AUGUTST 2019
VERSION 4

2019

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Community Risk Assessment Standard of Cover

Boulder Fire-Rescue

Commission on Fire Accreditation International

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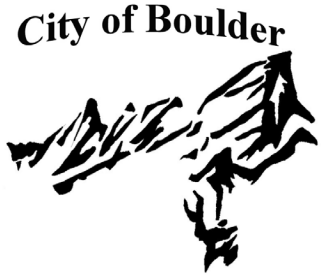

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The Boulder Fire-Rescue (BFR) Community Risk Assessment / Standard of Cover shall be updated on an annual basis to ensure it remains a living document. The CRA/SOC serves as one of the planning documents for the department.

Introduction

This document serves as the Boulder Fire-Rescue (BFR) Community Risk Assessment / Standard of Cover (CRA/SOC) Document.

The CRA/SOC serves as the primary deployment planning and resources allocation tool for BFR. The purpose of the document is to balance the assessed risks faced by the community and mitigate those through Community Risk Reduction approaches that include planning, response, education, and prevention. Contained within the CRA/SOC is information about station and apparatus locations, response trends, the specific risks faced by the citizens of the City of Boulder, and outlines BFR's level of service for response-based programs. The CRS/SOC describes the roles and responsibilities of each program area and highlights deployment strategies and operational elements required to maintain the stated level of service. Also, the document contains data elements and recommendations to enhance the Department's performance. The primary goals of the Department are to improve service delivery and increase safety for the citizens of The City of Boulder.

The CRA/SOC and its recommendations inform the Fire-Rescue Master Plan, through the analysis of gaps within the document. The Master Plan is a process which most departments in the City of Boulder use to guide the provision of services and construction of supporting facilities. Master plans establish; detailed policies; priorities; service standards; and facility and system needs. The master plan is intended to guide BFR for the next ten years to meet the community's service standards and sustainability goals.

The Master Plan and the CRA/SOC are also in support of the Boulder Valley Comprehensive Plan (BVCP) which is a joint planning effort between the City and Boulder County. Among the objectives included in the BVCP is the aim of informing decisions about how services such as police, fire, water utilities, and others are provided to the City. The BVCP is used to guide long-range planning, the review of development proposals and other activities that shape the built and natural environments in the Boulder Valley. The plan helps the community create and preserve a sustainable future for the Boulder Valley and a high quality of life. The plan provides a general statement of the community's desires for future development and preservation of the Boulder Valley, and the city and county use it to guide long-range planning, the review of development proposals and other activities that shape the built and natural environments in the Boulder Valley.

One of the challenges within the fire service is keeping pace with an increasing demand for its services. The CRA/SOC provides department management with a process to constantly measure and evaluate the level and quality of service delivered to the community. It also provides quantitative data to justify financial requests made to the City Council. The CRA/SOC ultimately assists the Department in ensuring a safe and effective response force for structural and wildland fire suppression, emergency medical incidents, hazardous materials, and specialty response situations.

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Section I: Jurisdiction Profile

History of The City of Boulder

During the 19th century, explorers Zebulon Pike, Stephan Long, and John Fremont were commissioned to explore the Boulder area. What was once unfit for settlement soon became a location of interest when William Gilpin, who later became the first governor of the Colorado Territory, reported findings of gold (About Boulder, 2015). The first settlement in Boulder County occurred at Red Rocks, now known as Settler's Park, by gold-seekers on October 17, 1858. One of the settlers, A.A. Brookfield, organized the Boulder City Town Company on February 10, 1859. From there, Boulder became a city. Sixty shareholders divided the 1,280 acres along Boulder Creek into 18 lots for each party. The remaining lots were put up for sale for $1000 each. Due to the high price of the lots, Boulder's growth rate remained low at only 324 by 1860. At that time, Boulder City was part of the Nebraska Territory; Boulder did not become the county seat until February of 1861. Then, in 1867, a Federal Bill established the Territory of Colorado.

While mining played an important role in bringing people to Boulder, the development of a strong agricultural industry encouraged people to stay. The town of Boulder became incorporated on November 3, 1871. Residential areas appeared in the Downtown, Mapleton Hill and Whittier Districts. Then, when commercial activities expanded in the downtown core, houses began to disappear from the Downtown District.

Education has remained prominent for Boulder's identity, along with mining and agriculture. Boulder is the home of the first schoolhouse in Colorado, located on the corner of Walnut and 15th Street. Citizens successfully lobbied the state legislature in the 1860s to have the state university located in Boulder; however, the actual site was not made available until 1872 when six Boulder citizens donated 44.9 acres for the project. In 1874 the state appropriated $15,000 to build the first building in the city. Community donations were gathered to match the project funds to complete the building. The building, "Old Main," is located on the southern end of town, in an area known as "The Hill," and still stands today. In 1877, the University of Colorado opened to a total of forty-four students, one professor, and a President.

The first private school in Boulder, Mount St. Gertrude Academy, was opened in 1892. The City of Boulder, by then accessible to visitors by railroad, was known as a community with a prosperous economy, a comprehensive educational system, and well-maintained residential neighborhoods. The railroad recommended Boulder as a site for a Chautauqua in 1897. Residents passed a bond issue on buying the land and raised the now-familiar Chautauqua Auditorium. Additionally, growth of the University of Colorado at the turn of the century led to the development of parts of University Hill. For residents, one mark of elegance was the installation of flagstone sidewalks in the 1880s.

Visitation to Boulder has always had a connection to Chautauqua Park. In 1898, a group of Texans searching for a retreat decided on Boulder and ultimately built one of the nation's most beautiful vacation spots. Completed July 4th, 1898, Chautauqua was particularly important for the area as its creation marked the beginning of Boulder's parks and open space land purchasing for preservation. This type of effort became one of Boulder's top priorities and still is today. The day after Chautauqua's grand opening, the City of Boulder purchased the eastern slope of Flagstaff Mountain from the United States Government.

In 1908, Boulder hired landscape architect Fredrick Law Olmstead Jr. to consult with them on how to best plan the city. The son of the creator of New York City's Central Park had recommendations which included putting wires underground and keeping streetlights beneath tree level. Most importantly, Olmstead Jr. also cautioned

them about suburban developers, “dirty industries,” and pandering to tourists. Olmstead Jr. stated that above all, Boulder must be a beautiful, prosperous town where people would spend their lives. Boulder would not be a place to make money before getting out.

With exceptional growth, sprawl seemed inevitable. After the city council scheduled an election for bonds to expand a water treatment plant, citizens asked the Council to create a Blue Line at 5,750 ft. elevation beyond which water lines would not extend. Citizens petitioned council and required them to put the item on the ballot. On July 21, 1959, the voters approved the Blue Line and defeated the water plant expansion. Above this line, the city would not provide water or sewer services to protect the view.

Additionally, during this decade, new subdivisions were planned, including the Highland Park-Martin Acres neighborhood located on the historic Martin Farm, and the North Boulder developments from Balsam north, originally part of the Tyler Farm. New neighborhoods brought the city's first two shopping centers, North Broadway and Basemar, in the northern and southern parts of the city. Science and tech industries had doubled Boulder's population from 1950 to 1960 and then jumped to 67,000 during the 1970s. In 20 years, from 1950 to 1970, the population grew by roughly 50,000 people.

The City of Boulder began a period of infill and re-use of its past architectural development after the purchase of thousands of acres of open space beginning in 1967, adopting the Boulder Valley Comprehensive Plan in 1970, and the passage of the building height restriction ordinance in 1972. Residents instituted a special 0.4 percent sales tax to purchase preserved land or "green space" around the city. With citizen advocacy, City Manager Ted Tedesco, and council put a one-cent sales tax on the ballot. Forty percent of the tax would go to open space, and 60% would go to transportation. The open space was a green belt to limit overdevelopment and protect the environment. Voters approved the tax by 61% of the voters and became the nation’s first voter-approved sales tax for open space.

Nature was protected, but this type of urban growth boundary hindered developers. Encircling the city with green space had several implications for emergency response. Due in part to the limited space causing real estate prices in Boulder to be as much as 1.5 times higher than the rest of the Denver-Metro area and the city’s limited new housing (2 % per year) (Boulder Economic Council, 2011), few emergency responders live within the city limits; this creates a significant staffing delay regarding the recall of personnel.

Many Boulder workers commute to the city, creating heavy traffic patterns each morning and evening. In-flow and out-flow traffic ultimately impede emergency response times. Moreover, the urban growth boundary in the form of green space surrounding Boulder geographically isolates the city; Most surrounding fire agencies are too far away to provide immediate response support, and as a result, needs for assistance are accommodated by mutual aid requests rather than automatic aid agreements.

Despite exceptional growth and some of the issues associated with maintaining it, the Boulder community was able to maintain eccentricity and geographic beauty. Boulder is known today for its emphasis on environmental preservation, education, and outdoor quality of life. While great change has ultimately altered the city since the city’s beginnings, breathtaking views, higher education, federal research, and entrepreneurial spirit is fostered throughout its transformation. Boulder’s charm is unrivaled among American cities, and it continues to maintain and promote these characteristics today.

History of Boulder Fire-Rescue

Boulder Fire-Rescue is legally established and recognized under Title 2 Government Organization, Chapter Five of the City of Boulder Charter and Revised Code. Section 2-5-2 of the City of Boulder Charter delegates the authority of the fire department and directs the responsibilities of the fire department to include without limitation:

"the suppression or extinguishment of fires, the provision of rescue and emergency medical services, the provision of fire inspection and fire prevention services, the management of hazardous substance incidents as defined by state law, and the planning or response to public disasters and emergencies, including, without limitation, windstorms, and flooding."

Service Delivery Milestones

1875-1894 - Four hose companies are formed and placed in service around the city
1875 - Boulder hose company is established
1883 - Six buildings were damaged or destroyed by a fire during a windstorm. The fire is Boulders most damaging fire to date
1898 – A decision is made to move to horsepower fire equipment
1913 – A Seagrave Seagrave combination hose chemical truck with ladders is purchased. It is the first motorized fire truck put in service
1915 - Boulder hose company closes its doors. The city of Boulder fire department assumes the fire protection role
1958 - New Station 1 and Station 2 constructed
1965 - Station 3 relocated and built
1976 - Station 6 built to provide service to IBM
1977 - Station 4 put in service
1982 - A training accident takes the lives of the engineer Duran and firefighter Smith (1/26/1982)
1991 – BFR increased staffing from two to three people on all apparatus 92. Station 5 relocated a new station
2000 - Station 7 built new firefighters hired
2008 - Contracted with AMR to provide dedicated
2008 - Implemented Blue Card Hazard Zone Management
2008 – Upgrade of Hazmat Unit to be a self-sufficient cross-staffed resource. The prior unit was a trailer that was limited in capability
2010 - First original training center complete
2010 - Purchased and outfitted two new wildland response vehicles for local and regional response
2012 - Hired an Administrative Battalion Chief (BC) to help support Operations
2013 - Hired an Administrative Assistant for the Fire Safety and Training divisions
2013 - Began a pilot program for a Light Response Vehicle (LRV) at station one following City Council goals of a reduction in the department's carbon footprint. After the pilot, the program was deemed ineffective; the program did not continue
2013 - Implemented ProQA, a prioritized emergency medical dispatch system with the hopes of limiting the number of vehicle responses to low acuity medical calls.
2013 - Installation of Automatic Vehicle Location (AVL) devices on all fire apparatus.
2014 - Implemented Smoke and CO detector install service to low-income customers
2014 - Implemented Citizens Fire Academy
2014 - Implemented Car Seat Install program
2015 - Completed the building of Station 8
2015 – Hired a Management Analyst
2015 - New computer-aided dispatch software
2017 – Begin First-In station alerting
2017 – Hired a second public educator
2018 – Hired a Sr. Budget Analyst and Project Manager of Data & Analytics

Government

The City of Boulder has a council-manager form of government where the 9-seat, at-large elected City Council sets policies and the council-appointed city manager administers them. The City Manager's Office consists of the city manager, two deputy city managers, a policy advisor, and support staff. The office ensures the proper management of city operations and public representation and participation. Boulder Fire-Rescue (BFR) is one of the city's 19 departments that fall under the operational purview of the City Manager's Office. The fire chief reports directly to the City Manager. The mission of the City Manager's Office is to:

Champion an engaged, collaborative, and innovative organizational culture; Provide professional leadership in the administration and execution of city policy as established by the council; Establish relationships and partnerships to implement community priorities.

Department Funding

As of 2019, Boulder Fire-Rescue Department (BFR) receives 98.6 percent of its $20.90 million in funding from the General Fund. The remaining 1.4% sourced from the Community, Culture and Safety Tax special fund that supports specific voter-approved capital projects of which BFR's relocation and construction of a new Station 3 is one. From a citywide perspective, the General Fund supports 45 percent of the city's $353.7 million budgeted expenditures. In 2019, the General Fund is set to receive 41 percent of its $152.6 million in revenue from Sales and Use Tax, 24 percent from property tax, and the remaining 35 percent from a combination of fees, cost allocation transfers, and other miscellaneous taxes. As a General Fund department, BFR is largely dependent upon the city's sales and use tax and property tax proceeds to fund its operations.

When considering BFR expenditures by category in 2019, personnel expenses account for 81 percent of the total budget and operating expenses account for 8 percent. The remaining 11 percent of operating expenses are for interdepartmental charges and modest capital investments. With most of its annual appropriation allocated to personnel and interdepartmental charges, there is little opportunity to enhance existing programs through re-allocation. For new programs or capital needs, specific new appropriation from either the general fund or other city revenue sources is required.

BFR works through the city's annual budget development process to secure expanded funding for new programs or initiatives as well as maintain funding for existing services. This process is a 9-month collaborative effort that begins with Council established work plan items that are set against the backdrop of economic conditions and the accepted prioritization of city programs and services. Council and community budget priorities filter down to the organization through the City's budget-making committee called the Executive Budget Team (EBT). The EBT is a city manager selected subset of department directors that help the city manager establish budget policies and provide the strategic budget vision for all city departments. BFR develops its annual budget independently at first and then engages with the EBT in a formalized manner throughout the budget process. This results in an EBT-approved departmental budget that aligns with the citywide strategy. It ultimately gets included in the annual budget that the City Manager submits to City Council for adoption.

	2017 Actual		2018 Approved Budget		2019 Recommended Budget		Variance 2018 to 2019	
	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
STAFFING AND EXPENDITURE BY PROGRAM								
Emergency Operations								
Fire-Rescue	24.25	$ 3,585,110	24.25	$ 3,645,443	24.25	$ 3,944,105	-	$ 298,662
Wildland Response	9.00	893,968	8.00	913,988	8.00	978,364	-	64,376
Dive Rescue	24.25	2,997,330	24.25	3,163,506	24.25	3,178,323	-	14,817
Hazardous Materials	24.25	3,131,417	24.25	3,300,456	24.25	3,325,213	-	24,757
Emergency Medical Services	24.25	3,598,357	24.25	3,789,956	24.25	3,823,773	-	33,817
Subtotal	106.00	$ 14,206,183	105.00	$ 14,813,349	105.00	$ 15,249,778	-	$ 436,429
Community Risk Reduction								
Public Education	2.67	$ 308,143	2.67	$ 295,145	2.67	$ 297,086	-	$ 1,941
Code Enforcement	4.17	496,901	4.17	550,927	3.17	414,050	(1.00)	(136,877)
Investigations	1.16	170,217	1.16	163,173	1.16	166,834	-	3,661
Subtotal	8.00	$ 975,262	8.00	$ 1,009,245	7.00	$ 877,970	(1.00)	$ (131,275)
Internal Support								
Facilities (Stations)	0.45	$ 440,682	0.45	$ 419,393	0.45	$ 672,422	-	$ 253,029
Fleet	0.45	1,250,734	0.45	1,472,986	0.45	1,273,685	-	(199,301)
Supplies & Equipment	0.45	157,436	0.45	153,823	0.45	129,402	-	(24,421)
Technology	1.13	892,002	1.13	392,742	1.13	412,744	-	20,002
Safety Equipment	0.63	533,086	0.63	544,045	0.63	502,699	-	(41,346)
Human Resources	0.13	120,050	0.13	144,433	0.13	73,884	-	(70,549)
Occupational Health	0.63	202,618	0.63	206,388	0.63	210,280	-	3,892
Training	3.13	604,084	3.13	608,273	3.13	625,754	-	17,481
Subtotal	7.00	$ 4,200,692	7.00	$ 3,942,083	7.00	$ 3,900,870	-	$ (41,213)
Administration								
Strategic Planning	2.00	$ 399,318	2.00	$ 372,120	2.00	$ 323,092	-	$ (49,028)
Finance	1.00	289,276	2.00	268,120	2.00	235,483	-	(32,637)
Collaborating Agency Relationships	-	320,618	-	245,653	-	311,600	-	65,947
Subtotal	3.00	$ 1,009,211	4.00	$ 885,893	4.00	$ 870,175	-	$ (15,718)
Total	**124.00**	**$ 20,391,348**	**124.00**	**$ 20,650,570**	**123.00**	**$ 20,898,793**	**(1.00)**	**$ 248,223**
EXPENDITURE BY CATEGORY								
Personnel		$ 16,705,387		$ 16,664,505		$ 16,905,289		$ 240,784
Operating		1,784,186		1,827,053		1,674,658		(152,395)
Interdepartmental Charges		1,901,775		2,159,012		2,018,846		(140,166)
Capital Improvement CCS		-		-		300,000		300,000
Total		**$ 20,391,348**		**$ 20,650,570**		**$ 20,898,793**		**$ 248,223**
STAFFING AND EXPENDITURE BY FUND								
General Fund	123.33	$ 20,271,977	123.22	$ 20,522,238	123.00	$ 20,598,793	(0.22)	$ 76,555
Open Space Fund	0.67	119,371	0.78	128,332	-	-	(0.78)	(128,332)
Capital Improvement CCS Fund	-	-	-	-	-	300,000	-	300,000
Total	**124.00**	**$ 20,391,348**	**124.00**	**$ 20,650,570**	**123.00**	**$ 20,898,793**	**(1.00)**	**$ 248,223**

Table 1: BFR 2019 Summary Budget

In 2018, BFR changed its internal budgeting method to program-based budgeting that provides programs with funding that's tied to performance measures. These measures are intended to support performance measures supported with specific funding streams. Departmental master planning focusses on aligning the design of departmental operations, programs, and annual spending plans with stated community priorities under the Sustainability + Resilience Framework.

The Sustainability + Resilience Framework serves as the main blueprint in planning departmental investments. By designing new initiatives to serve the categories and objectives within the framework, BFR can ensure that planned activities are supporting community priorities and funded by stated city priorities.

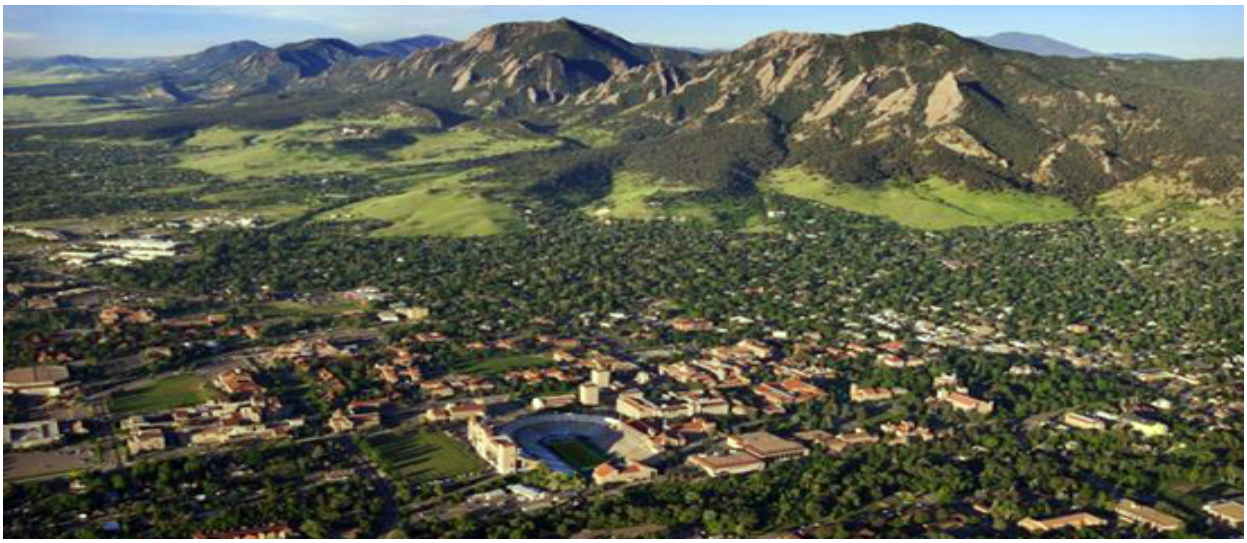
Figure 1: Sustainability + Resilience Framework

Figure 2: Sustainability + Resilience Framework Objectives

Section II: Documentation of Area Characteristics

The City of Boulder is home to the University of Colorado, the National Institute of Standards and Technology (NIST), the National Oceanic and Atmospheric Administration (NOAA), as a multitude of other science and technology-based companies. It is also the home training base for hundreds of world-class athletes.

Located along Boulder Creek at the base of the foothills of the Rocky Mountains, the city is roughly 18.5 miles east of the continental divide and 35 miles northwest of Denver. Canyons create steep, rugged terrain along the western edge of the city along the transition from the foothills to the plains. The canyons also serve as a funnel for strong winds into the city which have caused damage to homes and infrastructure due to their role in fueling the wildfire potential.



Location

Boulder is at an elevation of 5,430 feet (1,655 m) above sea level, at the base of the foothills of the Rocky Mountains. The city is 25 miles (40 km) northwest of Denver.

The city of Boulder is the county seat of Boulder County which is home to more than 300,000 residents and includes some of the most diverse, natural landscapes and sustainable development along the Northern Front Range of Colorado. The city of Boulder is the 11th most populous municipality in the state of Colorado.

Figure 3: State of Colorado

Boulder Quick Facts

Square Miles: 25.8
Elevation: 5430’
Population Density: Urban
Waterways: 1 sq. mile

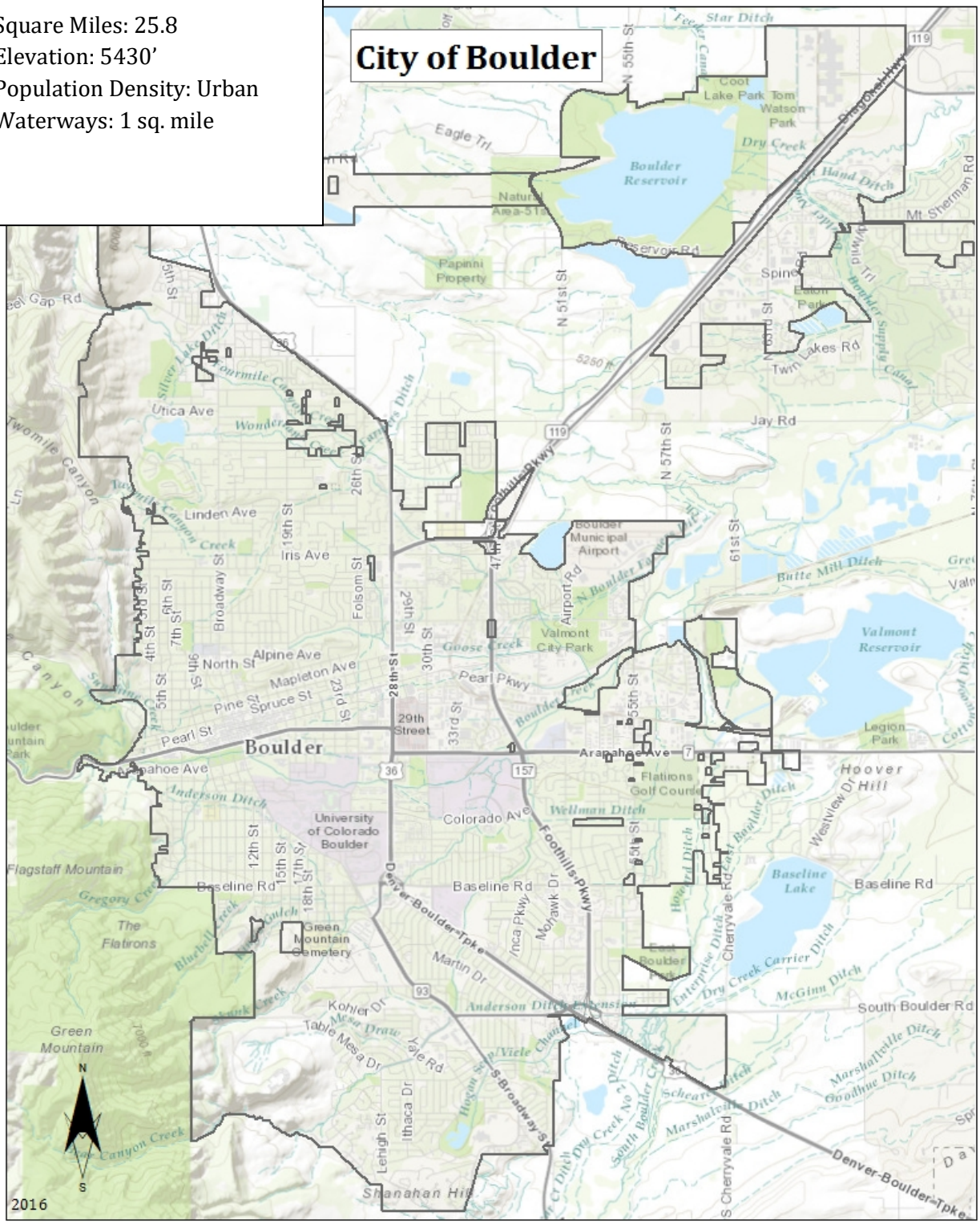


Figure 4: City of Boulder Map

Topography

The City of Boulder covers an area of 27square miles. Positioned in Boulder Valley where the Rocky Mountains met the Great Plains and surrounded by over 45,000 acres of land that has been preserved and protected. Wildlife habitat, unique geologic features, greenways and 145 miles of hiking trails are all managed by the city's Open Space and Mountain Parks. West of the city are slabs of sedimentary stone tilted up on the foothills, known as the Flatirons. The Flatirons are a widely recognized symbol of Boulder.

A variety of fuel types are present in and around Boulder caused by elevation differences. The lower elevations consist of grasslands, tall-grass prairie remnants and riparian vegetation (including cattails, cottonwoods, and other riparian hardwoods and shrubs) growing along watercourses and in drainages. This fuel type exhibits the most aggressive burning, even at night. Above 7500', Ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga menziesii*) become more prevalent primarily on north-facing slopes. There are also dense riparian shrub corridors and open-canopy woodlands broken by large grassy meadows in this area. At this elevation, fire occurrence and fire behavior are lower.

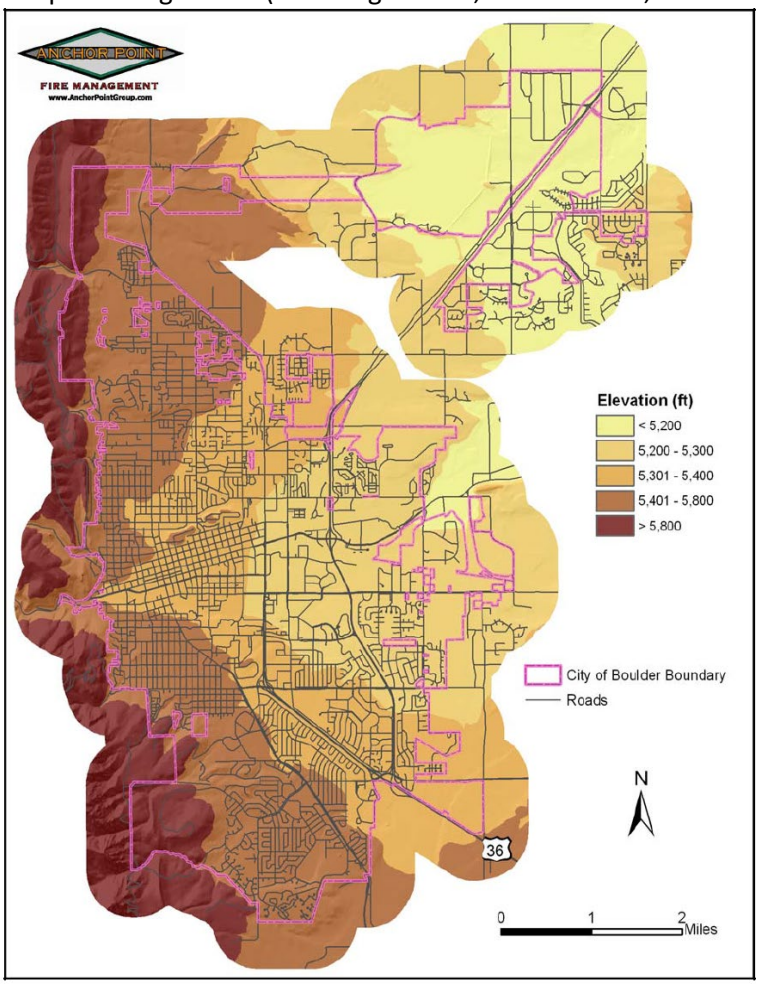


Figure 5: Boulder Topography Map

At 8500', Lodgepole Pine becomes common. Fire occurrence here is rare and does not usually present control problems unless drought and wind are involved. Elevations above 9500' are predominantly short-needle conifers or a spruce-fir fuel type. Around 11,500' is the tree line, and the tundra begins. Fire occurrence here is very rare.

The primary water flow through the city is Boulder Creek. The creek was named well ahead of the city's founding for the large granite boulders that have cascaded into the creek over time. It is from Boulder Creek that the city is believed to have taken its name. Boulder Creek has significant water flow, derived primarily from snowmelt and minor springs west of the city. The creek is a tributary of the South Platte River.

Geology

Two geologic provinces come together in the Boulder area. The eastern province is the Great Plains, ranging from flatlands to rolling hills, and the western province is the Rocky Mountains. The north-south front where the two provinces meet is called the Front Range. There were several active glaciers in the mountains west of Boulder. Glacial deposits and erosional features can be seen in the mountains west of the city.

There are no active fault lines near Boulder; however, there are a few recorded earthquakes in the region. Several small quakes and one 5.3 magnitude earthquake occurred in the late 1960s just northeast of Denver. Earthquake Hazard Mitigation Council attributes these quakes to deep injection of liquid waste at Rocky Mountain arsenal, just southeast of Boulder.

Physiography

The varying fuels change within the elevation zones throughout the area and do so depending on the diverse aspects of the slopes. The difference in exposure produces marked variations in short horizontal distances, creating microclimates. A south-facing slope will support dryland plant forms such as juniper, mountain mahogany, bunchgrass, yucca, and cactus. Whereas, a nearby north-facing slope might harbor boreal forms such as Douglas-fir, spruce, aspen, wild rose, and even mosses. The extreme terrain variations work to create many saddles, chimneys, and canyons. These features contribute to funnel wildfire events through the varied fuels; combined with urban development. There is an extremely complicated wildland/urban interface situation compounded by weather extremes and wind events. The inverse of the wildfire scenario is severe flooding, particularly in burn scar areas. The City of Boulder has one of the largest potentials for flash flooding within Colorado.

The historic flooding of 2013 provided an extreme example of that potential. The vulnerability to flash flooding is due to the city's geographical location at the base of the Rocky Mountains. It is perhaps the municipality's most probable community risk. Within the City of Boulder's 100-year floodplain, there are thousands of people and approximately 3,600 structures which have an assessed valuation of almost $1 billion.

Climate

Due to altitude and distance from any significant body of water, Boulder County is very dry. However, the climate is as varied as the topography. Summer temperatures frequently reach the upper 90 degrees with low humidity. Boulder receives an annual average of 18.17" of moisture, which means that the sun shines most days. An average year will bring 245 days of sunshine to the region.

Spring is typically windy with highly variable weather - an occasional blizzard, large temperature changes, and occasional gentle rain are all possibilities. Winters are usually dry with some periods of heavy or windblown snow, some very cold temperatures, and some surprisingly warm days. With wind and abundant sunshine, even heavy snow will melt within days, if not hours. Either a warm sunny

Climate Boulder - Colorado						°C | °F
	Jan	Feb	Mar	Apr	May	Jun
Average high in °F:	47	48	56	63	72	82
Average low in °F:	22	23	29	36	44	51
Av. precipitation in inch:	0.75	0.83	2.2	2.87	2.8	2.2
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-
Average snowfall in inch:	11	12	18	12	1	0
	Jul	Aug	Sep	Oct	Nov	Dec
Average high in °F:	88	85	78	66	54	45
Average low in °F:	57	56	48	38	29	21
Av. precipitation in inch:	1.77	1.85	1.69	1.54	1.22	0.94
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-
Average snowfall in inch:	0	0	1	6	14	14

Figure 6: Boulder Climate by Month

day following a storm will produce rapid melting, or the wind in the area will sublimate the snow.

The proximity to the continental divide allows Boulder to experience some of the strongest winds in the continental United States with gusts of 140 miles per hour or more. The wind associated with weather systems pushing up and over the western side of the divide encounter relatively little terrain to disrupt their flow before reaching Boulder. Boulder's windiest months are January and December, but large wind events have occurred in every month of the year. Historically large wildland fires reveal that most are wind-driven, fall or wintertime events.

Both Chinook and Bora winds have an impact on the climate in Boulder. Chinook winds form when a high-pressure system is sitting west of the continental divide and a low to the east. The greater the difference in pressure between the low on the lee side and the high on the windward side, the more forceful and rapid the high pressure will flow to the low pressure. In Boulder, Chinook winds occur down the eastern slope of the Front Range. Chinook winds have been known to reach up to 140 miles per hour and regularly reach 70 miles per hour. Chinook winds are warm drying winds typically driving relative humidity to single digits.

Bora winds are cold, dry winds originating in the northwest. They are usually associated with a passing cold front and are abundant in the fall and spring. Bora winds will affect a larger area than a Chinook wind but are not quite as strong. Typical gusts range from 50-60 mph.

Because of dry climate and winds associated with fall weather, wildfire activity in autumn is a concern. Still, Boulder treats its fire season as a year-round threat.

Development Within the Service Area

Boulder has a diverse economy. Industries with a significant presence in the area include aerospace, bioscience, data storage, light manufacturing, natural and organic products, outdoor recreation, photonics, professional and scientific services, renewable energy and energy research, software, and tourism. While most of the city's employers are small businesses, several major corporations, including Amgen, Ball, Cisco, Emerson, Google, IBM, Lockheed Martin, Microsoft, and Northrop Grumman, have a presence in Boulder.

Research institutions include the University of Colorado Boulder and more than a dozen federally funded research laboratories including the National Center for Atmospheric Research (NCAR), National Oceanic and Atmospheric Administration (NOAA), and National Institute of Standards and Technology (NIST). This diversity buffers the effects of economic downturns and contributes to the area's economic vitality.

Responding to the loss of several important historic buildings in the 1960s and early 1970s, Historic Boulder, Inc. drafted a historic preservation ordinance, which City Council unanimously adopted in 1974. The ordinance established an official municipal process to preserve and protect the historical, architectural, and environmental assets that contribute to Boulder's unique sense of place. With the adoption of the ordinance in 1974, Boulder became one of the first cities in Colorado with authority to designate and prevent the demolition or destruction of historical, architectural, and cultural resources considered valuable to the community. Today, more than 30 communities in Colorado have similar historic preservation ordinances, based on Boulder's model. Protecting significant buildings and neighborhoods helps maintain a connection between Boulder's past, present, and future generations. Community interest in preservation has resulted in more than 1,300 designated historic properties in Boulder, including 162 individual landmarks and ten historic districts.

Population

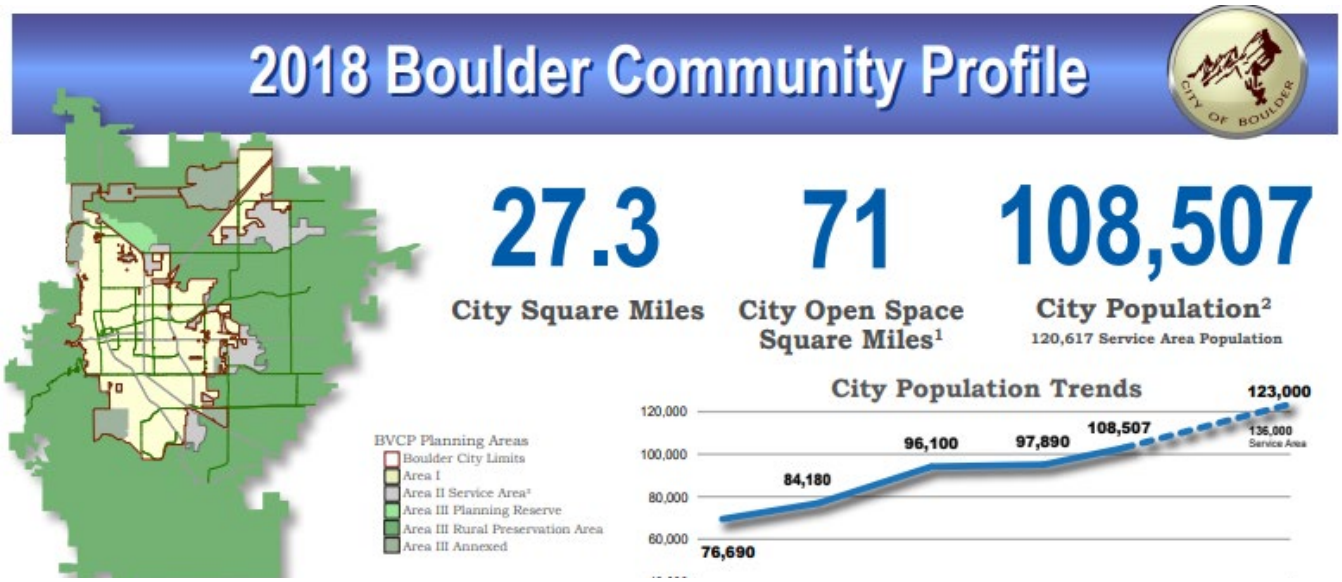


Figure 7: 2018 Community Profile

Boulder County has an estimated 326,078 residents. Between 1970 and 2000, the county's population increased from 131,889 to 291,288 or an average of 4% annually. From 2000 to 2010, the county's population grew by 0.7%. Since 2010, the County has experienced minimal growth.

From 2017 to 2018, the City of Boulder experienced a population increase of 68, a small decrease in the local group quarters population and a small increase in completed housing units led to the 2017 population increased by only 0.1%. The Boulder Valley Comprehensive Plan – 2018 Housing Unit, Population, and Employment Estimates and Projections Methodology provide more detail on how the city estimates current and future population. Note that the city's population estimates include both housing units and group quarters populations (e.g., dormitories, sororities and fraternities, jail, skilled nursing facilities, and group home shelters).

In 2018, the University of Colorado (CU) student enrollment was 34,510, up 7% from 2017. The presence of the university has a significant effect on the demographic characteristics of the city's residents, evidenced by a higher than average percentage of residents in the 18 to 24 age group, high rate of renter-occupied housing, and a relatively high percentage of residents with annual household incomes under $25,000. Additionally, the university influences high educational levels of Boulder residents. Boulder is the largest city in Boulder County, and approximately one-third of the county's residents live in within city limits.

The Map on the next page shows the City of Boulder's vulnerable populations. Results from the US Census 2013-2017 ACS Census shows the Age Dependency Ratio. The Age Dependency Ratio is the ratio of people under 18 plus those 65 and over divided by those people age 18 through 64.

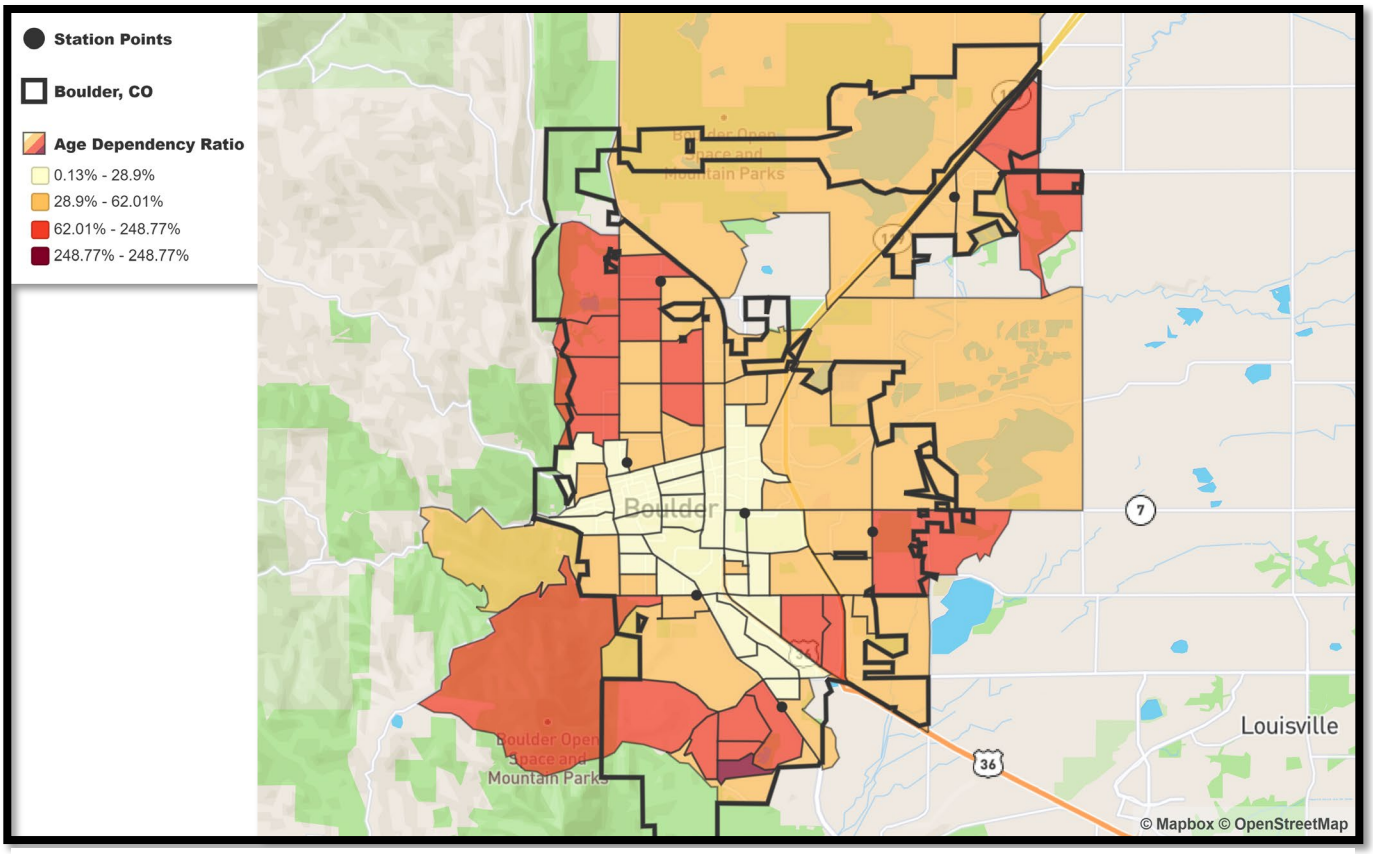


Figure 8: Age Dependency

Demographics

BFR serves citizens within and around the city limits of Boulder. The city is a highly developed urban-based population community surrounded by undeveloped wilderness and open space areas. The city had an estimated total population of 107,349 according to the 2018 Boulder Community Profile. This figure includes the University of Colorado (CU) students who live in Boulder. CU Boulder students represent approximately 22% of Boulder's population. The University's presence has a significant effect on the demographic characteristics of Boulder residents, evidenced by a higher than average percentage of residents in the 18 to 24 age group, high rate of renter-occupied housing, relatively high percentage of residents with annual household incomes under $25,000, and significantly higher levels of educational attainment.

After a dramatic increase in population from 1950 to 1970 (averaging nearly 12% a year), Boulder took steps to slow growth, the city's population grew an average annual rate of 1.6% from 1970 to 2000. Since 2000, Boulder's population has remained relatively stable. By 2035, Boulder's population is projected to increase to approximately 119,370, or .8% per year according to the 2010 US Census.

The median age of Boulder's population is 27.2 compared to the state median age of 36.5 years. One-third of the city's adult population is between 18 and 24, reflecting the influence of the university on the area's demographic profile. By comparison, 13% of U.S. adults are 18 to 24.

Boulder's population is highly educated and has the nation's highest percentage of residents with a bachelor's degree or higher. Ninety-four percent of city residents 25 or older have a high school diploma, and 67% have earned a bachelor's or advanced degree, more than twice the U.S. average of 28%.

Many factors influence the high number of area residents with college degrees, including the presence of the university, research labs, and a heavy concentration of business in advanced technology. Most working residents of Boulder work in white-collar occupations. Over 60% of the city's civilian workforce works in managerial, professional, or related occupations compared to 36% of the nation's workers.

Data from the Bureau of Labor Statistics Occupational Employment Survey illustrates the Boulder area's high concentration of employment in computers, mathematical, science, and engineering occupations. Boulder has a high concentration of computer software engineers (5 times the national average), physicists, hydrologists, chemists and environmental scientists (3 to 6 times the national average), computer hardware engineers (8 times the national average), and aerospace, electronics and materials engineers (4 to 5 times the national average). According to the Census data in the table below, the Boulder area also has a higher than average percentage of residents employed in the educational services, health care, and social assistance, professional, scientific, management, and administrative industries (2A.7).

The impact of University of Colorado students is seen when comparing the median household income and median family income for city residents. While the median household income in City of Boulder is less than the state, the median family income is significantly higher.

High education levels in the city contribute to a higher than average percentage of residents with household and family incomes over $100,000 (27%). In contrast, the city's student population influences a higher than average percentage of households with incomes under $25,000 (30%).

The University of Colorado and the cities desirable location influences Boulder's comparatively high real estate values and percentage of renter-occupied housing. Census data indicates 94% of the city's housing units were occupied when the census was conducted in 2010. Owner-occupied housing represented 47% of occupied housing in the city, and the median value of a home was $529,300. Renter-occupied housing represented 53% of occupied housing units. The median rent in the city was $1,082 per month. Almost two-thirds of the city's residents moved into their current homes in 2005 or later, demonstrating major change in the last decade.

According to the 2013-2017 American Community Survey, 80.98 people are Caucasian, reflecting a 9.1 percent decrease from 2010. Comparatively, Boulder County is 88.36% Caucasian. The state of Colorado lacks some of the diversity from both Black or African American and Hispanic or Latino populations as compared to national percentages. Additionally, the City of Boulder has similar representation in percent of foreign-born citizens as compared to national statistics. Additional data can is on the Census Reporter website.

City Planning Areas

While the City of Boulder has many zoning areas including residential, commercial, and mixed-use zoning, the city also plans to use a variety of other strategies. For example, the City of Boulder looks to neighborhoods, business districts, historical zones, and critical infrastructure before initiating major planning efforts. Officially, Boulder has 99 neighborhoods, eight historic districts, and four business districts.

Community Land Use and Zoning

The City of Boulder has 44 categories for planning. Land use and zoning can be broken down into the following general categories: agricultural, business, downtown, industrial, mixed-use, public, residential, mobile home, and "other" types of zoning. The screengrab to the right depicts the various zoning within the city. The map is available in an eMap format on the city website with an accompanying legend.

Local Landmark Designation

Landmark designation honors preserve and protect buildings and areas that have been determined to have a special character and historical, architectural, or aesthetic interest or value to the city. There are currently ten historic districts and 175 individual landmarks, totaling over 1,300 designated properties. The map below outlines the designated and potential historic districts in the City. Maps of the historic districts and a brief history of each can are on the city's website.

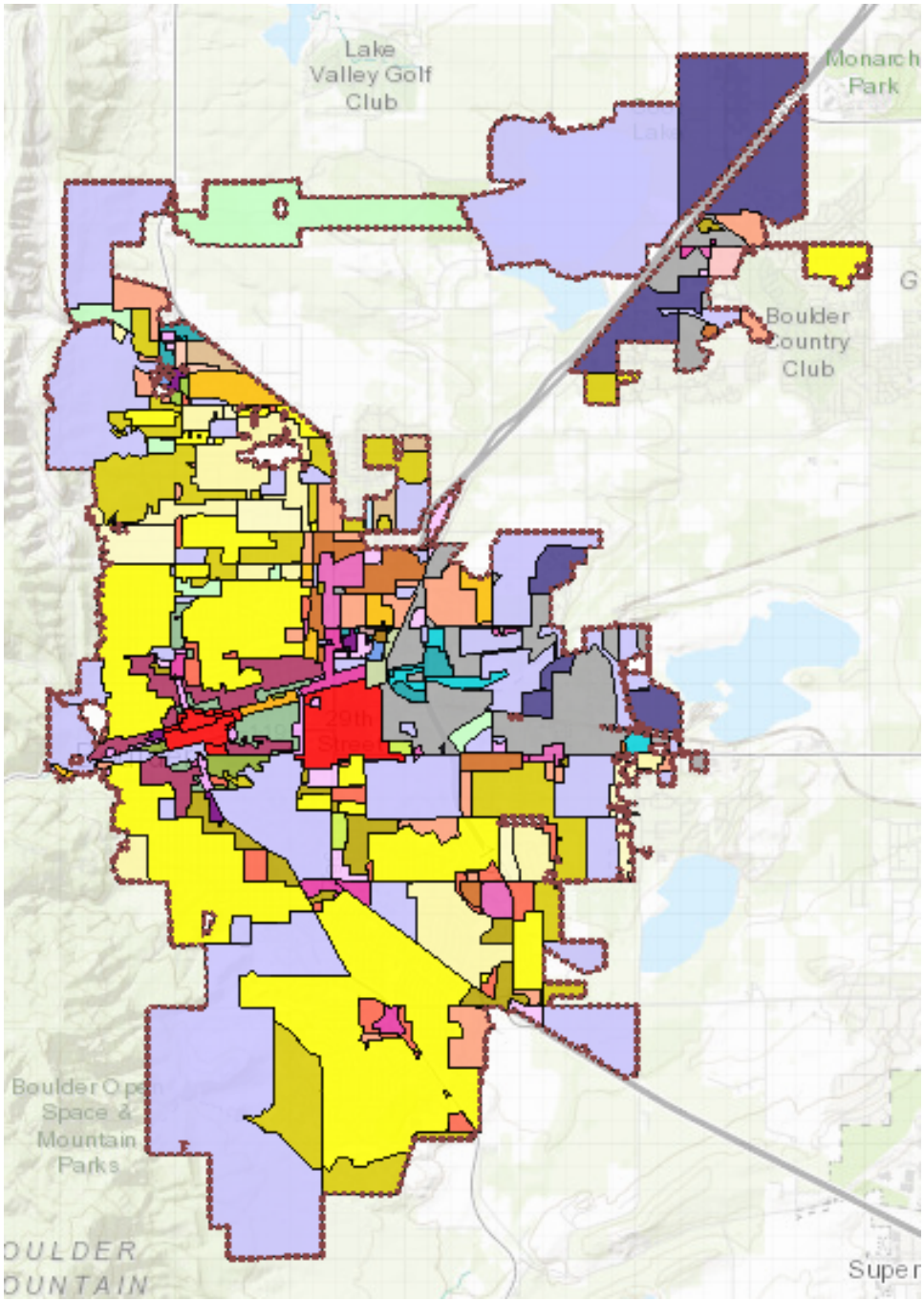


Figure 9: Community Land Use and Zoning

Colorado State Register of Historic Places

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 historical and archaeological sites. The Colorado State Register program is administered by the Office of Archaeology and Historic Preservation within History Colorado. History Colorado maintains an official list of all properties included in the Colorado State Register. Properties listed in the National Register of Historic Places are in the Colorado State Register. They may also be nominated separately to the Colorado State Register without inclusion in the National Register. History Colorado provides an overview of Properties in Boulder County listed on the Colorado State Register of Historic Pla ces.

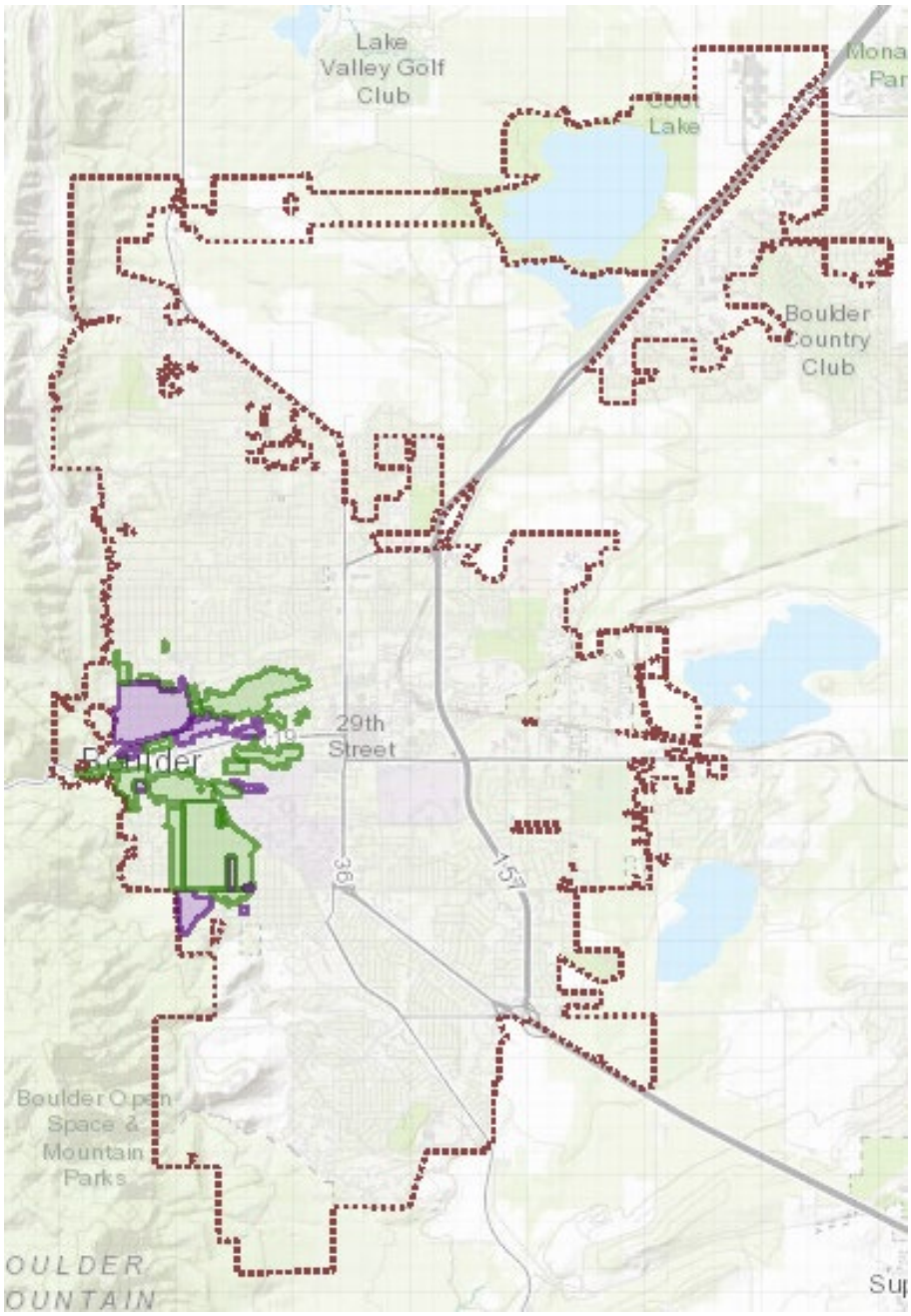


Figure 10: Historic Areas

Parks and Open Space

Most of the green space surrounds the city and is not within city limits demonstrated in the City of Boulder Zoning map. Zoning is not specific in any single area. Boulder's significant amount of Open Space has remained open partially due to the Blue Line — an unofficial north-south boundary on the city's west side, which in 1959 determined the elevation above which Boulder could not provide water service and launched the city's modern environmental movement in the process (2A.6). Depicted on the map below is the blue line.

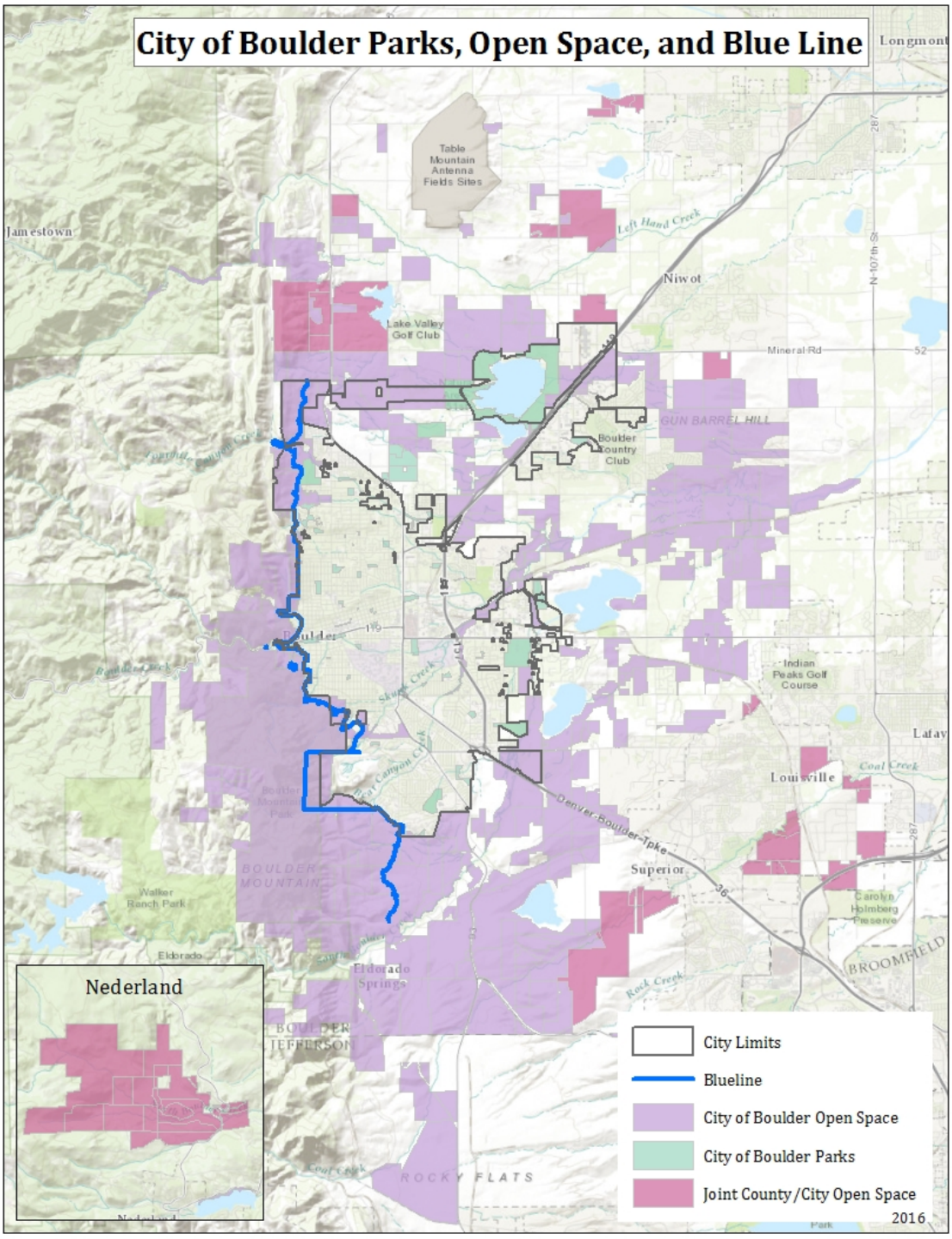


Figure 11: Blue Line and Open Space Map

Infrastructure

Critical infrastructures are systems or assists needed to maintain minimum services for the operation of a community. Critical infrastructure includes transportation, communications, water, power, and healthcare.

Transportation

Since Boulder has operated under residential growth control ordinances since 1976, the growth of employment in the city has outstripped population growth. Considerable road traffic enters and leaves the city since many employees live in surrounding communities. US 36 is the main highway feeding Boulder. Parking regulations in the city have been designed to discourage commuter parking and to encourage the use of mass transit.

The City of Boulder Transportation Division identifies roads, improvements, closures, and access points. According to the Transportation Master Plan (TMP) update in 2016, Boulder's street system is classified by road type with local streets comprising 71 percent, collector streets comprising 12 percent and arterial streets comprising 17 percent of the city's street system. Currently roughly half of the city's streets have an OCI rating in Very Good and Excellent ranges. Nearly 80 percent of the street system is rated "Good" or better.

New jobs in Boulder and residential growth throughout the region increase demand on the regional transportation system. Boulder continues to work with regional partners to improve travel options and the person-carrying capacity of all the major corridors connecting Boulder to surrounding communities. These partnerships seek solutions that improve regional travel for everyone, including people who use autos and transit.

The City of Boulder's annual traffic study found that approximately 49,000 vehicles enter Boulder during the morning rush, which is from 6 to 10 a.m. That is an increase of 2 percent compared to 48,000 vehicles in 2014, but it remains below the peak year of 2004 when about 51,000 vehicles entered the city during the morning rush. The 2015 traffic study also found that about 20,000 vehicles leave the city each day during the morning rush hour.

Over the years, Boulder has made significant investments in the multi-modal network. The city is now well known for its grade-separated bicycle and pedestrian paths. These paths create a network of bicycle lanes, cycle tracks, and on-street bicycle routes. Boulder also provides an innovative community transit network that connects downtown, the University of Colorado campuses, and local shopping amenities. While the city has no rail transit, local and regional shuttle busses receive funding from a variety of sources and emphasize minimal headways, enhanced route identity, easy fare payment, and community input in the design. Due in part to these investments in pedestrian, bicycle, and transit infrastructure, Boulder has been recognized both nationally and internationally for its transportation system.

Figure 12: Public Transportation in Boulder

Boulder has an extensive bus system operated by the Regional Transportation District (RTD). The HOP, SKIP, JUMP, Bound, DASH and Stampede routes run throughout the city and connect to nearby communities. Regional routes, traveling between nearby cities such as Longmont, Golden,

Fort Collins, and Denver, as well as Denver International Airport, are also available. There are over 100 scheduled daily bus trips on seven routes that run between Boulder and Denver on weekdays.

Long-term transit plans call for a 41-mile RTD commuter rail route called the *Northwest Rail Line* proposed to run from Denver through Boulder to Longmont, with stops in major communities along the way. These future transit plans, as well as the current Flatiron Flyer Bus Rapid Transit route, are part of FasTracks, an RTD transit improvement plan funded by a 0.4% increase in the sales tax throughout the Denver metro area.

Boulder, well known for its bicycle culture, boasts three hundred miles of bicycle-pedestrian paths, lanes, and routes that interconnect to create a renowned network of bikeways usable year-round. Boulder has 74 bike and pedestrian underpasses that facilitate safer and uninterrupted travel throughout much of the city. The city offers a route-finding website that allows users to map personalized bike routes around the city. Furthermore, in May 2011, B-cycle bike-sharing opened in Boulder with 100 red bikes and 12 stations.

Rail

One railroad travels through the City of Boulder. The Burlington Northern and Santa Fe Railroad (BNSF). The city of Boulder has declared “quiet zones” at-grade railroad crossing. These crossings include physical infrastructure and warning systems, so that train engineers are not required to sound the train horn at the crossing. While this infrastructure is in place to reduce the noise of passing trains, these safety measures also ensure citizens are aware of the crossings reducing risk.

Airport

Figure 13: Aerial View of Boulder Municipal Airport

In addition to multi-modal ground transportation, Boulder Municipal Airport is located 3 miles (4.8 km) from central Boulder. The City of Boulder owns the airport; it is used exclusively for general aviation, with most traffic consisting of single-engine airplanes and glider aircraft. Boulder Municipal Airport is a general aviation airport, providing business, private, recreational and emergency aviation services to the City of Boulder and surrounding communities. Boulder Municipal Airport does not offer commercial airline service.

Water Supply

The Water Department manages the upkeep and maintenance of the water system to include hydrants, and water mains, as well as to identify system issues which includes outages and improvements. Boulder's water supply system includes storage, conveyance, hydroelectric, and treatment facilities. The city owns approximately 7,200 acre-feet of reservoir storage space in the North Boulder Creek watershed, 11,700 acre-feet of storage in Barker Reservoir on Middle Boulder Creek and has up to 8,500 acre-feet of storage space in Boulder Reservoir.

Boulder's two water treatment facilities are the Betasso Water Treatment Facility (WTF), with approximately 45 million gallons per day (MGD) of treatment capacity and the Boulder Reservoir WTF at about 16 MGD. The city operates eight hydroelectric plants located within the municipal water supply system and sells the electricity to Xcel Energy. Four of these hydro plants are on raw water pipelines, and four are on treated water transmission pipeline.

Operation of the city's water system involves intricate relationships between water rights, water quality, laws, and legal agreements, streamflow's, reservoir storage operations, transmission pipeline operations, treatment capacity, hydropower production, and water demand. Balancing and managing these factors assures the availability of a sufficient water supply. Watersheds on the eastern slope just below the continental divide feed the city's Middle Boulder Creek and North Boulder Creek. Boulder also owns rights to the delivery of water from the Colorado-Big Thompson Project (CBT) and the Windy Gap Project. Both projects divert water from the western slope and deliver it through the CBT facilities, which are operated by the Northern Colorado Water Conservancy District (NCWCD). Like most western communities, Boulder depends on stored water most of the year. High streamflow from melting snowpack occurs for only a few spring and summer months. Natural streamflow in late summer and the winter are not sufficient to meet customer demands and are supplemented with previously-stored water supplies. The amount of water available changes from year to year depending on how much snow falls in the mountains. Therefore, Boulder must store water in reservoirs during wetter years to carry over for use in drier years. The city owns seven reservoirs and several natural lakes in the headwaters of the North Boulder Creek basin within the Silver Lake Watershed. The city also owns Boulder Reservoir northeast of Boulder and the Barker Reservoir facilities on Middle Boulder Creek.

Water Distribution

The City of Boulder is fortunate to have several high-quality sources of water, including the headwaters of Boulder Creek and diversions from the upper Colorado River on the west slope (map below). The city's ability to obtain water from both east and west slope sources provides a measure of water service reliability in response to moderate, localized droughts or other events.

Boulder receives drinking water from three sources: Arapahoe Glacier and Silver Lake Reservoir (40%), Barke Reservoir (40%) and the Colorado River (20%) via the Colorado-Big Thompson Transbasin Diversion Project. Water from the Arapahoe Glacier and Barker Reservoir feeds the Betasso Water Plant. The Feeder Canal connects water from the Colorado River. The treatment plant at 63rd Street Water treats the water; the water goes through a series of treatment steps including coagulation, sedimentation, filtration, before being distributed to homes.

Boulder's wastewater collection system consists of underground pipes that utilize gravity to transport untreated wastewater from residential, commercial and industrial properties to the city's water resource recovery facility (WRRF) located on 75th Street near Boulder Creek.

The WRRF is designed to treat more than 25 million gallons of wastewater per day in a 20-hour, multi-stage treatment process.

Approximately 13 million gallons of wastewater is treated every day, and a high-quality effluent (treated wastewater) returned to Boulder Creek. Wastewater is treated using several different treatment processes, including physical; microbiological; and chemical; Treatment includes disinfection of harmful bacteria, viruses, and protozoa. Many samples are collected and analyzed to ensure that the final discharge is meeting or exceeding the permit [1]that has been issued by the State of Colorado

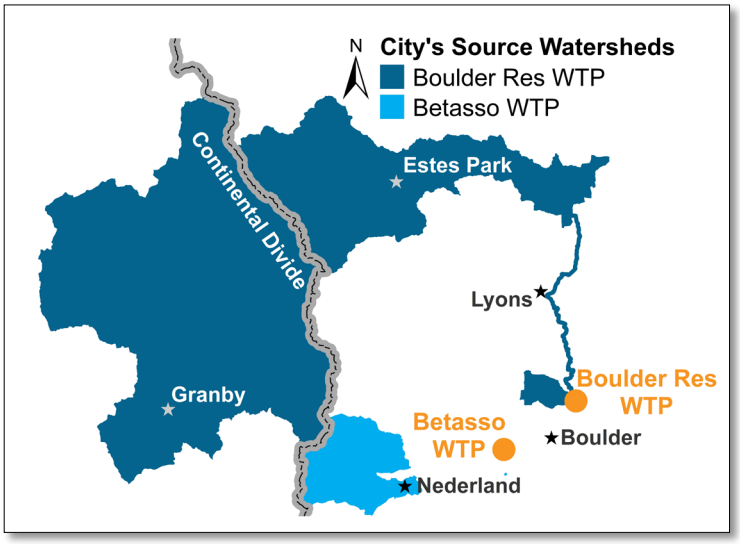


Figure 14: CIty's Sourced Watershed

During the past nine years, the one-megawatt solar photovoltaic system WRRF has generated more than 13 million kilowatt-hours of electricity, saving utility ratepayers more than $500,000. The system began generating clean, renewable power in August 2010 and has operated efficiently and reliably ever since, producing about 14 percent of the facility's annual power needs.

Stormwater

According to the City of Boulder Comprehensive Flood and Stormwater Master Plan, the Boulder Creek Watershed encompasses roughly 440 square miles and extends from the Continental Divide to the high plains east of Boulder. There are 15 major drainage-ways (or creeks) in Boulder. Seventeen sub-basins have are delineated, and the tributary drainage-ways all eventually lead to the Boulder Creek.

Regarding drainage, the collection system consists of a variety of storm sewers and open drainage ditches that collect water and divert the water to major drainage-ways. Irrigation ditches collect stormwater in many places in the City. Depending on the amount of rainfall, stormwater flows may exceed the capacity of the ditch and spill from the ditch in an uncontrolled manner. Rather than purely focusing on a structural solution, Boulder adheres to a series of guiding principles to balance both structural and non-structural solutions. These principles include maintaining and preserving natural draining, managing runoff, and eliminating drainage problems.

The stormwater quality program consists of public education, water quality monitoring, regulatory compliance, and source control. The city's municipal separate storm sewer system (MS4) permit requires these efforts. The city also participates in the Keep It Clean Partnership (KICP), a regional stormwater program providing public education and outreach. The stormwater quality program manages local activities to preserve, protect, and enhance water quality affecting Boulder's streams and drainages. Elements such as water quality regulation, sub-basin management, and stream enhancement contribute to a comprehensive framework for recognizing trends, philosophies, and standards while ensuring maximum effectiveness, cost-efficiency.

The Boulder Creek Watershed drains approximately 440 square miles on the eastern slope of the Rocky Mountains. The basin is bordered on the west by the Continental Divide where headwater tributaries begin in

[1] Permit number CO-0024147 issued by the Colorado Department of Public Health and Environment (CDPHE).

the Indian Peaks Wilderness. Boulder Creek flows through the City of Boulder and out to the confluence with St. Vrain River, and eventually the South Platte River. The many activities associated with various land features and land uses impact Boulder Creek.

The impacts include:

- sedimentation from highway maintenance and bank erosion;
- acid mine drainage from historic gold mines in the mountainous region of Boulder County;
- pollutants associated with urban runoff;
- stream channelization and reduced riparian habitat functions;
- pollutants from agricultural runoff;
- damage to riparian vegetarian and sedimentation from stream bank erosion from ranching practices; and
- point sources from industrial and municipal discharges.

To better understand impacts to Boulder's surface water, the city regularly examines water quality to discover how the community's water resources are changing over time, and to help identify and mitigate potential sources of pollution. A map of the City of Boulder Major Drainageways is on page 54 of the Comprehensive Flood and Stormwater Utility Master Plan.

Service Area

BFR is the Authority Having Jurisdiction (AHJ) within the City of Boulder, Colorado's geographical boundaries. BFR protects over $21 billion worth of property (2A.5), which encompasses 25.8 square miles of land and 312 road miles. The city is located within Boulder County and is the county seat. Boulder is the most populous municipality of Boulder County and the 11th most populous municipality in the state of Colorado. BFR shares several geographical boundaries with neighboring emergency service agencies; including Boulder Rural Fire Department, Rocky Mountain Fire Department, and Four Mile Fire Department (2A.1, 2A.2).

The wildland program has responsibility for fire management objectives for all city-owned and managed lands. There are several complications to this due to other jurisdictional authorities. City lands are far-reaching and spread throughout Boulder County and into adjoining Jefferson County. Twelve different agencies have city property in their response areas. Typically, this does not affect manual fuels treatment, as most are familiar with techniques and support mitigation. It does add to the complexity of implementing prescribed fire, as each jurisdiction has differing levels of acceptance to the use of fire as a tool for risk reduction. It also complicates response. There is no common notification practice for each jurisdiction to notify the wildland program of a wildland fire ignition on city land. BFR is in the process of revamping agreements for mutual and auto aid, and there is language that addresses a notification process. The other complicating factor is, all the land and jurisdictions with city land are outside the municipal boundary, limiting the city's jurisdictional authority. Said agencies are dispatched through Boulder County Communications Center, a separate dispatching agency from BFR. This not only continues to further the complication it significantly slows the notification and dispatching of city resource to an incident as it has to go from one PSAP to another for processing.

Planning Zones

The City of Boulder is 27 square miles bounded on all sides with established "city limits" border. The city is classified as a highly developed urban-based population community by the Boulder Valley Comprehensive Plan (BVCP) and US Census. Much of the land that borders the city is undeveloped wilderness and open space areas. The City of Boulder owns the land, but fire protection falls within other jurisdictions.

In 2016 the department established new planning zones. To establish fire planning zones, the Department divided the city into five (5) areas. These 5 zones were determined based on similar occupancy types and risk levels. The city limits and major atrial roads within the city (table below) outline the zones. Each of the 5 zones was further divided into subzones to gather a manageable set of data beneficial to determine risk in each zone (2A.3).

Area	General Description	Area Description	Sub-Area
A	Gunbarrel Area	The boundary is city limits	01-05
B	North Boulder	North of Iris/Linden West of Foothills Hwy (28th St.)	01-04
C	Central Boulder – West	South of Iris/Linden North of Baseline West of 30th	01-08
D	Central Boulder – East	East of 30th North of Baseline City limit boundary to the north and east	01-07
E	South Boulder	South of Baseline City limit Boundary to the west, south, and east	01-07

Table 2: Fire Planning Zones

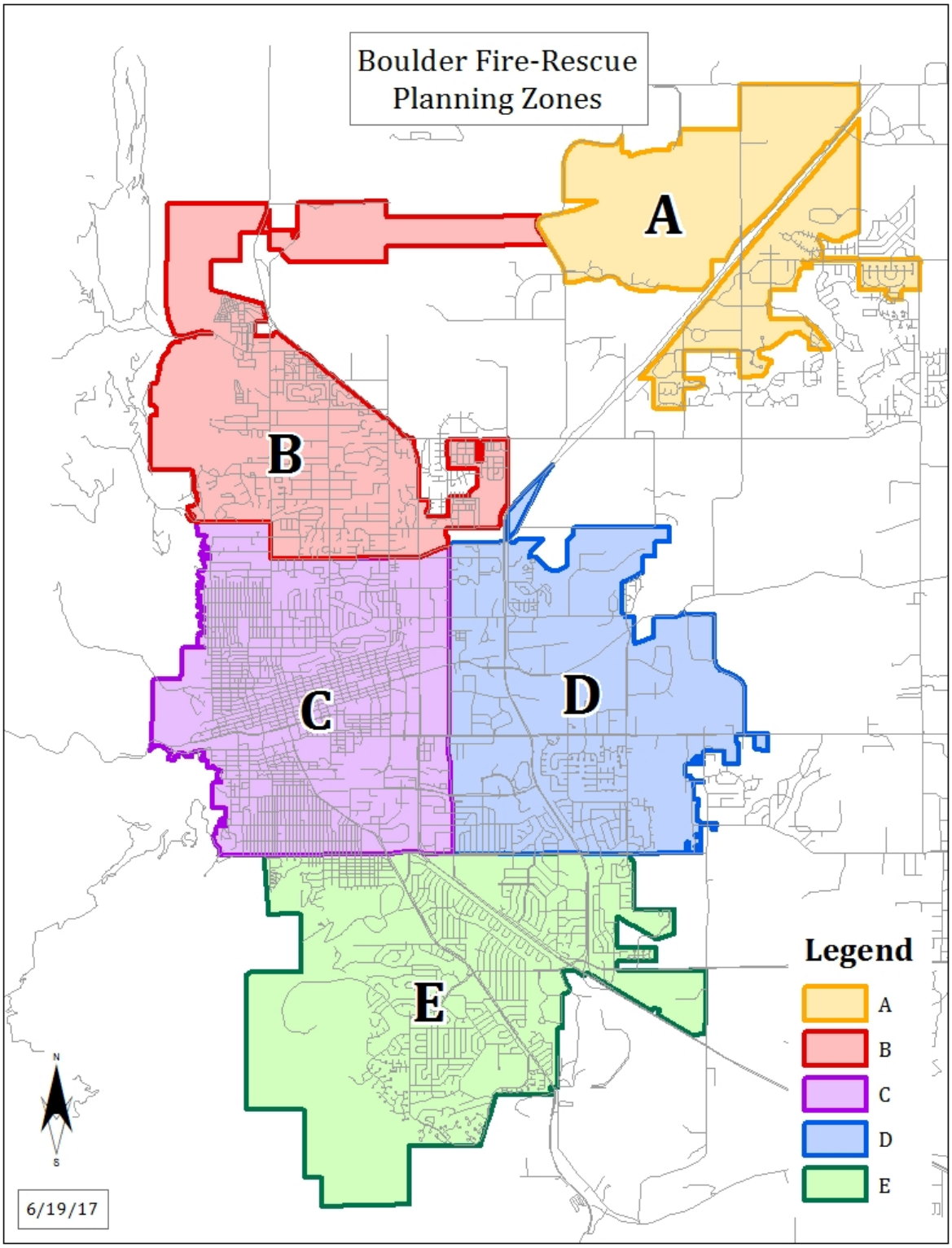


Figure 15: Fire Planning Zones

Boulder County Jurisdictions

The Boulder Rural Fire Department (BRFD) is responsible for providing service to approximately 25 square miles in the northern, eastern, and western portions of unincorporated Boulder County surrounding the City of Boulder. BRFD has 17 full-time career firefighters and 25 trained volunteer firefighters. BRFD responds to approximately 1000 calls per year.

Rocky Mountain Fire Department (RMFD) protects the properties located in the areas south, southeast, and west of the City of Boulder. RMFD has approximately 40 members and staffs two stations with seven firefighters and one duty chief.

Four Mile Fire Department (FMFD) is a combination fire department located to the west of the city. FMFD responds to approximately 95 calls per year and has 30 members who regularly respond to emergencies.

Boulder Mountain Fire Protection District (BMFD) is to the northwest of Boulder, Colorado. This combination fire department responds to structure fires, wildland fires, medical emergencies, motor vehicle accidents, and other community disasters. BMFD has a full-time chief, three full-time wildland specialist with approximately 50 volunteers operating out of 3 stations.

Lefthand Fire Protection District (LFPD) is 52 square mile of rugged ridges, canyons, and plains protected by 30 volunteer firefighters. This unique urban interface environment includes five subdivisions and several mountain neighborhoods.

Mountain View Fire Protection District (MVFPD) is in Weld and Boulder counties consisting of 184 square miles and a population of approximately 50,000 people. MVFPD is a full-service fire department providing both fire and emergency medical services. MVFPD serves the communities of Dacono, Erie, Mead, Niwot, and unincorporated areas of Boulder and Weld counties. MVFD operates out of eight stations; six staffed with approximately 100 firefighters, 10-12 part-time firefighters, and two unstaffed stations.

Automatic and Mutual Aid

Aside from the State Level Mutual Aid Agreement, BFR has developed reciprocal mutual aid and cooperative agreements with fire departments in surrounding communities. BFR has automatic aid agreements with both Boulder Rural Fire Department and Rocky Mountain Fire Department. BFR has cooperative agreements throughout the State of Colorado and with the federal government in the event of more widespread emergencies such as a major wildland fire.

BFR is also part of the Intergovernmental Agreement for Emergency Management and the Intergovernmental Agreement for Participation in the Boulder County Hazardous Material Response Plan. There are specific mutual aid and automatic aid agreements in the form of letters of understanding (LOU) and contracts with the following districts for various emergency services:

- The contract between the city of Boulder and the Hazardous Materials Response Authority
- The contract between the city of Boulder and Boulder Emergency Squad
- The contract between the city of Boulder and Rocky Mountain Rescue Group, Inc.
- Letter of Understanding between BFR, Boulder Rural, and Rocky Mountain Fire Protection District.
- Letter of Understanding between BFR and Boulder Rural Fire Protection District (BRFPD) (2007)
- Mutual Aid Agreement with Denver Metro

The letters of understanding between BFR, Boulder Rural, and Rocky Mountain Fire Protection District impact operations daily, BFR responds automatic aid to most of BRFPD's incidents. Below is a map of the Automatic Aid response areas.

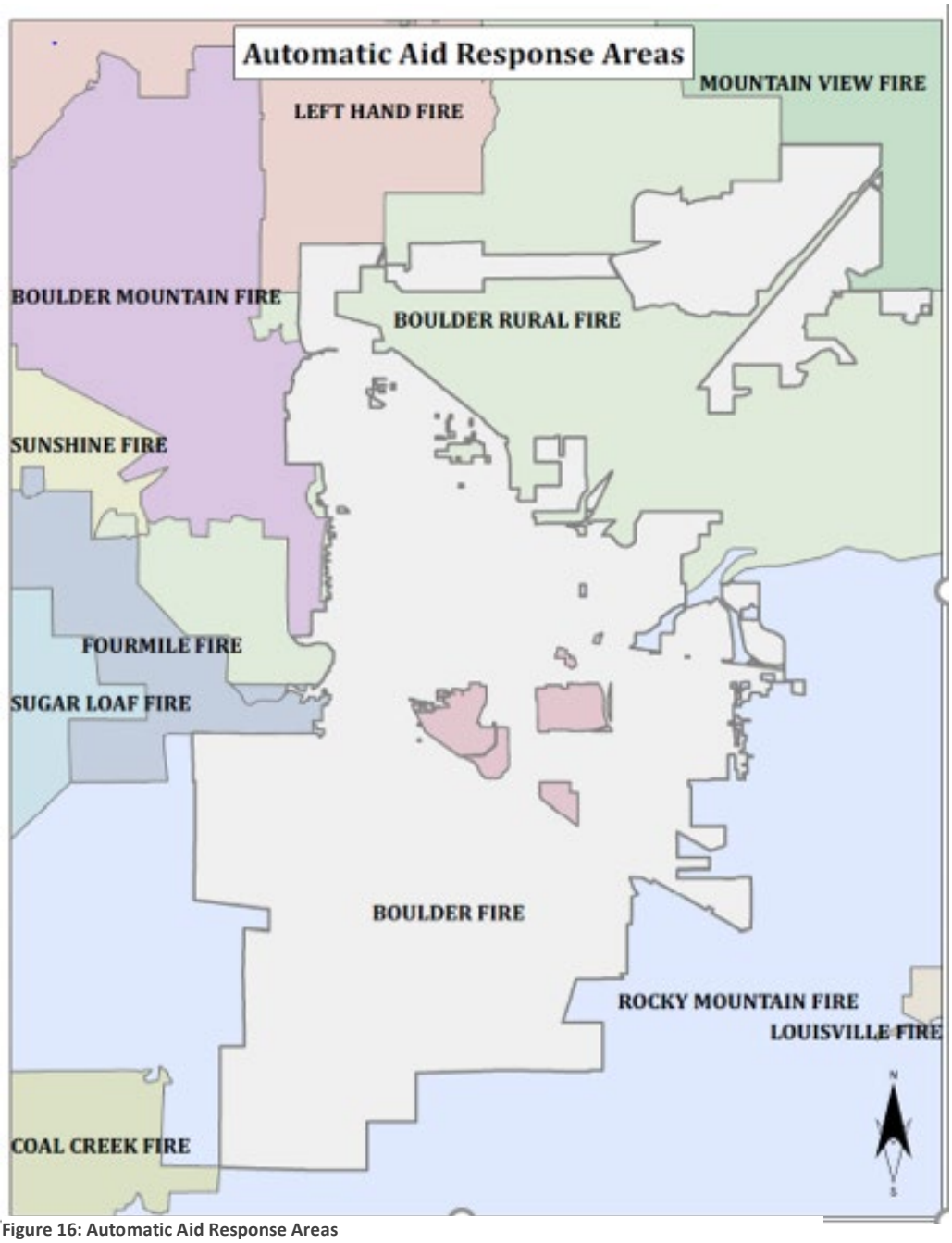


Figure 16: Automatic Aid Response Areas

Boulder County Cooperators

Rocky Mountain Rescue Group

The Boulder Fire-Rescue Department is responsible for assisting in the protection 70.8 square miles of city Open Space and Mountain Parks (OSMP) adjacent to the City of Boulder. Each year, over 5 million people visit and utilize the 150 miles of trails stretching throughout the 45,000 acres of open space. To provide medical and rescue assistance within Boulder OSMP, the City of Boulder contracts with Rocky Mountain Rescue Group (RMR). Rocky Mountain Rescue Group is an all-volunteer organization trained and equipped for all-weather search and rescue on mountainous terrain. Founded in 1947, RMR is one of the oldest mountain rescue teams in the country. RMR has a contract with the City of Boulder as well as the Boulder County Sheriff's Office as the county's primary mountain rescue agency. Rescue calls are diverse and can involve hikers with sprained ankles, fallen climbers, searches for missing parties, and evacuation of injured persons. Personnel from BFR will assist RMR in these rescues and will provide equipment, personnel, and command structure.

Boulder Emergency Squad

Boulder Emergency Squad (BES) is a volunteer technical search and rescue team serving Boulder County. BES is the primary dive rescue agency for Boulder County. Staffed by 42 members in 2015, BES is 100% volunteer supported. The primary source of funding for BES is the Boulder County Commissioners. BES works closely with the BFR to provide mutual-aid support for emergencies by providing air cascade, lighting support, and traffic control as well as a variety of technical rescue incident support.

Office of Emergency Management

The mission of the Boulder Office of Emergency Management (Boulder OEM) is to develop, coordinate, and lead a comprehensive emergency management program. Boulder OEM seeks to enable effective preparation for, efficient response to, and effective recovery from emergencies and disasters, to save lives, reduce human suffering, protect resources, and develop a more resilient community.

In the event of large-scale natural or technological disasters, the Boulder Fire-Rescue Department works with other agencies and organizations such as the City of Boulder/Boulder County Office of Emergency Management (Boulder OEM). The Boulder OEM coordinates with local, state, and federal partners to facilitate planning and response to emergencies. Given the importance of emergency response and recovery planning, the city continuously reviews the coordination with Boulder OEM to identify any areas of improvement.

The Boulder Office of Emergency Management has emergency management responsibilities for both the City of Boulder and Boulder County. Boulder OEM also coordinates with state and federal partners, many city and county departments, public safety agencies, municipalities, non-governmental organizations and private businesses throughout Boulder County to facilitate coordinated planning and response to emergencies.

Section III: Description of Agency Programs and Services

BFR is a full-time, paid, fire, and emergency services department with no volunteer resources. The Department provides Fire (structural and wildland), and Basic Life Support (BLS) Emergency Medical Services (EMS) to the City of Boulder. Aside from fire suppression, BFR supports a multi-jurisdiction HazMat team and a stand-alone water rescue team.

BFR coordinates with city efforts in the joint city/county Office of Emergency Management (OEM) and acts as the designated emergency response authority (DERA) for hazardous materials response in the city. In addition to emergency response, BFR provides fire-safety education to the public, preschool through seniors. Public education programs include including car seat inspections, an annual Citizen's Fire Academy, working with local businesses and organizations by inspecting buildings and reviewing construction plans for fire prevention code compliance.

BFR protects more than 21 billion dollars' worth of property within a city that encompasses 25.8 square miles. Surrounding the municipal boundaries is 70.8 square miles of city Open Space and Mountain Parks (OSMP). BFR responded to nearly 12,000 calls in 2017.

> "The Boulder Fire-Rescue Department strives to make Boulder a safe place to live, work, and play. BFR reduces the human suffering caused by fires, accidents, sudden illnesses, hazardous material releases, and other disasters."

BFR's current level of service is adequate to deliver the services expected by the community for the majority of incidents. For those rare incidents that tax the capacity of the department, external agency agreements have been established to provide additional resources if necessary. This level of service satisfies the expectations of Boulder citizens and elected officials.

Organization

Overseeing the department is a fire chief who reports directly to the City Manager. The Chief, in this capacity, provides for the overall strategic direction of the department and maintains external agency relationships. The fire department is staffed by 124 FTE sworn personnel and eight civilian employees who assigned to two major administrative branches, operations, and support. Each branch is led by a Deputy Chief, who in addition to the Fire Chief comprise the executive leadership of the department. The department is divided by function into two branches. One provides external customer support (operations) and the other internal customer support (support). Each branch is staffed commensurately to support the mission of the agency. Three administrative professionals provide administrative support; their assignments are in the office of the fire chief, community risk reduction, and training.

The department relies on external resources for large events and advanced life support (ALS) medical calls. American Medical Response (AMR) creates the ERF for emergency medical incidents. An urban population density informs the department's response and deployment standards. Outlined in the standards of cover benchmark statements are the targeted service level objectives. Service level objectives relate to industry standards and best practices. Each apparatus has both GPS technology and a Mobile Data Terminal. The terminals, GPS and the software help to centralize the department under one system by linking all the apparatus directly to the county's computer-aided dispatch system; this ensures that the closest apparatus is dispatched to the incident thus reducing response times.

FTE	Daily Min. Staffing		Stations	Engines	Quints	Ladders
12	25 FF	1 BC	7	5	2	1

Figure 17: 2019 Operations Minimum Staffing Table

Staffing

BFR has a traditional organizational structure for a department its size. The department has two major divisions, and within those two divisions, are four primary sub-divisions, which comprise the operational structure of the department. The department has a staff of 125 full-time equivalent (FTE) personnel. A portion of those FTE positions includes eight full-time personnel in the Wildland Division. The four divisions within the department under Support Services and Operations respectively are the community risk reduction and training divisions, and the fire operations and wildland divisions.

The International Association of Firefighters Local # 900 represents fire personnel. The current two-year collective bargaining agreement went into effect on January 1, 2017, and expired December 31, 2018. Wildland Division personnel are not represented by Local 900. Chief officers are selected based on city-supported promotional processes, and the Fire Chief is an appointed position. The table below represents the daily minimum staffing on fire apparatus.

Station	Apparatus	Personnel	Type
Station 1	2516 2501 2570	3 3 1	Type I Type I Pick-Up
Station 2	2502 2538	3 0	Type I Type III
Station 3	2503 2521	3 0	Type I Dive Van
Station 4	2504	3	Type I
Station 5	2505 2532	3 0	Type I Type VI
Station 6	2506	3	Type I
Station 7	2507 2523	3 0	Type I Hazmat Van
Station 8 (Wildland)	2531 2535 2539 2551 2552	0 0 0 0 0	Type VI Type VI Type III Pick-Up Pick-Up
Total Apparatus Minimum Staffing		25	

Figure 18: Daily Minimum Staffing

Operations

The Operations Division is directed by the Deputy Chief of Operations, who oversees the Community Risk Reduction Division, the Wildland Division, and three response Battalion Chiefs. The department staffs five fire engines, two quints, and one ladder truck operating out of seven fire stations working a 48/96-hour, 3-shift schedule. The minimum staffing on each front-line apparatus is three personnel, with the Battalion Chief having minimum staffing of one. Each shift has one roving Lieutenant, Engineer and six roving Firefighters that are assigned to vacancies or to increase staffing above minimums. The department org chart is below; additional org charts are available in the appendix.

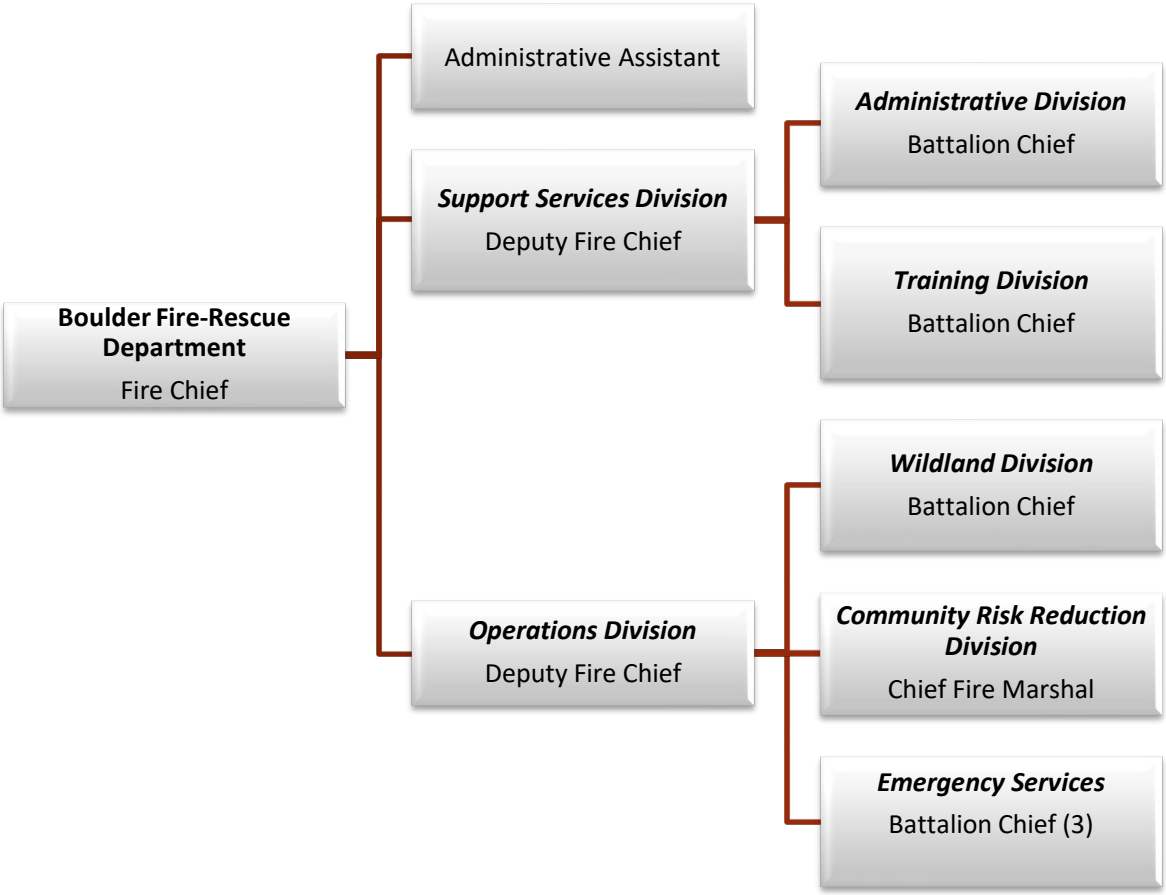


Figure 19: Department Organizational Chart

Wildland Division

The Wildland Division provides planning, mitigation, training, and suppression of wildland within the City of Boulder and its managed lands. The Division has nine employees that specialize in wildland fire and large incident management.

Directing the Wildland Division is the Wildland Division Chief who oversees a Wildland Fire Administrator and a Wildland Fire Operations Manager who supervises two Wildland Operations Specialists II and four Wildland Operations Specialists I. The Wildland Division provides planning, mitigation, training, and suppression of vegetation within the city of Boulder and its managed lands. All personnel within the Division have national experience and hold certifications through the National Wildfire Coordinating Group (NWCG).

The Division provides incident response plans, pre plans, fuels reduction prescriptions, prescribed fire planning, Wildland mitigation plans, and other associated documents to fire department management, as well as, other

City departments that have owned and managed lands throughout the county (OSMP, Utilities, parks, and rec). Along with preplanning, the Division provides the implementation of various fuels reduction projects throughout the city system through thinning and prescribed fire.

The Wildland Division also provides wildland fire and incident management training to the fire departments' front-line responders and support staff including basic wildland fire fighting through advanced fire-tactics, annual refresher training (including administration of annual work capacity testing), incident management and various other training modules.

The training delivered goes beyond the city boundaries and includes external cooperative partners that have city managed land within their response areas. The Division is responsible for tracking all wildland specific training and qualifications for all city employees through the state-sponsored IQS database system.

The Division also manages the repair, maintenance, and readiness of the wildland fire apparatus. BFR operates 3 Type 6 engines and 2 Type 3 urban interface pumpers. Front line response is with either a Type 6 from station 5 or a Type 3 from station 2. The balance of the wildland specific apparatus is at fire station 8. This equipment is maintained in a state of readiness for surge capacity, severity staffing or sent on regional or national deployments.

The Division's operations staff is at fire station 8. The initial attack on city managed lands outside of the municipal boundary is done by various career and volunteer fire departments. These agencies maintain agreements for services with the City of Boulder. The wildland Division provides a secondary response to any wildfire on or threatening city property. Division staff provides incident management and coordination of resources. Division staff typically serves in the roles of incident commander, Division supervisor, or various other command and general staff positions. Most Division staff is members of the county-wide Type 3 IMT as well as various positions on regional Type 1 and 2 Incident Management Teams (IMT).

Emergency Medical Services

The city uses a combined and integrated service network that initiates care from an enhanced 911 emergency call center operated by the city's Police Communication Center. First responders respond from each of the city's seven fire stations operated by BFR.

Advanced life support services and patient transport is provided by AMR, the ambulance service is under contract to Boulder County and the City. Almost all patients requiring follow-up medical care get transported to Boulder Community Health (BCH), a 265-bed Level II Trauma Center, the highest level available locally. The hospital is in east-central Boulder. If a level 1 Trauma Center is needed, BCH will transfer patients to Denver Health.

BCH offers 24-hour access to an interventional cardiac catheterization lab, surgery department, imaging, and an 18-bed intensive care unit. BCH is the only facility in Boulder County that performs open-heart surgery. BCH is also nationally certified as a Primary Stroke Center for providing high quality, specialized care, and better outcomes for stroke patients.

There are three aero-medical EMS units (Flight for Life Colorado, Airlife Denver and North Colorado Med Evac) that provide aero-medical transportation for severely injured or ill patients. There are some on-scene referrals, but most patients initially get transported from Boulder Community Hospital after initial treatment. EMS first response is provided on the campus of the University of Colorado by BFR with assistance from campus police.

Almost 100% of emergency response personnel from the fire department have a Colorado Emergency Medical Technician (EMT) certifications. All new hires since the mid-1990s must obtain and maintain Colorado EMT certification as a condition of employment. The department does not utilize or recognize paramedics within its ranks, though two individuals have this level of certification. The fire department operates eight first-line emergency response units, including one battalion chief command vehicle. All vehicles carry basic life support supplies and provide the initial response and typically assist AMR personnel with patient care. Fire station personnel and AMR units operate on a common radio channel and get dispatched to incidents through the city's 911 Communication Center.

Hazardous Materials Response

Hazardous materials response is a locally provided service mandated by federal law. The law requires Colorado to develop a hazardous materials response system. The responsibility for the development of this system was delegated to local jurisdictions by statute. The statute requires local governing bodies to appoint a Designated Emergency Response Authority (DERA) to respond to hazardous materials emergencies.

For minor hazardous materials incidents, BFR sends personnel to evaluate the scene. If incidents escalate or are major spills or emergencies, the Boulder County Hazardous Materials Response Authority (BCHMRA) sends personnel for assistance. BCHMRA members include personnel from the cities of Boulder, Longmont, Lafayette, Louisville, and the Boulder Rural, Rocky Mountain, and Mountain View Fire Protection Districts. The BCHMRA is staffed by resources from each of the partner entities and provides DERA services throughout Boulder County. According to the BCHMRA IGA, a minimum of 13 Colorado Certified Hazardous Materials Technicians will be available to respond 24 hours a day, seven days a week, and the following guidelines shall be followed:

The BCHMRA will arrive within 90 minutes of initial dispatch of the BCHMRA to each of the following response areas

- East of Broadway/Hwy 93/U.S. 36
- North of Hwy 128
- South of Hwy 66
- West of East County Line Road
- All other areas within the BCHMRA Response will provide coverage within 120 minutes of the initial dispatch of the BCHMRA

Initial dispatch of the BCHMRA will occur after initial Fire/Police size-up, reconnaissance, and life safety assessments, and a BCHMRA Response or Consult call is requested by the on-scene IC. Initial entry and recon of the event by the BCHMRA shall take place after all Team positions are in place, and it has been determined to be safe to begin rescue or mitigation efforts. The jurisdictions that are signatories to the Authority Agreement will ensure collective staffing levels to support a 24/7/365 response of the 13 qualified Technician level positions. Medical Support provided by the hosting jurisdictions' EMS or County EMS system. BFR supports the BCHMRA through its staff of 24 personnel who hold certification as hazmat technicians. To accomplish the response time goals of the IGA, BFR has minimum staffing of 3 technicians on shift per day.

Water Rescue

The Boulder area is a popular attraction for visitors, and this increase in population drives service demand. The Boulder community has two distinct areas of high use of recreational water areas. The Boulder Creek flows directly through the center of town and is virtually assessable the entire length of the creek as it flows through the city limits. This area sees a high use during spring runoff and is responsible for several incidents each year involving innertubes and kayaks. The Boulder Reservoir is the area's largest open body of water available for recreational use.

The BFR Water Rescue program is responsible for an initial emergency response to water emergencies. The purpose of the program is to provide training, equipment, and water/ice rescue services to the City of Boulder.

The Water Rescue Team has year-round capabilities for all water-related incidents including localized and area-wide flooding, open water dive rescue/recovery, surface ice rescue, ice diving, and swift water rescue and recovery.

Training Division

The Training Division staff includes a Chief, Captain, Safety Captain, and an Administrative Assistant. The Training Division is responsible for developing and providing comprehensive fire suppression and emergency medical service instruction to all members of the Department. The Division conducts regular exercises, live-fire drills, and specialized training. The Training Division is also responsible for training all new members entering the Department by ensuring proper onboarding and department familiarization.

All initial hires must first pass through the Firefighter Recruit Training Academy. The academy runs 16-weeks and meets all State Fire Marshal and NFPA Standards for Firefighter I certifications. Upon completion of the academy, recruits earn Firefighter I or II, Hazard Materials Operations and Car Seat Technician certifications. Recruits also receive training in water rescue, vehicle extrication, firefighter safety, and survival, low angle rope rescue, confined space rescue, 130/190 wildland training, forcible entry, hose management, search and rescue and various other fire ground operations.

The training division also manages in-service training, which is the training required to maintain certification. In-service training includes conducting live-fire training, aerial ladder operations, elevator rescue training, rail car rescue, gas and electrical utility control.

Support Services

The Support Services Division is staffed by five sworn personnel and four civilian employees that provide support for all line services within the department and is directed by the Deputy Chief of Support Services. The Division is responsible for overseeing the department's budget process, maintaining fleet and facilities, acquiring and renovating fire stations and facilities, overseeing the IT needs of the department, providing for departmental training, and providing for support for department initiatives such as accreditation and special research projects. The Support Services Division includes an Administrative Battalion Chief, a Training Division Chief, a Health and Safety Captain, a Training Captain, an Administrative Specialist, a Technical Systems Administrator, a Project Manager, and a Sr. Budget Analyst. The Support Services Division also provides for the provision of human resources activities by partnering with the City's HR department and legal support through the City Attorney's Office.

Community Risk Reduction Division

The Chief Fire Marshal oversees the Community Risk Reduction (CRR) Division. The staff includes four sworn personnel and four civilian employees. The CRR Division strives to identify and prioritize risk within the City of Boulder. The Division addresses risk with the intent to improve public safety and prevent the loss of property and life for the people who live and work within the community.

The 2012 International Fire Code (IFC) is the governing document for fire-related inspections within the city. Each of the approximately 5,000 businesses in Boulder has a fire code inspection once every other year; engine crews perform the inspections. The inspection checklist used is from the IFC.

Fire Inspectors conduct specialty Inspections. Specialty occupancies include:

- Marijuana
- Group H occupancies – Hazardous Material Users
- Food Trucks
- Educational occupancies
- Daycare centers

The public education programs target identified known community risks such as fire, flooding, and wildland fires. CRR provides fire-safety education for children and youth (preschool through college age) to senior citizens. Public education also focuses on people or groups that may have or present a greater risk to themselves or the community. Boulder Fire-Rescue Department provides annual education and hands-on training to both on-campus resident assistants and Greek organizations within the CU Boulder structure. The Division also works with local businesses and organizations by inspecting buildings and reviewing construction plans for fire prevention (2A.8).

Enforcement of the adopted fire code is another program that CRR uses to improve and reduce risk within the City. Through the fire code, CRR reviews and approves plans for new and remodeled buildings. Permits are issued, and follow-up inspections are performed to ensure the business is meeting the terms and conditions of the permit. Inspections of existing business are conducted to not only mitigate hazards, but to also educate the business owner on reducing risk to customers, employees, and emergency responders.

Lastly, fire investigation falls under the purview of CRR. Fire investigators investigate the causes of fire to identify risk and current trends that require the attention of the education or enforcement staff.

Administrative Battalion Chief

The Administrative Battalion Chief's duties center around the maintenance of all facilities, equipment, and apparatus. The Administration Battalion Chief oversees the maintenance of the department's apparatus, staff vehicles, and the department's eight stations and support facilities.

Information Technology Analyst

The Information Technology (IT) Analyst is responsible for the management and coordination of all departmental technology initiatives including software, hardware, telecommunications, and technology infrastructure projects and maintenance. The primary duties of the position include implementing and maintaining BFR software systems, ordering hardware and maintaining associated inventories, coordinating department telecommunications, and implementing technology infrastructure projects and maintenance. The IT

Analyst serves as the primary database administrator of all fire department records systems. Additional duties include participation in special departmental projects related to technology and data.

Project Manager Data and Analytics

The project manager of data and analytics is responsible for data analysis, project management, process improvement, gap analysis, and strategic planning efforts. The project manager of data and analytics manages the accreditation process and authors the CRA/SOC.

Senior Budget Analyst

The Senior Budget Analyst is responsible for the coordination of all departmental financial activities. Primary duties include development and ongoing monitoring of the annual budget, establishing and maintaining sound internal financial policies and processes related to purchasing and revenue collection, and ensuring adherence to citywide financial and accounting policies. Additionally, the Senior Budget Analyst serves as a strategic adviser to Boulder Fire-Rescue's Executive Leadership Team for matters including, but not limited to, budget development, master planning, collective bargaining agreement negotiations, and financial reporting and analysis.

Communications

The City is a member of the Boulder Regional Emergency Telephone Service Authority (BRETSA), formed in 1987 through a countywide Intergovernmental Agreement (IGA). BRETSA is authorized to set fees for 911 service. Utilizing the money collected through the 9-1-1 surcharge, BRETSA provides significant assistance in bringing Enhanced 911 (E-911) telephone and dispatching services to Boulder County and the cities, towns and fire protection districts located in Boulder County. The governing body of BRETSA is the Colorado Statutes and an IGA. Management oversight is through a Board.

The board consists of four permanent members and one rotating member having a one-year term. While BRETSA contracts out for needed services and support, as an emergency telephone service authority, it has no employees.

There are four public safety answering points (PSAP) in Boulder County, Colorado University, BFR/BPD, Longmont FD/PD, and Boulder County. Boulder County dispatched 24 of the 26 fire agencies in the County.

The Boulder Police Department is responsible for all public safety 911 access and communications services, including police, fire, and EMS dispatching. The oversight of the Communications Center is the responsibility of the Support Services Division of the Police Department, and day-to-day operational oversight is by a non-uniformed communications manager.

There are 26 authorized dispatchers and 4 Dispatcher Supervisors; all personnel has qualifications that allow them to operate in police, fire, and EMS dispatching. The center also employs a System Administrator, an Administrative Assistant, and the Communications Manager. The minimum staffing is four personnel, one for the police radio channel, one for fire and EMS, one of the data channel and one dedicated 911 call-taker. If necessary, the supervisor can fill in at any position.

For medical emergencies, the dispatch center uses Emergency Medical Dispatch (EMD) with Priority Dispatch ProQA software. During an emergency medical 911 call, ProQA guides the dispatcher through collecting the vital information from the caller, obtaining the patient's status, choosing an appropriate dispatch level, and instructing the caller with medically approved protocols until the dispatched units arrive at the scene.

Once the EMD determines the level of concern using the answers to key questions and the additional information, the proper dispatch determinant can be selected using the Dispatch Determinant Theory. There are six dispatch determinant categories, A = Alpha B = Bravo C = Charlie D = Delta E = Echo Ω = Omega.

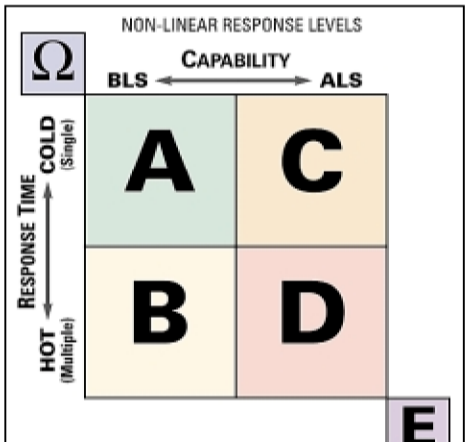


Figure 20: Non-Linear Response Level Theory

Fig. 3-14. Non-Linear Response Level Theory. The MPDS, v11.1 protocols. ©1978-2001 MPC.

Facilities and Apparatus

The department operates out ten facilities, of which seven are primary response stations. The average age of the primary fire stations is approximately 46 years of age. The remaining facilities provide a variety of services to the department, including apparatus maintenance, training, and facilities maintenance. The training center is a regional training facility shared with other County departments. Most of the Department's management and administrative functions are at Fire Headquarters, a shared building with Human Resources and Innovation and Technology.

All stations have one engine/pumper. The minimum staffing on the front-line apparatus is three personnel: one officer, one fire engineer, and one firefighter. The role of the engine company during fire suppression operations is to pump water onto the fire through a variety of fire hoses and associated appliances to lower the temperature of the fuel below its ignition temperature thereby extinguishing the fire. The engine crew operates provides BLS EMS hose lines, conducts search and rescue, and performs any other duties conducive to quick and effective fire containment that contributes to saving lives and protecting property.

The following pages discuss the station location and apparatus at each.

Station 1

2441 13th St. Boulder CO, 80304

Station 1 was built in 1957 and services central Boulder including the Pearl Street Mall and responded to approximately 4,500 emergency calls per year.

STATION 1 APPARATUS

TYPE	Year	Make	Model	Staffing
ENGINE 2501	2016	Pierce	Enforcer (Pumper)	3
LADDER 2516	2012	Pierce	Platform (100')	3
BC CAR	2018	Ford	F250	1

Figure 21: Apparatus at Station 1

Station 2

2225 Baseline Rd. Boulder, CO 80302

Station 2 was built in 1959 and services the the University of Colorado and University Hill area. Station 2 responded to approximately 2,800 emergency calls a year.

STATION 2 APPARATUS

TYPE	Year	Make	Model	Staffing
ENGINE 2502	2010	Pierce	Arrow XT	3
ENGINE 2538	2008	Pierce	Contender Type III	Cross Staffed

Figure 22: Apparatus at Station 2

Station 3

1585 30th St. Boulder, CO 80303

Station 3 was built in 1964, and covers the central portion of the city and responds to approximately 2,400 emergency calls per year. The Water Rescue Team is at Station 3.

STATION 3 APPARATUS

TYPE	Year	Make	Model	Staffing
ENGINE 2503	2011	Pierce	Arrow XT	3
DIVE VAN 2521	2005	Freightliner	Cargo Van	Cross Staffed
BOAT			16’ Flat Bottom	

Figure 23: Apparatus at Station 3

Station 4

4100 Darley Ave. Boulder, CO 80303

Station 4 was built in 1967 and staffed with a two-person “mini-pumper.” Station 4 services south Boulder and response to approximately 800 calls per year

STATION 4 APPARATUS

TYPE	Year	Make	Model	Staffing
ENGINE 2504	2016	Pierce	Enforcer	3

Figure 24: Apparatus at Station 4

Station 5

4365 19th St. Boulder, CO 80304

Station 5 was built in 1992 and was originally opened to provide service to north Boulder and was staffed with a two-person “mini-pumper.” In 1992, the station was relocated to its current location and responded to approximately 1,100 emergency calls a year.

STATION 5 APPARATUS

TYPE	Year	Make	Model	Staffing
ENGINE 2505	2019	Pierce	Dash	3
UNIT 2532	2000	Ford	F550 Type VI	Cross Staffed

Figure 25: Apparatus at Station 5

Station 6

5145 63rd St. Boulder, CO 80301

Fire Station 6 was built in 1979 to cover the Gunbarrel area and IBM headquarters. Fire Station 6 responds to approximately 300 emergency calls a year.

STATION 6 APPARATUS

TYPE	Year	Make	Model	Staffing
ENGINE 2506	2017	Pierce	75’ Quint	3

Figure 26: Apparatus at Station 6

Station 7

1380 55th Ave. Boulder, CO 80301

Station 7 was built in 2000 to provide services to eastern Boulder and responds to approximately 700 emergency calls a year. Station 7 houses a three-person Type I engine crew, Hazardous Materials truck, a hazardous materials trailer, and a confined space trailer. The Hazardous Materials Team is here.

STATION 7 APPARATUS

TYPE	Year	Make	Model		Staffing
ENGINE 2507	2017	Pierce	75' Quint		3
UNIT 2523	2008	Pierce	Contender Rescue	HazMat	Cross Staffed
RESERVE 2515	2004	Pierce	75' Arrow Quint		

Figure 27: Apparatus at Station 7

Station 8

6075 Reservoir Road Boulder, CO 80301

Station 8 is a dedicated Wildland Fire Station. Station 8, built-in early 2015, and located in Boulder County Regional Fire Training grounds; the station houses the Wildland Division and BFR's fire cache, including three additional staff response vehicles not listed in the chart below.

This station consolidated multiple Wildland facilities that were used by BFR. Co-located at the Boulder Regional Fire Training Center (BRFTC), the station will provide additional facilities when the training center is functioning as an incident command post during major Boulder County emergencies.

VEHICLE	TYPE	YEAR	MAKE	MODEL	STAFFING
2533	Type 6	2015	Ford 550	Custom	
2539	Type 3	2014	Pierce	Wildland Engine	
	Truck	2013	Ford	F-350	Cross Staffed
	Truck	2013	Ford	F-350	Cross Staffed

Figure 28: Apparatus at Station 8

Boulder Regional Fire Training Center

The fire department utilizes the BRFTC, located on approximately 10 acres east of the Boulder Reservoir, for much of its training activities. Opened in 2010, under a cooperative agreement between the City and Boulder County, the center is operated today under an intergovernmental agreement between the two. The mission of the Boulder County Regional Fire Training Center (BCRFTC) is to promote safety through training. The BCRFTC provides the facilities to foster education, practice, and promotion of skills for our fire service personnel.

The main features of the facility consist of a classroom building, a training tower, and a burn building. The main facility holds three classrooms, two conference rooms, offices for the training staff, kitchen facilities, restrooms, and locker room facilities, weight training area, and a large apparatus bay that can be used for inside training space or parking fire trucks inside during inclement weather while crews attend training sessions. The training center can seat 230 people. Each classroom has seating for 100, with both classrooms connected there is seating for 200. Additional seating is available in both conference rooms; the first floor can accommodate ten seats, and the second-floor conference room can accommodate 20 seats. If needed, the training center could accommodate an additional 250-300 in the apparatus bay. Training support functions like laundry and breathing air refill are also in this building.

The training tower is a five-story building providing numerous props and training opportunities: ladder training, high-rise operations, rappelling, roof smoke ventilation, and confined space rescue. The burn building is used to simulate fire attack, search and rescue, smoke ventilation, and a variety of other firefighting skills. Clean wooden pallets are burned to create just enough fire and smoke for training.

Other features of the training center include a pump test area for annual pump training, vehicle extrication areas for crews to become prurient in automobile extrication, a propane car fire simulator for crews to practice proper vehicle extinguishment techniques, and a large driving area for cone course for apparatus operation.

Inspections

Crews perform occupancy inspections. Occupancies get divided by the address of the building; odd addresses completed during the odd years even addresses completed on the even years. The occupancies are totaled, then divided evenly amongst the station territories and crews. Breaking up the territory is done automatically through ESRI software. “H” occupancies (fraternity sorority, schools, food trucks) are done by a fire inspector. In 2018 the department built an ESRI Operations Dashboard to monitor the progress of crews.

Ther is no requirement for pre-fire plans currently. IPads were purchased in 2017 and deployed in January of 2018. Crews collect data in the ESRI Collector App. Pre-Fire plans are available through the ESRI Viewer App and Active 911. In the future, a formal pre-planned program will be in place, as well as pre-plans available on each MDT.

Insurance Services Office (ISO)

The Fire Suppression Rating Schedule (FSRS) is a manual containing the criteria ISO uses in reviewing the fire prevention and fire suppression capabilities of individual communities or fire protection areas. The schedule measures the major elements of a community's fire protection system and develops a numerical grading using credits, called a Public Protection Classification (PPC™). The FSRS utilizes nationally accepted standards to compile the PPC.

During the last evaluation in 2015, BFR has a rating of ISO 03/3X. Class 1 through Class 8 represents fire suppression systems that include an FSRS credible dispatch center, fire department, and water supply. In a split classification, the first-class applies to properties beyond 1,000 feet of a hydrant or alternate water supply. The second class applies to properties beyond 1,000 feet of a fire hydrant but within five road miles of a recognized fire station. Below is the countrywide distribution of communities by the PPC grade and on the next page is a snapshot of BFR's rating schedule.

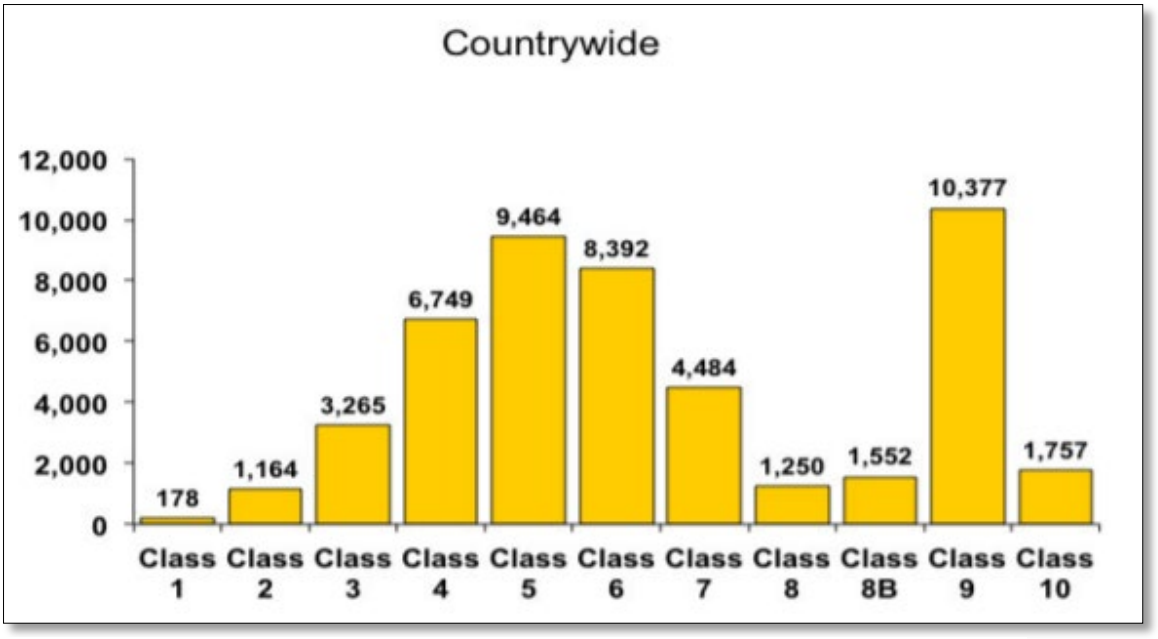


Figure 29: Countrywide Distribution of communities by PPC 2016

FSRS Feature	Earned Credit	Credit Available
Emergency Communications		
414. Credit for Emergency Reporting	2.55	3
422. Credit for Telecommunicators	2.75	4
432. Credit for Dispatch Circuits	1.80	3
440. Credit for Emergency Communications	7.10	10
Fire Department		
513. Credit for Engine Companies	5.81	6
523. Credit for Reserve Pumpers	0.48	0.50
532. Credit for Pump Capacity	3.00	3
549. Credit for Ladder Service	1.72	4
553. Credit for Reserve Ladder and Service Trucks	0.12	0.50
561. Credit for Deployment Analysis	7.35	10
571. Credit for Company Personnel	7.01	15
581. Credit for Training	6.34	9
730. Credit for Operational Considerations	2.00	2
590. Credit for Fire Department	33.83	50
Water Supply		
616. Credit for Supply System	29.01	30
621. Credit for Hydrants	2.84	3
631. Credit for Inspection and Flow Testing	2.40	7
640. Credit for Water Supply	34.25	40
Divergence	-3.59	--
1050. Community Risk Reduction	4.37	5.50
Total Credit	75.96	105.50

Figure 30: BFR's Rating Schedule

Community Expectations

The 2014 Boulder Community Survey indicated that 82% of respondents reported they felt at least somewhat safe from structural or house fires, a rating that was similar to the national benchmark and the same as reported in 2007. Nearly six in 10 of those completing the questionnaire felt safe from wildland fires, a decrease from previous years, perhaps due to the experience of the Four Mile Canyon fire in 2010. Ratings for fire response and EMS were up slightly from 2007 and were comparable to ratings in other communities.

In early 2018, BFR published a new community survey directly related to Fire Based ALS. The top three risks that residents and their families are concerned about are 1) emergency medical services, 2) structure fire suppression, and 3) wildfire mitigation. Ninety-Two percent of respondents are either very likely or likely to support BFR playing a role in ALS delivery, and 88% are either very likely or likely to support additional funding to support the delivery of these services. The Top three factors were in their decision to support BFR playing a role in ALS care were 1) lower average response times, 2) greater availability of ALS units in the City, and 3) continuity of care from the scene to the hospital. Feedback also included support of alternative response models for high-volume, low-acuity incidents.

The community values an emphasis on community risk reduction, and in particular, increased public awareness and education. Utilizing proactive mitigation related to wildfire has been communicated to staff. A focus group of BFR's citizen's academy identified these issues.
In 1970, the City of Boulder and Boulder County jointly adopted a comprehensive plan that guides land-use decisions in the Boulder Valley. The Boulder Valley Comprehensive Plan (BVCP) provides a general statement of the community's desires for future development and preservation of the Boulder Valley. The principles of sustainability and resilience are part of the framework of the comprehensive plan.

The determination of the adequacy of proposed or existing urban facilities and services surrounds five criteria. The Urban Service Standards are within the framework of these criteria. They include responsiveness to public objectives, the sufficiency of financing, operational effectiveness, proficiency of personnel, and location/adequacy of equipment and facilities.

According to the most recent Boulder Valley Comprehensive Plan update (2017), Urban Service Criteria and Standards are used to set the benchmark for providing a full range of urban services in the Boulder Valley. A basic premise of the Boulder Valley Comprehensive Plan is that "adequate urban facilities and services" are a prerequisite for urban development. Within the Boulder Valley, the City of Boulder is the provider of choice for urban services since it can meet all the service provision requirements embodied in the Urban Service Criteria and Standards.

The goals state in the BVCP for Urban Fire Protection and Emergency care outlined within the BVCP are as follows:

1. Responsiveness to Public Objectives:

a) Consistently evaluate current service delivery for fire protection, all-hazard response and EMS.
b) Evaluate current service delivery against national standards, national guidelines and customer expectations.
c) Develop benchmarks for improvement across all areas of service delivery.

2. Sufficiency of Financing:

a) Ensure current financing supports existing level of service delivery.
b) Plan for future financing to support benchmark service delivery.
c) Be organized to receive and utilize grants and state and federal funds when available.

BVCP cont.

3. Operational Effectiveness:

a) Fire and EMS response:

i. Provide fire and EMS response 24 hours per day, 365 days per year.
ii. Arrive at fires and medical emergencies, staffed and equipped to provide fire suppression and/or medical care, within six minutes of the original 911 call ninety percent of the time.
iii. Have an ERF dictated by the nature of the emergency, on scene within eleven minutes of the original 911 call ninety percent of the time.
iv. Collaborate with neighboring jurisdictions to supplement response when additional resources are needed.

b) All-Hazard response:

i. Equip and train personnel to respond to technical rescues, hazardous materials incidents, water rescues, and natural disasters.
ii. Collaborate with neighboring jurisdictions to supplement response when additional resources are needed.

BVCP cont.

c) Wildland Fire response and mitigation:

i. Equip and train personnel to respond to wildland fires in urban and rural settings.

ii. Collaborate with neighboring jurisdictions to supplement response when additional resources are needed.

iii. Integrate wildfire hazard mitigation planning with urban design and development.

d) Community Risk Reduction:

i. Provide fire safety education for all ages and demographic groups.

ii. Adopt fire and life safety codes.

iii. Review and approve plans for fire safety systems for new and remodeled buildings for compliance with fire and life safety codes.

d) Community Risk Reduction (cont.)

iv. Regularly inspect businesses and high hazard occupancies for code compliance. v. Provide voluntary home safety inspections.

vi. Work with the Local Emergency Planning Commission to maintain an inventory of hazardous materials storage. vii. Review the design of land development in relation to emergency response, access, and available water supply.

viii. Identify and mitigate risks associated with the negative impacts of climate change.

4. Proficiency of Personnel:

a) Firefighters shall be trained to perform the duties of their assigned position as well as those they may be expected to perform outside their assigned position.

b) Firefighters shall maintain appropriate certifications as dictated by the department, state and federal regulations.

c) EMS providers will be trained to the level of EMT-Basic or EMT-Paramedic based on whether they provide basic or advanced life support and will maintain that level of certification based on state and federal requirements.

d) Hazardous materials responders will achieve and maintain training and certification at the Operational or Technician level.

e) Wildland firefighters will achieve and maintain training and certification based on their expected level of response.

f) Administrative personnel will achieve and maintain training and certification based on their assigned job duties.

5. Adequacy of Equipment and Facilities:

a) Fire stations will be located in such a manner as to achieve response time goals. See Operational Effectiveness 3.a.

b) Fire stations will be constructed in such a manner as to provide adequate, appropriate and secure living space for current and anticipated staffing needs. Considerations will include privacy, nondiscrimination and occupational safety.

c) Fire stations will be constructed in a manner to help the city meet its climate action goals.

d) Fire apparatus and equipment will be designed and purchased to meet the current and expected needs of the department.

e) See also “Public Water” for information on fire hydrant requirements[2]

[2] Boulder Valley Comprehensive Plan

Innovation

Open Data Catalog

The City of Boulder has a public-facing open data catalog where departments voluntarily post data for public engagement. BFR has been a contributor to the open data catalog since 2016. Fire response areas, station locations, response times, and unit response times are all in the data catalog. Data sets are available through an ESRI GIS portal which allows for almost live updates to the data set.

Boulder Measures

The City of Boulder's Community Dashboard provides the public with data related to city programs and community indicators, organized according to the city's Sustainability + Resilience Framework. Developed by the community, the framework provides a vision for an inspired future and aligns efforts across the city by establishing a common language for goals and priorities. We are working to enhance this dashboard using public feedback, so check back for ongoing updates. Many of the community indicators in Boulder Measures also have the full underlying data published online in the Open Data Catalog.

Dashboards

ESRI Operations Dashboard - Operations Dashboard for ArcGIS is a configurable web app that provides location-aware data visualization and analytics for a real-time operational view of people, services, assets, and events. From a dynamic dashboard, view the activities and key performance indicators most vital to meeting your organization's objectives. BFR currently has 5 dashboards published for use by personnel. The dashboards in use are Incidents, Units, Inspection Progress, Home Assessments, and a Battalion Chiefs view.

Power BI - Power BI is a business analytics service that delivers insights to enable fast, informed decisions. The data can be transformed into visuals and share them with colleagues on any device. BFR is in the process of deploying these dashboards to SharePoint. By Q1 2020, all dashboards should be available to personnel.

Section IV: All-Hazard Risk Assessment and Response Strategies

Risk, as defined by the Federal Emergency Management Agency (FEMA), is a combination of hazard, vulnerability, and exposure. It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage.

The risk assessment process plays a crucial role in guiding the department when making decisions regarding resource allocation and deployment. The intent of a risk assessment is to guide the process of reducing or eliminating the loss of life and property resulting from local threats. Threats include hazards, such as fire, emergency medical events, floods, earthquakes, and tornadoes, as well as technological hazards such as terrorism, dam failures, and hazardous material spills (2B.4,2B.5,2B.6).

During a risk assessment, the department should define the difference between the capability to mitigate an emergency in a detached single-family dwelling, multi-family dwelling, industrial building, and high-rise by placing each in a separate category for assessment in the community risk model.

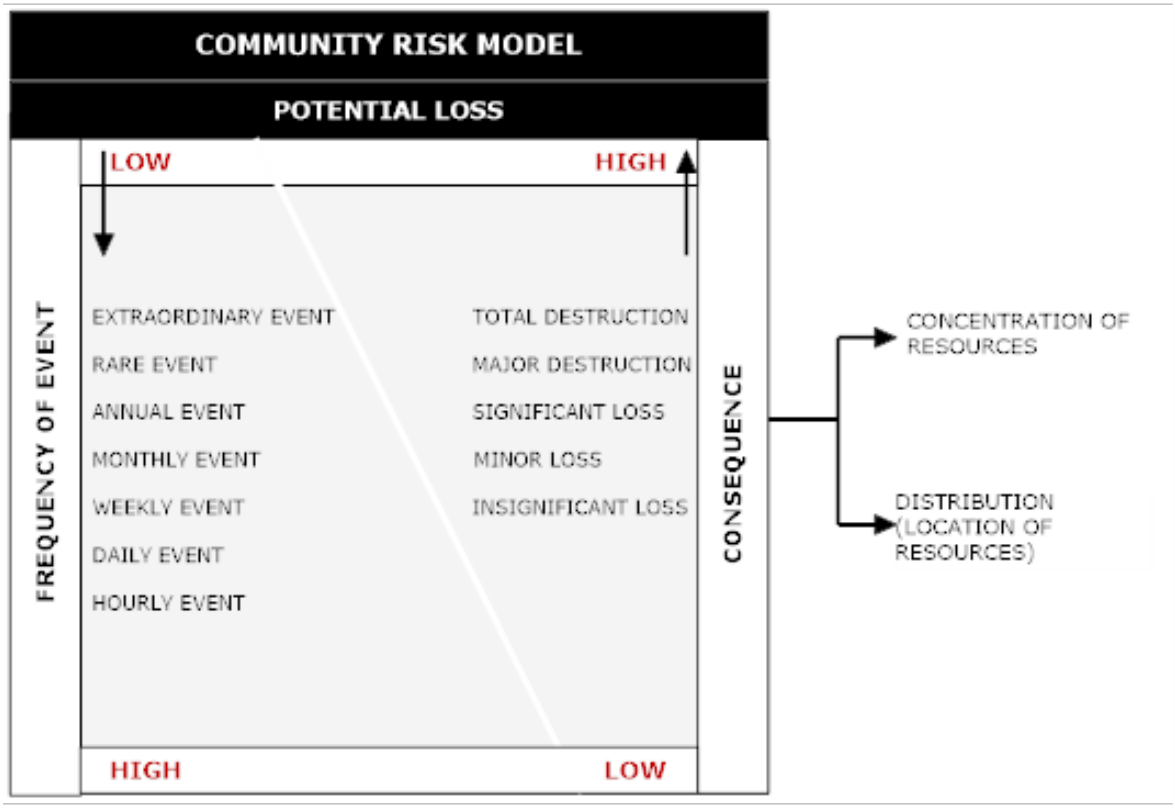


Figure 31: Community Risk Model

Natural and Community-Wide Hazards

The city of Boulder is at the base of the Rocky Mountains; the location is prone to severe weather events that include thunderstorms (including hail), lightning, and winter storms. These precipitation-oriented events can also lead to wide-scale flooding. The region also experiences high wind events, particularly during the Spring.

The community is home to several governmental facilities including the National Institute of Standards and Technology (NIST) laboratories, offices of the National Oceanographic and Atmospheric Administration (NOAA), as well as the University of Colorado, as well as several defense-oriented technology companies such as Ball Aerospace, McDonnel Douglas, and Lockheed Martin. These facilities are subject to the risk of terrorist attack and represent a large economic driver in the community.

Hazard	Geographic Extent	Probability of Future Occurrences	Magnitude/Severity	Significance
Avalanche	Limited	Unlikely	Negligible	Low
Dam Failure	Significant	Unlikely	Catastrophic	High
Drought	Extensive	Likely	Critical	High
Earthquakes	Significant	Occasional	Limited	Medium
Floods	Significant	Occasional	Catastrophic	High
Human Health Hazards:				
Pandemic Flu	Extensive	Occasional	Critical	High
West Nile Virus	Extensive	Likely	Negligible	Low
Landslides & Rockfalls	Limited	Occasional	Negligible	Low
Severe Weather:				
Extreme Temperatures	Extensive	Highly Likely	Negligible	Low
Fog	Significant	Unlikely	Negligible	Low
Hailstorms	Extensive	Likely	Limited	Medium
Thunderstorms	Extensive	Highly Likely	Limited	Low
Lightning	Extensive	Highly Likely	Limited	Medium
Tornadoes	Limited	Occasional	Negligible	Low
Windstorms	Extensive	Highly Likely	Limited	Medium
Soil Hazards:				
Expansive Soils	No Data	No Data	No Data	Low
Land Subsidence	No Data	No Data	No Data	Low
Volcanoes	Limited	Unlikely	Negligible	Low
Wildfire	Limited	Likely	Critical	High
Winter Storms	Extensive	Highly Likely	Critical	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

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Figure 32: City of Boulder Hazard Identification Table

Natural disasters

The number of natural disasters in Boulder County is 13 and is at the US average of 13. There have been five presidentially declared major disasters and four declarations of emergencies in most recent history. Causes of natural disasters: Fires: 5, Floods: 5, Storms: 4, Landslides: 3, Mudslides: 3, Snows: 2, Heavy Rain: 1, Hurricane: 1, Snowstorm: 1, Tornado: 1 (Note: some incidents may are in more than one category).

Drought

Unlike other weather events, drought does not occur quickly; it is a gradual process. Droughts differ from typical emergencies. 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 impacts are wide-reaching and may be economic, environmental, and 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.

The City of Boulder's Drought Plan gives guidance for recognizing droughts that will affect water supply availability and for responding appropriately to these droughts. The city uses rules and regulations to provide specific details that the city manager, in consultation with City Council, may use to declare or lift a drought alert stage as well as guide an appropriate response to a drought event.

Earthquake

Boulder-area historical earthquake activity is slightly below Colorado state average and 40% greater than the overall U.S. average.

Tornado

Boulder County historical tornado activity is above Colorado state average. It is 7% greater than the overall U.S. average. Both tornados in recent history were over 25 miles away from the city center.

Flooding

In the State of Colorado, Boulder has the highest flash flood risk. The City has a high-risk for flash flooding because it sits against the mouth of Boulder Canyon. Boulder Creek flows down Boulder Canyon and through downtown Boulder. Boulder Creek is a 31.4mile-long (50.5 km) creek draining the Rocky Mountains to the west of Boulder. Two tributaries form the creek rising along the Continental Divide: North and Middle Boulder Creek; and later joined by South Boulder Creek. In addition to Boulder Creek, 11 additional drainages flow into the City.

Figure 33: 2013 Flood Damage

Serious floods have affected downtown Boulder in 1894, 1896, 1906, 1909, 1916, 1921, 1938, and 1969 with the worst being those of May 31-June 2, 1894 and May 7, 1969. The flood of 1969 was the result of four days of almost continuous rainfall 11.27” measured in Morrison and 9.34” at the Boulder Hydroelectric Plant. There was one death reported and thousands of dollars’ worth of damage including two bridge washouts.

In 2013, an all-time 24-hour record rainfall of 9.08” deluged the city of Boulder resulting in widespread flash flooding and the death of three people. 12.27" had accumulated from September 9th through September 12th. This accumulation surpassed most tropical storm events. Other locations in the Boulder and Rocky Mountain Front Range picked up over 11” of precipitation in just a 24-hours. Flash floods occur quickly, and without warning, there is an immediate danger from strength of current, debris injury/drowning. Flash floods typically occur from heavy rainfall – overflow stream banks. Below is a map of the floodplains in Boulder.

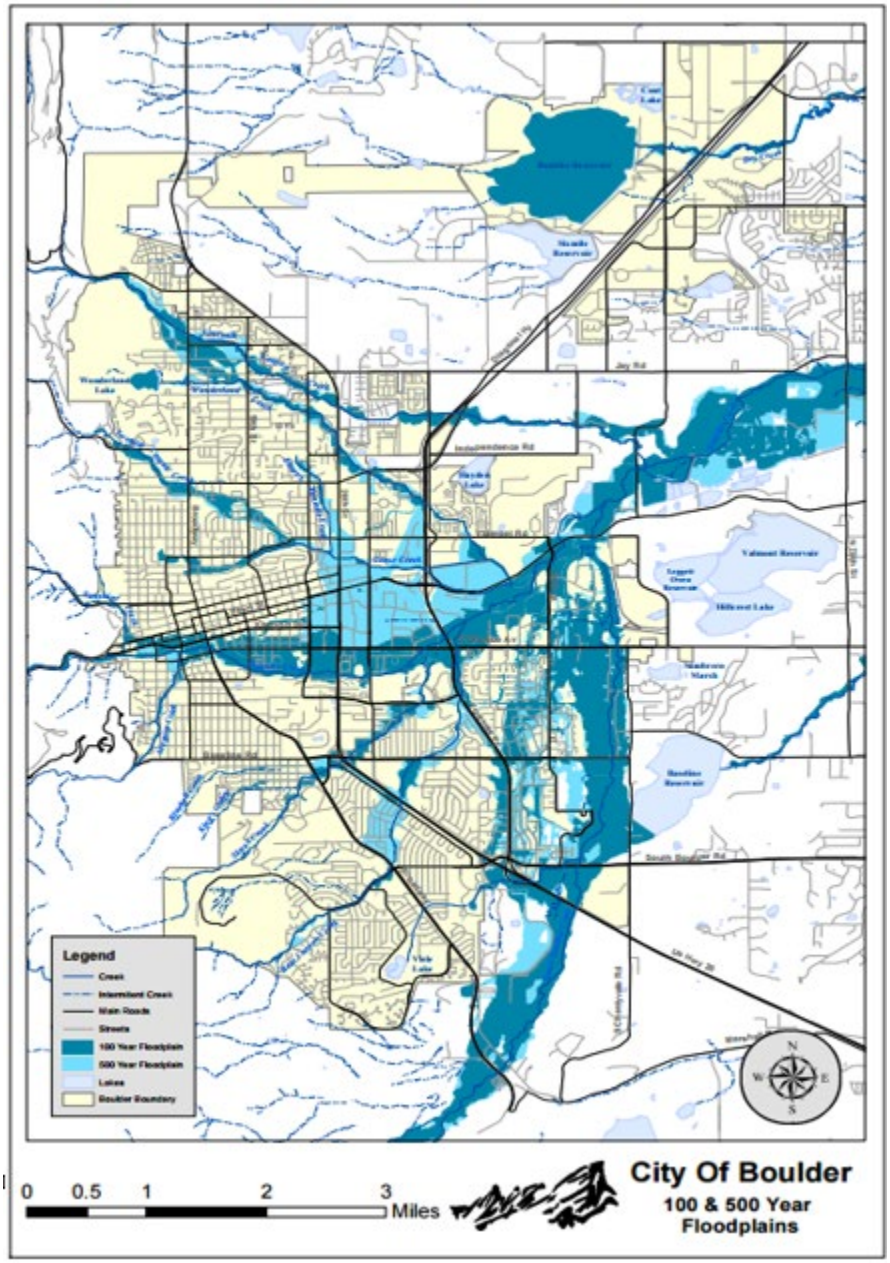


Figure 34: City of Boulder, 100- & 500-Year Floodplains

Critical Infrastructure

Critical infrastructure provides essential products and services to the public that are necessary to preserve the welfare and quality of life in the City and County of Boulder. Critical infrastructure support important public safety, emergency response, and disaster recovery functions. It is of great importance that the City prioritizes mitigation actions which reduce the risk of damage to these facilities that are so essential to the City's wellbeing (2A.9).

Aggregate	Classification	Classification Count
At Risk Population Facilities	After School Care	15
	Child Day Care	100
	Licensed Home Day Care	19
	Schools	40
	Senior Center	4
	Senior Housing	25
	Total	203
Essential Services Facilities	Airport	1
	Communications	64
	Emergency Medical Services	2
	Emergency Operation Centers	3
	Emergency Warning Systems	16
	Fire Station	7
	Government Buildings	17
	Hospitals	3
	Police	5
	Shelters	19
	Urgent Care Facility	2
	Utility - Power Plant	5
	Utility - Substation	4
	Utility - Wastewater Facilities	2
	Utility - Water Facilities	12
	Total	162
Hazardous Material Facilities	Hazmat Facilities	82
	Total	82
	Grand Total	447

Source: City of Boulder, Boulder County, CDOT, HAZUS-MH 2.1

Figure 36: City of Boulder Critical Facility Summary

Terrorism

Terrorisms definition, according to the Federal Emergency Management Agency is the use of force or violence against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion, or ransom. The most frequently used terrorist methods in the U.S are Chemical, Biological, Radiological, Nuclear, and Enhanced Explosive threats (CBRNE) which could be used during terrorist attacks.

Traditional weapons, such as guns are also used by terrorists worldwide, but demand fewer resources when these incidents occur. Although not listed in the acronym, Cyberterrorism is also a threat to our infrastructure. A cyber-attack could potentially disrupt communications, banking systems, power systems, and emergency networks. Since terrorist activities cannot be predicted, all areas of a city are at risk, and susceptible to the hazard. High-risk areas include main thoroughfares and interstates, railroads, airports, and chemical companies throughout the City.

Emergency Risk

The next section will evaluate the risk present to the population of the city of Boulder. The section will cover Emergency Medical, Fire, Wildfire, Rescue, Hazmat risk, and non-emergency risk. Due to the diverse population in the city of Boulder, there is an additional "human risk" factor that is not present in all communities, and that is the risk posed by the transient population in the city of boulder. Human risk includes college students and people experiencing homelessness. While difficult to measure, the department has been able to uncover an increase in incidents during certain periods. As seen the chart below, there is a distinct increase in call volume beginning in September and tapering off by November; the same time students return to college and subsequently go home for winter break.

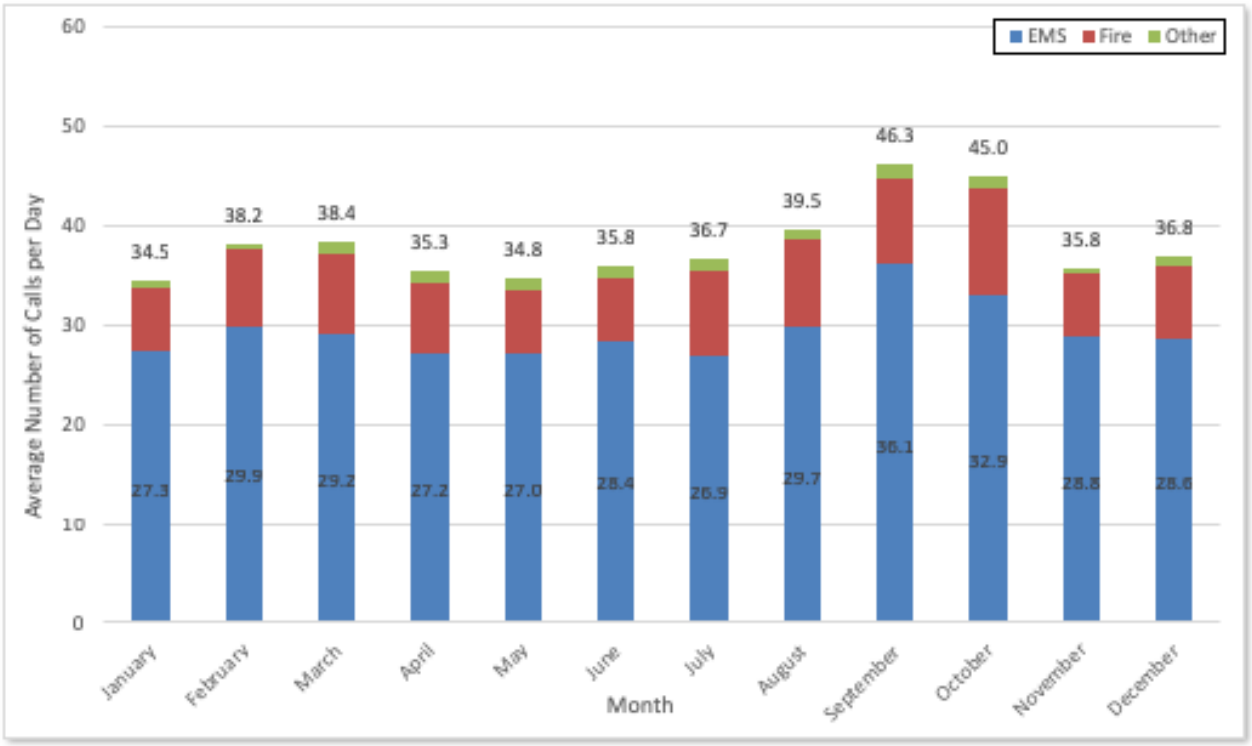


Figure 37: Average Calls per Month

Planning Zones

In 2016, BFR drafted a new methodology (2B.1) for identifying, assessing, categorizing, and classifying risk throughout the community. A building risk assessment form was used to categorize each building in one of four categories: maximum, high/special, moderate, and low risk. Buildings were grouped by similar risk level, and planning zone geography was outlined. Planning zone geography is based on main arteries in the city. Table 2 in section 1 describes each planning zone and its boundaries. Fire protection systems are identified and included in the risk assessment (2C.3), although they are not considered for the deployment of resources at this time. Consideration is being given to triaging fire alarm calls at Colorado University with the Police Department.

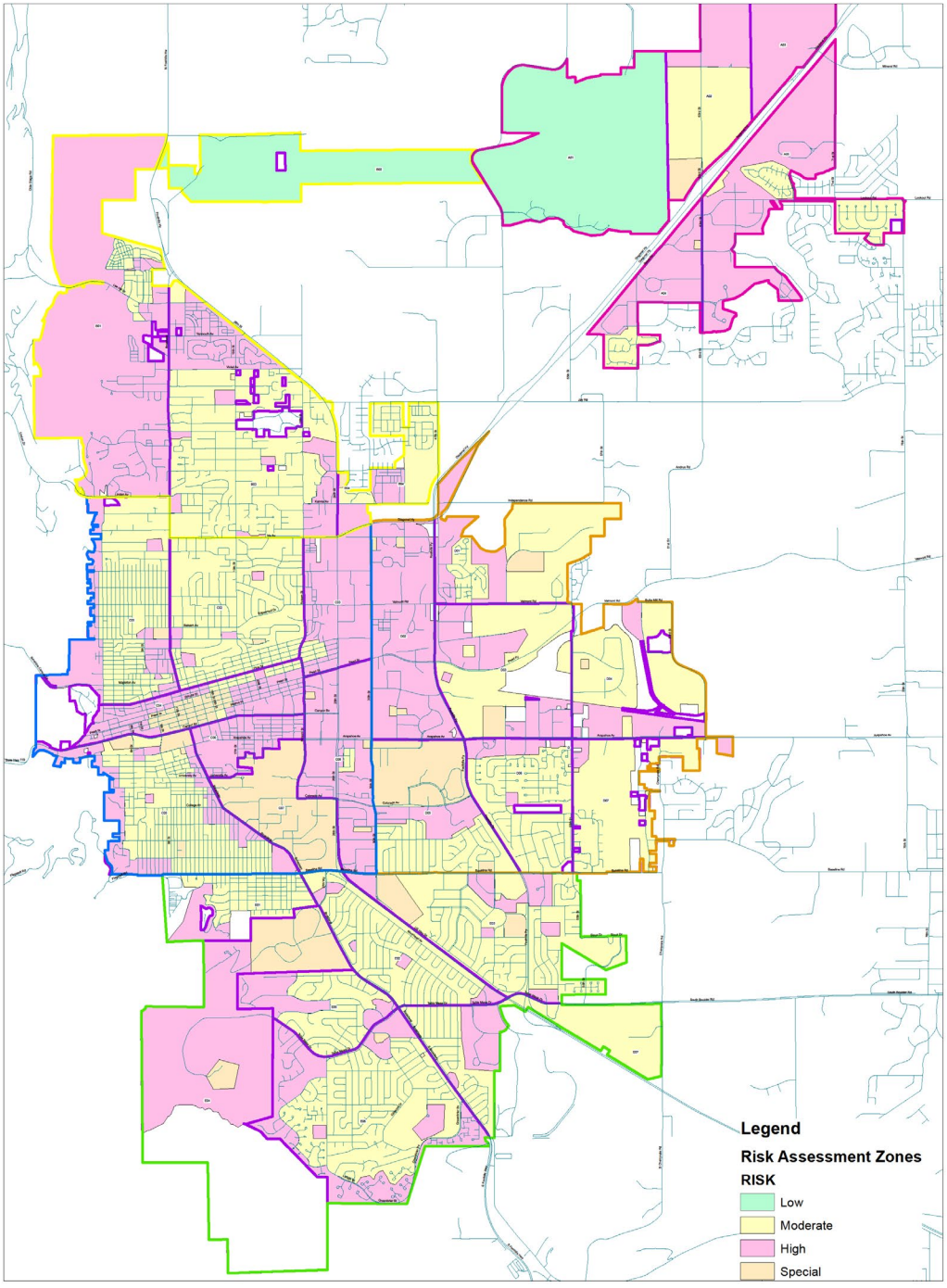


Figure 38: Planning Zone Risk Assessment

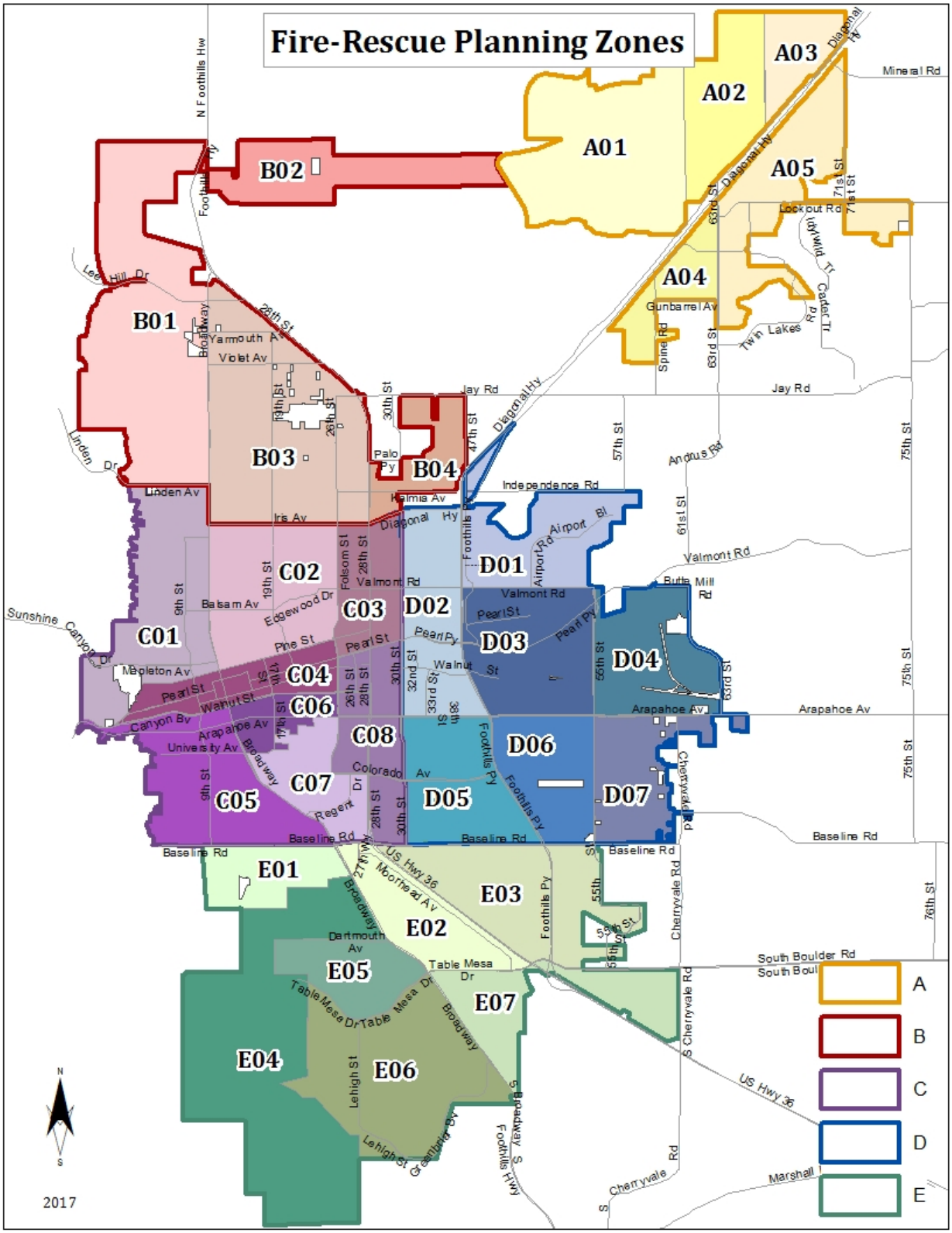


Figure 39: Planning Sub-Zones

Planning Zone and Sub- Zone Risk

Below are tables outlining risk in each subzone. The table includes and all-hazards approach to risk. The remainder of the planning zone contains: Open Space - A1 and A2 & Residential/Light Commercial - A5

Zone A Risk

The area is closest to Station 6.

Zone	Address	Special	Maximum	High	Moderate
A1	6055 Reservoir RD - BCRFTC	X			X
A2	5605 63rd - Boulder Reservoir Water Treatment Plant			X	
A3	6555 Monarch Rd - IBM			X	
A4	5145 N 63rd - BFRD Sta. 6	X			X
A5	6405 Odell Pl – Storage Units		X		

Table 3: Zone A Risk

Zone B Risk

The area is closest to Station 5.

Zone	Address	Special	Maximum	High	Moderate
B1	Lee Hill – access issues			X	X
	4900 N Broadway – light commercial				X
	Open Space WUI		X		
	Residential & Light Commercial				X
B2	Open Space				X
B3	4365 19th – BFRD Sta. 5	X			X
	1897 Sumac – Crestview Elementary			X	
	Quince & Broadway				X
	2100 Norwood – Centennial Middle School			X	
	3955 28th – Sunrise assistant living				X
	3845 Northbrook – high-density housing			X	
	2700 Winding Trail - residential high-density & access			X	
	Robin Hood Area – residential. High-density & access issues.			X	
	Willow Springs Shopping Center				X
	19th & Joslyn- residential – Density & access issues.			X	
	3690 Broadway – residential Melody Hts / access			X	
	Rest of Planning Zone - residential				X
B4	2800 Palo Parkway – Manor Care Senior Care				X
	2800 Kalmia – The Boulders – Residential high-density & access issues			X	
	Four Mile Creek - residential access, narrow streets and blockage			X	
	Pleasant View Fields - access				X

Table 4: Zone B Risk

Zone C Risk

The area closest to Station 1 and a portion of Station 3. The remainder of the planning zone contains Residential - C1, C2, C4, C5.

Zone	Address	Special	Maximum	High	Moderate
C1	1100 Alpine/1100 Balsam – Old Boulder Community Hospital				
	Open Space WUI		X		
	Balsam/Maxwell/Broadway/9th Residential access & density				X
C2	2121 Mesa – Mesa Vista long-term care facility				X
	2441 13th – BFRD Sta. 1	X			X
	3130 Repplier – Columbine Elementary			X	
	19th & Alpine – residential access				X
	1225 Alpine - commercial				X
	2600 Broadway - commercial				X
	2401 13th – Casey Middle School			X	
	Rest of Planning Zone				
C3	Commercial				X
	High-Density Housing				X
C4	Pearl Street Retail area		X		
	Open Space WUI		X		
C5	1777 6th – Boulder County Justice Center			X	
	1777 Broadway – City Government			X	
	Arap. 9th -6th – residential - access				X
	1150 7th – Flatirons Elementary School			X	
	1050 Arapahoe – Presbyterian Manor - Senior High Rise			X	
	Broadway corridor - Commercial High-Density Housing				X
	970 Aurora – Academy Senior Living				X
	Open Space WUI				
	2225 Baseline – BFRD Sta. 2	X			
C6	1604 Arapahoe – Boulder High School			X	
	Residential - Light Commercial				X
C7	University of Colorado - High-Density Residential Classrooms				X
C8	1585 30th – BFRD Sta. 3	X			
	29th Street Retail area			X	
	1055 Adams Cir. – Golden West Senior Residence/ High Rise			X	
	Commercial / Mixed Residential				X

Table 5: Zone C Risk

Zone D Risk

The area is closest to Station 7 and a portion of Station 3. The remainder of the planning zone contains Residential/industrial - D1, Commercial High-Density Residential D2

Medium Industrial Commercial D3, Light industrial D4, and Single Family Multi-Family Housing - D5,D6,D7.

Zone	Address	Special	Maximum	High	Moderate
D1	County Communications & Jail			X	
	Noble Park - High-Density Residential access issues				X
	Open Space WUI		X		
D2	3350 30th - Brookdale - Senior Living				X
	3375 34th - Brookdale - Senior Care			X	
	3065 Center Green Dr – Fire HQ			X	
	1805 33rd St – Police HQ/dispatch			X	
	3300 Fisher Dr – RTD Maintenance				X
D3	4747 Arapahoe – Boulder Foothills Hospital			X	
	Open Space WUI		X		
	Ball Aerospace	X			
	Pfizer Pharmaceutical		X		
	2075 55th – CordenPharma Chemical		X		
D4	5815 Arapahoe - Mixed-Use scary commercial industrial				
	County Sherffifs HQ				
	1901 63rd – Boulder County Recycling Center				X
D5	30th/Foothills/Arap/Colorado – CU east campus Student housing Light Industrial BioPharma Labs				X
	3995 Aurora - High Peaks Elementary School				X
	4685 Baseline – Boulder Manor Senior				X
D6	Arapahoe Corridor - Commercial				X
	1220 Eisenhower – Eisenhower Elementary School				X
D7	1380 55th – BFRD Sta. 7	X			
	Rest of Planning Zone	X			

Table 6: Zone D Risk

Zone E Risk

The area is closest to Station 2 and Station 4. The remainder of the planning zone contains Single-family residential – E1, E2, E3, E5, E6, E7

Zone	Address	Special	Maximum	High	Moderate
E1	Chautauqua	X	X		X
E2	505 27th Way Unprotected Multi-Family				X
	2700 Moorhead Residential with access issues				X
	3100 Bucknell – Halcyon School (Special Education)			X	
	3740 Martin Dr – Creekside Elementary School				X
E3	3300 Baseline - Williams Village high Rise Student housing			X	
	3275 Apache – Bear Creek Apartments High-density student housing				X
	4475 Laguna Apartments - access			X	
	4800 Baseline – Meadows Shopping Center				X
	350 Ponca/4950 Thunderbird Frasier Meadows Senior Living			X	
	4545 Sioux – Horizons K-8 School				X
	Manhattan to Tenino High-density Residential poor access				X
	290 Manhattan – Manhattan School of Arts				X
	South Boulder Circle High-density Residential poor access				X
E4	NCAR			X	
	NOAA		X		
	Open Space WUI		X		
E5	Open Space WUI		X		
E6	801 Gillaspie – Brookdale Meridian – Senior Living				X
	2500 Table Mesa – Bear Creek Elementary School				X
	1575 Lehigh – Mesa Elementary School				X
	1500 Knox – Southern Hills Middle School				X
	1515 Greenbriar – Fairview High School				X
	805 Gillespie Montessori School				X
	Open Space WUI – with limited access/narrow streets		X		
E7	1200 Broadway				X
	4655 Hanover – Summit Middle School				X
	Tantra Park – Multi-family housing with limit access				X
	Walden Cir – Multi-family with limited access				
	Table Mesa Commercial area				X
	Open Space WUI		X		

Table 7: Zone E Risk

Medical Risk

Close to 81% of the incidents handled by BFR annually involve the potential for treatment and transportation of individuals experiencing illness or traumatic injury. Emergency medical events are the most frequent non-fire risk. The nature of these injuries or illnesses can range from minor to life-threatening.

Most EMS incidents involve a single patient with repercussions to the patient's family, employer, and community. Motor vehicle accidents, workplace accidents, epidemic infectious disease, and other mass casualty incidents can affect multiple patients. The goal is to assess, treat, and stabilize the patient until an ambulance arrives. American Medical Response (AMR), a private ambulance service, is responsible for transporting patients.

Requests for EMS are increasing steadily. BFR experienced a 17% increase in EMS calls between 2006 and 2011, and an 11% increase between 2015 and 2018. With Boulder's population and employment projections, EMS incidents are expected to increase, particularly in areas redeveloped.

Risk Categories

Low

A low-risk EMS event is one that typically affects one patient and is low acuity. A low acuity incident has a determinant code of 'A' or 'B' in the priority dispatch systems. These events vary but are considered non-life threatening in nature.

Moderate

A moderate-risk EMS event is one that typically affects one patient. A moderate acuity incident would have a determinant code of 'C' or 'D' in the priority dispatch systems. These events are considered non-life threatening, but higher priority.

High

A high-risk EMS event is one that typically affects one patient. These events are medically severe and include cardiac and respiratory arrest. A high acuity incident has a determinant code of 'E' in the priority dispatch systems. These events are considered life-threatening.

Special

A special-risk EMS event is one that affects multiple patients. As with most agencies, the highest EMS risk is that of a Mass Casualty Incident (MCI). An MCI is any incident in which emergency medical services resources, such as personnel and equipment, are overwhelmed by the number and severity of casualties. These events can result from a wide variety of causes; however, for this category, the focus is on medical/traumatic injury risk. Within the category of MCI most commonly would be a multi-patient motor vehicle accident, second would be an active shooter event, and third would be an outbreak of an infectious disease.

Structure Fire Risk

The probability and consequence matrix from the CFAI Standard of Cover Manual is used to assist in the classification of fire risk, the. The matrix represents the considerations of risk in a community. Although there is always the possibility of an event occurring, the likelihood of the event is dependent on outside factors. During and after an event, there are potential consequences; the consequences range from insignificant to significant. The matrix displays the various combinations of the likelihood of an incident (probability) and the result

(consequence) for each of four risk categories (low, moderate, high, and maximum). To understand the fire risk posed to the community, BFR had to conduct a fire risk assessment for each occupancy within city limits.

Four relationships between structures/conditions and the distribution and concentration of resources. These relationships are low probability, low consequence, low probability, high consequence, high probability, low consequence, and high probability, high consequence.

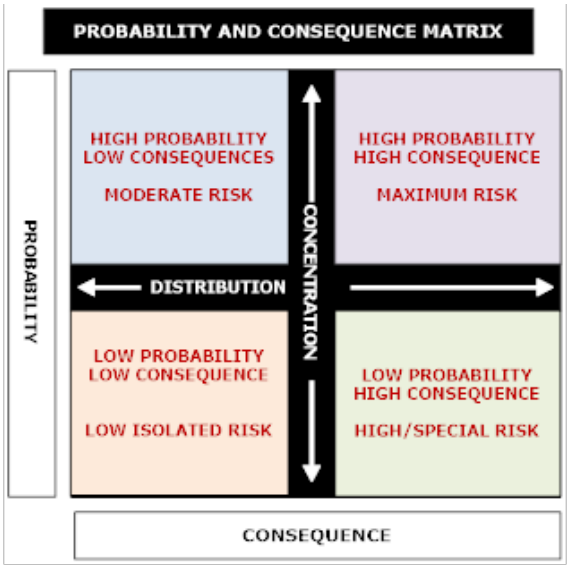


Figure 40: Probability and Consequence Matrix

LOW-RISK = LOW PROBABILITY, LOW CONSEQUENCE

A low-risk area is typically isolated from centers of population and has few buildings. These structures present the same strategic and logistical issues with low life loss potential and minimal financial impact on the local community if any at all.

Examples of a low-risk area are:

- undeveloped land/parking lots
- recreational areas (federal, state, and local parks)
- unoccupied structures (barns and small outbuildings, detached residential garages dumpsters)
- rural land with no occupied structures
- single-family homes with more than 2 acres of surrounding property

MODERATE-RISK = HIGH PROBABILITY, LOW CONSEQUENCE

A moderate-risk property will be in developed areas of average size. Structures have a significant risk of fire, but the consequence of a fire would be minimal to the community. Structures could have built-in fire suppression capabilities. The likelihood of fire is low, but the consequence of a fire would be significant and include high life loss. However, due to the built-in fire protection and suppression, the potential for a significant fire is greatly reduced. Examples of medium risk areas might include:

- detached, single-family housing including areas of suburban, terraced, semi-detached, multi-occupancy residential properties, mobile homes
- mixed low-risk industrial and residential areas
- Industrial or commercial areas of less than 5,000 sq. feet without high-hazard or high fire-load contents

HIGH-RISK = LOW PROBABILITY, HIGH CONSEQUENCE

Occupancies in the high-risk category include large commercial structures, shopping and business complexes, multi-story hotels, apartment buildings, theatres, schools, hospitals, and infrastructure facilities. Examples of such areas might include:

- Mercantile facilities, strip shopping centers, and business areas consisting of either single- or multi-story properties with a concentration of structures
- buildings with built-in fire suppression systems, but whose occupants are non-ambulatory or restrained (hospitals, medical facilities, personal care homes, and prisons)
- buildings with low occupant load, but these store high fire load materials or high-hazard materials
- infrastructure facilities, such as city halls, fire and police stations, schools, and city, state, or federal buildings
- industrial areas containing some high-risk occupancies
- aircraft off-airport property (hangars, operations facilities)

SPECIAL-RISK = HIGH PROBABILITY, HIGH CONSEQUENCE

Special-risk areas are typically commercial structures without built-in fire suppression systems. Occupancies include large shopping areas, multi-story hotels, and office complexes, and commercial facilities with extremely high fire load or hazardous materials.

These locations have the highest potential for life loss and community impact; additionally, they have the greatest risk of fire due to the lack of fire protection and suppression systems. Risks such as these frequently increase a fire department's need to have multiple alarm capability and an accurate assessment of its ability to concentrate resources. Failure to identify these risks often results in a department's inability to control the loss once a fire has occurred. These risks also create a fundamental need to assess mutual and automatic aid requirements to support the department's operations through assistance from other fire departments. Examples of maximum risk might include:

- the large shopping and business centers, large department stores, shopping malls, multi-story hotels, and office properties
- concentrations of theaters, cinemas, clubs, dance halls, and other entertainment centers
- concentrations of high-risk industrial or commercial property
- high-rise buildings, especially those without built-in fire suppression systems, or those without of service systems
- commercial buildings of more than 15,000 square feet with occupants who may require assistance

Smoke Detectors

The map below is a risk assessment that predicts the Census block groups least likely to have smoke alarms, and most likely to experience a fire fatality. It utilizes a mix of local fire incident data (where fire incidents have historically occurred) alongside US Census data to predict where fire risk is most likely. Areas in dark red are high-risk meaning they are least likely to have smoke alarms and most likely to experience a fire fatality. Lighter areas are low-risk meaning they are most likely to have smoke alarms and least likely to experience a fire fatality. The enigma smoke signals project is the basis for this model.

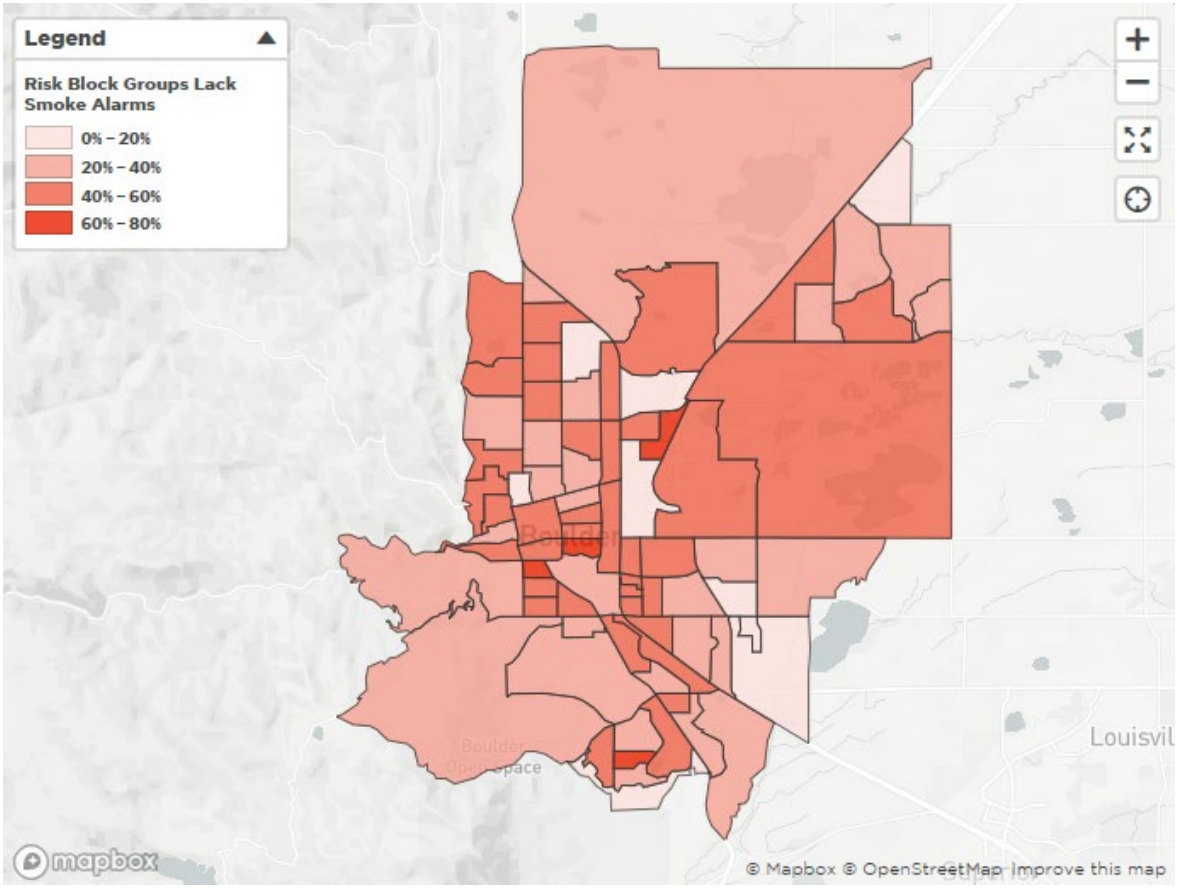


Figure 41: Smoke Detector Presence

Housing Density

Structures that contain 50 or more housing units present an increased fire risk due to more people per building and square footage per structure. Identifying (and keeping tabs on) buildings that contain a high number of housing units can be key to maintaining efficient community safety measures.

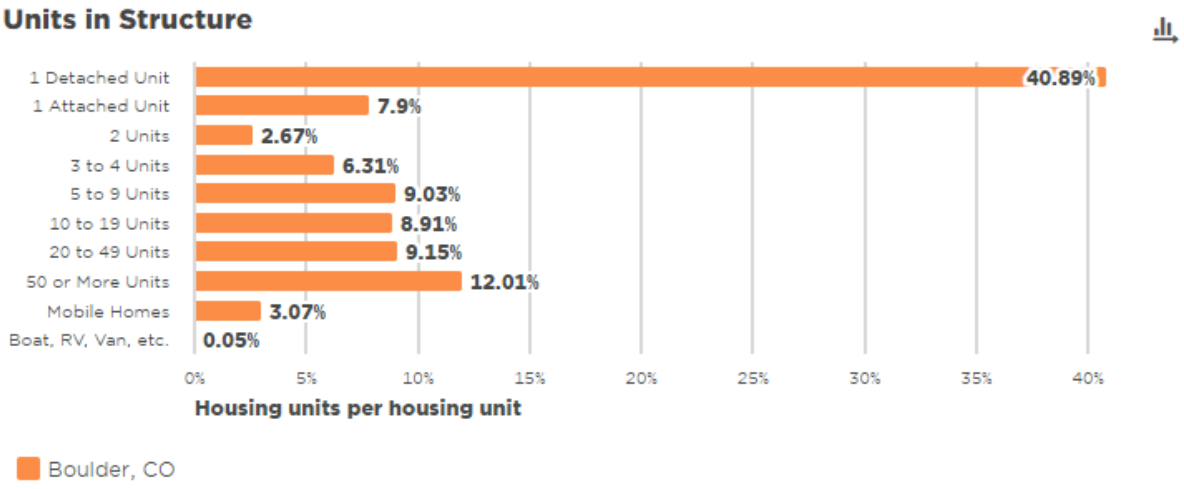


Figure 42: Residential Housing Units per Structure

Age of Housing Units

The U.S. Fire Administration reports socioeconomic factors, and the incidence of Fire found evidence that suggests the age of housing units is related to an increased fire risk. The bar chart below shows the percent of housing units in different age categories. Almost a quarter of all homes in Boulder were built in the 1970s. The median age of homes is 44 years old.

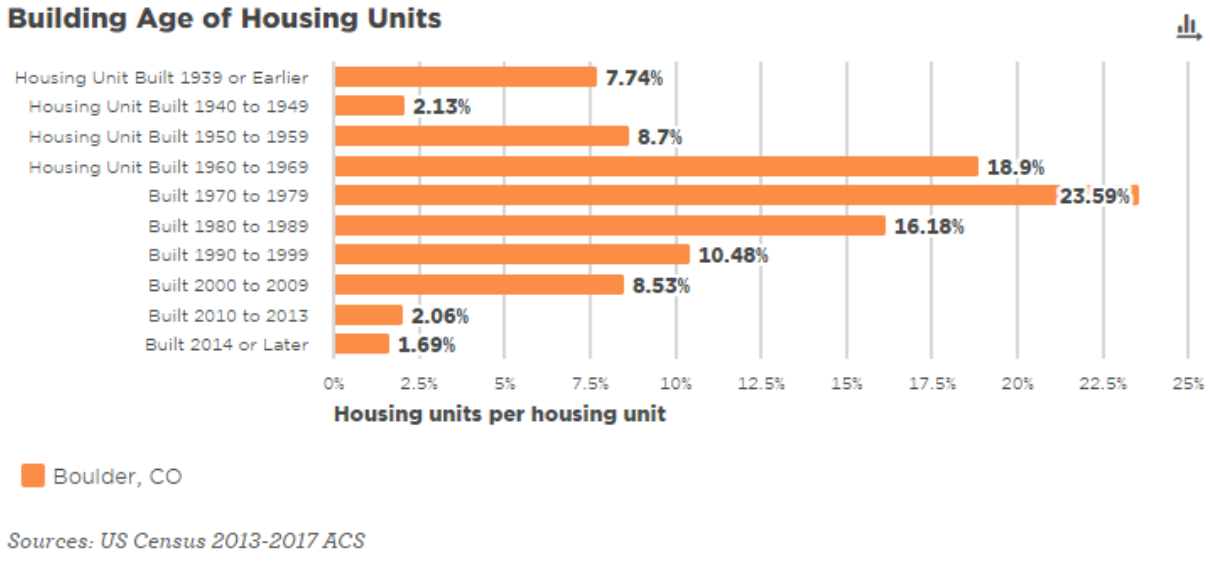


Figure 43: Age of Housing Units

Incidents of Structure Fires and Age of Structure

A regression analysis shows a correlation between older housing units and the increased risk of fire. In the City of Boulder, there is a weak negative correlation between incidents of structure fires and the age of structures.

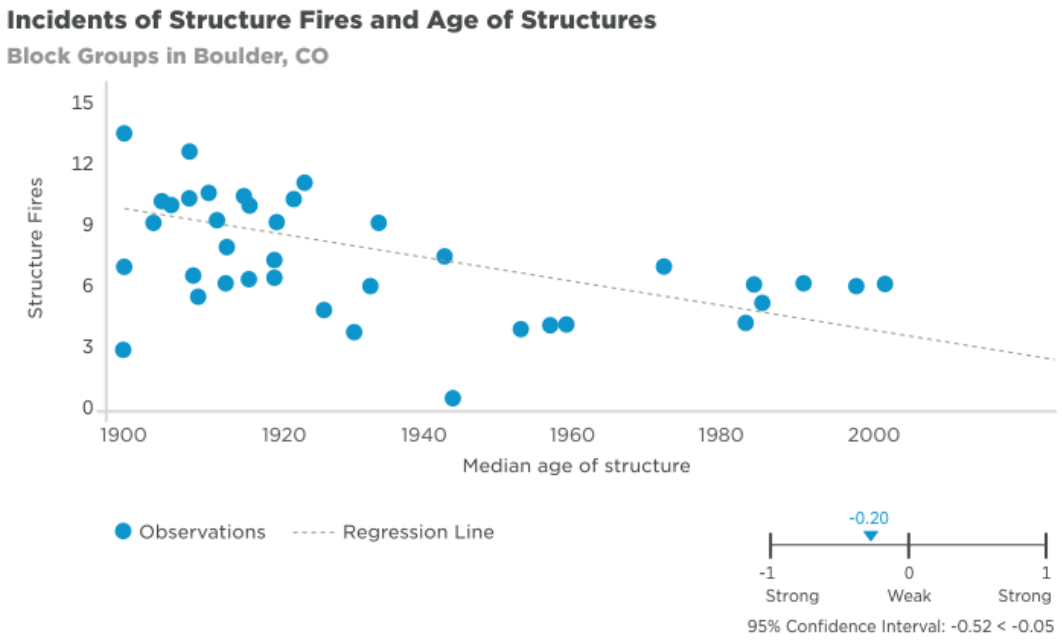


Figure 44: Incidents of Structure Fire vs. Age of Structure

Fire Flow and Available Water Supply

Like most Colorado communities, Boulder depends on stored water during most of the year. High streamflow and runoff from melting snowpack only occur during a few spring and summer months. The runoff from snowmelt gets captured in a series of reservoirs. The amount of water that is available for community use varies from year-to-year, depending on the snowpack in the surrounding mountains. The majority of the city's annual water supply comes from Silver Lake and Lakewood reservoirs on North Boulder Creek, Barker Reservoir on Middle Boulder Creek, and Boulder Reservoir.

The city maintains more than 450 miles of water pipe that serve more than 29,000 customers. The water department also maintains and services about 4,700 (294 private) fire hydrants. Fire hydrants are inspected, repaired, and painted by Public Works. The water department also routinely operates valves and flushes fire hydrants to ensure reliable, high-quality, potable water service.

The water system is extremely reliable, so volume and pressure in the system are excellent during normal fire operations. There are typically no problems acquiring and maintaining adequate fire flows.

According to the Boulder Valley Comprehensive Plan (BVCP), in single-family residential areas, fire hydrant spacing shall be no greater than 500 feet. No dwelling unit shall be over 250 feet from fire department access distance from the nearest hydrant measured along public or private roadways or fire lanes that are accessible and would be traveled by motorized firefighting equipment; in multiple-family, industrial, business or commercial areas, fire hydrant spacing shall not be greater than 350 feet. In all other areas, no exterior portion of any building shall over 175 feet of fire department access distance from the nearest hydrant measured along with public or private roadways or fire lanes that are accessible and would be traveled by motorized firefighting equipment; on divided highways; hydrants shall be on each side of highway.

Wildland Fire Risk

The major fire risk within the City of Boulder is the wildland interface primarily along the western edge of the city. Boulder County has experienced several major destructive wildfires in recent times. Notable fires are the 1989 Black Tiger, the 1990 Olde Stage, the 2003 Overland, and the 2010 Four-mile Canyon. These fires have collectively destroyed over 250 homes (and other structures), burned over 16,000 acres, and threatened the lives and properties of thousands of mountain residents. Wildfires have always been a natural occurrence in Boulder County, but various land management practices, including fire suppression, over the last 100 years has resulted in a forest with vegetation densities 10 to 100 times their natural state. Combine this with factors such as steep terrain, drought, high summertime temperatures, seasonal high winds, and an increased human presence in the form of development and recreational use, and the result is an environment prone to extreme wildfire behavior. Wildland Fire can have an immediate and primary impact on life safety for many residents living in and around the interface. The potential for large neighborhood conflagrations is real in the City of Boulder due to its layout and location in the foothills; this was evidenced by the Waldo Canyon Fire in Colorado Springs in 2012 in similar topography and proximity. Secondary impacts include damage to ecosystems and watershed, which can have decades-long impacts on the environment and ability to support community and economic vitality. The specific impacts include mudslides and drinking water contamination with sediment.

Summer is fire season with most fires occurring in July. However, wildfires occur throughout the year. In 2011, Colorado experienced major fires in January and February and a total of 64 fires in March. Dates of fires in the area demonstrate that wildfires occur year-round. Statistics from the Colorado State Forest Service from 1960-2009 show increases in the number and size of wildfires for the last several decades. These numbers do not include the elevated number of wildfires in 2010 and the beginning of 2011.

Although lightning is a concern, humans caused Boulder Counties' most catastrophic fires. The fire causes were arson (1980 Pine Brook Hills), discarded smoking material (Black Tiger), poorly extinguished campfire (2000 Walker Ranch), fireplace ashes that had dumped outside of a mobile home (2006 Elk Mountain), and a residential fire pit (2010 Fourmile Canyon Fire).

Wildfires can compromise water quality both during active burning and for months or years after the fire occurred. During active burning, ash can settle on lakes and reservoirs used for drinking water supplies.

Storms following wildfires are known to impair drinking water supplies in the western U.S., as burn areas are prone to greater rates of erosion, increasing the downstream accumulation of sediment in streams, rivers, and reservoirs. Thus, the potential impacts from past, current, and future wildfires on the quantity and quality of runoff are considerable, and may greatly impact water used for domestic, agricultural, and ecological water supplies.

Wildfires also impact recreation, as areas disturbed by fire can leave unstable soils, and rocks, as well as fire, weakened stress that could pose a significant safety hazard to those visiting fire impacted areas. These areas would possibly close for several months due to safety concerns for the visiting public.

Fire suppression and other management practices over the last 100 years have resulted in forests that are denser than their natural state. With more fuel, we are experiencing more frequent high severity wildfire. In addition to destroying homes, these fires have a negative ecological impact on the ecosystem. These fires also increase the risk of flooding and the cost of restoration.

The high percentage of human-caused fires suggests wildfire prevention efforts may be able to reduce the number of ignitions and subsequent catastrophic fires.

According to the Boulder Community Wildfire Protection Plan, most local plans define their communities and assign them a community hazard rating from “low” to “extreme.” The following table was produced using information from the local plans. Wildland dispatch configurations should also be dependent on the location of the incident.

Wildfire Risk Categories

The table below outlines the categories of wildfire risk in the City of Boulder. On the next page is a map showing the Wildland Urban Interface (WUI). WUI is an area within or adjacent to an “at-risk community” that is identified in recommendations to the Secretary of Agriculture in a Community Wildfire Protection Plan. An “at risk community” is defined as a community within the wildland urban interface listed in the Federal Register notice, “Wildland Urban Interface Communities within the Vicinity of Federal Lands that are at High Risk from Wildfire”. At risk communities are areas where conditions are conducive to a large-scale wildland fire disturbance event, thereby posing a significant threat to human life or property.

City of Boulder

Technical Assistance: Anchor Point Group, LLC
Date of Plan: September 2007

	Community	Rating	Score
33	*Kohler Area*	*Very High*	*12*
34	*Upper University/Boulder Canyon Area*	*Very High*	*16*
35	*Shanahan West Area*	*Very High*	*19*
36	*Chautauqua*	*High*	*22*
37	*Upper Table Mesa Area*	*High*	*23*
38	*Dakota Ridge Area*	*High*	*24*
39	*Wonderland Lake Area*	*Moderate*	*27*
40	*Shanahan East Area*	*Moderate*	*28*
41	*East Side Area*	*Low*	*30*
42	*Lee Hill Area*	*Low*	*32*

*Scores read from graph.

Table 8: Wildfire Risk

Wildland Urban Interface

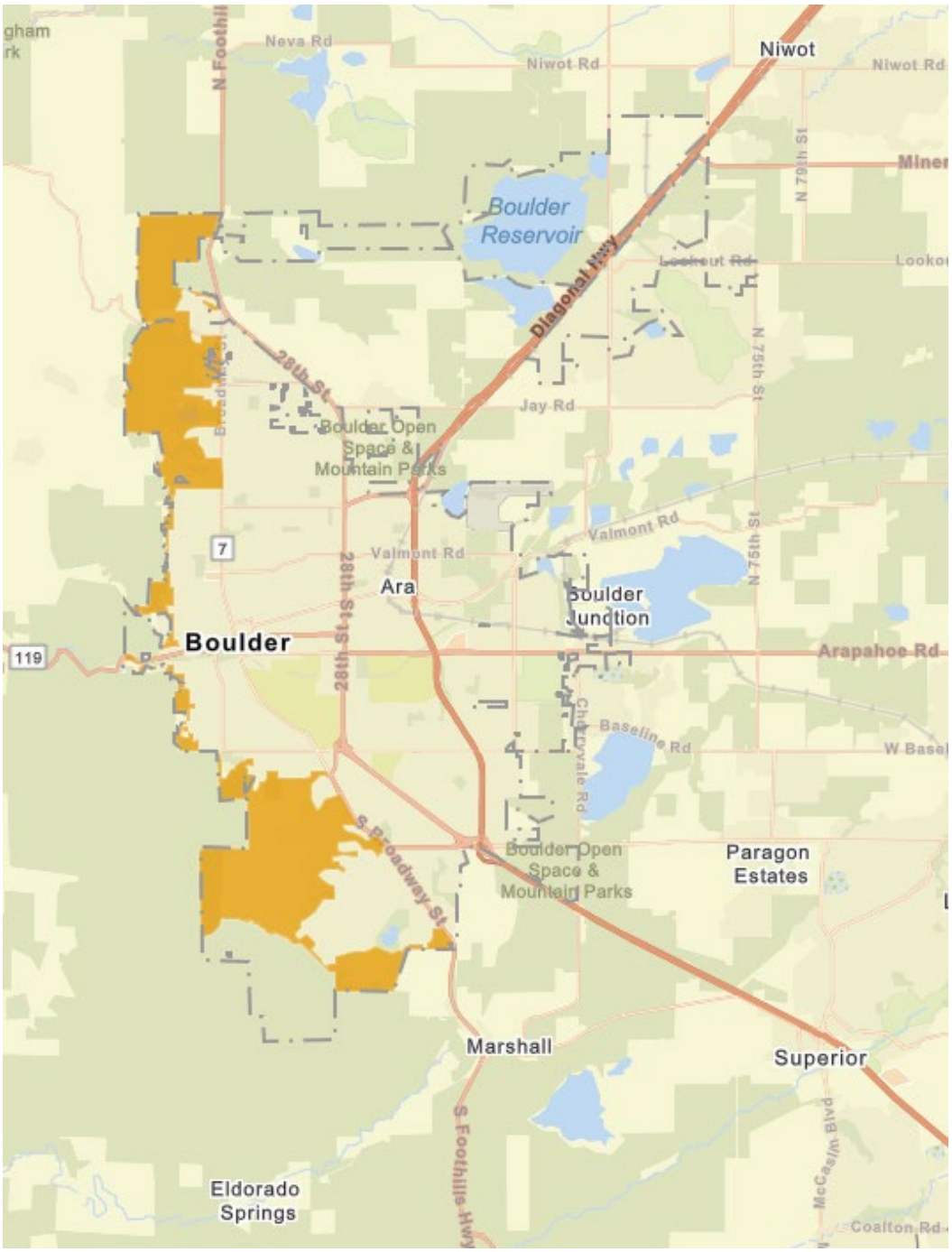


Figure 45: Wildland Urban Interface Map

Recent Wildfires

The shaded areas below is a pictorial representation of the most recent wildfires in Boulder County.

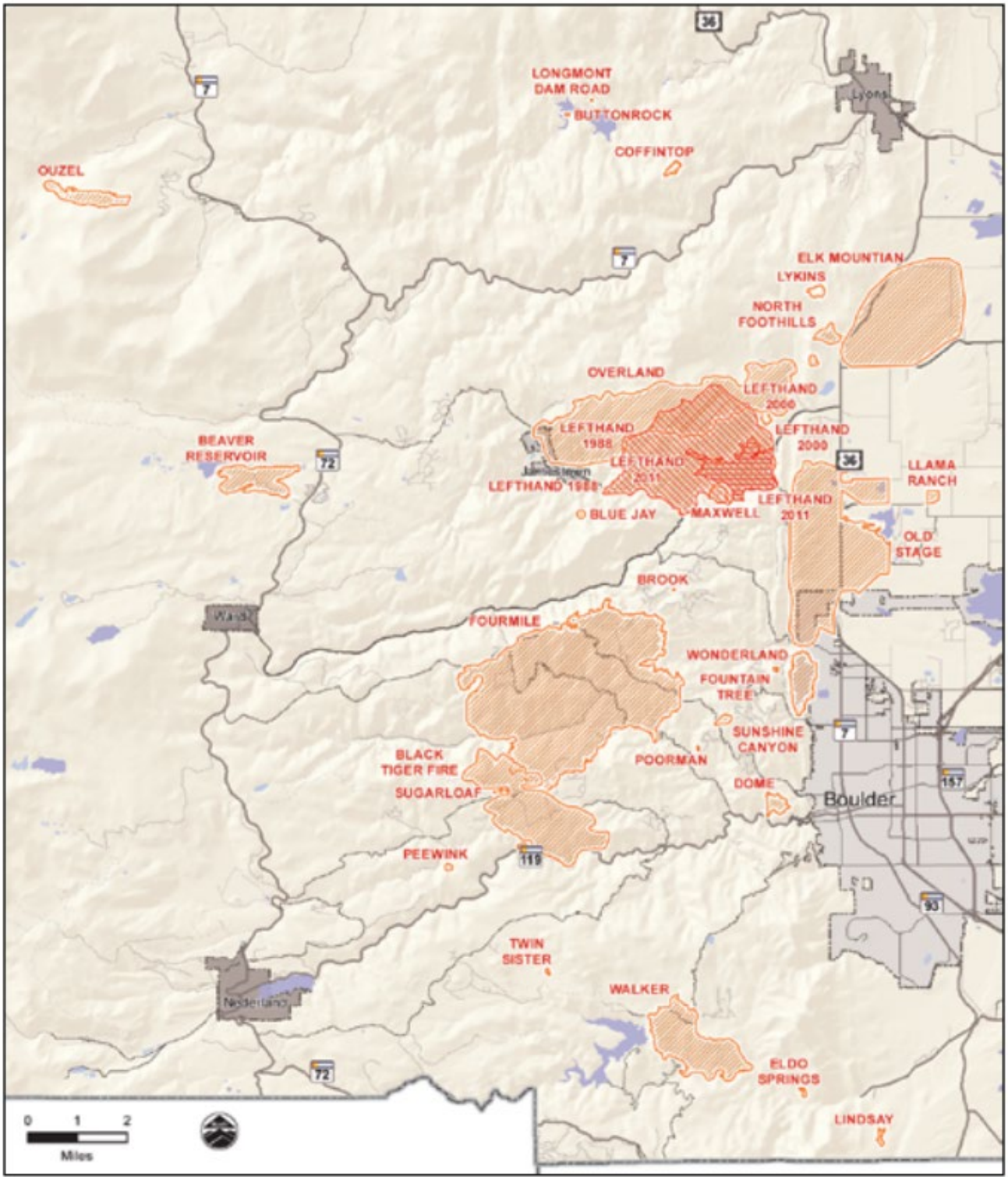


Table 9: Recent Wildfires

Technical Rescue Risk

Technical rescue incidents include water rescue (both surface and sub-surface), high angle rescue, collapse rescue, trench rescue, vehicle/machinery rescue, and confined space rescue. These incidents typically involve utilizing personnel with specialized skills and equipment to rescue persons who are unable to self-rescue from entrapment in a variety of conditions and environments. More common events are an elevator and low angle rescue, as compared to swift water.

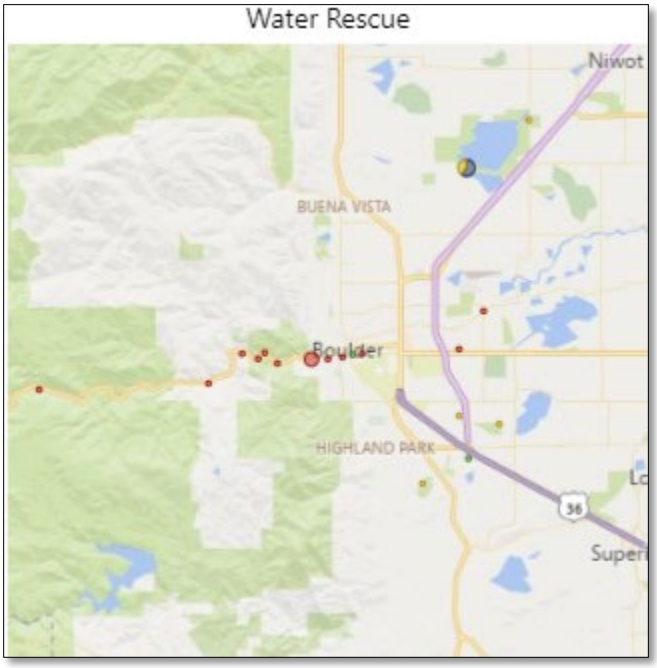


Figure 46: Water Rescue Incidents

Boulder Reservoir is a 700-acre recreation and water storage facility. Public use of the reservoir increases the potential for water rescue incidents. With freezing conditions in the winter, the water freezes and thaws throughout the winter, creating an unstable ice structure. Moving water is also a concern for BFR, with Boulder Creek traversing the city. Although water incidents are a risk, the frequency of these events is minimal. There are an average of 5 incidents a year, and happen were expected

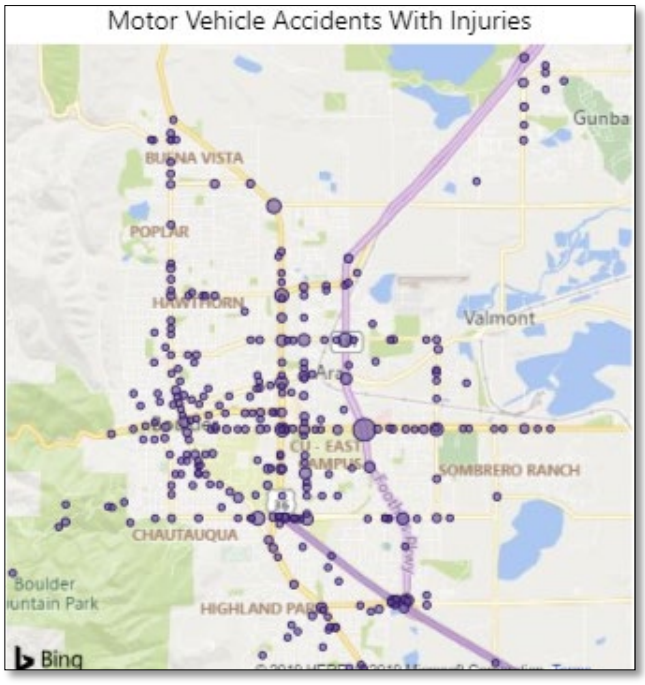


Figure 47: Motor Vehicle Accident History

The western part of the city includes mountainous terrain, combined with an active community of hikers, biker and rock climbers there is a high potential for high angle rescue incidents handled by Rocky Mountain Rescue (RMR).

According to the National Safety Council (NSC) Injury Facts, motor vehicle collisions (MVC) are the second leading cause of unintentional death. Impaired driving, distracted driving, speeding, and inexperience can cause a life to be cut short. In Boulder, approximately 6% of all incidents are motor vehicle-related.

The highest density of water rescues can be within, and just west of, planning zone C, outlined in blue. Zone C is the downtown corridor, but also the location of Boulder Creek.

The highest density of other rescue types is also located in planning zone C, as commuter traffic runs through this portion of the city.

Hazardous Materials Risk

Hazardous materials are chemical substances that, if released or misused, can pose a threat to the environment or the health of the population. These chemicals exist in industrial facilities, agriculture, medicine, research, and consumer goods. Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. These substances are most often released because of transportation accidents or because of chemical accidents in plants.

Historically speaking, in the City of Boulder the greatest number of hazardous materials incidents are low-risk. The incidents usually involve just the initial engine or ladder company. These calls would include leaking fuels from automobile accidents, minor spills at fixed facility research and manufacturing laboratories, fuel spills on construction sites, cut natural gas lines from excavations and carbon monoxide calls in residential buildings and single-family residences. They also involve small quantities of chemicals normally used in the home.

The largest risk of a moderate or high-risk hazardous materials incident in the City of Boulder and Boulder County lies with transportation. Rail incidents, although rare, pose the greatest risk due to the sheer volume of product involved. An incident involving a railcar or multiple cars could pose a serious threat to life and environment in the city and rural areas alike. A release could impact drinking water supplies and cause an economic impact on businesses and agriculture in the affected area.

Roadway incidents are more common than rail incidents. These incidents are the second area of concern because of the high frequency of occurrence. Although the quantities are less than in a rail incident, the vehicles carrying these products have greater access to a larger portion of the city and county. Roadway transportation also involves more product handling than rail as the railcars move through the city and county they load and unload less frequently and in fewer, designated locations. Roadway vehicles load and unload on a very frequent basis all over the city and county, from gas stations to chemical facilities to hospitals and manufacturing locations. The routes taken are broader. Even with the hazardous cargo (HC) route running along the east side of the city, these transport vehicles may be on any street at any time if the originating location or destination lies away from the HC route.

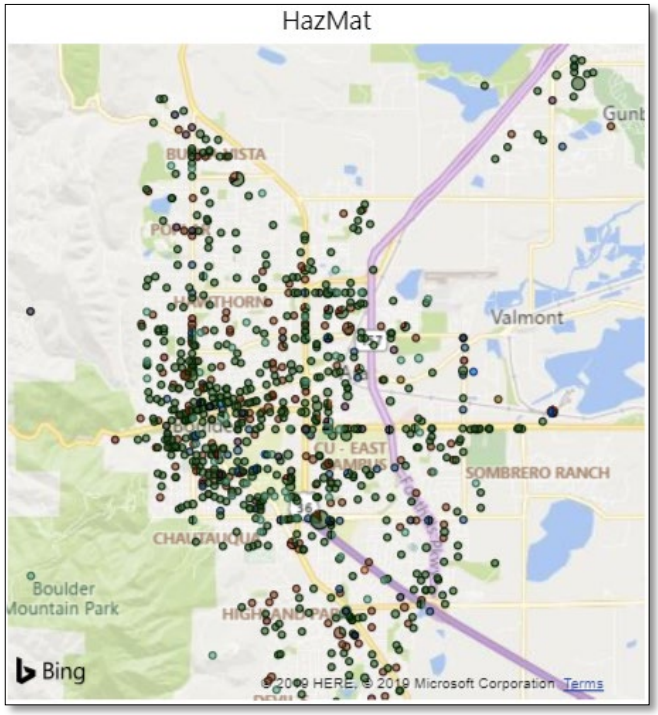


Figure 48: Hazmat Historical Incidents

The highest likelihood for a hazmat incident in the city of Boulder is in quadrant C, bordered in blue. The quadrant has the highest population a building density in the city. The map to the right depicts all hazmat incident in the last four years. The map includes all risk levels.

Section V: Current Deployment and Performance

The City of Boulder Fire-Rescue department is a medium-sized, all-career fire department that provides all-risk emergency services, including a dedicated wildland fire division. The goals of the mission statement are to make Boulder a safe place to live and work and to reduce the human suffering caused by fires, accidents, sudden illnesses, hazardous material releases, or other disasters.

BFR has eight stations that are located strategically around the city to provide a timely response to all incidents. All addresses in the City of Boulder limits are within two miles of a fire station. The department operates one ladder truck, and seven engines with designated staffing of 3 firefighters per company Emergency responders are at seven fire stations located throughout the incorporated areas of the city. The on-shift Battalion Chief is at Station 1 on 13th St.

BFR provides wildland mitigation, suppression, and education (public and in-house) out of Station 8. The station is located at the Boulder County Regional Fire Training Center and is used by the Wildland Division. The wildland division does not play a role in first-due (distribution) responses.

The department provides cross-staffing of 1 water rescue vehicle with a boat, 2 Type 6 brush engines, and 2 Type 3 brush engines. The Hazardous Materials unit, owned by the Boulder County Hazmat Authority, is located at Station 7 and cross-staffed by the personnel at that station.

BFR has established a dispatch configuration for each incident type. The incident type is based on the type of risk. Through evaluation of incident types and critical task analysis, it has been determined that the dispatch codes, and deployment array needs to be further evaluated to better match the needs of the community. A description of each dispatch configuration can is in the Appendix.

The department attempts to provide consistent service levels based on the number of resources available within the city and the distance between these resources (2C.1).

Incident Volume

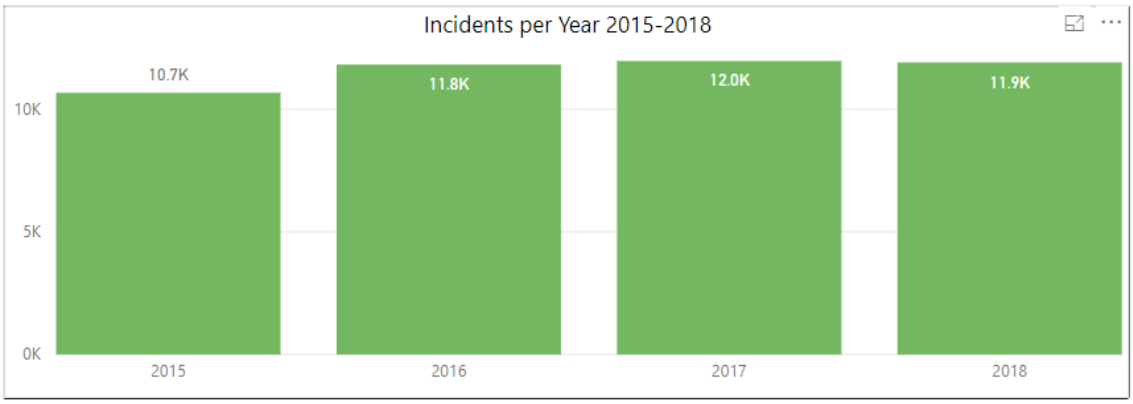


Figure 49: Incident Volume 2015-2018

Percent Change By Year	2015	2016	2017	2018
	7.67%	10.76%	1.24%	-0.49%

Table 10:Incident Volume Percent Change

Top 10 Incident Types 2018

PROBLEM (Type	%GT Count of MASTER_INCIDENT_NUMBER
EMS	78.46%
FIALAF-Fire Alarm	7.62%
FIREAF-Fire Assist	7.61%
FINONF - Non Struct Fire	1.61%
FISTRF-Struct Fire/Smoke insi	1.37%
GASF-Gas smell inside a bldg	1.28%
ODORF-Odors invests/gas outsid	0.90%
AutoAid: Tech Rescue	0.30%
HAZMINF-Minor hazmat response	0.30%
MUAIDF- BFD mutual aid	0.21%
Total	**100.00%**

Table 11: Top 10 Incident Types

Front Line Apparatus Responses[3]

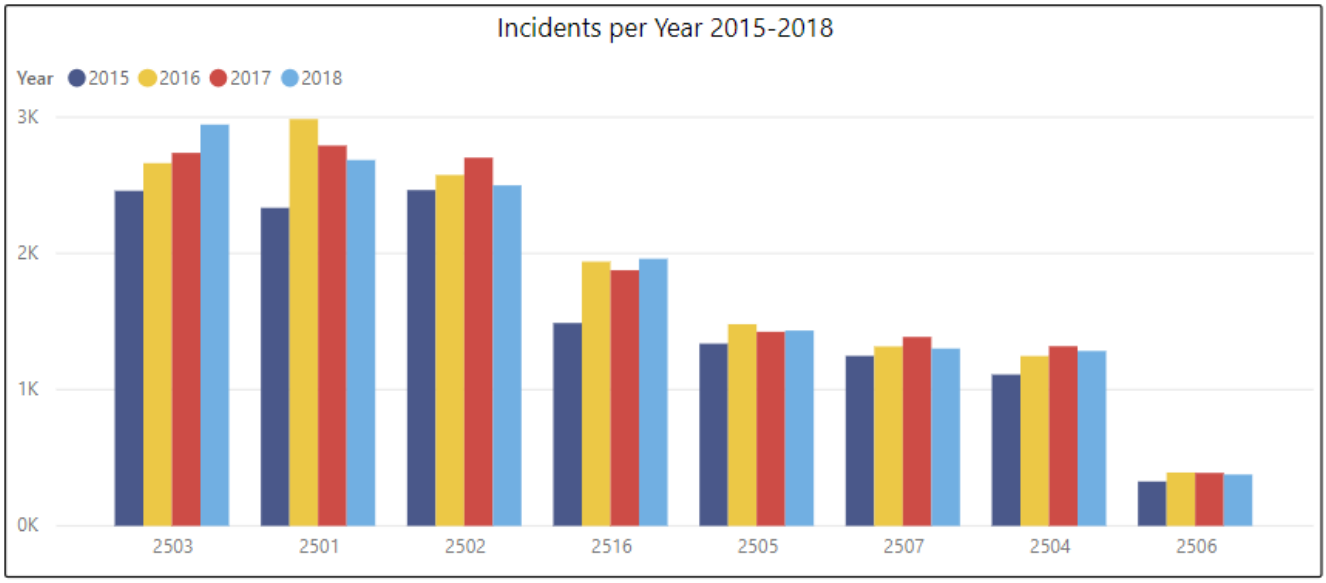


Figure 50: Front Line Apparatus Responses

Unit Call Volume Year Over Year: 2015-2018[4]

Unit	2015	2016	2017	2018	% Increase from previous year
2501	2335	2986	2792	2686	-3.95%
2502	2465	2576	2709	2500	-8.36%
2503	2460	2663	2738	2946	7.06%
2504	1111	1247	1319	1284	-2.73%
2505	1338	1481	1425	1434	0.63%
2506	326	392	391	377	-3.71%
2507	1248	1317	1387	1302	-6.53%
2516	1489	1940	1877	1961	4.28%

Table 12: Unit Call Volume Year Over Year

[3] Includes emergent and non-emergent responses.
[4] FHRMS

Incident Time of Day

Below is a stacked bar chart depicting four-time segments related to the time of day the BFR responds to emergencies. The chart covers the period between 2015 and 2018 While there is some variation, the distribution is even over the four periods.

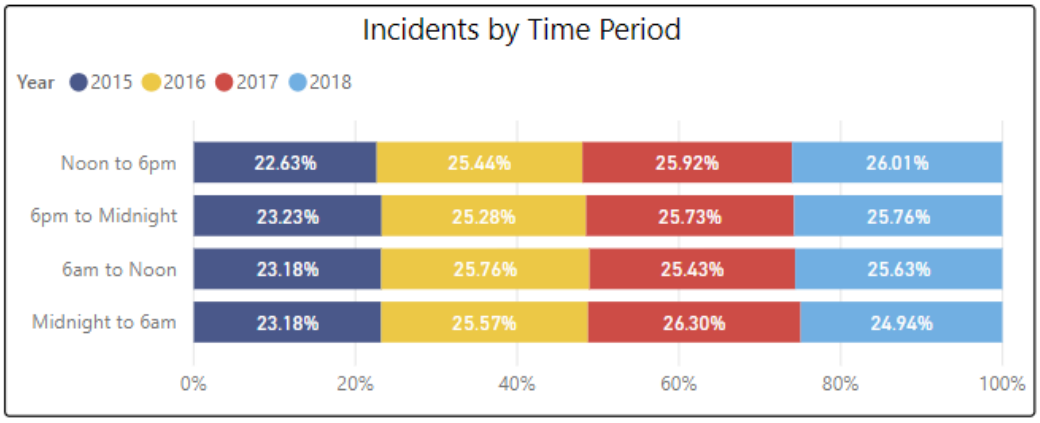


Figure 51: Incidents by Hour Block

Incident volume escalates from around 7 am and increases throughout the day. Finally decreasing around 1 am.

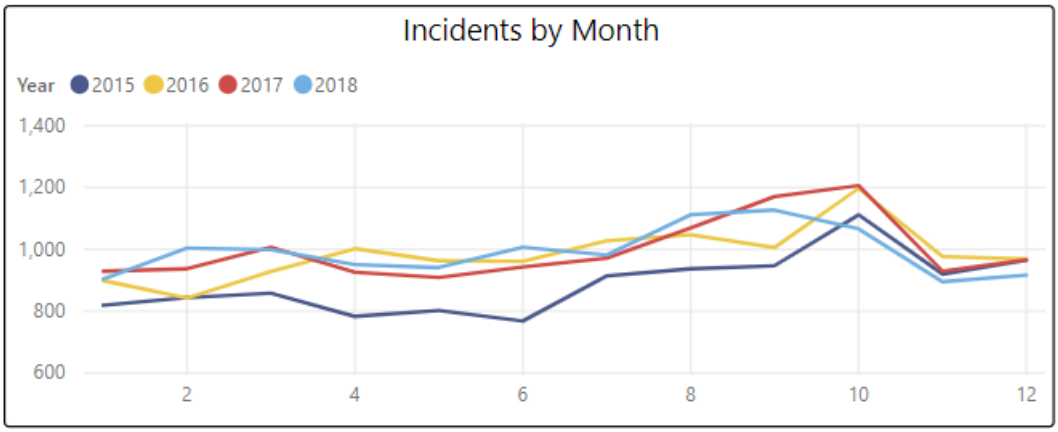


Figure 52: Incidents by Hour

11 calls tend to be highest in the summer months of July and August while lowest in the winter months of January and February.

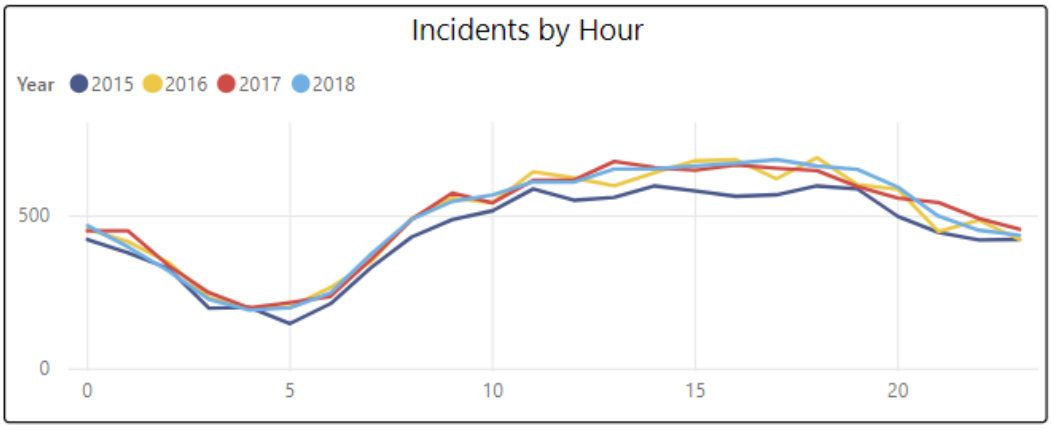


Figure 53: Incidents by Month

Incidents gradually increase throughout the week, with Friday and Saturday being the peak volume day.

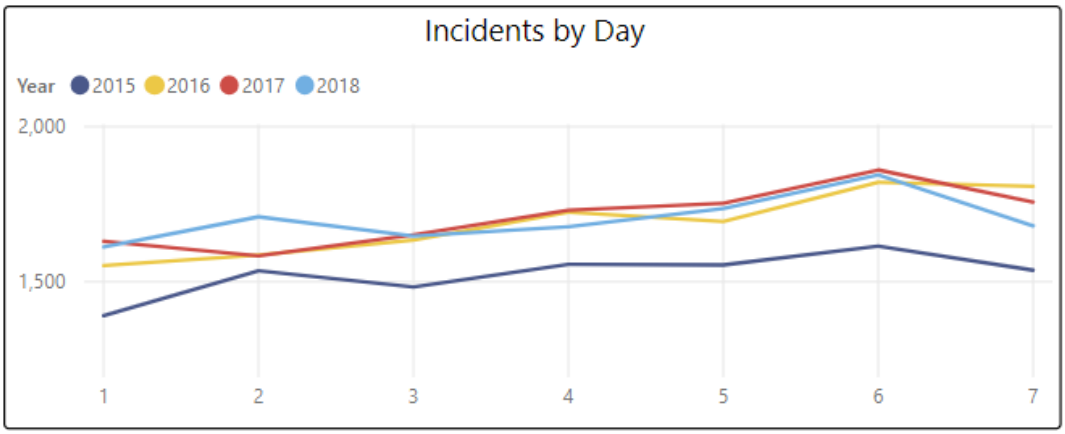


Figure 54: Incidents by Day

Below is a chart depicting the day and night call volume. Combining the data into two segments allows the department to see that the bulk of the incidents occur from 7am-7pm. In the City of Boulder 60% of the incidents occur between the hours of 7 am and 7 pm.

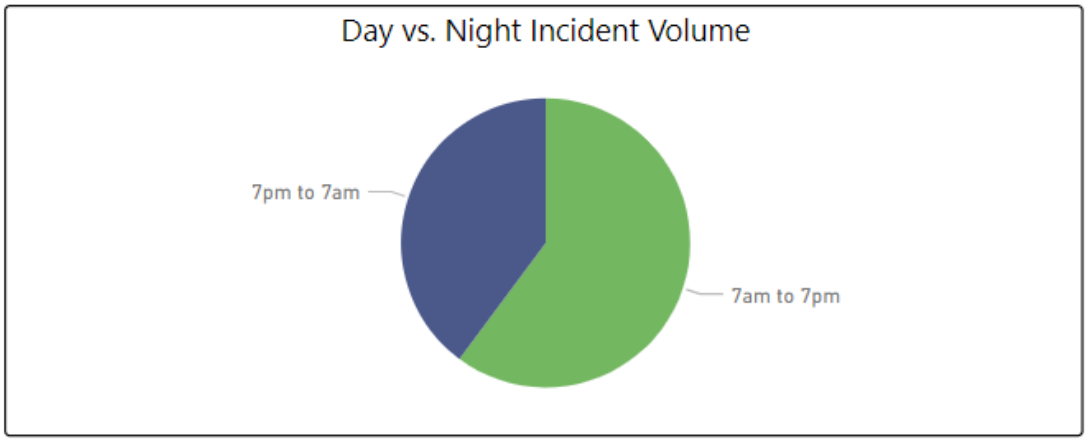


Figure 55: Day vs. Night Incidents

Time of day by Station

Below is a chart depicting the call volume by period for all stations in the system, including Station 8 which has varied staffing levels depending on the time of year (24 hours during high fire season, 40 hours/wk all other seasons). Call volume in Station 6's territory is the most varied; the bulk of the service area is industrial and only occupied during the day. Station 8's incidents are most likely to occur in the evening.

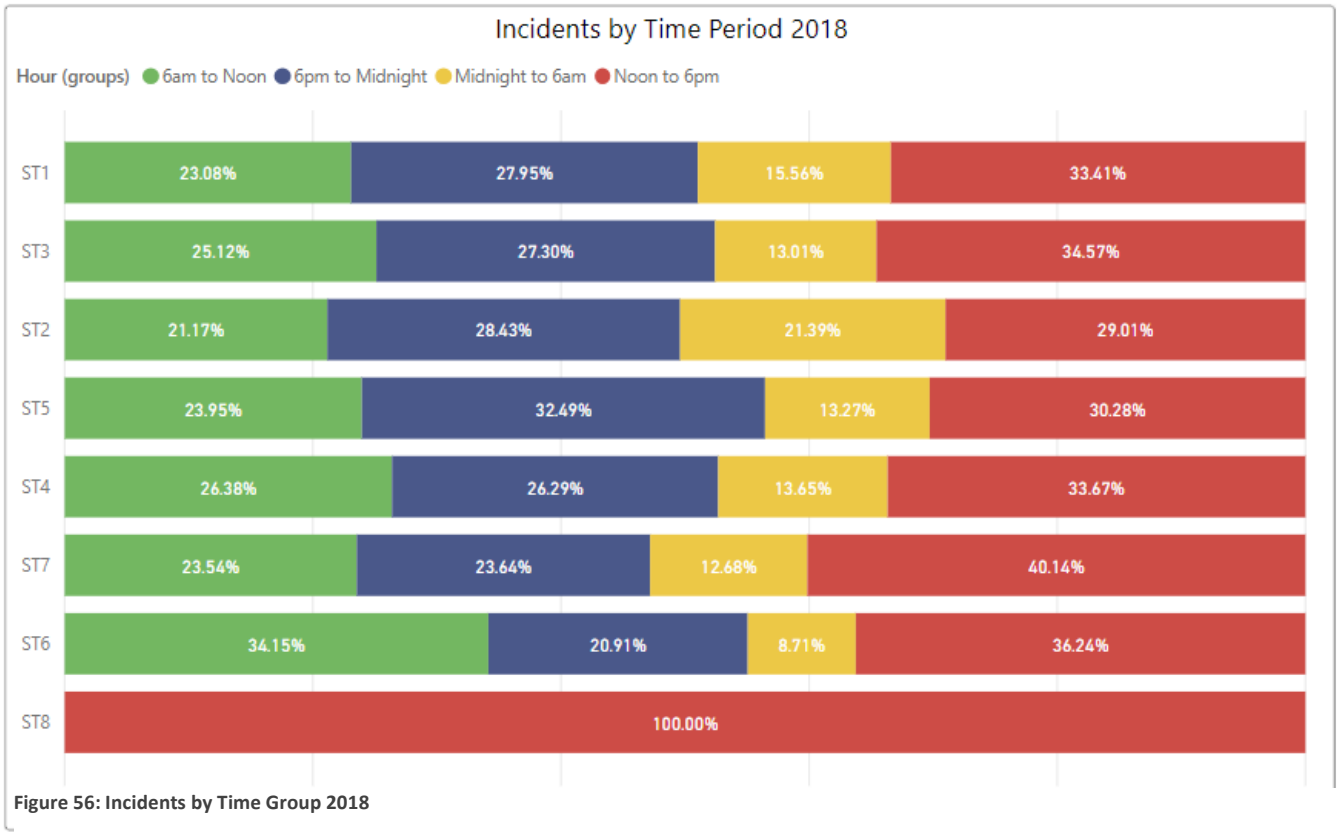


Figure 56: Incidents by Time Group 2018

Property and Content Loss

The chart below displays the property and content loss from 2015-2018. Property loss is consistent between each year, despite the content loss being high in 2015.

Year	cont_loss	prop_loss
2015	408,449.00	872,774.00
2016	273,770.00	1,525,668.00
2017	222,211.00	934,299.00
2018	130,981.00	939,199.00
Total	**1,035,411.00**	**4,271,940.00**

Figure 57: Property and Content Loss

Defining System Performance

The measurement of system performance falls into four categories: distribution, concentration, reliability, and comparability.

Adequate distribution of resources is necessary to respond to incidents throughout the jurisdiction, regardless of significance. Distribution of fire companies assures a specific response time performance for a percentage of the calls for service. Ideally, 100% of the community would have a fire company on the scene within the allotted response time. Distribution of fire companies is adequate if fire companies can respond to at least 90% of the incidents within the stated travel response-time goal.

Concentration is the spacing of multiple resources arranged close enough, so an initial effective response force (ERF) is on the scene within the Department's established response time goals. An initial ERF will most likely stop the escalation of the emergency for a specific risk type.

Fire stations and apparatus must be equally distributed in the community to provide a timely initial attack for all calls. Additionally, the fire station locations and staffing patterns must concentrate resources to respond to a major event within the desired response time goals. BFR apparatus have historically been placed based on distribution, while much of the equipment carried is based on concentration (e.g., high-rise pack in high-rise district).

Distribution

These measures are comparative measurements relative to the distribution of BFR resources. An example is locating first-due resources throughout the jurisdiction to provide all citizens with a quick response for initial intervention. The City of Boulder spans 27 square miles. BFR Vehicles are dispatched using Automatic Vehicle Location (AVL), therefore the closest unit is dispatched to most incidents.

BFR fire stations are located to ensure rapid deployment of first-due resources (primarily pumpers) for minimizing and terminating routine emergencies. The methodology for station location predates most of the modern planning tools in use now. Four out of the seven stations were built prior to 1970, and therefore, ISO standards were either not in place or prior versions. Due to this, the department is currently evaluating the present locations for relocation or provision of alternative response models. The Department strives for an equitable level of outcome, meaning that everyone has a fire station approximately within the same distance in the community. Units are dispatched using AVL; therefore the closest unit will respond to most emergencies. The map on the next page shows the 4 minute response time from each BFR station. Four minutes would be the ideal travel time for each unit according to National Standards.

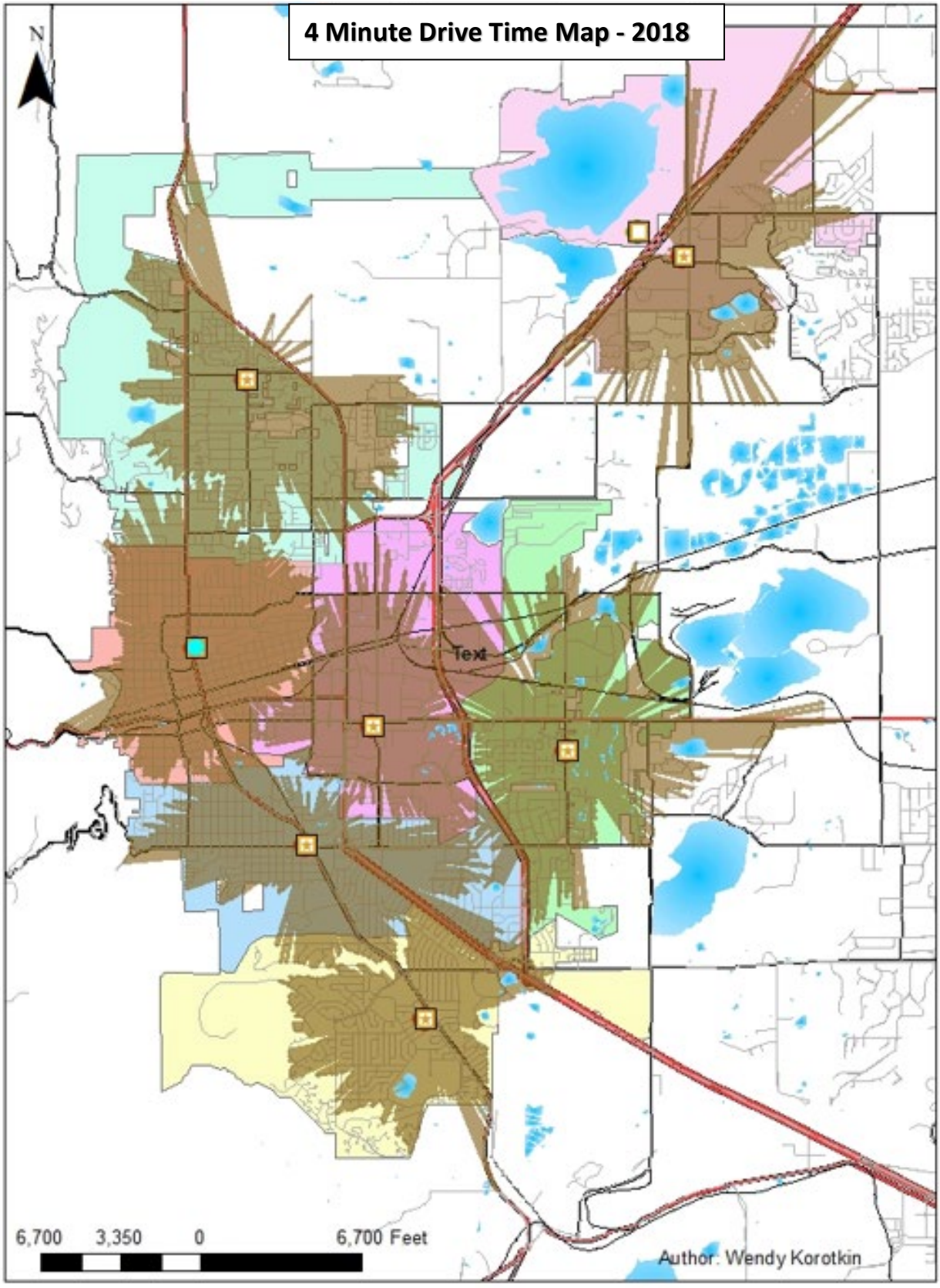


Figure 58: 4 Minute Drive Time

The chart below shows the percent of the area not covered by four-minute drive time at 80% speed

Station Area	Full area	Area Not Covered	Amount of Area Covered	% Covered
1	95,945,893.77	8,893,101.76	87,052,792.01	90.73%
2	86,833,934.67	14,074,604.54	72,759,330.12	83.79%
3	83,670,468.25	19,992,914.17	63,677,554.08	76.11%
4	143,385,020.70	66,675,831.39	76,709,189.31	53.50%
5	122,621,451.67	59,694,305.55	62,927,146.13	51.32%
6	111,988,125.99	72,863,134.54	39,124,991.45	34.94%
7	116,620,965.20	34,558,193.07	82,062,772.13	70.37%

Figure 59: Area Not Covered by 4 minute Drive Time

Incidents: Unit & Station/Year

Station	2015	2016	2017	2018
1	2905	3245	3120	3002
2	2178	2254	2375	2258
3	2545	2759	2713	2890
4	878	1029	1131	1084
5	1127	1265	1227	1312
6	269	303	316	287
7	757	912	1049	994

Figure 60: Incidents per Unit/Station

**Two vehicles respond out of Station 1. Engine 2501 and Ladder 2516

2018				
Station	**Unit Responses/Year**	**Responses/Day**	**Percent of Day**	**% Increase Since 2017**
1	3002	8.22	34%	8%
2	2258	6.19	26%	6%
3	2890	7.92	33%	10%
4	1084	2.97	12%	3%
5	1312	3.59	15%	5%
6	287	0.79	3%	0%
7	994	2.72	11%	2%
Total	11827	32.40	100%	

Figure 61: Unit Workload

Unit responses

Below is the number of incidents committed to by first-in units.

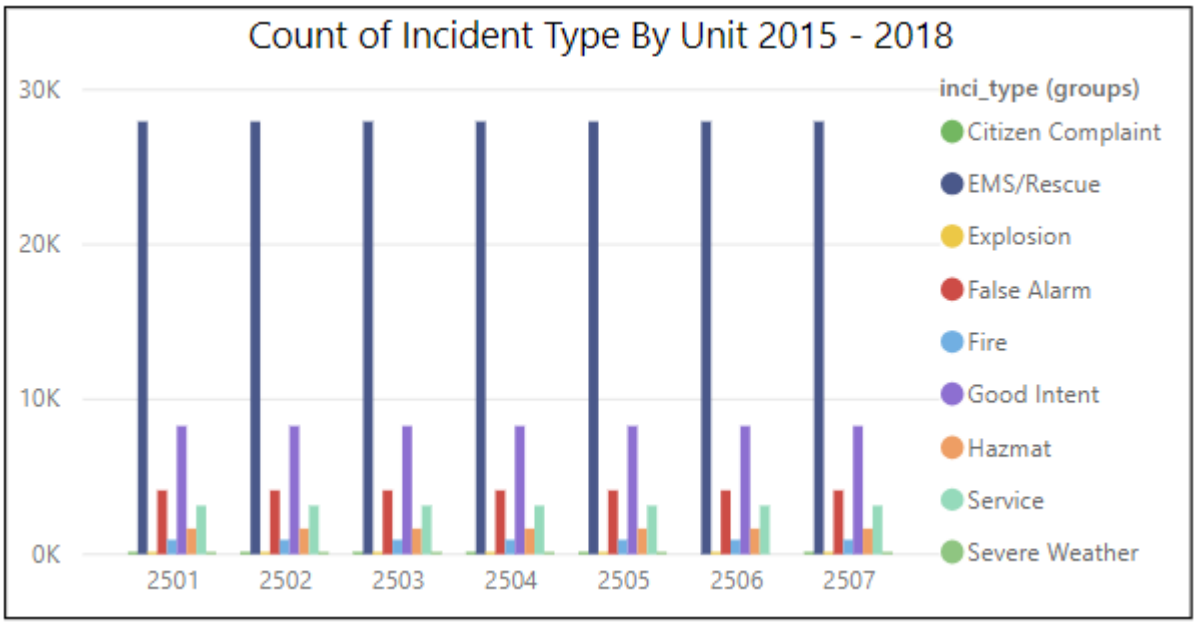


Figure 62: Incidents by NFIRS Type

Incident volume by unit by station territory

The table below depicts each of the first line units and which station area they respond to most. The highest numbers are in the stations first in territory. Volume and color are directly related, counts in green are the lowest volume while counts in red are the highest.

Station 1 – 2501 & 2516
Station 2 – 2502
Station 3 – 2503
Station 4 – 2504
Station 5 – 2505
Station 6 – 2506
Station 7 – 2507

Response Area 2017	ST1	ST2	ST3	ST4	ST5	ST6	ST7
2501	2272	165	191	24	110	7	20
2502	276	1947	258	137	19	3	64
2503	121	220	2163	42	65	14	112
2504	35	158	55	1017	13	3	32
2505	72	16	170	5	1113	34	9
2506	15	16	22	1	28	294	13
2507	44	169	171	35	19	12	934
2516	1398	135	187	30	87	18	24
Total	4233	2826	3217	1291	1454	385	1208

Figure 63: Response Area 2017

Response Area 2018	ST1	ST2	ST3	ST4	ST5	ST6	ST7
2501	2127	154	226	19	110	6	31
2516	1438	120	199	29	107	14	42
2502	225	1823	211	144	15	7	63
2503	151	231	2336	32	66	11	102
2504	49	144	53	984	3	2	25
2505	61	21	123	6	1165	32	20
2506	19	12	29	3	30	267	13
2507	47	138	181	41	10	12	870
2516	1438	120	199	29	107	14	42
2570	124	81	115	50	58	22	51
Total	4241	2724	3473	1308	1564	373	1217

Figure 64: Response Area 2018

Specialty Unit Incident Volume

Unit Type	Unit #	2015	2016	2017	2018	Total
Wildland Brush Truck	2335	3	2	2	2	9
Wildland	2534		2	1	7	10
Wildland Brush Truck	2532	3	6	12	5	26
Wildland Brush Truck	2531	1	11	3	1	16
Wildland Truck	2551	1	6	5	6	18
Wildland Type 3	2539	8	9	11	11	39
Wildland Type 3 Engine	2538	33	38	41	29	141
Dive Van	2521	31	21	26	24	102
Rescue Squad	2523	35	25	21	16	97

Figure 65: Specialty Unit Incident Volume

Turnout Compliance

The chart below shows unit turnout compliance

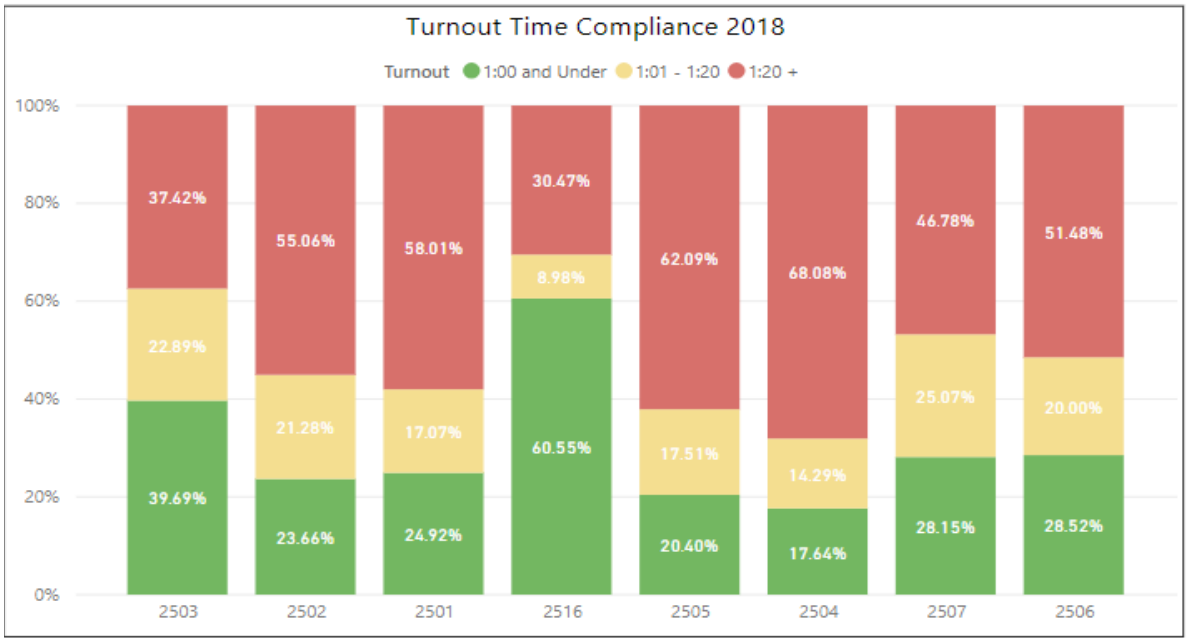


Figure 66: Turnout Time Compliance

Travel Compliance

The chart below displays the front-line apparatus and compliance with travel times under 4 minutes. This i ncludes emergent and non-emergent responses.

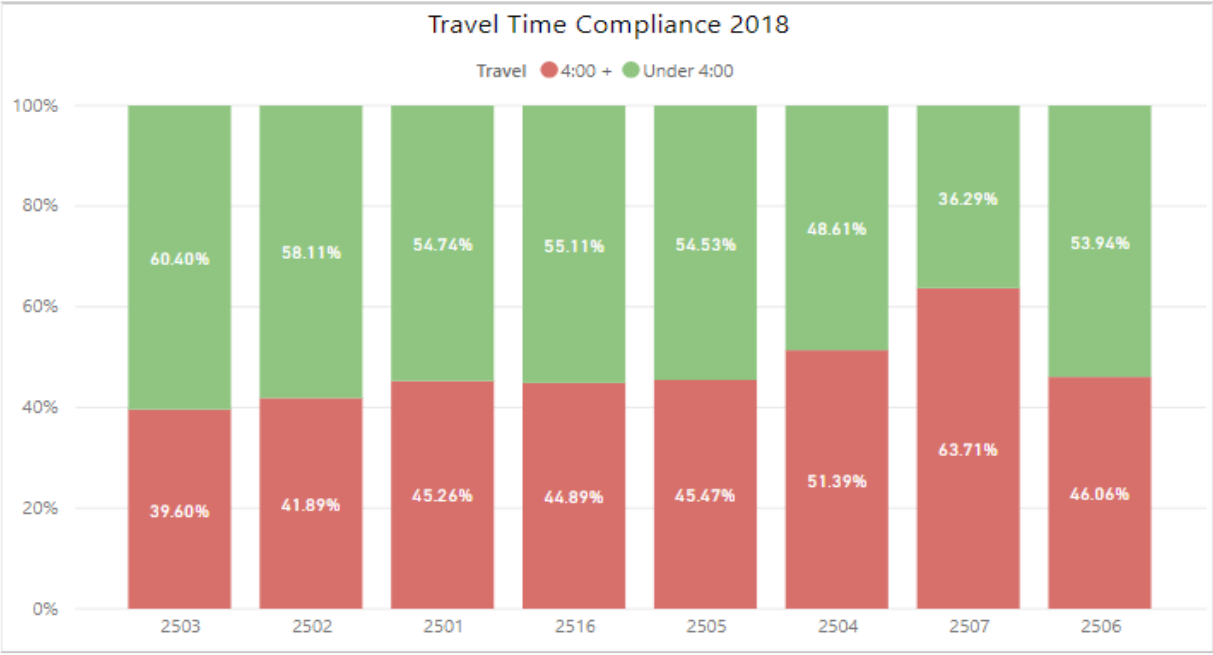


Figure 67: Travel Time Compliance

Total Response Time Compliance

The chart below displays the front-line apparatus and compliance with total response times under 6 minutes. This includes emergent and non-emergent responses.

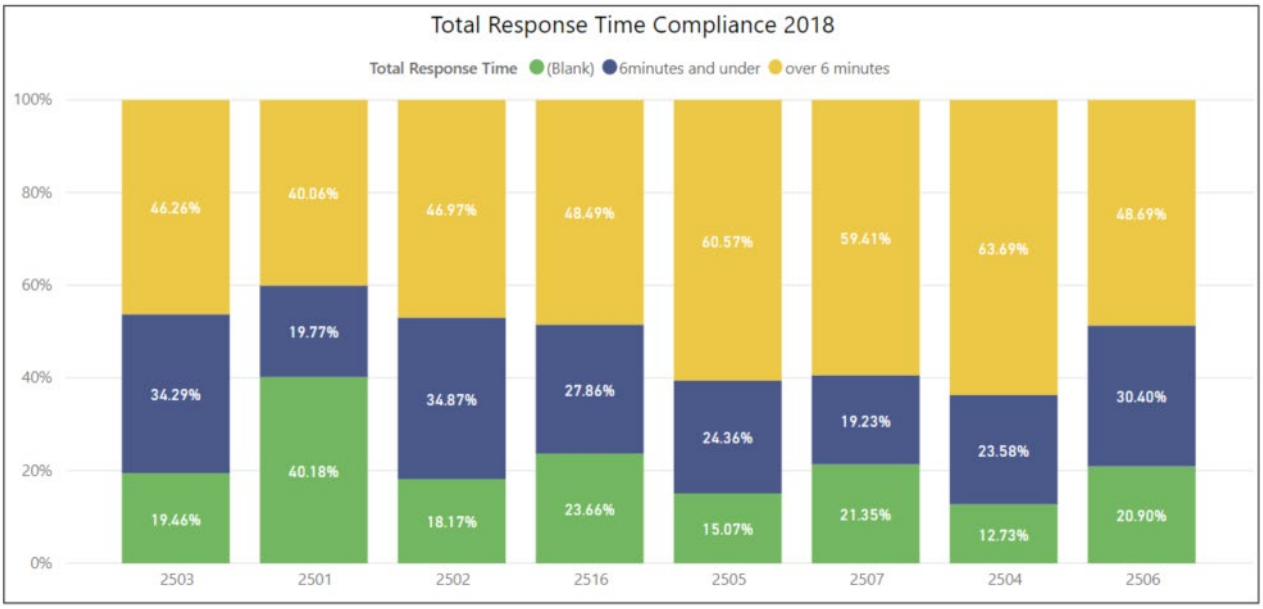


Figure 68: Total Response Time Compliance

Reliability

Response reliability addresses the ability of a resource to respond within each area. It is the probability that the unit assigned to the territory will be available to respond in that territory. It is also to determine the ability of the appropriate resource to meet the determined performance measure baseline.

As the number of calls increases, and the demand on crews increase (training, out of service time), the reliability decreases. Response reliability is a percentage. In 2017, 76% of calls were responded to by the first-due company. Data reflecting where units went during the time out of territory is below

Unit Hour Utilization

Unit hour utilization is the percent of the time during every 24 hours that a unit is committed to an incident. On the next page is a table that reflects first line apparatus and the BC's Unit Hour Utilization (UHU).

UHU is calculated by dividing the total time a unit is committed to all incidents during a year divided by the total time in a year. UHU is expressed as a percentage and describes the amount of time a unit is not available for response since it is already committed to an incident. The larger the percentage, the greater a unit's utilization, and the less available it is for assignment to an incident. Where performance can be measured at the 90th percentile, unit hour utilization greater than 10 percent means that the response unit will not be able to provide on-time response to its 90 percent target even if response is its only activity.

Unit Hour Utilization 2018

Unit	Total Commit Time	Number of Incidents	UHU
2501	2386:13:22	2686	8.32%
2502	2765:53:44	2500	9.65%

2503	2893:00:03	2946	10.09%
2505	1579:51:33	1284	5.51%
2504	1700:42:16	1435	5.93%
2506	491:31:05	377	1.71%
2507	1432:02:40	1302	5.00%
2516	2082:21:29	1961	7.26%
2570	682:19:12	505	2.38%

Figure 69: Unit Hour Utilization

Below is a heat map of all responses where BRF responded to incidents in greater than 390 seconds. Larger dots represent a greater density of incidents, and smaller dots represent less density of incidents.

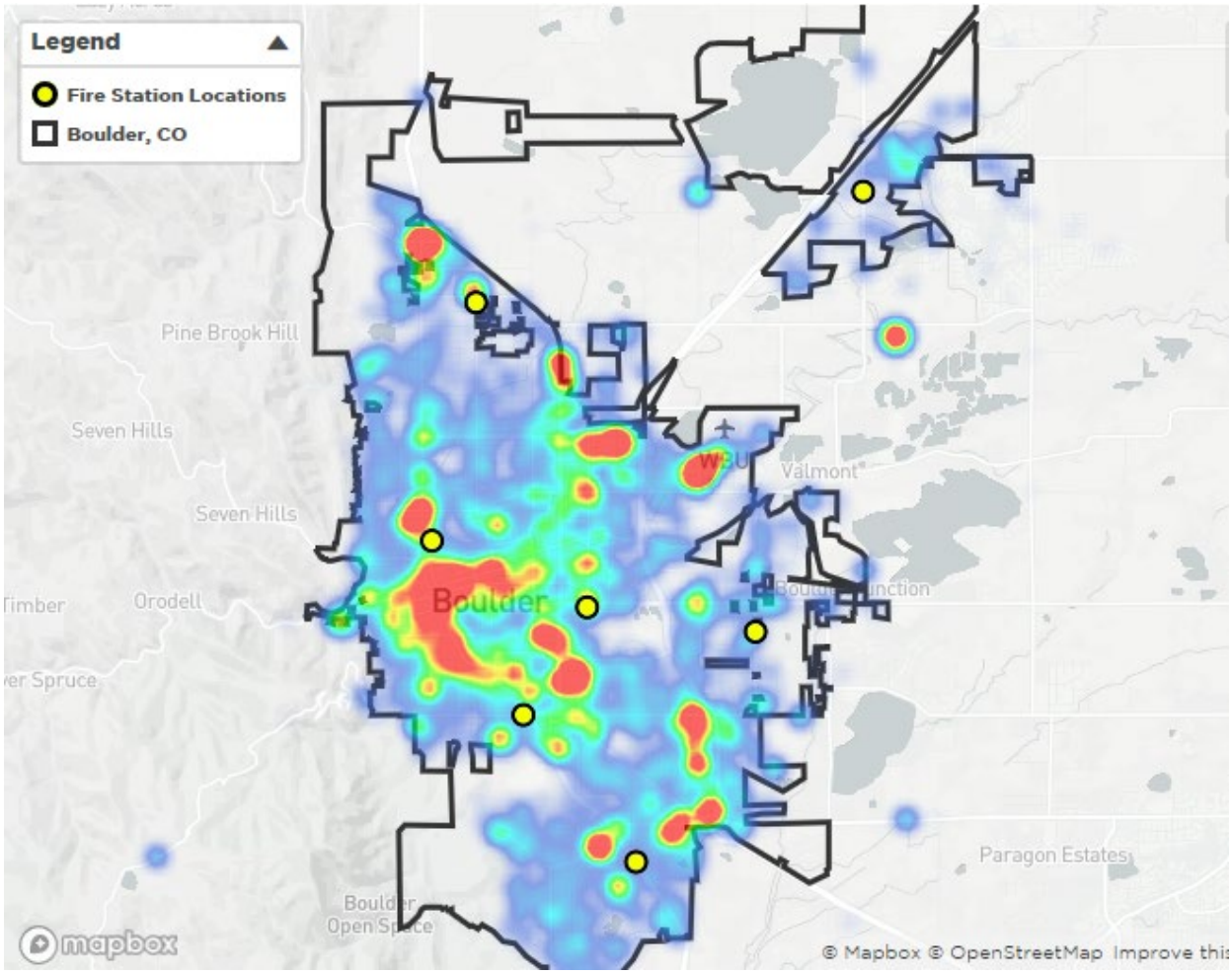


Figure 70: Response Times over 6 minutes and 30 seconds

Concurrent Incidents

The table on this page show the total number of concurrent 911 calls by response unit broken down by concurrency. Concurrent calls are those that occur simultaneously. The overwhelming majority of 911 calls occur by themselves. There were only 34 incidents dispatched at the same time as one another from 2015-2018.

Year	Month	Day	disp_time	Count of inci_no
2015	January	18	01:46:12	2
2018	June	20	09:11:49	2
2017	March	27	10:05:06	2
2018	March	8	10:05:20	2
2017	September	7	10:36:04	2
2017	December	23	10:41:10	2
2015	January	8	11:05:56	2
2016	October	5	12:08:01	2
2015	September	23	12:10:28	2
2018	May	20	13:37:48	2
2015	March	6	14:54:04	2
2016	July	18	17:08:15	2
2015	February	28	18:07:15	2
2015	April	3	20:38:53	2
2016	June	29	22:38:42	2
2015	March	1	22:58:49	2
2015	February	11	23:13:35	2
Total				**34**

Figure 71: Concurrent Incidents

Station Distribution Analysis: 2017

Station 1

In/Out of Territory Responses (Unit: 2501/2516)

Year	Total Number of Incidents in Territory	Handled by First Due	Handled by Another Unit
2017	4,233	3,670	998
2018	4,117	3565	552

Figure 72: Station 1 Distribution

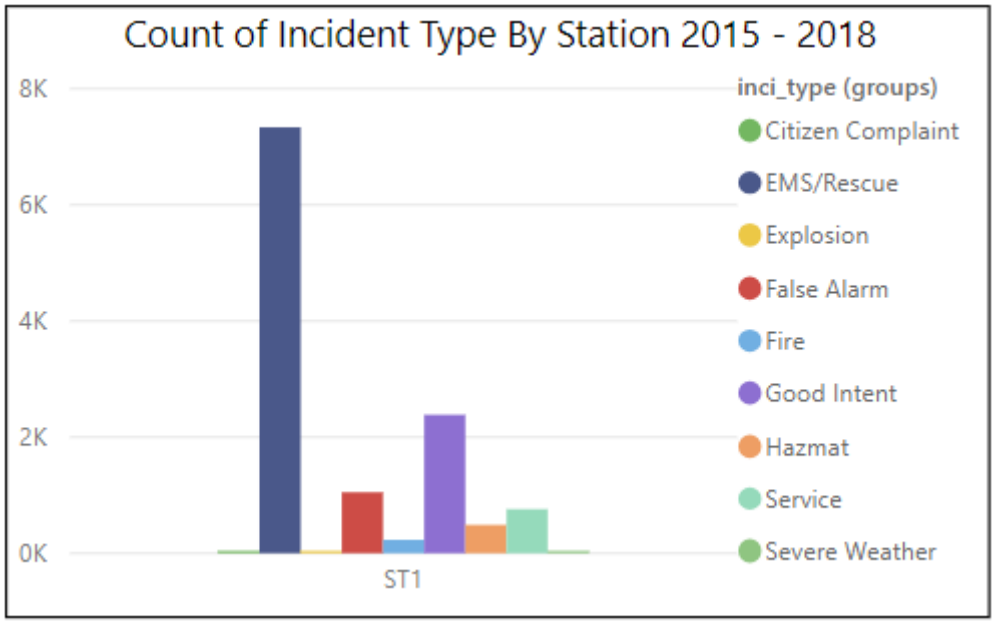


Figure 73: Count of Incident Type Station 1

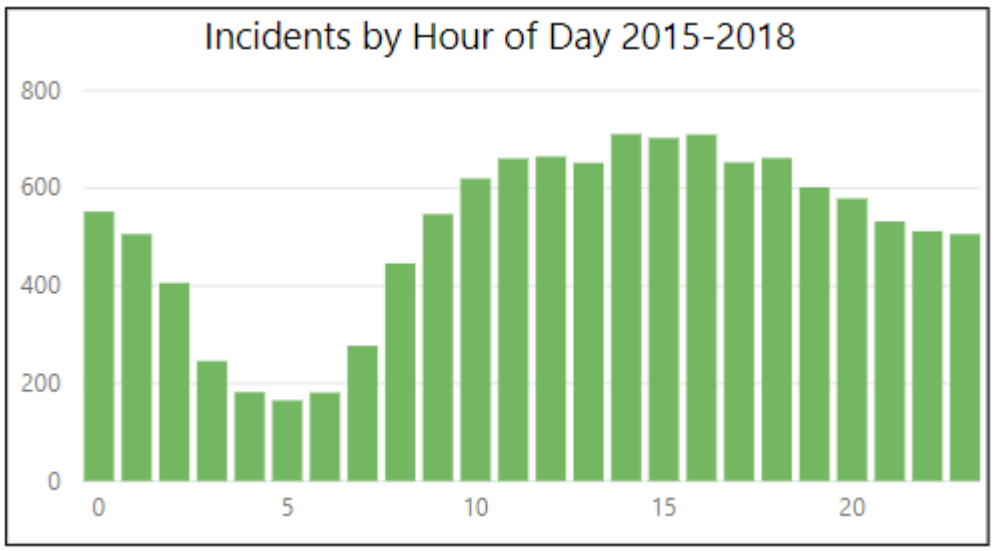


Figure 74: Incidents by Hour Station 1

Station 2

In/Out of Territory Responses (Unit: 2502)

Year	Total Number of Incidents in Territory	Handled by First Due	Handled by Another Unit
2017	2826	1947	757
2018	2643	1823	820

Figure 75: Station 2 Distribution

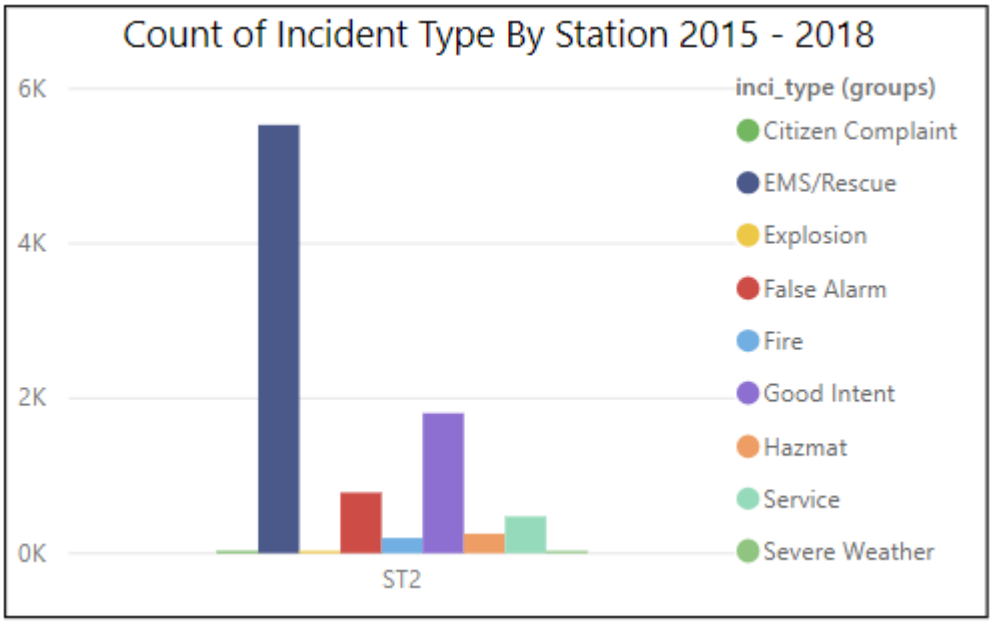


Figure 76:Count of Incident Type Station 2

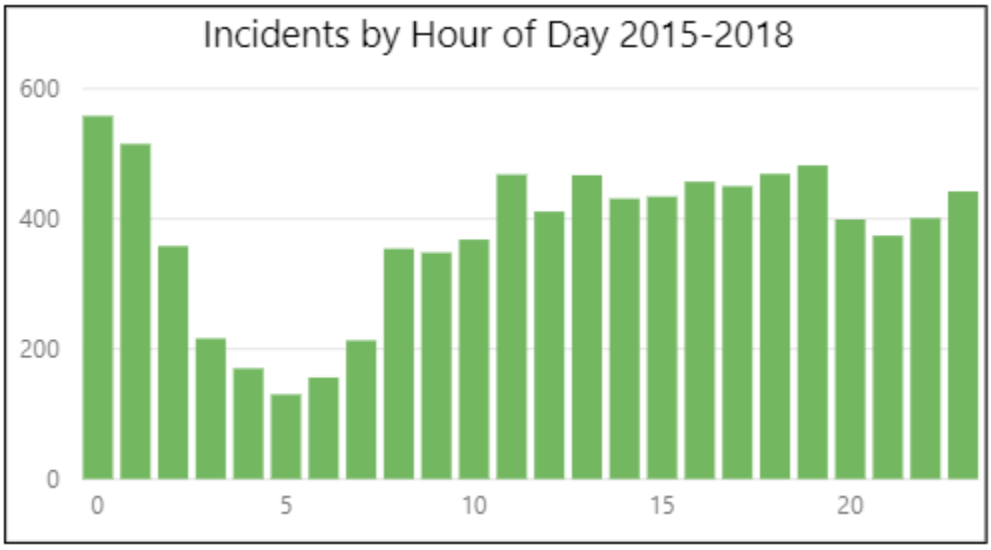


Figure 77: Incidents by Hour Station 2

Station 3

In/Out of Territory Responses (Unit: 2503)

Year	Total Number of Incidents in Territory	Handled by First Due	Handled by Another Unit
2017	3217	2163	574
2018	3358	2336	1022

Figure 78: Station 3 Distribution

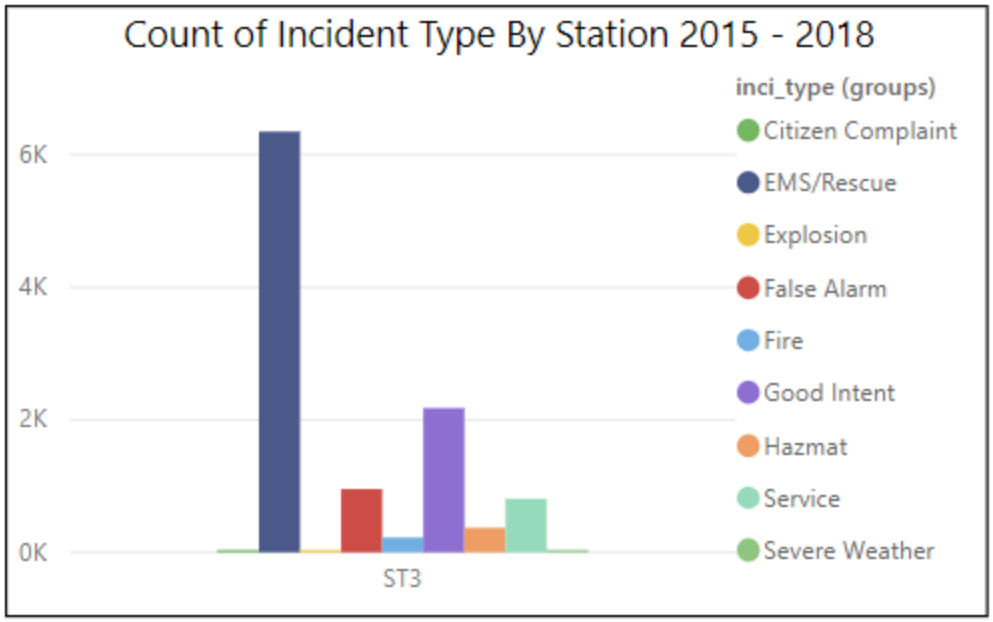


Figure 80:Count of Incident Type Station 3

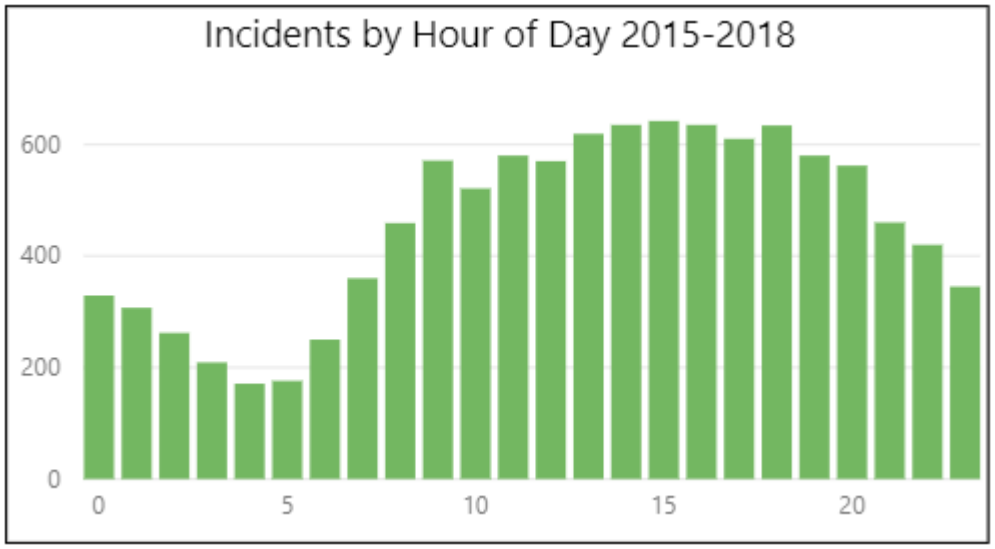


Figure 79: Incidents by Hour Station 3

Station 4

In/Out of Territory Responses (Unit: 2504)

Year	Total Number of Incidents in Territory	Handled by First Due	Handled by Another Unit
2017	1291	1017	296
2018	1258	984	984

Figure 81: Station 4 Distribution

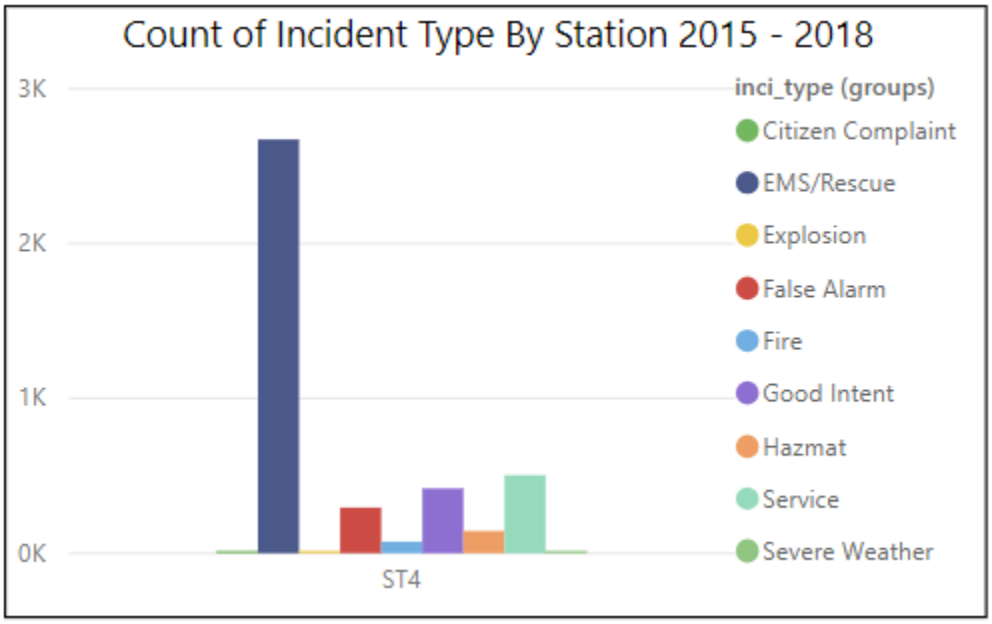


Figure 83:Count of Incident Type Station 4

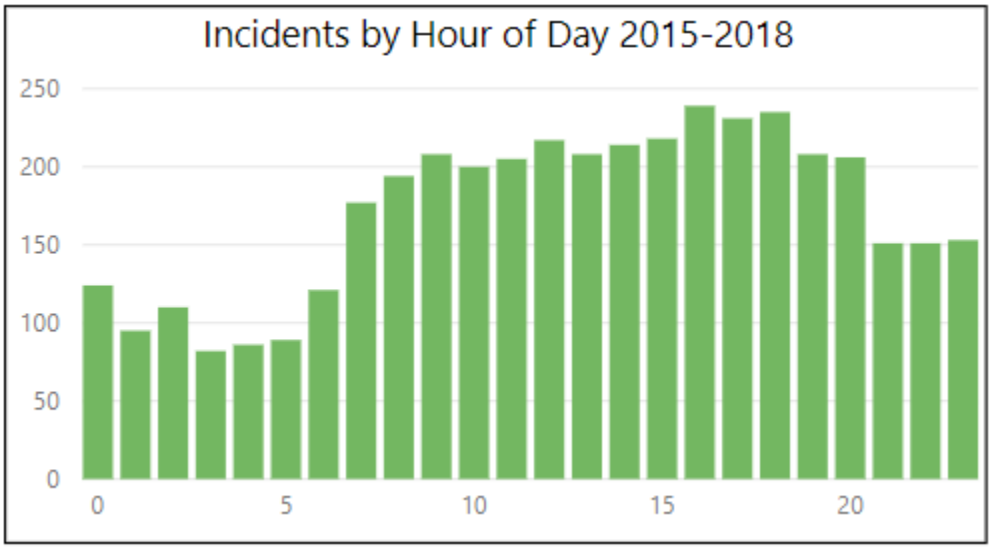


Figure 82: Incidents by Hour Station 4

Station 5

In/Out of Territory Responses (Unit: 2505)

Year	Total Number of Incidents in Territory	Handled by First Due	Handled by Another Unit
2017	1454	1113	306
2018	1506	1165	341

Figure 84: Station 5 Distribution

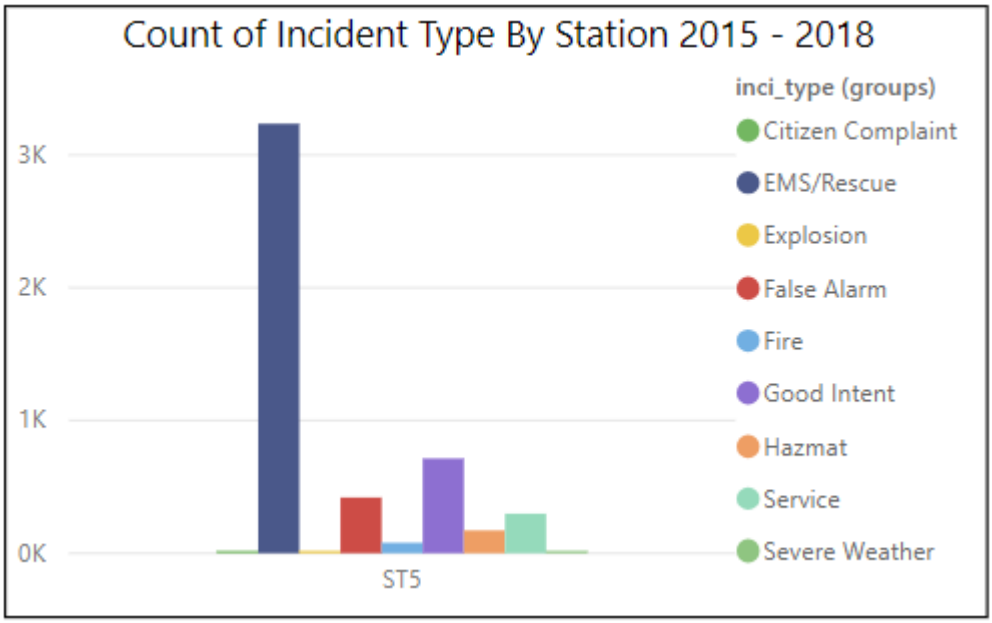


Figure 85:Count of Incident Type Station 5

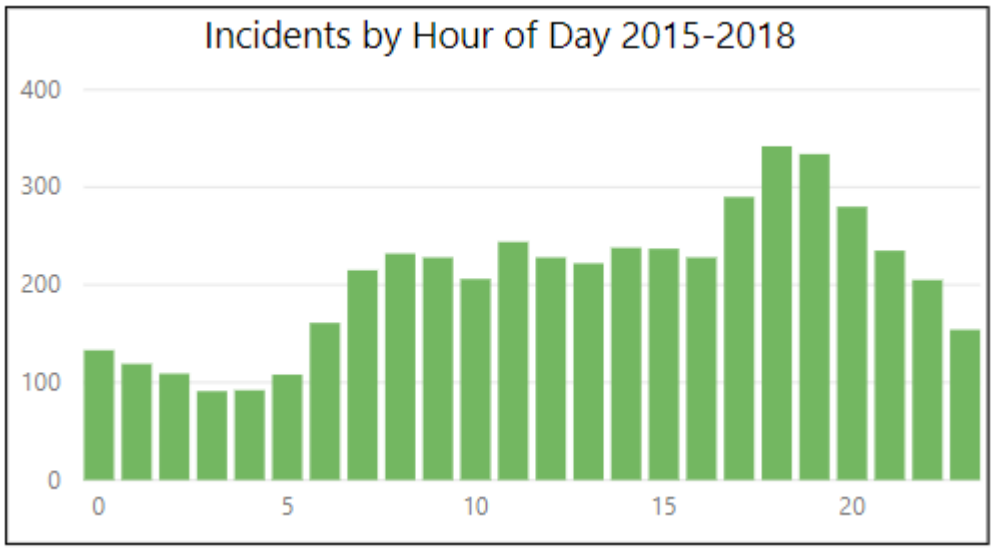


Figure 86: Incidents by Time of Day Station 5

Station 6

In/Out of Territory Responses (Unit: 2506)

Year	Total Number of Incidents in Territory	Handled by First Due	Handled by Another Unit
2017	385	294	95
2018	351	267	84

Figure 87: Station 6 Distribution

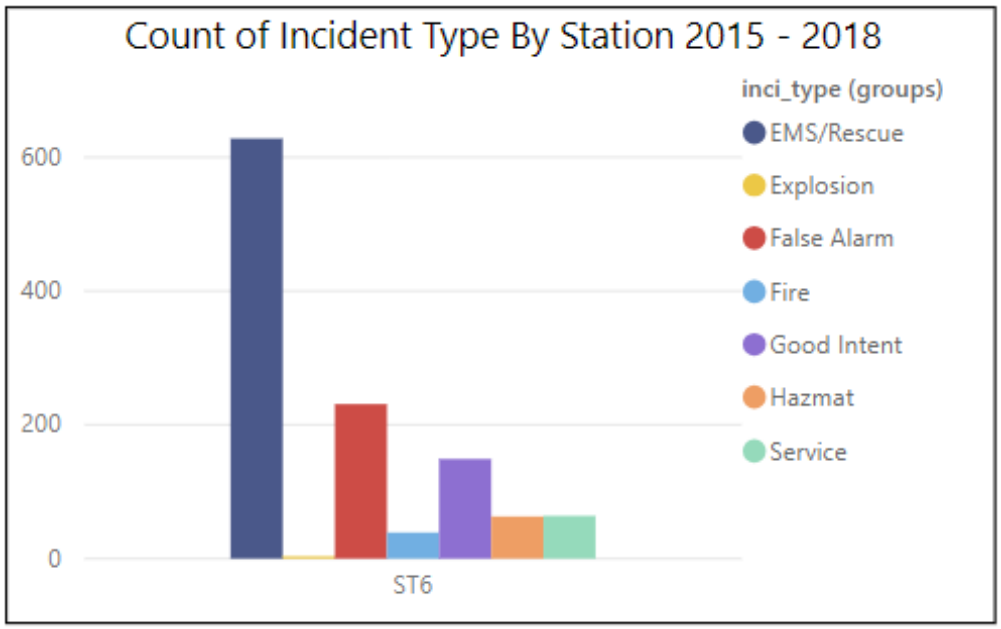


Figure 88:Count of Incident Type Station 6

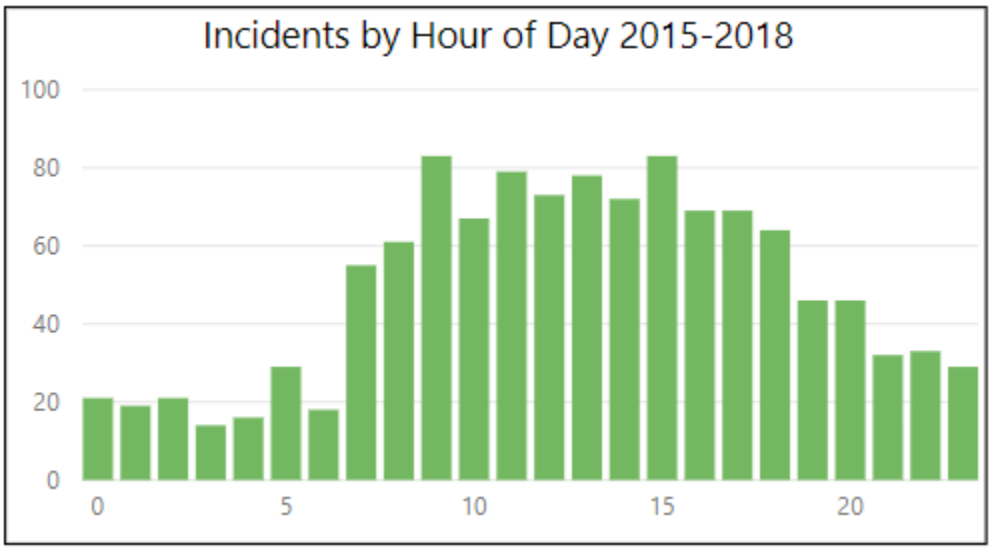


Figure 89: Incidents by Hour Station 6

Station 7

In/Out of Territory Responses (Unit: 2507)

Year	Total Number of Incidents in Territory	Handled by First Due	Handled by Another Unit
2017	1208	934	450
2018	1166	870	296

Figure 90: Station 7 Distribution

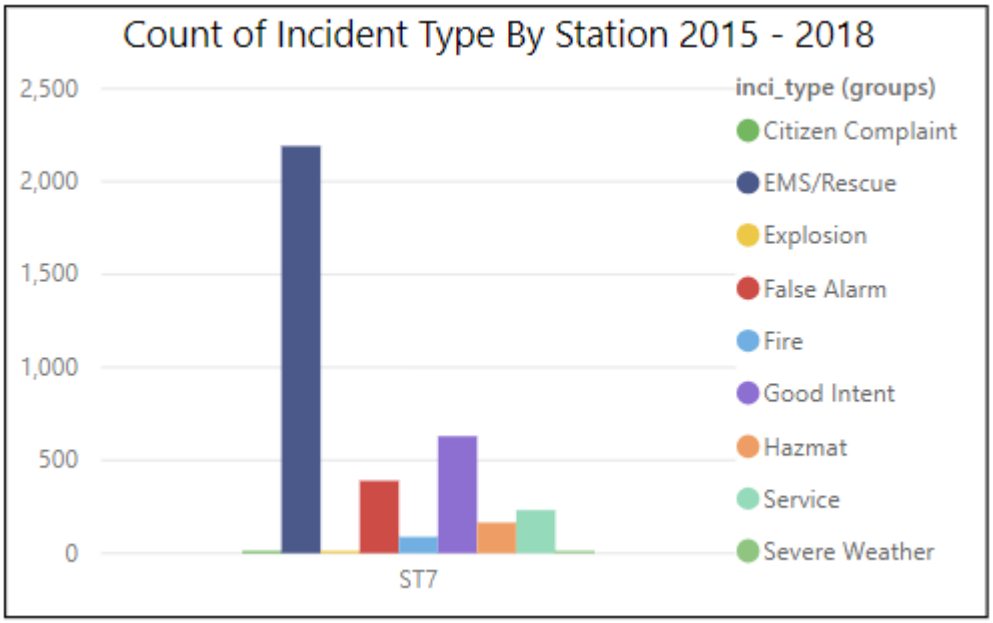


Figure 92:Count of Incident Type Station 7

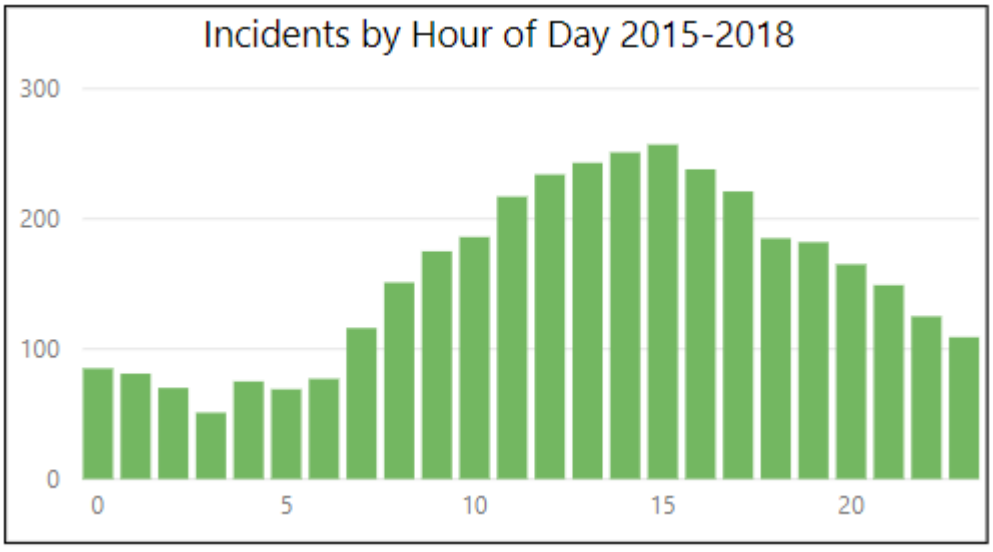


Figure 91: Incidents by Hour Station 7

Concentration

Concentration is the arrangement of resources within the jurisdiction. Resources should be spaced near one another to assemble an Effective Response Force (ERF) for the type and magnitude of an incident within adopted public policy periods. Historically, stations and equipment have been placed based on the assumption that all areas have the same risk and probability of an event occurring.

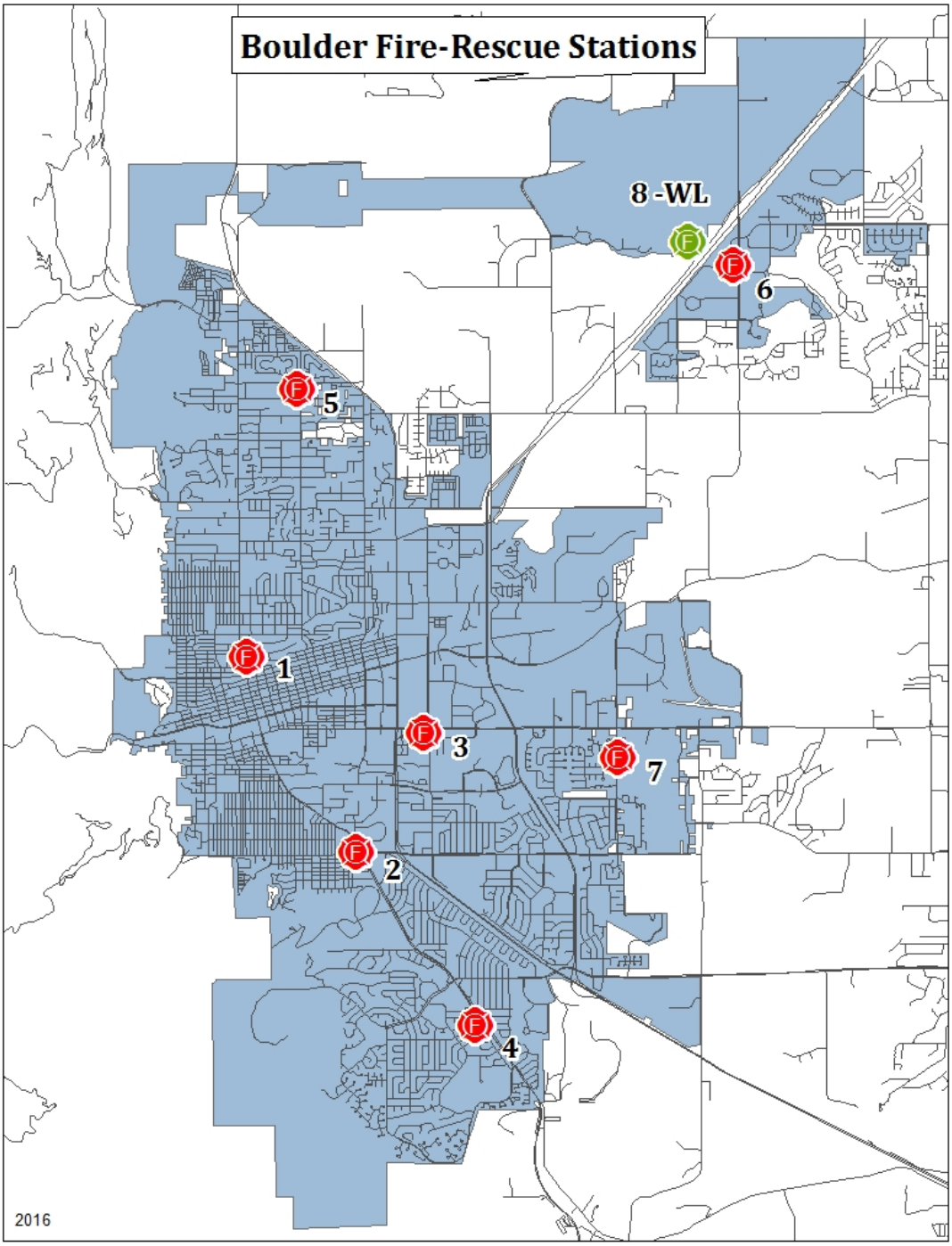


Figure 93: Boulder Fire-Rescue Station Map

Data Collection and Analysis

BFR uses multiple data gathering and analysis tools to collect and evaluate incidents. Each 911 call generates two data sets, what the caller perceives is happening (CAD data) and what Fire personnel report (FIREHOUSE RMS data). Both data sets share an incident number and all times; therefore, they are be cross-referenced. Below is a list of the analysis tools used:

- West Net – First In
- SQL Server Management Studio (SSMS)
- SQL Server Reporting Services (SSRS)
- Power BI
- Excel Business Services (analysis)
- Firehouse RMS – storage of records
- Tritech CAD – storage of records
- ESRI ArcGIS - ArcGIS is a collection of GIS software products that provides a standards-based platform for spatial analysis, data management, and mapping.

FIREHOUSE is the current records management system (RMS) and is a National Fire Incident Reporting System 5.0 (NFIRS 5.0) incident reporting software package. FIREHOUSE provides BFR with the ability to record, store, archive, and recall an incident, hydrant, occupancy, training, and personnel information, and retrieve reports regarding the same (2B.2,2B.3).

The incident module within FHRMS is used to record all fires and includes information about fire loss, injury and life loss, property loss, and other associated losses. The incident module complies with the National Fire Incident Reporting System (NFIRS) requirements. Company officers are responsible for the completion of all FHRMS reports. They are later quality checked by the on-shift Battalion Chief on duty[i]. The city also has an administrative policy on Information and Technology.

In early 2018, BFR began using First In, a product created by West Net. First In is a fire station alerting system that utilizes a series of remote units placed strategically throughout the fire station to notify fire personnel of an emergency call. The system is alerted by the CAD system and features pre-alert tones and Automated Voice Dispatch, selective alerting by company assignment, dorm remotes for individual dorm room alerting, heart-friendly ramping tones, video messengers for displaying call information on station monitors, back-up alerting as well as red safety lighting to ensure safety throughout the firehouse.

Data Methodology

The following is the data processing methodology that is used in-house. The data calculated for MySidewalk is calculated in the same manner utilizing different tools.

The processing time that is currently available is the alarm handling time. This time is imported from the Tritech CAD ‘PHONEPICK’ call time into the RMS system. Ideally, this is captured with the phone system Intrado/Viper.

The criteria for Alarm Handling tiers will be queried differently in CAD because the NFIRS codes are not available until the station officer enters them into Fire RMS. The criteria for the categories are in the from the Communications policy document.

The data analysis process includes

- Pulling the data using SQL
- Filtering by category, risk, and severity
- Counting personnel for minimum staffing to complete ERF
- Calculating the elapsed times for performance metrics using SQL
- Removing statistical outliers ((1.5 x interquartile range) above & below and set those aside in a separate report for analysis. An outlier is a data point that lies outside the overall pattern in a distribution.
- Running distributions analysis for 90 percentiles
- Complete response time charts

Exclusion criteria include exposures, zero en-route time, zero roll time, zero arrival time, no mutual aid, emergency response. For National Fire Incident Reporting System (NFIRS) reports the risk is assigned to structure fires using NFIRS property type. A detailed explanation can be found in the BFR 'Evaluation of Current Deployment' document. Call types, and severity are also used to divide the data into categories.

The number of incidents used to calculate total response times for the first and second unit are the same. The department exclude records if apparatus are missing timestamps to accurately assess response times. If missing timestamps were included the apparatus might not be captured in the correct dispatch order of arrival. In addition, using two different N counts would include response times that don't belong to a verifiable unit.

As an example canceled apparatus, non-emergent responses and units that are not dispatched at the same time have been removed from the dataset. Thereby excluding the entire record since the ERF cannot be met. This is part of a known CPSE/CFAI methodology that other departments use. The methodology ensures the n-counts match across multiple response time categories, which means that each incident has a processing, turnout, first unit travel, ERF, first unit total and ERF total. There are no orphaned response times in our performance charts.

The categories and criteria for measuring baseline performance at the 90th percentile is detailed in the following table, and continued on the next page.

Program	Hazard	CAD Incident Type	Min # of Personnel	Equipment	Additional Fields
HazMat	Low	ODORF-Odors invests/gas outsid, HAZMINF-Minor hazmat response	3	1E	
Wildland		FIWILF-Wildland/Grass fire	3	1E	
TRT		INJACC2F-Injury Accident J/O, UNACCF-Unknown if injury acc	5	1E 1AM	
EMS		Severity A/B	2	1AM	
Fire		FINONF - Non Struct Fire	3	1E	
HazMat	Moderate	GASF - Gas Smell inside	7	2E 1BC	
Wildland		FIWILF-Wildland/Grass fire	8	1E,1BC, 1 WL****	
TRT		MAACCF-Rollover or pinned acc	9	2E,1BC,1AM	
EMS		Severity C/D	4	1E 1AM	
Fire		FISTRF-Struct Fire/Smoke insi	19	4E, 1L, 1BC,1AM,1SO	NFIRS prop_use 419/429**

Program	Hazard	CAD Incident Type	# of Personnel	Equipment	Additional Fields
HazMat	High/Special	HAZMAJF-HAZMAT major response, HAZMFULLF-Countywide Hazmat	13	3E,1BC,1HM, 1AM + County	
Wildland		FIWILF – Wildland/Grass fire	8	1E,1B, 1 WL	
TRT		RESCUE - Special Rescue, REWATF - All Water Rescues,	11	2E,1DV,1BC,1AM	
EMS (ALS)		Severity E	4	1E + 1AM	CAD Severity C,D,E
Fire		FISTRF-Struct Fire/Smoke insi	19	4E, 1L, 1BC,1AM, 1SO	NFIRS prop_use <> 419,429

Figure 94: Risk Determination

Community Baselines

Response time is the most common performance measure used for fire services because it is understood by residents, easy to compute, and useful in the evaluation of results. The 2015 BVCP calls for BFR to: "have response times to location of emergency that is normally six minutes or less." This goal is supported by the National Fire Protection Association (NFPA) standards, which establishes a six-minute response 90 percent of the time.

Response Time Intervals

In the City of Boulder, all calls are dispatched by the Boulder Police Department, who serves as the public safety answering point (PSAP) for BFR. BFR measures alarm handing (processing), turnout, travel, and total response time (2C.5). The target service-level objectives in the benchmark statements are based on industry standards and best practices, and the needs of the department. The objectives are included in the BVCP which has been adopted by City Council. As of August 2019, BFR does not have access to the phone pickup time and relies on aggregate data from dispatch to calculate the time.

Alarm Handling/Call Processing: Elapsed time from when a call is answered in the dispatch center to when emergency vehicles are dispatched to the call.

Turnout Time: Elapsed time from when an emergency vehicle is dispatched to when it goes en route to the scene of the incident.

First Arriving Travel Time: Elapsed time from en route and arrival on-scene for the first arriving emergency vehicle/unit.

ERF Travel Time: Elapsed time from when the first ERF unit goes en route to when the last ERF unit arrives on the scene.

First Arriving Total Response Time: Elapsed time from when an emergent call is answered in dispatch to when the first emergency vehicle/unit arrives on the scene. First arriving total response time is the sum of each of the time components (alarm handling +turnout + first unit travel).

ERF Total Response Time: Elapsed time from when a call is answered in dispatch to when the last ERF unit arrives on the scene. ERF total response time is the sum of each of the time components (alarm handling +turnout + ERF unit travel).

Benchmarking

Establishing a benchmark offers the agency a figurative “target.” Below are the benchmark response-time objectives for each level of service. BFR considers the area served as an urban community. All response time benchmarks are for an urban population density.

Baseline Performance

Before measuring baseline emergency responses, all non-emergency responses, mutual aid assistance, exposures, and NULL arrival time values are removed. NULL time values are removed because these times represent an incomplete time segment. E.g., if a unit were canceled, the arrival time would be equal to NULL because it never happened. Upgrades and downgrades are also not considered because they would have been driving with the flow of traffic for a portion of their response. Measuring mutual-aid units does not assess BFR capabilities in the City of Boulder, therefore these responses are not included. For fire incidents, AMR was excluded because they are not used to create a fire ERF. Statistical outliers were removed when possible. The definition of a statistical outlier is 1.5 times the Interquartile Range *IQR).

Critical Tasking

Evaluating the critical tasks required for on-scene operations is another element of a standard of cover analysis. Understanding the critical tasks (2C.4) that need to be completed to mitigate this incident will assist in determining appropriate staffing levels, the number of units needed, deployment strategies, and duties required at an incident. A department must be able to determine what tasks should be completed to have a positive influence on the outcome of the situation and define the number of personnel and apparatus required to complete those tasks in an effective manner. Because each emergency varies, and the order of activities undertaken to achieve objectives may vary depending on the immediate needs. The variables of the scene should be assessed upon arrival to determine where the resources available can be most effectively used to meet our primary objectives, Life Safety (occupants, emergency workers, bystanders, etc.), Incident Stabilization, and Property Conservation (LIP).

A minimum number of personnel must be identified to initiate all tasks required, and an incident commander must be on-scene to assign the specific tasks. BFR critical tasks are not pre-assigned based on unit designation (e.g.: ladder trucks are not always assigned the task of ventilation); however, the incident commander takes into consideration the type of unit and equipment available before assigning a specific task to a crew.

All personnel has the training required to perform the specific tasks assigned. Assigning tasks to crews rather than to individuals maintains crew integrity and thereby increases firefighter safety, efficiency, and accountability. BFR defines critical tasks for low-risk fire incidents, residential/commercial structure Fires, EMS, TRT, and HazMat responses.

BFR is unable to record timestamps for critical tasking as there is no field to record them in. At this time, querying the CAD comments to derive task timestamps is the only way to access the information. Storing data in free-text fields is an area for improvement within BFR. Currently, BFR dispatches the same initial compliment to a residential structure fire and a commercial structure fire. In the case of a commercial occupancy fire, the IC would call for a second alarm. The policy in place currently allows for an additional four alarms.

All BFR critical tasking and deployment aligns with the Boulder Valley Fire Consortium (BVFC). Through the Standard of Cover process, BFR identified the need to alter the dispatch array and policies for fire incidents based on the critical task analysis.

Response Performance

The Commission on Fire Accreditation International (CFAI) has suggests response time elements as a cascade of events. This is like that used by the medical community to describe the events leading up to the initiation, mitigation, and ultimate outcome of a cardiac arrest. It is vital to keep in mind that certain time events defined, such as turnout and travel time, can be directly influenced by the fire service via station locations and design, staffing levels, as well as local rules and procedures for the response. Other factors, such as the alarm interval, can be influenced indirectly through public education and engineering initiatives. The fire service can also influence the call-processing interval through its ability to define standards and compel performance by its dispatch centers.

The “time-temperature curve” standard is from the National Fire Protection Association (NFPA) and the Insurance Services Organization (ISO). These entities have established that a typical point source of ignition in a residential house will “flash over” at some time between five and 10 minutes after ignition, turning a typical “room and contents” fire into a structural fire of some magnitude.

In communities where the fire service is the principal provider of Emergency Medical Services (EMS), the goal is for basic life support (CPR and defibrillation) to be available to a victim of a cardiac arrest within four minutes of the event. The goal of advanced life support (paramedic service) should be available within eight minutes or less of the event according to NFPA. Early notification, distribution, and concentration of emergency response services are thus paramount to successful resuscitation efforts.

In trauma events, the golden hour is the historic benchmark applied to victims with significant critical traumatic injuries. The golden hour reflects the concept that survivability decreases significantly if the patient isn’t in the operating room within one hour of receiving a critical traumatic injury. In October 2019, response time performance tracking was significantly improved. These new time charts can be found in the appendix.

Fire

Low-Risk Fire

Benchmark: Low-Risk Fire

The department's benchmark service level objectives are as follows:

> For 90% of all Low-Risk Fire incidents, the total response time for the arrival of the 1st unit, staffed with a minimum of 3 personnel shall be 6 minutes.

Critical Tasks: Low-Risk Fire

For a low-risk fire (ex: dumpster fire), the total personnel needed for an effective response force is 3. A dumpster fire compliment is: 1 engine (3).

Low-Risk – Fire Suppression	
Critical Task	Minimum Personnel
Incident command, size up, IAP, safety	1
Pump Operator	1
Fire Attack	1
Total	3

Table 13: Critical Tasks Low-Risk Fire

The first arriving Engine shall be capable of: providing a minimum of 3 personnel, providing a minimum of 1000 GPM and a minimum static water source (tank water) of 300 gallons; initiating command and providing for incident safety; requesting additional resources; deploying 200' of 1 ¾" hose-line while flowing a minimum of 150 GPM; establishing an uninterrupted water supply as needed; containing the fire; performing salvage and overhaul operations; conduct a fire cause determination, and produce related documentation.

Baseline: Low-Risk Fire

The department's 2015-2018 baseline response times are as follows:

For 90% of all low-risk fire incidents, the total response time for the arrival of the 1st unit/ERF, staffed with a minimum of 3 personnel, is 9 minutes and 51 seconds.

Fire – Low-Risk 90th Percentile Times Baseline Performance (CAD)			2015-2018	2019 YTD	2018	2017	2016	2015	Target (Agency Benchmark)
Alarm Handling	Pick-up to Dispatch	Urban	1:23	0:40	0:37	0:55	0:48	2:51	1:00
			N=1477	N=140	N=295	N=347	N=349	N=346	
Turnout Time	Turnout Time 1st Unit	Urban	2:13	2:05	2:13	2:09	2:15	2:16	1:20
Travel Time	Travel Time 1st Unit **Distribution**	Urban	7:41	6:40	7:12	8:07	7:56	7:07	4:00
	Travel Time ERF **Concentration**	Urban	7:41	6:40	7:03	8:07	7:53	7:26	4:00
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	9:51	8:43	9:07	9:58	10:06	10:30	6:00
			N=1477	N=140	N=295	N=347	N=349	N=346	
	Total Response Time ERF **Concentration**	Urban	9:51	8:43	9:07	9:58	10:13	10:36	6:00
			N=1477	N=140	N=295	N=347	N=349	N=346	

Table 14: Low-Risk Fire Baseline Performance

The response times above were completed using CAD call types. The response times above were completed using the CAD call types. NFIRS baseline performance charts have been completed, however the data seta are small.

Moderate Risk Fire

For all moderate fires the current deployment is 4E,1L,1BC.

Benchmark: Moderate

For 90 % of all moderate/ high-risk structure fires, the total response time for the arrival of the first-due unit, staffed with a minimum of 3 fire personnel, shall be 6 minutes.

For 90 % of all moderate/high-risk structure fires, the total response time for the arrival of the ERF of 19 personnel shall be 8 minutes.

Critical Tasks: Moderate

A structure fire compliment currently is comprised of: 4 engines (E) (12 personnel), 1 ladder (L) (3 personnel), safety officer (SO) (1 person), a battalion chief (BC) (1 person), and 1 ambulance (2 personnel).

Moderate-Risk Fire Response	
Critical Task	Minimum Personnel
Initial Incident Command - Includes: Size up, IAP, Safety	1
Initial Attack Line	1
Pump Operator – Includes: Positioning Apparatus, Pump Operations	1
Water Supply	1
Primary Search	2
Control Utilities	1
Ventilation	2
2nd Attack Line	2
2nd Water Supply	1
On Deck Crew	3
Assume Command (IC2)	1
Assume Safety Operations – Includes: Second 360, Re-evaluate IAP	1
Rehabilitation/Patient Care	2
Total Personnel	19

Table 15: Critical Tasks High-Risk Fire

The first due unit shall be capable of, but not required to simultaneously perform, the following tasks: providing 1000 GPM from a static water source (tank water) of 300 gallons; initiating command; requesting additional resources; establishing and advancing an attack line flowing a minimum of 150 GPM; establishing an uninterrupted water supply; containing the fire; rescuing at-risk victims; and performing salvage operations. It is understood that the first due unit has the responsibility to conduct a proper size-up and may delegate the other task to other arriving equipment. These operations shall be done in accordance with departmental standard operating guidelines while providing for the safety of responders and the general public.

The ERF shall be capable of: Establishment of incident command outside of the hazard area for the overall coordination and direction of the initial full alarm assignment with a minimum of one member dedicated to this task. Establishment of a Safety Officer, and EMS crew. Establishment of an uninterrupted water supply of a minimum of 1000 GPM with supply lines maintained by the driver/operator. Establishment of an effective water flow application rate of 300 GPM from two hand-lines, each of which has a minimum flow rate of 150 GPM with each hand-line operated by a minimum of two members; one team of two members to conduct search and rescue; at least one team, consisting of a minimum of two members to raise ground ladders and perform ventilation, establishment of an on-deck crew consisting of a minimum of three members and if an aerial device

is used in operations one member to function as an aerial operator to maintain primary control of the aerial device at all times.

Baseline: Moderate- Risk

The department's 2015-2018 baseline response times are as follows:

For 90 % of all moderate-risk structure fires, the total response time for the arrival of the first-due unit, staffed with a minimum of 3 fire personnel, is be 6 minutes and 28 seconds.

For 90 % of all moderate-risk structure fires, the total response time for the arrival of the ERF of 19 personnel is be 21 minutes and 40 seconds.

Fire Moderate -Risk 90th Percentile Times Baseline Performance			2015-2018	2019 YTD	2018	2017	2016	2015	Target (Agency Benchmark)
Alarm Handling	Pick-up to Dispatch	Urban	0:26	0:16	0:23	0:26	0:31		1:00
			N=19	N=3	N=6	N=5	N=5	N=0	
Turnout Time	Turnout Time 1st Unit	Urban	2:01	0:42	2:23	1:46	1:33		1:20
Travel Time	Travel Time 1st Unit **Distribution**	Urban	5:08	5:53	5:06	4:50	4:20		4:00
	Travel Time ERF **Concentration**	Urban	11:47	10:35	14:14	10:03	8:07		4:00
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	6:28	6:09	6:34	5:46	5:11		6:00
			N=19	N=3	N=6	N=5	N=5	N=0	
	Total Response Time ERF **Concentration**	Urban	21:40	19:25	17:10	15:53	26:03		6:00
			N=19	N=3	N=6	N=5	N=5	N=0	

Table 16: Moderate/High-Risk Fire Baseline Performance

The response times above were completed using the CAD call types and NFIRS Property use types. Moderate and high-risk fire have the same initial dispatch and same ERF. For additional personnel, a second alarm would be called. A second alarm will be excluded from the ERF calculation because they are not dispatched at the same time. The same number of units and personnel get dispatched to all moderate and high fires and the critical tasking is the same for both. The department has recognized that moderate fires are being over-dispatched and the department is in the process of aligning response to that of the Boulder Valley Fire Consortium (BVFC). There is further documentation in the "deployment evaluation," and Boulder Valley Fire Consortium Standard of Cover.

High Risk Fire

For all high risk fires the current deployment is 4E,1L,1BC. Additional Alarms are needed where additional personnel are required to fight the fire. A second alarm would yield an additional 12 people (3E) and a staff officer.

Benchmark: High

For 90 % of all moderate/ high-risk structure fires, the total response time for the arrival of the first-due unit, staffed with a minimum of 3 fire personnel, shall be 6 minutes.

For 90 % of all moderate/high-risk structure fires, the total response time for the arrival of the ERF of 19 personnel shall be 8 minutes.

Critical Tasks: High

A structure fire compliment currently is comprised of: 4 engines (E) (12 personnel), 1 ladder (L) (3 personnel), safety officer (SO) (1 person), a battalion chief (BC) (1 person), and 1 ambulance (2 personnel).

High-Risk Fire Response	
Critical Task	**Minimum Personnel**
Initial Incident Command - Includes: Size up, IAP, Safety	1
Initial Attack Line	1
Pump Operator – Includes: Positioning Apparatus, Pump Operations	1
Water Supply	1
Primary Search	2
Control Utilities	1
Ventilation	2
2nd Attack Line	2
2nd Water Supply	1
On Deck Crew	3
Assume Command (IC2)	1
Assume Safety Operations – Includes: Second 360, Re-evaluate IAP	1
Rehabilitation/Patient Care	2
Total Personnel	**19**

Table 17: Critical Tasks High-Risk Fire

The first due unit shall be capable of, but not required to simultaneously perform, the following tasks: providing 1000 GPM from a static water source (tank water) of 300 gallons; initiating command; requesting additional resources; establishing and advancing an attack line flowing a minimum of 150 GPM; establishing an uninterrupted water supply; containing the fire; rescuing at-risk victims; and performing salvage operations. It is understood that the first due unit has the responsibility to conduct a proper size-up and may delegate the other task to other arriving equipment. These operations shall be done in accordance with departmental standard operating guidelines while providing for the safety of responders and the general public.

The ERF shall be capable of: Establishment of incident command outside of the hazard area for the overall coordination and direction of the initial full alarm assignment with a minimum of one member dedicated to this task. Establishment of a Safety Officer, and EMS crew. Establishment of an uninterrupted water supply of a minimum of 1000 GPM with supply lines maintained by the driver/operator. Establishment of an effective water flow application rate of 300 GPM from two hand-lines, each of which has a minimum flow rate of 150 GPM with each hand-line operated by a minimum of two members; one team of two members to conduct search and rescue; at least one team, consisting of a minimum of two members to raise ground ladders and perform

ventilation, establishment of an on-deck crew consisting of a minimum of three members and if an aerial device is used in operations one member to function as an aerial operator to maintain primary control of the aerial device at all times.

Baseline: High- Risk

The department's 2015- 2018 baseline response times are as follows:

For 90 % of all moderate-risk structure fires, the total response time for the arrival of the first-due unit, staffed with a minimum of 3 fire personnel, is be 5 minutes and 7 seconds.

For 90 % of all moderate-risk structure fires, the total response time for the arrival of the ERF of 19 personnel is be 13 minutes and 11 seconds.

Fire High-Risk 90th Percentile Times Baseline Performance			2015-2018	2019 YTD	2018	2017	2016	2015	Target (Agency Benchmark)
Alarm Handling	Pick-up to Dispatch	Urban	0:21	0:18	0:44	0:21	0:09		1:00
			N=13	N=2	N=1	N=8	N=2	N=0	
Turnout Time	Turnout Time 1st Unit	Urban	1:48	1:44	1:44	1:49	1:32		1:20
Travel Time	Travel Time 1st Unit **Distribution**	Urban	2:57	1:41	1:41	3:01	2:45		4:00
	Travel Time ERF **Concentration**	Urban	11:06	10:52	7:45	11:07	5:44		4:00
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	5:07	3:30	3:39	5:40	3:36		6:00
			N=13	N=2	N=1	N=8	N=2	N=0	
	Total Response Time ERF **Concentration**	Urban	13:11	12:47	10:44	13:56	9:27		6:00
			N=13	N=2	N=1	N=8	N=2	N=0	

Table 18: Moderate/High-Risk Fire Baseline Performance

The response times above were completed using the CAD call types and NFIRS Property use types. No outliers were removed from this data set.

Wildland Fire

There is a low call volume in the Tritech CAD related to wildland fire. The data set does not include mutual aid request to the County. It is in the service level agreement that we provide a response to all city-owned lands, even if not within the municipal boundary. The Wildland Division should be able to provide acres burned for future iterations of the document, as well as time on scene.

There has historically not been a different level of wildland response based on risk, however it was determined during this process that there should be. In 2020, the department will be adopting the Boulder Valley Fire Consortium (BVFC) model of assessing low, moderate and high-risk, by indices and type of wildfire.

In the wildland fire environment, four basic safety hazards confront the firefighter -lightning, fire-weakened timber, rolling rocks, entrapment by running fires. Each firefighter must know the interconnection of Lookouts, Communications, Escape Routes, and Safety Zones (LCES). LCES will be established before fighting the fire: select lookouts, set up a communication, choose escape routes, and select safety zones. In the instance of a high/extreme fire, BFR will automatically need to request mutual aid for additional personnel.

Low-Risk Wildland Fire

The current response compliment for these incidents includes: 1 Engine, 1 Brush Truck, 1 Battalion Chief.

Benchmark: Low-Risk Wildland

The Department's benchmark service-level objectives are as follows:

> For 90 % of responses to low-risk Wildland Fire incidents, the total response time for the first due unit staffed with a minimum of 3 personnel shall be: 6 minutes.
>
> For 90 % of responses to low-risk Wildland Fire incidents, the total response time for the ERF unit staffed with a minimum of 3 personnel shall be: 6 minutes.

For low-risk wildfire incident within the city limits of Boulder, the effective response force is 3.

Low-Risk Wildland	
Critical Task	Minimum Personnel
Incident Command, size up, safety	1
Fire Attack/Structure Protection	2
Total	3

Table 19: Critical Task: Low-Risk Wildland

The first due unit shall be capable of fire attack, structure protection and water supply.

Baseline: Low-Risk Wildland

The Department's benchmark service-level objectives are as follows:

The department's 2015-2018 baseline response times are as follows:

> For 90 % of responses to low-risk Wildland Fire incidents, the total response time for the first due unit/ERF staffed with a minimum of 3 personnel is 8 minutes and 31 seconds.

Wildland Fire 90th Percentile Times Baseline Performance			2015-2018	2019 YTD	2018	2017	2016	2015	Target (Agency Benchmark)
Alarm Handling	Pick-up to Dispatch	Urban	0:44	0:41	0:37	0:46	0:32		1:00
			N=20	N=1	N=10	N=7	N=2	N=0	
Turnout Time	Turnout Time 1st Unit	Urban	1:51	0:56	1:48	1:49	1:59		1:20
Travel Time	Travel Time 1st Unit **Distribution**	Urban	6:08	4:52	6:08	6:56	4:27		4:00
	Travel Time ERF **Concentration**	Urban	6:08	4:52	6:08	6:56	4:27		4:00
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	8:31	6:29	8:04	9:21	6:40		6:00
			N=20	N=1	N=10	N=7	N=2	N=0	
	Total Response Time ERF **Concentration**	Urban	8:31	6:29	8:04	9:21	6:40		6:00
			N=20	N=1	N=10	N=7	N=2	N=0	

Table 20:Low-Risk Wildland Baseline Performance

Of these incidents, the wildland team responded to 10. In all instances, among all units, the wildland team responded in 20 minutes or less.

Alarm	Turnout	Travel	Total
0:08:34	0:08:37	0:19:58	0:20:24

Moderate-Risk Wildland

The response compliment for these incidents includes: 1 Engine, 1 Brush Truck, 1 Battalion Chief.

Benchmark: Moderate-Risk Wildland

The Department's benchmark service-level objectives are as follows:

> For 90 % of responses for moderate-risk Wildland Fire incidents, the total response time for the first due unit staffed with a minimum of 3 personnel shall be 6 minutes.
>
> For 90% of all wildfire incidents on City-owned property, the total response time for the arrival of the wildland team, staffed with two Engine Bosses and two Task Force Leaders (or higher) shall be 20 minutes.

Moderate-Risk Wildland	
Critical Task	Minimum Personnel
Incident Command, size up, safety, IAP, LCES	1
Fire Attack/Structure Protection	2
Anchor/Flank	3
Water Supply	3
Total	8

Table 21: Critical Tasks Moderate Wildland

The first due unit shall be capable of fire attack, structure protection and water supply. The ERF shall be capable of incident command, safety, IAP and LCES.

There is no response times chart for moderate-risk wildland fires from 2015-2018.

High-Risk Wildland Fire

Benchmark: High-Risk Wildland

The Department's benchmark service-level objectives are as follows:

> For 90 % of responses for high-risk Wildland Fire incidents, the total response time for the first due unit staffed with a minimum of 3 personnel shall be 6 minutes.
>
> For 90% of all wildfire incidents on City-owned property, the total response time for the arrival of the wildland team, staffed with two Engine Bosses and two Task Force Leaders (or higher) shall be 20 minutes.

High-Risk Wildland	
Critical Task	Minimum Personnel
Incident Command, size up, safety, IAP, LCES	1
Fire Attack/Structure Protection	2
Anchor/Flank	3
Water Supply	3
Total	8

Table 22: Critical Tasks High-Risk Wildland

The first due unit shall be capable of fire attack, structure protection and water supply. The ERF shall be capable of incident command, safety, IAP and LCES.

There is no performance chart for high-risk wildland fires from 2015-2018.

Emergency Medical Services

BFR responds to a wide variety of EMS calls, including falls, motor vehicle accidents, childbirth, difficulty breathing, and cardiac arrests. BFR sends an engine to all BLS incidents. Engine companies respond to all basic life support (BLS) calls; an engine and a private ambulance company respond to advanced life support (ALS) calls, the private ambulance transports patient to the hospital.

Seven Engines and one ladder are basic life support (BLS) first responders. Each piece of apparatus has three personnel. The department relies upon a third-party provider to provide Advanced Life Support (ALS) and transport to patients. The department utilizes the ambulance service to complete the ERF component of its EMS program.

There are between 2- 10 ALS ambulances in the system at any given time. Minimum staffing for the ALS ambulances is a minimum of two personnel, one of whom must be a paramedic. The ambulance providers are required to meet response time criteria of 7 minutes 90% of the time and 11 minutes 98% of the time.

The initial arriving fire department company shall have the capabilities of providing first responder medical aid with automatic external defibrillation until the third-party provider arrives on the scene. If the third-party provider unit arrives on scene first, its personnel shall initiate care, and the staff from the initial fire department company shall provide support as needed.

Low-Risk EMS

Benchmark: Low-Risk

The Department's benchmarks are as follows:

> For 90% of all lwo-risk EMS response incidents, the total response time for the arrival of the 1st Unit/ ERF, staffed with a minimum of 2 personnel, shall be 6 minutes.

Low-risk – EMS	
Critical Task	Minimum Personnel
Incident command	1
Patient Assessment/Treatment	1
Total	2

Table 23: Critical Tasks Low-Risk EMS

The first due BLS unit shall be capable of: providing incident command and producing related documentation; completing the patient assessment; providing appropriate treatment; performing automatic external defibrillator (AED); initiating cardiopulmonary resuscitation (CPR).

Baseline: Low-Risk

The department's 2015-2018 baseline response times are as follows:

> For 90% of all low-risk EMS incidents, the total response time for the arrival of the 1st unit/ERF, staffed with a minimum of 2 personnel, is 9 minutes and 49 seconds.

EMS Response Times Table: Low-Risk

EMS Low-Risk 90th Percentile Times Baseline Performance			2015-2018	2019 YTD	2018	2017	2016	2015	Target (Agency Benchmark)
Alarm Handling	Pick-up to Dispatch	Urban	3:07	3:04	3:13	3:11	3:00	00:59	1:00
			N=4285	N=552	N=929	N=1039	N=961	N=945	
Turnout Time	Turnout Time 1st Unit	Urban	1:53	1:36	1:46	1:40	1:46	2:07	1:00
Travel Time	Travel Time 1st Unit **Distribution**	Urban	6:06	5:14	5:07	5:14	5:21	6:11	4:00
	Travel Time ERF **Concentration**	Urban	6:06	5:14	5:07	5:14	5:21	6:11	4:00
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	9:49	8:19	8:16	8:23	8:53	10:07	6:00
			N=4285	N=552	N=929	N=1039	N=961	N=945	
	Total Response Time ERF **Concentration**	Urban	9:49	8:19	8:16	8:23	8:53	10:07	6:00
			N=4285	N=552	N=929	N=1039	N=961	N=945	

Table 24: EMS Response Times Table Low-Risk

The data set above was calculated utilizing BFR's current data procedures. Data from 2016 and 2015 does not reflect EMD use, as it was not fully integrated into the data set. The response times above were completed using the CAD call types. NFIRS baseline performance charts have been completed, however the data seta are small.

Moderate-Risk EMS

Benchmark: Moderate-Risk

The Department's benchmarks are as follows:

> For 90% of all moderate-risk EMS incidents, the total response time for the arrival of the 1st Unit, staffed with a minimum of 2 personnel, shall be 6 minutes.
>
> For 90% of all moderate-risk EMS incidents, the total response time for the arrival of the ERF, staffed with 5 personnel shall be 6 minutes.

Moderate-Risk EMS	
Critical Task	Minimum Personnel
Incident command	1
Airway Management/Patient Assessment/Treatment	
Possible AED/Chest Compressions/Medication	2
Patient Packaging/ Transport	2
Total	5

Table 16: Critical Tasks Moderate-risk EMS

The first due BLS unit shall be capable of: providing incident command and producing related documentation; completing the patient assessment; providing appropriate treatment; performing automatic external defibrillator (AED); initiating cardiopulmonary resuscitation (CPR). For high and moderate acuity incidents, a third-party ambulance is used to accomplish the ERF. During these events, there is a high likelihood that the patient will need ALS intervention. The ALS unit shall be capable of providing appropriate treatment; providing IV access medication administration.

Baseline: Moderate-Risk

The Department's baseline response time in 2015- 2018 is as follows:

For 90% of all moderate-risk EMS incidents, the total response time for the arrival of the 1st Unit is 8 minutes and 12 seconds.

For 90% of all moderate-risk EMS incidents, the total response time for the arrival of the ERF is 10 minutes and 11 seconds.

EMS Moderate-Risk 90th Percentile Times Baseline Performance			2015-2018	2019 YTD	2018	2017	2016	2015	Target (Agency Benchmark)
Alarm Handling	Pick-up to Dispatch	Urban	2:54	3:30	3:03	2:57	2:53	00:45	1:00
			N=8353	N=1276	N=2089	N=2194	N=2089	N=1536	
Turnout Time	Turnout Time 1st Unit	Urban	1:50	1:41	1:41	1:42	1:42	2:06	1:00
Travel Time	Travel Time 1st Unit **Distribution**	Urban	4:43	5:01	4:49	4:44	4:48	4:32	4:00
	Travel Time ERF **Concentration**	Urban	6:31	7:03	6:51	6:33	6:21	6:01	4:00
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	8:12	8:03	7:59	7:52	7:53	8:30	6:00
			N=8353	N=1276	N=2089	N=2194	N=2089	N=1536	
	Total Response Time ERF **Concentration**	Urban	10:11	10:09	9:57	9:49	9:46	10:03	6:00
			N=8353	N=1276	N=2089	N=2194	N=2089	N=1536	

Table 25: EMS Response Times Moderate-Risk

The data set above was calculated utilizing BFR's current data procedures. Data from 2016 and 2015 does not reflect EMD use, as it was not fully integrated into the data set. The response times above were completed using the CAD call types. NFIRS baseline performance charts have been completed, however the data seta are small.

In late 2019 the response model was changed. The ERF went from 5 to 8 in order to facilitate Pit Crew EMS. Pit Crew EMS is outlined on pg 150 of this document

High-Risk EMS

Benchmark: High-risk

The Department's benchmarks are as follows:

> For 90% of all high-risk EMS incidents, the total response time for the arrival of the 1st Unit, staffed with a minimum of 2 personnel, is 6 minutes.
>
> For 90% of all high-risk EMS incidents, the total response time for the arrival of the ERF, staffed with 5 personnel shall be 8 minutes.

The first due BLS unit shall be capable of: providing incident command and producing related documentation; completing the patient assessment; providing appropriate treatment; performing automatic external defibrillator (AED); initiating cardiopulmonary resuscitation (CPR). For moderate acuity incidents, a third-party ambulance is used to accomplish the ERF. During these events, there is a high likelihood that the patient will need ALS intervention. The ALS unit shall be capable of providing appropriate treatment; providing IV access medication administration.

High-Risk – EMS	
Critical Task	**Minimum Personnel**
Incident command	1
Airway Management/Patient Assessment/Treatment	
Possible AED/Chest Compressions/Medication	1
Patient Packaging/ Transport	2
Total	**4**

Table 26: Critical Tasks High-Risk EMS

The first due BLS unit shall be capable of: providing incident command and producing related documentation; completing the patient assessment; providing appropriate treatment; performing automatic external defibrillator (AED); initiating cardiopulmonary resuscitation (CPR). For high and moderate acuity incidents, a third-party ambulance is used to accomplish the ERF. During these events, there is a high likelihood that the patient will need ALS intervention. The ALS unit shall be capable of providing appropriate treatment; providing IV access medication administration.

Baseline: High-Risk

The Department's baseline response time in 2015-2018 is as follows:

For 90% of all high-risk EMS incidents, the total response time for the arrival of the 1st unit, staffed with a minimum of 2 personnel, is 7 minutes and 19 seconds.

For 90% of all high-risk EMS incidents, the total response time for the arrival of the ERF staffed with 5 personnel, is 9 minutes and 10 seconds.

EMS Response Times Table: High-risk

EMS High-risk 90th Percentile Times Baseline Performance			2015-2018	2019 YTD	2018	2017	2016	2015	Target (Agency Benchmark)
Alarm Handling	Pick-up to Dispatch	Urban	2:08	2:34	2:13	2:32	2:09	00:49	1:00
			N=31	N=57	`N=58	N=66	N=67	N=60	
Turnout Time	Turnout Time 1st Unit	Urban	1:40	1:32	1:34	1:35	1:40	1:50	1:00
Travel Time	Travel Time 1st Unit Distribution	Urban	4:34	4:13	4:31	4:53	4:26	4:27	4:00
	Travel Time ERF Concentration	Urban	6:06	6:04	6:14	6:19	6:29	5:27	4:00
Total Response Time	Total Response Time 1st Unit on Scene Distribution	Urban	7:19	6:57	6:42	6:59	7:11	7:33	6:00
			N=31	N=57	`N=58	N=66	N=67	N=60	
	Total Response Time ERF Concentration	Urban	9:10	8:50	8:19	9:23	8:41	9:09	6:00
			N=31	N=57	N=58	N=66	N=67	N=60	

Table 27: EMS Response Times High-Risk

The data set above was calculated utilizing BFR's current data procedures. Data from 2016 and 2015 does not reflect EMD use, as it was not fully integrated into the data set. The response times above were completed using the CAD call types. NFIRS baseline performance charts have been completed, however the data seta are small.

In 2019, the department implemented PIT crew ems, which increased the number of personnel required for an ERF from 5 to 8.

Technical Rescue

Depending on the incident, assets may be sent non-emergency, requested from other mutual aid partners, or not requested at all. The goal is to recognize and identify the need for technical rescue services involving incidents such as structural collapse, trench collapse, complicated or advanced vehicle extrication, confined space rescue, rope rescue, etc. They perform rescue or incident stabilization as necessary to accomplish life safety and property conservation. In cases of very large events such as a large life hazard structural collapse, perform initial steps toward incident mitigation to involve size-up, requesting additional technical rescue services, performing the rescue, shoring, and other steps toward incident stabilization until outside resources arrive to assist.

Low-Risk Technical Rescue

Benchmark: Low-Risk Technical Rescue

The Department's benchmark service-level objectives are as follows:

For 90 % of responses for Low-risk Technical Rescue incidents, the total response time for the first due unit/ERF, staffed with a minimum of 3 personnel, shall be 6 minutes.

Low-Risk – Technical Rescue	
Critical Task	Minimum Personnel
Incident command (size up, safety)	1
Access	2
Total	3

Table 28: Critical Tasks Low-Risk Technical Rescue

The first due unit shall be capable of incident command and access to the patient.

Baseline: Low-Risk Technical Rescue

The baseline for Low-Risk Technical Rescue in 2015-2018 is as follows:

> For 90 % of responses for low-risk technical rescue incidents, the total response time for the first due unit/ERF staffed with a minimum of 3 personnel is 5 minutes and 46 seconds.

Technical Rescue Low Risk **90th Percentile Times Baseline Performance**			**2015-2018**	**2019 YTD**	**2018**	**2017**	**2016**	**2015**	**Target (Agency Benchmark)**
Alarm Handling	Pick-up to Dispatch	Urban	0:55	0:29	0:38	0:40	0:40	0:51	1:00
			N=2004	N=373	N=487	N=512	N=342	N=89	
Turnout Time	Turnout Time 1st Unit	Urban	1:34	1:33	1:34	1:32	1:28	1:52	1:00
Travel Time	Travel Time 1st Unit **Distribution**	Urban	4:15	4:16	4:16	4:08	4:17	3:37	4:00
	Travel Time ERF **Concentration**	Urban	4:15	4:16	4:16	4:08	4:17	3:37	4:00
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	5:46	5:24	5:22	5:17	5:32	6:40	6:00
			N=2004	N=373	N=487	N=512	N=342	N=89	
	Total Response Time ERF **Concentration**	Urban	5:46	5:24	5:22	5:17	5:32		6:00
			N=2004	N=373	N=487	N=512	N=342	N=89	

Table 29: Response Times Low-Risk Technical Rescue

The response times above were completed using the CAD call types. NFIRS baseline performance charts have been completed, however the data seta are small.

Moderate-Risk Technical Rescue

Benchmark: Moderate-risk Technical Rescue

The Department's benchmark service-level objectives are as follows:

For 90 % of responses for moderate-risk technical rescue incidents, the total response time for the first due unit, staffed with a minimum of 3 personnel, shall be 6 minutes.

For 90 % of responses to moderate -risk technical rescue incidents, the total response time for the arrival of the effective response force (ERF), staffed with a minimum of 9 personnel, shall be 8 minutes.

Moderate-Risk Technical Rescue	
Critical Task	Minimum Personnel
Incident Command, size up	1
Safety Officer	1
Pump Operator	1
Extrication	2
Stabilization	2
Pt Triage	2
Total	9

Table 30: Critical Tasks Moderate-Risk Technical Rescue

Baseline: Moderate-Risk Technical Rescue

The baseline for moderate-risk technical rescue for 2015-2018 is as follows:

> For 90 % of responses for moderate-risk technical rescue incidents, the total response time for the first due unit, staffed with a minimum of 3 personnel, is 4 minutes and 12 seconds.
>
> For 90 % of responses to moderate-risk technical rescue incidents, the total response time for the arrival of the effective response force (ERF), staffed with a minimum of 9 personnel, is 10 minutes and 15 seconds.

Technical Rescue Moderate-Risk 90th Percentile Times Baseline Performance			2015-2018	2019 YTD	2018	2017	2016	2015	Target (Agency Benchmark)
Alarm Handling	Pick-up to Dispatch	Urban	0:36	0:44	0:30	0:40	0:21	0:32	1:00
			N=33	N=6	N=12	N=10	N=2	N=7	
Turnout Time	Turnout Time 1st Unit	Urban	2:12	1:19	2:08	2:02	2:15	2:07	1:00
Travel Time	Travel Time 1st Unit **Distribution**	Urban	4:12	2:59	3:10	4:24	3:03	3:08	4:00
	Travel Time ERF **Concentration**	Urban	8:56	5:50	9:39	7:44	9:15	4:04	4:00
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	6:24	3:51	4:16	6:41	5:39	5:54	6:00
			N=33	N=6	N=12	N=10	N=2	N=7	
	Total Response Time ERF **Concentration**	Urban	10:15	9:02	11:13	9:14	11:46	6:49	6:00
			N=33	N=6	N=12	N=10	N=2	N=7	

Table 31: Response Times Moderate-risk Technical Rescue

From 2015 – 2018 there is not enough data to draw any meaningful conclusions from 2015-2018.

The response times above were completed using the CAD call types. NFIRS baseline performance charts have been completed, however the data seta are even smaller.

High-Risk Technical Rescue

Benchmark: High-Risk Technical Rescue

The Department's benchmark service-level objectives are as follows:

> For 90 % of responses for Moderate-risk Technical Rescue incidents, the total response time for the first due unit, staffed with a minimum of 3 personnel, shall be 6 minutes.
>
> For 90 % of responses to Moderate-risk Technical Rescue incidents, the total response time for the arrival of the effective response force (ERF), staffed with a minimum of 12 personnel shall be 8 minutes.

High – Risk Technical Rescue	
Critical Task	Minimum Personnel
Incident Command, size up, safety	1
Pump Operator	1
Safety Officer	1
Air Monitor	1
Extrication	2
RIT	2
Rehab	2
Rigging/Hauling	2
Total	12

Table 32: Critical Tasks High-Risk Technical Rescue

The first due unit shall be capable of incident command and access to the patient.The ERF shall be capable of providing incident safety, extrication, stabilization, pt. triage, rigging/hauling and rehab.

There were zero high-risk technical rescue incidents from 2015-2018.

Hazmat

As mentioned earlier, Hazardous materials response is a locally provided service mandated by federal statute. Federal law requires Colorado to develop a hazardous materials response system. The responsibility for the development of this system was delegated to local jurisdictions by statute. The statute requires local governing bodies to appoint a Designated Emergency Response Authority (DERA) for the purpose of responding to hazardous materials emergencies. In order to provide the citizens with the best possible and most cost-effective response, Boulder County has one county Hazardous Materials Team. The team is comprised of City of Boulder, City of Longmont, Boulder Rural Fire Protection District, and City of Lafayette.

The response is the portion of incident management in which personnel are involved in controlling a hazardous materials incident defensively or offensively. The activities in the response portion of hazardous materials incident include (a) Analyzing the incident, (b) Planning the response, (c) Implementing the planned response, and (d) Evaluating the process.

Low-Risk Hazmat

Benchmark: Low-Risk Hazmat

The Department's benchmark service-level objectives are as follows:

> For 90 % of responses for low-risk hazmat incidents, the total response time for the first due unit ,staffed with a minimum of 3 personnel, shall be 6 minutes.
>
> For 90 % of responses for low-risk hazmat incidents, the total response time for the ERF unit, staffed with a minimum of 3 personnel, shall be 6 minutes.

Low-Risk – HazMat	
Critical Task	Minimum Personnel
Incident command	1
Contain, Control, Isolate	2
Total	3

Table 33: Critical Tasks Low-Risk Hazmat

The first due unit shall be capable of incident command, containing, controlling and isolating any spilled product.

Baseline: Low-Risk Hazmat

The baseline for low-risk hazmat from 2015-2018 is as follows:

> For 90 % of responses for low-risk hazmat incidents, the total response time for the first due unit/ERF staffed with a minimum of 3 personnel is 8 minutes and 4 seconds.

Hazmat Low-Risk 90th Percentile Times Baseline Performance			2015-2018	2019 YTD	2018	2017	2016	2015	Target (Agency Benchmark)
Alarm Handling	Pick-up to Dispatch	Urban	0:32	0:40	0:39	0:32	0:25	1:38	1:00
			N=118	N=20	N=46	N=42	N=25	N=4	
Turnout Time	Turnout Time 1st Unit	Urban	2:07	2:00	2:16	2:00	2:07	2:05	1:00
Travel Time	Travel Time 1st Unit **Distribution**	Urban	6:04	6:45	6:30	5:51	5:02	4:20	4:00
	Travel Time ERF **Concentration**	Urban	6:04	6:45	6:30	5:51	5:02	4:20	4:00
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	8:04	8:43	8:33	7:17	6:47	9:05	6:00
			N=118	N=20	N=45	N=42	N=25	N=4	
	Total Response Time ERF **Concentration**	Urban	8:04	8:43	8:33	7:17	6:47	9:05	6:00
			N=118	N=20	N=45	N=42	N=25	N=4	

Table 34: Response Times Table Low-Risk Hazmat

The response times above were completed using the CAD call types. NFIRS baseline performance charts have been completed, however the data seta are smaller.

Moderate-Risk Hazmat

Benchmark: Moderate-Risk Hazmat

The Department's benchmark service-level objectives are as follows:

> For 90 % of responses for Moderate-risk HazMat incidents, the total response time for the first due unit staffed with a minimum of 3 personnel shall be 6 minutes.

The Hazmat Authority benchmark service-level objectives are as follows:

> For 90 % of responses to Moderate-risk HazMat incidents, within the vicinity of East of Broadway/Hwy 93/U.S. 36, North of Hwy 128, South of Hwy 66, and West of East County Line Road, the total response time for the arrival of the effective response force (ERF) minimum of 7.
>
> For 90 % of responses to High-risk HazMat incidents, outside of the area defined above, the total response time for the arrival of the effective response force (ERF) minimum of 7.

Moderate-Risk Hazmat	
Critical Task	Minimum Personnel
Incident Command, size up, safety	1
Identify	1
Decontamination	2
Contain, Control, Isolate	3
Total	7

Table 35: Moderate-Risk Hazmat

The first due unit shall be capable of incident command, containing, controlling and isolating any spilled product. The ERF shall be capable of incident safety, identifying the product and decontamination.

Baseline: Moderate-Risk Hazmat

The baseline for moderate-risk hazmat from 2015-2018 is as follows:

For 90 % of responses for moderate-risk hazmat incidents, the total response time for the first due unit staffed with a minimum of 3 personnel is 5 minutes and 7 seconds.

For 90 % of responses for moderate-risk hazmat incidents, the total response time for the first due unit staffed with a minimum of 7 personnel is 11 minutes and 34 seconds.

Hazmat Moderate-Risk 90th Percentile Times Baseline Performance			2015-2018	2019 YTD	2018	2017	2016	2015	Target (Agency Benchmark)
Alarm Handling	Pick-up to Dispatch	Urban	0:45	0:27	0:33	0:42	0:34	2:11	1:00
			N=167	N=32	N=60	N=66	N=26	N=24	
Turnout Time	Turnout Time 1st Unit	Urban	2:19	2:35	2:20	2:14	2:20	2:38	1:00
Travel Time	Travel Time 1st Unit **Distribution**	Urban	5:07	4:53	5:18	4:30	4:44	5:01	4:00
	Travel Time ERF **Concentration**	Urban	9:14	7:28	9:41	8:28	7:58	9:09	4:00
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	7:28	7:27	7:30	6:49	7:04	9:03	6:00
			N=167	N=32	N=60	N=66	N=26	N=24	
	Total Response Time ERF **Concentration**	Urban	11:34	9:37	11:46	10:27	10:22	12:51	6:00
			N=167	N=32	N=60	N=66	N=26	N=24	

Table 36: Response Times Table Moderate-Risk Hazmat

The response times above were completed using the CAD call types. The response times above were completed using the CAD call types. NFIRS baseline performance charts have been completed, however the data seta are small. 2015 call data should be evaluated in more detail.

High-Risk Hazmat

Benchmark: High-Risk Hazmat

The Department's benchmark service-level objectives are as follows:

> For 90 % of responses to high-risk hazmat incidents, the total response time for the first due unit staffed with a minimum of 3 personnel shall be 6 minutes

The hazmat authority benchmark service-level objectives are as follows:

> For 90 % of responses to high -risk hazmat incidents, within the vicinity of East of Broadway/Hwy 93/U.S. 36, North of Hwy 128, South of Hwy 66, and West of East County Line Road, the total response time for the arrival of the effective response force (ERF) minimum of 13 people personnel shall be 90 minutes.
>
> The total response time for the arrival of the effective response force (ERF) minimum of 13 people personnel shall be 90 minutes.
>
> For 90 % of responses to high-risk hazmat incidents, outside of the area defined above, the total response time for the arrival of the effective response force (ERF) minimum of 13 people personnel shall be 120 minutes.

High-risk – Hazmat (3E,1BC,1HM, 1AM)	
Critical Task	Minimum Personnel
Hazmat Group Supervisor	1
Safety Officer	1
Entry Team Lead	1
Entry Team	2
Backup Entry Team	2
Research Lead	1
Research	1
Decontamination Leader	1
Decontamination Team	2
Site Access	1
Total	13

One hazmat unit can assess safety entry routes to the incident, identifying a defensive perimeter and an operational area and staging area, directing defensive operations, and initiating a site-specific written action plan. They shall be capable of preparing for and initiating offensive Hazmat operations, decontamination operations, and property conservation operations.

The charts below are the ERF that satisfies BFR's contribution to the hazmat authority. Currently times from the authority are not available for integration into BRF's data.

Baseline: High-Risk Hazmat

The baseline for high-risk hazmat from 2015-2018 is as follows:

> For 90 % of responses for high-risk hazmat incidents, the total response time for the first due unit staffed with a minimum of 3 personnel is 7 minutes and 40 seconds.

Hazmat High Risk 90th Percentile Times Baseline Performance			2015-2018	2019 YTD	2018	2017	2016	2015	Target (Agency Benchmark)
Alarm Handling	Pick-up to Dispatch	Urban	0:41	0:13	0:37	0:38	0:31		1:00
			N=4	N=1	N=1	N=2	N=1	N=0	
Turnout Time	Turnout Time 1st Unit	Urban	2:01	2:14	2:07	2:01	1:24		1:00
Travel Time	Travel Time 1st Unit Distribution	Urban	5:09	3:03	5:53	3:18	3:08		4:00
	Travel Time ERF Concentration	Urban	5:09	3:03	5:53	3:18	3:08		4:00
Total Response Time	Total Response Time 1st Unit on Scene Distribution	Urban	7:40	5:30	8:37	5:20	5:03		6:00
			N=4	N=1	N=1	N=2	N=1	N=0	
	Total Response Time ERF Concentration	Urban	7:40	5:30	8:37	5:20	5:03		6:00
			N=4	N=1	N=1	N=2	N=1	N=0	

Table 37: High Risk Hazmat Baseline Performance

The response times above were completed using the CAD call types.

NFIRS baseline performance charts have been completed, however the data seta are even smaller.

Section VI: Evaluation of Current Deployment and Performance

The following section will evaluate the current deployment and performance of BFR. Below is a map of response time distribution by planning zone and census block (2C.6).

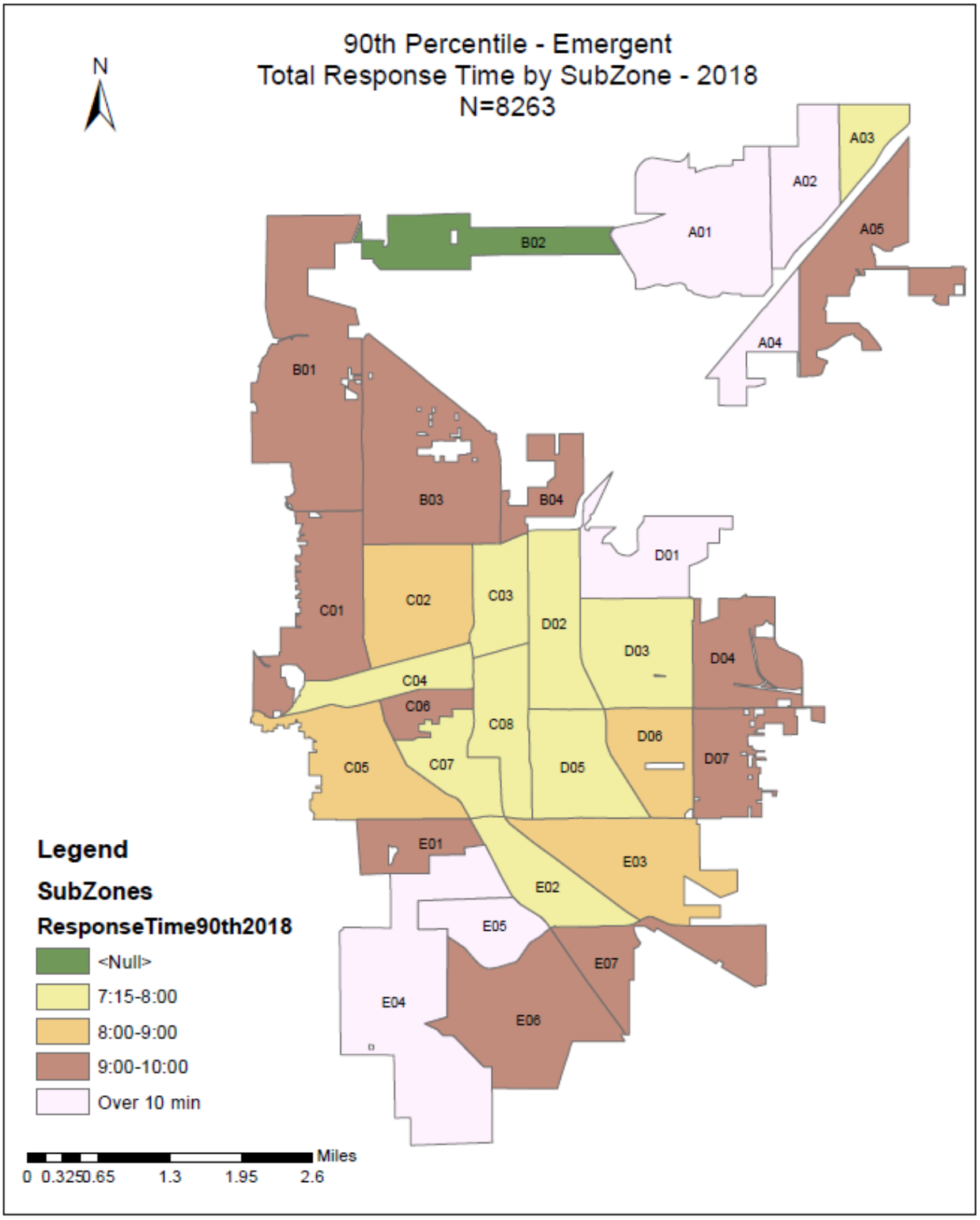


Figure 95: Response Times by Subzone

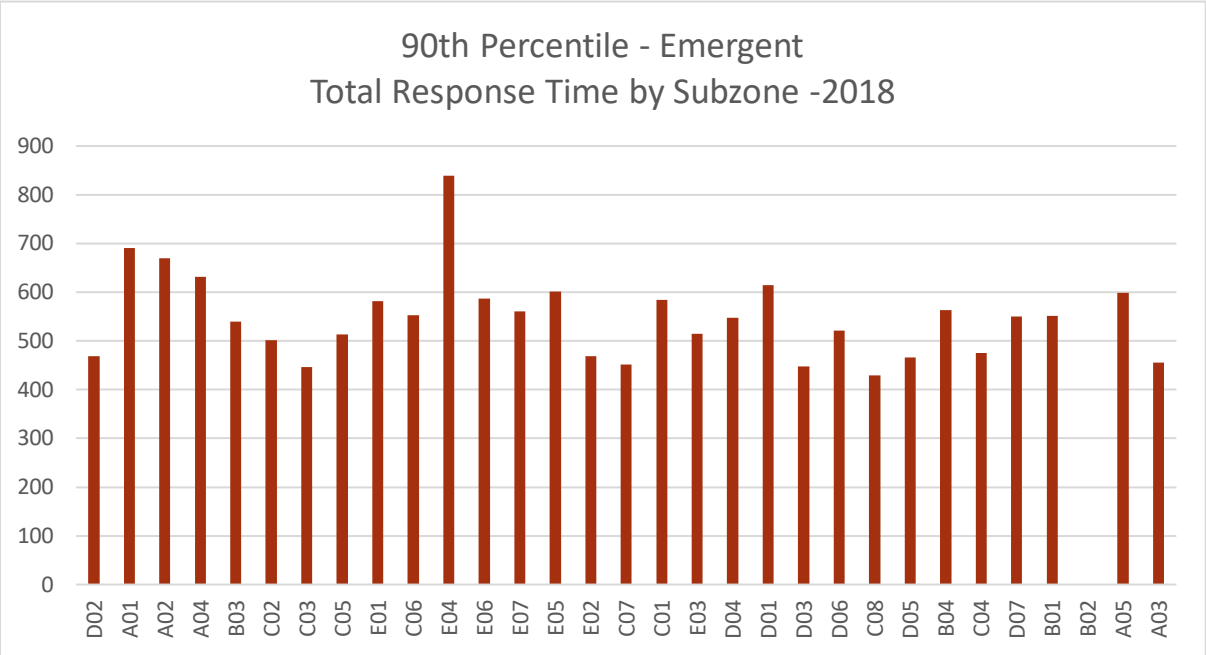


Figure 96: Subzone Call Distribution

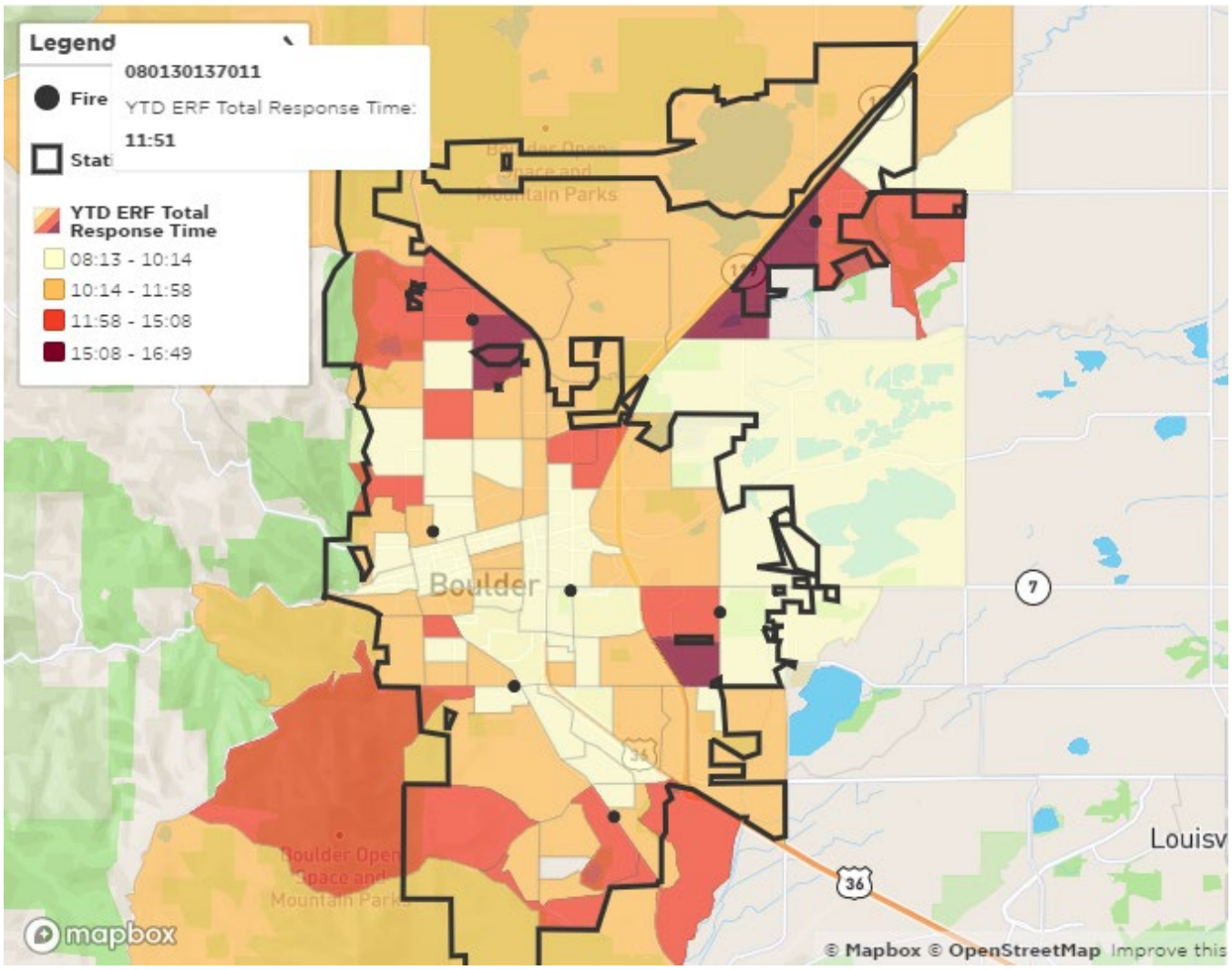
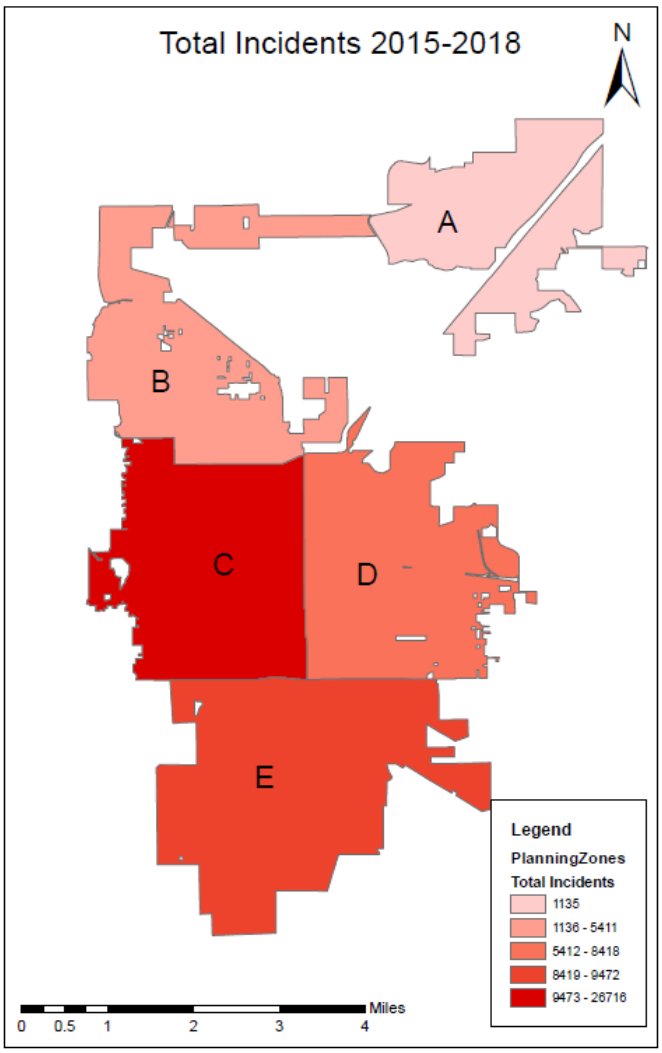


Figure 97: YTD Response Time by Census Zone

The map below compares historical risk to the population of the city by BFR planning zones. In general, risk aligns with the current population of the city. Zone B has a lower incident volume than would be expected based on population while zone D has slightly more incidents.



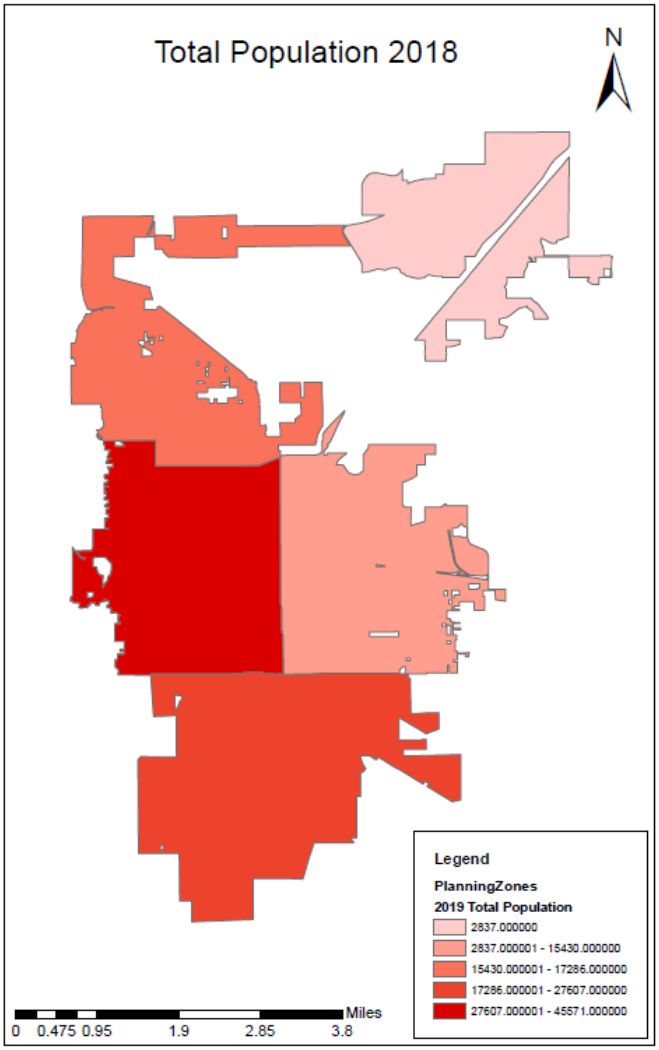
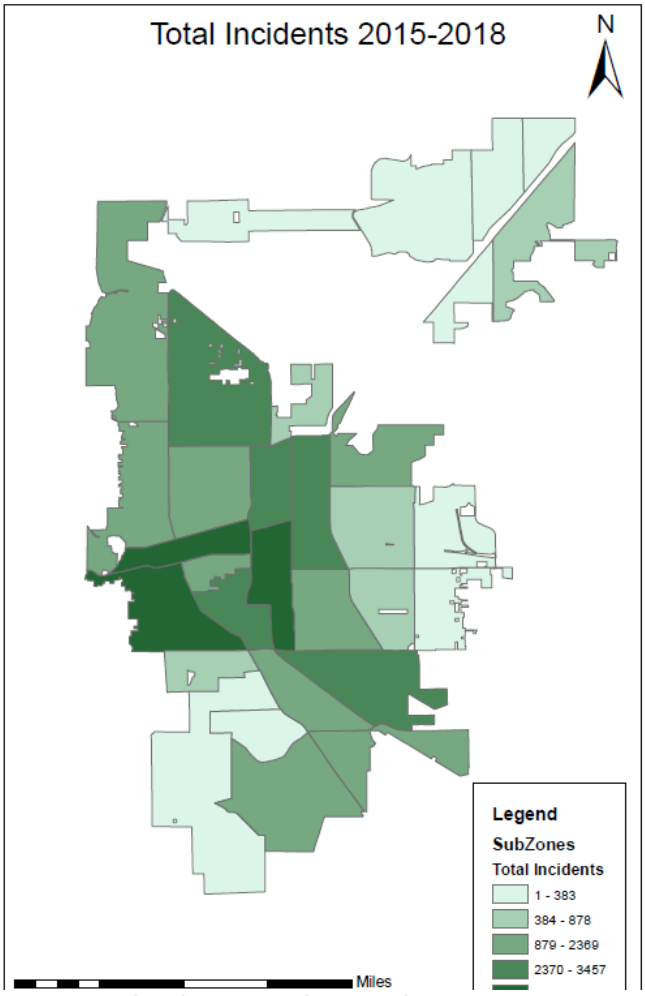


Figure 98: Total Incidents vs. Population in Planning Zones

The next map utilizes the same data but matches the data to the sub-zones used by the fire department.



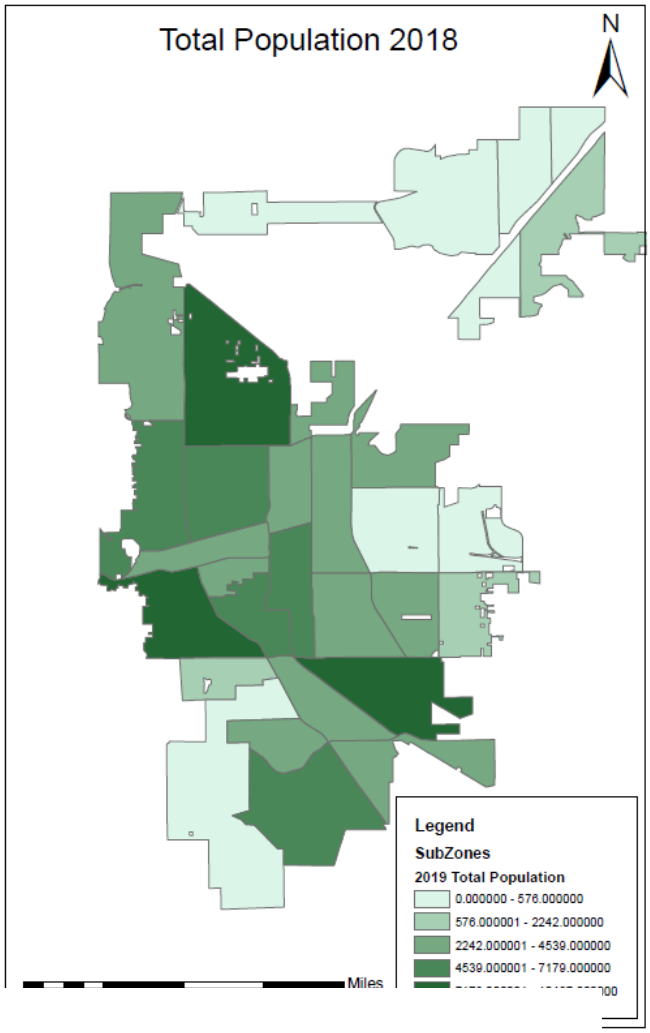


Figure 99: Total Incidents vs. Population in Sub-Zones

EMS Deployment and Performance

Emergency Medical Services account for almost 80% of the incidents that BFR is dispatched to. This statistic prompted City Council to recommend exploring the enhancement of EMS under a fire-based model. By charter, BFR has primary responsibility for "the provision of rescue and emergency medical services" within city limits. It does so through a combination of fire department response for BLS and third-party ambulance contractor response, which provides ALS care and patient transport.

In late 2016, an EMS incident analysis was conducted by the department (2C.7). The analysis examined two basic options; public/private delivery and purely public delivery of EMS. For practical purposes, the second model, fire-based EMS (FBEMS), was split between two implementation versions. The first version was to maintain the status quo and continue to use a private ambulance company. The second version was to shift responsibility for Advanced Life Support (ALS) to the fire department, within this solution were two implementation models immediate and gradual. The major differences in each system include:

• Status quo with the private ambulance	• ALS FBEMS system
• AMR manages staff, scheduling, and training • No significant short-term capital costs • No costs associated with purchasing or maintaining ambulances and equipment • BFR does not manage patient billing • BFR does not manage controlled substances • Below market employee pay; high employee turnover • Paramedics lack of familiarity with territory and patients • A continuing need to renegotiate a contract every few years • High reliance on taxpayer resources to cover response time objectives • Poor coordination with fire department quality control systems • Inability to use resources in an all-hazards approach	• Strengthened workforce • No concerns regarding private contract • Improved control over the quality of service provided, administrate efforts, continuity of care, and all-hazard response • Revenue generation offsets some fire department costs • FBEMS is a response model, not a profit-driven model • Running an EMS division is costly • Legal concerns of controlled substance management

Table 38: Fire Based EMS

Further analysis of each option is summarized in the white paper published by BFR. In 2018, BFR hired a team of consultants to verify the findings of the report, and identify the various options for deployment. BFR utilized the services of Fitch and Associates. Fitch and Associates used three years of data including: Community Response History, Fire Services, Emergency Medical Services.

Fitch and Associates conducted a thorough review of response times and found that BFR travel time is 7.1 minutes or less for 90% of the incidents. Four-minute travel time can be accomplished 82% of the time by using all eight fixed fire stations. Within the current configuration, the department cannot achieve a 4-minute travel time. Both studies were efforts to address performance gaps and identify areas for performance improvement (2C.7).

Below is a chart depicting the 6 options for Fire-Based ALS in the City of Boulder:

	System Characteristic	BLS First Response Status Quo	3.5 Ambulances	4 Ambulances	5 Ambulances	ALS First Response 3.5 Ambulances	4 Ambulances	5 Ambulances
Service Levels	Firefighter-Paramedics on Engines	No	No	No	No	Yes	Yes	Yes
	All-Hazard Response Increase	No	No	No	No	Yes	Yes	Yes
	ALS Travel Time in Minutes	7.5	8	8	6	5	5	5
Operations	Additional Emergency Personnel FTE Needed	n/a	13.0	15.0	18.0	13.0	15.0	18.0
	Additional Administrative FTE Needed	0	4.0	4.0	4.0	4.0	4.0	4.0
	Greenhouse Gas Reduction	No	No	No	No	Yes	Yes	Yes
	Unit Hour Utilization	n/a	0.254	0.222	0.178	0.254	0.222	0.178
	Capacity for Community Paramedicine	No	No	No	Yes	No	No	Yes
	Implementation Timeline	n/a	5 Years	5 Years	5 Years	5 Years	5 Years	5 Years
Cost (in Millions)	Stabilized Operating Cost	$0.5	$2.2	$2.7	$3.6	$2.9	$2.9	$3.3
	Possible Cost Mitigation (Savings)							
	Civilian Paramedics		($1.6)	($1.8)	($2.1)	($0.5)	($0.5)	($0.6)
	Resource Reallocation		n/a	n/a	n/a	($0.4)	($0.4)	($0.4)
	Range of Annual Cost	$0.5	$0.6 to $2.2	$0.9 to $2.7	$1.5 to $3.6	$2.0 to $2.9	$2.0 to $2.9	$2.3 to $3.3
	Range of 5-Year Total Cost[1]	$2.5	$3.0 to $11.0	$4.5 to $ 13.5	$7.5 to $18.0	$10.0 to $14.5	$10.0 to $14.5	$11.5 to $16.5

Table 39: Options for Implementing FBEMS

[1]Up to $1.5 million in additional one-time training costs could be avoided by laterally hiring firefighter paramedics vs. internal training

PIT Crew Model

The department is currently establishing a more robust approach to emergency medical incidents. As part of this effort, the medical director is currently establishing quality metrics, such as cardiac survival rates to further measure the quality of the response performance (2C.2). In 2019 the department changed the response to all Echo EMS incidents from 1 Engine to 2. This new critical tasking chart, below, will be used from 2019 on. The PIT crew model will provide citizens with more effective EMS care.

High – Cardiac/Respiratory Arrest (E)	
Critical Task	Minimum Personnel
Incident Command, size up, safety (LEAD)	1
Airway/BVM	1
CPR	1
Liaison	1
Monitor	1
Egress	1
Scribe	1
IV/IO Meds	1
Total	8

Table 40: PIT Crew Critical Tasking

BFR is also working with 911 to implement the Advanced SEND Protocol 38. Currently, communications use the problem nature EMSF, which falls under the Moderate-risk category and sends one ambulance and one engine on all responses of an unknown nature because the incidents are not Emergency Medical Dispatched (EMD). This is a problem since 60% of the time the engine is being canceled. Discussions began in July 2019. The protocol would allow police officers to EMD the calls they initiate. At the protocol is implemented with the City of Boulder Police Department, the department would like to offer the option of using the protocol to CU.

Non-Emergent Incidents

In 2018, BFR began to look at non-emergency calls and their outcomes. BFR began to identify these locations and create a plan to reduce the call volume. The first initiative took place in August 2019. The public safety educators met with the staff at the Boulder Shelter to discuss the issues they are facing. To address the increased call volume station area dashboards are being created to identify high volume call areas, risk levels, and call types.

Top 10 Medical Assist Locations 2018[5]

# of Incidents	Number	Street	Suffix	Station Territory	Location Name
176	1055	ADAMS	CIR	ST3	Golden West
171	4685	BASELINE	RD	ST2	Boulder Manor
120	1400	WALNUT	ST	ST1	RTD Bus Station
120	4869	BROADWAY		ST5	Boulder Shelter
105	3180	AIRPORT	RD	ST7	
96	2525	TAFT	DR	ST3	
91	4685	BASELINE	RD	ST7	
91	801	GILLASPIE	DR	ST4	
88	575	TANTRA	DR	ST4	

Table 41: Top 10 Medical Assist Locations

BFR also found that in 2018 Boulder Fire-Rescue responded to 11,906 incidents (15,262 unit* responses, 50% of which were emergent responses (lights and sirens)). Of those, 28.61% were recorded as ambulance assist or canceled incidents (39.2% of units were either canceled or assisted ambulance crews). This lead to a deployment study in the summer of 2019.

Fire Deployment and Performance

BFR is in the process of changing deployment to match that of the Boulder Valley Fire Consortium (BVFC). The process should be completed by the end of 2020. Re-defining the current benchmarks and completing a turnout study is also on the horizon for BFR.

Proposed Critical Tasking

After the most recent critical task analysis in 2019, it determined that dispatch procedures should change. Staff found that all structure fires were being dispatched the same compliment, with commercial fires having a second alarm added. This model is outdated and created a situation where dispatched units were frequently canceled.

The fire department should differentiate between residential and commercial structures on the initial dispatch. The total personnel required for a high-risk commercial structure fire should be 19, and in-line with the current structure fire deployment while the total personnel needed for a moderate structure fire (ex: residential structure) should be 16. BFR will be working with the Boulder Valley Fire Consortium (BVFC) to align resources. The following page outlines the new critical tasking that will be in place.

[5] Addresses without a number were excluded from the query – possible misrepresentation of number of incidents due to common place.

Moderate-risk – Fire Suppression (Single Family Residence.)	
Critical Task	Minimum Personnel
Incident command	1
Pump operator	1
360- IC1 / Initial attack line (min. 1 ¾ line)	2
Water Supply (5" supply lines from permanent water supply) *	1
Search and Rescue	2
Ventilation	2
Utilities*	1
Ambulance	2
Safety officer (certified incident safety officer)	1
On-Deck (Rapid Intervention Team (RIT)) *	2
	13

Table 42: BVCP Moderate-Risk Fire Critical Tasking

**Re-purposed positions

Special-risk - Fire Suppression	
Critical Task	Minimum Personnel
Initial Incident Command	1
Initial Attack (360)	2
Pump (FDC)	1
Water Supply	1
Primary Search	2
2nd Attack	2
On-Deck Fire Floor	2
Div. Sup. Fire Floor	1
P/S Ext. Floor Above	3
Lobby Control	3
Safety	1
Ambulance	2
	22

Table 43: BVCP Special-Risk Fire Critical Tasking

It was discovered that 2516 was the only designated ladder in the CAD system. The department would like to add 2506 and 2507 to include the ladder capability. Below are some additional CAD changes that would be beneficial to the department.

- Fire Alarms - Re-visit not sending anyone to CU – its sprinkled. Send PD first if they need help then they can call BFR
- Fire Assist – Look into what these entail

Hazmat Deployment and Performance

Based on an initial analysis, the delay for hazardous material response may be attributed to the special apparatus and assembling a specialized crew. Since the collection of this data, the deployment of personnel assigned to specialty teams into dedicated those dedicated stations with their equipment have been made and data is currently being collected on how that may have improved the response times.

Technical Rescue Deployment and Performance

To date, the communications department does not use the Priority Dispatch protocol 29 to dispatch car accidents. After protocol 38 for EMS is implemented, the departments will begin discussion on utilizing protocol 29 to right-size deployment to technical rescue incidents.

Wildland Deployment and Performance

Through the critical tasking process, it was determined that BFR only utilized one category for dispatching wildland fire incidents. It was determined that three dispatch levels should be determined as well, and a daily risk score based on indices. Although the current table is still in draft form, it should be adopted by the end of the year. The department will adopt the BVFC indices table, as well as the critical tasking tables below.

Primary Factors	>50% Humidity <5MPH Wind <___%ERC Percentile <60° Temperature	20-50% Humidity 5-15MPH Wind <___%ERC Percentile 60° - 80° Temperature	<20% Humidity >15MPH Wind >___%ERC Percentile >80° Temperature
Secondary Factors	Burning Index (BI): ____ LFM_a:____ LFM_b:____% 3-Day ERC Trend: _____	Burning Index (BI): ____ LFM_a:____ LFM_b:____% 3-Day ERC Trend: _____	Burning Index (BI): ____ LFM_a:____ LFM_b:____% 3-Day ERC Trend: _____

Table 44: Indicies Based Risk - Wildland

Landscaping Fires	LOW	MODERATE	HIGH
Lawn/Mulch Roadside City Park Flowerbeds Golf Course Sports Field	1 Engine 1 Brush	1 Engine 2 Brush 1 Tender 1BC	2 Engine 3 Brush 1 Tender 1BC BCSO FDO Overhead

Table 45: BVCP Wildland Risk Deployment - Landscaping Fires

Wildland Fires	LOW	MODERATE	HIGH
Lawn/Mulch Forest Roadside Ag. Field City Park Open Space Flowerbeds Hillside Golf Course Brush Mountain Sports Field Ditch	1 Engine 1 Brush 1BC	1 Engine 3 Brush 2 Tender 2BC 1BC BCSO FDO	2 Engine 3 Brush 2 Tender 1BC 2BC BCSO FDO Overhead *Check Aviation Availability

Table 46:BVCP Wildland Risk Deployment - Wildland Fires

Proposed Critical Tasking

Low – Urban + Indices	
Critical Task	Minimum Personnel
Incident Command, size up, safety, IAP, LCES	1
Fire Attack/Suppression	3
Water Supply	2
Assume Command	1
Total	7

Table 47:BVCP Wildland Critical Tasking

Moderate – Open Space + Indices	
Critical Task	Minimum Personnel
Incident Command, size up, safety, IAP, LCES	3
Div. A Suppression	3
Div B Suppression	6
Water Supply	2
Mop Up	3
Assume Command	1
Incident Complexity	1
Total	20

Table 48:BVCP Wildland Critical Tasking

High - Foothills	
Critical Task	Minimum Personnel
Incident Command, size up, safety, IAP, LCES	1
Div. A Suppression	3
Div B Suppression	9
Water Supply	2
Mop Up	3
Assume Command	1
Incident Complexity	1
Total	20+

Table 49:BVCP Wildland Critical Tasking

Section VII: Plan for Maintaining and Improving Response Capabilities

Factors Driving the Need for Change

BFR considered the current and emerging trends that have implications for the future of emergency response. These include the following:

Aging population (more seniors) – Boulder's population is aging, and the county population of age 60 and over is expected to double by 2020. In 2008, 12 percent of Boulder County's residents were over the age of 60. In 2020, that age group is expected to reach 21 percent.

Increase in population – The City of Boulder's 2016 population is 108,090, with projections indicating an increase to 114,000 by 2035. This figure could be even higher as the University of Colorado - with a current enrollment of approximately 30,000 - projects an additional 11,000 students by 2030.

Increase in EMS calls – With Boulder's population and employment projections, EMS incidents are expected to increase, particularly in areas being redeveloped. BFR experienced an increase of 11 percent in EMS calls between 2015 and 2017.

Year-round wildfire risk – As highlighted in the 2012 Fire-Rescue Master Plan, the city is surrounded by open space, which increases the risk of wildfires. Due to changes in climate, the wildfire risk has expanded from one season to all year. The city has recent experience with wildland/urban interface fires outside the historic fire season. Several of these fires have been significant events requiring intensive application of both internal and external resources.

Movement towards a more urban form – Areas of the city are becoming less suburban and more urban. In the last 10 years, 3,270 dwelling units have been constructed, and more than 5 million square feet of commercial and industrial space has been built, while not significantly expanding the city limits.

Housing Unit Density - Current trends and projections indicate that most new housing units will be in higher density multi-unit developments, and Boulder will continue to serve as a regional employment center. In some sections of the city, this creates new challenges for Fire and EMS service delivery because of impacts like increased population density, changes to street size and grid, and public areas designed for pedestrians, not large vehicles (2A.4).

Staffing Risk - The current age of the workforce is a concern. As of February 2019, 43% of line personnel fall between the ages of 50 and 60+. Only 3% of personnel are in their 20's and are between the ages of 27-29.

Age of Homes – The median home age is 44 years (built in 1975). This means there could be an increased fire risk in these occupancies due to the lack of working smoke detectors.

Planning for Change

There are several initiatives in process to set BFR up for future success. The document leading the change is the 2020 Master Plan, which serves as the departments strategic plan.

Master Plan 2020

The BFR Master Plan was originally developed in 1996 and revised in 2012. The BFR Master Plan is currently 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 BFR for the next 5 to 10 years in providing safety, education, and incident mitigation to the citizens of the City of Boulder.
Boulder Fire-Rescue began the Master Planning process in 2018 and should have a completed document by mid-2020.

Master Plan Informing Documents

The 2020 Master plan is guided by the CRA/SOC, the Boulder Valley Comprehensive Plan (BVCP) discussed in the Community Expectation Section, and information gathered from a plethora of internal and external initiatives. These initiatives included a technology needs assessment by ERP Consultants, and ALS feasibility study conducted by Fitch and Associates, a financial feasibility study, community engagement, and multiple strength, weakness, opportunity and threat assessments with members of the community, internal business partners and members of the fire department. The final stage of the process was a BFR retreat to hone in on the master plan priorities. The retreat consisted of three full working days dedicated to the Master Plan.

Technology Needs

The last technology needs analysis was conducted in 2011 before the last Master Plan update. By the time the next planning cycle rolls around technology is already 7-8 years old. The departments intent is to accompany each master plan update with a needs analysis. In 2018, the department retained the services of ERP Consultants to evaluate the technology needs of the fire department. ERP found 92 critical pain points and 13 medium pain points. Below is the initial evaluation of the BFR Business Process Ecosystem and the evaluation of each area. ERP found 92 critical pain points and 13 medium pain points.

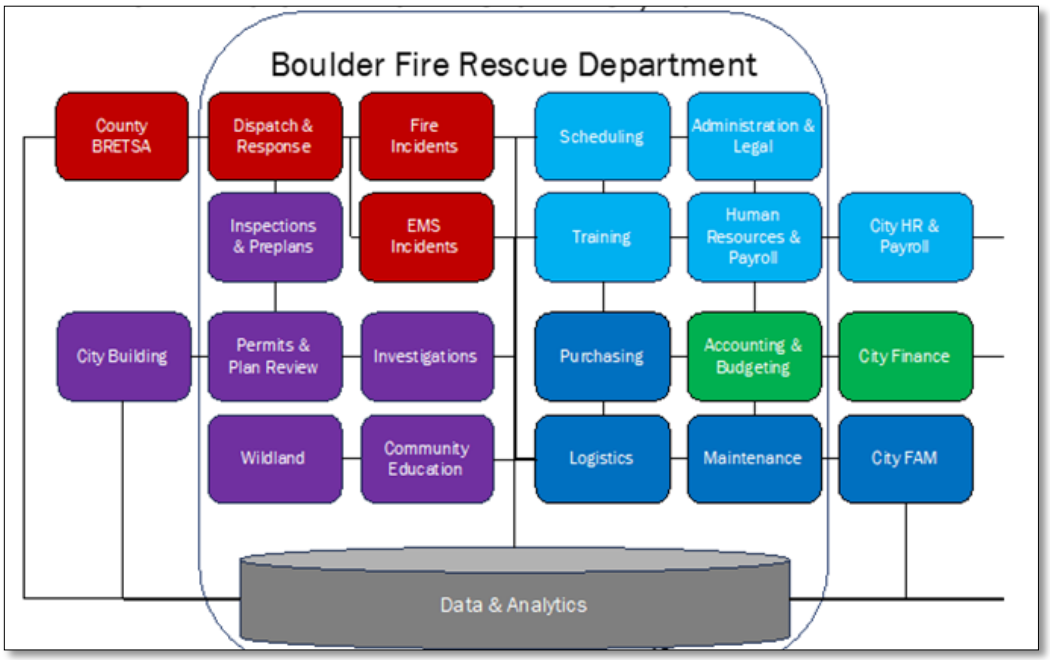


Figure 100: BFR Business Process Ecosystem

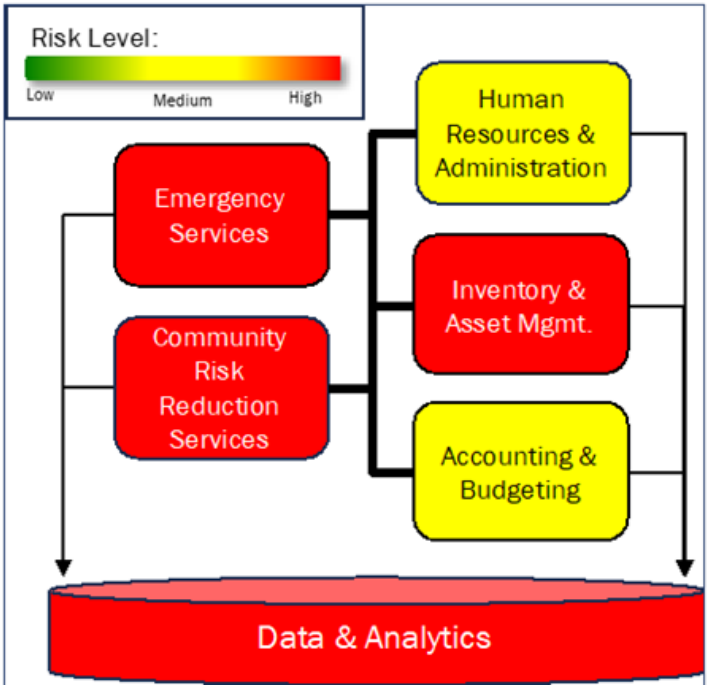


Figure 101: Technology RIsk

ERP presented BFR with three options, listed below. The department chose to implement Option 3, the hybrid approach. Within the three options were nine recommendations: 1. Hire IT Staff , 2. Replace Firehouse,3. Optimize CRR Application, 4. Add Logistics Application, 5. Adopt a BI Application, 6. Optimize Target Solutions, 7. Optimize Telestaff, 8. Optimize CAD/BRETSA, 9. Replace MDCs.

Area	Option 1 All-In-One RMS	Option 2 Best of Breed	Option 3 Hybrid
FIRE & PCR	Full Suite RMS Application	Emergency Services App	Emergency Services App
ALS & Transport Compliant			
Preplans		Community Risk Reduction App	Community Risk Reduction App
Purchasing		Purchasing App	Logistics App
Asset Management		Asset Mgmt. App	
Maintenance		Maintenance App	
Data & Analytics		Business Intelligence App	Business Intelligence App
Training		Training App	Training App
Scheduling/Rostering		Scheduling App	Scheduling App

Table 50: ERP Recommendations

ERP Recommendation Detail

1. **Before anything else, fill resource gap.**
    - Recommend combination of additional FTE, backfill IT platform support with City IT and setup consultant relationship to assist with short term IT initiatives i.e. RMS implementation, other app optimizations, etc.
2. **Replace FireHouse with a Best of Breed RMS platform.**
    - Emphasis and focus of Selection should be on Software as a Service platforms that include complete Mobile Access and cover NFIRS, PCR, Future NEMSIS needs, Integration with existing applications and open data access for extensive reporting capabilities.
    - Include evaluation of MDC devices and consolidation of use into a single device platform to access all data.
3. **Optimize Telestaff.**
    - Evaluate migrating Telestaff to the Software as a Service version of the platform.
    - Evaluate existing Telestaff rules and engine to determine if the platform can support the Labor Contract Language.
4. **Implement a Logistics Application.**
    - Select a Best of Breed Fire Industry specific Logistics platform that will automate Purchasing, track Inventory, manage BFRD assets, track equipment maintenance history and allow for extensive data access and reporting.
5. **Implement a Business Intelligence Application.**
    - Select a Best of Breed Business Intelligence application to centralize all critical data from BFRD applications into usable Dashboards and Analytics for reporting and accreditation.
6. **Evaluate Esri Collector and EnerGov platforms for extension to the Preplan process.**
    - Verify if annual Inspections and Preplans can both be managed in a single device and platform with a combination of EnerGov and Esri Collector for complete mobility of Inspections and Preplan creation and updates.
    - Validate Synchronization/Integration with City of Boulder GIS and CAD for direct access to data from Apparatus via MDC.
    - If Esri/EnerGov are not able to provide needed functionality, include in Software Selection process.
7. **Optimize Target Solutions and transfer checklist functionality to Logistics application.**
    - Evaluate the ability for an in-house curriculum that is generated by BFRD and distributed through Target Solutions.
    - Transfer all station and apparatus checks from Target Solutions to the newly selected Logistics application.
8. **Create and Implement a BRETSA Optimization Program.**
    - Program focus to improve the service, integration, analytic data and inclusion of vital operational data in CAD call distribution.
    - Include other Boulder County Service Organizations that rely on BRETSA CAD calls and data.
9. **Evaluate, Select and Replace MDC and Mobile hardware devices.**
    - Evaluate all mobile hardware requirements for BFRD
    - Perform standard selection process for replacement mobile hardware platform that can support all needed data, application and mobile needs.

EMS Deployment

In 2018 Fitch and Associates conducted a Financial Feasibility Study for ALS. In 2016 the council directed BFR to explore the enhancement of EMS under a fire-based model. The department wrote an EMS White Paper and presented it to council in 2017. Both the City Manager and City Council requested a third party validates and evaluated the white paper for financial feasibility and validity. Hiring a third party allowed for an objective study.

Fitch evaluated three years of data covering community response history, emergency medical services, fire service, and a review of response times.

BFR travel time =< 7.1 minutes for 90% of the incidents.

- 4-Minute Travel Time for 82% of calls with all eight stations
- 4-Minute Travel Time 90% of the time Not achievable with current station configuration

Their findings are summarized into 6 Options for Fire-Based ALS in Boulder, which would cost between $500k to $3.3million annually.

As of August 2019, no progress has been made. The department will continue to pursue Fire Based ALS, while also evaluating other deployment models such as the model proposed by the Governmental Entrepreneurial Leadership Accelerator (GELA) which is discussed later in the document.

Financial Feasibility

As part of the Master Plan update, Boulder Fire-Rescue (BFR) worked in conjunction with a third-party consultant, GK Baum & Co., to conduct a financial feasibility study on the cost (and additional budget support or revenue) needed to alter and/or enhance departmental programming to meet the strategic goals as stated in the updated Master Plan. The financial analysis focused on developing 10-year financial plans for the three possible levels of investment that can be pursued relative to the city's future financial condition. The three levels of investment are described below and consist of Fiscally Constrained – little to no additional investment in BFR programs, Action – moderate level of additional investment in BFR programs, and Vision – all of BFR's recommended program initiatives receive full budget support

The financial analysis took multiple factors into consideration including current department budget structure and levels, current funding sources, local sales and use tax and property tax projections, debt funding thresholds, variable cash flow schedules, etc. The result of the feasibility study indicated that, relative to current budget forecasts, BFR would need additional funding of between $3.6 million and $6.2 million per year to fund operational enhancements and capital infrastructure improvements. And this additional funding could be sourced through reallocations within the city's General Fund or supported by increased and potentially dedicated sales and use taxes or property taxes. It is anticipated that the City Council will indicate the level of investment that it would like to pursue when it accepts the Master Plan in late 2019 or early 2020. BFR staff will then build the possible additional funding into the subsequent year budgets that coincide with the Master Plan implementation timeline.

Community Engagement

Part of the continuous improvement process involves feedback from the community to assess the communities support for our initiatives. To accomplish this, the department used a public engagement plan based on the updated community engagement framework adopted by City Council. The department distributed the survey using “Be Heard Boulder.” Information cards were also handed out, and informal Q&A sessions happened around the community.

Data Summary:
Master Plan Site Visits – 978
Contributors – 218
Survey Submissions – 224
Questions – 7

The results of the survey indicated that overall, the communities’ priorities are in-line with ours. The community also placed value in community risk reduction activities.

The top three residents’ risk and concerns:

1) Emergency Medical Services

2) Structure Fire Suppression,

3) Wildfire Mitigation.

The Top three factors in support of Fire-Based ALS:

1) Lower Average Response Times

2) Greater availability of ALS units in the City

3) Continuity of Care from the Scene to the Hospital.

An additional outreach opportunity presented itself when BFR citizen academy alumni expressed interest in offering feedback. As identified during a focus group of BFR Citizen’s Academy alumni, the community values an emphasis on community risk reduction, in particular, increased public awareness and education. Also, utilizing proactive mitigation related to wildfire has been communicated to staff.

External and Internal SWOT Analysis

In the Spring of 2019, the department conducted a Strengths, Weakness, Opportunity, and Threat Analysis with internal and external stakeholders. The department also conducted a round-table discussion with participants from public safety agencies. Below are the results.

Total Sessions – 7 |Survey – 2 | Contributor*s - 26* |

Internal - Human Resources, Finance, CMO, Police Dept, AMR, OEM, Housing, Climate, IT, FAM

External – Faith-Based Community, CU, Boulder County Chiefs Participants

Internal Stakeholder Results

Opportunities	Threat
• CRR/Public Education /Community Risk Understanding - Employees and Community • Partnerships: Community, City Depts, Volunteers, etc. • Finance: Alternative funding (grants, health service org, etc.) • Fire Hazard Mitigation/Assessment • Increase Fire presence at EOC • More Community Exposure to Fire Dept/Firefighters (events, athletics, coaches) • Reduce emissions (GHG)	• Increase in Risk (events, aging pop, climate change) • General Fund (economic downturn, not able to create income) • Cyber Threats (hacking, fake threats, biotech) • Communications: Local/Regional issues • Emergency Shelter Information (people don't know where to go, power issues) • Increased Population (traffic, emergencies) • Staffing (too much overtime/lack staffing at community events)

Table 51: Internal SWOT Results

Public Safety Round Table - Start/Stop/Continue

- Consider Public Safety Model (evaluate opportunity and consequence)
- Consider Consolidation
- Make a concerted effort to increase moral communication and coordination
- Leadership Development
- Continued Development of the EMS process (define it)
- BFR is not in the news a lot; this does not define success (positive press)

External Stakeholder Results

Strengths	Opportunities
• Strong leadership/relationships with external partners • Crews are friendly, professional and experienced • Great prevention division • Coordination with BFR is easy	• Public Education (community, kids, fall prevention, non-English speaking) • Pre-Planning (CU, Faith-Based) • Employee Benefits: Retention (Daycare etc.) • Decentralize Decision Making (unified command)
Weakness	**Threats**
• Battalion Chiefs (communication, external relationships) • Pre-Planning (CU, Faith-Based) • Public Education: Fire Drills • Culture	• Lack of Public Education • Chemicals on campus (bad inventory, lead paint, asbestos, research facilities) • Safety at Faith Based Facilities

Table 52: External SWOT Results

Department SWOT Analysis

Boulder Fire-Rescue Employees Survey, November 2018

4 QUESTIONS / 39 RESPONSES (124 PERSONNEL)

Q1: PLEASE LIST UP TO 3 STRENGTHS OF BOULDER FIRE-RESCUE. (109/117)

Apparatus/Equipment/PPE	18
Dedicated Personnel (teamwork)	10
Depth of professional knowledge	6
Adaptability	5
24/7 coverage	4

Table 53: BFR SWOT Question 1 Responses

Q2: PLEASE LIST UP TO 3 WEAKNESSES OF BOULDER FIRE-RESCUE. (116/117)

Insufficient Funding	19
Outdated/Insufficient facilities (stations/storage)	11
Communication Gap between Line & Mgt	7
No guidance (clear direction)	6
Training (money, division, needs)	6

Table 54: BFR SWOT Question 2 Responses

Q3: WHAT 3 WORDS WOULD YOU USE TO DESCRIBE THE CULTURE AT BOULDER FIRE-RESCUE? (112/117)

Old school	9
Improving (evolving)	8
Frustrated/Irritated/Low Moral	8
Desire to Grow/Ready for Change	7
Entitled (Elitist)	7

Table 55: BFR SWOT Question 3 Responses

Q4: WHAT ONE THING SHOULD BFR START/STOP/CONTINUE? (39/39)

BFR should start a 24/7 safety officer coverage	2
Hold people accountable/to a higher standard	3
Start ALS	4
Start communicating the specific direction and goals of the department	3
Start improving fire stations/Infrastructure	2

Table 56: BFR SWOT Question 4 Responses

Other Initiatives

GELA

The Governmental Entrepreneurial Leadership Accelerator (GELA) supports governments—which need to do more with less—to encourage innovative problem solving to pressing public policy challenges. The program launched in 2016 with a pilot program, believed to be the first of its kind in the country. Silicon Flatirons partnered with the City and County of Denver to test out the accelerator. A Flatirons Report details the pilot program and serves as a blueprint for other governments to implement a similar program of their own.

In 2019, the accelerator brought together employees from the City and County of Denver, City of Boulder, and State of Colorado—including the Office of the Attorney General—with University of Colorado Law School students. These program fellows take part in a cutting-edge entrepreneurial curriculum, learn from experienced mentors, and test and pitch entrepreneurial solutions to identified challenges facing state and local governments.

The goal of the program is to fuel the kind of innovation in government that has marked tech-industry startup culture over the last three decades. The teams are designed to bring fresh eyes to the issues and foster group problem-solving. The program begins with a boot camp that teaches and develops basic entrepreneurial approaches to problem-solving, including lean startup methodology and design-centered thinking. Following the boot camp, fellows do extensive research and work with established government leaders to propose an innovative, yet a tangible solution to the problem. The accelerator concludes with Pitch Night where fellows present their solution to government officials in an engaging community event.

Boulder Fire-Rescue expressed to GELA that the department was looking for ways to reduce low acuity call volume by implementing alternative response models. These could include integrated community health, better call triage changes in the responses sent to medical emergencies. A reduction would increase response resiliency (2C.8), a reduction in greenhouse gas emissions, and a decrease in response times to emergency incidents.

The department presented the problem “how can Boulder Fire reduce the number of low-acuity incidents in the system, and better respond to those that will still need a response.”

The result was an evaluation of non-emergent and canceled incidents (crews canceled on-scene). BFR found that in 2018 Boulder Fire-Rescue responded to 11,906 incidents (15,262 unit* responses, 50% of which were emergent responses (lights and sirens)). Of those, 28.61% records are listed as ambulance assist or canceled incidents (39.2% of units were either canceled or assisted ambulance crews).

Vision Zero

Boulder has joined leading-edge cities from around the U.S. in setting a goal of zero traffic-related fatalities and serious injuries. The Transportation Division has formed the Vision Zero Community Partnership Committee to foster on-going implementation of the city's safety strategies in collaboration with the broader Boulder community. This committee brings together community stakeholders to foster partnerships and broad-based leadership on mitigation strategies to achieve Boulder's Vision Zero safety goals. The committee includes representation from the Transportation Advisory Board (TAB) as well as local, regional, and state-wide agency partners and is charged with providing input and offering feedback regarding the Safe Streets Boulder action plan and co-developing and disseminating VZ safety education and awareness messaging for the greater Boulder Valley community.

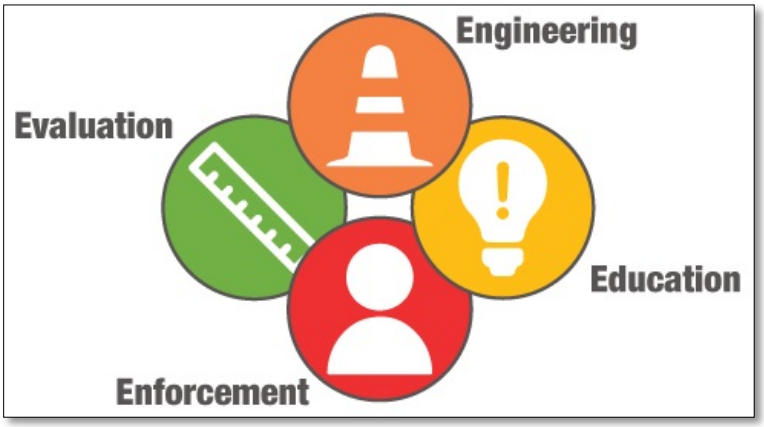
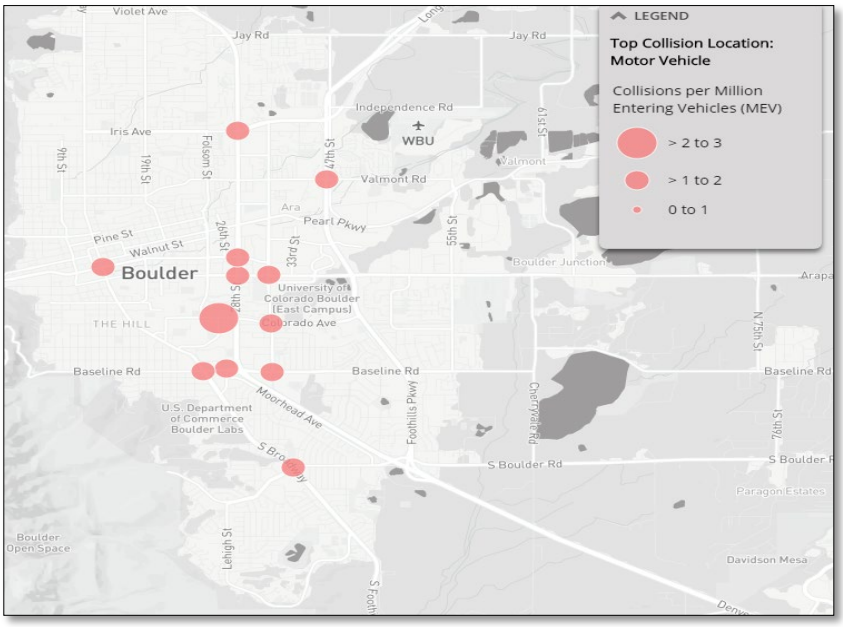


Figure 102: Vision Zero Methodology

Progress Snapshot

Since 2009, an average of 3,275 collisions per year has been reported within the City of Boulder. The percentage of collisions that resulted in a serious injury or fatality has been relatively flat at 2 percent of all collisions over these six years. The City of Boulder has fewer fatal collisions per capita than similar Colorado cities. While only 8 percent of all traffic collisions in the city involve a bicyclist or pedestrian, they account for approximately 60 percent of serious injuries and fatalities sustained in traffic collisions. BFR public safety educators are participating in this initiative.



An interactive map of Boulder is available on-line. The map highlights top collisions that involve motor vehicles, bicyclists, and pedestrians from 2012-2014. The website features Vision Zero strategies of engineering, education, and enforcement to reduce serious injuries and fatalities. A new map of close calls is also featured in this interactive map to pinpoint any trends and identify possible mitigation measures.

Figure 103: Vision Zero Top Collision Location

Quality Assurance/Quality Improvement

Although challenged with staffing, the department should attempt to establish a QA/QI program. BFR is now using more advanced EMT skills and should be evaluating the effectiveness of these skills. QA/QI this will be imperative when ALS is added.

QA/QCI considerations

- Number of people in the group
- Define the type of calls
- Medical Director review
- EMD review
    - Is there a 911 abuse problem in Boulder?
    - Is there a repeat caller database?
    - Do we have referral resources for people who consistently call 911?
- Measurement of each step of an incident

In 2018 firefighters began completing reports (MM), and Lieutenants check the report as the "OC". Discussion is still on-going about the final QC. This process was being completed by the Battalion Chiefs. Once the change was made to have firefighters write reports, the BC's stopped the QC process. As of August 2019, there are over 4,000 reports to be QC'ed and the process of having firefighter write reports has not been assimilated into daily operations.

Data Plan

For accuracy in the future, the "Alarm Handling" time interval should be calculated using the data from CAD and Intrado/Viper.

The outlier methodology will be evaluated, consideration will be given to using JMP or R to calculate 90th percentiles and remove outliers. Instead of removing zero times, the department may move towards using the low outlier calculation below the IQR. Consideration will also be given to alternative outlier definition such as utilizing Z Score outliers (Z Score >= 3 is considered an outlier).

This section should address the rules established by BFR in how data is qualified for processing. What happens with data points that are outlying and what rules are established and codified that applies to these data points?

The data coming from CAD does not appear to be correct; this is very evident when looking at processing times. The only thing I can think of is that when First Watch/West Net alerts the crews, that is marking a timestamp as the call being "completed" by the dispatcher.

Need better access to data

- There is currently no way to perform predictive maintenance on facilities and fleet due to the lack of good data.
- Fleet focus can accomplish this task, but the current users do not use the software to the best of their ability.

Section VIII: Appendix

Apparatus Details[6]

Front Line

Unit Number	Pump	Tank	Ladder/Platform
2516-5045	1500 single-stage PTO pump	300 gallons	100’ Platform
2501-5048	1000 gpm 2 stage pump	300 gallons	
2502-5043	1500 gpm 2 stage pump	500 gallons	
2503-5044	1500 gpm 1 stage pump	500 gallons	
2504-5049	1000 gpm 2 stage pump	300 gallons	
2505-5052	1500 gpm 1 stage pump	500 gallons	
2506-5050	1500 single-stage pump	300 gallons	75’ Stick
2607-5051	1500 single-stage pump	300 gallons	75’ Stick

Table 57: Front Line Apparatus Detail

Wildland

Unit Number	Pump	Tank	Ladder/Platform
2538-5042	500 single-stage pump	500 gallons (470 water/30 foam)	
2539-5047	500 single-stage pump	500 gallons (470 water/30 foam)	

Table 58: Wildland Apparatus Detail

Reserve

Unit Number	Pump	Tank	Ladder/Platform
2515-5038	1500 single-stage pump	500	75’ Stick
2514-5039	1500 single-stage pump	650 gallons + husky 12gpm foam system	
2513-5040	1500 single-stage PTO pump	620 gallons	

Table 59: Reserve Apparatus Detail

[6] If pump does not say PTO driven then it is a traditional split shaft driven pump.

Division Org Charts

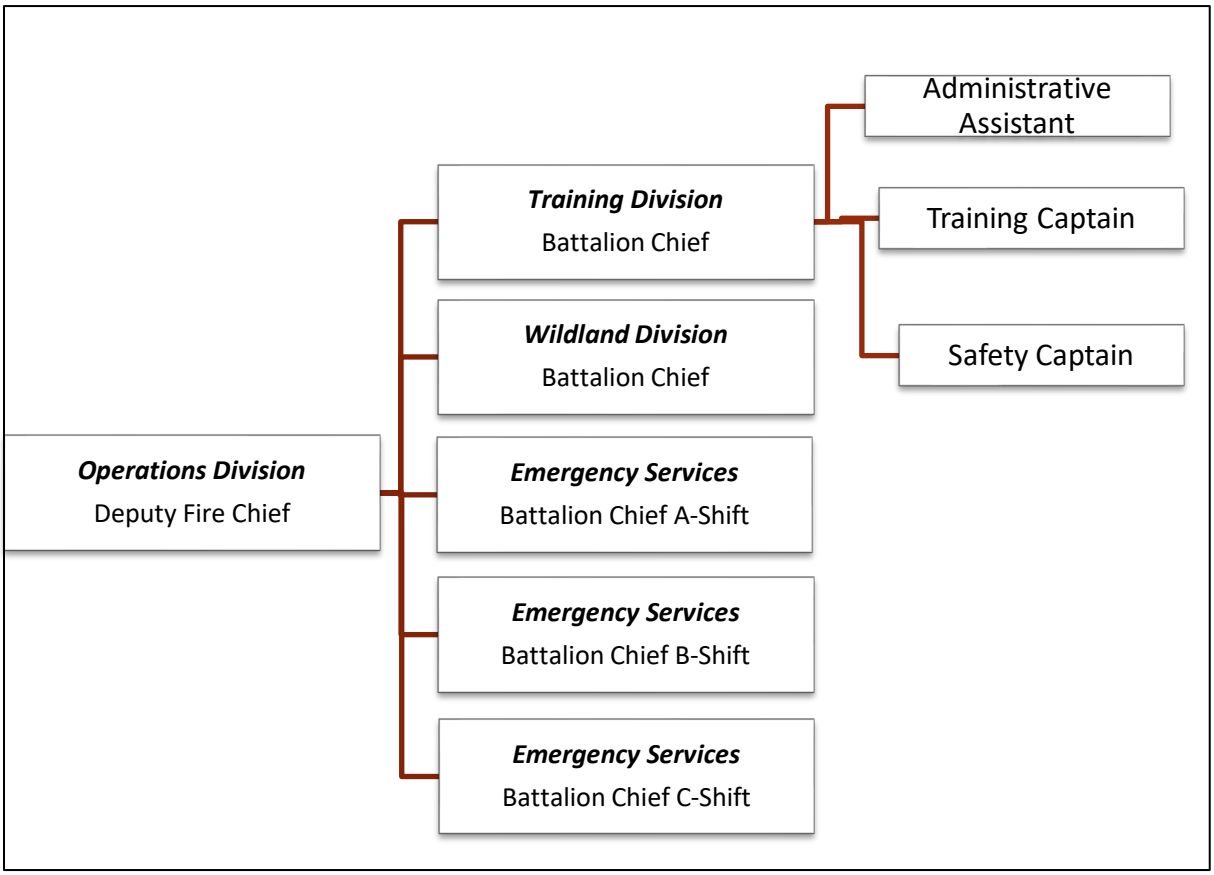


Figure 60: Operations Org Chart

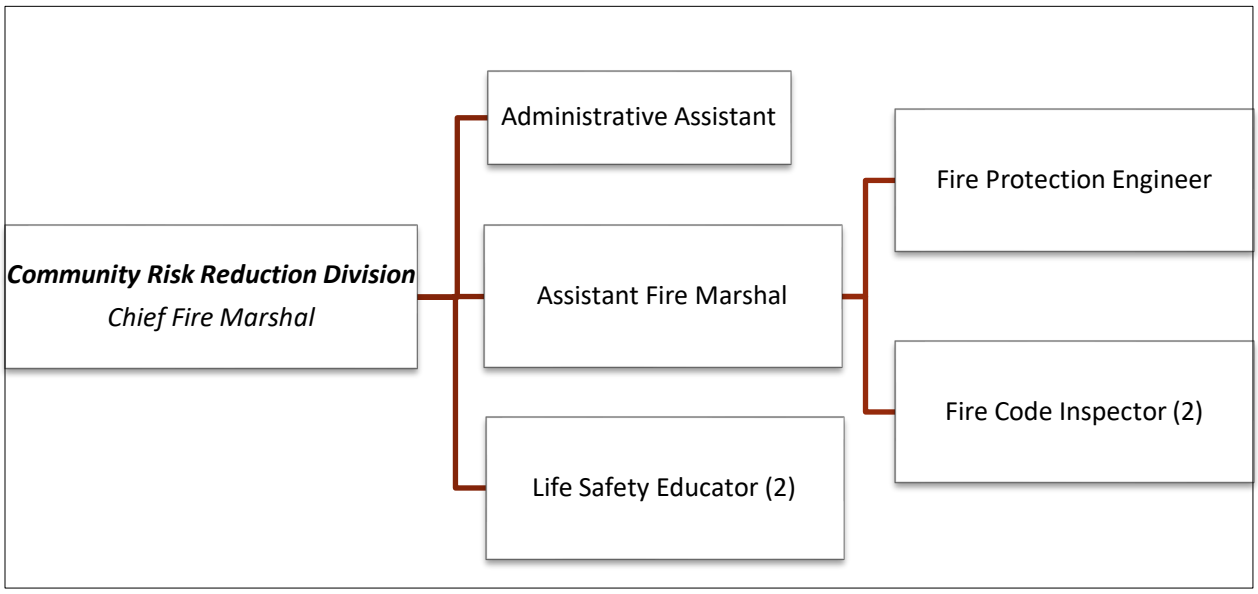


Figure 61: Community Risk Reduction Org Chart

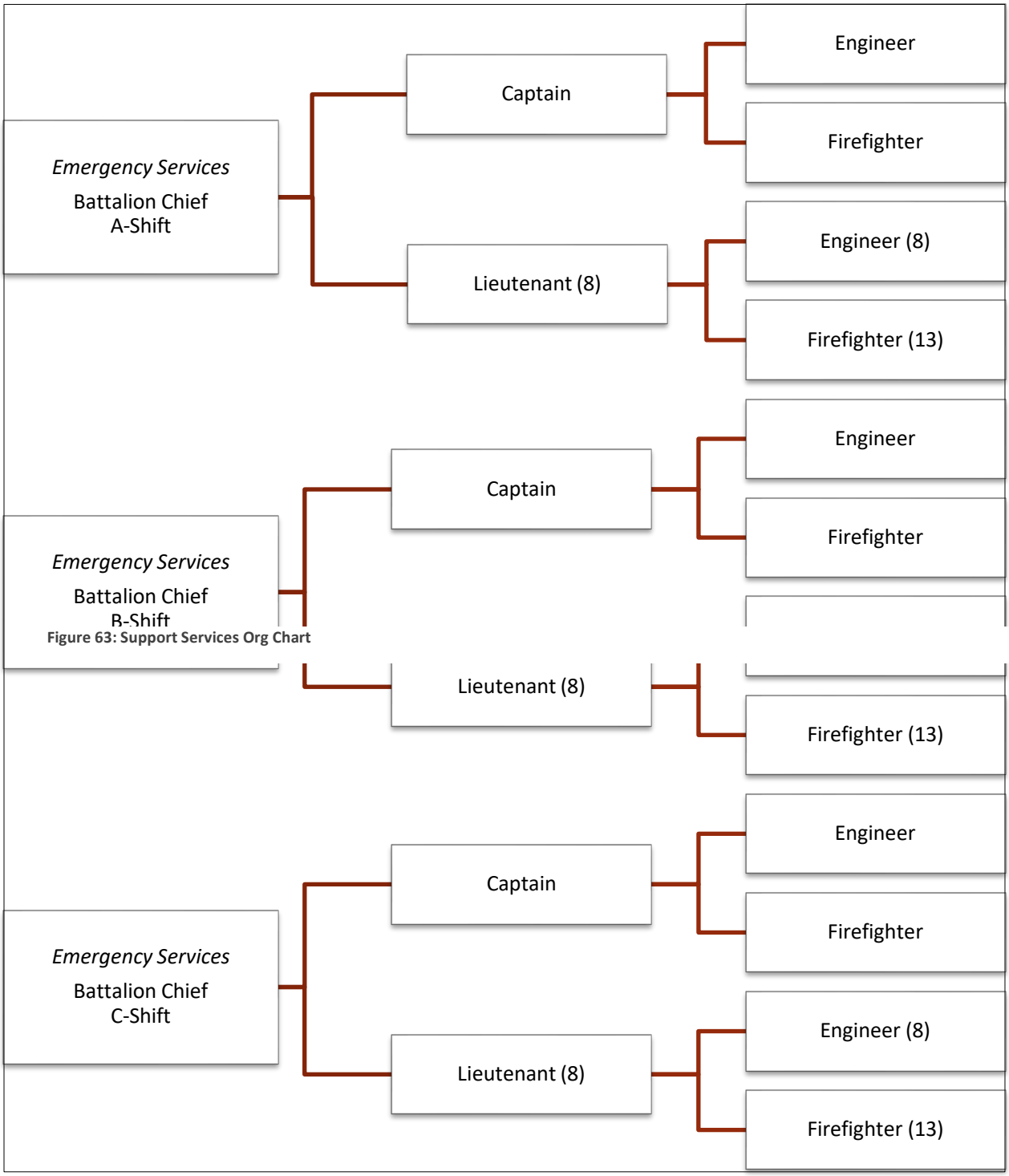


Figure 63: Support Services Org Chart

Figure 62: Emergency Services Org Chart

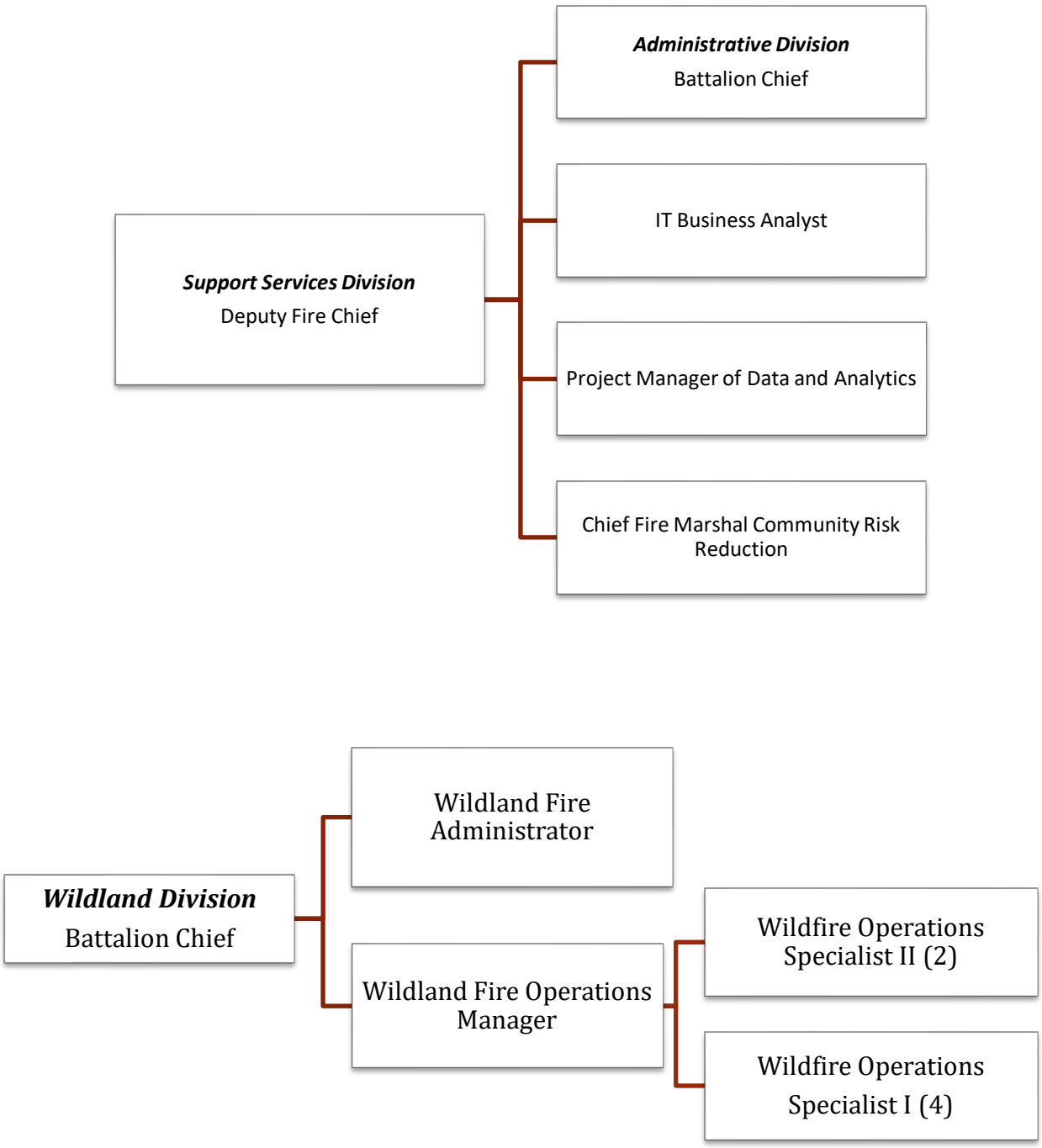


Figure 104: Wildland Org Chart

CAD Incident Types

Incident Type	Incident Type	Incident Type	Incident Type
AIACCF-Motorized Air Accident	zAbdominal Pain/Problem (L1)	zConvulsions/Seizure (L2)	zPsych/Suicide (L3)
ALMEDF-Medical Alarm	zAbdominal Pain/Problem (L3)	zDiabetic Problem (L1)	zSick (L1)
AMNONF-Blood draw/noncode amb	zAllergy/Envenomation (L1)	zDiabetic Problem (L3)	zSick (L2)
AutoAid: EMS	zAllergy/Envenomation (L1a)	zDrowning/Diving/SCUBA (L1)	zSick (L3)
AutoAid: Fire Non Structure	zAllergy/Envenomation (L2)	zDrowning/Diving/SCUBA (L1a)	zStab/Gun/Penetrating (L1)
AutoAid: Hazmat	zAllergy/Envenomation (L3)	zElectrocution (L1)	zStabbing-Stage (L1)
AutoAid: Injury Accident	zAnimal Bite/Attack (L1)	zEye Problem (L2)	zStabbing-Stage (L3)
AutoAid: Rescue Lost Pers	zAnimal Bite/Attack (L3)	zEye Problem (L3)	zStroke (L1)
AutoAid: Smoke Report	zAssault/Sex Assault (L1)	zFall (L1)	zTransfer/Interfacility (L8)
AutoAid: Structure Fire	zAssault/Sex Assault (L2)	zFall (L1a)	zTraumatic Injury (L1)
AutoAid: Tech Rescue	zAssault/Sex Assault (L3)	zFall (L2)	zTraumatic Injury (L2)
AutoAid: Unknown Injury Accide	zBack Pain (L1)	zFall (L3)	zTraumatic Injury (L3)
AutoAid: Water Rescue	zBack Pain (L3)	zFall (L4)	zUnconscious/Fainting (L1)
AutoAid: Wildland Fire	zBleeding (L1)	zGunshot Wound-Stage (L1)	zUnconscious/Fainting (L1a)
AutoAid: Wildland Task Force	zBleeding (L2)	zHeadache (L1)	zUnconscious/Fainting (L3)
BOMBF-Bomb Threat	zBleeding (L3)	zHeadache (L3)	zUnknown Problem (L1)
EMSF-All Medical Calls	zBreathing Problem (L1)	zHeart Problem/AICD (L1)	zUnknown Problem (L2)
FIALAF-Fire Alarm	zBreathing Problem (L1a)	zHeart Problem/AICD (L1a)	
FINONF - Non Struct Fire	zBurns/Explosion (L1)	zHeart Problem/AICD (L3)	
FIREAF-Fire Assist	zBurns/Explosion (L3)	zHeat/Cold Exposure (L1)	
FISTRF-Struct Fire/Smoke insi	zBurns/Explosion (L6)	zHeat/Cold Exposure (L2)	
FIWILF-Wildland/Grass fire	zCardiac/Resp Arrest (L1a)	zHeat/Cold Exposure (L3)	
GASF-Gas smell inside a bldg	zCardiac/Resp Arrest (L3)	zLabor/Delivery (L1)	
HAZMAJF-HAZMAT major response	zChest Pain (L1)	zOverdose/Poisoning (L1)	
HAZMFULLF-Countywide Hazmat	zChest Pain (L1a)	zOverdose/Poisoning (L2)	
HAZMINF-Minor hazmat response	zChest Pain (L3)	zOverdose/Poisoning (L3)	
INJACC2F-Injury Accident J/O	zChoking (L1)	zOverdose/Poisoning-Stage (L1)	
MAACCF-Rollover or pinned acc	zChoking (L1a)	zOverdose/Poisoning-Stage (L2)	
MUAIDF- BFD mutual aid	zChoking (L3)	zPregnancy (L1)	
ODORF-Odors invests/gas outside	zCO/Inhale/HAZMAT/CBRN (L1)	zPregnancy (L2)	
RESCUEF-Special Rescue	zCO/Inhale/HAZMAT/CBRN (L2)	zPregnancy (L3)	
REWATF-All Water Rescues	zConvulsions/Seizure (L1)	zPsych/Suicide (L1)	
UNACCF-Unknown if injury acc	zConvulsions/Seizure (L1a)	zPsych/Suicide (L2)	

Figure 105: CAD Incident Types

CAD/Firehouse Database Schema

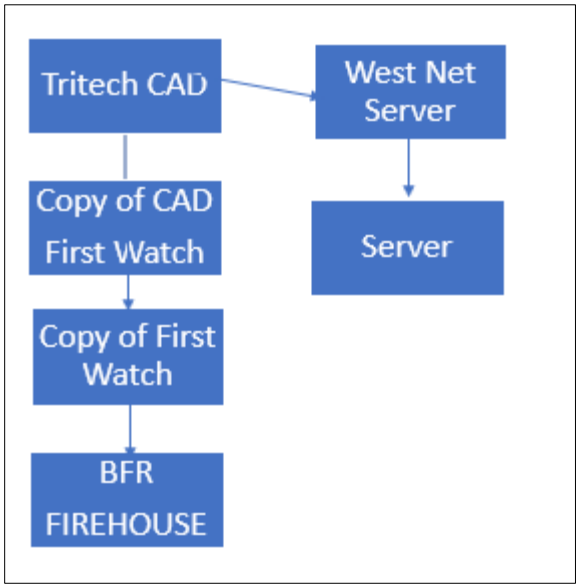


Figure 106: CAD Database Schema

Population by Census Block Map

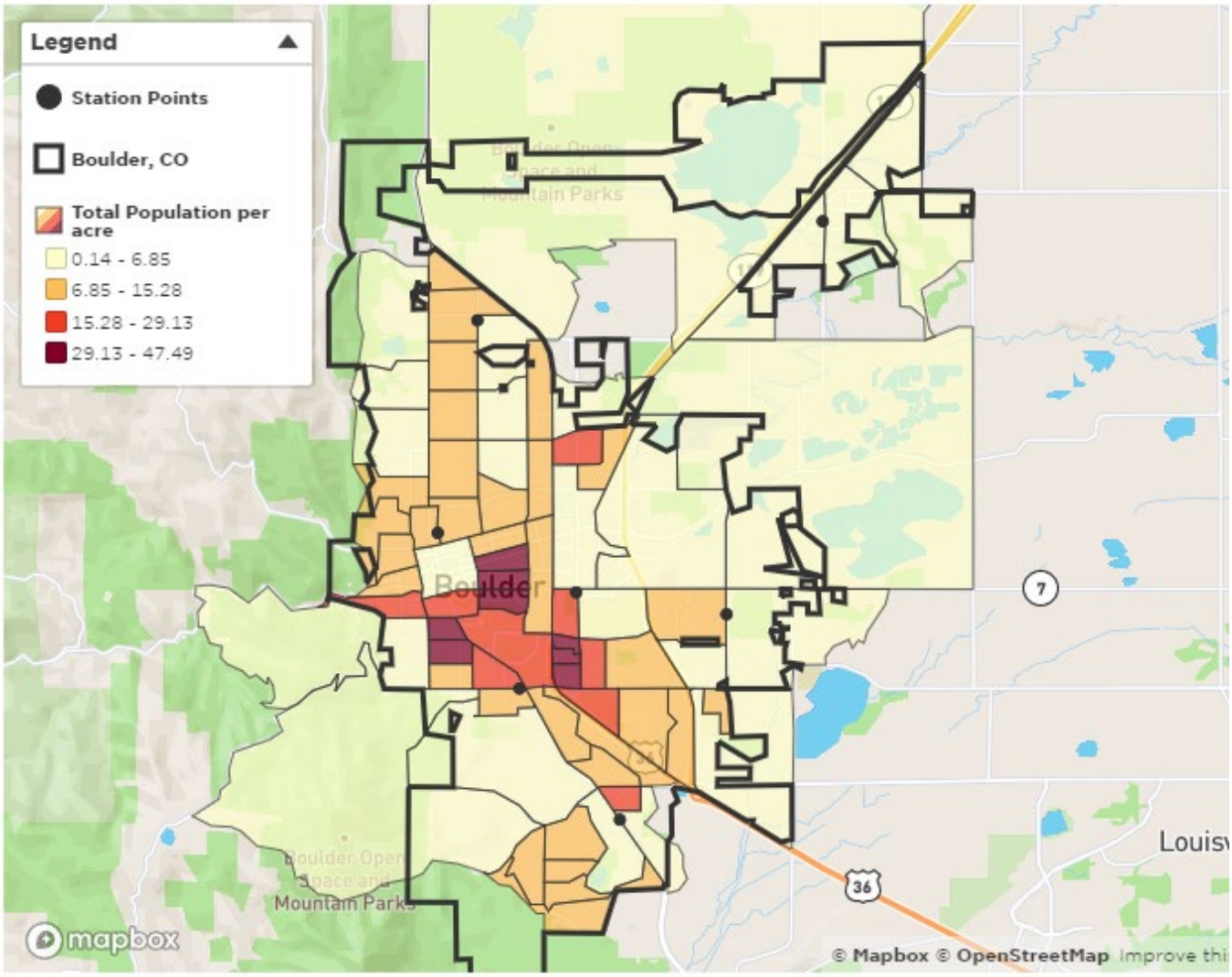


Figure 107: Population by Census Block

Year to Date Total Incidents by Census Block Map

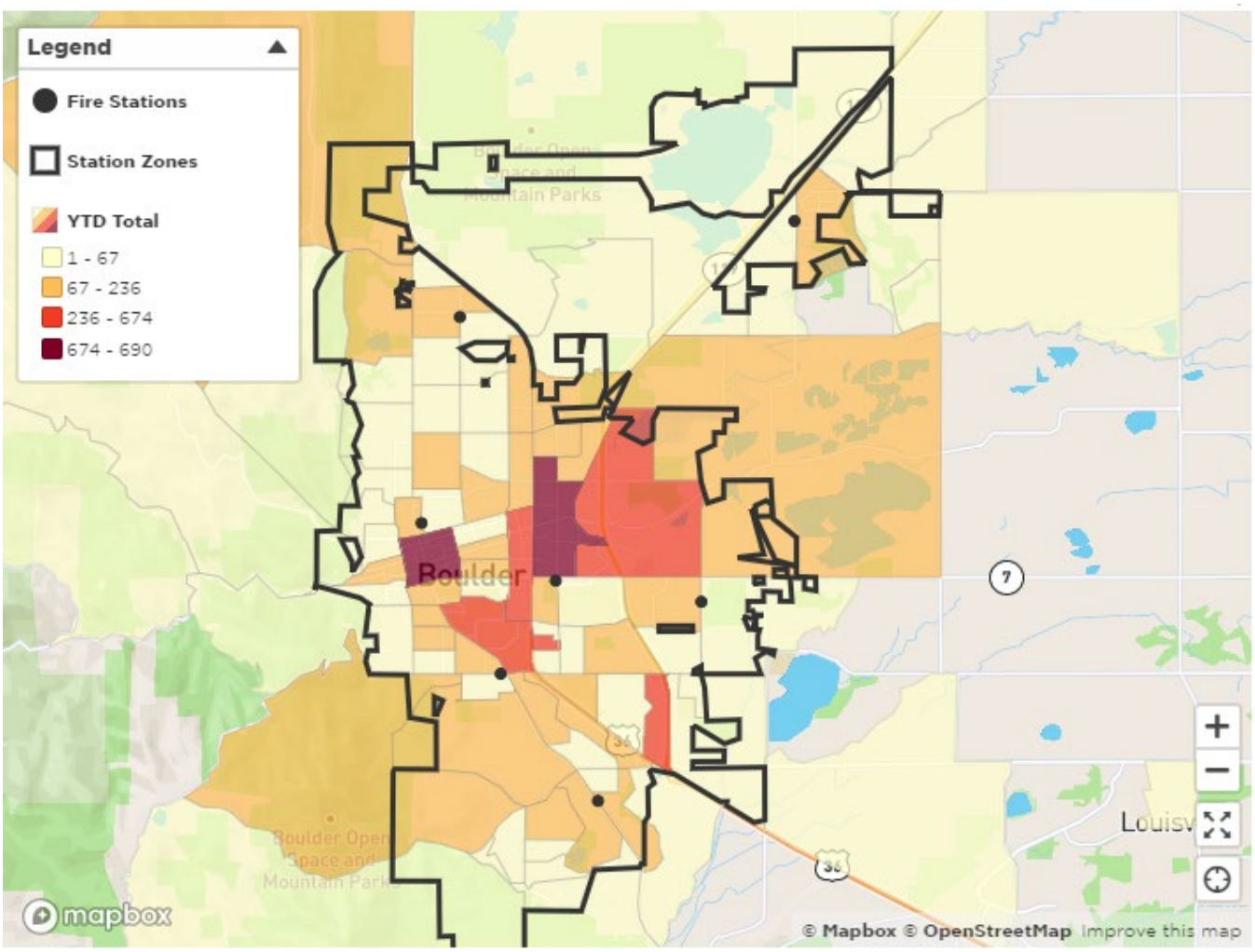


Figure 108: Incidents by Census Block

Year over Year Change in Total Incidents by Census Block Map

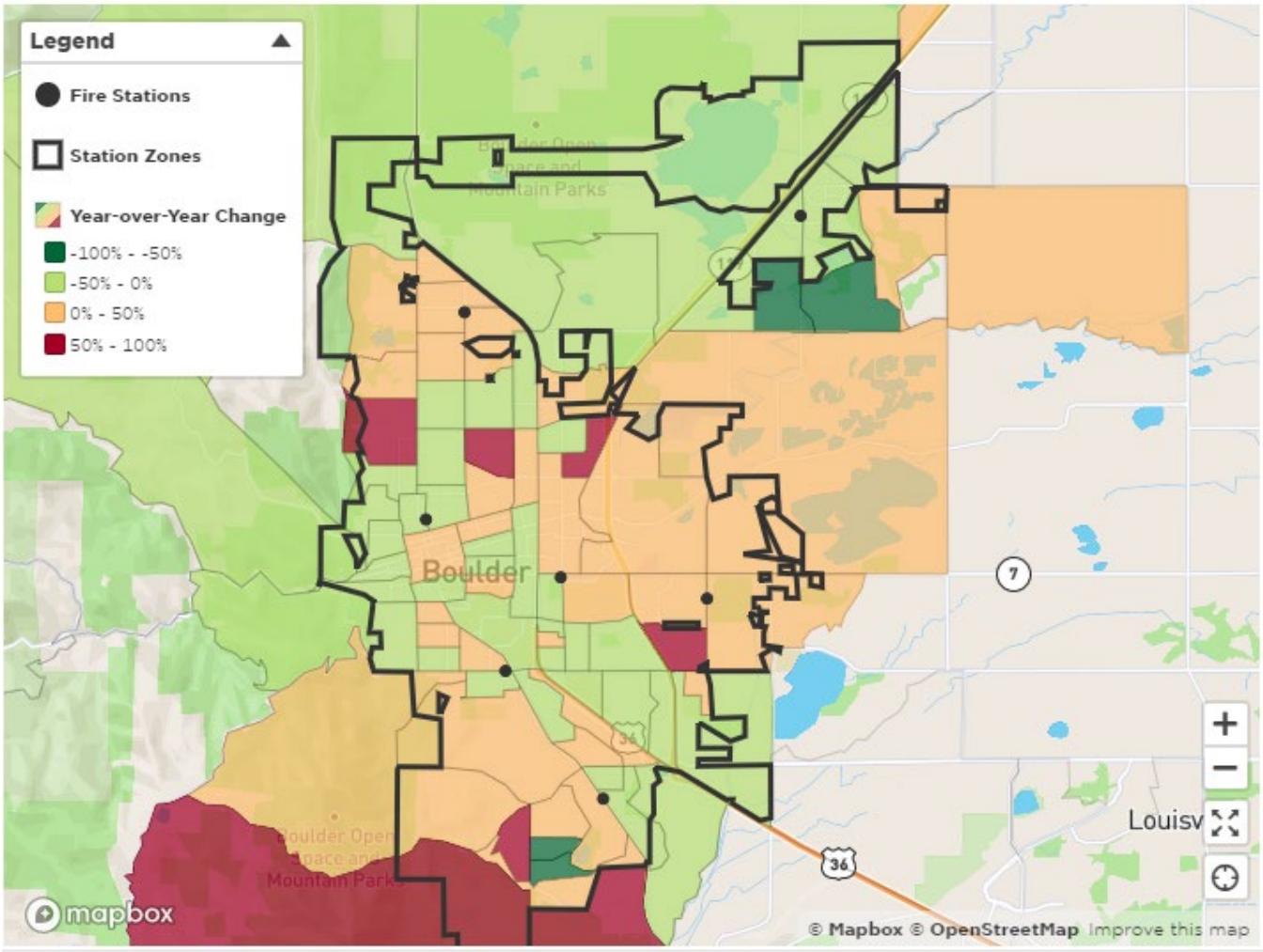


Figure 109: Year Over Year Incident Change by Census Block

Updated Performance Charts

The following pages show the departments performance charts with the new data minining methodology in place. A gap was identified with the CAD system reporting which caused an average of two minutes to be missing from the call processing times.

Performance Charts 2016-2018

Fire – Low Risk

Fire Low Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:42	2:29	2:52	2:47
Turnout Time	Turnout Time 1st Unit	Urban	2:07	2:09	2:08	1:54
Travel Time	Travel Time 1st Unit **Distribution**	Urban	6:20	6:16	6:14	5:02
	Travel Time ERF **Concentration**	Urban	6:20	6:16	6:14	5:02
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	9:56	9:44	9:45	8:23
			N=415	N=137	N=198	N=361
	Total Response Time ERF **Concentration**	Urban	9:56	9:44	9:45	8:23
			N=415	N=137	N=198	N=361

Fire – Moderate Risk

Fire Moderate Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	1:38	1:38	1:38	00:58
Turnout Time	Turnout Time 1st Unit	Urban	2:03	2:23	1:46	1:33
Travel Time	Travel Time 1st Unit **Distribution**	Urban	5:03	5:06	4:50	4:20
	Travel Time ERF **Concentration**	Urban	12:35	14:14	10:03	8:07
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	7:02	7:33	6:50	5:40
			N=17	N=6	N=5	N=5
	Total Response Time ERF **Concentration**	Urban	21:57	18:32	17:03	26:21
			N=17	N=6	N=5	N=5

Fire – High Risk

Fire High Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	1:14	1:08	1:23	0:56
Turnout Time	Turnout Time 1st Unit	Urban	1:50	1:25	1:49	1:32
Travel Time	Travel Time 1st Unit **Distribution**	Urban	4:07	4:05	4:00	2:24
	Travel Time ERF **Concentration**	Urban	9:48	6:06	11:59	5:44
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	7:05	6:28	6:24	4:31
			N=12	N=4	N=6	N=2
	Total Response Time ERF **Concentration**	Urban	22:06	20:40	18:33	10:22
			N=12	N=4	N=6	N=2

EMS – Low Risk

EMS Low Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	3:19	3:20	3:23	3:12
Turnout Time	Turnout Time 1st Unit	Urban	1:41	1:43	1:37	1:42
Travel Time	Travel Time 1st Unit **Distribution**	Urban	6:00	5:56	5:47	6:03
	Travel Time ERF **Concentration**	Urban	6:00	5:56	5:47	6:03
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	9:27	9:23	9:18	9:29
			N=3684	N=1262	N=1347	N=986
	Total Response Time ERF **Concentration**	Urban	9:27	9:23	9:18	9:29
			N=3684	N=1262	N=1347	N=986

EMS – Moderate Risk

EMS Moderate Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:54	3:12	3:08	3:00
Turnout Time	Turnout Time 1st Unit	Urban	1:50	1:38	1:40	1:377
Travel Time	Travel Time 1st Unit **Distribution**	Urban	4:43	4:55	4:40	4:41
	Travel Time ERF **Concentration**	Urban	6:31	6:58	6:30	6:30
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	8:12	8:09	8:01	7:53
			N=8195	N=2921	N=3015	N=2317
	Total Response Time ERF **Concentration**	Urban	10:11	10:20	9:59	9:59
			N=8195	N=2921	N=3015	N=2317

EMS – High Risk

EMS High Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:26	2:13	2:39	2:14
Turnout Time	Turnout Time 1st Unit	Urban	1:36	1:34	1:34	1:39
Travel Time	Travel Time 1st Unit **Distribution**	Urban	4:37	4:33	4:47	4:28
	Travel Time ERF **Concentration**	Urban	6:19	6:10	6:33	5:04
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	7:19	6:59	7:27	7:10
			N=211	N=65	N=70	N=69
	Total Response Time ERF **Concentration**	Urban	9:04	8:23	9:47	8:00
			N=211	N=65	N=70	N=69

Hazmat – Low Risk

Hazmat Low Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:42	2:58	2:32	1:53
Turnout Time	Turnout Time 1st Unit	Urban	2:06	2:17	1:58	2:03
Travel Time	Travel Time 1st Unit **Distribution**	Urban	6:05	6:31	6:09	4:39
	Travel Time ERF **Concentration**	Urban	6:05	6:31	6:09	4:39
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	9:42	9:49	9:30	7:44
			N=135	N=55	N=46	N=29
	Total Response Time ERF **Concentration**	Urban	9:42	9:49	9:30	7:44
			N=135	N=55	N=46	N=29

Hazmat – Moderate Risk

Hazmat Moderate Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:29	2:34	2:26	1:56
Turnout Time	Turnout Time 1st Unit	Urban	2:18	2:18	2:14	2:07
Travel Time	Travel Time 1st Unit **Distribution**	Urban	5:16	5:33	4:31	4:21
	Travel Time ERF **Concentration**	Urban	9:37	9:41	8:33	6:24
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	8:47	9:05	7:55	7:37
			N=181	N=70	N=73	N=24
	Total Response Time ERF **Concentration**	Urban	12:52	13:12	11:41	9:24
			N=181	N=70	N=73	N=24

Hazmat – High Risk

Hazmat High Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:09	2:05	1:54	2:11
Turnout Time	Turnout Time 1st Unit	Urban	2:06	2:07	2:01	1:24
Travel Time	Travel Time 1st Unit **Distribution**	Urban	5:08	5:53	3:53	3:08
	Travel Time ERF **Concentration**	Urban	5:08	5:53	3:53	3:08
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	9:59	10:05	9:16	6:43
			N=5	N=1	N=3	N=1
	Total Response Time ERF **Concentration**	Urban	9:59	10:05	9:16	6:43
			N=5	N=1	N=3	N=1

*this chart represents the first unit on-scene. There were 0 incidents where an ERF of 15 arrived.

Technical Rescue – Low Risk

Technical Rescue Low Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:16	2:09	2:07	2:08
Turnout Time	Turnout Time 1st Unit	Urban	1:29	1:45	1:40	1:27
Travel Time	Travel Time 1st Unit **Distribution**	Urban	4:14	3:52	3:42	4:07
	Travel Time ERF **Concentration**	Urban	4:14	3:52	3:42	4:07
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	6:34	6:41	6:29	6:12
			N=1547	N=250	N=269	N=155
	Total Response Time ERF **Concentration**	Urban	6:34	6:41	6:29	6:12
			N=1547	N=250	N=269	N=155

Technical Rescue – Moderate Risk

Technical Rescue Moderate Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	1:37	1:24	1:33	2:14
Turnout Time	Turnout Time 1st Unit	Urban	1:47	1:25	1:52	1:53
Travel Time	Travel Time 1st Unit **Distribution**	Urban	4:33	3:37	4:41	3:38
	Travel Time ERF **Concentration**	Urban	5:58	4:31	6:02	6:13
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	6:33	4:44	6:45	6:47
			N=62	N=22	N=23	N=15
	Total Response Time ERF **Concentration**	Urban	8:07	6:47	8:33	8:58
			N=62	N=22	N=23	N=15

Technical Rescue – High Risk

Technical Rescue High Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	1:40	1:36	1:40	
Turnout Time	Turnout Time 1st Unit	Urban	1:30	1:33	1:04	
Travel Time	Travel Time 1st Unit **Distribution**	Urban	6:20	4:22	6:33	
	Travel Time ERF **Concentration**	Urban	14:25	14:30	13:44	
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	9:07	7:36	9:17	
			N=2	N=1	N=1	N=0
	Total Response Time ERF **Concentration**	Urban	18:35	18:46	16:59	
			N=2	N=1	N=1	N=0

Wildland Fire – Low Risk

Wildland Low Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:28	2:14	2:04	2:54
Turnout Time	Turnout Time 1st Unit	Urban	1:52	1:51	1:51	1:49
Travel Time	Travel Time 1st Unit **Distribution**	Urban	5:56	5:57	4:08	6:51
	Travel Time ERF **Concentration**	Urban	5:56	5:57	4:08	6:51
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	11:33	10:05	11:02	11:25
			N=26	N=15	N=4	N=7
	Total Response Time ERF **Concentration**	Urban	11:33	10:05	11:02	11:25
			N=26	N=15	N=4	N=7

Wildland Fire – Moderate Risk

Wildland Moderate Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban				
Turnout Time	Turnout Time 1st Unit	Urban				
Travel Time	Travel Time 1st Unit **Distribution**	Urban				
	Travel Time ERF **Concentration**	Urban				
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban				
			N=0	N=0	N=0	N=0
	Total Response Time ERF **Concentration**	Urban				
			N=0	N=0	N=0	N=0

Wildland Fire – High Risk

Wildland High Risk 90th Percentile Times Baseline Performance			2016-2018	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban				
Turnout Time	Turnout Time 1st Unit	Urban				
Travel Time	Travel Time 1st Unit **Distribution**	Urban				
	Travel Time ERF **Concentration**	Urban				
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban				
			N=0	N=0	N=0	N=0
	Total Response Time ERF **Concentration**	Urban				
			N=0	N=0	N=0	N=0

Performance Charts 2016-2019

Fire – Low Risk

Fire Low Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:43	2:49	2:29	2:52	2:47
Turnout Time	Turnout Time 1st Unit	Urban	2:05	2:00	2:09	2:08	1:54
Travel Time	Travel Time 1st Unit **Distribution**	Urban	6:15	5:58	6:16	6:14	5:02
	Travel Time ERF **Concentration**	Urban	6:15	5:58	6:16	6:14	5:02
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	9:45	9:28	9:44	9:45	8:23
			N=625	N=146	N=137	N=198	N=361
	Total Response Time ERF **Concentration**	Urban	9:45	9:28	9:44	9:45	8:23
			N=625	N=146	N=137	N=198	N=361

Fire – Moderate Risk

Fire Moderate Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	1:38	1:15	1:38	1:38	00:58
Turnout Time	Turnout Time 1st Unit	Urban	2:00	0:38	2:23	1:46	1:33
Travel Time	Travel Time 1st Unit **Distribution**	Urban	5:07	5:34	5:06	4:50	4:20
	Travel Time ERF **Concentration**	Urban	14:32	18:14	14:14	10:03	8:07
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	7:04	6:28	7:33	6:50	5:40
			N=21	N=5	N=6	N=5	N=5
	Total Response Time ERF **Concentration**	Urban	21:50	21:43	18:32	17:03	26:21
			N=21	N=5	N=6	N=5	N=5

The quick turnout time in 2019 (:38) is attributed to utilizing the 90th percentile formula on an N=5. The longest turnout in the group was incident 19-0010412 with a turnout of 50 seconds.

Fire – High Risk

Fire High Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	01:15	01:04	1:08	1:23	0:56
Turnout Time	Turnout Time 1st Unit	Urban	1:49	1:44	1:25	1:49	1:32
Travel Time	Travel Time 1st Unit **Distribution**	Urban	3:03	01:41	4:05	4:00	2:24
	Travel Time ERF **Concentration**	Urban	9:51	10:52	6:06	11:59	5:44
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	4:45	4:17	6:28	6:24	4:31
			N=11	N=2	N=4	N=6	N=2
	Total Response Time ERF **Concentration**	Urban	13:57	13:30	20:40	18:33	10:22
			N=11	N=2	N=4	N=6	N=2

EMS – Low Risk

EMS Low Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	3:20	3:20	3:20	3:23	3:12
Turnout Time	Turnout Time 1st Unit	Urban	1:38	1:33	1:43	1:37	1:42
Travel Time	Travel Time 1st Unit **Distribution**	Urban	5:59	6:06	5:56	5:47	6:03
	Travel Time ERF **Concentration**	Urban	7:01	6:56	5:56	5:47	6:03
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	9:21	9:15	9:23	9:18	9:29
			N=4843	N=1253	N=1262	N=1347	N=986
	Total Response Time ERF **Concentration**	Urban	10:05	9:52	9:23	9:18	9:29
			N=4843	N=1253	N=1262	N=1347	N=986

In 2016, severity was not reported 100% of the time for EMS incidents.

EMS – Moderate Risk

EMS Moderate Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	3:04	3:05	3:12	3:08	3:00
Turnout Time	Turnout Time 1st Unit	Urban	1:39	1:39	1:38	1:40	1:377
Travel Time	Travel Time 1st Unit **Distribution**	Urban	4:48	5:01	4:55	4:40	4:41
	Travel Time ERF **Concentration**	Urban	6:43	7:05	6:58	6:30	6:30
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	8:00	8:10	8:09	8:01	7:53
			N=8578	N=2170	N=2921	N=3015	N=2317
	Total Response Time ERF **Concentration**	Urban	10:01	10:19	10:20	9:59	9:59
			N=8578	N=2170	N=2921	N=3015	N=2317

In 2016, severity was not reported 100% of the time for EMS incidents.

EMS – High Risk

EMS High Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:27	2:09	2:13	2:39	2:14
Turnout Time	Turnout Time 1st Unit	Urban	1:39	1:52	1:34	1:34	1:39
Travel Time	Travel Time 1st Unit **Distribution**	Urban	4:26	3:56	4:33	4:47	4:28
	Travel Time ERF **Concentration**	Urban	6:27	7:48	6:10	6:33	5:04
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	7:06	6:29	6:59	7:27	7:10
			N=224	N=27	N=65	N=70	N=69
	Total Response Time ERF **Concentration**	Urban	9:45	12:10	8:23	9:47	8:00
			N=224	N=27	N=65	N=70	N=69

In 2016, severity was not reported 100% of the time for EMS incidents.

In 2019, PIT Crew was established which changed the ERF from 4 to 8.
Further investigation was needed to understand the 4- minute increase in response time from 2018-2019.

To compare like items to one another, the total response time for an ERF of 4 in 2019 was 8:53 (n=77). A 30 sec increase from 2018.

2019
94 incidents with a severity of 'E'
31 incidents arrival of 8 or more people
31 incidents included in query (4 outlier, 27 included)
82 incidents with 4 or more people for ERF, 77 included in the data set

Hazmat – Low Risk

Hazmat Low Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:36	3:18	2:58	2:32	1:53
Turnout Time	Turnout Time 1st Unit	Urban	2:03	2:00	2:17	1:58	2:03
Travel Time	Travel Time 1st Unit **Distribution**	Urban	6:22	7:30	6:31	6:09	4:39
	Travel Time ERF **Concentration**	Urban	6:22	7:30	6:31	6:09	4:39
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	9:48	11:23	9:49	9:30	7:44
			N=167	N=36	N=55	N=46	N=29
	Total Response Time ERF **Concentration**	Urban	9:48	11:23	9:49	9:30	7:44
			N=167	N=36	N=55	N=46	N=29

Hazmat – Moderate Risk

Hazmat Moderate Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:27	2:18	2:34	2:26	1:56
Turnout Time	Turnout Time 1st Unit	Urban	2:20	2:25	2:18	2:14	2:07
Travel Time	Travel Time 1st Unit **Distribution**	Urban	5:15	4:54	5:33	4:31	4:21
	Travel Time ERF **Concentration**	Urban	9:16	8:52	9:41	8:33	6:24
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	8:48	8:48	9:05	7:55	7:37
			N=253	N=72	N=70	N=73	N=24
	Total Response Time ERF **Concentration**	Urban	12:50	12:44	13:12	11:41	9:24
			N=253	N=72	N=70	N=73	N=24

Hazmat – High Risk

Hazmat High Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:49	3:11	2:05	1:54	2:11
Turnout Time	Turnout Time 1st Unit	Urban	2:09	2:01	2:07	2:01	1:24
Travel Time	Travel Time 1st Unit **Distribution**	Urban	3:42	3:01	5:53	3:53	3:08
	Travel Time ERF **Concentration**	Urban	3:42	3:01	5:53	3:53	3:08
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	9:11	8:13	10:05	9:16	6:43
			N=12	N=2	N=1	N=3	N=1
	Total Response Time ERF **Concentration**	Urban	9:11	8:13	10:05	9:16	6:43
			N=12	N=2	N=1	N=3	N=1

*this chart represents the first unit on-scene. There were 0 incidents where an ERF of 15 arrived. Response times from the County Hazmat Authority are not currently available

Technical Rescue – Low Risk

Technical Rescue Low Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:13	2:08	2:09	2:07	2:08
Turnout Time	Turnout Time 1st Unit	Urban	1:29	1:28	1:45	1:40	1:27
Travel Time	Travel Time 1st Unit **Distribution**	Urban	4:13	4:14	3:52	3:42	4:07
	Travel Time ERF **Concentration**	Urban	4:13	4:14	3:52	3:42	4:07
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	6:35	6:39	6:41	6:29	6:12
			N=2039	N=488	N=250	N=269	N=155
	Total Response Time ERF **Concentration**	Urban	6:35	6:39	6:41	6:29	6:12
			N=2039	N=488	N=250	N=269	N=155

In 2019, the ambulance was included in the calculations. This resulted in a significant increase in call volume for low risk technical rescue, 488 from 250. At the time of the site visit in October, there were 373 incidents in this category.

For emergent incidents within the methodology used for performance chart calculations, in 2018 with AMR included in data set total including outliers = 618, excluding AMR = 292. In 2019 with AMR included in data set total including outliers = 556, excluding AMR = 258.

There is no significant time difference when AMR is excluded.

2019 Excluding AMR N=224 (Outlier = 34)

02:06	01:41	03:49	03:49	06:52	06:52
Alarm	Turn	1st_Travel	ERF_Travel	1st_Total	ERF_Total

Technical Rescue – Moderate Risk

Technical Rescue Moderate Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	1:30	1:19	1:24	1:33	2:14
Turnout Time	Turnout Time 1st Unit	Urban	1:51	1:34	1:25	1:52	1:53
Travel Time	Travel Time 1st Unit **Distribution**	Urban	4:24	3:14	3:37	4:41	3:38
	Travel Time ERF **Concentration**	Urban	5:50	4:52	4:31	6:02	6:13
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	6:14	4:37	4:44	6:45	6:47
			N=81	N=19	N=22	N=23	N=15
	Total Response Time ERF **Concentration**	Urban	7:51	6:41	6:47	8:33	8:58
			N=81	N=19	N=22	N=23	N=15

Technical Rescue – High Risk

Technical Rescue High Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	1:40		1:36	1:40	
Turnout Time	Turnout Time 1st Unit	Urban	1:30		1:33	1:04	
Travel Time	Travel Time 1st Unit **Distribution**	Urban	6:20		4:22	6:33	
	Travel Time ERF **Concentration**	Urban	14:25		14:30	13:44	
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	9:07		7:36	9:17	
			N=2	N=0	N=1	N=1	N=0
	Total Response Time ERF **Concentration**	Urban	18:35		18:46	16:59	
			N=2	N=0	N=1	N=1	N=0

Wildland Fire – Low Risk

Wildland Low Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban	2:29	2:11	2:14	2:04	2:54
Turnout Time	Turnout Time 1st Unit	Urban	1:15	1:15	1:51	1:51	1:49
Travel Time	Travel Time 1st Unit **Distribution**	Urban	5:53	5:33	5:57	4:08	6:51
	Travel Time ERF **Concentration**	Urban	5:53	5:33	5:57	4:08	6:51
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban	10:52	8:24	10:05	11:02	11:25
			N=30	N=4	N=15	N=4	N=7
	Total Response Time ERF **Concentration**	Urban	10:52	8:24	10:05	11:02	11:25
			N=30	N=4	N=15	N=4	N=7

Wildland Fire – Moderate Risk

Wildland Moderate Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban					
Turnout Time	Turnout Time 1st Unit	Urban					
Travel Time	Travel Time 1st Unit **Distribution**	Urban					
	Travel Time ERF **Concentration**	Urban					
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban					
			N=0	N=0	N=0	N=0	N=0
	Total Response Time ERF **Concentration**	Urban					
			N=0	N=0	N=0	N=0	N=0

Wildland Fire – High Risk

Wildland High Risk 90th Percentile Times Baseline Performance			2016-2019	2019	2018	2017	2016
Alarm Handling	Pick-up to Dispatch	Urban					
Turnout Time	Turnout Time 1st Unit	Urban					
Travel Time	Travel Time 1st Unit **Distribution**	Urban					
	Travel Time ERF **Concentration**	Urban					
Total Response Time	Total Response Time 1st Unit on Scene **Distribution**	Urban					
			N=0	N=0	N=0	N=0	N=0
	Total Response Time ERF **Concentration**	Urban					
			N=0	N=0	N=0	N=0	N=0