DESIGN CRITERIA FOR PUBLIC IMPROVEMENTS
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DIVISION 1

GENERAL REQUIREMENTS

Section 1.01 PURPOSE OF DOCUMENTS

The purpose of the Design Criteria is to govern any design and engineering performed regarding public improvements. Engineers and designers working on projects within Springville City should thoroughly read and understand these requirements before designing and creating construction plan sets for public improvements.

This division contains design criteria that are in addition to normal and acceptable engineering practices and are to be used on designs in the City. The City Engineer shall have authority to modify the criteria as needed to meet changing or unusual needs or conditions.

The design engineer shall contact the Springville City Engineer, 50 South Main Street, Springville, Utah 84663 for all matters dealing with engineering within a City's existing or proposed right-of-way or with any work connecting onto a City utility.

Section 1.02 USES OF THESE CRITERIA

The criteria contained in this document are organized into divisions and sections covering specific areas of design. It will often be necessary to use a number of sections for the design of a single project. For instance, the design of a street may require the use of standards regarding streets, sidewalks, pressure pipe, sewer and storm drain.

These standards are a guide for design, but not a substitute for good engineering. It is the obligation of the designer to use these standards responsibly and professionally to produce designs conforming with commonly accepted engineering practices and the Code of Professional Conduct. It will at times be desirable and/or necessary to vary from the standards in this document to produce a good product. When the need arises, please refer to the following section on variances.

Section 1.03 VARIANCES

When it becomes necessary or desirable to vary from the standards presented in this document, a variance may be requested from the City Engineer. Such a request shall be made in writing and will include:

a) The standard to be varied.
b) The proposed variation.
c) Justification for the variance.

A written response will be given within seven business days of the request. A variance determination may be appealed to the City Council.

Section 1.04 AMENDMENTS

Amendments to these standards may be requested by writing the City Engineer with details and justification for an amendment. The City Engineer along with the City Staff will meet periodically to discuss proposed amendments and make recommendations to the City Council. The City Council will entertain changes to the standards once a year at their discretion.

DIVISION 2

STREET DESIGN CRITERIA

Section 2.01 GENERAL

The following street design criteria shall apply to all street designs in the City. It will be necessary to refer to the current master transportation plan for correct street designation. Design shall comply with the current AASHTO guidelines on geometric design. Additional design criteria are specified in the Standard Drawings.

Section 2.02 MINIMUM AND MAXIMUM GRADES

The minimum acceptable grade slope measured at the centerline of the street is one-half percent (0.5%). The flow line of curb returns, knuckles and cul-de-sacs' shall also be no less than one-half percent (0.5%). The grade slope of any street shall not exceed eight percent (8.0%) unless authorized in writing by the City Engineer. In no case shall the grade slope exceed ten percent (10.0%).

Section 2.03 STREET DESIGN

The following street design criteria shall apply to all street designs in the City. Additional design criteria are specified in the Standard Drawings.

Sub-Section A. Design Speeds:

The following minimum design criteria shall be met:

1) Local street shall be designed to at least 25 mph.
2) Collector streets shall be designed to at least 35 mph.

Sub-Section B. Horizontal Curves:

Changes in horizontal alignment of over one degree shall be made using horizontal curves. In some cases horizontal alignment changes on local streets may be allowed without a horizontal curve if the resulting alignment functions as a two-legged intersection.

1) Local streets shall have a centerline radius of at least 150 feet. (Smaller radii may be permitted as a traffic calming measure when authorized by the City Engineer.)
2) Collector streets shall have a centerline radius of at least 370 feet.

Sub-Section C. Vertical Curves:

Streets shall be designed with vertical curves where grade changes greater than 1% occur. Vertical curves shall be designed using the appropriate design speed according to the latest AASHTO design guidelines. It is encouraged to include the "K" value in the profile illustrating the vertical curve.

Sub-Section D. Cul-de-sacs:

Downhill cul-de-sacs are strongly discouraged and may only be allowed if it can be demonstrated that surface drainage will be controlled in a manner acceptable by the City Engineer. A surface overflow drainage outlet will be designed to protect adjacent properties in the event the curb face inlet(s) become obstructed or clogged.

Sub-Section E. Widening Asphalt along an Existing Road:

When a development project requires asphalt widening due to the placing of new curb and gutter along an existing road, the cross slope of the new asphalt must be between one percent (1%) and four percent (4%).

The construction drawings must adequately show the cross slope and the asphalt "saw cut line" required to create the slope.

Sub-Section F. Finished Width of Exterior Roads:

When roads are designed along the exterior of developed property, a minimum of ten (10) feet of unobstructed asphalt on the opposite side of the designed centerline must be constructed. Depending on the classification of the road, additional width may be requested by the City. In no case shall the minimum width of asphalt constructed be less than 36 feet.

Section 2.04 INTERSECTION DESIGN

The following intersection design criteria shall apply to all intersection designs in the City. Additional design criteria are specified in the Standard Drawings.

Sub-Section A. Street Alignment and Offsets:

Angular street alignment at an intersection shall be as close to perpendicular as possible. In no case shall an intersecting street be more than 10° from perpendicular. Centerlines of opposing streets should match at the intersection whenever possible. Offsets of up to ten (10) feet may be allowed in a single intersection but separate intersections must have at least one-hundred fifty (150) feet of separation.

Sub-Section B. Curb Design:

Curb returns shall be designed such that there is a smooth transition from one leg of the intersection to another, using vertical curves where grade changes greater than 2% occur. The designer shall include enough information on the plans to demonstrate compliance. In some cases, this requires profiling the top back of curb through the curb returns. Elevations at the PC, PT, and appropriate sub-divided delta (central angle) locations will be required.

Sub-Section C. ADA Curb Ramp Design:

Curb ramps shall be designed in accordance with current ADA standards and guidelines, and shall meet the Accessibility Standards found in the Springville Standard Specifications (see Division 12, Concrete Curb and Gutter and Sidewalk). The standard drawings also include specific dimensional information.

Sub-Section D. Stop Controlled Grades at Intersections:

Streets that will have stop control at an intersection shall not have a grade slope of greater than four percent (4%) for a distance of fifty (50) feet from the intersecting streets right-of-way.

Sub-Section E. Roundabout Design:

Roundabouts shall be designed in accordance with the U.S. Department of Transportation publication FHWA-RD-00-067 (*Roundabouts: An Informational Guide*). Roundabouts in local streets shall also follow the criteria shown in the standard drawings. The engineer shall submit the circulatory design speeds with the design drawings.

DIVISION 3

SEWER DESIGN CRITERIA

Section 3.01 GENERAL

The following sewer design criteria shall apply to all gravity sewer system designs in the City. Additional design criteria are specified in the Standard Drawings.

The minimum sewer pipe shall be eight-inch (8") diameter and shall not be designed at a grade flatter than that which would provide a two (2) ft/sec cleansing velocity within the pipe. If the State guidelines require steeper grades than the manufacturer recommendations, the State guidelines shall apply. The engineer shall coordinate the pipe size with the City Engineer for future design capacities. Minimum slopes for differing pipe sizes are shown below:

MINIMUM SEWER MAIN SLOPES

Pipe Size	Min Slope (ft/ft)
4"	.02
6"	.01
8"	.0034
10"	.0025
12"	.0020
15"	.0015
18"	.0012
21"	.00095
24"	.00078
30"	.00058
36"	.00046

Section 3.02 MANHOLE DESIGN

Minimum manhole interior diameter is four (4) feet for manholes with one inlet and one outlet pipe. Manholes with two or more inlet pipes and one outlet pipe shall be a minimum of five (5) feet in diameter.

Spacing between manholes shall be no more than four hundred (400) feet unless special approval is granted by the City Engineer.

Pipe inverts through a manhole shall have a minimum two-tenths (0.20) fall from the inlet to the outlet when the pipes are greater that 100° apart in alignment. When the pipes are 90° to 100° apart in alignment, three-tenths (0.30) fall will be required. Pipe alignments under 90° will not be allowed and will require the construction of additional manholes.

A manhole must be provided at the end of all piping sections in a development. The manhole must be located as close to the edge of the project as reasonably possible when future adjacent land development is possible. A pipe stub of equivalent pipe diameter shall be placed in the manhole for future connection. The stub shall have a plug installed at the end of the pipe. No service laterals will be allowed in the stub.

Section 3.03 LATERAL CONNECTIONS

Lateral connections directly into a manhole will not be allowed. Sewer main must be of sufficient depth to allow for a minimum of three (3) feet of cover over the lateral connection. Sewer laterals are typically to be located 10' away from the water lateral on the down hill side. Water laterals are to be located as the center of lots.

Section 3.04 SEWER LIFT STATIONS

Sewer lift stations will only be allowed upon written approval by the City Engineer.

DIVISION 4

PRESSURE PIPE DESIGN CRITERIA

Section 4.01 GENERAL

The following pressure pipe design criteria shall apply to all pressure pipe designs in the City. Design shall comply with the current applicable AWWA standards. Additional design criteria are specified in the Standard Drawings.

Section 4.02 CULINARY WATER PIPE DESIGN

Sub-Section A. Pipe Material:

Ductile iron pipe shall be used in all areas east of 400 West and PVC pipe or ductile iron pipe wrapped in polyethylene will be used in all areas west of 400 West.

Ductile iron pipe shall conform to all requirements of ANSI/AWWA C151/A21.51, "American National Standard for Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined molds, for Water or Other Liquids." Minimum pressure Class will be 250 for pipes larger than 12-inch diameter. Pipes of 12-inch diameter and smaller shall be pressure Class 350. If thickness class pipe is used, pipes of diameters from 4 inches through 10 inches shall be minimum Class 51 and pipe from 12-inch diameter and larger shall be minimum Class 50.

Polyvinyl Chloride (PVC) pipe for the transmission and distribution of water shall be manufactured in accordance with AWWA C900-81, "AWWA Standard for Polyvinyl Chloride Pressure Pipe, 4-inch through 12-inch, for Water". The PVC pipe shall have a cast-iron-pipe-equivalent outside diameter. PVC pipe 14 inches and larger shall be manufactured in accordance with AWWA C905-88, "AWWA Standard for Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14-inch through 36-inch". All PVC pipe 4-inch and larger shall be DR. 18 with a working pressure of 150 PSI. Pipe smaller than 4-inch shall be schedule 40 PVC.

Sub-Section B. Fire Hydrant Spacing:

Fire Hydrants shall be placed in locations that allow for accessibility by the lay of a fire hose of no more than two hundred fifty (250) feet from the hydrant to the most remote point of any structure intended for occupancy. Buildings that are to be equipped with sprinkled fire suppression are to have a hydrant within one hundred (100) feet of the “Fire Department Connection” (FDC). Other requirements shall be based on the “International Fire Code” or as specified by the Springville City Fire Marshall.

Sub-Section C. Blow-off Locations:

If a fire hydrant is not located at the end of a cul-de-sac or temporary dead-end street, a blow-off hydrant shall be placed at those locations.

Section 4.03 PRESSURE IRRIGATION PIPE DESIGN

Sub-Section A. Pipe Material:

Polyvinyl Chloride (PVC) pipe for the transmission and distribution of water shall be manufactured in accordance with AWWA C900-81, "AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water:" PVC pipe fourteen inches (14”) and larger shall be manufactured in accordance with AWWA C905-88, "AWWA Standard for Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14-inch through 36-inch." All PVC pipe four-inch (4”) and larger shall be dimension ratio (DR) 18 with a working pressure of 150 psi. The PVC pipe shall have a cast-iron-pipe-

equivalent outside diameter. Pipe smaller than four inches (4") shall be schedule 40 PVC. Pressure Irrigation pipe shall be purple in color for easy identification.

Sub-Section B. Blow-off Locations:

A blow-off hydrant shall be placed at the end of all cul-de-sacs and temporary dead-end streets unless a irrigation pipe drain is placed at those locations.

Sub-Section C. Pipe Drainage Facilities:

Pressure irrigation pipe drains must be designed at all low-lying locations that will collect water at the end of the irrigation season. Care should be taken in the design process to assure the fewest number of drains as possible. Springville City must approve the location of all drains. Details of acceptable pipe drains are included in the standard drawings.

Section 4.04 PIPE LOOPING

Circumstances that require a culinary pipe to be placed under a sanitary sewer pipe require special construction. There must be 18" to 36" clear distance between the pipes. The culinary pipe must be in a casing that extends ten (10) feet on each side of the crossing. A detail of an acceptable pipe crossing is included in the standard drawings.

Section 4.05 AIR VALVES

The design engineer must give special consideration in the design of a pressure pipe system to include air valves of the appropriate type and location where necessary. Generally, special valves that may need to be designed into the system include vacuum relief valves, air and vacuum valves and combination air valves. Air valves are essential in the design of an expansive system in order to operate effectively. Without the proper application and placement of air valves, pipeline capacity may be reduced. Valves are especially necessary for pressure irrigation systems that are drained annually. In pressure irrigation systems, manual valves that provide air inlet and removal are generally acceptable. The design engineer should work closely with the City Engineer, Public Works Director and Water Superintendent to determine the most appropriate type and location of valves.

The following is a description of the application concerning the specified valves:

a) Vacuum Relief Valves shall be of the type that automatically admits large quantities of air to enter a system on negative pressure.
b) Air and Vacuum valves shall be of the type that automatically exhausts large quantities of air during the filling of a pipeline and to close water tight when the water enters the valve and allows air to re-enter during the draining or when a negative pressure occurs. The discharge orifice area shall be equal to or greater than the inlet of the valve.
c) Combination Air Valves shall be of the single housing style that combines the operating features of both an Air/Vacuum and Air Release Valve. The Air/Vacuum portion shall automatically exhaust large quantities of air during the filling of the pipeline and automatically allows air to re-enter the pipeline when the internal pressure of the pipeline approaches a negative value due to column separation, draining of the pipeline, power outage, pipeline break, etc. The Air Release portion shall automatically release small pockets of air from the pipeline while the pipeline is in operation and under pressure.
d) Air Inlet and Removal Valves using manual controls are used to flush air from the pressure irrigation system upon annual filling and emptying. Refer to the Standard Drawings for details.

DIVISION 5

STORM DRAINAGE CRITERIA

Section 5.01 GENERAL

The following storm drainage design criteria shall apply to all storm drainage designs in the City. Additional design criteria are specified in the Standard Drawings. The minimum allowed pipe size and material inside the City right-of-way is fifteen-inch (15") diameter reinforced concrete.

Section 5.02 INLET BOXES AND MANHOLES

Sub-Section A. Storm Water Inlets:

Curb face inlets (or an acceptable alternative) must be constructed at all low lying areas. Curb face inlet boxes will serve tributary piping and shall not be used as junction boxes or manholes. If multiple piping is required in a structure using a curb face inlet, a combination box shall be constructed which must include a manhole for access. No inlets shall be allowed at the bottom of an ADA ramp structure or in a designated pedestrian path. Inlets at drive cuts are discouraged and may only be used with approval of the City Engineer.

Sub-Section B. Manholes:

Minimum manhole interior diameter is four (4) foot for manholes with one inlet and one outlet pipe. Manholes with two or more inlet pipes and one outlet pipe shall be a minimum of five (5) foot in diameter.

Spacing between manholes shall be no more than four hundred (400) feet unless special approval is granted by the City Engineer.

Sub-Section C. Storm Water Treatment:

All new land development will require provisions for storm water treatment before the water is allowed to discharge into the existing City system. A design that will separate oils and particulates from the discharged water will have to be approved by the City Engineer. The treatment facility must be easily accessible and maintainable without unreasonable effort.

Section 5.03 MULTIPLE-LOT STORM DRAINAGE CALCULATIONS

The following information shall be included in the storm drainage calculations for multiple-lot development.

Sub-Section A. Hydrologic (Flow) Calculations:

1) A map showing drainage sub-basins and the piping system.
2) Cumulative peak flow calculations for each sub-basin (submit all input data, calculations and results).

Sub-Section B. Hydraulic (Inlet and Pipe) Calculations:

1) Capacity calculations for each segment of the pipe system.
2) Calculations demonstrating that flow rates in streets do not exceed maximums before being caught in storm drain inlets. "Section 5.07, Sub-Section C: Inlet Spacing" dictates the criteria required for allowable water spread.
3) Calculations demonstrating that inlets are sufficiently long to capture peak design flows.
4) Slopes shall be designed to have a two (2) foot pre second velocity. Minimum slopes for different size pipes are as follows:

MINIMUM STORM DRAIN MAIN SLOPES

Pipe Size	Min Slope (ft/ft)
15”	.0015
18”	.0012
21”	.00095
24”	.00078
30”	.00058
36”	.00046

Sub-Section C. Detention Calculations:

1) Detention volume requirement which includes an analysis that identifies the storm whose duration creates the greatest detention volume requirement, given storm duration and stage storage curve and outlet discharge curve.
2) Orifice calculations illustrating that the maximum release rate is not exceeded.

Section 5.04 COMMERCIAL SITE STORM DRAINAGE CALCULATIONS

The following information shall be included in the storm drainage calculations for commercial site property development.

Sub-Section A. Hydrologic (Flow) Calculations:

1) Peak flow calculations for the site (submit all input data, calculations and results).

Sub-Section B. Hydraulic (Inlet and Pipe) Calculations:

1) Capacity calculations for each segment of the pipe system.

Sub-Section C. Detention Calculations:

1) Detention volume requirement-an analysis that identifies the storm whose duration creates the greatest detention volume requirement, given storm duration and stage storage curve and outlet discharge curve.
2) Stage storage curve - generally required only on large detention basins.
3) Outlet discharge curve - generally required only on large detention basins.
4) Orifice calculations illustrating that the maximum release rate is not exceeded.

Section 5.05 LANDSCAPED STORM DETENTION BASIN REQUIREMENTS

Storm water must be detained such that the peak flow rate released from the site does not exceed 0.15 cubic feet per second per acre of development (cfs/acre). Detention basins must have vehicular access for maintenance and will not be allowed in the backyards of single family residences. The following limitations apply to detention basins:

a) The side slopes of the basin may not be steeper than 3:1 unless special circumstances warrant a change. Any change must be approved by the City Engineer. The bottom of the detention basin must slope toward the drain.
b) Within 10 feet of the outlet, the slope of the basin bottom must not be flatter than 5% unless a concrete apron is constructed around the outlet.
c) Excluding areas within 10 feet of the outlet, the maximum allowable depth of water in the basin is 3 feet. An additional one (1) foot of freeboard must be constructed on all basins.

d) Storm drain pipes are to be continuous through detention areas to allow low flows to proceed through the storm drainage system without having to come to the surface. These flows must still pass through the outlet restriction that limits runoff rates.
e) Basins are to be designed such that water does not run into them after storm water reaches a maximum depth (unless a free flowing overflow is provided)—this can usually be controlled by the elevation of an inlet box in the street adjacent to the basin.
f) Basins are to be designed such that when runoff exceeds design values or when restrictions plug, excess storm water will be directed to the street system or bypass the restriction by entering the piped system via a free flowing overflow.
g) A basin may be designed for dual use, but uses other than the detention of storm water must be approved by the City Engineer.
h) In cases where the basin detains water from, and is part of a project controlled by, a "Home Owners Association" (HOA), the HOA will be responsible to maintain the operation, landscaping and irrigation sprinkling of the basin.

Section 5.06 HARD SURFACE STORM DETENTION STORAGE REQUIREMENTS

Storm water ***may not*** be detained above ground on hard surface areas. If property is not available for a landscaped detention basin, storm water may be detained underground in an approved underground system. Storm water must be detained such that the peak flow rate released from the site does not exceed 0.15 cubic feet per second per acre of development (cfs/acre). Underground storage designs should be discussed with the City Engineer before submittal and will be approved on a case by case basis. The following limitations apply to underground detention storage:

a) Basins are to be designed such that when runoff exceeds design values or when restrictions plug, excess storm water will be directed to the street system or bypass the restriction by entering the piped system via a free flowing overflow.
b) The private property owner benefiting from the underground detention storage will be responsible to maintain the operation of the system.

Section 5.07 STORM WATER QUANTITY CRITERIA AND DESIGN GUDELINES

The following storm drainage criteria and design guidelines apply to all storm drainage plans in Springville and shall be used in storm drainage calculations. The City Engineer has authority to modify the criteria and guidelines as needed to meet changing or unusual needs or conditions.

Sub-Section A. Design Storm:

1) Frequency
   i. Design the piping system for a 10-year storm
   ii. Design detention for a 25-year storm with a 0.15 cfs/acre release rate.
   iii. Control the point of discharge and the flooding hazard of a 100-year storm
2) Intensity—per the following table:

Rainfall Intensities (inches/hour)			
Duration	**10 Year**	**25 Year**	**100 Year**
5 min	3.12	3.84	4.68
10 min	2.40	2.94	3.66
15 min	2.04	2.48	3.12
30 min	1.40	1.72	2.14
60 min	0.89	1.09	1.36

2 hours	0.52	0.62	0.77
3 hours	0.40	0.45	0.56
6 hours	0.23	0.26	0.33
12 hours	0.14	0.16	0.20
24 hours	0.08	0.10	0.12

Sub-Section B. Runoff Coefficients:

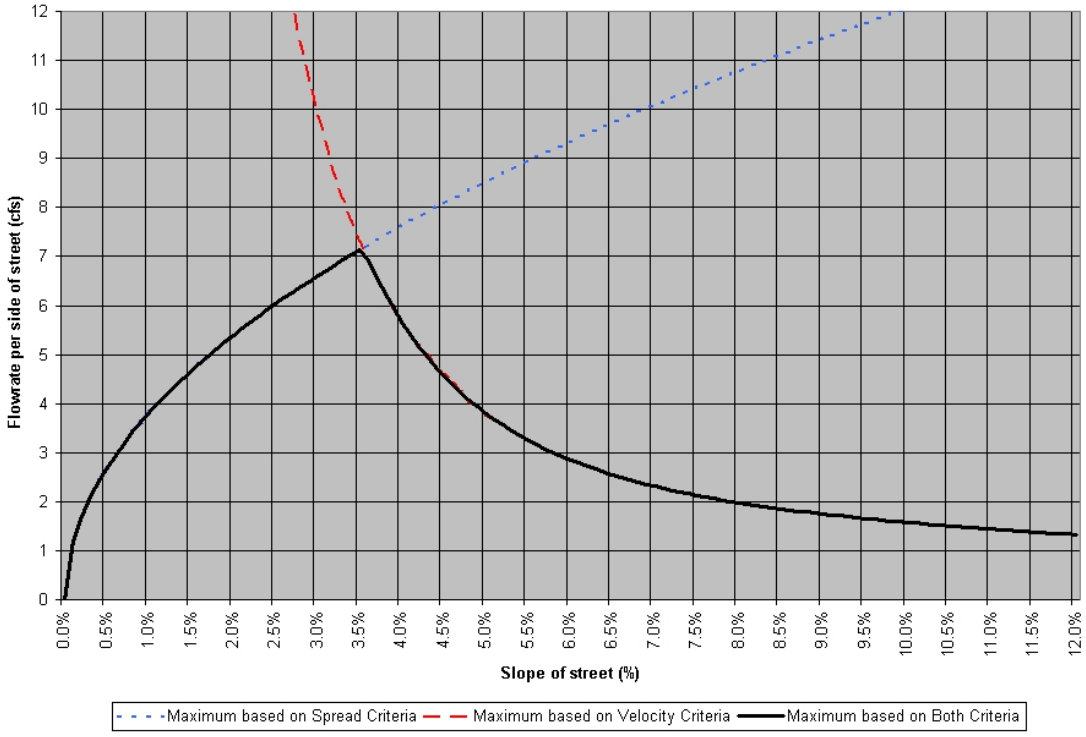
Springville City requires the design engineer to calculate a composite runoff coefficient based on surface type and associated runoff coefficient, weighted by the area of each surface type.

Sub-Section C. Inlet Spacing:

Two criteria must be met.

1) Spread of water in the street:
   Storm water must be delivered from the street into an underground piped system when the spread of water in the street covers the outside 8 feet of asphalt. This will leave one 12-foot traffic lane in local streets (that have 28 feet of asphalt), two 10-foot lanes in minor collector streets (that have 36 feet of asphalt) and three 12-foot lanes in major collector streets (that have 52 feet of asphalt) that are not submerged.
2) Gutter velocity:
   Water must be delivered from the street into an underground piped system when the velocity of water in the deepest part of the gutter reaches 10 feet per second (as a safety consideration).

Both of these requirements are a function of street slope and storm water flow rate. Storm water must be delivered from the street to storm drains when flows reach amounts shown in the following graph. This means that for a given longitudinal street slope, flows on the street surface must be delivered into the underground piped system when they reach the amount indicated on the graph by the solid line.



Note: The spread of water in the street is calculated using the Manning equation in the form developed by Izzard, with a roughness coefficient of 0.013 and the standard street cross section. The velocity criteria is based on the velocity at the deepest part of the gutter with the Manning Equation, with a roughness coefficient of 0.013, and using a depth at a point six inches from the face of the curb as the hydraulic radius.

Sub-Section D. Inlet Capacity:

The designer is to assume 50% blockage of inlets when considering storm drain inlet capacity.