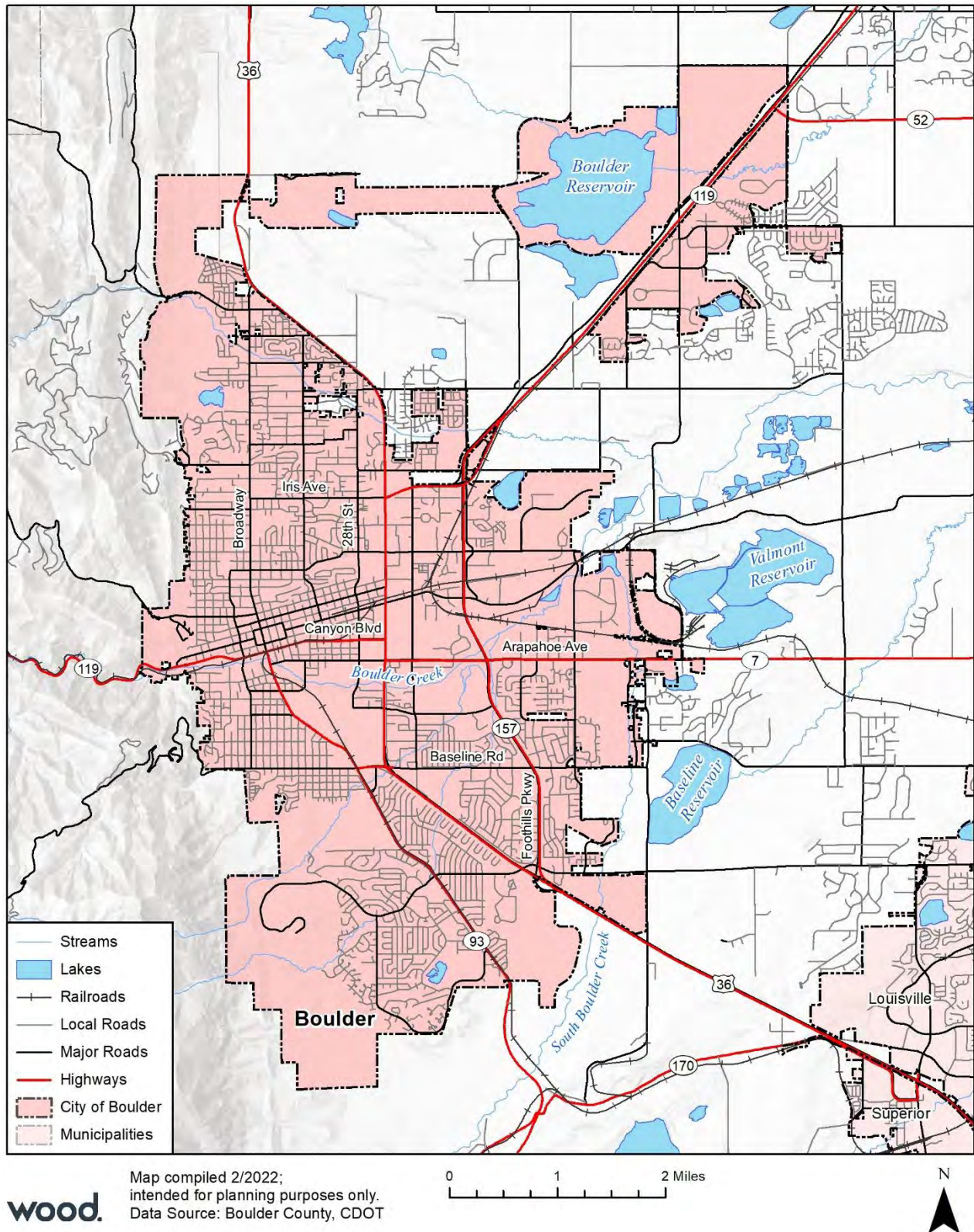
City of Boulder, surrounded by a greenbelt of trails and open space, is known for its natural beauty, outdoor recreation, natural product retailers, restaurants, alternate transportation options, diverse businesses, and technological and academic resources. It is a home-rule municipality with a council-manager form of government. The elected City Council, which consists of the mayor, the deputy mayor, and seven council members, sets the policies for the operation of the city government and appoints the city manager, who is tasked with the administrative responsibilities of the city.

B.1.1 Geography and Climate

At an elevation of 5,340 feet above sea level, the city is located along Boulder Creek at the base of the foothills of the Rocky Mountains, roughly 30 miles east of the Continental Divide and about 35 miles northwest of Denver. The Boulder foothills are home to the Flatirons, slabs of sedimentary rock tilted up on the foothills, which are unique to Boulder and provides a dramatic backdrop to the city. Boulder covers approximately 25.4 square miles and is characterized by gently rolling terrain, interrupted by small ridges. Fifteen major drainageways or creeks pass through Boulder, including Boulder Creek, which flows through the center of the city. A map of the City of Boulder jurisdictional limits is represented in Figure B-1.

The climate is generally semiarid with a series of extremes occurring throughout the winter and summer seasons. Most precipitation occurs during the winter and spring months with an average annual precipitation of 18.7 inches of rain and 79.4 inches of snow. In winter, temperatures can plunge to minus 30°F and hover below 0°F for days on end. These cold spells are often followed by periods of unseasonably warm weather. Temperatures often climb into the 60s in January and February.

Winter also brings snowstorms that regularly result in a foot or more of snow. Some of the most powerful winds recorded in the continental United States have occurred in or near the City of Boulder in December and January; gusts of more than 120 mph are not uncommon. In summer, temperatures can be in the upper 90s for days. These hot temperatures are moderated by low humidity that can drop into the single digits at times. With the semiarid climate that produces moderate average annual rainfall, most days have some sunshine.

Figure B-1 City of Boulder Municipal Boundaries and Planning Area

B.2 History

The Boulder Valley was first home to Native Americans, primarily the Southern Arapaho Tribe that maintained a village near Haystack Mountain. Utes, Cheyenne, Comanches, and Sioux were occasional visitors to the area. The first European settlers came to Boulder during the Pikes Peak Gold rush in 1858. These settlers established a permanent settlement at the head of Boulder Canyon, and in 1859, gold was discovered in Boulder in Gold Run Creek (Gold Hill). That same year, the Boulder City Town Company was formed.

Originally part of the Nebraska Territory, Boulder became part of the Colorado Territory when the territory was established by Congress in 1861. Boulder incorporated as a town in November of 1871 following its designation as the Boulder County seat in 1867. By 1882, Boulder City's population exceeded 3,000 and the town became a second-class city.

In 1874, the University of Colorado opened its doors after residents contributed \$15,000 to the territorial government. That year also saw the building of the railroad that connected Boulder to Denver. In the early years of the following decade, rail service was extended to the mountain communities west of Boulder.

At the turn of the century, Boulder relied on tourism to strengthen its economy. The Chautauqua auditorium was built in 1897 and the Hotel Boulderado opened to the public in 1909. Tourism continued to dominate the Boulder economy for the next 40 years. Boulder's population did not increase much between 1920 and 1940, but the city saw an influx of people following World War II. The population rose from 12,958 in 1940 to 20,000 in 1950. By 1950, Boulder leaders were actively recruiting new "clean" industries and improved transportation, and they secured a new highway, the Boulder-Denver Turnpike, and the National Bureau of Standards in 1952. Other research and development industries soon followed. With the turnpike to downtown Denver, Boulder continued to expand. From 1950–1972, the population grew from 20,000 to 72,000.

With the purchase of thousands of acres of open space beginning in 1967, the adoption of the Boulder Valley Comprehensive Plan in 1970, passage of the building height restriction ordinance in 1972, and the residential growth management ordinance in 1977, Boulder began a period of infill and reuse of its past architectural development that continues to the present day. The Historic Preservation Code was passed in September 1974 and has been instrumental in preserving significant portions of Boulder's past while encouraging the rehabilitation of historic buildings.

B.3 Economy

Boulder has a diverse economy that is supported by a prominence of entrepreneurship, global business, and research institutions. Data from the 2015-2019 American Community Survey (ACS) 5-year estimates show that the largest employment sectors in Boulder are the educational services, and health care and social assistance (29%), professional, scientific, and management, and administrative and waste management services (20%), and arts, entertainment, and recreation, and accommodation and food services (13.7%) sectors. Major employers in the city include the University of Colorado Boulder, federal labs, and the City of Boulder.

The city is home also to numerous start-ups and small businesses and a number of major private corporations, including Ball Aerospace, Cisco, Emerson, GE, Google, IBM, Lockheed Martin, Merck, Microsoft, Northrop Grumman, and Twitter have a presence in Boulder. Research institutions include the University of Colorado Boulder and more than a dozen federal research laboratories including the University Corporation for Atmospheric Research (UCAR), National Oceanic and Atmospheric Administration (NOAA), and National Institute of Standards and Technology (NIST). Education, healthcare, and government are also important sectors of the Boulder economy. This diversity has buffered the effects of the 2008 recession and

contributed to the area's economic vitality. The 2019 ACS reports that Boulder has 59,896 employed individuals 16 years and over.

According to the U.S. Census Bureau, the City of Boulder's 2020 population was estimated at 108,250, an 11.16% increase from the 2010 population of 97,385. This population is exclusive of the student population at the University of Colorado, which includes a total enrollment of 35,897 students.

Table B-1 2015-2019 ACS 5-Year Estimate Demographic Characteristics for the City of Boulder

Demographic	
Gender/Age	
Male	51.8%
Female	48.2%
Under 5 years	2.9%
65 years and over	11.2%
Race	
White	87.4%
Black or African American	1.2%
American Indian and Alaska native	0.2%
Asian	5.8%
Native Hawaiian or Pacific Islander	0.1%
Other	1.5%
Two or more races	3.8%
Other	
Average household size (owner-occupied)	2.27
Population with a disability	6.3%
Median family income	\$124,844
Median household income	\$69,520
Per capita income	\$44,942
Families below poverty level	5.4%
Individuals below poverty level	20.4%
Median home value	\$700,000

Source: U.S. Census Bureau 2015-2019 ACS 5-Year Estimates

B.4 Asset Inventory

B.4.1 Property Inventory

Table B-2 represents an inventory of property in the city of Boulder based on the Boulder County Assessor's data as of March 2022.

Table B-2 Boulder Property Inventory

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
Agricultural	6	53	\$27,267,100	\$27,267,100	\$54,534,200
Commercial	1,437	1,296	\$2,679,277,149	\$2,679,277,149	\$5,358,554,298
Exempt	735	1,315	\$2,600,750,622	\$2,600,750,622	\$5,201,501,244
Industrial	309	304	\$929,081,250	\$1,393,621,875	\$2,322,703,125
Mixed Use	83	187	\$314,016,168	\$314,016,168	\$628,032,336
Residential	31,523	26,925	\$16,575,234,102	\$8,287,617,051	\$24,862,851,153
Vacant	1	7	\$7,800	\$7,800	\$15,600
Total	34,094	30,087	\$23,125,634,191	\$15,302,557,765	\$38,428,191,956

Source: Boulder County Assessor, Wood GIS Analysis

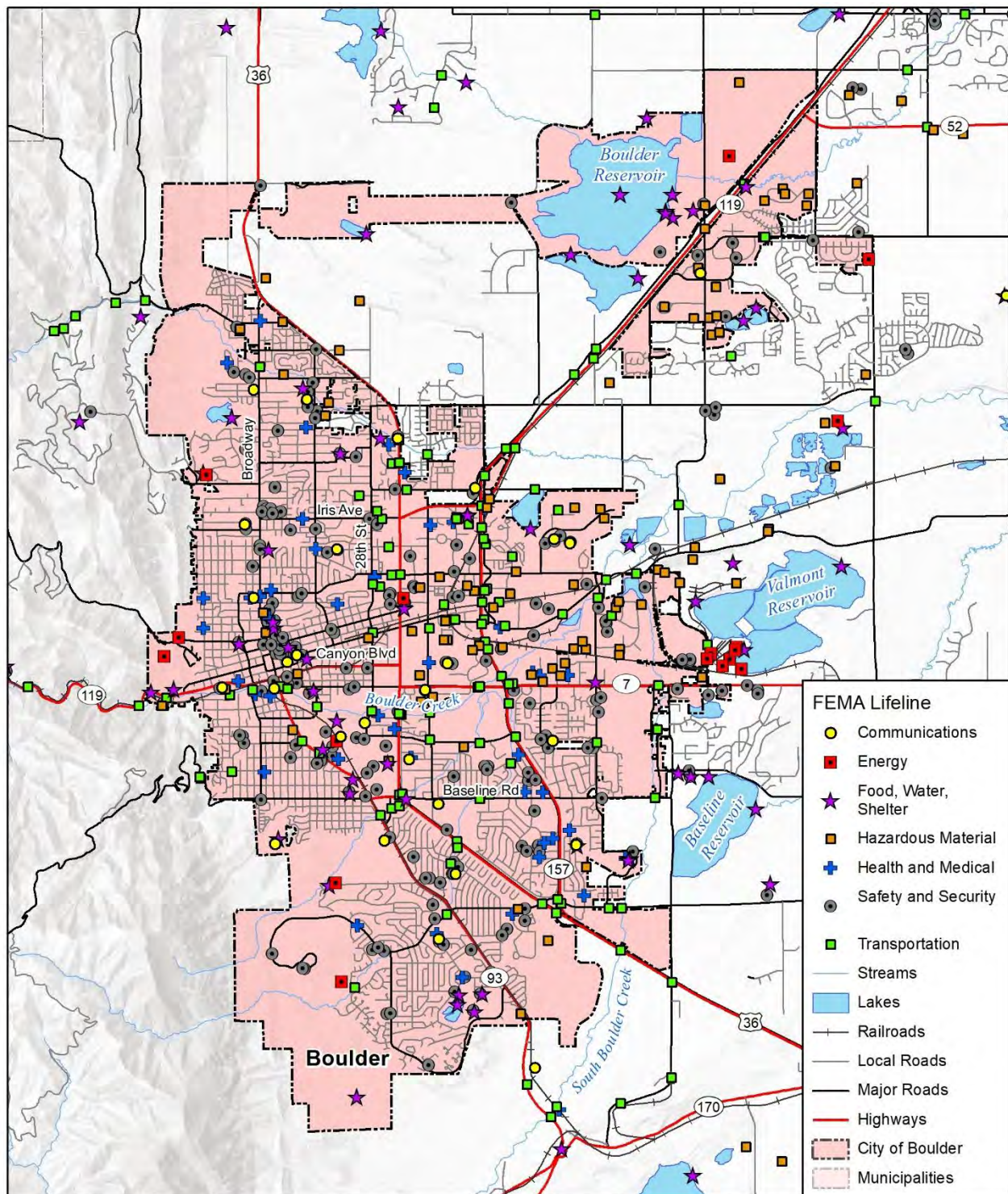
B.4.2 Critical Facilities

Table B-3 shows the critical facilities located in the City of Boulder organized by their respective FEMA Lifeline Category. The location of each facility is shown in Figure B-2.

Table B-3 Boulder Critical Facilities by FEMA Lifeline

FEMA Lifeline	Count
Communications	26
Energy	9
Food, Water, Shelter	44
Hazardous Materials	73
Health and Medical	45
Safety and Security	212
Transportation	85
Total	494

Source: Boulder County, City of Boulder HIFLD, NBI, BID, CDPHE, Wood Analysis

Figure B-2 City of Boulder Critical Facilities

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
City of Boulder, CDPHE, NBI, NID, HIFLD

wood.

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B.5 Hazard Summary

The most significant hazards in the City of Boulder are dam and levee failure, drought, flood, and wildfire. Hazards with medium significance in the city include air quality, communicable diseases, earthquake, extreme temperatures, severe winter storm, and windstorm. Refer to Section 4.3 Hazard Profiles and Section 4.5 Estimating Potential Losses in the base plan for detailed hazard analysis of the county as a whole. There are no hazards profiled which are unique to the City of Boulder, meaning all hazards in the city are possible elsewhere in the county as well. The overall hazard significance takes into account the geographic location, probability of occurrences, magnitude, and the impacts of climate change as a way to identify priority hazards for mitigation purposes. Section B.6 Vulnerability Assessment, where possible, analyzes the population, property, and other assets at risk to hazards ranked of medium or high significance that may vary from other parts of the planning area.

Table B-4 City of Boulder Hazard Summaries

Hazard Type	Geographic Extent	Occurrences	Magnitude / Severity	Increased Threat (Climate Change)	Hazard Level
Air Quality	Extensive	Highly Likely	Limited	Moderate	Medium
Avalanche	Limited	Unlikely	Limited	Low	Low
Communicable / Zoonotic Disease Outbreak	Extensive	Occasional	Critical	Substantial	Medium
Dam and Levee Failure	Significant	Unlikely	Critical	Moderate	High
Drought	Extensive	Likely	Critical	Severe	High
Earthquake	Extensive	Unlikely	Critical	Low	Medium
Extreme Temperatures	Extensive	Likely	Critical	Severe	Medium
Expansive Soils	Significant	Highly Likely	Limited	Substantial	Low
Flood	Extensive	Highly Likely	Critical	Severe	High
Hailstorm	Significant	Likely	Limited	Moderate	Low
Landslide	Limited	Unlikely	Limited	Substantial	Low
Lightning	Limited	Likely	Limited	Moderate	Low
Severe Winter Storm	Extensive	Highly Likely	Critical	Substantial	Medium
Subsidence	Significant	Likely	Limited	Moderate	Low
Tornado	Significant	Likely	Limited	Low	Low
Wildfire	Significant	Likely	Limited	Severe	High
Windstorm	Extensive	Likely	Critical	Moderate	Medium
Geographic Extent <ul style="list-style-type: none"> Limited: Less than 10% of planning area Significant: 10-50% of planning area 			Probability of Future Occurrences <ul style="list-style-type: none"> Highly Likely: Near 100% chance of occurrence in next year or happens every year. 		

<ul style="list-style-type: none"> • Extensive: 50-100% of planning area <p>Increased Threat from Climate Change</p> <ul style="list-style-type: none"> • Low- unlikely to become more of a threat due to climate change. • Moderate – possibly will become more of a threat due to climate change. • Substantial- likely to become more of a threat due to climate change. • Severe- highly likely to become more of a threat due to climate change 	<ul style="list-style-type: none"> • Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less. • Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years. • Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years. <p>Magnitude/Severity</p> <ul style="list-style-type: none"> • Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths • Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability. • Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability. • Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid <p>Significance</p> <ul style="list-style-type: none"> • Low: minimal potential impact • Medium: moderate potential impact • High: widespread potential impact
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B.6 Vulnerability Assessment

The intent of this section is to assess the City of Boulder’s vulnerability separate from that of the planning area as a whole, which has already been assessed in Sections 4.4 Vulnerability Assessment and 4.5 Estimating Potential Losses of the Base plan. This vulnerability assessment analyzes the population, property, critical facilities, and other assets at risk for the more significant hazards or where available data permits a more in-depth analysis. For more information about how specific hazards affect the County as a whole, see Chapter 4 Risk Assessment of the Base Plan.

Table B-3 lists summary information about the 494 critical facilities and other community assets identified by Boulder’s HMPC as important to protect or provide critical services in the event of a disaster. For additional information on the definitions behind each critical facility category, source, and other details refer to Section 3.3.2 of the Base Plan.

B.6.1 Vulnerability by Hazard

The hazard summaries in Table B-4 above reflect the hazards that could potentially affect Boulder. Based on this analysis, the priority hazard (High Significance) for mitigation are dam and levee failure, drought, flood, and wildfire. Due to the ability to quantify vulnerability further with available data, only the dam, flood, and wildfire hazards will be profiled in the following vulnerability assessment section.

Hazards assigned a significance rating of Low, and those which do not differ significantly from the County ranking (e.g., Low vs. High) are not addressed further in this plan and are not assessed individually for specific vulnerabilities in this section.

Dam Failure

Dam failures can result from a number of causes, or a combination of multiple factors, and the flooding that results from a failed dam generates tremendous energy which can be catastrophic to life and property downstream. Specific to the City of Boulder, the Barker Reservoir has the potential to have the worst impacts on the city if a dam failure occurred. The structural integrity of the dam during a Peak Maximum Flood (PMF) event was evaluated in a 2011 overtopping study by GEI consultants. The results of the study indicated that the stability of Barker Dam is not expected to be adversely affected due to overtopping in a PMF event. However, the dam failure hazard extent within city limits is considered significant, potentially impacting 10-50% of the planning area. The following sections evaluate some of the specific ways in which the City of Boulder is vulnerable to dam failure.

General Property and People

While there is no concrete data available to indicate any likelihood of failure, based on best available dam inundation data there are structures throughout Boulder potentially at risk of flooding due to dam failure. The dam failure inundation maps contain sensitive information and are not available for display in this public planning document. Based on a GIS analysis performed with the county parcel layer and the available dam inundation mapping (for planning purposes only), Table B-5 summarizes the exposed property values and building counts that are located within mapped inundation areas. It is important to note that these inundation areas include flooding potential originating from several different dams, and a scenario in which all of them fail simultaneously is very unlikely. There is a total property value of more than \$17 billion potentially at risk to dam inundation flooding.

There are a total of 8,639 buildings within the inundation areas, 6,673 are residential or mixed-use buildings. Based off an average household size of 2.17 people per household, there are an estimated 14,480 people in the City of Boulder residing in dam inundation zones.

Table B-5 Dam Inundation Hazard by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Agricultural	3	8	\$362,800	\$362,800	\$725,600	
Commercial	1,100	1,030	\$2,372,688,702	\$2,372,688,702	\$4,745,377,404	
Exempt	315	689	\$1,166,380,078	\$1,166,380,078	\$2,332,760,156	
Industrial	227	235	\$638,218,300	\$957,327,450	\$1,595,545,750	
Mixed Use	37	92	\$226,067,600	\$226,067,600	\$452,135,200	200
Residential	9,885	6,581	\$5,253,367,578	\$2,626,683,789	\$7,880,051,367	14,281
Vacant	1	4	\$7,800	\$7,800	\$15,600	
Total	11,568	8,639	\$9,657,092,858	\$7,349,518,219	\$17,006,611,077	14,480

Source: Boulder County GIS and Assessor's Office, U.S Census, Wood Analysis

Critical Facilities and Infrastructure

Utilizing the same GIS analysis methods, a review of the vulnerability of critical facilities and infrastructure in Boulder was conducted as well. Critical facilities provide services and functions that are essential for the whole community, especially during hazard response and recovery. FEMA refers to these facilities as

Community Lifelines. As discussed in the base plan, FEMA defines community lifelines as the most fundamental services in the community that, when stabilized, enable all other aspects of society. Essentially, these are the most important elements to the proper function of society and delivery of essential services, and as such it is vital to understand the community's vulnerabilities to these facilities. Table B-6 below summarizes these facilities. In total, there are 255 critical facilities in the city of Boulder which are vulnerable to dam inundation. The Safety and Security Community Lifeline Category has by far the most number of vulnerable facilities, with 106 locations identified.

Table B-6 Boulder Critical Facilities at Risk of Dam Inundation by Community Lifeline

FEMA Lifeline	Count
Communications	13
Energy	1
Food, Water, Shelter	17
Hazardous Material	45
Health and Medical	22
Safety and Security	106
Transportation	51
Total	255

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Economy

Extensive and long-lasting economic impacts could result from a major dam failure or inundation event, including the long-term loss of water in a reservoir, which may be critical for potable water needs, agriculture, or local wildlife. In addition to commercial and residential building impacts and direct damages, a dam inundation event which affected the major roads in and around Boulder would also significantly impact the economy by impeding regular business access, shipping, and travel. This could significantly affect the local economy, by limiting or completely impeding access to shops, restaurants, hotels, and other major industries which keep the local economy thriving.

Historical, Cultural, and Natural Resources

Dam or reservoir failure effects on the environment would be similar to those caused by flooding from other causes. Water could erode stream channels and topsoil and cover the environment with debris. For the most part the environment is resilient and would be able to rebound from whatever damages occurred, though this process could take years. However, historic and cultural resources could be affected just as housing or critical infrastructures would, were a dam to fail and cause downstream inundation that could further erode surfaces or cause scouring of structural foundations.

Drought

Drought is a more gradual phenomenon. Although droughts are sometimes characterized as emergencies, they differ from typical emergency events. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends.

General Property and People

Drought does not typically have a direct impact on buildings, although an increase in expanding or collapsing soils could affect building foundations. Developed areas in the City of Boulder may experience damages to landscaping if water use restrictions are put in place, however these losses are not considered

significant.

The historical and potential impacts of drought on populations include agricultural and recreation/tourism sector job loss, secondary economic losses to local businesses and public recreational resources, increased cost to local and state government for large-scale water acquisition and delivery, and water rationing and water wells running dry for individuals and families. Other public health issues can include impaired drinking water quality, increased incidence of mosquito-borne illness, an increase in wildlife-human confrontations and respiratory complications as a result of declined air quality in times of drought.

Critical Facilities and Infrastructure

Water supply issues for municipal, industrial, and domestic needs will be a concern for the entire city during droughts. Water restrictions could lead to economic and vegetation impacts in the City of Boulder. The City of Boulder relies primarily on snowpack in the watersheds feeding Middle and North Boulder creeks for its water supply. Higher temperatures can lead to declining snowpacks and earlier snowmelt and runoff. If Boulder County's future climate warms as expected, snowpack could become a less reliable mechanism for water storage, even without any changes in total precipitation. Future extended droughts that impact snowpack and runoff duration in the high mountains – especially if such droughts reduce the frequency or size of spring upslope storms – could push the city into more severe drought restrictions. Vulnerability increases with consecutive winters of below-average snowpack.

The need for water use limitations due to drought is not expected to happen often to Boulder's municipal water system given the city's diversified water rights portfolio that has a high degree of reliability. However, Boulder is in a semiarid climate, and drought is and will continue to be an expected part of the natural hydrologic cycle in the region.

Economy

Economic impacts will be largely associated with industries that use large quantities of water or depend on water for their business. Imposed water restrictions that arise from a severe drought would negatively impact businesses such as breweries, tech firms, and landscaping businesses. For example, landscaping businesses were affected in the droughts of the past as the demand for service significantly declined because landscaping was not watered. An extreme multi-year drought could impact the region with little warning. Combinations of low precipitation and unusually high temperatures could occur over several consecutive years. Intensified by such conditions, extreme wildfires could break out around or within the planning area, increasing the need for water.

Historic, Cultural, and Natural Resources

Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

Flood

The City of Boulder is situated in a region that drops in elevation dramatically from the western foothills at approximately 5,600 feet to the western plains with elevations near 5,200 feet, where excess rain and snow can contribute to downstream flooding.

Boulder is crossed by 15 major drainageways or creeks. The primary drainageway through the city is Boulder Creek with its headwaters at the Continental Divide near Arapahoe Pass and Diamond and Jasper Lakes. The tributary drainageways all eventually feed into Boulder Creek north of the Valmont Reservoir. Each of the watersheds for the respective drainages is highly urbanized as a result of the “built-out” condition of the study area. As such, the natural hazards related to stormwater and flood management are particularly complicated by the fact that space is at a premium and thus many structures are within the floodplain.

Flooding in Boulder is primarily caused by the overflow of the Boulder Creek. Flooding is mostly likely to occur in mid-June due to runoff from snowmelt or from heavy rainfall events, such as the September 2013 floods which heavily impacted the City of Boulder. The following details of the 2013 flood’s impacts on the City of Boulder are excerpted from the 2018 City of Boulder Local Hazard Mitigation Plan:

“The City of Boulder experienced a historic flooding event in September 2013 following unusual weather conditions, which lead to a record 432 mm (17 in.) of rainfall over a week. A cold front stalled over Colorado on September 9th and collided with warm humid air from the south. Rain fell continuously from September 9 to September 15. The National Weather Service released a statement on September 11 that the Front Range were already saturated and warned that any further rainfall would have difficulty being absorbed by the ground. The event was deemed a 1,000-year rain event. High flow velocities and debris accumulation contributed to flooding extending beyond banks. On September 12, Governor Hickenlooper declared a state of emergency in Boulder and 17 other counties. On September 15, President Obama declared States of Emergency in Boulder, El Paso, and Larimer counties, followed by 12 other counties on September 16.

The rainfall and subsequent flooding dropped historic levels within the city of Boulder. Some areas within or near the city received rainfall totaling 410 to 510 mm (16 to 20 inches) during the 1- week period. This event set a new 24-hour rainfall record of 9.08 inches which exceeded the previous record of 4.80 inches in 1919.

Eight watersheds comprise the larger Boulder Creek drainage basin: South Boulder Creek, Bear Canyon Creek, Skunk Creek, Gregory Canyon Creek, Boulder Creek, Goose and Twomile Canyon Creeks, Wonderland Creek, and Fourmile Canyon Creek. Only parts of three watersheds experienced peak flows that approached the 100-year event flow rate: Boulder Creek experienced a 50 to 100 plus year event flow rate; Twomile Canyon Creek experienced a 100 plus year event flow rate, and Fourmile Canyon Creek nearly experienced a 100-year event flow rate. In some areas of the city, particularly in areas within the watersheds of Goose and Twomile Canyon Creeks and Skunk Creek and its tributaries, overland flow in urban areas exceeded the effective 100 and 500-year floodplain extents. Areas around South Boulder Creek experienced urban flooding within the creek floodplain. The flooding met or exceeded the effective 100-year floodplain in many locations. Other locations, such as Boulder Creek, where engineered stormwater systems exist, urban flooding was experienced within the creek and floodplain but did not meet or exceed the effective 100-year floodplain extents.”

The scale and impacts of the flooding which occurred in 2013 can be used as an indicator of the potential severity of future events and served to highlight existing vulnerabilities for the City of Boulder to flooding.

General Property

Vulnerability to flooding was determined by summing potential losses to Boulder’s properties in GIS, by using the latest FEMA NFHL data along with the Boulder County parcel layer provided by the Assessor’s Office. FEMA’s NFHL data depicts the 1% annual chance (100-year) and the 0.2% annual chance (500-year) flood events. Figure B-3 below displays Boulder’s FEMA special flood hazard areas, color coded based on flood event (i.e., 100-year versus 500-year).

Based on the GIS analysis performed with the county parcel layer and the available FEMA flood mapping, the potential risk for the city's properties is shown in Table B-7 and Table B-8 below. Boulder's 1% annual chance flood zone has an estimated 2,228 improved parcels with 2,481 buildings, and over \$3.4 billion in total value exposed. The loss estimates from a 1% annual chance flood scenario are approximately \$842 million. There are 4,060 buildings in Boulder exposed to the 0.2% annual chance event, with a total exposed value of \$8.2 billion and more than \$2 billion in estimated losses in this flood scenario. Most properties in both floodplains at risk of flooding are residential.

For flood protection from Boulder Creek, a levee was constructed around the 75th Street Wastewater Treatment Plant. According to the City of Boulder's Flood Insurance Study (FIS), the levee was found to provide protection from the 1- 25% annual chance flood, and it meets all of the requirements set forth in Section 65.10 of the NFIP regulations. The University of Colorado South Campus Levee also provides protection from the 1% annual-chance flood event. According to GIS analysis, there is one building in Boulder which is located in an area protected by levee. This building represents approximately \$95 million in exposed value.

Table B-7 Summary of Boulder Properties Vulnerable to 1% Annual Chance Flood Events, by Property Type

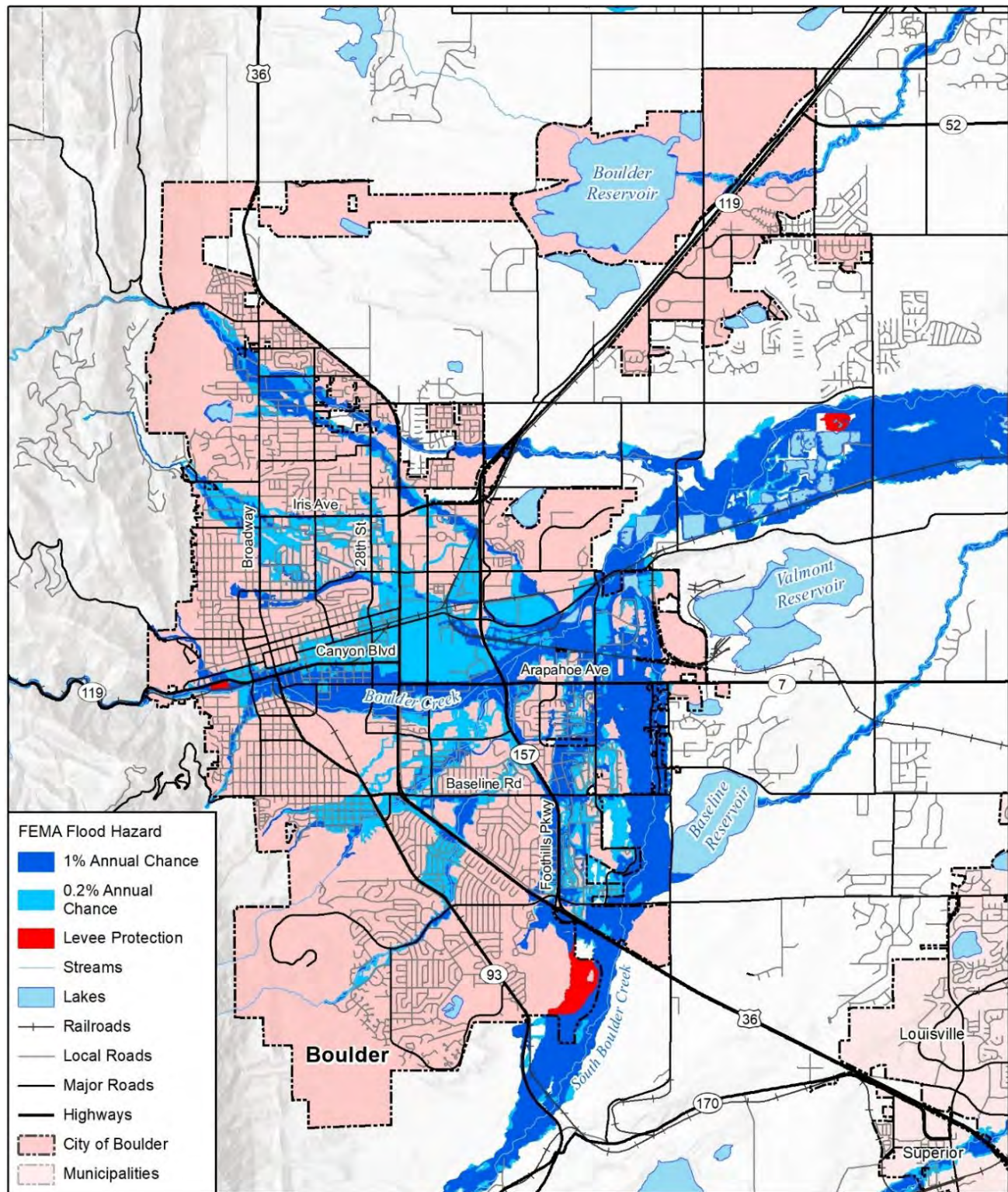
Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Agricultural	1	2	\$77,300	\$77,300	\$154,600	\$38,650	
Commercial	180	252	\$448,950,106	\$448,950,106	\$897,900,212	\$224,475,053	
Exempt	133	288	\$213,257,950	\$213,257,950	\$426,515,900	\$106,628,975	
Industrial	56	77	\$88,471,700	\$132,707,550	\$221,179,250	\$55,294,813	
Mixed Use	7	23	\$12,860,400	\$12,860,400	\$25,720,800	\$6,430,200	50
Residential	1,851	1,839	\$1,197,040,928	\$598,520,464	\$1,795,561,392	\$448,890,348	3,991
Total	2,228	2,481	\$1,960,658,384	\$1,406,373,770	\$3,367,032,154	\$841,758,039	4,041

Source: Boulder County, FEMA NFHL, U.S., Census Bureau, Wood Analysis

Table B-8 Summary of Boulder Properties Vulnerable to 0.2% Annual Chance Flood Events, by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Agricultural	3	8	\$362,800	\$362,800	\$725,600	\$181,400	
Commercial	460	451	\$1,148,166,449	\$1,148,166,449	\$2,296,332,898	\$574,083,225	
Exempt	105	213	\$418,698,940	\$418,698,940	\$837,397,880	\$209,349,470	
Industrial	56	61	\$237,921,200	\$356,881,800	\$594,803,000	\$148,700,750	
Mixed Use	15	23	\$75,301,000	\$75,301,000	\$150,602,000	\$37,650,500	50
Residential	5,050	3,304	\$2,865,563,148	\$1,432,781,574	\$4,298,344,722	\$1,074,586,181	7,170
Total	5,689	4,060	\$4,746,013,537	\$3,432,192,563	\$8,178,206,100	\$2,044,551,525	7,220

Source: Boulder County, FEMA NFHL, U.S., Census Bureau, Wood Analysis

Figure B-3 City of Boulder FEMA Flood Hazards

wood.

There are additional levee systems which are not shown in the map above located in the City of Boulder. Although these levee systems are not categorized by FEMA as Areas Protected by Levees, they do still provide protection from very extreme flood events. One such levee system is the Harrison Avenue Levee, located along Bear Creek. According to the National Levee Database, this levee system is protecting an area of Boulder from a flood event with .01% annual chance of overtopping the levee. There are an estimated 568 residents behind the levee, 361 buildings, and an estimated \$115 million in property value protected.

National Flood Insurance Program

The City of Boulder joined the National Flood Insurance Program (NFIP) on July 17, 1978. In exchange for a community adopting and enforcing a floodplain management ordinance, the NFIP makes affordable flood insurance available to private property owners and enables the community to retain its eligibility to receive certain federally backed monies and disaster relief funds.

The City of Boulder has the greatest number of policies and the largest insurance coverage of any community in Boulder County. NFIP insurance data indicates that as of March 2022, there were 3,612 policies in force in Boulder, resulting in \$930,782,600 of insurance in force. In Boulder, there have been 1,145 claims for flood losses filed since 1978, totalling approximately \$23,153,425 in paid losses. There have been 7 repetitive loss properties in the City of Boulder according to data made available from the CWCB in January 2021. There are no properties that meet the definition of a severe repetitive loss property.

Continued Compliance with the NFIP

Recognizing the importance of the NFIP in mitigating flood losses, the City of Boulder will place an emphasis on continued compliance with the NFIP. As an NFIP participant, the City has and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance as well as review of any potential development in special flood hazard areas.

People

The population exposed to the flood hazards described in the flood vulnerability analysis above was estimated by applying an average household size factor from the U.S. Census Bureau to the number of improved residential properties identified in the flood hazard areas within Boulder. These estimates yielded the population exposures shown in the table above in Table B-7 and Table B-8 above. As such, the 1% annual chance flood event could potentially displace 4,041 people, based on the residential structures which fall in those flood zones. A 0.2% annual chance flood event could displace as many as 7,220 people. For additional details on potential displacements by flood event, see the Boulder County Base Plan.

Critical Facilities and Infrastructure

There are a total of 83 critical facilities located in the 1% flood hazard zone, and 103 facilities in the 0.2% flood hazard area. The main critical facilities within Boulder located in the 1% floodplain fall into the Safety and Security FEMA Lifeline Category with 30 facilities, followed by Transportation with 26 facilities. Within the 0.2% flood hazard area, Safety and Security facilities possess the highest amount with 47 facilities. Table B-9 and Table B-10 below include a full inventory of the vulnerable facilities organized by their respective FEMA Lifeline Category.

Table B-9 Boulder Critical Facilities Exposed to 1% Annual Chance Flood Hazard

FEMA Lifeline	Count
Communications	4
Food, Water, Shelter	6

FEMA Lifeline	Count
Hazardous Material	8
Health and Medical	9
Safety and Security	30
Transportation	26
Total	83

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Table B-10 Boulder Critical Facilities Exposed to 0.2% Annual Chance Flood Hazard

FEMA Lifeline	Count
Communications	4
Energy	1
Food, Water, Shelter	6
Hazardous Material	16
Health and Medical	7
Safety and Security	47
Transportation	22
Total	103

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Economy

Flooding can have a major economic impact on the economy, including indirect losses such as business interruption, lost wages, reduced tourism and visitation, and other downtime costs. Flood events can cut off customer access to a business as well as close a business for repairs or permanently. A quick response to the needs of businesses affected by flood events can help a community maintain economic vitality in the face of flood damage. Responses to business damages can include funding to assist owners in elevating or relocating flood-prone business structures.

Flooding often coincides with the busy summer tourism months in Boulder County, and may impact, directly or indirectly (such as from the negative perception of potential danger to his hazard), the revenues of shops, restaurants, hotels, and other major industries which keep the local economy thriving.

Historical, Cultural, and Natural Resources

Natural areas within the floodplain often benefit from periodic flooding as a naturally recurring phenomenon. These natural areas often reduce flood impacts by allowing absorption and infiltration of floodwaters. Natural resources are generally resistant to flooding except where natural landscapes and soil compositions have been altered for human development or after periods of previous disasters such as drought and fire. Wetlands, for example, exist because of natural flooding incidents. Areas that are no longer wetlands may suffer from oversaturation of water, as will areas that are particularly impacted by drought.

There are also many historic and cultural resources in the downtown area of Boulder, large portions of which are vulnerable to 1% and 0.2% annual chance flooding.

Wildfire

Wildfire and urban wildfire are an ongoing concern for the City of Boulder. Generally, the fire season extends from spring to late fall. Fire conditions arise from a combination of hot weather, an accumulation of vegetation, and low moisture content in air and fuel. These conditions, especially when combined with high

winds and years of drought, increase the potential for wildfire to occur. The wildfire risk is predominantly associated with the wildland-urban interface, areas where development is interspersed or adjacent to landscapes that support wildland fire. A fire along this wildland-urban interface can result in major losses of property and structures. Significant wildfires can also occur in heavily populated areas. Rangeland and grassland fires are a concern in the eastern portion of Boulder County, including areas of the city, due to increased residential development in semi urban and rural areas.

General Property

Parcel analysis was conducted using GIS to analyze where parcels, buildings counts, property types and content values intersected with the wildfire hazards zones defined by the Colorado Forest Atlas, from highest to lowest risk. The Colorado Forest Atlas calculates a composite risk rating, defined as the possibility of loss or harm occurring from a wildfire. It identifies areas with the greatest potential impacts from a wildfire – i.e., those areas most at risk - considering all values and assets combined together – WUI Risk, Drinking Water Risk, Forest Assets Risk and Riparian Areas Risk. This risk index has been calculated consistently for all areas in Colorado, allowing for comparison and ordination of areas across the entire state

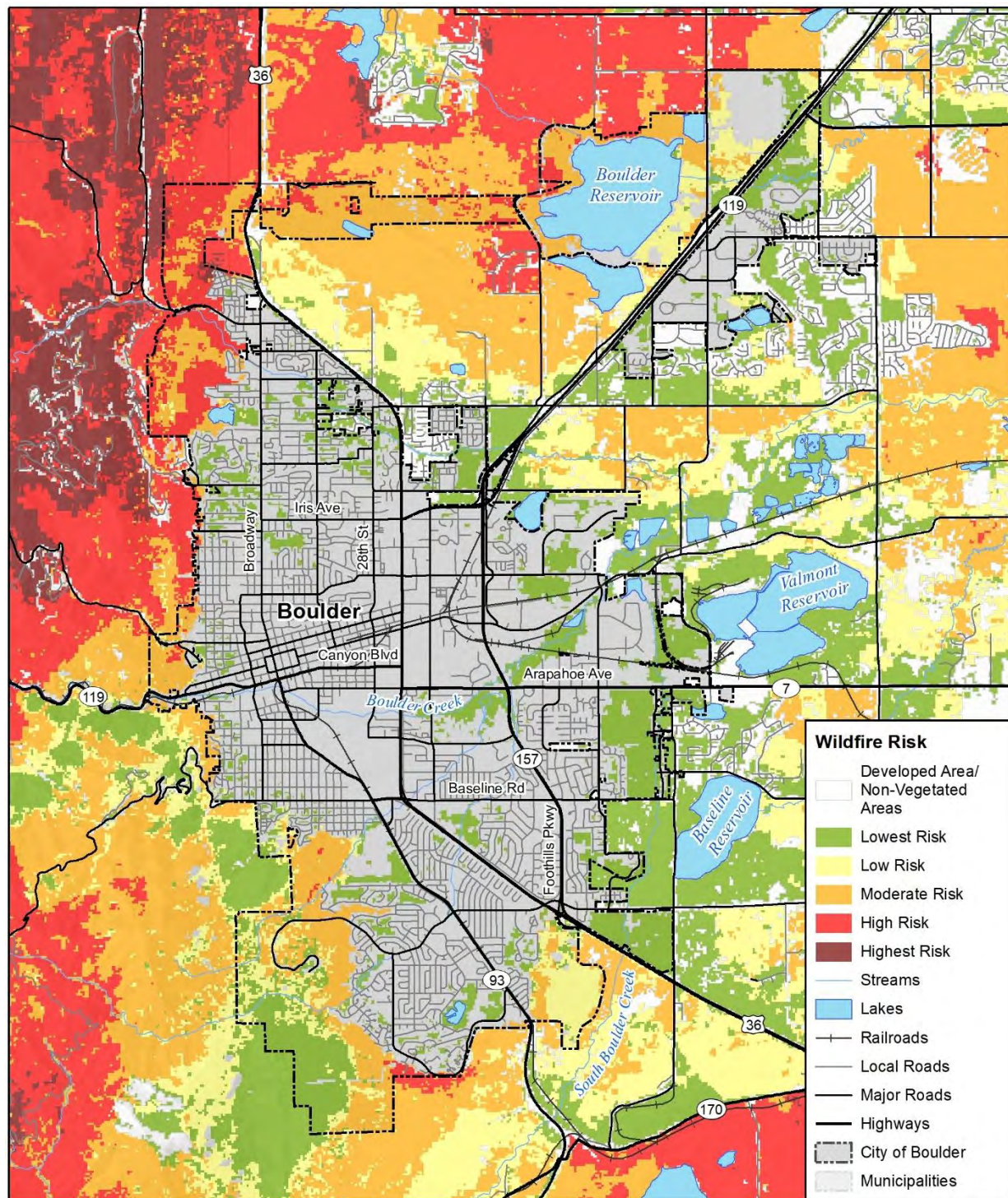
For the purposes of this analysis, the wildfire zone that intersected a parcel centroid was assigned as the threat zone for the entire parcel. Improvement values were then summed by wildfire rating area and then sorted by parcel type. Property improvements and estimated content values were then totaled to arrive at the Total Value column, which is also the estimated potential loss as wildfires typically result in complete loss to structure and contents. Boulder properties at risk to wildfires are listed in Table B-11 below and the wildfire risk areas are displayed in Figure B-4.

Table B-11 Property Values in Wildfire Zones by Parcel Type for Boulder

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Highest Wildfire Risk Hazard						
Residential	3	126	\$4,985,000	\$2,492,500	\$7,477,500	273
Total	3	126	\$4,985,000	\$2,492,500	\$7,477,500	273
High Wildfire Risk Hazard						
Exempt	2	1	\$0	\$0	\$0	
Residential	74	3	\$78,051,955	\$39,025,978	\$117,077,933	7
Total	76	4	\$78,051,955	\$39,025,978	\$117,077,933	7
Moderate Wildfire Risk Hazard						
Commercial	1	5	\$676,300	\$676,300	\$1,352,600	
Exempt	13	23	\$17,103,640	\$17,103,640	\$34,207,280	
Mixed Use	1	8	\$527,700	\$527,700	\$1,055,400	17
Residential	238	358	\$184,895,976	\$92,447,988	\$277,343,964	777
Total	253	394	\$203,203,616	\$110,755,628	\$313,959,244	794
Low Wildfire Risk Hazard						
Exempt	4	13	\$7,176,800	\$7,176,800	\$14,353,600	
Residential	83	106	\$76,173,329	\$38,086,665	\$114,259,994	230
Total	87	119	\$83,350,129	\$45,263,465	\$128,613,594	230
Lowest Wildfire Risk Hazard						
Agricultural	4	9	\$5,448,800	\$5,448,800	\$10,897,600	
Commercial	14	18	\$11,242,390	\$11,242,390	\$22,484,780	

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Exempt	60	160	\$313,143,275	\$313,143,275	\$626,286,550	
Industrial	3	25	\$8,335,300	\$12,502,950	\$20,838,250	
Mixed Use	3	9	\$88,874,600	\$88,874,600	\$177,749,200	20
Residential	1,970	2,815	\$1,264,317,359	\$632,158,680	\$1,896,476,039	6,109
Total	2,054	3,036	\$1,691,361,724	\$1,063,370,695	\$2,754,732,419	6,128

Source: Boulder County GIS and Assessor's Office, Colorado State Forest Service, Wood Analysis

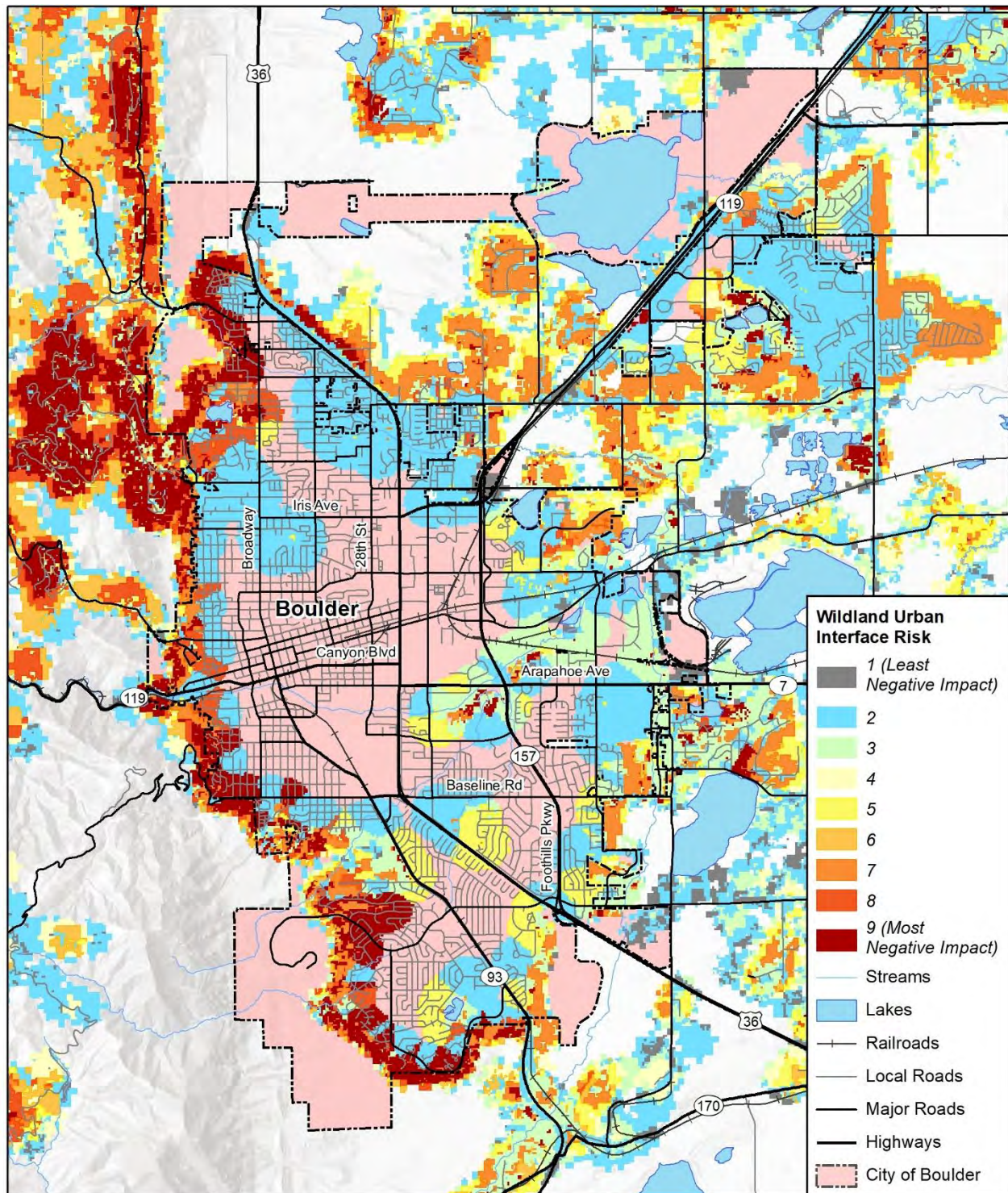
Figure B-4 City of Boulder Wildfire Risk

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
Colorado Forest Service - Colorado State Forest Service

wood.

The Colorado Forest Atlas also provides an analysis for Wildland-Urban Interface (WUI) risk based on housing density consistent with Federal Register National standards. The location of people living in the

wildland-urban interface and rural areas is essential for defining potential wildfire impacts to people and homes. To calculate the WUI Risk Index, the WUI housing density data was combined with flame length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9, while areas with low housing density and low flame lengths are rated -1. Data is modelled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers. WUI Risk for Boulder is mapped in Figure B-5 and vulnerable properties are detailed in Table B-12.

Figure B-5 City of Boulder WUI Risk

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
Colorado Forest Service - Colorado State Forest Service

wood.

Table B-12 City of Boulder WUI Risk Hazard by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
High WUI Risk Hazard						
Commercial	27	35	\$9,842,155	\$9,842,155	\$19,684,310	
Exempt	35	88	\$131,446,280	\$131,446,280	\$262,892,560	
Industrial	27	19	\$59,853,300	\$89,779,950	\$149,633,250	
Mixed Use	4	21	\$65,104,400	\$65,104,400	\$130,208,800	46
Residential	2,878	3,165	\$1,709,400,208	\$854,700,104	\$2,564,100,312	6,868
Vacant	1	7	\$7,800	\$7,800	\$15,600	
Total	2,972	3,335	\$1,975,654,143	\$1,150,880,689	\$3,126,534,832	6,914
Moderate WUI Risk Hazard						
Commercial	42	41	\$53,236,924	\$53,236,924	\$106,473,848	
Exempt	31	128	\$103,394,700	\$103,394,700	\$206,789,400	
Industrial	17	22	\$115,612,250	\$173,418,375	\$289,030,625	
Residential	2,862	1,936	\$1,173,047,444	\$586,523,722	\$1,759,571,166	4,201
Total	2,952	2,127	\$1,445,291,318	\$916,573,721	\$2,361,865,039	4,201
Low WUI Risk Hazard						
Commercial	1	5	\$676,300	\$676,300	\$1,352,600	
Exempt	13	23	\$17,103,640	\$17,103,640	\$34,207,280	
Mixed Use	1	8	\$527,700	\$527,700	\$1,055,400	17
Residential	238	358	\$184,895,976	\$92,447,988	\$277,343,964	777
Total	253	394	\$203,203,616	\$110,755,628	\$313,959,244	794

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

The properties most at WUI Risk in Boulder are residential with 3,165 high, 1,936 moderate, and 358 low risk residential structures. All vulnerable properties together represent upwards of \$5.8 billion in total property value across all WUI risk areas.

People

The last column of Table B-11 and Table B-12 above both summarize the number of people at risk to wildfire in the analyzed fire zones. Based on the assessment conducted, Boulder has an estimated 7,432 people residing in the wildfire risk hazard areas. As shown in the maps above, the far more extensive WUI risk areas within the city contain more vulnerable properties and residents, with an estimated 31,532 people residing in the WUI risk areas. These totals were estimated by multiplying the average persons per household in Boulder by the number of residential properties falling within the fire zones. Smoke resulting from fire, both locally and fires in other Western states, is an issue to local populations also.

Critical Facilities and Infrastructure

A total of six critical facilities were identified to be in moderate wildfire zones in Boulder, five in the low wildfire risk zone, and 25 within in the lowest wildfire zones, as listed in Table B-13 below. There are also 235 critical facilities located in WUI risk areas in Boulder, summarized in Table B-14.

Table B-13 Critical Facilities Wildfire Risk in Boulder by FEMA Lifeline Category

FEMA Lifeline	Count
Moderate Wildfire Risk Hazard	
Energy	2
Food, Water, Shelter	2
Hazardous Material	1
Safety and Security	1
Total	6
Low Wildfire Risk Hazard	
Communications	1
Energy	1
Food, Water, Shelter	1
Safety and Security	2
Total	5
Lowest Wildfire Risk Hazard	
Communications	5
Energy	2
Food, Water, Shelter	2
Hazardous Material	4
Safety and Security	9
Transportation	3
Total	25

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Table B-14 Critical Facilities WUI Risk in Boulder by FEMA Lifeline Category

FEMA Lifeline	Count
High WUI Risk Hazard	
Communications	2
Energy	4
Food, Water, Shelter	4
Hazardous Material	5
Health and Medical	4
Safety and Security	16
Transportation	2
Total	37
Moderate WUI Risk Hazard	
Communications	1
Energy	1
Hazardous Material	8
Health and Medical	2
Safety and Security	7
Transportation	3
Total	22
Low WUI Risk Hazard	
Communications	9
Food, Water, Shelter	15
Hazardous Material	35

FEMA Lifeline	Count
Health and Medical	12
Safety and Security	70
Transportation	35
Total	176

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Economy

Tourism, the accommodation and food services industry (e.g. hotels and restaurants), and retail are major components of Boulder County's economy, and the City of Boulder's as well. Wildland fires can, for example, lead to significant tourism reductions due to health and safety concerns, causing lost revenues from lack of visitation, stays in hotels, spending on restaurants and other commerce sources, and more.

The economic cost of fighting wildfires is also significant, as can be the cost of sudden or prolonged evacuations.

Historic, Cultural, and Natural Resources

Fire is a natural and critical ecosystem process in most terrestrial ecosystems, dictating in part the types, structure, and spatial extent of native vegetation. However, wildfires can cause severe environmental impacts, such as damage to fisheries, soil erosion, and spread of invasive plant species. Wildfires can also trigger numerous cascading hazards, such as landslides, erosion, and flooding.

Many ecosystems are adapted to historical patterns of fire occurrence. These patterns, called "fire regimes," include temporal attributes (e.g., frequency and seasonality), spatial attributes (e.g., size and spatial complexity), and magnitude attributes (e.g., intensity and severity), each of which have ranges of natural variability. Ecosystem stability is threatened when any of the attributes for a given fire regime diverge from its range of natural variability. Recent years have seen fires burning bigger and more intense, closer to existing urban centers in the Front Range, and the fire season extending into winter months. Each of these could indicate potential shifts to the area fire regime, which in turn adds uncertainty to the future vulnerability of the City of Boulder to fire.

B.7 Capability Assessment

Identification of loss prevention mechanisms already in place provides an assessment of Boulder's "net vulnerability" to natural disasters and the City's capability to mitigate them. This more accurately focuses the goals, objectives, and proposed actions of this plan. This part of the planning process is referred to as the mitigation capability assessment. The City of Boulder has several policies, regulations and codes that guide how the city manages development of hazard-prone areas. Many of these policies have multiple objectives. Those that are directly related to reducing losses to future development or the protection of critical facilities and/or vulnerable populations are summarized here.

The HMPC took two approaches to conducting this assessment for the city. First, an inventory matrix of common mitigation activities was made. The purpose of this effort was to identify activities and actions that were either in place, needed improvement, or could be undertaken, if deemed appropriate. Second, the HMPC conducted an inventory of existing policies, regulations, and plans. These documents were collected and reviewed to determine if they contributed to reducing hazard-related losses or if they inadvertently contributed to increasing such losses. This section summarizes the city's mitigation capabilities currently in place.

Table B-15 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Boulder.

Table B-15 City of Boulder Regulatory Mitigation Capabilities

Planning and Regulatory (ordinances, codes, plans)	Y/N	Comments
Building Codes	Y	International Building Code; National Electric Code
Building Codes Year	Y	2018 IBC, 2020 National Electric Code
BCEGS Rating	Y	3 for 1 and 2 family residential properties 3 for commercial and industrial properties
Capital Improvements Program (CIP) or Plan	Y	
Community Rating System (CRS)	Y	5, working towards Class 4; Change from Class 6 in 2012
Community Wildfire Protection Plan (CWPP)	Y	City of Boulder Wildland Urban Interface Community Wildfire Protection Plan, 2007
Comprehensive, Master, or General Plan	Y	Boulder Valley Comprehensive Plan
Economic Development Plan	Y	City of Boulder Economic Vitality Program
Elevation Certificates	Y	For new construction since 1991
Erosion/Sediment Control Program	Y	
Floodplain Management Plan	Y	
Flood Insurance Study	Y	
Growth Management Ordinance	Y	
Hazard-Specific Ordinance or Plan (Floodplain, Steep Slope, Wildfire)	Y	Comprehensive Flood and Stormwater Utility Master Plan, Greenways Master Plan, Raw Water Master Plan, Fire and Emergency Medical Services Master Plan, West Nile Virus Mosquito Management Plan, Drought, CWPP (currently being updated), Climate Preparedness, Wetlands Protection Program; Critical Facility and Mobile Population Ordinance
NFIP	Y	Since July 1978
Site Plan Review Requirements	Y	
Stormwater Program, Plan or Ordinance	Y	
Zoning Ordinance	Y	Chapter 9-5 Boulder Revised Code

Table B-16 identifies the personnel responsible for mitigation and loss prevention activities as well as related data and systems in Boulder.

Table B-16 City of Boulder Administrative/Technical Mitigation Capabilities

Personnel Resources	Y/N	Comments
Emergency Manager	Y	
Floodplain Administrator	Y	
Community Planning	Y	
Planner/Engineer (Land Development)	Y	
Planner/Engineer/Scientist (Natural Hazards)	Y	

Personnel Resources	Y/N	Comments
Engineer/Professional (Construction)	Y	
Resiliency Planner	Y	
Transportation Planner	Y	
Full-Time Building Official	Y	
GIS Specialist and Capability	Y	
Grant manager, Writer, or Specialist	Y	
Warning Systems/Services	Y	
<ul style="list-style-type: none"> General 	Y	Emergency Warning and Evacuation System, Citizens Alert System, Cable Television Interrupt, Emergency Alert System, Metropolitan Emergency Telephone System, National Warning System
<ul style="list-style-type: none"> Flood 	Y	Flood Warning Detection System
<ul style="list-style-type: none"> Wildfire 	Y	
<ul style="list-style-type: none"> Tornado 	Y	
<ul style="list-style-type: none"> Geological Hazards 	Y	

Table B-17 identifies financial tools or resources that Boulder could potentially use to help fund mitigation activities.

Table B-17 City of Boulder Financial Capabilities

Financial Resources	Y/N
Has the community used any of the following to fund mitigation?	
Levy for Specific Purposes with Voter Approval	Y
Utilities Fees	Y
System Development Fee	Y
General Obligation Bonds to Incur Debt	Y
Special Tax Bonds to Incur Debt	Y
Withheld Spending in Hazard-Prone areas	Y
Stormwater Service Fees	Y
Capital Improvement Project Funding	Y
Community Development Block Grants	Y

Table B-18 identifies existing education and outreach capabilities that the City of Boulder uses to inform the public about hazards and risks in the community.

Table B-18 City of Boulder Education and Outreach Capabilities

Education & Outreach	Y/N
Local citizen groups that communicate hazard risks	Y
Firewise	Y
StormReady	Y
Other – Annual flood awareness and flood safety outreach, water conservation education and rebates via Resource Central, BUSH program	Y

B.7.1 Opportunities for Capability Enhancement and Improvement

The plan update process provided the City of Boulder an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- Integrate risk assessment information into future updates to the City's Comprehensive Plan.
- Integrate risk assessment information into future updates of the City's Land Use Code.
- Providing training for staff members related to hazards or hazard mitigation grant funding in partnership with the County and DHSEM
- Improve the city's CRS rating

B.8 City Mitigation Capabilities by Organization

B.8.1 Public Works Departments

The Public Works Departments sustain and improve the quality of life in Boulder and provides many basic services. The departments oversee a long list of core services for the city, including the city's water resources, maintains the city's infrastructure, completes a variety of street, sewer, and construction projects each year; and keeps roadways safe for passage. The department also serves as first responders in emergency situations where Public Works services are required. The four departments are: Transportation and Mobility, Utilities, Facilities and Fleet, and Planning & Development Services.

Utilities Department

The City of Boulder's Public Works - Utilities Department manages the city's three municipal utilities (water, wastewater, and stormwater and flood management). The division manages the city's raw water supplies and provides high-quality treated water that meets all standards in a cost-effective manner. The Utilities Department effectively collects and treats wastewater and mitigates the potential loss from floods through the development of flood channels and the installation and maintenance of storm sewers.

B.8.2 Stormwater and Flood Management Utility Program

The Stormwater and Flood Management Utility was established in 1973 and is responsible for the city's flood management, stormwater quality, and stormwater drainage programs. Its responsibilities include the following:

- Administration and operations
- Utility rates and finance
- Program development and management
- Flood and stormwater regulation and compliance
- System master planning and design

- Public education and community outreach
- Flood prediction and response
- Stormwater quality management
- Emergency preparedness and day-to-day operations
- Capital improvements and land management

The Stormwater and Flood Management Utility provides funding for both stormwater and flood channel maintenance activities. Flood utility staff remove sediment from channels, stabilize banks, and remove trees or tree limbs that have fallen into the creeks. Adjacent landowners are required to handle leaning trees or trees that have fallen away from the creek channel.

Management of information is an important component of the city's Stormwater and Flood Management Utility program. Since 1989, significant advances have been made in computerized information management techniques, including GIS.

B.8.3 Capital Improvement Program

The Capital Improvement Program covers a six-year time period within which funding priorities are reflected in the staging and timing of projects. In the Stormwater and Flood Management Utility, the majority of the project funding is focused on life safety and critical facility hazard mitigation issues. Capital Improvement Program expenditures are prioritized based on the following criteria:

- Life safety (high hazard) mitigation
- Flood emergency response capability
- Critical facility (vulnerable population) hazard mitigation
- Property damage mitigation
- Collaboration with other Greenways Program Objectives
- Potential for operation and maintenance cost savings
- Accommodating new growth and development

B.8.4 Water Resources Advisory Board

The Water Resources Advisory Board (WRAB) consists of five members appointed to five-year terms by City Council that meet monthly. The WRAB was formed to review capital improvement programs, the community and environmental assessment process, and the utilities master plan; advise City Council, the Planning Board, and city staff; and provide recommendations concerning policy issues on operating programs.

B.8.5 Greenways Program

The Greenways Program provides recreation and transportation opportunities along Boulder Creek, its 14 major tributaries and Boulder Slough. The Program for these riparian corridors is guided by six program objectives: environmental protection, wetland habitat restoration, water quality enhancements, preservation of cultural resources, flood mitigation, and storm drainage improvements.

Greenways projects are funded from the Transportation Fund, Stormwater and Flood Management Utility Fund, and the Lottery Fund. The activities of the program are coordinated by the Greenways Coordinator who works under the direction of the Utilities Project Coordinator in the Public Works Department.

In 1984, the city adopted the Boulder Creek Corridor Plan, which recommended development of a continuous path and other improvements along the entire length of Boulder Creek. These improvements provided flood hazard mitigation, a linear urban park for recreational and transportation use, and restoration and enhancement of wetlands and fish and wildlife habitat. Design guidelines were established to set standards for appearance, quality, and placement of elements that were incorporated into the Boulder Creek corridor.

When completed in 1987, the Boulder Creek corridor provided recreational and transportation opportunities as well as a buffer zone between the stream channel and nearby development. Wetlands were restored along the corridor to provide stormwater and flood retention and filtering. The project also restored the riparian habitat along the creek, which had become considerably degraded. Natural vegetation was planted and corridor use was redirected to the Boulder Creek path to reduce ongoing damage. Aquatic habitat, which had been severely affected by diminished stream flows and creek channelization, was restored. A self-sustaining creek channel and healthy aquatic habitat were established with the implementation of minimum streamflow agreements for Boulder Creek.

The Greenways Program was an outgrowth of the Boulder Creek Corridor Plan. The basis of the program is the understanding that stream corridors are a vital link in the larger ecosystem, and that each stream is an important natural and cultural resource in the community. The public support of the Boulder Creek Corridor Plan led to an interest in expanding the program to include six additional tributaries within the city. The city designated over 20 miles of stream corridors along the following tributaries of Boulder Creek for inclusion in the original Greenways Program:

- South Boulder Creek
- Bear Canyon Creek
- Skunk Creek
- Goose Creek
- Wonderland Creek
- Fourmile Canyon Creek
- Elmer's Two-mile Creek (this creek was later added as a tributary to Goose Creek because it was considered an important transportation corridor)

Funding for a Greenways Master Plan was approved by City Council in December 1987. The plan was developed by staff from the Planning, Public Works, Parks and Recreation, and Open Space and Mountain Parks, and Real Estate departments and adopted by City Council in January 1989. A refined master plan, design guidelines, a capital improvement program, and a more detailed reproducible map were approved in September 1990. An interdepartmental staff group, under the direction of the Greenways Coordinator updated the Greenways Master Plan in December 2001. The plan included an evaluation of the program to date and historical information about the program, an identification and evaluation of projects and opportunities for each of the Greenways objectives, and a maintenance strategy, organization structure, procedures and processes for project planning and public involvement, and a proposed financing plan.

The latest update was in 2011 and includes two key components:

- The expansion of the Greenways Program to include all the fourteen major tributaries to Boulder Creek within the City of Boulder;
 - Bear Canyon Creek
 - Bluebell Canyon Creek
 - Dry Creek No. 2
 - Elmer's Two Mile Creek
 - Fourmile Canyon Creek
 - Goose Creek
 - Gregory Canyon Creek
 - Kings Gulch
 - Skunk Creek
 - South Boulder Creek
 - Sunshine Creek
 - Two Mile Canyon Creek
 - Viele Canal
 - Wonderland Creek

- A summary of current changes to policies and plans that affect implementation of the Greenways Program. The update also provides descriptions of current conditions based on changes that have occurred within the system since the last plan update in 2001. The purpose and objectives of the Greenways Program have not changed.

In 2021, The Greenways Advisory Committee recommended a “2022-2027 Greenways Program Capital Improvement Plan” to the City Council. The focus of the Greenways CIP in 2018-2020 is on flood mitigation, bicycle and pedestrian multi-use paths and underpasses, and habitat and water quality improvements along the Fourmile Canyon Creek corridor. These improvements are also being coordinated with the development of the Violet Park site. In addition, possible habitat restoration projects during the next few years include:

- Habitat improvements along Fourmile Canyon Creek upstream of Broadway in conjunction with OSMP flood mitigation efforts (sediment removal)
- Creek widening and restoration on Boulder Creek at Valmont and 55th in conjunction with OSMP
- Goose Creek, railroad to 47th Street tree plantings
- Removal of Russian Olive trees east of 75th Street along Boulder Creek

B.8.6 Public Works - Transportation and Mobility Department

The Transportation and Mobility (T&M) Department and the Transportation Master Plan acknowledge that trails and bikeways are an important planning consideration, which, when in keeping with other program goals, may be accommodated in or near creek corridors. In many cases, stream corridors can be creatively developed to function as efficient bicycle and pedestrian transportation systems while simultaneously functioning as storm drainage and flood channels, open space and wildlife corridors, and attractive recreation corridors. The Stormwater and Flood Management Utility, the T&M Department, and the Greenways Program frequently cooperate to achieve goals and objectives in common areas.

Loss prevention capabilities include:

- Numerous major access routes for emergency preparedness response
- Airport access
- All new bridges and underpasses are designed to convey 100-year flood event flows

B.8.7 Transportation Advisory Board

The Transportation Advisory Board (TAB) consists of five members appointed by City Council, each to five-year terms that meet monthly. The TAB advises City Council, Planning Board and city staff on transportation issues, reviews transportation community environmental assessments, reviews plans for capital improvements, reviews and recommends changes to the Transportation Master Plan and works with neighborhood groups, residents and staff on traffic mitigation issues

B.8.8 Planning and Development Services Comprehensive Planning Programs

The Planning and Development Services Comprehensive Planning is responsible for citywide and subcommunity and area planning. The Planning Department and portions of the Public Works Department together form Planning and Development Services (P&DS). P&DS is a service area that was formed to support its customers and the delivery of services. The P&DS Center provides customers with building and construction permits and applications, GIS mapping services, development review, inspections, licensing, zoning information, long range planning, and historic preservation.

B.8.9 Parks and Recreation Department

The Parks and Recreation Department and the Parks and Recreation Master Plan recognize the importance of undeveloped open land and natural parks in the city for quiet, passive recreation and hazard mitigation.

Where park lands occur along the city's drainageways, the Stormwater and Flood Management Utility may cooperate with the Parks and Recreation Department and the Greenways Program to achieve open land/natural park objectives while promoting drainage and flood control objectives.

Working with the Boulder OEM, the City of Boulder Parks and Recreation Department completed emergency action plans for each recreation facility and program in 2009. This project was an action recommendation in the 2008 Multi-Hazard Mitigation Plan. These plans were developed with the assistance and input from staff at each facility and program. In addition, program supervisory staff attended training on emergency preparedness and hazard awareness, and each facility and program created an emergency plan that can be used by staff to inform park users to shelter-in-place or evacuate (including signage and instructions). Each plan discusses the appropriate actions to take during a flood and identifies possible evacuation sites (high ground).

B.8.10 Open Space and Mountain Parks Department

The Open Space and Mountain Parks Department operates in accordance with city charter provisions and missions, among which are to preserve and restore natural areas with associated unusual, spectacular, historically important, scientifically valuable, or rare examples of native flora and fauna; preserve water resources in their natural or traditional state, including wildlife habitats or fragile ecosystems; promote utilization of program lands for passive recreational use; preserve agricultural land uses and land suitable for agricultural production; and use lands wisely to prevent encroachment on floodplains. The Open Space and Mountain Parks Department, through area management planning, provides guidance and direction for management of specific areas, develops a framework for evaluating and incorporating appropriate uses of open space, prepares inventories and analyses of resources; provides opportunities for public participation, and coordinates resource management, protection, and planning with other city departments and public and private landowners.

B.8.11 Urban Forestry Department

The City's Urban Forestry Department maintains a healthy and safe urban forest, and preserves an extensive and diverse tree cover throughout the city. Responsibilities include:

- Public tree maintenance and planting programs, tree inventory
- Tree Safety Inspection Program (TSIP) and Integrated Pest Management (IPM)
- Commercial tree program
- Storm damage response
- Arborist licensing, education and outreach

Urban Forestry manages the Urban Forest Strategic Plan activities and response to hazards such as the Emerald Ash Borer invasion.

B.8.12 City Manager's Office – Resilience Program

Resilience is the ability of a community to prepare for and respond effectively to stress. Some of the stresses will come on suddenly, like the 2013 flood, wildfires, violence or illnesses. Others take their toll over time, such as economic hardship, social inequality, or the declining health of a community and its members. Resilience is a new way of thinking about the community in a holistic way that adds to and deepens the way we already plan for a sustainable future. Resilience is about anticipating the inevitable events that cause disruption and then developing the strategies to reduce their impacts to the greatest extent possible.

While resilience itself is not new, Boulder is one of the first 32 cities recently chosen to participate in the 100 Resilient Cities program. Pioneered by the Rockefeller Foundation, 100 Resilient Cities is the first organization to use resilience as a systematic framework, on a global scale, for actively managing and

prioritizing city operations and activities. The program funds the City's Chief Resilience Officer and supports the City's Comprehensive Resilience Strategy. The City's "Resilient Boulder" program and "Resilient Together" outreach platform both provide communication and collaboration tools critical to the City's hazard mitigation and response capabilities.

B.8.13 Police Department

The Boulder Police Department (BPD) has adopted a policing philosophy that is built around the provision of service, as represented by proactive problem solving through the establishment of community partnerships, and safety, as represented by the aggressive application of modern law enforcement techniques. This philosophical shift from the traditional 911-driven, pure reactive approach to the delivery of police services emphasizes community-based, prevention-oriented policing. The issues and concerns in need of police attention emerge from ongoing discussion and interaction between the BPD and the community. The department defines its fundamental responsibilities as encompassing six general functions:

- Enforcing laws and preserving public safety and order
- Reducing crime and disorder through prevention and intervention
- Responding to community needs through partnerships and joint problem-solving
- Investigating and reporting serious and non-serious crimes for prosecution
- Providing information and service referrals
- Managing and administering BPD operations

The Boulder Police Department (BPD) Master Plan was originally developed in 1996 and revised in 2013. The BPD Master Plan is being updated to better reflect current and emerging trends such as an increase in community expectations and advances in technology and communications. The master plan is intended to guide BPD for the next 5 to 10 years in providing safety, education, enforcement, and investigative services to the City of Boulder.

B.8.14 Fire-Rescue Department

The City of Boulder Fire-Rescue Department is responsible for the protection of life and property through fire prevention, education, fire suppression, and emergency medical and rescue services. The Fire-Rescue Department has a staff of 116, seven fire stations, and a budget of approximately \$15.5 million to provide fire suppression, rescue, emergency medical care, fire prevention services, and public education for the population within Boulder's city limits. All addresses in the City of Boulder limits are within two miles of a fire station. The fire chief reports to the city manager and oversees the department's five divisions: Emergency Services, Fire Prevention, Training, Wildland, and Administration. Two permanent wildland fire positions including a wildland fire crew supervisor were added in 2012. This additional staffing was an action recommendation in the 2008 Multi-Hazard Mitigation Plan.

Boulder's firefighters do a lot more than fight fires. Every firefighter is a state certified emergency medical technician. Every engine crew is equipped with, and trained to operate, a cardiac defibrillator. The city's firefighters are also prepared to deal with flooding in a business or house, extricate someone from a vehicle accident, rescue people from a stalled elevator or a collapsed trench, and effectively deal with carbon monoxide alarms or tree branches on power lines. Many of Boulder's firefighters have advanced training in dive rescue, hazardous material spills, wildland firefighting, or fire safety education.

Boulder's firefighters also provide proactive services for the safety and well-being of the public. The engine crews and Fire Prevention Division inspect Boulder businesses to ensure they comply with the International Fire Code and Boulder Revised Code. The fire safety education team reaches virtually every elementary school student in the city during October, fire prevention month, through the school system. College students are taught fire safety through the Greek and Residence Assistants Fire Academies.

The Fire Prevention Division not only promotes fire safety and education, but also investigates fire, performs plan reviews for new or remodeled buildings, and performs building inspections to ensure compliance with the fire code. The department also has a training division that concentrates on recruit training, continuing education to the entire department, and emergency medical services training.

The Wildland Division was established in 1998 to help protect residents, visitors, and city lands from wildland fire. The response area of the division covers approximately 400 square miles. The division's purpose is to manage wildland fire activities on or threatening City of Boulder land. Another reason the division was established was to carry on and expand the prescribed fire program on city lands. To help accomplish this, the division assists the Open Space and Mountain Parks Department with their ecosystem management and forest health projects. The division educates the public on wildfire prevention, mitigation, and safety and provides training to city employees and local, state, and federal co-operators. The Public Safety Tax approved by voters in 1997 added seasonal personnel to respond to wildland fires occurring on and around Boulder's open lands. That crew is also available to conduct wildland fire mitigation, forest thinning, and prescribed burning.

The Fire-Rescue Department has seven fire stations strategically located around the city:

- Station One (Central Station)—2441 13th Street
- Station Two—2225 Baseline Road
- Station Three—1580 30th Street,
- Station Four—4100 Darley Avenue
- Station Five—4365 19th Street
- Station Six—5145 North 63rd Street
- Station Seven—1380 55th Street

Each station operates 24 hours per day, seven days per week and is equipped to respond to fire, medical, and other emergencies. Medical calls accounted for 62 percent of the total calls for service in 2011. The Fire-Rescue Department also participates in a countywide joint training center. The current facility is at 960 Lee Hill Road.

An update to the Fire and Emergency Medical Service Master Plan was adopted in June 2012. The master plan service standards are as follows:

- Emergency Services: Arrival of 1st unit dispatched to an emergency within 6 minutes 80% of the time. Arrival of all units dispatched to an emergency within 11 minutes 80% of the time.
- Hazardous Materials Team: Arrival of 1st unit dispatched to an emergency within 6 minutes 80% of the time. Arrival of all units dispatched to an emergency within 11 minutes 80% of the time.
- Wildland Coordination: Arrival of 1st unit dispatched to an emergency within 6 minutes 80% of the time. Arrival of all units dispatched to an emergency within 11 minutes 80% of the time.
- Dive Team: Arrival of 1st unit dispatched to an emergency within 6 minutes 80% of the time. Arrival of all units dispatched to an emergency within 11 minutes 80% of the time.

Traffic congestion and various traffic mitigation measures have impacted the department's ability to continue to meet the emergency response service standards. To ease the impact, the department activated traffic control devices that were installed at signaled intersections around the city. The department has also initiated an aggressive public education program funded by the Public Safety Tax of 1997. One purpose of the public education program is to reduce the demand for service by promoting a higher awareness of personal safety. As traffic congestion and the number of service calls increase, the addition of new fire stations will be necessary in areas where the response times are adversely impacted.

B.9 Mitigation Capabilities: Plans, Policies, and Studies

B.9.1 Boulder Valley Comprehensive Plan

First adopted in 1978, the Boulder Valley Comprehensive Plan (BVCP) is a joint plan between the City of Boulder and Boulder County providing shared land use decision making in the Boulder Valley. The plan sets a course for the future growth and development of the city and the lands just outside the city's boundaries. The plan is adopted by four bodies: the City of Boulder Planning Board, the City Council, the County Planning Commission, and the Board of County Commissioners. The City and County jointly adopted the 2015 Major Update to the BVCP in August of 2017, which is the seventh major update. The updated plan includes guidance for resilience and sustainability, diversity of housing including for middle incomes, achieving greater community benefits, arts and culture, and other refreshed policies. The following is a summary of the core components of this plan:

- The BVCP policies guide decisions about growth, development, preservation, environmental protection, economic development, affordable housing, culture and the arts, neighborhood character, and transportation. The policies also inform decisions about the manner in which services are provided, such as police, fire, emergency medical services, water utilities, flood control, and human services.
- The BVCP Land Use Designation and Area I, II, III Maps define the desired land use pattern for the Boulder Valley regarding location, type, and intensity of development.

Boulder Valley Comprehensive Plan Policies

The general policies and principles that relate to mitigating the impacts of natural hazards are detailed below. These policies provide overarching direction for planning, development, and programs in the Boulder Valley.

General Policies

- Sustainability as a unifying framework to meet environmental, economic and social goals.
- Environmental stewardship and climate action.

Urban Design Linkages Policies

- **Urban Open Lands (2.19):** Open lands within the fabric of the city provide recreational opportunities, transportation linkages, gathering places and density relief from the confines of the city as well as protection of the environmental quality of the urban environment. The city will promote and maintain an urban open lands system to serve the following functions: active and passive recreation, environmental protection, flood management, multimodal transportation, enhancement of community character and aesthetics.
- **Boulder Creek, Tributaries and Ditches as Important Urban Design Features (2.20):** Boulder Creek, its tributaries and irrigation ditches will serve as unifying urban design features for the community. The city and County will support the preservation or reclamation of the creek corridors for natural ecosystems, wildlife habitat, and cultural resources; for recreation and bicycle and pedestrian transportation; to provide flood management; to improve air and water quality; and to provide a contrast to urban development. Path development will be sensitive to the ecology, terrain, and privacy of adjacent residents and surroundings.

Community Conservation Policies

- **Preservation of Historic and Cultural Resources (2.24):** The city and county will identify, evaluate and protect buildings, structures, objects, districts, sites and natural features of historic, architectural, archaeological, or cultural significance with input from the community. The city and county will seek protection of significant resources through local designation when a proposal by the private sector is

subject to discretionary development review.

Preserve and Enhance Biodiversity and Native Ecosystems Policies

- **Natural Ecosystems (3.03):** The city and county will protect and restore significant native ecosystems on public and private lands through land use planning, development review, conservation easements, acquisition, and public land management practices. The protection and enhancement of biological diversity and habitat for federal endangered and threatened species and state, county, and local species of concern will be emphasized. Degraded habitat may be restored, and selected extirpated species may be reintroduced as a means of enhancing native flora and fauna in the Boulder Valley. (See policy 2.05 Open Space Preservation.)
- **Maintain and Restore Ecological Processes (3.05):** Recognizing that ecological processes, such as wildfire and flooding, are integral to the productivity and health of natural ecosystems, the city and county will work to ensure that, when appropriate precautions have been taken for human safety and welfare, ecological processes will be maintained or mimicked in management of natural lands.
- **Wetland Protection (3.06):** Natural and human-made wetlands are valuable for their ecological and, where appropriate, recreational functions, including their ability to enhance water and air quality. Wetlands also function as important wildlife habitat, especially for rare, threatened, and endangered plants and wildlife. The city and county will continue to develop programs to protect and enhance wetlands in the Boulder Valley. The city will strive for no net loss of wetlands by discouraging their destruction or requiring the creation and restoration of wetland in the rare cases when development is permitted and the filling of wetlands cannot be avoided.
- **Invasive Species Management (3.07):** The city and county will promote efforts, both public and private, to prevent the introduction or culture of invasive plant and animal species and seek to control their spread. High priority will be given to managing invasive species that have, or potentially could have, a substantial impact on city and county resources.

Protect and Enhance the Quality of the Urban Environment Policies

- **Urban Environmental Quality (3.10):** To the extent possible, the city and County will seek to protect the environmental quality of areas under significant human influence, such as agricultural and urban lands, and will balance human needs and public safety with environmental protection. The city will develop community-wide programs and standards for new development and redevelopment so that negative environmental impacts will be mitigated and overall environmental quality of the urban environment will not worsen and may improve.
- **Urban Forests (3.11):** The city will support, promote and, in some cases regulate, the protection of healthy existing trees and the long-term health and vitality of the urban forest in the planning and design of public improvements and private development. The city will encourage overall species diversity, native and low water demand tree species where appropriate.
- **Water Conservation (3.12):** The city and county will promote the conservation of water resources through water quality protection, public education, monitoring, and policies that promote appropriate water usage. The city will endeavor to minimize water waste and reduce water use during peak demand periods. New development and redevelopment designed to conserve water will be encouraged.

Protect Geologic Resources and Manage Natural Hazards Policies

- **Unique Geological Features (3.14):** Due to its location at the interface of the Great Plains and the Rocky Mountains, Boulder Valley has a number of significant or unique geological and paleontological features. The city and county will attempt to protect these features from alteration or destruction through a variety of means, such as public acquisition, land use planning and regulation, and density transfer within a particular site.
- **Hazardous Areas (3.16):** Hazardous areas that present danger to life and property from flood, forest

fire, steep slopes, erosion, unstable soil, subsidence, or similar geological development constraints will be delineated, and development in such areas will be carefully controlled or prohibited.

- **Wildfire Protection and Management (3.18):** The city and county will require on-site and off-site measures to guard against the danger of fire in developments adjacent to natural lands and consistent with forest and grassland ecosystem management principles and practices. Recognizing that fire is a widely accepted means of managing ecosystems, the city and county will integrate ecosystem management principles with wildfire hazard mitigation planning and urban design.
- **Preservation of Floodplains (3.19):** Undeveloped floodplains will be preserved or restored where possible through public land acquisition of high hazard properties, private land dedication, and multiple program coordination. Comprehensive planning and management of floodplain lands will promote the preservation of natural and beneficial functions of floodplains whenever possible.
- **Flood Management (3.20):** The city will protect the public and property from the devastating impacts of flooding in a timely and cost-effective manner while balancing community interests with public safety needs. The city will manage the potential for floods by implementing the following guiding principles: preserve floodplains, be prepared for floods, help people protect themselves from flood hazards, prevent unwise uses and adverse impacts in the floodplain, and seek to accommodate floods, not control them. The city will manage flood recovery by protecting critical facilities in the 500-year floodplain and implementing multi hazard mitigation and flood response and recovery plans.
- **Nonstructural Approach (3.21):** The city will seek to preserve the natural and beneficial functions of floodplains by emphasizing and balancing the use of nonstructural measures with structural mitigation. Where drainageway improvements are proposed, a nonstructural approach should be applied wherever possible to preserve the natural values of local waterways while balancing private property interests and associated cost to the city.
- **Protection of High Hazard Areas (3.22):** The city will prevent redevelopment of significantly flood-damaged properties in high hazard areas. The city will prepare a plan for property acquisition and other forms of mitigation for flood-damaged and undeveloped land in high hazard flood areas. Undeveloped high hazard flood areas will be retained in their natural state whenever possible. Compatible uses of riparian corridors, such as natural ecosystems, wildlife habitat and wetlands will be encouraged wherever appropriate. Trails or other open recreational facilities may be feasible in certain areas.
- **Larger Flooding Events (3.23):** The city recognizes that floods larger than the 100-year event will occur resulting in greater risks and flood damage that will affect even improvements constructed with standard flood protection measures. The city will seek to better understand the impact of larger flood events and consider necessary floodplain management strategies including the protection of critical facilities.

Protect and Improve Water and Air Quality Policies

- **Protection of Water Quality (3.24):** Water quality is a critical health, economic, and aesthetic concern. The city and county will protect, maintain, and improve water quality within the Boulder Creek watershed as a necessary component of existing ecosystems and as a critical resource for the human community. The city and county will seek to reduce point and nonpoint sources of pollutants protect and restore natural water system, and conserve water resources. Special emphasis will be placed on regional efforts such as watershed planning and priority will be placed on pollution prevention over treatment.
- **Water Resource Planning Acquisition (3.25):** Water resource planning efforts will be regional in nature and incorporate the goals of water quality protection, and surface and ground water conservation. The city will continue to obtain additional municipal water supplies to insure adequate drinking water, maintain instream flows and preserve agricultural uses. The city will seek to minimize

or mitigate the environmental, agricultural, and economic impacts to other jurisdictions in its acquisition of additional municipal water supply to further the goals of maintaining instream flows and preventing the permanent removal of land from agricultural production elsewhere in the state.

- **Drinking Water (3.26):** The city and county will continually seek to improve the quality of drinking water and work with other water and land use interests as needed to assure the integrity and quality of its drinking water supplies. The city and county will employ a system- wide approach to protect drinking water quality from sources waters to the water treatment plant and throughout the water distribution system.
- **Minimum Flow Program (3.27):** The city will pursue expansion of the existing in-stream flow program consistent with applicable law and manage stream flows to protect riparian and aquatic ecosystems within the Boulder Creek watershed.
- **Surface and Groundwater (3.28):** Surface and groundwater resources will be managed to prevent their degradation and to protect and enhance aquatic, wetland and riparian ecosystems. Land use and development planning and public land management practices will consider the interdependency of surface and groundwater and potential impacts to these resources from pollutant sources, changes in hydrology, and dewatering activities.
- **Wastewater (3.29):** The city will pursue sustainable wastewater treatment processes to achieve water quality improvements with greater energy efficiency and minimal chemical use. Pollution prevention and proactive maintenance strategies will be incorporated in wastewater collection system management. The county will discourage the installation of private on-site wastewater systems where municipal collection systems are available or where a potential pollution or health hazard would be created.
- **Protection of Air Quality (3.30):** Air quality is a critical health, economic, and aesthetic concern. The city and county will seek to reduce stationary and mobile source emissions of pollutants. Special emphasis will be placed on local and regional efforts to reduce pollutants, which cause adverse health effects and impair visibility.

Community Health

- **Safety (8.07):** The city will promote safety by fostering good neighborhood relations, building a sense of community pride and involvement, and promoting safe and attractive neighborhoods. The city and county will provide police, fire protection and emergency management services and preparedness education to ensure a safe community.

Fire Protection Considerations

The following seven philosophies provide general direction when establishing goals and objectives for fire protection in the City of Boulder:

- **Shared Responsibility for Fire Protection:** The city emphasizes private sector self- protection through code regulations and design incentives. Installation of automatic fire sprinkler systems is now required by ordinance for many uses.
- **Balance between Built-In Fire Protection and Public Fire Protection Service:** Municipal fire protection requires a balance between services provided by the city through fire stations, apparatus, and personnel and that provided by built-in automatic fire systems. Automatic systems offer a high degree of protection from fire originating in those protected properties. City-provided protection supplements the built-in systems and is designed to handle fires in nonprotected buildings, outside fires, medical emergencies, and non-fire emergencies and events.
- **Generalist Theory of Operation:** The Fire-Rescue Department believes that each fire apparatus should have diverse equipment and that the firefighters should be generalists rather than specialists. Every front-line fire truck has firefighting and rescue equipment along with emergency medical

supplies. Each firefighter must pass a comprehensive training program that supports that generalist approach. State of Colorado emergency medical technician certification is required, and every firefighter's training includes firefighting, hazardous materials response, and training for rescues involving vehicle accidents, fires, water, and ice incidents.

- **Basic Level of Emergency Medical Service:** The Fire-Rescue Department provides basic lifesaving services. The emergency medical care system in the city is a multi-tiered system involving Fire-Rescue, public/private partnership with a private ambulance service, and area hospitals, each providing a respectively higher degree of medical support.
- **Specialist Capabilities:** In addition to the general capabilities, the Fire-Rescue Department provides more specialized services:
 - The Dive Team responds to emergencies at the Boulder Reservoir, Boulder Creek, and other bodies of water within the city.
 - The Hazardous Materials Team responds to hazardous chemical releases, including chemical spills on manufacturing sites and during transport.
 - The Wildland Fire Team, with the help of additional seasonal wildland firefighters, responds to fires in open space and on the edges of the city, including the foothills.
 - The Public Education Team works with the department's fire-safety coordinator to provide public education in fire prevention.
- **Training:** The Fire-Rescue Department offers a wide variety of services to the citizens of Boulder. To maintain an adequate level of proficiency in many areas of emergency service, the department conducts extensive training in all service areas including firefighting, fire prevention, emergency medical care, hazardous materials, rescue, and public education. Joint training exercises are conducted with other county agencies.
- **Impact of Infill:** City fire stations are strategically located to meet the emergency response service standards. As population within service area increases, the number of calls for fire and emergency service will increase. When one fire response unit in a station exceeds 1,500 calls per year, additional apparatus and staffing needs to be provided.

The BVCP describes the following future activities and projects of the Fire-Rescue Department:

- **Anticipate and Prepare for Year-Round Wildfire Risk:** Consider new codes for wildland interface and residential construction practices. Continue to focus on wildland fire planning, mitigation and protection, including more coordination with other city departments and regional partnerships with the Sheriff's Office and service providers. Continue to replace seasonal wildland fire crews with full-time employees.
- **Implement a Plan to Identify Remaining Wood Roofs by the End of 2014:** One of the key wildfire mitigation policies enacted by the city is the passage of an ordinance banning wood roofs and requiring existing wood roofs to be replaced by 2014. The wood roof replacement ordinance has been implemented with nearly 100% compliance.
- **Apparatus Replacement:** The city is developing a planned fire truck replacement program.

B.10 Floodplain Regulations

The city has numerous codes and regulations in place governing floodplains. Some of the following descriptions are taken directly from the regulations and others are taken from existing plans and documents summarizing key regulatory elements of floodplain management including the 2004 Comprehensive Flood and Stormwater Utility Master Plan and Background Documents.

Significant work has been completed since that time and a major flood event in September 2013 has influenced the public's perceptions related to flooding. An updated Stormwater Master Plan was completed

in 2017. An update to the Comprehensive Flood Plan is currently ongoing to evaluate the following types of considerations:

- Climate change
- Floodplain, stormwater, water quality and groundwater regulations
- Floodplain mapping practices
- Prioritization of capital improvement projects

The Comprehensive Flood Plan update will include a public process to gather ideas and feedback from the community. The Mile High Flood Control District will also contribute funding and assistance.

B.10.1 Stormwater and Flood Management Utility (Boulder Revised Code—Title 11 Utilities and Airport: Chapter 5)

As previously discussed, the city has established and operates the Stormwater and Flood Management Utility pursuant to Title 11 Chapter 5 of the Boulder Revised Code. The purpose of this code section is to protect public health, safety, and welfare from damage associated with stormwater runoff and floods by requiring that property owners in the city pay for a share of the cost of the drainage facilities necessary to manage such stormwater and floods.

Also included in this section is the requirement to develop a master drainage plan for the city, based on engineering studies, that indicates the location of all city drainage facilities. The intent is to identify and alleviate present and future drainage and flooding problems in the city by means of presenting the general data and information essential in understanding the relationship between rainfall and storm runoff.

B.10.2 Regulations Governing the Floodplain (Boulder Revised Code—Title 9 Land Use Regulations: Chapter 3)

The city has had floodplain policies in place for over 50 years. During this time, the city has mapped 100-year floodplains to identify flood hazard areas and developed master plans to pursue mitigation of flood impacts.

The many critical environmental factors predominant in floodplains suggest that the approach to floodplain management should be oriented more toward preservation of floodplains and their beneficial environmental functions and less toward structural flood control measures. There is evidence that the city's floodplain policy is moving towards non-structural flood mitigation measures as much as possible.

The floodplain is considered to include all land areas subject to inundation by floodwaters. The adopted regulatory floodplain is based on a predicted flood which has a 1 percent chance of being equaled or exceeded in any given year. This area is commonly called the 100-year floodplain. Development within the floodplain must include flood protection measures that mitigate the risk of property loss or damage resulting from a 100-year flood. Within the floodplain, the following zones are defined:

- **Conveyance Zone:** Also known as the floodway, this includes all areas in the floodplain that would be required for the passage or conveyance of the entire flood flow (measured in cubic feet per second) resulting from the encroachment (or blocking out) of the floodplain from the edges, allowing no greater than a maximum six-inch increase in the depth of flood waters. (The conveyance zone or floodway is usually a narrowed corridor within the floodplain.) This conveyance zone definition is more restrictive than that used by FEMA (but consistent with the new State of Colorado regulations), which allows a maximum one-foot increase in floodwater depth.
- **High Hazard Zone:** All areas in the floodplain where floodwater depth would equal or exceed four feet (or where the product number of the floodwater velocity (in feet per second) multiplied by the floodwater depth (measured in feet) would equal or exceed four). Because of life safety concerns,

development in the high hazard zone is the most restricted.

- **Flood Fringe:** Those portions of the floodplain that are not in the conveyance zone or in the high hazard zone.

The city requires new development to be elevated or floodproofed 2 feet above the base, or 1% annual chance, flood event. This elevation is referred to as the 'flood protection elevation' in the Code. This concept of "freeboard" provides added protection for floods that exceed the base flood. Regulations that pertain to the entire floodplain include the following:

- A floodplain development permit must be acquired prior to any development within the floodplain
- Floodproofing of buildings or structures must meet city standards
- No hazardous materials may be stored at or below flood protection elevation with the exception of existing or replacement underground fuel storage tanks that are constructed to prevent discharge into floodwaters and that are adequately anchored against a flood
- Parking areas may not be located in areas where flood depths exceed 18 inches
- Rental properties in the floodplain must be posted with appropriate informational signs to warn tenants of flood hazards
- Manufactured housing must be elevated on a permanent foundation so that the lowest floor is above the flood protection elevation, and the structure must be sufficiently anchored
- New structures should be oriented with longitudinal axis parallel to the predicted direction of flow of floodwaters
- Existing structures will be rehabilitated to conform with regulations when substantially expanded, enlarged, modified, or improved
- New residential structures must be elevated so that the lowest floor is at or above the flood protection elevation
- New nonresidential structures must be floodproofed or have the lowest finished floor elevated above the flood protection elevation
- Any new structure must be adequately anchored, constructed of material resistant to flood damage, and designed and located so that electrical, heating and ventilation, plumbing, and air conditioning systems are not inundated
- Fully enclosed areas that are subject to flooding must also allow for automatic equalization of flood forces by providing for entry and exit of floodwaters

In addition to the regulations governing the floodplain, uses, structures, or developments in the conveyance zone that result in any rise in the elevation of the 100-year flood are prohibited. Proposed changes to the regulations in 2012 may allow an exception to this. Localized rises within flood channels or on specific properties may be permissible if all impacted property owners agree in writing to accept the rise and there is no adverse impact on any insurable structure or any other property. Construction of new, or expansion, enlargement, or substantial modification of existing structures intended for human occupancy in the high hazard zone, is not allowed.

Critical Facility and Mobile Population Ordinance

The city's Comprehensive Flood Study Master Plan (CFS MP, 2004) called for the development of 500-year protection standards for critical facilities in line with Federal guidance to ensure access to, use of and uninterrupted service for critical facilities such as fire and police stations, water and wastewater treatment facilities, utility infrastructure for water, sewer, gas, electric and communications, schools, day care and senior care facilities, hospitals, major roads and bridges, and hazardous material storage. The development of a critical facilities ordinance was identified as a mitigation action as part of the original development of this Multi-Hazard Mitigation Plan which was originally adopted in 2008. The action item outlined the need for the development and adoption of an ordinance that regulates new construction and improvements for

critical facilities to the 500-year flood level to protect these facilities from flood losses and damages that could render them unusable during times of need.

In 2013, the City Council approved the Critical Facilities and Lodging Facilities Ordinance that went into effect in March 2014. The new ordinance expanded the regulation of mobile populations and the critical facility categories of essential service, at-risk population and hazardous materials facilities to areas encompassed by the 500-year floodplain.

In the 500-year floodplain:

- Substantial improvements or modifications to, or development of, new at-risk population and essential service facilities will be constructed so that the lowest floor of the entire building is protected to the level of the 500-year flood elevation plus one foot. Smaller building additions will also protect the new construction to that level.
- Existing hazardous materials buildings with modifications requiring a floodplain development permit or a building permit which exceeds 25 percent of the market value of the existing structure are required to secure the hazardous material from flooding within a 10-year implementation window. New hazardous material facilities would be required to secure the hazardous materials from flooding as a condition of the permit.

In the 500- and 100-year floodplains, emergency management plans will be required for:

- Critical facilities and mobile population facilities requiring building permits for new construction, development requiring a floodplain development permit, the addition of any floor area, or any building permit for a substantial improvement and must be developed as a condition of the permit.
- All other existing critical facility and mobile population facilities will be required to develop emergency management plans within a 10-year implementation window from the ordinance adoption.

Emergency management plans will include either shelter in place or evacuation plans. The most appropriate method of protection will be defined, and evacuation routes or sheltering locations will be posted in the building, similar to requirements for fire response. This requirement will ensure that necessary flood education and protection information is available during times of flooding.

Critical facilities and mobile population facilities will continue to be regulated within the area encompassed by the 100-year floodplain, consistent with other types of buildings, with the exception of the requirement to develop an emergency management plan. Existing 100-year regulations will remain in place and a revision of the definition of hazardous materials is included in the recommended ordinance. Existing critical and mobile population facilities can continue to operate in their current capacity.

Floodplain Development Permits (Boulder Revised Code—Title 9 Land Use Regulations: Chapter 3)

The city requires that a floodplain development permit be acquired for any development within the floodplain. The City Manager, through the Public Works Department, is responsible for review and approval or denial of floodplain development permits and the development of conditions of approval where appropriate. Developments that propose a change in a watercourse must be referred to the Planning Board for recommendation. Permit approvals for development in the conveyance or high hazard zone do not become effective for fourteen days following issuance and are subject to Planning Board review, public noticing, and appeal procedures.

The city assesses fees for the processing of floodplain development permits, variances, and flood map revisions. The city also coordinates its floodplain regulations with several other agencies, each of which regulate to the 100-year floodplain standard. These agencies include FEMA, the Colorado Water Conservation Board, the MHFD, and Boulder County.

Floodplain development permit applications are reviewed by city staff within the Public Works Department, who provide public notice of the application if high hazard or conveyance zones are affected and make a recommendation of application approval, with or without conditions, or denial. Concerns considered in the review of a floodplain development permit application include compliance with regulations governing floodplains, conveyance zones, and high hazard areas; effects on drainage efficiency or capacity; whether the project will have an adverse environmental effect on the watercourse, including banks and streamside vegetation; effect of the project on adjacent, upstream, and downstream properties; the relationship of the project to the BVCP and applicable floodplain management programs; and whether the cumulative effects of the project with other existing and anticipated uses will increase flood heights.

Design and Construction Standards (Boulder Revised Code—Title 9 Land Use Regulations: Chapter 9)

The city's Design and Construction Standards (DCS) regulate the design and construction of public infrastructure, improvements, and landscaping within the city's public rights-of-way and public easements. The DCS requirements for stormwater management are primarily based on the MHFD drainage criteria manuals. The updated DCS was adopted by City Council on October 17, 2000, with the passage of City of Boulder Ordinance No. 7088.

Stormwater issues related to land development and redevelopment are addressed through a variety of review processes coordinated by the Planning and Development Services workgroup. Most development and redevelopment projects are required to submit a stormwater report and plan prepared by a licensed professional engineer. The report and plan are required to address how the identified project will maintain historical runoff rates and mitigate water quality impacts. On-site detention storage is required for all developments other than individual single-family lots that are not part of a larger development where the runoff coefficient for the site is increased.

B.11 Natural Resource & Historic Preservation Protection Considerations

The City of Boulder has many regulations to protect the valuable resources within Boulder Valley. Taken directly from the regulations, highlights of these provisions are provided below.

B.11.1 Streams, Wetlands and Water Body Protection (Boulder Revised Code—Title 9 Land Use Regulations: Chapter 3)

The City of Boulder has adopted a streams, wetlands and water body protection ordinance to preserve, protect, and enhance streams, wetlands and water bodies by discouraging development activities in streams, wetlands, water bodies and adjacent areas. The ordinance establishes a goal of no net loss of wetland acreage and function by regulating activities in and around streams, wetlands and water bodies. These rules apply to all streams, wetlands and water bodies that are mapped within Boulder's city limits as well as all streams, wetlands and water bodies on city- owned land and all city activities affecting streams, wetlands or water bodies regardless of location.

City streams, wetlands and water body permits are required for projects that affect streams, wetlands, water bodies and associated buffer zones surrounding streams, wetlands and water bodies. The surrounding buffer zones vary in size based upon the functional classification of the stream, wetland and water body. Low functioning streams, wetlands and water bodies have a 25- foot outer buffer. High functioning streams, wetlands and water bodies have a 50-foot buffer area which consists of a 25-foot inner buffer and a 25-foot outer buffer. The regulations and permitting requirements are most restrictive for activities that directly impact streams, wetlands and water bodies and are the least restrictive for activities that only impact outer buffer areas. Maintenance of an existing public or private road, structure, or facility, including drainage facilities, water conveyance structures, dams, fences, or trails are permissible subject to the requirement of

best management practices as identified in city Wetlands Protection Program Best Management Practices (May 1995). The maintenance activities may not materially change or enlarge any existing facility, structure, or road.

B.11.2 Protection of Trees and Plants (Boulder Revised Code—Title 6 Health, Safety, and Sanitation: Chapter 6)

The purpose of this chapter is to protect the public health, safety, and welfare by prescribing requirements for the protection of trees and plants within the city, including, without limitation, trees, shrubs, lawns, and all other landscaping. The City Council finds that all trees, plants, and other landscaping, located, standing, or growing within or upon city property, including, without limitation, any city-owned or city-controlled street, alley, rights-of-way, or other public place or city or mountain park, recreation area, or open space, belong to the city and are a community asset comprising a part of the public infrastructure. The City Council finds that the requirements of this chapter are necessary to ensure the continued protection, maintenance, replacement, and management of city-owned trees, plants, and other landscaping.

B.12 Building and Construction Considerations

The City of Boulder has adopted the 2018 International Code Council (ICC) codes, with local amendments through March 3, 2020. The adopted building codes are:

- 2018 International Building Code
- 2018 International Residential Code
- 2018 International Fire Code
- 2018 International Mechanical Code
- 2018 International Plumbing Code
- 2018 International Fuel Gas Code
- 2020 National Electrical Code
- 2018 International Property Maintenance Code
- 2018 International Existing Building Code
- 2020 City of Boulder Energy Conservation Code
- 2018 International Wildland-Urban Interface Code

B.12.1 Building Code (Boulder Revised Code—Title 10 Structures: Chapter 5)

The intent of the Building Code is to protect the public health and safety by regulating the construction, alteration, repair, wrecking, and moving of structures in the city. The City Council adopted the 2006 edition of the International Building Code and the 1997 edition of the Uniform Code for the Abatement of Dangerous Buildings with certain amendments and deletions found to be in the best interests of the residents of the city.

Elements of the International Building Code (IBC) relevant to natural hazards mitigation are described below.

Roofing (10-5-2(u))

All roof assemblies and roof coverings required to be listed by this section shall be tested in accordance with ASTM Standard E 108 or UL Standard 790. Class A roofs and the exceptions noted in IBC 1505.3 for Class B roofs as described in IBC chapter 15 are the only roof assemblies and roof coverings allowed to be installed on any new or existing building within the City of Boulder. Wood shakes, wood shingles, and wood roof covering materials are prohibited except as provided in Section 10-5-5, "Wood Roof Covering Materials Prohibited," for certain minimal repairs.

Wood Roof Covering Materials Prohibited (10-5-5)

No person shall install or cause to be installed any wood roof covering materials, including, without limitation, wood shakes or wood shingles. This prohibition includes wood roof covering materials with fire retardant treatments of any kind.

No person owning a building with wood roof covering materials shall fail to remove or cause to be removed from the building all wood roof covering materials before January 1, 2014, and to replace the removed roofing with approved roof covering materials that conform to the IBC as adopted, and no person shall thereafter take possession or ownership of a building with wood roof covering materials.

"Wood roof covering material" means an exterior surface material used as a top covering and made of wood. "Wood," for the purposes of this definition, means any natural or composite material containing at least fifty percent wood by volume.

Snow Load (10-5-2(v))

The minimum roof snow load shall be thirty pounds per square foot, but the design roof load shall not be less than that determined by IBC Section 1607.

Wind Velocities (10-5-2(w))

In IBC Table 1609.3.1, the three-second gust wind speed for the city shall be 110 miles per hour.

B.12.2 Residential Building Code (Boulder Revised Code—Title 10 Structures: Chapter 5.5)

The purpose of this chapter is to protect the public health and safety by regulating the construction, alteration, repair, wrecking, and moving of residential structures in the city. The City Council adopted the 2012 edition of the International Residential Code with certain amendments found to be in the best interests of the city.

Elements of the International Residential Code (IRC) relevant to natural hazards mitigation are described below.

Climatic and Geographic Design (10-5.5-2(e))

The climatic and geographic design criteria applicable to IRC Table R301.2.1 are as follows:

- Roof snow load = thirty pounds per square foot
- Three second wind gust velocity = 110 miles per hour
- Seismic design category = B
- Weathering = severe
- Frost line depth = 32 inches
- Termite = slight
- Decay = none to slight
- Winter design temperature = 2 degrees Fahrenheit
- Ice shield underlayment = No

The building code does not specifically spell out seismic criteria for non-residential structures, specifically critical facilities. The design of critical facilities is based on criteria stated in the International Building Code and ASCE 7 Design Loads for Buildings and Other structures.

Roof Covering Materials (10-5.5-2(g))

All roof covering materials shall be listed as Class A or B as tested in accordance with UL Standard 790 or

ASTM Standard E 108. Roof assemblies with covering of brick, masonry, slate, clay, or concrete roof tile; exposed concrete roof deck; ferrous or copper shingles or sheets; and metal sheets and shingles shall be considered Class A roof coverings.

Wood Shingles (10-5.5-2(h))

Wood shakes, wood shingles, and wood roof covering materials are prohibited except as provided in Section 10-5-5, "Wood Roof Covering Materials Prohibited"

Wood Shakes (10-5.5-2(i))

Wood shakes, wood shingles, and wood roof covering materials are prohibited except as provided in Section 10-5-5, "Wood Roof Covering Materials Prohibited" (see above).

B.12.3 Fire Prevention Code (Boulder Revised Code—Title 10 Structures: Chapter 8)

The purpose of this chapter is to protect public health and safety by regulating the use, condition, construction, alteration, and repair of property, structures, and occupancies in the city in order to prevent the ignition and spread of fire and risk of harm to persons or property from fire and other causes. The City Council adopted the 2012 edition of the International Fire Code with certain amendments, additions, and deletions found to be in the best interests of the city.

Elements of the International Fire Code amended by the city relevant to natural hazards mitigation are described below.

Accessible Private Drive (10-8-2(b.9))

"Accessible private drive" means a 20-foot unobstructed clear width with a 12-foot hard, all- weather, drivable surface that can support 40 tons on 10 wheels and has an SU 30 turning radius for the fire department's fire apparatus.

Open Burning and Recreational Fires (10-8-2(b.10))

No person shall kindle or maintain outside of a habitable building any bonfire or burn or permit to be burned any trash, paper, rubbish, wastepaper, wood, weeds, brush, plants, or other combustible or flammable material anywhere within the city limits or anywhere on city property outside of the city limits, except when:

- The burning is in the course of an agricultural operation in the growing of crops as a gainful occupation and presents no fire hazard to other property in the vicinity;
- The burning is a smokeless flare, or a safety flare used to indicate some danger to the public;
- The burning is a training fire conducted by the fire department or is a training fire conducted by another fire department or privately for industrial or commercial fire training purposes and approved in writing by the fire chief; or
- The burning is solely for fuels mitigation to alleviate wildland fire potential, or for weed abatement to assist restoration of native plants.

Mobile or portable type outdoor fireplaces are prohibited within the city limits or anywhere on city property outside of the city limits.

B.12.4 Historic Preservation (Boulder Revised Code—Title 9 Land Use Regulations: Chapter 11)

The purpose of this chapter is to promote the public health, safety, and welfare by protecting, enhancing, and perpetuating buildings, sites, and areas of the city reminiscent of past eras, events, and persons

important in local, state, or national history or providing significant examples of architectural styles of the past. It is also the purpose of this chapter to develop and maintain appropriate settings and environments for such buildings, sites, and areas to enhance property values, stabilize neighborhoods, promote tourist trade and interest, and foster knowledge of the city's living heritage.

Historic Preservation Program and Ordinance

In the early 1970s, reacting to the demolition of a number of important buildings, concerned Boulder citizens initiated a grassroots effort to protect the city's historic resources. The resulting Boulder Historic Preservation Ordinance was the first such document in Colorado with the authority to designate and protect historic, architectural, or cultural resources considered valuable to the community as a whole. Many excellent examples of architecture from the turn-of-the twentieth century survive in these neighborhoods, in part, as a result of the city's adoption of the ordinance in 1974.

The purpose of this code is to protect, enhance, and perpetuate buildings, sites, and areas of the city reminiscent of past eras, events, and persons important in local, state, or national history or to provide significant examples of architectural styles of the past. The purpose of the code is also to develop and maintain appropriate settings and environments for such buildings, sites, and areas to enhance property values, stabilize neighborhoods, promote tourist trade and interest, and foster knowledge of the city's living heritage.

The code established the Landmarks Board charged with the responsibility of carrying out its provisions and goals. The code has four areas of focus:

- Designation of landmarks and historic districts
- Review and approval authority of proposed alterations to these buildings and to new construction or proposed demolition in these areas
- Review of applications for demolition or moving of non-landmarked buildings over 50 years old to prevent the loss of buildings that may have historical or architectural significance and to provide the time necessary to initiate designation or to consider alternatives for the building
- Requirement of prior approval of exterior changes to buildings or sites or proposed demolitions to preserve the historic integrity of individual landmarks and properties within historic districts

Urban Service Criteria and Standards

Also included in the BVCP, the Urban Service Standards set the benchmark for providing a full range of urban services in the Boulder Valley. These standards are intended to be minimum requirements or thresholds for facilities and services that must be delivered to existing or new urban development to be considered adequate. Included in the standards are criteria for stormwater and flood management as detailed below:

- Responsiveness to public objectives
 - Have personnel on call 24 hours per day for stormwater and flood emergencies
- Sufficiency of financing
 - Have revenue sources that are guaranteed so that revenues are available for stormwater and flood management related projects, materials, equipment, facilities, and personnel
 - Be organized to request and receive Urban Drainage and Flood Control District, state, and federal funds, if available, for projects, facilities, and equipment
- Operational effectiveness
 - Use annual budget for personnel, equipment, projects, facilities, and materials

- Meet standards as exemplified by the Urban Drainage and Flood Control District
- Adopt regulations consistent with FEMA
- The following are standards for stormwater and flood management criteria for new urban development within the Boulder Valley:
 - ◆ Runoff analysis will be based upon proposed land use and will take into consideration all contributing runoff from areas outside the study area
 - ◆ Storm runoff will be determined by the Rational Method or the Colorado Urban Hydrograph Procedure
 - ◆ All local collection systems shall be designed to transport the following storm frequency:
 - Single-family residential—two-year storm
 - All other areas—five-year storm
 - ◆ The major drainageway system will be designed to transport the 100-year event or a modified standard in an approved plan
 - ◆ Storm runoff quantity greater than the “historical” amount will not be discharged into irrigation ditches without the approval of the flood regulatory authority or the appropriate irrigation ditch company
 - ◆ The type of pipe to be installed will be determined by the flood regulatory authority and will be based upon flows, site conditions, and maintenance requirements
 - ◆ All new urban development in the Boulder service area, which will be annexed, will be required to meet the intent of the adopted City of Boulder floodplain regulations.
 - ◆ Erosion and sedimentation control will be exercised
 - ◆ Detention storage requirements will be reviewed by the flood regulatory authority
- Proficiency of personnel
 - All flood control maintenance crews will be staffed by personnel trained and capable of operating the equipment necessary to maintain the stormwater and flood management system
- Location and adequacy of equipment and facilities
 - Provide essential equipment and vehicles for stormwater and flood management maintenance activities

B.13 City of Boulder Mitigation Action Plan

The City of Boulder developed mitigation goals and objectives in 2018 which differ from the proposed goals for the entire county, but nevertheless seek to reduce the community’s risks and vulnerabilities in a similar manner. The goals were defined as broad-based public policy statements that:

- Represent basic desires of the community.
- Encompass all aspects of community, public and private.
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome.
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

The City of Boulder’s goals are as follows:

Goal 1: Increase Community Awareness of Boulder’s Vulnerability to Natural Hazards

- Objective 1.1: Inform and educate the community about the types of hazards the City of Boulder is exposed to, where they occur, and recommended responses.

Goal 2: Reduce Vulnerability of People, Property, and the Environment to Natural Hazards

- Objective 2.1: Reduce impacts of hazards on residents and vulnerable populations in the community.
- Objective 2.2: Reduce impacts to critical facilities and services.
- Objective 2.3: Reduce impacts to existing buildings and infrastructure to the extent possible
- Objective 2.4: Reduce impacts to future development and infrastructure to the extent possible
- Objective 2.5: Reduce impacts to the city's natural and historic resources.
- Objective 2.6: Reduce impacts to public health.

Goal 3: Increase Interagency Capabilities and Coordination to Reduce the Impacts of Natural Hazards and Increase Community Resiliency

- Objective 3.1: Continue to collaborate and coordinate with other agencies on planning, projects, hazard response, and funding opportunities.
- Objective 3.2: Minimize economic impacts of natural hazards

B.13.1 Status on Previous Mitigation Actions

The City of Boulder has been successfully implementing mitigation actions which were identified in their previous 2018 Local Hazard Mitigation Plan. The 2018 mitigation strategy for Boulder contained 25 actions, 21 of which been carried forward into this 2022 update and are detailed in Section B.13.2 below. Two of the 2018 actions has been completed and two have been deleted. Three new actions were developed during the 2021-2022 planning effort and are detailed in the next section, giving a total of 24 mitigation actions for the 2022 plan update.

Table B-19 2018 Mitigation Action Statuses

Mitigation Action Title	Hazard	2022 Status
Develop updated city continuity of operations and emergency evacuation plans	All Hazards	Completed
Develop flood mitigation plans following mapping updates	Flood	Completed
Implement a community assisted floodproofing program focusing on critical facilities	Flood	Deleted
Review city landscape codes for drought	Drought	Deleted

B.13.2 City of Boulder 2022 Mitigation Actions

Name of Action: Water System Resilience – Improvements to Water Treatment Reliability and Redundancy

Project Description/Background:

The City owns and operates two potable water treatment facilities that supply water to customers. These are the Betasso Water Treatment Facility (BWTF) rated at 40 million gallons per day (mgd) and the 63rd Water Treatment Facility (63rd WTF) rated at 16 mgd. Initial construction of the 63rdWTF took place in 1969 to provide critical backup supply during times when BWTF is offline for repairs or emergencies. In addition, the facility is required for use of critical water rights from the western slope. Since the 63rdWTF construction, various expansion and improvement projects have been constructed to maintain service and the ability to meet more stringent regulations. Overall, the facility has provided high-level service to City water customers

but is aging and needs repairs. The focus of this project is twofold: 1) replacing major power supply and electrical components on the campus and to improve their reliability and redundancy and 2) Repair and replacement (R&R) of the existing treatment process on campus called the high service pump station (HSPS). The HSPS was built in 1969 and is the sole source of supply to the distribution system from the 63rd WTF. Minor repairs have been implemented over time, but the station is now at its end of useful life. The project also contemplates converting the existing power supply of the station to a lower voltage that is less hazardous and more easily maintained.

Other Alternatives: No action.

Hazards Mitigated: Earthquake, Drought, Severe Winter Storm, Tornado, Windstorm

Goal(s) Addressed: 2

Responsible Office: City of Boulder Public Works – Utilities Department staff.

Priority (High, Medium, Low): High

Cost Estimate: \$24 to \$31M

Benefits (Avoided Losses): Switching the power supply to lower voltage is less hazardous and is easier to maintain. Adding redundancy to critical treated water pumping system, enhancing overall system reliability, drought resiliency, and level of service.

Potential Funding: City of Boulder

Schedule: Anticipated completion end of 2024

Status: New Action in 2022

Name of Action: Treated Water Transmission System Resilience and Reliability

Project Description/Background: The City's vision of the Boulder Valley Comprehensive Plan (BVCP) is in part met through proactive planning, operation, maintenance, and improvement of \$2B in treated water infrastructure. A vital subset of this valuable community asset is the water transmission system consisting of storage tanks, transfer pumping & hydropower facilities, and large-diameter pipe that conveys water regionally throughout the City. Proactive planning for these assets incorporates several upcoming projects over the next 6-year horizon, the first of which is already in the engineering design phase for pipelines along 63rd Street north of Boulder Creek and along Broadway between Table Mesa and Baseline. Storage tank projects contemplate major rehabilitation and additional storage tank redundancy for increased resiliency during planned outages or emergency situations.

Other Alternatives: No action.

Hazards Mitigated: Earthquake, Drought, Severe Winter Storm, Tornado, Windstorm

Goal(s) Addressed: 2

Responsible Office: City of Boulder Public Works – Utilities Department staff.

Priority (High, Medium, Low): High

Cost Estimate: \$25 to \$75M

Benefits (Avoided Losses): These critical projects will proactively address aging infrastructure thereby preventing service interruptions and will also upsize piping to improve level of service to customers during normal and emergency uses such as fires or other emergency situations.

Potential Funding: City of Boulder

Schedule: Anticipated completion end of 2030

Status: New Action in 2022

Name of Action: Undergrounding Electric Utilities

Project Description/Background: Many of the electric utility lines in the city are located above ground. The goal of this work is to develop a clear and concise allocation of undergrounding funds and approve criteria associated with their use that allows for the undergrounding of primary circuits, neighborhood circuits, and reserves funding to be leveraged in collaboration with city projects to stretch funds further.

Staff is now working with Xcel Energy to draft evaluation criteria and to develop high-level cost estimates to inform the undergrounding plan. The first project that has been identified for potential undergrounding is the North Broadway Reconstruction Project. Xcel Energy is currently developing the undergrounding design and cost estimate for this work.

Other Alternatives: None

Hazards Mitigated: Earthquake, Severe Winter Storm, Tornado, Windstorm

Goal(s) Addressed: 2, 3

Responsible Office: City of Boulder, Climate Initiatives Department

Priority (High, Medium, Low): Medium

Cost Estimate: \$16 Million (initial project, future investment opportunities to fund future phases) Complete project exceeds \$500 Million

Benefits (Avoided Losses): Improves reliability of electric utility to users and enhances resilience of the electric utility system.

Potential Funding: Staff time and city funds, HMGP and BRIC grants

Schedule: Initiate in 2021, first project(s) by 2026 and on-going projects beyond 2026

Status: New in 2021

Name of Action: Enhance Critical Facility Data

Project Description/Background: The city's critical facility data is collected and organized in accordance with the critical facility ordinance. The data is not a comprehensive list of all critical facilities and infrastructure as established in FEMA guidelines. The data needs to be regularly updated and maintained to facilitate future updates to this plan and for use in other applications

Other Alternatives: None

Hazards Mitigated: All hazards

Goal(s) Addressed: 1, 3

Responsible Office: Risk Management

Priority (High, Medium, Low): Low

Cost Estimate: \$10,000 initial+ \$3,000- \$5,000/year update

Benefits (Avoided Losses): Map based critical facility data (in addition to facilities designated by city code) would allow the City risk management office to more quickly and effectively able to track and update critical facilities and develop more accurate representations of risk.

Potential Funding: Staff time and city funds

Schedule: Annual updates for current critical facilities data and as funding becomes available for enhancing data.

Status: Continuing - Annual Implementation

Name of Action: Emergency Back-Up Power

Project Description/Background: Two of the city's critical and essential facilities do not have back-up power - the Municipal Building and the Main Library. The Municipal Building houses the City Manager Office, the City Attorney Office, Central Records, and City Council Chambers. The Main Library is a mass gathering location and provides key services and is an information hub for many Boulder citizens. The Main Library also houses the city's television services and studio. Both facilities lack emergency back-up power. Note, both facilities are located in the 100-year floodplain and surrounded by the high hazard and conveyance zones. Generators would likely have to be placed on the flat roofs.

Other Alternatives: A quick connection for a large generator could provide a less expensive option for extended outages along with small UPS systems to key systems.

Hazards Mitigated: All hazards

Goal(s) Addressed: 2

Responsible Office: Facilities and Asset Management

Priority (High, Medium, Low): High

Cost Estimate: \$400,000 per building for generator; \$75,000 per building for quick connect

Benefits (Avoided Losses): Key staff productivity losses due to power outages; loss of public access television; disruptions to City Council meetings, Planning Board meetings and other board and committee meetings held both at the Municipal Building and Main Library

Potential Funding: Compete with other needs in city's new General Fund Capital Fund; currently \$400M identified as unfunded in city needs with a capital fund of \$3.7 million in 2018

Schedule: 2022-2023

Status: Continuing – Not Started

Name of Action: Hazard Education

Project Description/Background: Considering the physical, social, and economic challenges of the 21st century, communities need to become more resilient. Resilient individuals, communities and cities are resourceful, adaptable, flexible, inclusive, and integrated. Being resilient includes being aware of vulnerabilities, preparing for the future and having the ability to act quickly in an emergency. Being resilient also means having a strong network of people to reach out to and rely on. This project would promote hazard education through a collaborative network of community leaders, organizations, and government departments providing outreach and education to the public on resilience individually and at a community level. The City's participation in the CRS includes annual flood hazard awareness activities that can be leveraged into this multi-hazard hazard education project.

The Disaster Preparedness Guide is now available in Spanish and is distributed during community preparedness programs.

Other Alternatives: CERT programs and traditional push/pull models

Hazards Mitigated: All Hazards

Goal(s) Addressed: 1

Responsible Office: Office of Emergency Management, Fire, Police

Priority (High, Medium, Low): Medium

Cost Estimate: \$10,000

Benefits (Avoided Losses): Increase in personal preparedness and community resiliency to decrease reliance of governmental assistance during disasters

Potential Funding: City funds, staff time

Schedule: Annual Implementation

Status: Continuing - In Progress.

Name of Action: Increase Individual Warning Systems Capacity Available

Project Description/Background: All areas of city are not covered by sirens, which primarily are intended to warn people in the outdoors (see separate project to enhance outdoor sirens). This project would create a wireless mesh network to increase resiliency to outages and enhance warning systems capacity. In 2019 Boulder OEM achieved FEMA- Integrated Public Alert Warning System (IPAWS) access. This capability permits Boulder OEM and Police and Fire Dispatch to launch public warnings using NOAA Weather Radio, Emergency Alert System (EAS) and Wireless Emergency Alerts (WEA). The system will be live in late 2019 or early 2020 upon final approval by FEMA once OEM completes the functional test of the system.

In 2019 Boulder OEM increased capacity to provide public messaging, alerting, and warning with non-English speaking residents. Translation services are now available to the EOC call center, evacuation door hangers created and distributed to the Police Department.

Other Alternatives: None

Hazards Mitigated: All hazards

Goal(s) Addressed: 1

Responsible Office: Boulder Planning

Priority (High, Medium, Low): High

Cost Estimate: \$100,000 initial estimate

Benefits (Avoided Losses): Increase resiliency of wireless network

Potential Funding: Public/Private Partnership

Schedule: 2022-2024

Status: Continuing – Not Started

Name of Action: Outreach Efforts Associated with BoCo911Alert.com

Project Description/Background: Now that many families had stopped using telephone land lines efforts need to be made to ensure that emergency notifications can be sent to people potentially impacted by emergency situations. Public safety agencies throughout Boulder County are switching to a new emergency notification system which is accessible at BoCo911Alert.com. This system will allow residents of the county and all cities within the county to be notified of an emergency situation in a variety of ways, including on their cell phone, home and work phones and by text messaging and e-mail. This project would include

outreach efforts to raise awareness about BoCO911Alert.com to increase the number of subscribers.

Other Alternatives: Emphasize radio or television communications instead.

Hazards Mitigated: All hazards

Goal(s) Addressed: 1

Responsible Office: Boulder OEM

Priority (High, Medium, Low): High

Cost Estimate: \$10,000

Benefits (Avoided Losses): Improved ability to notify the public of emergency situations. Potential for avoided deaths and injuries due to early warning notification.

Potential Funding: City funds

Schedule: 2022-2024

Status: Continuing - Not Started

Name of Action: Prepare pre-disaster forms to facilitate public infrastructure mitigation through the FEMA public assistance program during post-disaster recovery

Project Description/Background: Following a disaster there is a 60 day filing time to complete project sheets to qualify for funding under the Public Assistance (PA) program within a Stafford Act (Presidential Disaster) Declaration. Having the critical infrastructure project sheets completed in advance and updated yearly ensures that the City of Boulder will qualify to the maximum benefit under a disaster declaration within reimbursement cost share guidelines. In addition, if mitigation projects are included in the assessment and written into the project sheets it will increase opportunities to apply mitigation projects into the recovery process. This project would entail assembling, in a pre-disaster environment, data for PA forms for infrastructure that would be expected to be impacted by; flood, fire, or technological hazards.

Boulder OEM researched in 2020 which forms would be helpful to pre-populate to make Public Assistance funds easier to access following a disaster.

Other Alternatives: Wait until the disaster and hire consultants to complete the arduous process and hopefully complete the projects within the time frame allotted and to the detail required to maximize benefits.

Hazards Mitigated: Flood, wildfire, severe winter storm, tornado, windstorm

Goal(s) Addressed: 2, 3

Responsible Office: Boulder Office of Emergency Management

Priority (High, Medium, Low): Low

Cost Estimate: Staff time to create and maintain the project sheets and printing of project sheet plan.

Benefits (Avoided Losses): Having the critical infrastructure project sheets completed in advance and updated yearly ensures that the City of Boulder will qualify to the maximum benefit under a disaster declaration within reimbursement cost share guidelines.

Potential Funding: City staff time; FEMA PA funding following Presidential Disaster Declaration with 25% local cost share.

Schedule: 2022-2024 as staff time becomes available

Status: Continuing – In Progress

Name of Action: Increase Public Awareness of Flood Risk and Safety Measures

Project Description/Background: Increased public awareness of hazards in the city and county is a goal of this plan and a continuing action of the city and County of Boulder Office of Emergency Management. This project would continue and supplement existing outreach efforts with additional web-based information on hazards and personal preparedness measures.

The Boulder OEM launched a redesigned website in August 2010, which includes warning system information, hazard information, personal preparedness information and resources, and a downloadable emergency preparedness guide. In addition, Boulder OEM introduced a Facebook page, Twitter account and RSS feeds to increase outreach efforts and information flow to the public during an emergency.

The City of Boulder Public Works Department provides flood hazard information and safety preparedness updates on the website: www.boulderfloodinfo.net. Each year, city staff distributes flood awareness materials, organizes outreach booths, and presents flood information to community members from various sectors. Activities can include online media, social media, print advertisements, presentations, education programs or utility bill inserts. The materials and activities include important flood safety messages and points users to the city website which includes more detailed information about flood plain maps and safety measures that should be taken pre, post and during a flood event. Each year, efforts have reached more than 100,000 public members.

Other Alternatives: No action

Hazards Mitigated: Flooding

Goal(s) Addressed: 1

Responsible Office: Boulder Office of Emergency Management; City of Boulder Public Works Department

Priority (High, Medium, Low): High

Cost Estimate: Limited direct financial costs through use of existing staff time

Benefits (Avoided Losses): Benefits include reduced impacts to life and property as a result of a more hazard awareness and better prepared citizenry. A better prepared public will reduce the impacts on emergency services during hazard events.

Potential Funding: Grants (state), in-kind staff time

Schedule: Annual Implementation

Status: Continue-in progress.

Name of Action: Enhance Outdoor Emergency Warning System - add sirens to NW, East & SE areas of the City

Project Description/Background: There are 11 outdoor warning sirens operating in the City of Boulder currently. The sirens should be evaluated for all risk placement to ensure coverage serves the identified hazard message capability of the system. For example, the sirens in sector 5 may need to be moved further west to increase coverage capability. The movement may require additional sirens towards the core of the city in the Northern corridor. In addition, to cover the entire city in outdoor warning sirens it possibly could require 6 additional sirens. Yearly verification of the functional status of all sirens is performed and the sirens are remotely tested once a month from April to August with silent testing weekly.

Other Alternatives: Outdoor emergency warning systems typically involve audible mechanisms that may

be heard over large areas. Fixed-location warning sirens are generally the most efficient systems for such coverage. Other alternatives for emergency warning could be human-intervention methods, such as loudspeaker systems affixed to moving vehicles and individual door-to-door contacts by emergency personnel. These human-intervention alternatives require time consuming dissemination and place people in harm's way during critical emergencies. Other alternatives include radio and telephone notifications that may not be effective for notifying larger area and outdoor recipients. No other alternative appears to offer an advantage for outdoor warning over an audible siren system.

Hazards Mitigated: All hazards

Goal(s) Addressed: 1

Responsible Office: Boulder Office of Emergency Management, City of Boulder, Boulder Fire, Boulder Public Works

Priority (High, Medium, Low): Low

Cost Estimate: Estimated \$45,000 per siren unit with a recommendation of at least 6 additional sirens citywide, total initial cost: \$250,000

Benefits (Avoided Losses): Outdoor emergency warning sirens offer a notification system that can be implemented immediately by emergency operations in time of need. Warning sirens are recognized by the general population as a standard and accepted method of emergency notification. While multiple methods of emergency notification, including pagers, radio, television, reverse 911 calls, Internet, and cell phone listserv messaging, should be employed to reach all populations in the community, the outdoor emergency warning siren system offers the first line of defense in emergency preparedness. Having complete coverage ensures a standard of minimum alerting capability throughout the city.

Potential Funding: City of Boulder

Schedule: 2022-2024 with specific dates to be determined based on policy decision by city

Status: Continue-in progress. As of early 2022 a siren inventory has been verified to determine coverage gaps and determined approximate six locations where sirens should be installed; three sirens west of Broadway (one west of Lee Hill Road and Broadway, one west of Linden Avenue and Broadway, and one in the vicinity of Boulder Community Hospital); the neighborhood southeast of the intersection of Baseline Road and Foothills Parkway (near the East Boulder Recreation Center or Manhattan Middle School); the area around 55th Street and Valmont Road; and also the city properties in Gunbarrel, as there are no nearby sirens in that area at all. Sirens are intended for outdoor warning, so they don't necessarily need to be placed only in neighborhoods but anywhere the active Boulder citizens play outdoors.

Name of Action: Maintain Urban Tree Canopy

Project Description/Background: Boulder Forestry continues to implement portions of the Urban Forest Strategic Plan on an annual basis. The city LiDAR data is expected Q4, 2021 and will be used for the tree planting prioritization and diversity project to determine the change in urban tree canopy since 2013 and prioritize tree planting based upon urban heat island areas, stormwater runoff and equity variables. In 2019-2020, Boulder Forestry planted 836 trees on public property; 1669 public trees were removed however due to pest issues, weather related events and safety related concerns and many more on private property and through both city and private construction projects. A major snowstorm on 9/9/2020 necessitated emergency storm damage pruning to over 2500 public trees and a city-wide branch pickup collecting over 52,500 cubic yards of branches; total cost for the event exceeded \$800,000. Tree Trust activities and the tree sale and giveaway were canceled in 2020 and for 2021 due to COVID

Other Alternatives: A tree planting prioritization project using updated LiDAR data is planned for 2020 to

determine the change in UTC since 2013 and prioritize tree planting based upon urban heat island areas, stormwater runoff and other variables. Since the 2013 emerald ash borer detection, Boulder Forestry has planted an average of 486 trees on public property annually of 37 different species to improve tree diversity. The Forestry team partnered with the National Arbor Day Foundation and its corporate sponsors to giveaway a total of 785 1-gallon tree seedlings to Boulder residents in annual giveaways since 2016. Sponsorship from Boulder County and Climate Initiatives helped support an annual Tree Sale of a total of 340 15-gallon trees to residents in 2018 and 2019. In this same time period, 5,564 public trees have been removed however, due to insect and disease pests, weather related events and safety related concerns and many more on private property and through both city and private construction projects.

Hazards Mitigated: Air Quality, Extreme Temperatures, Flood, Windstorm, Winter Storm

Goal(s) Addressed: 2, 3

Responsible Office: City Parks and Recreation, Forestry Division

Priority (High, Medium, Low): High

Cost Estimate: \$200,000 city funds, \$520,000 other

Benefits (Avoided Losses): The Urban Forest Strategic Plan (UFSP) was approved by the Park and Recreation Advisory Board on June 4, 2018. The UFSP established an overarching goal to maintain 16% urban tree canopy (UTC) within Boulder. Four themes and detailed goals and objectives of sustainable urban forestry were developed to guide the future management of the urban forest. These included 1) *Plan* – to increase the resilience and sustainability of the urban forest; 2) *Manage* – to further refine Boulder Forestry operations and increase funding to match community expectations; 3) *Protect* – review and update municipal code, policies, and design and construction standards that support tree protection, planting and longevity; and 4) *Engage* – connect and educate the community with the most current information on the urban forest to mobilize activists and facilitate policy implementation.

Potential Funding: City funds, grants, partnerships

Schedule: 2022-2024, projects implemented as funding becomes available

Status: Continue - In Progress

Name of Action: Implement Flood Mitigation Plans

Project Description/Background: Implement flood mitigation projects identified. The preliminary design of flood mitigation improvements are underway for Gregory Canyon Creek. City Council provided direction for city staff to proceed with Phase 1 preliminary design for the South Boulder Creek Flood Mitigation project.

Other Alternatives: No action

Hazards Mitigated: Flood

Goal(s) Addressed: 2

Responsible Office: City of Boulder Utilities Division

Priority (High, Medium, Low): High

Cost Estimate: \$100,000,000

Benefits (Avoided Losses): Avoid unnecessary future losses in the city of Boulder by addressing the highest benefit flood mitigation efforts first.

Potential Funding: City of Boulder Stormwater fund, FEMA's pre-disaster mitigation program

Schedule: 2022-2024, implemented as funding becomes available

Status: Continue- In Progress

Name of Action: Relocate Fire Station Outside 100-year Flood Risk

Project Description/Background: Relocate one of the city's fire stations which is currently located within the 100-year floodplain. Land has been acquired and the architectural design of the fire station is the next step.

Other Alternatives: No action

Hazards Mitigated: Flood, Fire

Goal(s) Addressed: 2

Responsible Office: FAM/Fire and Rescue

Priority (High, Medium, Low): Medium

Cost Estimate: \$13,000,000

Benefits (Avoided Losses): Avoid unnecessary future losses to city of Boulder infrastructure while also aiding in the fire department's resilience and ability to respond to emergencies adequately.

Potential Funding: Grants, bonds, city funds

Schedule: 2022-2024, construction as funding becomes available

Status: Continue – In Progress

Name of Action: Prioritize Flood Hazards

Project Description/Background: The prioritization work is planned to follow the Comprehensive Flood and Stormwater Master Plan update.

Other Alternatives: No action

Hazards Mitigated: Flood

Goal(s) Addressed: 2

Responsible Office: Public Works

Priority (High, Medium, Low): High

Cost Estimate: \$50,000-100,000

Benefits (Avoided Losses): Avoid unnecessary future losses in the city of Boulder by addressing the highest risk flood hazards first.

Potential Funding: MHFD, city funds

Schedule: 2022-2024, implemented as funding becomes available

Status: Continue – Not Started

Name of Action: Update the Comprehensive Flood and Stormwater Master Plan

Project Description/Background: Utilities staff has begun work on an update to the Comprehensive Flood & Stormwater (CFS) Master Plan. A community working group has been selected to participate in this process.

Other Alternatives: No action

Hazards Mitigated: Flood

Goal(s) Addressed: 2

Responsible Office: Public Works

Priority (High, Medium, Low): High

Cost Estimate: \$50,000-100,000

Benefits (Avoided Losses): Ensuring plans have the most up to date information and strategies appropriate for community needs will provide the city with the best practices for flood and stormwater management.

Potential Funding: MHFD, city funds

Schedule: Scheduled completion in 2022

Status: Continue – In Progress

Name of Action: Acquire High Hazard Zone Properties

Project Description/Background: Properties located in the city's High Hazard Zone are periodically purchased to help facilitate drainageway improvements throughout the city when they become available. 712 Pleasant was purchased in 2019 and was deconstructed in 2020 to permit Gregory Canyon Creek drainageway improvements to convey flows associated the 10-year storm event.

Other Alternatives: No action

Hazards Mitigated: Flood

Goal(s) Addressed: 1, 2

Responsible Office: Public Works

Priority (High, Medium, Low): Medium

Cost Estimate: Based on property value

Benefits (Avoided Losses): Eliminate repetitive losses of property and assets and reduce recovery costs by avoiding areas exposed to high hazard.

Potential Funding: MHFD, city funds

Schedule: Annual Implementation

Status: Continue – Annual Implementation

Name of Action: Update City's Floodplain Maps

Project Description/Background: A floodplain mapping study has begun for the Sunshine Canyon Creek drainageway.

Other Alternatives: No action

Hazards Mitigated: Flood

Goal(s) Addressed: 1, 2

Responsible Office: Public Works

Priority (High, Medium, Low): Medium

Cost Estimate: \$100,000-150,000 per study

Benefits (Avoided Losses): Ensure future losses are reduced or avoided altogether with accurate and up to date mapping of flood hazards.

Potential Funding: MHFD, city funds

Schedule: Keep maps 10 years current

Status: Continue – Annual Implementation

Name of Action: Implement Wildland Fire Mitigation Program for Watersheds

Project Description/Background: The Wildfire Erosion and Sediment Transport Tool was completed in May 2019. The Tool predicts post-fire erosion and sediment transport to the water supply and recommends a rehabilitation plan depending on the fire location, extent, and severity. Staff continue to work with local, state, and federal partners on wildfire planning efforts.

Other Alternatives: No action

Hazards Mitigated: Wildfire

Goal(s) Addressed: 1, 2, 3

Responsible Office: City of Boulder Utilities Division

Priority (High, Medium, Low): Medium to High

Cost Estimate: \$100,000,000

Benefits (Avoided Losses): By implementing this plan cascading hazards such as erosion, flooding, landslides, and debris flows can be avoided and their impacts on the water quality in the area lessened.

Potential Funding: City of Boulder Water Resources Fund and the Colorado State Forest Service

Schedule: Start in 2022

Status: Continue – Not Started

Name of Action: Wildland Fire Management Plan

Project Description/Background: During 2020 OSMP and City Fire staff made progress towards identifying Values at Risk, turnback standards, and Best Management Practices for fire response on City lands. Work will continue in 2021 and efforts may be rolled into the development of an updated City of Boulder CWPP.

Other Alternatives: No action

Hazards Mitigated: Wildfire

Goal(s) Addressed: 1, 2, 3

Responsible Office: OSMP/Fire

Priority (High, Medium, Low): Medium

Cost Estimate: \$50,000 – 100,000

Benefits (Avoided Losses): More effective fire management practices will lead to less impacts and losses of natural resources and property in coming years due to wildfire.

Potential Funding: Grant Funding

Schedule: Start in 2022

Status: Continue – Not Started

Name of Action: Update CWPP

Project Description/Background: An updated CWPP is being drafted. This document will outline fire mitigation work completed since the development of the original 2007 CWPP as well as identify new projects and collaborative efforts.

Other Alternatives: No action

Hazards Mitigated: Wildfire

Goal(s) Addressed: 1, 2, 3

Responsible Office: OSMP/Fire

Priority (High, Medium, Low): Medium

Cost Estimate: \$50,000

Benefits (Avoided Losses): An updated CWPP will better prepare the city to prioritize wildfire risk reduction efforts in accordance with changes in the area fire regime and community growth.

Potential Funding: Grant Funding

Schedule: Start in 2022

Status: Continue – Not Started

Name of Action: Implement CWPP

Project Description/Background: Most outlined projects from the original 2007 CWPP have been completed. In 2021 crews will focus on additional thinning work in “High Hazard” areas called out in the CWPP including Chautauqua, Shanahan, and Kohler Mesa. OSMP and City Fire staff will continue to work towards updating the CWPP.

Other Alternatives: No action

Hazards Mitigated: Wildfire

Goal(s) Addressed: 2

Responsible Office: Boulder Fire, OSMP

Priority (High, Medium, Low): High

Cost Estimate: TBD by project

Benefits (Avoided Losses): Reduce the impacts of wildfires on the city and wildland urban interface areas.

Potential Funding: Grant Funding, city general funds

Schedule: Annually through 2022

Status: Continue – Annual Implementation

Name of Action: Implement Forest Ecosystem Management Plan

Project Description/Background: City OSMP continues to implement portions of the Forest Ecosystem Management Plan on an annual basis. To date, a total of approximately 2000 acres have been thinned as part of forest health and fire mitigation projects on city OSMP lands. Roughly 75% of all the projects outlined

in the plan are complete. Prescriptive thinning and burning will continue in 2021 with collaborative projects planned with OSMP and City Fire. OSMP will be increasing staffing in 2021 and will focus efforts in the City WUI.

Other Alternatives: No action

Hazards Mitigated: Wildfire

Goal(s) Addressed: 2

Responsible Office: OSMP

Priority (High, Medium, Low): High

Cost Estimate: \$80,000-150,000 annually

Benefits (Avoided Losses): Increase protection of the city and surrounding wildlands by reducing the impacts and severity of wildfires.

Potential Funding: Grant Funding, city general funds

Schedule: Annually through 2022

Status: Continue – Annual Implementation

Name of Action: Update City's Drought Plan

Project Description/Background: Complete an update to the city's drought plan. Identify and implement priority projects identified in the Drought Plan. Drought plan revisions have been initiated by assessing drought triggers and water use reductions through updated water supply modeling that also includes climate change assessments. Drought plan assessments and revisions will continue into 2022.

Other Alternatives: No action

Hazards Mitigated: Drought

Goal(s) Addressed: 1, 2, 3

Responsible Office: Public Works

Priority (High, Medium, Low): High

Cost Estimate: \$1.5 Million +

Benefits (Avoided Losses): Better prepare the city to respond to drought and increased demand on municipal water supplies.

Potential Funding: Grant Funding, city general funds

Schedule: Scheduled completion for plan update in 2022, implementation of projects annually

Status: Continue – In Progress

Annex C: City of Lafayette

Annex C City of Lafayette

C.1 Community Profile

The City of Lafayette encompasses 9.48 square miles and is located on the eastern edge of Boulder County, just northwest of Denver. Lafayette's altitude is 5,236 feet above sea level.

In 1888, Mary Miller, a prominent farmer on whose land the discovery of coal in 1884 began coal mining in the area, platted 150 acres for the Town of Lafayette (named for her late husband). By July of 1888, the first houses were built and a second mine, the Cannon, was in operation. Within six months, there were two general stores, a livery stable, and several boarding houses.

In January 1900, Lafayette suffered a devastating fire that destroyed much of the town's original business district. By 1914, Lafayette had recovered sufficiently to support two banks, four hotels, three restaurants, a "picture show," a bakery, a candy store, a local newspaper, two poolrooms, and a pickle factory. Lafayette also had a brick works and a power station that provided electricity to Boulder, Louisville, Longmont, and Fort Collins.

As natural gas slowly replaced the use of coal for fuel, the mines began cutting production and finally closed. In 1956, the Black Diamond Mine was the last Lafayette mine to close. Many Lafayette miners continued to work at the Eagle Mine in Erie until it shut down in 1979. With the decline of mining, agriculture again became the dominant economic activity in the Lafayette area. Rapid growth in Denver and Boulder brought Lafayette substantial residential growth and as the town grew, the farming-based economy shifted again to commercial enterprises and small industrial and manufacturing concerns.

C.1.1 Population

The estimated 2020 population of the City of Lafayette was 30,777. Select 2019 Census Bureau estimates of demographic and social characteristics for Lafayette are shown in Table C-1.

Table C-1 Lafayette's Demographic and Social Characteristics

Characteristic	
Gender/Age	
Male (%)	49.5
Female (%)	50.5
Under 5 Years (%)	6.0
65 Years and Over (%)	13.4
Race/Ethnicity (one race)	
White (%)	84.0
Hispanic or Latino (Of Any Race) (%)	20.1
Other	
Average Household Size	2.42
High School Graduate or Higher (%)	95.1

Source: U.S. Census Bureau, ACS 2019 Estimates, [census.gov](https://www.census.gov)

C.1.2 Economy

According to the 2019 Census Bureau ACS estimates, the industries that employed most of Lafayette's labor force were management, business, science, education and arts (51%); sales and office (21%); service, food, protection and healthcare (16%); production, transportation, and material moving (7%); and natural resources, construction and maintenance (4%). Select 2019 estimates from the Census Bureau on economic characteristics for Lafayette are shown in Table C-2.

Table C-2 Lafayette's Economic Characteristics

Characteristic	
Families below Poverty Level	7,938
Individuals below Poverty Level	1,853
Median Home Value, 2015-2019	\$422,000
Median Household Income	\$85,130
Per Capita Income	\$50,988
Population in Labor Force	24,423

Source: U.S. Census Bureau, ACS 2019 Estimates, [census.gov](https://www.census.gov)

C.2 Hazard Summary

The most significant hazards for Lafayette are floods and severe winter storm. Refer to Section 4.4 Vulnerability Assessment for detailed vulnerability to the flood hazard. Due to the historical coal mining in the area subsidence of the land surface is a concern in Lafayette. Hazard maps associated with land subsidence can be referenced in the City's Comprehensive Plan. The City has mapped areas of very low-low, moderate, and high subsidence hazard, based on the probability of a subsidence event occurring. Other hazards that could impact Lafayette include dam failure, drought, flood, lightning, tornado, windstorm, wildfire and communicable/zoonotic disease outbreak.

Table C-3 City of Lafayette Hazard Summaries

Hazard	Geographic Extent	Probability of Future Occurrences	Magnitude/Severity	Threat from Climate Change	Overall Significance
Air Quality	Extensive	Highly Likely	Critical	Moderate	Medium
Avalanche	Limited	Unlikely	Limited	Low	Low
Communicable Disease	Extensive	Likely	Critical	Substantial	Medium
Dam and Levee Failure	Significant	Unlikely	Catastrophic	Moderate	High
Drought	Extensive	Likely	Catastrophic	Substantial	High
Earthquake	Extensive	Occasional	Catastrophic	Low	Medium
Expansive Soils	Significant	Highly Likely	Limited	Substantial	Low
Extreme Heat	Extensive	Likely	Critical	Severe	Low
Flood	Significant	Highly Likely	Critical	Severe	High
Hailstorm	Extensive	Likely	Limited	Moderate	Medium
Landslide	Limited	Occasional	Limited	Substantial	Low
Lightning	Extensive	Likely	Limited	Moderate	Medium
Subsidence	Significant	Likely	Limited	Moderate	Medium
Tornado	Significant	Likely	Limited	Low	Medium
Wildfire	Significant	Highly Likely	Critical	Severe	High
Windstorm	Extensive	Highly Likely	Critical	Moderate	High
Winter Storm (Severe)	Extensive	Highly Likely	Catastrophic	Substantial	High

Geographic Extent <ul style="list-style-type: none"> Limited: Less than 10% of planning area Significant: 10-50% of planning area Extensive: 50-100% of planning area 	Probability of Future Occurrences <ul style="list-style-type: none"> Highly Likely: Near 100% chance of occurrence in next year or happens every year.
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<p>Increase Threat from Climate Change</p> <ul style="list-style-type: none"> • Low- unlikely to become more of a threat due to climate change. • Moderate – possibly will become more of a threat due to climate change. • Substantial- likely to become more of a threat due to climate change. • Severe- highly likely to become more of a threat due to climate change 	<ul style="list-style-type: none"> • Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less. • Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years. • Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years. <p>Magnitude/Severity</p> <ul style="list-style-type: none"> • Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths • Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability. • Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability. • Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid <p>Significance</p> <ul style="list-style-type: none"> • Low: minimal potential impact • Medium: moderate potential impact • High: widespread potential impact
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C.3 Asset Inventory

C.3.1 Property Inventory

Table C-4 Lafayette's Property Inventory

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
Agricultural	4	13	\$2,263,500	\$2,263,500	\$4,527,000
Commercial	296	317	\$350,497,615	\$350,497,615	\$700,995,230
Exempt	206	280	\$288,637,394	\$288,637,394	\$577,274,788
Industrial	84	99	\$136,223,730	\$204,335,595	\$340,559,325
Mixed Use	20	52	\$29,404,800	\$29,404,800	\$58,809,600
Residential	10,283	10,464	\$3,926,237,876	\$1,963,118,938	\$5,889,356,814
Vacant	1	1	\$8,700	\$8,700	\$17,400

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
Total	10,894	11,226	\$4,733,273,615	\$2,838,266,542	\$7,571,540,157

Source: Boulder County Assessor's Office, Wood GIS Analysis

C.3.2 Other Assets

Table C-5 is a detailed inventory of assets identified by the City's planning team. This inventory includes critical facilities. For more information about how "critical facility" is defined in this plan, see Section 4.4 Vulnerability Assessment.

Table C-5 Lafayette's Assets

Name of Asset	Type	Address	Replacement Value (\$)	Occupancy/ Capacity #	Hazard Specific Info
Good Samaritan Hospital	Economic		\$300 M	1,000	
Wal-Mart	Economic		\$20 M	300	
Water Treatment Facility	Lifeline		\$15 M	13 MGD	
Potable Water Storage Tanks	Lifeline		\$9M		
Wastewater Facility	Lifeline		\$10 M	4.4 MGD	
Lift Station	Lifeline		\$ 0.5 M		
Communication Tower	Essential		\$1.5 M	150' Tall Sheriff Communications	

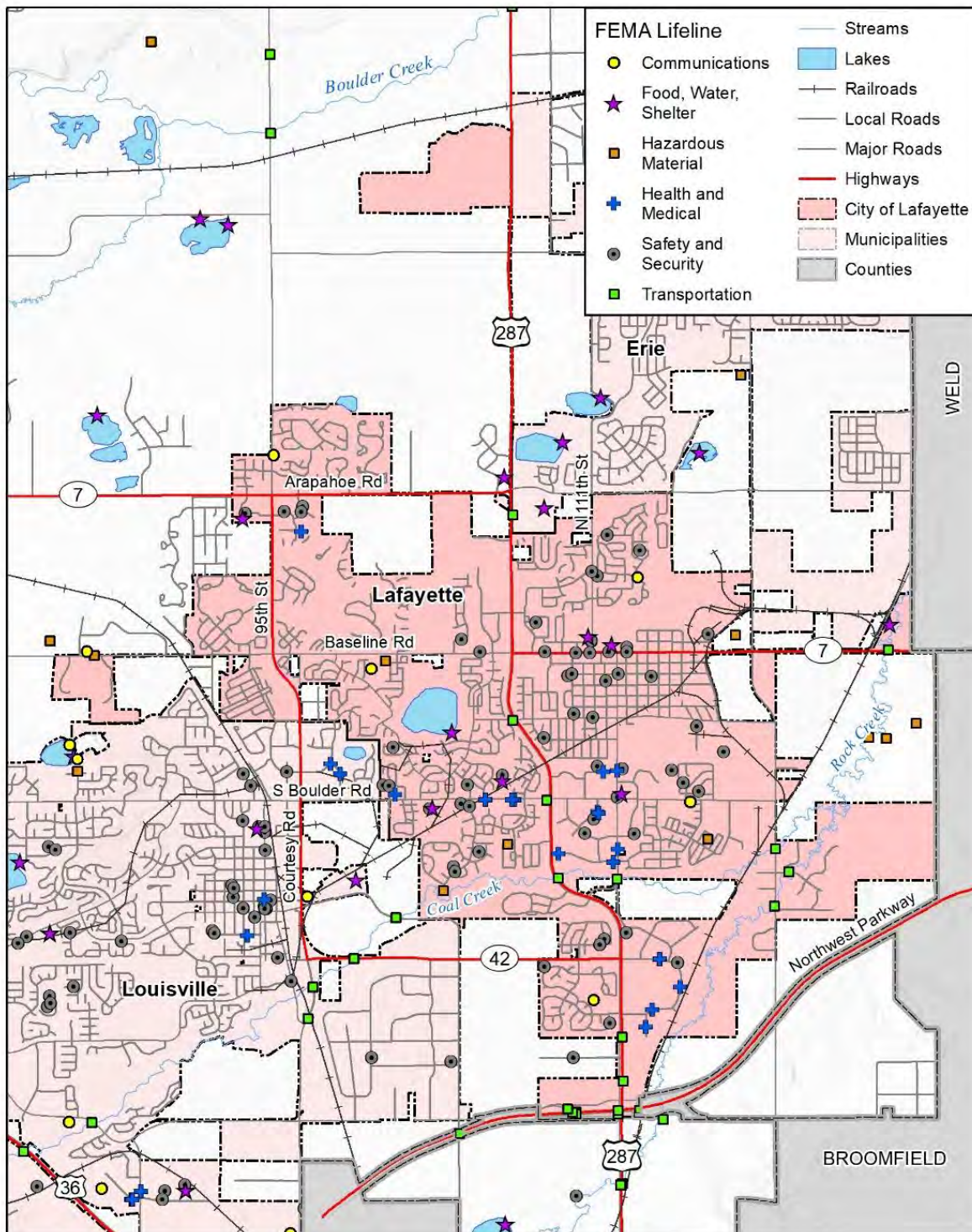
Source: City of Lafayette, Boulder County

Some of the facilities listed above are also in GIS databases provided by Boulder County. Critical facility counts and types are shown in Table C-6 and in the map in Figure C-1. Shelters may be in facilities such as schools or recreation centers and are not indicated on the map.

Table C-6 Summary of Lafayette's Critical Facilities in GIS

FEMA Lifeline	Total
Communications	6
Energy	-
Food, Water, Shelter	8
Hazardous Materials	5
Health and Medical	19
Safety and Security	65
Transportation	17
Total	120

Source: Boulder County, HIFLD, NBI, BID, CDPHE, Wood Analysis

Figure C-1 Location of Critical Facilities in Lafayette

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
City of Boulder, CDPHE, NBI, NID, HIFLD

wood.

0 0.5 1 Miles



C.3.3 Economic Assets

Economic assets at risk may include major employers or primary economic sectors, such as, agriculture, whose losses or inoperability would have severe impacts on the community and its ability to recover from disaster. After a disaster, economic vitality is the engine that drives recovery. Every community has a specific set of economic drivers, which are important to understand when planning ahead to reduce disaster impacts to the economy. When major employers are unable to return to normal operations, impacts ripple throughout the community.

According to the City of Lafayette Community Profile 2018, the City's major employers are Good Samaritan Medical Complex, Medtronic, Universal Forest Products (manufactured building components), Wal-Mart, Rocky Mountain Instruments (laser optic manufacturer), Ball Aerospace, and GE Dharmacon (RNA transfer technology).

C.3.4 Natural, Cultural, And Historic Resources

Natural Resources

Assessing the vulnerability of Boulder County to disaster also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons: The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy. If these resources are impacted by a disaster, knowing so ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts are higher. The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources. Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.

Historic And Cultural Resources

Table C-7 lists the properties in Lafayette that are on the National Register of Historic Places and/or the Colorado State Register of Historic Properties (for more information about these registers, see Section 4.4 Vulnerability Assessment).

Table C-7 Lafayette's Historic Properties/Districts in National and State Registers

Property	Address	Date Listed
Congregational Church	300 E. Simpson St.	05/20/1983
Ewing Family Farmhouse	1915 N. 95th St.	12/13/1995
Kulgren House	209 E. Cleveland St.	05/20/1983
Lafayette House	600 E. Simpson St.	05/20/1983
Lewis House	108 E. Simpson St.	05/20/1983
Miller House	409 E. Cleveland St.	05/20/1983
The Terrace	205- 207 E. Cleveland St.	11/03/1987

Sources: National Register of Historic Places and the Colorado State Register of Historic Properties, City of Lafayette Register of Historic Places

The Lafayette Register of Historic Places was established by City ordinance in 1998. The purpose of the register is to protect local structures, sites, or neighborhoods that represent distinctive examples of architecture, are associated with famous historic events or persons, or make a special contribution to the distinctive character of Lafayette. Table C-7 lists the properties on Lafayette's Register of Historic Places not already mentioned in Table C-8 above.

Table C-8 Additional Historic Properties in Lafayette

Property	Address	Date Listed
	106 W. Geneseo St.	03/19/2019
Alderson Building	418-424 E. Simpson St.	07/21/2015
Angevine House	610 E. Simpson St.	08/15/2000
Beckett House	307 E. Cleveland St.	04/07/2009
Catholic Rectory	109 W. Cannon St.	09/18/2012
Evans House	201 E. Chester St.	09/18/2012
James W. Graham, Jr. House	303 W. Simpson St.	01/02/2019
Henderson House	209 W. Simpson St.	11/28/2007
Albert & Rosie James House	310 W. Simpson St.	11/18/2008
Knill/Green House	200 E. Cannon St.	02/17/2009
Lafayette Cemetery	111 W. Baseline Road	12/09/2008
Lafayette High School	101 E. Baseline Road	12/09/2008
Lafayette Methodist Church	211 E. Geneseo St.	06/29/2000
Maxwell House	406 E. Baseline Road	06/17/2004
Nelson House	108 W. Geneseo St.	06/18/2019
Padfield House	104 E. Simpson St.	09/18/2007
Pearce House	608 E. Geneseo St.	10/03/2017
Richards House	201 E. Cleveland St.	05/18/2010
Swennes House	410 W. Cleveland St.	06/19/2007
Thomas House	513 Elm St.	06/13/2000
Waneka Granary	East side of Waneka Lake	06/19/2001
Weiler House	401 E. Baseline Road	06/27/2000
Welter/McWilliams House	306 W. Cannon St.	08/06/2019

Source: City of Lafayette Register of Historic Places

It should be noted that as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

C.4 Growth and Development Trends

Table C-9 illustrates how Lafayette has grown in terms of population and number of housing units between 2010 and 2019.

Table C-9 Lafayette's Change in Population and Housing Units, 2010-2019

2010 Population	2019 Population	Percent Change (%) - Population 2010-2019	2010 # of Housing Units	2019 # of Housing Units	Percent Change (%) - # Housing Units 2010-2019
24,550	30,653	+24.86	10,023	12,587	+25.58

Source: Colorado Division of Local Government State Demography Office

Like many communities within the rapidly growing U.S. Highway 36 Corridor, the City of Lafayette witnessed significant growth in population over the last decade. Growth projections shown in Table C-10 take into account the City's Growth Management Requirement, which limits housing construction to approximately

200 units per year.

Table C-10 Lafayette's Population Projections 2010-2024

	2010	2013	2019	2024*
Population	24,550	26,690	30,653	33,878
Percent Change (%)	--	+8.72	+14.85	+10.52

*ESRI estimates- derived from U.S. Census data

C.5 Vulnerability Assessment

The intent of this section is to assess Lafayette's vulnerability separate from that of the planning area as a whole, which has already been assessed in Sections 4.4 Vulnerability Assessment and 4.5 Estimating Potential Losses of the Base plan. This vulnerability assessment analyzes the population, property, critical facilities, and other assets at risk for the more significant hazards or where available data permits a more in-depth analysis. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment of the Base Plan.

Table C-6 lists summary information about the 120 critical facilities and other community assets identified by Lafayette's HMPC as important to protect or provide critical services in the event of a disaster. For additional information on the definitions behind each critical facility category, source, and other details refer to Section 3.3.2 of the Base Plan.

C.5.1 Vulnerability by Hazard

Dam Failure

General Property

While there is no concrete data available to indicate any likelihood of failure, based on best available dam inundation data there might be structures potentially at risk of dam failure flooding. The dam failure inundation maps contain sensitive information and are not available for display in this public planning document. Based on a GIS analysis performed with the county parcel layer and the available dam inundation mapping (for planning purposes only), the following potential damages would be expected in Lafayette. Waneka Lake Dam is a high hazard dam located within city limits.

Table C-11 Dam Inundation Hazard By Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Commercial	60	63	\$58,784,200	\$58,784,200	\$117,568,400	
Exempt	44	54	\$94,260,645	\$94,260,645	\$188,521,290	
Industrial	16	36	\$42,672,030	\$64,008,045	\$106,680,075	
Mixed Use	2	6	\$16,538,200	\$16,538,200	\$33,076,400	15
Residential	2,761	2,767	\$727,094,027	\$363,547,014	\$1,090,641,041	6,918
Total	2,883	2,926	\$939,349,102	\$597,138,104	\$1,536,487,206	6,933

Source: Boulder County Assessor's Office, U.S. Census, DOLA, DWR, Wood Analysis

People, Critical Facilities and Infrastructure

Based on the GIS analysis summarized in the table above, it is expected that around 6.933 people in

Lafayette might be at risk of dam inundation hazards. Also based on the GIS analysis summarized in the table below, it is expected that around 32 critical facilities in Lafayette might be at risk of dam inundation hazards.

Table C-12 Lafayette Critical Facilities at Risk of Dam Failure

FEMA Lifeline	Count
Communications	1
Food, Water, Shelter	3
Hazardous Material	2
Health and Medical	8
Safety and Security	15
Transportation	3
Total	32

Source: Boulder County Assessor, HFLD, Wood Analysis

Economy

In addition to commercial and residential building impacts, a dam inundation event that affected the major roads which give access to the city. Which could significantly affect the local economy, by limiting or completely impeding access to shops, restaurants, hotels, and other major industries which keep the local economy thriving.

Historical, Cultural, and Natural Resources

Dam or reservoir failure effects on the environment would be similar to those caused by flooding from other causes. For the most part the environment is resilient and would be able to rebound, though this process could take years. However, historic and cultural resources could be affected just as housing or critical infrastructures would.

Flood

The major drainageways through Lafayette are Coal Creek, Rock Creek and Bullhead Gulch. Flooding is mostly likely to occur due to heavy spring or summer rain events.

General Property

Vulnerability to flooding was determined by summing potential losses to Lafayette properties in GIS, by using the latest FEMA NFHL data along with the Boulder County parcel layer provided by the Assessor's Office. FEMA's NFHL data depicts the 1% annual chance (100-year) and the 0.2% annual chance (500-year) flood events. Table C-13 below displays Lafayette's FEMA special flood hazard areas present in the city, color coded based on flood event (i.e. 100-year versus 500-year).

Based on the GIS analysis performed with the county parcel layer and the available FEMA flood mapping, the potential risk for the City is shown in Table C-13 and Table C-14. Lafayette's 1% annual chance flood zone presents has 76 properties and over an estimated \$70 million total value exposed. The 0.2% annual chance event would add an additional 30 properties, with loss estimates for both flood events totaling nearly \$21 million in Lafayette. Most properties at risk of flooding from both events are residential.

Table C-13 Summary of Lafayette Properties Vulnerable to 1% Annual Chance Flood Events, by Property Type

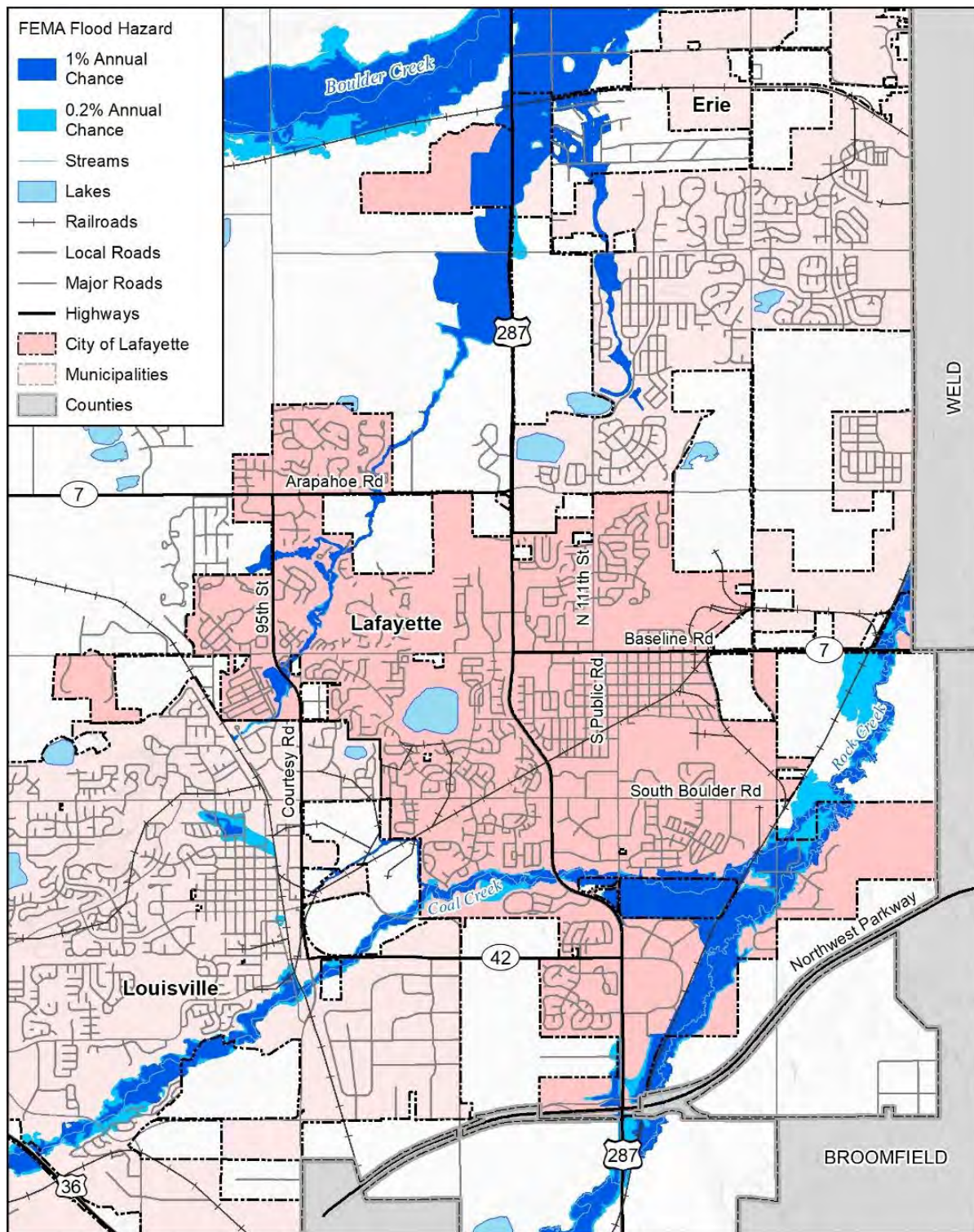
Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Commercial	31	19	\$6,419,800	\$6,419,800	\$12,839,600	\$3,209,900	
Exempt	3	10	\$225,300	\$225,300	\$450,600	\$112,650	
Industrial	11	14	\$16,875,500	\$25,313,250	\$42,188,750	\$10,547,188	
Residential	29	33	\$10,316,321	\$5,158,161	\$15,474,482	\$3,868,620	83
Total	74	76	\$33,836,921	\$37,116,511	\$70,953,432	\$17,738,358	83

Source: Boulder County Assessor, U.S. Census, DOLA, FEMA NFHL Effective 8/15/2019, Preliminary 9/30/2019, Wood Analysis

Table C-14 Summary of Lafayette Properties Vulnerable to 0.2% Annual Chance Flood Events, by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Commercial	25	14	\$4,486,920	\$4,486,920	\$8,973,840	\$2,243,460	
Exempt	1	1	\$0	\$0	\$0	\$0	
Residential	13	15	\$2,726,100	\$1,363,050	\$4,089,150	\$1,022,288	38
Total	39	30	\$7,213,020	\$5,849,970	\$13,062,990	\$3,265,748	38

Source: Boulder County Assessor, U.S. Census, DOLA, FEMA NFHL Effective 8/15/2019, Preliminary 9/30/2019, Wood Analysis

Figure C-2 City of Lafayette FEMA Flood Hazard Areas

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
FEMA NFHL Effective 8/15/2019, Preliminary 9/30/2019

wood.

0 0.5 1 Miles



People

The population exposed to the flood hazards described in the flood vulnerability analysis above was estimated by applying an average household size factor to the number of improved residential properties identified in the flood hazard areas within Lafayette. These estimates yielded the population exposures shown in the table above in Table C-13 and Table C-14. As such, the combined 1% and 0.2% annual chance floods would potentially displace 121 people, based on the residential structures which fall in those flood zones. For additional details on potential displacements by flood event, see the Boulder County Base Plan.

Critical Facilities and Infrastructure

There are a total of 8 critical facilities located in both the 1% and 0.2% flood hazard areas. The main critical facilities within Lafayette located in the 1% floodplain are transportation with 6 total, which are bridges. Within the 0.2% flood hazard areas within Lafayette; Food, Water, Shelter and Transportation both have one each.

Table C-15 FEMA 1% Annual Chance Flood Hazard for Critical Facilities in Lafayette

FEMA Lifeline	Count
Transportation	6
Total	6

Source: Boulder County Assessor, CDPHE, NBI, Wood Analysis

Table C-16 FEMA 0.2% Annual Chance Flood Hazard for Critical Facilities in Lafayette

FEMA Lifeline	Count
Food, Water, Shelter	1
Transportation	1
Total	2

Source: Boulder County Assessor, CDPHE, NBI, Wood Analysis

Economy

Flooding can have a major economic impact on the economy, including indirect losses such as business interruption, lost wages, and other downtime costs. Flooding often coincides with the busy summer tourism months in Boulder County, and may impact, directly or indirectly (such as from the negative perception of potential danger to his hazard), the revenues of shops, restaurants, hotels, and other major industries which keep the local economy thriving.

Historical, Cultural and Natural Resources

The environment is mostly resilient to general flooding. However, cultural or historic properties within floodplains would be affected in similar ways as property and critical facilities/infrastructure, especially those with underground or basement levels where water would easily seep and potential ruin archives, resources, or other important assets.

Wildfire

General Property

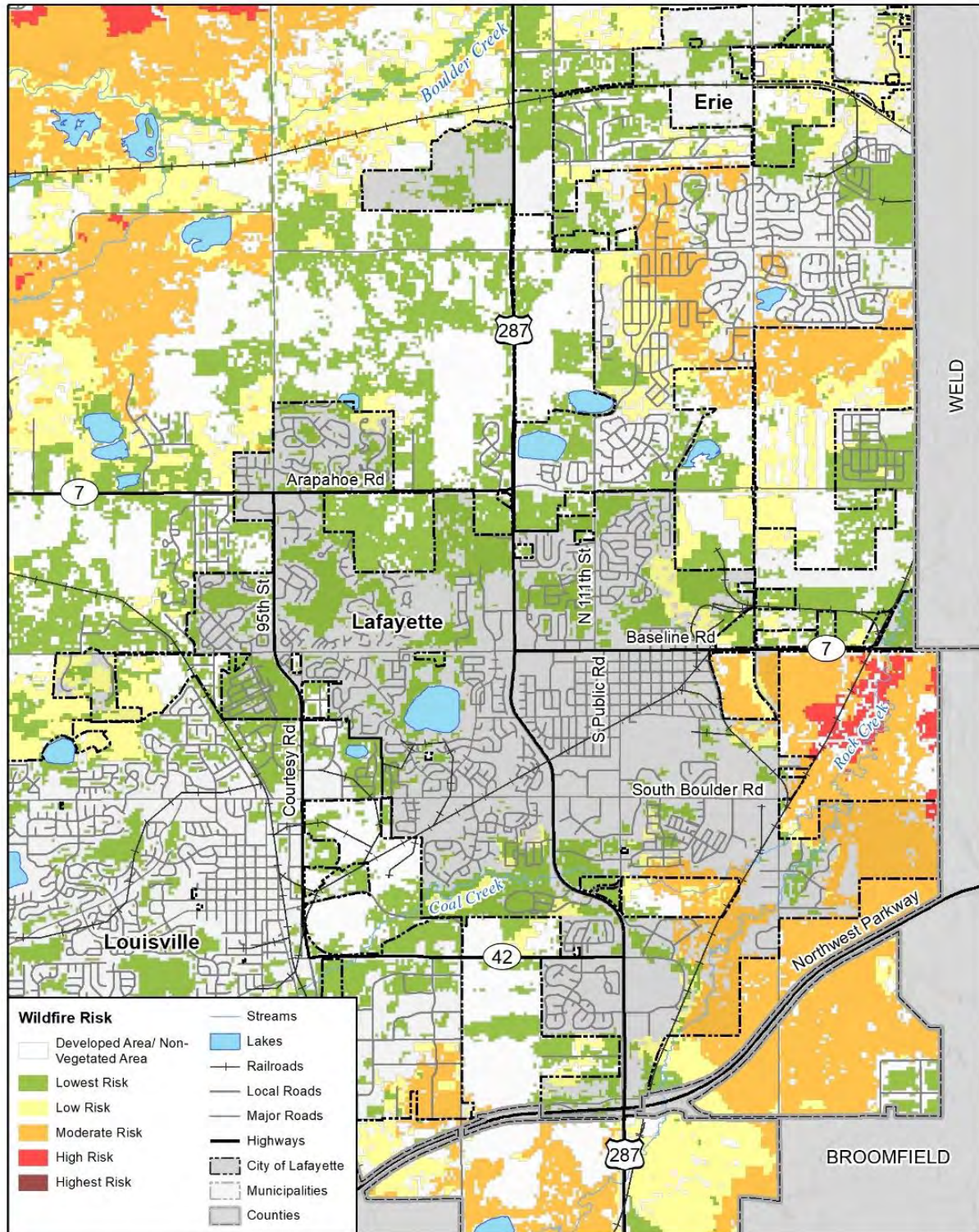
Parcel analysis was conducted using GIS to analyze where parcels, buildings counts, property types and content values intersected with the wildfire hazards zones defined by the Colorado Forest Atlas, from highest to lowest risk. The Colorado Forest Atlas calculates a composite risk rating, defined as the possibility of loss or harm occurring from a wildfire. It identifies areas with the greatest potential impacts from a wildfire

– i.e. those areas most at risk - considering all values and assets combined together – WUI Risk, Drinking Water Risk, Forest Assets Risk and Riparian Areas Risk. This risk index has been calculated consistently for all areas in Colorado, allowing for comparison and ordination of areas across the entire state. For the purposes of this analysis, the wildfire zone that intersected a parcel centroid was assigned as the threat zone for the entire parcel. Improvement values were then summed by wildfire rating area and then sorted by parcel type. Property improvements and estimated content values were then totaled to arrive at the Total Value column, which is also the estimated potential loss as wildfires typically result in complete loss to structure and contents. Lafayette Property's at risk to wildfires are listed in Table C-17 below. The highest properties at risk in Lafayette are to the residential ones with a building count of 76 total have a moderate wildfire risk. There are also a 190 people located in a moderate risk of wildfire risk hazard zone within the City of Lafayette. Lafayette's wildfire risk is also highlighted in Figure C-3 **Error! Reference source not found..**

Table C-17 Property Values in Moderate Wildfire Zones by Parcel Type for Lafayette

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Commercial	1	2	\$490,100	\$490,100	\$980,200	
Exempt	2	26	\$8,701,200	\$8,701,200	\$17,402,400	
Industrial	2	8	\$5,477,200	\$8,215,800	\$13,693,000	
Residential	40	76	\$81,177,050	\$40,588,525	\$121,765,575	190
Total	45	112	\$95,845,550	\$57,995,625	\$153,841,175	190

Source: Boulder County Assessor's Office, U.S. Census, DOLA, Colorado Forest Service - Colorado State Forest Service, Wood Analysis

Figure C-3 City of Lafayette Wildfire Risk

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
Colorado Forest Service - Colorado State Forest Service

wood.

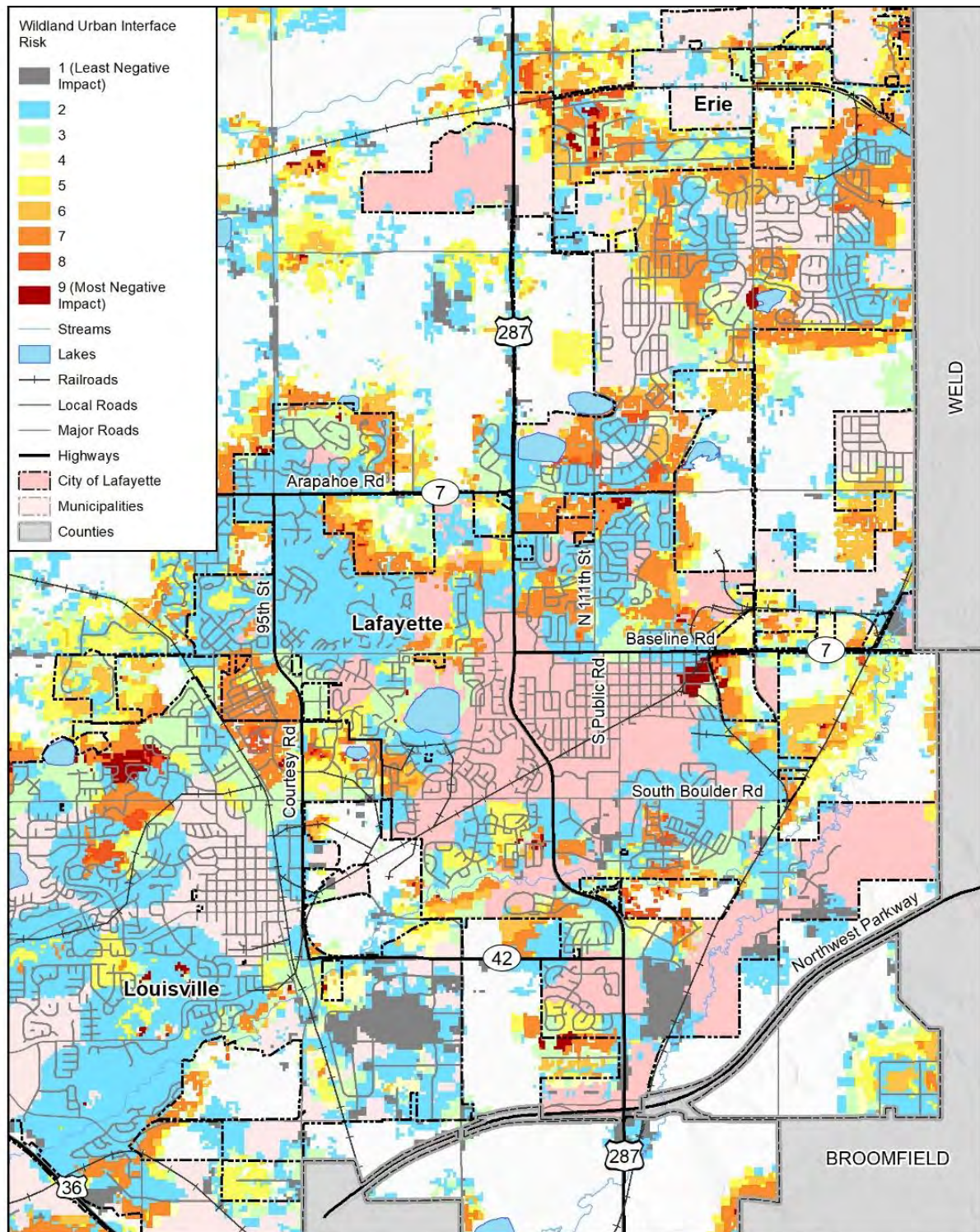
0 0.5 1 Miles

N



Wildland-Urban Interface

The Colorado Forest Atlas also provides an analysis for Wildland-Urban Interface (WUI) risk based on housing density consistent with Federal Register National standards. The location of people living in the wildland-urban interface and rural areas is essential for defining potential wildfire impacts to people and homes. To calculate the WUI Risk Index, the WUI housing density data was combined with flame length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9, while areas with low housing density and low flame lengths are rated -1. Data is modelled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers. WUI Risk for Lafayette is mapped in Figure C-4.

Figure C-4 City of Lafayette Wildland Urban Interface (WUI) Risk

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
Colorado Forest Service - Colorado State Forest Service

0 0.5 1 Miles



wood.

Table C-18 WUI High Risk Hazard for Lafayette

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Agricultural	3	1	\$1,356,800	\$1,356,800	\$2,713,600	
Commercial	5	11	\$7,474,400	\$7,474,400	\$14,948,800	
Exempt	9	11	\$5,421,685	\$5,421,685	\$10,843,370	
Industrial	4	4	\$16,454,300	\$24,681,450	\$41,135,750	
Mixed Use	3	3	\$2,222,700	\$2,222,700	\$4,445,400	7
Residential	922	947	\$489,734,431	\$244,867,216	\$734,601,647	2,349
Vacant	2	2	\$311,600	\$311,600	\$623,200	
Total	948	979	\$522,975,916	\$286,335,851	\$809,311,767	2,356

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

Table C-19 WUI Moderate Risk Hazard for Lafayette

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Commercial	18	15	\$31,093,100	\$31,093,100	\$62,186,200	
Exempt	14	5	\$28,857,300	\$28,857,300	\$57,714,600	
Industrial	1	2	\$957,900	\$1,436,850	\$2,394,750	
Residential	923	748	\$387,605,870	\$193,802,935	\$581,408,805	1,870
Total	956	770	\$448,514,170	\$255,190,185	\$703,704,355	1,870

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

People

The last column of the previous tables above summarizes the number of people at risk to wildfire in the analyzed fire zones. These totals were estimated by multiplying the average persons per household in Lafayette by the number of residential properties falling within the fire zones. Smoke resulting from fire is an issue to local populations also.

The properties most at WUI Risk in Lafayette are residential with 979 and 770 for high and moderate risk respectively. An estimated total of 4,226 people within Lafayette reside in areas of WUI Risk. Not detailed are the properties in the low WUI risk zone. Within Lafayette 5,539 properties are at a low WUI risk. Another 13,090 residents of Lafayette are located in a low WUI risk zone.

Critical Facilities and Infrastructure

One critical was identified to be in a low wildfire zone in Lafayette as listed in Table C-20 below.

Table C-20 Critical Facilities in Lafayette Wildfire Risk

FEMA Lifeline	Count
Safety and Security	1
Total	1

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Economy

Tourism, the accommodation and food services industry (e.g. hotels and restaurants), and retail are major components of Boulder County's economy, and Lafayette's as well. Wildland fires can, for example, lead to

significant tourism reductions due to health and safety concerns, causing lost revenues from lack of visitation, stays in hotels, spending on restaurants and other commerce sources, and more.

Historical, Cultural and Natural Resources

Wildfires are a common and naturally occurring phenomenon in forested areas and can benefit forest health in many respects. But the climate change trend which is leading to hotter, more widespread, and destructive fires can make it more difficult for the environment to recover, and lead to increased flood runoff or other secondary/cascading hazards. This can severely impact water quality and watershed health for years after a fire.

With regards to historic or cultural structures and resources, wildfires would affect those in similar ways as general property and critical facilities/infrastructure, having the potential for burn downs and hence possible complete loss of important historical assets.

C.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment summarizes Lafayette's regulatory mitigation capabilities, administrative and technical mitigation capabilities, and fiscal mitigation capabilities and then discusses these capabilities in further detail along with other mitigation efforts as they pertain to the National Flood Insurance Program's Community Rating System (CRS). Although the CRS is flood-focused, this discussion also incorporates activities related to other hazards into the categories established by the CRS.

C.6.1 Mitigation Capabilities Summary

Table C-21 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Lafayette.

Table C-21 Lafayette's Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Comprehensive plan	Yes	2022 Comprehensive Plan
Zoning ordinance	Yes	Municipal Code Chapter 26
Subdivision ordinance	Yes	Municipal Chapter 26
Growth management ordinance	Yes	Municipal Chapter 30
Floodplain Management Plan	No	
Floodplain ordinance	Yes	Municipal Chapter 26
Site plan review requirements	Yes	Municipal Code Chapter 26
Other special purpose ordinance (stormwater, steep slope, wildfire)	Yes	Open Space, Disaster Emergency Services, Stormwater, Fire Prevention
Building code	Yes	2015 International Codes
BCEGS Rating	No	
Fire department ISO rating	Yes	Rating: 2
Erosion or sediment control program	Yes	
Stormwater management program	Yes	
Capital improvements plan	Yes	
Economic development plan	Yes	
Local emergency operations plan	Yes	
Other special plans	Yes	Parks, Recreation, Open Space and Trails Master Plan 2013; Fire Department Master Plan, 2012; 2008 Water Conservation Plan,

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Flood insurance study or other engineering study for streams	Yes	Mile High Flood District and FEMA
Participate in the National Flood Insurance Program	Yes	March 18, 1980
Participate in the Community Rating System	No	
Elevation certificates	Yes	Where required
Community Wildfire Protection Plan (CWPP)	No	

Table C-22 identifies the personnel responsible for mitigation and loss prevention activities as well as related data and systems in Lafayette.

Table C-22 Lafayette's Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/engineer with knowledge of land development/land management practices	Yes	Planning Department and Public Works Department	
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Planning and Building Department and Public Works Department (City Engineer)	
Planner/engineer/scientist with an understanding of natural hazards	Yes	Public Works Department and Planning and Building Department (City Engineer)	
Personnel skilled in GIS	Yes	Planning and Building Department and Information Technology	
Full-time building official	Yes	Planning and Building Department	
Floodplain manager	Yes	Public Works Department	
Emergency manager	Yes	Fire Chief, Police Chief	
Grant writer	Yes	Various Departments	
Transportation Planner	Yes	Public Works – Transportation Engineer	
Resiliency Planner	Yes	Sustainability Coordinator	
Other personnel	Yes		
GIS Data – Hazard areas	Yes	Planning and Building Department	
GIS Data – Critical facilities	No	Information Technology	Could be easily identified
GIS Data – Building footprints	No	Planning and Building Department and Information Technology	
GIS Data – Land use	Yes	Planning and Building Department	
GIS Data – Links to assessor's data	Yes	Online	
Warning systems/services	Yes	Fire, Police	

Personnel Resources	Yes/No	Department/Position	Comments
(Reverse 9-11, cable override, outdoor warning signals)			

Table C-23 identifies financial tools or resources that Lafayette could potentially use to help fund mitigation activities.

Table C-23 Lafayette's Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Y/N)	Comments
Community Development Block Grants	No	
Capital improvements project funding	Yes	
Authority to levy taxes for specific purposes	Yes	
Fees for water, sewer, gas, or electric services	Yes	
Impact fees for new development	Yes	
Incur debt through general obligation bonds	Yes	
Incur debt through special tax bonds	Yes	
Incur debt through private activities	Yes	
Withhold spending in hazard-prone areas	Yes	
Stormwater Service Fees	Yes	

Table C-24 Lafayette's Education and Outreach Mitigation Capabilities

Education & Outreach	Yes/No Comments
Local citizen groups that communicate hazard risks	No
Firewise	No
StormReady	No
Other	Open Space Advisory Committee

C.6.2 Opportunities for Capability Enhancement

The plan update process provided the City of Lafayette an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- The City of Lafayette adopted a new comprehensive plan in December 2021. Opportunity exists to implement the resiliency and other strategies through programs and development regulations. The City is currently re-writing it's Land Development Code.
- Providing training for staff members related to hazards or hazard mitigation grant funding in partnership with the County and DHSEM

- Improve operational resilience through all hazards planning and incident management training

C.6.3 Community Rating System Activities (All Hazards)

National Flood Insurance Program

The City of Lafayette joined the National Flood Insurance Program (NFIP) on March 18, 1980. The NFIP allows private property owners to purchase affordable flood insurance and enables the community to retain its eligibility to receive certain federally backed monies and disaster relief funds.

NFIP insurance data indicates that as of March 2022, there were 69 policies in force in Lafayette, resulting in \$22,456,300 of insurance in force. There have been 6 claims totalling \$4,716. Further information on the properties located within the SFHA and 0.2% flood zones are located in Table C-13 And Table C-14 above.

There are no repetitive loss or severe repetitive loss properties in the City of Lafayette.

Continued Compliance with the NFIP

Recognizing the importance of the NFIP in mitigating flood losses, the City of Lafayette will place an emphasis on continued compliance with the NFIP. As an NFIP participant, the town has and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance as well as review of any potential development in special flood hazard areas.

Community Rating System Categories

The Community Rating System (CRS) categorizes hazard mitigation activities into six categories. These categories, and applicable Lafayette activities, are described below. Note: some of the activities are appropriate to multiple categories. For purposes of simplicity, they are only included in the category deemed most appropriate based on the definitions and examples provided in the CRS Coordinator's Manual.

Preventive

Preventive activities keep problems from getting worse. The use and development of hazard-prone areas is limited through planning, land acquisition, or regulation. They are usually administered by building, zoning, planning, and/or code enforcement offices.

Lafayette Comprehensive Plan, 2021

The Comprehensive Plan was last adopted in 2021. It establishes policies and strategies for advancing key community priorities, including land use and development, parks and open space, multi-modal transportation, and sustainable infrastructure. The Comprehensive Plan sets the stage for more detailed planning through mater plans, capital planning, small area plans, and development regulations. Information was also collected from the most recent Community Survey (2021), Census, Denver Regional Council of Government (DRCOG), the Downtown Vision Plan (2010), the CDOT 2013 Planning Environmental Linkage (PEL) Study, and the Parks, Recreation, Open Space, & Trails (PROST) Master Plan (2019), and the Sustainability Plan (2021).

Policies that are most related to hazard mitigation include the following:

4.11 *Conservation and Acquisitions*. The city will preserve and protect lands that benefit wildlife and represent the open space values of the greater Lafayette community.

4.16 *Preservation of Riparian Areas and Natural Habitats*. The city will coordinate development to protect and enhance the quality, continuity, and ecological integrity of riparian and other sensitive habitat areas.

Environmental Pollution

- 5.11 The city will safeguard the health, safety, and welfare of the public and the environment during the development of oil and gas resources.
- 5.13 The city will work to reduce and/or prevent adverse water quality impacts associated with development and land use.

Environmental Hazards and Development.

- 6.2 The city will continue to restrict development in the 100-year floodplain such that no structure is located, constructed, extended, converted, or altered without full compliance with Lafayette's floodplain standards.
- 6.3 The city will restrict development in areas that are at risk of subsidence from previous mining activities.

Development

- 6.4 The city will promote sustainable building practices, including, but not limited to, the use of durable materials, low impact development practices, and building design that promotes health and life safety through features that are resilient to natural and human-made hazards.

Emergency Preparedness

- 6.6 The city will routinely review and update emergency planning protocols and coordinate this process with Boulder County, surrounding municipalities, and other agencies.
- 6.7 The city will involve community groups and community members in preparedness planning and activities, emphasizing shelter-in-place options, neighborhood-level communications, and emergency responsiveness.
- 6.8 The city will continue to work with Boulder County in updating and implementing the Boulder County Emergency Management and Preparedness Program and the Boulder County Hazard Mitigation Plan.
- 6.9 The city will ensure the continued operations for critical facilities and utilities during hazard and emergency events.

Economic and Social Events

- 6.10 The city will maintain sufficient fund reserves to protect itself during times of economic hardship or disaster.
- 6.11 The city will continue to diversify its employment base and its sources of funds to prevent over-reliance on particular revenue sources.
- 6.12 The city will continue to identify risks to future economic vitality.
- 6.13 The city will continue to partner with local and regional organizations and agencies to increase awareness of the social vulnerability index and provide sufficient services to residents in need.

Climate Change

- 6.14 The city will develop strategies to prepare and adapt to climate change impacts expected over the next century.
- 6.15 The city will work to minimize the degree of climate change caused by human activities.
- 6.16 The city will proactively conduct water planning and pursue water conservation.

Police, Fire, and Community Services

- 10.1 The city will periodically evaluate its police and fire services to ensure that services are adequately provided to residents and visitors in Lafayette.
- 10.2 The city will coordinate its police and fire services with other departments in Boulder and

surrounding counties, to provide for response planning for the community.

Code of Ordinances

Chapter 26 Development and Zoning (Includes Floodplain Standards)

This chapter encourages the most appropriate use of land throughout the City and ensures a logical growth of the various physical elements of the City to secure safety from fire, flood, and other dangers; to conserve property values; to prevent overcrowding; to facilitate adequate provisions of services; and to preserve and promote the public health, safety, and welfare of the inhabitants of the city and the general public, among other things.

It includes a number of ordinances that indirectly mitigate hazards (e.g., zoning and subdivision ordinances). Among the regulations specific to hazard mitigation are the Development and Design Standards, which state that land subject to natural hazards such as flooding shall be considered unsuitable for residential occupancy or other uses which impair the health, safety, or welfare of the inhabitants, and the Floodplain Standards:

- The purposes of these standards are to promote the public health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:
- Protect human life and health;
- Minimize expenditure of public money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimize prolonged business interruptions;
- Minimize damage to public facilities and utilities such as water and gas mains; electric, telephone, and sewer lines; and streets and bridges located in areas of special flood hazard;
- Help maintain a stable tax base by providing for the second use and development of areas of special flood hazard so as to minimize future flood blight areas;
- Ensure that potential buyers are notified that property is in an area of special flood hazard; and
- Ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

In order to accomplish its purposes, this Section includes methods and provisions for:

- Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;
- Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;
- Controlling the alteration of natural floodplains, stream channels, and natural protective barriers which help accommodate or channel floodwaters;
- Controlling filling, grading, dredging, and other development which may increase flood damage; and
- Preventing or regulating the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards in other areas.

Specifically, the regulations require a development permit for construction of development in any area of special flood hazard, outline the duties and responsibilities of the planning director in administering this section, and set standards for flood hazard reduction, including anchoring, construction materials and methods, design and location of utilities, subdivision proposals, elevation (base flood elevation), floodproofing, and mobile homes. Additional provisions more stringently limit development in floodways.

Other Regulations

- **Chapter 45 Fire Prevention and Protection:** The purpose of the Fire Prevention Code is to provide the City with rules and regulations to improve public safety by promoting the control of fire hazards;

regulating the installation, use, and maintenance of equipment; regulating the use of structures, premises, and open areas; providing for the abatement of fire hazards; establishing the responsibilities and procedures for code enforcement; and setting forth the standards for compliance and achievement of these objectives.

- **Chapter 80 Parks, Open Space, and Golf:** Two ordinances in this chapter are related to hazard mitigation. The Open Space Ordinance establishes an open space advisory committee to examine the City's needs for additional open space and make recommendations to the Planning Commission and City Council and establishes open space use regulations. The Trees Ordinance promotes and protects the welfare of trees within the community by providing regulations for planting, maintaining, and removing certain trees. (Trees prevent soil erosion and provide shade and wind breaks).
- **Chapter 104 Stormwater:** This chapter establishes a stormwater utility enterprise and an associated stormwater utility enterprise fund. Stormwater utility means all facilities used for collecting and conducting drainage and/or stormwater to, through, and from drainage areas to the points of final outlet including, but not limited to, any and all of the following: conduits and appurtenant features, canals, ditches, streams, gulches, gullies, flumes, culverts, bridges, streets, curbs, gutters, and pumping stations. The chapter imposes on each and every improved lot and parcel of land within the City a monthly usage fee for stormwater utility facilities.

Other

Lafayette's Major Basin Planning Phase B Report (1980) serves to guide the general concepts and approach for the City of Lafayette regarding the planning of drainage facilities required for new development.

Lafayette is currently working on two (2) Major Basin Planning efforts with Mile High Flood District (MHFD). The first is the Lafayette Area Basin OSP. This plan is anticipated to be completed in 2022. The second is the Bullhead Gulch/Prince Tributary MDP. This plan was recently kicked off and is anticipated to be completed in 2022.

The City's Public Works Department has a Stormwater Management Program. The current focus is on stormwater quality (quantity is regulated in the City's codes).

The City is concurrently developing a water demand study that will be used to inform drought planning and water conservation efforts. Lafayette contracts with Colorado Mosquito Control for mosquito-control services.

Property Protection

Property protection activities are usually undertaken by property owners on a building-by-building or parcel basis.

No current projects/activities.

Natural Resource Protection

Natural protection activities preserve or restore natural areas or their natural functions. They are usually implemented by parks, recreation, or conservation agencies or organizations.

Lafayette owns over 1,000 acres of open space. Open space provides wildlife habitat, protects riparian areas and view corridors, provides buffers between other communities, and connects trail systems. It is acquired and maintained through two separate open-space taxes.

The Open Space Advisory Committee is appointed by City Council to make recommendations regarding the acquisition and management of open space properties.

The City of Lafayette 2001-2002 Open Space Management Policies (2000), which was created by the City of

Lafayette Open Space Advisory Committee, identifies the City's official definition for open space and provides general guidelines for the use of the City's open space as well as maintenance and management guidelines for open space and open space riparian areas. An inventory of open space properties is provided detailing each property's attributes, characteristics, and associated issues; suggested uses and controls; and citizen suggestions for each property's use.

The City of Lafayette Parks, Recreation, Open Space and Trails Master Plan (2019) provides a tool to help the City implement its open space and trails vision with strategic recommendations that build off of the guiding principles outlined in the Comprehensive Plan.

Emergency Services

Emergency services measures are taken during an emergency to minimize its impacts. These measures are the responsibility of city or county emergency management staff and the owners or operators of major or critical facilities.

Lafayette's Fire Department Master Plan (2015) established goals and objectives for the department and set forth recommendations that allow the department to maintain existing services and improve services in a cost-effective manner.

Structural Projects

Structural projects keep hazards away from an area (e.g., levees, reservoirs, other flood control measures). They are usually designed by engineers and managed or maintained by public works staff.

No current projects/activities.

Public Information

Public information activities advise property owners, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of natural resources (e.g., local floodplains). They are usually implemented by a public information office.

The Open Space Advisory Committee organizes several activities each year to stimulate public appreciation of Lafayette's natural resources.

The City offers water conservation tips on its website.

The City has published a WaterWise Landscaping Best Practices Manual in conjunction with the Town of Erie for citizens to use in making choices about their home landscaping to best use limited water resources

C.7 Mitigation Strategy

A hazard mitigation action planning committee re-evaluated the Hazard Identification Risk Assessment (HIRA) to reassess risk based on actions taken since the previous plan was adopted. The following mitigation actions were identified and evaluated by the committee. These represent new or continued actions identified in supporting plans and documents or actions identified by the committee that support overall hazard mitigation.

Table C-25 Lafayette Mitigation Action Progress and Summary

Mitigation Actions	Responsible Office	Status
Establish emergency shelter centers in the city of Lafayette	City of Lafayette	Completed

Mitigation Actions	Responsible Office	Status
Replace Emergency Outdoor Warning Sirens	City of Lafayette	Completed
Mine Subsidence Protection Program	City of Lafayette, Public Works, Lafayette Fire Dept.	Deleted. There is not a local program and the Colorado Division of Natural Resources administers this statewide
Continue to implement sound floodplain management practices as communities participating in the NFIP	Lafayette planning and building Dept.	Continue In progress
Continue to Develop City All Hazard Preparedness Plan	Fire Department	New in 2022
All-Hazards Incident Management Planning	City of Lafayette	New in 2022
Mitigation Planning	City of Lafayette	New in 2022
Identifying Wildfire Mitigation Opportunities	Lafayette Fire Dept. and Public Works	New in 2022
Enhance Warning and Alert Communication	Lafayette Fire Dept., and Police Dept.	New in 2022
Implement Water Conservation Plan	Public Works	New in 2022

The city has completed two existing actions from the previous version of this mitigation plan, including:

- Establish emergency shelter centers in the city of Lafayette
- Replace Emergency Outdoor Warning Sirens

Through the implementation of these mitigation actions the threats to multiple hazards have been reduced including dam failure, flood, tornado, wildfire, windstorm, and winter storm.

One mitigation action is continuing in progress:

- Continue to implement sound floodplain management practices as communities participating in the NFIP

Also, three new mitigation actions were identified by the City of Lafayette in 2022 and they are bulleted below and detailed further in the next section.

- Continuing to Develop City All Hazard Preparedness Plan
- All-Hazards Incident Management Planning
- Flood Mitigation Planning

While these are the current priority mitigation efforts, the City will partner on broader efforts where

applicable on countywide projects that focus on wildfire, winter storm, windstorm and other hazards.

C.7.1 City of Lafayette Mitigation Actions

The following are descriptions of the updated mitigation actions for Lafayette.

Name of Action: Continue to implement sound floodplain management practices as communities participating in the NFIP

Hazard Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 1, 3 and 4

Issue/Background: Continue to review and update high risk flood areas in collaboration with Mile High Flood District.

Other Alternatives: No action

Action Status: In progress/ongoing.

Responsible Office: Lafayette Public Works, and Planning and Building Dept.

Priority (High, Medium, Low): Medium

Cost Estimate: Staff time.

Existing or Potential Funding: City budget

Benefits (avoided losses): Avoid the loss of life and damages to properties.

Schedule: Annual implementation.

Name of Action: Continue to Develop City All Hazard Preparedness Plan

Hazard Addressed: All Hazards

Mitigation Goal or Objective Addressed: Goals 1 and 2

Issue/Background: Continue to develop program related to preparedness for all hazards that pose a risk to the city.

Other Alternatives: Rely on county support

Action Status: New in 2022

Responsible Office: Fire Department

Priority (High, Medium, Low): Medium

Cost Estimate: \$100,000

Existing or Potential Funding: City budget

Benefits (avoided losses): Protection of life and property. Building a safer community through increase of operational resilience capabilities; Incident Management Best Practices

Schedule: 12-18 months

Name of Action: All-Hazards Incident Management Planning

Hazard Addressed: All Hazards

Mitigation Goal or Objective Addressed: Goals 1 and 2

Issue/Background: This project is slated for multiple phases over 2022 and 2023:

- I: Department head awareness level training of incident management philosophies and incident command fundamentals.
- II: Tabletop exercise to determine vulnerabilities in the system design.
- III: Elected officials training to establish roles and lines of communications during emergencies.
- IV: Facilitated exercise to test system as designed.
- V: Recurring exercises to maintain readiness.

Other Alternatives: Rely on county EOC

Action Status: New in 2022/In progress Efforts are currently underway

Responsible Office: Emergency Management is a function of the fire department. Partners include all city departments and integration and support from the County Office of Disaster Management.

Priority (High, Medium, Low): Medium

Cost Estimate: \$25,000

Existing or Potential Funding: Current City Funds

Benefits (avoided losses): Increased operational resilience through coordinated response to emergencies, improved continuity of government, enhanced preparedness for recovery after disasters, and improved intra-departmental communications. Strengthen intergovernmental coordination, communication, and capabilities regarding mitigating hazard impacts.

Schedule: Completion by end of 2023

Name of Action: Flood Hazard Mitigation Planning

Hazard Addressed: Flood

Mitigation Goal or Objective Addressed: Goal 2

Issue/Background: The City is currently in the process of finalizing an updated Lafayette Master Drainage Plan in collaboration with the Mile High Flood District. The new action includes the prioritization and funding source identification to implement recommendations/projects in the plan.

Other Alternatives: Rely on existing planning documents.

Action Status: New in 2022 and in progress

Responsible Office: City of Lafayette

Priority (High, Medium, Low): Medium

Cost Estimate: \$100,000-250,000

Existing or Potential Funding: City budget, Mile High Flood District

Benefits (avoided losses): Understand flood risk and identify alternatives to reduce flood related hazards and losses for future implementation.

Schedule: Anticipated completion of plan in 2023.

Name of Action: Identifying Wildfire Mitigation Opportunities

Hazard Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1, 2 and 4

Issue/Background: Utilize regional subject matter experts to evaluate wildfire and grassland fire risk around high-density areas in the city and to identify wildfire mitigation opportunities including:

- Identify fuels that pose risk to the community and develop a fuels management and fuel reduction plan if warranted,
- Evaluation of existing buildings codes and opportunities to enhance codes to reflect wildfire risk,
- Development of public outreach materials related to wildfire mitigation

Other Alternatives: No Action

Action Status: New in 2022

Responsible Office: Fire Department, Public Works, County OEM

Priority (High, Medium, Low): High

Cost Estimate: \$50,000-\$100,000 and Staff Time

Existing or Potential Funding: General Fund

Benefits (avoided losses): Avoid wildfire event that leads to urban conflagration. Avoid damages to property and loss of life.

Schedule: 2023-2025

Name of Action: Enhance Warning and Alert Communication

Hazard Addressed: Wildfire, Flood, Dam and Levee Failure

Mitigation Goal or Objective Addressed: Goals 1 and 4

Issue/Background: Enhance warning and alert communication capabilities through the development of warning polygons for the entire City of Lafayette, in coordination with neighboring municipalities and Boulder County to decrease the time evacuation takes in emergencies. Following the development of warning polygons, implement a public outreach campaign to inform the public of warning and alerts related to evacuation. Participate in county-wide efforts to improve evacuation route identification and dissemination.

Other Alternatives: No action

Action Status: New in 2022

Responsible Office: Fire Department, Police Department, County OEM

Priority (High, Medium, Low): High

Cost Estimate: \$25,000 - \$50,000 and Staff Time

Existing or Potential Funding: Dept. Budget

Benefits (avoided losses): Avoid loss of life.

Schedule: 2022-2023

Name of Action: Implement actions identified in the City of Lafayette Water Conservation Plan

Hazard Addressed: Drought

Mitigation Goal or Objective Addressed: Goals 2 and 4

Issue/Background: The City of Lafayette developed the 2018 Water Conservation Plan as part of the City's water conservation program. The plan lists 19 current and planned measures and programs. The implementation of those actions will help to mitigate drought by stretching existing water supplies through conservation and system efficiencies. The plan is evaluated on an annual basis and will be revised in 2023.

Other Alternatives: No action

Action Status: New in 2022

Responsible Office: Public Works

Priority (High, Medium, Low): High

Cost Estimate: Staff Time

Existing or Potential Funding: Dept. Budget, General Fund

Benefits (avoided losses): Reduce the impacts of drought and extend water supplies

Schedule: Annual Implementation 2022-2028

Annex D: City of Longmont

Annex D City of Longmont

D.1 Community Profile

Longmont encompasses approximately 30 square miles and sits at an elevation of 4,979 feet above sea level. It is located along the northern Front Range in Boulder and Weld counties and is 37 miles from Denver and 16 miles from Boulder.

In 1870, a group of prominent men in Chicago decided to start a new town in Colorado. They sold memberships in this new town, called “The Chicago-Colorado Colony” and used the money to buy 60,000 acres of land in a carefully chosen site in northern Colorado. They planned the town and brought people, lumber, and building materials to the barren site where they built a small town by the summer of 1871. They named the new town “Longmont” in honor of Longs Peak, clearly visible from the town. For thousands of years prior, American Indian tribes – including the Clovis, Folsom and Plano people – traveled throughout the area where Longmont is today.

While the climate of Longmont is dry, the soil is rich, and will produce excellent crops if water is brought to it. One of the great achievements of the Chicago-Colorado Colony was building large irrigation ditches to bring water from the rivers to the fields of wheat, fruit trees, and peas that farmers planted.

The Colony planners designed Longmont to look like many other towns in America. The original one square-mile plan had stores along Main Street, homes arranged in a grid spreading out from Main Street, and industrial buildings located along the railroad and the St. Vrain River. As the town grew, large-scale agricultural industries arrived. The richness of Longmont’s soil attracted many people.

By 1910, the population of Longmont had doubled just about every ten years since its founding. Growth slowed after this and World War I and the pandemic of 1918 took their tolls on Longmont.

In 1925, the Ku Klux Klan gained control of Longmont’s City Council in an election. They began construction of Chimney Rock Dam, above Lyons. In the 1927 election, they were voted out of office, and their influence soon declined. Work on Chimney Rock Dam was abandoned as unfeasible, and its foundations are still visible in the St. Vrain River.

Longmont was affected by the Great Depression, the prolonged drought during the 1930s, and World War II. In 1950, the City’s economy was based primarily on agriculture, and Mayor Ralph Price, foreseeing a need for more water for a thirsty town, spearheaded the construction of Button Rock Dam, built seven miles upstream from Lyons on the North St. Vrain River. It paid for itself almost immediately, holding what could have been a disastrous flood in check, and filling the reservoir in a few days rather than the years it was projected to take.

In the 1960s, Longmont began to see a shift toward an economy based on advanced technologies. In 1962, the U.S. government built an air traffic control center in Longmont. Three years later, IBM built a large facility seven miles from the city, which accelerated Longmont’s growth. Up to this point the city had grown modestly, but it doubled in size between 1960 and 1970, and again between 1970 and 1980.

Events in the 1970s and 1980s forced Longmont residents to re-examine their community. Two of Longmont’s long-time employers, the Kurer-Empson vegetable cannery and the Great Western Sugar factory, closed in the 1970s, leaving few links with Longmont’s agricultural heritage.

Recessions and cutbacks at IBM and StorageTek, a computer storage company founded by several ex-IBM employees, slowed growth during the 1980s, but rapid growth resumed in the 1990s. The 2000 Census measured Longmont’s population at 71,093, a jump of nearly 20,000 since 1990. Growth in high-technology businesses continued throughout the 2000s, which fueled continued population growth.

By 2010 Longmont's population had grown to 86,270. In September 2013, a major flood struck Colorado's Front Range, with serious impacts to Longmont. Both the St. Vrain River and Left Hand Creek overflowed into neighborhoods and business districts. Rebuilding began immediately and continues still today, with continued investment in the Resilient St. Vrain Project (RSVP). In 2019, the City's population was estimated at 97,530.

D.1.1 Population

With a growth rate of approximately 1.5%, the estimated 2019 population of the City of Longmont was 97,833. The Census American Community Survey (ACS) 1 – Year estimate of 2019 demographic and social characteristics for Longmont are shown in Table D-1.

Table D-1 Longmont's Demographic and Social Characteristics

Characteristic	
Gender/Age	
Male	48.3%
Female	51.7%
Under 5 Years	5.5%
65 Years and Over	15.3%
Race	
White	91.9%
Asian	1.7%
2 or more races	1.8%
American Indian & Alaska Native (AIAN)	0.3%
Black/African American	2.3%
Native Hawaiian & Other Pacific Islanders	0.0%
Ethnicity	
Hispanic or Latino (Of Any Race)	23.8%
Other	
Average Household Size	2.58%
High School Graduate or Higher	89.3%

Source: U.S. Census Bureau, 2019- 1 Year Estimate ACS & Longmont Community Profile 2019

D.1.2 E.1.2 Economy

According to the 2019 American Community Survey (ACS) 1-Year Estimate, the industries that employed most of Longmont's labor force were educational, health, and social services (20.4%); professional, scientific, management, administrative, and waste management services (15%); manufacturing (14.3%); retail trade (11%) and arts, entertainment, and recreation, and accommodation and food services (9.8%). Select economic characteristics for Longmont from the ACS Census estimate are shown in Table D-2.

Table D-2 Longmont's Economic Characteristics

Characteristic	
Families below Poverty Level	6.2%
Individuals below Poverty Level	8.2%
Median Home Value	\$436,700

Characteristic	
Median Household Income	\$82,974
Per Capita Income	\$39,797
Population in Labor Force	71.5%
Unemployment*	2.0%

Source: U.S. Census Bureau, 2019 1-Year ACS & 5-Year ACS

D.2 HAZARD SUMMARY

The most significant hazards for Longmont are floods, dam and levee failure, drought, tornado, severe winter storm and wildfire. Refer to Section 4.4 Vulnerability Assessment for detailed analysis for the county as a whole. There are no hazards that are unique to Longmont. The overall hazard significance takes into account the geographic location, probability of occurrences and magnitude as a way to identify priority hazards for mitigation purposes. Section D.5 Vulnerability Assessment, where possible, analyzes the population, property, and other assets at risk to hazards ranked of medium or high significance that may vary from other parts of the planning area. Other hazards that could impact Longmont include Communicable/ Zoonotic Disease and Outbreaks. Dam and Levee Failure, Drought, Floods, Landslide/Mud and Debris Flow/ Rockfall. Also Lightning, severe Winter and Windstorms. Also tornadoes and wildfires have a medium risk of affecting Longmont.

Table D-3 City of Longmont Hazard Summaries

Hazard Type	Geographic Extent	Probability of Future Occurrences	Magnitude / Severity	Increased Threat (Climate Change)	Hazard Significance
Air Quality	Extensive	Highly Likely	Critical	Moderate	Medium
Avalanche	Limited	Highly Likely	Limited	Low	Low
Communicable / Zoonotic Disease Outbreak	Extensive	Occasional	Critical	Substantial	Medium
Dam and Levee Failure	Significant	Unlikely	Catastrophic	Moderate	High
Drought	Extensive	Likely	Catastrophic	Substantial	High
Earthquake	Extensive	Occasional	Catastrophic	Low	Medium
Expansive Soils	Significant	Highly Likely	Limited	Substantial	Low
Extreme Temperatures	Extensive	Likely	Critical	Severe	Low

Hazard Type	Geographic Extent	Probability of Future Occurrences	Magnitude / Severity	Increased Threat (Climate Change)	Hazard Significance
Flood	Significant	Highly Likely	Critical	Severe	High
Hailstorm	Extensive	Likely	Limited	Moderate	Limited
Landslide/Mud and Debris Flow/Rockfall	Limited	Occasional	Limited	Substantial	High*
Lightning	Extensive	Likely	Limited	Moderate	Medium
Severe Winter Storm	Extensive	Highly Likely	Catastrophic	Substantial	Medium
Subsidence	Significant	Likely	Limited	Low	Low
Tornado	Significant	Likely	Limited	Low	Medium
Wildfire	Significant	Highly Likely	Critical	Moderate	High
Windstorm	Extensive	Highly Likely	Catastrophic	Substantial	High

Geographic Extent

- Limited: Less than 10% of planning area
- Significant: 10-50% of planning area
- Extensive: 50-100% of planning area

Increase Threat from Climate Change

- Low- unlikely to become more of a threat due to climate change.
- Moderate – possibly will become more of a threat due to climate change.
- Substantial- likely to become more of a threat due to climate change.

Probability of Future Occurrences

- Highly Likely: Near 100% chance of occurrence in next year or happens every year.
- Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less.
- Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years.
- Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.

Magnitude/Severity

- Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
- Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability.
- Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or

- Severe- highly likely to become more of a threat due to climate change

injuries/illnesses treatable do not result in permanent disability.

- Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance

- Low: minimal potential impact
- Medium: moderate potential impact
- High: widespread potential impact

**Note: This is related to the potential for debris flow in the watershed that includes the City's water supply and Button Rock Reservoir.*

D.3 ASSET INVENTORY

D.3.1 Property Inventory

Table D-4 represents an inventory of property in Longmont based on the Boulder and Weld County Assessor's data as of March 2022.

Table D-4 Longmont's Property Inventory

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
Agricultural	14	36	\$4,366,266	\$4,366,266	\$8,732,532
Commercial	1,076	963	\$975,091,102	\$975,091,102	\$1,950,182,204
Exempt	441	796	\$639,262,943	\$639,262,943	\$1,278,525,886
Industrial	195	271	\$489,665,660	\$734,498,490	\$1,224,164,150
Mixed Use	111	215	\$118,634,626	\$118,634,626	\$237,269,252
Residential	29,478	31,974	\$11,366,791,434	\$5,683,395,717	\$17,050,187,151
Vacant	10	18	\$1,209,367	\$1,209,367	\$2,418,734
Total	31,325	34,273	\$13,595,021,398	\$8,156,458,511	\$21,751,479,909

Source: Boulder and Weld County Assessor's Office, Wood Analysis

D.3.2 Other Assets

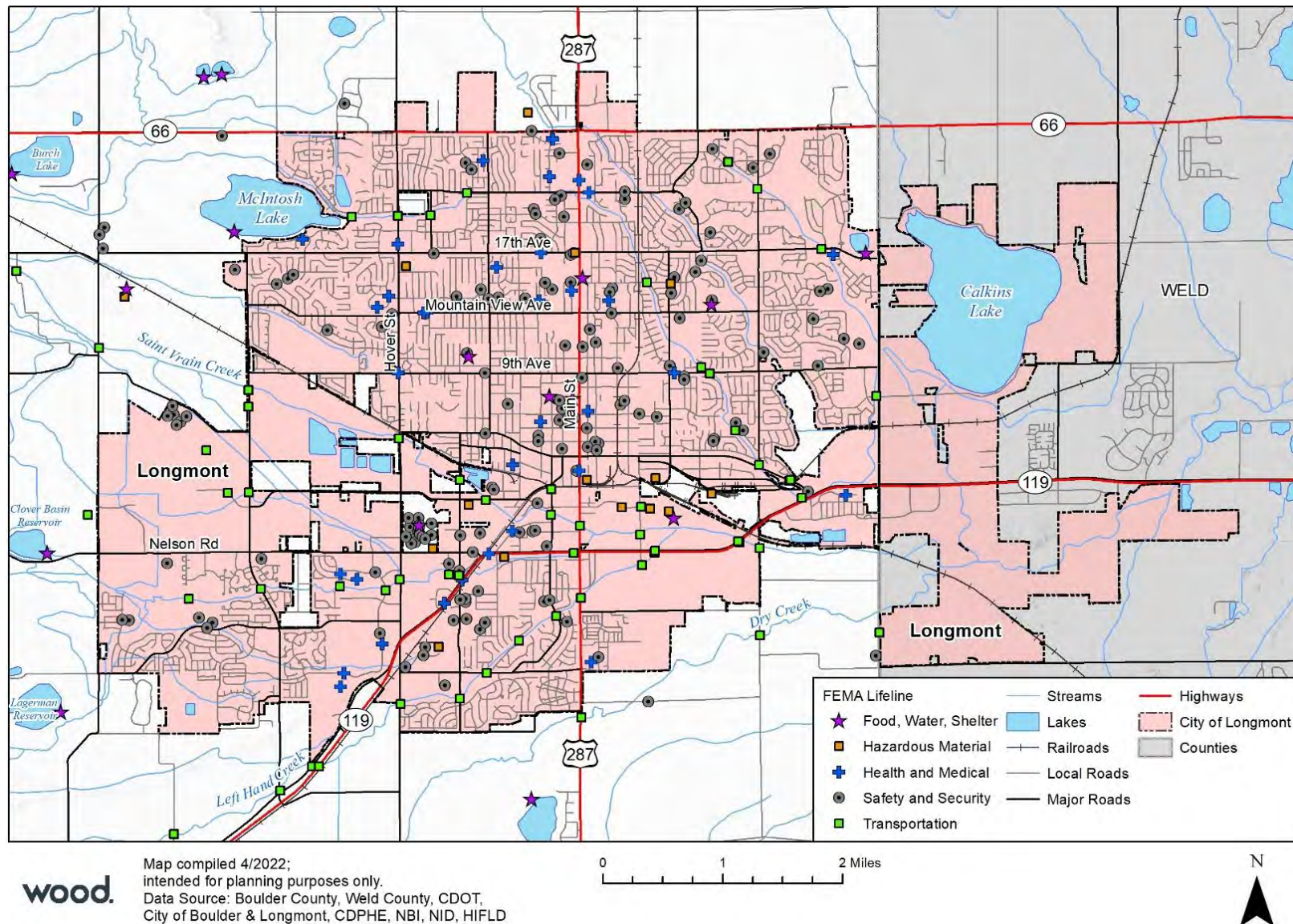
Table D-5 is a detailed inventory of assets identified by the City's Planning Division. This inventory includes critical facilities. For more information about how "critical facility" is defined in this plan, see Section 4.4 Vulnerability Assessment. Longmont's base map and critical facility locations are located in Figure below.

Table D-5 Summary of Longmont's Critical Facilities In GIS

Facility Type	Sub-Type	Count
Food, Water, Shelter	Dam Low Hazard	1
	Red Cross Shelter	5
	Wastewater Treatment	1
	Total	7
Hazardous Material	Hazardous Material	13
	RMP Facility	3
	Total	16

Facility Type	Sub-Type	Count
Health and Medical	Assisted Living Residence/Nursing Home	16
	Disability Care	1
	EMS Facility	1
	End Stage Renal Disease	3
	Federally Qualified Health Center	1
	Home and Community Based Services	8
	Hospice	2
	Hospital	2
	Rehabilitation or Recovery	1
	Surgery or Transplant	4
	Total	39
Safety and Security	Boulder County Building	23
	Childcare Provider	83
	Fire Station	6
	Government Building	1
	Library	2
	Police Station	1
	School	34
	Total	150
Transportation	Airport	1
	Bridge Non-Scour Fair Condition	25
	Bridge Non-Scour Good Condition	19
	Bridge Non-Scour Poor Condition	2
	Total	47
	Grand Total	259

Source: City of Longmont, Boulder and Weld County, CDPHE, NBI, NID, HIFLD

Figure D-1 Location of Critical Facilities in Longmont

D.3.3 Economic Assets

Economic assets at risk may include major employers or primary economic sectors, such as, agriculture, whose losses or inoperability would have severe impacts on the community and its ability to recover from disaster. After a disaster, economic vitality is the engine that drives recovery. Every community has a specific set of economic drivers, which are important to understand when planning ahead to reduce disaster impacts to the economy. When major employers are unable to return to normal operations, impacts ripple throughout the community.

Longmont's top employers as of 2020 are listed in Table D-6.

Table D-6 Longmont Area's Top Employers

Company Name	Product	Employees
St. Vrain Valley Schools	School District	3,543
City of Longmont	City government	1,625
Seagate Technology	Computer disk drives	1,430
Intrado	911 Database & mapping services	755
Longmont United Hospital	Regional Hospital	671
UCHealth Longs Peak Hospital	Regional Hospital	540
McLane Western	Grocery distribution center	460
Federal Aviation Administration	Aviation control center	422
Circle Graphics	Digital billboards/personal photography printing	400
AveXis	Biotech gene therapy	354
Crocs	Croc shoes	345
The J.M. Smucker Company	"Uncrustables" food production	250
Baker Hughes	Power generation & energy technology	232
Wiland	Direct marketing services	225
BC Services, Inc.	Professional accounts receivable firm	220
Xilinx	Programmable logic (software)	215
DigitalGlobe	Satellite imagery	206
Micron Technology	Electronic microdisplays & enterprise drives	206
Nite Ize	Mobile, hardware LED lights	200
PharMerica	Regional billing office	200
Intel Corporation	Hardware & software engineering	165
NEOTech	Contract manufacturing	156
Western Digital	Computer disk drives	153
Current, powered by GE	LED light products	125
Sun Construction & Design Services	Construction & design services	122
Mentor Graphics	Software design	118
Woodley's Fine Furniture	Custom furniture	117
Golden Triangle Construction	Construction services	115
Cambrex Pharmaceuticals	Pharmaceutical development	103
PTA Corporation	Plastic injection molding	98

Company Name	Product	Employees
MKS Instruments	Vacuum measurement instruments	97
Claremont Foods	Food packaging	95
Sparkfun Electronics	Electronic kits	95
EnerSys/ABSL Space Products	lithium-ion batteries for spacecraft and launch vehicles.	92

Source: Longmont Economic Development Partnership (LEDP)

D.3.4 Natural, Cultural, And Historic Resources

Assessing the vulnerability of Longmont to disaster also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- If these resources are impacted by a disaster, knowing so ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts are higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.

Natural Resources

Natural resources of importance in Longmont include Union Reservoir, Golden Ponds, Sandstone Ranch, Jim Hamm Nature Area, St. Vrain Creek Corridor, Lefthand Creek Corridor, Dry Creek Corridor, and Lake McIntosh. For information about natural resources in Boulder County, which includes Longmont, see Section 4.4 Vulnerability Assessment.

Historic And Cultural Resources

Table D-7 lists the properties in Longmont that are on the National Register of Historic Places and/or the Colorado State Register of Historic Properties for more information about these registers, see Section 4.4.5 Community Services, of the Boulder County Hazard Mitigation Plan.

Table D-7 Longmont's Historic Properties/Districts in National and State Registers

Property	Address	Date Listed
Callahan, T. M., House	312 Terry Street	5/16/1985
Dickens Opera House	300 Main Street	7/28/1987
Downtown Historic District	Bounded by 5th Avenue on the north; 3rd Avenue on the South; Coffman Street on the West, and Emery Street on the East.	10/2017
East Side Historic District	Bounded by Longs Peak Avenue, Collyer Street, 4th Avenue, and Emery Street	10/2/1986
Empson Cannery	15 3rd Avenue	1/5/1984
Hoverhome and Hover Farmstead	1303-1309 Hover Road	1/15/1999
Longmont Carnegie Library	457 4th Avenue	11/3/1992
Longmont College	546 Atwood Street	8/12/1987
Longmont Fire Department	667 4th Avenue	5/16/1985
St. Stephen's Episcopal Church, 1881	470 Main Street	2/24/1975
West Side Historic District	Roughly bounded by 5th, Terry, 3rd, and Grant	1/7/1987

Sources: *Directory of Colorado State Register Properties*, www.coloradohistory-oahp.org/programareas/register/1503/;
National Register Information System, www.nr.nps.gov/

The City of Longmont currently has 134 designated historic structures located throughout the city. A structure may be designated for preservation if it has historical, architectural, or geographical importance to the community. Table D-8 lists Longmont's designated historic landmarks.

Table D-8 Designated Historic Landmarks in Longmont

	Property Name	Address	Construction Year	Designation Year
1	Callahan House ¹	312 Terry Street	1892	1973
2	St. Stephens Church ²	470 Main Street	1881	1974
3	Old Mill Park ³	237-239 Pratt Street	1859-80's	1974
4	Central School	1000 Block Fourth Avenue	1878	1976
5	Imperial Hotel	301 Main Street	1881	1977
6	Fire Station ⁴	667 Fourth Avenue	1907	1977
7	Wiswall-Denio House	902 Third Avenue	1892	1977
8	Robert Stephens House	503 Bross Street	1891	1977
9	William Butler House	255 Pratt Street	1884	1978
10	Library Hall	335 Pratt Street	1871	1978
11	Mead House	502 Collyer Street	1883	1978
12	Old Allen House	924 Second Avenue	1870's	1978
13	Longmont Presbyterian College ⁵	546 Atwood Street	1886	1978
14	Kiteley House	220 Ninth Avenue	1891-92	1978
15	George W. Allen House	703 Third Avenue	1892	1978
16	Presbyterian Church	402 Kimbark Street	1905	1978
17	Corner House	600 Baker Street	ca 1905-11	1980
18	J.B. Thompson House	537 Terry Street	ca 1887	1980
19	Starbird-Hartman House	324 Eighth Avenue	ca 1889	1980
20	P.E. Hamm House	709 Third Avenue	ca 1906	1980
21	D.C. Donovan House	347 Pratt Street	1900	1980
22	Spangler House	1032 Collyer Street	1903	1981
23	Zimbeck House	601 Collyer Street	1896	1981
24	Lutes Drug Store	379 Main Street	ca 1890	1983
25	Webb House	536 Collyer Street	ca 1900	1983
26	Kuner-Empson Cannery ⁶	15 Third Avenue	ca 1903	1983
27	Dickens Opera House ⁷	300 Main Street	1881	1983
28	Andrews House	719 Third Avenue	1907	1985
29	Dobbins House	419 Collyer Street	1885	1985
30	Traylor Hardward	346 Main Street	1879	1985
31	Bemis-Rowen House	545 Collyer Street (6th & Collyer)	1886	1985
32	Hubbard House	243 Pratt Street	1873	1985
33	M.J. Perrin House	501 Emery Street	1902	1985
34	Beckwith House ¹¹	207 Bowen Street	Late 1880's	1985

	Property Name	Address	Construction Year	Designation Year
35	A.M. Preston House ⁸	314 Bross Street	1905	1985
36	Turrell House	201-203 Bowen Street	1880's	1986
37	Sullivan-Mahony House	326 Bross Street	1892	1986
38	Fox-Downer House	920 Third Avenue	1897	1986
39	Van Zant-Fry House	1237 Third Avenue	1906	1986
40	Margaret Hertha House	615 Emery Street	1883	1986
41	Emmons-Adler House	858 Third Avenue	1903	1986
42	James W. Bacon House	407 Bowen Street	1885	1987
43	Earl Sprague House	902 Fifth Avenue	ca 1905	1987
44	F.J. Miller/Lou Allen House	1236 Third Avenue	1905	1987
45	Atwood-Jones House	503 Collyer Street	1883	1987
46	S.D. Arms House	437 Collyer Street	1887	1987
47	Williams-Pennock House	403 Collyer Street	1901	1987
48	J.E. Bump House	1117 Third Avenue	1902	1987
49	Sprague-Large House	413 Collyer Street	1901	1988
50	Golden-Miner House	817 Collyer Street	1893	1988
51	Masonic Temple	312 Main Street	1905	1988
52	W.P.A. Post Office	501 Fifth Avenue	1936	1988
53	H.W. Preston House	319 Bross Street	1880	1988
54	Judge Secor House	247 Pratt Street	1903	1988
55	J. Crawler House	734 Baker Street	1888 est.	1988
56	Friend Wright House	824 Collyer Street	1905	1989
57	Charles Lewis House	517 Collyer Street	1899	1989
58	J.J. Beasley/Sheeder Drug	372 Main Street	1886	1990
59	Trojan Theater	513 Main Street	1939	1991
60	J.M. Anderson House	436 Pratt Street	1902	1991
61	Great Western Hotel	250 Kimbark	1919	1993
62	U.S. Post Office/American Legion Building	525 Third Avenue	1905	1994
63	Mumford/Cole House	525 Collyer Street	1881	1994
64	L.F. Steuerwald House	914 Third Avenue	1897	1994
65	Historic Hover Farm (east portion)	1303 Hover Road	1893	1994
66	Johnson/Gunning House	1206 Third Avenue	1924	1995
67	Carnegie Library ⁹	457 Fourth Avenue	1912	1995
68	Kistler/Gunning House	1005 Third Avenue	1909	1995
69	Ludlow House	812 Third Avenue	1917	1995
70	Grosjean House	321 Gay Street	1919	1995
71	H.P. Nelson House	306 Collyer Street	1901	1995
72	Dobbins/Pierce	509 Collyer Street	1919	1995
73	Carlton-Calkins Commercial Building	416 Main Street	1906	1996
74	Pump House Brewery	540 Main Street	1912-1918	1996
75	Hover Farmstead (west portion)	1303 Hover Street	1913-1914	1996

	Property Name	Address	Construction Year	Designation Year
76	Pike Road Barn	13076 Pike Road	1898	1997
77	Carlson/Wallace Property	10662 Pike Road	1910	1997
78	Hover Home	1309 Hover Street	1913-1914	1997
79	Old City Electric Building	103 Main Street	1931	1997
80	Charles A. Ball House	1021 Third Avenue	1917	1997
81	Park Hotel	246 Main Street	1907	1997
82	E.B. Hanson	438 Collyer Street	1906	1998
83	Nowlen Home	345 Mountain View	1900	1998
84	Secor Clarke home	318 Pratt Street	1891	1999
85	Baker House	730 Kimbark Street	1889	1999
86	Kramer Home	1110 Longs Peak Avenue	1920s (?)	1999
87	Alex Bloom House	524 Emery Street	1908	1999
88	Morse Coffin House ¹⁰	990 SH 119 (Sandstone Ranch)	1880s	1999
89	3rd Avenue Grocery	1283 3rd Avenue	1915	2000
90	Historic Longmont City Hall	505 Fourth Avenue	1922	2001
91	Hildreth House	726 Kimbark Street	1910	2001
92	Booth House	634 Emery Street	1907	2001
93	St. Stephens Episcopal Church	513 Emery Street	1894	2002
94	O'Connor / Bragg House	415 Emery Street	1904	2002
95	Carrie Rendahl House	511 Gay Street	1904 est.	2003
96	Historic City Warehouse	375 Kimbark Street	1927	2003
97	Ed Jones Building	519 Fourth Avenue	1897	2003
98	John Jr. and Nellie Townley House	960 5th Avenue	1928	2003
99	Busch House	724 Collyer Street	1908	2003
100	G.W. Booth House	1019 3rd Avenue	1908	2003
101	Hartman-Greenamyre House	535 Collyer Street	1908	2004
102	White-Smith House	426 Emery Street	1885-1887	2004
103	Mellinger-Spangler House	731 Collyer Street	1909	2004
104	Longmont National Bank	400 Main Street	1888-1889	2004
105	Dickens Homestead	136 S. Main Street	1872	2004
106	Graham House	616 Baker Street	1906	2004
107	Jennings House	102 4th Avenue	1895	2004
108	Lockling House	1130 Collyer Street	1915	2004
109	Slater House	608 Emery Street	1906	2004
110	Davis-Price House	542 Collyer Street	1887	2004
111	Smith-Abbot House	802 Baker Street	1899	2004
112	Miller House	428 Baker Street	1900	2004
113	German Congregational Church	641 Martin Street	1881	2005
114	Wymann-White House	420 Terry Street	1886	2006
115	Clawson House	535 Baker Street	1906	2006
116	Blakeslee House	202 Pratt Street	1933	2006
117	Higbee House	251 Gay Street	1895	2006

	Property Name	Address	Construction Year	Designation Year
118	Secor House	430 Pratt Street	1907	2006
119	Young - Blum House	422 Pratt Street	1907	2006
120	Smith-Balliet House	545 Baker Street	1910	2007
121	Knott House	437 Vivian Street	1907	2007
122	Johnson's Corner	1117 Neon Forest Circle	1937	2007
123	First Baptist Church	701 Kimbark Street	1921	2009
124	Jacobsen House	619 Collyer Street	1925	2009
125	B.F. Flemming House	1249 3rd Avenue	1909	2010
126	Rider House	352 Collyer Street	1910	2012
127	G.W. Butler House	1241 3rd Avenue	ca 1920	2015
128	Lavridson House	408 4th Avenue	ca 1920	2015
129	Christopher/Copeland House	208 5th Avenue	ca 1900	2016
130	Nicholas House	1266 Longs Peak Avenue	ca 1910	2016
131	Reinert House	330 Collyer Street	1907	2016
132	Dell House	430 Emery Street	ca 1900	2017
133	Price/Hartman House	1400 E 9th Avenue	1898	2017
134	Anaya House	710 Martin Street	1951	2019
135	Barger / Nickell House	719 Atwood Street	1905	2019
136	Turrell/ Andrew House	864 4th Avenue	1862	2019

1 Entered in the National Register of Historic Places on May 16, 1985.

2 Entered in the National Register of Historic Places on February 24, 1975.

3 Includes Affolter Cabin, Hauck Milk House, Townley House, Billings Cabin, Secor Centennial Gardens and Mill Pond

4 Entered in the National Register of Historic Places on May 16, 1985.

5 Entered in the National Register of Historic Places on August 12, 1987.

6 Entered in the National Register of Historic Places on October 28, 1983.

7 Entered in the National Register of Historic Places on July 28, 1987.

8 Ne: Jones Townley House

9 Entered in the National Register of Historic Places on December 3, 1992.

10 Entered in the National Register of Historic Places in 1984.

It should be noted that as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

D.4 Growth and Development Trends

Table D-9 illustrates how Longmont has grown in terms of population and number of housing units between 2010 and 2019. The table illustrates that Longmont is undergoing significant, and rapid, growth.

Table D-9 Longmont's Change in Population and Housing Units, 2010-2019

2010 Population	2019 Population Estimate	Estimated Percent Change 2010 - 2019	2010 # of Housing Units	2019 Estimated # of Housing Units	Estimated Percent Change 2010 - 2019
86,429	96,672	+11.9	35,075	41,696	+18.9

Source: US Census Bureau, City of Longmont

D.5 Vulnerability Assessment

The intent of this section is to assess Longmont's vulnerability separate from that of the planning area as a whole, which has already been assessed in Sections 4.4 Vulnerability Assessment and 4.5 Estimating Potential Losses of the Base plan. This vulnerability assessment analyzes the population, property, critical facilities, and other assets at risk for the more significant hazards or where available data permits a more in-depth analysis. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment of the Base Plan.

Table D-5 lists summary information about the 259 critical facilities and other community assets identified by Longmont's HMPC as important to protect or provide critical services in the event of a disaster. For additional information on the definitions behind each critical facility category, source, and other details refer to Section 3.3.2 of the Base Plan.

D.5.1 Vulnerability by Hazard

The hazard summaries in Table D-3 above reflect the hazards that could potentially affect City. Based on this analysis, the priority hazard (High Significance) for mitigation are Floods and Severe Winter Storms. Those of Medium or High significance for the City of Longmont are identified in Table D-3.

Due to the ability to quantify vulnerability further with available data, only the dam, flood, and wildfire hazards will be profiled in the following vulnerability assessment section.

Hazards assigned a significance rating of Low and which do not differ significantly from the County ranking (e.g., Low vs. High) are not addressed further in this plan and are not assessed individually for specific vulnerabilities in this section.

Dam Failure

General Property

While there is no concrete data available to indicate any likelihood of failure, based on best available dam inundation data there might be structures potentially at risk of dam failure flooding. The dam failure inundation maps contain sensitive information and are not available for display in this public planning document. Based on a GIS analysis performed with the county parcel layer and the available dam inundation mapping (for planning purposes only), the following potential damages would be expected in Longmont.

Table D-10 Estimated Dam Inundation Exposure to Properties in Longmont

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Agricultural	2	7	\$539,400	\$539,400	\$1,078,800	
Commercial	359	459	\$432,560,779	\$432,560,779	\$865,121,558	
Exempt	136	240	\$95,407,941	\$95,407,941	\$190,815,882	
Industrial	103	141	\$141,326,960	\$211,990,440	\$353,317,400	
Mixed Use	28	86	\$58,101,126	\$58,101,126	\$116,202,252	213
Residential	3,981	4,598	\$1,393,086,271	\$696,543,136	\$2,089,629,407	11,403

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Vacant	1	1	\$66,760	\$66,760	\$133,520	
Total	4,610	5,532	\$2,121,089,237	\$1,495,209,582	\$3,616,298,819	11,616

Source: Boulder and Weld County Assessor's Office, DWR, Wood Analysis

People, Critical Facilities and Infrastructure

Based on the GIS analysis summarized in the table above, it is expected that around 11,616 people in Longmont might be at risk of dam inundation hazards. Also based on the GIS analysis summarized in the table below, it is expected that around 81 critical facilities in Longmont might be at risk of dam inundation hazards.

Table D-11 Longmont Critical Facilities at Risk of Dam Failure

FEMA Lifeline	Count
Food, Water, Shelter	2
Hazardous Material	12
Health and Medical	14
Safety and Security	31
Transportation	22
Total	81

Source: City of Longmont, Boulder and Weld County, DWR, CDPHE, NBI, NID, HIFLD

Economy

In addition to commercial and residential building impacts, a dam inundation event that affected the major roads which give access to the city. Which could significantly affect the local economy, by limiting or completely impeding access to shops, restaurants, hotels, and other major industries which keep the local economy thriving.

Historical, Cultural, and Natural Resources

Dam or reservoir failure effects on the environment would be similar to those caused by flooding from other causes. For the most part the environment is resilient and would be able to rebound, though this process could take years. However, historic and cultural resources could be affected just as housing or critical infrastructures would.

Flood

The major drainageway through Longmont is the St. Vrain River and Left Hand Creeks. The streambed is straight and rough containing large rocks. The floodplain is largely confined to the channel but does increase to between 300 to 400 feet in width in the ponds and behind some of the culverts.

Flooding in Longmont is primarily caused by the overflow of the St. Vrain River, and smaller tributaries such as Left Hand and other surround creeks. Flooding is mostly likely to occur in mid-June due to runoff from snowmelt. Major past flooding within the town was caused by backwater from blocked culverts and bridges. Many of the culverts have since been replaced; however, if these become blocked, they would again cause flooding around major crossings.

General Property

Vulnerability to flooding was determined by summing potential losses to Longmont's properties in GIS, by using the latest FEMA NFHL data along with the Boulder County parcel layer provided by the Assessor's Office. FEMA's NFHL data depicts the 1% annual chance (100-year) and the 0.2% annual chance (500-year) flood events. Figure below displays Longmont's FEMA special flood hazard areas present in the town, color coded based on flood event (i.e. 100-year versus 500-year).

Based on the GIS analysis performed with the county parcel layer and the available FEMA flood mapping, the potential risk for the Town is shown in Table D-12 and Table . Longmont's 1% annual chance flood zone presents has 716 properties and over an estimated \$382 million total value exposed. The 0.2% annual chance event would add an additional 2,722 properties, with loss estimates for both flood events equaling about \$12.9 million in Longmont. Most properties at risk of flooding from both events are residential.

Table D-12 Summary of Longmont Properties Vulnerable to 1% Annual Chance Flood Events, by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Commercial	68	126	\$47,857,800	\$47,857,800	\$95,715,600	\$23,928,900	
Exempt	67	89	\$28,918,637	\$28,918,637	\$57,837,274	\$14,459,319	
Industrial	44	72	\$49,676,560	\$74,514,840	\$124,191,400	\$31,047,850	
Mixed Use	10	34	\$5,469,300	\$5,469,300	\$10,938,600	\$2,734,650	84
Residential	300	397	\$63,630,540	\$31,815,270	\$95,445,810	\$23,861,453	985
Total	489	718	\$195,552,837	\$188,575,847	\$384,128,684	\$96,032,171	1,069

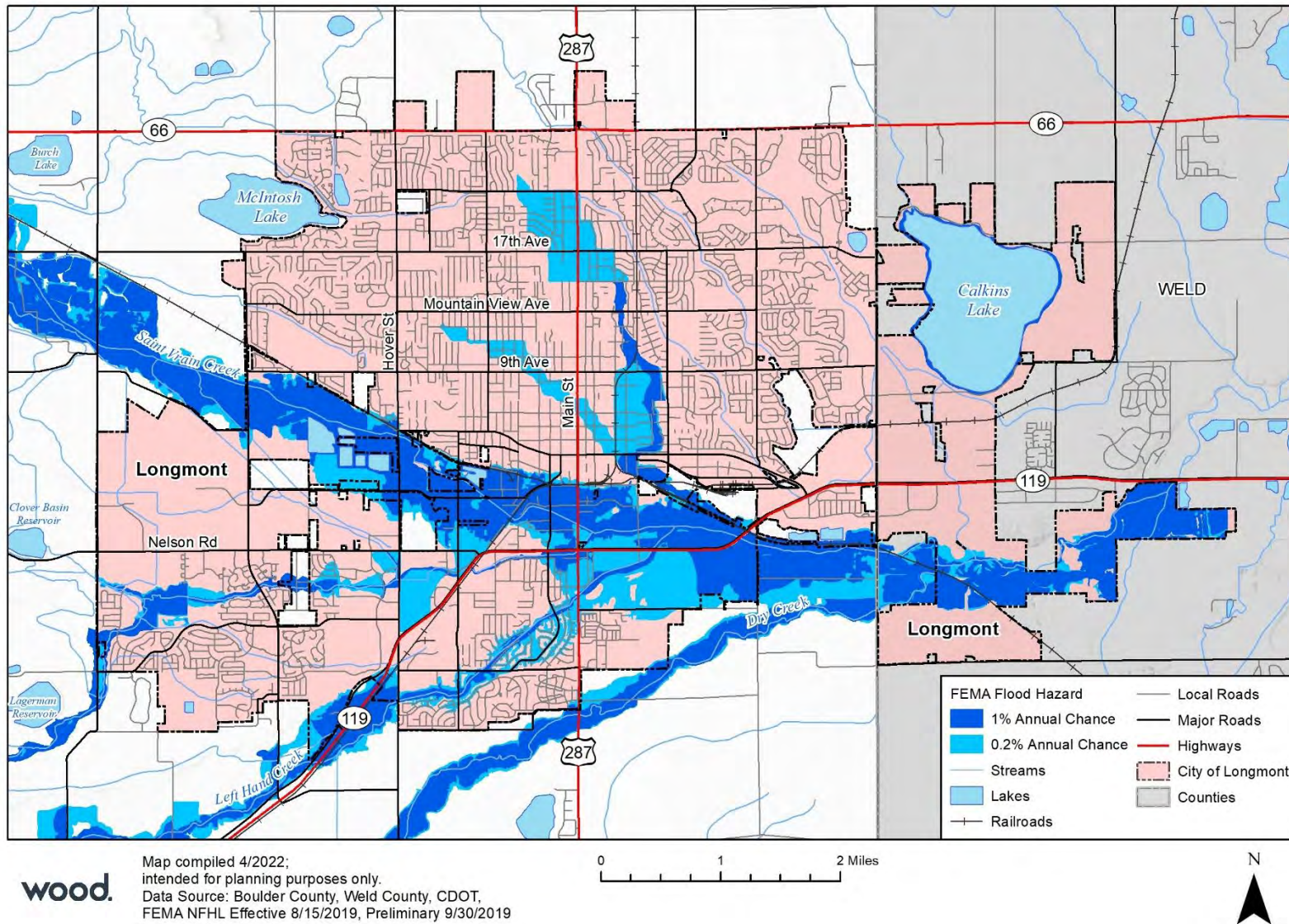
Source: Boulder and Weld County, FEMA NFHL Effective 8/15/2019 & Preliminary 9/30/2019, U.S., Census Bureau, Wood Analysis

Table D-13 Summary of Longmont Properties Vulnerable to 0.2% Annual Chance Flood Events, by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Agricultural	2	6	\$451,800	\$451,800	\$903,600	\$225,900	
Commercial	192	257	\$264,786,201	\$264,786,201	\$529,572,402	\$132,393,101	
Exempt	55	93	\$54,167,417	\$54,167,417	\$108,334,834	\$27,083,709	
Industrial	33	42	\$68,778,500	\$103,167,750	\$171,946,250	\$42,986,563	
Mixed Use	18	45	\$10,978,300	\$10,978,300	\$21,956,600	\$5,489,150	112
Residential	1,810	2,279	\$557,649,627	\$278,824,814	\$836,474,441	\$209,118,610	5,652
Total	2,110	2,722	\$956,811,845	\$712,376,282	\$1,669,188,127	\$417,297,032	5,764

Source: Boulder and Weld County, FEMA NFHL Effective 8/15/2019 & Preliminary 9/30/2019, U.S., Census Bureau, Wood Analysis

Figure D-2 FEMA Special Flood Hazard Areas in Longmont



People

The population exposed to the flood hazards described in the flood vulnerability analysis above was estimated by applying an average household size factor to the number of improved residential properties identified in the flood hazard areas within Longmont. These estimates yielded the population exposures shown in the table above in Table and Table. As such, the combined 1% and 0.2% annual chance floods would potentially displace 6,833 people, based on the residential structures which fall in those flood zones. For additional details on potential displacements by flood event, see the Boulder County Base Plan.

Critical Facilities and Infrastructure

There are a total of 64 critical facilities located in both the 1% and 0.2% flood hazard areas. The main critical facilities within Longmont located in the 1% floodplain are transportation with 17. Within the 0.2% flood hazard area, Safety and Security facilities possess the highest amount with 19.

Table D-14 FEMA 1% Annual Chance Flood Hazard for Critical Facilities in Longmont

FEMA Lifeline	Count
Food, Water, Shelter	1
Hazardous Material	9
Safety and Security	6
Transportation	17
Total	33

Table D-15 FEMA 0.2% Annual Chance Flood Hazard for Critical Facilities in Longmont

FEMA Lifeline	Count
Food, Water, Shelter	2
Hazardous Material	1
Health and Medical	3
Safety and Security	19
Transportation	6
Total	31

Source: City of Longmont, Boulder and Weld County, FEMA NFHL Effective 8/15/2019 & Preliminary 9/30/2019, CDPHE, NBI, NID, HIFLD

Source for 1% Annual Chance Also

Economy

Flooding can have a major economic impact on the economy, including indirect losses such as business interruption, lost wages, and other downtime costs. Flooding often coincides with the busy summer tourism months in Boulder County, and may impact, directly or indirectly (such as from the negative perception of potential danger to his hazard), the revenues of shops, restaurants, hotels, and other major industries which keep the local economy thriving.

Historical, Cultural, and Natural Resources

The environment is mostly resilient to general flooding. However, cultural or historic properties within floodplains would be affected in similar ways as property and critical facilities/infrastructure, especially those with underground or basement levels where water would easily seep and potential ruin archives, resources, or other important assets.

Wildfire

General Property

Parcel analysis was conducted using GIS to analyze where parcels, buildings counts, property types and content values intersected with the wildfire hazards zones defined by the Colorado Forest Atlas, from highest to lowest risk. The Colorado Forest Atlas calculates a composite risk rating, defined as the possibility of loss or harm occurring from a wildfire. It identifies areas with the greatest potential impacts from a wildfire – i.e. those areas most at risk - considering all values and assets combined together – WUI Risk, Drinking Water Risk, Forest Assets Risk and Riparian Areas Risk. This risk index has been calculated consistently for all areas in Colorado, allowing for comparison and ordination of areas across the entire state. The Wildfire Risk Classes for Longmont are shown in in Table , Table and Figure D-3 below.

Table D-16 Property Values in High Wildfire Zones by Parcel Type for Longmont

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Exempt	2	2	\$12,372,386	\$12,372,386	\$24,744,772	
Residential	380	51	\$233,620,240	\$116,810,120	\$350,430,360	126
Vacant	4	4	\$407,460	\$407,460	\$814,920	
Total	386	57	\$246,400,086	\$129,589,966	\$375,990,052	126

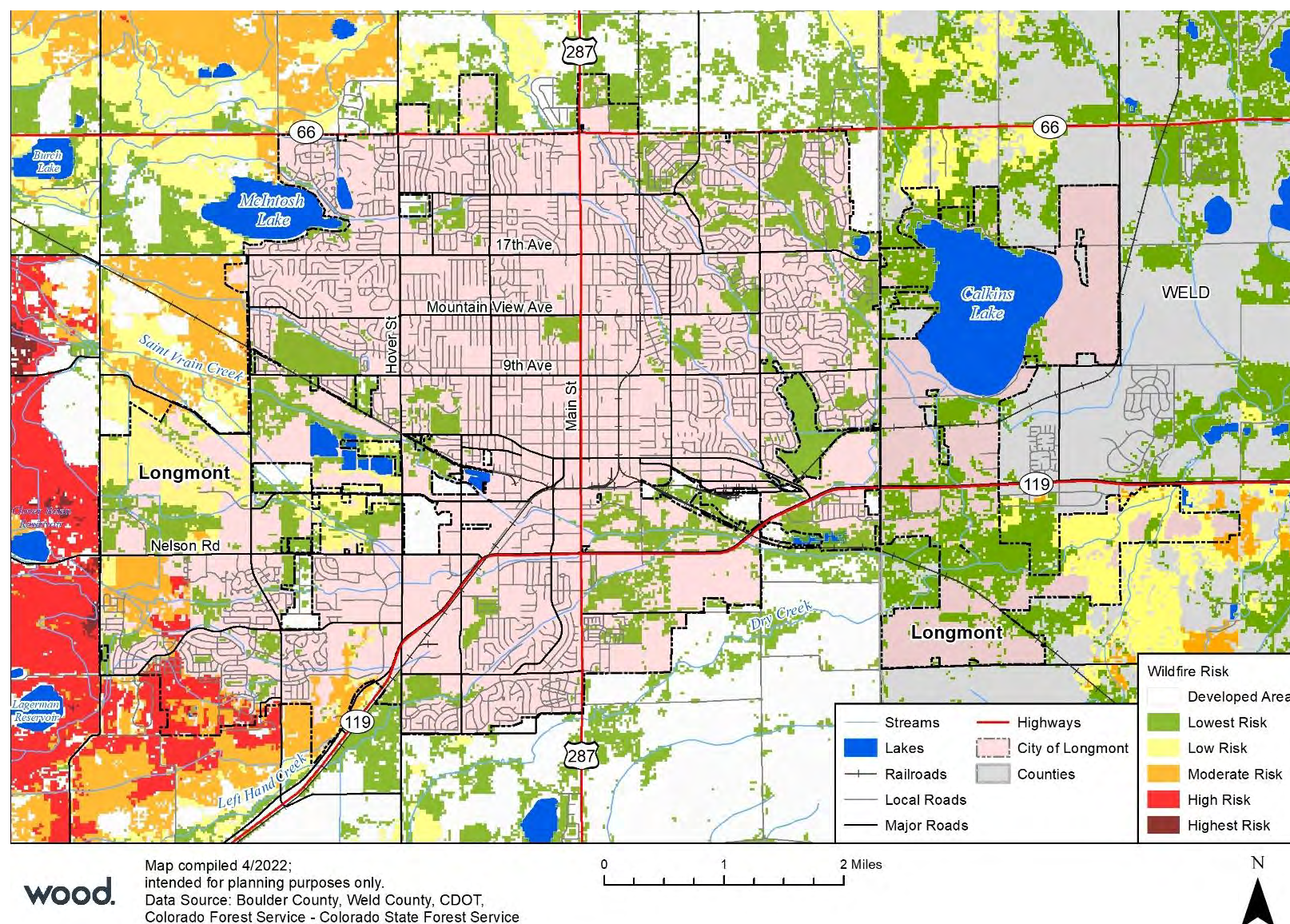
Source: Boulder and Weld County, Colorado Forest Service, U.S., Census Bureau, Wood Analysis

Table D-17 Property Values in Moderate Wildfire Zones by Parcel Type for Longmont

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Commercial	1	2	\$3,094,000	\$3,094,000	\$6,188,000	
Exempt	3	8	\$5,099,777	\$5,099,777	\$10,199,554	
Residential	288	276	\$197,532,890	\$98,766,445	\$296,299,335	684
Total	292	286	\$205,726,667	\$106,960,222	\$312,686,889	684

Source: Boulder and Weld County, Colorado Forest Service, U.S., Census Bureau, Wood Analysis

Figure D-3 City of Longmont Wildfire Risk



Wildland-Urban Interface

The Colorado Forest Atlas also provides an analysis for Wildland-Urban Interface (WUI) risk based on housing density consistent with Federal Register National standards. The location of people living in the wildland-urban interface and rural areas is essential for defining potential wildfire impacts to people and homes. To calculate the WUI Risk Index, the WUI housing density data was combined with flame length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9, while areas with low housing density and low flame lengths are rated -1. Data is modelled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers. WUI Risk for Longmont is mapped in Figure D-4.

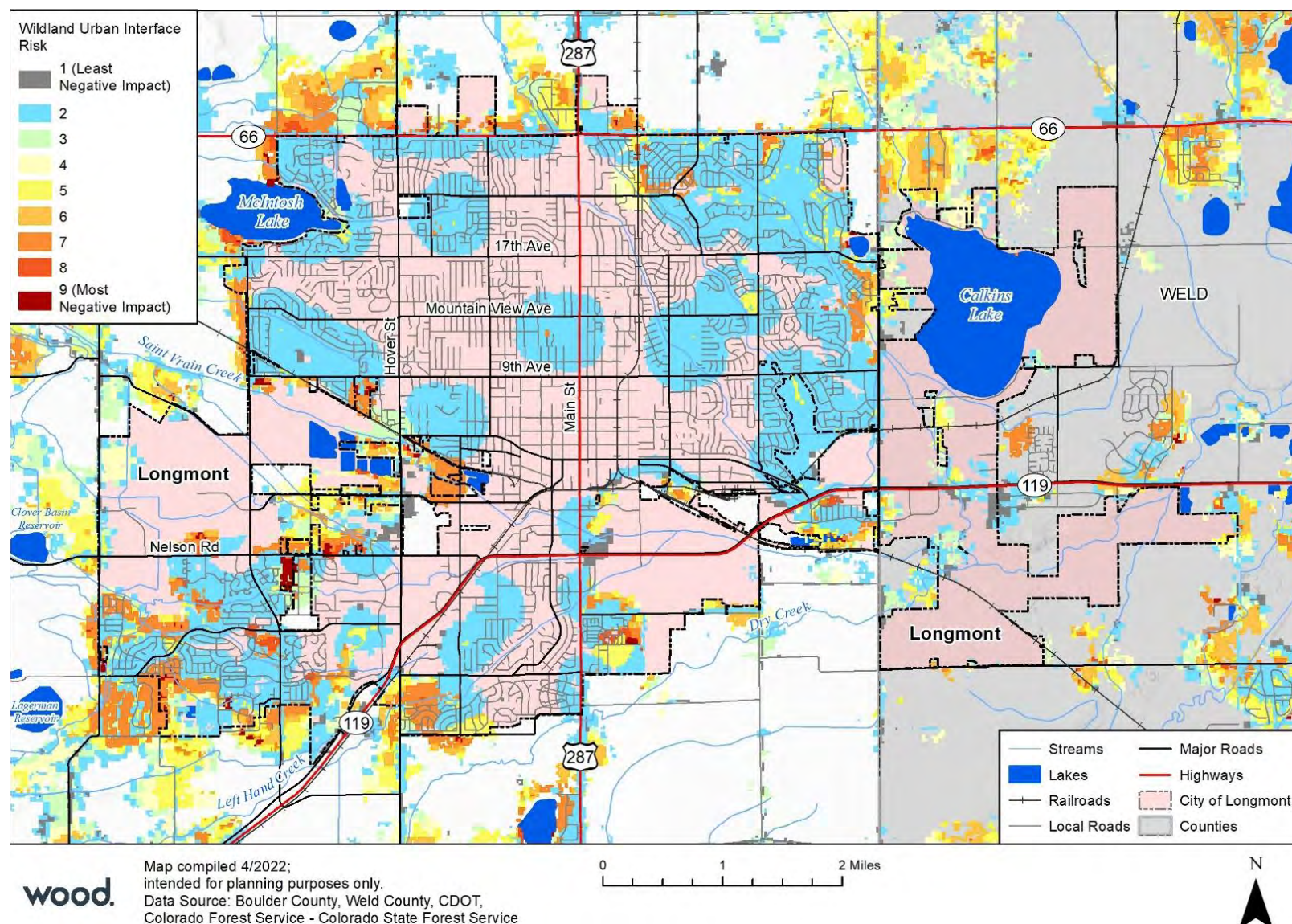
Figure D-4 City of Longmont WUI Risk

Table D-18 WUI High Risk Hazard for Longmont

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Agricultural	3	1	\$1,356,800	\$1,356,800	\$2,713,600	
Commercial	5	11	\$7,474,400	\$7,474,400	\$14,948,800	
Exempt	9	11	\$5,421,685	\$5,421,685	\$10,843,370	
Industrial	4	4	\$16,454,300	\$24,681,450	\$41,135,750	
Mixed Use	3	3	\$2,222,700	\$2,222,700	\$4,445,400	7
Residential	922	947	\$489,734,431	\$244,867,216	\$734,601,647	2,349
Vacant	2	2	\$311,600	\$311,600	\$623,200	
Total	948	979	\$522,975,916	\$286,335,851	\$809,311,767	2,356

Source: Boulder and Weld County, Colorado Forest Service, U.S., Census Bureau, Wood Analysis

Table D-19 WUI Moderate Risk Hazard for Longmont

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Agricultural	3	7	\$797,300	\$797,300	\$1,594,600	
Commercial	1	10	\$1,100,000	\$1,100,000	\$2,200,000	
Exempt	15	28	\$25,065,214	\$25,065,214	\$50,130,428	
Industrial	1	1	\$3,919,700	\$5,879,550	\$9,799,250	
Mixed Use	1	4	\$3,715,300	\$3,715,300	\$7,430,600	10
Residential	949	815	\$359,672,776	\$179,836,388	\$539,509,164	2,021
Vacant	3	4	\$400,660	\$400,660	\$801,320	
Total	973	867	\$394,670,950	\$216,794,412	\$611,465,362	2,031

Source: Boulder and Weld County, Colorado Forest Service, U.S., Census Bureau, Wood Analysis

The properties most at WUI Risk in Longmont are residential with 947 and 813 for high and moderate risk respectively. Along with a total of 4,387 people within Longmont being at WUI Risk. Not pictured is the low WUI related risk within Longmont. 14,785 properties are at a low WUI risk and a total of 35,524 people have a low WUI related risk as well.

People

The last column of Table and Table above summarizes the number of people at risk to wildfire in the analyzed fire zones. Based on the assessment conducted, Longmont has an estimated 126 people at risk in the wildfire zone considered to be high. Also 684 of the population in Longmont live in a moderate wildfire risk area for wildfires and a total of 53 residential properties are considered to be at a low risk of wildfire damage to people and property. These totals were estimated by multiplying the average persons per household in Longmont by the number of residential properties falling within the fire zones. Smoke resulting from fire is an issue to local populations also.

Critical Facilities and Infrastructure

A total of 3 critical facilities were identified to be in medium wildfire zones in Longmont as listed in Table below.

Table D-20 Critical Facilities in Longmont Wildfire Risk

FEMA Lifeline	Count
Health and Medical	2
Safety and Security	1
Total	3

Source: City of Longmont, Boulder and Weld County, Colorado Forest Service, CDPHE, NBI, NID, HIFLD

Economy

Tourism, the accommodation and food services industry (e.g. hotels and restaurants), and retail are major components of Boulder County's economy, and Longmont's as well. Wildland fires can, for example, lead to significant tourism reductions due to health and safety concerns, causing lost revenues from lack of visitation, stays in hotels, spending on restaurants and other commerce sources, and more.

Historical, Cultural and Natural Resources

Wildfires are a common and naturally occurring phenomenon in forested areas and can benefit forest health in many respects. But the climate change trend which is leading to hotter, more widespread, and destructive fires can make it more difficult for the environment to recover, and lead to increased flood runoff or other secondary/cascading hazards. This can severely impact water quality and watershed health for years after a fire.

With regards to historic or cultural structures and resources, wildfires would affect those in similar ways as general property and critical facilities/infrastructure, having the potential for burn downs and hence possible complete loss of important historical assets.

D.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment summarizes Longmont's regulatory mitigation capabilities, administrative and technical mitigation capabilities, and fiscal mitigation capabilities and then discusses these capabilities in further detail along with other mitigation efforts as they pertain to the National Flood Insurance Program's Community Rating System (CRS). Although the CRS is flood-focused, this discussion also incorporates activities related to other hazards into the categories established by the CRS.

D.6.1 Mitigation Capabilities Summary

Table D-21 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Longmont.

Table D-21 Longmont's Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Comprehensive plan	Yes	Envision Longmont Multimodal & Comprehensive Plan
Zoning ordinance	Yes	Land Development Code
Subdivision ordinance	Yes	Land Development Code
Growth management ordinance	Yes	Signatory to Mile High Compact, Super IGA with Boulder County and

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
		Weld County Coordinated Planning Agreement
Floodplain Management Plan	No	
Participate in the National Flood Insurance Program	Yes	Joined July 5, 1977
Elevation Certificates	Yes	On file at DRC
Participate in the Community Rating System	Yes	May 2019, Class 5
Floodplain ordinance	Yes	Municipal Code, Title 20
Site plan review requirements	Yes	Land Development Code, Title 15
Other special purpose ordinance (stormwater, steep slope, wildfire)	Yes	Land Development Code
BCEGS Rating	Yes	Under review, previously a 4
Building code	Yes	2018 International Building Code
Fire department ISO rating	Yes	Rating 4
Erosion or sediment control program	Yes	Land Development Code
Stormwater management program	Yes	Land Development Code, Title 14
Capital improvements plan	Yes	
Economic development plan	Yes	Advance Longmont 2.0
Local emergency operations plan	Yes	Longmont EOP 2019, Office of Emergency Management
Other special plans	Yes	Many listed in Section E.5.2
Flood insurance study or other engineering study for streams	Yes	Post 2013 flood Preliminary FIRMs dated 9/30/2019
Other	Yes	

Table D-22 identifies the personnel responsible for mitigation and loss prevention activities as well as related data and systems in Longmont.

Table D-22 Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/engineer with knowledge of land development/land management practices	Yes	Planning Division, Public Works and Natural Resources	
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Public Works and Natural Resources (PWNR), Building Services	
Planner/engineer/scientist with an understanding of natural hazards	Yes	Public Works and Natural Resources (PWNR)	
Personnel skilled in GIS	Yes	ETS, PWNR, Planning, Consolidated Services	
Full-time building official	Yes	Building Services	
Floodplain manager	Yes	PWNR	
Emergency manager	Yes	Public Safety	

Personnel Resources	Yes/No	Department/Position	Comments
Grant writer	Yes	Grant Writers housed in various city departments, and contracted out	
Transportation Planner	Yes	External Services, Planning	
Resiliency Planner	Yes	Environmental Services	
Other personnel	Yes		
GIS Data – Hazard areas	Yes	Consolidated Services	Floodplain
GIS Data – Critical facilities	Yes	Consolidated Services	City CIKY & Schools
GIS Data – Building footprints	Yes	Consolidated Services	Download from BoCo
GIS Data – Land use	Yes	Consolidated Services	
GIS Data – Links to assessor's data	Yes	Consolidated Services	Download from BoCo
Warning systems/services (Reverse 9-11, cable override, outdoor warning signals)	Yes	Longmont OEM	Refer to D.6.2 Public Information

Table D-23 identifies financial tools or resources that Longmont could potentially use to help fund mitigation activities.

Table D-23 Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Yes/No)	Comments
Community Development Block Grants	Yes	
Capital improvements project funding	Yes	
Authority to levy taxes for specific purposes	Yes	With voter approval
Fees for water, sewer, gas, or electric services	Yes	
Impact fees for new development	Yes	
Incur debt through general obligation bonds	Yes	With voter approval
Incur debt through special tax bonds	Yes	With voter approval
Incur debt through private activities	Yes	With voter approval
Withhold spending in hazard-prone areas	Yes	
Stormwater Service Fees	Yes	\$14.90 per Residential and Non-Residential Customers
Other: Longmont Urban Renewal Authority (LURA) tax increment proceeds	Yes	Upon negotiations with taxing entities and approval of LURA Board. Can only be accessed for mitigation efforts within designated urban renewal districts subject to availability of funds.

Longmont has had one Hazard Mitigation Grant Program Project (HMGP). The project is now closed and was in relation to DR-4145 in 2013. The cost share percentage was 0.64 and the project amount \$2,159,074. This project was state side and had a benefit cost ratio of 1.028.

Table D-24 identifies existing education and outreach capabilities that the City of Longmont uses to inform

the public about hazards and risks in the community.

Table D-24 City of Longmont's Education and Outreach Capabilities

Capability/Program	Yes/No (Briefly Describe)
Local Citizen Groups That Communicate Hazard Risks	Yes
Firewise	Yes
StormReady	Yes
Be Ready Longmont	Yes
Community Emergency Response Team (CERT)	Yes

D.6.2 Opportunities for Capability Enhancement and Improvement

The plan update process provided the City of Longmont an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- Integrate risk assessment information into future updates to the City's Comprehensive Plan.
- Integrate risk assessment information into future updates of the City's Land Use Code.
- Providing training for staff members related to hazards or hazard mitigation grant funding in partnership with the County and DHSEM

D.6.3 Community Rating System Activities (All Hazards)

National Flood Insurance Program

The City of Longmont joined the National Flood Insurance Program (NFIP) on July 5, 1977. In exchange for a community adopting and enforcing a floodplain management ordinance, the NFIP makes affordable flood insurance available to private property owners and enables the community to retain its eligibility to receive certain federally backed monies and disaster relief funds.

NFIP insurance data indicates that as of March 2019, there were 418 policies in force in Longmont, resulting in \$138,617,000 in flood insurance benefits. Of these policies, 138 are in the 100-year floodplain, out of a current total of 499 buildings in the 100-year (2012 FIRMs). Therefore, there are buildings in the current effective 100-year floodplain that do not have flood insurance.

In Longmont, the 2022 data indicates that there have been 48 claims paid for a total of \$4,189,811.08. Fortunately, there are no repetitive or severe repetitive loss structures in Longmont.

Since the 2013 flood, the governor of Colorado (Hickenlooper) allocated State funds to update the hydrology, hydraulics and floodplain mapping of the creeks and streams most impacted by the flood. In Longmont, the revisions included St. Vrain and Left-Hand Creeks. The Flood Insurance Study (FIS) and Flood Insurance Rate Maps (FIRMs) were issued as Preliminary FIRMs on 9/30/2019 and are planned to become effective sometime mid-to late 2022

Continued Compliance with the NFIP

Recognizing the importance of the NFIP in mitigating flood losses, the City of Lafayette will place an emphasis on continued compliance with the NFIP. As an NFIP participant, the town has and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance as well as review of any potential development in special flood hazard areas.

Community Rating System

The Community Rating System (CRS) is a voluntary program for NFIP-participating communities. It provides flood insurance premium discounts to policyholders in communities that provide higher floodplain management standards than the minimum NFIP requirements. As of May 2019, Longmont had a CRS class rating of 5 (on a scale of 1-10, 1 being the best). This rating provides a 25 percent discount for all policyholders until they reach the max amount allowed.

Community Rating System Categories

The City of Longmont was initiated into the Community Rating System (CRS) on October 1, 1992. The goals of the CRS program include: reducing and avoiding flood damage to insurable property, supporting the benefits of flood insurance, and to foster comprehensive floodplain management. The CRS program categorizes hazard mitigation activities into four major categories. These categories, and applicable Longmont activities, are described below.

A CRS Class 5 rating means:

- This rating provides a 25 percent discount for all policyholders until they reach the max amount allowed.
- The discount applies to all current flood insurance policy holders and all new policies
- The discount is applied to flood insurance policies by an insurance agent, not by the City
- Contact your insurance agent to ensure the discount is applied to your flood insurance policy

Public Information Activities

For this category CRS credits local activities that advise people about flood hazards, encourage the purchase of flood insurance and provide information about ways to reduce flood damage. These activities generally serve all City of Longmont residents.

Activities that Longmont receives CRS credit for include:

- Floodplain map and flood protection information provided on the City's website
- Several protection outreach events regarding, flood insurance, floodplain mapping changes, updates on CIP projects that impact the floodplain and flooding, every year including presentations at various venues and participation in other events.
- Copies of all previous floodplain studies and submittals
- Copies of Elevation Certificates
- Flood insurance rating support
- In person meetings

Mapping and Regulations

These activities provide increased protection from new development for growing communities. Credit is given for providing information that are not normally shown on FIRM maps, enforcing higher than FEMA's minimum regulations, preserving open space, protecting natural floodplain functions, and managing storm water.

Some of the activities that Longmont receives CRS credit for include:

- Providing previous versions of floodplain maps to the public
- Providing 2013 flood extents on the City's website
- Enforcing a ½ ft floodway as required by the State of Colorado
- A robust Open Space program that includes property in the floodplain (a large portion of Longmont's credit comes from having a large amount of open space in the floodplain)

- Strong MS4 program that manages water quality

Flood Damage Reduction Activities

This series of activities credits communities for programs that support existing structures and or property that is already in the floodplain. Credit is provided for floodplain management plans, flood damage reduction, and maintenance of the natural channel system.

Some of the activities that Longmont receives CRS credit for include:

- Multi-Hazard Mitigation Planning with Boulder County
- Longmont's Wildlife Management Plan (2018)
- Annual Inspection and maintenance of Longmont's natural channel systems

Warning and Response

This series provides credit for measures that protect life and property during a flood, through flood warning and response programs. There is credit for the maintenance of levees and for state regulatory program for dams as well as for program that prepare for the potential failure of levees and dams.

Longmont currently has no levees but there are 8 high hazard dams that are near enough to Longmont to affect the city if one of them were to breach. Longmont receives CRS credit for keeping emergency action plans for each of these high hazard dams. Credit for the City's Emergency Operations Plan and warning system is included in this series as well.

Prevention of Hazards

Preventive activities keep problems from getting worse. The use and development of hazard-prone areas is limited through planning, land acquisition, or regulation. They are usually administered by engineering, building, zoning, planning, and/or code enforcement offices. The plans and documents summarized below assist in hazard prevention.

Envision Longmont Multimodal and Comprehensive Plan (2016)

In 2016, City Council adopted the Envision Longmont Multimodal and Comprehensive Plan. An update to the plan is scheduled to commence in 2022. The plan identifies Longmont's priorities for the next 10 – 20 years. It provides strategic guidance for the long-term needs and desires of the community and identifies ways to achieve them. This includes addressing changes in population, where and how to grow, ways to expand transportation options, plus approaches to balance growth and embrace diversity.

The plan is organized around six guiding principles that reflect elements of Longmont's desired future. The principles and their supporting goals and policies are intended to promote a more sustainable and resilient Longmont. The guiding principles include:

- Livable centers, corridors and neighborhoods
- A complete, balanced, and connected transportation system
- Housing, services, amenities, and opportunities for all
- A safe, healthy, and adaptable community
- Responsible stewardship of our resources
- Job growth and economic vitality through innovation and collaboration



Sustainability Plan

In 2016, the City of Longmont updated its Sustainability Plan to focus on actions that can be implemented within the next five to ten years to help promote environmental stewardship, social equity, and economic vitality for all residents and businesses of Longmont. The Plan includes actions that will be led by internal City departments to enhance sustainability, but also emphasizes involvement of other partner organizations, the business community, and Longmont residents in creating and maintaining a thriving, sustainable community.

The purpose of this Sustainability Plan is to clearly articulate Longmont’s sustainability vision and objectives, establish meaningful targets, and define actionable strategies to support achievement of the vision. It is intended to serve as a tool for City of Longmont leaders and departments to guide decision-making as it relates to prioritizing projects, implementing programs, and communicating and interacting with the public. This Sustainability Plan is also intended to be used by the Longmont community as a guide for how to take action to enhance sustainability at all levels – individual, household, business, neighborhood, and community.

The sustainability vision for Longmont sets the stage for future decision-making and actions. In addition to an engaged community, the underlying dimensions of this vision include environmental stewardship, social equity, and economic vitality (the “triple bottom line”). Each of these dimensions are connected and inter-related. All dimensions support one another in creating a sustainable community.

Municipal Code

Title 20 Floodplain Regulations

Longmont’s Title 20 Floodplain Regulations protect new, existing, additions to existing buildings and critical facilities from flooding by requiring freeboard, flood proofing and most importantly, removal from an existing floodplain before construction can begin.

The purpose of this title is to promote the public health, safety, and general welfare; to minimize public and private flood losses due to flood conditions in areas subject to flood hazards; and to promote wise use of the floodplain by provisions designed to do the following:

- Protect human life and health
- Minimize expenditure of public money for costly flood-control projects
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the public
- Minimize prolonged business interruptions
- Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, and streets and bridges located in areas of special flood hazard
- Help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future flood damages
- Ensure that potential buyers are notified that property is in an area of special flood hazard
- Ensure that those who occupy the areas of special flood hazard assume responsibility for their actions
- Protect floodplain occupants from a flood which is or may be caused by their own or other land use and which is or may be undertaken without full realization of the danger, through:
 - Regulating the manner in which structures designed for human occupancy may be constructed so as to prevent danger to human life within such structures
 - Regulating the method of construction of water supply and sanitation systems so as to prevent disease, contamination, and unsanitary conditions
 - Delineating and describing areas that could be inundated by floods so as to protect individuals from purchasing floodplain lands for purposes which are not in fact suitable

Specifically, the regulations require

- A Floodplain Development Permit for any construction and/or development in all areas of the 1% chance floodplain (one-hundred-year) within the corporate limits of the City,
- Establishment of the Floodplain, Floodway and Floodplain Fringe Zones,
- Sets use and development requirements for each flood zone,
- Outlines the duties and responsibilities of the floodplain administrator, chief building official and the Public Works director in administering this ordinance.

Title 20 update is planned for 2022.

City of Longmont participated in the “Mitigating Hazards Through Land Use Solutions” workshop with several other Colorado communities where floodplain management improvements were discussed, listed and prioritized. Longmont’s solutions focused on updating and revising Title 20, Floodplain Regulations.

Title 15 Land Development Code Update (2018)

The Land Development Code (LDC) update was one of the implementation projects identified in the Envision Longmont Multimodal and Comprehensive Plan (Envision Longmont Plan). The LDC is Title 15 of the Municipal Code and regulates items related to the physical development of the City including annexation, zoning, subdividing and developing property, permitted uses for specific properties, building placement and height, building design, parking, lighting, and landscaping, among other items. The last comprehensive update to the LDC was in 2001.

Changes were made to all sections of the LDC. However, the following is a brief description and summary of the most substantive changes related to floodplain management.

Chapter 15.02 - Development Procedures

This chapter addresses the procedures and criteria associated with major, minor, and administrative development applications required under the LDC. Revisions include:

Figure 2.1: Major Development Applications



- Added a table and flowcharts to further clarify procedures and decision making authority
- Changed the review of appeals of administrative decisions and nonconforming uses from the Board of Adjustment (BOA) to the Planning and Zoning Commission (PZ)
- Changed preliminary planned unit developments (PUDs) to overall PUDs – the goal is to allow for a review of overall PUD plans without the level of detail currently required for preliminary PUDs, which will save applicants review time and cost.
- Added short term rentals as an administrative application
- Included modifications for infill and redevelopment to administrative modifications and revised consistent with current practice in the former code
- Provided clarifications for the section regarding public and common/private improvements

Chapter 15.03 - Zoning Districts

This chapter addresses all of the proposed zoning districts and dimensional standards, including lot dimensions and areas, setbacks, building height, etc. Revisions include:

- Substantially revised the lineup of zoning districts to correspond to the Envision Longmont land use categories
- Included additional mixed-use zoning districts to accommodate the demand for this type of development and to provide another important tool in implementing the Envision Longmont Growth Framework.
- Updated dimensional standards within districts to provide more flexibility for creative and innovative development, while protecting existing stable neighborhoods
- Added easy to read tables and labeled graphics to provide information on dimensional standards such as lot size, building setbacks, and building height
- Added the alley incentives for reduced lot area and width to the dimensional standards tables for easier

reference

- Revised the dimensional standards tables to remove stories in residential districts and feet in mixed use and nonresidential districts to allow more flexibility in terms of building design (for example a 2-1/2 story residential design could be built within the 35 foot height limit)
- Added a section regarding residential density to reference the density ranges in the Envision Longmont land use categories and allowed exceptions
- Clarified the exceptions/allowances to height requirements, such as affordable housing, developments near transit centers and vertical mixed use developments within a major center or along a major corridor, as well as greenfield development on larger parcels in the R-MN district, that would be eligible for additional building height

Chapter 15.05 – Development Standards

This chapter addresses standards for development, including rivers/streams, riparian area, wetland, species and habitat protection, landscaping, vehicle and multi-modal pedestrian access and connectivity, parking, oil and gas, fences and walls, residential, mixed-use and nonresidential design, outdoor storage and screening, outdoor lighting, adequate public facilities/quality of life benchmarks, wireless telecommunications, mobile homes, and residential compatibility. Many sections within this chapter were updated substantially, some have minor changes recommended. Other sections are not being updated at this time, but will be included as future updates. Revisions include:

- Based on recent Council direction, revised the river/stream, riparian areas and wetlands setback modification section so that Council will need to approve any request to reduce the setback. P/Z will provide a recommendation to Council
- Removed required open space percentages, while retaining landscaping requirements for specific areas including: pocket parks, plazas and courtyards, buffers, parking lots, streetscapes, individual lots, etc. to help reduce landscaping costs while still providing a quality site design
- Added an exception to the pocket park standards for residential developments near existing, planned and/or budgeted public neighborhood parks
- Reorganized the off-street parking and loading section and expanded the parking table to correspond with table of allowed uses in Chapter 15.04
- Moved the oil and gas operations and facilities section from the use regulations in Chapter 15.04. No revisions are proposed other than section reference changes
- Expanded the residential design standards to include more specific attached residential standards
- Consolidated the nonresidential and mixed use design standards
- Updated the graphics for design standards
- Added an exemption for unshielded low level lighting, such as porch lights and patio light strings
- Revised standards for mobile homes consistent with 2016 recommendations from a mobile home consultant
- Added residential compatibility standards to address transitions between more intensive zoning districts and less intensive residential zoning districts – see additional discussion below.

Chapter 15.09 – Enforcement and Penalties

This chapter addresses enforcement of the provisions of the LDC and associated penalties for noncompliance. This section was revised to improve enforcement and penalties provisions consistent with code enforcement and legal recommendations.

Open Space Master Plan

The Open Space Master Plan Update was completed in 2018 is the plan for acquiring and managing land as open space.

In November of 2000, the residents of Longmont voted to approve an additional 0.2 cent sales tax to be specifically used for the acquisition and development of Open Space in and around the community. It was originally scheduled to sunset in 2020 but the sales tax was extended in 2007 and the sunset clause was extended to 2034.

Wildlife Management Plan

In the fall of 2018, the City of Longmont launched a planning effort to conduct an update to the existing 2006 Wildlife Management Plan. Since 2006, the City has experienced many changes including growth, a significant flood event in 2013, the purchases of properties as designated Open Space, and several major planning efforts that support the City's intent to be a sustainable community. Both the City's 2016 "Sustainability Plan" and the 2016 "Envision Longmont: Multimodal & Comprehensive Plan" call for environmental stewardship and responsible stewardship of natural resources within Longmont. This Plan provides City Council and Staff with science-based recommendations for working toward these so that wildlife can be enjoyed by future generations.

This 2019 Wildlife Management Plan Update (Plan) builds off a number of important City planning efforts and integrates pertinent ecological principles and concepts of biological conservation with proven science-based management techniques. Inclusion of the community's input was at the forefront of the City's vision for this project, and the City worked diligently at providing a variety of opportunities for public participation throughout the development of the Plan. Additionally, adherence to the City's philosophy of "coexistence with wildlife," and the principles, objectives, and strategies for stewardship of the natural environment established in the 2016 "Longmont Sustainability Plan" was of substantial importance to the City.

Natural Stream Management Plan

The City of Longmont completed a plan to maintain and improve the City's natural stream systems. The plan not only addresses the existing conditions of the City's natural drainage channels but also includes plans to improve the habitat and functioning of the channels.

Emergency Operations Plan

A new Emergency Operation Plan was adopted by the City in 2020. Emergency service measures are taken during an emergency to minimize its impacts. These measures are the responsibility of city or county emergency management staff and the owners or operators of major or critical facilities.

Structural Projects

In addition to plans and documents that support hazard mitigation, the City also completes structural projects to keep hazards away from an area (e.g., levees, reservoirs, other flood control measures). They are usually designed by engineers and managed or maintained by public works staff.

The Public Works and Natural Resources Department, manages the administration, engineering, and planning for the City's storm drainage utility and manages flood control.

Capital Improvement Projects (CIP)

- For existing structures in the floodplain, the City has a list of CIP projects to reduce the floodplain in some areas.
- The City's CIP list also includes storm water infrastructure projects that reduce urban flooding.

Resilient St. Vrain Project Example

The Resilient St. Vrain Project (RSVP) is Longmont's extensive, multi-year project to fully restore the St. Vrain Greenway and improve the St. Vrain Creek channel to protect people, property and infrastructure from future flood risk. In addition, RSVP will substantially reduce the 100-year floodplain, containing 100-year

flood flows in the improved creek channel once fully constructed. The project will coordinate with other transportation related Capital Improvement Program (CIP) projects to replace existing bridge crossings over St. Vrain Creek with new structures that pass 100-year flood flows – thereby protecting critical transportation corridors through the City. (e.g. Main Street, S. Pratt Parkway, Boston Avenue, Sunset Street, Hover Road and Airport Road which were all impacted during the September 2013 flood event.) The lack of emergency access across St. Vrain Creek during the 2013 flood event impacted not only, Longmont, but the surrounding region. Initial phases of the RSVP are complete, some are currently under construction and others are in final design with construction funded and scheduled.

- Sandstone Ranch is complete with the St. Vrain Greenway Trail to Sandstone Ranch Park open to the public.
- City Reach 1 (Main Street downstream to Left Hand Creek) is complete.
- The Main Street Bridge and S. Pratt Parkway bridge replacement projects are complete.
- Replacement of the S. Sunset Street Bridge which was destroyed in the flood, was constructed in collaboration with Boulder County, and is also complete.
- City Reach 2A (Colorado Way downstream to Main Street) is complete.
- City Reach 2B, which includes the complete replacement of the BNSF railroad bridge, is complete.
- Izaak Walton Reach 1 (Boston Ave. downstream to Price Road/BNSF railroad bridge) is in final design, under construction and is anticipated to be completed in 2022.
- Izaak Walton Reach 2 (S. Sunset Street downstream to Boston Ave. including Boston Ave. bridge replacement) is currently designed by the US Army Corps of Engineers (USACE) as a project reach under their Section 205 Program.

Longmont Design Standards and Construction Manual

Longmont Design Standards and Construction Manual is being updated and is waiting for final City Council approval expected in 2022.

Storm Drainage Criteria Manual (1984)

The Storm Drainage Criteria Manual (1984) specifies the design and technical criteria for all drainage analysis and construction.

Public Information

Public information activities advise property owners, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of natural resources (e.g., local floodplains). They are implemented by Public Works and Natural Resources, Office of Emergency Management and the City's Communications group.

Emergency Information

The City's Emergency Information web page provides information and links regarding emergency preparedness, evacuation, and relocation and other helpful resources.

Longmont uses the Everbridge System for emergency notification. The system will be used to notify residents about imminent threats to health and safety such as the need to evacuate due to a wildfire, hazardous spills or other emergencies. It may also be used in situations where a child or adult is missing who is in need of medical attention.

All landlines are automatically registered to receive emergency alerts. Anyone living or working within the City of is also encouraged to register additional communication devices i.e. cell phones, VoIP (voice over Internet protocol), email to receive emergency notifications. Residents and visitors are also encouraged to use NOAA All-Hazards Weather Radios to receive weather alerts from the National Weather Service. At the

time of the adoption of this plan, the Boulder Office of Emergency Management is deploying the use of IPAWS (Integrated Public Alert and Warning System) across all jurisdictions in the county.

Flooding Information

The City's website also has a Flooding Information page where links to the City's floodplain maps, flood preparedness and safety, stream status and monitoring, flood insurance pages and detailed information on floodplain management.

D.7 City of Longmont Mitigation Strategy

A hazard mitigation action planning committee re-evaluated the Hazard Identification Risk Assessment (HIRA) to reassess risk based on actions taken since the previous plan was adopted. The following mitigation actions were identified and evaluated by the committee. These represent new or continued actions identified in supporting plans and documents or actions identified by the committee that support overall hazard mitigation.

Staff identified projects in part by building off previously identified implementation strategies in related planning and sustainability documents. Specifically, the following documents were used to develop these strategies: Tree Canopy Study (2008), Climate Action Task Force Recommendations (2020), Water Efficiency Master Plan (2017); the development of strategies was also more broadly informed by the Envision Longmont Multimodal & Comprehensive Plan (2016), the Sustainability Plan (2016), and efforts of the 2012 Joint Front Range Climate Change Vulnerability Study (2012). In addition, these were vetted through detailed conversations with City staff to identify preferable options for moving forward.

Other mitigation projects listed below are proposed solutions from other studies, existing conditions, and on-going programs. These descriptions are included in the detailed Mitigation Action descriptions below.

D.7.1 Status on Previous Mitigation Actions

The City of Longmont has been successfully implementing mitigation actions which were identified in their previous 2018 Local Hazard Mitigation Plan. The 2018 mitigation strategy for Longmont contained several mitigation actions, eight of which been carried forward into this 2022 update. Twelve new actions were developed during the 2021-2022 planning effort and are detailed in the next section, giving a total of 20 mitigation actions currently identified for the 2022 plan update. While these actions are "new" to this hazard mitigation plan 2022 update, many of these actions have been ongoing or identified in related planning mechanisms. They are captured here to have a comprehensive compendium of mitigation actions for the City.

Table D-25 Longmont Mitigation Action Summary and Status

Mitigation Action Title	Responsible Office	Hazard(s)	2022 Status
Floodplain Management	Longmont Department of Public Works and Natural Resources (PWNR)	Flooding	Continuing in Process
Expand the City of Longmont CERT Program	Longmont Office of Emergency Management (OEM)	Multi-Hazard	Continuing in Process
Fire Mitigation at Button Rock Preserve	PWNR	Wildfire	Continuing in Process

Mitigation Action Title	Responsible Office	Hazard(s)	2022 Status
Community Rating System (CRS)	PWNR	Flooding	Continuing in Process
St. Vrain Creek Improvement Project/ Resilient St. Vrain Project	PWNR	Flooding	Continuing in Process
Channel Improvements on SVC at 119 th Street	PWNR	Flooding	Continuing in Process
Increase Tree Canopy	PWNR	Extreme Heat	Continuing in Process
Vulnerability Assessment for Climate Impacts, development and engagement strategy	PWNR	Extreme Heat, Flood	New in 2022
Neighborhood/Community-based Resilience Plans	PWNR, Planning, Community Services	All Hazards	New in 2022
Outdoor water efficiency/conservation	PWNR	Drought, Extreme Heat	New in 2022
Upgrade Power System Protection	Longmont Power & Communications (LPC)	Wildfire	New in 2022
Tree Trimming near Power Equipment	LPC	Wildfire	New in 2022
Power Grid Modernization	LPC	Wildfire, Long Term Electric Power Outages, Climate Emergency	New in 2022
Stormwater Master Plan	PWNR	Flooding	New in 2022
Natural Channel Maintenance Plan	PWNR	Flooding	New in 2022
Storm Drainage Criteria Manual	PWNR	Flooding	New in 2022
Ecological Restoration	PWNR	Flood, Wildfire, Drought	New in 2022
Floodplain Regulations Update	PWNR	Flooding	New in 2022
Stormwater System Improvements	PWNR	Flooding	New in 2022
Airport Road Flood Protection Project (Western Boundary Flood Protection Project)	PWNR	Flooding	Continuing- Not Started

The City has made progress on implementing the mitigation strategy identified in previous versions of this annex. The table below identifies those projects that have been completed that have helped to improve the resiliency of the City to hazards such as flood and drought.

Table D-29 Completed Mitigation Actions

Mitigation Action Title	Responsible Office	Hazard(s)	2022 Status
St. Vrain Creek Overflow Channel west of City-Golden Property, Heron Lake Channel	PWNR	Flooding	Completed 2016

Mitigation Action Title	Responsible Office	Hazard(s)	2022 Status
City of Longmont Wastewater Treatment Plant Flood Protection	PWNR	Flooding	Completed 2016
Pressurization of the South St. Vrain Pipeline	PWNR	Flooding, Drought	Completed
North Pipeline reconstruction to minimize future flood damage	PWNR	Flooding	Completed in 2022
South St. Vrain Pipeline Flood Repair	PWNR	Flooding	Completed in 2015
Left Hand Creek at Kanemoto Park	PWNR	Flooding	Completed in 2013

D.8 Longmont Mitigation Action Plan

Below is the list of continuing and new mitigation actions.

Name of Action: Floodplain Management

Hazard Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 1, 2, and 5

Community Lifeline Addressed: Safety and Security | Food, Water, Shelter | Transportation

Issue/Background: There are 4 FEMA mapped floodplains and 2 City-mapped floodplains within the City of Longmont. The 2013 flood severely damaged the area around the City's two largest creeks, St. Vrain and Left Hand Creeks. The State and FEMA updated the Flood Insurance Study (FIS) and Flood Insurance Rate Maps for those two creeks after the 2013 flood resulting in a much larger floodplain for St. Vrain Creek and some changes to the Left Hand Creek mapped floodplains. However, the other two FEMA mapped creeks were not updated with the current mapping update. The other two creeks through Longmont that have not been updated (Dry Creek No. 1 including Old Dry Creek and Spring Gulch No1.) appear to not have been updated since the floodplains were first delineated in 1977.

Other Alternatives: No action

Action Status: Longmont joined the NFIP on October 26, 1973. Significant work has been completed since that time and a major flood event in September 2013 has influenced the public's perceptions related to flooding. Longmont's Community Rating System Number is 5. Longmont is striving to improve their CRS score by continuing to participate in the NFIP and promoting floodplain management activities that mitigate and help:

- Climate change
- Floodplain, stormwater, water quality and groundwater regulations
- Floodplain mapping practices
- Prioritization of capital improvement projects

Responsible Office: Public Works and Natural Resources Department

Priority (High Medium, Low): High

Cost Estimate: \$225,000 to update modelling and mapping for both creeks.

Existing or Potential Funding: No existing Longmont funding is available. Currently neither the Storm Drainage CIP Fund nor the Storm Drainage Operations Fund have any available funds for either CIP projects or plans beyond servicing existing bond debt. Potential funding would be BRIC funding.

Benefits (avoided losses): Minimize flood related damage. Development has occurred on both sides of both of these creeks and there is no doubt that the floodplains have changed and Longmont is not managing the actual risk these creeks present especially for new development.

Potential or current subject matter expertise: Hydrology and Hydraulics modeler expertise, GIS expertise, FEMA submittal expertise, Project Manager. Longmont can manage this project in-house and has FEMA submittal expertise but Longmont does not have the in-house expertise to do floodplain modelling or mapping

Schedule: Continuing in Process

Name of Action: Expand the Longmont Community Emergency Response Team (CERT) Program

Hazards Addressed: Multi-Hazard

Mitigation Goal or Objective Addressed: Prepares residents for multiple types of hazards and engages them in the planning process. Goals 1, 4

Community Lifeline Addressed: Safety and Security

Issue/Background: After the 2013 Floods many residents voiced that they were not prepared for the severity of the emergency. Many residents left behind important documents and items, such as medication, when they were evacuated to a shelter.

Other Alternatives: Expand the BeReady Longmont Preparedness Outreach Program

Action Status: In Progress

Responsible Office: City of Longmont Office of Emergency Management (OEM)

Priority (High, Medium, Low): Medium

Cost Estimate: \$10,000 (\$2,000 per year)

Existing or Potential Funding: Colorado North Central Region Citizen Corps Grants

Benefits (avoided losses): This education program will better prepare our residents to act during an emergency saving the time it takes them to take lifesaving action.

The program also prepares residents to help one another during an emergency. Groups can help staff a shelter, staff the EOC and assist in river watch during run off season.

Potential or current subject matter expertise: CERT Trainers, community outreach specialist, program management, grant specialist

Schedule: Continuing in Process. By 2026, the plan is to educate and train 250 (50/year) community members to prepare themselves, their families, and be prepared to assist their neighbors after an emergency or disaster. FEMA recognized CERT Basic Courses are delivered twice a year.

Name of Action: Fire Mitigation at Button Rock Preserve

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 2

Community Lifeline Addressed: Food, Water, Shelter

Issue/Background: The Button Rock Preserve is a reservoir watershed with a mixed conifer forest comprised primarily of ponderosa pine interspersed with Douglas-fir. While fire is often beneficial for Front

Range ecosystem health, decades of fire exclusion policy have increased the risk of extensive high severity stand replacing fires leading to a high threat to life, property, and infrastructure, as well as important natural resources and ecosystem services. Following the Big Elk fire adjacent to Button Rock Preserve, the City began developing implementing the Button Rock Stewardship Plan in 2002 to preserve forest health and reduce the risks of catastrophic fires and noxious weed invasion. The plan outlines management actions in various areas in the preserve to achieve the forest health and safety goals including forest thinning. As an example, since 2004, 918 acres have been thinned to reduce wildfire risk. In addition to forest thinning, prescribed fire is a necessary tool to help reduce fuel loads by way of burning existing and future slash piles created by thinning projects and through burning accumulated ground fuels and overly dense young trees. Additionally, the City has created the Wildfire Rehabilitation (Management) Plan to maximize the efficiency and effectiveness of both administrative and resource management actions following a fire within the Button Rock Preserve and its immediate surrounding area. Wildfire mitigation is important to protect the water quality in Ralph Price Reservoir as it is the City of Longmont's primary water supply.

Other Alternatives: None

Action Status: In progress. The City has been thinning the forest since 2004. The last time the City conducted any prescribed burning at Button Rock Preserve was in 2010 to burn slash piles. Discussions about burning existing slash piles and conducting prescribed broadcast burning through areas of forest previously thinned have been held but no firm plans are in place.

Responsible Office: Public Works and Natural Resources

Priority (High, Medium, Low): High

Cost Estimate: \$75,000 - \$100,000 annually. Forest management and thinning is an on-going effort and currently costs between \$75,000 - \$100,000 annually based on the current level of effort. Additional resources may be required to conduct prescribed burning but have not been determined.

Existing or Potential Funding: Annual grants from Colorado State Forest Service (CSFS) and City funding from water rates. To date, these funding sources are the only ones available and limit the amount of thinning that can be accomplished annually.

Benefits (avoided losses): The mitigation efforts reduce fire fuels around Ralph Price Reservoir, which reduces the risk of large wildfires that can threaten Longmont's water supply.

Potential or current subject matter expertise: forest health, water supply water quality, forest thinning techniques, wildfire modelling

Schedule: Continuing in Process. Forest management and thinning has been underway since 2004 with 918 acres of thinning completed. An additional 10 – 15 years is needed to initially address all areas around in Preserve. On going annual management of the forest will be needed.

Name of Action: Community Rating System (CRS)

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 1-4

Community Lifeline Addressed: Safety and Security | Food, Water, Shelter

Issue/Background: This is a FEMA program that is monitored by Insurance Services Office (ISO). The City provides services in many of the general activities, including: Public Information Activities, Mapping and Regulations, and Flood Reduction Activities. The City's CRS classification went from Class 8 to Class 5 in 2018 resulting in a 25% discount on flood insurance for property that is still within the 1% chance (100-year) floodplain and a 10% discount for properties outside the 1% chance floodplain, i.e. lower risk zones.

Other Alternatives: Drop CRS activities resulting in no (0%) discount on flood insurance premiums.

Action Status: Continue - In Progress

Responsible Office: Public Works and Natural Resources

Priority (High, Medium, Low): High

Cost Estimate: Currently use Senior Civil Engineer and other staff time + \$15,000 for outreach activities

Existing or Potential Funding: Storm Drainage Fund

Benefits (avoided losses): Minimize flood risks, public education on mapping changes, information on what to do before, during, and after a flood and flood insurance, updated floodplain information on the City's website, creek and drainage system maintenance.

Potential or current subject matter expertise: Floodplain and hydrologic modelling and mapping, GIS, CFM, FEMA, ISO, and CRS Manual

Schedule: Requires annual recertification by May 1 and verification every 3 to 5 years. Cycle Verification August 2022.

Name of Action: St. Vrain Creek Improvement Project/Resilient St. Vrain Project

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Increase in community safety and resiliency by increasing the capacity of the St. Vrain Creek channel to carry the updated 100 year flood flows for St. Vrain Creek through Longmont. Goals 1, 2,3

Community Lifeline Addressed: Safety and Security | Food, Water, Shelter | Energy | Transportation

Issue/Background: The Resilient St. Vrain Alternatives Analysis Study focused on the 100 year storm flows in the St. Vrain Creek through Longmont that range from approximately 13,300 cfs at Airport Road to 17,700 cfs at County Line Road. The existing capacity of the Creek channel through the City is approximately 3,500 to 5,000 cfs resulting in a floodplain that is over half a mile in width impacting hundreds of individual properties and significant City infrastructure that will be damaged in any flood exceeding the capacity of the existing Creek channel. This was demonstrated during the 2013 flood event that caused over \$45 million in damage to the community in one event. Many projects have been initiated based on this study, some have already been constructed but overall project is not yet complete. The remaining projects needed to complete the upstream reaches through Longmont are described below.

Other Alternatives: Do Nothing; large detention facility west of town (not feasible)

Action Status: Continuing in progress.

Responsible Office: Public Works and Natural Resources Department

Priority (High, Medium, Low): High

Cost Estimate: \$140,000,000

Existing or Potential Funding: Existing: City Funding = approx. \$32 million; FEMA PA = \$30 million; FEMA HMGP = \$1.6 million; CDBG-DR = \$13.8 million. Potential: U.S. Army Corps of Engineers = \$10 million; FEMA PDM = \$10 million; other.

Benefits (avoided losses): This project would result in significant increased public safety and resiliency to the community protecting private property and public infrastructure and significant reduction in public safety risks due to future flooding events.

Schedule: Preliminary Design – complete.

- Final Design and Construction is being completed in phases as work is funded.
- Sandstone Ranch Reach (County Line Road to Boulder Creek) – complete.
- City Reach 1 (Main Street to Left Hand Creek) – complete.
- City Reach 2A (Colorado Way to Main Street) – complete.
- City Reach 2B (upstream of BNSF RR to Colorado Way) – under construction.
- Izaak Walton Reach 1 (Boston Ave. to upstream of BNSF RR) – final design complete; construction 2021.
- Izaak Walton Reach 2 (S. Sunset Street to Boston Ave.) – final design 2021; construction 2022.
- City Reach 3 (Airport Road to S. Sunset Street) – unfunded.

Name of Action: Channel Improvements on St. Vrain Creek at 119th Street

Hazard Addressed: Flooding

Mitigation Goal or Objective Addressed: Increase in community safety and resiliency by increasing capacity of the St. Vrain Creek channel at the 119th Street bridge crossing to carry the 100-year (1-percent annual exceedance probability) flood flows. Goals 1, 2

Community Lifeline Addressed: Safety and Security | Transportation

Issue/Background: The remapping of St. Vrain Creek after the 2013 floods by the state and FEMA (Preliminary FIRMs dated 9/30/2019) showed the City of Longmont large areas of inundation that were either not within the City’s jurisdiction at the time when the Resilient St. Vrain Alternatives evaluation Study was conducted in 2014 or were not recognized as a potential hazard until the Preliminary Maps were completed. As such, the Preliminary FIRMs show that the existing capacity of St. Vrain Creek from approximately 2,100-ft upstream of the State Highway 119 bridge crossing downstream to County Line Road (Weld County Road 1) is undersized and 100-year storm flows cause out of bank flooding and road overtopping at 119th Street. City owned property and infrastructure (i.e. St. Vrain Greenway and the 119th Street Trailhead) are subject to damages in large storm events. Additionally, overtopping of 119th Street causes road closures, potential damages due to roads washing out, and is a hazard to public safety.

Other Alternatives: None

Action Status: New in 2022

Responsible Office: Public Works and Natural Resources

Priority (High Medium, Low): Low

Cost Estimate: \$6,000,000

Existing or Potential Funding: FEMA Mitigation Funding and City Storm Drainage Fund (local match).

Benefits (avoided losses): This project would result in a significant increase in public safety and resiliency to the community protecting public and private property and public infrastructure and significant reduction in risks from future flooding events.

Potential or current subject matter expertise: floodplain management, project management, engineers, landscape architects, and irrigation designers

Schedule: 2023 depending on funding availability

Name of Action: Increase Tree Canopy

Hazards Addressed: Extreme Heat

Mitigation Goal or Objective Addressed: Goal 1: Reduces loss of life and personal injury by reducing the

heat island affect and minimizing the impacts of extreme heat.

The short term goal is to maintain tree canopy through the 15 year life-cycle of the emerald ash borer in Longmont. Long term goals are to increase tree canopy within the Longmont Planning Area. Increasing the tree canopy will increase shade, which can provide protection from extreme heat.

Community Lifeline Addressed: Safety and Security | Health and Medical

Issue/Background: The 2008 Tree Canopy Study determined that current tree canopy in the Longmont Planning Area is 8% with the potential of 47%. Since that study, the goal has to sustain and expand tree canopy while dealing with the emerald ash borer. The City is also competing with rising water costs (residents water their trees less) and a hotter and drier climate. Most trees within the City require some supplemental water to maintain good health and the City is currently seeking new varieties that are more drought tolerant.

It is important to not lose tree canopy because it can help reduce the number and impact of extreme heat days in Cities by providing cooling. A 2016 study in Toronto Canada, found that heat-related ambulance calls were reduced by 80% by just a 5% increase in tree canopy.¹ Currently, due to a hotter climate, the emerald ash borer and reduced budget from COVID-19, the City's short-term goal is to maintain tree canopy.

Tree canopy should be expanded in a strategic method. A study in Ann Arbor Michigan used a health impact assessment to identify neighborhoods more vulnerable to the negative impacts of extreme heat.² This study will analyze health, pollution, crime, and demographic indicators of neighborhoods in relation to tree canopy and identified the need for targeted tree planting.

Other Alternatives: Besides planting trees and vegetation, the other alternative recommended by the U.S. EPA is green roofs.

Action Status: Continue In Progress. In 2022, the City will complete an updated tree canopy study to better understand progress made since 2008.

Responsible Office: Public Works and Natural Resources

Priority: Medium

Cost Estimate: \$25,000/year

Existing or Potential Funding: Existing: Tree Mitigation Fund, Potential: Boulder County Sustainability Tax Funding

Benefits (avoided losses): Reduced extreme heat days, reduced hospitalizations due to extreme heat

Potential of current subject matter expertise: Forestry, natural resources analyst, project management

Schedule: In Progress. Will better understand current tree canopy by the end of 2020 and will have a better idea of when we will reach the 18% Tree Canopy target.

¹ Graham, D. A., Venus, J. K., Kenny, N. A., & Brown, R. D. (2016). The relationship between neighbourhood tree canopy cover and heat-related ambulance calls during extreme heat events in Toronto, Canada. *Urban Forestry & Urban Greening*, 20, 180–186. doi: 10.1016/j.ufug.2016.08.005

² Cameron, Lorraine & Smith, Dominic & Wirth, Julia & Stanbury, Martha. (2013). Health Impact Assessment of Targeted Tree Planting in Ann Arbor Michigan and Identification of Neighborhoods Vulnerable to Climate Change.

Name of Action: Vulnerability Assessment for Climate Impacts, Development and Engagement Strategy

Hazards Addressed: Extreme heat/cold, Flood, Wildfire

Mitigation Goal or Objective Addressed: Goal 2 – Reduce impacts of hazard events on property, critical facilities/infrastructure, and the environment OR Goal 4 – Improve public awareness regarding hazard vulnerability and mitigation

There is not yet a specific goal or objective that addresses identifying and reducing risks associated with climate change. However, the Climate Action Task Force Recommendations Report called for the creation of a climate adaptation plan to prepare for the impact of climate change. Staff are currently developing a climate risk and vulnerability map which is the first step of creating this plan.

Community Lifeline Addressed: Safety and Security | Health and Medical

Issue/Background: Even as many communities, including Longmont, work to reduce greenhouse gas pollution to mitigate the effects of climate change, we know that our community will suffer some climate change impacts – most likely more high and extreme heat days, worsening air pollution, and increased risk of wildfires and flooding. Recent studies show that we have already begun experiencing those impacts, but action within the next decade is critical if we are to avoid the most catastrophic impacts of climate change. Those most likely to suffer impacts disproportionately are low-income residents, older adults, children, and those with certain health conditions.³

Staff is conducting a climate risk and vulnerability assessment in order to understand what the projected impacts are likely to be for Longmont and where those most vulnerable to impacts reside within Longmont. In addition, it will be necessary to develop a community engagement strategy to then work with those most vulnerable to climate impacts in order to determine strategies to best mitigate and adapt to projected impacts that effectively and equitably meet community needs.

Resource on Extreme Heat: C40 Cities Climate Leadership Group (2019). How to adapt your city to extreme heat. C40 Knowledge Hub. https://www.c40knowledgehub.org/s/article/How-to-adapt-your-city-to-extreme-heat?language=en_US

Other Alternatives: N/A

Action Status: New in 2022

Responsible Office: Public Works and Natural Resources – Sustainability

Priority: High

Cost Estimate: \$80,000 for the assessment and community engagement plan; community engagement and implementation TBD

Existing or Potential Funding: Existing: Boulder County Sustainability Tax Funding in 2021 and 2022

Benefits (avoided losses): Reduced hospitalizations and deaths due to extreme heat and poor air quality; reduced need for potential crisis response during unexpected extended heat waves.

³ IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Goris, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.

Potential of current subject matter expertise: Sustainability, Senior Services, Community Services, Longmont OEM, Boulder County Public Health

Schedule: In Progress. The assessment and mapping work began in 2021, with anticipated completion in 2022; community engagement strategy should be developed in 2022, with community engagement and strategy development happening in 2022; implementation beginning in 2023.

Name of Action: Neighborhood/Community-based Resilience Plans

Hazards Addressed: Pandemic/Communicable/Zoonotic Disease Outbreak, Drought, Extreme Heat, Flood, Wildfire

Mitigation Goal or Objective Addressed: Goal 2 – Reduce impacts of hazard events on property, critical facilities/infrastructure, and the environment OR Goal 4 – Improve public awareness regarding hazard vulnerability and mitigation

Community Lifeline Addressed: Safety and Security | Health and Medical

Issue/Background: Several hazards identified for Longmont and Boulder County may impact neighborhoods or specific segments of the community differently. Identifying plans, policies, and projects to help diverse populations adapt and thrive in the face of challenges like pandemic, drought, and extreme heat. Neighborhood residents and other hyper-local stakeholders know their neighborhoods best. Preparing neighborhood-based plans will enable the city to identify local solutions that have the best opportunities for successful implementation. These plans can identify physical improvements (e.g. areas to plant additional trees to provide shade and offer relief from extreme heat) or can offer programmatic solutions (e.g. identifying local streets where vehicle access could be limited to promote opportunities for bicycling and walking while having to maintain social distance during a pandemic). The 2021 and 2022 wildfires in Boulder County have also shown a need to educate residents not just in forested areas but also in grasslands on wildfire preparedness and steps they can take to protect themselves and their homes.

Other Alternatives: Incorporate information and actions into other subarea/neighborhood plans, comprehensive plan, or sustainability plan.

Action Status: New in 2022

Responsible Office: Planning Division, Sustainability, Community & Neighborhood Resources, Fire Department

Priority: Medium

Cost Estimate: TBD – based on scope of plans, number of plan, individual components

Existing or Potential Funding: Grants, internal funding TBD

Benefits (avoided losses): More prepared and resilient neighborhoods

Potential of current subject matter expertise: Planning Division, Sustainability, Community & Neighborhood Resources

Schedule: Anticipated implementation beginning in 2023.

Name of Action: Outdoor Water Efficiency/Conservation

Hazards Addressed: Drought, Extreme Heat

Mitigation Goal or Objective Addressed: Goal 2 – Reduce impacts of hazard events on property, critical facilities/infrastructure, and the environment OR Goal 4 – Improve public awareness regarding hazard vulnerability and mitigation

Reduce citywide water consumption by 10% by the City planning horizon (assumed to be 2048) compared to the 2004 baseline. Increase ability to meet future water demands with increasing population, increasing temperatures, and climate variability.

Community Lifeline Addressed: Food, Water, Shelter

Issue/Background: If future water conservation goals are not met, then the water supplies for the City of Longmont will be approximately 2,250 acre-feet short during a seven-year-long drought (using the variability assumption of water conservation saving of 928 acre-feet for Longmont's planning horizon).

The impact of climate change and climate variability was approximated at an eight percent impact on treated water demand, with a possible range between six to ten percent. This variability was calculated using the different climate variability scenarios for the Front Range of Colorado from the 2012 Joint Front Range Climate Change Vulnerability Study (Woodbury, Baldo, Yates, & Kaatz, 2012). If climate extremes follow the hot and dry model and cause a ten percent increase in treated water demand, this could lead to a future shortage in water supply. Water conservation methods is an important strategy to ensuring an adequate water supply.

Outdoor irrigation is approximately half of water consumption within the City of Longmont. Indoor plumbing codes have become significantly more efficient, so developing strategies for water wise landscaping helps ensure that during times of drought, water demand is being met by the community.

Other Alternatives: Indoor water conservation programs (the City has these programs), increase new supply (could be more costly)

Action Status: New in 2022. This is an ongoing effort, the City has had a Water Efficiency Master Plan since 2008. The Water Efficiency Master Plan was last updated in 2017. The next update will begin in 2022 and will evaluate more ambitious water conservation goals to address the impacts of climate change on water quality and availability. The next plan will be finalized by 2024.

Responsible Office: Public Works and Natural Resources

Priority: High

Cost Estimate: Current Program: \$200,000/year; Expanded program: TBD, depends on new program development

Existing or Potential Funding: Public Works Natural Resources Water Budget, Cash-in-Lieu Water Fund, Northern Water Conservancy District Collaborative Water-Efficient Landscape Grant Program, Colorado Water Conservation Board Grants, USBR WaterSMART Grants

Benefits (avoided losses): Decreased impact of seven-year droughts

Potential of current subject matter expertise: Water conservation, land management, data management, waterwise landscaping, project management, marketing and outreach

Schedule: Annual implementation; by 2024: Update the Water Efficiency Master Plan

Name of Action: Upgrade Power System Protection

Hazards Addressed: Wildfire, windstorm

Mitigation Goal or Objective Addressed: Goals 1 and 2, Reduce potential electric system from starting fires

Community Lifeline Addressed: Safety and Security | Food, Water, Shelter | Energy | Communications

Issue/Background: On an electrical power system, a "fault" occurs when the normal operation is disrupted

by a foreign object (for example, a tree touching the power lines, or a small animal getting too close to the lines) or a piece of equipment fails and allows electricity to flow where it normally does not. When a fault occurs on an overhead power line, equipment can be damaged when excessive current flows. In these situations, the electrical system is protected by some means that clears the fault by turning off the power to that portion of the circuit. The simplest of these protective devices is an overhead expulsion fuse. When these fuses operate, they are designed to fall away from the mechanism that holds them in place to create a visual opening to allow the crews to know it has failed and the power is off to that portion of the circuit. The least expensive way of doing this is to release some of the energy from the fault in a small flash that mechanically opens the fuse support, called a cutout. This, however, sends sparks flying when it occurs. Much of this energy can be contained within the fuse, however, by using a much more expensive fusing device that is current-limiting, often called a "sand fuse" because the fuse element is surrounded by sand. LPC has chosen to use these more expensive fuses only in areas that in our evaluation have an elevated fire danger.

Other Alternatives: In addition to using sand fuses to replace the less expensive expulsion versions, a more versatile and safer alternate is a protective device known in the industry as a "Trip Saver." When they operate to clear a fault, these devices contain all the released energy within the device. They also have the capability to reenergize the line after waiting a prescribed period for the fault to clear, since the majority of problems on an overhead line are intermittent (such as a branch falling across some lines, creating a momentary short). A secondary advantage is rapid restoration of power to customers with minimal interruption, versus requiring a crew to travel to the location of the fuse to restore power. Another important factor to consider is that, while more than 10 times the cost of a sand fuse, a Trip Saver does not need to be replaced after each operation and does not always require a crew to reset or replace it, potentially saving on overall costs.

Action Status: New in 2022

Responsible Office: Longmont Power & Communications (LPC)

Priority: High

Cost Estimate: \$200,000 - \$1 Million

Existing or Potential Funding: Current Electric Rates include a portion for replacing depreciated and failing equipment, but new initiatives for system improvement, such as wider use of sand fuses or Trip Savers, will likely result in rate increases if other funding sources are not identified.

Benefits (avoided losses): Lower wildfire risk, faster power restoration

Potential of current subject matter expertise: LPC has personnel currently on staff that are fully capable of designing and constructing the project.

Schedule: 2022-2025

Name of Action: Tree Trimming Adjacent to Power Equipment

Hazards Addressed: Wildfire, windstorm

Mitigation Goal or Objective Addressed: Goals 1 and 2; Reduce potential for electric system to start wildfires; Minimize damage from falling branches and trees

Community Lifeline Addressed: Safety and Security | Food, Water, Shelter | Energy | Communications

Issue/Background: Electric and Communication utilities with both overhead and above-ground facilities must actively manage vegetation growth or run the risk of damages and/or not being able to access equipment from over growth. If not kept in check, trees and other vegetation can damage or destroy

equipment thru added moisture retention, abrasion, and of course falling into lines and other facilities. This project would entail strategic tree trimming to reduce potential power system impacts.

Other Alternatives: None

Action Status: New in 2022

Responsible Office: Longmont Power & Communications (LPC)

Priority: High

Cost Estimate: Currently budgeted at \$330,000 / year

Existing or Potential Funding: Current Electric Rates include a portion for vegetation management focused on outage prevention and minimizing physical harm to infrastructure (such as a tree falling in a storm and knocking down a line, or a branch repeatedly rubbing against a cable and wearing through the insulation)

Benefits (avoided losses): Lower fire risk, more reliable electric service, fewer work-hours to restore power during unplanned outages, reduced damage to existing infrastructure

Potential of current subject matter expertise: LPC has personnel currently on staff that are fully capable of designing and constructing the project

Schedule: Annual Implementation 2022-2027.

Name of Action: Power Grid Modernization

Hazards Addressed: Wildfire, Windstorm

Mitigation Goal or Objective Addressed: Goals 1 and 2; Reduce potential that electric system starts wildfires or is out of service for an extended period of time; use power more efficiently to reduce carbon footprint

Community Lifeline Addressed: Safety and Security | Food, Water, Shelter | Energy | Communications

Issue/Background: It has been established that electric infrastructure has been the cause of some of the largest and costliest wildfires in terms of lives lost and economic impact in recent years. This clearly was the case in California during 2018 with the devastating Camp Fire, where about 153,000 acres burned, 18,800 structures were destroyed, and 85 people perished. Pacific Gas & Electric, along with its management team, have been held liable for more than \$13.5 Billion in damages for this and other fires caused during 2017 & 2018. Grid Modernization or "Smart Grid" deployment has many tools that can aid with all the hazards listed above by reducing the energy to a persistent fault, automatically healing the grid, and allowing the power on the grid to be better managed.

Other Alternatives: Pre-emptively turn off power to high-wildfire risk areas during periods of high fire danger; however, this would lead to businesses and residents to turn to back up and portable generators that also present a potential to spark a fire. Use of these portable generators could also work contrary to LPC's response to the climate emergency, as many backup generators run on fossil fuels.

Action Status: New in 2022

Responsible Office: Longmont Power & Communications (LPC)

Priority: High

Cost Estimate: Currently budgeted at \$1.7 Million over the next 5 years for a project that will likely take 10 to 15 years to complete and potentially cost upwards of \$25 Million to complete.

Existing or Potential Funding: Current Electric Rates include a portion for replacing depreciated and failing equipment, but new initiatives to modernize the grid will likely result in rate increases if other funding sources are not identified.

Benefits (avoided losses): Lower wildfire risk, faster power restoration

Potential of current subject matter expertise: LPC has personnel currently on staff that are fully capable of designing and constructing the project

Schedule: In progress 2022-2027 as funding and work crew availability permits

Name of Action: Stormwater Master Plan

Hazard Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 1, 2 and 5

Community Lifeline Addressed: Safety and Security | Food, Water, Shelter | Transportation

Issue/Background: Annual urban flooding issue due to no or undersized stormwater facilities throughout the City. The City is currently working on a city-wide stormwater master plan update. Existing Conditions analysis is nearly complete but the project is a 3-year project and due to COVID-19 there may not be enough funds available to complete the project. Once complete, many projects needed to reduce urban flooding will be identified.

Other Alternatives: Allow stormwater flooding to continue to occur throughout the City.

Action Status: New in 2022

Responsible Office: Public Works and Natural Resources

Priority (High Medium, Low): High

Cost Estimate: \$500,000 to complete the master plan.

Existing or Potential Funding: Existing: Storm Drainage Operations not a CIP fund, Potential: BRIC grant funding

Benefits (avoided losses): Minimize continuous flood damage to City infrastructure and private property from an undersized stormwater system for the City.

Potential or current subject matter expertise: Project Management, hydrology and hydraulics modelling expertise, GIS expertise, report production expertise and PLS surveying. None of this expertise is available in-house.

Schedule: In Progress and expected to be completed late 2022- early 2023

Name of Action: Natural Channel Maintenance Plan

Hazard Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 1 and 2; Create a plan with standard operating procedures to perform regular maintenance on the City's stream corridors to maintain flood capacity and infrastructure while also identifying projects to increase the hydraulic, geomorphic, ecological, and physicochemical functions of streams.

Community Lifeline Addressed: Safety and Security | Food, Water, Shelter | Transportation

Issue/Background: The City of Longmont has approximately 28.5 miles of stream corridors that convey flood flows and sediment through the City. As many of these streams flow through urban areas, it is

essential for the City conduct routine maintenance to remove flood impediments and make sure that infrastructure on the stream is functional to protect the residents of Longmont as well as to comply with Federal regulations. This became even more apparent after the 2013 flood. The City also recognizes that these streams provide critical aquatic and terrestrial habitat. Planning is necessary to identify needs for maintenance and stream restoration as well as to provide guidance on how to perform these tasks.

Other Alternatives: None

Action Status: New in 2022

Responsible Office: Public Works and Natural Resources Department

Priority (High Medium, Low): High

Cost Estimate: \$95,000

Existing or Potential Funding: The City spent \$50,000 in 2019 on Phase I of the plan which included existing conditions assessment and data collection. The City has budgeted \$30,000 in 2021 and 2022 to publish the plan. The City has a 5-year CIP to implement stream restoration projects with guidance from the plan funded at \$277,500 in 2022, \$1,107,500 in 2023, \$1,107,500 in 2024.

Benefits (avoided losses): The plan, when implemented, would reduce future flooding as well as make streams more resilient to flood events requiring less restoration.

Potential or current subject matter expertise: The City has several staff within the Public Works & Natural Resources Department that are subject matter experts.

Schedule: Publishing of the plan in 2022. Additional funding necessary to complete phase II data gathering such as floodplain mapping and vegetation influence on flooding.

Name of Action: Storm Drainage Criteria Manual

Hazard Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 1, 2, and 5

Community Lifeline Addressed: Safety and Security | Food, Water, Shelter | Transportation

Issue/Background: Longmont's Storm Drainage Criteria Manual has not been updated since 1984. It is seriously outdated. It doesn't even include a chapter on Floodplain Management. The City of Longmont Public Improvements Design Standards and Construction Specifications was updated by Longmont staff during 2018 and 2019. However, it has not been adopted yet, partially because Section 300 – Storm Drainage Improvements updates were not acceptable to the CAO. There is no Floodplain Management Section in the Design Standards manual. The COA recommended that the Storm Drainage Criteria Manual be updated instead of trying to do that within the Design manual. Consultants and CIP projects need standards for design of stormwater and flood protection projects.

Other Alternatives: Continue as we have been without a useful Drainage Criteria Manual.

Action Status: New in 2022

Responsible Office: Public Works and Natural Resources

Priority (High Medium, Low): High

Cost Estimate: \$300,000

Existing or Potential Funding: There is no existing City funding available for this project at this time. Potential funding would be BRIC Grant funding.

Benefits (avoided losses): Longmont has been using revised storm drainage and floodplain management criteria but it has not been documented or officially adopted by City Council. Floodplain Management is done on a case-by-case basis as there is no written criteria beyond the Floodplain Management Ordinance which includes very little specific criteria. Consistent criteria will provide consultants and CIP engineers with the necessary information to complete their projects within the expectation and criteria set forth by the City. In addition, consistency is key to managing expectations from submitters i.e. every project is treated the same.

Potential or current subject matter expertise: Engineers familiar with stormwater criteria needed for development, CIPs and regulatory agencies, publication specialists, and lawyers (CAO and outside with expertise in stormwater regulations). None of this expertise is available in-house.

Schedule: 2022-2024 contingent upon funding.

Name of Action: Ecological Restoration

Hazards Addressed: Flood, Wildfire, Drought

Mitigation Goal or Objective Addressed: Goals 1 and 2; Restore diverse, functioning, native ecosystems such as grasslands, riparian areas, wetlands, and forests to increase resiliency to natural disasters such as floods, wildfires and drought.

Community Lifeline Addressed: Safety and Security | Food, Water, Shelter | Health and Medical |Energy |Transportation

Issue/Background: Ecosystems are critical to human survival through the provisioning of such ecosystem services as flood retention, pollination, pollutant filtration, and carbon sequestration. Diverse, functioning native ecosystems are able to withstand natural disasters and recover which in turn reduces the negative impact on human life. The more diverse an ecosystem's plant and animal species are, the more they are able to adapt to environmental changes caused by disasters. Also, ecosystems are more resilient when such functions as floodplain connectivity, natural fire regimes, and habitat connectivity are able to occur. Many of Longmont's ecosystems are in a degraded state as described in the existing conditions evaluation undertaken in 2019 for the Natural Streams Management Plan, still in production. Ecological restoration activities such as noxious weed control, seeding and planting native plants, prescribed burning, forest thinning, and stream channel reshaping aim to create more healthy ecosystems.

Other Alternatives: None

Action Status: New in 2022

Responsible Office: Public Works & Natural Resources Department/Parks& Natural Resources Division

Priority: High

Cost Estimate: There has not been an analyses of the cost for all restoration projects across all City of Longmont properties. \$300,000 annually would be a reasonable starting point.

Existing or Potential Funding: Multiple City operating budgets such as Open Space, Water, Sanitation, Parks, Stormwater Operations contribute \$20,050 to annual weed control as well as to the salaries of staff performing vegetation management. Open Space operating budget also earmarks \$40,000 annually for native plant propagation. There are potential grants that could be pursued for ecological restoration such as Great Outdoors Colorado RESTORE Colorado Grant.

Benefits (avoided losses): Implementing ecological restoration would help mitigate losses associated with flooding, wildfire, and drought such as flood related erosion damage and sedimentation of water bodies following catastrophic wildfire.

Potential of current subject matter expertise: Staff within the Parks & Natural Resources Division are experts in ecological restoration

Schedule: 2022-2027 with annual implementation

Name of Action: Floodplain Regulations Update

Hazard Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 1 and 2

Community Lifeline Addressed: Safety and Security | Food, Water, Shelter | Transportation

Issue/Background: Longmont experienced a significant and damaging flood in 2013. The Floodplain Management Ordinance should be updated with lessons learned from that event. Several updates have been proposed through the "Mitigation Solutions through Land Use" workshop Longmont participated in (2018).

Other Alternatives: No action.

Action Status: New in 2022

Responsible Office: Public Works and Natural Resources

Priority (High Medium, Low): High

Cost Estimate: \$50,000

Existing or Potential Funding: There is no existing City funding available for this project. Potential funding would be a BRIC grant.

Benefits (avoided losses): Avoidance of flooding and flood damages to public and private property and public safety.

Potential or current subject matter expertise: Code language expertise, there is 1 in-house expert in this area but would require a significant time investment that is not available. Expert consultant help would be required.

Schedule: 2022

Name of Action: Stormwater System Improvements

Hazard Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 1, 2, and 5

Community Lifeline Addressed: Safety and Security | Food, Water, Shelter | Transportation

Issue/Background: The City of Longmont stormwater system (minor system) is severely undersized or completely lacking in the older areas of the City which causes flooding nearly every time it rains. Longmont has commissioned a City-wide Stormwater Master Plan update (2019) which will result in a preferred plan to address flooding and conveyance problems. Longmont expects the list of projects to be extensive and expensive. A preliminary analysis of the known problem areas and improvements that were not completed from the last master plan update resulted in a large of costs.

Other Alternatives: Allow continuous flooding from smaller rain events to occur throughout the City and only address the worst problem areas. However, the public is very vocal about problems with stormwater flooding and likely someone would have to be hired by the City just to support public complaints.

Action Status: New in 2022.

Responsible Office: Department of Public Works and Natural Resources

Priority (High Medium, Low): High

Cost Estimate: \$9,000,000 (total for 10-year priority project list)

Existing or Potential Funding: Storm Water CIP Fund which is currently only generating enough money to cover outstanding bond repayments. There are no funds after 2020 for Stormwater Improvements.

Benefits (avoided losses): Decrease damages to private and City property and infrastructure due to urban flooding.

Potential or current subject matter expertise: stormwater engineer, GIS, Hydrology and Hydraulics modelling expert, construction management, project management

Schedule: Annual CIP process for these projects each year. Most often these projects are completed after runoff season has been completed on an annual basis.

Name of Action: Airport Road Flood Protection Project

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 1, 2, and 5

Community Lifeline Addressed: Safety and Security

Issue/Background: Flood damage occurs in the western portion of the City of Longmont caused by breeches in the St. Vrain Creek. This project would also protect the community from flood flows to the north that could overtop McIntosh Reservoir and flow south and west to the same areas of the City. By using concrete jersey barriers we will reduce the risk of flooding to this part of the city. Flood damage, occurred in the 2013 flood where flood flows breached the existing St. Vrain Creek channel and flowed to the north causing severe damage to private property and public infrastructure in several neighborhoods in western portions of the City.

Other Alternatives: No action

Action Status: Continuing – not started. Deferred action due to lack of funding source.

Responsible Office: Public Works and Natural Resources Department

Priority (High, Medium, Low): High

Cost Estimate: \$2,000,000

Existing or Potential Funding: City Enterprise Fund

Benefits (avoided losses): This project would result in significant increased public safety and resiliency to the community protecting private property and public infrastructure and significant reduction in public safety risks due to future flooding events. Though the barriers will not remain permanent fixtures, per resident discontent, we now have the supplies and pre drilled holes to put these out at the last minute if needed.

Potential or current subject matter expertise: floodplain management, project management, landscape architect, irrigation, engineers

Schedule: 2022-2024. Project start is dependent on an approved funding source which is not identified at this time.

Annex E: Louisville

Annex E Louisville

E.1 Community Profile

The City of Louisville is a home rule municipality with 8 square miles within the municipal boundaries. The city lies in southeastern Boulder County roughly six miles east of the City of Boulder and 25 miles northwest of Denver. The Louisville area is characterized by generally flat lands and low hills with some gently rolling terrain trending toward Coal Creek and Rock Creek.

The City of Louisville's history is based on coal mines and the coal mining industry. Louisville is an area that was known as the Northern Coal Field, an extensive coal field in Boulder and Weld counties. In August 1877 the first coal mine was opened and Louis Nawatny, a landowner in the area, platted his farmland into the town and named it after himself. Coal miners from around the world moved to the new town to work in the new, safer mine. Because mining was seasonal, and strikes too often interrupted production, the economy was generally depressed. Family gardens and odd jobs were the way of life during summertime unemployment.

From 1890 to 1928, the Acme Mine operated directly beneath the original town of Louisville. Worked on two levels, the Acme produced nearly two million tons of coal and was one of 171 coal mines in Boulder County. There were 30 mines that opened in and around Louisville. During the peak years of 1907 to 1909, there were 12 mines in operation. The use of coal declined following World War II, and the last mines in and around Louisville closed in 1952.

The community has become a generally middle-class community where the workers leave for all manner of jobs in every direction. In recent years, a variety of advanced industries including bioscience, advanced engineering, software, and natural products have opened facilities and offices in Louisville providing employment opportunities and attracting new residents.

E.1.1 Population

According to the 2020 Census the estimated population of the City of Louisville is 21,171. Select 2019 American Community Survey demographic and social characteristics for Louisville are shown in Table E-1

Table E-1 Louisville's Demographic and Social Characteristics

Characteristic	Percentage
Gender/Age	
Male (%)	49.1%
Female (%)	50.9%
Under 5 Years (%)	4.8%
65 Years and Over (%)	13.9%
Race/Ethnicity (one race)	
White (%)	89.6%
Hispanic or Latino (Of Any Race) (%)	7.0%
Average Household Size	2.41
High School Graduate or Higher (%) (Population 25 years and over)	97.5%

Source: U.S. Census Bureau, 2019 American Community Survey

E.1.2 Economy

According to the 2019 American Community Survey, the industries that employed most of Louisville's labor force were educational, health and social services (26.2%); professional, scientific, management, administrative and waste management services (20.6%); retail trade (8.7%); Arts, entertainment, and recreation, and accommodation and food services (8.5%) and manufacturing (8.4%); Select economic characteristics for Louisville from the 2019 American Community Survey are shown in Table E-2.

Table E-2 Louisville's Economic Characteristics

Characteristic	Percentage
Families Below Poverty Level	2.5%
Individuals Below Poverty Level	5.9%
Median Home Value	\$573,400.00
Median Household Income	\$103,017
Population 16 years and older in Labor Force	11,904

Source: U.S. Census Bureau. 2019 American Community Survey

E.2 Hazard Summary

The most significant hazards for Louisville are floods, severe winter storms, and wildfire. Due to the impacts from the Marshall Fire in December 2021, the city determined the wildfire hazard level should be increased from Medium to a High hazard. Refer to Section 4.4 Vulnerability Assessment for detailed countywide vulnerability analysis. There are no hazards that are unique to Louisville. The overall hazard significance takes into account the geographic location, probability of occurrences and magnitude as a way to identify priority hazards for mitigation purposes. Section E.5 Vulnerability Assessment, where possible, analyzes the population, property, and other assets at risk to hazards ranked of medium or high significance that may vary from other parts of the planning area. Other hazards that could impact Louisville include dam failure, drought, hailstorm, earthquake, extreme heat, lightning, tornado, windstorm, and communicable/zoonotic disease outbreak. Due to the historical coal mining in the area subsidence of the land surface is a concern in Louisville. During the update of this annex the Louisville HMPC noted that most of the hazards are not singular often multiple compound and amplify each other. The Marshall Fire in late 2021 demonstrated the cascading nature of hazards that resulted from a combination of drought, strong winds in advance of a winter storm, and a wildfire.

Table E-3 City of Louisville Hazard Summary

Hazard Type	Geographic Extent	Probability of Future Occurrences	Magnitude / Severity	Increased Threat (Climate Change)	Hazard Level
Air Quality	Extensive	Highly Likely	Critical	Moderate	Medium
Avalanche	Limited	Unlikely	Negligible	Low	Low
Communicable / Zoonotic Disease Outbreak	Extensive	Likely	Critical	Substantial	High
Dam and Levee Failure	Extensive	Occasional	Critical	Moderate	Medium

Hazard Type	Geographic Extent	Probability of Future Occurrences	Magnitude / Severity	Increased Threat (Climate Change)	Hazard Level
Drought	Extensive	Likely	Limited	Substantial	Medium
Earthquake	Extensive	Occasional	Limited	Low	Low
Extreme Temperatures	Extensive	Occasional	Limited	Severe	Low
Expansive Soils	Extensive	Highly Likely	Limited	Substantial	Low
Flood	Significant	Likely	Critical	Severe	High
Hailstorm	Significant	Likely	Limited	Moderate	Low
Landslide/Mud and Debris Flow/Rockfall	Significant	Likely	Limited	Substantial	Medium
Lightning	Extensive	Highly Likely	Limited	Moderate	Medium
Severe Winter Storm	Extensive	Highly Likely	Critical	Substantial	High
Subsidence	Extensive	Occasional	Limited	Moderate	Medium
Tornado	Significant	Occasional	Limited	Low	Medium
Wildfire	Significant	Likely	Critical	Severe	High
Windstorm	Extensive	Highly Likely	Limited	Moderate	Medium

Geographic Extent

- Limited: Less than 10% of planning area
- Significant: 10-50% of planning area
- Extensive: 50-100% of planning area

Probability of Future Occurrences

- Highly Likely: Near 100% chance of occurrence in next year or happens every year.
- Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less.
- Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years.
- Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.

Magnitude/Severity

- Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
- Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability.
- Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability.
- Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Increase Threat from Climate Change

- Low- unlikely to become more of a threat due to climate change.
- Moderate – possibly will become more of a threat due to climate change.
- Substantial- likely to become more of a threat due to climate change.
- Severe- highly likely to become more of a threat due to climate change

Significance

- Low: minimal potential impact
- Medium: moderate potential impact
- High: widespread potential impact

E.3 Asset Inventory

E.3.1 Property Inventory

Table E-4 represents an inventory of property in Louisville based on the Boulder County Assessor's data as of March 2022.

Table E-4 Louisville Property Inventory

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
Agricultural	3	6	\$728,800	\$728,800	\$1,457,600
Commercial	251	245	\$433,063,223	\$433,063,223	\$866,126,446
Exempt	88	158	\$165,149,034	\$165,149,034	\$330,298,068
Industrial	148	117	\$501,166,046	\$751,749,069	\$1,252,915,115
Mixed Use	9	22	\$16,367,500	\$16,367,500	\$32,735,000
Residential	7,325	7,201	\$2,872,098,425	\$1,436,049,213	\$4,308,147,638
Vacant	2	2	\$699,500	\$699,500	\$1,399,000
Total	7,826	7,751	\$3,989,272,528	\$2,803,806,339	\$6,793,078,867

Source: Boulder County Assessor's Office

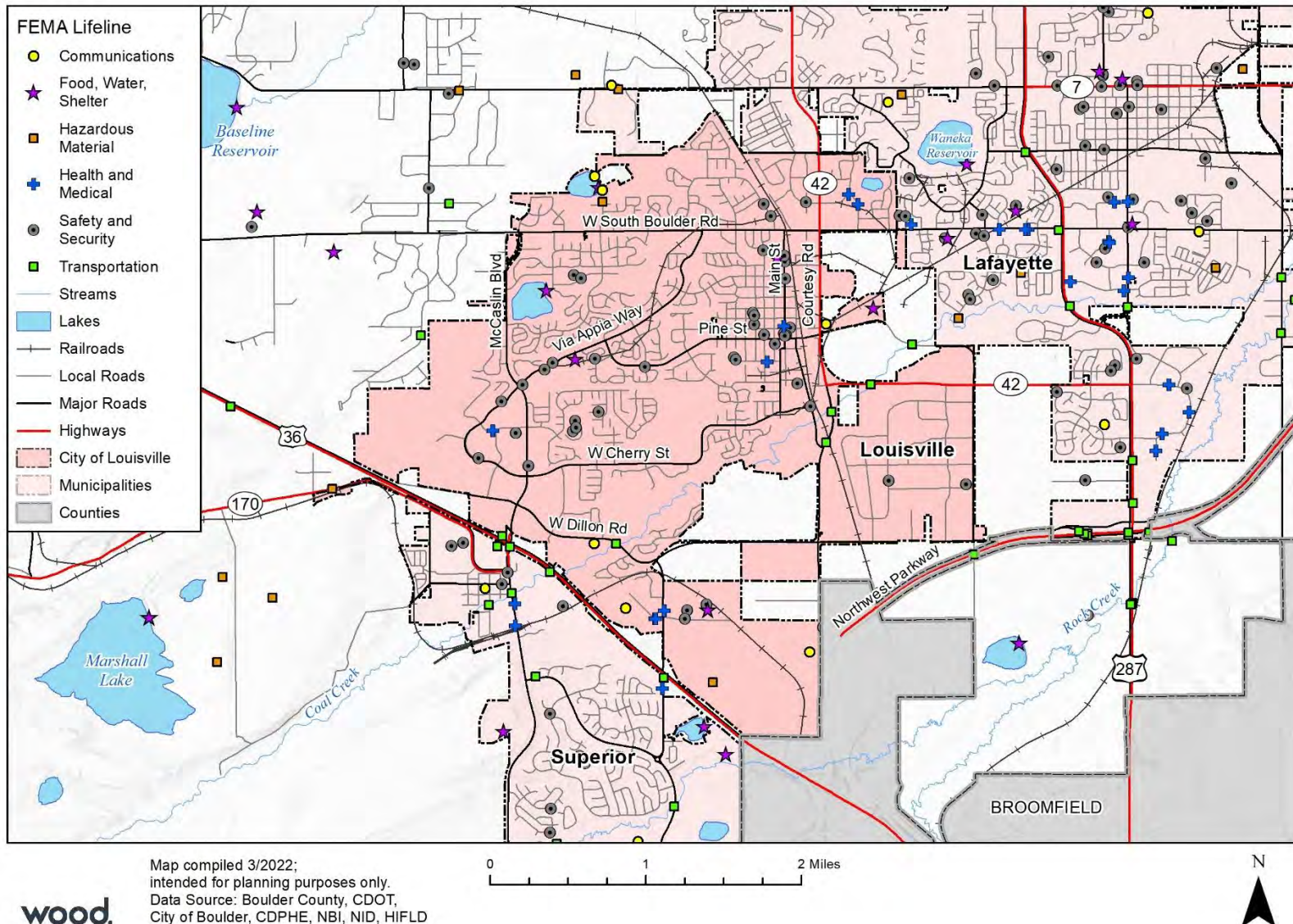
E.3.2 Critical Facilities

Table E-5 shows the critical facilities organized by FEMA Lifeline identified in the City of Louisville. The location of each facility is shown on Figure E-1.

Table E-5 Louisville Critical Facilities by FEMA Lifeline

FEMA Lifeline	Count
Communications	6
Food, Water, Shelter	6
Hazardous Materials	2
Health and Medical	8
Safety and Security	43
Transportation	4
Total	69

Source: Boulder County, HIFLD, CDPHE, Wood Analysis

Figure E-1 City of Louisville Critical Facilities

E.3.3 Economic Assets

Economic assets at risk may include major employers or primary economic sectors, whose losses or inoperability would have severe impacts on the community and its ability to recover from disaster. After a disaster, economic vitality is the engine that drives recovery. Every community has a specific set of economic drivers, which are important to understand when planning ahead to reduce disaster impacts to the economy. When major employers are unable to return to normal operations, impacts ripple throughout the community.

According to 2019 data from the Colorado Department of Labor and Employment, the following are Louisville's major employers.

- Balfour Senior Living
- Avista Adventist Hospital
- Fresca Foods
- City of Louisville
- Design Mechanical
- Global Healthcare Exchange
- Sierra Nevada Corporation
- Centennial Peaks Hospital
- Medtronic
- JumpCloud

E.3.4 Natural, Historic, and Cultural Resources

Assessing the vulnerability of Louisville to disaster also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons:

The community may decide these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy. If these resources are impacted by a disaster, knowing so ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts are higher. The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.

Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.

Natural Resources

Floodplains along Coal and Rock creeks hold relatively intact riparian corridors that are critical for flood protection, wildlife movement, and the aquatic health of the streams. Boulder County and the Colorado Natural Heritage Program have not identified any rare, endangered, threatened, imperiled plant and animal species or critical wildlife habitats within the city limits or on City open space. The Colorado Tallgrass Prairie Natural Area lies just to the west of the city. Prebles Meadow jumping mice are found along Coal Creek, but not in the segment through Louisville.

For information about natural resources in Boulder County, which includes Louisville, see Section 4.4 Vulnerability Assessment of the base plan.

Historic and Cultural Resources

Table E-6 lists the properties in Louisville that are on the National Register of Historic Places and/or the Colorado State Register of Historic Properties (for more information about these registers, see Section 4.4 Vulnerability Assessment of the base plan).

Table E-6 Louisville's Historic Properties/Districts in National and State Registers

Property	Address	Date Listed
Denver Elevator--Grain Elevator	Tract 712 near CO 42	2/14/1986
Ginacci House	1116 LaFarge Street	2/14/1986
Jacoe Store	1001 Main Street	2/14/1986
Lackner's Tavern	1006 Pine	2/14/1986
LaSalla House	1124 Main Street	2/14/1986
National Fuel Company Store	801 Main Street	2/14/1986
Petrelli--DelPizzo House	1016 Main Street	2/14/1986
Rhoades House	1024 Grant	2/14/1986
Robinson House	301 Spruce	2/14/1986
Stolmes House	616 Front Street	2/14/1986
Tego Brothers Drugstore--State National Bank of Louisville	700 Main Street	2/14/1986
Thomas House	700 Lincoln	2/14/1986

Sources: *Directory of Colorado State Register Properties*, www.coloradohistory-oahp.org/programareas/register/1503/; *National Register Information System*, www.nr.nps.gov/

Additionally, six properties have been designated as Louisville historic landmarks (Table E-7).

Table E-7 Louisville's Historic Landmarks

Property	Address	Year Designated
Austin-Niehoff House	717 Main Street	9/6/2005
Louisville Center for the Arts	801 Grant Avenue	9/6/2005
Jacoe Store	1001 Main Street	9/20/2005
Tomeo House	1001 Main Street	9/20/2005
Jordinelli House	1001 Main Street	9/20/2005
Jannucci House	1116 LaFarge Avenue	4/15/2008
Fabrizio House	557 Jefferson Avenue	2010
Ball House	1117 Jefferson Avenue	2010
Jacoe-Conarroe House	1131 Jefferson Avenue	2010
Zarini House	1109 LaFarge Avenue	2010
Adkins House	816 McKinley Avenue	201
Zarini-Ross House	501 South Street	2010
Rex Theater	817 Main Street	2011
Thomas House	700 Lincoln Avenue	2011
Sotelli Bouse	1021 Jefferson Avenue	2011
Caranci House	1145 Main Street	2011
Hibler House	612 Grant Avenue	2012
Allera House	1005 Lafarge Avenue	2012
Thomas-Decker House	733 Pine Street	2012
Guenzi House	1036 Walnut Street	2012
Butcher-Jones House	1013 Jefferson Avenue	2013

Property	Address	Year Designated
Restas-Morgan House	1131 Spruce Street	2013
James House	700 Pine Street	2013
Porta House	925 Lafarge Avenue	2013
Di Francia Saloon	740 Front Street	2014
Pearson Store	927 Main Street	2014
D'Agostino House	1245 Grant Avenue	2015
Atkin House	1101 Grant Avenue	2015
Louisville Grain Elevator	540 County Road	2015
Vaughn House	701 Lincoln Avenue	2015
Steinbaugh House	945 Front Street	2015
Mudrock House	613 Grant Avenue	2016
Standard Oil Sign	947 Pine Street	2016
Black Family House	725 Lincoln Avenue	2016
Louisville Hospital	721 Grant Avenue	2016
Romeo House	701 Garfield Avenue	2016
Gorce House	625 Lincoln Avenue	2017
Agatha Stecker House	720 Pine Street	2017
Joseph Stecker House	722 Pine Street	2017
Blue Parrot Sign	640 Main Street (Blue Parrot Sign)	2018
Harney House	620 Grant Avenue	2018
DiSalvo House	1021 Main Street	2018
Trott/Downer Cabins	Miners Field	2019
Wattel House	816 Lincoln	2019
816 Main Street	816 Main Street	2019
Damiana House	917 La Farge	2020
La Salle House	833 Jefferson Avenue	2020
Mancini House	908 Rex Street	2020
Berardi House	1016 Grant Avenue	2020
DeSantis House	1200 Jefferson Avenue	2020
Stecker-Kerr House	633 La Farge Avenue	2020
Koci House from 1201 Lincoln Avenue	1201 Lincoln Avenue (633 La Farge Avenue)	2020

Source: City of Louisville Historic Preservation Commission, www.louisvilleco.gov

It should be noted that as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

E.4 Growth and Development Trends

Table E-8 illustrates how Louisville has grown in terms of population and number of housing units between 2014 and 2019.

Table E-8 Louisville's Change in Population and Housing Units, 2014-2019

2014 Population	2019 Population Estimate	Estimated Percent Change 2014-2019	2014 # of Housing Units	2019 Estimated # of Housing Units	Estimated Percent Change 2014-2019
20,112	20,860	4%	6,357	7,740	22%

Source: U.S. Census Bureau, 2014 and 2019 American Community Survey

According to the City's 2013 Comprehensive Plan, growth in Louisville can be attributed to the fact the residential market improved and compensated for the lack of growth between 2000 and 2010 and residential supplies had completed the entitlement process. The plan also estimated that based on current zoning, the city would be built out at a population of 22,145 (assuming 2.4 people per household).

E.5 Vulnerability Assessment

The intent of this section is to assess Louisville's vulnerability separate from that of the planning area as a whole, which has already been assessed in Sections 4.4 Vulnerability Assessment and 4.5 Estimating Potential Losses of the base plan. This vulnerability assessment analyzes the population, property, critical facilities, and other assets at risk for the more significant hazards or where available data permits a more in-depth analysis. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment of the base plan.

E.5.1 Vulnerability by Hazard

The hazard summaries in Table E-3 above reflect the hazards that could potentially affect the city. Based on this analysis, the priority hazards (High Significance) for mitigation are flood and winter storm. Those of medium significance for the City of Louisville are identified below.

- Communicable/zoonotic disease outbreak
- Dam and levee failure
- Drought
- Landslide/Mud and Debris Flow/Rockfall
- Lightning
- Tornado
- Wildfire
- Windstorm

Due to the ability to quantify vulnerability further with available data, only dam inundation, flood, and wildfire hazards will be profiled in the following vulnerability assessment section.

Hazards assigned a significance rating of Low, and which do not differ significantly from the County ranking (e.g., Low vs. High) are not addressed further in this plan and are not assessed individually for specific vulnerabilities in this section.

Dam Failure

General Property and People

While there is no concrete data available to indicate any likelihood of failure, based on best available dam inundation data there might be structures potentially at risk of dam failure flooding. The dam failure inundation maps contain sensitive information and are not available for display in this public planning document. Based on a GIS analysis performed with the best available data 491 people are potentially at risk of a dam inundation event. Table E-9 shows the potential exposure to people and property in Louisville.

Table E-9 Estimated Dam Inundation Exposure to Properties in Louisville

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Commercial	43	55	\$47,429,710	\$47,429,710	\$94,859,420	
Exempt	9	25	\$13,137,125	\$13,137,125	\$26,274,250	
Industrial	2	3	\$955,600	\$1,433,400	\$2,389,000	
Mixed Use	4	3	\$1,000,500	\$1,000,500	\$2,001,000	7
Residential	140	200	\$66,314,922	\$33,157,461	\$99,472,383	484
Total	198	286	\$128,837,857	\$96,158,196	\$224,996,053	491

Source: Boulder County Assessor's Office, U.S. Census, DOLA, DWR, Wood Analysis

Critical Facilities and Infrastructure

Based on the GIS analysis summarized in the Table E-10, it is expected that around 9 critical facilities in Louisville are exposed to a potential dam inundation event. The majority fall within the safety and security lifeline.

Table E-10 Critical Facilities Exposed to Dam Inundation

FEMA Lifeline	Count
Communications	1
Food, Water, Shelter	1
Safety and Security	5
Transportation	2
Total	9

Source: Boulder County Assessor, HFLD, Wood Analysis

Refer to Section 4.3.4 of the base plan for the location of dams in Boulder County.

Economy

In addition to commercial and residential building impacts, a dam inundation event that affected the major roads which give access to the city. Which could significantly affect the local economy, by limiting or completely impeding access to shops, restaurants, hotels, and other major industries which keep the local economy thriving.

Historical, Cultural, and Natural Resources

Dam or reservoir failure effects on the environment would be similar to those caused by flooding from other causes. For the most part the environment is resilient and would be able to rebound, though this process could take years. However, historic and cultural resources could be affected just as housing or critical infrastructures would.

Flood

According to the 2019 Boulder County Flood Insurance Study, Louisville has experienced flood damages on Coal Creek in the past. The 2013 flood event impacted homes, infrastructure, trails, and the public golf course in Louisville. As shown in Figure E-2 Coal Creek is primary cause of flooding in the City of Louisville.

General Property and People

Vulnerability to flooding was determined by summing potential losses to Louisville properties using GIS,

the building footprint layer provided by Boulder County and the latest FEMA NFHL data. A separate parcel analysis was also conducted, where the parcel was used to create a centroid, or point, representing the center of each parcel polygon, in order to get the number of improved parcels, property types, and improved values. FEMA's NFHL data depicts the 1% annual chance (100-year) and the 0.2% annual chance (500-year) flood events. Figure E-2 below displays Louisville's FEMA special flood hazard areas present in the city, color coded based on flood event (i.e., 100-year versus 500-year).

Based on the GIS analysis performed and the available FEMA flood mapping, the potential risk for the city is shown in Table E-11 and Table E-12. Louisville 1% annual chance flood zone presents has 16 residential buildings and over an estimated \$2 million in estimated losses. According to the analysis, 125 buildings (116 of which are residential) are exposed to the 0.2% annual chance event, totaling over \$16 million of damages to buildings and contents.

Table E-11 City of Louisville Properties at Risk to 1% Annual Chance Flood Zone

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Residential	16	16	\$5,897,600	\$2,948,800	\$8,846,400	\$2,211,600	39
Total	16	16	\$5,897,600	\$2,948,800	\$8,846,400	\$2,211,600	39

Source: Boulder County Assessor, U.S. Census, DOLA, FEMA NFHL Effective 8/15/2019, Preliminary 9/30/2019, Wood Analysis

Table E-12 City of Louisville Properties at Risk to 0.2% Annual Chance Flood Zone

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Commercial	2	4	\$1,043,200	\$1,043,200	\$2,086,400	\$521,600	
Exempt	3	5	\$8,294,284	\$8,294,284	\$16,588,568	\$4,147,142	
Residential	96	116	\$31,938,203	\$15,969,102	\$47,907,305	\$11,976,826	281
Total	101	125	\$41,275,687	\$25,306,586	\$66,582,273	\$16,645,568	281

Source: Boulder County Assessor, U.S. Census, DOLA, FEMA NFHL Effective 8/15/2019, Preliminary 9/30/2019, Wood Analysis

The population exposed to the flood hazards described in the flood vulnerability analysis above was estimated by applying an average household size factor to the number of improved residential properties identified in the flood hazard areas within Louisville. These estimates yielded the population exposures shown in the table above in Table E-11 and Table E-12. As such, the combined 1% and 0.2% annual chance floods would potentially displace 320 people, based on the residential structures which fall in those flood zones. For additional details on potential displacements by flood event, see the Boulder County Base Plan.

Critical Facilities and Infrastructure

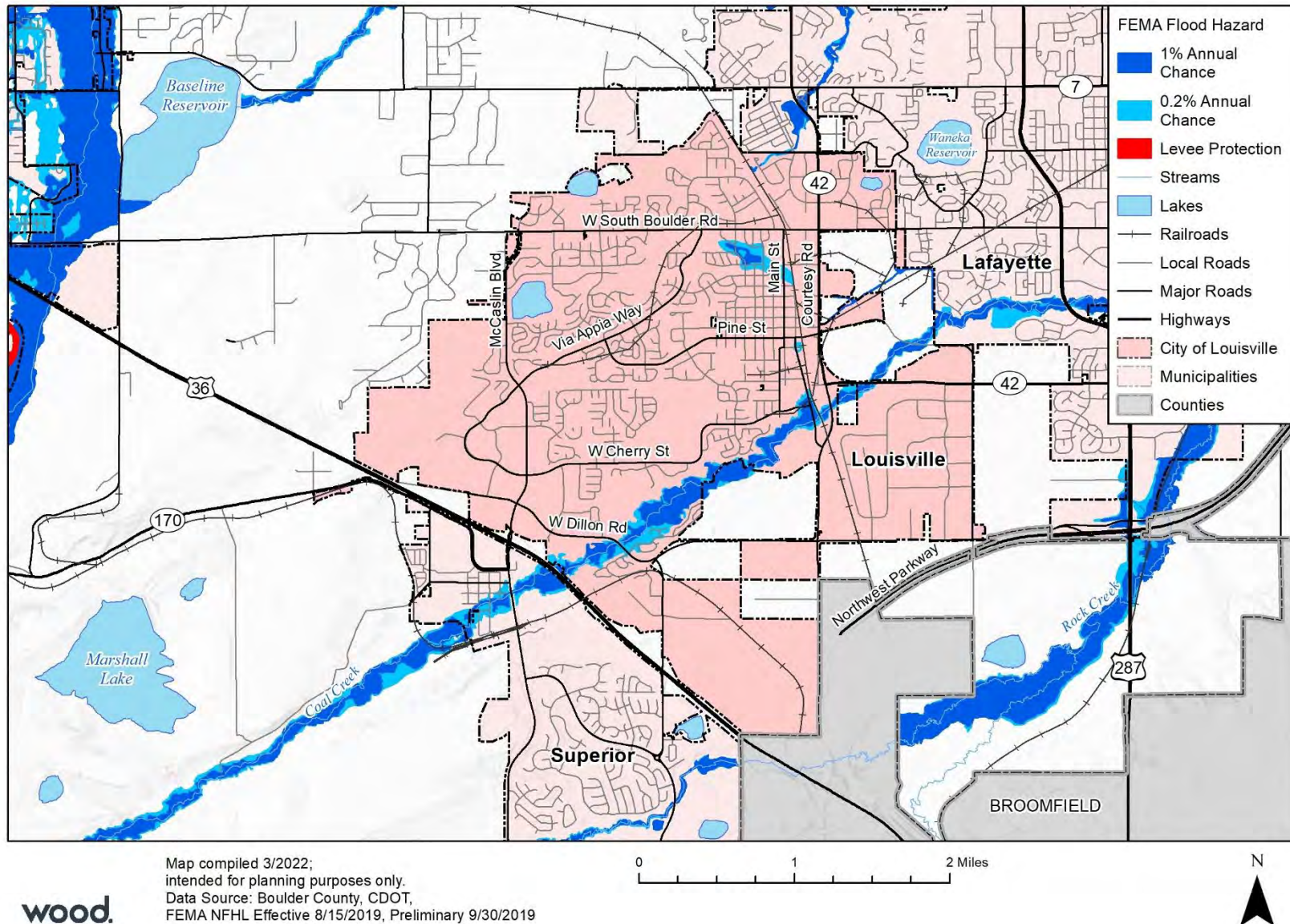
There are a total of 4 critical facilities located in both the 1% and 0.2% flood hazard areas. Most of the critical facilities identified as being at risk to flooding fall within the Safety and Security FEMA Lifeline. These include two childcare providers (one within the 1% and one within the 0.2%) and Louisville Fire Station 1 (within the 0.2%). There is also one bridge that is within the 1% annual chance flood zone.

Table E-13 Louisville Critical Facilities at Risk Within 1% and 0.2% Annual Chance Flood Zone

FEMA Lifeline	Count
1% Flood Zone	

FEMA Lifeline	Count
Safety and Security	1
Transportation	1
Total	2
0.2% Flood Zone	
Safety and Security	2
Total	2
Grand Total	4

Source: Boulder County Assessor, CDPHE, NBI, Wood Analysis

Figure E-2 City of Louisville Flood Hazard Areas

Economy

Flooding can have a major economic impact on the economy, including indirect losses such as business interruption, lost wages, and other downtime costs.

Historical, Cultural and Natural Resources

The environment is mostly resilient to general flooding. However, cultural or historic properties within floodplains would be affected in similar ways as property and critical facilities/infrastructure, especially those with underground or basement levels where water would easily seep and potential ruin archives, resources, or other important assets.

Wildfire

General Property

Wildfire Risk analysis used best available data from the wildfire hazards zones defined by the Colorado Forest Atlas from the State Forest Service. Parcel analysis was conducted using GIS to analyze where parcels, buildings counts, property types and content values intersected with the wildfire hazards zones defined by the Colorado Forest Atlas, from highest to lowest risk. The Colorado Forest Atlas calculates a composite risk rating, defined as the possibility of loss or harm occurring from a wildfire. It identifies areas with the greatest potential impacts from a wildfire – i.e., those areas most at risk - considering all values and assets combined together – WUI Risk, Drinking Water Risk, Forest Assets Risk and Riparian Areas Risk. This risk index has been calculated consistently for all areas in Colorado, allowing for comparison and ordination of areas across the entire state. The Wildfire Risk Classes for Louisville are shown in in Table E-14 and Figure E-3 below.

Based on this analysis Louisville has 1,467 structures at risk of wildfire, 35 of which are at moderate or high risk. Residential property types have the greatest number of parcels at risk of wildfire.

Note, this analysis does not account for urban conflagration or the losses from the December 2021 Marshall Fire.

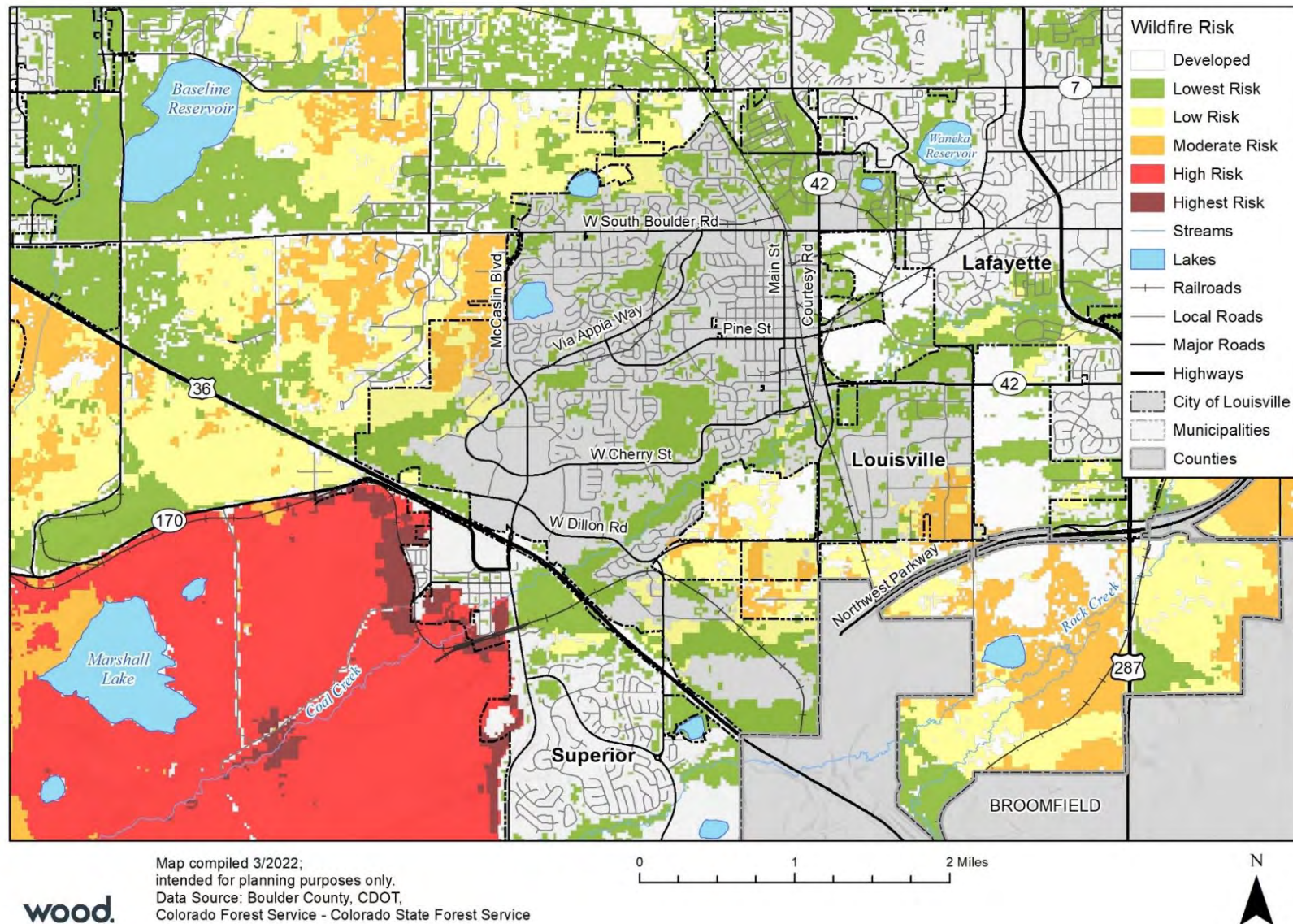
Due to the Marshall Fire, and the regular incidence of high wind events in Louisville, the city recognizes the clear and present increased risk of wildfire without intensive mitigation solutions that will require planning, funding, and time to implement.

Table E-14 Properties within the Highest to Lowest Wildfire Risk

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Highest Wildfire Risk						
Exempt	1	1	\$322,500	\$322,500	\$645,000	
Total	1	1	\$322,500	\$322,500	\$645,000	0
Moderate Wildfire Risk						
Exempt	3	7	\$7,166,200	\$7,166,200	\$14,332,400	
Industrial	2	9	\$26,387,300	\$39,580,950	\$65,968,250	
Residential	8	18	\$4,652,581	\$2,326,291	\$6,978,872	44
Total	13	34	\$38,206,081	\$49,073,441	\$87,279,522	44
Low Wildfire Risk						
Agricultural	1	9	\$110,800	\$110,800	\$221,600	
Commercial	4	12	\$13,255,300	\$13,255,300	\$26,510,600	

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Exempt	3	24	\$0	\$0	\$0	
Industrial	1	2	\$3,919,700	\$5,879,550	\$9,799,250	
Mixed Use	2	4	\$298,200	\$298,200	\$596,400	10
Residential	53	64	\$23,054,200	\$11,527,100	\$34,581,300	159
Vacant	1	2	\$304,800	\$304,800	\$609,600	
Total	65	117	\$40,943,000	\$31,375,750	\$72,318,750	169
Lowest Wildfire Risk						
Agricultural	3	5	\$728,800	\$728,800	\$1,457,600	
Commercial	9	33	\$24,172,800	\$24,172,800	\$48,345,600	
Exempt	27	70	\$53,440,200	\$53,440,200	\$106,880,400	
Industrial	35	28	\$92,204,000	\$138,306,000	\$230,510,000	
Mixed Use	1	4	\$9,672,400	\$9,672,400	\$19,344,800	10
Residential	882	1,174	\$443,552,866	\$221,776,433	\$665,329,299	2,841
Vacant	1	1	\$698,000	\$698,000	\$1,396,000	
Total	958	1,315	\$624,469,066	\$448,794,633	\$1,073,263,699	2,851

Source: Boulder County Assessor's Office, U.S. Census, DOLA, Colorado Forest Service - Colorado State Forest Service, Wood Analysis

Figure E-3 City of Louisville Wildfire Risk

Wildland-Urban Interface Risk

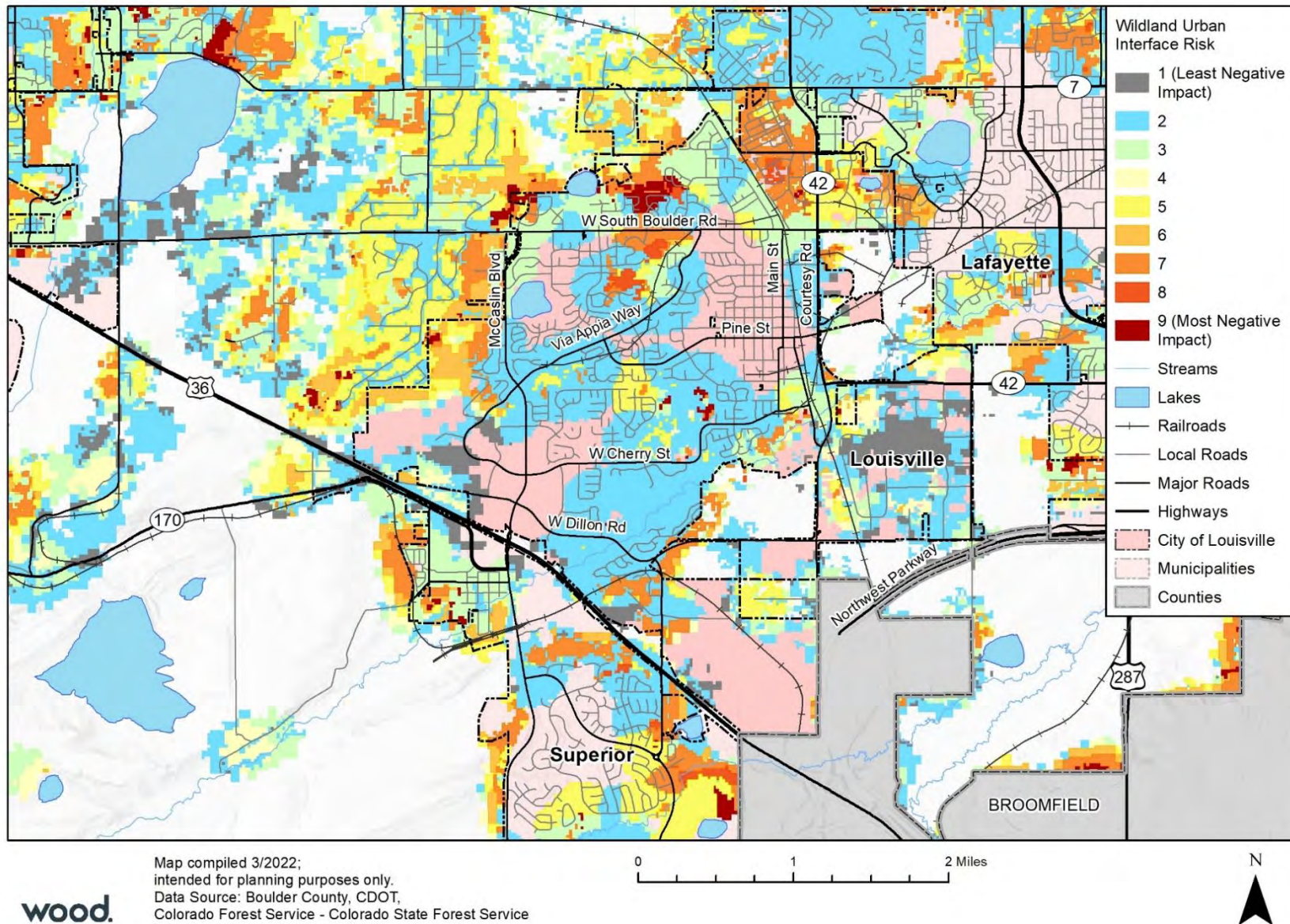
The Colorado Forest Atlas also provides an analysis for Wildland-Urban Interface (WUI) risk based on housing density consistent with Federal Register National standards. The location of people living in the wildland-urban interface and rural areas is essential for defining potential wildfire impacts to people and homes. To calculate the WUI Risk Index, the WUI housing density data was combined with flame length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9, while areas with low housing density and low flame lengths are rated -1. Data is modelled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers. WUI Risk for Louisville is mapped in Figure E-4.

Based on this analysis Louisville has 1,095 structures within WUI risk areas, 978 of which are at moderate to high WUI risk. Residential property types have the greatest number of structures (986) within WUI risk areas. Note, this analysis does not account for urban conflagration or the losses from the December 2021 Marshall Fire. Based on what the City of Louisville experienced in the Marshall Fire, the risk within these WUI areas increase in extreme wind conditions.

Table E-15 Properties Within High to Low WUI RISK

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
High WUI Risk						
Commercial	1	1	\$1,411,700	\$1,411,700	\$2,823,400	
Exempt	9	18	\$24,620,500	\$24,620,500	\$49,241,000	
Residential	537	559	\$279,362,492	\$139,681,246	\$419,043,738	1,353
Total	547	578	\$305,394,692	\$165,713,446	\$471,108,138	1,353
Moderate WUI Risk						
Commercial	19	15	\$20,353,300	\$20,353,300	\$40,706,600	
Exempt	8	12	\$10,205,200	\$10,205,200	\$20,410,400	
Industrial	25	9	\$33,372,000	\$50,058,000	\$83,430,000	
Residential	473	363	\$210,016,311	\$105,008,156	\$315,024,467	878
Vacant	1	1	\$698,000	\$698,000	\$1,396,000	
Total	526	400	\$274,644,811	\$186,322,656	\$460,967,467	878
Low WUI Risk						
Agricultural	1	9	\$110,800	\$110,800	\$221,600	
Commercial	4	12	\$13,255,300	\$13,255,300	\$26,510,600	
Exempt	3	24	\$0	\$0	\$0	
Industrial	1	2	\$3,919,700	\$5,879,550	\$9,799,250	
Mixed Use	2	4	\$298,200	\$298,200	\$596,400	10
Residential	53	64	\$23,054,200	\$11,527,100	\$34,581,300	159
Vacant	1	2	\$304,800	\$304,800	\$609,600	
Total	65	117	\$40,943,000	\$31,375,750	\$72,318,750	169

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

Figure E-4 City of Louisville Wildland Urban Interface Risk

People

The last column of Table E-14 and Table E-15 above summarizes the number of people at risk to wildfire in the analyzed fire zones. Based on the assessment conducted, Louisville has an estimated 44 people living within the moderate wildfire risk zone. No residential properties were identified in the high wildfire risk zone. In terms of people living within WUI risk areas, an estimated 2,400 residents live within the low to high WUI risk areas. Of those, 2,231 are estimated to be living within the moderate to high WUI risk areas. In addition to living within wildfire or WUI risk areas, smoke resulting from wildfires, even fires outside of Boulder County or the state have been an issue for people in Louisville and Boulder County in the past.

Critical Facilities and Infrastructure

The City of Louisville has a total of 6 critical facilities at lowest to moderate risk to wildfire. Most (3) facilities are identified as being a food, water, shelter lifeline. These include the Louisville No.1 dam, a Red Cross Shelter and a City wastewater treatment plan. The safety and security lifeline has the second most facilities identified (2) at risk and include a fire station, Louisville Station 3 and a Boulder County Building. There are also 41 critical facilities within the low to high WUI Risk. The following tables show the results of the GIS analysis and is organized by wildfire or WUI risk and Lifeline. Refer to Chapter 4 of the Base Plan for more information on the methodology of the GIS analysis.

Table E-16 Critical Facilities Within Wildfire Risk Areas by FEMA Lifeline

FEMA Lifeline	Count
Moderate Wildfire Risk	
Safety and Security	1
Total	1
Low Wildfire Risk	
Food, Water, Shelter	1
Total	1
Lowest Wildfire Risk	
Communications	1
Food, Water, Shelter	2
Safety and Security	1
Total	4
Grand total	6

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Table E-17 Critical Facilities Within WUI Risk Areas by FEMA Lifeline

FEMA Lifeline	Count
High WUI Risk	
Food, Water, Shelter	1
Safety and Security	1
Total	2
Moderate WUI Risk	
Health and Medical	2
Total	2
Low WUI Risk	

FEMA Lifeline	Count
Communications	5
Food, Water, Shelter	1
Hazardous Material	1
Health and Medical	4
Safety and Security	22
Transportation	4
Total	37
Grand Total	41

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Economy

Tourism, the accommodation and food services industry (e.g., hotels and restaurants), and retail are major components of Boulder County's economy, and Louisville's as well. Wildland fires can, for example, lead to significant tourism reductions due to health and safety concerns, causing lost revenues from lack of visitation, stays in hotels, spending on restaurants and other commerce sources, and more.

Historical, Cultural and Natural Resources

Wildfires are a common and naturally occurring phenomenon in forested areas and can benefit forest health in many respects. But the climate change trend which is leading to hotter, more widespread, and destructive fires can make it more difficult for the environment to recover, and lead to increased flood runoff or other secondary/cascading hazards, such as erosion, landslides, mudslides, and debris flows, and flooding. This can severely impact water quality and watershed health for years after a fire. Wildfires can negatively impact air quality, water quality, and vegetation and biodiversity.

With regards to historic or cultural structures and resources, wildfires would affect those in similar ways as general property and critical facilities/infrastructure, having the potential for burn downs and hence possible complete loss of important historical assets.

E.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment summarizes Louisville's regulatory mitigation capabilities, administrative and technical mitigation capabilities, and fiscal mitigation capabilities and then discusses these capabilities in further detail along with other mitigation efforts as they pertain to the National Flood Insurance Program's Community Rating System (CRS). Although the CRS is flood-focused, this discussion also incorporates activities related to other hazards into the categories established by the CRS.

E.6.1 Mitigation Capabilities Summary

Table E-18 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Louisville.

Table E-18 Louisville's Regulatory Mitigation Capabilities

Regulatory Tool (Ordinances, codes, plans)	Yes/No	Comments
Comprehensive plan	Yes	Louisville Comprehensive Plan, 2013
Zoning ordinance	Yes	Louisville Municipal Code

Regulatory Tool (Ordinances, codes, plans)	Yes/No	Comments
Subdivision ordinance	Yes	Louisville Municipal Code
Growth management ordinance	Yes	Louisville Comprehensive Plan, 2013
Site plan review requirements	Yes	Louisville Municipal Code
Floodplain ordinance	Yes	Louisville Municipal Code
Other special purpose ordinance (stormwater, steep slope, wildfire)	Yes	Louisville Municipal Code and Louisville Public Works
Building code	Yes	International Building Code, 2018
BCEGS Rating	No	
Fire department ISO rating	Yes	2 out of 10
Erosion or sediment control program	Yes	Louisville Land Municipal Code
Stormwater management program	Yes	Louisville Public Works
Capital improvements plan	Yes	Louisville Public Works
Economic development plan	Yes	Louisville Economic Vitality Department
Local emergency operations plan	Yes	Louisville Police Department
Other special plans	Yes	Drought Management Plan, Open Space Master Plan, Comprehensive Plan of Fire and Emergency Services 2005-2015
Flood insurance study or other engineering study for streams	Yes	FEMA Flood Insurance Study, August 15, 2019
Elevation certificates	Yes	Noneffective after 2019 map update
Community Wildfire Protection Plan (CWPP)	No	
Participate in the National Flood Insurance Program (NFIP)	Yes	Joined: 5/4/1973
Participate in Community Rating System (CRS)	Yes	Class 6

Table E-19 identifies the personnel responsible for mitigation and loss prevention activities as well as related data and systems in Louisville.

Table E-19 Louisville's Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/engineer with knowledge of land development/land management practices	Yes	Public Works Department and Planning & Building Safety Department staff members	Public Works Director, City Engineer, Civil Engineer III, Planning Director, Planner III
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Public Works Department and Planning & Building Safety Department	Public Works Director, City Engineer, Civil Engineer III, Planning Director, Chief Building Official, and Building Inspectors.
Planner/engineer/scientist with an understanding of natural hazards	No		
Personnel skilled in GIS	Yes	Staff members in the following Departments: City Manager's Office, Public Works Dept., Planning & Building	There is no one centralized location for GIS. Staff throughout the organization are skilled in the use of GIS at various levels.

Personnel Resources	Yes/No	Department/Position	Comments
		Safety Dept., PROS – Parks, Recreation & Open Space, and IT	
Full-time building official	Yes	Planning & Building Safety Department	Chief Building Official
Floodplain manager	Yes	Planning & Building Safety Dept., Director	
Emergency manager	Yes	Partner of Boulder Office of Emergency Management	
Grant writer	No		No specific person designated for the organization
Other personnel	No		
GIS Data – Hazard areas	Yes	Personnel are throughout the organization – no centralized GIS team	
GIS Data – Critical facilities	Yes	Personnel are throughout the organization – no centralized GIS team	
GIS Data – Building footprints	Yes	Personnel are throughout the organization – no centralized GIS team	
GIS Data – Land use	Yes	Personnel are throughout the organization – no centralized GIS team	
GIS Data – Links to assessor's data	Yes	Personnel are throughout the organization – no centralized GIS team	
Warning systems/services	Warning systems/services	Warning systems/services	Warning systems/services
(Reverse 9-11, cable override, outdoor warning signals)	Yes	City of Louisville	City also operates low power FM Radio Station
Transportation Planner	Yes	Personnel are throughout the organization – including Planning & Building Safety, Public Works, City Manager's Office	
Resiliency Planner	Yes	Personnel are throughout the organization – including Planning & Building Safety, Public Works, City Manager's Office	

Table E-20 identifies financial tools or resources that Louisville could potentially use to help fund mitigation activities.

Table E-20 Louisville's Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Y/N)	Comments
Community Development Block Grants	Yes	
Capital improvements project funding	Yes	
Authority to levy taxes for specific purposes	No	
Fees for water, sewer, gas, or electric services	Yes	
Impact fees for new development	Yes	
Incur debt through general obligation bonds	Yes	
Incur debt through special tax bonds	No	
Incur debt through private activities	No	
Withhold spending in hazard-prone areas	No	
Stormwater Service Fees	Yes	

Table E-21 identifies education and outreach mitigation capabilities that Louisville currently has in place.

Table E-21 Louisville's Education & Outreach Mitigation Capabilities

Education & Outreach	Y/N
Local citizen groups that communicate hazard risks	No
Firewise	No
StormReady	No
Other	Annual flood awareness and flood safety outreach- Mile High Flood District completes annual high risk notifications and City communications required by CRS certification through NFIP

E.6.2 Opportunities for Capability Enhancement and Improvement

The plan update process provided the city with an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- Integrating risk assessment information into future updates to the City's Comprehensive Plan.
- Integrating risk assessment information into future updates of the City's Land Use Code.
- Providing training for staff members related to hazards or hazard mitigation grant funding in partnership with the County and DHSEM
- Developing a Community Wildfire Protection Plan.
- Becoming a Firewise community.
- Becoming a StormReady community.
- Expanding staffing and other resources to address hazard planning and resiliency.

E.6.3 Community Rating System Activities (All Hazards)

National Flood Insurance Program (NFIP)

The City of Louisville joined the National Flood Insurance Program (NFIP) on May 4, 1973. The NFIP allows private property owners to purchase affordable flood insurance and enables the community to retain its eligibility to receive certain federally backed monies and disaster relief funds. Community Rating System (CRS) on The CRS is a voluntary program for NFIP-participating communities. It provides flood insurance discounts to policyholders in communities that provide extra measures of flood above the minimum NFIP requirements. As of 2022, Louisville had a CRS class rating of 6 (one a scale of 1-10, 1 being the best). This rating provides a 15 percent discount for policyholders within a special flood hazard area (SFHA) and a 5 percent discount for those outside of an SFHA.

NFIP insurance data indicates that as of March 2022, there were 58 policies in force in Louisville, resulting in 17,504,900 of insurance in force. There are no repetitive loss properties located in the City of Louisville.

Continued Compliance with the NFIP

Recognizing the importance of the NFIP in mitigating flood losses, the City of Louisville will place an emphasis on continued compliance with the NFIP. As an NFIP participant, the city has and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance as well as review of any potential development in special flood hazard areas.

Community Rating System Categories

The Community Rating System (CRS) categorizes hazard mitigation activities into six categories. These categories, and applicable Louisville activities, are described below. Note: some of the activities are appropriate to multiple categories. For purposes of simplicity, they are only included in the category deemed most appropriate based on the definitions and examples provided in the CRS Coordinator's Manual.

Preventive

Preventive activities keep problems from getting worse. The use and development of hazard-prone areas is limited through planning, land acquisition, or regulation. They are usually administered by building, zoning, planning, and/or code enforcement offices.

City of Louisville Comprehensive Plan (2013)

The City's Comprehensive Plan gives general guidance, establishing a Vision Statement with 13 Core Community Values and a flexible Framework Plan with supporting community-based principles, policies, and implementation strategies recommended by the Planning Commission and adopted City Council to realize the community's vision for the City. The Vision Statement with its 13 Core Community Values and the Framework plan with its supporting principles and policies cover a broad range of subject matter related to aspirations, services, and issues needing to be addressed within Louisville. Combined, these elements serve to direct future policy decisions to preserve vital community attributes and service levels and manage growth.

Louisville Municipal Code

Title 17 Zoning (Includes Floodplain Zoning) : The Ordinances codified in chapters 17.04 through 17.72 are enacted for the purpose of promoting the health, safety, morals, convenience, order, prosperity and welfare of the present and future inhabitants of the city, by lessening congestion in the streets and roads; by securing safety from fire and other dangers; by providing adequate light and air; by avoiding undue

congestion of population and facilitating the adequate provision of transportation, water, schools, sewerage and other public requirements through the classification of land uses and the distribution of land development and utilization; and by other means in accordance with a comprehensive development plan and the zoning map adopted in section 17.04.060.

Ordinance No. 1625, Series 2012: An ordinance repealing and reenacting with amendments Chapter 17.56 of the Louisville Municipal Code concerning floodplain zoning was adopted November 20, 2012. This ordinance adopted the model floodplain zoning code developed by the Federal Emergency Management Agency (FEMA) the minimum standards for floodplain development codes developed by the State of Colorado. This adopted ordinance was reviewed by representatives from FEMA and the Colorado Water Conservation Board for compliance.

Ordinance No. 1764, Series 2018: An ordinance adopting by reference the 2018 editions of the International Building Code, including the International Residential Code, International Mechanical Code, International Fuel Gas Code, International Energy Conservation Code, International Fire Code, International Existing Building Code, International Property Maintenance Code, International Plumbing Code, and the 1997 Uniform Code for the Abatement of Dangerous Building; enacting certain amendments to the foregoing international codes; amending, repealing and reenacting certain sections of Title 15 of the Louisville Municipal Code in connection with the adoption of the foregoing international codes; and establishing penalties for violations of such codes was adopted August 27, 2018.

Ordinance No. 1751, Series 2017: An Ordinance Adopting the 2017 National Electric Code: Title 4 City Open Space: This title establishes a board of citizens to advise City staff and council on matters related to the acquisition, management, restoration, preservation, and use of open space lands and establishes standards for the acquisition, management, restoration, use, and preservation of such open space lands.

Title 13 Water and Sewers: This title includes provisions to construct, operate, and maintain stormwater facilities and to establish a methodology and requirement for the payment of reasonable stormwater utility fees for property owners to pay for a share of the costs of improvements and facilities reasonably necessary to manage stormwater. Furthermore, it promotes the general public health, safety, and welfare by reducing the potential for the movement of emergency vehicles to be impeded or inhibited during storm or flooding periods; by minimizing storm and flood losses, inconvenience, and damage resulting from runoff; and by promoting activities which improve the water quality of runoff in the City of Louisville.

Title 16 Subdivisions—Among the purposes of these regulations, as they relate to hazard mitigation, are the following:

- To promote the health, safety, convenience, order, prosperity and welfare of the present and future inhabitants of the city
- To promote orderly growth and to provide for the harmonious development of the City in accordance with its comprehensive plan
- To provide for adequate light, air, and privacy and to secure safety from fire, flood, and other danger
- To ensure that public facilities and services are available and will have sufficient capacity to serve the development
- To mitigate the pollution of air, streams, and ponds; assure the adequacy of drainage facilities; safeguard the water table; and encourage the wise use and management of the natural environment
- To preserve and enhance to the extent reasonably possible the natural beauty and topography of the city and areas of historical or archeological importance and to ensure appropriate development with regard to such natural, historical and archaeological sites and features
- To otherwise plan for and regulate the use of land so as to provide planned and orderly use of land and protection of the environment in a manner consistent with constitutional rights

Design standards require consideration of steep land, areas having inadequate drainage, and other natural hazard areas and limit development as necessary.

Other

Most areas identified as geologic hazard areas are protected as open space, thus prohibiting development.

The City's Engineering Department has an ongoing maintenance program for inspecting storm drainage facilities. The department also provides detailed hydraulic modeling to identify any deficiencies and what improvements are necessary. The city is currently following the Louisville/Boulder County Outfall System Plan, as completed in 1982, for necessary improvements to the stormwater system. Developers are responsible for completing elements of the outfall system to meet the City's land development and engineering codes.

The City's Stormwater Storm Drainage Design and Technical Criteria (1982) presents the minimum design and technical criteria for the analysis and design of storm drainage systems.

Property Protection

Property protection activities are usually undertaken by property owners on a building-by-building or parcel basis.

No current projects/activities.

Natural Resource Protection

Natural protection activities preserve or restore natural areas or their natural functions. They are usually implemented by parks, recreation, or conservation agencies or organizations.

The city provides a balanced system of open space composed of environmentally sensitive areas, natural areas, wildlife corridors, habitat areas, trails, and greenways using a variety of conservation methods to meet both the needs of the citizens and the City's resource protection goals.

The City's Open Space Master Plan inventoried, classified, and provided management direction for 26 City-owned and 10 jointly owned properties. While it provides detailed direction for managing and enhancing the cultural, agricultural, recreational, and ecological resources, it does not target any land for future acquisition.

Emergency Services

Emergency services measures are taken during an emergency to minimize its impacts. These measures are the responsibility of city or county emergency management staff and the owners or operators of major or critical facilities.

The City's Drought Management Plan (2014) (<https://www.louisvilleco.gov/home/showdocument?id=448>) is a guide for the varying degrees of drought experienced in the normal variations of weather patterns. It identifies the conditions that formally place the City in a designated level of drought and pre-determine the general responses appropriate for given drought conditions. It also establishes the general framework for when drought conditions require special communications with residents and the type of information anticipated to be communicated.

The Louisville Fire Protection District provides fire protection and emergency medical services through a predominantly volunteer staff. The district has a comprehensive plan of fire and emergency services 2005–2015. The purposes of the plan are to provide a framework to review the basic organizational and performance requirements of the fire department, identify goals and objectives, and use as a basis to project programming and fire service policy.

The City's Public Works Operations Division has a Snow Control Plan to keep streets safe and accessible during periods of ice and snow. The goal is to provide snow and ice control services on all major City streets and to plow selected streets through subdivisions to provide access and egress to citizens' homes. Streets are cleared according to established priorities. Priorities are set based on traffic volume, public safety, and access to emergency facilities and schools.

Structural Projects

Structural projects keep hazards away from an area (e.g., levees, reservoirs, other flood control measures). They are usually designed by engineers and managed or maintained by public works staff.

No current projects/activities.

Public Information

Public information activities advise property owners, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of natural resources (e.g., local floodplains). They are usually implemented by a public information office.

The City's Planning Department invites property owners to visit its office or email them for information regarding whether or not their property is in a flood zone (and if so, which one). A flood insurance rate map information form is available on the City's web site.

The City's Public Works Operations Division posts a snow removal map along with safety tips on their web site.

E.7 Louisville Mitigation Projects

A review of 2016 mitigation actions progress reports indicates that the City of Louisville has been successful in implementing actions identified in the 2016 HMP Mitigation Strategy, thus, working diligently towards meeting the 2016 plan goals. The Louisville's 2016 mitigation strategy contained 14 mitigation actions. As of March 2022, 7 of these actions have been completed, 1 deferred and 6 are continuing. The table below summarizes progress implementing mitigation actions. The New Actions in 2022 are included in the mitigation action worksheets following Table E-22.

Table E-22 Mitigation Action Progress Summary

Mitigation actions	Responsible Office	Status	Estimated Completion Date	Priority Then	Priority Now
Debris Removal Citywide	-	Completed	-	High	High
In Stream Hazardous Removal	-	Completed	-	High	High
Trails Citywide	-	Completed	-	High	High
Golf Course Reconstruction	-	Completed	-	High	High
Golf Course Irrigation	-	Completed	-	High	High
Water Intake Building	-	Completed	-	High	High
County Road Bridge	-	Completed	-	High	High
Drainageway 7-1	Public Works	Continuing-Not Started	2025	High	High
Coal Creek Station piping	Public Works	Continuing-In Progress	2024	High	High

Mitigation actions	Responsible Office	Status	Estimated Completion Date	Priority Then	Priority Now
Bullhead Gulch underpass	Public Works	Deferred due to railroad requirements	-	High	-
Cottonwood Park Floodplain	Public Works	Continuing-In Progress	Spring 2023	High	High
96 th and Dillon Drainageway G	Public Works	Continuing-In Progress	2022	High	High
Goodhue Ditch Diversion at Coal Creek	Public Works	Continuing-In Progress	2028	High	High
Dual 30" RCP for Highway 42	Public Works	Continuing-Not Started	2030	High	High

Name of Action: 96th and Dillon Piping, Drainageway G

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goal 2

Issue/Background: Piping, culverts crossing Dillon to be installed by developer

Other Alternatives: No action

Action Status: Continue-In progress. Under Construction. Will be completed in 2022.

Responsible Office: Public Works

Priority (High, Medium, Low): High

Cost Estimate: \$200,000

Existing or Potential Funding: FEMA HMA grants

Benefits (avoided losses): Piping reduces risk for additional flooding and hazardous conditions to people, property, facilities and the environment.

Schedule: 2022

Name of Action: Coal Creek Station Piping

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goal 1 and Goal 2

Issue/Background: Piping when development occurs. Development is being planned and expected to be complete by 2022-2025

Other Alternatives: No action

Action Status: Continue-In progress . Development is in design with a plat/PUD. Construction plans have not been submitted for review yet. Waiting on developer to submit construction plans for review.

Responsible Office: Public Works

Priority (High, Medium, Low): High

Cost Estimate: \$500,000

Existing or Potential Funding: FEMA HMA grants

Benefits (avoided losses): Piping to reduce risk for additional flooding and hazardous conditions to people, property, facilities and the environment.

Schedule: 2022.

Name of Action: Cottonwood Park Floodplain

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goal 1 and Goal 2

Issue/Background: Remove townhomes from floodplain

Other Alternatives: No action

Action Status: Continue-In progress . In design stages of the project as of March 2022.

Responsible Office: Public Works Dept. in coordination with Mile High Flood District.

Priority (High, Medium, Low): High

Cost Estimate: \$1,200,000

Existing or Potential Funding: FEMA HMA grants, Mile High Flood District funding.

Benefits (avoided losses): Removal from floodplain reduces risk for additional flooding and hazardous conditions to people, property, facilities and the environment.

Potential or current subject matter expertise:

Schedule: Currently in design. Construction to start in Fall 2022 and Complete in Spring 2023. .

Name of Action: Drainageway 7-1 Improvements

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goal 1, reduce the loss of life and personal injuries from hazard events and Goal 2, reduce impacts of hazard events on property, critical facilities/infrastructure and the environment.

Issue/Background: Build channel on Harney Lastoka Open Space

Other Alternatives: No action

Action Status: Continue-Not started. The project will move forward after completion of the Coal Creek Station development project (see above).

Responsible Office: Public Works Department in conjunction with Mile High Flood District.

Priority (High, Medium, Low): High

Cost Estimate: \$3,000,000

Existing or Potential Funding: FEMA HMA grants and Mile High Flood District funding

Benefits (avoided losses): Channel improvements reduce risk for additional flooding and hazardous conditions to people, property, facilities, and the environment.

Schedule: 2028. Will begin design upon completion of the Coal Creek Station project (see above)

Name of Action: Dual 30" RCP for Highway 42

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goal 1, reduce the loss of life and personal injuries from hazard events and Goal 2, reduce impacts of hazard events on property, critical facilities/infrastructure and the environment.

Issue/Background: Master Drainage Plan, pipes under Highway 42 to address flooding at Miner's Field. Storm flow diverted around upstream of Miner's Field to storm sewer at Spruce Street.

Other Alternatives: No action

Action Status: Continue-Not Started. Pending Funding and any improvements on Highway 42 to complete work in conjunction with the road project.

Responsible Office: Public Works department in conjunction with Mile High Flood District. **Priority (High, Medium, Low):** High

Cost Estimate: \$350,000

Existing or Potential Funding: FEMA HMA grants and Mile High Flood District funding

Benefits (avoided losses): Piping reduces risk for additional flooding and hazardous conditions to people, property, facilities and the environment.

Schedule: 2030

Name of Action: Goodhue Ditch Diversion at Coal Creek

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goal 1, reduce the loss of life and personal injuries from hazard events and Goal 2, reduce impacts of hazard events on property, critical facilities/infrastructure and the environment.

Issue/Background: Diversion at ditch through Coal Creek Station and Drainageway 7-1 (after those 2 projects complete). To be completed by developer with Coal Creek Station piping. However, Drainageway 7-1 requires completion before it can be fully implemented.

Other Alternatives: No action

Action Status: Continue-Not started. Drainageway 7-1 requires completion before it can be fully designed and constructed.

Responsible Office: Public Works Department in conjunctions with the Mile High Flood District

Priority (High, Medium, Low): High

Cost Estimate: \$300,000

Existing or Potential Funding: FEMA HMA grants and Mile High Flood District funding

Benefits (avoided losses): Diversion reduces risk for additional flooding and hazardous conditions to people, property, facilities and the environment.

Potential or current subject matter expertise:

Schedule: 2028

Name of Action: Post-Disaster Code Enforcement Projects

Hazards Addressed: Wind, Wildfire, Flood, Earthquake, Expansive Soils, Subsidence, Tornado.

Mitigation Goal or Objective Addressed: Goals 1 through 4

Issue/Background: After the Marshall Fire, as Louisville looks toward rebuilding, the City is facing extraordinary needs associated with enforcing local building codes during post-disaster reconstruction. In addition, the complexity of the debris removal process will also outstrip our ability to resource code enforcement and administration staff. We aim to ensure that enforcement and inspection processes are in compliance with all applicable laws and ordinances in our post-disaster recovery period.

Buildings built back to code will mitigate against wind and other hazards and ensure that all other disaster-resistant codes are implemented during disaster reconstruction. Hazards associated with structures built out of compliance with current local to national regulations and best practices for ignition resistant construction. Will prevent rebuilding post-disaster without adequate oversight, resulting in hazardous materials, practices, or methods applied in reconstruction. Avoids economic impacts from slowed, delayed, or halted reviews and approvals.

Other Alternatives: No action

Action Status: New in 2022

Responsible Office: City of Louisville, Building and Planning Department State of Colorado, CDPS

Priority (High, Medium, Low): High

Cost Estimate: \$730,000 annual. \$1,825,000 total.

Existing or Potential Funding: No existing funding. City funds are currently inadequate to fund the numbers and types of positions we need for the duration we need them. Potential funding: FEMA HMA grants, State grants

Benefits (avoided losses): Avoid delays in reconstruction due to lack of staff and capacity to perform all elements of the building inspection process. Avoid local economic impacts caused by delays in the rebuilding process. Avoid properties rebuilt with substandard work, not to code, or a variety of other issues by resourcing adequate staff to manage the unprecedented increase in reviews and inspections needed. Ensure rebuilt homes are built to all applicable standards that help to prevent hazards that may spread to other properties or worsen an active disaster incident.

Schedule: December 31, 2024

Name of Action: Enhance Communications through Hazard Awareness/Emergency Preparedness Campaign and Evaluation of Current System

Hazards Addressed: All Hazards

Mitigation Goal or Objective Addressed: Goal 1 and Goal 4

Issue/Background: Louisville will develop a hazard awareness/emergency preparedness campaign to ensure that residents are aware of potential hazards and how to be prepared (i.e. evacuation, insurance, etc.).

Louisville will also hire a consultant to evaluate the current emergency notification system to understand if there are additional local communication efforts necessary to meet the needs of our specific community hazard profile. The purpose of the study will be to augment communications provided in partnership with the Boulder Office of Emergency Management.

Other Alternatives: None.

Action Status: New in 2022

Responsible Office: City of Louisville Administration, Boulder Office of Emergency Management

Priority (High, Medium, Low): Medium

Cost Estimate: \$50,000

Existing or Potential Funding: Existing: None. City funds are currently inadequate to fund the campaign and study. Potential: FEMA HMA grants

Benefits (avoided losses): Avoid loss of life and personal injuries due to lack of hazard awareness and emergency preparedness. Avoid impacts to property, facilities/infrastructure, and the environment by raising hazard awareness.

Schedule: 2022

Name of Action: Water Meter Replacement

Hazards Addressed: Wildfire, Drought

Mitigation Goal or Objective Addressed: Goals 1 and 2

Issue/Background: Water meters will be replaced throughout the City with smart meters and wireless remote shutoff valves. Water meters that are currently located in basements/crawlspaces will be relocated outside into a meter pit by the sidewalk. This will prevent meters from being destroyed during a house fire and prevent possible contamination of the potable water system during a fire due to loss of water pressure. The remote shut off valve will allow the city to turn off water to destroyed homes remotely to keep pressure in the water system for fighting fires. Additionally, the smart meters can detect and report leaks to home owners, which can be used to reduce water loss and increase supply/capacity and drought resistance.

Other Alternatives: None

Action Status: New in 2022

Responsible Office: Louisville Public Works Dept.

Priority (High, Medium, Low): High

Cost Estimate: \$4,000,000

Existing or Potential Funding: City Water Fund

Benefits (avoided losses): This will prevent meters from being destroyed during a fire and prevent possible contamination of the potable water system during a fire due to loss of water pressure. The remote shut off valve will allow the city to turn off water to homes remotely to keep water pressure in the system for fighting fires.

Schedule: Start replacement in 2022 and complete in 2024

Name of Action: Install 2 MG Water Tank

Hazards Addressed: Wildfire, Drought

Mitigation Goal or Objective Addressed: Goals 1 and 2

Issue/Background: Install a new 2-million-gallon water tank within the water system. During the recent Marshall Fire, several fires were being fought and the City's supply ran critically low. Increasing storage capacity in the water system will allow more redundancy in the system and allow the City more capacity in

a similar fire in the future. Additionally, a new water tank will increase the City's supply and capacity, which is critical for drought resistance.

Other Alternatives: None

Action Status: New in 2022

Responsible Office: Public Works

Priority (High, Medium, Low): High

Cost Estimate: \$3,500,000

Existing or Potential Funding: City Water Fund

Benefits (avoided losses): During the recent Marshall Fire, several fires were being fought and the City's supply ran critically low. Increasing storage capacity in the water system will allow more redundancy in the system and allow the City more capacity in a similar fire in the future.

Schedule: 2030

Name of Action: Generator Upgrade

Hazards Addressed: Wildfire, Lightning, Windstorm, Winter Weather, Earthquake

Mitigation Goal or Objective Addressed: Goals 1 and 2

Issue/Background: Upgrade or replace the current generator at the Howard Berry Water Treatment Facility to use diesel fuel. During the recent Marshall Fire, natural gas and electricity was turned off to the water plant. The plant could not operate during the fire because it had no power. The current generator only run on natural gas. Upgrading/replacing the generator would allow the plant to run in a similar fire scenario

Other Alternatives: None

Action Status: New in 2022

Responsible Office: Public Works

Priority (High, Medium, Low): High

Cost Estimate: \$500,000

Existing or Potential Funding: City Water Fund, State grants, FEMA HMA grants

Benefits (avoided losses): During the recent Marshall Fire, natural gas and electricity was turned off to the water plant. The plant could not operate during the fire because it had no power. The current generator only run on natural gas. Upgrading/replacing the generator would allow the plant to run in a similar fire scenario.

Schedule: 2024

Name of Action: Identifying Wildfire Mitigation Hazards/Opportunities on Public Lands

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1, 2 and 4

Issue/Background: The City will hire a consultant to assist with identifying wildfire mitigation hazards/opportunities on public lands, including parks, open space, etc. within Louisville that is under the City's stewardship. The study will include consideration of protection of community assets/structures, analysis of risk areas that lead into and out of public lands and mitigation actions (i.e. wildfire resistant

fencing).

This item is listed on City Council's 2022 Work Plan as a high priority. After completing the study, the City will define and refine mitigation opportunities based on the findings and focus on implementation.

Other Alternatives: None

Action Status: New in 2022

Responsible Office: City of Louisville Parks/Open Space, City Manager's Office

Priority (High, Medium, Low): High

Cost Estimate: \$50,000-\$100,000

Existing or Potential Funding: FEMA HMGP/BRIC

Benefits (avoided losses): Fire damage to public lands and potentially to private property.

Schedule: 2022

Annex F: Town of Erie

Annex F Town of Erie

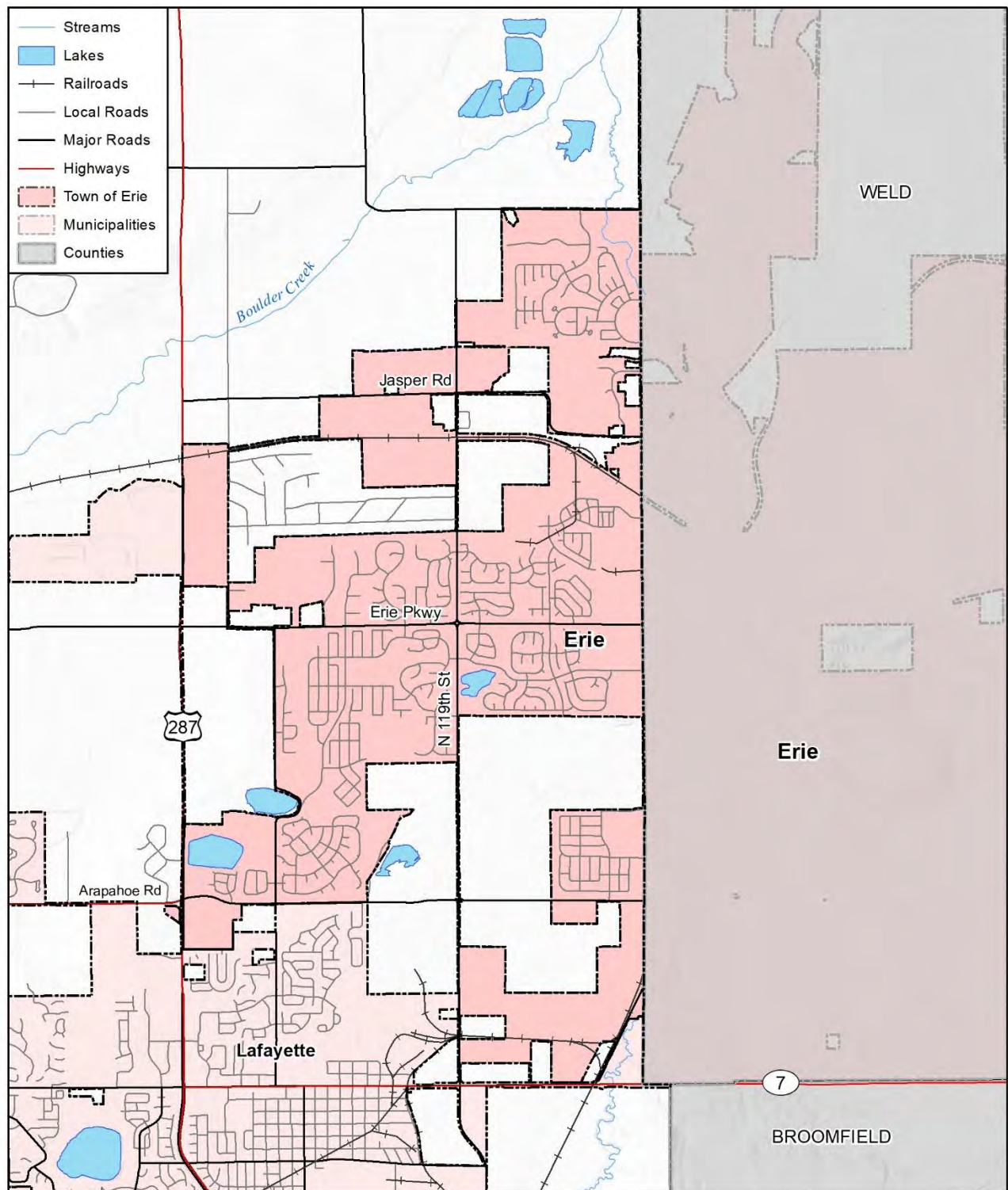
F.1 Community Profile

"Erie is a community which recognizes the importance of conserving and enhancing its historic small town character, the roots from which it grew, preserving the natural environment in which it resides; a caring community which offers its residents an environment in which to seek a high quality of life; a balanced community with a diverse range of housing, employment, educational, shopping and recreational opportunities; and a vital community which provides financial and social support for quality of life programs."

Town of Erie Comprehensive Plan

The Town of Erie is located in eastern Boulder County and southwest Weld County. Erie's Planning Area spans 48 square miles, extending from the north side of State Highway 52 south to State Highway 7, and between US 287 on the west and Interstate 25 to the east. Erie is approximately 35 minutes from Denver International Airport, 25 minutes to Denver and 20 minutes from Boulder. The entire Town is covered by this plan, including the Weld County portion.

The original plat for Erie was filed in 1871, following establishment of the Briggs Mine, the first commercial coal mine in Weld County. It was also in 1871 that the Union Pacific Railroad extended a spur westward from Brighton on its main line between Denver and Cheyenne. Coal from the Erie deposits was needed to fuel their huge steam locomotives. The Boulder Valley Railroad, as it was called then, opened up the northern coal fields for development. Soon coal from Erie mines was being shipped by rail to markets in Denver and as far east as Kansas City. The Town of Erie was incorporated in 1874.

Figure F-1 Town of Erie, Boulder County Portion

wood.

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT

0 1 2 Miles



F.1.1 Population

According to the U.S. Census Bureau American Community Survey (ACS) 2015-2019 estimates, there are 8,390 residential housing units within the Town. The total population of Erie as of the 2020 census is 30,038, which is a 65.6% increase since the 2010 census when the town recorded a population of 18,135. It is important to note however that Erie's population is split between two counties, with approximately 42% of the population (12,791 residents) residing in Boulder County and the remaining 17,247 residing in Weld County. 4,478 of the total residential units in Erie are located in Boulder County. The vast majority of housing units in the town are single family homes with the remaining homes multi-family units.

The 2015 Comprehensive Plan forecasted an ultimate build out population of 68,820 and a 2025 population of 40,640. However, the pace of development has been slower than forecasted one decade ago. Applying a conservative estimate of 400 new single-family building permits annually – it is possible the Town's 2025 population would be in the range of 33,000 to 35,000.

As reported during the June 30, 2015, Board of Trustees Study Session there are 13,142 dwelling units approved by various agreements with the Town and another 2,895 dwelling units are either in process or un-annexed and likely to be developed. Based on these numbers, the Town's estimated build out population is 65,526 (approximately 5% less than the 2005 Comprehensive Plan estimate).

To view existing and future residential development, please visit www.erieco.gov/maps and select Development Activity Map.

Select Census demographic and social characteristics for Erie are shown in Table F-1.

Table F-1 Erie's Demographic and Social Characteristics

Characteristic	
Gender/Age	
Male (%)	49.4%
Female (%)	50.6%
Under 5 Years (%)	8.2%
65 Years and Over (%)	9.9%
Race/Ethnicity (one race)	
White (%)	92.1%
Black or African American alone	0.2%
Hispanic or Latino (Of Any Race) (%)	10.2%
Other	
Average Household Size	2.93
High School Graduate or Higher (%)	96.8%

Source: 2019 United States Census/American Community Survey

F.1.2 Economy

According to the U.S. Census Bureau ACS 2015-2019 estimates the industries that employed most of Erie's labor force were education, health and social services (23.9%), professional, scientific, and management, administrative and waste management services (17.6%), manufacturing (11.7%), and retail trade (8.4%). Select economic characteristics for Erie from the 2019 ACS estimates are shown in Table F-2.

Table F-2 Erie's Economic Characteristics

Characteristics	
Families below Poverty Level, 2019	3.9%
Individuals below Poverty Level, 2019	5.3%
Median Home Value 2019	\$468,600
Median Household Income, 2019	\$119,555
Per Capita Income, 2019	\$46,090
Population in Labor Force 2019	73.9%

Source: 2019 United States Census/American Community Survey

F.2 Hazard Summary

The most significant hazards for Erie are droughts, floods, extreme temperatures, hailstorms, and severe winter storm. Refer to Section 4.4 Vulnerability Assessment for detailed hazard vulnerability analysis for the county as a whole. There are no hazards that are unique to Erie. The overall hazard significance takes into account the geographic location, probability of occurrences, and magnitude as a way to identify priority hazards for mitigation purposes. Section F.5 Vulnerability Assessment, where possible, analyzes the population, property, and other assets at risk to hazards ranked of medium or high significance that may vary from other parts of the planning area. Other hazards that could impact Erie include communicable disease outbreaks, dam and levee failure, drought, earthquake, expansive soils, lightning, subsidence, and wildfire. Due to its location on the plains in eastern Boulder County the Town has a slightly higher risk from tornados than other communities in this plan.

Table F-3 Town of Erie Hazard Summaries

Hazard Type	Geographic Extent	Occurrences	Magnitude / Severity	Increased Threat (Climate Change)	Hazard Level
Air Quality	Extensive	Highly Likely	Limited	Moderate	Medium
Avalanche	Limited	Unlikely	Limited	Low	Low
Communicable / Zoonotic Disease Outbreak	Extensive	Occasional	Critical	Substantial	Medium
Dam and Levee Failure	Significant	Unlikely	Critical	Moderate	Medium
Drought	Extensive	Likely	Critical	Substantial	High
Earthquake	Extensive	Unlikely	Critical	Low	Medium
Extreme Temperatures	Extensive	Likely	Critical	Severe	High
Expansive Soils	Significant	Highly Likely	Limited	Substantial	Medium
Flood	Extensive	Highly Likely	Critical	Severe	High
Hailstorm	Significant	Likely	Limited	Moderate	High
Landslide	Limited	Unlikely	Limited	Substantial	Low
Lightning	Limited	Likely	Limited	Moderate	Medium
Severe Winter Storm	Extensive	Highly Likely	Critical	Substantial	High
Subsidence	Significant	Likely	Limited	Moderate	Medium
Tornado	Significant	Likely	Limited	Low	Medium

Hazard Type	Geographic Extent	Occurrences	Magnitude / Severity	Increased Threat (Climate Change)	Hazard Level
Wildfire	Significant	Likely	Limited	Severe	Medium
Windstorm	Extensive	Likely	Critical	Moderate	Medium
Geographic Extent <ul style="list-style-type: none"> Limited: Less than 10% of planning area Significant: 10-50% of planning area Extensive: 50-100% of planning area Increase Threat from Climate Change <ul style="list-style-type: none"> Low- unlikely to become more of a threat due to climate change. Moderate – possibly will become more of a threat due to climate change. Substantial- likely to become more of a threat due to climate change. Severe- highly likely to become more of a threat due to climate change 			Probability of Future Occurrences <ul style="list-style-type: none"> Highly Likely: Near 100% chance of occurrence in next year or happens every year. Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less. Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years. Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years. Magnitude/Severity <ul style="list-style-type: none"> Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability. Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability. Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid Significance <ul style="list-style-type: none"> Low: minimal potential impact Medium: moderate potential impact High: widespread potential impact 		

F.3 Asset Inventory

F.3.1 Property Inventory

Table F-4 represents an inventory of properties in the portion of the Town of Erie which is in Boulder County, based on Boulder County Assessor's data as of March 2022.

Table F-4 Erie's Property Inventory

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
Agricultural	6	9	\$2,763,400	\$2,763,400	\$5,526,800
Commercial	11	17	\$15,255,400	\$15,255,400	\$30,510,800
Exempt	20	34	\$25,158,621	\$25,158,621	\$50,317,242
Industrial	4	5	\$5,033,400	\$7,550,100	\$12,583,500
Mixed Use	4	29	\$11,297,600	\$11,297,600	\$22,595,200
Residential	4,478	4,513	\$1,849,076,559	\$924,538,280	\$2,773,614,839
Total	4,523	4,607	\$1,908,584,980	\$986,563,401	\$2,895,148,381

Source: Boulder County Assessor's Office

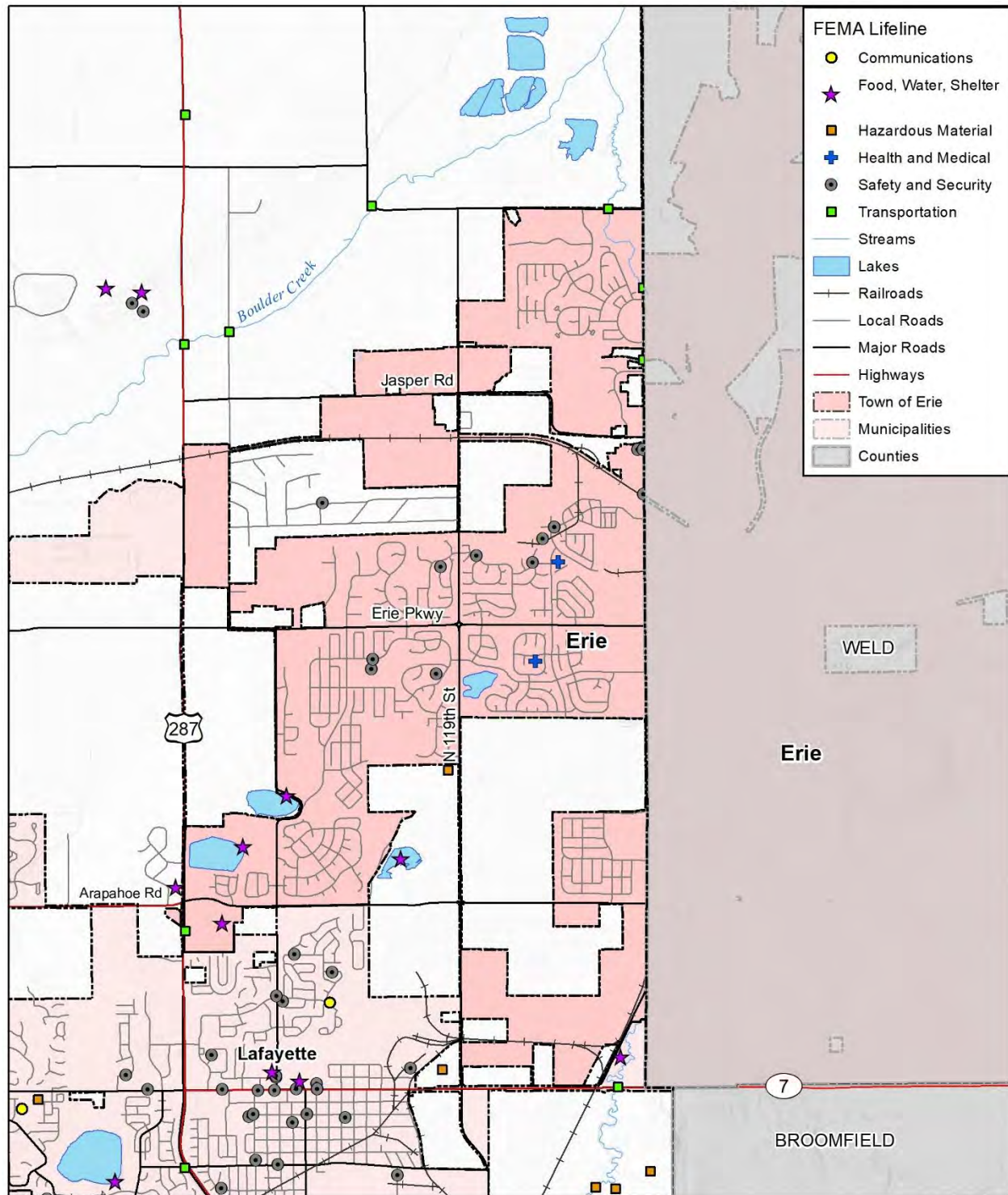
F.3.2 Other Assets

Table F-5 is a detailed inventory of critical facilities derived from a variety of sources and organized based on their corresponding FEMA Lifeline Category. Figure F-2 below details the locations of these facilities. Table F-6 further details specific assets identified by the Town's planning team.

Table F-5 Summary of Erie's Critical Facilities in GIS by FEMA Lifeline Category

FEMA Lifeline	Total
Communications	-
Energy	-
Food/Water/Shelter	2
Hazardous Materials	-
Health and Medical	2
Safety and Security	14
Transportation	4
Total	22

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD

Figure F-2 Location of Critical Facilities in Erie

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
City of Boulder, CDPHE, NBI, NID, HIFLD

wood.

0 1 2 Miles



Table F-6 Erie's Assets

Name of Asset	Type	Address	Replacement Value (\$)²	Hazard Specific Info
Town Hall	Essential/ Public Safety, Vital	645 Holbrook Erie, CO 80516	3,015,531	
MVFPD Fire Station #6	Essential/ Public Safety	50 Bonanza Dr., Erie, CO 80516	630,758	
Police Station and Municipal Court	Essential/ Public Safety, Vital	1000 Telleen Ave. Erie, CO	15,000,000	
Water Treatment Facility	Essential/ Utility, Hazardous Materials	1700 Pioneer Pl. Erie, CO 80516	19,389,713	Chemicals
1Water Reclamation Facility	Essential/ Utility	1000 Briggs St., Erie, CO 80516	8,867,758	
North Water Reclamation Facility	Essential/ Utility	501 St. Hwy 287, Erie, CO 80516	18,000,000	
Erie Community Center	Essential/ Shelter	450 Powers St., Erie, CO 80516	18,000,000	
Erie Community Library	Essential/ Shelter	400 Powers St., Erie, CO 80516	2,637,045	
Leon A. Wurl Service Center	Vital	150 Bonnell Ave., Erie, CO 80516	5,000,000	
Erie Municipal Airport	Essential/ Air Transportation	395 Airport Dr., Erie, CO 80516	1,552,369	
Electrical Substation	Essential/ Utility	905 County Line Rd., Erie, CO 80516	n/a	
Electrical Substation	Essential/ Utility	2350 WCR 6 Erie, CO 80516	n/a	
Erie High School	Essential/ Shelter, At-Risk Population	3180 WCR 5 Erie, CO 80516	17,806,467	
Soaring Heights K-8	Essential/ Shelter, At-Risk Population	3280 WCR 5 Erie, CO 80516	n/a	
Erie Middle School	Essential/ Shelter, At-Risk Population	650 Main St., Erie, CO 80516	n/a	
Black Rock Elementary	Essential/ Shelter, At-Risk Population	2000 Mtn. View Pkwy, Erie, CO 80516	8,099,688	
Red Hawk Elementary	Essential/ Shelter, At-Risk Population	1500 Telleen Ave., Erie, CO 80516	n/a	
Erie Elementary	Essential/ Shelter, At-Risk Population	4137 E. County Line Rd, Erie, CO 80516	3,504,700	
Aspen Ridge Preparatory School	Essential/ Shelter, At-Risk Population	705 Austin Avenue, Erie, CO 80516	3,232,814	
Vista Ridge Academy	Essential/ Shelter, At-Risk Population	3100 Ridge View Dr., Erie, CO 80516	4,022,478	
Meadowlark School	Essential/ Shelter, At-Risk Population	2300 Meadow Sweet Ln. Erie, CO 80516	n/a	
Blue Mtn. Montessori School	Essential/ Shelter, At-Risk Population	201 S. Briggs St., Erie, CO 80516	176,150	

Name of Asset	Type	Address	Replacement Value (\$)²	Hazard Specific Info
Primrose Academy	Essential/ Shelter, At-Risk Population	2998 Ridge View Dr., Erie, CO 80516	990,664	
The Goddard School	Essential/ Shelter, At-Risk Population	3000 Village Vista Dr., Erie, CO 80516	747,638	
Wee School Preschool	Essential/ Shelter, At-Risk Population	690 Briggs St., Erie, CO 80516	163,478	
Erie Reservoir	Essential/ Utility	3155 US 287, Erie, CO 80516	n/a	
Prince Reservoir #2	Essential/ Utility	3050 N. 111th St., Erie, CO 80516	n/a	
Thomas Reservoir	Essential/ Utility	2000 N. 119th St., Erie, CO 80516	n/a	
1.5 MGD and 4 MGD Water Storage Tanks	Essential/ Utility	1375.35 WCR 7, Erie, CO 80516	n/a	
Colorado National Golf Course Clubhouse	Essential/ Shelter	2700 Vista Pkwy, Erie, CO 80516	2,498,800	
Century Link Communications	Essential	360 Wells St., Erie, CO 80516	n/a	
Avista Family Medicine – Urgent Care	Essential	611 Mitchell Way, Ste. 103, Erie, CO 80516	n/a	
Oil & Gas Wells	Hazardous Materials	Throughout Region³	n/a	
Tri County Self Storage	Hazardous Materials	1401 E. County Line Rd., Erie, CO 80516	2,933,300	Unknown chemical storage potential
County Line Lumber	Hazardous Materials	4047 NE County Line Rd, Erie, CO 80516	651,000	Misc. building products & materials
Napa Auto Parts	Hazardous Materials	1020 Carbon Ct., Erie, CO 80516	n/a	Solvents
Magnum Plastics	Hazardous Materials	425 & 475 Bonnell Ave., Erie, CO 80516	1,568,244	Solvents
John Murphy Millworks	Hazardous Materials	1065 Telleen Ave., Erie, CO 80516	682,300	Solvents
Phillip's Seeding	Hazardous Materials	2405 CR 1, Erie, CO 80516	85,772	Chemicals
Azar Woodcraft	Hazardous Materials	455 Young Ct., Erie, CO 80516	n/a	Solvents
Safeway	Retail/Hazardous Materials	3333 Arapahoe Rd., Erie, CO 80516	3,193,400	Propane Storage
King Soopers	Retail/Hazardous Materials	1891 HWY 7 Erie, CO 80516		
7-11	Hazardous Materials	3240 Village Vista Dr.	1,057,832	Propane Storage, Gas
Conoco	Hazardous Materials	4200 County Line Rd., Erie, CO 80516	177,600	Propane Storage, Gas
Shell Service Station	Hazardous Materials	3334 Arapahoe Rd., Erie, CO 80516	920,200	Propane Storage, Gas
Stop & Save	Hazardous Materials	681 Mitchell Way, Erie, CO 80516	866,798	Propane Storage, Gas

Name of Asset	Type	Address	Replacement Value (\$)²	Hazard Specific Info
County Line Auto Body	Hazardous Materials	1021 Carbon Ct., Erie, CO 80516	866,798	Welding Material, Paint
Blue Sky Club House	Community	1455 Sunset Way, Erie, CO 80516	n/a	Pool Chemicals

The Town of Erie has additional base maps accessible on the web that include community assets www.erieco.gov/maps.

F.3.3 Economic Assets

Economic assets at risk may include major employers or primary economic sectors, such as, agriculture, whose losses or inoperability would have severe impacts on the community and its ability to recover from a disaster. After a disaster, economic vitality is the engine that drives recovery. Every community has a specific set of economic drivers, which are important to understand when planning ahead to reduce disaster impacts to the economy. When major employers are unable to return to normal operations, impacts ripple throughout the community.

According to One Northern Colorado, the following are some of Erie's major employers:

- St. Vrain Valley School District
- Town of Erie
- Safeway Stores, Inc.
- U.S. Postal Service
- Magnum Plastics
- Waste Connections
- Air Mechanical Inc.
- Vector Air
- Primrose
- Colorado National Golf Course
- The Goddard School

F.3.4 Natural, Historic, and Cultural Resources

Assessing the vulnerability of Erie to disaster also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons:

The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.

If these resources are impacted by a disaster, knowing so ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts are higher.

The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.

Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.

Natural Resources

Erie has 1,292 acres of dedicated parks and open space. The Parks Division is responsible for maintaining community and regional parks, improved arterial rights-of-way, ball fields, trails, Town-owned open space, and storm water detention facilities. Maintenance includes, but is not limited to, maintenance of park

equipment, mowing, weed control, irrigation, planting, fertilization, pruning, and trash pickup. The Town currently maintains:

- 149 acres of developed parks
- 1143 acres of open space
- 62 miles of roadsides
- 58 miles of trail corridor
- 59 acres of landscaping at Town facilities

During September and October 2007, a team of scientists explored selected natural areas on undeveloped lands throughout Erie's Planning Area to create a Natural Areas Inventory. The inventory was assembled into a reference document that describes and rates natural areas, their value to humans and wildlife, and how to protect them. Erie contains a range of valuable natural resources that contribute to its visual quality and character, provide valuable wildlife habitat, and provide connections to other open space corridors in the region. Areas of primary significance include the Coal and Boulder Creek corridors.

Erie's planning area is crisscrossed by many waterways, including Boulder Creek and Coal Creek, and a number of irrigation canals and ditches built to serve agricultural lands surrounding the community. Protection of these features and of the surrounding floodplain is a key issue for the community.

For information about natural resources in Boulder County, which includes Erie, see the Vulnerability Assessment.

Historic And Cultural Resources

The Town of Erie Historic Preservation Advisory Board meets to discuss issues related to the preservation of historic structures, documents and artifacts in Erie. The board reports to the Board of Trustees in an advisory capacity. Commissioners are appointed by the Board of Trustees in staggered four-year terms.

The Erie Historical Society (EHS) was founded in 1984 to preserve Erie, Colorado's history. EHS honors those hard-working pioneers who mined the coal, worked the fields and ran the railroads, as well as the pioneer women who raised the families and educated the children.

The purpose of this society shall be to bring together those people interested in history especially the history of Erie, and area to bring about an appreciation of the heritage of the American West. It will collect and preserve artifacts of the period and shall provide educational programs illustrating life in the early 20th century. It shall preserve and disseminate printed historical material regarding the community.

Understanding the history of the community is basic to our democratic way of life, gives us a better understanding of our state and nation and promotes a better appreciation of our American Heritage.

The Erie Historical Society educates through projects like the Wise Homestead Museum, to commemorate early homesteaders and through partnerships with community members. Historic talks by local historians and lecturers provide a glimpse back in time and reveal remarkable stories about the people who settled in our region of Colorado.

The EHS preserves the area's rich history through projects like the Wise Homestead Museum, at 11611 Jasper Road. The two-story Western Victorian farmhouse was built by Erie settler O.E. Wise in 1870 and has been restored by local and state Historical Societies. As such, the Wise Homestead Museum is considered a historic/cultural resource located in Erie.

F.4 Growth and Development Trends

Table F-7 illustrates how Erie has grown in terms of population and number of housing units between 2005 and 2020. Note, the figures below include only the estimated population and housing units in the Town of

Erie which are within Boulder County. The total population of the town in 2020 was 30,038.

Table F-7 Erie's Change in Population and Housing Units, 2005-2020

2005 Population Estimate	2020 Population	Percent Change 2005-2020	2005 # of Housing Units Estimate	2020 # of Housing Units	Percent Change 2005-2020
6,932	12,652	45.21%	2,500	4,221	40.77%

Source: Colorado DOLA, State Demography Office

Over the past two decades, Erie has experienced a significant amount of growth compared to historic rates. From 1990 to 2000, Erie experienced a 400 percent increase in population. From 2010 to 2020, Erie experienced a 65.6% increase in population. Household and population projections between 2000 and 2025 are shown in Table F-8.

Table F-8 Erie's Household and Population Projections, 2000-2025

Year	# of Dwellings	Change	Total Population	Change
2000	2,328	--	6,985	--
2005	5,016	+2,688	15,048	+8,063
2010	6,630	+1,614	19,890	+4,842
2015	7,323	+693	22,000	+2,110
2025	14,580	+7,257	40,680	+18,680
2000-2025	--	+12,252	--	+33,695

Source: Town of Erie Comprehensive Plan, www.erieco.gov/

The dominant land use in incorporated Erie is single family residential with the predominant commercial areas located along major arterials (I-25, Highway 7, Highway 287, Highway 52 and the County Line Road and Erie Parkway intersection). There is one active landfill and one temporarily closed landfill in the incorporated area, comprising approximately 668 acres.

F.5 Vulnerability Assessment

The intent of this section is to assess Erie's vulnerability separate from that of the planning area as a whole, which has already been assessed in Sections 4.4 Vulnerability Assessment and 4.5 Estimating Potential Losses of the Base plan. This vulnerability assessment analyzes the population, property, critical facilities, and other assets at risk for the more significant hazards or where available data permits a more in-depth analysis. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment of the Base Plan.

Table F-5 lists summary information about the 22 critical facilities and other community assets identified by Erie's HMPC as important to protect or provide critical services in the event of a disaster. For additional information on the definitions behind each critical facility category, source, and other details refer to Section 3.3.2 of the Base Plan.

F.5.1 Vulnerability by Hazard

The hazard summaries in Table F-3 above reflect the hazards that could potentially affect City. Based on this analysis, the priority hazards (High Significance) for mitigation are Floods, Severe Winter Storms, Tornado, and Windstorm. Those of Medium or High significance for the Town of Erie are identified in Table F-3.

Due to the ability to quantify vulnerability further with available data, only the dam, flood, and wildfire

hazards will be profiled in the following vulnerability assessment section.

Hazards assigned a significance rating of Low and which do not differ significantly from the County ranking (e.g., Low vs. High) are not addressed further in this plan and are not assessed individually for specific vulnerabilities in this section.

Dam Failure

General Property

While there is no concrete data available to indicate any likelihood of failure, based on best available dam inundation data there might be structures potentially at risk of dam failure flooding. The dam failure inundation maps contain sensitive information and are not available for display in this public planning document. Based on a GIS analysis performed with the county parcel layer and the available dam inundation mapping (for planning purposes only), the following potential damages would be expected in Erie.

Table F-9 Estimated Dam Inundation Exposure to Properties in Erie

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Agricultural	3	7	\$1,467,900	\$1,467,900	\$2,935,800	
Exempt	2	10	\$396,200	\$396,200	\$792,400	
Residential	89	106	\$41,189,169	\$20,594,585	\$61,783,754	321
Total	94	123	\$43,053,269	\$22,458,685	\$65,511,954	321

Source: Boulder County GIS and Assessor's Office, U.S Census, Wood Analysis

People, Critical Facilities and Infrastructure

Based on the GIS analysis summarized in the table above, it is expected that around 321 people in Erie might be at risk of dam inundation hazards. Also based on the GIS analysis summarized in the table below, it is expected that around 3 critical facilities in Erie might be at risk of dam inundation hazards.

Table F-10 Erie Critical Facilities at Risk of Dam Failure

FEMA Lifeline	Count
Food, Water, Shelter	1
Transportation	2
Total	3

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Economy

In addition to commercial and residential building impacts and direct damages, a dam inundation event which affected the major roads in and around Erie would significantly impact the economy by impeding regular business access, shipping, and travel. This could significantly affect the local economy, by limiting or completely impeding access to shops, restaurants, hotels, and other major industries which keep the local economy thriving.

Historical, Cultural, and Natural Resources

Dam or reservoir failure effects on the environment would be similar to those caused by flooding from other causes. For the most part the environment is resilient and would be able to rebound, though this process could take years. However, historic and cultural resources could be affected just as housing or critical

infrastructures would.

Flood

The major drainageways near Erie are Coal Creek and Boulder Creek. Flooding in Erie is primarily caused by the overflow of these creeks. Flooding is mostly likely to occur in mid-June due to runoff from snowmelt or from heavy rainfall events, such as the 2013 floods which impacted Erie.

General Property

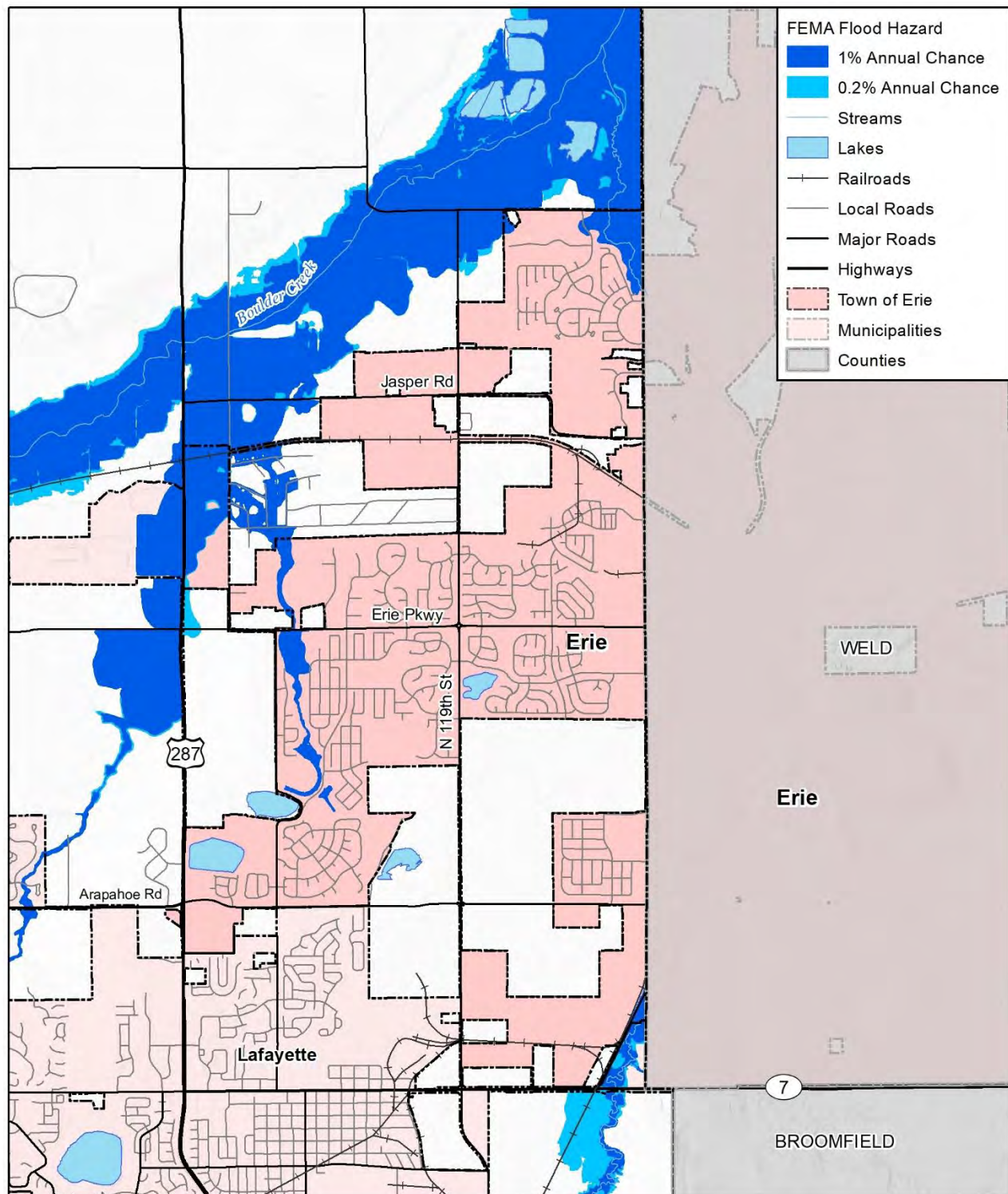
Vulnerability to flooding was determined by summing potential losses to Erie's properties in GIS, by using the latest FEMA NFHL data along with the Boulder County parcel layer provided by the Assessor's Office. FEMA's NFHL data depicts the 1% annual chance (100-year) and the 0.2% annual chance (500-year) flood events. Figure F-3 below displays Erie's FEMA special flood hazard areas present in the town, color coded based on flood event (i.e. 100-year versus 500-year).

Based on the GIS analysis performed with the county parcel layer and the available FEMA flood mapping, the potential risk for the Town is shown in Table F-11. Erie's 1% annual chance flood zone presents has 8 properties and over an estimated \$4.7 million total value exposed. There are no properties in Erie exposed to the 0.2% annual chance event. Most properties at risk of flooding are residential.

Table F-11 Summary of Erie Properties Vulnerable to 1% Annual Chance Flood Events, by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Agricultural	2	1	\$558,900	\$558,900	\$1,117,800	\$279,450	
Residential	5	7	\$2,367,990	\$1,183,995	\$3,551,985	\$887,996	21
Total	7	8	\$2,926,890	\$1,742,895	\$4,669,785	\$1,167,446	21

Source: Boulder County, FEMA NFHL, U.S., Census Bureau, Wood Analysis

Figure F-3 Town of Erie FEMA Flood Hazards

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
FEMA NFHL Effective 8/15/2019, Preliminary 9/30/2019

0 0.5 1 Miles



wood.

People

The population exposed to the flood hazards described in the flood vulnerability analysis above was estimated by applying an average household size factor to the number of improved residential properties identified in the flood hazard areas within Erie. These estimates yielded the population exposures shown in the table above in Table F-11. As such, the 1% annual chance flood event would potentially displace 21 people, based on the residential structures which fall in those flood zones. For additional details on potential displacements by flood event, see the Boulder County Base Plan.

Critical Facilities and Infrastructure

There are a total of 2 critical facilities located in the 1% flood hazard area, both of which are within the transportation FEMA Lifeline Category.

Economy

Flooding can have a major economic impact on the economy, including indirect losses such as business interruption, lost wages, and other downtime costs. Flooding often coincides with the busy summer tourism months in Boulder County, and may impact, directly or indirectly (such as from the negative perception of potential danger to his hazard), the revenues of shops, restaurants, hotels, and other major industries which keep the local economy thriving. Flooding can also obviously result in massive direct losses to the economy in the form of damages to buildings.

Historical, Cultural, and Natural Resources

The environment is mostly resilient to general flooding. However, cultural or historic properties within floodplains would be affected in similar ways as property and critical facilities/infrastructure, especially those with underground or basement levels where water would easily seep and potential ruin archives, resources, or other important assets.

Wildfire

General Property

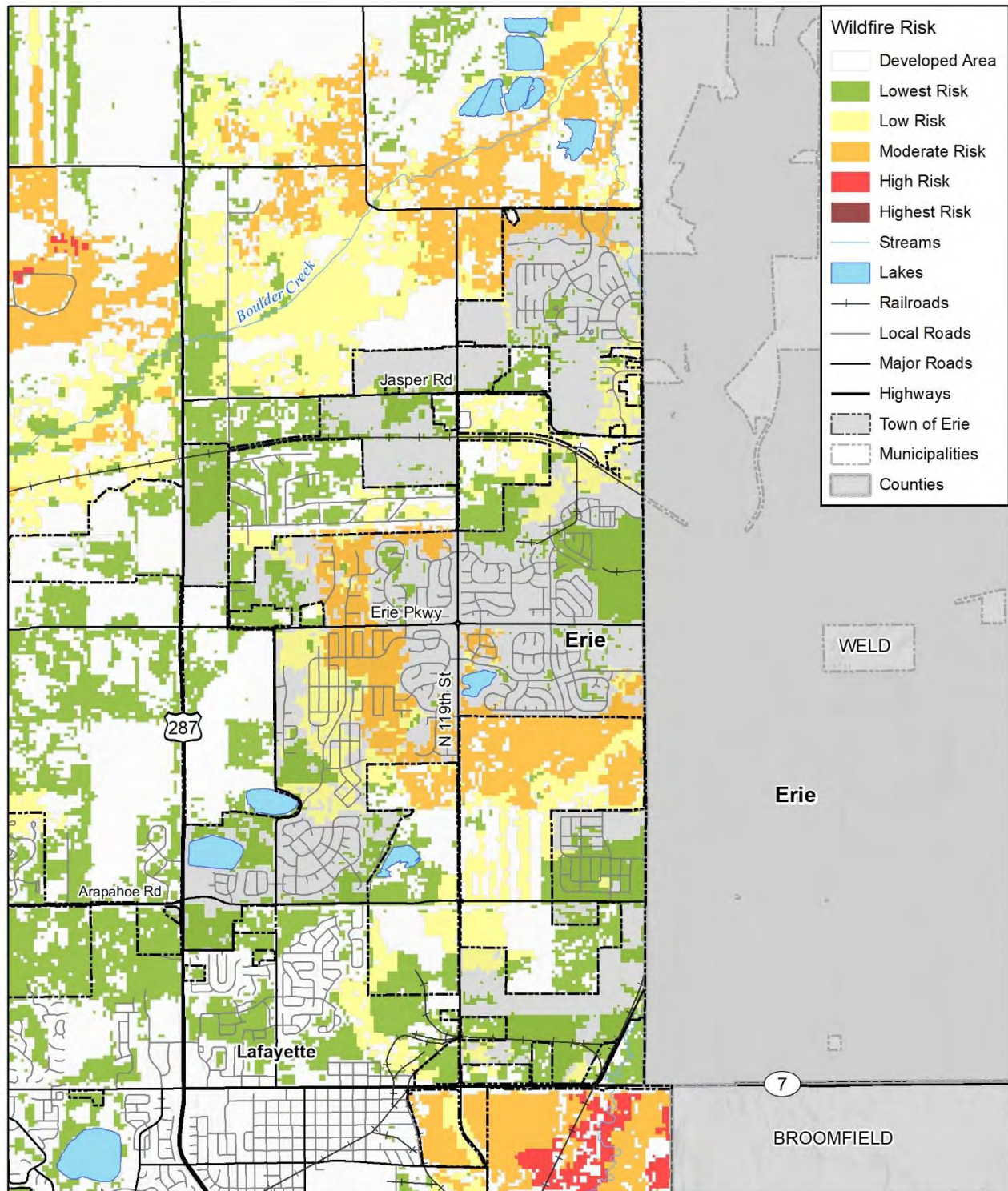
Wildfire threat was estimated from the County's Wildfire Protection Assessment Rating layer, which classifies areas into Lowest, Low, Moderate, High, and Highest ratings. Parcel analysis was conducted using GIS to analyze where parcels, buildings counts, property types and content values intersected with the wildfire hazards zones defined by the Colorado Forest Atlas, from highest to lowest risk. The Colorado Forest Atlas calculates a composite risk rating, defined as the possibility of loss or harm occurring from a wildfire. It identifies areas with the greatest potential impacts from a wildfire – i.e. those areas most at risk - considering all values and assets combined together – WUI Risk, Drinking Water Risk, Forest Assets Risk and Riparian Areas Risk. This risk index has been calculated consistently for all areas in Colorado, allowing for comparison and ordination of areas across the entire state

For the purposes of this analysis, the wildfire zone that intersected a parcel centroid was assigned as the threat zone for the entire parcel. Improvement values were then summed by wildfire rating area and then sorted by parcel type. Property improvements and estimated content values were then totaled to arrive at the Total Value column, which is also the estimated potential loss as wildfires typically result in complete loss to structure and contents. Erie properties at risk to wildfires are listed in Table F-12 below and the wildfire risk areas are displayed in Figure F-4. Erie does not have any exposure to high or highest risk wildfire hazards.

Table F-12 Property Values in Wildfire Zones by Parcel Type for Erie

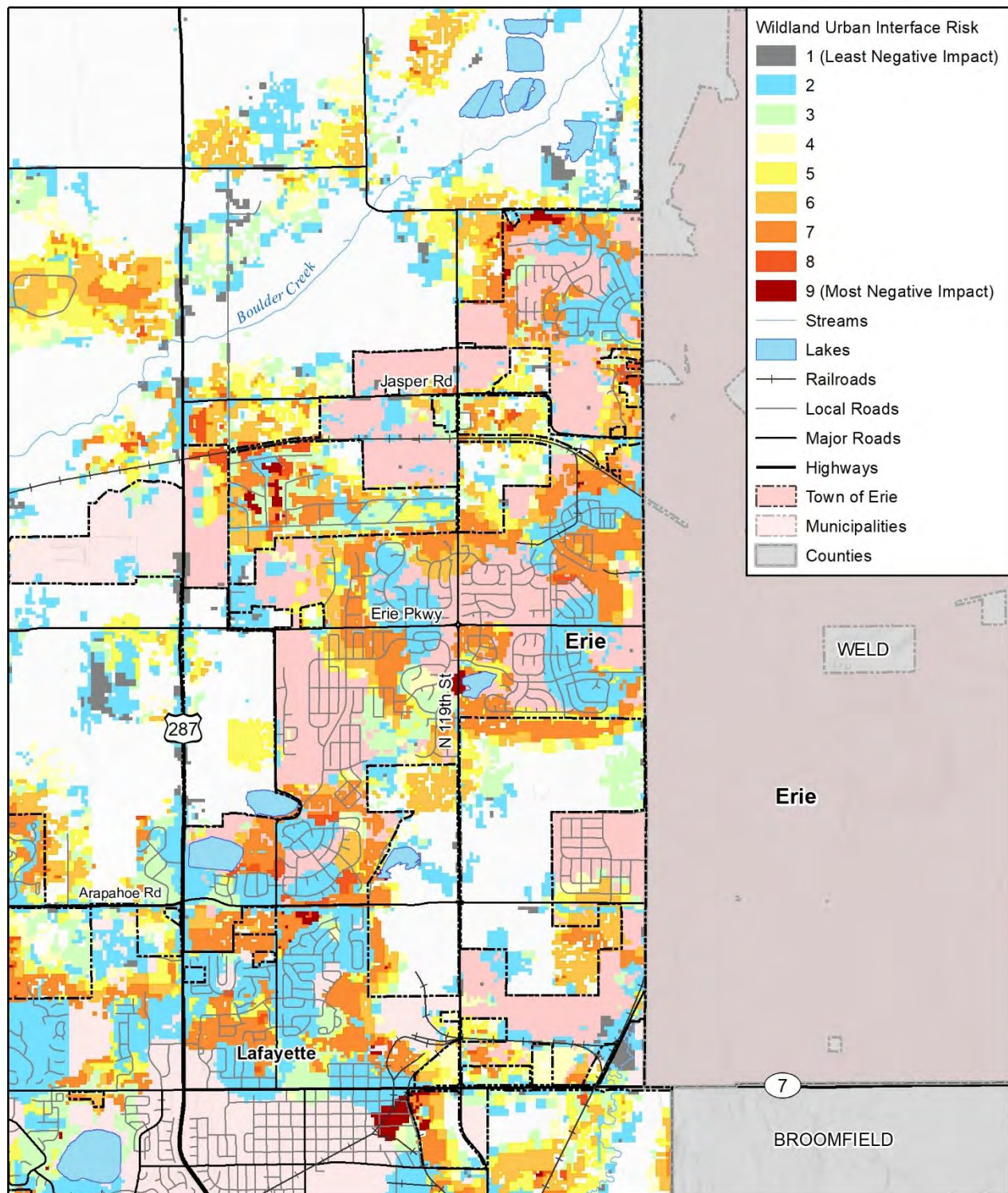
Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Moderate Wildfire Risk Hazard						
Commercial	1	2	\$898,600	\$898,600	\$1,797,200	
Exempt	3	5	\$17,650,131	\$17,650,131	\$35,300,262	
Residential	407	487	\$201,733,195	\$100,866,598	\$302,599,793	1,476
Total	411	494	\$220,281,926	\$119,415,329	\$339,697,255	1,476
Low Wildfire Risk Hazard						
Agricultural	1	3	\$657,400	\$657,400	\$1,314,800	
Commercial	1	4	\$559,000	\$559,000	\$1,118,000	
Exempt	2	4	\$437,090	\$437,090	\$874,180	
Residential	405	440	\$206,429,940	\$103,214,970	\$309,644,910	1,333
Total	409	451	\$208,083,430	\$104,868,460	\$312,951,890	1,333
Lowest Wildfire Risk Hazard						
Agricultural	2	4	\$884,800	\$884,800	\$1,769,600	
Exempt	8	13	\$6,812,300	\$6,812,300	\$13,624,600	
Residential	537	639	\$252,389,944	\$126,194,972	\$378,584,916	1,936
Total	547	656	\$260,087,044	\$133,892,072	\$393,979,116	1,936

Source: Erie GIS and Assessor's Office, Wood Analysis

Figure F-4 Town of Erie Wildfire Risk

wood.

The Colorado Forest Atlas also provides an analysis for Wildland-Urban Interface (WUI) risk based on housing density consistent with Federal Register National standards. The location of people living in the wildland-urban interface and rural areas is essential for defining potential wildfire impacts to people and homes. To calculate the WUI Risk Index, the WUI housing density data was combined with flame length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9, while areas with low housing density and low flame lengths are rated -1. Data is modelled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers. WUI Risk for Erie is mapped in Figure F-5.

Figure F-5 Town of Erie WUI Risk

wood.

Table F-13 Town of Erie High WUI Risk Hazard by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Commercial	1	2	\$559,000	\$559,000	\$1,118,000	
Exempt	6	10	\$20,168,331	\$20,168,331	\$40,336,662	
Residential	541	528	\$250,519,225	\$125,259,613	\$375,778,838	1,600
Total	548	540	\$271,246,556	\$145,986,944	\$417,233,500	1,600

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

Table F-14 Town of Erie Moderate WUI Risk Hazard by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Agricultural	2	4	\$884,800	\$884,800	\$1,769,600	
Commercial	1	2	\$898,600	\$898,600	\$1,797,200	
Exempt	4	7	\$4,173,590	\$4,173,590	\$8,347,180	
Residential	587	602	\$249,323,735	\$124,661,868	\$373,985,603	1,824
Total	594	615	\$255,280,725	\$130,618,858	\$385,899,583	1,824

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

Table F-15 Town of Erie Low WUI Risk Hazard by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Commercial	9	11	\$13,797,800	\$13,797,800	\$27,595,600	
Exempt	7	12	\$557,600	\$557,600	\$1,115,200	
Industrial	4	5	\$5,033,400	\$7,550,100	\$12,583,500	
Mixed Use	1	24	\$2,635,200	\$2,635,200	\$5,270,400	73
Residential	1,488	1,507	\$619,985,830	\$309,992,915	\$929,978,745	4,566
Total	1,509	1,559	\$642,009,830	\$334,533,615	\$976,543,445	4,639

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

The properties most at WUI Risk in Erie are residential with 541 high, 587 moderate, and 1,488 low risk residential structures, together representing upwards of \$1.7 billion in total property value across all WUI risk areas.

People

The last column of Table F-12, Table F-13, Table F-14, and Table F-15 above summarizes the number of people at risk to wildfire in the analyzed fire zones. Based on the assessment conducted, Erie has an estimated 1,476 people at risk to moderate wildfire potential, 1,333 at risk to low wildfire potential, and 1,936 at risk to the lowest wildfire potential, along with a total of 8,063 people within Erie residing in WUI Risk areas. These totals were estimated by multiplying the average persons per household in Erie by the number of residential properties falling within the fire zones. Smoke resulting from fire is an issue to local populations also.

Critical Facilities and Infrastructure

A total of 4 critical facilities were identified to be in moderate wildfire zones in Erie and 2 in the lowest wildfire zones, as listed in Table F-16 below. There are also 17 critical facilities located in WUI risk areas in Erie, summarized in Table F-17.

Table F-16 Critical Facilities Wildfire Risk in Erie by FEMA Lifeline Category

FEMA Lifeline	Count
Moderate Wildfire Risk Hazard	
Safety and Security	3
Transportation	1
Total	4
Lowest Wildfire Risk Hazard	
Food, Water, Shelter	1
Health and Medical	1
Total	2

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Table F-17 Critical Facilities WUI Risk in Erie by FEMA Lifeline Category

FEMA Lifeline	Count
High WUI Risk Hazard	
Health and Medical	1
Total	4
Moderate WUI Risk Hazard	
Safety and Security	5
Total	5
Low WUI Risk Hazard	
Food, Water, Shelter	1
Safety and Security	5
Transportation	2
Total	8

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Economy

Tourism, the accommodation and food services industry (e.g. hotels and restaurants), and retail are major components of Boulder County's economy, and Erie's as well. Wildland fires can, for example, lead to significant tourism reductions due to health and safety concerns, causing lost revenues from lack of visitation, stays in hotels, spending on restaurants and other commerce sources, and more.

Historical, Cultural and Natural Resources

Wildfires are a common and naturally occurring phenomenon in forested areas and can benefit forest health in many respects. But the climate change trend which is leading to hotter, more widespread, and destructive fires can make it more difficult for the environment to recover, and lead to increased flood runoff or other secondary/cascading hazards, such as erosion, landslides, mudslides, and debris flows, and flooding. This can severely impact water quality and watershed health for years after a fire. Wildfires can negatively impact air quality, water quality, and vegetation and biodiversity.

With regards to historic or cultural structures and resources, wildfires would affect those in similar ways as general property and critical facilities/infrastructure, having the potential for burn downs and hence possible complete loss of important historical assets.

F.6 Capability Assessment

Capabilities are the programs and policies currently in place to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment summarizes Erie's regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities and education and outreach capabilities. It then discusses these capabilities in further detail along with other mitigation efforts as they pertain to the National Flood Insurance Program's Community Rating System (CRS). Although the CRS is flood-focused, this discussion also incorporates activities related to other hazards into the categories established by the CRS.

F.6.1 Mitigation Capabilities Summary

Table F-18 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Erie.

Table F-18 Erie's Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Master plan	Yes	Town of Erie Comprehensive Plan, 2015
Zoning ordinance	Yes	Erie Municipal Code
Subdivision ordinance	Yes	Erie Municipal Code, Standards and Specifications
Growth management ordinance (policy)	No	
Floodplain ordinance	Yes	Erie Municipal Code
Participated in the National Flood Insurance Program (NFIP)	Yes	Joined 10/17/1978
Participate in the Community Rating System (CRS)	No	
Other special purpose ordinance (stormwater, steep slope, wildfire)	Yes	Wildfire: Public Burning Ban - Ordinance
Building code	Yes	2015 International Codes
BCEGS Rating	No	
Fire department ISO rating	Yes	Rating: 3/9
Erosion or sediment control program	Yes	Erie Municipal Code
Stormwater management program	Yes	Erie Municipal Code
Site plan review requirements	Yes	Erie Municipal Code
Capital improvements plan	Yes	Budget
Economic development plan	Yes	Town of Erie Economic Development Plan
Local emergency operations plan	Yes	Town of Erie Local Emergency Operations Plan
Other special plans	Yes	Water Conservation Master Plan Drought Management Plan
Flood insurance study or other engineering study for streams	Yes	Outfall Systems Plans, Flood Insurance Study, Letters of Map Revision
Elevation certificates	Yes	Required for construction in the FHAD
Community Wildfire Protection Plan (CWPP)	No	
Other	Yes	Natural Areas Inventory, Vulnerability Assessment, Coal Creek Flood Control Project

Table F-19 identifies the personnel responsible for mitigation and loss prevention activities as well as related data and systems in Erie.

Table F-19 Erie's Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/engineer with knowledge of land development/land management practices	Yes	Department of Planning and Development Civil Engineers/Director	
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Chief Building Official Civil Engineers/Director	
Planner/engineer/scientist with an understanding of natural hazards	Yes	Public Works & Civil Engineers	
Transportation Planner	Yes	Public Works	The position is approved for 2022
Resiliency Planner	Yes	Public Works	
Personnel skilled in GIS	Yes	Public Works & GIS Technician	
Full-time building official	Yes	Chief Building Official Building Inspectors	
Floodplain manager	Yes	Public Works & Civil Engineer	
Emergency manager	Yes	Chief of Police	
Grant writer	Yes	Assistant to the Town Administrator	
Other personnel	Yes	Chief of Police Police Deputy Chief Commander	
GIS Data – Hazard areas	Yes	Public Works – GIS Coordinator	
GIS Data – Critical facilities	Yes	Public Works – GIS Coordinator	
GIS Data – Building footprints	Yes	Public Works – GIS Coordinator	
GIS Data – Land use	Yes	Public Works – GIS Coordinator	
GIS Data – Links to assessor's data	Yes	Public Works – GIS Coordinator	
Warning systems/services (Reverse 9-11, cable override, outdoor warning signals)	Yes	Everbridge, Reverse 911, Cable Override, Website, Email List serve, Facebook, Twitter	

Table F-20 identifies financial tools or resources that Erie could potentially use to help fund mitigation activities.

Table F-20 Erie's Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Yes/No)	Comments
Community Development Block Grants	Yes	
Capital Improvements project funding	Yes	
Authority to levy taxes for specific purposes	Yes	
Fees for water, sewer, gas, or electric services	Yes	

Financial Resources	Accessible/Eligible to Use (Yes/No)	Comments
Impact fees for new development	Yes	
Incur debt through general obligation bonds	Yes	
Incur debt through special tax bonds	Yes	
Incur debt through private activities	No	
Withhold spending in hazard-prone areas	No	
Stormwater Service Fees	Yes	

Table F-21 identifies existing education and outreach capabilities that the Town of Erie uses to inform the public about hazards and risks in the community.

Table F-21 Town of Erie's Education and Outreach Capabilities

Capability/Program	Yes/No (Briefly Describe)
Local Citizen Groups That Communicate Hazard Risks	No
Firewise	No
StormReady	Yes, send out mailer every year
Other?	

F.6.2 Opportunities for Capability Enhancement and Improvement

The plan update process provided the Town of Erie an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- Integrate risk assessment information into future updates to the Town's Comprehensive Plan.
- Integrate risk assessment information into future updates of the Town's Land Use Code.
- Providing training for staff members related to hazards or hazard mitigation grant funding in partnership with the County and DHSEM
- Achieving Firewise certification

F.6.3 Community Rating System Activities (All Hazards)

National Flood Insurance Program

The Town of Erie joined the National Flood Insurance Program (NFIP) on October 17, 1978. In exchange for a community adopting and enforcing a floodplain management ordinance, the NFIP makes affordable flood insurance available to private property owners and enables the community to retain its eligibility to receive certain federally backed monies and disaster relief funds.

NFIP insurance data indicates that as of March 2022, there were 49 policies in force in Erie (including both Boulder and Weld counties), resulting in \$13,056,200 of insurance in force. In Erie, there have been six claims for flood losses filed since 1978, totalling approximately \$20,152 in paid losses. There is one repetitive loss property in the Town of Erie.

Continued Compliance with the NFIP

Recognizing the importance of the NFIP in mitigating flood losses, the Town of Erie will place an emphasis on continued compliance with the NFIP. As an NFIP participant, the Town has and will continue to make

every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance as well as review of any potential development in special flood hazard areas.

Community Rating System Categories

The Community Rating System (CRS) categorizes hazard mitigation activities into six categories. These categories, and applicable Erie activities, are described below. Note: some of the activities are appropriate to multiple categories. For purposes of simplicity, they are only included in the category deemed most appropriate based on the definitions and examples provided in the CRS Coordinator's Manual.

Preventive

Preventive activities keep problems from getting worse. The use and development of hazard-prone areas is limited through planning, land acquisition, or regulation. They are usually administered by building, zoning, planning, and/or code enforcement offices.

2015 Comprehensive Plan

The Town of Erie Comprehensive Plan is an advisory document that outlines the community's vision and goals for the future and provides guidance for Town officials in making choices regarding the long-range needs of the community. The plan's goals and guiding principles, policies, and recommendations, along with the Future Land Use map (see Figure B.2 above), provide guidance for decisions affecting growth and annexation, the use and development of land, preservation of open space, and the expansion of public facilities and services. The following goals and policies directly mitigate hazards addressed in this plan:

Goal: Protect Sensitive Areas—Preserve environmentally sensitive areas from development

- Discourage Development in Sensitive or Hazard Areas: The Town will discourage developments where a significant risk to life and property exist, as in areas of floodplain, geologic hazard, unstable soils, undermined areas, and steep slopes in accordance with the recommendations of the Colorado Geologic Survey, FEMA, and the Office of Mined Lands.

Goal: Environmentally Sensitive Design Promote environmentally sensitive design that minimizes the use of and impacts to renewable and non-renewable resources

- Develop Water Conservation Principles: The Town will encourage conservation of water resources in the landscape through the use of xeriscaping principles (i.e., where landscapes are designed with drought-tolerant plants in low water zones as well as fully irrigated zones) and the use of non-potable water for landscape irrigation.
- Undermined Areas: Development should not be permitted over undermined areas unless risks can be mitigated. Portions of the site deemed to be undevelopable due to the effects of undermining should be integrated as part of an overall open space network.

Goal: Establish an Open Space Program—Conserve and maintain important open space lands in and around Erie

- Characteristics of Open Space: Open space is characterized as undeveloped land that is permanently committed to be maintained in a natural or agricultural state and that serves one or more functions identified in the plan, including protecting the public from natural and geologic hazards.

A number of other goals and policies in the comprehensive plan indirectly mitigate hazards addressed in this plan. The Natural Resource and Environment and Open Space chapters, in particular, further mitigate hazards by protecting valuable natural resources (e.g., wetlands, riparian areas).

Erie Municipal Code**Drainage and Flood Control**

In regard to hazard mitigation, Erie's strongest and most directly related regulations are those related to drainage and flood control. These regulations were designed to promote the public health, safety, and general welfare; to minimize flood losses in areas subject to flood hazards; and to promote wise use of the floodplain. More specifically, they were established to:

To reduce the hazard of floods to life and property through:

- Prohibiting certain uses which are dangerous to life or property in time of flood;
- Restricting uses which would be hazardous to the public health in time of flood;
- Restricting uses which are particularly susceptible to flood damage, so as to alleviate hardship and eliminate demands for public expenditures for relief and protection;
- Requiring permitted floodplain uses, including public facilities which serve such uses, to be protected against flood by providing flood proofing and general flood protection at the time of initial construction;
- Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities; and
- Requiring that uses vulnerable to floods, including facilities which serve such uses be protected against flood damage at the time of initial construction.

To protect floodplain occupants from a flood which is or may be caused by their own or other land use and which is or may be undertaken without full realization of the danger, through:

- Regulating the manner in which structures designed for human occupancy may be constructed so as to prevent danger to human life within such structures;
- Regulating the method of construction of water supply and sanitation systems so as to prevent disease, contamination and unsanitary conditions;
- Delineating and describing areas that could be inundated by floods so as to protect individuals from purchasing floodplain lands for purposes which are not in fact suitable;
- Minimizing the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimizing prolonged business interruptions;
- Ensuring that potential buyers are notified that property is in an area of special flood hazard; and
- Ensuring that those who occupy the areas of special flood hazards assume responsibility for their actions.

To protect the public from the burden of avoidable financial expenditures for flood control and relief by:

- Regulating all uses within the floodplain areas so as to produce a method of construction and a pattern of development which will minimize the probability of damage to property and loss of life or injury to the inhabitants of the flood hazard areas;
- Minimizing damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in areas of special flood hazard; and
- Helping maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future flood blight areas.

To protect the storage capacity of floodplains and to assure retention of sufficient floodway area to convey flood flows which can reasonably be expected to occur by:

- Regulating filling, dumping, dredging, and alteration of channels by deepening, widening, or relocating;

- Prohibiting unnecessary and damage creating encroachments;
- Encouraging uses such as agriculture, recreation and parking; and
- Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities.

To protect the hydraulic characteristics of the small watercourses, including the gulches, sloughs and artificial water channels used for conveying floodwaters, which make up a portion of the urban drainage system, by:

- Regulating filling, dumping, and channelization so as to maintain the natural storage capacity and slow flow characteristics;
- Prohibiting encroachment into the small watercourses to maintain the natural storage capacity and slow flow characteristics;
- Encouraging uses such as greenbelt, open space, recreation, and pedestrian and riding trails;
- Controlling the alteration of natural floodplains, stream channels and natural protective barriers, which help accommodate or channel floodwaters;
- Controlling filling, grading, dredging, and other development which may increase flood damage; and
- Preventing or regulating the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards in other areas.

Specifically, the regulations create two overlay zoning districts, the Floodway and Floodway Fringe districts, to identify properties within special flood hazard areas, require a development permit for construction of development in either district, identify permitted uses and conditions for permitted uses in the districts, sets standards and requirements for development in the districts, and outlines the duties and responsibilities of the floodplain administrator.

Other Regulations

- **Water and Wastewater:** These regulations prohibit waste of water and establish the Town of Erie Water Conservation Program. The requirements for water conservation are voluntary unless made mandatory through a town board resolution. Additionally, the Town administrator may establish water usage hours and restrictions for the safety and welfare of the Town.
- **Zoning Regulations:** This title is in accordance with the comprehensive plan and is designed to promote the health, safety, and general welfare; to prevent the overcrowding of land; to avoid undue concentration of population; and to facilitate the adequate provision of services (including water and drainage), among other things. No building or structure may be erected, constructed, reconstructed, altered, repaired, moved, or used unless in conformance with these regulations, and no land may be used unless in conformance with these regulations.
- **Subdivision Regulations:** The purpose of this title is to assist orderly, efficient, and integrated development and to promote the health, safety, morals, convenience, order, prosperity, and general welfare of the present and future residents of the Town. General design standards call for preservation of natural features and attention to hazardous conditions. Land subject to hazardous conditions, such as landslides, mudflows, rockfalls, snowdrifts, possible mine subsidence, shallow water table, floods, etc., cannot be subdivided until the hazards have been mitigated or will be mitigated by the subdivision and construction plans. The design standards chapter also addresses surface water drainage and abandoned mines.

Other

The Erie Outfall System Plan evaluates the impact of existing and projected future development on flood peaks and presents a preliminary design of the plan, including stormwater outfall systems that safely convey the projected 100-year flood under future development conditions. The purpose of the outfall system

planning study was to identify alternate methods to convey stormwater to enhance public health and safety and minimize property damage.

The Erie Drought Management Plan was originally developed in 2015 by the Public Works Department with consultant assistance. The plan enhances Erie's ability to mitigate drought impacts before they occur and identify and properly determine the severity of a drought based on Erie's potential shortage of supply.

Property Protection

Property protection activities are usually undertaken by property owners on a building-by-building or parcel basis.

No projects currently identified.

Natural Resource Protection

Natural protection activities preserve or restore natural areas or their natural functions. They are usually implemented by parks, recreation, or conservation agencies or organizations.

Erie has a Natural Areas Inventory Report that delineates and inventories the natural features and unique characteristics of undeveloped lands for their uniqueness as natural areas. Erie's natural areas are those places with natural resources such as wildlife habitat and corridors, native prairie and plant diversity, aquatic habitats and wetlands, significant topographic features, and scenic views that potentially offer opportunities to preserve, enhance, and recognize Erie's natural heritage. This report serves to highlight those locations and features that are worthy of sensitivity during land use planning.

Erie has a Community Forestry Program, which attends to the care and management of public tree resources in the Town's urban/community environment. Among the program's recognized benefit of trees are the following mitigation-related benefits: reduce soil erosion, provide shade for cooling, living snow fence, and living wind break.

Erie's Open Space and Trails Advisory Board advises the Board of Trustees on open space and trails related issues.

Erie's Water Conservation Master Plan (2014) provides guidance for effective water conservation while controlling costs related to implementation. The plan evaluates Erie's water demands and supplies, defines goals specific to the conservation program, and evaluates and selects conservation measures/programs for implementation. It focuses on conservation measures and programs that are compatible with Erie's water supply system, water resources management strategy, and community values.

Water Conservation Program: The Town has intentionally developed a diverse water portfolio in order to provide enough flexibility to meet customer demands under most conditions. Erie continually monitors and adjusts water rights, leases, and deliveries to meet the anticipated demands. Moreover, the Town continually monitors and adjusts operations and procedures to manage the demands. When certain "trigger" conditions are reached, the Town will react in kind to implement planned, water reduction actions (water conservation action levels). The Town of Erie maintains as its baseline, a voluntary water conservation program. Erie residents are asked to voluntarily comply with Action Level 1 of the Town's Water Conservation Program, which calls for twice-weekly lawn watering. Under Action Level 1, residents with even-numbered addresses are asked to water on Sunday and Thursday. Residents with odd numbered addresses are asked to water on Wednesday and Saturday. Lawn watering is recommended between 7:00pm and 7:00am.

Residential Irrigation Audits: The Town of Erie has partnered with the Center for Resource Conservation, to provide an irrigation audit program for commercial and residential irrigation systems. This program meets one of the requirements of the Water Conservation Plan. An irrigation audit is designed to pinpoint

inefficiencies in an irrigation system, which contributes to water waste, unnecessary runoff, and increased run-time and maintenance costs.

The Town of Erie contracts with mosquito control contractors to provide the Town's mosquito surveillance and control activities during the summer months.

Emergency Services

Emergency services measures are taken during an emergency to minimize its impacts. These measures are the responsibility of city or county emergency management staff and the owners or operators of major or critical facilities.

The Town of Erie Senior staff, first responders, and various administrative and Department of Public Works staff are National Incident Management System (NIMS) certified.

Mountain View Fire Rescue, based out of Longmont, currently has two fire stations located in Erie and provides for Erie's fire protection and emergency medical services.

Structural Projects

Structural projects keep hazards away from an area (e.g., levees, reservoirs, other flood control measures). They are usually designed by engineers and managed or maintained by public works staff.

- Erie received Hazard Mitigation Grant Program funding for a traffic signal at Erie Pkwy and WCR 7.
- Erie received federal bridge repair funding for a ditch crossing at WCR 5 north of HWY 52.
- Erie receives drainage system maintenance assistance from the Mile-High Flood District (MHFD) for the following drainage facilities:
 - Arapahoe Ridge Filing 1 Detention pond
 - Arapahoe Ridge Filing 2 Detention Pond
 - Orchard Glen Filing 1 Detention Pond
 - Orchard Glen Filing 2 Detention Pond
 - Drainage Channel in Orchard Glen Filing 2 between Marfell St. and Madison Ct.
 - Canyon Creek Filing 1 Detention Pond
 - Canyon Creek Filing 3 Detention Pond
 - Canyon Creek Filing 6 Detention Pond
 - Drainage Channel through Canyon Creek and Creekside from Erie Parkway to the Creekside Detention Pond south of the railroad tracks
 - Creekside Detention Pond south of the railroad tracks
 - Creekside Detention Pond southwest of County Line Road and Telleen Ave
 - Drainage Channel along the south side of the Railroad Tracks west of County Line Road
 - Kenosha Farms Detention Pond
 - Drainage Channel between Erie Village and Kenosha Farms from the point of intersection of the two channels north to the pond.
 - Compass Detention Pond at the NW corner of County Line Road and Arapahoe Road
- After construction is complete and final acceptance is issued, the following drainage facilities will receive maintenance assistance from MHFD:
 - Drainage channel through Flatiron Meadows from Arapahoe Ridge Filing 1 to Erie Parkway
 - Detention in Flatiron Meadows south of Erie Parkway
 - Coal Creek from County Line Rd. to Kenosha Rd.
- MHFD provided up to 50% matching funds working with the Town of Erie for the following drainage improvement projects:

- Arapahoe Ridge Filing 1 Detention Pond reconstruction
- Arapahoe Ridge Filing 2 Detention Pond reconstruction
- 111th Street Drainage Design
- Old Town By-Pass Drainage Improvements
- Creekside Regional Detention Pond south of the railroad tracks
- Coal Creek from Cheesman St to Kenosha Rd

Erie received a Pre-Disaster Mitigation grant from FEMA for replacement of a culvert at a Coal Creek crossing.

Erie received a DOLA grant and a loan from CWCB for improving Coal Creek including the construction of a levee to protect Old Town from the 100-year flood, this was in the mid 90's

The U.S. Army Corps of Engineers has inspected Erie's levee and determined that it qualifies for Public Law 84-99 Rehabilitation assistance for Non-Federal flood Control Projects. This inspection has also insured that Erie's Levee continues to be certified by FEMA for flood Protection purposes.

After the 2013 floods Town of Erie Department of Public Works staff worked with FEMA, the State of Colorado, and other Federal agencies and managed the process of submitting and seeking reimbursement for nearly 40 projects totaling more than \$1.3 million.

Public Information

Public information activities advise property owners, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of natural resources (e.g., local floodplains). They are usually implemented by a public information office.

The Town of Erie maintains an "Emergency Preparedness" website which provides community-specific information and links to emergency preparedness information from a variety of local, state, and federal sources on its website.

Erie makes available the Boulder Office of Emergency Management Emergency Preparedness Guide and the READYColorado "Pack a Kit Checklist" on the Town's website.

The Town utilizes its website (www.erieco.gov), social media (Facebook and Twitter) and Erie Government Television (Comcast Channel 8) to promote general Public Health and Safety Information. These media outlets are considered by the Town to be valuable tools for providing the residents of Erie with information about matters pertaining to public health and safety. In fact, 94% of respondents to a statistically valid Citizen Survey conducted in 2017 site the Town of Erie's website as their preferred source for obtaining information about the Town. Additionally, 82% of respondents cited Erie Edition newsletter as a preferred source for obtaining information about the Town. Media releases, Newsflashes, educational programming and public notices pertaining to family emergency preparedness are some examples of information disseminated by the Town.

During and after the 2013 flood and severe weather incidents in Erie, the Town utilized its social media and website to keep the public informed and provided essential public health and safety instructions.

The Town promotes Water-Wise Landscaping Best Practices for citizens to use in making choices about their home landscaping to best use limited water resources.

In November 2014, the Erie Police Department graduated 26 Erie Residents from a two-day CERT (Community Emergency Response Team) Training program. These residents learned about disaster preparedness for a variety of hazards that may impact our community. Through classroom training and hands on exercises, CERT members were taught what it takes to assist others in their neighborhood or workplace following an event when professional responders are not immediately available to assist.

F.7 Mitigation Action Plan

In order to identify and select mitigation measures to support the mitigation goals, each hazard identified in the plan was evaluated in regard to the various options for mitigation. Hazards that pose a significant threat to the community were considered the priority in the development of hazard specific mitigation measures. The following sections outline the status of actions previously identified in the 2016 plan, as well as detailed information about the new mitigation actions which the Town of Erie plans to pursue in 2022 moving forward.

F.7.1 Status on Previous Mitigation Actions

The Town of Erie has been successfully implementing mitigation actions which were identified in the previous HMP. The 2016 mitigation strategy for Erie contained 7 actions, one of which was identified as completed in the 2016 plan.

Table F-22 2016 Mitigation Action Statuses

Mitigation Action Title	Hazard	2022 Status
Continue to implement sound floodplain management practices as communities participating in the NFIP	Flood	Annual Implementation
Install additional outdoor warning sirens at new MVFR stations to be built starting 2015	All hazards	Completed
Emergency generator for town hall	All hazards	Completed
Coal Creek Trail improvements	Flood	Awaiting approval from FEMA for next stages of this project. Carried forward as continuing projects segmented by reaches.
Boulder Creek Trail improvements	Flood	Completed
Portable radio kit	All hazards	Completed

F.7.2 Town of Erie 2022 Mitigation Guide - Erie Co 12 Projects

Mitigation Action Guides (MAGs) provide an in-depth explanation of priority mitigation projects that have been identified during the local hazard mitigation planning process. MAGs link jurisdictionally or organizationally specific mitigation actions to locally assigned implementation mechanisms. The actions are ranked in order of priority based on a modified-STAPLEE Action Rating conducted by the Hazard Mitigation Planning Committee. MAGs facilitate project implementation and maintenance over time.

Town of Erie: County Line Road, Telleen to Cheesman LIFELINE: Transportation SUBCOMPONENT: Roadway	
PRIORITY: Medium	HAZARDS ADDRESSED: Severe storm
LOCATION: County Line Road, Telleen to Cheesman	GOALS ADDRESSED: 2
RECOMMENDATION DATE: Design 2021	
TARGET COMPLETION DATE: 2023	
ISSUE: This section of County Line road has multiple connections and is between two schools and a day care center. There are no turn lanes or sidewalks. It is difficult for children to cross the roadway to get to school and	

Town of Erie: County Line Road, Telleen to Cheesman**LIFELINE: Transportation****SUBCOMPONENT: Roadway**

cars back up waiting to make left turns. The Town has applied for a Safer Main Streets funding for this project. There have been multiple accidents in the stretch of County Line Road.

RECOMMENDATION: Assuming the project will receive funding in early 2021, begin the design, and work with the power company to underground overhead lines. Construction is anticipated to begin in 2022. The project will include left turn lanes, rectangular rapid flashing beacons for pedestrian crossings, bike lanes and sidewalks on each side.

LEAD AGENCY: Public Works (Todd Fessenden), 303-926-2895.

EXPECTED COST: \$2,950,000

SUPPORT AGENCIES:

POTENTIAL FUNDING SOURCES: Transportation Impact Fund for 20%, DRCOG Safer Main Streets funding for 80%

PROGRESS MILESTONES:

Town of Erie: Coal Creek Improvements Reach 1**LIFELINE: Safety and Security****SUBCOMPONENT: Community Safety**

PRIORITY: High

HAZARDS ADDRESSED: Flooding

LOCATION: Coal Creek from south of Cheesman St to north of Briggs St

GOALS ADDRESSED: 1 and 2

RECOMMENDATION DATE: Early 2021

TARGET COMPLETION DATE: Mid 2022

ISSUE: A Coal Creek Master Plan and a Flood Hazard Area Delineation (FHAD) study was completed for Coal Creek in 2016. The flows in Coal Creek increased from the FIS. Because of the increased flows, the Town worked with MHFD to study three reaches of Coal Creek from Cheesman St to Kenosha Rd. Reach 1 is just east of Old Town Erie. This section of Erie is protected from the 100-year flood with a levee. To ensure the Levee has adequate freeboard to continue to protect the Town, this section was designed. Currently the design and a CLOMR is being reviewed by FEMA.

RECOMMENDATION: Once the CLOMR is approved by FEMA, the construction of the improvements will be completed, and a LOMR submitted to FEMA.

ACTION: Coal Creek Improvements Reach 1

LEAD AGENCY: Public Works (Todd Fessenden), 303-926-2895.

EXPECTED COST: \$2,000,000

SUPPORT AGENCIES:

POTENTIAL FUNDING SOURCES: Storm Drainage Fund

PROGRESS MILESTONES:

3-Town of Erie: Coal Creek Improvements Reach 2**LIFELINE: Safety and Security****SUBCOMPONENT: Community Safety**

PRIORITY: High

HAZARDS ADDRESSED: Flooding

LOCATION: Coal Creek from Briggs Street to County Line Road.

GOALS ADDRESSED: 1 and 2

RECOMMENDATION DATE: begin design 2022

TARGET COMPLETION DATE: 2026

ISSUE: A Coal Creek Master Plan and a Flood Hazard Area Delineation (FHAD) study was completed for Coal Creek in 2016. The flows in Coal Creek increased from the FIS. Because of the increased flows, the Town worked with MHFD to study three reaches of Coal Creek from Cheesman St to Kenosha Rd. Reach 2 is between Briggs Street and County Line Road. Currently there is a conceptual design for this section. Property for the Coal Creek

3-Town of Erie: Coal Creek Improvements Reach 2**LIFELINE: Safety and Security****SUBCOMPONENT: Community Safety**

improvements needs to be acquired and a final design and permitting is needed before construction can occur. The improvements in this reach along with Reach 1 and 3 and a Bridge Replacement for County Line Road, has the potential to remove Weld County properties from the Flood Hazard Zone.

RECOMMENDATION: Prepare a preliminary design and apply for funding for final design and construction.

ACTION: Coal Creek Improvements Reach 3

LEAD AGENCY: Public Works (Todd Fessenden),
303-926-2895.

EXPECTED COST: \$12,000,000

SUPPORT AGENCIES:

POTENTIAL FUNDING SOURCES: Storm Drainage Fund Grant funding from multiple sources such as CWCB, GoCO, FEMA and DRCOG.

PROGRESS MILESTONES:

4-Town of Erie: Coal Creek Improvements Reach 3**LIFELINE: Safety and Security****SUBCOMPONENT: Community Safety**

PRIORITY: High

HAZARDS ADDRESSED: Flooding

LOCATION: Coal Creek from County Line Road to Kenosha Road

GOALS ADDRESSED: 1 and 2

RECOMMENDATION DATE: Early 2021

TARGET COMPLETION DATE: Mid 2022

ISSUE: A Coal Creek Master Plan and a Flood Hazard Area Delineation (FHAD) study was completed for Coal Creek in 2016. The flows in Coal Creek increased from the FIS. Because of the increased flows, the Town worked with MHFD to study three reaches of Coal Creek from Cheesman St to Kenosha Rd. Reach 3 is between County Line Road and Kenosha Road. Currently the design and a CLOMR is being reviewed by FEMA.

RECOMMENDATION: Once the CLOMR is approved by FEMA, the construction of the improvements will be completed, and a LOMR submitted to FEMA.

ACTION: Coal Creek Improvements Reach 3

LEAD AGENCY: Public Works (Todd Fessenden),
303-926-2895.

EXPECTED COST: \$5,000,000

SUPPORT AGENCIES:

POTENTIAL FUNDING SOURCES: Storm Drainage Fund and Mile High Flood District

PROGRESS MILESTONES:

5-Town of Erie: Old Town Drainage Improvements**LIFELINE: Safety and Security****SUBCOMPONENT: Community Safety**

PRIORITY: High

HAZARDS ADDRESSED: Flooding

LOCATION: Old Town Erie to Coal Creek

GOALS ADDRESSED: 1 and 2

RECOMMENDATION DATE: begin design 2021,
begin implementation of improvements in 2023

TARGET COMPLETION DATE: 2024 for near term improvements

ISSUE: Old Town Erie's storm drainage system does not handle a minor storm. A conceptual plan has been developed to add detention and additional storm sewer systems. With redevelopment of Old Town Erie, storm drainage improvements are needed to improve the existing conditions and not make it worse. .

5-Town of Erie: Old Town Drainage Improvements**LIFELINE: Safety and Security****SUBCOMPONENT: Community Safety**

RECOMMENDATION: Begin the design for implementation of the Old Town Infrastructure Improvements for drainage. Need to review conceptual recommendations and implement a plan to complete improvements. Conceptual plan recommends 2.5 mill in next 5-years and 9.3 mill for mid to long term implementation.

ACTION: Old Town Drainage Improvements

LEAD AGENCY: Public Works (Todd Fessenden),
303-926-2895.

EXPECTED COST: \$3,500,000 for near term and 9,500,000 for long term.

SUPPORT AGENCIES:

POTENTIAL FUNDING SOURCES: Storm Drainage Fund Grant funding from multiple sources such as CWCB and DRCOG.

PROGRESS MILESTONES:

6-Town of Erie: Zone 3 Storage Tank**LIFELINE: Food Water Shelter****SUBCOMPONENT: Water**

PRIORITY: Medium

HAZARDS ADDRESSED: Severe storm, Drought

LOCATION: North of SH 52

GOALS ADDRESSED: 1 and 2

RECOMMENDATION DATE: Design 2021

TARGET COMPLETION DATE: 2024

ISSUE: The Town is developing new water supplies that will be located on the north side of Erie. By constructing a new water treatment facility close to the water supplies the infrastructure needed to transport water for treatment will be reduced. A second water treatment facility will provide redundancy in the event of a natural disaster.

RECOMMENDATION: begin the design and permitting in 2021. Begin construction in 2022.

ACTION: Zone 3 Water Storage Tank

LEAD AGENCY: Public Works (Todd Fessenden),
303-926-2895.

EXPECTED COST: \$7,000,000

SUPPORT AGENCIES:

POTENTIAL FUNDING SOURCES: Water Fund

PROGRESS MILESTONES:

7-Town of Erie: Well project**LIFELINE: Food Water Shelter****SUBCOMPONENT: Water**

PRIORITY: Medium

HAZARDS ADDRESSED: Severe storm, Drought

LOCATION: North of SH 52

GOALS ADDRESSED: 1, 2, and 5

RECOMMENDATION DATE: Design 2020

TARGET COMPLETION DATE: 2024

ISSUE: The Town is developing new water supplies that the well system is part of. Having diversified water supplies will provide redundancy in the event of a natural disaster.

RECOMMENDATION: The design of a well system for water supply is underway. The installation and distribution system for the well system will begin construction in 2021. The water from the well system will be treated from a new water treatment facility.

ACTION: Well project

LEAD AGENCY: Public Works (Todd Fessenden),
303-926-2895.

EXPECTED COST: \$4,000,000

SUPPORT AGENCIES:

POTENTIAL FUNDING SOURCES: Water Fund

PROGRESS MILESTONES:

8-Town of Erie: Zone 2 Water System Improvements**LIFELINE: Food Water Shelter****SUBCOMPONENT: Water**

PRIORITY: High	HAZARDS ADDRESSED: Severe storm (Extreme Temperatures), Drought
LOCATION: Linear project between WCR 3, WCR 7, SH 52 and Erie Parkway	GOALS ADDRESSED: 1 and 2
RECOMMENDATION DATE: Design 2021	
TARGET COMPLETION DATE: 2024	
ISSUE: The Zone 2 Waterline Improvement project will provide the first phase in a needed Zone 2 transmission waterline and new Zone 2 water storage tank. This transmission line and storage tank will provide reliability to the Zone 2 water system. It is also needed to get water out to the Zone 2 distribution system.	
RECOMMENDATION: begin the design and property acquisition for the storage tank and easements where the waterline is outside of right-of-way.	
ACTION: Zone 2 Water System Improvements	
LEAD AGENCY: Public Works (Todd Fessenden), 303-926-2895.	EXPECTED COST: \$12,000,000
SUPPORT AGENCIES:	POTENTIAL FUNDING SOURCES: Water Fund
PROGRESS MILESTONES:	

9-Town of Erie: Zone 3 Storage Tank**LIFELINE: Food Water Shelter****SUBCOMPONENT: Water**

PRIORITY: Medium	HAZARDS ADDRESSED: Severe storm, Drought
LOCATION: SW corner of Erie	GOALS ADDRESSED: 1 and 2
RECOMMENDATION DATE: Design 2021	
TARGET COMPLETION DATE: 2024	
ISSUE: The Zone 3 storage tank is needed for reliability. The existing tanks are on the east side of Erie, by placing a new storage tank on the west side it provides reliability and a balance to the water distribution system.	
RECOMMENDATION: begin the design and property acquisition for the storage tank and easements for waterlines needed to connect to the tank waterline is outside of right-of-way.	
ACTION: Zone 3 Water Storage Tank	
LEAD AGENCY: Public Works (Todd Fessenden), 303-926-2895.	EXPECTED COST: \$7,000,000
SUPPORT AGENCIES:	POTENTIAL FUNDING SOURCES: Water Fund
PROGRESS MILESTONES:	
10-Town of Erie: Zone 3 Waterline Improvements	
LIFELINE: Food Water Shelter	
SUBCOMPONENT: Water	
PRIORITY: High	HAZARDS ADDRESSED: Severe storm, Drought
LOCATION: from the existing water treatment facility west of 119th street to the existing water storage tank west of WCR 7.	GOALS ADDRESSED: 1 and 2
RECOMMENDATION DATE: Construction 2021	
TARGET COMPLETION DATE: 2021	
ISSUE: The Zone 3 Waterline Improvement project will provide an additional transmission waterline connecting the water treatment facility to the water storage tank site. It is not only needed to provide a back-up transmission line to the storage tank, but it is needed to get water out to the distribution system.	

9-Town of Erie: Zone 3 Storage Tank**LIFELINE: Food Water Shelter****SUBCOMPONENT: Water**

RECOMMENDATION: This project is 95% designed and will be ready to bid and begin construction in 2021.

ACTION: Zone 3 Waterline Improvements

LEAD AGENCY: Public Works (Todd Fessenden),
303-926-2895.

EXPECTED COST: \$5,200,000

SUPPORT AGENCIES:

POTENTIAL FUNDING SOURCES: Water Fund

PROGRESS MILESTONES:

11-Town of Erie : Erie Parkway & WCR 7 Intersection Improvements**LIFELINE: Transportation****SUBCOMPONENT: Roadway**

PRIORITY: High

HAZARDS ADDRESSED: Severe storm (Hail, Winter Storm)

LOCATION: Erie Parkway & WCR 7

GOALS ADDRESSED: 1 and 2

RECOMMENDATION DATE: Design 2020

TARGET COMPLETION DATE: 2021

ISSUE: The Town has designed the intersection improvements and is actively acquiring the additional ROW and easement needed for construction. The project includes adding turn lanes and a traffic signal. This intersection has experienced multiple accidents. The first phase is to improve the roadway and the second is to install a traffic signal.

RECOMMENDATION: Complete the right of way acquisition needed for the roadway improvements, then bid and construct the roadway improvements, then install the traffic signal.

ACTION: Erie Parkway & WCR 7 Intersection Improvements

LEAD AGENCY: Public Works (Todd Fessenden),
303-926-2895.

EXPECTED COST: \$4,000,000

SUPPORT AGENCIES:

POTENTIAL FUNDING SOURCES: Transportation Impact Fund
for roadway improvements, FHWA funding for Traffic Signal

PROGRESS MILESTONES:

12-Town of Erie: Signal Communication Project**LIFELINE: Transportation****SUBCOMPONENT: Roadway**

PRIORITY: High

HAZARDS ADDRESSED: Severe storm (Hail, Winter Storm)

LOCATION: Town wide

GOALS ADDRESSED: 1 and 2

RECOMMENDATION DATE: Design 2021

TARGET COMPLETION DATE: 2022

ISSUE: The Town began looking into a signal communications project in 2018. Without adequate funding the project was put on hold. The Town was successful in acquiring funding in late 2020 for the design and implementation of the project. This project will allow Town Staff to monitor and control the traffic signals. It will assist during storm events to monitor the roadway conditions. By having signals communicating traffic flow will be safer.

RECOMMENDATION: Complete the funding agreement, start the design and implement the communications project.

ACTION: Signal Communication Project

LEAD AGENCY: Public Works (Todd Fessenden),
303-926-2895.

EXPECTED COST: \$910,000

12-Town of Erie: Signal Communication Project**LIFELINE: Transportation****SUBCOMPONENT: Roadway**

SUPPORT AGENCIES:

POTENTIAL FUNDING SOURCES: General Fund, DRCOG
funding qualified intersections

PROGRESS MILESTONES:

Annex G: Town of Lyons

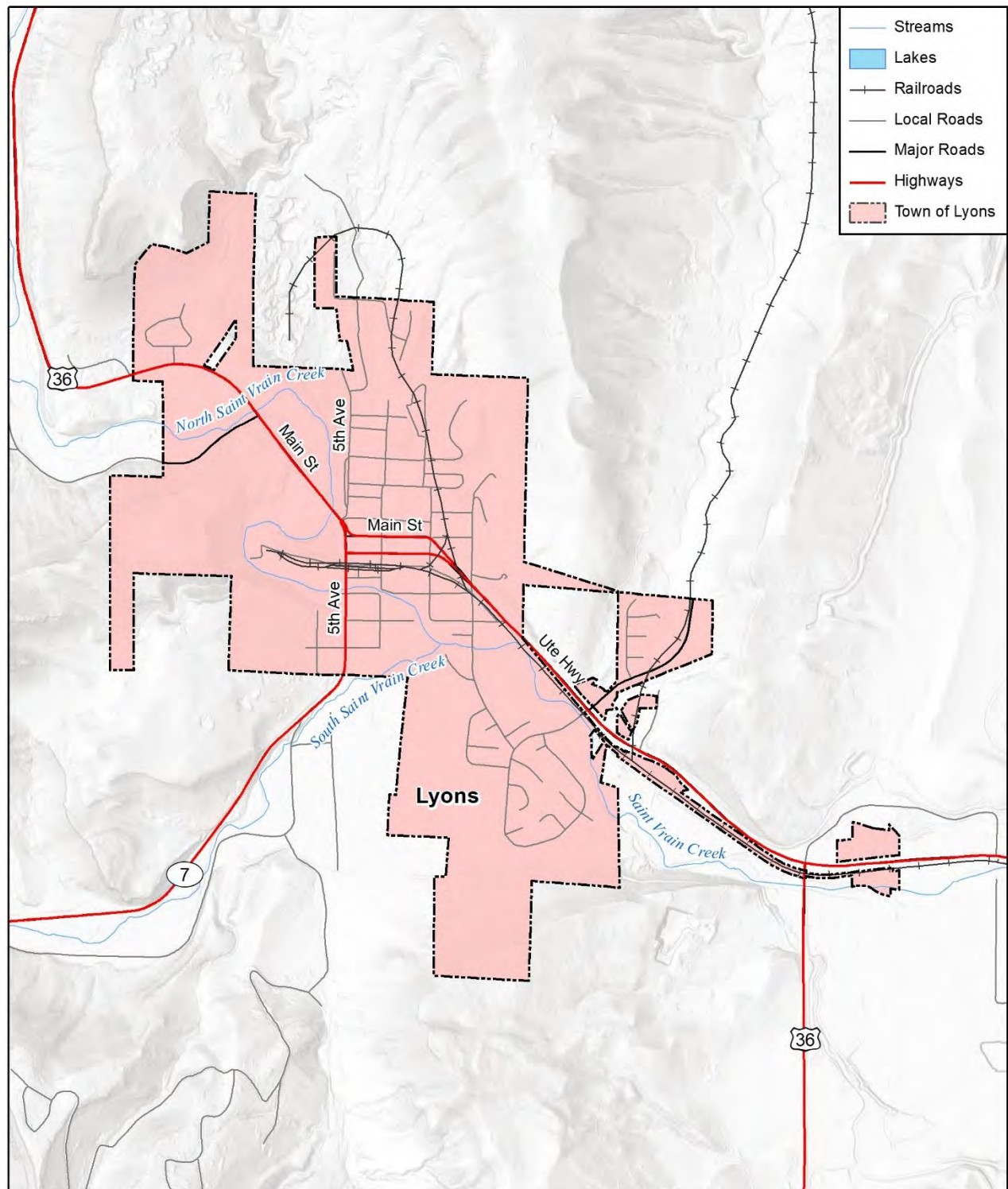
Annex G Town of Lyons

G.1 Community Profile

Lyons is a statutory town (1.3 square miles) in north-central Colorado, 14 miles northwest of Boulder and 10 miles west of Longmont. The Town lies at the base of a valley at an elevation averaging 5,374 feet surrounded by steep, red sandstone mountains. It is at the confluence of the South St. Vrain and the North St. Vrain Creek drainages on the east side of the Continental Divide. Lyons has mild climate, both in the summer and winter months.

In 1880, E.S. Lyon from Connecticut relocated to the area to improve his health. Lyons became established as a mining and agricultural center. The area contained durable salmon-red sandstone which was much in demand for building at the time. A new quarry town was plotted (although not incorporated until 1891). Within three years of its founding, Lyons had a narrow-gauge railroad, extended by the Denver, Utah, and Pacific Railroad, to haul out sandstone. The scale of quarrying expanded, and the Union Pacific was persuaded to extend a standard gauge to Lyons. Stone was then shipped to Omaha as well as to Denver. During this period about 1,000 tons of stone per day were quarried in Lyons. Around 1906, concrete began to replace stone in construction, and employment opportunities in the Town dwindled. Growth in Boulder County in the 1960s brought new residents to the Town (in the form of commuters) to Longmont and Boulder. Some quarrying continues, although the railroad spurs have been removed.

Today, Lyons is popular for outdoor recreation, outdoor wedding and events venues, music festivals, and art. It has maintained its unique character and has a vibrant Main Street that is occupied by small businesses, restaurants, and artisans. Figure G-1 details the extent of the Town of Lyons.

Figure G-1 Town of Lyons**wood.**

Map compiled 2/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT

0 0.25 0.5 Miles



G.1.1 Population

The estimated 2019 population of the Town of Lyons was 2,047 as projected by the Colorado Department of Local Affairs. This number was derived by multiplying the number of residential units receiving utility services from the Town of Lyons, by the average household size from the data below. Select U.S. Census Bureau American Community Survey (ACS) 2015-2019 5-year estimates for demographic and social characteristics of Lyons are shown in Table G-1.

Table G-1 Lyons Demographic and Social Characteristics

Characteristic	
Gender/Age	
Male (%)	47.8
Female (%)	52.2
Under 5 Years (%)	5.6
65 Years and Over (%)	7.5
Race/Ethnicity (one race)	
White (%)	94.2
Hispanic or Latino (Of Any Race) (%)	5.8
Other	
Average Household Size	2.36
High School Graduate or Higher (%)	90.7

Source: 2019 United States Census/American Community Survey

G.1.2 Economy

The Town of Lyons has a limited economic base to support its residents. There is no single large employer or industry. Lyons is primarily a bedroom community with approximately 200 independently owned small businesses. Most residents commute to the larger communities nearby for their employment. Farming and ranching still play a small role in the local economy. The businesses that are in Town are generally small local businesses, predominantly specialty retail and personal services stores and eating and drinking establishments that derive the greatest portion of their business from visitors. There are basic retail and personal services for residents including a market, post office, bank, and hardware store among the many artisan shops and restaurants.

According to the American Community Survey (ACS) 2015-2019 5-year estimates, the industries that employed most of Lyons' labor force were educational, health and social services (24%); professional, scientific, management, administrative, and waste management services (15.5%); manufacturing (14.3%); and other services, except public administration (7.2%). Select economic characteristics for Lyons from the American Community Survey (ACS) 2015-2019 5-year estimates are shown in Table G-2.

Table G-2 Lyons' Economic Characteristics

Characteristic	
Families below Poverty Level	0.9%
Individuals below Poverty Level	4.1%
Median Home Value	\$577,200
Median Household Income	\$103,533
Per Capita Income	\$47,538

Characteristic	
Population in Labor Force	1,124

Source: U.S. Census Bureau (2019 estimates), www.census.gov/

G.2 Hazard Summary

The hazards of most concern for Lyons includes dam failure, flood, severe winter storms, windstorms, and wildfire. Hillside development on steep slopes and ridgelines has been a major concern for reasons that include drainage impacts on downstream properties. There are also traffic concerns associated with a state highway serving as Main Street and single access points through existing neighborhoods.

With records dating back to 1894, Lyons has had some type of significant flood or fire event occur every decade. The worst in terms of flood was in 1941 and 1969, and most recently, 2013. The most recent nearby wildland fires burning over 1,000 acres each and causing millions of dollars of damage have occurred in 1988, 1989, 1990, 2000, 2003, 2010, and 2020. The historic town and surrounding local area have had damage or destruction to roads, bridges, homes, business, railroads, farmland, and streams. Localized, nuisance flooding and small wildland fires occur almost every year.

In 2017, The Town prepared a Hazard Identification and Risk Assessment (HIRA) to understand areas of vulnerability to hazards and to identify and refine actions which can be taken to reduce the local risk from potential hazards. The HIRA identifies and provides detailed data regarding hazards; inventory assets; analyze risks (potential impacts and estimated losses of each hazard); and assess the Town's overall vulnerability to hazards. The HIRA is intended to be a resource for planning and resilience capacity building, developed in accordance with the Disaster Mitigation Act of 2000. The HIRA was revisited and used as the basis for informing this Annex during the 2021 Boulder County HMP update.

Table G-3 Town of Lyons Hazard Summaries

Hazard Type	Geographic Extent	Occurrences	Magnitude / Severity	Increased Threat (Climate Change)	Hazard Level
Air Quality	Extensive	Highly Likely	Limited	Moderate	Medium
Avalanche	Limited	Occasional	Negligible	Low	Low
Communicable / Zoonotic Disease Outbreak	Limited	Occasional	Negligible	Substantial	Low
Dam and Levee Failure	Limited	Occasional	Critical	Moderate	High
Drought	Significant	Likely	Critical	Substantial	Medium
Earthquake	Significant	Unlikely	Limited	Low	Low
Extreme Temperatures	Extensive	Likely	Limited	Severe	Low
Expansive Soils	Significant	Highly Likely	Limited	Substantial	Low
Flood	Extensive	Highly Likely	Critical	Severe	High
Hailstorm	Significant	Likely	Limited	Moderate	Medium
Landslide	Limited	Likely	Limited	Substantial	Low
Lightning	Limited	Likely	Limited	Moderate	Medium
Severe Winter Storm	Extensive	Highly Likely	Limited	Substantial	Medium
Subsidence	Limited	Unlikely	Limited	Moderate	Low

Hazard Type	Geographic Extent	Occurrences	Magnitude / Severity	Increased Threat (Climate Change)	Hazard Level
Tornado	Limited	Occasional	Negligible	Low	Low
Wildfire	Significant	Likely	Limited	Severe	High
Windstorm	Extensive	Likely	Limited	Moderate	Low
Geographic Extent <ul style="list-style-type: none"> Limited: Less than 10% of planning area Significant: 10-50% of planning area Extensive: 50-100% of planning area Increase Threat from Climate Change <ul style="list-style-type: none"> Low- unlikely to become more of a threat due to climate change. Moderate – possibly will become more of a threat due to climate change. Substantial- likely to become more of a threat due to climate change. Severe- highly likely to become more of a threat due to climate change 		Probability of Future Occurrences <ul style="list-style-type: none"> Highly Likely: Near 100% chance of occurrence in next year or happens every year. Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less. Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years. Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years. Magnitude/Severity <ul style="list-style-type: none"> Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability. Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability. Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid Significance <ul style="list-style-type: none"> Low: minimal potential impact Medium: moderate potential impact High: widespread potential impact 			

Other hazards were discussed by the HIRA Advisory Committee, but ultimately not included in this plan. Hazards in the Boulder County Hazard Mitigation Plan that do not affect Lyons include avalanche, subsidence, and expansive soils. A 2017 geologic hazard study for Boulder County did not indicate the presence of subsidence or expansive soils in the area. Human health hazards including pandemic flu and West Nile Virus are considered in other planning mechanisms and not profiled in detail herein. Thunderstorm is not identified as an individual hazard, but is recognized for its role in the flood, lightning, and windstorm hazards, and is addressed accordingly in those hazard profiles.

G.3 Asset Inventory

As a starting point for analyzing the Town of Lyons' vulnerability to identified hazards, the Advisory Committee used a variety of data to define a baseline against which all disaster impacts could be compared. If a catastrophic disaster were to occur in the Town, the following information describes significant assets at risk. Data used in this baseline assessment included:

- Property Inventory,
- Critical Facilities and Other Assets,
- Economic Assets, and
- Natural, Historic, and Cultural Resources.

G.3.1 Property Inventory

Table G-4 represents an inventory of property in Lyons based on the Boulder County Assessor's data as of March 2022.

Table G-4 Lyons' Property Inventory

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
Agricultural	2	6	\$863,500	\$863,500	\$1,727,000
Commercial	42	55	\$15,447,800	\$15,447,800	\$30,895,600
Exempt	48	61	\$6,924,600	\$6,924,600	\$13,849,200
Industrial	7	4	\$189,000	\$283,500	\$472,500
Mixed Use	17	41	\$7,100,300	\$7,100,300	\$14,200,600
Residential	831	940	\$457,921,997	\$228,960,999	\$686,882,996
Total	947	1,107	\$488,447,197	\$259,580,699	\$748,027,896

Source: Boulder County Assessor's Office

G.3.2 Critical Facilities and Other Assets

Table G-5 is a detailed inventory of critical facilities derived from a variety of sources and organized based on their corresponding FEMA Lifeline Category. Figure G-2 below details the locations of these facilities.

Table G-5 Summary of Lyon's Critical Facilities by FEMA Lifeline Category

FEMA Lifeline	Total
Communications	2
Energy	-
Food/Water/Shelter	1
Hazardous Materials	1
Health and Medical	-
Safety and Security	10
Transportation	6
Total	21

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD

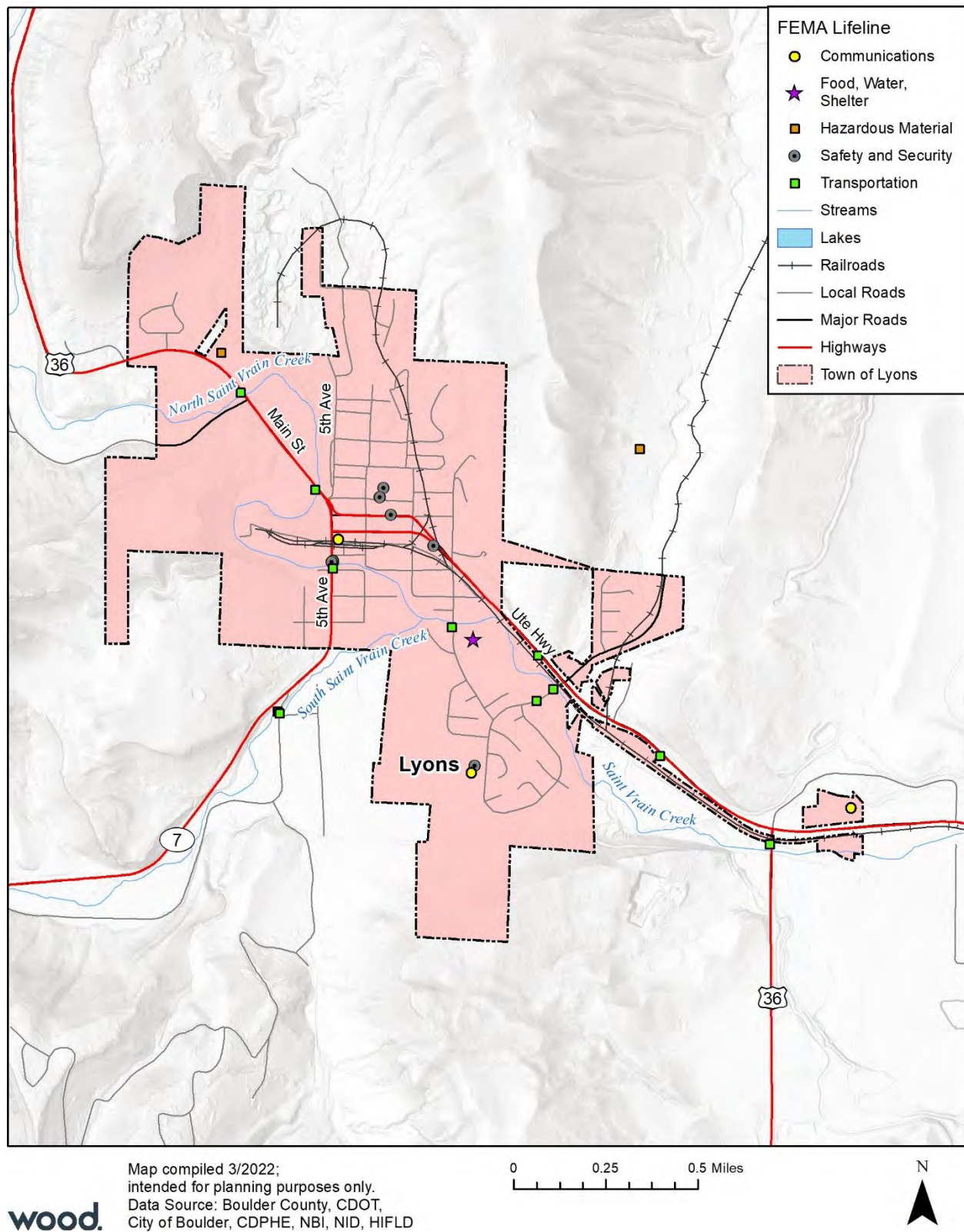
Figure G-2 Location of Critical Facilities in Lyons

Table G-6 is a detailed inventory of other assets identified by the Town's planning team.

Table G-6 Lyons Assets

Name of Asset	Type	Replacement Value (\$)	Displacement Cost (\$)	Occupancy/ Capacity #	Hazard Specific Info
Lyons Town Hall	Essential	2,500,000	\$4,109/day	20	100 yr. flood fire
Public Works / Sheriff's Office	High potential loss	1,000,000	\$3,060/day	6	100 yr. flood Fire
Wastewater plant	Essential	8,000,000	\$/day	2	100 yr. flood
Post Office Bldg., town owned	High potential loss	1,500,000	Loss of lease payment of \$268/day	8	100 yr. flood Fire
Walt Self Senior Housing	High potential loss	2,250,000		24	Dam failure Fire
Fire Station	Essential	1,200,000		40	Dam failure Fire
Public Works buildings Ute Hwy	High potential loss	2,000,000		16	Fire
Hwy 36 Bridge at Apple Valley	Transportation and lifeline	CDOT 10-15 million			Flood
Hwy 36 Bridge at 5 th Ave	Transportation and lifeline	CDOT 10-15 million			Flood
Hwy 7 Bridge at 5 th Ave	Transportation and lifeline	CDOT 10-15 million			Flood
McConnell St Bridge	Transportation and lifeline	2,800,000			Flood
Highway 36 in Lyons Town limits	Transportation and lifeline	25-35 million			Flood
Water and Sewer Lines	Essential	7 miles of infrastructure at \$150 per lin ft.; \$5,965,000	3,000/day		100 yr. flood
LaVern Johnson Park facilities	Economic	\$3,000,000	\$2,000/day	500	Flood/fire
Bohn Park Facilities	Economic	3,000,000	\$1,000/day	500	Flood/fire
Historic landmark 500 W Main and Planet Bluegrass	Historical asset	2,200,000		4,000 during an event, it is in the flood way	Flood
High school	High potential loss	20,500,000		500	Dam failure
Depot historical landmark	Historical	1,200,000	364/day	30	Flood, dam failure

Name of Asset	Type	Replacement Value (\$)	Displacement Cost (\$)	Occupancy/ Capacity #	Hazard Specific Info
Sandstone Park, visitor center and facilities	Economic	400,000	380/day		Fire, dam failure
Corridor Trail	Economic	1,000,000			Flood, dam
Water service high pump station	Transportation and lifeline	1,800,000	2,700/day		
Sewer lift stations	Transportation and lifeline	750,000	1,200/day		
Whitewater kayak park	Economic	1,250,000	380/day		
Town street paving	Transportation and lifeline	\$130/sq. yard			

G.3.3 Economic Assets

Economic assets at risk may include major employers or primary economic sectors, such as, agriculture, whose losses or inoperability would have severe impacts on the community and its ability to recover from disaster. After a disaster, economic vitality is the engine that drives recovery. Every community has a specific set of economic drivers, which are important to understand when planning to reduce disaster impacts to the economy. When major employers are unable to return to normal operations, impacts ripple throughout the community.

In 2019, the following were Lyons' major employers:

- St. Vrain Valley School District
- U.S. Postal Service
- Sierra Sage, LLC
- Mocon Inc.
- Town of Lyons Municipal Government
- Telluride Bluegrass Festival Inc.
- St. Vrain Market

G.3.4 Natural, Historic, And Cultural Resources

In evaluating the vulnerability of a given area to disaster, it is important to inventory the cultural and natural resources specific to that area. Cultural and natural resources are important to identify pre-disaster for four reasons:

- The Town may decide that these areas are worthy of a greater degree of protection than currently exists due to their unique and irreplaceable nature.
- Should these resources be impacted by a disaster, knowing about them ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts is high.
- The rules for repair, reconstruction, restoration, rehabilitation, and/or replacement usually differ from the norm.
- Natural resources, such as wetlands and riparian habitat, can have beneficial functions that contribute to the reduction of flood levels and damage.

Cultural and natural resources identified in the Town include:

- Planet Bluegrass
- Lyons Depot Building
- Lyons Regional Library
- Redstone Museum (old school building)
- Parks and open space
- Open space in Boulder County adjacent to Town
- North and South St Vrain Creek riparian areas

Table H.6 lists the properties in Lyons that are on the National Register of Historic Places and/or the Colorado State Register of Historic Properties (for more information about these registers, see Section 4.4 Vulnerability Assessment). Those properties that are only on the Colorado State Register are indicated with an asterisk.

Table G-7 Lyons' Historic Properties/Districts in National and State Registers

Property	Address	Date Listed
First Congregational Church of Lyons	High and 4th Streets	12/12/1976
Longmont Power Plant	Old Apple Valley Road	9/10/1987
Lyons Railroad Depot	400 block of Broadway	12/2/1974
Lyons Sandstone Buildings (Lyons Historic District)	U.S. 36 and CO 7	4/29/1980
LaVern Johnson Park Shelter House* Memorial**	600 Park Drive	3/10/1993
North St. Vrain Creek Bridge	CO 7 at milepost 32.98	10/15/2002

Sources: *Directory of Colorado State Register Properties*, www.coloradohistory-oahp.org/programareas/register/1503/; *National Register Information System*, www.nr.nps.gov/

*Only on the Colorado State Register of Historic Properties

**Was destroyed by the 2013 Flood and will be rebuilt as a memorial only

It should be noted that as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, if the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

G.4 Growth and Development Trends

Table G-8 illustrates how Lyons has grown in terms of population and number of housing units between 2010 and 2019.

Table G-8 Lyons' Change in Population and Housing Units, 2010-2019

2010 Population	2019 Population Estimate	Estimated Percent Change 2010-2019	2010 # of Housing Units	2019 # of Housing Units	Estimated Percent Change 2010-2019
2,038	2,047	+ < 1%	968	909	6.09%

Source: Colorado Division of Local Government State Demography Office, www.dola.colorado.gov/dlg/demog/

Much of the Town has been developed within and around the floodplains of the St Vrain creek corridors. One of the unique factors constraining the Town's growth is the lack of developable land outside of the floodplain. For several decades, the Boulder County Open Space program has purchased land surrounding the Town of Lyons, including within the Town's planning area. This, combined with a historic growth in housing demand, has left the Town with virtually no developable land to relocate housing or critical public facilities that are in the floodplain. The few parcels or lots that do exist are constrained by conservation

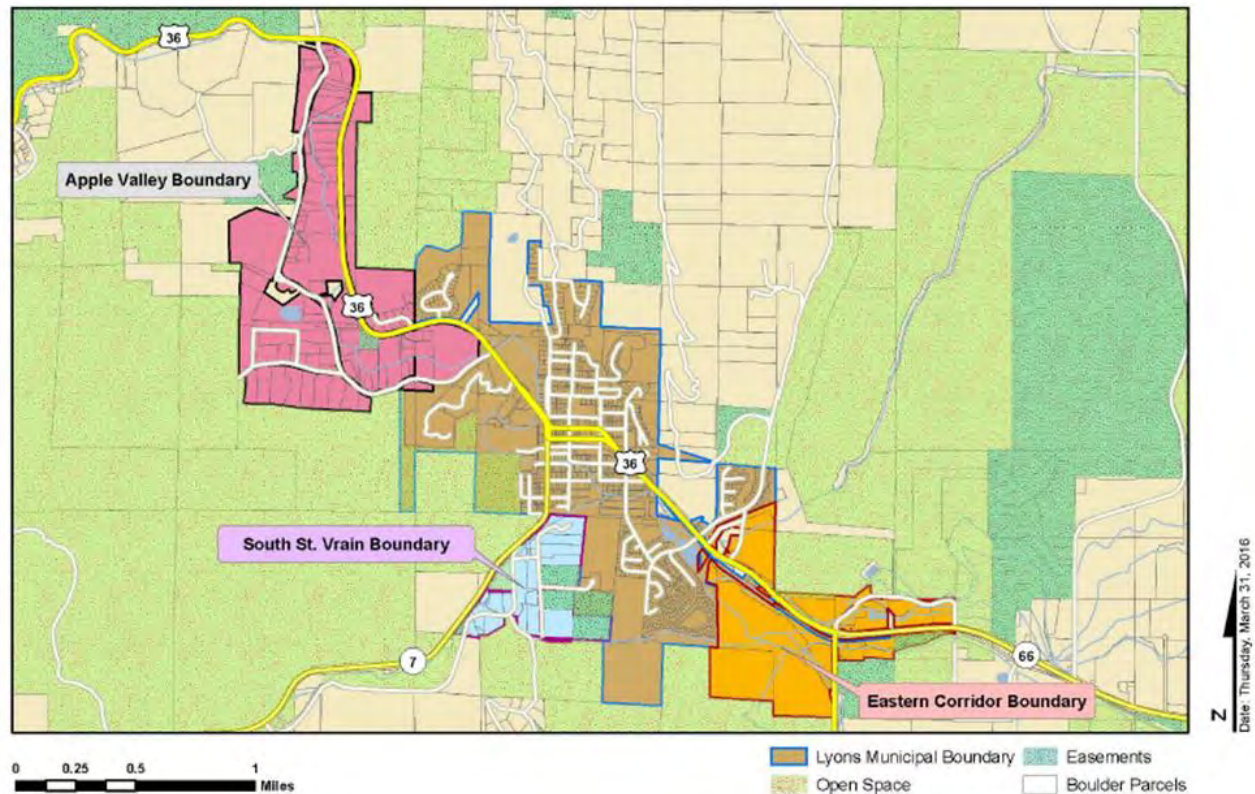
easements, terrain unsuitable for development, or extremely high prices that make it difficult for the Town to purchase them (APA CPAT Report 2014).

The Lyons Comprehensive Plan (March 2010 and updated in 2021) is the primary long-term planning document for the Town, providing the framework for decisions that affect the Town's physical, social, and economic characteristics. It is intended to provide a foundation for policy direction, land use decisions, and public investments. It is also meant to help the Town prioritize and direct resources toward special initiatives that will help achieve community goals. The Comprehensive Plan recognized and affirmed the necessity to grow and diversify the Town's economy through expansion of its municipal boundaries. The community's Economic Development Commission has also suggested that expansion will be essential, as land for development is becoming increasingly scarce and properties previously targeted for future development have either been purchased by Boulder County for open space or designated as "no development areas." While most parcels within the Town are largely developed, the Town is considering annexations and development within the Lyons Primary Planning Area (LPPA) as described in the 2017 LPPA Master Plan (which serves as an amendment to the 2010 Comprehensive Plan). The Lyons Primary Planning Area consists of three Subareas: The Eastern Corridor, South St. Vrain and Apple Valley shown in Figure G-3 below. The LPPA Master Plan explains that "to this end, it will be imperative that the Town continually monitor impacts associated with growth. In addition, it will be important to maintain high standards for development within a proactive, yet protective investment climate." The following maps come from the 2017 LPPA Master Plan.

For the purposes of this HIRA the planning area includes the incorporated boundaries of Lyons as well as the LPPA subareas as potential growth areas into adjacent unincorporated Boulder County. The vulnerability of all these areas is analyzed further by hazard and broken out by sub area where feasible. The Advisory Committee noted that as of May 2017 development was pending in the Eastern LPPA for a Town Public Works building/yard.

The Town of Lyons is approaching build out for single-family residential homes and this should occur within the next two years. Additional residential development will need to be higher density infill unless annexation occurs.

Development along the St. Vrain River is a concern with respect to flood safety issues. Some redevelopment is occurring in the 1% special hazard flood area and would be at risk during a future flooding event. In 2013, 45 mobile home units were destroyed and have not been replaced. Additionally, 28 residential properties that were damaged in the flood were purchased through the FEMA HMGP and CDBG-DR programs.

Figure G-3 Lyons Primary Planning Area

G.5 Vulnerability Assessment

The intent of this section is to assess Lyons' vulnerability separate from that of the planning area as a whole, which has already been assessed in Sections 4.4 Vulnerability Assessment and 4.5 Estimating Potential Losses of the Base plan. This vulnerability assessment analyzes the population, property, critical facilities, and other assets at risk for the more significant hazards or where available data permits a more in-depth analysis. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment of the Base Plan.

Table G-5 and Table G-6 lists summary information about the 21 critical facilities and other community assets identified by Lyons' HMPC as important to protect or provide critical services in the event of a disaster. For additional information on the definitions behind each critical facility category, source, and other details refer to Section 3.3.2 of the Base Plan.

G.5.1 Vulnerability by Hazard

The hazard summaries in Table G-3 above reflect the hazards that could potentially affect Lyons. Based on this analysis, the priority hazards (High Significance) for mitigation are dam failure, flood, severe winter storms, windstorms, and wildfire. Those of Medium or High significance for the Town of Lyons are identified in Table G-3.

Due to the ability to quantify vulnerability further with available data, only the dam, flood, and wildfire hazards will be profiled in the following vulnerability assessment section.

Hazards assigned a significance rating of Low and which do not differ significantly from the County ranking (e.g., Low vs. High) are not addressed further in this plan and are not assessed individually for specific

vulnerabilities in this section.

Dam Failure

Dams are manmade structures built for a variety of uses, including flood protection, power, agriculture, water supply, and recreation. Dams typically are constructed of earth, rock, concrete, or mine tailings. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded and the density, type, and value of development and infrastructure located downstream.

Dam failures can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding, which result in overtopping
- Earthquake
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage or piping or rodent activity
- Improper design
- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway

General Property

While there is no concrete data available to indicate any likelihood of failure, based on best available dam inundation data there might be structures potentially at risk of dam failure flooding. The dam failure inundation maps contain sensitive information and are not available for display in this public planning document. Based on a GIS analysis performed with the county parcel layer and the available dam inundation mapping (for planning purposes only), the following potential damages would be expected in Lyons.

Table G-9 Estimated Dam Inundation Exposure to Properties in Lyons

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Agricultural	1	4	\$555,200	\$555,200	\$1,110,400	
Commercial	10	18	\$3,262,000	\$3,262,000	\$6,524,000	
Exempt	35	41	\$2,693,800	\$2,693,800	\$5,387,600	
Industrial	1	3	\$1,000	\$1,500	\$2,500	
Mixed Use	4	17	\$2,494,000	\$2,494,000	\$4,988,000	43
Residential	240	268	\$120,976,369	\$60,488,185	\$181,464,554	678
Total	291	351	\$129,982,369	\$69,494,685	\$199,477,054	721

Source: Boulder County GIS and Assessor's Office, U.S Census, Wood Analysis

People

As shown in the table above, GIS analysis indicates that approximately 721 residents of Lyons may reside within dam inundation zones in the town. According to the Lyons 2017 HIRA, a large portion of the town core adjacent to the North St Vrain River would need to be evacuated in the event of a failure at Button Rock Dam. The message would be to get to high ground quickly as the water could reach the town within 55 minutes.

Critical Facilities and Infrastructure

Based on the GIS analysis summarized in Table G-10, it is expected that 12 critical facilities in Lyons might be at risk of dam inundation hazards. It is likely all the bridges over the North St Vrain would be destroyed,

resulting in loss of mobility and compromised access/egress.

Table G-10 Lyons' Critical Facilities at Risk of Dam Failure

FEMA Lifeline	Count
Communications	1
Food, Water, Shelter	1
Safety and Security	4
Transportation	6
Total	12

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Economy

In addition to commercial and residential building impacts and direct damages, a dam inundation event which affected the major roads in and around Lyons would significantly impact the economy by impeding regular business access, shipping, and travel. This could significantly affect the local economy, by limiting or completely impeding access to shops, restaurants, hotels, and other major industries which keep the local economy thriving.

Historical, Cultural, and Natural Resources

Dam or reservoir failure effects on the environment would be similar to those caused by flooding from other causes. For the most part the environment is resilient and would be able to rebound, though this process could take years. However, historic and cultural resources could be affected just as housing or critical infrastructures would. According to the 2017 Lyons HIRA Planet Bluegrass is located within the Button Rock inundation zone, which is a significant cultural resource and economic asset to the town. A large number of people attend music festivals in the summer months at this venue

Flood

The Town of Lyons has two major creeks, the North and South St Vrain that have a confluence in the core of the Town, and smaller watersheds that are prone to flash flooding. The Town is situated in a watershed that drops in elevation dramatically, where excess rain and snow can contribute to downstream flooding. Other basins within or draining into the Town include Red Hill Gulch, Eagle Canyon, Steamboat Valley, Third Avenue, Ewald Avenue, North St Vrain, South St Vrain, Lyons valley Park and Stone Canyon.

The Town's location at the base of the foothills of the Rocky Mountains makes it vulnerable to flash flooding that can occur with little or no warning. Within the Town, two types of flooding are of concern: flash flooding that is likely to result in damage to property and life-safety issues and stormwater drainage flooding, which results from more frequent minor storm events that occur every year but are less damaging in nature. Figure G-4 illustrates the extent of the town's mapped flood hazard areas.

According to the Lyons 2017 HIRA, the most devastating flood event in the Town of Lyons is the September 2013 floods. In the Saint Vrain Basin 17 inches of rain fell and sustained approximately 25,000 cfs causing flooding to the Town of Lyons, Hygiene, and Longmont. 1 person died while evacuating their home. The flood destroyed critical segments of the Town's electrical, sewage, and potable water systems, as well as damaging or destroying nearly 30% of the Town's housing stock. The floodwaters breached the wastewater treatment facility, contaminating Lyon's water supply. Multiple sections of the St. Vrain left the original channel and the flood permanently damaged many of the Town's roads, bridges, parks, trails, and stream channels. Floodwaters also destroyed Lyons Public Works facilities and equipment and inundated the Town Hall and Library building. The total amount of damage to the Town of Lyons was estimated at \$50 million,

including \$5 million in temporary measures.

General Property

Vulnerability to flooding was determined by summing potential losses to Lyons' properties in GIS, by using the latest FEMA NFHL data along with the Boulder County parcel layer provided by the Assessor's Office. FEMA's NFHL data depicts the 1% annual chance (100-year) and the 0.2% annual chance (500-year) flood events. Figure G-4 below displays Lyons' FEMA special flood hazard areas present in the town, color coded based on flood event (i.e. 100-year versus 500-year).

Based on the GIS analysis performed with the county parcel layer and the available FEMA flood mapping, the potential risk for the Town is shown in Table G-11. Lyons' 1% annual chance flood zone presents has 142 buildings and over an estimated \$48.4 million in total value exposed. Potential estimated losses in this flood scenario could be as high as \$12 million. In the 0.2% annual chance flood zone there are 114 buildings and \$62.3 million in total property value.

Table G-11 Summary of Lyons Properties Vulnerable to 1% Annual Chance Flood Events, by Property Type

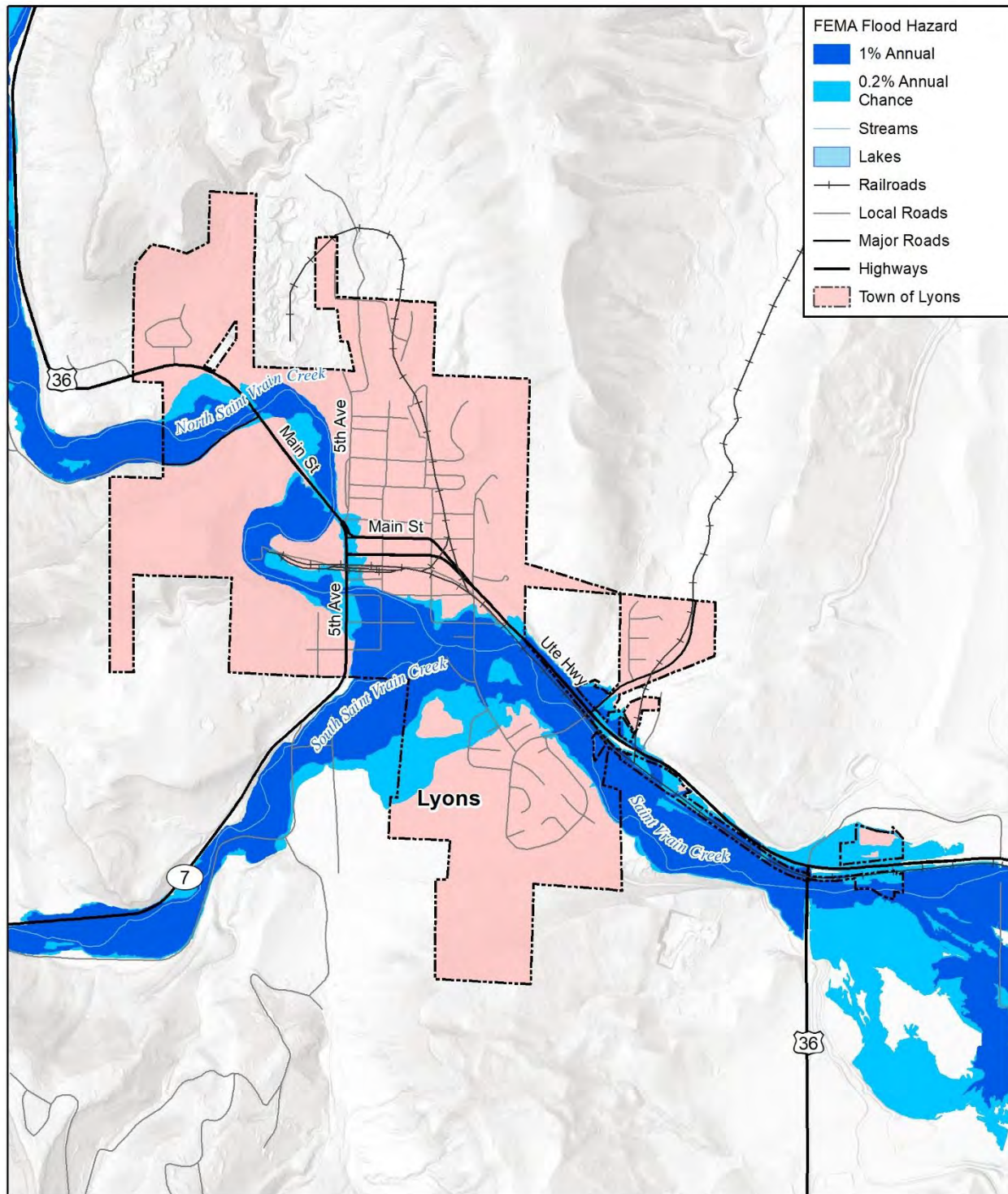
Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Agricultural	1	1	\$308,300	\$308,300	\$616,600	\$154,150	
Commercial	4	8	\$512,700	\$512,700	\$1,025,400	\$256,350	
Exempt	25	29	\$561,900	\$561,900	\$1,123,800	\$280,950	
Industrial	1	1	\$1,000	\$1,500	\$2,500	\$625	
Mixed Use	1	8	\$73,100	\$73,100	\$146,200	\$36,550	20
Residential	69	95	\$30,371,315	\$15,185,658	\$45,556,973	\$11,389,243	240
Total	101	142	\$31,828,315	\$16,643,158	\$48,471,473	\$12,117,868	261

Source: Boulder County, FEMA NFHL, U.S., Census Bureau, Wood Analysis

Table G-12 Summary of Lyons Properties Vulnerable to 0.2% Annual Chance Flood Events, by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Agricultural	1	6	\$555,200	\$555,200	\$1,110,400	\$277,600	
Commercial	8	14	\$3,343,800	\$3,343,800	\$6,687,600	\$1,671,900	
Exempt	8	9	\$1,320,800	\$1,320,800	\$2,641,600	\$660,400	
Mixed Use	4	13	\$2,494,000	\$2,494,000	\$4,988,000	\$1,247,000	33
Residential	74	72	\$31,225,794	\$15,612,897	\$46,838,691	\$11,709,673	182
Total	95	114	\$38,939,594	\$23,326,697	\$62,266,291	\$15,566,573	215

Source: Boulder County, FEMA NFHL, U.S., Census Bureau, Wood Analysis

Figure G-4 Town of Lyons FEMA Flood Hazards

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
FEMA NFHL Effective 8/15/2019, Preliminary 9/30/2019

wood.

0 0.25 0.5 Miles



People

Vulnerable populations in the Town include residents living in known flooding areas or near areas vulnerable to flash floods. Certain populations are particularly vulnerable. This may include the elderly and very young; mobile homes; low-income housing areas; tourists and visitors; and those with developmental, physical, or sensory disabilities. These populations may be more vulnerable to flooding due to limitations of movement, fiscal income, challenges in receiving and understanding warnings, or unfamiliarity with surroundings.

The population exposed to the flood hazards described in the flood vulnerability analysis above was estimated by applying an average household size factor to the number of improved residential properties identified in the flood hazard areas within Lyons. These estimates yielded the population exposures shown in the table above in Table G-11 and Table G-12. As such, the 1% annual chance flood event would potentially displace 261 people and 215 people in the 0.2% annual chance flood, based on the residential structures which fall in those flood zones. For additional details on potential displacements by flood event, see the Boulder County Base Plan.

Critical Facilities and Infrastructure

There is a total of 3 critical facilities in Lyons located in the 1% flood hazard area, all of which are within the transportation FEMA Lifeline Category. These transportation lifelines are likely all bridges. Table G-13 details the critical facilities located in the 0.2% annual chance flood hazard zone.

Table G-13 Lyons Critical Facilities Exposed to 0.2% Annual Chance Flood Hazard by FEMA Lifeline Category

FEMA Lifeline	Count
Communications	1
Food, Water, Shelter	1
Transportation	3
Total	5

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Economy

Flooding can have a major economic impact on the economy, including indirect losses such as business interruption, lost wages, and other downtime costs. Flooding often coincides with the busy summer tourism months in Boulder County, and may impact, directly or indirectly (such as from the negative perception of potential danger to his hazard), the revenues of shops, restaurants, hotels, and other major industries which keep the local economy thriving. Flooding can also obviously result in massive direct losses to the economy in the form of damages to buildings.

Based on the risk assessment and the Lyons 2017 HIRA, it is evident that floods will continue to have potentially devastating economic impacts to Lyons. In addition to the damage losses previously quantified, there are impacts that are not quantified, but can be anticipated in future events, which include:

- Disruption of and damage to public infrastructure
- Injury and loss of life;
- Health hazards associated with mold and mildew;
- Damage to roads/bridges resulting in loss of mobility and compromised access/egress;
- Significant economic impact (jobs, sales, tax revenue) upon the community;
- Negative impact on commercial and residential property values;
- Deposition of sediment in confluence area

- Transportation egress/access issues, and
- Significant disruption to students and teachers as temporary facilities and relocations would likely be needed

Historical, Cultural, and Natural Resources

The environment is mostly resilient to general flooding. However, cultural or historic properties within floodplains would be affected in similar ways as property and critical facilities/infrastructure, especially those with underground or basement levels where water would easily seep and potential ruin archives, resources, or other important assets. Cultural resources at risk in Lyons include the library and Planet Bluegrass in 0.2% annual chance zone.

Wildfire

Wildfire and urban wildfire are an ongoing concern for the Town of Lyons, as the community is surrounded by high risk wildfire areas. Generally, the fire season extends from spring to late fall, though fire can occur at any time of year depending on weather conditions.

Potential losses from wildfire include human life; structures and other improvements; natural and cultural resources; quality and quantity of the water supply; assets such as timber, range and crop land, and recreational opportunities; and economic losses. Smoke and air pollution from wildfires can be a severe health hazard. In addition, catastrophic wildfire can lead to secondary impacts or losses, such as future increased flooding and landslides debris flows during heavy rains.

General Property

Wildfire threat was estimated from the County's Wildfire Protection Assessment Rating layer, which classifies areas into Lowest, Low, Moderate, High, and Highest ratings. Parcel analysis was conducted using GIS to analyze where parcels, buildings counts, property types and content values intersected with the wildfire hazards zones defined by the Colorado Forest Atlas, from highest to lowest risk. The Colorado Forest Atlas calculates a composite risk rating, defined as the possibility of loss or harm occurring from a wildfire. It identifies areas with the greatest potential impacts from a wildfire – i.e. those areas most at risk - considering all values and assets combined together – WUI Risk, Drinking Water Risk, Forest Assets Risk and Riparian Areas Risk. This risk index has been calculated consistently for all areas in Colorado, allowing for comparison and ordination of areas across the entire state

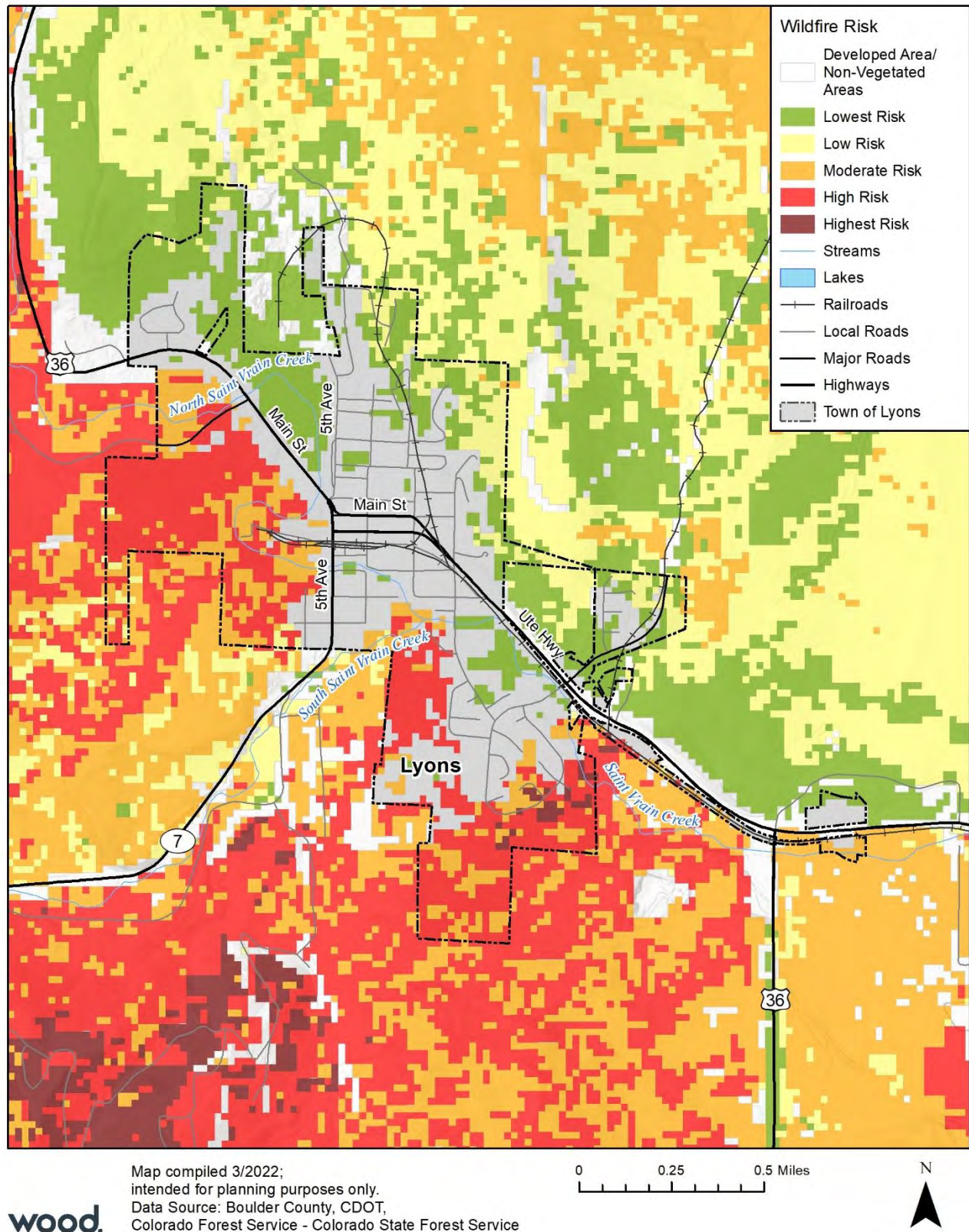
For the purposes of this analysis, the wildfire zone that intersected a parcel centroid was assigned as the threat zone for the entire parcel. Improvement values were then summed by wildfire rating area and then sorted by parcel type. Property improvements and estimated content values were then totaled to arrive at the Total Value column, which is also the estimated potential loss as wildfires typically result in complete loss to structure and contents. Lyons properties at risk to wildfires are listed in Table G-14 below and the wildfire risk areas are displayed in Figure G-5.

Table G-14 Property Values in Wildfire Zones by Parcel Type for Lyons

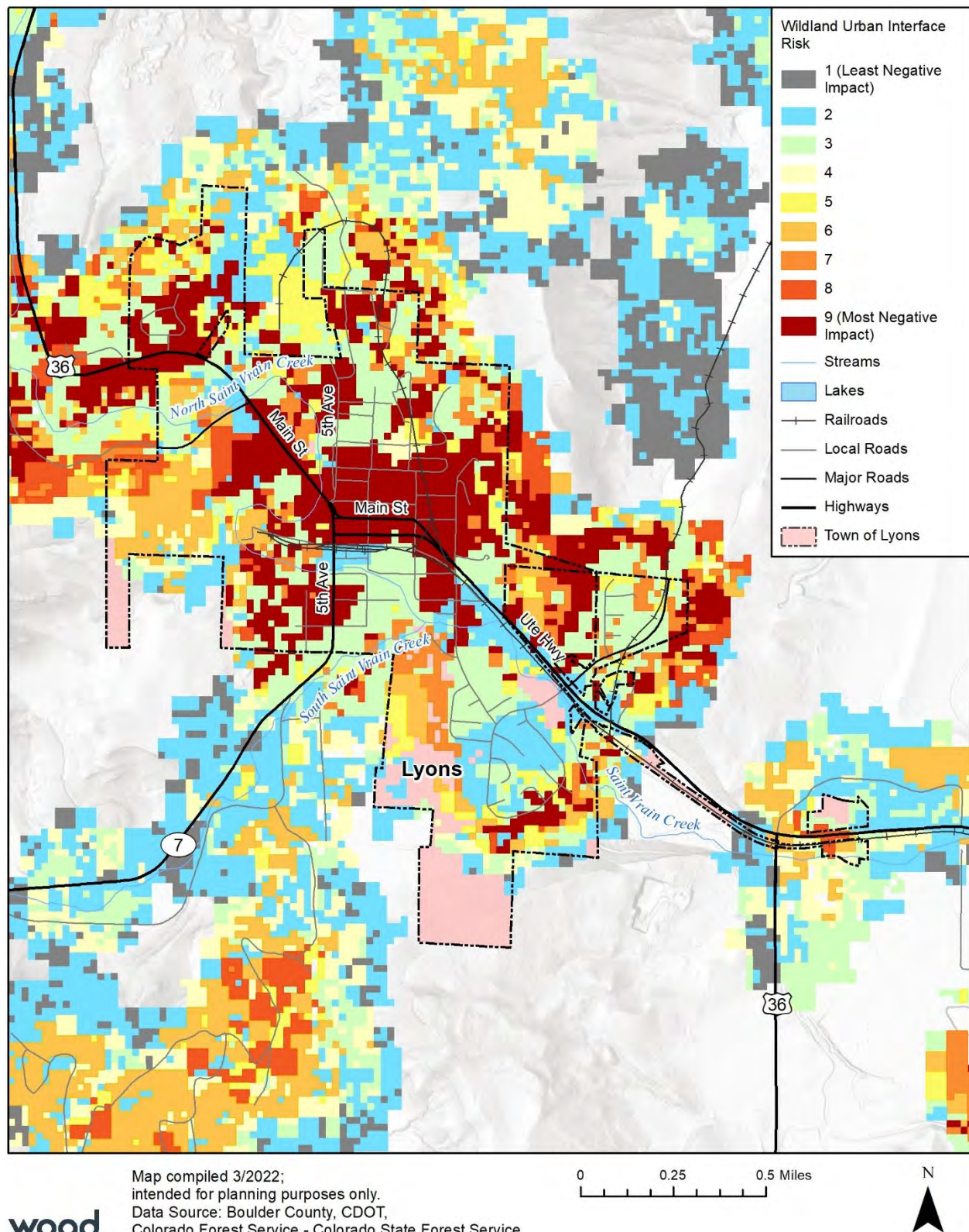
Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Highest Wildfire Risk Hazard						
Exempt	1	4	\$0	\$0	\$0	
Residential	8	63	\$5,753,900	\$2,876,950	\$8,630,850	159
Total	9	67	\$5,753,900	\$2,876,950	\$8,630,850	159
High Wildfire Risk Hazard						

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Exempt	2	1	\$48,700	\$48,700	\$97,400	
Mixed Use	2	2	\$762,400	\$762,400	\$1,524,800	5
Residential	39	39	\$23,467,190	\$11,733,595	\$35,200,785	99
Total	43	42	\$24,278,290	\$12,544,695	\$36,822,985	104
Moderate Wildfire Risk Hazard						
Exempt	3	7	\$7,166,200	\$7,166,200	\$14,332,400	
Industrial	2	9	\$26,387,300	\$39,580,950	\$65,968,250	
Residential	8	18	\$4,652,581	\$2,326,291	\$6,978,872	44
Total	13	34	\$38,206,081	\$49,073,441	\$87,279,522	44
Low Wildfire Risk Hazard						
Residential	33	52	\$25,428,600	\$12,714,300	\$38,142,900	132
Total	33	52	\$25,428,600	\$12,714,300	\$38,142,900	132
Lowest Wildfire Risk Hazard						
Commercial	2	7	\$511,000	\$511,000	\$1,022,000	
Exempt	2	7	\$92,200	\$92,200	\$184,400	
Mixed Use	1	12	\$1,845,200	\$1,845,200	\$3,690,400	30
Residential	101	145	\$65,966,991	\$32,983,496	\$98,950,487	367
Total	106	171	\$68,415,391	\$35,431,896	\$103,847,287	397

Source: Boulder County Assessor's Office, Colorado State Forest Service Wood Analysis

Figure G-5 Town of Lyons Wildfire Risk

The Colorado Forest Atlas also provides an analysis for Wildland-Urban Interface (WUI) risk based on housing density consistent with Federal Register National standards. The location of people living in the wildland-urban interface and rural areas is essential for defining potential wildfire impacts to people and homes. To calculate the WUI Risk Index, the WUI housing density data was combined with flame length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9, while areas with low housing density and low flame lengths are rated -1. Data is modelled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers. WUI Risk for Lyons is mapped in Figure G-6.

Figure G-6 Town of Lyons WUI Risk

wood.

Table G-15 Town of Lyons High WUI Risk Hazard by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Commercial	29	37	\$11,189,500	\$11,189,500	\$22,379,000	
Exempt	16	21	\$3,035,000	\$3,035,000	\$6,070,000	
Industrial	6	1	\$188,000	\$282,000	\$470,000	
Mixed Use	13	26	\$5,762,200	\$5,762,200	\$11,524,400	66
Residential	348	420	\$182,812,863	\$91,406,432	\$274,219,295	1,063
Total	412	505	\$202,987,563	\$111,675,132	\$314,662,695	1,128

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

Table G-16 Town of Lyons Moderate WUI Risk Hazard by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Agricultural	1	2	\$308,300	\$308,300	\$616,600	
Commercial	1	3	\$78,000	\$78,000	\$156,000	
Exempt	1	2	\$48,700	\$48,700	\$97,400	
Industrial	1	1	\$1,000	\$1,500	\$2,500	
Mixed Use	1	2	\$689,300	\$689,300	\$1,378,600	5
Residential	62	61	\$35,571,110	\$17,785,555	\$53,356,665	154
Total	67	71	\$36,696,410	\$18,911,355	\$55,607,765	159

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

Table G-17 Town of Lyons Low WUI Risk Hazard by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Agricultural	1	3	\$555,200	\$555,200	\$1,110,400	
Commercial	10	10	\$3,103,300	\$3,103,300	\$6,206,600	
Exempt	29	34	\$3,010,900	\$3,010,900	\$6,021,800	
Mixed Use	3	12	\$648,800	\$648,800	\$1,297,600	30
Residential	414	454	\$236,437,524	\$118,218,762	\$354,656,286	1,149
Total	457	513	\$243,755,724	\$125,536,962	\$369,292,686	1,179

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

The properties most at WUI Risk in Lyons are residential with 420 high, 61 moderate, and 454 low risk residential structures, together representing upwards of \$739.6 million in total property value across all WUI risk areas.

People

The last column of Table G-14, Table G-15, Table G-16, and Table G-17 above summarizes the estimated number of people at risk to wildfire in the analyzed fire zones. Based on the assessment conducted, Lyons has an estimated 836 people residing in wildfire risk areas, along with more than 2,000 people within Lyons residing in WUI Risk areas, essentially the entire population of the town. These totals were estimated by multiplying the average persons per household in Lyons by the number of residential properties falling within the fire zones. Smoke resulting from fire is an issue to local populations also.

Critical Facilities and Infrastructure

A total of 3 critical facilities in Lyons were identified to be in the lowest wildfire risk zone. There are also 19 critical facilities located in WUI risk areas in Lyons, summarized in Table G-18.

Table G-18 Critical Facilities WUI Risk in Lyons by FEMA Lifeline Category

FEMA Lifeline	Count
High WUI Risk Hazard	
Communications	1
Safety and Security	5
Transportation	2
Total	8
Low WUI Risk Hazard	
Communications	2
Food, Water, Shelter	1
Hazardous Material	1
Safety and Security	5
Transportation	2
Total	11

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Economy

Tourism, the accommodation and food services industry (e.g. hotels and restaurants), and retail are major components of Boulder County's economy, and Lyons' as well. Wildland fires can, for example, lead to significant tourism reductions due to health and safety concerns, causing lost revenues from lack of visitation, stays in hotels, spending on restaurants and other commerce sources, and more.

Historical, Cultural and Natural Resources

Wildfires are a common and naturally occurring phenomenon in forested areas and can benefit forest health in many respects. But the climate change trend which is leading to hotter, more widespread, and destructive fires can make it more difficult for the environment to recover, and lead to increased flood runoff or other secondary/cascading hazards, such as erosion, landslides, mudslides, and debris flows, and flooding. This can severely impact water quality and watershed health for years after a fire. Wildfires can negatively impact air quality, water quality, and vegetation and biodiversity.

The St. Vrain watershed and the Buttonrock Reservoir are among the areas around Lyons that could be impacted by wildfire. Large-scale wildfire could result in the degradation of the watershed, which could result in deposition of debris into water sources.

With regards to historic or cultural structures and resources, wildfires would affect those in similar ways as general property and critical facilities/infrastructure, having the potential for burn downs and hence possible complete loss of important historical assets. Given the entirety of Lyons is within WUI risk areas, it is safe to assume that all historic and cultural resources in the town are potentially vulnerable to wildfire.

G.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment summarizes Lyons' regulatory mitigation capabilities, administrative and technical mitigation capabilities, and fiscal mitigation capabilities

and then discusses these capabilities in further detail along with other mitigation efforts as they pertain to the National Flood Insurance Program's Community Rating System (CRS). Although the CRS is flood-focused, this discussion also incorporates activities related to other hazards into the categories established by the CRS.

G.6.1 Mitigation Capabilities Summary

Table G-19 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Lyons.

Table G-19 Lyons' Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Master plan	Yes	Town of Lyons Comprehensive Plan, 2010 to be updated in 2021, Lyons Recovery Action Plan, 2014
Zoning ordinance	Yes	Lyons Municipal Code
Subdivision ordinance	Yes	Lyons Municipal Code
Growth management ordinance	Yes	Growth is controlled by IGA with Boulder County and annexation regulations
Floodplain ordinance	Yes	Ordinance 920, updated in 2012
Participation in the National Flood Insurance Program (NFIP)	Yes	Joined 8/1/1980
Participate in the Community Rating System (CRS)	No	
Site plan review requirements	Yes	Lyons Municipal Code
Other special purpose ordinance (stormwater, steep slope, wildfire)	Yes	Stormwater Master Plan 2016, steep slope
Building code	Yes	2015 International Building Code
BCEGS Rating	No	
Fire department ISO rating	Yes	Lyons Fire Protection District Rating: 3
Erosion or sediment control program	Yes	Building Regulations
Stormwater management program	Yes	Lyons Municipal Code
Capital improvements plan	Yes	Updated Annually
Economic development plan	Yes	Annual Work Plans from the Economic Development Commission
Local emergency operations plan	Yes	Emergency Operations Plan Boulder County
Other special plans	Yes	Boulder County OEM, Lyons Flood Hazard Mitigation Plan, 1994, Lyons COOP Plan, 2013
Flood insurance study or other engineering study for streams	Yes	FEMA Flood Insurance Study, December 18, 2012; Letter of Map revision
Elevation certificates	Yes	Required before, during and after construction in SHFA
Community Wildfire Protection Plan (CWPP)	Yes	Lyons FPD CWPP

Table G-20 identifies the personnel responsible for mitigation and loss prevention activities as well as related data and systems in Lyons.

Table G-20 Lyons' Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/engineer with knowledge of land development/land management practices	Yes	Staff and Independent Contractors in Place	Planning Staff and MurraySmith
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Independent Contractors	MurraySmith and Charles Abbott and Associates (CAA)
Planner/engineer/scientist with an understanding of natural hazards	Yes	Independent Contractors	Certified Flood Plain Manager
Transportation Planner	Yes	Planning Staff	
Resiliency Planner	Yes	Planning/Utilities Staff	
Personnel skilled in GIS	Yes	Planning Staff	Boulder County Assistance
Full-time building official	Yes	Independent Contractor	CAA
Floodplain manager	Yes	Town Administrator Victoria Simonsen	
Emergency manager	Yes	Boulder County Office of Emergency Management	Town Administrator in conjunction with BCSO
Grant writer	Yes	Town of Lyons Staff	
GIS Data – Hazard areas	Yes	Boulder County GIS Coordinator	
GIS Data – Critical facilities	Yes	Boulder County GIS Coordinator	
GIS Data – Building footprints	Yes	Boulder County GIS Coordinator	
GIS Data – Land use	Yes	Boulder County GIS Coordinator	
GIS Data – Links to assessor's data	Yes	Boulder County GIS Coordinator	
Warning systems/services (Reverse 9-11, cable override, outdoor warning signals)	Yes	Contract with Boulder Regional Communications Center, Boulder County Sheriff's Office	Reverse 9-11, outdoor sirens
Other			

Table G-21 identifies financial tools or resources that Lyons could potentially use to help fund mitigation activities.

Table G-21 Lyons' Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Yes/No)	Comments
Community Development Block Grants	Yes	Grant cycle and availability of funds
Capital improvements project funding	Yes	Limited resources
Authority to levy taxes for specific purposes	Yes	With voter approval
Fees for water, sewer, gas, or electric services	Yes	By Board of Trustees ordinance

Financial Resources	Accessible/Eligible to Use (Yes/No)	Comments
Impact fees for new development	Yes	By Board of Trustees ordinance
Incur debt through general obligation bonds	Yes	With voter approval
Incur debt through special tax bonds	Yes	With voter approval
Incur debt through private activities	Yes	With Board of Trustees approval
Withhold spending in hazard-prone areas	Yes	Board of Trustees Resolution
Stormwater Service Fees	Yes	Stormwater Utility

Table G-22 identifies existing education and outreach capabilities that the Town of Lyons uses to inform the public about hazards and risks in the community.

Table G-22 Town of Lyons' Education and Outreach Capabilities

Capability/Program	Yes/No (Briefly Describe)
Local Citizen Groups That Communicate Hazard Risks	Yes
Firewise	No
StormReady	No
Other: Lyons Prepared – Volunteer group that works with the Lyons Fire Dept. for disaster preparedness and communications	Yes

G.6.2 Opportunities for Capability Enhancement and Improvement

The plan update process provided the Town of Lyons an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- Integrate risk assessment information into future updates to the Town's Comprehensive Plan.
- Integrate risk assessment information into future updates of the Town's Land Use Code.
- Providing training for staff members related to hazards or hazard mitigation grant funding in partnership with the County and DHSEM
- Leverage stormwater utility fees as match to hazard mitigation grants
- Achieving Firewise certification
- Becoming a StormReady community
- Participate in the Community Rating System

G.6.3 Community Rating System Activities (All Hazards)

Plans and Policies

HIRA Mitigation Action Plan, 2017

The mitigation action plan presents the updated recommendations developed by the HIRA Advisory Committee, outlining how Lyons can reduce the risk and vulnerability of people, property, infrastructure, and natural resources to future disaster losses. The actions are captured in the tables in Section G.7 Lyons' Mitigation Action Plan. Over time the implementation of these projects will be tracked as a measure of demonstrated progress on meeting the plan's goals. Table G-23 in Section G.7 below includes information on the 8 mitigation actions identified in the 2017 plan which the Town of Lyons has completed since the last plan update. Table G-24 includes those actions identified in the 2017 plan which are being continued

in the 2022 mitigation action plan.

Lyons Recovery Action Plan, 2014

This document is the result of an intense community planning process which began in mid-December 2013, a mere three months after the flood waters hit Lyons and was carried out in January-February 2014. Hundreds of citizens engaged in the process, from attending Town Hall meetings to more intense commitments as members of Recovery Working Groups that met weekly to develop and refine objectives and project ideas. The Town of Lyons received technical and facilitation support from the FEMA community planning team, the State's Department of Local Affairs, Natural Capitalism Solutions Inc. and the University of Colorado at Denver.

This plan lays the framework for Lyons to build back stronger and more resilient in the future. It reflects our intentions for the Lyons of tomorrow. And it represents our ability to come together as a community to chart our course to recovery.

The following goals and related objectives are most relevant to hazard mitigation.

- Infrastructure Goal 1: Provide adequate, safe and efficient public utilities.
 - Objective 1.1: Ensure that the Town has a long-term plan for providing water, wastewater and electrical services to residents and businesses in Lyons' planning area.
 - Objective 1.2: Keep Lyons safe and secure.
- Public Facilities Goal: Upgrade public facilities to provide important services to residents and improve town attractiveness to visitors
 - Objective 1.3: Ensure that government services, critical functions, communications and disaster response can be provided in an adequate, safe and secure facilities.
- Stream Goal 1: Protect and promote Lyons' unique natural environment and resources and lead the community toward environmental sustainability.
 - Objective 1.1: Maximize opportunities to restore and conserve riverine natural resources, such as habitat, fisheries, and native plant species, to optimize environmental, recreational, and flood mitigation benefits.
- Stream Goal 2: Protect the natural and built environment from flood events and other hazards along the St. Vrain River.
 - Objective 2.1: Reinforce hazard mitigation techniques to accommodate increased water capacity and velocity from flooding and run-off, recreational, and flood mitigation benefits.
 - Objective 2.2: Restore and enhance Lyons Valley Park/the McConnell Ponds to provide a variety of wildlife habitats, recreational uses, and flood mitigation benefits.

Lyons Municipal Code

Title 8 Building Regulations (Includes Flood-Proofing, Flood Damage Prevention Regulations)

The purpose of Lyons' flood-proofing regulations is to provide uniform regulations and establish special flood-proofing requirements and minimum standards of design and construction for building and structures susceptible to flood damage.

It is the purpose of the flood damage prevention regulations to promote the public health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

- Protect human life and health;

- Minimize expenditure of public money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimize prolonged business interruptions;
- Minimize damage to public facilities and utilities such as water and gas mains; electric, telephone, and sewer lines; and streets and bridges located in areas of special flood hazard;
- Help maintain a stable tax base by providing for the second use and development of areas of special flood hazard so as to minimize future flood bright areas;
- Insure that potential buyers are notified that property is in an area of special flood hazard; and
- Ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

In order to accomplish its purposes, the regulations include methods and provisions for:

- Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;
- Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;
- Controlling the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters;
- Controlling filling, grading, dredging, and other development which may increase flood damage; and
- Preventing or regulating the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas.

Specifically, the regulations require a development permit for construction of development in any area of special flood hazard, outline the duties and responsibilities of the zoning and building inspector in administering the regulations, and set standards for flood hazard reduction, including anchoring, construction materials and methods, design and location of utilities, subdivision proposals, elevation (base flood elevation), floodproofing, and mobile homes. Additional provisions more stringently limit development in floodways.

- Title 6 Public Ways and Property: This title includes a chapter designed to promote and protect the public health, safety, and general welfare by providing for the regulation of the planting, maintenance, and removal of trees, shrubs, bushes, and other woody vegetation within the Town.
- Title 7 Public Utilities: Among this title's regulations are outdoor watering, sprinkling, and irrigation restrictions that authorize emergency regulations and limit residential sprinkling and irrigation.
- Title 9 Zoning Regulations: These regulations were designed to secure safety from fire, panic, and other dangers; to promote the public health and general welfare; to prevent overcrowding of land; to avoid undue concentration of population; and to facilitate the adequate provision of public services (among other things). Hill side requirements limit development of slopes more than 10 percent to planned unit developments that provide for protection against rockfalls, unstable slopes, landslides, soil erosion, runoff, and preservation of scenic natural areas.
- Title 10—Subdivision Regulations: These regulations are designed to promote and protect the public health, safety, and general welfare and to provide for orderly growth and harmonious, efficient development. Their mitigation-related purposes include the following:
 - Establish minimum uniform standards for subdivision design, including planning and engineering criteria, environmental factors, performance guarantees, and planned unit development requirements.
 - Assure the planning for and provision of public services.
 - Secure adequate sites for open space.
 - Preserve natural vegetation and cover.

- Prevent ponding or erosion from surface and subsurface runoff.
- Regulate development in areas of geological and topographical hazards, including, but not limited to, floodplains, areas of unstable or expansive soils, excessive slopes or slope areas, or areas poorly suited for building or construction.
- Protect against the loss or injury from inappropriate use of the land.

Design standards and criteria address drainage easements, steep slope protection, and wetlands and riparian areas. Public improvements and construction standards regulate construction of public improvements (facilities) in subdivisions, including bridges, culverts, drainage channels, and other infrastructure required to span water bodies, watercourses, irrigation ditches and natural or manmade drainage area; storm drainage improvements and storm sewers; and fire hydrants. They also require public improvements such as water, sanitary sewer, storm sewer, telephone, electric, natural gas, and other similar utility lines to be placed underground.

Other Master Plans and Guidance

The Town adopted a storm water master plan (2016) that provides recommendations for a system of public improvements and developer requirements for detaining and conveying stormwater.

Since the 2013 Flood, the Town of Lyons has completed nearly \$75 million of infrastructure improvements and mitigation strategies.

National Flood Insurance Program

The Town of Lyons joined the National Flood Insurance Program (NFIP) on August 1, 1980. The NFIP allows private property owners to purchase affordable flood insurance and enables the community to retain its eligibility to receive certain federally backed monies and disaster relief funds.

NFIP insurance data indicates that as of December 31, 2020, there were 73 policies in force in Lyons, resulting in \$19,708,500 of insurance in force. Of these 62 were for residential properties (all but 2 were single-family homes), 11 were non-residential and 51 were in A and AE zones.

In Lyons, there have been 81 claims for flood losses totaling \$4,447,267. The vast majority of losses were to single-family homes. Fifty-three of the losses were associated with pre-FIRM structures in an A zone. There were no repetitive or severe repetitive losses.

Continued Compliance with the NFIP

Recognizing the importance of the NFIP in mitigating flood losses, the Town of Lyons will place an emphasis on continued compliance with the NFIP. As an NFIP participant, Lyons has and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance as well as review of any potential development in special flood hazard areas.

Community Rating System Categories

The Community Rating System (CRS) categorizes hazard mitigation activities into six categories. These categories, and applicable Lyons's activities, are described below. Note: some of the activities are appropriate to multiple categories. For purposes of simplicity, they are only included in the category deemed most appropriate based on the definitions and examples provided in the CRS Coordinator's Manual.

Preventive

Preventive activities keep problems from getting worse. The use and development of hazard-prone areas is limited through planning, land acquisition, or regulation. They are usually administered by building, zoning,

planning, and/or code enforcement offices.

Property Protection

Property protection activities are usually undertaken by property owners on a building-by-building or parcel basis.

Current property protection includes requiring Flood Plain Development Permits for all improvements in the special flood hazard area, and elevating homes upon substantial damage or improvement. All new public construction, including roads and bridges, are being built to current flood protection standards.

Natural Resource Protection

Natural protection activities preserve or restore natural areas or their natural functions. They are usually implemented by parks, recreation, or conservation agencies or organizations.

The Town of Lyons purchased 28 properties in the floodplain/floodway to return to natural habitat;

Emergency Services

Emergency services measures are taken during an emergency to minimize its impacts. These measures are the responsibility of city or county emergency management staff and the owners or operators of major or critical facilities.

The Lyons Fire Protection District provides fire safety and protection services to the Town.

The Town has installed two emergency sirens. The sirens will be remotely activated from the Boulder Regional Communication Center.

Structural Projects

Structural projects keep hazards away from an area (e.g., levees, reservoirs, other flood control measures). They are usually designed by engineers and managed or maintained by public works staff.

The Town has restored nearly three miles of stream banks within town limits to mitigate future damage from flooding. All new public construction, including roads and bridges, are being built to current flood protection standards. The McConnell Bridge and 2nd Avenue Bridge have both been rebuilt to withstand a 100-year flood event.

Public Information

Public information activities advise property owners, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of natural resources (e.g., local floodplains). They are usually implemented by a public information office.

The Town has distributed emergency preparedness brochures in the utility bills on an annual basis. The Town has published newspaper articles on emergency issues such as flood in flood season and wildfire during fire season. The town's website has current information and an e-blast is sent to prepare residents for upcoming weather or other potential hazards. The Town has staffed emergency preparedness educational booths at town festivals.

The Town regularly sends out emails with emergency preparedness messages, and during times of emergency, continually posts water height notifications and other emergency information. There is permanent Emergency Preparedness information on the Town of Lyons Website.

G.7 Lyons's Mitigation Action Plan

Mitigation Goals

The Boulder County Hazard Mitigation Plan has the following broad goals which also apply to Lyons as a participant in that planning effort. For the purposes of mitigation planning, goals are broad-based public policy statements. Mitigation actions define strategies to attain the goals and are more specific and measurable.

- Goal 1: Reduce the loss of life and personal injuries from hazard events
- Goal 2: Reduce impacts of hazard events on property, critical facilities/infrastructure, and the environment
- Goal 3: Strengthen intergovernmental coordination, communication, and capabilities in regard to mitigating hazard impacts
- Goal 4: Improve public awareness regarding hazard vulnerability and mitigation
- Goal 5: Address hazard identification in the context of climate change

Identification And Analysis Of Mitigation Actions

Progress on, and development of, mitigation actions was assessed during the 2017 HIRA process and the 2021 Boulder County HMP update process. As part of the HIRA process the Advisory Committee reviewed the previously identified actions in the 2014 Lyons Annex to the County Hazard Mitigation Plan to assess progress on implementation. These reviews were completed using a worksheet and a facilitated discussion to capture information on each action including if the action was completed or deferred to the future. In addition, action strategies with a hazard mitigation component were identified in related planning mechanism including the St Vrain Watershed Master Plan, the Lyons FPD Community Wildfire Protection Plan, and Lyons Recovery Action Plan. Another important reference included mitigation and planning policy recommendations in the American Planning Association's 'Living with the Saint Vrain' Community Assistance Planning Team Report developed in 2014 following the flood (APA CPAT 2014).

New mitigation actions were also developed during the HIRA process. The Advisory Committee considered and reviewed viable mitigation options, or alternatives, that supported reducing losses from the hazards profiled in the HIRA. The Advisory Committee was provided with the following categories of mitigation actions, which originate from the NFIP Community Rating System:

- Prevention: Administrative or regulatory actions or processes that influence the way land and buildings are developed and built.
- Property protection: Actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area.
- Structural: Actions that involve the construction of structures to reduce the impact of a hazard.
- Natural resource protection: Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.
- Emergency services: Actions that protect people and property during and immediately after a disaster or hazard event.
- Public information/education and awareness: Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

At a mitigation strategy workshop and through email the Advisory Committee was provided a matrix showing examples of potential mitigation action alternatives for each of the identified hazards. Another reference document titled "Mitigation Ideas" developed by FEMA was provided. This document lists the common alternatives for mitigation by hazard grouped by the FEMA categories of Plans and Regulations, Structure and Infrastructure Projects, Education and Awareness, Natural Systems Protection and Emergency

Services. The Advisory Committee was also provided the results of the public survey for consideration of mitigation actions proposed by the public. The HMPC was asked to consider both future and existing buildings in considering possible mitigation actions. A facilitated discussion then took place to examine and analyze the options. A list of potential strategies was an outcome of this process, which was further refined through email and subsequent input from the Advisory Committee and discussion with Town staff.

Prioritization Process

Once the mitigation actions were identified, the Advisory Committee was provided FEMA's recommended prioritization criteria STAPLEE to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another. STAPLEE is an acronym for the following:

- Social: Does the measure treat people fairly? (e.g., different groups, different generations)
- Technical: Is the action technically feasible? Does it solve the problem?
- Administrative: Are there adequate staffing, funding, and other capabilities to implement the project?
- Political: Who are the stakeholders? Will there be adequate political and public support for the project?
- Legal: Does the jurisdiction have the legal authority to implement the action? Is it legal?
- Economic: Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- Environmental: Does the action comply with environmental regulations? Will there be negative environmental consequences from the action?

Other criteria used to assist in evaluating the priority of a mitigation action includes:

- Does the action address hazards or areas with the highest risk?
- Does the action protect lives?
- Does the action protect infrastructure, community assets or critical facilities?
- Does the action meet multiple objectives (Multiple Objective Management)?

G.7.1 Town of Lyons 2022 Mitigation Actions

The Town of Lyons has made demonstrated progress toward successful implementation of multiple planning mechanism. Continued implementation will be accomplished by adhering to the schedules identified for each action and through constant, pervasive, and energetic efforts to network and highlight the benefits to the Town and stakeholders. This effort is achieved through the routine actions of monitoring meeting agendas for hazard mitigation related initiatives, coordinating on the topic at meetings, and promoting a safe, sustainable, and resilient community. Additional mitigation strategies could include consistent and ongoing enforcement of existing policies and vigilant review of programs for coordination and multi-objective opportunities. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development.

Simultaneous to these efforts, it is important to maintain a constant monitoring of funding opportunities that can be leveraged to implement some of the more costly recommended actions. This will include creating and maintaining a bank of ideas on how to meet local match or participation requirements. When funding does become available, the Town will be able to capitalize on the opportunity. Funding opportunities to be monitored include FEMA pre- and post-disaster funds, state and federal earmarked funds, and other grant programs, including those that can serve or support multi-objective applications.

Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions. These existing mechanisms could include:

- Lyons Comprehensive plan
- LPPA Master Plan

- Land development regulations
- Community Wildfire Protection Plans (CWPP)
- Boulder County Hazard Mitigation Plan
- Lyons Recovery Action Plan
- St Vrain Stream Corridor Master Plan
- Transportation plans
- Capital Improvement Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of the County Hazard Mitigation Plan and this HIRA document.

Table G-23 Completed Mitigation Actions

Action Description	Responsible Office	Comments	2022 Status
Develop community wildfire protection plan for Lyons	Lyons Fire Protection District	Complete; Plan was completed August 2011.	Completed
Continue to implement sound floodplain management practices as communities participating in the NFIP	Lyons Administration and Building / Permitting Departments	Complete: This has been completed for the 100 year flow with the construction of an overflow channel. The plan remains in 500 year floodplain.	Completed
Develop flood protection for the Lyons wastewater treatment plan	Lyons Public	Ongoing. FEMA and state community assistance visit in 2016 to review and ensure compliance. 2 foot freeboard requirement added for elevations in the 100 year floodplain.	Completed
Improve storm drain conveyance in Lyons	Lyons Public Works and Engineering	Stormwater Master Plan draft complete but not approved as of 5/24/17. Next step would be to establish a stormwater utility fee to develop a funding source for the recommended flood reduction projects in the plan.	Completed. Ordinance No. 1025, approved 1/2/2018
Evaluate and adopt a stormwater ordinance and determine a funding mechanism	Lyons Public Works, Town Administration	A stormwater drainage ordinance would set criteria to mitigate runoff associated with new development. Stormwater mitigation through encouragement of low impact development/green infrastructure techniques would be considered in the ordinance development. The stormwater master plan contains information on projects needed to mitigate risk to the town. A funding source for projects is needed; this action would evaluate the options to fund stormwater projects including the feasibility of a stormwater utility and incentivize low impact development and best management practices by incorporation into the land development Code.	Completed. Ordinance No. 1025, approved 1/2/2018
Formally adopt the Stormwater Master Plan	Lyons Public Works	The stormwater master plan contains information on the significant risk to	Completed. Ordinance No.

Action Description	Responsible Office	Comments	2022 Status
		stormwater drainage flooding within the Town. The first step towards implementation would be adoption by the Town.	1025, approved 1/2/2018
Develop water system loop and install additional fire hydrants in Lyons	Lyons Public Works	Water system loop improvements in process 5/2017; Further evaluation did not indicate a need for additional fire hydrants.	Completed. Sections of the town water system are looped. The town is looking for grant funding for a 2 nd water storage tank.
Update designated emergency response authority (DERA) agreement with Lyons FPD with the intent to ensure capabilities are in place to minimize the effects of a hazardous materials incident.	Town Administration, Lyons Fire Protection District	Colorado Revised Statutes 29-22-102 provides for the designation of emergency response authorities for hazardous substance incidents. Once designated, a DERA is responsible for providing and maintaining the capability for emergency response to a hazardous materials incident occurring within its jurisdiction. The agreement with Lyons FPD needs to be reviewed and updated.	Completed

The Town of Lyons identified 13 actions in their 2017 HIRA which are continuing in the 2022 Mitigation Action Plan, shown in Table G-24 below, followed by 9 new actions identified during the 2021-2022 Boulder County HMP update.

Table G-24 Mitigation Action Plan – 2017 Continuing Actions

Action ID	Action Description	Responsible Department and Partners	Hazard(s) Mitigated	Timeframe	Priority	Background and Implementation Details	2022 Status
MH-1	Develop a town evacuation plan with improved coordination on shelters	Boulder County OEM, ESF 6 Emergency Coordinator, Lyons Fire Protection District, Community Development	Multi- Flood, wildfire, dam failure	2017-2018	Medium	Several hazards identified in the HIRA could result in evacuations of large portions of the town including wildfire, flood and dam failure. Evacuation and shelter planning is needed to ensure that there are cooperative agreements with facilities that could be used for sheltering purposes. There also needs to be an evaluation of shelter locations such as churches and schools to ensure they are accessible during flood events with formalized agreements and have adequate capacity. Shelters and evacuation routes need to be strategically located so there are options in case the town is split by flooding. Lessons learned from the 2013 flood and recent wildfire events should be considered in the planning. Town staff will work with County OEM who will facilitate the evacuation planning and the Emergency Support Function (ESF) 6 Emergency Coordinator will address the sheltering aspect.	Continue – In Progress. The Lyons Prepared volunteer group has practiced an evacuation scenario with Lyons Fire. We are discussing a town and fire district coordinated practice evacuation drill.
MH-2	Build the HIRA into development review checklists for new construction in the Lyons Primary Planning Areas and Town to reduce impacts to future development	Community Development	Multi-wildfire, flood, debris flows, landslide and rockfall susceptibility, steep slopes	2017-2018	High	This project would formally acknowledge the HIRA to ensure that hazards are considered when planning, siting and approving new development to ensure a safe and resilient community. At a minimum, hazard maps within the HIRA should be reviewed as part of the development review process. A checklist will be developed to ensure the HIRA is considered. This would include a checklist for staff and PCDC review and	Continue – Not Started

Action ID	Action Description	Responsible Department and Partners	Hazard(s) Mitigated	Timeframe	Priority	Background and Implementation Details	2022 Status
						would include at a minimum if the development is within or near stormwater flooding, wildfire hazard, debris flows, landslide and rockfall susceptible areas, and steep slopes.	
MH-3	Develop a Hazard Overlay District that may include the wildfire, flood, debris flows, landslide and rockfall susceptibility, steep slopes, and drainage.	Community Development	Multi-wildfire, flood, debris flows, landslide and rockfall susceptibility, steep slopes	2018-2019	High	Development of a hazard overlay district is another way that the Town can formally acknowledge the HIRA to ensure that hazards are considered when planning, siting and approving new development. Individual hazard layers will be utilized in GIS. Available GIS will be reviewed for level of detail and applicability. Restrictions or recommendations for various hazard areas will be developed and implemented as appropriate.	Continue – Not Started
MH-4	Develop ordinance on post-disaster building moratorium	Lyons Public Works Community Development Lyons Administration Building Dept.	Flood, wildfire, earthquake	2017-2018	High	An ordinance to place a temporary moratorium on re-building needs to be developed to ensure that mitigation is incorporated into the post-disaster environment. The ordinance would become effective when the Board of Trustees and Mayor declare a local disaster in coordination with Boulder County (typically when outside resources are needed for response and recovery). This moratorium will be all-hazard. As an example a wildfire could trigger the need for conformance with the floodplain regulations if structures are deemed substantially damaged. See also related recommendation in APA CPAT Report 2014.	Continue – Not Started
MH-5	Develop critical facility protection including back-up	Lyons Public Works	Multi – Dam Failure, Flood, Extreme	2017-2022	Medium	Many of the hazards identified in the HIRA have the potential to cause power outages to critical facilities within town and limit	Continue - In Progress. Backup Power

Action ID	Action Description	Responsible Department and Partners	Hazard(s) Mitigated	Timeframe	Priority	Background and Implementation Details	2022 Status
	power and floodproofing the Town Hall, Depot Building, Waste Water Treatment Plant, SCADA System, Water Treatment Plant		Temperatures High Winds, Lightning, Severe Winter Weather, Wildfire, Tornadoes, Hail			critical services and functions when needed most. This project would identify backup power needs and options for facilities and determine cost effective solutions such as mobile generators that could be deployed where needed. The HIRA indicates flood risk to some town facilities, notably from the 0.2% annual chance flooding or dam failure flooding. This would evaluate options to minimize risk to Town Hall and the water and wastewater infrastructure.	installed at Wastewater Treatment Facility, all sewer lift stations, and new Public Works Buildings
MH-6	Develop a Continuity of Operations Plan (COOP)	Community Development, Boulder County Emergency Management	Multi – Dam Failure, Flood, Extreme Temperatures High Winds, Lightning, Severe Winter Weather, Wildfire, Tornadoes, Hail	2019-2020	Medium	Many of the hazards identified in the HIRA have the potential to limit the Town's critical services and functions when needed most. A continuity of operations plan would establish protocols to ensure staffing and key operations are maintained in the response and recovery environment. The plan would be led with expertise from Boulder OEM and incorporate lessons learned from the 2013 flood.	Continue – In Progress.
MH-7	Reverse 911 Enhancements and Adaptation for Lyons	Boulder County Emergency Management, County Sheriff Town Administration	Multi- Dam Failure, flood, wildfire, tornado	2017-2018	High	Boulder County's R911 system notifies highly populated areas first. In 2013 during the flood Lyons was one of the last to receive R911 notification due to this limitation. This project would work with County OEM and Sheriff's office to adapt the system so communities higher in a watershed such as Lyons receive notifications first for events such as flooding.	Continue – In Progress.
F-3	Consider joining the National Flood Insurance Program's	Lyons Public Works Community Development	Flood	2018	Medium	The CRS rewards communities that enhance their floodplain management program by reducing flood insurance costs for residents. The town has a substantial number of	Continue – In Progress.

Action ID	Action Description	Responsible Department and Partners	Hazard(s) Mitigated	Timeframe	Priority	Background and Implementation Details	2022 Status
	Community Rating System (CRS)	Lyons Administration				properties with flood insurance thus there could be a potential benefit to joining the CRS. This project would evaluate the merits and administrative requirements of joining CRS. Recommendations from a Community Assistance Visit from the Colorado Water Conservation Board and FEMA should also be reviewed in regards to enhancing the town's floodplain management program and NFIP compliance. See also related recommendation in APA CPAT Report 2014.	
F-4	Evaluate flood prone property for buyout or flood mitigation as funding allows.	Lyons Public Works, Community Development, Lyons Administration, Building Dept.	Flood	2017-2022	Low	The HIRA indicates that considerable flood risk to residential property remains, despite multiple buy-outs and elevations in the confluence area in Town following the 2013 flood. Funding sources should be evaluated for long term implementation of elevation or buyouts, including FEMA Flood Mitigation Assistance, Hazard Mitigation Assistance including Hazard Mitigation Grant Program and CDBG_DR funding following future disasters in Colorado. This should be revisited annually and following a presidential disaster declaration anywhere in the state as HMGP funding could be available.	Continue – Annual Implementation
LS-1	Review setback requirement on steep slopes and amend to account for rockfall and landslide hazards.	Community Development	Landslides/ Debris flow/ Rockfall, wildfire	2017-2019	Low	The Town has steep slope regulations that could be broadened to mitigate landslide, debris flow and rockfall hazards. This would also review HB1041- Areas of state interest within Lyons for applicability to hazard areas including considerations for landslides and rockfall.	Continue – In Progress
WF-1	Evaluate Lyons FPD CWPP	Community Development,	Wildfire	2017-2018	High	The Lyons FPD CWPP identifies lack of defensible space and close exposures of	Continue - In Process. The

Action ID	Action Description	Responsible Department and Partners	Hazard(s) Mitigated	Timeframe	Priority	Background and Implementation Details	2022 Status
	implementation of recommendations for Lyons	Lyons Fire Protection District				adjacent wood houses and structures to areas with high vegetation as features exacerbating wildfire risk in the Town. Ingress and egress issues as well as building construction types were some areas of concern when the CWPP was completed. As an outcome of the CWPP development, Lyons now offers free one-on-one wildfire mitigation consultations to all of its residents. The Lyons FPD has a wildfire mitigation team that will perform mitigation projects such as thinning, limbing, removal of hazard trees, and constructing fuel breaks for a fee. This project would assess progress on implementation and where additional effort should be focused.	Town and Lyons Fire are working together through a number of these issues on a regular basis
WF-2	Increase coordination with Lyons FPD regarding wildfire mitigation and transition to land use code	Community Development, Lyons Fire Protection District, Town Administration	Wildfire	2017-2018	Medium	The Lyons Fire Protection District has a wildland code adopted as of 2017 and has considered adopting a newer version- which could be affected by potentially moving to the 2015 IFC in 2017. Some of the Fire Wise guidelines and principles with regards to fire mitigation, defensible space, egress and other areas are employed. This project would further coordinate with Lyons FPD on these issues in regards to wildfire mitigation and integration into Lyons building and land use codes and regulations.	Continue – In Progress. Working on implementing Wildland Urban Interface WUI into municipal and building code
HM-1	Evaluate intersection improvements at Hwy 7 and US36 corner to mitigate the potential for a hazardous materials spill in town.	Community Development, Colorado Department of Transportation	Hazardous Materials	2017-2018	Medium	This project would entail coordination with CDOT on evaluation of safety at this intersection and implement potential improvements, such as fresh paint, increased width of turning lane, and divider.	Continue – In Progress

Name of action: Steamboat Valley Storm Water Mitigation

Hazards Addressed: Flooding due to heavy rain event

Mitigation Goal or Objective Addressed: Reduce the volume and velocity of water coming down Steamboat Valley following a heavy rain event.

Issue/Background: The main drainage basin on the north side of Lyons is Steamboat Mountain. This drainage basin drains directly into the town, through a residential neighborhood and into the business district before entering the North St. Vrain Creek. The storm water master plan identifies a detention pond being constructed north of Horizon Avenue that will hold the flow and slow down the velocity of water coming into the town. The flagstone storm water conveyance needs replaced with a larger, modern fixture.

Other Alternatives: Increase the capacity of the storm drainage system in town.

New or Deferred Action: New in 2022

Responsible Office: Town of Lyons storm water utility

Priority (High, Medium, Low): High

Cost Estimate: \$15 million

Existing or Potential Funding: FEMA Mitigation Grant Funds

Benefits (avoided losses): Reduction in loss of public and private property damage

Potential or current subject matter expertise: RG and Associates, Town Engineer

Schedule: 2022-2024, depending upon funding availability

Name of action: Red Hill Gulch Stormwater Drainage Plan

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: The runoff from the Red Hill Gulch watershed creates an overflow of the South Ledge Ditch and an alluvial fan of water throughout Bohn Park and Lyons Valley Subdivision.

Issue/Background: Installation of detention ponds or increased capacity to handle the flow during large events.

Other Alternatives: none

New or Deferred Action: New in 2022

Responsible Office: Town of Lyons and Boulder County

Priority (High, Medium, Low): Medium

Cost Estimate: \$1,000,000

Existing or Potential Funding: FEMA Mitigation Grant

Benefits (avoided losses): Reduction in the loss claims submitted by homeowners whose basements flood and damage to public areas.

Potential or current subject matter expertise: Consultants and town engineer

Schedule: Some steps being taken in 2021, but more needed

Name of action: Ewald Avenue Stormwater Improvements

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Improve public safety and damage to road infrastructure caused by stormwater flows by defining a channel flow path.

Issue/Background: At least one time per year, the Ewald Avenue Watershed sheet flows along the steep hillsides toward residential development. The watershed does not have a defined channel flow path.

Other Alternatives: none

New or Deferred Action: New in 2022

Responsible Office: Town of Lyons

Priority (High, Medium, Low): Medium

Cost Estimate: \$750,000

Existing or Potential Funding: Stormwater Utility Fund

Benefits (avoided losses): Improve public safety and extend the life of the road.

Potential or current subject matter expertise: Consultants and town engineer

Schedule: 2022-2024, depending upon funding availability

Name of action: Lyons Valley Park Stormwater Improvements

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Increase public safety and reduce damage to roadways.

Issue/Background: The runoff from this watershed has no defined flow path and is primarily conveyed down McConnell Drive in front of the middle/high school. Water runs swift and high on this street with ponding at the cul de sacs adjacent to it.

Other Alternatives: Define a flow path, increase storm water pipe capacity.

New or Deferred Action: New in 2022

Responsible Office: Town of Lyons

Priority (High, Medium, Low): Medium

Cost Estimate: \$1,500,000

Existing or Potential Funding: FEMA Mitigation Grant; Stormwater Utility Fund

Benefits (avoided losses): Increased safety in residential neighborhood, increase pavement life.

Potential or current subject matter expertise: Consultants and town engineer

Schedule: 2022-2024, depending upon funding availability

Name of action: 3rd Avenue Stormwater Improvements

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Increase capacity for stormwater flows to improve public safety and extend the life of the roadway.

Issue/Background: 3rd Avenue has inadequate storm water conveyance for an annual storm event.

Other Alternatives: unknown

New or Deferred Action: New in 2022

Responsible Office: Town of Lyons

Priority (High, Medium, Low): Medium

Cost Estimate: \$3,000,000

Existing or Potential Funding: FEMA Mitigation Grant or Stormwater Utility Fund

Benefits (avoided losses): Improve public safety and reduce pavement damage.

Potential or current subject matter expertise: Consultants and town engineer

Schedule: 2022-2027

Name of action: Stone Canyon Storm Water Improvements

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Increase capacity for stormwater runoff in the Stone Canyon Watershed.

Issue/Background: With heavy rain events, the current stormwater detention is inadequate for capacity.

Other Alternatives: Build larger or additional detention pond.

New or Deferred Action: New in 2022

Responsible Office: Town of Lyons

Priority (High, Medium, Low): Medium

Cost Estimate: \$1,400,000

Existing or Potential Funding: FEMA Mitigation Grant or Stormwater Fund

Benefits (avoided losses): minimizing flooding of infrastructure and public improvements.

Potential or current subject matter expertise: Consultant and town engineer

Schedule: 2022-2027

Name of action: Wildfire Mitigation Plan

Hazards Addressed: Wildfires

Mitigation Goal or Objective Addressed: Reduce damage due to wildfires.

Issue/Background: Every year, wildfires break out near Lyons. We would like to hire a consultant to put together a wildfire mitigation plan and implementation plan for our community.

Other Alternatives: Work with local Fire Protection District on public education.

New or Deferred Action: New in 2021

Responsible Office: Town of Lyons and Lyons Fire Protection District

Priority (High, Medium, Low): High

Cost Estimate: \$10,000-50,000

Existing or Potential Funding: Not Budgeted / Unknown

Benefits (avoided losses): Reduce potential for fire loss.

Potential or current subject matter expertise: Consultant

Schedule: 2021-2022

Name of action: Back up power for Critical Facilities

Hazards Addressed: Flood, Lightning, Severe Winter Storm, Tornado, Windstorm.

Mitigation Goal or Objective Addressed: To be able to continue to provide sewer collection in the event of a power outage at the wastewater treatment facility

Issue/Background: The Town of Lyons operates a wastewater treatment facility that is provided power by Lyons Power and backup power by Longmont Power. However, in the past during severe weather events both power sources have been compromised. The town feels that a generator at the facility is critical to continuity of sewerage treatment for the community.

Other Alternatives: Rent a large generator following an outage.

New or Deferred Action: New action.

Responsible Office: Town of Lyons

Priority (High, Medium, Low): High

Cost Estimate: \$250,000

Existing or Potential Funding: Wastewater Fund

Benefits (avoided losses): Ability to provide sewer service and avoid sewage back up in basements of homes and businesses.

Potential or current subject matter expertise: Consulting engineers and in house engineering expertise.

Schedule: Upon funding availability over 2022-2207

Name of action: Undergrounding of Electrical Lines

Hazards Addressed: Severe Winter Storm, Windstorm, Tornado

Mitigation Goal or Objective Addressed: Prevent power outages and build resiliency during severe weather events.

Issue/Background: Many of Lyons electric facilities are aging and above ground. The town has a policy to underground new facilities. However, funding for mitigating existing facilities, especially in older parts of town, does not exist. These lines are the most vulnerable to power outages during severe weather events.

Other Alternatives: Continue to maintain and repair lines as they are damaged.

New or Deferred Action: New action.

Responsible Office: Town of Lyons Utilities

Priority (High, Medium, Low): Medium

Cost Estimate: >\$1,000,000

Existing or Potential Funding: Electric Fund Reserves

Benefits (avoided losses): Ability of residents to shelter in place due to severe weather events. Reduction in losses due to power outages such as food spoilage. Increased safety for persons on special medical

equipment requiring electricity.

Potential or current subject matter expertise: Electric Contractor

Schedule: Sections to be taken as funding allows over 2022-2207

Annex H: Town of Nederland

Annex H Town of Nederland

H.1 Community Profile

Nederland sits in a valley created by a glacier thousands of years ago. Native Americans used the valley and river left behind by the glacier before the first hunters and trappers looking for beaver pelts found their way to the area in the early 1800's. A relatively flat area with a good water source and ample wildlife, the valley was an attractive place for early settlers.

In the mid-19th century, the first white homesteaders who settled here gave it a variety of names. First known as Dayton, then Brownsville, and in 1871, when the first post office was located here, it was called Middle Boulder. That was the same year Abel Breed bought the silver-rich Caribou Mine and decided to bring his ore from Caribou Hill to the "warmer" climate of Middle Boulder for milling. It was also the same year the Boulder Canyon Road was completed, though it would be nearly forty years before the first automobile (a Stanley Steamer) would make the difficult trip up from Boulder in 1910.

In 1873, Breed sold the Caribou Mine to the Mining Company Nederland from Holland. Breed's Caribou Mill in Middle Boulder became known among the miners as "the Netherlands," meaning "low lands" (which it is compared to the town of Caribou at 10,000' elevation). In 1874 when the town incorporated, the people chose Nederland as the new name.

The mines at Caribou soon declined, however, and the Dutch company pulled out just a few years later. By 1890, there was little ore to be milled and Nederland became another mountain ghost town, with only a handful of families living here year-round.

A second mining boom began just after the turn of the century. Sam Conger, who had discovered the Caribou silver mine, found tungsten in areas to the north and east of Nederland, and he knew its value in making steel. The old silver mill in Nederland was converted to process tungsten. By 1916, Nederland had a population of nearly 3,000, about twice its present number. During this time, you could travel to Nederland by train, Stanley Steamer, and car. In addition, the town of Lakewood grew north of Nederland and the town of Tungsten sprung up at the foot of Barker Dam. An unnaturally flat area and a small house that once served as the miners' mess hall on the south side of the canyon road just below the dam is scant evidence of the town that still appears on some area maps.

By 1920, the Town's population had plummeted to about 200 people. Automobiles replaced the train, and the cabins became summer getaways for rich folks from the Front Range. For the next 20 years, small mines, farming, ranching, and tourists — picnicking at the new Barker Reservoir, kept the Town alive.

The last small boom was in the 1940's, when demand for tungsten again picked up during World War II. But once again, as demand for tungsten fell, the town was left to a small group of miners, farmers, ranchers, and summer people. Eventually the theater, bowling alley, stores, and banks closed.

Nederland in the 1960's saw a steady increase in population, starting with "hippies" who brought a vibrant music scene and a new lifestyle to the sleepy valley. By the 1990's, Nederland's population had grown quite a bit, accounting for new residents who commuted all along the Front Range for work. At this time, Barker Meadow was developed into the town's only shopping center and plans were underway to spruce up downtown to attract more tourist and encourage local residents to spend their dollars in town, instead of "down the hill" in Boulder.

At the turn of the 21st century, the town's population growth had leveled out. New attractions brought increased tourism and increased revenue to local businesses. A new fire station and new library solidified Nederland's position as the hub of the Peak to Peak Community.

H.1.1 Population

According to the 2020 Census the estimated population of the Town of Nederland is 1,481. Select 2019 American Community Survey demographic and social characteristics for Nederland are shown in Table H-1.

Table H-1 Nederland's Demographic and Social Characteristics

Characteristic	Percent
Gender/Age	
Male	57.6%
Female	42.4%
Under 5 Years	3.1%
65 Years and Over	8.1%
Race	
White	95.4%
Asian	0.4%
2 or more races	1.9%
American Indian & Alaska Native (AIAN)	0.0%
Black/African American	0.0%
Native Hawaiian & Other Pacific Islanders	0.0%
Hispanic or Latino (Of Any Race)	6.2%
Other	
Average Household Size	2.17%
High School Graduate or Higher	97.9%

Source: U.S. Census, American Community Survey, 2019

H.1.2 Economy

Nederland's economy is local, community based, self-sufficient and is characterized by diverse and essential products, services and jobs that both support the local community and are mindful of potential impacts on the environment.

Town of Nederland business licenses are required for all businesses located and/or conducting business within the Town of Nederland, whether they collect sales tax or not. This includes home-based businesses and non-profits as well as more traditional commercial, store-front businesses. Information on applicable fees is available on our Fee Schedule. See "other licenses" page for liquor and marijuana.

Table H-2 Nederland Economic Characteristics

Characteristic	Percent
Families below Poverty Level	2.9%
Individuals below Poverty Level	17.3%
Median Home Value	\$436,700
Median Household Income	\$100,259
Per Capita Income	\$56,074
Population in Labor Force	79.6%
Unemployment*	1.8%

Source: U.S. Census Bureau, 2019 1-Year ACS & 5-Year ACS

According to the 2019 American Community Survey, the industries that employed most of Nederland's labor force were educational, health and social services (25.8%), professional, scientific, management, administrative and waste management services (21.9%); Arts, entertainment, and recreation (9.5%); Manufacturing (9.4%) and Construction (9.3%) Arts. Select economic characteristics for Nederland from the 2019 American Community Survey are shown above in Table H-2.

H.2 Hazard Summary

The most significant hazards for Nederland are winter storm, wind, wildfire and landslide/mud and debris flow/rockfall. Refer to Section 4.4 Vulnerability Assessment for detailed analysis for the county as a whole. There are no hazards that are unique to Nederland. The overall hazard significance takes into account the geographic location, probability of occurrences and magnitude as a way to identify priority hazards for mitigation purposes. Section H.5 Vulnerability Assessment, where possible, analyzes the population, property, and other assets at risk to hazards ranked of medium or high significance that may vary from other parts of the planning area. Other hazards that could impact Nederland include Communicable/Zoonotic Disease and Outbreaks, expansive soil, flood, hail and subsidence.

Table H-3 City of Nederland Hazard Summaries

Hazard Type	Geographic Extent	Probability of Future Occurrences	Magnitude / Severity	Increased Threat (Climate Change)	Hazard Level
Air Quality	Extensive	Highly Likely	Critical	Limited	Low
Avalanche	Limited	Occasional	Limited	Low	Low
Communicable/Zoonotic Disease Outbreak	Extensive	Occasional	Critical	Substantial	Medium
Dam and Levee Failure	Limited	Occasional	Critical	Moderate	Medium
Drought	Extensive	Likely	Limited	Substantial	Low
Earthquake	Extensive	Unlikely	Catastrophic	Low	Low
Expansive Soils	Significant	Likely	Limited	Low	Low
Extreme Temperatures	Extensive	Likely	Critical	Severe	Low
Flood	Limited	Likely	Critical	Severe	Medium
Hailstorm	Extensive	Likely	Limited	Moderate	Medium
Landslide/Mud and Debris Flow/Rockfall	Significant	Likely	Critical	Substantial	High
Lightning	Extensive	Likely	Limited	Moderate	Medium
Subsidence	Significant	Likely	Limited	Low	Low
Tornado	Significant	Unlikely	Limited	Low	Low
Wildfire	Extensive	Highly Likely	Critical	Severe	High
Windstorm	Extensive	Highly Likely	Critical	Moderate	High
Winter Storm (Severe)	Extensive	Highly Likely	Critical	Substantial	High

<p>Geographic Extent</p> <ul style="list-style-type: none"> Limited: Less than 10% of planning area Significant: 10-50% of planning area Extensive: 50-100% of planning area <p>Increase Threat from Climate Change</p> <ul style="list-style-type: none"> Low- unlikely to become more of a threat due to climate change. Moderate – possibly will become more of a threat due to climate change. Substantial- likely to become more of a threat due to climate change. Severe- highly likely to become more of a threat due to climate change 	<p>Probability of Future Occurrences</p> <ul style="list-style-type: none"> Highly Likely: Near 100% chance of occurrence in next year or happens every year. Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less. Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years. Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years. <p>Magnitude/Severity</p> <ul style="list-style-type: none"> Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability. Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability. Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid <p>Significance</p> <ul style="list-style-type: none"> Low: minimal potential impact Medium: moderate potential impact High: widespread potential impact
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H.3 Asset Inventory

H.3.1 Property Inventory

Table H-4 represents an inventory of property in Nederland based on the Boulder County Assessor's data as of March 2022.

Table H-4 Nederland Property Inventory

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
Commercial	45	51	\$17,156,126	\$17,156,126	\$34,312,252
Exempt	39	44	\$7,300,800	\$7,300,800	\$14,601,600
Industrial	1	1	\$160,000	\$240,000	\$400,000
Mixed Use	14	15	\$4,268,200	\$4,268,200	\$8,536,400
Residential	706	807	\$288,663,998	\$144,331,999	\$432,995,997

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
Vacant	1	1	\$10,900	\$10,900	\$21,800
Total	806	919	\$317,560,024	\$173,308,025	\$490,868,049

Source: Boulder County Assessor's Office, Wood Analysis

H.3.2 Critical Facilities

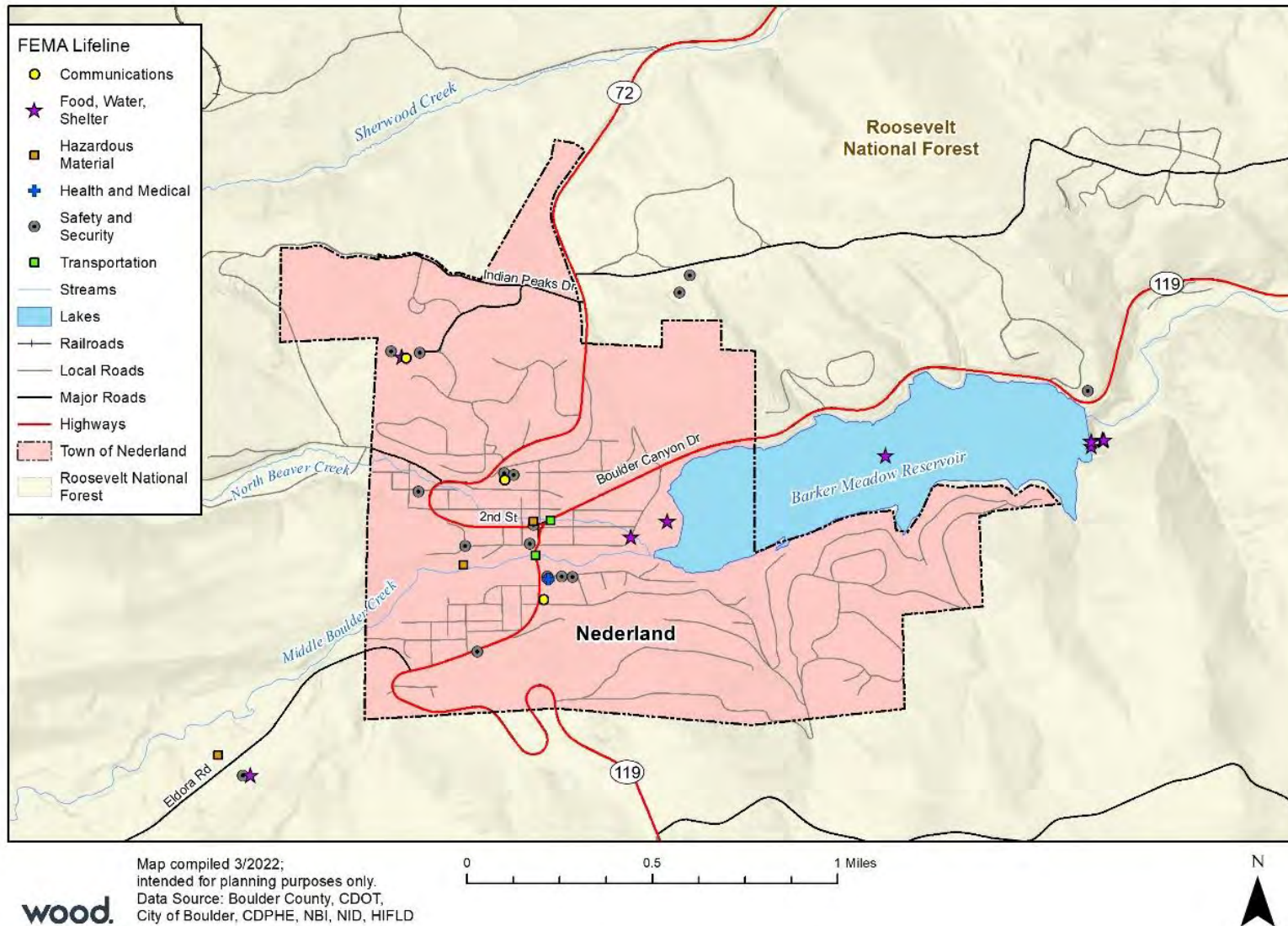
Table H-5 is a detailed inventory of critical facilities derived from a variety of sources and organized based on their corresponding FEMA Lifeline Category. For more information about how "critical facility" is defined in this plan, see Section 4.4 Vulnerability Assessment. Nederland base map and critical facility locations are located in Figure H-1 below.

Table H-5 Summary of Nederland Critical Facilities by FEMA Lifeline

FEMA Lifeline	Total
Communications	3
Energy	-
Hazardous Materials	2
Health and Medical	1
Food Water Shelter,	3
Safety and Security	14
Transportation	2
Total	25

Source: Town of Nederland, Boulder County, HIFLD, CDPHE, Wood Analysis

Figure H-1 Nederland's Base Map and Critical Facilities



H.3.3 Economic Assets

Economic assets at risk may include major employers or primary economic sectors, such as agriculture, whose losses or inoperability would have severe impacts on the community and its ability to recover from disaster. After a disaster, economic vitality is the engine that drives recovery. Every community has a specific set of economic drivers, which are important to understand when planning ahead to reduce disaster impacts to the economy. When major employers are unable to return to normal operations, impacts ripple throughout the community.

According to the Nederland Profile from the Denver Regional Council of Governments, the major employers in Nederland are the tourist industries, the Boulder Valley School District, and Town Government.

H.3.4 Natural, Cultural, and Historic Resources

Assessing the vulnerability of Nederland to disaster also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- If these resources are impacted by a disaster, knowing so ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts are higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.

Natural Resources

Nederland is situated amidst a classic alpine backdrop: snowcapped peaks, coniferous forests, and rushing (or sometimes trickling) streams and water bodies. From its inception, this setting has strongly influenced the town's quality of life, connection to the environment, and economy. For more information about Nederland's Natural Resources reference The Town's Comprehensive Plan:

<https://nederlandco.civicweb.net/document/31342>

Historic

The history of Nederland is documented in the Mining Museum, owned and operated by Boulder County, complete with working mining machinery, and the Gillaspie House, owned by the Town of Nederland and operated by the Nederland Area Historical Society, with antiques and artifacts that illustrate life in Nederland during the turn of the last century and beyond.

Table H-6 lists the properties in Nederland that are on the National Register of Historic Places and/or the Colorado State Register of Historic Properties (for more information about these registers, see Section 4.4 Vulnerability Assessment).

Table H-6 Nederland's Historic Properties/Districts in National and State Registers

Property	Address	Date Listed
Gillaspie House	Bridge Street	12/17 /1998
Cardinal Mill	167 Bergren Rd, Nederland, CO 80466	12/22/2011
Rock Mountain Mammoth Mine	Nederland Vicinity	07/06/10

Sources: Directory of Colorado State Register Properties

It should be noted that as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

Cultural Resources

Within the Town of Nederland, there is the Nederland Elementary School and Teens, Inc., an alternative high school. The Nederland Middle/Senior High School is located just outside of Town limits in unincorporated Boulder County. The majority of the youth in Nederland attend one of these schools and these facilities can serve as emergency shelters if needed.

Nederland has a series of tourist's attractions. One of the most beloved cultural assets though is the Carousel of Happiness, which is a non-profit arts and culture organization.

H.4 Growth and Development Trends

Table H-7 illustrates how Nederland has grown in terms of population and number of housing units between 2015 and 2020.

Table H-7 Nederland's Change in Population and Housing Units, 2015-2020

2015 Population	2020 Population Estimate	Estimated Percent Change 2015-2020	2015 Estimated # of Housing Units	2020 Estimated # of Housing Units	Estimated Percent Change 2015-2020
1446	1559	7%	686	791	15%

Source: U.S. Census Bureau, 2014 and 2019 American Community Survey

No significant development trends are expected; however, some limited to moderate growth at wildland interface areas in residential areas is anticipated.

H.5 Vulnerability Assessment

The intent of this section is to assess Nederland's vulnerability separate from that of the planning area as a whole, which has already been assessed in Sections 4.4 Vulnerability Assessment and 4.5 Estimating Potential Losses of the Base plan. This vulnerability assessment analyzes the population, property, critical facilities, and other assets at risk for the more significant hazards or where available data permits a more in-depth analysis. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment of the Base Plan.

H.5.1 Vulnerability by Hazard

The hazard summaries in Table H-3 above reflect the hazards that could potentially affect the Town. Based on this analysis, the priority hazards (High Significance) for mitigation are wildfire, wind, winter storm, and landslide/mud and debris flow/rockfall. Those of Medium significance for the Town of Nederland are identified in Table H-3.

Due to the ability to quantify vulnerability further with available data, only the flood, and wildfire hazards will be profiled in the following vulnerability assessment section.

Hazards assigned a significance rating of Low and which do not differ significantly from the County ranking (e.g., Low vs. High) are not addressed further in this plan and are not assessed individually for specific vulnerabilities in this section.

Flood

General Property

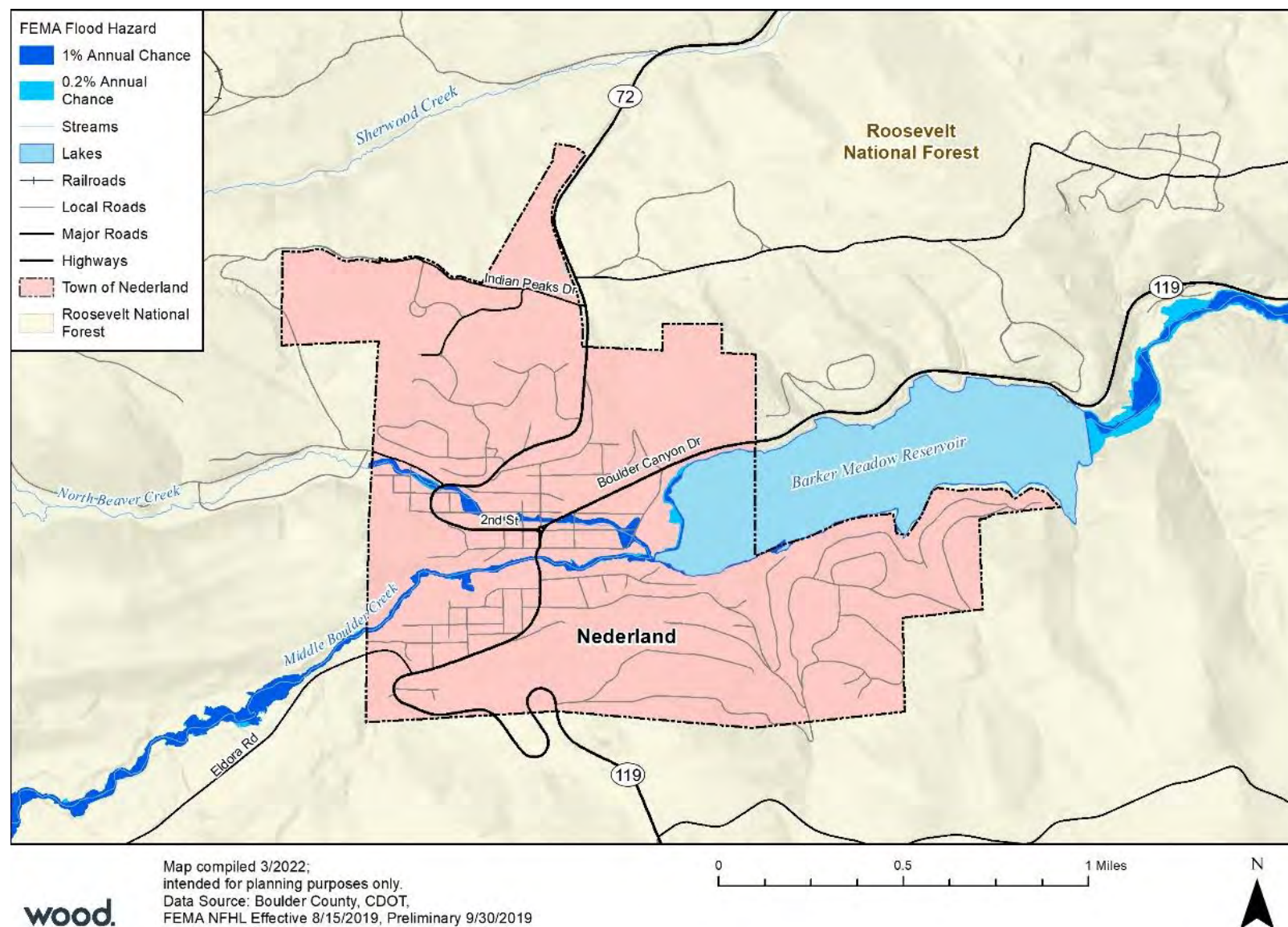
Vulnerability to flooding was determined by summing potential losses to Nederland's properties in GIS, by using the latest FEMA NFHL data along with the Boulder County parcel layer provided by the Assessor's Office. FEMA's NFHL data depicts the 1% annual chance (100-year). Figure H-2 below displays Nederland's FEMA special flood hazard areas present in the town, color coded based on flood event (i.e. 100-year versus 500-year). The 0.2% 500 year chance of flood events is not mapped.

Based on the GIS analysis performed with the county parcel layer and the available FEMA flood mapping, the potential risk for the Town is shown in Table H-8. Nederland's 1% annual chance flood zone presents has 28 buildings and over an Most properties at risk of flooding from both estimated \$8 million in total estimated losses.

Table H-8 Summary of Nederland Properties Vulnerable to 1% Annual Chance Flood Events, by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Commercial	1	2	\$234,900	\$234,900	\$469,800	\$117,450	
Exempt	4	4	\$1,284,000	\$1,284,000	\$2,568,000	\$642,000	
Residential	12	22	\$3,499,650	\$1,749,825	\$5,249,475	\$1,312,369	48
Total	17	28	\$5,018,550	\$3,268,725	\$8,287,275	\$2,071,819	48

Source: Boulder County, FEMA NFHL, U.S., Census Bureau, Wood Analysis

Figure H-2 FEMA Special Flood Hazard Areas in Nederland

People

The population exposed to the flood hazards described in the flood vulnerability analysis above was estimated by applying an average household size factor to the number of improved residential properties identified in the flood hazard areas within Nederland. These estimates yielded the population exposures shown in the table above in Table . As such, the 1% annual chance floods would potentially displace 48 people, based on the residential structures which fall in those flood zones. For additional details on potential displacements by flood event, see the Boulder County Base Plan.

Critical Facilities and Infrastructure

There are a total of two critical facilities located in the 1% flood hazard areas. The critical facilities fall within the transportation (1) and food, water and shelter lifelines (1).

Figure H-3 FEMA 1% Annual Chance Flood Hazard for Critical Facilities in Nederland

FEMA Lifeline	Count
Food, Water, Shelter	1
Transportation	1
Total	2

Source: Town of Nederland, Boulder County, Assessor's Office, NBI, Wood Analysis

Economy

Flooding can have a major economic impact on the economy, including indirect losses such as business interruption, lost wages, and other downtime costs. Flooding often coincides with the busy summer tourism months in Boulder County, and may impact, directly or indirectly (such as from the negative perception of potential danger to his hazard), the revenues of shops, restaurants, hotels, and other major industries which keep the local economy thriving.

Historical, Cultural, and Natural Resources

The environment is mostly resilient to general flooding. However, cultural or historic properties within floodplains would be affected in similar ways as property and critical facilities/infrastructure, especially those with underground or basement levels where water would easily seep and potential ruin archives, resources, or other important assets.

Wildfire

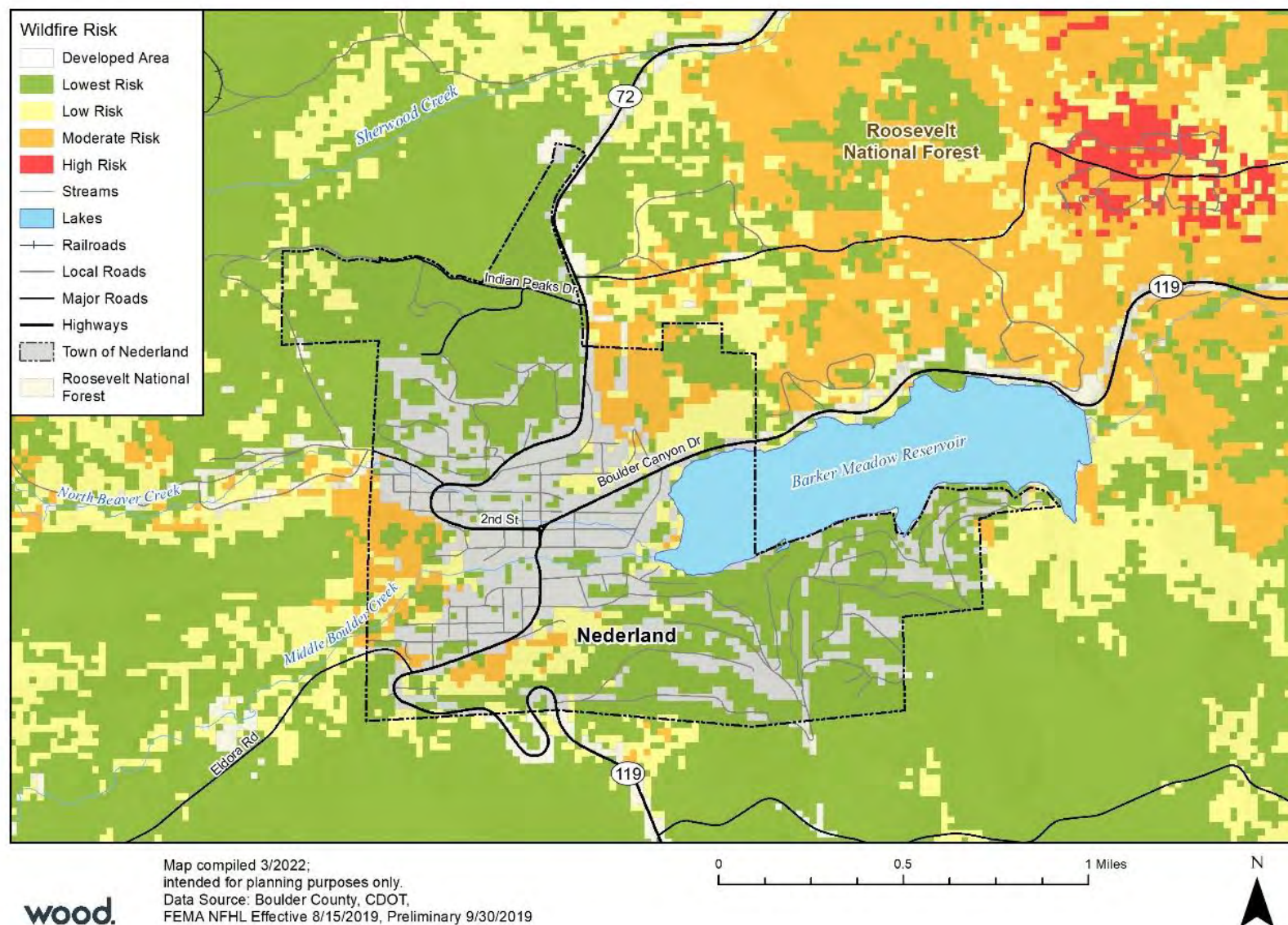
General Property

Parcel analysis was conducted using GIS to analyze where parcels, buildings counts, property types and content values intersected with the wildfire hazards zones defined by the Colorado Forest Atlas, from highest to lowest risk. The Colorado Forest Atlas calculates a composite risk rating, defined as the possibility of loss or harm occurring from a wildfire. It identifies areas with the greatest potential impacts from a wildfire – i.e., those areas most at risk - considering all values and assets combined together – WUI Risk, Drinking Water Risk, Forest Assets Risk and Riparian Areas Risk. This risk index has been calculated consistently for all areas in Colorado, allowing for comparison and ordination of areas across the entire state. The Wildfire Risk Classes for Nederland are shown in, Table and Figure H-4 below. The areas in Nederland with a moderate to high risk of wildfires are located in the Northeast part of area with the Roosevelt National Forest.

Table H-9 Property Values in Moderate Wildfire Zone by Parcel Type for Nederland

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Exempt	1	1	\$0	\$0	\$0	
Residential	27	36	\$8,808,500	\$4,404,250	\$13,212,750	78
Total	28	37	\$8,808,500	\$4,404,250	\$13,212,750	78

Source: Boulder County Assessor's Office, Wood Analysis

Figure H-4 Town of Nederland Wildfire Risk

Wildland-Urban Interface

The Colorado Forest Atlas also provides an analysis for Wildland-Urban Interface (WUI) risk based on housing density consistent with Federal Register National standards. The location of people living in the wildland-urban interface and rural areas is essential for defining potential wildfire impacts to people and homes. To calculate the WUI Risk Index, the WUI housing density data was combined with flame length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9, while areas with low housing density and low flame lengths are rated -1. Data is modelled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers. WUI Risk for Nederland is mapped in Figure H-5.

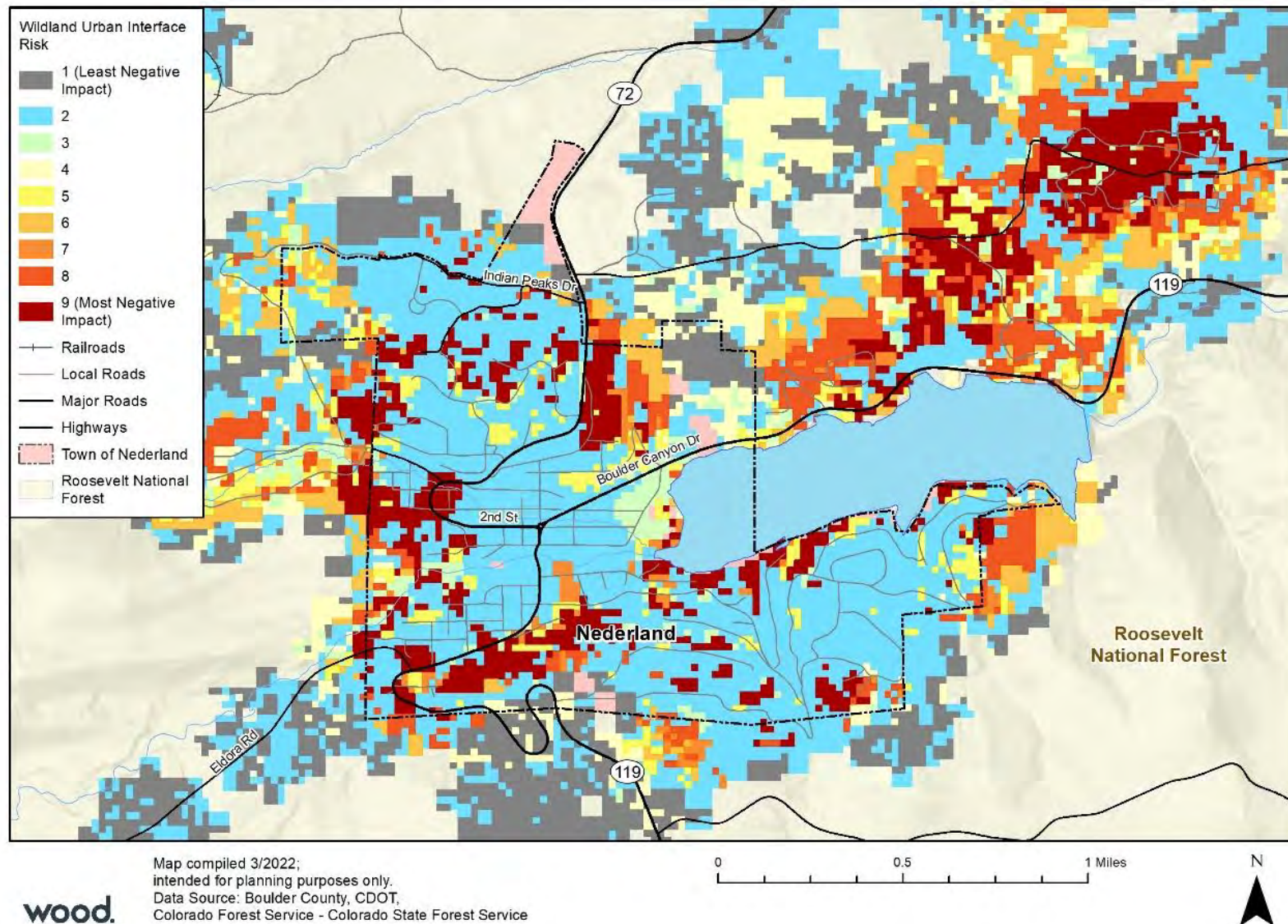
Figure H-5 Town of Nederland WUI Risk

Table H-10 WUI High Risk Hazard for Nederland

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Commercial	8	8	\$8,607,480	\$8,607,480	\$17,214,960	
Exempt	8	13	\$2,224,100	\$2,224,100	\$4,448,200	
Residential	129	134	\$53,308,160	\$26,654,080	\$79,962,240	291
Vacant	1	1	\$10,900	\$10,900	\$21,800	
Total	146	156	\$64,150,640	\$37,496,560	\$101,647,200	291

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

Table H-11 WUI Moderate Risk Hazard for Nederland

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Commercial	2	2	\$353,800	\$353,800	\$707,600	
Exempt	1	2	\$0	\$0	\$0	
Mixed Use	2	2	\$212,700	\$212,700	\$425,400	4
Residential	41	50	\$25,026,190	\$12,513,095	\$37,539,285	109
Total	46	56	\$25,592,690	\$13,079,595	\$38,672,285	113

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

The properties most at WUI Risk in Nederland are residential with 156 and 56 for high and moderate risk respectively. Along with a total of 404 people within Nederland being at WUI Risk. Not pictured is the low WUI related risk within Nederland. 706 properties are at a low WUI risk and a total of 1,380 people have a low WUI related risk as well.

People

The last column of Table and Table H-11 above summarizes the number of people at risk to wildfire in the analyzed fire zones and WUI Fire Zones. Based on the assessment conducted, Nederland has an estimated 78 people at risk in the wildfire zone considered to be moderate. Also 113 of the population in Nederland live in a high WUI wildfire risk area. for wildfires and a total of 53 residential properties are considered to be at a low risk of wildfire damage to people and property. These totals were estimated by multiplying the average persons per household in Nederland by the number of residential properties falling within the fire zones. Smoke resulting from fire is an issue to local populations also.

Critical Facilities and Infrastructure

A total of 8 critical facilities were identified to be in medium wildfire zones in Nederland as listed in Table H-12 below.

Table H-12 Critical Facilities Within Nederland Wildfire Risk

FEMA Lifeline	Count
Communications	1
Food, Water, Shelter	1
Safety and Security	6
Total	8

Source: Boulder County Assessor's Office, Wood Analysis

Economy

Tourism, the accommodation and food services industry (e.g. hotels and restaurants), and retail are major components of Boulder County's economy, and Nederland's as well. Wildland fires can, for example, lead to significant tourism reductions due to health and safety concerns, causing lost revenues from lack of visitation, stays in hotels, spending on restaurants and other commerce sources, and more.

Historical, Cultural and Natural Resources

Wildfires are a common and naturally occurring phenomenon in forested areas and can benefit forest health in many respects. But the climate change trend which is leading to hotter, more widespread, and destructive fires can make it more difficult for the environment to recover, and lead to increased flood runoff or other secondary/cascading hazards. This can severely impact water quality and watershed health for years after a fire.

With regards to historic or cultural structures and resources, wildfires would affect those in similar ways as general property and critical facilities/infrastructure, having the potential for burn downs and hence possible complete loss of important historical assets.

H.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment summarizes Nederland's regulatory mitigation capabilities, administrative and technical mitigation capabilities, and fiscal mitigation capabilities and then discusses these capabilities in further detail along with other mitigation efforts as they pertain to the National Flood Insurance Program's Community Rating System (CRS). Although the CRS is flood-focused, this discussion also incorporates activities related to other hazards into the categories established by the CRS.

H.6.1 Mitigation Capabilities Summary

Table H-13 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Nederland.

Table H-13 Nederland's Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Comprehensive plan	Yes	2013
Zoning ordinance	Yes	Nederland Municipal Code
Subdivision ordinance	Yes	Nederland Municipal Code
Growth management ordinance	Yes	
Site plan review requirements	Yes	
Floodplain ordinance	Yes	
Floodplain Management Plan	No	Desired outcome to have a Floodplain Management Plan
Other special purpose ordinance (stormwater, steep slope, wildfire)	Yes	Community Wildfire Protection Plan
Building code	Yes	Nederland Municipal Code; 2012 Building Codes
BCEGS Rating	No	
Fire department ISO rating	Yes	
Erosion or sediment control program	No	Desired outcome to have an erosion/sediment control program

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Storm water management program	Yes	Master Infrastructure Plan
Capital improvements plan	Yes	
Economic development plan	Yes	
Local emergency operations plan	Yes	
Other special plans	Yes	Master Infrastructure Plan
Flood insurance study or other engineering study for streams	Yes	
Flood Hazard Mitigation Plan Update	No	The updated Master Infrastructure Plan was completed in 2021, which shows map of flood hazard areas.
Other: USFS MOU	Yes	
Other: CPAW technical grant with a goal to create a Wildfire Mitigation plan	No	Town is actively pursuing funding for a CWPP plan as recommended under the CPAW grant.
Participate in the National Flood Insurance Program	Yes	08/22/75
Elevation Certificates	Yes	
Participate in the Community Rating System (CRS)	No	

Table H-14 identifies the personnel responsible for mitigation and loss prevention activities as well as related data and systems in Nederland.

Table H-14 Nederland's Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/engineer with knowledge of land development/land management practices	Yes	Town Administrator, Deputy Town Administrator, Deputy Zoning Administrator	
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Contract with JVA	
Planner/engineer/scientist with an understanding of natural hazards	Yes	Contract with JVA	
Personnel skilled in GIS	Yes	Contract with Terra Cognita	
Full-time building official	Yes	Contract for Safebuilt	
Floodplain manager	Yes	Town Administrator and Public Works Manager	
Emergency manager	Yes	Police Marshal	
Grant writer	Yes	Department Heads, Sustainability Coordinator	
Transportation Planner	No		Town does have a Traffic Control Supervisor
Resiliency Planner	No		A Resiliency Team was formed post COVID; not on active group anymore though
GIS Data – Hazard areas	No		

Personnel Resources	Yes/No	Department/Position	Comments
GIS Data – Critical facilities	Yes		
GIS Data – Building footprints	Yes		
GIS Data – Land use	Yes		
GIS Data – Links to assessor's data	Yes		
Warning systems/services (Reverse 9-11, Everbridge, BCares, cable override, outdoor warning signals)	Yes		

Table H-15 identifies financial tools or resources that Nederland could potentially use to help fund mitigation activities.

Table H-15 Nederland's Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Yes/No)	Comments
Community Development Block Grants	Yes	
Capital improvements project funding	Yes	
Authority to levy taxes for specific purposes	Yes	
Fees for water, sewer, gas, or electric services	Yes	
Impact fees for new development	Yes	
Incur debt through general obligation bonds	Yes	
Incur debt through special tax bonds	Yes	
Incur debt through private activities	Yes	
Withhold spending in hazard-prone areas	No	
Stormwater Service Fees	No	Desired outcome to have a stormwater service fee.

Table H-16 identifies existing education and outreach capabilities that the Town of Nederland uses to inform the public about hazards and risks in the community.

Table H-16 City of Nederland Education and Outreach Capabilities

Capability/Program	Yes/No (Briefly Describe)
Local Citizen Groups That Communicate Hazard Risks (Peak-to-Peak Housing & Human Services Emergency Group)	Yes
Firewise	No
StormReady	No
Other?	Yes: Social Media (Facebook, Instagram, Twitter), TextMyGov, Everbridge

H.6.2 Opportunities for Capability Enhancement and Improvement

The plan update process provided the Town of Nederland an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where

capabilities could be improved or enhanced. Specific opportunities could include:

- Integrate risk assessment information into future updates to the Town's Comprehensive Plan.
- Integrate risk assessment information into future updates of the Town's Land Use Code.
- Providing training for staff members related to hazards or hazard mitigation grant funding in partnership with the County and DHSEM.
- Become a Firewise Community.
- Written protocols and action plans for hazard mitigation, including enhanced polygon plans to assess predetermined evacuation areas.

H.6.3 Community Rating System Activities (All Hazards)

National Flood Insurance Program

The Town of Nederland adopted updated flood plain regulations in December 2008, along with the rest of the State of Colorado, to ensure compliance with the revised statewide flood rule.

The Town is working with CHAMP through a grant-funded program to update a Flood Hazard Mitigation Plan for the state which will include information specific to Nederland. It is anticipated that this plan will be completed in 2022.

NFIP insurance data indicates that as of March 2022, there were 12 policies in force in Nederland, resulting in \$3,421,700 of insurance in force. There have been 2 claims since 1978 for \$7,463. According to data from the Colorado Water Conservation Board, as of January 2021 there were no repetitive loss structures.

Continued Compliance with the NFIP

Recognizing the importance of the NFIP in mitigating flood losses, the Town of Nederland will place an emphasis on continued compliance with the NFIP. As an NFIP participant, the Town has and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance as well as review of any potential development in special flood hazard areas to ensure compliance with local floodplain regulations. The Town will periodically review the floodplain ordinance for updates, particularly when there are changes or updates to NFIP maps or the State of Colorado floodplain rules.

Community Rating System Categories

The Community Rating System (CRS) categorizes hazard mitigation activities into six categories. These categories, and applicable Nederland activities, are described below. Note: some of the activities are appropriate to multiple categories. For purposes of simplicity, they are only included in the category deemed most appropriate based on the definitions and examples provided in the CRS Coordinator's Manual.

Preventive

Preventive activities keep problems from getting worse. The use and development of hazard-prone areas is limited through planning, land acquisition, or regulation. They are usually administered by building, zoning, planning, and/or code enforcement offices.

- Building, Zoning Codes
- Code Enforcement Program

Property Protection

Property protection activities are usually undertaken by property owners on a building-by-building or parcel

basis.

- Building Codes
- Town Clean-up Program
- Nuisance Codes
- CPAW

Natural Resource Protection

Natural protection activities preserve or restore natural areas or their natural functions. They are usually implemented by parks, recreation, or conservation agencies or organizations.

- Source Water Protection Plan
- CWPP (Wildfire)
- Comprehensive Plan
- Parks and Rec, Open Space Master Plan
- Trails Master Plan
- CPAW

Emergency Services

Emergency services measures are taken during an emergency to minimize its impacts. These measures are the responsibility of city or county emergency management staff and the owners or operators of major or critical facilities.

- COOP Plan
- Excel Energy Response Plan
- Emergency Plan for Utilities

Structural Projects

Structural projects keep hazards away from an area (e.g., levees, reservoirs, other flood control measures). They are usually designed by engineers and managed or maintained by public works staff.

- Water Intake/Flood Control Gate
- Pipeline repairs to prevent I&I, flooding at waste water treatment plant

Public Information

Public information activities advise property owners, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of natural resources (e.g., local floodplains). They are usually implemented by a public information office.

- Press Information Officer
- Partner with regional agencies
- Social Media (Town Webpage, Facebook, Twitter, etc.)

The Town of Nederland received CDBG-DR funds to address infrastructure damage caused in the 2013 Flood. Roadways, shoulders, culverts, and drainage improvements construction were completed and a certification form is attached to this document.

The Town also received a Small Communities Grant from the State to repair extensive damage to the waste water system due to the flood. The final evaluation form is attached.

- FEMA Repairs
- CAT "F": Pipeline repairs post September 2013 flood (Attached)
- CAT "C": Roadway repairs and storm water mitigation (Attached)

H.7 Nederland Hazard Mitigation Projects

Name of Action: Nederland Combined Hazard Mitigation - Blocked Access Identification and Mitigation

Hazards Addressed: Wildfire, Windstorm, Debris Flow, Severe Winter Storm

Mitigation Goal or Objective Addressed: Goals 1, 2, 3 and 4

Issue/Background: Downed trees and blocked roads are a commonality with all four hazards. Nederland has experienced all of these events with varying degrees of impact. The blocking of access by trees, snow and to a lesser extent debris has created significant issues with emergency access to citizens during these events. Nederland lacks capacity in equipment to effectively deal with these events. This project would identify pre-event areas of potential blockage so that mitigation options can be evaluated, including strategic tree trimming, improved drainage or debris basins, and strategic snow storage. Additional chainsaws, skid steer, snow/debris removal equipment and an all-terrain utility vehicle would also greatly improve emergency response capability during these events in the event that not all areas are mitigated.

Other Alternatives: work with existing equipment.

Action Status: Continuing – not completed.

Responsible Office: Town of Nederland

Priority (High, Medium, Low): High

Cost Estimate: \$275,000

Existing or Potential Funding: Grant funding, existing departmental budgets

Benefits (avoided losses): The mitigation of blocked access for emergency response would prevent potential loss of life and property damage due to inability to reach emergency scenes.

Potential or current subject matter expertise: Emmett Pelletier, Streets Supervisor, 303-258-3167

Schedule: As funding permits; estimated time for completion 3-5 years.

Name of Action: Nederland Combined Hazard Mitigation - Emergency Communications

Hazards Addressed: Wildfire, Windstorm, Debris Flow, Severe Winter Storm (All)

Mitigation Goal or Objective Addressed: Goals 1, 2, 3 and 4

Issue/Background: Effective communication among first response organizations is vital to achieve effective coordination of emergency responses. During various hazards, roads are typically blocked, requiring coordination between Law, Fire and Public Works, EOC or DOC and other response agencies. Recently significant 700/800mhz radio infrastructure improvements have occurred in the area. While various State of Colorado and Boulder County agencies are able to take advantage of this improved infrastructure, The Town of Nederland (Law and Public works) and Nederland Fire Protection District, lack the radio technology to interface on this system. The addition of several satellite phones will remove dependency on a likely overburdened cellular tower system.

Other Alternatives: Use existing VHF radio system with poor interoperability.

Action Status: Continuing – not completed.

Responsible Office: Town of Nederland, Nederland Fire Protection District

Priority (High, Medium, Low): High

Cost Estimate: \$550,000

Existing or Potential Funding: Grant funding

Benefits (avoided losses): New communication equipment will improve interoperability among first responders, reducing delay and miscommunication of operation objects during all emergency hazard conditions. This improved performance will reduce the potential for loss of life and property.

Potential or current subject matter expertise: Michael Scott, Nederland Fire Protection District 303-258-9161

Schedule: As funding permits; estimated time for completion 3-5 years.

Name of Action: FEMA- CAT “F” Pipeline Repairs and Improvements

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Prevent flooding, inflow and infiltration to waste water treatment system.

Issue/Background: This project entails a combination of repairing and improving sewer collection pipelines to reduce damages from flooding and impacts to the water supply. The system incurred damages after the 2013 Flood. Some repairs have been made but additional improvements are needed.

Other Alternatives: Repairing to previous condition.

Action Status: In progress

Responsible Office: Town of Nederland Public Works Department.

Priority (High, Medium, Low): High

Cost Estimate: \$718,000

Existing or Potential Funding: Existing Funding (FEMA, CDPHE, CDBG-DR)

Benefits (avoided losses): Protection of water quality (Barker Reservoir) and wastewater collection system

Potential or current subject matter expertise: Jennifer Landon, Utilities Manager, 303-258-3088

Schedule: Started in 2016 and will be a continuous focus annually as Town does not have funding to complete at one time.

Name of Action: Nederland Community Wildfire Protection Plan Update

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1, 2, 3 and 4

Issue/Background: In May of 2011, the Community Wildfire Protection Plan (CWPP) for the Nederland Area was completed. This plan was a collaborative effort between the Town of Nederland, the Nederland Fire Protection District and the Timberline Fire Protection District. This plan identifies relative wildfire risk among geographic areas, identifies values at risk and establishes specific action plans for those areas. Since adoption, numerous wildfire mitigation efforts have occurred by Federal, County, Town agencies as well as the neighborhood level. Significant progress has been made, but an update to the plan is needed to evaluate progress and to re-stratify risk and mitigation strategies. CWPP updates typically occur at the 5-7 year intervals, which we are past. In addition, the Town of Nederland and the NFPD received an assistance grant from Community Wildfire Planning and Assistance (CPAW). CPAW is currently drafting recommendations for the Town and FD.

Other Alternatives: Continue work from existing plan without re-evaluation.

Action Status: Continuing – not completed

Responsible Office: Nederland Fire Protection District

Priority (High, Medium, Low): High

Cost Estimate: \$25,000

Existing or Potential Funding: Grant funding; Town is actively pursuing funding for the CWPP update in 2022 through a CPAW grant.

Benefits (avoided losses): An updated plan will maintain visibility of high priority goals and direct ongoing mitigation efforts. These efforts directly impact potential wildfire losses to properties, infrastructure and damage to local economy.

Potential or current subject matter expertise: Nederland Fire Protection District 303-258-9161

Schedule: As funding permits; estimated time for completion 1-2 years.

Name of Action: Improve Stormwater Drainage System Capacity

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 2

Issue/Background: Significant runoff could flood the Town due to inadequate drainage and culverts. To prevent this issue, the Town must prioritize Installing, re-routing, or increasing the capacity of a storm drainage system. This project will investigate the options to improve capacity and provide direction for mitigation and implementation. Options that will be evaluated include increasing drainage or absorption capacities with detention and retention basins, relief drains, spillways, drain widening/dredging or rerouting, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, or channel redirection. Increasing dimensions of drainage culverts in flood-prone areas will also be evaluated.

Other Alternatives: No action

Action Status: New in 2022

Responsible Office: Town of Nederland Public Works

Priority (High, Medium, Low): High

Cost Estimate: \$100,000

Existing or Potential Funding: Grant funding

Benefits (avoided losses): Addressing the drainage issues in Town would prevent potential loss of life and property damage due to flooding.

Potential or current subject matter expertise: Town Administrator & Streets Supervisor 303-258-3266

Schedule: As funding permits; estimated time for completion 3-5 years.

Annex I: Town of Superior

Annex I Town of Superior

I.1 Community Profile

The Town of Superior in southeast Boulder County is bounded by the Rocky Flats Wildlife Refuge and State Highway 128 to the south, the City of Boulder and Boulder County Open Space to the west and northwest, U.S. 36 to the east and northeast, and the City and County of Broomfield and Jefferson County to the southeast. The total planning area, including the existing town limits and potential annexation areas, is approximately 4.26 square miles.

The elevation of Superior ranges from 5,475 feet along Coal Creek in “Original” Superior to 5,980 feet on the ridge paralleling State Highway 128. Rock Creek and Coal Creek are the major drainage basins that flow through the Town. Both converge with Boulder Creek and eventually St. Vrain Creek, a major tributary to the South Platte River.

The climate is semi-arid, with an average of 18 inches of precipitation per year. Temperatures range from -22°F. to 104°F.

The Town of Superior was founded in 1896 by William C. Hake and incorporated in 1904. At that time, the Town’s economy was based largely on farming and coal mining in the surrounding foothills. The shaft to the Industrial Coal Mine was sunk in 1896 on the hillside immediately to the south of the present location of Original Superior. The coal was said to be of “Superior” quality, and so the Town was named.

Mining was the major force in Superior’s history until 1945 when, similar to other mines located throughout southeast Boulder County, the removal of coal from the Industrial Mine became uneconomical, and the mine was closed. Commercial development that supported the mining industry also came to a halt, and the Town evolved into a quiet ranching and farming community. In the 1990s, the economic and new construction boom made Superior one of the fastest growing communities in the nation.

I.1.1 Population

The estimated 2020 population of the Town of Superior was 13,099. Select Census 2019 demographic and social characteristics for Superior are shown in Table I-1.

Table I-1 Superior’s Demographic and Social Characteristics

Characteristic	Percent
Gender/Age	
Male (%)	48.9
Female (%)	51.1
Under 5 Years (%)	5.6
65 Years and Over (%)	7.3
Race/Ethnicity (one race)	
White (%)	76.8
Hispanic or Latino (Of Any Race) (%)	6.8
Other	
Average Household Size	2.85
High School Graduate or Higher (%)	98.1

Source: U.S. Census Bureau, 2019 Quick Facts, www.census.gov/

I.1.2 Economy

The Town of Superior is a bedroom community to the Denver-Boulder metropolitan region and offers limited opportunities for residents to work within the Town boundaries. According to 2018 OnTheMap Census data, the industries that employed most of Superior's labor force were professional, scientific, and technical services (15.8%); health care and social assistance (10.9%); and educational services (10.5%). Select economic characteristics for Superior from the Census Bureau are shown in Table I-2.

Table I-2 Superior's Economic Characteristics

Characteristic	
Individuals below Poverty Level (%)	4.2
Median Home Value	\$576,800
Median Household Income, 2019	\$127,292
Per Capita Income, 2018	\$52,492

Source: U.S. Census Bureau, 2019 Quick Facts, www.census.gov/

I.2 Hazard Identification and Summary

The most significant hazards for Superior are wildfires, floods, expansive soils, severe winter storm and windstorm. Refer to Section 4.4 Vulnerability Assessment for detailed vulnerability on the countywide level. Due to the historical coal mining in the area subsidence of the land surface is a concern in Superior.

Coal Creek runs through Original Superior and has occasionally caused flood damage in the Town's history. Notably, flooding occurred in the Spring of 1935 and resulted in damage to the 3rd Avenue bridge, leaving the 2nd Avenue bridge as the only means for vehicular access to a segment of this neighborhood. In 1995, flooding caused damage to the structural buttress of the 2nd Avenue bridge. In mid-September 2013 Boulder County, including the Coal Creek and Rock Creek Basins received over 18 inches of rain over a three-day period, a storm calculated to be excess of the 100-year storm. The portion of the Rock Creek Basin located in Superior had been master-planned in accordance with the Mile High Flood District (formally known as the Urban Drainage & Flood Control District) standards and the drainageway improvements functioned as planned with only minor channel damage. Along Coal Creek within Original Superior, which had been platted over a hundred years ago, flooding caused damage to about a dozen building structures. Floodwaters overtopped the 2nd Avenue Bridge, causing erosion of the approach embankments, but little damage to the structure itself. Subsequent to the flooding, the Town, in conjunction with FEMA, removed flood debris, repaired street damage and worked with residents to mitigate flood damage. The Town also purchased for open space a parcel contiguous to development south of Coal Creek and constructed an emergency access to be used in the event of a future flood. In 2015, the Town, in conjunction with the Mile High Flood District (formally known as the Urban Drainage & Flood Control District) and the Hazard Mitigation Grant Program, undertook a flood mitigation project to add capacity at the 2nd Avenue Bridge and improve channelization of Coal Creek. These improvements will remove most of the building structures along Coal Creek from the 100-year floodplain. In 2015 the Town also purchased two small properties along Coal Creek that were in the 100-year floodplain and were incorporated into the overall flood mitigation project. The Town is planning another flood mitigation project on Coal Creek, between 2nd Avenue and McCaslin Blvd. The Town has acquired a parcel through the development review process to facilitate this project.

Table I-3 Town of Superior Hazard Summary

Hazard Type	Geographic Extent	Probability of Future Occurrences	Magnitude / Severity	Increased Threat (Climate Change)	Hazard Significance
Air Quality	Extensive	Highly Likely	Critical	Moderate	Medium
Avalanche	N/A	N/A	N/A	Moderate	N/A
Communicable / Zoonotic Disease Outbreak	Limited	Occasional	Negligible	Low	Low
Dam and Levee Failure	Significant	Occasional	Critical	Substantial	Low
Drought	Extensive	Occasional	Limited	Moderate	Medium
Earthquake	Extensive	Occasional	Negligible	Substantial	Low
Extreme Temperatures	Extensive	Occasional	Negligible	Low	Low
Expansive Soils	Significant	Occasional	Negligible	Severe	Low
Flood	Limited	Likely	Limited	Substantial	High
Hailstorm	Extensive	Occasional	Limited	Severe	Medium
Landslide/Mud and Debris Flow/Rockfall	N/A	N/A	N/A	Moderate	N/A
Lightning	Extensive	Occasional	Negligible	Substantial	Low
Severe Winter Storm	Extensive	Highly Likely	Limited	Moderate	High
Subsidence	Limited	Occasional	Negligible	Substantial	Low
Tornado	Extensive	Occasional	Negligible	Moderate	Low
Wildfire	Significant	Likely	Critical	Severe	High
Windstorm	Extensive	Highly Likely	Limited	Severe	High

Geographic Extent

- Limited: Less than 10% of planning area
- Significant: 10-50% of planning area
- Extensive: 50-100% of planning area

Probability of Future Occurrences

- Highly Likely: Near 100% chance of occurrence in next year or happens every year.
- Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less.
- Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years.
- Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.

Magnitude/Severity

- Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
- Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability.
- Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability.
- Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Increase Threat from Climate Change

- Low- unlikely to become more of a threat due to climate change.

	<ul style="list-style-type: none"> • Moderate – possibly will become more of a threat due to climate change. • Substantial- likely to become more of a threat due to climate change. • Severe- highly likely to become more of a threat due to climate change <p>Significance</p> <ul style="list-style-type: none"> • Low: minimal potential impact • Medium: moderate potential impact • High: widespread potential impact
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I.3 Asset Inventory

I.3.1 Property Inventory

Table I-4 represents an inventory of property in Superior based on the Boulder County Assessor's data as of March 2022.

Table I-4 Superior's Property Inventory

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value
Commercial	32	49	\$162,963,009	\$162,963,009	\$325,926,018
Exempt	28	52	\$13,671,675	\$13,671,675	\$27,343,350
Mixed Use	1	13	\$3,110,000	\$3,110,000	\$6,220,000
Residential	3,925	3,973	\$2,052,115,131	\$1,026,057,566	\$3,078,172,697
Total	3,986	4,087	\$2,231,859,815	\$1,205,802,250	\$3,437,662,065

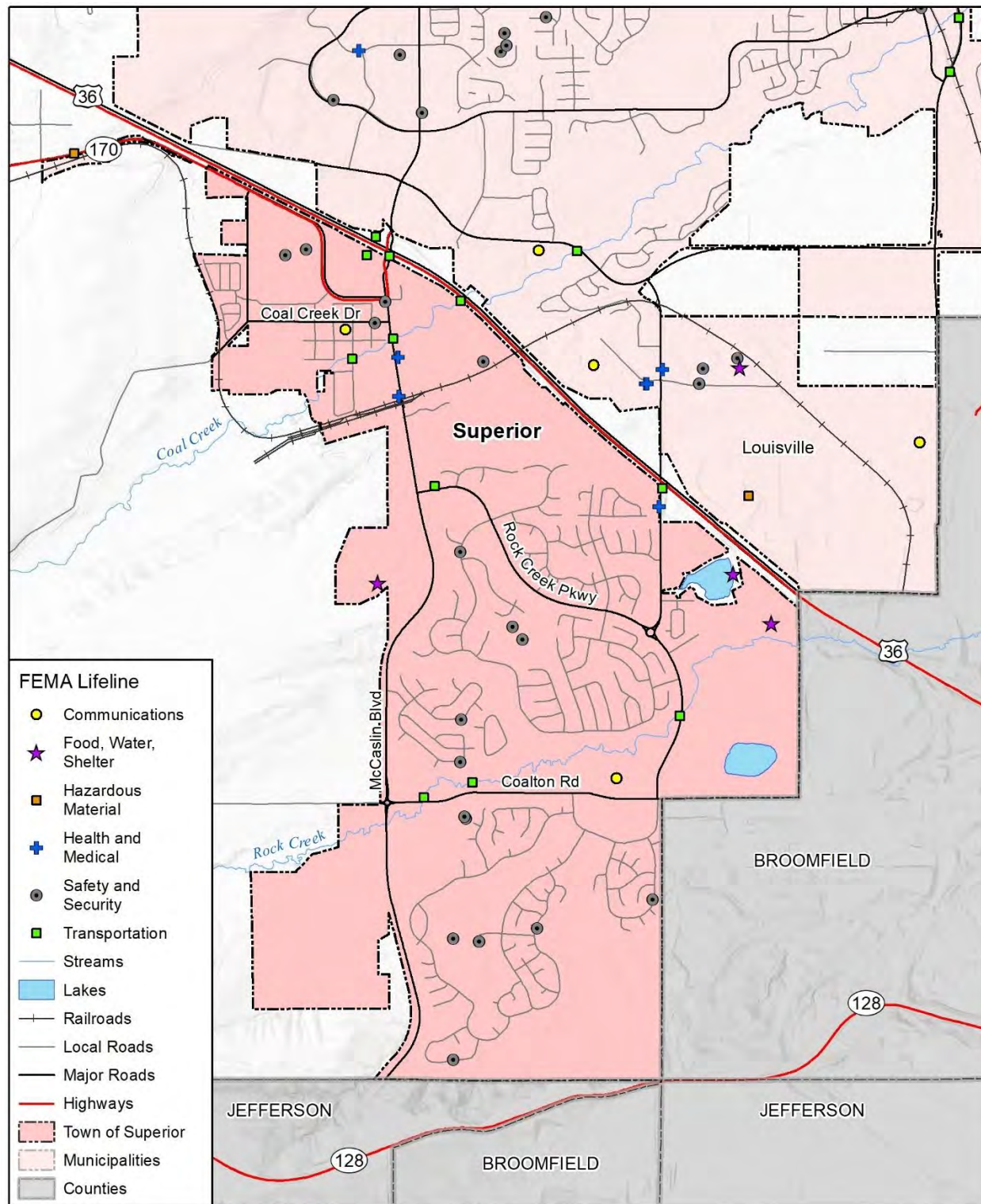
Source: Boulder County Assessor's Office

Critical facility counts and types in GIS databases provided by Boulder County and organized by FEMA Lifeline are shown in Table I-5 and in the map in Figure I-1.

Table I-5 Summary of Superior's Critical Facilities in GIS

FEMA Lifeline	Count
Communications	2
Food, Water, Shelter	2
Health and Medical	2
Safety and Security	19
Transportation	8
Total	31

Source: Boulder County, HIFLD, CDPHE, Wood Analysis

Figure I-1 Superior's Base Map and Critical Facilities

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
City of Boulder, CDPHE, NBI, NID, HIFLD

wood.

I.3.2 Economic Assets

Economic assets at risk may include major employers or primary economic sectors, such as, agriculture, whose losses or inoperability would have severe impacts on the community and its ability to recover from disaster. After a disaster, economic vitality is the engine that drives recovery. Every community has a specific set of economic drivers, which are important to understand when planning ahead to reduce disaster impacts to the economy. When major employers are unable to return to normal operations, impacts ripple throughout the community.

The following are Superior's major employers:

- Costco Wholesale
- Target Corporation
- Boulder Valley School District
- Key Equipment Finance
- SDL International
- Safeway Stores Inc.
- Whole Foods

I.3.3 Natural, Historic, And Cultural Resources

Assessing the vulnerability of Superior to disaster also involves conducting an inventory of the natural, historical, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- If these resources are impacted by a disaster, knowing so ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts are higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.

Natural Resources

The Town contains a variety of wildlife because of its location between the foothills and the plains. It likely receives infrequent visits from species inhabiting plains, foothill, montane, and aquatic/riparian habitats. The Town is the edge of geographical range for numerous species. The abundance of wildlife species varies widely within and across habitats and cannot be obtained without detailed population studies.

Historic and Cultural Resources

The Coal Creek Agricultural Site (Grasso Park) at 122 E. William Street was listed on the Colorado State Register of Historic Properties (for more information about this register, see Section 4.4 Vulnerability Assessment) on March 11, 1998.

It should be noted that as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

I.4 Growth and Development Trends

Table I-6 illustrates how Superior has grown in terms of population and number of housing units between

2010 and 2019.

Table I-6 Superior's Change in Population 2010-2019

2010 Population	2019 Population Estimate	Estimated Percent Change 2010-2019	2010 # of Housing Units	2019 Estimated # of Housing Units	Estimated Percent Change 2010-2019
12,481	13,087	+4.9%	4,698	4,952	+5.4%

Source: Colorado Division of Local Government State Demography Office, www.dola.colorado.gov/dlg/demog/

Until 1986, Superior was confined to a small area of residential development flanking Coal Creek and included limited commercial activity. In 1987, the Rock Creek Planned-Unit Development was submitted to the Town, and the residents voted to annex Rock Creek Ranch in exchange for improved services and utilities. The first building permit was issued in 1990. Development along the U.S. 36 corridor and increasing growth and development in the Denver/Boulder metropolitan area has resulted in an increase in residential and commercial development in the communities adjacent to the Town. In addition, growth caps imposed by the City of Boulder prompted increased development in surrounding communities.

The Town of Superior contains undeveloped parcels adjacent to the U.S. 36 corridor that have attracted the attention of the development community. To the west of Superior, the landscape between Boulder and Superior has remained relatively unchanged due to the acquisition of large tracts of open space by Boulder County and the City of Boulder.

I.5 Vulnerability Assessment

The intent of this section is to assess Superior's vulnerability separate from that of the planning area as a whole, which has already been assessed in Sections 4.4 Vulnerability Assessment and 4.5 Estimating Potential Losses of the base plan. This vulnerability assessment analyzes the population, property, critical facilities, and other assets at risk for the more significant hazards or where available data permits a more in-depth analysis. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment of the base plan.

I.5.1 Vulnerability by Hazard

The hazard summaries in Table I-3 above reflect the hazards that could potentially affect the Town. Based on this analysis, the priority hazards (High Significance) for mitigation are flood, wind and winter storm.

Due to the ability to quantify vulnerability further with available data, only dam inundation, flood, and wildfire hazards will be profiled in the following vulnerability assessment section.

Hazards assigned a significance rating of Low, and which do not differ significantly from the County ranking (e.g., Low vs. High) are not addressed further in this plan and are not assessed individually for specific vulnerabilities in this section.

Dam Failure

General Property and People

While there is no concrete data available to indicate any likelihood of failure, based on best available dam inundation data there might be structures potentially at risk of dam failure flooding. The dam failure inundation maps contain sensitive information and are not available for display in this public planning document. Based on a GIS analysis performed with the best available data 966 people are potentially at risk of a dam inundation event. Table I-7 shows the potential exposure to people and property in Superior.

Table I-7 Estimated Dam Inundation Exposure to Properties in Superior

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Exempt	1	8	\$341,800	\$341,800	\$683,600	
Residential	650	355	\$236,508,600	\$118,254,300	\$354,762,900	966
Total	651	363	\$236,850,400	\$118,596,100	\$355,446,500	966

Source: Boulder County Assessor, U.S. Census, DOLA, DWR, Wood Analysis

Critical Facilities and Infrastructure

Based on the GIS analysis summarized in the Table I-8, it is expected that around 2 critical facilities in Superior are exposed to a potential dam inundation event. The majority fall within the safety and security lifeline.

Table I-8 Critical Facilities Exposed to Dam Inundation

FEMA Lifeline	Count
Food, Water, Shelter	1
Safety and Security	1
Total	2

Source: Boulder County Assessor, Wood Analysis

Refer to Section 4.3.4 of the base plan for the location of dams in Boulder County.

Economy

In addition to commercial and residential building impacts, a dam inundation event that affected the major roads which give access to the town. Which could significantly affect the local economy, by limiting or completely impeding access to shops, restaurants, hotels, and other major industries which keep the local economy thriving.

Historical, Cultural, and Natural Resources

Dam or reservoir failure effects on the environment would be similar to those caused by flooding from other causes. For the most part the environment is resilient and would be able to rebound, though this process could take years. However, historic and cultural resources could be affected just as housing or critical infrastructures would.

Flood

Prior to the 2013 flood event, damage caused by flooding in Superior was minor due to the small stream sizes of Coal and Rock Creeks and amount of agricultural land near the creeks. Infrastructure including roads, bridges and irrigation structures have experienced the greatest damages due to flooding in the past. According to the 2019 Boulder County Flood Insurance Study, the 2013 flood event created split flows from Coal Creek led to flooded streets and houses in old town Superior. The flood event also caused bank erosion near bridges and floodwater left debris throughout the town and in open space areas.

General Property and People

Vulnerability to flooding was determined by summing potential losses to Superior properties using GIS, the building footprint layer provided by Boulder County and the latest FEMA NFHL data. A separate parcel analysis was also conducted, where the parcel was used to create a centroid, or point, representing the center of each parcel polygon, in order to get the number of improved parcels, property types, and

improved values. FEMA's NFHL data depicts the 1% annual chance (100-year) and the 0.2% annual chance (500-year) flood events. Figure I-2 below displays Superior's FEMA special flood hazard areas present in the town, color coded based on flood event (i.e., 100-year versus 500-year).

Based on the GIS analysis performed and the available FEMA flood mapping, the potential risk for the town is shown in Table I-9 and Table I-10. Superior 1% annual chance flood zone presents has 3 buildings, 1 of which is a residential building, and over an estimated \$195,945 in estimated losses for all property types. According to the analysis, 43 buildings (38 of which are residential) are exposed to the 0.2% annual chance event, totaling over \$3 million of damages to buildings and contents.

Table I-9 Town of Superior Properties at Risk to 1% Annual Chance Flood Zone

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Exempt	2	2	\$123,875	\$123,875	\$247,750	\$61,938	
Residential	2	1	\$357,352	\$178,676	\$536,028	\$134,007	3
Total	4	3	\$481,227	\$302,551	\$783,778	\$195,945	3

Source: Boulder County Assessor, U.S. Census, DOLA, FEMA NFHL Effective 8/15/2019, Preliminary 9/30/2019, Wood Analysis

Table I-10 Town of Superior Properties at Risk to 1% Annual Chance Flood Zone

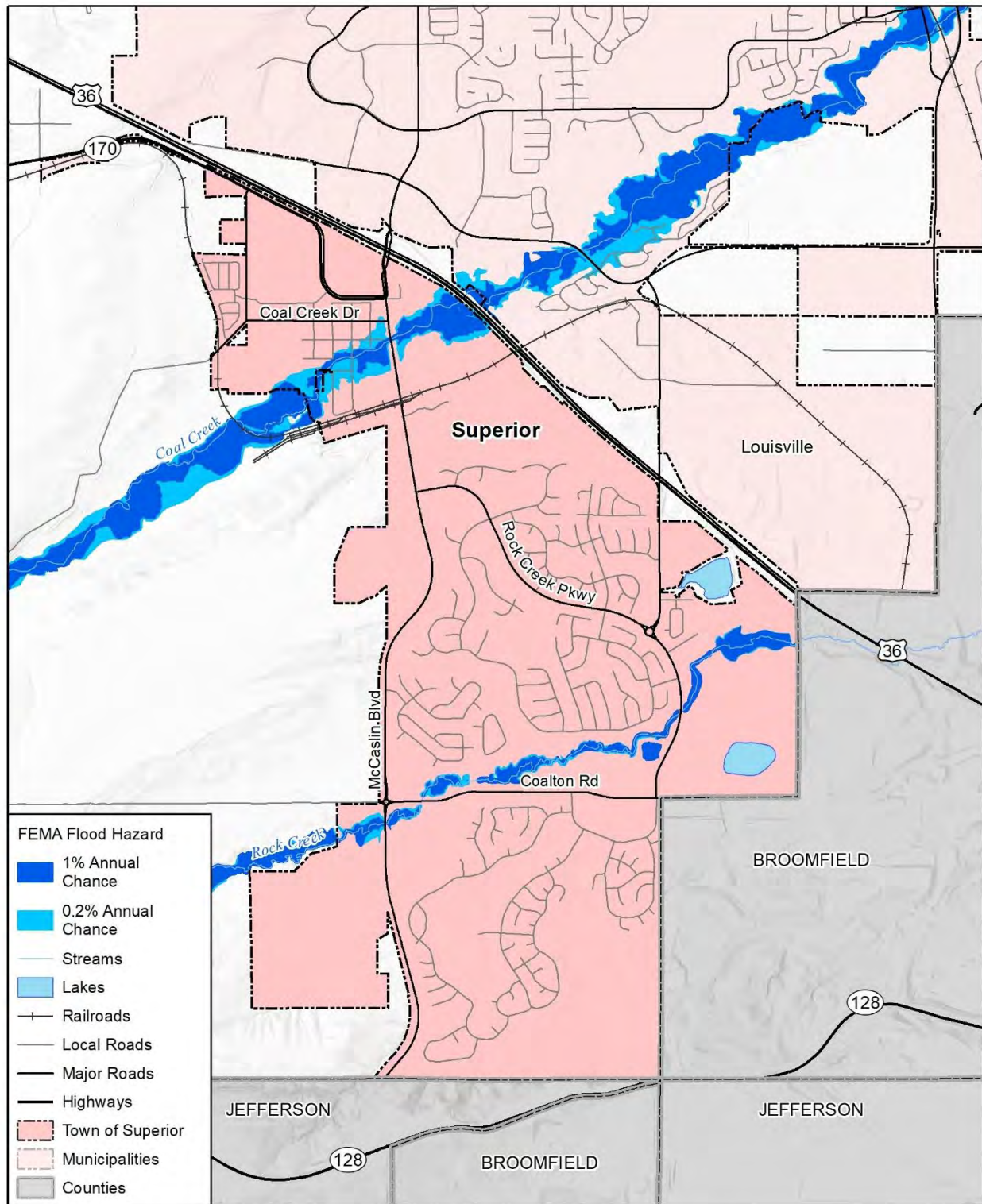
Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Estimated Loss	Population
Exempt	4	5	\$250,900	\$250,900	\$501,800	\$125,450	
Residential	23	38	\$8,595,469	\$4,297,735	\$12,893,204	\$3,223,301	103
Total	27	43	\$8,846,369	\$4,548,635	\$13,395,004	\$3,348,751	103

Source: Boulder County Assessor, U.S. Census, DOLA, FEMA NFHL Effective 8/15/2019, Preliminary 9/30/2019, Wood Analysis

The population exposed to the flood hazards described in the flood vulnerability analysis above was estimated by applying an average household size factor to the number of improved residential properties identified in the flood hazard areas within Superior. These estimates yielded the population exposures shown in the table above in Table I-9 and Table I-10. As such, the combined 1% and 0.2% annual chance floods would potentially displace 106 people, based on the residential structures which fall in those flood zones. For additional details on potential displacements by flood event, see the Boulder County Base Plan.

Critical Facilities and Infrastructure

There are a total of 2 critical facilities located in 1% flood hazard area. No critical facilities were identified as being located in the 0.2% flood hazard area. The 2 critical facilities fall within the Transportation FEMA Lifeline category and are identified as being bridges.

Figure I-2 Town of Superior Flood Hazard Areas

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
FEMA NFHL Effective 8/15/2019, Preliminary 9/30/2019

0 0.5 1 Miles



wood.

Economy

Flooding can have a major economic impact on the economy, including indirect losses such as business interruption, lost wages, and other downtime costs.

Historical, Cultural and Natural Resources

The environment is mostly resilient to general flooding. However, cultural or historic properties within floodplains would be affected in similar ways as property and critical facilities/infrastructure, especially those with underground or basement levels where water would easily seep and potential ruin archives, resources, or other important assets.

Wildfire

General Property

Parcel analysis was conducted using GIS to analyze where parcels, buildings counts, property types and content values intersected with the wildfire hazards zones defined by the Colorado Forest Atlas, from highest to lowest risk. The Colorado Forest Atlas calculates a composite risk rating, defined as the possibility of loss or harm occurring from a wildfire. It identifies areas with the greatest potential impacts from a wildfire – i.e., those areas most at risk - considering all values and assets combined together – WUI Risk, Drinking Water Risk, Forest Assets Risk and Riparian Areas Risk. This risk index has been calculated consistently for all areas in Colorado, allowing for comparison and ordination of areas across the entire state. The Wildfire Risk Classes for Superior are shown in in Table I-11 and Figure I-3 below.

Based on this analysis Superior has 473 structures at risk of wildfire, 116 of which are within area of the highest to high risk. Residential property types have the greatest number of parcels at risk of wildfire.

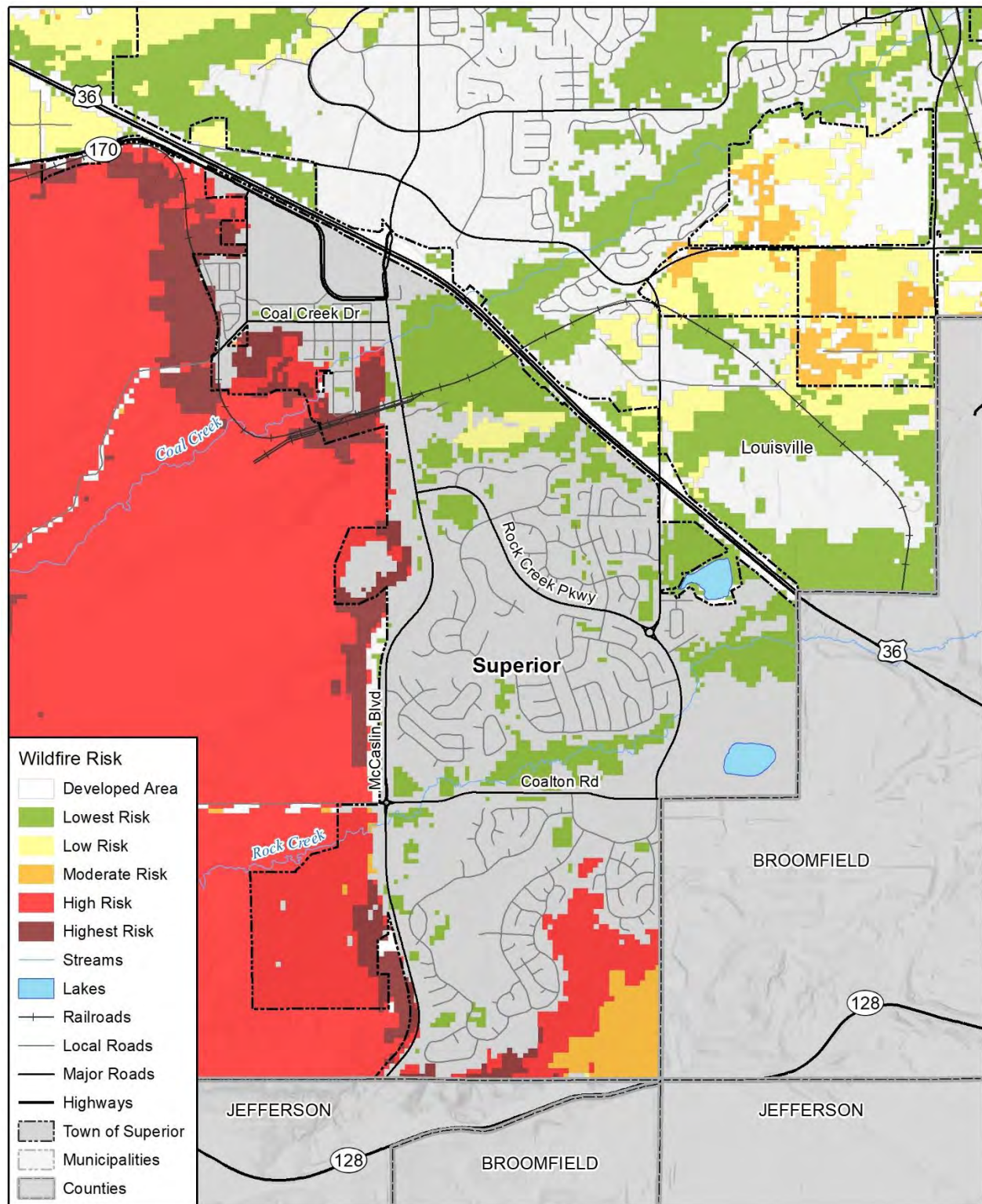
Note, this analysis does not reflect the impacts from the December 2021 Marshall Fire.

Table I-11 Properties within the Highest to Lowest Wildfire Risk

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Highest Wildfire Risk						
Commercial	2	3	\$14,577,662	\$14,577,662	\$29,155,324	
Exempt	1	10	\$0	\$0	\$0	
Mixed Use	1	1	\$3,110,000	\$3,110,000	\$6,220,000	3
Residential	78	72	\$40,664,429	\$20,332,215	\$60,996,644	196
Total	82	86	\$58,352,091	\$38,019,877	\$96,371,968	199
High Wildfire Risk						
Exempt	2	2	\$227,500	\$227,500	\$455,000	
Residential	28	28	\$14,445,880	\$7,222,940	\$21,668,820	76
Total	30	30	\$14,673,380	\$7,450,440	\$22,123,820	76
Low Wildfire Risk						
Residential	40	47	\$15,856,750	\$7,928,375	\$23,785,125	128
Total	40	47	\$15,856,750	\$7,928,375	\$23,785,125	128
Lowest Wildfire Risk						
Commercial	5	7	\$29,359,526	\$29,359,526	\$58,719,052	
Exempt	10	11	\$249,075	\$249,075	\$498,150	
Residential	237	292	\$116,346,969	\$58,173,485	\$174,520,454	794

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Total	252	310	\$145,955,570	\$87,782,086	\$233,737,656	794

Source: Boulder County Assessor's Office, U.S. Census, DOLA, Colorado Forest Service - Colorado State Forest Service, Wood Analysis

Figure I-3 Town of Superior Wildfire Risk

Wildland-Urban Interface

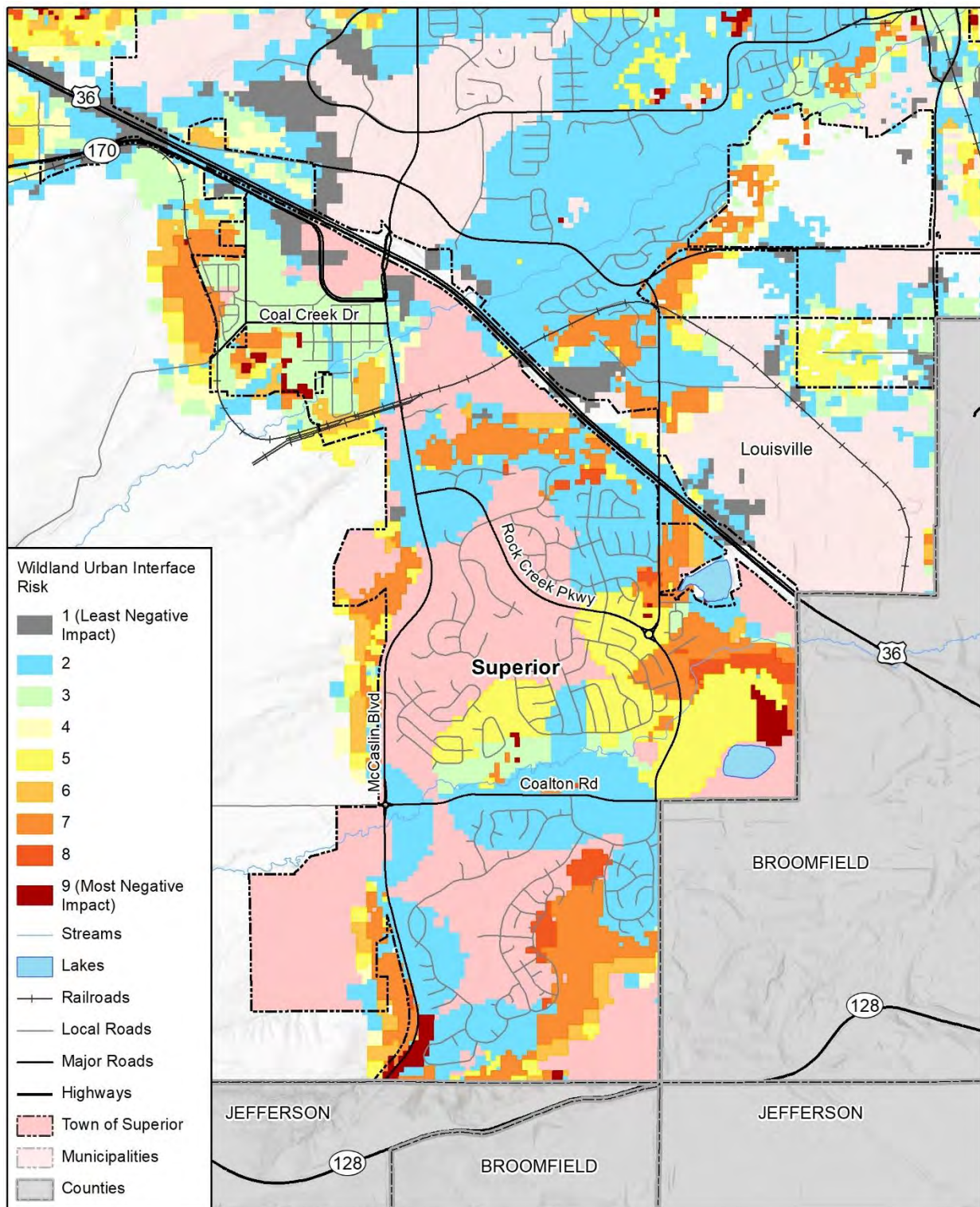
The Colorado Forest Atlas also provides an analysis for Wildland-Urban Interface (WUI) risk based on housing density consistent with Federal Register National standards. The location of people living in the wildland-urban interface and rural areas is essential for defining potential wildfire impacts to people and homes. To calculate the WUI Risk Index, the WUI housing density data was combined with flame length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9, while areas with low housing density and low flame lengths are rated -1. Data is modelled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers. WUI Risk for Superior is mapped in Figure I-4.

Based on this analysis Superior has 2,792 structures within WUI risk areas, 1,084 of which are at moderate to high WUI risk. Residential property types have the greatest number of structures (2,719) within all WUI risk areas.

Table I-12 Properties Within High to Low WUI RISK

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
High WUI Risk						
Commercial	1	3	\$8,272,800	\$8,272,800	\$16,545,600	
Exempt	2	3	\$0	\$0	\$0	
Mixed Use	1	7	\$3,110,000	\$3,110,000	\$6,220,000	19
Residential	310	360	\$200,470,161	\$100,235,081	\$300,705,242	979
Total	314	373	\$211,852,961	\$111,617,881	\$323,470,842	998
Moderate WUI Risk						
Commercial	3	2	\$10,412,388	\$10,412,388	\$20,824,776	
Residential	483	709	\$447,937,605	\$223,968,803	\$671,906,408	1,928
Total	486	711	\$458,349,993	\$234,381,191	\$692,731,184	1,928
Low WUI Risk						
Commercial	19	32	\$103,710,687	\$103,710,687	\$207,421,374	
Exempt	15	26	\$9,043,600	\$9,043,600	\$18,087,200	
Residential	1,923	1,650	\$820,260,185	\$410,130,093	\$1,230,390,278	4,488
Total	1,957	1,708	\$933,014,472	\$522,884,380	\$1,455,898,852	4,488

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

Figure I-4 Town of Superior Wildland Urban Interface Risk

People

The last column of Table I-11 and Table I-12 above summarizes the number of people at risk to wildfire in the analyzed fire zones. Based on the assessment conducted, Superior has an estimated 275 people living within the high to highest risk zones. An additional 922 residents live within the low to lowest wildfire risk areas. No residential properties were identified in the moderate wildfire risk zone. In terms of people living within WUI risk areas, an estimated 7,404 residents live within the low to high WUI risk areas. Of those, 2,916 are estimated to be living within the moderate to high WUI risk areas. In addition to living within wildfire or WUI risk areas, smoke resulting from wildfires, even fires outside of Boulder County or the state have been an issue for people in Superior and Boulder County in the past.

Critical Facilities and Infrastructure

The Town of Superior has a total of 4 critical facilities at lowest to highest risk to wildfire. Most (3) facilities are identified as being a food, water, shelter lifeline. This includes a high hazard dam within the highest wildfire risk areas, and assisted living residence or nursing home and a childcare provider located within the lowest wildfire risk area. There are also 22 critical facilities within the low to high WUI Risk areas. The following tables show the results of the GIS analysis and is organized by wildfire or WUI risk and Lifeline. Refer to Chapter 4 of the Base Plan for more information on the methodology of the GIS analysis.

Table I-13 Critical Facilities Within Wildfire Risk Areas by FEMA Lifeline

FEMA Lifeline	Count
Highest Wildfire Risk	
Food, Water, Shelter	1
Total	1
Lowest Wildfire Risk	
Health and Medical	1
Safety and Security	1
Total	2
Grand total	4

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Table I-14 Critical Facilities Within WUI Risk Areas by FEMA Lifeline

FEMA Lifeline	Count
High WUI Risk	
Food, Water, Shelter	1
Safety and Security	1
Total	2
Moderate WUI Risk	
Health and Medical	1
Safety and Security	1
Transportation	1
Total	3
Low WUI Risk	
Communications	2
Safety and Security	10

FEMA Lifeline	Count
Transportation	5
Total	17
Grand Total	22

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Economy

Tourism, the accommodation and food services industry (e.g., hotels and restaurants), and retail are major components of Boulder County's economy, and Superior's as well. Wildland fires can, for example, lead to significant tourism reductions due to health and safety concerns, causing lost revenues from lack of visitation, stays in hotels, spending on restaurants and other commerce sources, and more.

Historical, Cultural and Natural Resources

Wildfires are a common and naturally occurring phenomenon in forested areas and can benefit forest health in many respects. But the climate change trend which is leading to hotter, more widespread, and destructive fires can make it more difficult for the environment to recover, and lead to increased flood runoff or other secondary/cascading hazards, such as erosion, landslides, mudslides, and debris flows, and flooding. This can severely impact water quality and watershed health for years after a fire. Wildfires can negatively impact air quality, water quality, and vegetation and biodiversity.

With regards to historic or cultural structures and resources, wildfires would affect those in similar ways as general property and critical facilities/infrastructure, having the potential for burn downs and hence possible complete loss of important historical assets.

I.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment summarizes Superior's regulatory mitigation capabilities, administrative and technical mitigation capabilities, and fiscal mitigation capabilities and then discusses these capabilities in further detail along with other mitigation efforts as they pertain to the National Flood Insurance Program's Community Rating System (CRS). Although the CRS is flood-focused, this discussion also incorporates activities related to other hazards into the categories established by the CRS.

I.6.1 Mitigation Capabilities Summary

Table I-15 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Superior.

Table I-15 Superior's Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Comprehensive Plan	Yes	Town of Superior 2001 Comprehensive Plan with 2012 Amendment
Zoning ordinance	Yes	Land Use Code Chapter 16
Subdivision ordinance	Yes	Land Use Code Chapter 16
Growth management ordinance	No	
Floodplain ordinance	Yes	Land Use Code Chapter 16
Site plan review requirements	Yes	

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Other special purpose ordinance (stormwater, steep slope, wildfire)	Yes	Drainage, Storm Water Management, Erosion Control (Land Use Code Chapter 16)
BCEGS Rating	No	
Building code	Yes	2018 International Building Code; 2021 IECC with opt-out option for Marshall Fire-impacted homes to use 2018 IECC
Fire department ISO rating	Yes	Rating: 3
Erosion or sediment control program	Yes	
Stormwater management program	Yes	
Capital improvements plan	Yes	2022 Town of Superior Budget
Economic development plan	No	
Local emergency operations plan	No	Included in Boulder County's Emergency Operations Plan
Other special plans	Yes	Coal Creek and Rock Creek Master Drainageway Plan, 2019; Parks, Recreation, Open Space, and Trails Master Plan, 2021
Flood insurance study or other engineering study for streams	Yes	FEMA Flood Insurance Study, August 15, 2019; Flood Insurance Rate Map, 2019, Flood Hazard Area Delineation Coal Creek and Rock Creek, 2014
Community Wildfire Protection Plan	No	
Participate in the National Flood Insurance Program (NFIP)	Yes	
Participate in the Community Rating System (CRS)	No	
Elevation Certificates	Yes	

Table I-16 identifies the personnel responsible for mitigation and loss prevention activities as well as related data and systems in Superior.

Table I-16 Superior's Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/engineer with knowledge of land development/land management practices	Yes	Administration Department, Assistant Town Manager	
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Public Works and Utilities Department, Director	
Planner/engineer/scientist with an understanding of natural hazards	No		
Personnel skilled in GIS	Yes	Public Works & Utilities Coordinator	
Full-time building official	Yes		SAFEbuilt
Floodplain Administrator	Yes	Public Works/Town Civil Engineer	
Emergency Manager	Yes	Administration/Disaster & Preparedness Manager	Also work with Boulder County OEM
Grant writer	No		
Transportation Planner	Yes	Public Works Dept.	

Personnel Resources	Yes/No	Department/Position	Comments
Resiliency Planner	No		
Other personnel	No		
GIS Data – Hazard areas	Yes	Public Works & Utilities Coordinator	
GIS Data – Critical facilities	Yes	Public Works & Utilities Coordinator	
GIS Data – Building footprints	No		
GIS Data – Land use	Yes	Public Works & Utilities Coordinator	
GIS Data – Links to assessor's data	Yes	Public Works & Utilities Coordinator	
Warning systems/services (Reverse 9-11, cable override, outdoor warning signals)	Yes	Boulder County Sheriff's Office	Reverse 9-11, Emergency Warning Sirens, Boulder County

Table I-17 identifies financial tools or resources that Superior could potentially use to help fund mitigation activities.

Table I-17 Superior's Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Yes/No)	Comments
Community Development Block Grants	Yes	
Capital improvements project funding	Yes	
Authority to levy taxes for specific purposes	Yes	
Fees for water, sewer, gas, or electric services	Yes	
Impact fees for new development	Yes	
Incur debt through general obligation bonds	Yes	
Incur debt through special tax bonds	Yes	
Incur debt through private activities	No	
Withhold spending in hazard-prone areas	Yes	
Stormwater Service Fees	Yes	

Table I-18 identifies education and outreach mitigation capabilities that Superior currently has in place.

Table I-18 Superior's Education & Outreach Mitigation Capabilities

Education & Outreach	Yes/No Comments
Local citizen groups that communicate hazard risks	No
Firewise	No
StormReady	No
Other	The Mile High Flood District distributes Flood Hazard Warning brochures to all properties in the floodplain

I.6.2 Opportunities for Capability Enhancement and Improvement

The plan update process provided the town with an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- Integrating risk assessment information into the 2023 update of the Town's Comprehensive Plan.
- Integrating risk assessment information into future updates of the Town's Land Use Code.
- Providing training for staff members related to hazards or hazard mitigation grant funding in partnership with the County and DHSEM
- Consider becoming a certified Firewise and certified StormReady community after reviewing Town staffing capacity.

I.6.3 Community Rating System Activities (All Hazards)

National Flood Insurance Program

The Town of Superior joined the National Flood Insurance Program (NFIP) on September 28, 1979. The NFIP allows private property owners to purchase affordable flood insurance and enables the community to retain its eligibility to receive certain federally backed monies and disaster relief funds.

NFIP insurance data indicates that as of March 2022, there are 16 policies in force in Superior, resulting in \$5,012,00 of insurance in force. All were for residential properties (single-family homes). Since 1978 there have been 5 claims for a total of \$98,052. There are no repetitive loss structures located in the Town of Superior.

Continued Compliance with the NFIP

Recognizing the importance of the NFIP in mitigating flood losses, the Town of Superior will place an emphasis on continued compliance with the NFIP. As an NFIP participant, the town has and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance as well as review of any potential development in special flood hazard areas.

Community Rating System Categories

The Community Rating System (CRS) categorizes hazard mitigation activities into six categories. These categories, and applicable Superior activities, are described below. Note: some of the activities are appropriate to multiple categories. For purposes of simplicity, they are only included in the category deemed most appropriate based on the definitions and examples provided in the CRS Coordinator's Manual.

Preventive

Preventive activities keep problems from getting worse. The use and development of hazard-prone areas is limited through planning, land acquisition, or regulation. They are usually administered by building, zoning, planning, and/or code enforcement offices.

Town of Superior 2001 Comprehensive Plan with 2012 Amendment

The purpose of this plan is to provide a basis for current and future land use decisions in the Town of Superior. This plan seeks to facilitate rational decisions regarding future development that are based on limited natural resources, economic considerations, and sound community design and planning principles. Plan goals and related policies particularly relevant to hazard mitigation include the following:

Goal: Protect and promote the health, safety, education, and welfare of residents and employees within the

Town.

Emergency Preparedness Plan

Coordinate with the Boulder County Sheriff's department to develop an emergency preparedness plan for the Town of Superior. Communicate with Town residents about the plan's recommendations.

Service Coordination

Coordinate with the Boulder Valley School District, the Rocky Mountain Fire Protection District, and other suppliers of services, facilities, and utilities in planning for future development and in the siting process of these public facilities.

Growth Management

Guide the location of growth to assure the maximum utilization and efficiency of public facilities and services.

Coal Creek/Rock Creek Master Drainage Plan

Implement the Coal Creek/Rock Creek Master Drainage Plan as approved by the Board of Trustees. The Plan depicts general areas targeted for detention/retention facilities; final site selection/location areas are flexible and subject to development review.

Impact Fees

Assess impact fees for future development that necessitates infrastructure improvements including, but not limited to, paved access, utilities and public services. In addition, generate development agreements to enable future enforcement of developer commitments to construct or finance needed infrastructure and services and other commitments/agreements that result in fulfilling the goals set forth in this Comprehensive Plan.

Water Supply

Maintain a reliable, permanent supply of water that will meet the present and future needs of the community.

Goal: Ensure that a high quality, natural environment is preserved and integrated into future development. Promote and encourage the preservation of existing natural resources including vegetation, drainages, wetlands, ridgelines, steep slopes, wildlife habitat and migration corridors.

Regional Air Quality Studies

Cooperate with air quality studies conducted at a regional level and use the data in land use planning.

Subsidence

Prohibit development which could endanger public safety or property on or near areas determined to be geologically unstable. Subsidence reports certified by qualified professionals shall be required, prior to development in any areas known or suspected of being undermined, to prove the safety of these areas.

Mitigation Of Impacts

Require future development to mitigate negative impacts on environmentally scarce and valuable lands

Goal: Minimize the effects of future development on the function and quality of local and regional waterways and overall water quality.

Floodway Management

Within the floodway (as defined by FEMA studies adopted by the Town of Superior), intermittently permit recreational and public uses, if such uses do not adversely impact the environmental character of the area or development downstream.

Floodplain Management

Develop floodplain management policies to preserve riparian habitat and wildlife migration corridors within the Town. Flood-prone areas of streams and creeks in the Town shall be designated as "floodplain management areas," with special development standards applied therein.

Coordination

Coordinate with Boulder County and appropriate regional, state, and federal agencies in flood control, water quality and stormwater and irrigation run-off programs to realize the greatest benefit from all of these programs.

Drainage Corridors

Protect natural features and habitat associated with drainage corridors.

Goal: Preserve those areas of existing open space that offer natural links between neighborhoods and community centers, that offer unique outdoor recreation and enjoyment, that provide important ecological functions, and that contribute to the community's aesthetic beauty in order to maintain an enjoyable and healthy community.

Reservoirs And Drainageways

Protect, enhance, and develop the existing reservoirs and creek drainageways to protect wildlife habitat and to provide amenities for public use.

Goal: Develop a multi-modal transportation system to efficiently meet the local and regional transportation needs of residents and businesses in a safe, convenient, and efficient manner while minimizing negative environmental and community impacts.

Alternative Modes Of Transportation

Encourage alternative modes of transportation through the establishment of bicycle routes, pedestrian corridors, neighborhood electric vehicle routes, and transit stops linking residential areas with commercial, recreational, and open space facilities with established or proposed regional bicycle systems and with transit hubs. Encourage the adoption and facilitation of additional alternative modes of transportation, including neighborhood electric vehicles, and continue to monitor similar advancements and regulations in neighboring communities.

Regional Transportation District Services And Facilities

Encourage Regional Transportation District (RTD) to provide transit services and facilities that adequately serve the travel needs of commuters and transit-dependent groups.

Superior Rtd Park-N-Ride Facility

Encourage public transit by promoting the Superior RTD park-n-Ride facility as the primary regional transit hub within the Town and by promoting local bus routes. Coordinate with RTD on a future direct route from Superior to Denver International Airport using the Northwest Parkway.

U.S. 36 Bus Rapid Transit (Brt) High Occupancy Vehicle (Hov) Managed Lanes

Support the development of managed lanes on U.S. 36 with a bus/rapid transit station to serve the Town of Superior. Participate in all U.S. 36 corridor meetings and support pedestrian/bicycle/local bus access to the BRT stations.

Transit-Oriented Design Principles

Encourage potential development near the bus/rapid transit stations to use and implement transit-oriented design principles when master planning future development parcels.

McCaslin Boulevard/U.S. 36 Interchange

Improve traffic flow of the McCaslin Boulevard/U.S. 36 interchange by constructing a Diverging Diamond Interchange (DDI) and reconfiguring the west side ramps to provide more direct access to RTD's park-n-Ride. The DDI best achieves maximization of the existing infrastructure including the bridge structure over US36, accommodates or enhances bicycle and pedestrian mobility, maintains transit connectivity, and accommodates the near-term and mid-term traffic demand.

McCaslin Boulevard Traffic Flows

Ensure effective traffic flows along McCaslin Boulevard between SH 128 and Rock Creek Parkway without exceeding the road's existing functional classification as an arterial.

Neighborhood Connections

Ensure neighborhood connections between the Town Center and S. 88th St and S. Coal Creek Drive that respond to projected traffic counts for the proposed Land Uses as depicted on the 2012 Comprehensive Plan's Community Framework and Land Use Plan.

Vehicular, Bicycle, And Pedestrian Access

Ensure safe, effective, and direct access between McCaslin Boulevard, the Town Center, and properties southeast of Original Superior for vehicular, bicycle and pedestrian access.

Future Street Connections

Require development submittals to plan for future street connections by including infrastructure improvements that could potentially support future road connections.

Superior Municipal Code

Building Regulations (Including the Flood Control Plan)

Among the Building Regulations is the Town's Flood Control Plan. It is the purpose of these regulations to promote the public health, safety, and general welfare and to minimize public and private losses due to flood conditions to specific areas by provisions designed to:

- Protect human life and health;
- Minimize expenditure of public money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimize prolonged business interruptions;
- Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines and streets and bridges located in areas of special flood hazard;
- Help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future flood blight areas;

- Ensure that potential buyers are notified that property is in an area of special flood hazard; and
- Ensure that those who occupy the areas of special flood hazards assume responsibility for their actions.

In order to accomplish its purposes, the Flood Control Plan includes methods and provisions for:

- Restricting or prohibiting uses which are dangerous to health, safety and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;
- Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;
- Controlling the alteration of natural floodplains, stream channels and natural protective barriers, which help accommodate or channel flood waters;
- Controlling filling, grading, dredging and other development which may increase flood damage; and
- Preventing or regulating the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas.

Specifically, the regulations require a development permit for construction of development in any area of special flood hazard, outline the duties and responsibilities of the building inspector in administering the regulations, and set standards for flood hazard reduction, including anchoring, construction materials and methods, design and location of utilities, subdivision proposals, elevation (one-foot above base flood elevation), floodproofing, and mobile homes. Additional provisions more stringently limit development in floodways.

Land Use Code (Superior Development Code)

The Town's Land Use Code establishes the regulations and standards governing the use and development of land within the Town. Included are provisions for the annexation, subdivision, and zoning of land. Also included are the Town standards for the use of land. It is the intent of this code to ensure the orderly, efficient, and integrated development of the Town in a way that both promotes the health, safety, and general welfare of its residents and that is compatible and protective of the natural environment. Related to hazard mitigation, the Town seeks to:

- Provide a high quality of life for its residents;
- Maintain property values;
- Provide for the adequate and concurrent provision of public infrastructure and services;
- Ensure well-planned subdivisions by establishing adequate standards for design, improvements, and review;
- Prevent loss of life and property from fire, flooding, geologic hazards, and other natural or manmade dangers; and
- Conserve open space and significant environmental features.

Mitigation-specific regulations are described here:

The Zoning Regulations establish a few mitigation-related districts, which include the following:

- The Open Space and Recreation District was established as a conservation district to preserve the environment and natural character of the landscape within the district. Land within the district may be protected from development, but may also be used for trails, buffering between land uses, defining the edges of urbanization and the preservation of valuable natural features. In addition, this district is intended to provide open space areas for passive, active and developed recreation.
- The Open Space and Natural Uses District was established as a protection district to preserve the open space and undeveloped character of those properties within the district. Land within the district is protected from development but low-impact improvements to the land such as trails, trailheads, flood-control facilities, and reclamation may be allowed.

- The Overlay Environmental Constraints District was established to identify areas of natural or manmade hazards, such as steep slopes or ground subsidence, and wildlife potential or areas of unique environmental features or visual resources such as wildlife areas or ridgelines where additional study and design features are needed to mitigate the hazard or the visual effects of development.
- The Overlay Floodplain Management District was established to control development within the floodways and floodplains to minimize the threat to life and property and meet the requirements of the National Flood Insurance Program.

The Subdivision Regulations dictate that to be subdivided, land shall be of such character that it can be used safely for development purposes without unnecessary danger to health or peril of fire, flood, or other menace.

The Floodways and Floodplains Regulations prohibit artificial obstructions within floodways, identify permissible uses within floodways, and restrict construction within floodways and floodplains (also see discussion of Flood Control Plan above). They also require setbacks for development in areas located outside a designated floodplain but where a stream is located.

The Drainage, Stormwater Management, and Erosion Control Regulations require that all development conform to the natural contours of the land, and natural and preexisting manmade drainage ways remain undisturbed (to the extent practicable); drain properly; plan for stormwater management; control sedimentation and erosion;

The Steep Slope Areas Regulations restrict development on land which has slopes in excess of twenty percent (20 percent) shall be designated as steep slope areas. As such, these areas are susceptible to erosion, and development has the potential of creating unstable slope conditions that are hazardous to inhabitants and property.

The Subsidence Hazard Areas Regulations restrict development in identified subsidence hazard areas.

Other

The Coal Creek & Rock Creek Master Drainageway Plan (2014) provides an overall concept and approach for landowners, developers, and the Town of Superior to plan the drainage facilities required for new development. The Town's consulting water engineers revised the existing conditions hydrologic model that can be used by developers and the Town to evaluate proposed drainage improvements.

The Town has a floodplain program to address safety concerns associated with homes and other structures currently located either partially or wholly within the Coal Creek floodplain, and to create additional open space parks and wildlife habitat along Coal Creek.

Property Protection

Property protection activities are usually undertaken by property owners on a building-by-building or parcel basis.

No current projects/activities.

Natural Resource Protection

Natural protection activities preserve or restore natural areas or their natural functions. They are usually implemented by parks, recreation, or conservation agencies or organizations.

The purpose of the Town's Parks, Recreation, Open Space, and Trails Master Plan (2005) is to obtain community input and present information about existing levels of service for parks, recreation, natural open space, and trails in the Town and make recommendations for the future.

The Town's Open Space Summary Report (2005) reviews currently undeveloped properties in Superior and discusses their potential value to the Town as undeveloped open space.

The Wildlife Survey and Habitat Evaluation for the Town of Superior, Colorado (2003), consists of a wildlife assessment and development of a GIS mapping of wildlife data on 18 privately owned properties. The goal of the project was to describe wildlife habitats, corridors, enhancement opportunities, and human interaction with wildlife on each of these properties to provide a basis for making acquisition recommendations, evaluating development proposals, and assisting in the development of an open space management plan.

Emergency Services

Emergency services measures are taken during an emergency to minimize its impacts. These measures are the responsibility of town or county emergency management staff and the owners or operators of major or critical facilities.

No current projects/activities.

Structural Projects

Structural projects keep hazards away from an area (e.g., levees, reservoirs, other flood control measures). They are usually designed by engineers and managed or maintained by public works staff.

In 2015, the Town, in conjunction with the Mile High Flood District (Formally known as the Urban Drainage & Flood Control District) and the Hazard Mitigation Grant Program, undertook a flood mitigation project to add capacity at the 2nd Avenue Bridge and improve channelization of Coal Creek. These improvements will remove most of the building structures along Coal Creek from the 100-year floodplain

Public Information

Public information activities advise property owners, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of natural resources (e.g., local floodplains). They are usually implemented by a public information office. Some methods of public information could include monthly articles and information on fire safety or monthly articles on environmental education as well as community events. The Town also has an ongoing water conservation campaign with conservation tips available on the Town's website.

Another method of public information is through the Emergency Warning Siren System. This system is coordinated with the Boulder County Office of Emergency Management

I.7 Superior Mitigation Actions

A review of 2016 mitigation actions progress reports indicates that the Town of Superior has been successful in implementing actions identified in the 2016 HMP Mitigation Strategy, thus, working diligently towards meeting the 2016 plan goals. Superior's 2016 mitigation strategy contained 1 mitigation action, the purchasing of 2 properties that located within the Coal Creek floodplain. This action was completed in 2015. The New Actions in 2022 are included in the following mitigation action worksheets.

Name of Action: Coal Creek Stormwater Management Upgrade

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 1 and 2

Issue/Background: This is an ongoing program of drainageway and pond maintenance for the Storm Water system. The 2021 project will upgrade the Coal Creek drainageway from 2nd Avenue to McCaslin Boulevard

with flood mitigation improvements including a concrete trail. This project will be done in coordination with the Mile High Flood District.

Other Alternatives: No action

Action Status: New

Responsible Office: Public Works & Utilities

Priority (High, Medium, Low): High

Cost Estimate: \$1,027,544

Existing or Potential Funding: This project is being done in coordination with the Mile High Flood District who will share 50% of the \$800,000 total project cost.

Benefits (avoided losses): Minimize flooding

Schedule: Work started in 2020. Annual Implementation.

Name of Action: Acquire Additional Floodplain Properties

Hazards Addressed: Flooding

Mitigation Goal or Objective Addressed: Goals 1, 2, and 5

Issue/Background: Acquire destroyed properties in existing 100-year floodway to prevent future flood losses. These properties could also be used for additional storage of flood waters during major floods. Due to the Marshall Fire, these properties have become more viable for purchase.

Other Alternatives: No action

Action Status: New

Responsible Office: Public Works

Priority (High, Medium, Low): High

Cost Estimate: \$1.5 million

Existing or Potential Funding: FEMA HMA Grants and Mile High Flood District funding

Benefits (avoided losses): Reduce number of structures in the floodplain; reduce loss of life and personal injuries from flooding; mitigate against future flood losses.

Schedule: 2 years

Name of Action: Enhance Landscaping Measures

Hazards Addressed: Drought, Flooding, Wildfire, Wind

Mitigation Goal or Objective Addressed: Goals 1, 2, 3 and 5

Issue/Background: Mitigate drought conditions by replacing annual beds with water wise and fire-resistant perennials and/or xeriscape and hardscape design. Develop tree planting plan to help reduce the amount of stormwater runoff, increase carbon sequestration, reduce wildfire spread. Create defensible space around Town-owned structures. Develop and implement a fuels management program to reduce hazardous vegetative fuels on public lands and near essential infrastructure through using contractors through mechanical treatments such as disking, mowing, and chopping as well as chemical treatments, grazing, and biomass removal. Xeriscape medians. Mowing & bagging fuel along critical open space and urban development.

Other Alternatives: No action

Action Status: New

Responsible Office: Superior Parks, Recreation & Open Space; Boulder County Open Space, Mile High Flood District

Priority (High, Medium, Low): High

Cost Estimate: \$3 million over 5 years

Existing or Potential Funding: Colorado Parks Foundation, Keep America Beautiful Community Restoration and Resiliency Fund, Great Outdoors Colorado, Colorado Parks and Wildlife Grant Programs, Waste Management Charitable Giving.

Benefits (avoided losses): Avoid loss of life and loss of property; conserving water; improved water quality; increased awareness, minimizing fiscal impact of hazards/disasters. Hazardous fuels reduction projects will be designed to moderate fire behavior.

Schedule: Annual implementation – 1 year. Annual: Fuels management program, defensible space. Plant material replacement in first year and then every 3 years; tree planting plan, and landscape recommendations are one-time projects.

Name of Action: Facilities and Infrastructure Improvements for Fire and Wind Resistance

Hazards Addressed: Wildfire, Wind

Mitigation Goal or Objective Addressed: Goals 1, 2 and 5

Issue/Background: As a result of the Marshall Fire, hundreds of residential buildings, as well as several Town-owned properties, sustained damage or were completely consumed by fire. To increase resiliency against future hazards, the Town plans to install cost effective fire and wind-resistant materials at the following facilities that are currently not hardened: Water Treatment Plant; Wastewater Treatment Plant; the Community Center; Park Field Office; all Parks structures such as playground safety surfacing, shade structures, restrooms, storage buildings, and shelters; and Town Hall.

Examples of materials include: Cement Board, brick, metal roofs, concrete retaining structures, pour-in-place playground safety surfacing instead of engineered wood fiber (EWF). Structural modifications that may be necessary such as: attic venting, leaf gutter covers, etc.

Other Alternatives: No action

Action Status: New

Responsible Office: Administration; Parks, Recreation and Open Space; Public Works; Planning & Building Department

Priority (High, Medium, Low): Medium

Cost Estimate: \$5 million

Existing or Potential Funding: BRIC Funding through FEMA

Benefits (avoided losses): Loss of life and property; increase resiliency against future hazards/disasters; minimize fiscal impacts of disasters; reduce vulnerability of critical lifeline facilities that would minimize impacts to residents for disaster relief.

Schedule: 3 years

Name of Action: Hazard Awareness Outreach/Education/Emergency Preparedness Campaign**Hazards Addressed:** All Hazards**Mitigation Goal or Objective Addressed:** Goals 1, 2, and 4

Issue/Background: Develop a hazard awareness outreach/education/emergency preparedness campaign to ensure that staff and residents are aware of potential hazards and how to be prepared and ensure their safety, much like FEMA's Resolve to be Ready campaign. Use existing outreach tools including posting on social media and mailing information to residents.

Other Alternatives: No action**Action Status:** New**Responsible Office:** Administration; Partner with Boulder OEM**Priority (High, Medium, Low):** High**Cost Estimate:** \$50,000**Existing or Potential Funding:** FEMA HMA funds

Benefits (avoided losses): Avoid loss of life and personal injuries due to lack of hazard awareness and emergency preparedness. Avoid impacts to property, facilities/infrastructure, and the environment by raising hazard awareness.

Schedule: 1 year 2022-2023**Name of Action: Increase Water Storage Capacity****Hazards Addressed:** Drought, Wildfire**Mitigation Goal or Objective Addressed:** Goals 1 & 2

Issue/Background: Install a new water tank within the existing water system. During the recent Marshall Fire, several fires were being fought and the Town's supply ran out. Increasing storage capacity in the water system will allow more redundancy in the system and allow the Town more capacity in a similar fire in the future. Additionally, a new one-million-gallon water tank will increase the Town's supply and capacity, which is critical for drought resistance.

Other Alternatives: No action**Action Status:** New**Responsible Office:** Public Works**Priority (High, Medium, Low):** Medium**Cost Estimate:** \$3.5 million**Existing or Potential Funding:** Water rate increase to fund a portion. Other FEMA funding or DOLA.

Benefits (avoided losses): Avoid loss of life, loss of property, increasing community risk reduction, minimize fiscal impact of disasters.

Schedule: 2 years for design and construction

Name of Action: Hire a Consultant to Develop Landscape Recommendations

Hazards Addressed: Drought, Wildfire, Flooding, Erosion, Wind

Mitigation Goal or Objective Addressed: Goals 1, 2, 3, 4, and 5

Issue/Background: Hire a consultant to develop landscape recommendations for residents and the Town including plants to avoid and provide educational materials and outreach programs.

Other Alternatives: No action

Action Status: New

Responsible Office: Parks, Recreation and Open Space

Priority (High, Medium, Low): Medium

Cost Estimate: \$25,000-35,000 for recommendation development, \$10,000 annually for outreach programs

Existing or Potential Funding: Colorado Parks Foundation, Keep America Beautiful Community Restoration and Resiliency Fund, Great Outdoors Colorado, Colorado Parks and Wildlife Grant Programs, Waste Management Charitable Giving

Benefits (avoided losses): Avoid loss of life and loss of property; conserving water; improved water quality; increased awareness; minimizing fiscal impact of hazards/disasters.

Schedule: 1 year and then Annual implementation.

Name of Action: Develop Appendix to the Open Space Master Plan for Storm-Water Drainage Improvements and Erosion Mitigation

Hazards Addressed: Flood, Erosion

Mitigation Goal or Objective Addressed: Goals 1, 2, and 5

Issue/Background: Hire a consultant to develop an appendix to the Open Space Master Plan to identify storm-water drainage improvements and erosion mitigation strategies to prevent potential flooding.

Other Alternatives: No action

Action Status: New

Responsible Office: Parks, Recreation & Open Space

Priority (High, Medium, Low): Medium

Cost Estimate: \$35,000

Existing or Potential Funding: Congressional Grant submitted to Hickenlooper for Open Space Master Plan.

Benefits (avoided losses): Avoid loss of life and loss of property due to flooding and erosion; minimizing fiscal impact of hazards/disasters.

Schedule: 1 year 2023-2024

Annex J: Four Mile Fire Protection District

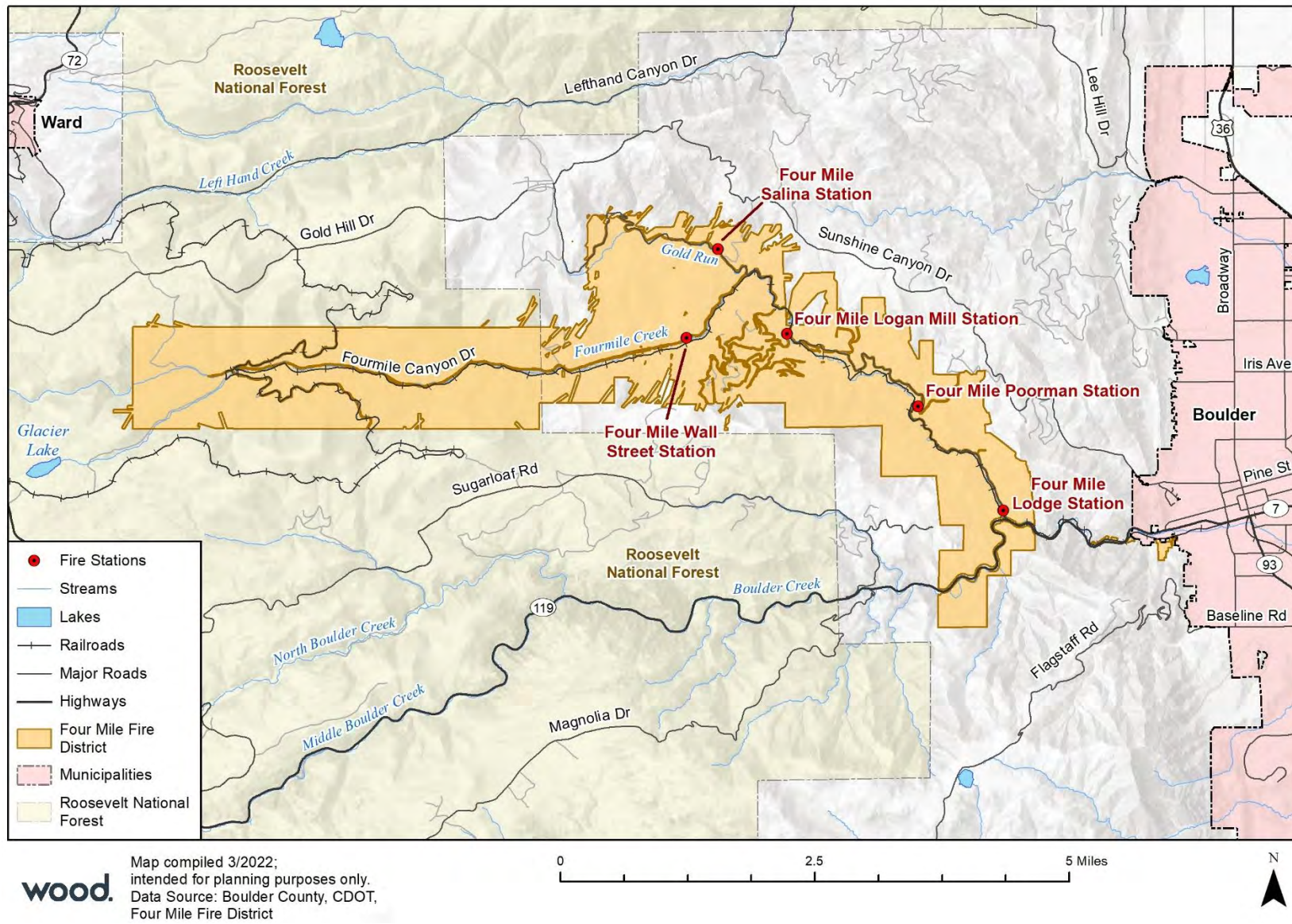
Annex J Four Mile Fire Protection District

J.1 Community Profile

The Four Mile Fire Protection District (FPD) is a combination organization that provides professional fire and medical first response and wildfire mitigation services to our community. We are in the foothills of the Rocky Mountains, just west of Boulder, Colorado. Historic towns in our district include Orodell, Crisman, Salina, Summerville, Wallstreet, and Sunset. The population of our district is approximately 950, spread over an area of 15 square miles.

We respond to around 100 calls for service (via 911) per year. Our department has 30 rostered volunteers, and about half of those respond regularly, three permanent staff, and a seasonal staff that fluctuates between 4-10 wildland firefighters. We have four stations which house a total of seven emergency response vehicles: three pumpers, three tenders and a brush truck. Figure J-1 below shows the extent of the districts boundaries.

Figure J-1 Four Mile Fire Protection District Boundaries



J.2 Hazard Summary

Four Mile Fire Protection District's greatest risks are due to landslides, wildfire, winter storm and flood. Refer to Table J-1 for the hazard rankings for each of Four Mile Fire Protection District's hazards.

Table J-1 Four Mile Fire Protection District Hazard Summary

Hazard Type	Geographic Extent	Probability of Future Occurrences	Magnitude / Severity	Increased Threat (Climate Change)	Hazard Significance
Air Quality	Extensive	Highly Likely	Critical	Moderate	Medium
Avalanche	Limited	Occasional	Negligible	Moderate	Low
Communicable / Zoonotic Disease Outbreak	Extensive	Occasional	Negligible	Low	Medium
Dam and Levee Failure	Significant	Occasional	Critical	Substantial	Medium
Drought	Extensive	Occasional	Critical	Moderate	Medium
Earthquake	Extensive	Unlikely	Critical	Substantial	Low
Extreme Heat	Extensive	Unlikely	Critical	Low	low
Expansive Soils	Limited	Occasional	Negligible	Severe	Low
Flood	Extensive	Highly Likely	Critical	Substantial	High
Hailstorm	Limited	Occasional	Limited	Severe	Low
Landslide/Mud and Debris Flow/Rockfall	Extensive	Highly Likely	Critical	Moderate	High
Lightning	Significant	Likely	Limited	Substantial	Medium
Severe Winter Storm	Extensive	Likely	Critical	Moderate	Medium
Subsidence	Limited	Unlikely	Negligible	Substantial	Low
Tornado	Limited	Occasional	Negligible	Moderate	Low
Wildfire	Extensive	Occasional	Critical	Low	High
Windstorm	Significant	Likely	Limited	Severe	Medium

Geographic Extent

- Limited: Less than 10% of planning area
- Significant: 10-50% of planning area
- Extensive: 50-100% of planning area

Probability of Future Occurrences

- Highly Likely: Near 100% chance of occurrence in next year or happens every year.
- Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less.
- Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years.

Magnitude/Severity

- Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
- Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability.
- Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability.
- Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and

<ul style="list-style-type: none"> Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years. 	<p>services for less than 24 hours; and/or injuries/illnesses treatable with first aid</p> <p>Increase Threat from Climate Change</p> <ul style="list-style-type: none"> Low- unlikely to become more of a threat due to climate change. Moderate – possibly will become more of a threat due to climate change. Substantial- likely to become more of a threat due to climate change. Severe- highly likely to become more of a threat due to climate change <p>Significance</p> <ul style="list-style-type: none"> Low: minimal potential impact Medium: moderate potential impact High: widespread potential impact
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J.3 Asset Inventory

Table J-2 lists the critical facilities within the district boundaries organized by FEMA Lifeline. There are five fire stations operated by the district: the Wall Street Station, Salina Station, Logan Mill Station, Poorman Station, and Lodge Station. The locations of these are shown in Figure J-1 above.

Table J-2 Critical Facilities within District Boundaries

FEMA Lifeline	Count
Hazardous Materials	1
Food, Water, Shelter	1
Transportation	1
Energy	1
Safety and Security	5
Total	9

Source: Boulder County, City of Boulder HIFLD, NBI, BID, CDPHE, Wood Analysis

J.4 Vulnerability Assessment

The intent of this section is to assess the Four Mile Fire Protection district's vulnerability to hazards separate from that of the planning area as a whole, which has already been assessed in Sections 4.4 Vulnerability Assessment and 4.5 Estimating Potential Losses of the base plan. This vulnerability assessment analyzes the population, property, critical facilities, and other assets at risk within the district, specifically focused on wildfire. All other hazards present within the district boundaries are addressed in the county base plan and jurisdictional annexes. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment of the base plan.

J.4.1 Vulnerability by Hazard

Wildfire

Wildfire is the primary ongoing concern for the Four Mile Fire Protection District. Generally, the fire season extends from spring to late fall. Fire conditions arise from a combination of hot weather, an accumulation of vegetation, and low moisture content in air and fuel. These conditions, especially when combined with high winds and years of drought, increase the potential for wildfire to occur. The wildfire risk is

predominantly associated with the wildland-urban interface, areas where development is interspersed or adjacent to landscapes that support wildland fire. A fire along this wildland-urban interface can result in major losses of property and structures. Rangeland and grassland fires are a concern in the eastern portion of Boulder County, including areas of the city, due to increased residential development in semi urban and rural areas.

As described in other annexes, the Colorado Forest Atlas calculates a composite risk rating, defined as the possibility of loss or harm occurring from a wildfire. It identifies areas with the greatest potential impacts from a wildfire – i.e. those areas most at risk - considering all values and assets combined together – WUI Risk, Drinking Water Risk, Forest Assets Risk and Riparian Areas Risk. This risk index has been calculated consistently for all areas in Colorado, allowing for comparison and ordination of areas across the entire state. Table J-3 below illustrates the extent of these risk areas throughout the Four Mile FPD and surrounding areas.

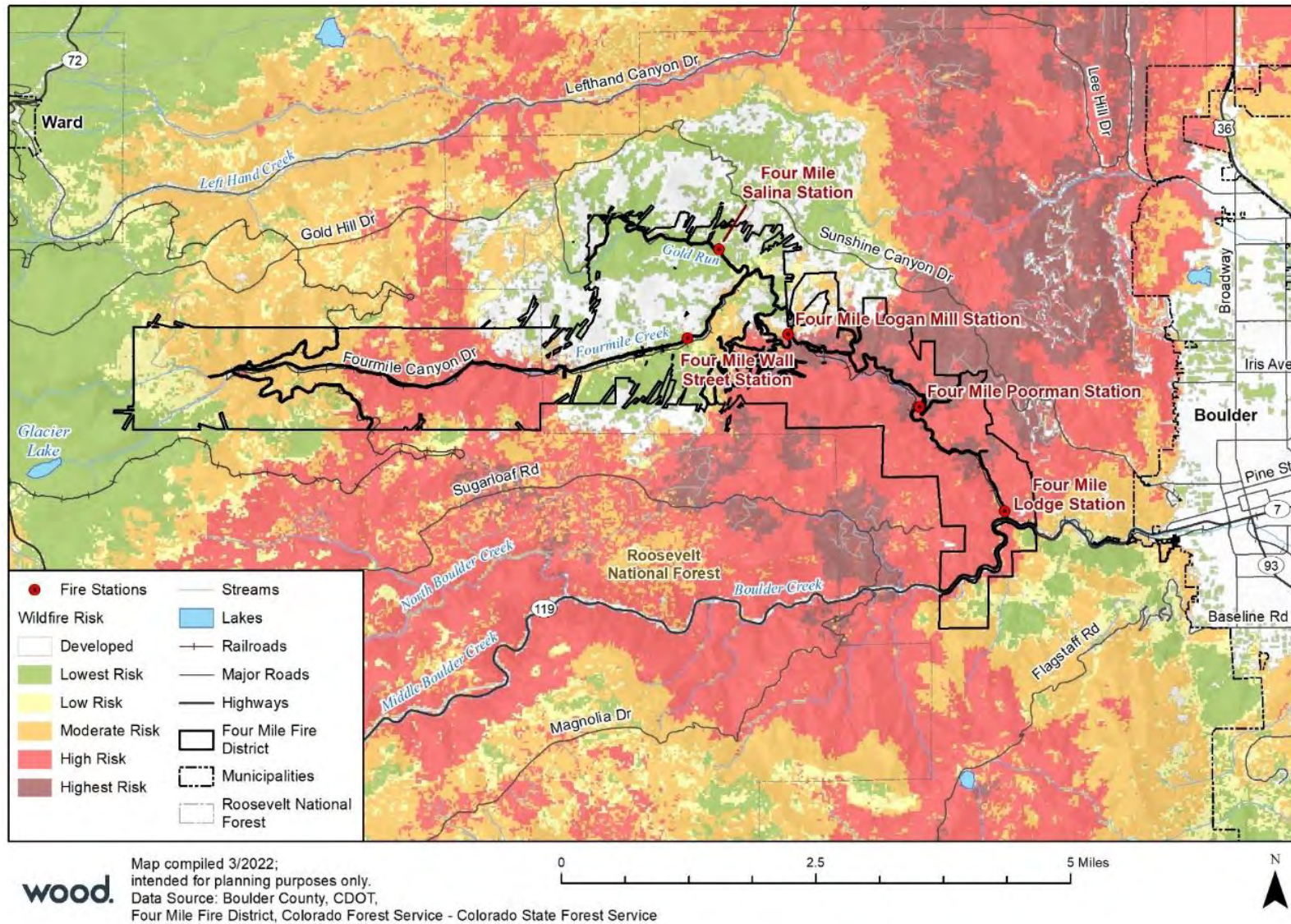
For the purposes of analyzing vulnerability and wildfire risk within the district, the Colorado Forest Atlas was compared with the boundaries of the Four Mile FPD in GIS in order to get an estimate of the number of acres within the district which fall into each risk category. The results of this analysis are shown in Table J-3 below.

Table J-3 Four Mile FPD Wildfire Risk Acres

Wildfire Risk	Acres
Highest	457
High	2,488
Moderate	1,294
Low	617
Lowest	1,222
Non-Vegetated Areas	884
Total	6,962

Source: Boulder County GIS and Assessor's Office, Colorado State Forest Service, Wood Analysis

Figure J-2 Four Mile Fire Protection District Wildfire Risk



The Colorado Forest Atlas also provides an analysis for Wildland-Urban Interface (WUI) risk based on housing density consistent with Federal Register National standards. The location of people living in the wildland-urban interface and rural areas is essential for defining potential wildfire impacts to people and homes. To calculate the WUI Risk Index, the WUI housing density data was combined with flame length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9, while areas with low housing density and low flame lengths are rated -1. Data is modelled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers. WUI Risk for the Four Mile FPD and surrounding areas is mapped in Figure J-3 and vulnerable properties are detailed in Table J-4.

Figure J-3 Four Mile Fire Protection District WUI Risk

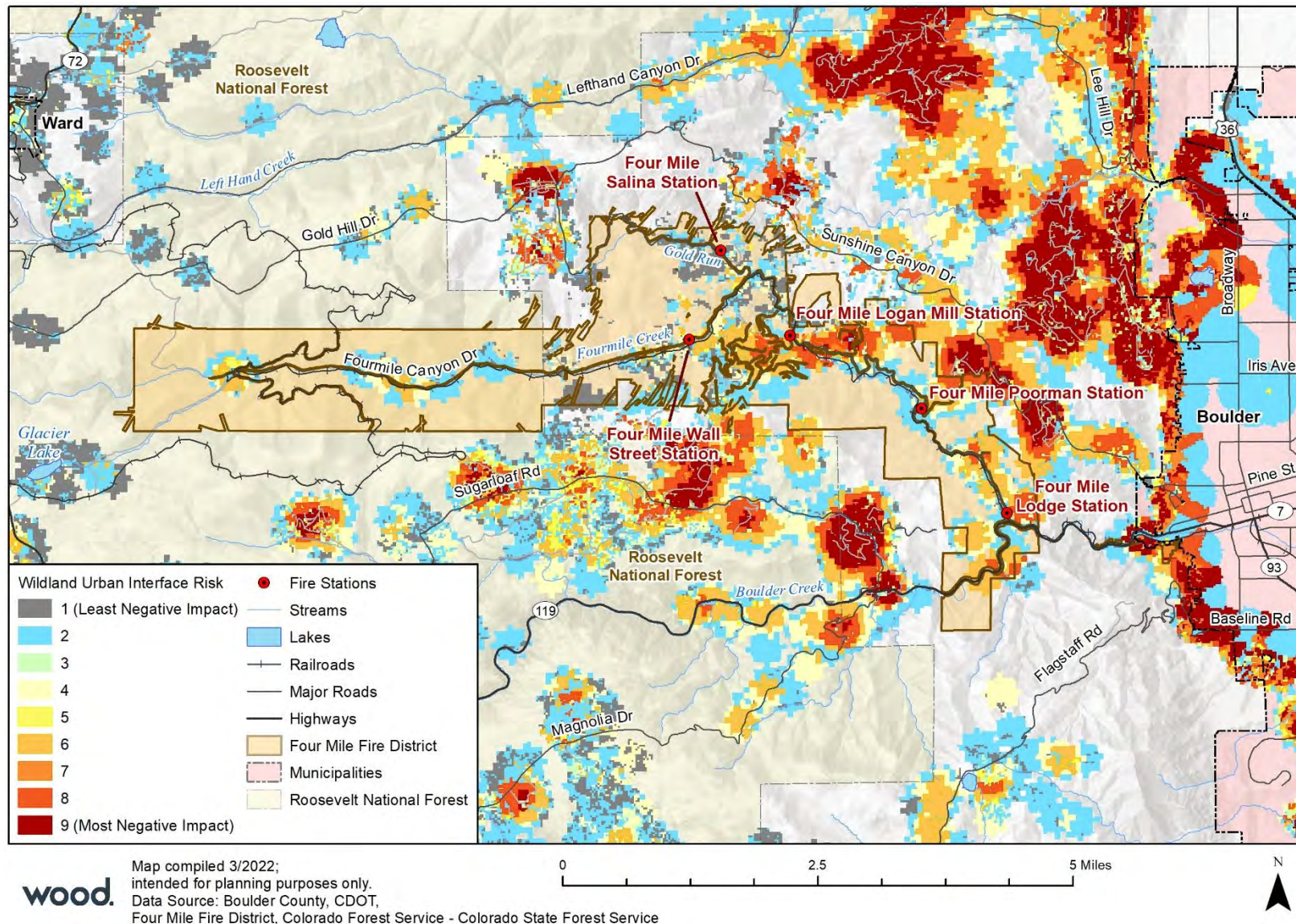


Table J-4 Four Mile FPD WUI Risk Acres

Wildfire Risk	Acres
High	269
Moderate	905
Low	1,345
Total	2,519

Source: Colorado State Forest Service, Boulder County Assessor's Office, Wood GIS Analysis

Critical Facilities and Infrastructure

A total of seven critical facilities were identified within the FPD to be in wildfire risk zones, three of which are in the Safety and Security Lifeline Category, as listed in Table J-5 below. There are also 4 critical facilities located in WUI risk areas in the Four Mile FPD, summarized in Table J-6.

Table J-5 Critical Facilities Wildfire Risk in Four Mile FPD by FEMA Lifeline Category

Wildfire Risk	FEMA Lifeline	Count
Highest	Safety and Security	1
High	Food, Water, Shelter	1
	Safety and Security	1
	Transportation	1
Moderate	Energy	1
	Safety and Security	1
Lowest	Hazardous Materials	1
Total		7

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Table J-6 Critical Facilities WUI Risk in Four Mile FPD by FEMA Lifeline Category

Wildfire Risk	FEMA Lifeline	Count
Moderate	Safety and Security	1
	Safety and Security	2
Low	Transportation	1
Total		4

Source: Boulder County, CDOT, CDPHE, NBI, NID, HIFLD, Wood Analysis

Landslide/Mud and Debris Flow/Rockfall

According to the CGS, a mudslide is a mass of water and fine-grained earth materials that flows down a stream, ravine, canyon, arroyo, or gulch. If more than half of the solids in the mass are larger than sand grains—rocks, stones, boulders—the event is called a debris flow. A debris fan is a conical landform produced by successive mud and debris flow deposits, and the likely spot for a future event. Due to the steep, mountainous characteristics of the land within the Four Mile FPD, there is a heightened vulnerability to debris flows and landslides in the district when compared to the county as a whole. The mud and debris

flow problem can be exacerbated by wildfires that remove vegetation that serves to stabilize soil from erosion, creating a unique vulnerability for the district. Heavy rains on the denuded landscape can lead to rapid development of destructive mudflows.

Based on GIS analysis conducted using data from the Colorado Geological Survey, a risk assessment was conducted for properties and critical facilities within the district that are vulnerable to areas which could experience debris flows. Figure J-4 below shows areas with susceptibility to debris flows in the vicinity of the Four Mile FPD. According to the analysis, there is an estimated \$30.5 million in total property value vulnerable to debris flows within the district. Approximately 198 people also reside in these vulnerable areas.

Table J-7 Four Mile Fire Protection District Conditional Debris Flow Hazard by Property Type

Property Type	Improved Parcels	Building Count	Improved Value	Content Value	Total Value	Population
Exempt	26	35	\$231,841	\$231,841	\$463,682	
Residential	48	85	\$20,026,988	\$10,013,494	\$30,040,482	198
Vacant	1	1	\$400	\$400	\$800	
Total	75	121	\$20,259,229	\$10,245,735	\$30,504,964	198

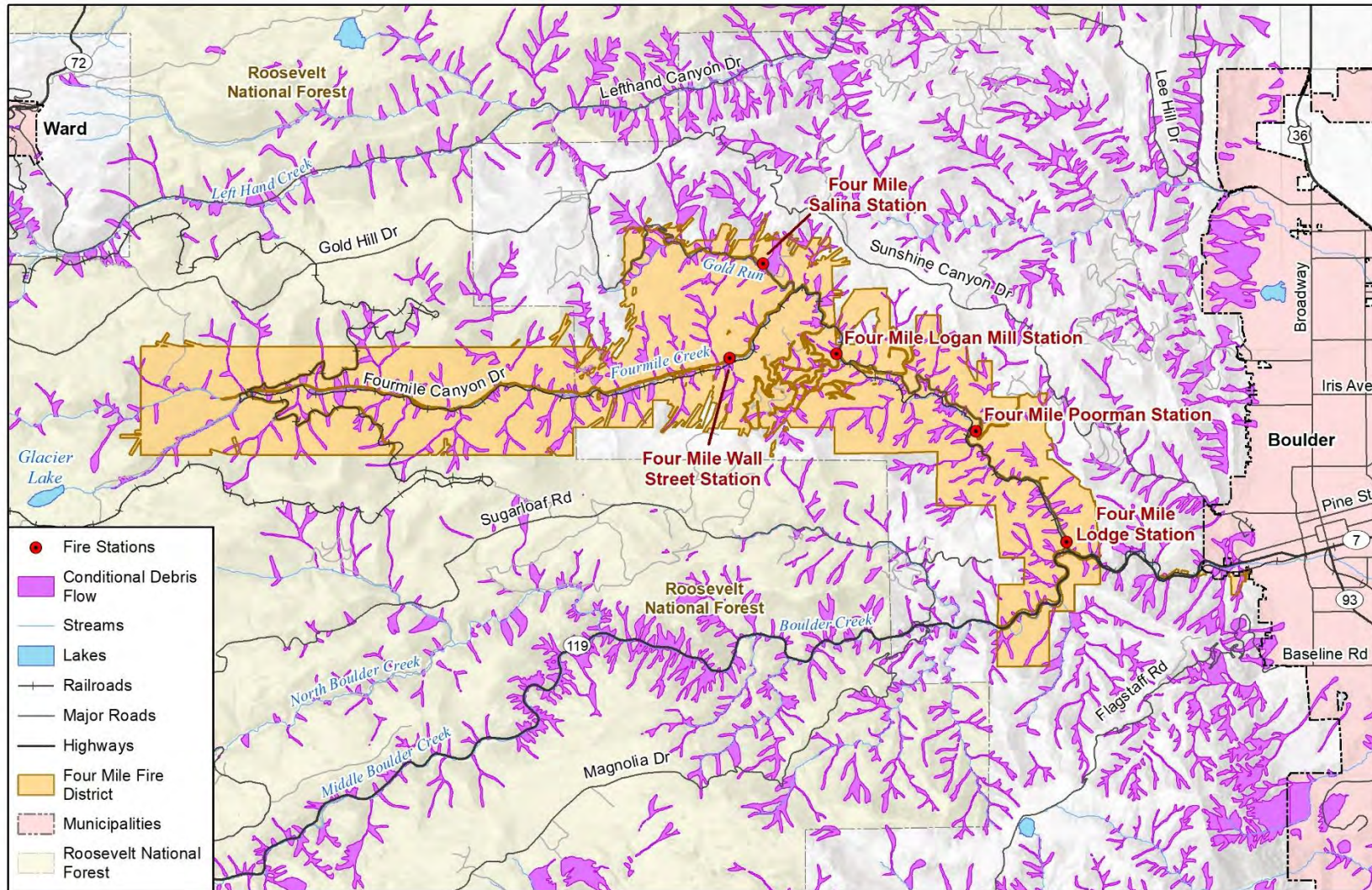
Source: Boulder County Assessor's, CGS, Four Mile FPD

Critical facilities within the district also are vulnerable to conditional debris flows, including two of the districts' stations. There is also a bridge which is vulnerable to debris flow.

Table J-8 Four Mile Fire Protection District Conditional Debris Flow Hazard for Critical Facilities

FEMA Lifeline	Count
Safety and Security	1
Transportation	1
Total	3

Figure J-4 Four Mile Fire Protection District Conditional Debris Flows



wood.

Map compiled 3/2022;
intended for planning purposes only.
Data Source: Boulder County, CDOT,
Four Mile Fire District, Colorado Geologic Survey

J.5 Mitigation Capabilities Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment summarizes Four Mile FPD's regulatory mitigation capabilities, administrative and technical mitigation capabilities, and fiscal mitigation capabilities and then discusses these capabilities in further detail along with other mitigation efforts as they pertain to the National Flood Insurance Program's Community Rating System (CRS). Although the CRS is flood-focused, this discussion also incorporates activities related to other hazards into the categories established by the CRS.

Table J-9 Four Mile Fire Protection District Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Master plan	Yes	
Zoning ordinance	Yes	Boulder County standards
Subdivision ordinance	No	
Growth management ordinance	No	
Floodplain ordinance	Yes	County
Site plan review requirements	Yes	
Other special purpose ordinance (stormwater, steep slope, wildfire)	No	
BCEGS Rating	N/A	
Building code	Yes	
Fire department ISO rating	Yes	8
Erosion or sediment control program	Yes	
Stormwater management program	Yes	
Capital improvements plan	N/A	
Economic development plan	N/A	
Local emergency operations plan	Yes	
Other special plans	N/A	
Flood insurance study or other engineering study for streams	N/A	
Elevation certificates	N/A	
Community Wildfire Protection Plan (CWPP)	Yes	2006
Other		

Table J-10 Four Mile Fire Protection District Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/engineer with knowledge of land development/land management practices	No		

Personnel Resources	Yes/No	Department/Position	Comments
Engineer/professional trained in construction practices related to buildings and/or infrastructure	No		
Planner/engineer/scientist with an understanding of natural hazards	Yes	Four Mile FPD	
Personnel skilled in GIS	Yes	Four Mile FPD	
Full-time building official	N/A		
Floodplain manager	N/A		
Emergency manager	No		
Grant writer	Yes	Four Mile FPD	
Other personnel	Yes	Four Mile FPD	
GIS Data – Hazard areas	Yes		
GIS Data – Critical facilities	Yes		
GIS Data – Building footprints	Yes		
GIS Data – Land use	Yes		
GIS Data – Links to assessor's data	Yes		
Warning systems/services (Reverse 9-11, cable override, outdoor warning signals)	Yes	County	

Table J-11 Four Mile Fire Protection District Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Yes/No)	Comments
Community Development Block Grants	Yes	Project implementation grants
Capital improvements project funding	No	
Authority to levy taxes for specific purposes	No	
Fees for water, sewer, gas, or electric services	No	
Impact fees for new development	No	
Incur debt through general obligation bonds	No	
Incur debt through special tax bonds	No	
Incur debt through private activities	No	
Withhold spending in hazard-prone areas	No	
Stormwater Service Fees	N/A	

Table J-12 Four Mile Fire Protection District Education and Outreach Opportunities

Education & Outreach	Yes/No Comments
Local citizen groups that communicate hazard risks	Yes – Fourmile Watershed Coalition
Firewise	No
StormReady	No

Education & Outreach	Yes/No Comments
Other	

J.5.1 Opportunities for Capability Enhancement and Improvement

Based on the capability assessment, Four Mile FPD has several existing mechanisms in place that already help to mitigate hazards, specifically wildfire. According to the district, several services are offered to the community for wildfire mitigation, including defensible space treatment, slash chipping, hazard tree felling, landscape scale thinning projects, and forest agriculture and forest health projects. Continuing to expand the education and involving more stake holders will create a safer WUI area and lead to significantly less damage when the next WUI fire occurs.

Opportunities exist to improve education of community members, practice evacuation drills, and potentially improve notification methods. Evacuation remains a critical element for wildland fire. New efforts to work on education of hazards, what to do in an emergency, and what residents can do to reduce their overall risk could be explored to enhance capabilities in the district. Training and education along with practice becomes a critical element in making sure the community understand their role in life safety.

J.6 Community Rating System Activities (All Hazards)

National Flood Insurance Program

The Fourmile FPD operates under the County's adopted floodplain regulations along with rest of the State of Colorado. Fourmile FPD participates and coordinates with the Boulder County's Floodplain Management Department.

Community Rating System Categories

The Community Rating System (CRS) categorizes hazard mitigation activities into six categories. These categories are not applicable to Four Mile FPD activities. The residences of Fourmile's Fire District are covered under the County's Flood Insurance and CRS rating

J.7 Four Mile Mitigation Projects

Name of Action: Four Mile Canyon Drive Defensible Space

Hazards Addressed: Wildfire.

Mitigation Goal or Objective Addressed: Goal 1 and Goal 2

Issue/Background: Create defensible space around 140 structures along the main corridor of our district and to treat 150 acres of contiguous hazardous fuels along this same corridor, totaling 364 acres.

Other Alternatives: Other Alternatives include no work or fuel reduction/wildfire mitigation projects at property owners' discretion and at their expense. This would not have a comparable benefit as the cross-boundary project that is currently being implemented. While individual property owners may elect to have hazardous fuels reduction treatment performed on their property, the effectiveness of the cross-boundary project is cumulative in its effect.

Action Status: Continue – Not Started

Responsible Office: Four Mile Fire Protection District

Priority (High, Medium, Low): High

Cost Estimate: \$100,000

Existing or Potential Funding: State and Federal Grant funds

Benefits (avoided losses): The benefit of mitigation against large-scale, high intensity fire spread is in life safety, property preservation, critical infrastructure protection and ecological benefits. Avoided losses are difficult to predict with accuracy, but wildfire impact resulting from large-scale incidents has included loss of life, and destruction measured in the billions of dollars.

Potential or current subject matter expertise: The project is being implemented by the Four Mile Fire Crew. The Fire Crew performs work with reference to mitigation standards set forth by the Colorado State Forest Service, and will consult with experts as needed on ancillary issues such as bio-mass utilization, wildlife protection and any other issues as they might arise.

Schedule: Project identified during the 2018 plan update, 5-6 month completion time upon project start.

Name of Action: Emergency Generator Purchase/Installation

Hazards Addressed: All Hazards.

Mitigation Goal or Objective Addressed: Goal 1, 2, 3, and 4

Issue/Background: Objective is to ensure uninterrupted communications and functionality of our fire protection district's primary fire station and command center.

Action Status: Continue – Not Started

Responsible Office: Four Mile Fire Protection District

Priority (High, Medium, Low): High

Cost Estimate: \$100,000

Existing or Potential Funding: State and Federal Grant funds, district operating budget

Benefits (avoided losses): The benefit will be ensuring continuous and uninterrupted communications and response ability for the district by creating redundancy in the power supply.

Potential or current subject matter expertise: The project is being implemented by the Four Mile Fire Crew. The Fire Crew performs work with reference to mitigation standards set forth by the Colorado State Forest Service, and will consult with experts as needed on ancillary issues such as bio-mass utilization, wildlife protection and any other issues as they might arise.

Schedule: Project identified during the 2018 plan update, 1 month completion time upon project funding

Name of Action: Poorman Fuel Break

Hazards Addressed: Wildfire.

Mitigation Goal or Objective Addressed: Goal 1 and Goal 2

Issue/Background: The Four Mile Fire Protection District has been severely impacted by wildfire, flooding and debris flow events. The proposed project will develop a fuel break to improve safety of critical wildfire ingress and egress routes. In addition to the immediate benefit of decreasing high severity wildfire risk, avoiding future wildfire events will have a correlative flood mitigation impact, as scientific study has overwhelmingly demonstrated the increased flood potential in wildfire affected areas. Objective is to decrease wildfire risk and increase community safety.

Other Alternatives: Other Alternatives include no work or fuel reduction/wildfire mitigation projects at property owners' discretion and at their expense. This would not have a comparable benefit as the cross-boundary project that is currently being implemented. While individual property owners may elect to have hazardous fuels reduction treatment performed on their property, the effectiveness of the cross boundary

project is cumulative in its effect.

Action Status: New action

Responsible Office: Four Mile Fire Protection District

Priority (High, Medium, Low): High

Cost Estimate: \$100,000

Existing or Potential Funding: \$46,000 awarded from the Colorado State Forest Service Forest Restoration and Wildfire Risk Mitigation grant program. \$20,000 in homeowner contributions. \$30,000 in Fire District match.

Benefits (avoided losses): The benefit of mitigation against large-scale, high intensity fire spread is in life safety, property preservation, critical infrastructure protection and ecological benefits. Avoided losses are difficult to predict with accuracy, but wildfire impact resulting from large-scale incidents has included loss of life, and destruction measured in the billions of dollars.

Potential or current subject matter expertise: The project is being implemented by the Four Mile Fire Crew. The Fire Crew performs work with reference to mitigation standards set forth by the Colorado State Forest Service, and will consult with experts as needed on ancillary issues such as bio-mass utilization, wildlife protection and any other issues as they might arise.

Schedule: Project implementation began in 2020 and the expected timeline for project completion is roughly 16 months.

Name of Action: Canyon Side/ Eagle's Way Treatment

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1 and 2

Issue/Background: The Four Mile Fire Protection District has been severely impacted by wildfire, flooding and debris flow events and continues to be at risk of future wildfire events. This project focuses on limbing and thinning along Canyonside Drive and using the access thinning to link existing defensible spaces. Thinning should be conducted to conform to the shaded fuel break guidelines described in the Access Route Fuels Modification Recommendations section. If combined with defensible spaces for all homes this project will help protect the primary access route into (and out of) the Canyon side community. This project ties in with the Anemone Hill project completed by City of Boulder OSMP.

Other Alternatives: Other Alternatives include no work or fuel reduction/wildfire mitigation projects at property owners' discretion and at their expense. This would not have a comparable benefit as the cross-boundary project that is currently being implemented. While individual property owners may elect to have hazardous fuels reduction treatment performed on their property, the effectiveness of the cross boundary project in its cumulative effect.

Action Status: New action

Responsible Office: Four Mile Fire Protection District

Priority (High, Medium, Low): High

Cost Estimate: \$244,400

Existing or Potential Funding: An application to the Colorado State Forest Service Forest Restoration and Wildfire Risk Mitigation grant program. Match funding is being provided by the City of Boulder and Four Mile and Boulder Rural Fire Protection Districts.

Benefits (avoided losses): The benefit of mitigation against large-scale, high intensity fire spread is in life safety, property preservation, critical infrastructure protection and ecological benefits. Avoided losses are difficult to predict with accuracy, but wildfire impact resulting from large-scale incidents has included loss of life, and destruction measured in the billions of dollars.

Potential or current subject matter expertise: The project will be jointly implemented by the Four Mile Fire Crew and City of Boulder Open Space and Mountain Parks. Additional expertise will be provided by Colorado State Forest Service as needed.

Schedule: Pending grant award, implementation would begin in 2022.

Name of Action: Community Wildfire Risk Reduction

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1, 2 and 3

Issue/Background: In August 2020 a Memorandum of Understanding (MOU) was signed by 13 local, state and federal organizations outlining collaboration and coordination activities to improve forest health and reduce wildfire risk in Boulder County. The purpose of the MOU is to establish a collaborative framework for the Partners to set mutual goals and priorities, utilize existing forest management tools and legal authorities and align their decisions on where to make the investments needed to achieve the vision and outcomes set forth within the MOU on the forested landscapes in Boulder County. The proposed project will support local, established collaboratives in building and formalizing partnerships required to 'set mutual goals and priorities' which are needed to 'align decisions.' The project will facilitate development of trusted, long-term, multi-agency and community partnerships across sectors. This will set the foundation for the development of priority areas, priority projects and contribute to an increase in the pace and scale of forest restoration, wildfire mitigation and other wildfire preparedness activities. Objective is to increase the pace and scale of wildfire mitigation and forest restoration through increased inter-agency and community collaboration of planning and implementation.

Other Alternatives: Other Alternatives include no work or a non-collaborative, non-coordinated approach to fuel reduction/wildfire mitigation projects.

Action Status: New action

Responsible Office: Four Mile Fire Protection District

Priority (High, Medium, Low): High

Cost Estimate: \$100,000

Existing or Potential Funding: A FEMA BRIC grant was submitted in 2020.

Benefits (avoided losses): The benefit of mitigation against large-scale fire spread is in life safety, property preservation, critical infrastructure protection and ecological preservation. Avoided losses are difficult to predict with accuracy, but wildfire impact resulting from large-scale incidents has included loss of life, and destruction measured in the billions of dollars.

Potential or current subject matter expertise: The Four Mile Fire Protection District is coordinating with local, state and federal agencies and working with communities for the development and implementation of this project. As such, there is a wealth of subject matter expertise available through the agencies committed to the project.

Schedule: This project will begin once funds are received; anticipated 2022-2023.

Name of Action: Debris Flow Early Warning System

Hazards Addressed: Landslide/debris flow. Hazards include debris flow and landside hazards in a post-wildfire setting or otherwise.

Mitigation Goal or Objective Addressed: Goals 1 and 2

Issue/Background: Landslides and debris flows are common geologic hazards in Colorado; numerous slope failures occur every year due to melting snow and rainfall and threaten life and property. There are several areas in Boulder County that are highly prone to hillslope instability. The hydrological and soil dynamics that produce debris flows are exacerbated in post-wildfire environments. Objective is to increase the predictability of debris flow and landslide hazards giving downstream communities time to evacuate when necessary. This project will develop a system designed for monitoring and forecasting slope instability to understand the mechanisms that lead to slopes failure. The project will inform a more robust debris flow early warning system to assist emergency managers in determining when to evacuate at risk communities. Phase II will include the acquisition and analysis of data from the 10 monitoring stations, the development of warning system thresholds and development of a concept design for a quick deploy "tool-kit" for monitoring systems in post-wildfire settings at risk of debris flows.

Other Alternatives: Other Alternatives include no work and acceptance of the status quo which is primarily developing warning thresholds through rain gage data.

Action Status: New action

Responsible Office: Four Mile Fire Protection District

Priority (High, Medium, Low): High

Cost Estimate: \$250,000

Existing or Potential Funding: No funding has been identified for Phase 2 of this project; internal and external grants will be researched.

Benefits (avoided losses): Benefits of this project include potential lives saved through early warning to downstream communities at risk of debris flow hazards.

Potential or current subject matter expertise: Current subject matter expertise is available through partnerships with the Colorado School of Mines and Colorado Geological Survey.

Schedule: Phase 1 of this project is occurring, but additional funding is required for further developed of the warning system (Phase 2). **2022-2024**

Name of Action: Wild Turkey Trail/Evening Star Treatment

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1 and 2

Issue/Background: The Four Mile Fire Protection District has been severely impacted by wildfire, flooding and debris flow events and continues to be at risk of future wildfire events. This project focuses on limbing and thinning along Wild Turkey Trail and Evening Star Road from the intersection of Wild Turkey Trail and Logan Mill Road to the intersection of Evening Star Road and Logan Mill Road. Limbing and thinning should be continued from the intersection of Evening Star and Logan Mill south along Logan Mill to the dead end at 1310 Logan Mill and along Fred Road from the intersection with Wild Turkey Trail to the dead end at the driveway for 822 Fred Road. Thinning should be conducted to conform to the shaded fuel break guidelines. If combined with defensible spaces for all homes, this project will help protect a critical access route, as well as breaking the continuity of fuels in the hazardous Logan Mill Community.

Other Alternatives: Other Alternatives include no work or fuel reduction/wildfire mitigation projects at property owners' discretion and at their expense. This would not have a comparable benefit as the cross-boundary project that is currently being implemented. While individual property owners may elect to have hazardous fuels reduction treatment performed on their property, the effectiveness of the cross boundary project is cumulative in its effect.

Action Status: New action

Responsible Office: Four Mile Fire Protection District

Priority (High, Medium, Low): High

Cost Estimate: \$98,800

Existing or Potential Funding: No funding source has been identified for this project. ; internal and external grants will be researched.

Benefits (avoided losses): The benefit of mitigation against large-scale fire spread is in life safety, property preservation, critical infrastructure protection and ecological preservation. Avoided losses are difficult to predict with accuracy, but wildfire impact resulting from large-scale incidents has included loss of life, and destruction measured in the billions of dollars.

Potential or current subject matter expertise: The Four Mile Fire Protection District has a significant amount of experience developing and implementing wildfire mitigation projects. Additionally, the District collaborates and partners with a wide range of agencies which include foresters, scientists and other practitioners. Existing relationships with other agencies will be leveraged as needed for expertise and assistance.

Schedule: 2022-2024.

Name of Action: Puma Walk/ Escape Route Treatment

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1 and 2

Issue/Background: The Four Mile Fire Protection District has been severely impacted by wildfire, flooding and debris flow events and continues to be at risk of future wildfire events. This project focuses on limbing and thinning along Puma Walk and the southern escape route from the dead end of Puma Walk in the north to the intersection of the escape route and Boulder Canyon (Hwy 119). Thinning should be conducted to conform to the shaded fuel break guidelines described in the Access Route Fuels Modification Recommendations section. If combined with defensible spaces for all homes, this project will help protect an important escape route, as well as providing a critical fuel break between the heavy fuels in the Arkansas Mountain area and the Logan Mill community.

Other Alternatives: Other Alternatives include no work or fuel reduction/wildfire mitigation projects at property owners' discretion and at their expense. This would not have a comparable benefit as the cross-boundary project that is currently being implemented. While individual property owners may elect to have hazardous fuels reduction treatment performed on their property, the effectiveness of the cross boundary project in its cumulative effect.

Action Status: New action

Responsible Office: Four Mile Fire Protection District

Priority (High, Medium, Low): High

Cost Estimate: \$10,000

Existing or Potential Funding: There is no funding identified for this project; internal and external grants will be researched.

Benefits (avoided losses): The benefit of mitigation against large-scale fire spread is in life safety, property preservation, critical infrastructure protection and ecological preservation. Avoided losses are difficult to predict with accuracy, but wildfire impact resulting from large-scale incidents has included loss of life, and destruction measured in the billions of dollars.

Potential or current subject matter expertise: The Four Mile Fire Protection District has a significant amount of experience developing and implementing wildfire mitigation projects. Additionally, the District collaborates and partners with a wide range of agencies which include foresters, scientists and other practitioners. Existing relationships with other agencies will be leveraged as needed for expertise and assistance.

Schedule: 2022-2024

Name of Action: Alaska Road Treatment

Hazards Addressed: Wildfire

Mitigation Goal or Objective Addressed: Goals 1 and 2

Issue/Background: This project focuses on limbing and thinning along Blue Ribbon Road and Alaska Road. Limbing and thinning should be continued along the unpaved 4WD road connecting the end of Alaska and Wendelyn Road with Logan Mill Road. Thinning should be conducted to conform to the shaded fuel break guidelines described in the Access Route Fuels Modification Recommendations section. If combined with defensible spaces for all homes, this project will help protect a critical access route, as well as breaking the continuity of fuels in Sunshine Gulch. Objective is to ensure uninterrupted communications and functionality of our fire protection district's primary fire station and command center.

Other Alternatives: If funding is not awarded for this project, the alternative will likely be the purchase of a less powerful, portable generator. This alternative would be significantly inferior to our proposed project. A portable generator could power limited communications and lights in the event of grid power loss. While this would allow the station to maintain basic functions, it would not allow the station to serve as a command center during an emergency.

New or Deferred Action: New action

Responsible Office: Four Mile Fire Protection District

Priority (High, Medium, Low): High

Cost Estimate: \$75,400

Existing or Potential Funding: No funding has been identified for this project; internal and external grants will be researched.

Benefits (avoided losses): The benefit of mitigation against large-scale fire spread is in life safety, property preservation, critical infrastructure protection and ecological preservation. Avoided losses are difficult to predict with accuracy, but wildfire impact resulting from large-scale incidents has included loss of life, and destruction measured in the billions of dollars.

Potential or current subject matter expertise: The Four Mile Fire Protection District has a significant amount of experience developing and implementing wildfire mitigation projects. Additionally, the District collaborates and partners with a wide range of agencies which include foresters, scientists and other

practioners. Existing relationships with other agencies will be leveraged as needed for expertise and assistance.

Schedule: 2022-2024.

Appendix A: Kick-Off Meeting Documentation

PowerPoint and agenda



**BOULDER
HAZARD
MITIGATION PLAN**

April 2019

1

HMP steps

CRS Steps

1. Organize the planning effort
2. Involve the public
3. Coordinate with other departments and agencies
4. Identify the hazards
5. Assess the risks
6. Set goals
7. Review possible activities
8. Draft an action plan
9. Adopt the plan
10. Implement, evaluate and revise the plan

FEMA Process Steps

1. Organize resources
2. Assess risks
3. Develop the mitigation plan
4. Implement the plan and monitor progress

2

Past Plan Participants

County	Municipalities	Districts
<ul style="list-style-type: none"> ■ OEM ■ Sheriff ■ Land Use ■ Assessor's Office ■ Building Department ■ Commissioner's Office ■ Public Health ■ Information Technology ■ Transportation 	<ul style="list-style-type: none"> ■ Erie ■ Jamestown ■ Lafayette ■ Longmont ■ Louisville ■ Lyons ■ Superior ■ Ward 	<ul style="list-style-type: none"> ■ Boulder County Fire Chiefs ■ Boulder Fire Chiefs ■ Lefthand Fire Protection District ■ Four Mile Fire Protection District

3

Goal Definition

- For the purpose of this mitigation plan, goals were defined as broad-based public policy statements that:
- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

4

Hazard	Geographic Scope	Probability of Future Occurrence	Magnitude/Severity	Significance
Avalanche	Localized	High/Low	High/Low	Low
Earthquake	Regional	High/Low	High/Low	High
Fire	Regional	High/Low	High/Low	High
Flash Flood	Localized	High/Low	High/Low	High
Glacier	Regional	High/Low	High/Low	High
Ice Storm	Regional	High/Low	High/Low	High
Lightning	Regional	High/Low	High/Low	High
Rockfall	Localized	High/Low	High/Low	High
Seismicity	Regional	High/Low	High/Low	High
Thunderstorm	Regional	High/Low	High/Low	High
Tornado	Regional	High/Low	High/Low	High
Wildfire	Regional	High/Low	High/Low	High
Winter Storm	Regional	High/Low	High/Low	High
Winter Weather	Regional	High/Low	High/Low	High
Winter Weather	Regional	High/Low	High/Low	High

Hazard Vulnerability Assessment

Step 1: Complete the Community Hazard Profile

Geographic Location: Boulder, Colorado
 Occurrence: Occasional - High/Low/Low
 Magnitude: High/Low/Low
 Hazard Level: Low - Medium - High

Step 2: Complete the Vulnerability Assessment

Review the hazard analysis and determine which hazards have a high hazard level rating and complete the community asset inventory or values at risk assessments.

Hazard Type	Geographic Location	Occurrence	Magnitude/Severity	Significance
Avalanche	Localized	High/Low	High/Low	Low
Earthquake	Regional	High/Low	High/Low	High
Fire	Regional	High/Low	High/Low	High
Flash Flood	Localized	High/Low	High/Low	High
Glacier	Regional	High/Low	High/Low	High
Ice Storm	Regional	High/Low	High/Low	High
Lightning	Regional	High/Low	High/Low	High
Rockfall	Localized	High/Low	High/Low	High
Seismicity	Regional	High/Low	High/Low	High
Thunderstorm	Regional	High/Low	High/Low	High
Tornado	Regional	High/Low	High/Low	High
Wildfire	Regional	High/Low	High/Low	High
Winter Storm	Regional	High/Low	High/Low	High
Winter Weather	Regional	High/Low	High/Low	High
Winter Weather	Regional	High/Low	High/Low	High

Community Asset Inventory or Values at Risk

Asset Type	Number of Structures	Value of Structures	Number of People
Residential	100	\$10,000,000	100
Commercial	50	\$5,000,000	50
Industrial	20	\$2,000,000	20
Public	10	\$1,000,000	10
Religious	5	\$500,000	5
Healthcare	3	\$300,000	3
Education	2	\$200,000	2
Government	1	\$100,000	1
Other	1	\$100,000	1

Community Profile Format

- Annex:
 - Community Profile
 - Population
 - Economy
 - Hazard Summary
 - Asset Inventory
 - Economic Assets
 - Natural, Historic, and Cultural Resources
- Natural Resources
 - Historic and Cultural Resources
 - Growth and Development Trends
 - Capability Assessment
 - Mitigation Capabilities Summary

Mitigation Project Worksheets

- Title
- Hazards Addressed:
- Mitigation Goal or Objective Addressed:
- Issue/Background:
- Other Alternatives:
- New or Deferred Action:
- Responsible Office:
- Priority (High, Medium, Low):
- Cost Estimate:
- Existing or Potential Funding:
- Benefits (avoided losses):
- Potential or current subject matter expertise:
- Schedule:



MHMP Activity	Description	Date Initiated	Date Completed
Community Engagement Meeting	<ul style="list-style-type: none"> Advertise the meeting 1 month ahead of the meeting date. Longmont Library. Have staff available to review the plan, answer questions and provide a presentation to the community on the MHMP. 	July 2020	August 2020
Engage policy groups for Adoption of the MHMP	<ul style="list-style-type: none"> Written notification to policy groups on the adoption process. Schedule adoption meetings Attend Board, Council or trustee meetings to facilitate adoption of MHMP 	September 2020	November 15, 2020
Social Media Announcement	<ul style="list-style-type: none"> Community review of the plan through a posting on Facebook and Twitter directing potential viewers to the Boulderopen.com website. 	September 2020	September 30, 2020
Final Draft	<ul style="list-style-type: none"> Take community feedback and make final revisions to the MHMP 	October 1, 2020	November 1, 2020
FEMA Approval	<ul style="list-style-type: none"> Submit locally adopted MHMP to FEMA for approval 	December 1, 2020	TBD
FEMA Plan Revisions	<ul style="list-style-type: none"> MHMP participants attend a final meeting to review FEMA comments and review process 	March 2021	March 2021
FEMA Adoption	<ul style="list-style-type: none"> Letter of adoption by FEMA received by OEM. Distribute electronic copy of the letter to MHMP participants. 	April 2021	May 1, 2021

9

Copy of Boulder Natural Hazard Mitigation Plan Survey 2019

Thank you for participating in the Boulder Natural Hazard Mitigation Plan Revision survey. Our Plan is a framework that guides our communities in making decisions and developing policies to reduce or eliminate risk to life and property. It identifies the types of hazards that threaten our communities, evaluates our vulnerability to those threats, and outlines a strategy to reduce or eliminate the risk posed by those threats. The local and federal governments often require communities to complete a Hazard Mitigation Plan in order to be eligible for certain types of disaster assistance and recovery funding. The Boulder Office of Emergency Management and the Hazard Mitigation Planning Committee are now updating the plan originally developed in 2008, updated in 2013 and expires in April of 2021.

This survey will help the Hazard Mitigation Planning Committee determine the concerns and questions the community has about the hazards we face and guide decisions throughout the revision process.

Like us on Facebook and follow us on Twitter. We will post regular updates and information about the revision process. These sites will also provide you with a virtual forum in which you can post comments, ask questions, and interact with your Hazard Mitigation Planning Committee representatives.

Visit our website for more information about the Natural Hazard Mitigation Plan <http://bouldermhmp.com>

* 1. Please provide your name, email address, and phone number. Boulder County will only use this information to contact you to respond your questions and comments. We will not share this information with anyone.

Name:

Email Address:

Phone Number:

10

* 2. Please select the jurisdictions in which you live and/or work (select all that apply).

☐ City of Boulder

☐ Town of Erie

☐ Town of Jamison

☐ City of Lafayette

☐ City of Longmont

☐ City of Louisville

☐ Town of Lyons

☐ Town of Nederland

☐ Town of Superior

☐ Town of Wood

☐ Allentown

☐ Caribou

☐ Coal Creek

☐ Eldora

☐ Eldorado Springs

☐ Gold Hill

☐ Glenwood

☐ Higgins

☐ Hunt

☐ Unincorporated Boulder County

Other (please specify):

11

3. Are you aware of the Boulder County Multi-Hazard Mitigation Plan developed in 2008?

- ☐ Yes
- ☐ No

4. Did you participate in the development of the 2016 Boulder County Multi-Hazard Mitigation plan in any way?

- ☐ Yes, I was a member of the Hazard Mitigation Planning Committee
- ☐ Yes, I attended a public meeting
- ☐ Yes, I provided comments on the Draft Plan
- ☐ No, I did not participate but I was aware of the plan and followed the development through news media
- ☐ No, I did not participate in any way

12

Title: Hazard Mitigation Plan Kick-Off Meeting

Kozak, Michelle • Gentile, George • Case, Cole • Santaroni, Gary • Amington, Katie • Enbalim, Lance • Webster, James B. • Glowacki, Theresa • Hayfield, Camie • Mullane, Mark • Tavach, Jeff • Jen Campbell <jen.campbell@bouldercolorado.gov> • Turner, K. <turner.k@bouldercolorado.gov> • arthur@bouldercolorado.gov • daniel@bouldercolorado.gov • breadansullivan@bryd.org • gregory.hanson@hosa.gov • kstewart@edfcd.org • Calderazzo, Mike • Stewart, Kim • Van Horn, Patricia • karang@mednetlandco.org • meschuks@bouldercolorado.gov • Blum, Verna • Trice, Chris • arnes@bouldercolorado.gov • Dan Eamon <damon@bouldercolorado.gov> • sonyashk@state.co.us • marlow.thompson@state.co.us • gary.djongs@colorado.edu • Hayes, David • Ramon, Rick • Gibson, Bret • nadenecher@myfcd.org • McKinney, Seth • Peter.Gibbons@longmontcolorado.gov • Tara.Schweidinger@schweidinger@gmail.com • Sanchez, Kimberly • Ed.Stefford@bouldercolorado.gov • Victoria.Simpson • Holtschlag, Andrew • Buback, Julie • Pickett, Stacey • Shepherd, Chakra <Shepherd.C@bouldercolorado.gov>

Bichten, David • Alimonte, Nicole <nicole.alimonte@harsco.org> • Malinowski, Joe • Thomas, Mike • Graham, Brian • Weiss, Nicole • Rosalia, Brian • Stimmer, C. Linny • Monica Bonetani • Monica Bonetani <monica@longmontcolorado.gov> • Meisler, Philip • Meisler.P@bouldercolorado.gov • Shannon McVane <shannon.mcvane@longmontcolorado.gov> • Kevin Emsel <kevin.emsel@longmontcolorado.gov> • Wlodarski, Lisa • Campbell, Chris • Maxwell, Jeffrey • Reinold, Stefan

Start time: Fri 4/12/2019 8:30 AM

☐ All day ☒ Time/Power

End time: Fri 4/12/2019 11:30 AM

☒ Make Recurring

Location: 1750 33rd Street, Boulder, Houston Room Boulder, Clark and Renard

Room Finder

HMP Kick Off Meeting Present...

Confirmation

Boulder Hazard Mitigation Plan...

Greetings,

Please come and be part of the Boulder Hazard Mitigation Plan Kick-Off meeting. As always getting the right people in the room requires assistance from the core participants. Please send me contact information or forward the invitation to others that you feel would be important to attend the meeting.

Agenda

0830- 0900 Introductions and expectations
 0900-0915 Boulder OEM, State and FEMA Mitigation Officers Opening Remarks
 0915-0945 The Plan that was- review the process, goals, structure and projects of the current plan.
 0945- 0955 Break
 0955- 1130 Introduce the new plan's timeline and group discussion on the new plan's structure, process, goals and define next steps.

Once again please forward this invitation as necessary to ensure we have all the partners in the room as possible. I do have a capacity of right around 100 and will need to triage RSVPs if we exceed this room limit. Also review the word document it has instructions on room use but more importantly parking.

Thanks and I look forward to seeing you all there.

1. Event Name HAZARD MITIGATION Plan Kick off		2. Operational Period (Date /Time) From: 8:30 - To: 12:00 4/12/19		3. Check-in Location <input type="checkbox"/> EOC <input checked="" type="checkbox"/> Other		CHECK-IN LIST (Personnel) EOC 211p-OS	
Personnel check-in information							
4. Name	5. Organization / Agency	6. ESF / Section / Assignment	7. Contact Information		8. Time		
			Phone #	Email	In		
ANDREW NORBOHM	BOEM		5-7382	anorbohm@bouldercounty.org			
Varda Blum	Boco Trans.		-2659	vblum@bouldercounty.org			
JEFF ARTHUR	CITY OF BOULDER UTILITIES		303-441-4418	arthurj@bouldercounty.org			
Monica Bartolini	Longmont Floodplain Admin.		303-651-8328	monica.bartolini@longmontcolorado.gov			
SHANNON McVANEY	LONGMONT OEM		303-774-3793	shannon.mcvaney@longmontcolorado.gov			
NEZETTE RYDELL	NWS		303-494-3210	nezette.rydell@noaa.gov			
Brian Rasipajla	LPD		303-661-1374	brianr@cityofflafayette.com			
Carrie Haverfield	BcSO	IS	3-441-3989	chaverfield@bouldercounty.org	0830		
Christy Wiseman	Boco Land Use	14	303-441-3930	cwiseman@bouldercounty.org	8:30		
Joe Malinowski	BCPLA	8-10	3-441-1197	jmalinowski@bouldercounty.org	8:20		
Mark Thompson	DISEM	5	720-630-6770	mark.thompson@state.co.us	753		
Nicole Wobus	Boco Land Use	14	720-364-3298	nwobus@bouldercounty.org	8:30		
Jim Webster	Boco Land Use		720-564-2600	jwebster@bouldercounty.org			
9. Prepared By:		Date /Time		10. Date /Time sent to Resources Unit			
CHECK-IN LIST (Personnel)				EOC 211p-OS			

(1)

1. Event Name	2. Operational Period (Date /Time) From: - To:	3. Check-in Location <input type="checkbox"/> EOC <input type="checkbox"/> Other		CHECK-IN LIST (Personnel) EOC 211p-OS	
Personnel check-in Information					
4. Name	5. Organization / Agency	6. ESF / Section / Assignment	7. Contact Information Phone # Email		8. Time In
STEFAN REINOLD	BCPO5		303 678 6202	SREINOLD@Bouldercounty.org	
Mike Thomas	Boulder County Transportation	ESF 14	720-564-2655	mthomas@bouldercounty.org	
Bret Gibson	4-Mile Fire	ESF 13	3-579 1821	cbret@bouldercounty.org	08:30
Patrick VanHorne	Boulder OEM	—	3/565-7409	pvanhorne@bouldercounty.org	
Justin Bukartek	Boulder OEM		3/565-7408	jbukartek@bouldercounty.org	
Kate Dunlap	City of Boulder-PW	ESF 28	303-53-7209	kate.dunlap@bouldercounty.org	
David Booton	BCSO	ESF 9 10 13	303-859-7968	dbooton@bouldercounty.org	0830
Richard Peebles	BCSO	ESF 9, 10, 13	303-859-0062	rpeebles@bouldercounty.org	0830
Christin Shepherd	COB		441-3425	shepherd.c2@bouldercounty.org	8:30
Michelle Krezek	Boulder County - BOCC	Policy Group	3-441-3549	mkrezek@bouldercounty.org	8:30
Nicole Amice	FEMA	Senior Planner		nicole.amice@fema.dhs.gov	
Garry Sanfarian	BOCC	23		gsanfarian@bouldercounty.org	✓
Larry Ranglos	COB	14	970 420 6047	lranglos@bouldercounty.org	8:30
9. Prepared By		Date /Time		10. Date /Time sent to Resources Unit	
CHECK-IN LIST (Personnel)					

EOC 211p-OS

1. Event Name	2. Operational Period (Date /Time) From: - To:	3. Check-in Location <input type="checkbox"/> EOC <input type="checkbox"/> Other		CHECK-IN LIST (Personnel) EOC 211p -OS	
Personnel check-in Information					
4. Name	5. Organization / Agency	6. ESF / Section / Assignment	7. Contact Information Phone # Email		8. Time In
Dale Case	Boulder County Land Use		720-544-2804	dcase@bouldercounty.org	
SMH McHenry	BCSO FIRE MANAGER	13	303-548-9624	smchenry@bouldercounty.org	
Dave Hayes	Louisville		303-282-1209	DHayes@louisville.co.gov	
Peter Gibbons	City of Longmont		303-532-7200	peter.gibbons@longmontcolorado.gov	8:00
Karen Gerrig	Town of Nederland		303-258-5236 x100	karn@nederlandco.org	8:50
9. Prepared By		Date /Time		10. Date /Time sent to Resources Unit	
CHECK-IN LIST (Personnel)				EOC 211p -OS	

(3)

Appendix B: Meeting 2 Documentation, Goals and Community Engagement

3. Are you aware of the Boulder County Multi-Hazard Mitigation Plan developed in 2008?

☐ Yes

☐ No

4. Did you participate in the development of the 2016 Boulder County Multi-Hazard Mitigation plan in any way?

☐ Yes, I was a member of the Hazard Mitigation Planning Committee

☐ Yes, I attended a public meeting

☐ Yes, I provided comments on the Draft Plan

☐ No, I did not participate but I was aware of the plan and followed the development through news media

☐ No, I did not participate in any way

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Copy of Boulder Natural Hazard Mitigation Plan Survey 2019

Boulder County Hazards

The Boulder County Hazard Mitigation Planning Committee needs to know which hazards you are most concerned about and the mitigation efforts on which you believe we should focus.

* 5. Below is a list of hazards the Boulder County Multi-Hazard Mitigation Plan currently addresses. Please select the 3 hazards of most concern to you:

<input type="checkbox"/> Avalanche	<input type="checkbox"/> Lightning
<input type="checkbox"/> Dam and Levee Failure	<input type="checkbox"/> Pandemic Flu
<input type="checkbox"/> Drought	<input type="checkbox"/> Severe Winter Storm
<input type="checkbox"/> Earthquake	<input type="checkbox"/> Subsidence
<input type="checkbox"/> Explosive Falls	<input type="checkbox"/> Tornado
<input type="checkbox"/> Extreme Temperatures	<input type="checkbox"/> West Nile Virus
<input type="checkbox"/> Flood	<input type="checkbox"/> Wildfire
<input type="checkbox"/> Hailstorm	<input type="checkbox"/> Windstorm
<input type="checkbox"/> Landslide/Mud and Debris Flow/Debris	

6. Are there any hazards not listed in Question 5 that you believe the Hazard Mitigation Planning Committee should consider?

☐ Yes

☐ No

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7. If you answered YES to Question 6, what additional hazards do you believe the Hazard Mitigation Planning Committee should consider?

* 8. Of all the hazards you have identified in Question 5 and Question 7 which do you consider to be the greatest threat to you and your community?

9. If the hazard you identified in Question 8 as being the greatest threat to you and your community occurred in your neighborhood today, what would be the likely impact to you and your family?

* 10. In the past 5 years, have you or any local organizations in your community taken any actions to reduce or eliminate the impact of this hazard?

☐ Yes

☐ No

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11. If you answered YES to Question 10, please describe the actions you or your community have taken to reduce or eliminate the impact of this hazard.

* 12. What actions do you believe your local government or Boulder County can take to help reduce or eliminate the impact of these hazards?

13. Are there any other comments, questions, or concerns you would like the Hazard Mitigation Planning Committee to consider?

Copy of Boulder Natural Hazard Mitigation Plan Survey 2019

Thank you for taking the time to complete this survey. The Hazard Mitigation Planning Committee will carefully consider your responses.

"Like" the Boulder Office of Emergency Management on Facebook and follow us on Twitter for updates about the Boulder County Multi-Hazard Mitigation Plan revision process and further opportunities to provide your feedback!

<http://www.facebook.com/BoulderOEM>

<http://twitter.com/BoulderOEM>

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Appendix B: Meeting 2 Documentation, Goals and Community Engagement

MIHMP Activity	Description	Date Initiated	Date Completed
Introduction to MIHMP Planning/Kickoff Meeting	<ul style="list-style-type: none"> Overall Plan Goals, Hazard analysis 	April 12, 2019	April 12, 2019
MIHMP Goal Setting meeting	<ul style="list-style-type: none"> The goals from the City of Boulder and Boulder County MIHMPs will be integrated or new goals created for the upcoming process. 	June 5, 2019	July 15, 2019
Social media blitz	<ul style="list-style-type: none"> Post on the Boulderoreem.com website announcements that we are starting the planning process. Direct viewers to Facebook and Twitter to take the HMP survey. 	July 1, 2019	December 31, 2019
Hazards, Risk & Vulnerability assessment	<ul style="list-style-type: none"> Complete a review of the hazards associated with both MIHMP and modify as needed. Send GIS and information requests to the Assessor's Office and GIS. Complete HVA process with participants of the plan. 	December 2019	February 28, 2020
HMP Draft Version 1	<ul style="list-style-type: none"> Once completed send through social media outlets to stakeholders and the community 	March 1, 2020	March 14, 2020

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MIHMP Activity	Description	Date Initiated	Date Completed
Review mitigation strategies and community capabilities.	<ul style="list-style-type: none"> Take the risks from the HVA and determine what mitigation programs are in place and inventory community capabilities 	March 1, 2020	March 30, 2020
Mitigation projects and community profiles completed and submitted.	<ul style="list-style-type: none"> Collect all mitigation and community profiles and format under the MIHMP planning format. 	April 2020	May 30, 2020
HMP Re-engagement meeting at Sheriff HQ Meeting room.	<ul style="list-style-type: none"> Start to develop mitigation project worksheets. 	April 2020	April 2020
HMP Draft Version 2	<ul style="list-style-type: none"> Once completed send through social media outlets to stakeholders and the community 	June 2020	June 30, 2020
Community Engagement Meeting	<ul style="list-style-type: none"> Advertise the meeting 1 month ahead of the meeting date. Boulder Clerk and Recorder Building or Library. Have staff available to review the plan, answer questions and provide a presentation to the community on the MIHMP. 	June 2020	July 2020

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MIHMP Activity	Description	Date Initiated	Date Completed
Community Engagement Meeting	<ul style="list-style-type: none"> Advertise the meeting 1 month ahead of the meeting date. Longmont Library. Have staff available to review the plan, answer questions and provide a presentation to the community on the MIHMP. 	July 2020	August 2020
Engage policy groups for Adoption of the MIHMP	<ul style="list-style-type: none"> Written notification to policy groups on the adoption process. Schedule adoption meetings Attend Board, Council or trustee meetings to facilitate adoption of MIHMP. 	September 2020	November 15, 2020
Social Media Announcement	<ul style="list-style-type: none"> Community review of the plan through a posting on Facebook and Twitter directing potential viewers to the Boulderoreem.com website. 	September 2020	September 30, 2020
Final Draft	<ul style="list-style-type: none"> Take community feedback and make final revisions to the MIHMP. 	October 1, 2020	November 1, 2020
FEMA Approval	<ul style="list-style-type: none"> Submit locally adopted MIHMP to FEMA for approval 	December 1, 2020	TBD
FEMA Plan Revisions	<ul style="list-style-type: none"> MIHMP participants attend a final meeting to review FEMA comments and review process 	March 2021	March 2021
FEMA Adoption	<ul style="list-style-type: none"> Letter of adoption by FEMA received by OEM. Distribute electronic copy of the letter to MIHMP participants. 	April 2021	May 1, 2021

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2022 – 2027 Boulder Hazard Mitigation Plan

1. Event Name HMP-Goal Setting		2. Operational Period (Date /Time) From: 0900 - To: 1200 July 15, 2019		3. Check-in Location <input type="checkbox"/> EOC <input checked="" type="checkbox"/> Other Clerk & Recorder		CHECK-IN LIST (Personnel) EOC 211p-OS	
Personnel check-in Information							
4. Name	5. Organization / Agency	6. ESF / Section / Assignment	7. Contact Information		8. Time		
			Phone #	Email	In	Out	
Justin Bukartek	Boulder OEM	N/A	3/565-7408	jbukartek@bouldercounty.org			
Mark Thompson	DHSEM		(720) 630-0770	mark.thompson@state.ca.us	9:05		
Stacey Proctor	Bolo Transportation		3-441-1107	sproctor@boulder-county.org	9:00		
Nicole Wobus	Bolo Land Use	14	303-564-2298	nwobus@bouldercounty.org	9:05		
Victoria Simonsen	Town of Lyons		3-823-6622	vsimonsen@townoflyons.com	9:00		
Kate Dunlap	City of Boulder		303-447-7462	dunlapk@boulderColorado.gov	9		
Christin Shepherd	City of Boulder		(303) 441-3423	shepherd.c2@boulderColorado.gov	9		
Varda Blum	Boulder County		720 564-2659	vblum@bouldercounty.org	9		
Jim Webster	BC Land Use		720 564-2600	jwebster@bouldercounty.org	9		
STEFAN REINOLD	BC P.O.S		303 335 8308	SREINOLD@bouldercounty.org	9		
Stacy Gahagen	SUVSD		720-389 1476	gahagen-stacy@suvsd.org	9		
Lee Mathis	Erie P.D.		303-901 9916	lmathis@erieco.gov	9		
Dan Self	Lotyell PD		303-210-6872	dan.self@cityoflotyell.com	9		
9. Prepared By		Date /Time		10. Date /Time sent to Resources Unit			
CHECK-IN LIST (Personnel)							

EOC 211p-OS

1. Event Name <i>NMP Goal Setting</i>		2. Operational Period (Date /Time) From: <i>9</i> - To: <i>12</i> <i>7/15/2019</i>		3. Check-in Location <input type="checkbox"/> EOC <input checked="" type="checkbox"/> Other <i>Clark + Reardon</i>		CHECK-IN LIST (Personnel) EOC 211p-OS	
Personnel check-in Information							
4. Name	5. Organization / Agency	6. ESF / Section / Assignment	7. Contact Information		8. Time In		
			Phone #	Email			
<i>Mike Thomas</i>	<i>Boulder County Trans.</i>		<i>720-564-2655</i>	<i>mthomas@bouldercounty.org</i>			
<i>Monica Bartolini</i>	<i>City of Longmont</i>		<i>303-651-8328</i>	<i>monica.bartolini@longmontcolorado.co</i>			
<i>SHARON McVANEY</i>	<i>Longmont OEM</i>		<i>303-774-3143</i>	<i>SHARON.McVANEY@LONGMONT.CO.ARGO.CO</i>			
<i>Joycelyn Fankhauser</i>	<i>BCHHS</i>	<i>4/19</i>	<i>3.591.4424</i>	<i>jfankhauser@bouldercounty.org</i>			
<i>KEVIN STEWART</i>	<i>UDFCO</i>	<i>5</i>	<i>3.455.6277</i>	<i>kstewart@udfcd.org</i>			
9. Prepared By		Date /Time		10. Date /Time sent to Resources Unit			
CHECK-IN LIST (Personnel)							

Appendix C: Meeting 3 Documentation: February 28, 2020 Review goal Revisions, Public Survey Results, Mitigation Strategy

Appendix C: Meeting 3 Documentation: February 28, 2020 Review goal Revisions, Public Survey Results, Mitigation Strategy

BOULDER HMP 2020

Goals, Survey, HVA, Projects, Next Steps

Goal 1: Reduce the loss of life and personal injuries from hazard events

- Continue to manage development in areas, including property acquisitions to remove development from hazardous locations, pursuing relocation/elevation actions for flood-at-risk properties, and providing enforcement measures following disasters to ensure that all redevelopment and recovery activities are in compliance with existing development codes. Continue programs to further identify hazards including incorporating future uncertain climate predictions.
- Continue programs to further identify hazards including but not limited to, fire, flood, erosion, wildfire, wind, drought, debris flows, rock fall, etc. and assess risk associated. Provide timely notification and direction to the public of imminent and potential hazards.
- Provide timely notification and direction to the public of imminent and potential hazards, including installing rain gauges, soil saturation sensors and stream monitoring systems for early warning identification of pending flooding situations and debris flows. Continue public education programs to improve residents ability to make informed decisions based on their hazard risks.
- Continue to manage development and mitigation efforts in hazard prone areas.
 - Add Inclusivity and Affordable Housing. Use such as: XXXXXX. Identify and prepare for: Enhancing early warning systems through.
 - Add resiliency component and expand beyond flooding situations i.e. tornado and differentiate between detections versus warning.

Goal 2: Reduce impacts of hazard events on property, critical facilities/infrastructure, and the environment

- Continue to manage development and placement of structures in hazard-prone areas, including applying land use regulations to minimize exposure to potential hazards and expanding current wildfire mitigation and defensible space programs on both public and private lands (recommend removing specific examples and have a separate list addressing variety of hazards). Create incentives and continue to provide assistance for the public to mitigate hazards on their own property.
- Protect existing property to the extent possible through regulations, codes, education, cooperative agreements, hazard reduction projects, and other means. Continue to manage development and protect existing properties in hazard-prone areas through regulations to minimize exposure to potential hazards.
- Protect infrastructure and critical facilities to minimize loss of services following a hazard event including installation of back-up generators and other vital infrastructure at critical county facilities.
- Create incentives for the public to mitigate hazards on their own property through education, cooperative land acquisitions, Elevation and relocation programs, Community Wildfire Protection Plans, TDRs and TDCs, and other means as they become available or are created. Restore natural function of environmental processes. Or restore natural function of environmental process.
- Continue to reduce flood losses through compliance with National Flood Insurance Program requirements; continue to comply with Community Rating System requirements, where applicable (i.e., Boulder County, Longmont, and Louisville). NFIP is mandatory and CRS is not. Monitor progress and implement adaptive management as needed to incorporate new and improved best practices including those resulting from future uncertain climate predictions.
 - Need to add environment bullet in title but not in objectives.

Goal 3: Strengthen intergovernmental coordination, communication, and capabilities regarding mitigating hazard impacts

- Promote planning efforts that foster cooperation and coordination among jurisdictions, agencies, and organizations involved in hazard mitigation.
- Establish and maintain processes and resources to incorporate mitigation and resiliency into recovery efforts following a hazard event.

Goal 4: Improve public awareness and preparedness regarding hazard vulnerability and mitigation

- Enhance public education efforts regarding hazards and risks in Boulder County and the role of the public in mitigation.
- Continue engaging the public in hazard mitigation planning and implementation.
- Combine mitigation education efforts with existing governmental and nongovernmental outreach programs.
- Incorporate the most up-to-date climate predictions with all whole community mitigation programs and projects.

Goal 5: Address hazard identification in the context of climate change

- Strive to identify and address common issues related to hazard mitigation and climate changes.
- Monitor the ever-changing environment and continue to identify new or changing hazards.
- Address hazard identification in the context of climate change.

Boulder Natural Hazard Mitigation Plan Survey 2019

Friday, January 17, 2020

2184

Total Views

335

Total Responses

Date Created: Friday, June 07, 2019

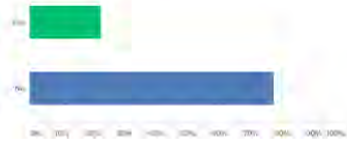
Complete Responses: 255



Appendix C: Meeting 3 Documentation: February 28, 2020 Review goal Revisions, Public Survey Results, Mitigation Strategy

Q6: Are there any hazards not listed in Question 5 that you believe the Hazard Mitigation Planning Committee should consider?

Answered: 282 Skipped: 73



Powered by SurveyMonkey

17

Q6: Are there any hazards not listed in Question 5 that you believe the Hazard Mitigation Planning Committee should consider?

Answered: 282 Skipped: 73

ANSWER CHOICES	RESPONSES
Yes	28.51%
No	71.49%
TOTAL	282

Powered by SurveyMonkey

18

Q10: In the past 5 years, have you or any local organizations in your community taken any actions to reduce or eliminate the impact of this hazard?

Answered: 298 Skipped: 67



Powered by SurveyMonkey

19

Q10: In the past 5 years, have you or any local organizations in your community taken any actions to reduce or eliminate the impact of this hazard?

Answered: 268 Skipped: 67

ANSWER CHOICES	RESPONSES
Yes	55.72%
No	44.28%
TOTAL	268

Powered by SurveyMonkey

20

Appendix C: Meeting 3 Documentation: February 28, 2020 Review goal Revisions, Public Survey Results, Mitigation Strategy

⚠️ We weren't able to deliver this message to 7 recipients because their email addresses are no longer valid.
This email message will be sent to about 30 recipients.

Shannon, Allison **Automatic Reply:** Hi, I'm not working right now. My work hours are Tuesday (8-2 Wednesday 7:30-1) and Thursday (7:30-3:30). Abby Due to COVID-19, the Boulder County Community Planning & Permitting Department is conducting business and providing services virtually. Our physical office is closed. Attendee responses: 2 accepted, 3 tentatively accepted, & 1 declined.

Send Update

Title: HMP HVA and Project Sheet Meeting

Required:

- Allum, Linda • Borden, David • Eric Olson <eric.olson@bouldercounty.gov> • Brian Reardon <brianr@bouldercounty.gov> • Case, Dale • Chris Bagnall <cbagnall@bouldercounty.gov> • Chris Shepherd <shepherd2@bouldercounty.gov>
- David Hayes <DHayes@bouldercounty.gov> • Greg Hansen <gregory.hansen@bouldercounty.gov> • Hayden, Carrie • Karen Gentry <kgentry@bouldercounty.gov> • Kate Dunlap <kdunlap@bouldercounty.gov> • Ken Cain <ken.cain@bouldercounty.gov>
- Keith, Michelle • Mahoney, Joe • Mark Thompson <mark.thompson@bouldercounty.gov> • McKenna, Jeff • Maria Runtala <maria.runtala@bouldercounty.gov> • Nicole Arneson <nicole.arneson@bouldercounty.gov> • Patrick <patrick@bouldercounty.gov>
- Peter Johnson <peterjohnson@bouldercounty.gov> • Rector, Stacey • Richard Stefan • Sanjay, Gaur • Shannon McVary <shannon.mcvary@bouldercounty.gov> • Todd Lewis <todd.lewis@bouldercounty.gov> • Thomas, Mike • Webster, James R • Wessman, Cliff
- Wesley, Nicole • Armitage, Katie • Blakeslee, Justin • Mahanah, Andrew • Patrick Vanhook <patrick.vanhook@bouldercounty.gov> • Victor Amador <victor.amador@bouldercounty.gov> • Stewart, Tony • Rick Bashor • gahagen@bouldercounty.gov • Mattis, Lee
- David Wolf <david.wolf@bouldercounty.gov> • Janyah, Eshwar <janyah.eshwar@bouldercounty.gov> • Stewart, Michael

(Optional):

- Hartsel, Mike • Lucy, Kelly • Winkler, Lisa • Campbell, Chris • Kathy, Jonathan <Kathy@bouldercounty.gov> • Masucci, Molly • Shannon, Allison • Erica Roberts

Start time: Wed 2/19/2020 1:00 PM ☐ All day ☐ Time zones

End time: Wed 2/19/2020 4:00 PM ☐ Make Recurring

Location: SHHQ Training Room 3600 Flatiron Parkway 📍 Show Maps

Attachments:

- Hazard Mitigation Goals updated 2019.docx
- 2019 Community Hazard Mitigation Survey Response for Questions.docx
- 2019 Survey results.pdf
- HMP 2019 Survey app - iOS
- MHMP 2019-2023 Activity Schedule January 2020.docx

Greetings All,

First if there is someone missing on the email list please let me know so I may add them and if I need to delete a name also let me know, thank you.

Secondly, my apologies for a very late notice on this invite rooms are scarce and it just took some time to verify a location. I am going to run 2 more HVA open sessions if needed in March if this one you just cannot make. One will be the first week in March and the last on the last week of March.

The list of documents should bring you up to speed and please perform the following actions:

1. Review the HMP goals and let me know if I have adequately incorporated the feedback. These will be used to link projects to the plan's goals.
2. MHMP Activity schedule shows the action items as best predicted at this time. I would like to meet on February 19 from 1:30 p.m. to 3:30 p.m. at the Boulder County Sheriff's Office training room. (address is 3600 Flatiron Parkway) Purpose of this meeting is to orient communities on how to conduct an HVA and complete project work sheets. If assistance is needed appointments will be scheduled to assist with completing the process.
3. The community survey is closed and the results are attached. The comment section had to be extracted and placed in a Word document for viewing by the masses. Comments are to be used by the HMP committee to see if there is anything useful for evaluating risk, vulnerability and strategies to address them. OEM will aggregate responses to ensure our risk profile is consistent with the community.

Thanks and if you have questions please let me know, I will advise on the location of the meeting once I secure the venue.

Shannon Allison <shannon.allison@bouldercounty.gov> Documented by Cheryl K. Wilson 2/19/2020

1. Event Name	2. Operational Period (Date /Time) From: 1:00pm - To: 4:00 p.m.	3. Check-in Location <input type="checkbox"/> EOC <input checked="" type="checkbox"/> Other SHERIFF TRAINING ROOM		CHECK-IN LIST (Personnel) EOC 211p-OS
Personnel check-in Information				
4. Name	5. Organization / Agency	6. ESF / Section / Assignment	7. Contact Information Phone # Email	
SHANNON McVAUGH	Longmont COEM		303-774-3793	shannon.mcvau@longmontcolorado.gov
Peter Gildars	Longmont COEM		303-774-4423	Peter.Gildars@longmontcolorado.gov
bycelyn Fankhauser	HHS	6/19	3.591.4424	jfankhaus@bouldercounty.org
Monica Bartolini	Longmont PW		303-651-6328	monica.bartolini@longmontcolorado.gov
Bret Gibson	Four Mile Fire PD	13	3-579-1821	chiefbret@gmail.com
Kate Dunlap	Boulder		303-442-7412	dunlapk@boulderco.gov
KEVIN STEWART	MHFD		3/455.6277	kstewart@mhfd.org
Christin Shepherd	COB		(3) 441-3425	shepherd@boulderco.gov
Dave Boston	BCSO ES		(3) 441-3625	dboston@bouldercounty.org
Kelly Lucy	BCSO ES		3-877-1720	klucy@bouldercounty.org
Stacey Proctor	BOCO CPP		3-441-1107	sproctor@bouldercounty.org
Jim Webster	BOCO CPP		720-564-2600	jwebster@boulderco.gov
9. Prepared By MIKE CHAND Date /Time 2/19/20 / (1:30pm)				
10. Date /Time sent to Resources Unit				

CHECK-IN LIST (Personnel)
EOC 211p-OS

78.4%


Appendix D: Meeting 4 Documentation, Developing Mitigation Actions

21

24

29


Appendix E: Meeting 5 Documentation: Plan Finalization December 13, 2021



Boulder County Hazard Mitigation Plan Update

Plan Finalization Webinar

December 13, 2021 – 9:00-10:30 am



wood.

Agenda

1. Introductions
2. Plan Requirements and Deficiencies to Address
3. Risk Assessment Update Revisions
4. New Mitigation Action Revisions/Needs
5. Capability Assessment Revisions/Needs
6. Project Schedule and Next Steps
7. Questions

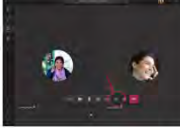
Meeting Logistics

- Please mute your mic when not speaking.
- ...but please feel free to unmute when you have something to say!
- You can also use the chat log to make comments, ask questions, or provide information.
- This meeting is being recorded.
- Slides, meeting summary, and recording will be made available.

Introductions

Introductions

- Boulder County
 - Mike Chard – Director, OEM
- Wood Environment and Infrastructure Solutions
 - Jeff Brislaen – Program Director/Project Manager
 - Scott Field – QA/QC
 - Amy Carr – Hazard Mitigation Planner
 - Chris Johnson – Hazard Mitigation Planner/GIS
 - Mack Chambers – GIS
- Attendees:
 - For documentation purposes please type your name, title, and affiliation in the Chat box.



FEMA's Regulation Checklist and Final Plan needs

Element	Need
Element A	Planning Process
Need:	Description of 2021 process including public involvement and outreach to neighbouring jurisdictions
Element B	Hazard identification and Risk Assessment
Need:	Jurisdictional differences on vulnerabilities
Element C1	Community Mitigation Capabilities
Need:	Missing capabilities required to include by state DHEM
Element C4	Develop a Mitigation Strategy
Need:	Missing adequate number of new actions
Element D	Plan Review, Evaluation and Implementation
Need:	Progress on mitigation actions. Reflect changes in development.
Element E	Plan Adoption
Need:	Adoption from jurisdictions, when FEMA approved
Optional:	High Hazard Potential Dam Risks
Need:	Related mitigation action

Mitigation Planning Process and Requirements

Mitigation Planning

FEMA's original 4-Phase DMA Planning Guidance

Phase 1: Organize Resources

Phase 2: Risk Assessment


Phase 3: Develop a Mitigation Plan

Phase 4: Adoption and Implementation


Element B: Hazard Identification and Risk Assessment

Risk Assessment

- Hazard identification (what can happen here?)
- Vulnerability Assessment (what will be affected?)




Hazard Identification – Profile the Hazards



- Hazard description
- Past occurrences
- Geographic location
- Magnitude/severity
- Probability of future occurrences
- Climate change considerations

Vulnerability Assessment – What Will Be Affected?

- Inventory residential and commercial structures
- Inventory critical facilities and infrastructure
- Determine value of structures
- Determine the number of people in hazard areas
- Identify vulnerable infrastructure
- Identify development trends / constraints
- Identify historic, cultural, and natural resource areas
- Estimate losses



Element C1-2: Capability Assessment

Review Community Capabilities

What's already in place related to hazard mitigation?

- Inventory of a community's existing and proposed policies, programs, and ordinances that may reduce vulnerability to hazards
- Determine each jurisdiction's technical and fiscal abilities to implement mitigation initiatives. Include ability to attract and leverage funding
- Identify opportunities to expand or improve capabilities
 - Evaluate the effectiveness
 - Note gaps, shortfalls or conflicts associated with their design, enforcement or implementation

Capability Assessment Update – Specific Comments

- Does your community have a BCEGS rating?
- Does your community have elevation certificates?
- Does your community have a Resiliency Planner? A Transportation Planner?
- Which of these financial capabilities has your community used for mitigation?
- Mitigation Education and Outreach
 - Specific examples of outreach?
 - Firewise, StormReady participants?

Element C4: Mitigation Actions


Developing New Mitigation Actions

Disaster Mitigation Act – Mitigation Action Requirements

- Each jurisdiction must have at least one** new mitigation action
- Plan must have at least one action at a minimum that addresses each identified hazard and must be true mitigation (not preparedness), preferably of different categories.
- Need to demonstrate continued NFIP compliance**
 - Actions must be prioritized
 - Relative priority: High, Medium, Low
 - Actions must have detail on implementation and administration
 - Actions must have a review of benefit vs cost
 - Actions must address existing and future development


Develop a Mitigation Strategy

- Review & update plan goals & objectives
- Review mitigation alternatives
- Draft an action plan




Review Mitigation Alternatives

- Plans and Regulations
- Structure and Infrastructure Projects
- Education and Awareness
- Natural systems protection
- Actions must be prioritized




Projects Eligible for FEMA Funding – Wildfire

- Defensible Space
- Hazardous Fuels Reduction Activities
 - Community level vegetation management
 - Vegetation removal
 - Vegetation clearing and/or thinning
 - Slash removal
 - Vertical clearance of tree branches
- Structural Protection Through Ignition-Resistant Construction Activities




Projects Eligible for FEMA Funding – Flood

- Acquisition
- Dry and Wet Flood-proofing
- Elevation
- Minor Localized Flood Reduction Projects
 - Detention ponds
 - Channel stabilization
- New Policy Change: Levee Projects if no duplication of programs with Army Corp
- Infrastructure Retrofit
 - Culverts, bridges, etc.




Projects Eligible for FEMA Funding – Winter Storm

- Ensure development and enforcement of building codes for snow loads
- Burying overhead power lines
- Informing the public about severe winter weather impacts
- Organizing outreach to vulnerable populations including establishing and promoting accessible heating centers
- Retrofitting public buildings to withstand snow loads and prevent roof collapse



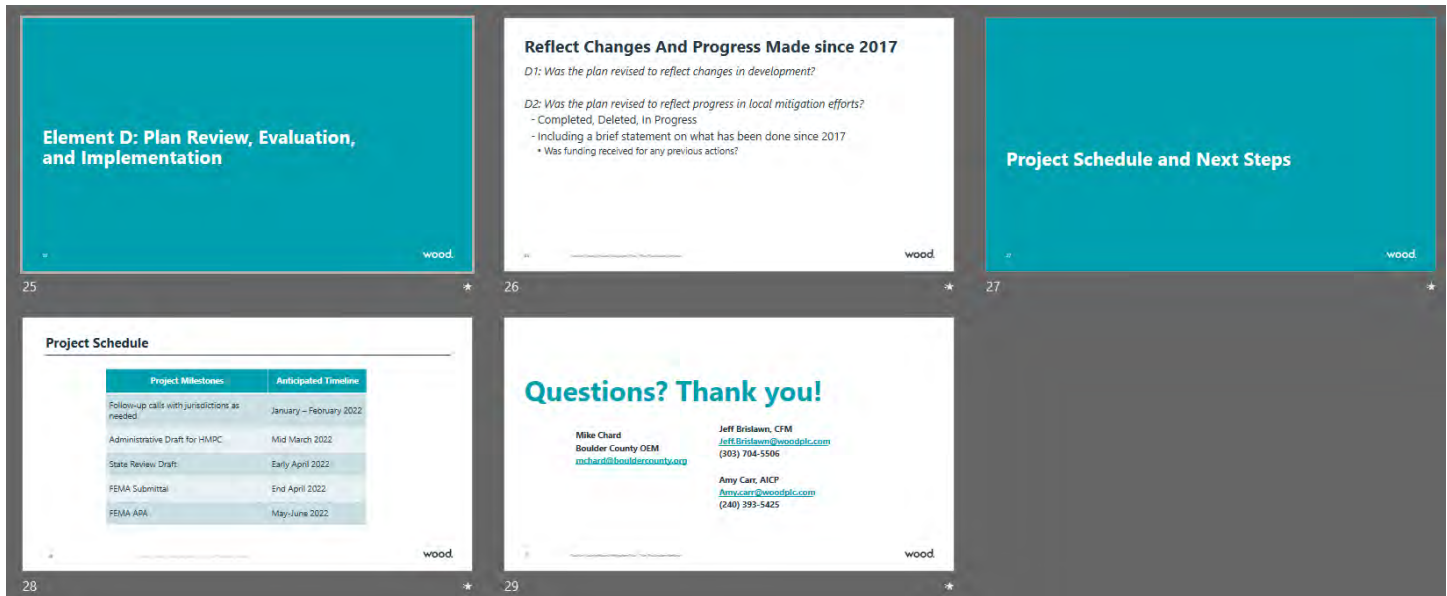
Other Mitigation Projects Eligible for FEMA Funding

- Property Acquisition
- Landslide channel/slope stabilization
- Utility Protection/ Infrastructure Retrofit
- Safe Rooms
- Generator Installation
- Seismic Building/Infrastructure Retrofit
- Climate Resilience Activities
 - Groundwater Recharge
 - Green Infrastructure



Sources of Ideas for Mitigation Actions

- Hazard Identification and Risk Assessment
- Public survey input
- Comprehensive Plans
- Water protection & usage plans, watershed plans, etc
- Capital Improvement Plans, drainage plans
- FEMA 'Mitigation Action Portfolio' publication
 - https://www.fema.gov/sites/default/files/2020-08/fema_mitigation-action-portfolio-support-document_08-01-2020_0.pdf



Chat Log and Attendance Record

[12/13/2021 9:03 AM] Mark Thompson (Guest)
 Mark Thompson, DHSEM, markw.thompson@state.co.us

[12/13/2021 9:03 AM] Miranda Fisher (Guest)
 Miranda Fisher, Town of Nederland

[12/13/2021 9:03 AM] Thomas, Mike
 Mike Thomas, County PW, 720-564-2655

[12/13/2021 9:03 AM] Watson, Kelly
 Kelly Watson, Boulder County CP&P, kwatson@bouldercounty.org

[12/13/2021 9:03 AM] Victoria Simonsen

Victoria Simonsen, Town of Lyons

[12/13/2021 9:06 AM] Andrew Kosinuk

Andrew Kosinuk, andrew.kosinuk@colorado.edu, 303-735-5280

[12/13/2021 9:06 AM] Case, Dale

Dale Case, CP&P720-564-2604 dcase@bouldercounty.org

[12/13/2021 9:06 AM]

Lee Mathis (External) has temporarily joined the chat.

[12/13/2021 9:07 AM] Carr, Amy

Amy Carr, Hazard Mitigation Planner, Wood

[12/13/2021 9:07 AM] Shepherd, Christin

Christin Shepherd, City of Boulder, Floodplain Administratorshepherd2@bouldercolorado.gov303-441-3425

[12/13/2021 9:12 AM] Monica Bortolini

Please tell us the pass word again.

[12/13/2021 9:14 AM] Scott, Kim

Kim Scott kscott@bouldercounty.org

Collin Judkins (External) has temporarily joined the chat.

[12/13/2021 9:35 AM] Thomas, Mike

Please define "WUI(?) Code"

[12/13/2021 9:36 AM] Thomas, Mike

Thank you!

[12/13/2021 9:37 AM] Chard, Mike

User Name BHMPT Password BoulderHMPT2022!

[12/13/2021 9:40 AM] Maya (Guest)

Can you put the Mitigation Action Portfolio link in the chat?

[12/13/2021 9:41 AM] Brislawn, Jeff P

https://www.fema.gov/sites/default/files/2020-08/fema_mitigation-action-portfolio-support-document_08-01-2020_0.pdf

[12/13/2021 9:51 AM] Thomas, Mike

For Dam Safety, should also get State Engineer's office involved.

[12/13/2021 10:02 AM] CHRIS O'BRIEN

Chris O'Brien, Cobrien@lefthandfire.org 3038176009

[12/13/2021 10:06 AM] Lee Mathis

Lee Mathis lmathis@erieco.gov

[12/13/2021 10:06 AM] Shannon McVaney

updates would be nice

[12/13/2021 10:06 AM] Victoria Simonsen

I would be interested in this.

[12/13/2021 10:06 AM] CHRIS O'BRIEN

Yes please

[12/13/2021 10:06 AM] Bloom, Joanna

Thanks for organizing and updates are great!

[12/13/2021 10:07 AM] Maya (Guest)

Thanks!

Appendix F: Posting of Hazard Mitigation Plan on Website and Community Engagement (Public and Neighboring Jurisdictions)

Appendix F: Posting of Hazard Mitigation Plan on Website and Community Engagement (Public and Neighboring Jurisdictions)

The screenshot displays the Boulder Office of Emergency Management (OEM) website. The header includes the OEM logo and navigation links. The main content area features a welcome message and a section for the Hazard Mitigation Plan. A red arrow points from the 'Hazard Mitigation Plan' link in the main content area to a detailed view of the plan. Another red arrow points from the 'Hazard Mitigation Plan' link in the sidebar to a community feedback form.

Welcome to the Boulder office of Emergency Management

Boulder Office of Emergency Management

EMERGENCY STATUS
FOR UPDATES ON DISASTERS AND OTHER EMERGENCY SITUATIONS, VISIT THE ACTION BELOW.

EMERGENCY UPDATES

Emergency Messages Sign-Up
Sign up to receive critical information about emergencies and disasters to help you stay safe and informed. You'll receive text messages, emails, and phone calls when needed.

The Boulder Office of Emergency Management (OEM) plans, coordinates and supports a wide-range of activities that help prepare for, respond to, and recover from disasters and large-scale emergencies, while also reducing vulnerabilities to hazards.

EMERGENCY PREPAREDNESS TESTING SCHEDULES
The Boulder Office of Emergency Management is preparing for the next disaster. The City of Boulder will begin a series of emergency testing on April 5, 10 AM on Saturdays, April 5.

EMERGENCY PREPAREDNESS GUIDE
Download the Boulder 2021 Emergency Preparedness Guide which provides a comprehensive overview of the plan to the possible risks and hazards in our community.

Hazard Mitigation Plan
The Hazard Mitigation Plan is a framework that guides our communities in making decisions and developing policies to reduce or eliminate risk to life and property. As we update our plan, we'd love to hear from you!

DISASTER PREPAREDNESS
Disasters can happen at any time. It's important to be prepared. This page provides information on how to prepare for disasters and how to stay safe.

BE INFORMED
There are many ways to get information. During and after an emergency, the city will get information about you using various methods.

HAZARDS
Boulder County and the surrounding areas are at risk of a wide range of hazards. This page provides information on the hazards in our area.

Hazard Mitigation Plan

2021 – 2026 Boulder Hazard Mitigation Plan – Community Review

Hazard Mitigation Plan Feedback/Comments

The Hazard Mitigation Plan is a framework that guides our communities in making decisions and developing policies to reduce or eliminate risk to life and property. As we update our plan, we'd love to hear from you!

Name *

First Last

Email *

How did you hear about the Hazard Mitigation Plan - Community Review?

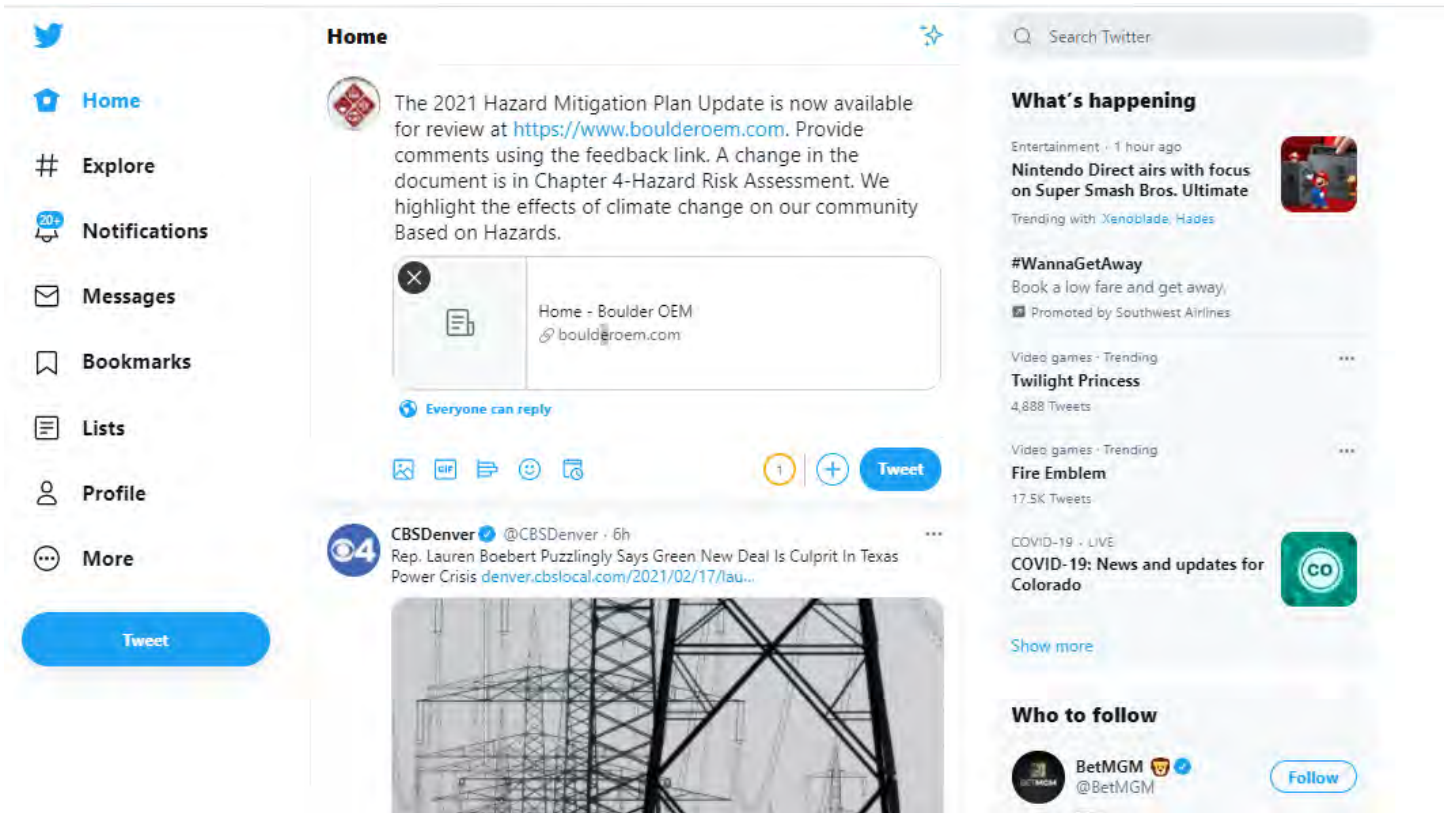
Comments/Feedback

Please check the box below. *

☐ I'm not a robot

reCAPTCHA Privacy - Terms

Submit



**Boulder Oem**

Just now · 🌐

...

The 2021 Hazard Mitigation Plan Update is now available for review by the community at <https://www.boulderoem.com>. Please provide comments using the feedback/comments link. A big change in the document from the previous years is in Chapter 4 "Hazard Risk Assessment". In the 2021 version we highlight the effects of climate change on our community and how the each hazard we face in Boulder impacts our community past and present.



threats and hazards by text message, email, and/or on your cell, home or work phone. For more ... [🔗](#)

🔥 Hazard Mitigation Plan

- [2021 – 2026 Boulder Hazard Mitigation Plan](#) [🔗](#)
- [Hazard Mitigation Plan Feedback/Comments](#) [🔗](#)

The Hazard Mitigation Plan is a framework that guides our communities in making decisions and developing policies to reduce or eliminate risk to life and property. As we update our plan, we'd love to hear from you!

Appendix F: Posting of Hazard Mitigation Plan on Website and Community Engagement (Public and Neighboring Jurisdictions)

Landing Page	Acquisition			Behavior			Conversions		
	Sessions	% New Sessions	New Users	Bounce Rate	Pages / Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
	659,085 % of Total: 100.00% (659,085)	44.53% Avg for View: 44.53% (0.00%)	293,490 % of Total: 100.00% (293,490)	49.00% Avg for View: 49.00% (0.00%)	2.28 Avg for View: 2.28 (0.00%)	00:02:17 Avg for View: 00:02:17 (0.00%)	0.00% Avg for View: 0.00% (0.00%)	0 % of Total: 0.00% (0)	\$0.00 % of Total: 0.00% (\$0.00)
<input type="checkbox"/> 1. /emergency-status/	246,623 (37.42%)	40.06%	98,793 (33.66%)	44.92%	2.29	00:02:42	0.00%	0 (0.00%)	\$0.00 (0.00%)
<input type="checkbox"/> 2. /	150,435 (22.82%)	42.56%	64,029 (21.82%)	23.71%	3.10	00:02:54	0.00%	0 (0.00%)	\$0.00 (0.00%)

Boulder OEM homepage has had 150,435 views since Oct 1st, but only 3 comments from the online form form.

Entry Id	Name	Last	Email	How did you hear about the	Comments/Feedback	Date Created
1	David	Swenson	kdsenson@msn.com	Longmont Leader	I think a serious plan for forest maintenance needs to be considered to reduce the risk of wild fires. This would include logging and brush clearing, especially by homeowners in the mountains. I know it reduces the beauty of the area, but as last summer's wildfires show, it needs to be done!	2020-12-16 14:05:03
2	Nadejda	Sena	nadejda.sena@gmail.com	https://www.boulderoem.com/	Please address man-made hazards and cyber security threats due to culture of compliance negligence in Boulder County organizations.	2020-12-16 18:47:51
3	Pat	Cantwell	patcantwell@yahoo.com	The Longmont Leader	Please consider eliminating the chemicals called PFAS and PFOS – known as forever chemicals from any Hazard mitigation, including fire fighting. These chemicals are in the blood of virtually every person on the planet. And they will only accumulate. These poisons are found in everyone, even unborn babies – and who is responsible for it?	2020-12-17 09:34:20



Appendix F: Posting of Hazard Mitigation Plan on Website and Community Engagement (Public and Neighboring Jurisdictions)

The screenshot shows a Facebook interface. On the left is a sidebar with navigation links: Boulder Oem, Pages (9+ updates), Find Friends (2 requests), Groups (1 new), Marketplace, Events, Memories, Saved, Jobs, and See More. Below this is 'Your Shortcuts' with a link to Boulder Office of Emergency Management.

The main content area displays a post from 'Boulder Oem' (verified page) posted 'Just now'. The post text reads: 'The 2021 Hazard Mitigation Plan Update is now available for review by the community at <https://www.boulderoem.com>. Please provide comments using the feedback/comments link. A big change in the document from the previous years is in Chapter 4 "Hazard Risk Assessment". In the 2021 version we highlight the effects of climate change on our community and how the each hazard we face in Boulder impacts our community past and present.' Below the text is a red heart icon and a link to 'Feedback/Comments'. A large graphic titled 'Hazard Mitigation Plan' is also visible, listing '2021 - 2026 Boulder Hazard Mitigation Plan' and 'Hazard Mitigation Plan Feedback/Comments'. The graphic text states: 'The Hazard Mitigation Plan is a framework that guides our communities in making decisions and developing policies to reduce or eliminate risk to life and property. As we update our plan, we'd love to hear from you!' Below the graphic is a video thumbnail showing a red and white striped traffic cone on a road.

At the bottom of the post are interaction buttons: Like, Comment, and Share. Below these is a comment input field with the placeholder text 'Write a comment...' and a 'Press Enter to post.' button.

On the right side of the page, there are 'Sponsored' ads, 'Your Pages' (including Boulder Office of Emergency Management with 20+ notifications and a 'Create Promotion' button), 'Contacts' (George R Weber and Linda Carrizales), and 'Group Conversations' (with a 'Create New Group' button).

HMP Review Period April 28, 2022 – May 6, 2022

From: [Chard, Mike](#)
To: [Braddock, Cynthia](#); [Lewis, Melanie](#); [Petersen, Jana](#); [Krezek, Michelle](#); [Fankhouser, Joycelyn](#); [CHRIS O'BRIEN](#); [Mullane, Mark](#); [Case, Dale](#); [Webster, James B.](#); [Reinold, Stefan](#); [Thomas, Mike](#); [Proctor, Stacey](#); [Gazzetti, Virginia](#); [Watson, Kelly](#); [Malinowski, Joe](#); [Campbell, Chris](#); [John Benson](#); [Greg Schwab](#); [Mike Cusklevy](#); [Rob Price](#); [KenCairn, Brett](#); [Christin Sheppard](#); [Ed Stafford \(stafforde@bouldercolorado.gov\)](#); [Jeff Arthur](#); [Rosipajla, Brian](#); [Hayes, David](#); [Megan Davis](#); [Emily Hogan](#); [Kevin Esmail](#); [Monica Bortolini](#); [Almone, Nicole](#); [Gibson, Bret](#); [maya@boulderwatershedcollective.org](#); [Greg Hansen](#); [Stewart, Kim](#); [Victoria Simonsen](#); [Miranda Fisher](#); [Richard Peebles](#); [Matt Magley \(mattm@superiorcolorado.gov\)](#); [Garry Dejong](#); [Jeff Durbin](#); [Douville, Chris](#); [Rindahl, Bruce](#)
Cc: [Carr, Amy](#); [Brislawn, Jeff P](#)
Subject: HMP review
Date: Thursday, April 28, 2022 11:26:11 AM
Attachments: [Boulder County HMP Update DRAFT 4-18-22 \(1\).pdf](#)
[HMP Review and Comments Document.xlsx](#)

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Boulder Hazard Mitigation Planning Committee

A draft of the base plan of the Boulder County Hazard Mitigation Plan update is available for the HMPC to review before it is finalized and submitted for public review and state/FEMA review and approval. Please provide any comments by email or use the review document by May 6th. Other sections of the plan, including jurisdictional annexes, are in final development and will be available as they become available.

Michael N. Chard
 Director
 Office of Disaster Management for City of Boulder & Boulder County
 303-565-7878
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Neighboring Jurisdictions Review Period April 28, 2022 – May 6, 2022**From:** Chard, Mike**Sent:** Thursday, April 28, 2022 10:56 AM**To:** Lori Hodges (hodgeslr@co.larimer.co.us) <hodgeslr@co.larimer.co.us>; Hal Grieb <hrgrieb@jeffco.us>; Merrie Garner <MGarner@fffd.us>; Roy Rudisill <rrudisill@co.weld.co.us>; Ronald Sigman <RSigman@adcogov.org>; cshuck@broomfield.org; kevin.kurecich@state.co.us; nwhittington@gilpincounty.org**Subject:** Boulder Hazard Mitigation Plan Review

Neighboring jurisdictions to Boulder County and interested organizations:

Boulder County is in the process of finalizing our Hazard Mitigation Plan update. As neighboring jurisdiction or a potentially interested stakeholder, we wanted to notify your jurisdiction, agency, or organization that a draft of the base plan is available for review before it is finalized and submitted for public review and state/FEMA review and approval. Please provide any comments by email by May 6th or you may use the attached HMP review document. Other sections of the plan, including jurisdictional annexes, are in final development and will be available soon.

Thank you for taking the time to review the base plan and for any feedback that you are willing to provide.

Michael N. Chard

Director


Office of Disaster Management for City of Boulder & Boulder County

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Second Public Review Period May 13, 2022 – May 20, 2022



EMERGENCY STATUS MITIGATION PREPAREDNESS RESPONSE RECOVERY PARTNERSHIPS ABOUT OEM


04/22/22 – Boulder County has enacted **Level 1 Fire Restrictions**



EMERGENCY WARNING SIRENS TESTING SCHEDULED

The Boulder Office of Emergency Management, in partnership with Boulder County and the City of Boulder, will begin audible testing of the countywide emergency sirens at 10 a.m. on Monday, May 2.


[Read More](#)



EMERGENCY PREPAREDNESS GUIDE

Download the Boulder DEM Emergency Preparedness Guide, which provides a comprehensive view on how to prepare for the possible risks and hazards in our community.

[Read More](#)



PUBLIC ALERT AND WARNING SYSTEM

Why use warning over pre-evacuation or voluntary? The types of wildfires we have that are devastating involve fast moving and escalating fires. The pre-evacuation or voluntary implies less urgency.

[Read More](#)

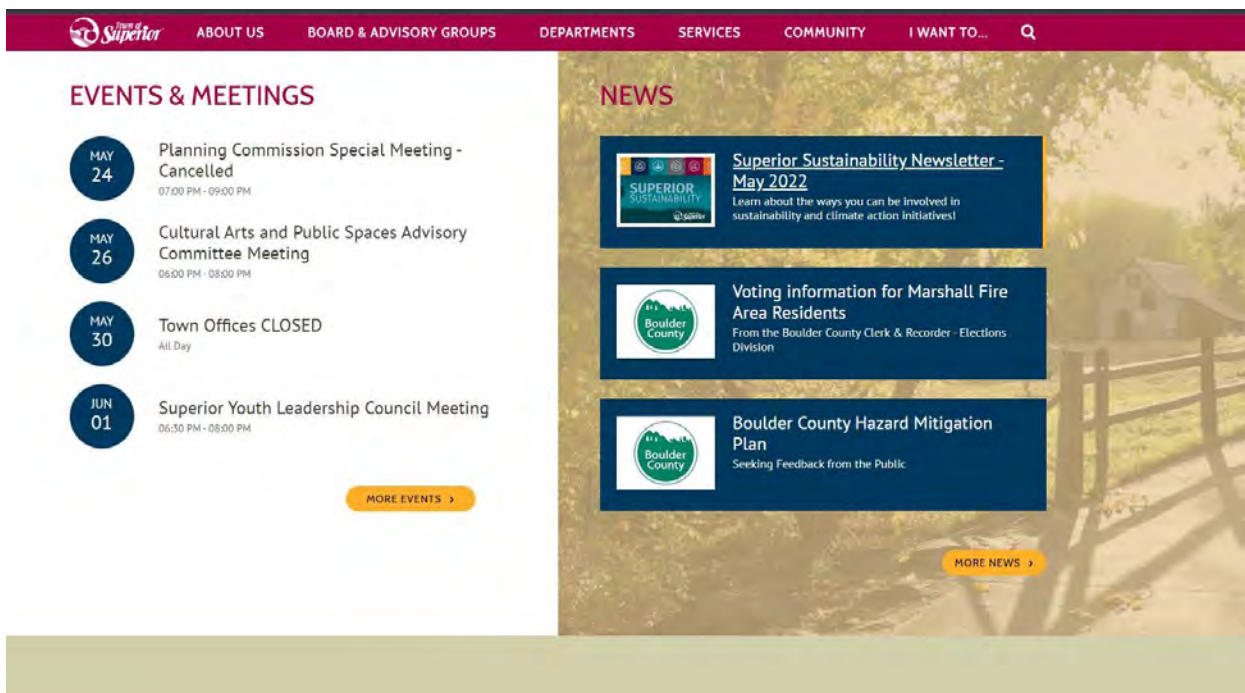
Hazard Mitigation Plan

- 2021 – 2026 Boulder Hazard Mitigation Plan
- Submit Feedback/Comments

The Hazard Mitigation Plan is a framework that guides our communities in making decisions and developing policies to reduce or eliminate risk to life and property. As we update our plan, we'd love to hear from you!

Appendix F: Posting of Hazard Mitigation Plan on Website and Community Engagement (Public and Neighboring Jurisdictions)





Appendix F: Posting of Hazard Mitigation Plan on Website and Community Engagement (Public and Neighboring Jurisdictions)

The screenshot shows the Town of Superior website. The navigation bar includes links for ABOUT US, BOARD & ADVISORY GROUPS, DEPARTMENTS, SERVICES, COMMUNITY, and I WANT TO... A search icon is also present. The left sidebar lists various links such as About Superior, Bids, RFPs, RFQs, Board of Trustees, Town Events, Contact Us, Demographics, Important Links, and Moving to Superior. The main content area features a 'News' section with a post titled 'Boulder County Hazard Mitigation Plan Seeking Feedback from the Public'. The post date is 05/17/2022 12:30 PM. The text of the post states that the draft Boulder County Hazard Mitigation Plan is now available for public comment and provides a link to the Boulder Office of Emergency Management website. A callout box titled 'Hazard Mitigation Plan' lists three items: '2021 - 2027 Boulder Hazard Mitigation Plan', 'Boulder Hazard Mitigation Plan Annex Updates', and 'Submit Feedback/Comments'. Below the callout box, a paragraph explains the purpose of the Hazard Mitigation Plan.

Town of Superior

ABOUT US | **BOARD & ADVISORY GROUPS** | **DEPARTMENTS** | **SERVICES** | **COMMUNITY** | **I WANT TO...**

News

Boulder County Hazard Mitigation Plan

Seeking Feedback from the Public

Post Date: 05/17/2022 12:30 PM

The draft Boulder County Hazard Mitigation Plan is now available for public comment. The Hazard Mitigation Plan is a framework that guides our communities in making decisions and developing policies to reduce or eliminate risk to life and property. As Boulder County updates their plan, they would love to hear from you! The materials for review are located on the [Boulder Office of Emergency Management website](#). Comments are being accepted until Friday, May 20.

Hazard Mitigation Plan

- 2021 - 2027 Boulder Hazard Mitigation Plan
- Boulder Hazard Mitigation Plan Annex Updates
- Submit Feedback/Comments

The Hazard Mitigation Plan is a framework that guides our communities in making decisions and developing policies to reduce or eliminate risk to life and property. As we update our plan, we'd love to hear from you!

This is a screenshot. Please click on the image to visit to the Boulder OEM website.

Public Comments Received from Public Review Period

Entry Id	Comments/Feedback	Response
1	I think a serious plan for forest maintenance needs to be considered to reduce the risk of wild fires. This would include logging and brush clearing, especially by homeowners in the mountains. I know it reduces the beauty of the area, but as last summer's wildfires show, it needs to be done!	Already addressed in plan
2	Please address man-made hazards and cyber security threats due to culture of compliance negligence in Boulder County organizations.	Man-made can be considered for next update
3	Please consider eliminating the chemicals called PFAS and PFOS – known as forever chemicals from any Hazard mitigation, including fire fighting. These chemicals are in the blood of virtually every person on the planet. And they will only accumulate. These poisons are found in everyone, even unborn babies – and who is responsible for it?	Outside scope of HMP
4	<p>I'm looking for others' comments and feedback so I know exactly what this is about. Are they posted somewhere that the public can read?</p> <p>In the meantime, I'd like to suggest that firebreaks be created in critical areas to mitigate the spread of wildfires so that residents have more time to react. Increasing reaction time would also require reverse 911 calls be made sooner to announce the presence of a potential threat. Perhaps alarms should be sounded early and often. Residents may have a bit more time to find and add necessities like critical documents and seasonal clothing to their to-go bags.</p> <p>Xcel could turn gas and electricity off as soon as wind gusts peak at a particular speed regardless of the time of year. Of course this would be a true hardship for some but it could mitigate a horrific disaster for others.</p> <p>Residents and businesses could be incentivized to perform some fire-ready activities like removing combustible landscape materials from within thirty feet of their homes/businesses and adding small mesh to their soffit and other exterior vents.</p> <p>The most critical suggestions might be to add requirements to our building codes that only fire resistant (and flood, wind) materials be used when renovating and in new construction and that landscape companies be required to advertise and sell only plant varieties that are fire (and drought) resistant. Yes homes will cost a bit more but it's critical that we build for safety and sustainability in a climate chaotic world.</p> <p>Our Governor could shift his care and concern for the oil, gas and other polluting industries and their employees to the rest of the population and take stronger steps to expedite the switch we must make to 100% renewables. We need him to take on a role as benign dictator who will stop making everyone grumble a bit and instead make us all angry but eventually thankful, and with better health, trust in government to take on the difficult tasks, and much safer much sooner.</p>	Fire and fuel breaks are addressed in mitigation actions
5	Criminalize weed again. If you cannot do so, fund research that can identify the correlation of drug use and destructive/irresponsible behaviors. Our ancestors spent many years to protect and preserve such enviable	Outside scope of HMP

Appendix F: Posting of Hazard Mitigation Plan on Website and Community Engagement (Public and Neighboring Jurisdictions)

Entry Id	Comments/Feedback	Response
	<p>geography... To lose it all to out-of-state greed is the highest disservice.</p> <p>Get rid of pot.</p> <p>Get rid of crime.</p> <p>Get rid of poorly constructed infrastructure.</p> <p>Get rid of out-of-state investment.</p> <p>It's that simple.</p>	
6	Hello Im with Empire Solutions a company out of Northern CO and we specialize in demo, mitigation, and restoration work. I am trying to find out how we can help. My number is [REDACTED]	
7	Lots of fuel in Bear Creek. Please clean it up.	Riparian vegetation has been deemed important for ecosystem and to remove it would increase flood risk
8	<p>I have made this recommendation in the past to Town of Superior meetings:</p> <p>The current practice of running a lawn mower along the open space fence maybe once a month is critically deficient. Suggest the width be increased to at least 3 passes of the mower to lower the prairie grass running along the fence. It must be kept about an inch or two high at most. Fire resistant ground cover like gravel would increase the safety of the fire-break.</p> <p>An emergency triggered activation of the irrigation system would be expensive, given the system was blown out and winterized when the Marshall Fire approached our homes, but it may be a true life and property savior in the future.</p> <p>We get universal alerts when a parent runs off with a child in a custody dispute, even in Pueblo or San Luis Valley. We certainly should get an area-wide cell phone alert when a wildfire is approaching.</p> <p>Thanks, [REDACTED]</p>	Addressed in Superior mitigation actions
9	So grateful to see the work that has been done and the care that has been taken by FEMA to keep the hazardous material from blowing. We are in Coal Creek Crossing and a bit concerned about the dumps to the west and east of us because we are exposed to all the carcinogens from the burned junk whenever the wind blows. We have been diligent about keeping our house shut up tight and running air purifiers 24/7, but at some point would like to be able to open the windows. Hopefully the owners of the junk yards will get started on clean up soon.	Outside scope of HMP
10	I believe the Wildfire Hazard Map should be modified to declare the western boundary of the City of Boulder to be increased from "high risk" to "highest risk" after our experience with the destructive Marshall Fire. This grassland fire spread to dense housing developments causing an urban conflagration as thousands of homes were destroyed and damaged.	Data provided is based on scientific methodology developed by CSFS and cannot be changed.

Appendix F: Posting of Hazard Mitigation Plan on Website and Community Engagement (Public and Neighboring Jurisdictions)

Entry Id	Comments/Feedback	Response
	<p>The City of Boulder is in the path of high winds from the west nearly year around which could carry an ember storm into the city from a fire in the miles of dry forest to the west.</p> <p>Let's prevent a recurrence of the Marshall Fire by focusing attention and resources to the western boundary of the city of Boulder.</p>	
11	<p>Because of the Billion dollar, 1,000 lost homes from the Marshall Fire, the Wildland Fire risk assessment needs it own in-depth risk assessment. The section in the report is brief for such an important and likely risk. Specifically, the in-depth Wildland Fire Risk Assessment should examine Federal (USFS), State wildfire risk assessment standards, provide detailed maps (not county maps) of each municipality showing the western flanks exposed to wind/fire, analyze the wind/fire loading combination. The in-depth risk assessment for wildland fire should include wildland fire experts, officials from municipalities, and concerned citizens (such as myself). My Superior townhouse complex was just 100-feet from being engulfed in the Marshall Fire. We need to understand this risk that is obviously high and unacceptable - and then move to mitigation to reduce the risk. We learned the hard way that open space next to suburbs with winds is a recipe for disaster. We need to apply that learning to keep it from happening again. I am an engineer and a dam safety risk manager. Thanks for the opportunity to comment. [REDACTED]</p>	<p>More detailed maps are provided in the jurisdictional annexes. A more in-depth assessment could be addressed in future updates to the plan as fire behavior science and modeling evolves.</p>

Appendix G1: County HMP Project Status Reports 2016-2018

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
Mechanical Treatment of Boulder County Parks and Open Space Forests	Boulder County Parks & Open Space	High	Goal 2	Flood & Wildfire	In Progress	<p>2016- Completed 32.1 acres with in-house operations at Hall Ranch.</p> <p>Completed 199 acres via Helicopter Yarding Contract at Betasso funded by FEMA HMGP and CSFS</p> <p>2017- Completed approximately 30 acres with in-house operations at Hall Ranch and Williams Merlin.</p> <p>Completed 35 acres by contract at Heil Valley Ranch.</p> <p>2018-Completed approximately 5 acres with in-house operations at Williams Merlin.</p> <p>Started 47 acres of ecological aspen promotion treatments by contract at Reynolds Ranch.</p>
Restoration of Fire as an Ecological Process within Boulder County Parks and Open Space Forest	Boulder County Sheriff & Parks and Open Space	Medium	Goal 2	Flood, Debris Flows & Wildfire	In Progress	<p>2016- Completed 249 acres of Rx Fire at Heil Valley Ranch</p> <p>2017- Completed 185 acres of Rx Fire at Rabbit Mountain</p> <p>Completed 40 acres of Rx Fire at Hall Ranch</p> <p>2018-Completed 40 acres of Rx Fire at Rabbit Mountain Ranch.</p>
Management within the Boulder County Parks and Open Space (BCPOS) System	Boulder County Sheriff & Parks and Open Space	Medium	Goal 2	All Hazards	In Progress	2016, 2017, 2018, and 2019- See Above Mechanical and Rx Fire.
Landscape Restoration and Climate Change Adaptation	Boulder County Parks & Open Space	Medium	Goal 2	All Hazards	In Progress	2016, 2017, 2018, and 2019-See above Mechanical and Rx Fire treatments.
Research and Monitoring the Health and Resiliency of Boulder County Parks and Open Space (POS) Forest and the impact of POS Management	Boulder County Parks & Open Space	Medium	Goal 2	Flood, Debris Flows & Wildfire	In Progress	<p>2016- Inventoried over 537 acres of Forest, Approved 696 acres of prescriptions, and Inventoried 272 acres for legacy trees.</p> <p>2017- Inventoried 460 acres of Forest, wrote prescriptions for 663 acres, approved management on 354 acres, and marked 61 acres for treatment.</p> <p>2018-Inventoried 590 acres of forest, mapped 92 acres of legacy trees and 30 acres of slash piles.</p>
Boulder County Community Forestry Sort Yards	Boulder County Parks & Open Space	Medium	Goal 2,3	Wildfire	In Progress	2016- 1373.6 total tons diverted from landfill with over 6509 loads. 1180 individual users dropped off biomass for forest health and fire mitigation on private property

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
						<p>2017- 1192 total tons diverted from the landfill with 6945 loads. Over 1250 individual users dropped off biomass for forest health and fire mitigation on private property</p> <p>2018- 1505 total tons diverted from the landfill with 6878 loads.</p>
Boulder County Youth Corps Forestry and Fire Projects	Boulder County Parks & Open Space	Medium	Goal 2	Wildfire	In Progress	<p>2016 and 2017-We had two Youth Corps teams each year work successfully piling slash (600+ total piles over two years) created from forestry operations.</p> <p>2018- We had one Youth Corps Team piling over 200 piles of slash at Walker Ranch.</p>
Boulder County Wildfire Mitigation Requirements for New Homes and Remodels	Boulder County Land-Use	Medium	Goal 1,2,4	Wildfire	In Progress	<p>2018: Boulder County has been implementing wildfire mitigation requirements since 1993. 2018 was another busy year with more than 100 building permits issued with wildfire mitigation requirements.</p> <p>2018 was the fifth year of Wildfire Partners. This public-private partnership continues to serve as a national model for effective mitigation. In 2018, more than 1,800 homeowners and multiple home retrofit contractors continued to harden and retrofit structures as part of our certification process. More than 800 homes have received their Wildfire Partners Certificate.</p>
Boulder County Wildfire Partners and Defensible Space	Boulder County Land-Use	High changed from medium	Goal 1,2,4	Wildfire	In Progress	<p>2018: Purchase of the grinder supports the Community Forestry Sort Yards as well as Wildfire Partners. For more 2018 was the fifth year of Wildfire Partners. This public-private partnership continues to serve as a national model for effective mitigation. We performed at least 330 individual home assessments in 2018 (in addition to our work with new homeowners and building permit applicants who select the regulatory path). We also continued to work with the 1,450 participants who joined the program from 2014-2017. In 2018, our forestry contractors have completed projects totaling more than \$524,000.</p>
Boulder County Wildfire Partners and Grinder	Boulder County Land-Use	Medium	Goal 1,2,4	Wildfire	On-going	<p>2018: Purchased the grinder that supports the Community Forestry Sort Yards as well as Wildfire Partners.</p>
Boulder County Forest Health Education and Outreach Program	Boulder County Land-Use	Medium	Goal 1,4	Wildfire	In Progress	<p>2018: Enewsletters were sent on a variety of topics to participants in this program.</p>
May Wildfire Awareness Month	Boulder County Land-Use	Medium	Goal 1,4	Wildfire	On-going	<p>2018: Wildfire Awareness Month was moved to May and featured a variety of mitigation contests to engage residents who</p>

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
						were new to mitigation and who have been performing mitigation for years.
Boulder County Community Chipping Program	Boulder County Land-Use	High	Goal 1,4	Wildfire	In Progress	2018: Boulder County provided funded 12 community chipping projects. At the time of this update, communities are still in the process of reporting their results so data on the number of participants and the total chipping costs is not available.
Saws and Slaws	Boulder County Land-Use	High	Goal 1,4	Wildfire	On-going	2018-2019: Boulder County provided funding for Saws and Slaws projects.
Firewise Communities	Boulder County Land-Use	Medium	Goal 1,2,3,4	Wildfire	Progress On-going	2018-2019: Boulder County supported Firewise communities with funding through its Wildfire Partners and community chipping programs.
Property Acquisition	Boulder County Land Use / Transportation	High	Goal 1,2	Flood	In Progress	<u>2018</u> -- Finished HUD funded planning effort for long term flood hazard mitigation program (including acquisition, elevation, and relocation of structures) and property conversion to open space.
Elevation of Flood-prone structures	Boulder County Land Use / Transportation	Medium	Goal 1,2	Flood	In Progress	<u>2017</u> -- Five residential structures funded through HMGP for elevation not able to show cost reasonableness. Projects closed, and homes not elevated. <u>2018</u> -- Finished HUD funded planning effort for long term flood hazard mitigation program (including acquisition, elevation, and relocation of structures) and property conversion to open space..
Incorporate identified resiliency actions including projects, policies, and programs into Transportation plans, codes, and standards.	Boulder County Transportation	High	Goals 1,2,3,4	All Hazards	In Progress	<u>2018</u> -- initiated HUD funded Floodplain Program and Transportation Resiliency Study (F&TRS) and county funded Transportation Master Plan (TMP) update with integrated resiliency component
Acquisition of properties damaged in the September 2013 Rain and flood event through CDBG-DR and other available relevant programs	County, Jamestown, Lyons	Medium	Goal 1,2	Debris Flows	Complete	Completed acquisition and demolition/reclamation of 47 Rain and flood event damaged properties split between HUD CDBG-DR and FEMA Hazard Mitigation Grant Program funding sources
Replace and/ or upsize structures to improve resilience <ul style="list-style-type: none"> 55th at Boulder/Whiterock Ditch 	Boulder County Transportation	High	Goal 2	Flood	In Progress	2018 -- completing design

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
<ul style="list-style-type: none"> N 61st at Fourmile Canyon Creek Overland Rd at South St. Vrain Creek 						
Replace minor structure at Baseline Rd over Dry Creek #3	Boulder County Transportation	High	Goal 2	Flood	In Progress	<p>Minor structure replacement - prioritized "Urgent" in 2017-2018 structure inspection report. Design to integrate improved conveyance, with underpass and permanent BMPs, ecological integration improvements. transportation looking at crossing alternatives.</p> <p>2018 – Included in Mile High Flood District (MHFD) funding request for 2020 design and construction funding</p>
Replace Bridges on N. 61 st St. and N 75 th St over Boulder Creek	Boulder County Transportation	Low	Goal 2	Flood	In Progress	
Improve flood conveyance of Boulder Creek under N. 95th St.	Boulder County Transportation	Medium	Goal 2	Flood	In Progress	<p>Additional structure north of existing crossing location will improve resiliency of both the road and the creek itself.</p> <p>2018 –Included in MHFD funding request for 2022 design funding</p>
Replace Bridge on East County Line Road over Boulder Creek	Boulder County Transportation	Medium	Goal 2	Flood	In Progress	<p>Boulder County Transportation is looking at improving flood resiliency on two creek crossings on East County Line Road: Dry Creek #2 and Boulder Creek. Replacement of one or both of these structures is dependent on the availability of road and bridge funding. Boulder Creek bridges undersized but otherwise in good condition. No immediate plans to replace but design should include resiliency measures and ability to match conveyance of CDOT structure directly upstream. The ECLR structure is undersized for flood events on Dry Creek #2. The creek departs the channel west of the roadway and overtops to the north. Transportation is looking at ways to accommodate these flows for future flood events. No progress to date.</p>
Sugarloaf Rd improvements for 2,000 ft. above intersection with SH 119 to lessen potential for landslide related road closure	Boulder County Transportation	High	Goal 2	Landslide	In Progress	
Update Floodplain maps, regulations and education/ outreach	Boulder County Transportation	High	Goal 1,2,3,4	Flood	In Progress	<p>Local map adoption of 150 miles of revised mapping in 2017. Additional 70 miles of draft mapping currently being reviewed.</p>

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
						Local code text update in 2016 and 2017. Conducting extensive outreach for text and map updates 2018 – Designed improvements <u>2017</u> -- Local map adoption of 150 miles of revised mapping and code text update. Extensive outreach conducted. 2018 -- Local map adoption of 70 miles of revised mapping. Extensive outreach conducted.
Floodplain program evaluation and improvement	Boulder County Transportation	High	Goal 1,2,3,4	Flood	In Progress	<u>2017</u> -- Local map adoption of 150 miles of revised mapping and code text update. Extensive outreach conducted. <u>2018</u> -- Local map adoption of 70 miles of revised mapping. Extensive outreach conducted.
Public Warning Plan Annex for EOP	Boulder OEM	High	Goal 1,4	All Hazards	Completed	2018: The Public Warning annex was included in the 2017 Emergency Operations Plan Update in November.
Continue involvement in Climate Adaptation Planning Process	Boulder OEM / BOCC	Medium	Goal 1,4	All-Hazards	In Progress	No work completed in 2018 but discussions did create an initiative to integrate climate change into the Hazard Mitigation Plan Update scheduled for February 2019.
Community Hazards Education and Preparedness Plan	Boulder OEM	Medium	Goal 1,3,4	All Hazards	In Progress	2018: Performed 7 Better Together Community Programs. Conducted Boulder Preparedness Fair in Longmont.
Landslide Early Warning Capability	Boulder OEM	High	Goal 1	Debris Flows	In Progress	2018: Working on developing test sites for potential technology solutions.
Flood Control District in non-UDFCD covered areas	Boulder County / BOEM	High	Goal 1,2,4	Flood	No Longer Relevant	In 2017 this determined to be unfeasible at this time.
Integration of Land Use and Mitigation Plans	Boulder OEM and Boulder County Land Use	Medium	Goal 1,2,3,4	Flood, Wildfire, Landslides	In Progress	No action taken to date.
Install Generators at Critical County Facilities	Boulder County Admin Services	High	Goal 2	All Hazards	Completed	Facilities installed 4 generators using HMPG funding at the following critical facility locations. 1. Longhorn Road District 2. Nederland Road District 3. Fairgrounds Exhibit Building 4. Fairgrounds Clover Building
Strategic Continuity, Response, and Recovery Plan	Boulder County Departments and Offices	High	Goal 1,2,3,4	All Hazards	Completed	Emergency Operations Plan is revised, and the Recovery Plan is completed. Now department level plans are being worked on. Continuity of Operations Plans are completed and also being refreshed and updated.

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
BOCO Strong Regional Resiliency Plan	BOCO Strong	Medium	Goal 1,2,3,4	All Hazards	Completed.	Resiliency strategies and plans were completed in 2017.

Appendix G2: City of Boulder HMP Project Status Report 2019

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
Enhance critical facility data	Risk Management	Low	Goal 2, 3	All Hazards	No Action Taken to Date Or In Progress Or Completed	2019 update- working with PW GIS to finalize critical infrastructure list. Expected completion Q1 2020
Emergency back-up power	Facilities and Asset Management	High	Goal 2	All Hazards	Completed	Emergency Generator transfer switch installed at East Boulder Recreation Center. This allows for a generator power source to be used to supply the facility during power outages.
Hazard education	Boulder OEM, Fire, Police, CRS	Medium	Goal 1,2,3	All Hazards	In progress	2019 Update- The Disaster Preparedness Guide is now available in Spanish and is distributed during community preparedness programs.
Increase outdoor and individual warning systems capacity available	Boulder Planning	High	Goal 1	All Hazards	In progress	2019 Update- In 2019 Boulder OEM achieved FEMA- Integrated Public Alert Warning System (IPAWS) access. This capability permits Boulder OEM and Police and Fire Dispatch to launch public warnings using NOAA Weather Radio, Emergency Alert System (EAS) and Wireless Emergency Alerts (WEA). The system will be live in late 2019 or early 2020 upon final approval by FEMA once OEM completes the functional test of the system. In 2019 Boulder OEM increased capacity to provide public messaging, alerting and warning with non-English speaking residents. Translation services are now available to the EOC call center, evacuation door hangers created and distributed to the Police Department.
Outreach efforts associated with BoCo911alert.com	Boulder OEM	High	Goal 1	All Hazards	In progress	2019 Update-Boulder OEM continues to promote community sign-up in the telephone emergency alert system on the BoulderOEM.com website and during public education campaigns.
Develop updated city continuity of operations and facility emergency evacuation plans	CMO / Department Heads	High	Goal 1,2,3	All Hazards	In progress	2019 Update- Boulder OEM has engaged all city departments to develop or update facility emergency plans (FEP) and department continuity of operations plans (COOP). Completion of both plans will occur in 2020.
Prepare pre-disaster FEMA forms	Boulder OEM	Low	Goal 1,2,3	All Hazards	No action taken to date	2019 Update- Boulder OEM is researching in 2020 which forms would be helpful to pre-populate to make Public Assistance funds easier to access following a disaster.
Increase Public Awareness of Flood Risk and Safety Measures	Boulder OEM / Public Works	High	Goal 1,2,3	Flood	In progress	2019 Update- Boulder OEM is working with city departments to deliver "Better Together Programs" each year. In 2019 the

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
						program was delivered in October and will continue each year with additional deliveries as budget and schedules permit.
Enhance outdoor warning systems	Boulder OEM	Low	Goal 1,2,3	All Hazards	No action Recommend at this time but should be evaluated every 2 years based on development	2019 Update-The outdoor warning system is tested weekly using the silent testing program developed in 2017. The system is physically tested during the annual Outdoor Warning System test from April to August. The current capability covers high density outdoor areas such as CU, along Boulder Creek, the Soccer Park and Western edge of the City.
Maintain urban tree canopy	City Parks and Recreation, Forestry Division	High	Goal 1,2	All Hazards	In progress	<p>2019 Update- The Urban Forest Strategic Plan (UFSP) was approved by the Park and Recreation Advisory Board on June 4, 2018. The UFSP established an overarching goal to maintain 16% urban tree canopy (UTC) within Boulder. Four themes and detailed goals and objectives of sustainable urban forestry were developed to guide the future management of the urban forest. These included 1) <i>Plan</i> – to increase the resilience and sustainability of the urban forest; 2) <i>Manage</i> – to further refine Boulder Forestry operations and increase funding to match community expectations; 3) <i>Protect</i> – review and update municipal code, policies, and design and construction standards that support tree protection, planting and longevity; and 4) <i>Engage</i> - connect and educate the community with the most current information on the urban forest to mobilize activists and facilitate policy implementation.</p> <p>A tree planting prioritization project using updated LiDAR data is planned for 2020 to determine the change in UTC since 2013 and prioritize tree planting based upon urban heat island areas, stormwater runoff and other variables. Since the 2013 emerald ash borer detection, Boulder Forestry has planted an average of 486 trees on public property annually of 37 different species to improve tree diversity. The Forestry team partnered with the National Arbor Day Foundation and its corporate sponsors to giveaway a total of 785 1-gallon tree seedlings to Boulder residents in annual giveaways since 2016. Sponsorship from Boulder County and Climate Initiatives helped support an annual Tree Sale of a total of 340</p>

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
						<p>15-gallon trees to residents in 2018 and 2019. In this same time period, 5564 public trees have been removed however, due to insect and disease pests, weather related events and safety related concerns and many more on private property and through both city and private construction projects.</p> <p>In the development of the UFSP, stakeholders expressed a desire for a community-based urban forest advocacy group to promote, protect, and enhance the urban forest. In 2018, the Boulder Tree Trust was launched under the PLAY Boulder Foundation. Two groups of 'Tree Tender' volunteers were trained in 2019 with more sessions planned in 2020.</p>
Implement flood mitigation plans	City of Boulder Public Works Utilities Division	High	Goal2	Flood	In Progress	2019 Update- The preliminary design of flood mitigation improvements are underway for South Boulder Creek and Gregory Canyon Creek
Relocate fire station outside 100-year flood risk	FAM / Fire and Rescue	Medium	Goal2	Flood	In progress	Land has been acquired and fire station architectural design is the next step.
Prioritize flood hazards	City of Boulder Public Works	High	Goal2	Flood	No action taken to date	2019 Update- The prioritization work is planned to follow the Comprehensive Flood and Stormwater Master Plan update
Update the Comprehensive Flood and Stormwater Master Plan	City of Boulder Public Works	High	Goal2	Flood	In Progress	2019 Update- A staff team is assembled and developing a request for proposal (RFP) to hire a consulting team to assist with this work
Develop flood mitigation plans following mapping updates	City of Boulder Public Works Utilities Division	High	Goal2	Flood	In Progress	2019 Update- Flood mitigation plans are currently under development for Upper Goose Creek, Two-mile Canyon Creek, Skunk Creek, Bluebell Canyon Creek and King's Gulch
Acquire High Hazard Zone Properties	City of Boulder Public Works	Medium	Goal1,2	Flood	In Progress	2019 Update- High hazard zone properties are considered for purchase when they become available. 712 Pleasant was purchased in 2019
Update City's floodplain maps	City of Boulder Public Works	Medium	Goal1,2	Flood	In Progress	2019 Update- A floodplain mapping study for Sunshine Canyon Creek is currently being initiated.
Implement a community assisted floodproofing focusing on critical facilities	City of Boulder Public Works	Low	Goal 2,3	Flood	No Action Taken To date	2019 Update- City development services staff continue to promote flood hazard awareness for critical facilities through ordinance requirements for emergency management plans. There is currently little to no budget allocated for community assisted floodproofing programs.

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
Implement a community assisted floodproofing focusing on critical facilities	City of Boulder Public Works	Low	Goal 2,3	Flood	No Action Taken to Date	2019 Update- City development services staff continue to promote flood hazard awareness for critical facilities through ordinance requirements for emergency management plans. There is currently little to no budget allocated for community assisted floodproofing programs.
Implement Wildland Fire Mitigation Program for Watersheds	City of Boulder Utilities Division	Medium to High	Goal 1,2,3	Wildfire	Completed	2019 Update- The Wildfire Erosion and Sediment Transport Tool was completed in May 2019. The Tool predicts post-fire erosion and sediment transport to the water supply and recommends a rehabilitation plan depending on the fire location, extent, and severity. Staff continue to work with local, state, and federal partners on wildfire planning efforts.
Wildfire Management Plan	OSMP / Fire	Medium	Goal 1,2,3	Wildfire	In Progress	2019 Update- D. Burke/ Fire Department Some initial tasking has been done but not much progress from the fire side. (Oliver)
Update Community Wildfire Protection Plan	OSMP / Fire	Medium	Goal 1,2,3	Wildfire	In Progress	Currently drafting an update to the original CWPP. Should have a draft by end of Q4 2019.- (B. Oliver)
Implement Community Wildfire Protection Plan	OSMP / Fire	High	Goal 2	Wildfire	In progress	Most outlined projects from original CWPP have been completed. Looking for the update to determine next actions. (B. Oliver)
Implement forest ecosystem management plan	OSMP	High	Goal 2	Wildfire	In progress	2019 Update- Chris Wanner City OSMP continues to implement portions of the Forest Ecosystem Management Plan on an annual basis. In 2019, city staff thinned 160 acres of forest in high risk areas including adjacent to Shanahan Ridge and Eldorado Springs. To date, a total of approximately 1800 acres have been thinned as part of forest health and fire mitigation projects on city OSMP lands. Prescriptive thinning and burning will continue in 2020 with collaborative projects planned with CSFS, City Fire, and Boulder Mountain Fire.
Review City landscape codes for drought	Development Review	Medium	Goal 2	Drought	No action to date	Review is scheduled to begin in 2020
Update City's Drought Plan and identify and implement priority projects identified in the Drought Plan	Public Works	High	Goal 1,2,3	Drought	In Progress	2019 Update- Drought plan revisions have been initiated by assessing drought triggers and water use reductions through updated water supply modeling that also includes climate change assessments. Drought plan assessments and revisions will continue into 2020.

Appendix G3: County HMP Project Status Report for 2019-2021

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
Mechanical Treatment of Boulder County Parks and Open Space Forests	Boulder County Parks & Open Space	High	Goal 2	Flood & Wildfire	In Progress	<p>2019-Completed 4 acres with in-house operations at Williams Merlin. Completed 14 acres with SO crew at Hall Ranch. Contractor completed final 19 acres of the 47-acre project at Reynold Ranch</p> <p>2020- Completed 2.1 acres with in-house operations at Williams Merlin. Completed 1.8 acres with in-house operations at Reynolds Ranch. Contractor completed 162 acres at Heil utilizing aerial tree yarding (helicopter).</p> <p>2021-Completed 1.5 acres with in-house operations at Reynolds Ranch. SO crew completed 3 acres of fuels reduction at Mud Lake.</p>
Restoration of Fire as an Ecological Process within Boulder County Parks and Open Space Forest	Boulder County Sheriff & Parks & Open Space	Medium from High	Goal 2	Flood, Debris Flows & Wildfire	In Progress	<p>2019-Completed 35 acres of Rx fire at Dowe Flats, 10 acres at Rabbit Mountain, and a 5 acres at Heil Valley Ranch</p> <p>2020-No Rx fire activities occurred</p> <p>2021-Completed 27 acres of Rx fire along the Nelson Loop at Hall Ranch</p>
Fire Management within the Boulder County Parks and Open Space (BCPOS) System	Boulder County Sheriff & Parks & Open Space	Medium	Goal 2	All Hazards	In Progress	2019- 2021- See Above Mechanical and Rx Fire.
Landscape Restoration and Climate Change Adaptation	Boulder County Parks & Open Space	Medium	Goal 2	All Hazards	In Progress	2019-2021- See Above Mechanical and Rx Fire.
Research and Monitoring the Health and Resiliency of Boulder County Parks and Open Space (POS) Forest and the impact of POS Management	Boulder County Parks & Open Space	Medium	Goal 2	Flood, Debris Flows & Wildfire	In Progress	<p>2019-Inventoried 154 acres of forest at Caribou/Sherwood, surveyed 126 acres at Caribou/Sherwood and Hall Ranch to identify legacy trees, completed unit preparation work on 176 total acres for the Lichen Loop Project at Heil Valley Ranch (162 ac) and for the work at Hall Ranch (14 ac).</p> <p>2020-Completed post treatment inventory on 1,004 acres at Hall and Heil Ranch.</p> <p>2021-Completed a forest inventory of 82 data plots, spanning approximately 1,556 acres. One hundred acres of Caribou/Sherwood project were marked, mapped and ready to move forward for harvesting.</p>

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
Boulder County Community Forestry Sort Yards	Boulder County Parks & Open Space	Medium	Goal 2,3	Wildfire	In Progress	<p>2019-1,543 total tons of biomass diverted from the landfill with 6,176 loads. 1,474 different users dropped off material at the sort yards</p> <p>2020-1,612 total tons of biomass diverted from the landfill with 9,563 loads. 1,875 different users dropped off material at the yards</p> <p>2021-1,960 total tons of biomass diverted from the landfill with 8,439 loads. 1,972 different users dropped off material at the yards</p>
Boulder County Youth Corps Forestry and Fire Projects	Boulder County Parks & Open Space	Medium	Goal 2	Wildfire	In Progress	<p>2019-One Youth Corps team worked at Reynolds Ranch and built 42 slash piles, rehabilitated 1.5 miles of skid trails, assisted with Schoolhouse spring ex-closure</p> <p>2020-Covid 19 cancelled the youth corps season so no forestry crews were utilized</p> <p>2021-One modified Youth Corps team helped build slash piles and stack wood on three acres at Mud Lake.</p>
Boulder County Wildfire Mitigation Requirements for New Homes and Remodels	Boulder County Community Planning & Permitting	Medium	Goal 1,2,4	Wildfire	In Progress	<p>Boulder County has been implementing wildfire mitigation requirements since 1993. Homeowners who apply for building permits (new construction, additions and decks) performed wildfire mitigation according to our land use and building codes and Wildfire Partners program.</p> <p>2019- Boulder County has been implementing wildfire mitigation requirements since 1993. In the first 10 months of 2019, 95 homeowners (new construction, additions and decks) performed wildfire mitigation according to our land use and building codes.</p> <p>2020-, participants in Wildfire Partners continued to harden and retrofit structures as part of our certification process. More than 1,000 homes have received their Wildfire Partners Certificate.</p> <p>2021 - participants in Wildfire Partners continued to harden and retrofit structures as part of our certification process. We have issued more than 1,200 Wildfire Partners Certificates.</p>

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
						2022- In 2022, there are new code requirements for residents of eastern Boulder County.
Boulder County Wildfire Partners and Defensible Space	Boulder County Community Planning & Permitting	High changed from medium	Goal 1,2,4	Wildfire	In Progress	<p>2019 was the sixth year of Wildfire Partners. This public-private partnership continues to serve as a national model for effective mitigation. In the first 10 months of 2019, we performed 240 assessments (197 for new participants) as well as numerous inspections. This year we celebrated the completion of our 2,000-initial assessment.</p> <p>2022-2022 is the ninth year of Wildfire Partners. This public-private partnership continues to serve as a national model for effective mitigation. In 2021, we performed 374 new assessments, certified 115 homes, and performed numerous other site visits (re-assessments, re-certification, and inspections). We have issued over 1,200 Wildfire Partners Certificates.</p>
Boulder County Wildfire Partners and Grinder	Boulder County Community Planning & Permitting	Medium	Goal 1,2,4	Wildfire	In Progress	<p>2019-Three community grinding events (Lyons, Lake of The Pines, Wild Tiger fuels reduction), processing 53 tons of biomass material</p> <p>2020-No community grinding events were held</p> <p>2021-Five community grinding events were held, processing over 100 tons of material</p>
Boulder County Forest Health Education and Outreach Program	Boulder County Community Planning & Permitting	Medium	Goal 1,4	Wildfire	In Progress	<p>2019: Wildfire Partners worked with 27 landowners to plan for future forest health and wildfire mitigation projects</p> <p>2022- Wildfire Partners worked with 22 landowners to expand their defensible space projects into defensible space zone 3.</p>
May Wildfire Awareness Month	Boulder County Community Planning & Permitting	Medium from high	Goal 1,4	Wildfire	In Progress	Because of COVID, no community events were conducted during Wildfire Awareness Month. Homeowners were encouraged to work on their individual properties instead.
Boulder County Community Chipping Program	Boulder County Community Planning & Permitting	High	Goal 1,4	Wildfire	In Progress	2019: Boulder County provided funded 7 community chipping projects. At the time of this update, communities are still in the process of reporting their results so data on the number of participants and the total chipping costs is not available.

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
						2020-Boulder County launched a new Wildfire Partners Chipping Program in 2020. It provided free chipping to Wildfire Partners throughout the entire program area. The program served 377 properties. We hauled away 125 truckloads of chips.
Saws and Slaws	Boulder County Community Planning & Permitting	High	Goal 1,4	Wildfire	Completed	. Boulder County did not fund Saws and Slaws in 2021
Firewise Communities	Boulder County Community Planning & Permitting	Medium	Goal 1,2,3,4	Wildfire	Completed	Boulder County did not provide direct support to Firewise Communities in 2021
Acquisition of Flood-prone Properties	Boulder County Community Planning & Permitting	Medium from High	Goal 1,2	Flood	In Progress	<u>2019</u> – Began implementing 2017 FEMA Flood Mitigation Assistance (FMA) Advanced Assistance grant to collect data necessary to apply for FEMA FMA property acquisition grants. <u>2020</u> – Continued FMA Advance Assistance Grant work to prepare for future opportunities for property acquisition. Focus has been on the development of benefit cost analysis methodology and an FMA application package specific to Boulder County residents/properties for future use.
Elevation of Flood-prone structures	Boulder County Community Planning and Permitting	Medium from high	Goal 1,2	Flood	In Progress	<u>2019</u> – Began 2017 FEMA Flood Mitigation Assistance (FMA) Advance Assistance grant to collect data necessary to apply for FEMA FMA elevation grants. <u>2020</u> – Continued FMA Advance Assistance Grant work to prepare for future opportunities for property elevation. Focus has been on the development of benefit cost analysis methodology and an FMA application package specific to Boulder County properties for future use.
Incorporate identified resiliency actions including projects, policies, and programs into Transportation plans, codes, and standards.	Boulder County Public Works and Community Planning and Permitting	High	Goals 1,2,3,4	All Hazards	In Progress	2019 action – complete F&TRS and TMP 2020 action- Begin implementation of highest priority recommended actions of the F&TRS and the TMP. Continued implementation of recommended actions from F&TRS and TMP. Implementation of PDM AA- Resilient Design grant, which includes conceptual designs of 2-3 infrastructure projects identified in the F&TRS.

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
Replace and/ or upsize structures to improve resilience <ul style="list-style-type: none"> • 55th at Boulder/Whiterock Ditch • N 61st at Fourmile Canyon Creek • Overland Rd at South St. Vrain Creek 	Boulder County Public Works	High	Goal 2	Flood	In Progress	2019, 2021 action – permitting Overland Road at South St. Vrain Creek- Surveys and Alternative Assessment Memo completed in 2019; transportation looking at crossing alternatives. Design anticipated to start in 2020 and construction to follow contingent on timelines for right-of-way and permitting. 2022 - perform work: •55th St at Boulder and White Rock Ditch structure replacement completed July 2019; •N 61st St at Fourmile Canyon Creek – Design completed in 2019;
Replace minor structure at Baseline Rd over Dry Creek #3	Boulder County Public Works	High	Goal 2	Flood	In Progress	2019 – Updated request for funding to MHFD; entered into shared funding agreement with MHFD; Completed structure selection report; begin design in November; 2020 – Design anticipated to start in 2020 and construction to follow contingent on timelines for right-of-way and permitting.;
Replace Bridges on N. 61 st St. and N 75 th St over Boulder Creek	Boulder County Public Works	Low	Goal 2	Flood	In Progress	2019 – Included N 75th St Bridge in MHFD's 5-Year CIP funding with design funds in 2022 and construction funds in 2023. The N 61st St Bridge was deprioritized.
Improve flood conveyance of Boulder Creek under N. 95th St.	Boulder County Public Works	Medium	Goal 2	Flood	In Progress	2019 – Included in MHFD's 5-Year CIP funding request for design funds in 2020 and construction funding in 2022 2023-2026 – Design and construction
Replace Bridge on East County Line Road over Boulder Creek	Boulder County Public Works	Medium	Goal 2	Flood	In Progress	Identified in Boulder Creek Drainage Master Plan (MHFD - 2015) as flood risk. Bridge is undersized but otherwise in good condition. No immediate plans to replace but design should include resiliency measures and ability to match conveyance of CDOT structure directly upstream.
Sugarloaf Rd improvements for 2,000 ft. above intersection with SH 119 to lessen potential for landslide related road closure	Boulder County Public Works	High	Goal 2	Landslide	In Progress	2019 – Applying for funding to perform project 2021/2022 - Construction

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
Floodplain Management Program updates and Flood Education/Outreach (Action formally titled: "Update Floodplain maps, regulations and education/ outreach")	Boulder County Community Planning and Permitting	Medium	Goal 1,2,3,4	Flood	In Progress	2019 action – complete F&TRS and TMP, begin implementation of recommended actions2020- Complete FEMA pre-award requirements; finalize design; complete procurement process. 2022- the floodplain program is working on new code revisions and improvements to outreach/public communication strategies as recommended by the F&TRS.
Flood Hazard Studies and Flood Hazard Mapping. (Action formally titled: "Floodplain program evaluation and improvement")	Boulder County Community Planning and Permitting	Medium	Goal 1,2,3,4	Flood	In Progress	2017 -- Local map adoption of 150 miles of revised mapping and code text update. Extensive outreach conducted. 2018 -- Local map adoption of 70 miles of revised mapping. Extensive outreach conducted. 2019 action – Continued County wide FEMA map revision process, continued outreach and education around mapping, regulations, and resiliency. Continued county wide FEMA map revision process, continued outreach and education around mapping, regulations, and resiliency. 2022- The county is working with FEMA to complete FEMA's adoption of 220 miles of re-mapped floodplain. The county is also actively integrating new Fluvial Hazard Zone data from the Colorado Water Conservation Board into its review of proposed development, flood hazard outreach/education, and mitigation project planning.
Public Warning Plan Annex for EOP	Boulder OEM	High	Goal 1,4	All Hazards	Completed	2019-2020: Public Alert and Warning Plan is in version 1 draft form and shall be adopted by April 2020. The plan was created because BOEM received authorization to become an Integrated Public Alert and Warning System site in 2019. This allows the EOC to launch wireless emergency alerts, NOAA radio and Emergency Alert System alerts and warnings.
Continue involvement in Climate Adaptation Planning Process	Boulder OEM / BOCC	Medium	Goal 1,4	All-Hazards	In Progress	2019-2020: Continuing to integrate climate into the 2021 plan update. Workshops have been held in November and December 2019 to scope the content and how to integrate this issue in the HMP.
Community Hazards Education and Preparedness Plan	Boulder OEM	Medium	Goal 1,3,4	All Hazards	In Progress	2019- Completed 3 Better together programs. Distributed door warning hangers for flood and fire for use in non-English speaking environments.

Mitigation Action Title	Responsible Office	Priority	Goals	Hazards	Status	Update
						<p>Performed 7 Better Together Community Programs. Conducted Boulder Preparedness Fair in Longmont.</p> <p>COVID 19 Response caused all preparedness programs to be suspended until later in 2021.</p>
Debris Flow/Landslide Early Detection and Warning System <i>(Renamed. Formally Landslide early Warning Capability)</i>	Boulder OEM	High	Goals 1-5	Landslide, Debris Flows	In Progress	<p>2019: Developed thresholds for public alert and warning for landslides. Incorporated the threshold levels into the Severe Weather Plan.</p> <p>Working on developing test sites for potential technology solutions.</p> <p>Four mile Watershed Coalition, USGS, CSGS, BOEM and BOCO have identified locations in the Calwood burn scar for early detection test sites to be deployed in 2021. The work done in 2020 cleared the way for the system to be matured to the level of a test environment today.</p>
Integration of Land Use and Mitigation Plans	Boulder OEM and Boulder County Land Use	Medium from high	Goal 1,2,3,4	Flood, Wildfire, Landslides	In Progress/ Ongoing	<p>Update to the Geology Element of the Comprehensive Plan was adopted by Planning Commission in 2018 which identifies hazards and constraints and establishes policies to mitigate hazards.</p> <p>2019-2020: Natural Hazards information integrated into the County's 2020 update.</p>
Implementation of Watershed Master Plan Projects	Parks and Open Space, Transportation, Community Planning and Permitting	High	Goal 1,2,3,4	Flood	In progress/ Ongoing	<p>Watershed Master Plans (St. Vrain Creek, Left Hand Creek, Fourmile Creek, Little Thompson Creek, Fourmile Canyon Creek, Boulder Creek, and Coal Creek have been developed related to 2013 post flood event. The development of watershed master plans continues to be a priority for the County and will continued to be developed over time.</p>

Appendix H: Adoption Resolutions