



# Land Use

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## BOULDER COUNTY PLANNING COMMISSION

Wednesday, March 21, 2018, at 3:00 p.m.

Commissioners' Hearing Room, Third Floor  
Boulder County Courthouse, 1325 Pearl Street, Boulder, CO

### PUBLIC HEARING

#### Overview of Geologic Hazard Mapping Study, Outcomes and Next Steps

*Staff:* Nicole Wobus, Long Range Planning and Policy Manager, Land Use Department

### AGENDA

1. Staff presentation
2. Questions for staff
3. Public Comment (3 minute allowance per individual speaker)

### SUMMARY

Staff will present an overview of CDBG-DR resiliency grant-funded work completed by a geotechnical consulting team in 2017. The consultants' work included: 1) county-wide mapping of landslide potential and updates to other hazard-related maps, and 2) providing tools and guidance for planners. The county is integrating the outcomes of the work to address potential geotechnical-related hazards identified through land use planning processes.

### ACTION REQUESTED

No action is requested from Planning Commission at this time. This is an informational item only; however, staff anticipates returning to Planning Commission later in 2018 to adopt final maps as part of the BCCP annual map update process.

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## I. OVERVIEW OF STUDY OBJECTIVES AND OUTCOMES

### **Study Overview**

Following the 2013 flood, the county has been better preparing for future disasters. Part of that effort includes improving geologic hazard-related maps where appropriate. With grant funding,<sup>1</sup> the Land Use Department contracted with Cesare, Inc. (prime contractor) and TerraCognito GIS Services, Inc. (subcontractor) to conduct this work. Goals of the project included characterization of geologic hazards on a countywide scale, prioritization of significant geologic hazards, and geological and geotechnical consultation and educational services for planning staff.

Cesare provided mapping and policy support services, as well as educational resources for planners. Cesare conducted an educational workshop for planners, and performed case study reviews of actual development applications. As part of the project the Cesare team completed a thorough review of the county's existing geologic hazard-related mapping and policies, including background materials related to the Geology Element of the Boulder County Comprehensive Plan "BCCP". Cesare also shared best practices from other communities in Colorado for requiring geologic hazard studies and referrals to the Colorado Geologic Survey. Workshop and report materials resulting from the study will serve as reference materials and provide guidance for Boulder County planners into the future.

Cesare's project work spanned from fall, 2016 to March, 2017. Cesare then submitted a report addendum in October of 2017 after identifying an improved approach for presenting debris flow potential mapping. [Cesare Inc.'s full March 2017 report is available here](#). The [October 2017 addendum to the report is available here](#).

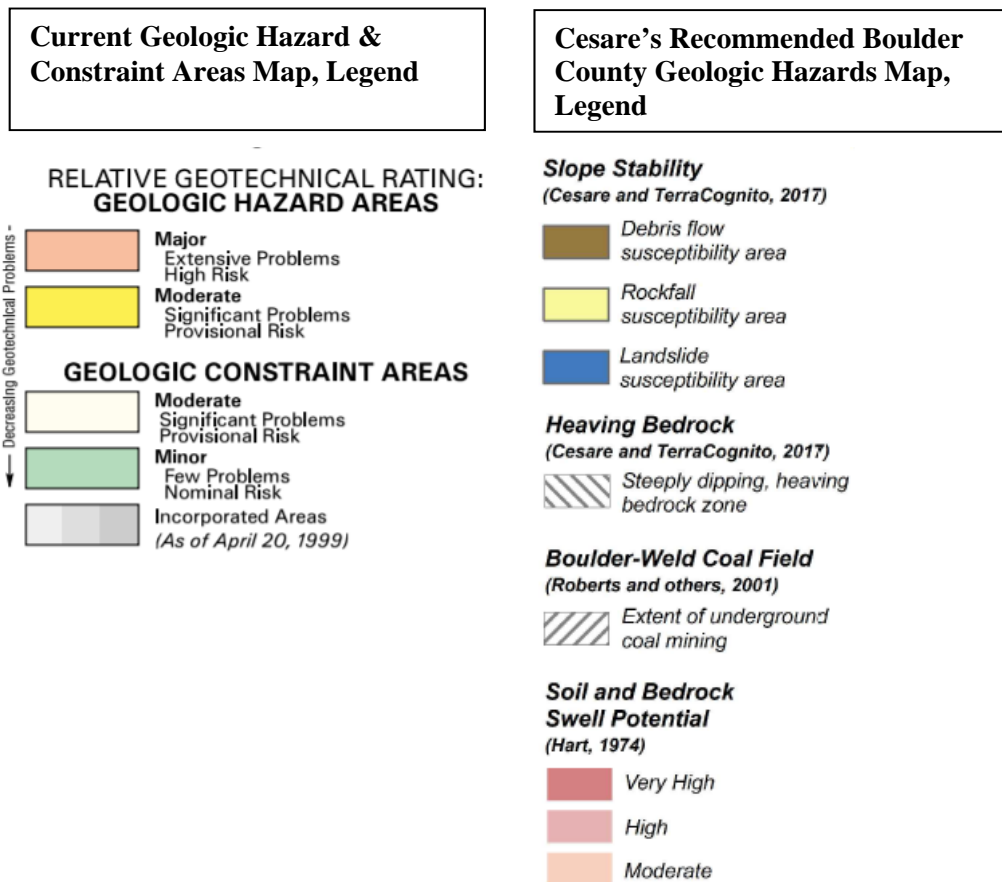
### **Map Package**

The most notable changes to the county's geologic hazard maps resulting from the study include increasing the level of granularity through high resolution digitized mapping, improving information related to landslide and rockfall susceptibility, and delineating the "steeply dipping heaving bedrock zone" within Boulder County. In contrast to the county's current BCCP Geologic Hazard and Constraint Areas Map, which identifies only broad categories of hazards (i.e., major and moderate geologic hazard areas, and moderate and minor geologic constraint areas), the "Boulder County Geologic Hazard Map" included in the Cesare map package identifies specific types of geologic hazards. This information flags areas of potential concern, and helps planners determine the appropriate types of studies that might be necessary to characterize the constraints of a specific property and better inform planning decisions.

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<sup>1</sup> Grant funding was provided by the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant-Disaster Recovery (CDBG-DR) program, administered by the Colorado Department of Local Affairs (DOLA).

**Figure 1. Comparison of Current BCCP Geologic Hazard and Constraint Areas Map with Mapping Categories Used in Cesare’s Geologic Hazard Map**



**Maps updated or created by Cesare** (Plate numbers denote map plates from Cesare reports):<sup>2</sup>

- **Boulder County Geologic Hazards Map** (Plate 9) – a compilation of available, updated, and newly created geologic hazard data
- Landslide Inventory (Plate 6)
- Landslide Susceptibility Map (Plate 7)
- Steeply Dipping Heaving Bedrock Map (Plate 8)
- Rockfall Susceptibility Map (Plate 10)
- Debris Flow Susceptibility Map (Plate 11)

**Additional geologic hazard-related county maps included in Cesare reporting** (reviewed by Cesare but not updated):

- Geologic Hazard and Constraint Area Map (from existing BCCP) (Plate 1)
- Boulder County Geology Map (Plate 2)

<sup>2</sup> **DISCLAIMER:** The mapping is for illustrative purposes only and the features depicted are approximate. More site specific studies may be required to draw accurate conclusions. Boulder County makes no warranties regarding the accuracy, completeness, reliability, or suitability of this mapping. Boulder County disclaims any liability associated with the use or misuse of this map. In accessing or relying on this map, the user fully assumes any and all risk associated with the information contained herein. Geologic hazard mapping prepared by Cesare, Inc. is still undergoing review and is subject to revision.

- Swelling Soils and Bedrock Map (Plate 3)
- Boulder-Weld Coal Field- Extents of Abandoned Coal Mines (Plate 4)
- Boulder-Weld Coal Field- Depth of Overburden (Plate 5)

The map package components can be used by planners to help determine if site specific studies may be necessary, to guide recommendations on mitigation, as well as to inform on surface and subsurface conditions which may have impacts on short and long range planning decisions.

### **Study Recommendations**

Cesare recommends that site specific geologic hazard and geotechnical reports be conducted for properties with mapped hazards, and that those site specific studies undergo third party review, a service provided by the Colorado Geologic Survey (CGS). Cesare recommends that the geologic hazard map package be updated regularly and supplemented with additional useful information as it becomes available. Cesare also suggests the county consider future field verification of the landslide inventory and the steeply dipping heaving bedrock maps. Similar to the geo-event database maintained by the Colorado Department of Transportation for their roadway corridors, Cesare recommends that Boulder County begin an inventory of rock fall and landslide events along roadway corridors and elsewhere across Boulder County where possible. Finally, Cesare recommends the county take a proactive approach to debris flow monitoring and alarms, and partner with the Office of Emergency Management and other entities that are working toward slope failure early warning systems. See the full list of study recommendations in the Cesare final report (Section 11, p. 43-45).

## **II. NEXT STEPS**

### **Finalizing Updated Mapping and Colorado Geological Survey Coordination**

The Cesare mapping still requires additional peer review and revision before it is finalized and ready for adoption into the BCCP.

Staff consulted the Colorado Geologic Survey (CGS) for an initial review of the Cesare study and mapping. CGS finds that the updated mapping is a valuable resource for planning purposes, though it requires some additional data review and quality control, as would any product of a modeling effort. CGS also pointed out that the state’s own debris flow potential mapping, completed after the work conducted by Cesare, uses a different methodology that has both pros and cons relative to the Cesare methodology. As a result, CGS recommends that the county take advantage of both the CGS and Cesare debris flow potential outputs.

CGS found policy-related recommendations in the Cesare report to be sound and consistent with the practices of other communities in the state. Specifically, Cesare recommended that Land Use Department staff call for property-specific geologic hazard and geotechnical studies when particular hazards are shown to exist on a property and that those studies undergo third party review (e.g., by CGS). Cesare’s report provided a table with recommended guidance for which types of studies should be required when various mapped hazards exist on a property (See Cesare Final Report, p. 40, Table 2, “Recommended Geological and Geotechnical Land Use Guidelines”).

### **Implementation**

Land Use Department staff is working toward integrating the updated mapping and other outcomes of the Cesare study into our regular practices. Planning staff is gaining familiarity with the updated geologic hazard maps and using them to identify properties that may benefit from additional geotechnical studies. Staff is looking at ways to prioritize when additional geologic or geotechnical review is necessary.

The updated maps are available for reference in the Land Use Department's electronic mapping program, and available to the public at [this website](#). The updated geologic hazard maps will be provided to applicants and referenced by planners during land use reviews. However, the maps will also undergo additional review by the CGS, among others, and may be revised accordingly.

Staff will work with Cesare and CGS to identify appropriate next steps for mapping 'clean up' and quality control. Staff anticipates that a refined version of the mapping will be presented to Planning Commission later in 2018 as part of the BCCP annual map update process. Any revised mapping will be made available to planners and the public. The county anticipates adopting the maps as part of the Boulder County Comprehensive Plan.

Land Use Department staff will coordinate with other departments to explore the feasibility of implementing other study recommendations (e.g., coordination with Transportation and OEM regarding an inventory of rock fall events and slope failure warning systems), and will establish a work plan for addressing priority items.

### **URLs for LINKS PROVIDED IN DOCUMENT**

- Cesare Inc.'s full March 2017 report: <https://assets.bouldercounty.org/wp-content/uploads/2017/06/cesare-geologic-hazard-study-boulder-county-20170331.pdf>
- The October 2017 addendum to the report: <https://assets.bouldercounty.org/wp-content/uploads/2018/03/cesare-geologic-hazard-study-boulder-county-addendum-1-20171010.pdf>
- Updated Geologic Hazard Mapping website: <https://www.bouldercounty.org/property-and-land/land-use/planning/geologic-hazard-mapping/>

## EXECUTIVE SUMMARY

Cesare, Inc., (Cesare) has partnered with Boulder County Land Use Department to assist in consultation, awareness, education, and characterization of geotechnical and geological hazard conditions impacting Boulder County, Colorado. This study was completed in part due to the impacts of the September 2013 extreme rain and flood event and made possible through funding from a Community Development Block Grant-Disaster Recovery (CDBG-DR) Resiliency Planning and Capacity Building grant. The goals of the services provided by Cesare included characterization of geologic hazards on a countywide scale, prioritization of significant geologic hazards, and geological and geotechnical consultation services for the Development Review Team (DRT). Cesare provided an educational workshop for Boulder County planners, as well as mapping and policy support services.

The first task of this study consisted of research, data compilation and review, and outreach to determine the available information and to also become aware of overlapping or related studies which had already been completed, were occurring concurrently or were planned for the near future by others. Appendices A, B, and C provide outreach contacts and lists of available information and resources. Based on the results of this initial research phase, the project evolved such that characterizing the landslide hazard across Boulder County became a high priority. Mapping efforts were targeted to characterize the landslide potential for Boulder County, as well as the steeply dipping heaving bedrock hazard. Additionally, Cesare provided ongoing consultation with DRT, reviewing cases with geologic or geotechnical aspects and offering feedback and recommendations. Cesare also provided an educational geologic hazard workshop tailored for planners.

The Geology Element of the Boulder County Comprehensive Plan was last updated in 1984 and included a description of the geological and geotechnical background of the County. The Geology Element describes physiography, soils, groundwater, and economic geology, and is a good reference for Boulder County planners, geologists, engineers, and the public. The Geology Element also describes geotechnical considerations related to geologic hazards, such as snow avalanches, expansive soils, flooding, groundwater degradation, landslides, rockfall, soil creep, and ground subsidence. The Geology Element includes a Geologic Hazard and Constraint Area map to be used in partnership with a geotechnical land use guidelines table to help guide planners in determining appropriate site specific study recommendations. Based on conversations and feedback, Cesare determined that Boulder County could benefit from a more layered approach to the geologic hazard map that would more clearly delineate individual hazards, rather than ranking areas of the County based on the number of hazards in a certain area.

Cesare partnered with TerraCognito, a geospatial analysis firm, to compile a map package of available mapping and global information system (GIS) data, as well as, new data created for this study. The components of this map package are intended to be used as informational and

planning tools by Boulder County to assist in land use decisions and prioritizations. These maps are not intended to replace site specific studies into the geotechnical or geologic hazard aspects of existing or proposed development areas. Maps which were newly created for this study include a robust light detection and ranging (LiDAR) terrain model with countywide coverage, landslide inventory map, landslide potential map, steeply dipping heaving bedrock map, as well as maps depicting tree height, tree density, and tree root strength index. Maps created through GIS transformation, modification, or combination include geology (1:100,000 scale), bedrock strike and dip orientation, bedrock foliation orientation, surficial soils, swelling soils and bedrock (Hart, 1974), undermined area map (Roberts and others, 2001).

The map package is intended to be used in partnership with an updated geological and geotechnical land use guidelines table. Also integrated here are guidelines and site study recommendations for flood zones and fluvial hazard zone, which are being mapped by others concurrently and in the near future. Guidelines for flood zones and fluvial hazard zones will be determined by others.

The map package components are intended to be used by planners to help guide recommendations for site specific studies, as well as, to inform on surface and subsurface conditions which may have impacts on short and long range planning decisions. The use of third-party reviewers for geologic hazard and geotechnical reports is recommended. Cesare also recommends that the geologic hazard map package be updated regularly and supplemented with additional useful information as it becomes available. The bibliography and list of additional resources included as Appendices B and C should be considered meaningful reference lists for planners. A consideration for the future would also include field verification of the landslide inventory and the steeply dipping heaving bedrock maps.

Similar to the geo-event database maintained by the Colorado Department of Transportation for their roadway corridors, Cesare recommends that Boulder County begin an inventory of rockfall and landslide events along roadway corridors and elsewhere across Boulder County where possible. Cesare also recommends taking a proactive approach to debris flow monitoring and alarms and that Boulder County take an active partnership role with the Office of Emergency Management and other entities that are working toward slope failure early warning systems.

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