CHAPTER 14.0 DETENTION (STORAGE)

14.1 Introduction

This chapter provides design criteria and procedures to be used for detention facilities within the County. Detention facilities are designed to attenuate the increased runoff rates that occur as a result of development, namely those that increase the amount of impervious surface.

While this chapter focuses primarily on detention required to control downstream flooding and stream erosion, the engineer should understand that some Projects will also require water quality control to be provided. If both water quality and detention are required, it is often beneficial to consider facilities that can provide both. CHAPTER 15.0 addresses water quality controls and should be reviewed prior to developing detention plans and designs.

The engineer should also understand that incorporated communities within the County may have other detention requirements, some of which may be based on master planning efforts that extend into the community's growth management area (GMA). In general, a Project that is located within a GMA will be subject to that community's detention requirements. The County Engineer should be consulted to determine the appropriate detention requirements.

Finally, the engineer should refer to the *Storage* chapter of the MHFD Manual for any design criteria, considerations and guidance not specifically addressed in this chapter.

14.2 Threshold for Requiring Detention

The County will require detention for any Project that increases runoff to the extent that downstream properties and/or infrastructure could reasonably be perceived to experience adverse impacts (e.g., increased flooding, increased erosion, decreased level of service) as a direct result of the increased runoff from the development. This criterium is intended to protect public health, safety and the environment while also providing flexibility for requiring detention only where it is necessary to achieve those objectives.

The County will generally require detention for Projects with any of the following characteristics:

- Any Project with a disturbance of 1 acre or greater,
- Any Project that results in 5,000 square feet or more of new impervious surface, or
- Any Project that increases the imperviousness by 10% or greater compared to pre-development[1] conditions.
- Any Project where existing master plans require detention

[1] "Pre-development" in this case is considered to be the conditions of the site/property prior to the planned development. For example, if the existing conditions have 25% impervious surface, detention may only be required if the development increases the impervious surface to 35% or more.

The County may provide exemptions from detention requirements for Projects with the following characteristics:

- Additions to an existing structure on a residential lot,
- Development of a single parcel where total imperviousness is less than 25%,
- Single-lot residential development that is not part of a common plan of development, or
- Other situations that the County Engineer deems to be low risk for adverse downstream impacts.

If detention requirements are waived, the County may still require post-construction water quality and/or runoff reduction practices (see CHAPTER 15.0).

14.3 Detention Volume Requirements and Allowable Release Rates

The County requires detention be designed and operated according to the "Full Spectrum Detention" (FSD) approach outlined in the *Storage* chapter of the MHFD Manual. The FSD approach includes capture and control of two different runoff volumes, the excess urban runoff volume (EURV) and the 100-year runoff volume. The County allows the water quality capture volume (WQCV) to be "nested" within the EURV. The allowable release rate for the EURV is based on the allowable drain time for the type of detention facility being used. For example, extended detention basins must have an EURV drain time 52-72 hours when the WQCV is incorporated into the design. The 100-year runoff volume must be released at a rate no greater than 90% of the pre-development 100-year maximum runoff rate.

The EURV and 100-year runoff volumes shall be calculated based on the methods described in the *Storage* chapter of the MHFD Manual. Note: The "Simplified Equation" is only valid for contributing areas equal to or less than 10 acres.

The 100-year pre-development discharge may be calculated using Equation 12-5 of the *Storage* chapter of the MHFD Manual or more detailed hydrologic modeling. In either case, the undeveloped watershed imperviousness used must be no greater than 2%.

14.4 Types of Detention Facilities

See Table 14-1 for discussion on allowable and non-allowable types of detention facilities, as well as general application considerations.

Table 14-1: Types of Detention Facilities and Allowable Applications

Detention Facility Type	Application Considerations
Extended Detention Basin	Most common application of FSD. Best suited for larger sites with more than 2 acres of impervious area because orifice sizes become too small to avoid clogging.
Bioretention	Generally used for WQCV only, but can be modified to include FSD. Best suited for smaller sites with impervious areas less than 2 acres.
Sand Filter	Generally used for WQCV only, but can be modified to include FSD. Best suited for smaller sites with impervious areas less than 2 acres. Should only be considered over bioretention where sediment loads are expected to be high.
Parking Lot	Parking lot detention is not allowed in the County.
Underground	Underground detention is not allowed in the County due to inspection and maintenance difficulties.
Retention Ponds	Retention ponds are not allowed in the County due to complexities with verifying they can operate in accordance with *CRS §37-92-602(8)*. Retention basins also require acquisition of a water right and/or augmentation plan that often make them infeasible for most developments.

14.5 Detention and Water Rights

All detention facilities must be designed and operated in accordance with Colorado Revised Statute *CRS §37-92-602(8).* This statute requires, among others, that 97% of captured runoff from rainfall events equal to or less than the 5-year event must be drained or infiltrated within 72 hours. It also requires 99% of captured runoff from rainfall events equal to or greater than the 5-year event must be drained or infiltrated within 120 hours.

New stormwater detention and infiltration facilities requiring notification (see Table 14-2) must be reported to all parties on the Substitute Water Supply Plan (SWSP) Notification List maintained by the State Engineer. Information that must be provided includes:

1. Location of the facility,
2. Approximate surface area at design volume, and
3. Data demonstrating the facility has been designed in compliance with the release rate requirements of the statute, as described above. The Stormwater Detention and Infiltration Design Data (SDI) Sheet, downloadable from MHFD as the *Compliance Design Data Workbook*, is organized in the preferred format for the State Engineer's Office portal, and its use is recommended.

The Stormwater Detention and Infiltration Facility Notification portal, developed by MHFD, may be used to complete the reporting requirement for new facilities and will automatically direct notifications to the required recipients. The compliance portal is located here:

https://maperture.digitaldataservices.com/gvh/?viewer=cswdif

Table 14-2: Types of facilities requiring notification per CRS §37-92-602(8) (From MHFD Memorandum regarding CRS §37-92-602(8))

BMP	Water Quality Only	Flood Control Included
Grass Buffers	Not Required	Not Required
Grass Swales	Not Required	Not Required
Bioretention (with or without an underdrain)	Not Required	Required
Green Roof	Not Required	N/A
Extended Detention Basin	Required	Required
Sand Filter	Not Required	Required
Permeable Pavement Systems	Not Required	Required
Media Filter Drain	Not Required	Not Required
Underground Detention Vaults	Required	Required
Constructed Wetland Pond	N/A, Subject to Water Rights	
Constructed Wetland Channel	N/A, Subject to Water Rights	
Retention Pond	N/A, Subject to Water Rights	

14.6 Design Criteria and Considerations

The design of detention facilities shall follow the criteria, methods and guidance provided in the *Storage* chapter of the MHFD Manual. These address aspects of detention facility design such as grading, embankments, side slopes, freeboard, emergency spillways, outlet structures, trash racks and others.

- In addition, the lowest floor elevation for buildings adjacent to a storage facility must be higher than the embankment crest elevation of the storage facility.

14.7 Impacts to Downstream Property and Infrastructure

All designs shall also consider impacts to downstream property and infrastructure. The engineer shall demonstrate that downstream infrastructure has sufficient capacity to safely convey design discharges from the detention facility. If sufficient capacity or infrastructure does not exist, the developer may be responsible for downstream improvements.

14.8 Maintenance

All detention facilities shall be considered privately-owned, and maintenance will be the responsibility of the property owner. The property owner is encouraged to follow maintenance procedures and recommendations outlined in *Volume 3* of the MHFD Manual. The County has the right to inspect a facility at any time and require maintenance at the owner's expense.

The design engineer is encouraged to employ design techniques that reduce maintenance needs and expense. There is guidance on these design techniques in both the *Storage* chapter and Volume 3 of the MHFD Manual.

14.9 Submittal Requirements

Drainage Reports shall include the following information (at a minimum) to document detention facility design:

- Plans shall show location, type and ownership of detention facilities,
- Plans shall show water surface elevations and volumes of the WQCV, EURV and 100-year and 100-year freeboard elevation,
- Plans shall show the emergency overflow location, direction of flow and discharge.
- Summary tables of required WQCV, EURV and 100-year storage volumes along with supporting calculations,
- Summary tables of required and provided discharge rates and drawdown times along with supporting calculations, and
- Print outs of modeling software inputs and outputs.

The County recommends use of the MHFD-Detention workbook for FSD design and calculations.

14.10 References

Mile High Flood District. New Colorado Revised Statute §37-92-602(8) explanation memo and FAQ's:https://mhfd.org/wp-content/uploads/uploads/resources/guidance%20documents/UDFCD_Stormwater_Legislation_Memo_2016-03-09.pdf

Colorado Division of Water Resources. Administrative Statement Regarding the Management of Storm Water Detention Facilities and Post-Wildland Fire Facilities in Colorado: https://dnrweblink.state.co.us/dwr/ElectronicFile.aspx?docid=3576581&dbid=0