CITY OF BOULDER

COMPREHENSIVE FLOOD AND STORMWATER MASTER PLAN

DRAFT

TECHNICAL MEMORANDUM 5

GROUNDWATER

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Prepared by:

Tetra Tech
1560 Broadway, Suite 1400
Denver, CO 80202

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Technical Memorandum Summary

The following policy recommendations are included in this Technical Memorandum:

- Educate the community on dewatering systems and give a better understanding of operation and maintenance requirements for a dewatering system.
- Update and keep current education materials related to localized options for addressing sump pump discharges and share interdepartmentally to ensure consistent messaging.

1 Introduction

Much of the City of Boulder is built in areas with groundwater that can be within a few feet of the ground surface, depending on the season. This can present issues with short-term dewatering during construction and longer-term dewatering associated with permanent, subterranean structures (i.e., basements and underground parking garages). In the latter instance, the most common method to limit water damage is a permanent footing drain system connected to a sump pump. Water is collected by the footing drains and then either pumped to the surface where it is discharged at grade or pumped into a nearby storm sewer.

The Colorado Department of Public Health and Environment (CDPHE) issues permits related to groundwater discharge that focus on discharge volume and water quality[1]. Activities associated with single family residential buildings are generally exempt from these permits, which make a distinction between infiltration from stormwater and groundwater. If stormwater infiltrates into the ground and is dewatered prior to reaching the zone of saturation, it is not considered groundwater. Therefore, it is presumed that if a typical residential basement construction requires dewatering, it is in direct response to precipitation events and the pumped water is assumed to be stormwater; thus, requires no permit. Discharging stormwater comingled with groundwater does require coverage under a state Colorado Discharge Permit System (CDPS) discharge permit and is not required to meet the criteria and provisions of WQP-27, Low Risk Discharges Policy when discharging to the surface.

Groundwater

Groundwater exists in the voids present in the layers of soil and rock and is typically defined by areas where all the spaces and cracks are completely filled with water, also called the zone of saturation. Locating and mapping depths to groundwater can be tricky because the composition and depths of soil and rock can vary substantially, even within a few lateral feet.

Per City of Boulder regulations, infiltrated stormwater or uncontaminated groundwater can either be discharged to grade with no permit or to the city storm sewer with a city permit[2] as long as the discharge complies with state regulations. City of Boulder permitting includes a review of system capacity among other considerations. Discharges to grade must generally follow historic drainage patterns and should not leave the property in such a way that creates adverse impacts to adjacent properties or the public right-of-way[3]. The improper discharge of sump pumps can create nuisance drainage that may impact adjacent properties and create hazards in the rights-of-way, such as the formation of ice and slime on sidewalks and roads.

For the purposes of this memorandum, the word "groundwater" is used generically to mean any underground water which is not exclusively regulated by the State.

[1] *General Permit No. COG603000 for Discharges from Subterranean Dewatering Activities*
[2] *BRC 11-5-5 (d)(2) relates to storm sewer discharge regulations*
[3] BRC 8-2-8 details water discharges that are prohibited, required remediation, and city enforcement actions

2 Policy Analysis

Policy analysis consists of a systematic process that identifies and compares potential policy options to address identified issues or actions. Using this method, alternatives that most effectively and efficiently address issues become recommendations. As part of Technical Memorandum #2, Policy and Program Evaluation, improvement actions related to infiltrated stormwater and uncontaminated groundwater were identified as follows:

- Consider regulating groundwater dewatering activities to mitigate impacts
- Minimize subsurface structures that require permanent dewatering systems
- Discuss whether groundwater should be addressed by the Utility

Technical Memorandum #2 identified goals and objectives that could be used to evaluate the existing groundwater programs within the Utility. As part of the analysis on groundwater policy, these goals and objectives were reviewed and refined to meet the current and future needs.

GOAL: Mitigate impacts on groundwater or surface water quantity and quality, groundwater recharge, local water wells, wetlands, and ecosystems

Objective: Minimize subsurface structures that require ongoing dewatering

GOAL: Address the unintended consequences created by dewatering activities that cause harm to adjacent properties or create hazards in the public right-of-way

Objective: Reduce the number of complaints related to improper groundwater discharge

Objective: **Identify and publish** mitigation and remediation measures that can be implemented by private property owners to encourage compliance with state and local regulations

The following section includes discussion of approaches used in other locations throughout the United States to address issues similar to the identified improvement actions.

Right-of-Way Hazard Created by Improper Discharge

Regulating Groundwater

The city has given much consideration to the regulation of groundwater dewatering activities[4]. However, nuisance problems persist due to limited options for lawful discharge of pumped subsurface water. Small lot sizes and lots containing little pervious area common to Boulder result in a lack of space for onsite infiltration of sump pump discharge, leading to nuisance runoff. Residents may be unaware of regulations and/or effective means to discharge sump water. This runoff can cause private property damage, both at the discharge site and to properties adjacent to the discharge site, especially during times of high groundwater or large precipitation events. Nuisance runoff that crosses the public right-of-way creates resource demands on city staff who are frequently called to investigate sump pump discharge complaints. Additionally, groundwater in Boulder naturally contains pollutants like arsenic, silver, and selenium and increasing discharge of sump pumps into the storm sewer system raises concerns about whether these storm sewer inputs may create future problems with the city's Municipal Separate Storm Sewer System (MS4) permit. While individual sump pump discharge locations may not require State permitting, the cumulative effects of these discharges could become significant contributors of future pollutants that the city would be required to manage.

Many other communities across the United States experience similar issues with both short-term and long-term dewatering activities and have tried increasing dewatering regulations to address the problem. In 2016, the City of Palo Alto, California, began requiring groundwater dewatering mitigation measures as part of their construction dewatering regulations. These measures include either constructing a cutoff wall or undergoing a hydrogeologic study, installation of a groundwater monitoring well, a dewatering plan, and a groundwater use plan to address the method and location of discharge. Although Palo Alto is seeing some initial benefit from such measures, the long-term groundwater impacts are still unknown. Additionally, building construction costs have increased significantly due to the significant costs associated with the cutoff wall and hydrogeologic study.

Elsewhere, communities have considered enacting a wholesale prohibition of subterranean structures for all new construction to reduce issues associated with dewatering. However, no successful examples of implementing this type of citywide regulation were found. For example, West University Place, Texas, proposed banning the construction of all residential basements in 2011, but met opposition from the community and was ultimately unsuccessful in getting the measure passed. Therefore, they instead passed a regulation limiting the size, location and use of new basements below residential and commercial structures.

Lastly, there is also precedent for regulating basement depths based on the widespread presence of high groundwater. Multiple cities in Wisconsin and in coastal areas have regulations that require basement floors to be constructed one or two feet above the seasonal-high groundwater elevation based on the widespread presence of high groundwater. Within the City of Boulder, the claim is often made that building height restrictions limit the final construction size, and therefore, basements are necessary to increase livable area beneath houses. However, these locations do not have the same height restrictions as Boulder and therefore may not be as limiting in terms of final construction size.

In Boulder, the construction of residential subterranean structures is currently prohibited within the 100-year floodplain. This regulation could potentially be expanded to include other areas with high groundwater outside the 100-year floodplain, but determining these areas can be problematic. Mapping Boulder's groundwater depths would provide an increased degree of accuracy in determining areas of high groundwater but would be resource-

[4] *Until 2019, the city had a groundwater discharge permit that was subsequently discontinued due to its duplicative nature with State permits.*

and cost-prohibitive such that the gain achieved in reducing nuisance sump pump discharges may not justify the cost. Boulder could consider whether the application of more stringent regulations on groundwater impacts should be applied on a case-by-case basis dependent on engineering reports. However, this approach may not achieve consistent, equitable or practical resolution to groundwater discharge issues.

Alternatives to Regulations

There are, of course, areas of the U.S. where basements are not commonplace. This practice is often driven not by regulations, but rather by foundation and constructability issues. For example, areas with excessively high groundwater or expansive clays such as "caliche" soils can experience interior flooding and problems with damp walls. Dewatering systems in these areas can often prove inadequate in handling the high volume of water and are not reliably covered by insurance when they fail. These issues are frequently avoided altogether by eliminating construction of subterranean structures in these areas.

In locations where soil and groundwater conditions make the construction of basements unfavorable, cities may find it necessary to balance the desire for basement construction by educating builders and the community about challenges and potential risks related to subterranean construction. Education efforts result in more informed home buyers and potentially a diminished desire to construct a home with a basement. However, this approach does not eliminate the problems altogether. Rather, dewatering activities become something to manage versus something to eliminate.

3 Recommendations

Ongoing dewatering activities associated with subterranean construction including those from single family residential basements can create unintended consequences that can harm adjacent properties or present hazards in the public right-of-way. The location and movement of groundwater varies significantly throughout the city and mapping and identifying the depths of seasonally high groundwater can be costly and impractical. Increasing regulations may be marginally effective in reducing dewatering issues but can increase construction costs and raise equity concerns. Therefore, because of the questionable benefit and potential for limited return on investment, it is not recommended that Boulder pursue further regulation at this time.

It is therefore recommended that Boulder enhance education of the community on the public and personal hazards associated with subterranean construction in an equitable manner, including:

- Educating the community on dewatering systems and give a better understanding of operation and maintenance requirements for a dewatering system.
- Update and keep current education materials related to localized options for addressing sump discharges and share interdepartmentally to ensure consistent messaging.

Knowledge about the proper discharge from dewatering systems may lead to a reduction in nuisance drainage and associated damage to private property and hazards in the public rights-of-way. New construction of subterranean features could be discouraged in any education campaign, and private property owners with sump pumps and those looking to build can be made aware of the hazards associated with improper discharge and encouraged or incentivized to properly discharge. The desired outcome is to discourage new subterranean construction and to correct problems associated with existing improper sump pump discharge.