

## CHAPTER 3.0 DRAINAGE PRINCIPLES AND POLICIES

### 3.1 Introduction

Effective stormwater management is essential to the health and environmental and economic well-being of a community. The MHFD's guiding principles of sound drainage planning are hereby adopted by the County and inform the policies that drive the criteria of the Standards.

### 3.2 Principles

**1. Drainage is a regional phenomenon that does not respect the boundaries between government jurisdictions or between properties.** This makes it necessary to formulate programs that include both public and private involvement. Overall, the governmental entities most directly involved must provide coordination and master planning, but drainage planning must be integrated on a regional level if optimum results are to be achieved. The manner in which proposed drainage systems fit into existing regional systems must be quantified and discussed in the master plan.

**2. A storm drainage system is a subsystem of the total urban water resource system.** Stormwater system planning and design for any site must be compatible with comprehensive regional plans and should be coordinated with planning for land use, open space and transportation. Erosion and sediment control, flood control, site grading criteria, and water quality all closely interrelate with urban stormwater management. Any individual master plan or specific site plan should normally address all of these considerations.

**3. Every urban area has an initial (i.e., minor) and a major drainage system, whether or not they are actually planned and designed.** The initial drainage system, sometimes referred to as the "minor system," is designed to provide public convenience and to accommodate moderate, frequently occurring flows. The major system carries more water and operates when the rate or volume of runoff exceeds the capacity of the minor system. Both systems should be carefully considered.

**4. Runoff routing is primarily a space allocation problem.** The volume of water present at a given point in time in an urban region cannot be compressed or diminished. Channels and storm drains serve both conveyance and storage functions. If adequate provision is not made for drainage space demands, stormwater runoff will conflict with other land uses, result in damages, and impair or disrupt the functioning of other urban systems.

**5. Planning and design of stormwater drainage systems should not be based on the premise that problems can be transferred from one location to another.** Urbanization tends to increase downstream peak flow by increasing runoff volumes and velocities. Stormwater runoff can be stored and slowly released via detention facilities to manage peak flows, thereby reducing the drainage capacity required immediately downstream.

**6. An urban storm drainage strategy should be a multi-objective and multi-means effort.** The many competing demands placed upon space and resources within an urban region argue for a drainage management strategy that meets a number of objectives, including water quality enhancement, groundwater recharge, recreation, wildlife habitat, wetland creation, protection of landmarks/amenities, control of erosion and sediment deposition, and creation of open spaces.

**7. Design of the storm drainage system should consider the features and functions of the existing drainage system.** Every site contains natural features that may contribute to the management of stormwater without significant modifications. Existing features such as natural streams, depressions, wetlands, floodplains, permeable soils, and vegetation provide for infiltration, help control the velocity of runoff, extend the time of concentration, filter sediments and other pollutants, and recycle nutrients. Each development plan should carefully map and identify the existing natural system. Techniques that preserve or protect and enhance the natural features are encouraged. Good designs improve the effectiveness of natural systems rather than negate, replace or ignore them.

**8. In conjunction with new development and redevelopment, coordinated efforts should be made to minimize increases in, and reduce where possible, stormwater runoff volumes, flow rates, and pollutant loads to the maximum extent practicable.** Key practices include:

- The perviousness of the site and natural drainage paths should be preserved to the extent feasible. Areas conducive to infiltration of runoff should be preserved and integrated into the overall runoff management strategy for the site.
- The rate of runoff should be slowed. Preference should be given to stormwater management systems that maximize vegetative and pervious land cover. These systems will promote infiltration, filtering and slowing of the runoff. It should be noted that, due to the principle of mass conservation, it is virtually impossible to prevent increases in post-development runoff volumes for all storm events when an area urbanizes. Existing stormwater regulations typically require control of peak flows to predevelopment levels to the maximum extent practicable, and increasingly, regulatory agencies are implementing requirements focused on the control of runoff volumes for smaller, frequently occurring events. Increased flow volumes may not cause flooding problems if a watershed has a positive outfall to a stream or river; however, increases in runoff volumes may cause problems for small, enclosed watersheds (i.e. draining to a lake) or into streams of limited capacity. Increases in runoff volumes, if not appropriately managed, can also adversely affect stream stability.
- Pollution control is best accomplished by implementing a series of measures, which can include source controls, minimizing directly connected impervious area, and construction of on-site and regional facilities to control both runoff and pollution. Implementing measures that reduce the volume of runoff produced by frequently occurring events through infiltration and disconnection of impervious areas is one of the most effective means for reducing the pollutant load delivered to receiving waters.

**9. The stormwater management system should be designed beginning with the outlet or point of outflow from the project, giving full consideration to downstream effects and the effects of offsite flows entering the system.** The downstream conveyance system should be evaluated to ensure that it has sufficient capacity to accept design discharges without adverse upstream or downstream impacts such as flooding, stream bank erosion, and sediment deposition. In addition, the design of a drainage system should take into account the runoff from upstream sites, recognizing their future development runoff potential (e.g., imperviousness).

**10. The stormwater management system requires regular maintenance.** Failure to provide proper maintenance reduces both the hydraulic capacity and pollutant removal efficiency of the system. The key to effective maintenance is clear assignment of responsibilities to an established entity and a regular schedule of inspections to determine maintenance needs and to ensure that required maintenance is conducted. Local maintenance capabilities should be a consideration when selecting specific design criteria for a given site or project.

**11. Floodplains should be preserved whenever feasible and practicable.** Nature has claimed prescriptive easement for floods, via its floodplains, that cannot be denied without public and private cost. Floodplain encroachment must not be allowed unless competent engineering and planning have proven that flow capacity is maintained, risks of flooding are defined, and risks to life and property are strictly minimized. Preservation of floodplains is a policy of MHFD to manage flood hazards, preserve habitat and open space, create a more livable urban environment, and protect the public health, safety, and welfare (White 1945).

**12. Reserve sufficient right-of-way for lateral movement of incised floodplains.** Whenever an urban floodplain is contained within a narrow non-engineered channel, its lateral movement over time can cause extensive damage to public and private structures and facilities. For this reason, whenever such a condition exists, it is recommended that, at a minimum, the channel be provided with grade control structures and a right-of-way corridor be preserved of a width corresponding to normal depth calculations for the future stable channel geometry, plus maintenance access requirements.

### 3.3 Planning Policies

New development and redevelopment have the potential to impact drainage, both upstream and downstream. Those impacts can be analyzed, and solutions can be developed to reduce, minimize or eliminate impacts as part of the drainage planning process. The County's planning policies include the following:

1. Require drainage planning for all new development, minor expansion, change of use, or major redevelopment, as defined in the Larimer County Land Use Code. Drainage

planning may include, but is not necessarily limited to, preparation of engineering reports and development plans in accordance with requirements of these Standards.

### **Types of Projects in the County Requiring Drainage Planning\***

**New Development:** Any construction activity or site alteration on a site that has not been previously developed.

**Minor Expansion:** Any development activity that includes the following: 1) Expansion of a mixed use-building by more than 2,000 square feet of non-residential space or the lesser of more than 10 dwelling units or 10% of the number of dwelling units; or 2) Expansion of a non-residential building by the greater of either 2,000 square feet or more than 20% of the total square footage of the building.

**Change of Use:** Any change of use that involves or requires on-site or off-site improvements, including but not limited to parking; landscaping, screening, or buffering; drainage facilities; outdoor uses on the lot, including sales, display, and storage.

**Major Redevelopment:** Any development activity on a mixed-use or non-residential site that involves change to 75 percent or more of the square footage of a primary structure. Major redevelopment shall be measured cumulatively over a rolling five-year period in the same ownership, starting with the applicant's most recent development application.

\*All of these types of developments are collectively referred to as "**Projects**" throughout these Standards

2. Require implementation of solutions for potential drainage impacts so as not to transfer drainage problems from one location to another.

Comprehensive and multi-jurisdictional drainage planning is a successful approach that reduces overall drainage impacts and aims to distribute stormwater management responsibilities equitably throughout a watershed. In addition, the County encompasses many cities and towns that have developed their own drainage criteria and watershed master plans.

3. Encourage and cooperate with other local and regional agencies on the development and/or implementation of watershed-scale drainage planning and policies. This policy shall include adhering to Agreements (existing and/or future) with those agencies that have established drainage criteria and policies for their respective Growth Management Areas (e.g., City of Fort Collins, City of Loveland, etc.).

Drainage planning can present opportunities that benefit other societal needs such as transportation, recreation, open space, water quality, and others. Coordination among both private and public entities, and within various departments of the County, may be necessary to accomplish these multi-objective goals.

4. Consider stormwater runoff and drainage solutions as a potential resource for other social, environmental, and economic benefits and, where possible, encourage the development of drainage plans that incorporate those other benefits.

### 3.4 Technical/Design Standards Policies

The Standards presented herein establish guidelines, criteria and methods for effective stormwater management planning and design. The County’s technical/design policies include the following:

1. Require drainage planning and design be conducted according to the Standards presented in this document.

The County has very diverse characteristics (e.g., land use, population density, topography, geology) that effect how stormwater may be managed in different locations. It is not always feasible or responsible to apply drainage criteria developed for highly urbanized areas to areas that are not.

2. Recognize the need for different drainage design criteria for “rural” and “urban” areas, where allowable by local, state and federal regulations.

#### **Rural vs. Urban Areas as Defined by the Larimer County Land Use Code\***

**Rural** areas are characterized by rural residential development with accessory agricultural and minimal infrastructure and support services.

**Urban** areas are characterized by a mix of residential, commercial, and industrial development.

In reality, urbanization occurs over a spectrum of imperviousness from low-density rural areas to denser suburban areas to very dense downtown areas. In general, urban areas are those within the County’s Growth Management Area and rural areas are those zoned as agricultural or rural land uses.

\*A zoning map is available on the Larimer County Planning Department webpage.

Drainage design requires consideration of the frequency and extent of disruptions and damage that may occur from storm events of different magnitudes. Accordingly, these Standards include design requirements for both a minor (initial) storm event and the major storm event. Minor storm event criteria are intended to minimize disruptions from more frequently occurring events. Major storm event criteria are intended to minimize damages from larger, less-frequent events.

3. Require drainage systems that are designed for both a minor (initial) storm event and a major storm event. The minor storm event shall vary based on infrastructure type and

location (generally 2-year to 10-year return period storm event). The major storm event shall be the 100-year return period storm event.

The disruptions and damages mentioned above are most often associated with streets and roadways. Drainage can be conveyed directly on streets/roadways (e.g., curb and gutter), adjacent to streets/roadways (e.g., roadside swales) or below streets/roadways (e.g., pipes and culverts). These Standards establish reasonable limits for the interactions of drainage designs on streets/roadways.

4. Recognize that streets and roadways have the primary purpose of serving traffic needs and that street/roadway drainage Criteria serve to balance traffic needs, public safety, and costs of constructing and maintaining drainage infrastructure.

Development and redevelopment generally increase the rate and volume of runoff from a site, which can lead to flooding and stream degradation downstream. Stormwater detention can be used to reduce those rates and volumes closer to predevelopment conditions.

5. Require all new development and redevelopment to provide aboveground stormwater detention following the MHFD's "full-spectrum detention" approach.

Portions of the County fall within the State of Colorado's municipal separate storm sewer system (MS4) boundaries. Development and redevelopment projects conducted within those boundaries must adhere to certain requirements of the State's MS4 permit, including implementation of post-construction stormwater control measures (aka permanent water quality treatment facilities).

6. Require all new development and redevelopment within the County's MS4 boundaries to provide permanent water quality treatment according to the Criteria presented in the Standards.

### 3.5 Operation and Maintenance Policies

Drainage infrastructure requires proper maintenance in order to maintain its function. Typical maintenance activities include sediment and debris removal, vegetation upkeep and erosion control. It is important that all infrastructure be accessible for maintenance. The County's operation and maintenance policies include the following:

1. Development-wide stormwater conveyance facilities shall only be situated in an outlet, common area lot, or road Right-of-Way/Easement. Drainage easements shall only be used to convey stormwater drainage from an individual lot to a dedicated development-wide stormwater facility. Approved grading and drainage plans shall not be altered unless prior approval from the County Engineer is obtained. This shall be documented and memorialized in HOA documents or as part of a recorded maintenance agreement.

2. The owners of all stormwater management facilities and infrastructure are responsible for maintenance unless it is documented that another party shall be responsible for maintenance.
3. Require maintenance access be provided to all stormwater management facilities.
4. The County reserves the right to enter a property to maintain stormwater management facilities if the owner fails to do so, and the owner shall be responsible for reimbursing the County for those costs.

### 3.6 Floodplain Management Policies

The County participates in the National Flood Insurance Program (NFIP). The NFIP establishes minimum criteria for development within floodplains and participation in the program allows property owners to obtain flood insurance from the federal government. The County's floodplain management policies include the following:

1. The County implements and enforces floodplain development regulations that meet or exceed the minimum standards of the NFIP, Section 44, Parts 59, 60, 65, 70 of the Federal Code of Regulations.

Further, the Colorado Water Conservation Board has issued floodplain rules and regulations for all of Colorado.

2. The County implements and enforces floodplain development regulations that meet or exceed the rules, regulations, and standards of the Colorado Water Conservation Board.