



## INFORMATION ITEM MEMORANDUM

To: Mayor and Members of Council

From: Nuria Rivera-Vandermyde, City Manager  
Chris Meschuk, Deputy City Manager  
Joe Taddeucci, Director of Public Works – Utilities  
Dan Burke, Director of Open Space and Mountain Parks  
Mike Chard, Director of Office of Emergency Management  
Jonathan Koehn, Director of Climate Initiatives  
Joanna Bloom, Deputy Director of Public Works – Utilities  
Chris Douville, Deputy Director of Public Works – Utilities  
Chris Douglass, Utilities Engineering Manager  
Kim Hutton, Water Resources Manager  
Meghan Wilson, Water Quality Manager

Date: Sept. 1, 2022

**Subject: Water Resilience: Planning for Drought, Flood and Fire**

---

### EXECUTIVE SUMMARY

The City of Boulder Utilities Department provides water, wastewater, stormwater and flood management services to protect human and environmental health. A critical component of this work is to implement projects and plans to build resilience in these systems, particularly in the context of climate change and potential impacts from drought, flooding and fires, whether in wildland areas west of Boulder or in the wildland-urban interface (WUI).

This memo describes some of these efforts, including two major planning documents that will go before City Council in September:

- Ongoing water supply and drought planning help ensure the reliability of water essential to basic public health, safety and welfare. The Drought Plan, which is adopted by City Manager rule and will go before council for associated code

changes in September, provides a framework for identifying and responding to drought conditions in the water supply.

- The Comprehensive Flood and Stormwater Plan (CFS), scheduled for a public hearing and council consideration on September 15, 2022, describes the city’s strategy for prioritizing major flood mitigation projects and related activities in an equitable manner.
- Ongoing planning efforts and project implementation to prepare for wildland fires and fires in the WUI will mitigate impacts to the city’s source water and treated water distribution system.
- Emergency planning and response efforts help educate and provide community members with the right tools to prepare for disasters and clarify staff roles and responsibilities in an emergency event.

These efforts will help ensure that basic services, including drinking water and flood protection, will continue to be provided even as the community faces more extreme weather events and the threat of wildland fire increases. Recently, through efforts such as the CFS and Drought Plan updates, Utilities staff have integrated racial equity considerations into plans to identify specific actions to better support community members more equitably.

This memo is intended to provide City Council a summary of water-related resilience efforts managed by the city.

## **BACKGROUND**

### **Water Supply and Drought Planning**

A potential stressor to Boulder’s water supply system is climate change and associated drought. In 2019, Boulder [assessed potential climate change impacts](#) to the municipal water system using scenarios from the Intergovernmental Panel on Climate Change global climate models. All of the assessed scenarios project warmer temperatures and show a seasonal shift in precipitation; however, they vary in change of annual precipitation between wetter and drier. Due to the warmer temperatures, even under the wetter annual scenarios, Boulder projects total municipal water demand will increase in all scenarios.

Across the southwestern United States, projected climate change impacts include significant reductions in precipitation and warmer temperatures that will likely contribute to greater frequency and intensity of drought<sup>1</sup>. Recent attention has been on the Colorado River Basin experiencing a “megadrought” and the effects on water supplies that support 40 million people in seven states, Mexico and many tribes<sup>2</sup>. Lake Powell and Lake Mead, which are the two largest reservoirs on the Colorado River, are at unprecedented low levels. In June 2022, the Bureau of Reclamation Commissioner requested that states benefitting from the Colorado River supplies develop plans to protect storage amounts in

---

<sup>1</sup> <https://www.c2es.org/wp-content/uploads/2018/10/resilience-strategies-for-drought.pdf>

<sup>2</sup> <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2016WR019638>

Lake Powell and Lake Mead. In response to the Commissioner's request, the Upper Colorado River Commission, of which the State of Colorado is a member, [outlined a plan](#) to aid in the recovery of the system's storage levels.

Boulder receives approximately one-third of its municipal water supply on average from the headwaters of the Colorado River through the Colorado-Big Thompson (C-BT) project operated by Northern Colorado Water Conservancy District. As such, Boulder is monitoring both the hydrologic conditions of the Colorado River Basin as well as developments by the river commissions and Northern Colorado Water Conservancy District. In addition, Boulder is assessing its vulnerability to disruptions in the availability of Colorado River supplies. With about two-thirds of Boulder's water supply coming from the Boulder Creek basin, Boulder anticipates a greater reliance on these native supplies in the event of lower Colorado River supplies.

### *Water Supply Reliability*

Water supply reliability has a specific meaning in Boulder's municipal water system. In 1989, Boulder City Council adopted level of service goals, called the "reliability criteria" for Boulder's water supply. Recognizing the financial and environmental costs of developing a municipal water supply in a semi-arid climate that meets all water demands at all times, City Council and the community established an acceptable frequency of water use restrictions for droughts of varying severity. The reliability criteria were reconfirmed through the 2009 Source Water Master Plan process as appropriate planning guidelines.

Boulder uses the reliability criteria to inform strategic planning and assess long-range water supply plans and evaluations. Recent climate change and water supply assessments indicate that Boulder can reliably meet future demands under many climate change scenarios. While investments in infrastructure and water conservation will be important in improving reliability in some of the more severe scenarios, it may also be appropriate to reassess the reliability criteria the next time the Water Utility Master Plan is updated.

### *Water Conservation*

Boulder's [water conservation program](#) helps achieve water efficiency and lower per capita water demand over an extended period of time. Since 2001, Boulder's per capita water demand has decreased by 30%, an amount attributable not only to the water conservation program but also the replacement of water use fixtures and permanent water use reductions in response to the 2002 drought. In addition, Boulder's water budget rate structure incentivizes the efficient use of water by charging higher rates for water use above a customer's water budget.

The water conservation program offers annual support services to help customers who are interested in using water more efficiently. Boulder partners with ReSource Central and Partners for a Clean Environment (PACE) to conduct lawn conversions (grass to garden), educational seminars, and irrigation audits. Additionally, the water conservation program collaborates with the Climate Initiatives team to further our community's conservation

goals and performs outreach to educate community members on indoor and outdoor water savings tips via social media posts and utility bill inserts. Water efficiency will become more important with climate change, particularly under the hottest and driest climate projections. Through regular updates to the [Water Efficiency Plan](#), Boulder adapts the water conservation program to meet water use goals and changing conditions<sup>3</sup>.

### *Drought Planning*

Boulder has developed a Drought Plan to manage droughts as they occur. The Drought Plan provides a framework for identifying drought conditions that affect the municipal water supply system and for making a formal drought declaration, which provides the city manager with the authority to implement response measures to reduce customer demand and maximize city supplies. The Drought Plan is structured to support the city in meeting the reliability criteria. Ultimately, the purpose of the plan is to ensure the availability of water in a drought for uses deemed essential to basic public health, safety and welfare.

Boulder first developed a Drought Plan in 2003 following the 2002 drought and revised it in 2010 to incorporate the city's newly adopted [water budget structure](#). Staff began the current update in 2020 for several reasons, including to evaluate the use of more prescriptive water use restrictions to achieve demand reduction goals during a drought, and to use the recent climate change assessment discussed above to refine the city's drought identification methodology and drought response approach. The updated plan is a clearer, easy-to-use resource for staff in responding to a drought. Throughout the update, staff sought feedback from other city departments, the Water Resources Advisory Board (WRAB) and the community.

Under the plan, each spring Boulder determines whether to declare a drought based on data-driven considerations, including water supply, environmental conditions and municipal water demand. This assessment includes a calculation called the Projected Storage Index (PSI) and incorporates Boulder Creek basin and C-BT project reservoir storage and Boulder's municipal water demand. As warranted by the PSI calculation and conditions, the city manager may declare a Drought Alert Stage, ranging from a drought watch to three stages of drought with increasing intensity, and implement necessary drought response measures to reduce demand (see Table 1).

---

<sup>3</sup> Boulder anticipates an update to the Water Efficiency Plan in 2023. The current Water Efficiency Plan was completed in 2016.

**Table 1: Projected Storage Index, Drought Alert Stages and Demand Reduction Goals<sup>4</sup>**

<b>Projected Storage Index (PSI)</b>	<b>Drought Alert Stage</b>	<b>Annual Citywide Water Demand Reduction Goals</b>	<b>Response Overview</b>
As Conditions Warrant	Watch	-	Water conservation is encouraged. This is a pre-declaration communication tool to raise public awareness of conditions.
0.85 to 0.56	1	Up to 20%	Limitations are placed on lower-priority outdoor uses.
0.55 to 0.41	2	Up to 30%	Additional limitations are placed on lower-priority outdoor uses to allow higher-priority uses.
0.4 or Less	3	Up to 50%	Additional limitations are placed on outdoor water uses; some indoor use limits may be required to prioritize health and safety.

The revised [Drought Plan](#) updates Guiding Principles that identify essential and preferred water uses to prioritize in a drought, with uses associated with basic health and safety as the highest priority. The Guiding Principles also reflect community values, including equity, environment and local food production, and inform appropriate drought response measures, such as outdoor water use restrictions. During the drought period, staff will actively monitor progress of achieving demand reduction goals, the status of water supplies and the degree of financial impacts to the water utility. Education and outreach, enforcement, drought response measures and demand reduction goals may be adjusted as needed.

*Water Supply and Drought Planning on Open Space*

Separate from the municipal water supply, Boulder also has water rights, purchased over many decades using open space funds, that are managed as part of the Open Space and Mountain Parks (OSMP) agricultural land stewardship program. Agricultural uses of water, including irrigation and stock water, also have ecological benefits that support important species such as the Northern leopard frog. As indicated in Section 176.b of the Boulder City Charter, one of the purposes for purchasing Open Space land is the “preservation of water resources in their natural or traditional state, scenic areas or vistas, wildlife habitats, or fragile ecosystems.”

The OSMP department manages water rights in 62 ditches and numerous wells, springs, ponds, and lakes, which are mostly allocated and utilized as part of OSMP’s agricultural

---

<sup>4</sup> [City of Boulder Drought Plan](#).

leasing program. OSMP currently has leases with 29 agricultural tenants across over 270 agricultural fields throughout the OSMP system. Water rights managed by OSMP are sourced from the eastern side of the continental divide, and few can be stored; therefore, OSMP's water supplies are heavily reliant on annual snowpack. Several of the water rights have senior priorities in the water rights administration system and reliably yield water throughout much of the growing season. Despite this, and in part due to lack of storage, operations can be severely affected by drought and variability in stream flows, particularly for vegetable growers. Moreover, staff has recently seen water sources like springs dry up. OSMP realizes the need for additional water sources for operations, and, due to a variety of constraints, has very limited opportunity to use supplemental sources such as C-BT water or water leased from the Utilities department.

Many of the agricultural tenants OSMP partners with are familiar with drought cycles and have their own strategies to deal with them. Grass hay, which is the predominant crop type in the OSMP system, is more resilient to drought and flood cycles than many other crops. In particularly severe droughts, tenants may employ various strategies, such as switching from haying to pasture grazing, changing crops to more drought-tolerant species, trucking in hay and thinning cattle herds. These strategies can be quite costly to the tenants. Dry conditions also have ecological impacts, including to wetlands and various species. Continuing to protect and restore open space lands and employing strategies to mitigate the effects of climate change are critical to ecosystem health and resilience, as described in the [2019 OSMP Master Plan](#).

## **Flood Planning**

The city is nearing completion of an update to the [Comprehensive Flood and Stormwater Master Plan \(CFS\)](#), which is the guiding policy document for Boulder's Stormwater and Flood Utility. The purpose of the plan is to improve the management of stormwater and drainageways to help protect people, places, property and ecosystems in a way that builds resilience and is consistent with community values. The CFS was informed by community input, lessons learned from the 2013 flood, Boulder's Racial Equity Plan and updated information on climate change impacts.

Throughout the CFS Master Plan development, the community communicated a sense of urgency in completing the construction of flood and storm projects, especially in the context of a changing climate and more frequent and intense storm events. The CFS recommends addressing climate change impacts through four main approaches:

- **Implement projects expeditiously** –The sooner projects are implemented, the better the community will be protected from frequently occurring storm events.
- **Maximize flood protection and/or storage in major flood mitigation projects** – Address uncertainty by designing resilient infrastructure and implementing projects with the highest feasible and practical level of flood protection.
- **Be a leader in implementing climate science into Utility planning and engineering work** – Closely follow agency guidance as climate change science is integrated into flood regulations and Boulder-specific scientific studies are completed.

- **Maximize natural features such as wetlands into flood mitigation projects** – Incorporate environmental features into projects to the extent feasible to promote creek corridor restoration, water quality enhancement and carbon footprint reduction.

To support moving forward expeditiously, the CFS includes a discussion of funding, staff resources and community and political support needed to accelerate the construction of flood mitigation projects. The plan also includes a project prioritization framework that provides an objective, consistent way to compare and prioritize major flood projects, which will support equity and faster project completion. These and other key outcomes that reflect community values heard during the plan update are shown in **Table 2** below.

**Table 2: CFS Key Outcomes and Recommendations**

<b>Outcomes and Recommendations</b>	<b>Plan Details</b>
Prioritize projects to do the greatest good first	Created a project prioritization framework to prioritize when major flood mitigation projects should be funded and constructed
Provide services equitably	Incorporated racial equity into policies, current and future outreach and education efforts, and provision of services
Make infrastructure resilient to climate change	Developed proactive measures to address climate change through infrastructure resilience
Prepare for the extremes	Clarified roles and responsibilities for city staff and community members related to flood preparedness, flood warning and emergency response
Inform the community to create a prepared community	Refined outreach and education efforts to reach targeted audiences with a focus on vulnerable populations and non-English speaking community members
Maintain the system we have	Defined support needs and public and private maintenance responsibilities for stormwater drainage systems and major drainageways
Adequately fund the program	Defined three funding levels that result in different pacing of CIP implementation

Knowing that infrastructure alone cannot eliminate all dangerous flooding conditions, the plan supports continuous improvement of the city’s engagement and outreach efforts to reach shifting demographics, renters, those experiencing homelessness and English and non-English speakers. The CFS Master Plan recognizes the role that individuals and community members have in flood preparedness and outlines specific responsibilities related to both institutions and the community that range from a focus on awareness and preparedness under normal conditions to coordinated response and action during life-threatening flash floods. Further discussion of this topic is included in the Emergency Response section below.

## Fire Planning

### *Source Water Protection/Wildland Fire Planning*

Wildland fires are a natural component of Colorado's forested and grassland ecosystems. However, wildland fire frequency and extent have been increasing due to drought conditions, warming temperatures associated with climate change, more people visiting and living in the wildland-urban interface, and declining forest health. Nine of the 20 largest fires in the state's recorded history having occurred since 2018.

The city's water supply comes from forested watersheds: Barker Reservoir, North Boulder Creek and Carter Lake. Wildland fires are expected to occur in these watersheds and could incur significant costs associated with post-fire impacts. Post-fire erosion and sediment transport (due to reduced vegetation and burned soils) can lead to increased water treatment costs, drinking water taste and odor issues, reduced reservoir water storage capacity, water infrastructure damage and long-term source water quality changes.

Due to these potential impacts to the city's source water, staff have been actively planning for wildland fire impacts and partnering with landowners and land managers to implement wildland fire mitigation projects. Activities include:

- Partnering with the Colorado Forest Restoration Institute to develop a customized wildland fire planning tool, which helps staff understand potential post-fire impacts to the source water system based on modeling of fire scenarios and associated sediment loading in streams and reservoirs. The tool would inform watershed recovery strategies and financial planning post-fire (further details provided in the [October 2019](#) and [October 2020](#) WRAB meetings).
- Planning forest thinning projects in the Barker Reservoir Watershed to improve access for firefighters, protect infrastructure, and potentially reduce fire spread, burn severity, and post-fire erosion. Currently the city is partnering with a private landowner, Boulder Watershed Collective, and Colorado State Forest Service to thin a dense lodgepole pine stand and restore meadow conditions along Middle Boulder Creek. The city also continues to remove trees around water infrastructure to protect against fire impacts.
- Importing critical drinking water infrastructure data into the U.S. Forest Service's fire response database, which may help first responders protect the city's water supply assets during a wildland fire. The city's source water reservoirs may be used by firefighting helicopters to pull water for response efforts.
- Leading the development of the [Colorado Post-Fire Playbook](#), which guides water providers in planning for wildland fire recovery and provides tools post-fire to quickly identify financial and personnel resources to aid in recovery.

While forest thinning is the most effective way to minimize the potential for high severity burns and post-fire impacts to source water supplies, these projects are expensive and require landowner participation and community acceptance. As city staff continue to pursue these projects, advanced planning, such as using the wildland fire planning tool

and playbook, will facilitate recovery should a fire occur in one of the city's source watersheds.

### *System Operations/Urban Fire Planning*

The city owns and operates a complex treated water utility system valued at approximately \$2 billion and includes water treatment facilities, storage tanks, pumping and hydroelectric stations, over 400 miles of pipelines and nearly 30,000 customer meters. In addition to ensuring water demands are met and the water is safe to drink, the system supplies water for urban fire protection and is a major contributing factor in how the city is evaluated by the Insurance Services Office (ISO) for its degree of urban fire resilience. Nearly 40% of how ISO scores cities is related to water/supply. Currently the city is ranked by the ISO in the top tier. This reflects high-level urban fire protection and translates directly to our customers in the form of lower home insurance premiums.

Potable water infrastructure systems are typically sized to fight urban structure fires, not wildland fires. When compared to typical urban structure fires, fires at the wildland-urban interface are more dynamic, cover larger areas and have water demands well in excess of those needed for single structure fires. Boulder frequently provides access to source water reservoirs for firefighting in areas in and adjacent to those watersheds. Still, recent wildland fires in the western United States, including the Marshall and NCAR fires, have emphasized a growing need to leverage treated water system infrastructure during a fire in wildland-urban interface areas.

Using realistic fire scenarios, in 2021 Utilities and Fire Department staff evaluated treated water system performance and ways to maximize potable water delivery in the event of a wildland fire. This evaluation concluded that the city treated water infrastructure performs well even under the high-stress, high-demand of the wildland fire planning scenarios. Improvements identified included an additional water storage tank in the city, improvements to the largest three existing tanks, and upsizing key large-diameter pipelines that connect city water storage tanks to each other. These concepts can be implemented over time to optimize and increase system performance and are being considered as part of long-range planning for the capital improvement program.

### **Emergency Response**

Because of the risk of flooding and wildland fire to the City of Boulder and the city's Utilities assets outside of the city boundaries, Utilities staff actively plan for emergencies and participate in response when emergencies occur. When a potential flood scenario is developing, the Boulder City and County Office of Disaster Management (ODM) coordinates with Mile High Flood District, the National Weather Service and others on weather forecasting, patterns, predictions and probability of impact information. These agencies may issue alerts, including:

- Heightened Readiness or Low Impact Flooding (Be aware and prepare),
- Flash Flood Watch (Life-threatening flash flood may occur), or
- Flash Flood Warning (Life-threatening flash flood is imminent or occurring).

Emergency response staff use a variety of tools to alert community members of a potential emergency event, including Everbridge, which community members opt into; Wireless Emergency Alerts, which send a wireless message to anyone currently located within the city or a specified polygon; sirens, which are intended to reach people who are outside or in cars; and door-to-door notifications.

The response management structure for a flood varies depending on the magnitude of the storm. City staff take the lead in small- to medium-scale flood events involving low impact, localized flooding, providing engineering expertise, construction management, technical support and maintenance services to alleviate the impacts of flooding. In larger flood emergencies, Boulder ODM coordinates with the Police and Fire departments to manage disaster response and recovery. During a large-scale event, ODM activates the Emergency Operations Center (EOC). Utilities staff the EOC by providing flood modeling information upon request as well as the other roles described for a small to medium event.

The city also engages community members in understanding flood risk, steps they can take to prepare for a flood or other emergency and the importance of flood insurance. Because of the city's active floodplain management program, community members with a National Flood Insurance Program (NFIP) policy can receive up to a 25% discount. As part of the CFS update, city staff heard valuable feedback from the community on how best to engage people in planning for emergencies, including maximizing opportunities to educate at in-person events and translating materials into Spanish. Additional information on flood emergency planning and response can be found in the CFS (see Attachment A).

For other emergencies, such as wildland fire or a fire in the wildland-urban interface, planning activities and the response structure are similar to flood emergencies. Because of potential impacts to water supply and potable water supplies in any emergency, Utilities also maintains emergency response plans specific to drinking water, source water protection and dam safety. Utilities staff work with ODM and other city departments to plan and execute at routine emergency exercises specific to water-related emergencies.

## **NEXT STEPS**

**Drought:** The updated Drought Plan is in the approval process. In [May 2022](#) (link includes plan) WRAB voted to recommend that the City Manager approve the updated Drought Plan. In September, Council will consider certain code changes that support the update. Following that, the Drought Plan and related City Manager Rule will be presented to the City Manager for approval.

**Flood:** The Comprehensive Flood and Stormwater Master Plan is also in the approval process. In July 2022, WRAB held a public hearing on the plan and voted to recommend approval of the plan. The plan is scheduled for a public hearing at the Sept. 15, 2022, City Council meeting, when staff will seek council acceptance.

**Fire Planning:** Staff will continue to implement wildland and urban fire planning projects as described above.

## **ATTACHMENT**

Attachment A: Comprehensive Flood and Stormwater Master Plan, Technical Memorandum #9: Flood Preparedness, Warning, Response, and Recovery



# 9 Flood Preparedness, Warning, Response, and Recovery

The City of Boulder is one of the highest flash flood risk communities in Colorado (Pettem 2016, Truby and Boulas 1983). Floods can happen at any time with little or no warning. City floodplains and stormwater infrastructure are designed to convey water during storm events in a way that reduces flood risk to the community. Infrastructure alone cannot eliminate all dangerous flooding conditions, however, and it is important for the city and community members to prepare in advance and be able to respond when conditions warrant. This Chapter summarizes roles, responsibilities, and community resources available for the various phases of a flood, including:

- The city's flood education and outreach efforts
- Flood insurance
- Emergency warning and alert resources
- Emergency operations and associated organizational structure
- Recommendations



**Floods can happen anywhere.  
At any time.**

**With little to no warning.**



## Roles, Responsibilities and Resources

Many structures within the City of Boulder were constructed prior to the mapping of Boulder's floodplains, the enactment of floodplain regulations, and the development of a Stormwater and Flood Management Utility. Because the city is prone to flash flooding along with various other hazards, flood preparedness, flood warning, and emergency response are all critical for life safety and property protection. National and regional agencies generally identify four levels of flooding as defined below, and the city and community members both have a role to play in each phase.

1. **Normal Operations** || *Be aware and prepare*
2. **Heightened Readiness or Low Impact Flooding** || *Be aware and prepare – flooding is possible and/or low impact flooding is imminent or occurring*
3. **Flash Flood Watch** || *Life-threatening flash flood may occur*
4. **Flash Flood Warning** || *Life-threatening flash flood is imminent or occurring*

Under **Normal Operating Conditions**, city staff review emergency response plans and functions, and participate in emergency preparedness exercises.

Community members should consider buying flood insurance, develop and discuss personal emergency response plans and evacuation routes, sign up for emergency alerts and ensure contact information is up to date, and take floodproofing precautions such as those described by the National Weather Service (NWS) in [this resource](#).

When a potential flood scenario is developing, the Office of Disaster Management for City of Boulder & Boulder County (ODM) coordinates with Mile High Flood District (MHFD), Skyview Weather, the National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), and others on weather forecasting, patterns, predictions, and probability of impact information. Primary data sources used by these agencies include radar, lightning detection software, gauge-adjusted radar rainfall software, rain gauges, streamflow gauges, and topography, including drainage boundaries. Key severe storm characteristics of concern include slow moving storms, the presence of lightning indicating convection-based thunderstorms, rain intensity of two inches or more per hour, and storm events that cause ground saturation. Additionally, MHFD has developed a [Flash Flood Prediction Program \(F2P2\)](#) which runs April through September in the Denver/Boulder metropolitan area. This program uses information from MHFD's partnership with NWS and local governments to provide notifications of heavy rain and flood threats.



These agencies may issue a Flood Advisory indicating a **Heightened Readiness** stage, which typically indicates nuisance flooding conditions. Both City of Boulder and ODM staff monitor conditions and NWS and MHFD activity during this stage. Additionally, city staff respond to nuisance flooding and other issues as they arise and begin flood response preparations. Preparations include referring to flood action plans, ensuring resources and materials are readily available, and identifying critical system components that may be impacted and/or may need to be operated.

---

Community members should stay aware, review preparedness plans, and [sign up for emergency notifications](#).

---

In a **Flood Watch**, where weather conditions are favorable for flooding and life-threatening flash flooding may occur, city preparation activities increase. City staff continue to respond to nuisance flooding and additionally prepare to shut valves and headgates, set up barricades, and identify critical system components that may be impacted and/or may need to operate. These activities are largely performed by Utilities Maintenance staff, with support from technical experts as needed.

---

Community Members should continue to monitor weather, prepare household members (including pets) for possible evacuation or moving to higher ground, and charge electronic devices to stay connected to alerts and other notifications. Community members should also identify potential evacuation routes and be prepared to re-route if flood waters are encountered.

---

Under a **Flood Warning** where life-threatening flash flood is imminent or occurring, a more comprehensive response and event management structure is needed. In this situation, ODM activates the Emergency Operations Center (EOC) to coordinate flood response efforts with the support of Emergency Support Functions (ESF) described below. During such an event, city public works personnel staff the *ESF 3 – Public Works* position in the EOC. Utilities staff responsibilities and involvement are largely situationally dependent, as no two events are the same. As a guide, Utilities has established high-level actions and duties for various departmental workgroups including the Engineering / Flood and Stormwater team for different flood threat levels. This guide and set of actions are summarized under the Emergency Operations Plan and the Public Works' operational response plans, as defined by the city in conjunction with ODM. Specific actions and tasks in the response plan should be annually reviewed and updated as needed to stay current and practiced. The internal emergency operational plans utilize an All-Hazard Alert (AHA) framework to assist with defining roles and responsibilities and providing clarity for the four levels/phases of flooding.

When either **Flood Watch** or **Flood Warning** conditions are issued by the weather agencies, or demonstrated conditions warrant, the City of Boulder Police and Fire Communication Center (BPFC) will send a message to the Boulder Fire Department and Boulder Police to indicate flood status. The BPFC issues emergency notifications to the public and activates the public warning sirens as directed by incident command. ODM will activate the Emergency Operations Center if a flash flood warning is imminent or issued and provide coordination and manage capabilities that are needed to support response and the community. Depending on the scale of flooding, alerts may be issued city-wide or to a specific area. BPFC has pre-planned polygon maps in Everbridge associated with flooding in areas. Additionally, Wireless Emergency Alerts (WEA) may also be broadcast to anyone with a WEA capable cell phone within a geographic radius of a specific area. The alerting systems described in **Table 9-1** below can be tied to polygons if alerts are issued to a particular area and wireless emergency alerts will bleed over



beyond the intended polygons at least 1/10 of a mile- and as far as citywide, depending on individuals' cellular handset technology.

As noted above, one important distinction once active flooding is occurring, is that the response management structure varies depending on the magnitude of the storm. City staff take the lead in small to medium-scale flood events involving low impact, localized flooding. For such events, Boulder's Utilities staff response includes providing engineering expertise, construction management, technical support, and maintenance services to alleviate the impacts of flooding.

Utilities also has a key supporting role in larger flood emergencies. In such events, ODM leads disaster response and recovery efforts in coordination with the State Emergency Management Agency. During a large-scale event, ODM activates the EOC with support from various ESFs. City of Boulder Utilities staff support *Emergency Response Function 3: Public Works and Engineering Annex* during EOC activation, including providing flood modeling information upon request during an emergency. The other roles described for a small to medium event are also provided. **Table 9-1** below summarizes the various roles and responsibilities described in this section.

**Table 9-1 – Flood Preparation and Response Roles and Responsibilities**

Flooding Phase	City Utilities Staff Responsibilities*	Community Member Responsibilities	Other Key Agency Contributions	Available Community Resources
<p><b>Normal Operations</b></p> <p><i>Be aware and prepare</i></p>	<ol style="list-style-type: none"> <li>1. Update and maintain Emergency Response Plans, including updating contact lists and confirming /clarifying roles</li> <li>2. Perform Emergency Response Exercises</li> <li>3. Update and maintain public education and outreach materials</li> <li>4. Maintain equipment and supplies needed for emergency response</li> <li>5. Perform routine maintenance on flood and storm infrastructure and systems</li> </ol>	<ol style="list-style-type: none"> <li>1. <a href="#">Prepare and know your risk</a></li> <li>2. <a href="#">Obtain flood insurance</a></li> <li>3. <a href="#">Sign up for alerts</a></li> <li>4. Have an <a href="#">emergency preparedness kit</a> ready</li> <li>5. Ensure your sump pump is functioning properly</li> </ol>	<ol style="list-style-type: none"> <li>1. ODM supports emergency response training and planning. Monitors for developing situations.</li> <li>2. MHFD manages stream gages and related data, provides flood preparedness and response materials, and coordinates with municipalities on flood maintenance projects.</li> <li>3. NWS monitors weather and provides weather-related information, provides flood preparedness and response materials.</li> </ol>	<ol style="list-style-type: none"> <li>1. <a href="http://Boulderfloodinfo.net">Boulderfloodinfo.net</a></li> <li>2. <a href="#">Community Guide to Flood Safety</a></li> <li>3. Flood Awareness Flash Drive (handed out at various city events)</li> <li>4. <a href="#">City of Boulder and related flood preparedness information</a></li> <li>5. <a href="#">NWS Before a flood actions</a></li> </ol>



Flooding Phase	City Utilities Staff Responsibilities*	Community Member Responsibilities	Other Key Agency Contributions	Available Community Resources
<p><b>Heightened Readiness or Low Impact Flooding</b></p> <p><i>Be aware and prepare - flooding is possible and/or low impact flooding is imminent or occurring</i></p>	<ol style="list-style-type: none"> <li>1. Respond to nuisance flooding and issues</li> <li>2. Alert work groups of potential needs and EOC staffing assignments</li> <li>3. Identify critical system components that may be impacted</li> </ol>	<ol style="list-style-type: none"> <li>1. Account for all members of your household (including pets)</li> <li>2. Stay tuned to local weather networks</li> <li>3. Be prepared to evacuate or seek higher ground</li> </ol>	<ol style="list-style-type: none"> <li>1. ODM, MHFD, and NWS monitor weather and provide weather-related alerts and notifications as situation warrants.</li> <li>2. ODM staff monitor conditions and NWS and MHFD activity under these conditions.</li> </ol>	<ol style="list-style-type: none"> <li>1. Report non-emergency flooding on <a href="#">Inquire Boulder</a></li> <li>2. <a href="#">NWS</a> radio weather reports</li> </ol>
<p><b>Flash Flood Watch</b></p> <p><i>Life-threatening flash flood may occur later in the day</i></p>	<ol style="list-style-type: none"> <li>1. Oversee resource acquisition for Utilities Maintenance</li> <li>2. Employ specific plan of action: i.e., bridges to monitor, water valves to shut down, evaluate conditions of water resources, monitor dam safety, and implement dam emergency action plans as needed.</li> <li>3. Coordinate with ditch companies for head gate closures and/or emergency operations by ditch company personnel.</li> <li>4. Monitor water quality and quantity issues.</li> <li>5. Staff ESF3 if EOC is activated.</li> </ol>	<ol style="list-style-type: none"> <li>1. Account for all members of your household (including pets)</li> <li>2. Stay tuned to local weather networks</li> <li>3. Be prepared to evacuate or seek higher ground (there may be only moments to react)</li> </ol>	<ol style="list-style-type: none"> <li>1. ODM coordinates with Boulder Police and Fire to indicate flood status. Police and Fire determine the need for emergency notifications. 911 center issues the emergency notifications to the public and activate sirens as situation warrants.</li> <li>2. ODM activates the EOC as needed to coordinate flood response and recovery activities, including coordination with local, State, and Federal agencies.</li> <li>3. MHFD and NWS continue to monitor weather and provide weather-related alerts and notifications as situation warrants.</li> </ol>	<ol style="list-style-type: none"> <li>1. <a href="#">NWS</a> radio weather reports</li> <li>2. City communication networks, including social media accounts</li> </ol>



Flooding Phase	City Utilities Staff Responsibilities*	Community Member Responsibilities	Other Key Agency Contributions	Available Community Resources
<p><b>Flash Flood Warning</b></p> <p><i>Life-threatening flash flood is imminent or occurring</i></p>	<ol style="list-style-type: none"> <li>1. Oversee resource acquisition for Utilities Maintenance</li> <li>2. Oversee damage/repairs to water distribution and wastewater collection systems.</li> <li>3. Assess immediate and residual field damages; assists and prioritize crews as needed.</li> <li>4. Employ specific plan of action: i.e., bridges to monitor, water valves to shut down, evaluate conditions of water resources, monitor dam safety and implement dam emergency action plans as needed.</li> <li>5. Coordinate with ditch companies for head gate closures and/or emergency operations by ditch company personnel.</li> <li>6. Monitor water quality and quantity issues.</li> <li>7. Provide staffing and situational awareness for ESF3 at the EOC .</li> </ol>	<ol style="list-style-type: none"> <li>1. Stay tuned to local weather networks</li> <li>2. Follow any evacuation orders</li> <li>3. Seek higher ground (never walk or drive through floodwaters)</li> <li>4. Practice electrical/gas safety, particularly at night. Have battery operated flashlights available as part of your preparedness kit.</li> </ol>	<ol style="list-style-type: none"> <li>1. Same as Flash Flood Watch</li> </ol>	<ol style="list-style-type: none"> <li>1. City communication networks, including social media accounts</li> <li>2. Emergency services, such as <a href="#">ODM</a></li> <li>3. <a href="#">NWS during a flood actions</a></li> </ol>

\* This table primarily focuses on City Utilities staff responsibilities. Numerous other city departments also have significant roles in natural disasters.

**Fire/Flood** – One element of emergency response not covered in the above table relates to runoff and debris flow following a wildland fire. Post-fire drainage evaluation is necessary when a fire occurs in drainages in and surrounding Boulder. Fires of different magnitude involve different scales of incident management. Large fires will likely be managed by state or federal agencies, including resources to manage runoff and debris flow. For such



significant events, city staff may play a minor supporting role in providing drainage information to the managing agencies. For events of smaller scale, city staff may play a more direct role in evaluating the situation and making and implementing recommended erosion control measures. Staff from Utilities Flood and Stormwater Engineering and/or Water Quality in cooperation with Open Space and Mountain Parks staff and ODM, among other departments will often need to coordinate on recommended erosion control measures.

**Dam Safety** - Boulder is situated downstream of water supply dams. Dam owners, including Boulder, coordinate with the State of Colorado and other regulatory agencies on dam safety, emergency preparedness exercises and other management activities. Dam safety is a component of infrastructure management and is outside the scope of this master plan. The responsibility for flood preparedness remains the same for dams and hydrologic flooding. Community members should refer to recommendations in this chapter.

## Public Outreach and Education

In the preparedness phase of flooding, the Utility engages in extensive public outreach and education efforts to educate the community about flood risks. However, demographics change, and the need is ongoing, particularly considering the significant number of renters. The 'Be Heard Boulder' questionnaire launched at the beginning of the master plan update process identified the following community concerns and perceptions about flooding:

- Who is at risk?
- How big is the risk?
- Preparation is key
- Warn the community earlier

The CFS Community Working Group echoed these same themes by noting the importance of focusing on equity and in reaching traditionally hard to reach populations. To do this, the Utility should routinely use the city's new Racial Equity Instrument and continue to investigate effective and creative outreach strategies and develop a mechanism to understand the efficacy of outreach and education efforts being conducted.

1. The public outreach and education strategy should be updated to provide structure and process for aligning activities with the overall CFS Master Plan goals. The city's approach currently aligns with Community Rating System (CRS) Activity 330. The city should maintain this approach and continue to identify and evaluate additional applications that could result in broader public awareness and involvement.

As part of a public outreach and education strategy, the following actions should be considered for inclusion:

- 7) Identify goal and objective evaluation metrics, including outputs (i.e., administrative and programmatic activities) and anticipated outcomes (i.e., changes in awareness and behavior).
- 8) Conduct a target audience characterization to identify subgroups of the community that have shared characteristics and communication needs/preferences/capabilities. These audiences exist within different geographic areas of the community that require targeted messaging based on flood risk, vulnerability and neighborhood. The use of existing or new survey tools could be used to determine awareness and communication preferences.
- 9) Align with city's Racial Equity Plan and consider the following outreach strategies for Spanish-speaking residents<sup>14</sup>:

<sup>14</sup> Recommendations developed by the CWG Community Connectors



- a) Maximize in-person outreach opportunities, including having a presence at community events, manufactured housing communities, and through partnerships, such as those with Boulder's Neighborhood Services team, Boulder Housing Partner, Intercambio de Comunidades, El Centro AMISTAD, and schools
  - b) Offer opportunities and assistance for people to sign up for emergency alerts during community events/ informational sessions
  - c) Where possible, hold public meetings in Spanish, versus using Spanish language interpretation
  - d) When using interpretation services in a Community Working Group setting, have a dedicated interpreter for the duration of the outreach period, that is embedded in the team and learns the technical terms
  - e) Provide translated infographics, flyers, and pamphlets
  - f) Consider developing short, catchy informational videos and social media posts
- 10) Identify communication channels, stakeholders, and partners that can help tailor and disseminate messaging. Specifically, develop a concrete approach for how the city and response agencies will reach non-English speaking residents when ordering evacuations. Identify and disseminate resources for the Spanish-speaking and other non-English speaking communities to access in an emergency.
  - 11) Develop key messaging which can be tailored by theme (i.e., preparedness, response, and recovery) and by key target and sub-target audiences. Identify messaging gaps. Specifically include information about how these efforts relate to personal safety, and how this subject is relevant to residents. For example, flood mitigation and preparation can save lives, and can keep access to places like schools and hospitals open.
  - 12) Organize existing messaging by format and distribution channel (i.e., print, electronic, in-person events, virtual events, innovative formats) by phase and by sub-target audiences to identify messaging gaps or oversaturation. Schedule routine debriefs related to these efforts to establish continuous improvement.

Additionally, the city should update its annual flood communications plan and schedule to include lessons learned during the COVID-19 pandemic, including effective distribution methods, guidance and guidelines on hosting in-person or virtual events, evaluation methods, and associated costs.

## Flood Insurance and the Community Rating System

Another preparedness activity involves flood insurance. The City of Boulder participates in the National Flood Insurance Program (NFIP) by adopting and enforcing floodplain management ordinances and providing public education to reduce future flood damage. In exchange, the NFIP makes federal government-backed flood insurance available to homeowners, renters<sup>15</sup>, and business owners regardless of whether they are in the floodplain. The NFIP also has a voluntary incentive-based program called the Community Rating System (CRS), which ranks communities on a 1-10 scale (Class 1 being the 'best') and allows communities to obtain discounts on flood insurance premiums if community floodplain management activities exceed minimum NFIP standards. Participation in the CRS Program generally involves receiving points for performing flood management activities that reduce and avoid flood damage to insurable property and that foster comprehensive floodplain management in exchange for insurance discounts. Boulder first entered the CRS Program in 1992 as a Class 9 community, which provided a 5% discount on flood insurance premiums. Since then, the city has maintained an active floodplain

<sup>15</sup> Typically, renters or mobile home insurance policies do not cover flood damage, so community members should be aware of what coverage is provided under individual policies.



management program and now holds a CRS Class 5 rating, providing NFIP flood insurance policy holders with up to a 25% discount<sup>16</sup>.

Ability to recover from flood damages can be a major consideration for residents who do not have access to Federal insurance programs, and/or who lose childcare, income, or struggle to pay for flood repairs on top of monthly bills. The city should use the Racial Equity instrument to evaluate how best to support residents who do not, or cannot, qualify for FEMA backed flood insurance after a flood.

In addition to providing communities with discounts on flood insurance rates, FEMA's CRS program is nationally recognized as being a comprehensive guide for best practices related to floodplain management, stormwater drainage, and stormwater quality. The city's commitment to implementing diverse and comprehensive programs in this arena is recognized through its current Class 5 rating under the CRS program. The Community Working Group has expressed a desire to maximize insurance benefits. One option would be to move to a Class 4, which would increase reductions by approximately 5% to a total of up to 30% on NFIP flood insurance premiums for community members. A significant hurdle for communities in achieving the Class 4 rating is the prerequisite requirement for Watershed Master Planning (WMP) under CRS Activity 450, which entails completing a unified plan that addresses both storm and flood management. Approval of the CFS Master Plan update would likely meet this "CRS Activity 450 WMP" criteria. However, additional prerequisites and 500 additional CRS points would be needed to achieve a Class 4 rating. Significant additional staff and financial resources would be needed to refine existing programs or implement new programs that would garner the necessary Class 4 credit points. Therefore, these improvements should be considered when implementing priority flood and storm projects and programs based on staff capacity and in comparison to community benefits associated with other work plan priorities.

## Emergency Warning Dissemination

Early warning systems are a critical life-safety aspect of flood management, some of which require community member sign-up, which ideally would occur in the preparedness phase of a flood. Boulder Police and Fire use the Emergency Warning alerts summarized in **Table 9-2** below in coordination with ODM when forecasted or actual current conditions warrant. Evaluation of how to optimize emergency warning dissemination, including addressing language access issues, should continue to be considered and refined to ensure coverage in areas where most needed, particularly when considering socially vulnerable individuals who may be less likely to receive warning messages.

**Table 9-2 – Emergency Alert Systems**

Mechanism	Audience	Benefits	Drawbacks
Everbridge (Auto)	Landline phones	The communications centers/dispatch centers receive quarterly updates on landlines from Century Link and Comcast to ensure landline numbers are current.	Few residents have landlines; if solicitor-block features are present, the emergency telephone notification will not go through to warn the resident.

<sup>16</sup> The maximum discount for CRS applies to properties in the FEMA defined Special Flood Hazard Area, generally in the 100-year flood plain. Other properties receive a lower discount of 10%.



Mechanism	Audience	Benefits	Drawbacks
Everbridge (Opt-In)	Residents and commuters	<p>Notifications are received by cell, home, and work phones; text message; and email. Can sign up for multiple locations (i.e., work and home).</p> <p>Webpage for signup is available in multiple languages</p> <p>Allows for Spanish messaging</p>	<p>Requires action from the public to sign up online; those wary of providing personal information, may not be inclined to opt-in; if cell phone numbers or locations registered in the system change, then the residents may not get the notifications as expected.</p> <p>Spanish messaging may depend on cell carrier</p>
Integrated Public Alert Warning System (IPAWS) / Wireless Emergency Alerts (Auto)	Anyone with a WEA capable cell phone, television, radio, or NOAA weather radio.	<p>Wireless Emergency Alerts (WEA) Broadcasts messages to anyone located in the city or a specified polygon with a WEA capable cell phone.</p> <p>Allows for Spanish messaging</p> <p>Emergency Alert System (EAS) broadcasts notifications to television and radio stations.</p> <p>NOAA Weather Radio broadcasts to weather radios in the range of the radio system.</p>	<p>A cell phone tower must be within the polygon. Therefore, the locations of all cell phone towers should be linked into the Everbridge system.</p> <p>Spanish messaging may depend on cell carrier</p> <p>EAS only reaches viewers or listeners of TV and radio stations and is not required to be transmitted by the stations once received.</p> <p>NOAA Weather Radio will only be received by public who have a NOAA weather radio turned on. The system also can be used by proprietary platforms and apps causing changes to the notification content and warning areas.</p>
Sirens (Auto)	People outdoors or in cars	Notifies people recreating in or near waterways and commuters	<p>May not be heard indoors (particularly in apartment buildings); can be difficult to decipher audio message associated with the alert; depending on location relative to the siren, the sound may not be heard and/or the message can sound distorted</p>



Mechanism	Audience	Benefits	Drawbacks
Door-to-Door Notifications (Auto)	Local residents	Experience demonstrates that during an emergency, residents may not get the warning even if all systems are used. First responders will need to deploy to the hazard area to set up roadblocks and go door to door, if possible, to warn and assist residents.	There will be areas inaccessible to first responders and door-to-door notifications will not be made. Spanish speaking residents may not understand English-only evacuation directions.

*Note: (Auto) indicates no community member action is needed to receive an alert; (Opt-In) requires community member registration.*

### Everbridge

Currently, the city has access to and uses the Everbridge platform, which is recognized as a top platform across the country. The redundancy and speed are currently unmatched by competitors, as the total number of activations “pushed out” by phone, email, text to the community far exceeds any other platform. Additionally, when an alert message is acknowledged by the intended recipient, the system does not continue to send same message. This keeps the system from duplicating unwanted messages to an inbox, phone or text. Although this system is currently the most successful at sending targeted alerts, the “opt-in” feature can be a challenge as it requires community member action to register. The city should keep apprised of technological improvements to all alert systems and consider upgrades as they become available.

### Wireless Emergency Alerts (WEA)

In early 2022, Boulder gained new emergency alert capability that allows police and fire departments to send Integrated Public Alert Warnings (IPAWS), including Wireless Emergency Alerts (WEA), to the public. These messages activate all enabled cell phones in a specific geographic area with sounds and text, similar to Amber Alerts and National Weather Service emergency notices, without requiring users to opt-in or subscribe to the service in advance. When possible, these alerts include direction from emergency responders on what steps to take. While the city still strongly encourages individuals to register through Everbridge opt-in notifications for the most targeted emergency messaging, the use of WEA will allow officials to reach out-of-town visitors, unhoused individuals, and people outside of their opt-in addresses during a life-threatening emergency. ODM holds the administrative responsibility for the WEA service, which can be activated by individual jurisdictions that are part of sender groups. In Boulder, the sender group is led by the 911 Communications manager with input from Public Safety PIOs and other communications staff.

### Outdoor Warning Sirens

The ODM coordinates with BPFCA for activating the outdoor warning sirens in the event of an outdoor emergency. These sirens are owned and maintained by the City of Boulder. Boulder’s current sirens are aging, and some are approaching the end of their useful life. The city should investigate potential upgrades to newer outdoor warning systems, as well as available federal funding sources, which can be used to help offset purchase costs if new



sirens are warranted. Additionally, siren coverage is currently determined using a proximity function that sets a fixed distance surrounding each siren. Since these sirens are intended to warn people who are outdoors at the time of an emergency, variables such as weather conditions, prevailing wind directions, and building and terrain heights should all be incorporated into an updated coverage analysis.

## Flood Response Operations

As noted previously, once an emergency event reaches a certain threshold, a more formal and comprehensive incident management structure is necessary and requires an activation of the EOC. The overarching EOC framework and comprehensive set of ESFs are shown in the figure below. For the Utilities Department, main duties and responsibilities fall under ESF 3 – Public Works. ESF 3 duties are described as:

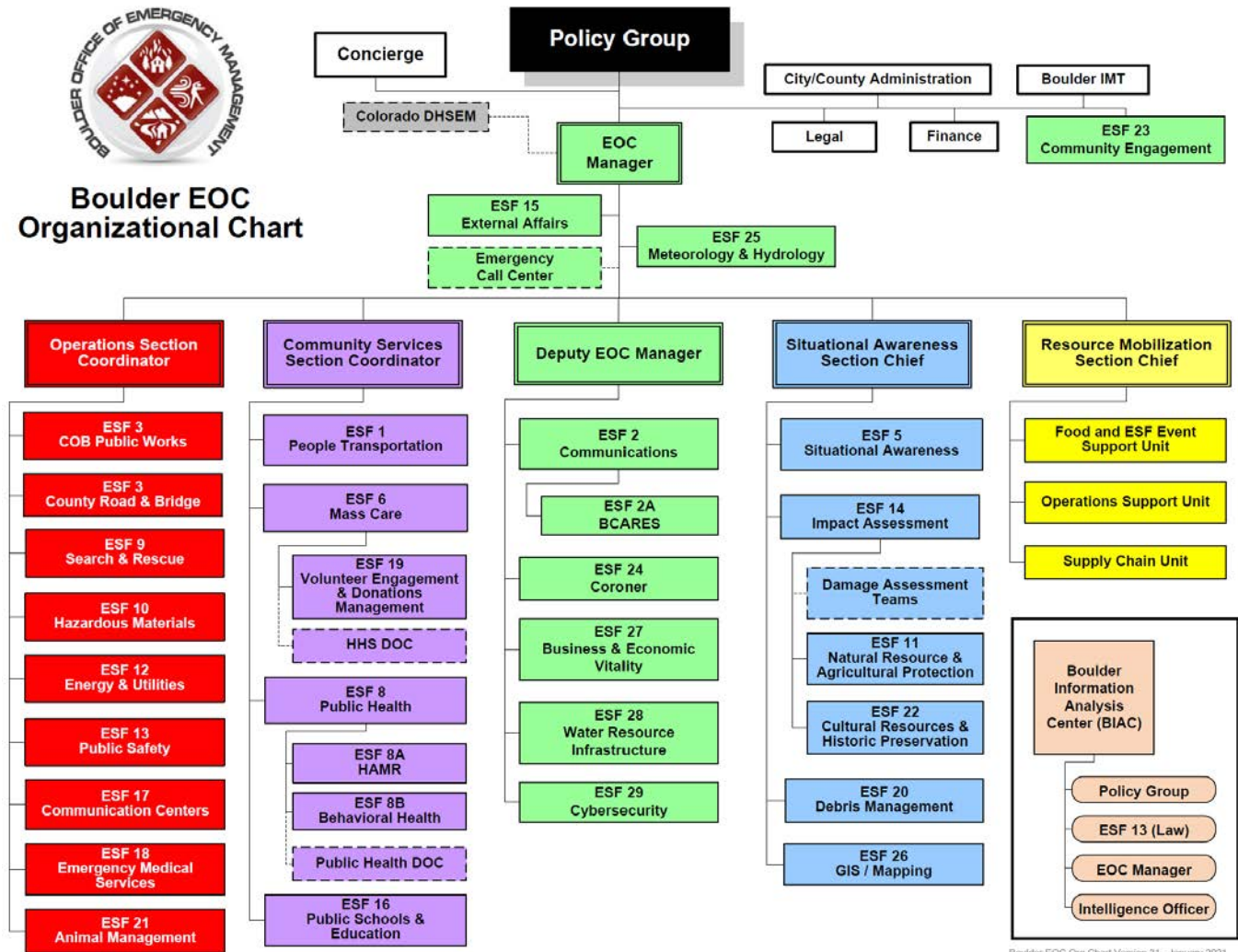
*ESF 3 is structured to provide public works / public utilities and road and bridge-related support for the changing requirements of incident management, to include preparedness, prevention, response, recovery and mitigation actions. Public utilities includes city-provided water, wastewater, and stormwater/flood systems and infrastructure. Activities within the scope of this function include conducting pre-and post-incident assessments of public works and infrastructure and reporting damage; executing emergency contract support for life-saving and life-sustaining services; providing technical assistance to include engineering expertise, construction management, contracting and real estate services; providing emergency repair of damaged infrastructure and critical facilities; recovery programs including coordinating the restoration and recovery of the transportation and public utility infrastructure; and coordinating and supporting prevention, preparedness and mitigation among transportation infrastructure stakeholders at the local and State levels.*

# Flood Preparedness, Warning, Response, and Recovery COMPREHENSIVE FLOOD AND STORMWATER

Master Plan



## Boulder EOC Organizational Chart



Boulder EOC Org Chart Version 31-- January 2021



## Recommendations

To proactively address Boulder’s flood risk, the following recommendations for emergency preparedness and response activities should be considered:

- **Emergency Response and Roles** - Review and update existing city emergency response plans. Confirm and clarify city Utilities staff response roles internally and with partnering agencies for small to medium events (no EOC activation) and for large events (full EOC activation) and update accordingly in the Emergency Operations Plan and operational response plans.
- **Education and Outreach** – City staff should periodically review and update city resources available to the community. Consider education and outreach goals and objectives; target audiences (especially vulnerable and non-English speaking audiences); communication channels, stakeholders, and partners that can help tailor and disseminate messaging.
- **Emergency Alert Systems** – City staff should periodically review and update emergency alert systems and references available to the community and should investigate potential upgrades to newer outdoor warning systems.
- **Equity** – City staff should apply the city’s Racial Equity Plan and Instrument to emergency preparedness and response plans and activities and consider whether identifying and evaluating outside resources, programs or partnerships could provide support to community members that don’t qualify for FEMA programs because of lack of information, documentation, or immigration status.
- **Community Members** – Consider buying flood insurance, develop and discuss personal emergency response plans and evacuation routes, sign up for emergency alerts and ensure contact information is up to date, and take floodproofing precautions such as those described by the National Weather Service (NWS) in [this resource](#).

### Targeted Outreach

One of the most important aspects of the city’s education and outreach program should be to connect with community members that will most likely require additional support before, during, and after a flood with equitable distribution of tools and resources for flood preparedness.

Traditional outreach strategies and media often overlook or miss such populations, and it is important for the city to develop and implement effective strategies such as in-person community meetings and include tools to remove language barriers, which is particularly important for the Spanish-speaking community.



---

## References

---

Boulder County CO use of alert notification system. [Emergency Mass Notification System - Boulder County](#)

Federal Emergency Management Agency (FEMA), 2003. Homeland Security Presidential Directive-5, To enhance the ability of the United States to manage domestic incidents by establishing a single, comprehensive national incident management system.

FEMA's Community Rating System (CRS) 2017 Manual and 2021 Addendum. [The CRS Coordinator's Manual - CRSresources](#)

Pettem, Silvia. 2016. Boulder's Floods and Flood Management: Past & Present. Boulder, CO: City of Boulder.

Truby, J., and L. Boulas. 1983. Colorado's Vulnerability to Very High Risk Natural Hazards, Revised. Division of Disaster Emergency Services.