CHAPTER 7.0 STREETS

7.1 Introduction

This chapter provides criteria for allowable drainage encroachment in streets and roadways in the County and procedures for determining encroachment.

The primary function of streets and roadways is to provide safe traffic movement, therefore stormwater drainage and conveyance in streets must be designed to prevent or minimize interference with that objective. Encroachment criteria are based on the classification of the street/roadway being evaluated and are different for the minor and major events. Minor event criteria are more stringent because those events occur more frequently and would otherwise impede traffic movement more frequently. Similarly, criteria are generally more stringent for higher traffic streets/roadways (e.g., arterials) compared to those with lower traffic (e.g., local roadways). To meet encroachment criteria, the engineer must generally design a storm drain system or open channel system (e.g., roadside swales) along with adequate placement of inlets to convey excess flows off the streets/roadways.

7.2 Street Classifications

Streets shall be classified as Local, Minor Collector, Major Collector, or Arterial depending upon their functionality and Urban or Rural depending on their location. The link below is the County's most recent (2018) functional classification map, however these classifications are updated periodically so it is recommended to check the County's website for the most up-to-date version.

https://www.larimer.gov/sites/default/files/uploads/2018/functional_classification_36x48.pdf

For more detailed information regarding street classifications within the County, please refer to the Larimer County Urban Area Street Standards and Larimer County Rural Area Road Standards.

7.3 Minor and Major Events

Table 7-1 presents the minor and major storm events to be used for encroachment analysis. The minor storms are different for rural and urban streets/roadways.

Table 7-1 Minor and major storm design events for rural and urban streets and roadways

Roadway Location	Minor Storm	Major Storm
Rural	10-year	100-year
Urban	2-year	100-year

7.4 Encroachment and Cross-Street Flow Criteria

Encroachment criteria for the minor storm event (Table 7-2) and major storm event (Table 7-3) are presented below.

Table 7-2 Encroachment criteria for minor storm event

Street Classification	Maximum Depth and Inundation Area
Local	No curb overtopping allowed. Where there is no curb, flows may not encroach beyond the edge of ROW. Flow may spread to crown.
Minor Collector	No curb overtopping allowed. Where there is no curb, flows may not encroach beyond the edge of ROW. One lane must be kept free of water.
Major Collector & Arterial	No curb overtopping allowed. Where there is no curb, flows may not encroach beyond the edge of ROW. One lane must be kept free of water in each direction.

Table 7-3 Encroachment criteria for major storm event

Street Classification	Maximum Depth and Inundation Area
Local	Maximum depth of water is 6" over the crown or 12" at the edge of pavement (whichever is more restrictive). Buildings shall have at least 18" of freeboard*.
Minor Collector	Maximum depth of water is 6" over the crown or 12" at the edge of pavement (whichever is more restrictive). Buildings shall have at least 18" of freeboard*.
Major Collector & Arterial	No inundation over the crown. Maximum depth of water at edge of pavement is 12". Buildings shall have at least 18" of freeboard*.
*Freeboard requirements are based on the water surface elevation in the street/roadway. Where freeboard requirements cannot be met, buildings shall be floodproofed according to the County floodplain regulations.	

Cross-street flow can occur under several conditions; 1) where runoff spreads across the crown of a roadway, 2) where runoff is conveyed across an intersection in a cross-pan and 3) where a roadway is overtopped due to culvert or bridge capacity constraints. Cross-flow depths that are not within a cross-pan must meet the requirements in Table 7-2 and Table 7-3 above. Allowable cross-street flow depths using cross-pans are provided in Table 7-4.

Table 7-4 Allowable cross-street flow depths using cross-pans

Street Classification	Minor Storm Flow	Major Storm Flow
Local & Minor Collector	6” depth in cross-pan	12” depth in cross-pan
Major Collector & Arterial	No cross flow allowed	No cross flow allowed

7.5 Design Procedures

Hydraulic calculations must be completed to determine the capacity of street cross sections and the resulting encroachment. These calculations are often performed in conjunction with inlet calculations and/or roadside swale calculations. The engineer shall perform these calculations according to the procedures outlined in the *Streets, Inlets and Storm Drains* chapter of the MHFD Manual. The MHFD-Inlet design spreadsheet incorporates many of these design procedures and is recommended to be used within the County.

7.6 Submittal Requirements

Drainage Reports shall include the following information (at a minimum) to document street capacity calculations:

- Drawing plans shall identify the classification of all roadways,
- Drawing plans shall include cross-sections showing maximum extents of encroachment, flow depths and water surface elevations, and
- All cross pans shall be labeled on drawing plans.