

**TABLE OF CONTENTS**  
**PART III - MINIMUM DESIGN STANDARDS**  
**Section 105**

**STORM DRAINS AND IRRIGATION**

<b>105.1. STORM DRAINS.....</b>	<b>105.1</b>
<b>105.2. METHODS OF ANALYSIS .....</b>	<b>105.1</b>
105.2.1. <u>Rational Method</u> .....	105.1
105.2.2. <u>Colorado Urban Hydrograph Method</u> .....	105.1
105.2.3. <u>Facility Capacity Criteria</u> .....	105.3
105.2.4. <u>Runoff Detention</u> .....	105.3
105.2.5. <u>Detention Volume</u> .....	105.3
105.2.6. <u>Detention Time</u> .....	105.3
105.2.7. <u>Maximum Release Rate</u> .....	105.3
105.2.8. <u>Detention Structures</u> .....	105.3
105.2.9. <u>Detention Pond Slopes</u> .....	105.3
105.2.9. <u>Flood Hazard Exposure</u> .....	105.3
<b>105.3 WATER QUALITY ENHANCEMENT .....</b>	<b>105.3</b>
<b>105.4. IRRIGATION .....</b>	<b>105.3</b>

## PART III - MINIMUM DESIGN STANDARDS

### SECTION 105.

#### STORM DRAINS AND IRRIGATION

##### 105.1. STORM DRAINS

All design and analysis of storm drainage systems in the City of Rifle shall be done in accordance with the following specifications.

Drainage easements and improvements shall be designed by a registered engineer to accommodate expected runoff as determined by the drainage plan. Improvements shall be installed to specification by the City Council through their designated representative. All drainage improvements described herein shall be the financial responsibility of the subdivider, subject to provision under the City of Rifle Public Works Manual.

The rate of runoff from any developed area shall not exceed the historic rate of runoff based on a twenty-five (25) year rainfall event.

##### 105.2. METHODS OF ANALYSIS

The following methods of runoff estimation shall be utilized for determining the rate of runoff from a particular site as applicable:

1. Rational Method: Used for Drainage Basins less than 20 acres in size and for minor system design.
2. SCS TR 55 Methods: Used for drainage basins up to 20 square miles in size. Also used for flood flow determination and design in minor and major systems. Also used to compute flood storage volumes.
3. Unit Hydrograph: Used for drainage basins up to 1000 square miles in size. Also used for flood flow determination and design in minor and major systems. Also used to compute flood storage volumes.

105.2.1. Rational Method - Flows may be determined by the extended form of the rational formula: for basins under twenty (20) acres in size.

- A. Rainfall intensities shall be taken from City of Rifle 1DF curves. (At end of this section)
- B. Concentration times for flow analysis should never be less than ten (10) minutes.

105.2.2. Facility Capacity Criteria - All drainage facilities must be approved by the City Engineer.

- A. Curb flow capacity is reached when the flow crosses the back of the curb or the crown of the street is reached, whichever is less.
- B. Transfer of water from one flow line to another, by flow over the crown, will not be allowed.
- C. Storm sewer shall be designed to carry the 25-year Storm runoff.
- D. Minimum size for storm drainage pipe shall be fifteen (15) inches.
- E. Pipe under streets shall be designed for soil and live loads in accordance with acceptable highway design criteria. The D-Load method is an acceptable method of design.

- F. Collector streets shall be drained so that the center twelve (12) feet are clear of water during the 25-year storm.
- G. Arteries shall be drained so that the center 24 feet are clear of water during the 100-year storm.
- H. Local streets shall have the catch basins at the point where either side of the street reaches its capacity for the 25-year frequency storm.
- I. Catch Basin Capacity in cubic feet per second: Shall be calculated in accordance with the methods outlined either 105.2.1 or 105.2.2.
- J. Culverts under streets (excepting arterials) shall be designed with an emergency overflow for passing the 100-year storm. In determining the required capacity of the overflow, the culvert shall be assumed blocked unless its cross-sectional area exceeds twenty (20) square feet, in which case 60% of its flow capacity may be used.
- K. Major channels shall be designed to safely pass the 100-year storm. If major channel has been mapped by FEMA, then proof shall be provided to the City that installation of the crossing will not negatively impact the floodplain of that particular stream. When impacts are found, then those impacts shall be properly mitigated to the discretion of the Public Works Director.
- L. Velocities in any conduit or channel shall be controlled so that the conduit or channel will not be damaged by flows from the 100-year flood, unless otherwise instructed by the Public Works Director.
- M. Suggested values of Manning's "n" appear in Table 105-I below.

**TABLE 105-I**

Roughness Coefficient

<b>Character of Section</b>	<b>Mannings 'n'</b>
Polyvinyl Chloride Pipe .....	0.011
Concrete Pipe .....	0.013
Corrugated Metal: 2 2/3" x 1/2" Corrugation .....	0.024
3" x 1" Corrugations .....	0.027
Structural Plate: 6" x 2" Corrugations .....	0.033
Open Channels: Undisturbed .....	0.035
Earth Reshaped .....	0.020
Grassed and Shaped .....	0.030
Smooth Concrete Lined.....	0.013
Rip Rap Lined.....	0.035

105.2.3. Runoff Detention - The City of Rifle Landuse Code requires that additional runoff caused by development be detained on the development site. The base storm for calculation and design is that of the 25-year rainfall. The Public Works Director may "release" a developer of the runoff detention obligation if it can be shown that the down stream drainage appurtenances and/or receiving stream are not negatively impacted or brought to a point in excess of their capacity. This statement, however, does not relive obligations stated in 105.3, below.

105.2.4. Detention Volume - Detention volumes shall be determined in accordance with The Manual. The acceptable means applicable to the method of runoff estimation.

105.2.5. Detention Time - No specific detention time is required under normal conditions. However, if the Public Works Director determines that a longer detention time is in the City's best interest, he may require a flow rate less than half the historic peak flow rate ( $Q_H/2$ ) before two (2) times the historic concentration time ( $2T_c$ ) is reached.

105.2.6. Maximum Release Rate - The maximum release rate from the detention facility shall not exceed the historical peak runoff rate for the same frequency storm.

When it is in the City's best interest to alter this release rate, the Public Works Director may request a specific release rate.

105.2.7. Detention Structures - The type and design of the detention structure must be approved by the City Engineer.

Generally acceptable examples of detention facilities are ponds or buried pipe.

Overflow structures shall be provided where the design capacity of the detention structure can be exceeded. This overflow structure shall return the overflow water to the historic channel without causing damage to either the detention or overflow structures.

105.2.9. Detention Pond Slopes – Side slope on detention ponds shall be a maximum of 2:1. Bottom of pond shall be a minimum of 2% across landscaped areas.

105.2.10. Flood Hazard Exposure - Developers shall design and accomplish final grading in such a manner that buildings and basement openings will be at or above an elevation that will prevent adverse effect from storm water due to a 100-year return frequency storm.

### **105.3. WATER QUALITY ENHANCEMENT**

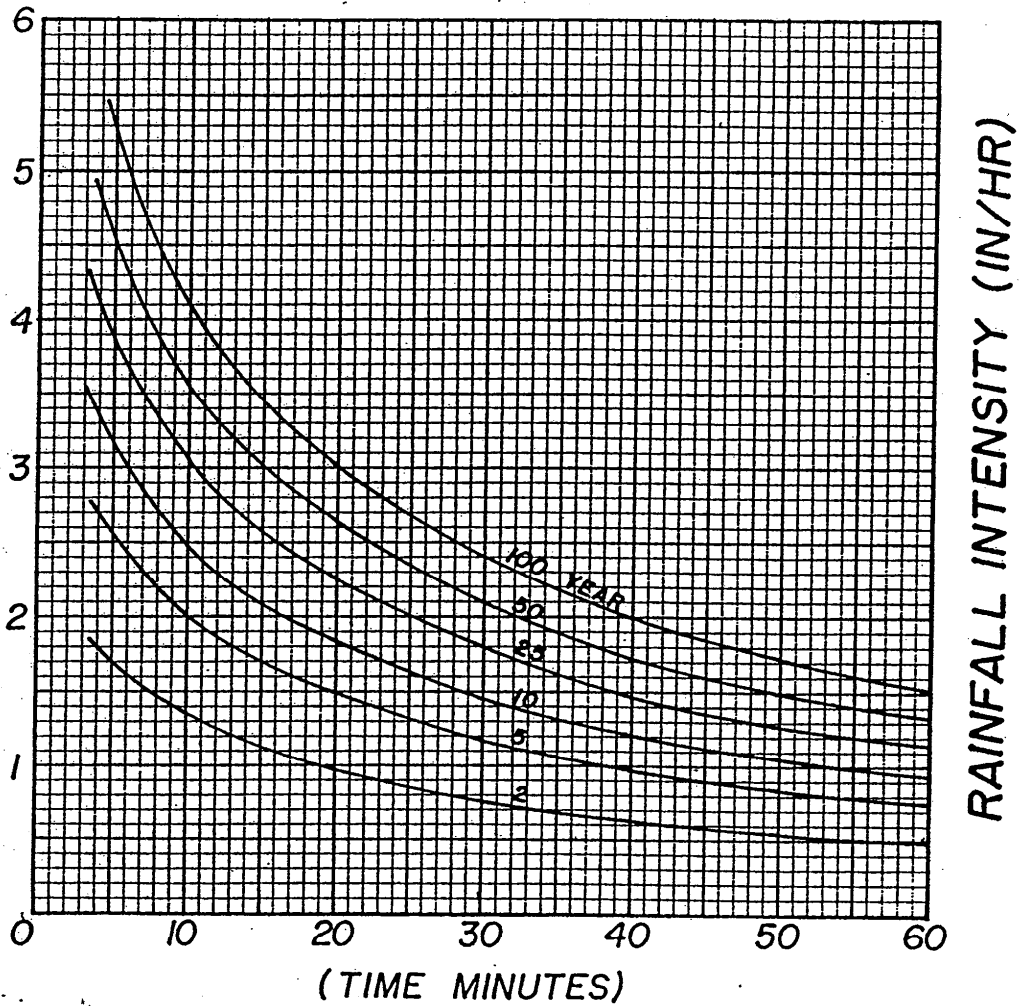
Water quality enhancement of stormwater runoff must be provided in accordance with the requirements of the Colorado Department of Public Health and Environment.

### **105.4 IRRIGATION**

Required ditch flow shall be determined by existing water rights flowing across and below the design point and certificate of water rights flowing across and below the property shall be submitted to the City Engineer. Alternatively, the ditch pipe and/or structures shall be designed to carry a consistent flow of water as existing ditch is capable. Unless otherwise approved by the City Engineer, all irrigation ditches must be piped.

All irrigation ditch piping must be approved, signed and dated by the President or other authorized officer of the ditch company, prior to approval by the City Engineer.

# INTENSITY - DURATION - FREQUENCY CURVES



RIFLE, COLORADO