SECTION 8.0 – STREETS
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SECTION 8.0 STREETS

8.1 INTRODUCTION

The criteria presented in this section shall be used in the evaluation of the allowable drainage encroachment within public streets. The review of all submittals shall be based on the criteria herein.

8.2 FUNCTION OF STREETS IN THE DRAINAGE SYSTEM

Urban and rural streets, specifically the curb and gutter or the roadside ditches, are part of the storm drainage system. When the drainage in the street exceeds allowable limits, a storm drain system or an open channel is required to convey the excess flows. However, the primary function of the urban street system is for traffic movement, and, therefore, the drainage function is secondary and must not interfere with the traffic function of the street.

Design criteria for collecting and moving runoff water on public streets are based on a reasonable frequency and magnitude of traffic interference. Depending on the character of the street, certain traffic lanes can be inundated during specific design storm runoff events. The primary function of the streets during the initial storm runoff event is to convey the nuisance flows quickly and efficiently to the storm drain or open channel drainage without interference with traffic movement. During the major storm runoff event the function of the streets is to provide a passageway for the flood flows with minimal damage to the urban environment, and passage of emergency vehicles.

8.3 STREET CLASSIFICATIONS AND CAPACITY LIMITATIONS

8.3.1 STREET CLASSIFICATIONS

The streets in the City are classified for drainage use according to the average daily traffic (ADT) for which the street is designed and the adopted City classifications. The larger the ADT, the more restrictive the allowable drainage encroachment into the driving lanes is. Refer to the City of Greeley Standard Details and "Street Design Criteria" for specific dimensions and cross sections of each street classification. The adopted City classifications are summarized in the following table:

TABLE 8.3.1 – CITY OF GREELEY STREET CLASSIFICATIONS

CITY OF GREELEY STREET CLASSIFICATIONS		
Classification	**Width (Flow line to Flow line)**	**City of Greeley Standard Detail No.***
Local - Low Volume*	No Curb & Gutter Shoulder Only w/Ditch	S-1
Local – Commercial / Industrial & Residential	40'	S-2
Local – Performance Option 14	34'	S-2-14

Minor Collector	52'	S-3
Major Collector	64'	S-4
Minor Arterial	64'	S-5
Major Arterial (with Raised Median)	2 Lanes at 33' each	S-6

* Reference: See City of Greeley Street Design Criteria Manual for Standard Detail Nos. S-1 to S-6 plus street options.

8.3.2 STREET CAPACITY - INITIAL STORM

The street capacity for initial storm runoff events is determined by the limitations set forth below:

TABLE 8.3.2 – STREET CAPACITY – INITIAL STORM -- MINOR STORM

STREET CAPACITY FOR INITIAL STORM or MINOR STORM RUNOFF		
Street Classification	**Curb Overtopping Allowed**	**Maximum Pavement Encroachment**
Local[1] Low Volume	No	Flow may spread to crown of street
Local Commercial / Industrial & Residential & Performance Option 14 w/ vertical curb	No	Flow may spread to crown of street
Local Commercial / Industrial & Residential & Performance Option 14 w/ rollover curb	Yes 5” max above gutter FL	Flow may spread to crown of street
Minor Collector	No	Flow must leave a minimum 10' wide center lane open
Major Collector	No	Flow must leave a minimum 10' wide center lane open
Minor Arterial	No	Flow must leave a minimum of one traffic lane open each direction

Major Arterial	No	Flow must leave a minimum of one traffic lane open each direction
*Note: [1]For Local - Low Volume Streets see Section 5.4 of these Criteria for the design and capacity of roadside ditches.		

8.3.3 STREET CAPACITY - MAJOR STORM

The street capacity during major storm events is determined by the limitations set forth below:

TABLE 8.3.3 – STREET CAPACITY FOR MAJOR STORM RUNOFF

STREET CAPACITY FOR MAJOR STORM RUNOFF[1]			
Street Classification	**Maximum Depth At Gutter Flow line**	**Maximum Depth at Crown**	**Allowable Inundation**
Local[2], Local Commercial / Industrial / Residential / Option 14	18"	N/A	No inundation at groundline[3]
Collector	18"	N/A	No inundation at groundline[3]
Arterial	18"	6"	No inundation at groundline[3]

Notes:
[1]Most restrictive condition shall control design
[2]For Local - Low Volume Streets see Section 5.4 of these Criteria for the design and capacity of roadside ditches.
[3]Includes inundation of residential dwellings, public, commercial and industrial buildings

8.4 HYDRAULIC EVALUATION FOR STREET CAPACITY

8.4.1 ALLOWABLE STREET CAPACITY - INITIAL STORMS

The determination of the Allowable Street Capacity shall be based on the following procedure: determine the Theoretical Capacity based on the street cross section; compute the street flow; then, apply the appropriate reduction factor to calculate the Allowable Street Capacity.

Based on the Maximum Pavement Encroachment for the various street classifications presented in Section 8.3, the Theoretical Capacity of each street section is calculated using the Modified Manning's formula shown below:

$$Q = (0.56)\,(Z/n)\,S^{1/2}\,d^{8/3}$$ **Equation 8.4.1**

Where: Q = discharge in cfs

$Z = 1/S_x$, where S_x is the cross slope of the pavement (ft/ft)

d = depth of water at face of curb (feet)

S = longitudinal grade of street (ft/ft)

n = Manning's roughness coefficient

Note: This equation does not pertain to streets with borrow ditches. Also, the solution to the above equation can be obtained through the use of the nomograph (Figure 8-1 and included for information only).

The Allowable Capacity of a Street Section is then calculated by multiplying the Theoretical Capacity by the appropriate reduction factor found in Figure 8-2. The purpose of the reduction factor is to account for various street conditions, which decrease the street capacity. These conditions may include street overlays, parked vehicles, debris and hail accumulation, and deteriorated pavement.

The Designer will find the Allowable Street Capacity already calculated in Table 8-1 for several of the standard, symmetrical street sections. The calculations were performed for various allowable flow depths and street slopes. A Manning's n-value of 0.016 was used for the calculations at all street slopes.

Other accepted street options used within the City are not included in the Figures and Tables. The Designer shall calculate the Theoretical Capacity using equation 8.4.1, then calculate the Allowable Street Capacity by multiplying the Theoretical Capacity obtained, by the appropriate reduction factor found in Figure 8-2. These street options shall meet the requirements specified in the Street Capacity for Initial Storm Runoff depending on ADT and Street Classification (Contact Traffic Division for this information). These calculations shall be included in the Drainage Report.

The Allowable Street Capacity will also need to be reduced if non-symmetrical street sections are encountered. Street capacity calculations at critical locations of non-symmetrical street sections shall be submitted in the Drainage Report.

8.4.2 ALLOWABLE STREET CAPACITY - MAJOR STORMS

The street capacity for the major storm is determined by the depth and inundation limits set forth in Section 8.3.3. The Allowable Street Capacity is found by using the same procedure outlined in Section 8.4.1 with one exception due to the addition of grass areas. A weighted Manning's n for the entire roadway cross-section will be used in Equation 8.4.1 to find the maximum theoretical flowrate – Q.

Again, the Designer will find the Allowable Street Capacity already calculated in Table 8-1 for several of the City's standard, symmetrical street sections. A Manning's value of 0.016 for the pavement and sidewalk areas and 0.033 for the grass area was used to determine capacity. The maximum allowable depth at the gutter flowline is 18 inches. The street capacity criteria for both the initial and major storms are graphically displayed by Figures 8-3 and 8-4.

For non-symmetrical streets, such as shown in Figure 8-13, street capacity calculations shall be performed at all critical locations and shall be submitted to the City for review. The computed street capacity must never exceed the allowable street capacity presented in these criteria.

8.4.3 RURAL STREETS (LOCAL, LOW-VOLUME STREETS WITHOUT CURB AND GUTTER)

Rural streets are characterized by the use of roadside ditches instead of curb and gutters. The capacity is limited by the depth in the ditch and the maximum flow velocity. Refer to Section 5.4 for the design and capacity of roadside ditches.

8.5 ALLOWABLE STREET CROSS-FLOW CONDITIONS

8.5.1 CROSS STREET FLOW AT INTERSECTIONS

Cross street flow normally occurs at converging street intersections where the flow must cross from one side to the other in either a cross pan (where allowed) or across the street crown. The restrictions for flow depth at intersections are set forth below:

TABLE 8.5.1 – ALLOWABLE CROSS-STREET FLOW AT INTERSECTIONS

ALLOWABLE CROSS STREET FLOW AT INTERSECTIONS		
Street Classification	**Initial Storm or Minor Storm Runoff**	**Major Storm Runoff**
Local w/ vertical curb	Maximum 6" Depth at Street Crown or in Cross Pan	Maximum 18" Depth Above Gutter Flow line
Local w/ rollover curb	Maximum 5" Depth at Street Crown or in Cross Pan	Maximum 18" Depth Above Gutter Flow line
Collector	Maximum 6" Depth Above Cross Pan Flow line (Where Cross Pan is Allowed)	Maximum 18" Depth Above Gutter Flow line
Minor Arterial	None Allowed	Maximum 6" Depth Above Crown
Major Arterial	None Allowed	Maximum 6" Depth Above Crown

8.5.2 STREET OVERTOPPING

In locations of culvert crossings, the opportunity for the flow in the drainage way to exceed the road culvert capacity and subsequently overtop the crown of the street must be investigated. The restrictions for street overtopping are set forth below:

TABLE 8.5.2 – ALLOWABLE CULVERT OVERTOPPING

ALLOWABLE CULVERT OVERTOPPING		
Street Classification	**10-Year Storm Maximum Depth**	**Major Storm Maximum Depth[1.]**
Local	None	18" At The Gutter Flow line
Local w/Roadside Ditch	None	6" At The Street Crown
Collector & Minor Arterial	None	6" At The Street Crown
Major Arterial	None	No Overtopping Allowed For bridges the minimum clearance between the low chord and the EGL shall be 6".
1. The maximum headwater for the 100-year design flows shall be 1.5 times the culvert diameter or 1.5 times the rise dimension for pipe shapes other than round.		

8.6 DESIGN EXAMPLE – DETERMINATION OF STREET CAPACITY

GIVEN:

Street with a traffic classification of "Minor Collector" and a slope of 1.0 percent.

FIND:

Maximum allowable capacity for initial and major storm.

SOLUTION:

STEP 1: Determine the allowable depth:
From Section 8.3, for a Minor Collector, the maximum depth at the curb (without overtopping) would be 6" for the initial storm.

STEP 2: Determine the allowable initial storm gutter capacity:

From Table 8-1, for a "Minor Collector" with an allowable depth of 0.50 feet and a slope of 1.0 percent, read the allowable gutter capacity of 8.6 cfs.

STEP 3: Determine the allowable major storm street capacity:
From Table 8-1, for a "Minor Collector" with a slope of 1.0 percent, read the allowable capacity of 610 cfs for the full street section, assuming the street is symmetrical.

8.7 CHECKLIST

To aid the Designer and Reviewer, the following checklist has been prepared:

1. Determine the street classification first and then the allowable flow depth and gutter capacity.
2. Use the flattest street slope to determine the gutter capacity.
3. To calculate the allowable street flow, use the appropriate reduction factor (F) to calculate the allowable gutter capacity.
4. Check for non-symmetrical street evaluation.
5. Check for cross-flow conditions at intersections and allowable culvert overtopping depths.
6. Storm drains required when gutter capacity is exceeded.
7. Check adequacy of downstream facilities.

Local-Residential w/ 3-3/8" tall rollover curb						
Gutter Slope (ft/ft)	Reduction Factors (from Figure 8-2) Initial Storm	Reduction Factors (from Figure 8-2) Major Storm	Initial Storm (half street) Theoretical Capacity w/ 5" of water above flow line (cfs)	Initial Storm (half street) Allowable Capacity w/ 5" of water above flow line (cfs)	Major Storm (full street) Theoretical Capacity (cfs)	Major Storm (full street) Allowable Capacity (cfs)
0.004	0.500	0.500	5.8	**2.9**	459	**230**
0.005	0.650	0.650	6.5	**4.2**	514	**334**
0.006	0.800	0.800	7.1	**5.7**	563	**450**
0.008	0.800	0.800	8.2	**6.6**	650	**520**
0.009	0.800	0.800	8.7	**7.0**	689	**551**
0.010	0.800	0.800	9.2	**7.4**	726	**581**
0.020	0.800	0.700	13.0	**10.4**	1027	**719**
0.040	0.610	0.500	18.4	**11.2**	1453	**727**
0.060	0.410	0.375	22.6	**9.3**	1779	**667**
0.080	0.280	0.270	26.1	**7.3**	2054	**555**

Local-Commercial / Industrial & Residential w/ vertical curb						
Gutter Slope (ft/ft)	Reduction Factors (from Figure 8-2) Initial Storm	Reduction Factors (from Figure 8-2) Major Storm	Initial Storm (half street) Theoretical Capacity (cfs)	Initial Storm (half street) Allowable Capacity (cfs)	Major Storm (full street) Theoretical Capacity (cfs)	Major Storm (full street) Allowable Capacity (cfs)
0.004	0.500	0.500	6.9	**3.5**	386	**193**
0.005	0.650	0.650	7.7	**5.0**	432	**281**
0.006	0.800	0.800	8.4	**6.7**	473	**378**
0.008	0.800	0.800	9.7	**7.8**	547	**438**
0.009	0.800	0.800	10.3	**8.2**	580	**464**
0.010	0.800	0.800	10.8	**8.6**	611	**489**
0.020	0.800	0.700	15.3	**12.2**	864	**605**
0.040	0.610	0.500	21.7	**13.2**	1222	**611**
0.060	0.410	0.375	26.6	**10.9**	1497	**561**
0.080	0.280	0.270	30.7	**8.6**	1728	**467**

Minor Collector						
Gutter Slope (ft/ft)	Reduction Factors (from Figure 8-2) Initial Storm	Reduction Factors (from Figure 8-2) Major Storm	Initial Storm (half street) Theoretical Capacity (cfs)	Initial Storm (half street) Allowable Capacity (cfs)	Major Storm (full street) Theoretical Capacity (cfs)	Major Storm (full street) Allowable Capacity (cfs)
0.004	0.500	0.500	6.8	**3.4**	482	**241**
0.005	0.650	0.650	7.6	**4.9**	539	**350**
0.006	0.800	0.800	8.4	**6.7**	591	**473**
0.008	0.800	0.800	9.7	**7.8**	682	**546**
0.009	0.800	0.800	10.2	**8.2**	724	**579**
0.010	0.800	0.800	10.8	**8.6**	763	**610**
0.020	0.800	0.700	15.3	**12.2**	1079	**755**
0.040	0.610	0.500	21.6	**13.2**	1525	**763**
0.060	0.410	0.375	26.4	**10.8**	1868	**701**
0.080	0.280	0.270	30.5	**8.5**	2157	**582**

TABLE 8-1

City of Greeley - Standard Street Section Capacities **Revised March 2007**

Major Collector						
Gutter Slope (ft/ft)	Reduction Factors (from Figure 8-2)		Initial Storm (half street)		Major Storm (full street)	
	Initial Storm	Major Storm	Theoretical Capacity (cfs)	Allowable Capacity (cfs)	Theoretical Capacity (cfs)	Allowable Capacity (cfs)
0.004	0.500	0.500	6.8	**3.4**	527	**264**
0.005	0.650	0.650	7.6	**4.9**	589	**383**
0.006	0.800	0.800	8.4	**6.7**	646	**517**
0.008	0.800	0.800	9.7	**7.8**	745	**596**
0.009	0.800	0.800	10.2	**8.2**	791	**633**
0.010	0.800	0.800	10.8	**8.6**	833	**666**
0.020	0.800	0.700	15.3	**12.2**	1179	**825**
0.040	0.610	0.500	21.6	**13.2**	1667	**834**
0.060	0.410	0.375	26.4	**10.8**	2041	**765**
0.080	0.280	0.270	30.5	**8.5**	2357	**636**

Minor Arterial						
Gutter Slope (ft/ft)	Reduction Factors (from Figure 8-2)		Initial Storm (half street)		Major Storm (full street)	
	Initial Storm	Major Storm	Theoretical Capacity (cfs)	Allowable Capacity (cfs)	Theoretical Capacity (cfs)	Allowable Capacity (cfs)
0.004	0.500	0.500	6.8	**3.4**	339	**170**
0.005	0.650	0.650	7.6	**4.9**	379	**246**
0.006	0.800	0.800	8.4	**6.7**	416	**333**
0.008	0.800	0.800	9.7	**7.8**	480	**384**
0.009	0.800	0.800	10.2	**8.2**	509	**407**
0.010	0.800	0.800	10.8	**8.6**	537	**430**
0.020	0.800	0.700	15.3	**12.2**	759	**531**
0.040	0.450	0.450	21.6	**9.7**	1073	**483**
0.060	0.275	0.275	26.4	**7.3**	1315	**362**
0.080	0.175	0.175	30.5	**5.3**	1518	**266**

Major Arterial						
Gutter Slope (ft/ft)	Reduction Factors (from Figure 8-2)		Initial Storm (half street)		Major Storm (full street)	
	Initial Storm	Major Storm	Theoretical Capacity (cfs)	Allowable Capacity (cfs)	Theoretical Capacity (cfs)	Allowable Capacity (cfs)
0.004	0.500	0.500	6.8	**3.4**	367	**184**
0.005	0.650	0.650	7.6	**4.9**	410	**267**
0.006	0.800	0.800	8.4	**6.7**	450	**360**
0.008	0.800	0.800	9.7	**7.8**	519	**415**
0.009	0.800	0.800	10.2	**8.2**	551	**441**
0.010	0.800	0.800	10.8	**8.6**	581	**465**
0.020	0.800	0.700	15.3	**12.2**	821	**575**
0.040	0.450	0.450	21.6	**9.7**	1161	**522**
0.060	0.275	0.275	26.4	**7.3**	1422	**391**
0.080	0.175	0.175	30.5	**5.3**	1642	**287**

TABLE 8-1A

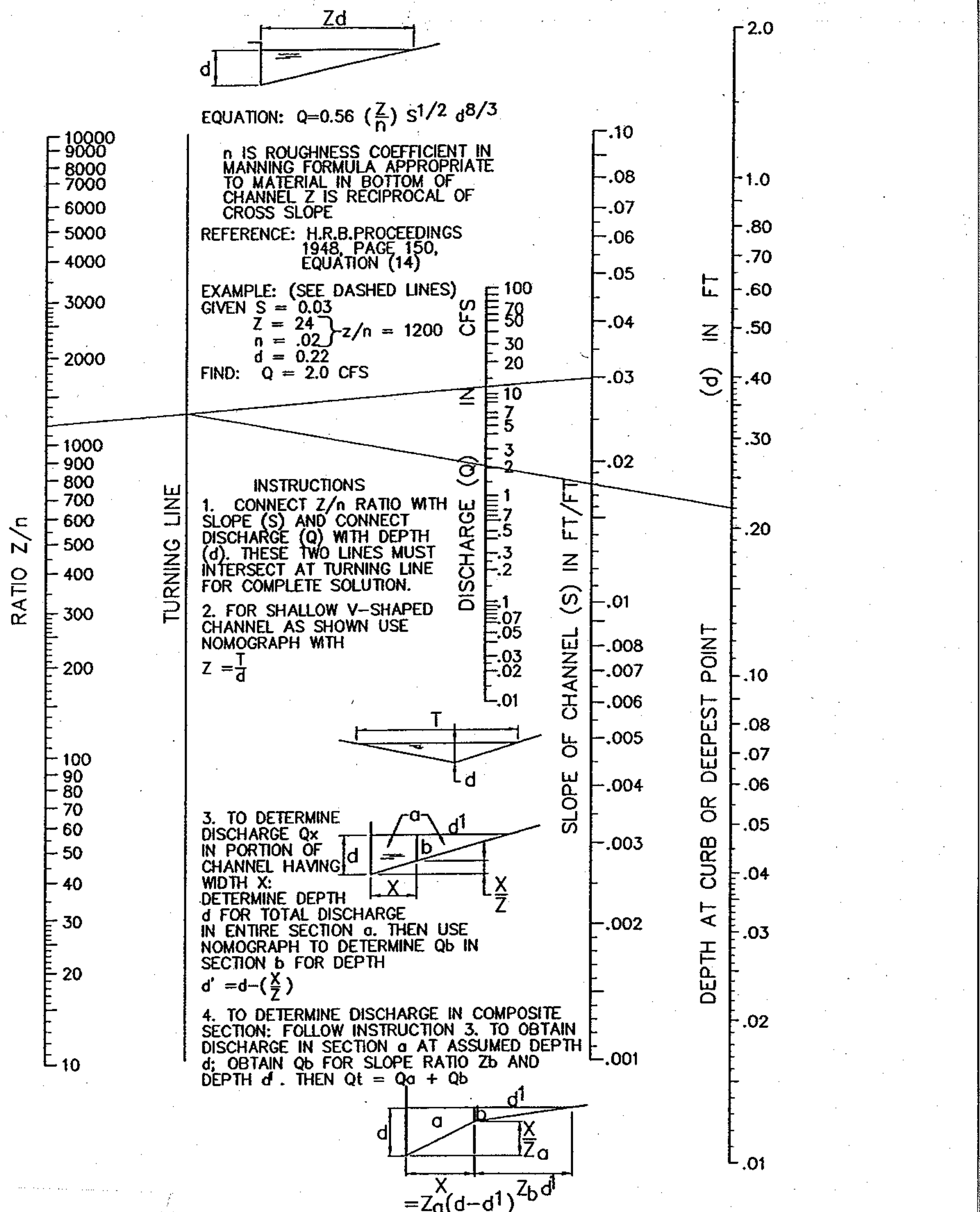
City of Greeley - Standard Street Section Capacities **Revised March 2007**

Performance Option 14 w/ 3-3/8" tall rollover curb						
Gutter Slope (ft/ft)	Reduction Factors (from Figure 8-2)		Initial Storm (half street)		Major Storm (full street)	
	Initial Storm	Major Storm	Theoretical Capacity w/ 5" of water above flow line (cfs)	Allowable Capacity w/ 5" of water above flow line (cfs)	Theoretical Capacity (cfs)	Allowable Capacity (cfs)
0.004	0.500	0.500	5.4	**2.7**	434	**217**
0.005	0.650	0.650	6.1	**4.0**	485	**315**
0.006	0.800	0.800	6.6	**5.3**	531	**425**
0.008	0.800	0.800	7.7	**6.2**	613	**490**
0.009	0.800	0.800	8.1	**6.5**	650	**520**
0.010	0.800	0.800	8.6	**6.9**	686	**549**
0.020	0.800	0.700	12.1	**9.7**	970	**679**
0.040	0.610	0.500	17.1	**10.4**	1371	**686**
0.060	0.410	0.375	20.9	**8.6**	1679	**630**
0.080	0.280	0.270	24.2	**6.8**	1939	**524**

Performance Option 14 w/ vertical curb						
Gutter Slope (ft/ft)	Reduction Factors (from Figure 8-2)		Initial Storm (half street)		Major Storm (full street)	
	Initial Storm	Major Storm	Theoretical Capacity (cfs)	Allowable Capacity (cfs)	Theoretical Capacity (cfs)	Allowable Capacity (cfs)
0.004	0.500	0.500	7.2	**3.6**	356	**178**
0.005	0.650	0.650	8.0	**5.2**	398	**259**
0.006	0.800	0.800	8.8	**7.0**	436	**349**
0.008	0.800	0.800	10.1	**8.1**	504	**403**
0.009	0.800	0.800	10.7	**8.6**	534	**427**
0.010	0.800	0.800	11.3	**9.0**	563	**450**
0.020	0.800	0.700	16.0	**12.8**	797	**558**
0.040	0.610	0.500	22.6	**13.8**	1126	**563**
0.060	0.410	0.375	27.7	**11.4**	1380	**518**
0.080	0.280	0.270	32.0	**9.0**	1593	**430**

TABLE 8-1B

City of Greeley - Standard Street Section Capacities   Revised March 2007



EQUATION: $Q=0.56\ (\frac{Z}{n})\ S^{1/2}\ d^{8/3}$

n IS ROUGHNESS COEFFICIENT IN MANNING FORMULA APPROPRIATE TO MATERIAL IN BOTTOM OF CHANNEL Z IS RECIPROCAL OF CROSS SLOPE

REFERENCE: H.R.B.PROCEEDINGS 1948, PAGE 150, EQUATION (14)

EXAMPLE: (SEE DASHED LINES)
GIVEN S = 0.03
Z = 24, n = .02 } z/n = 1200
d = 0.22
FIND: Q = 2.0 CFS

INSTRUCTIONS

1. CONNECT Z/n RATIO WITH SLOPE (S) AND CONNECT DISCHARGE (Q) WITH DEPTH (d). THESE TWO LINES MUST INTERSECT AT TURNING LINE FOR COMPLETE SOLUTION.

2. FOR SHALLOW V-SHAPED CHANNEL AS SHOWN USE NOMOGRAPH WITH $Z = \frac{T}{d}$

3. TO DETERMINE DISCHARGE Qx IN PORTION OF CHANNEL HAVING WIDTH X: DETERMINE DEPTH d FOR TOTAL DISCHARGE IN ENTIRE SECTION a. THEN USE NOMOGRAPH TO DETERMINE Qb IN SECTION b FOR DEPTH $d' = d - (\frac{X}{Z})$

4. TO DETERMINE DISCHARGE IN COMPOSITE SECTION: FOLLOW INSTRUCTION 3. TO OBTAIN DISCHARGE IN SECTION a AT ASSUMED DEPTH d; OBTAIN Qb FOR SLOPE RATIO Zb AND DEPTH d'. THEN Qt = Qa + Qb

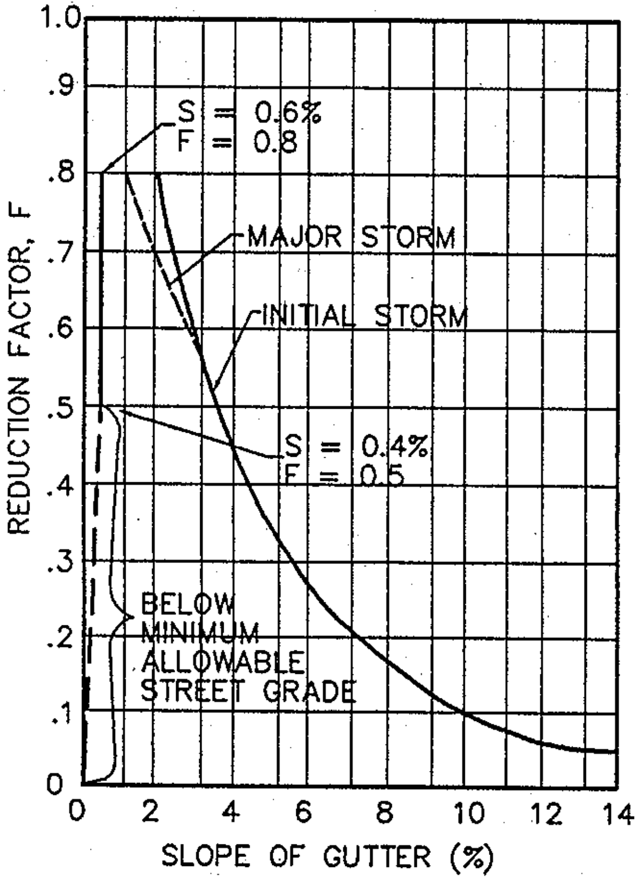
City of Greeley Colorado
Great. From the Ground Up.

NOMOGRAPH FOR FLOW IN TRIANGULAR GUTTERS

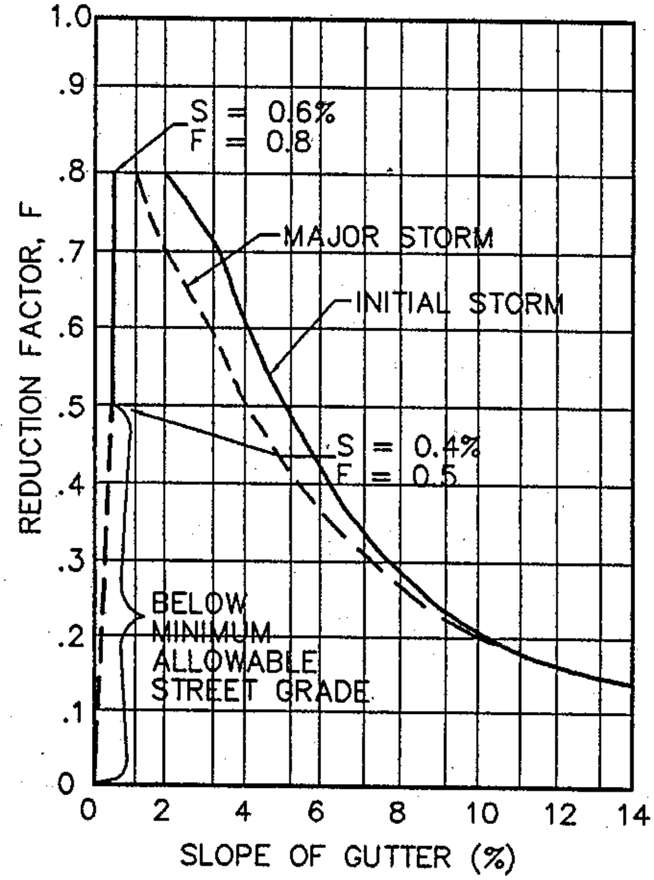
FIGURE 8-1

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

SCALE: NTS
REVISED NOV 1997



REDUCTION FACTOR FOR ALLOWABLE GUTTER CAPACITY WHEN APPROACHING AN ARTERIAL STREET



REDUCTION FACTOR FOR ALLOWABLE GUTTER CAPACITY LOCAL AND COLLECTOR STREETS

City of Greeley Colorado
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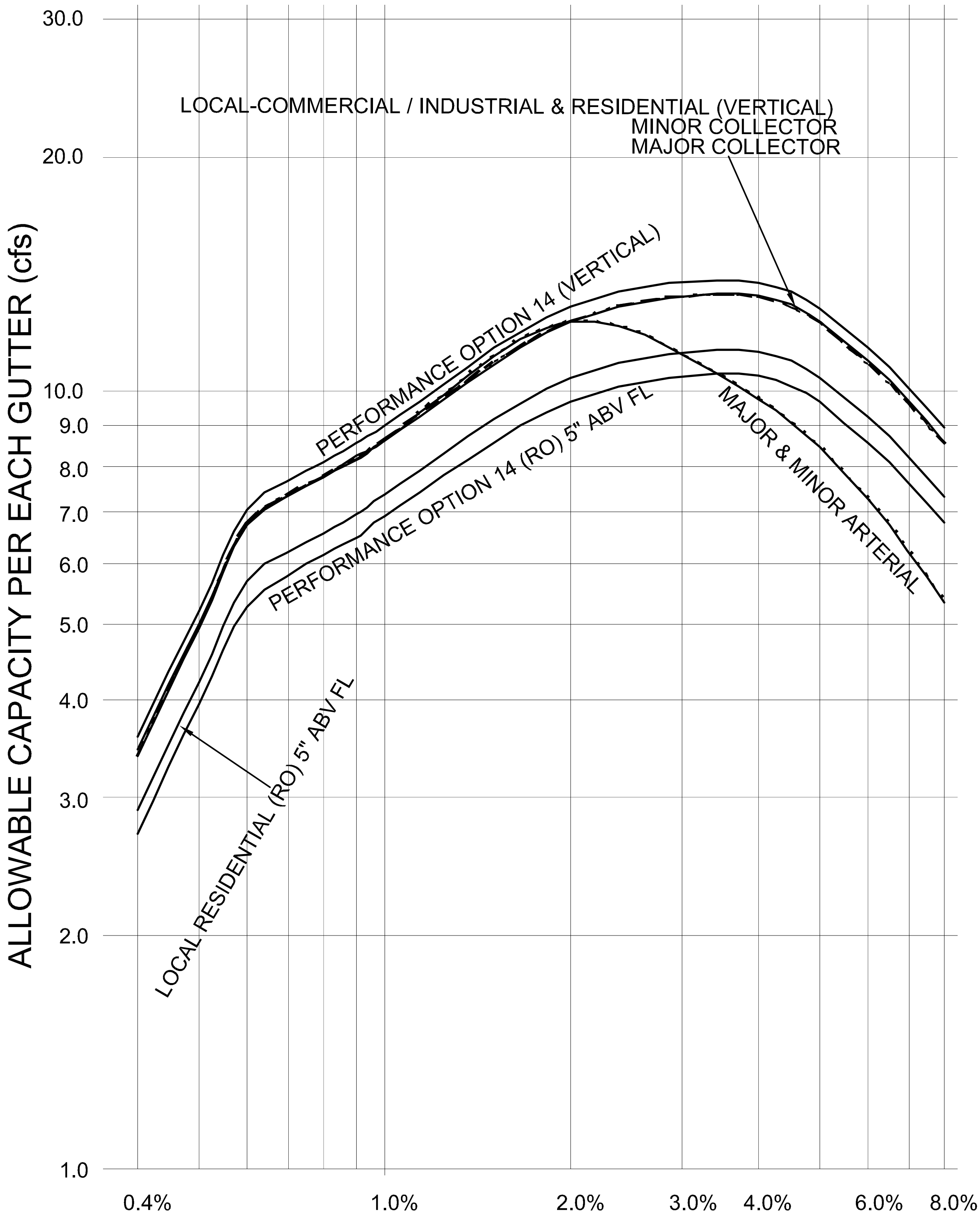
GUTTER CAPACITY REDUCTION CURVES

FIGURE 8-2

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

SCALE: NTS
REVISED NOV 1997

INITIAL STORM



1. THE GRAPH WAS CREATED USING FLOW MASTER WITH MANNING'S FORMULA. THE IMPROVED LOTTER'S METHOD WAS USED FOR THE WEIGHTED ROUGHNESS METHOD. STREET CROSS SECTIONS FOR EACH SLOPE AND EACH TYPE OF STREET LISTED ARE SHOWN.
ROUGHNESS FACTOR FOR PAVEMENT AND CONCRETE n = .016
ROUGHNESS FACTOR FOR LANDSCAPE AND GRASS AREAS n = .033
2. FIGURE INCLUDES REDUCTION FACTOR FOR ALLOWABLE STREET CAPACITY.

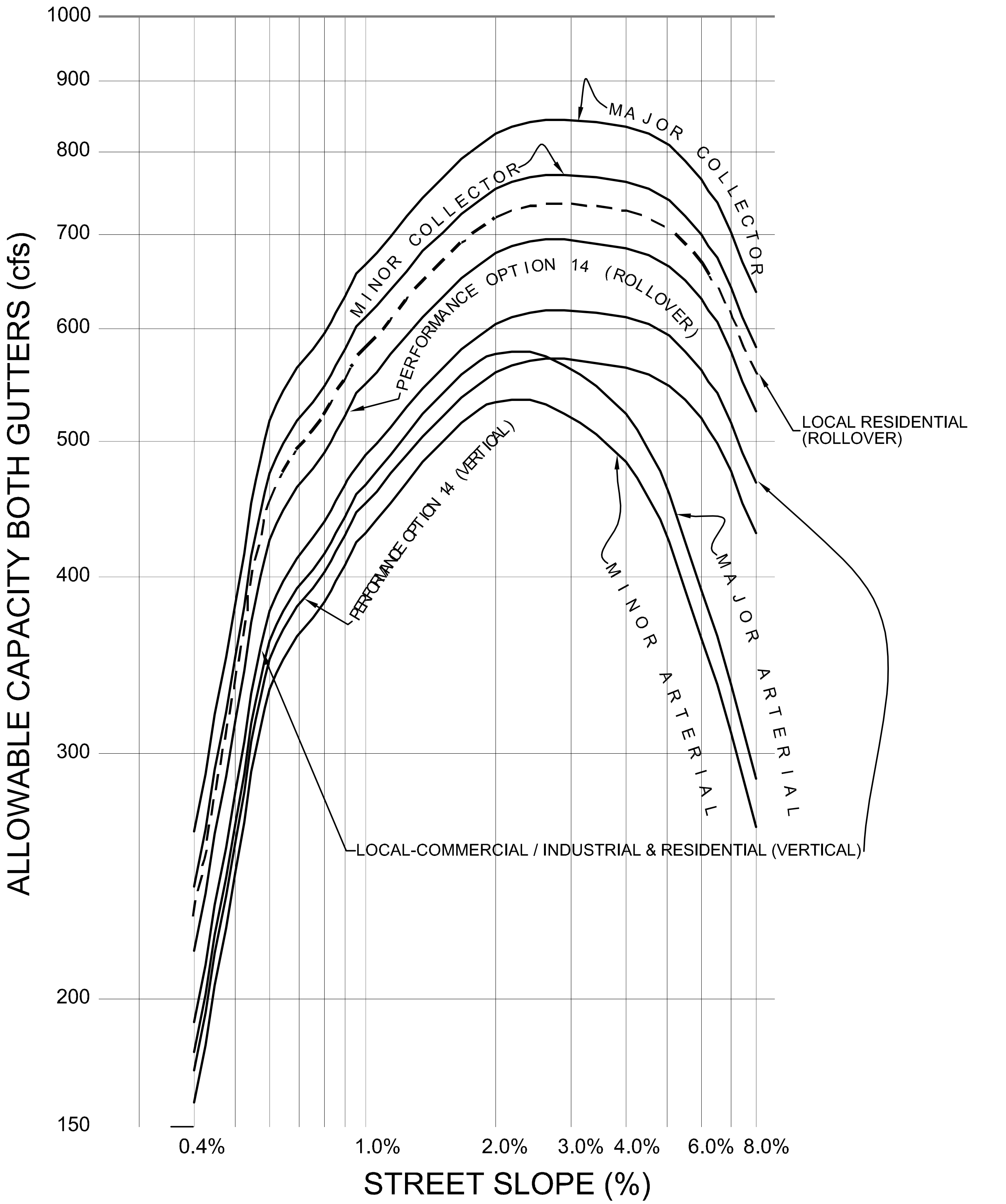
City of Greeley Colorado
Great. From the Ground Up.

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

FIGURE 8-3

SCALE: NTS
REVISED MARCH 2007

MAJOR STORM



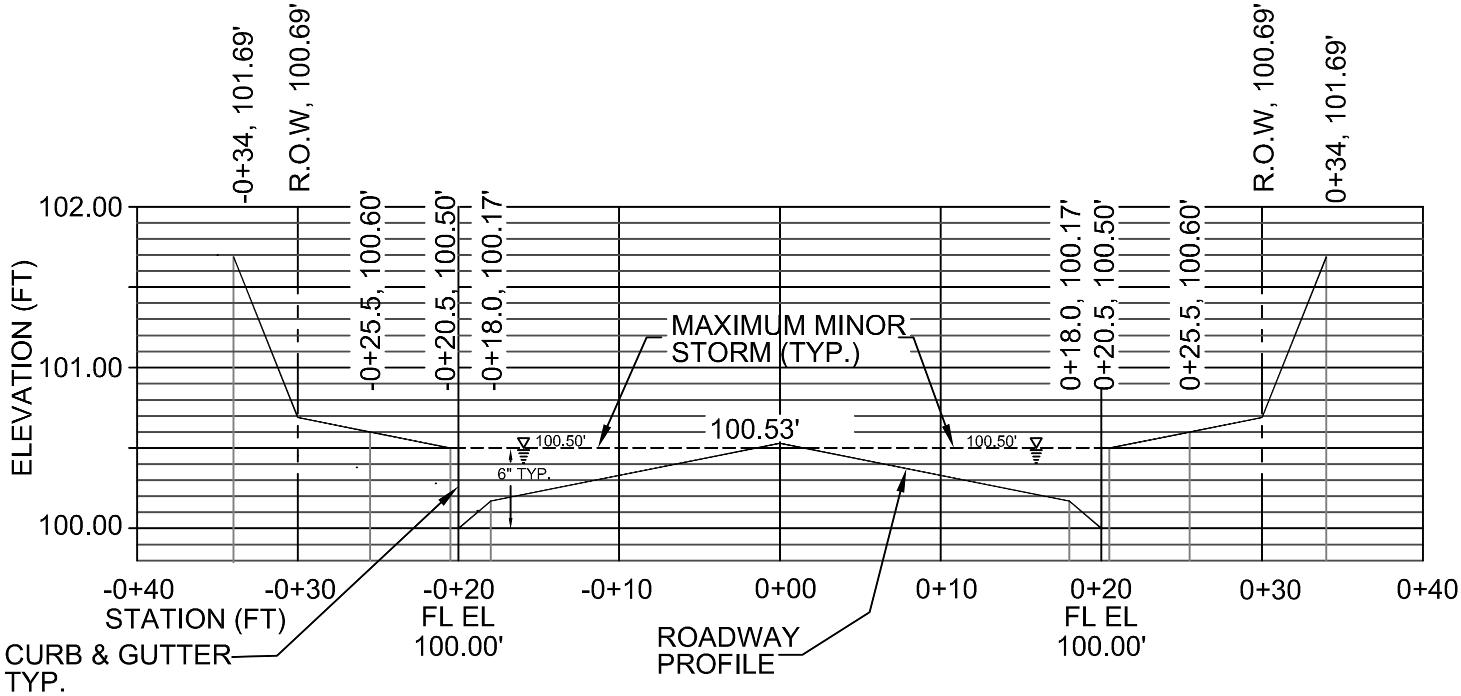
1. THE GRAPH WAS CREATED USING FLOW MASTER WITH MANNING'S FORMULA. THE IMPROVED LOTTER'S METHOD WAS USED FOR THE WEIGHTED ROUGHNESS METHOD. STREET CROSS SECTIONS FOR EACH SLOPE AND EACH TYPE OF STREET LISTED ARE SHOWN.
ROUGHNESS FACTOR FOR PAVEMENT AND CONCRETE n = .016
ROUGHNESS FACTOR FOR LANDSCAPE AND GRASS AREAS n = .033
2. FIGURE INCLUDES REDUCTION FACTOR FOR ALLOWABLE STREET CAPACITY.

City of Greeley Colorado
Great. From the Ground Up.

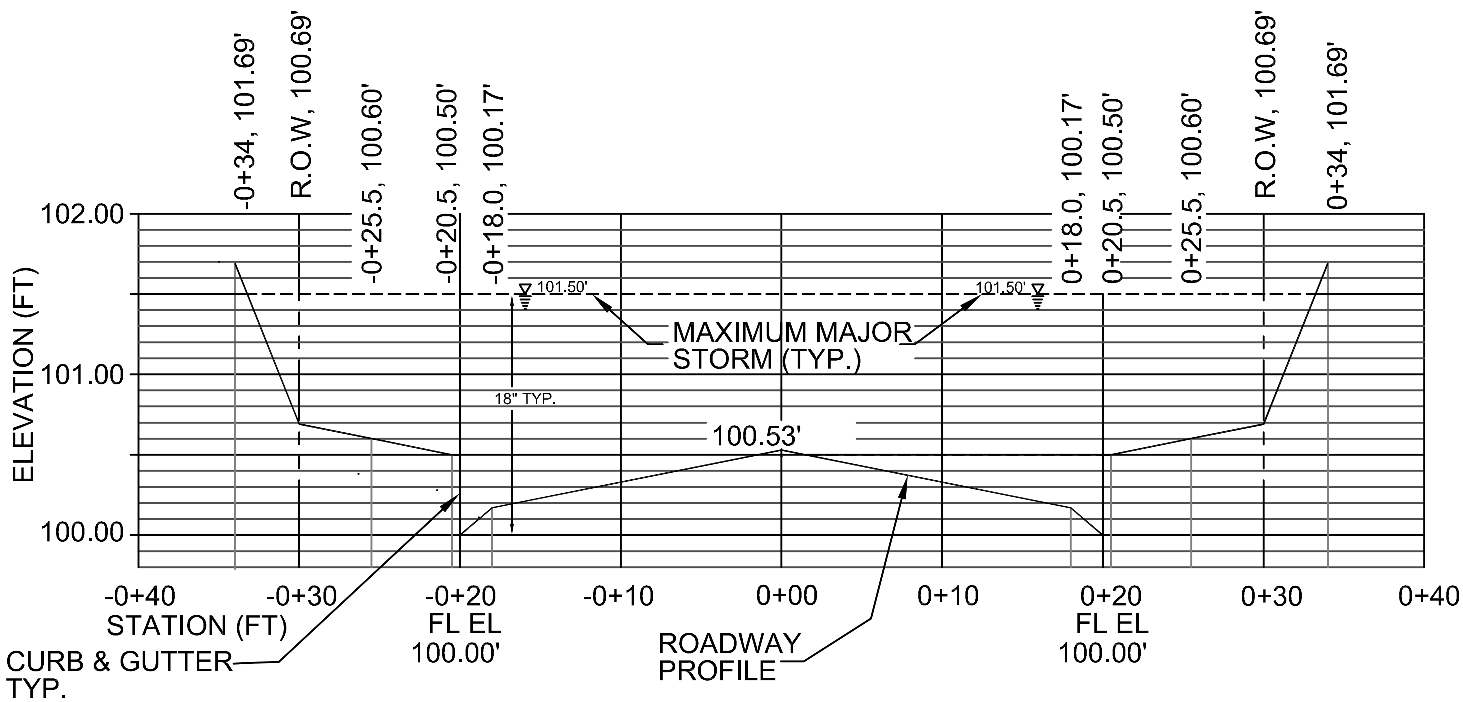
PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

FIGURE 8-4

SCALE: NTS
REVISED MARCH 2007



MINOR STORM
LOCAL COMMERCIAL/INDUSTRIAL & RESIDENTIAL
VERTICAL CURB WITH 6" OF WATER ABOVE FL



MAJOR STORM
LOCAL COMMERCIAL/INDUSTRIAL & RESIDENTIAL
VERTICAL CURB WITH 18" OF WATER ABOVE FL

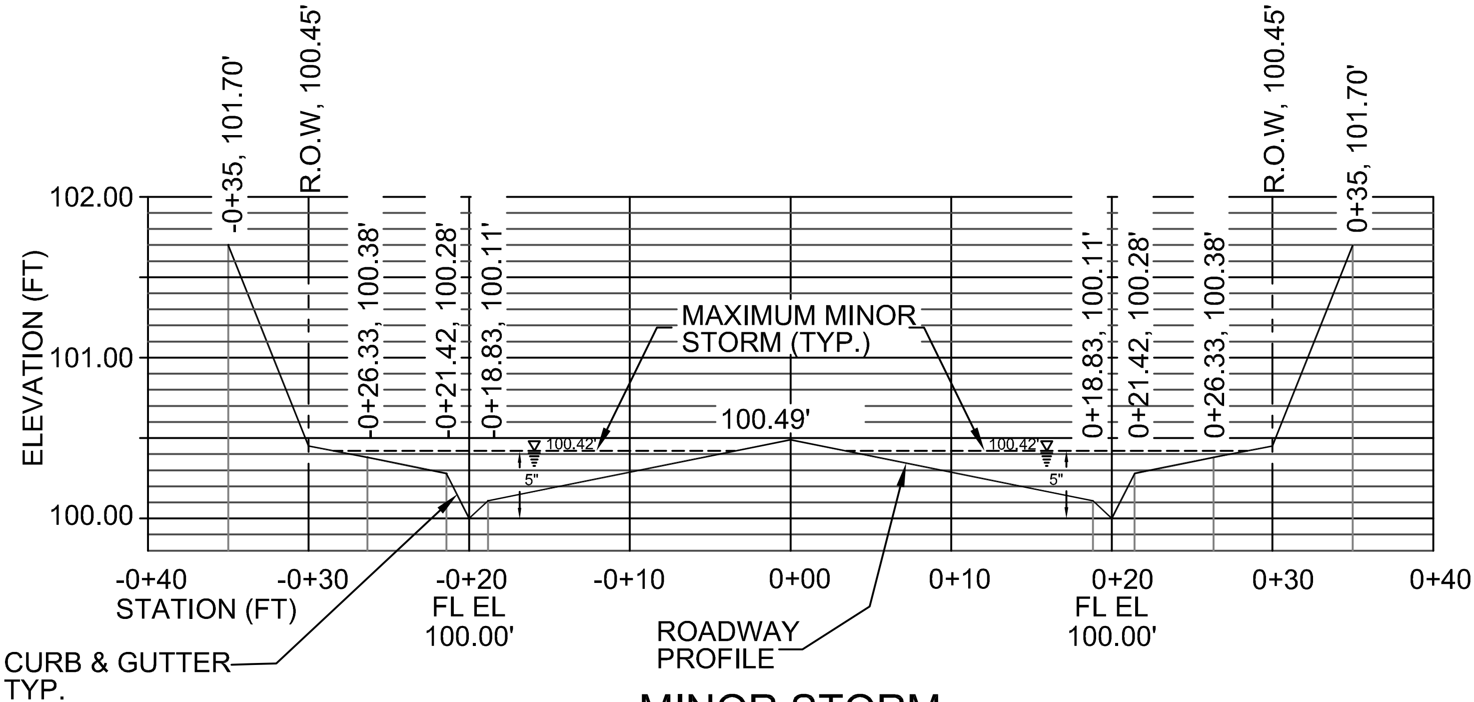
City of Greeley Colorado
Great. From the Ground Up.

STANDARD ROADWAY SECTION

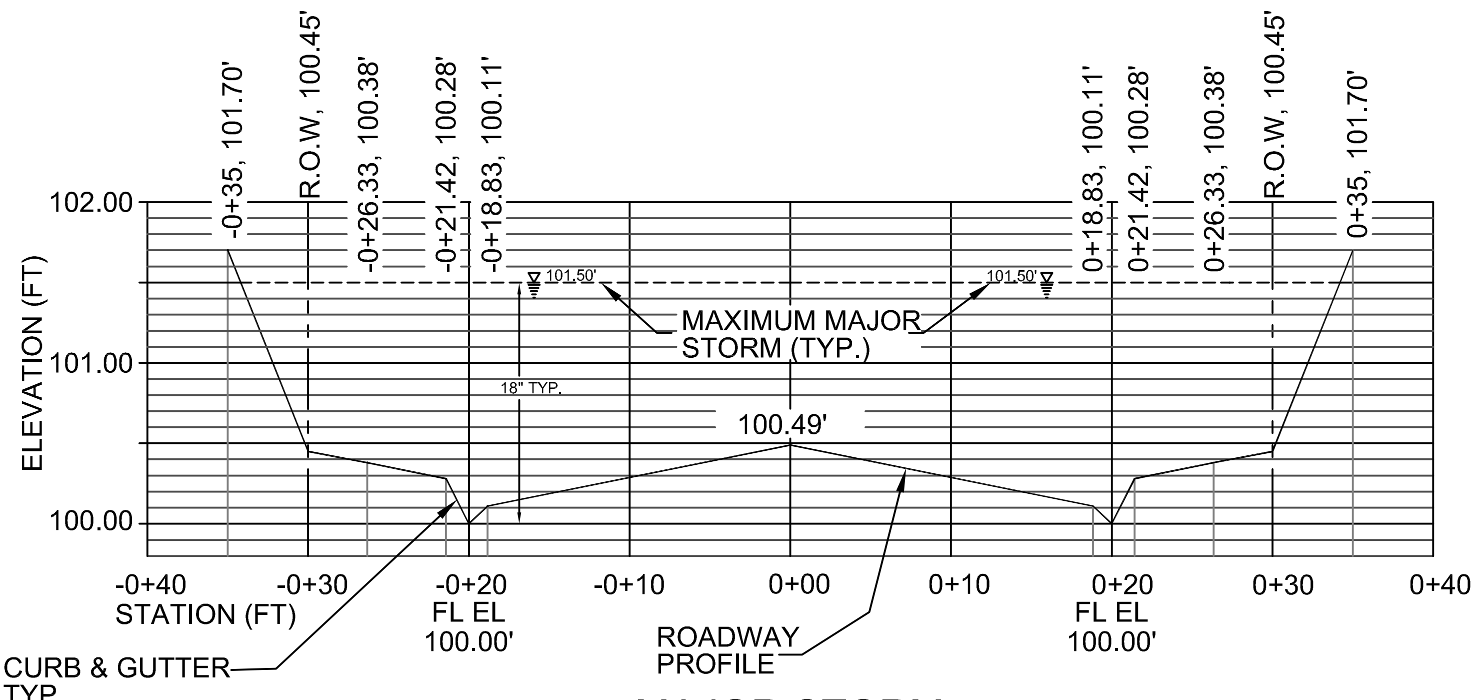
FIGURE 8-5

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

SCALE: NTS
REVISED MARCH 2007



MINOR STORM
LOCAL COMMERCIAL/INDUSTRIAL & RESIDENTIAL
ROLLOVER CURB WITH 5" OF WATER DEPTH AT FL



MAJOR STORM
LOCAL COMMERCIAL/INDUSTRIAL & RESIDENTIAL
ROLLOVER CURB WITH 18" OF WATER DEPTH AT FL

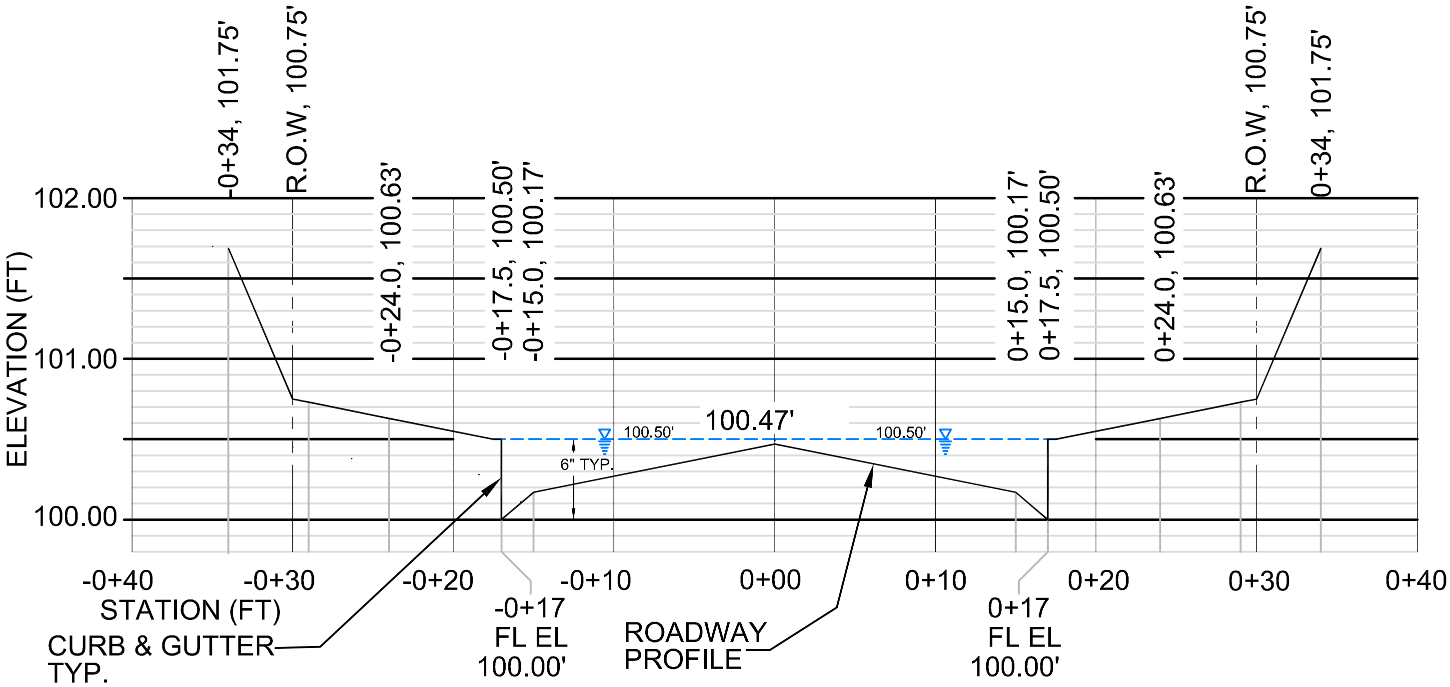
City of Greeley Colorado
Great. From the Ground Up.

STANDARD ROADWAY SECTION

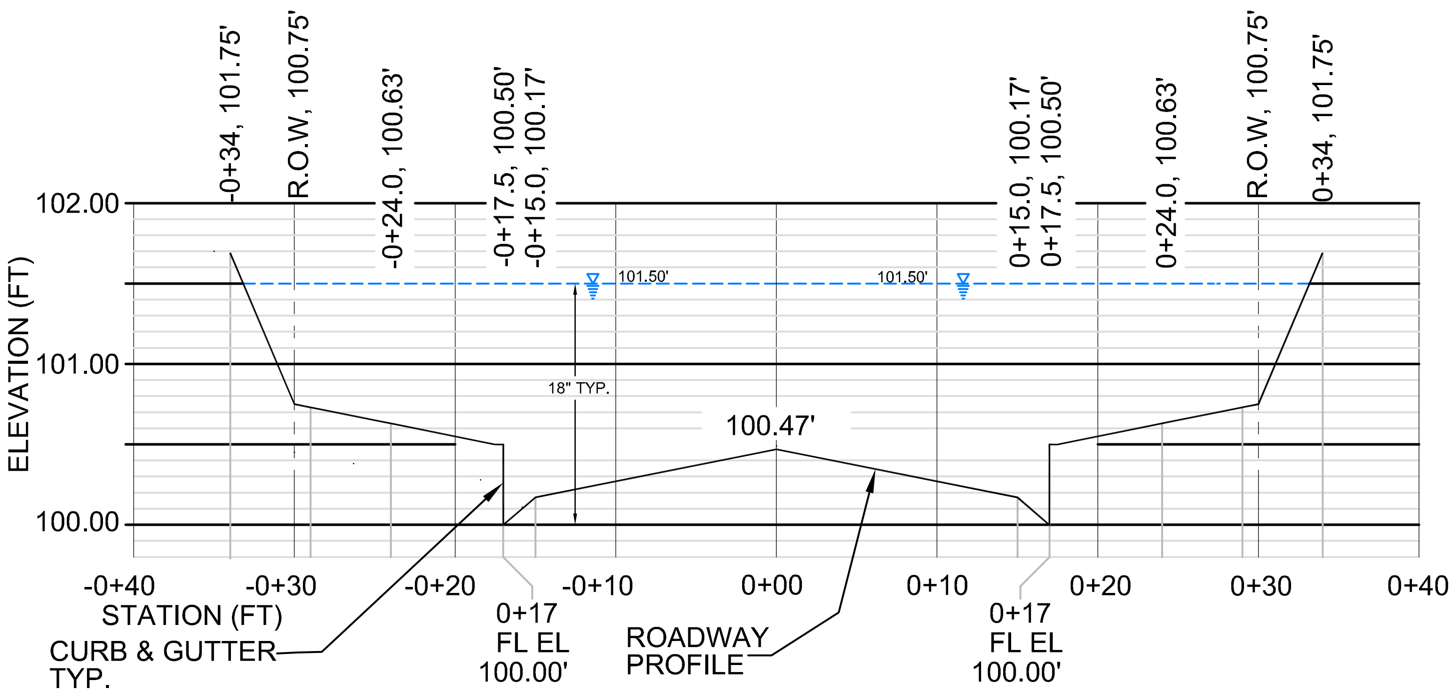
FIGURE 8-6

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

SCALE: NTS
REVISED MARCH 2007



MINOR STORM
PERFORMANCE OPTION 14
VERTICAL CURB WITH 6" OF WATER ABOVE FL



MAJORSTORM
PERFORMANCE OPTION 14
VERTICAL CURB WITH 18" OF WATER ABOVE FL

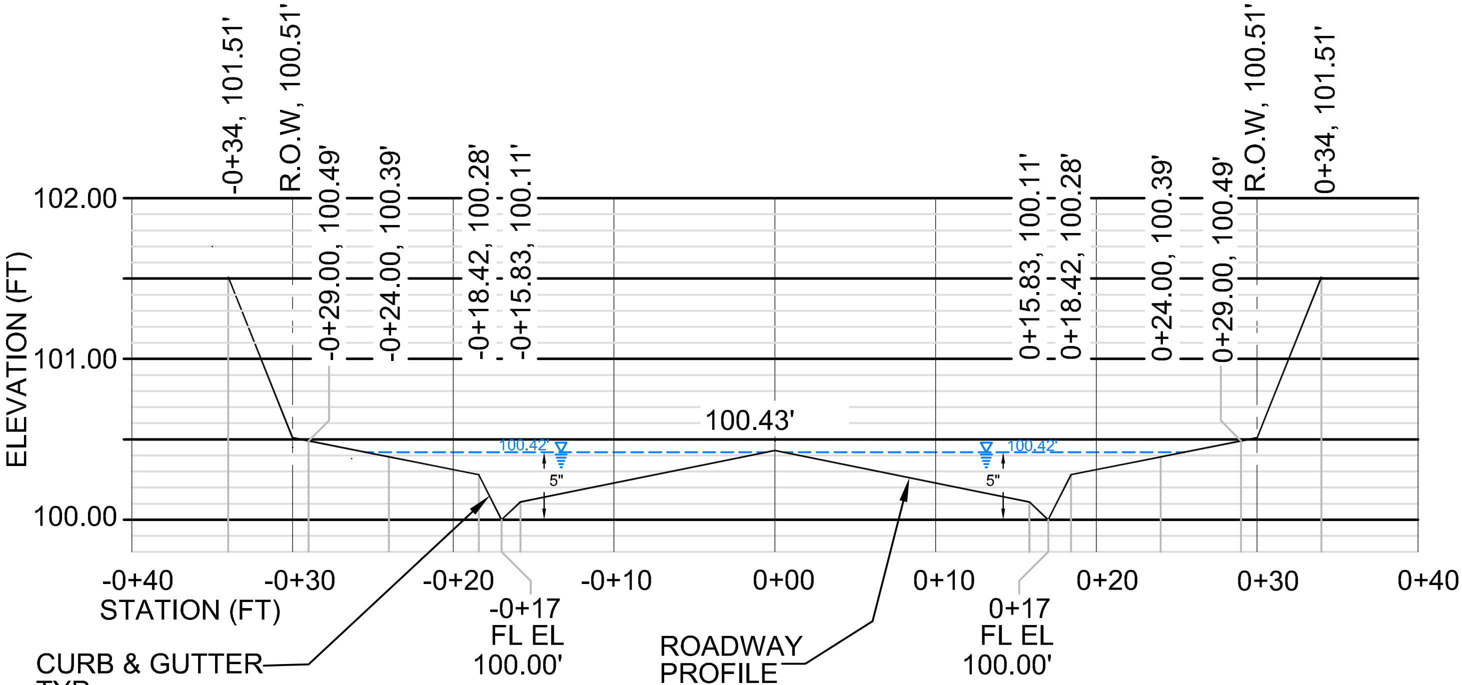
City of Greeley Colorado
Great. From the Ground Up.

STANDARD ROADWAY SECTION

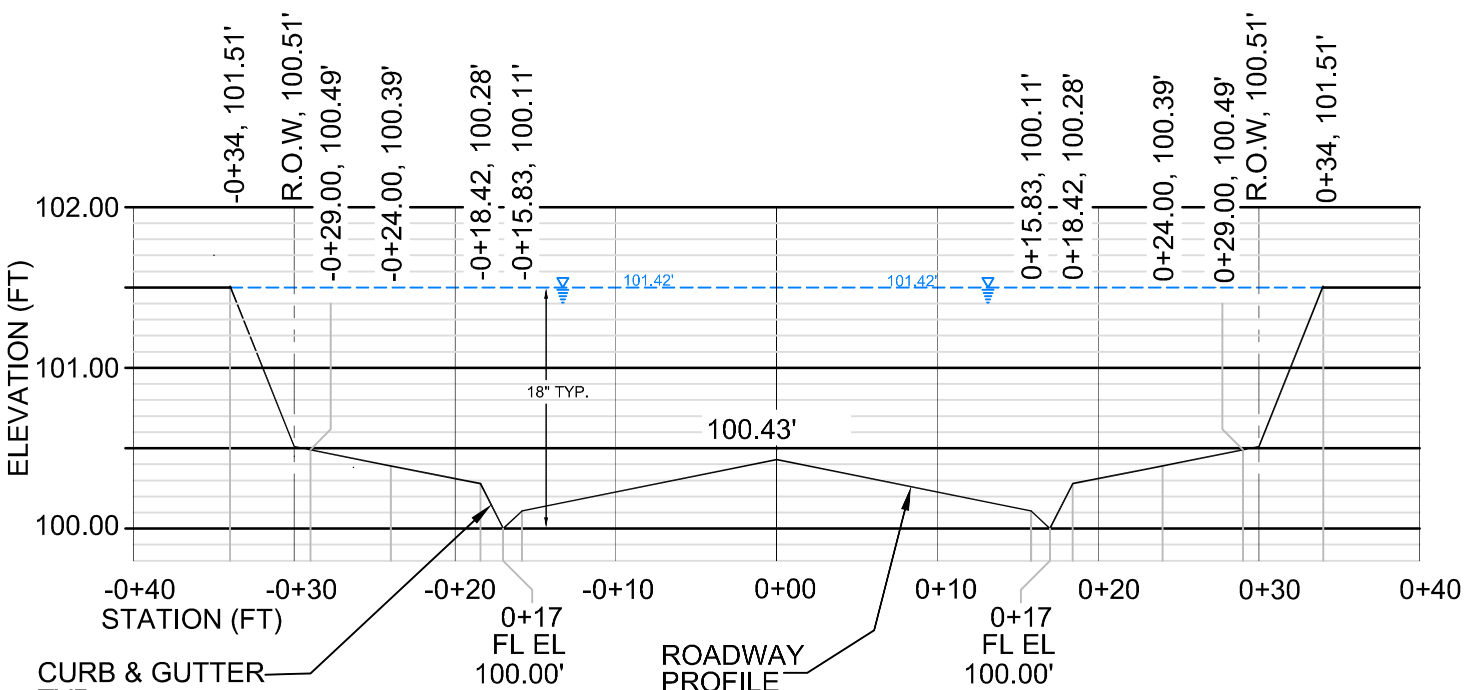
FIGURE 8-7

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

SCALE: NTS
REVISED MARCH 2007



MINOR STORM
PERFORMANCE OPTION 14
ROLLOVER CURB WITH 5" OF WATER DEPTH AT FL



MAJOR STORM
PERFORMANCE OPTION 14
ROLLOVER CURB WITH 18" OF WATER DEPTH AT FL

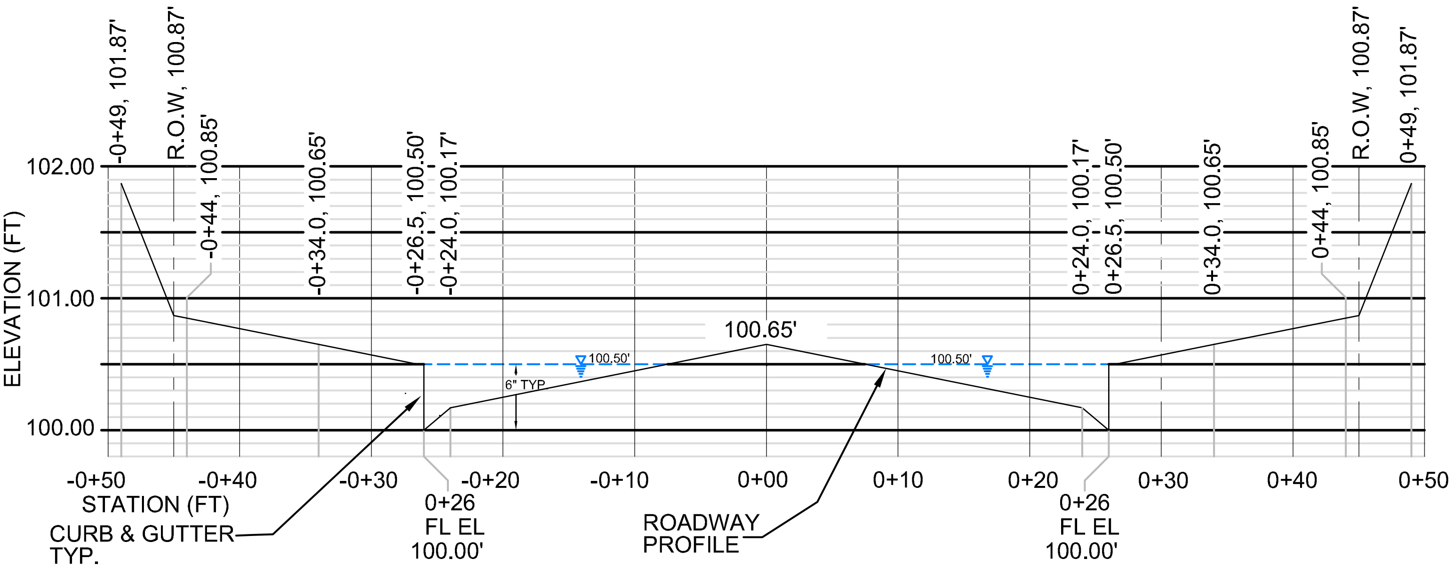
City of Greeley Colorado
Great. From the Ground Up.

STANDARD ROADWAY SECTION

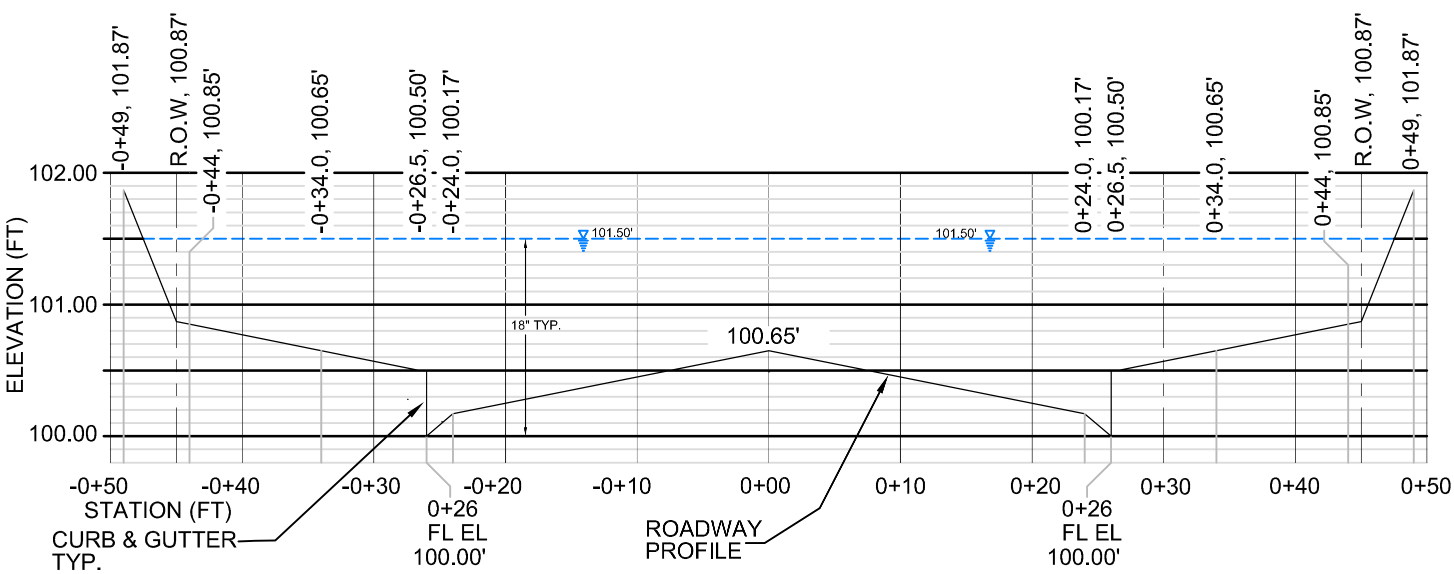
FIGURE 8-8

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

SCALE: NTS
REVISED MARCH 2007



MINOR STORM
MINOR COLLECTOR
VERTICAL CURB WITH 6" OF WATER ABOVE FL



MAJOR STORM
MINOR COLLECTOR
VERTICAL CURB WITH 18" OF WATER ABOVE FL

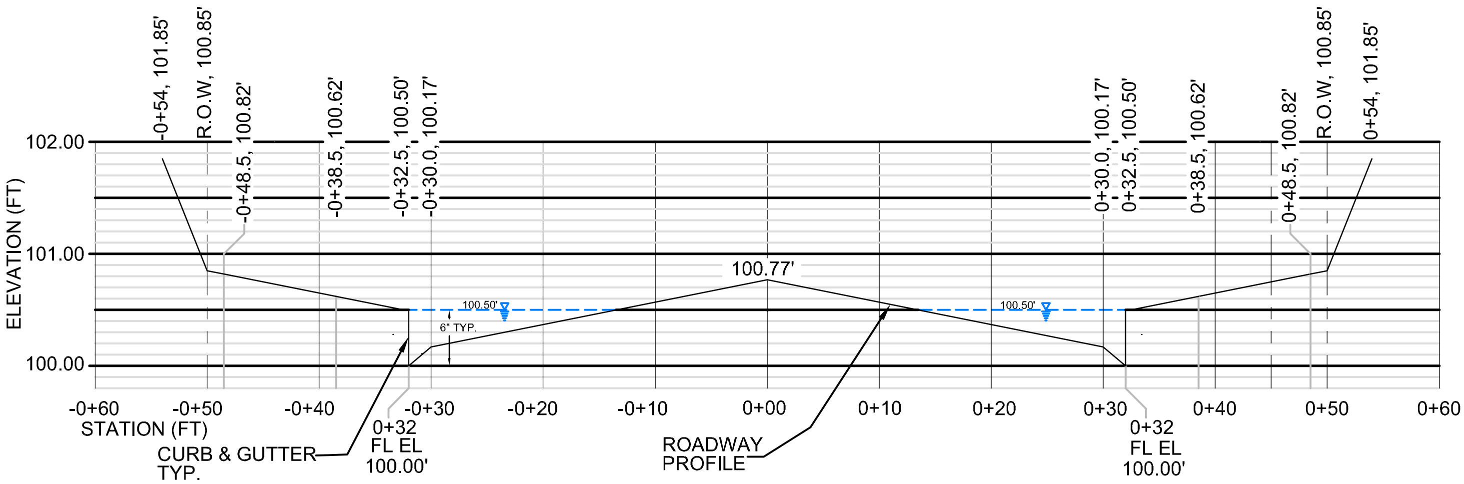
City of Greeley Colorado
Great. From the Ground Up.

STANDARD ROADWAY SECTION

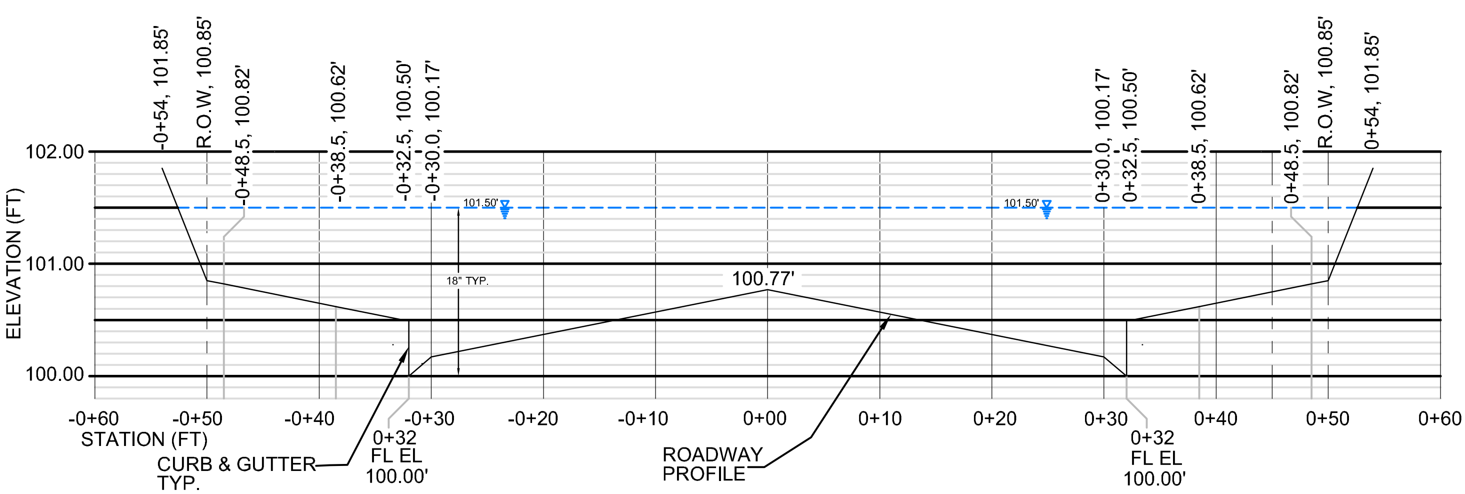
FIGURE 8-9

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

SCALE: NTS
REVISED MARCH 2007



MINOR STORM
MAJOR COLLECTOR
VERTICAL CURB WITH 6" OF WATER ABOVE FL



MAJOR STORM
MAJOR COLLECTOR
VERTICAL CURB WITH 18" OF WATER ABOVE FL

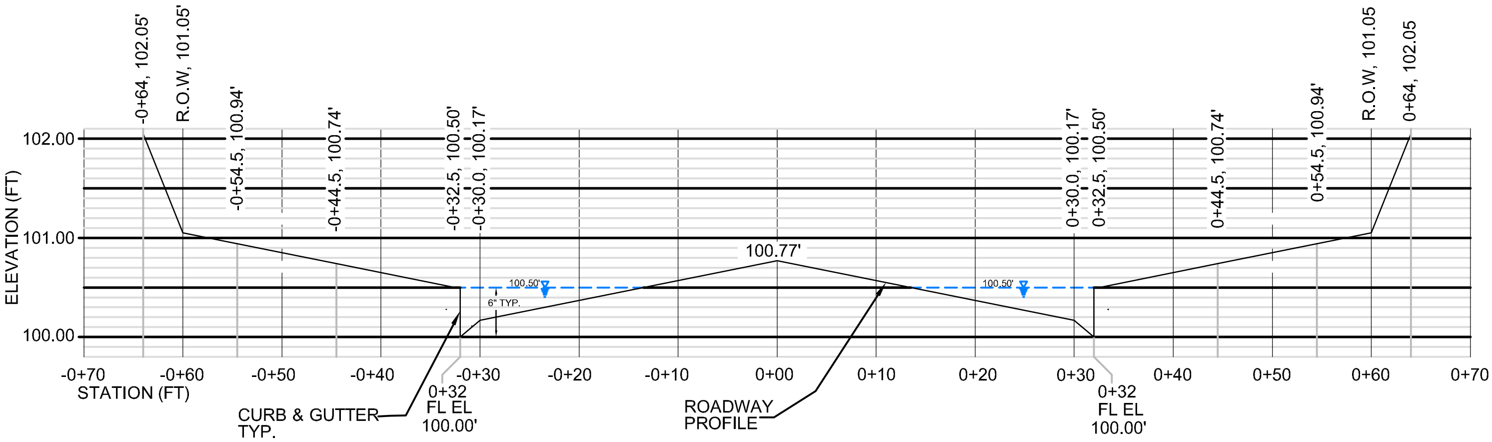
City of Greeley Colorado
Great. From the Ground Up.

STANDARD ROADWAY SECTION

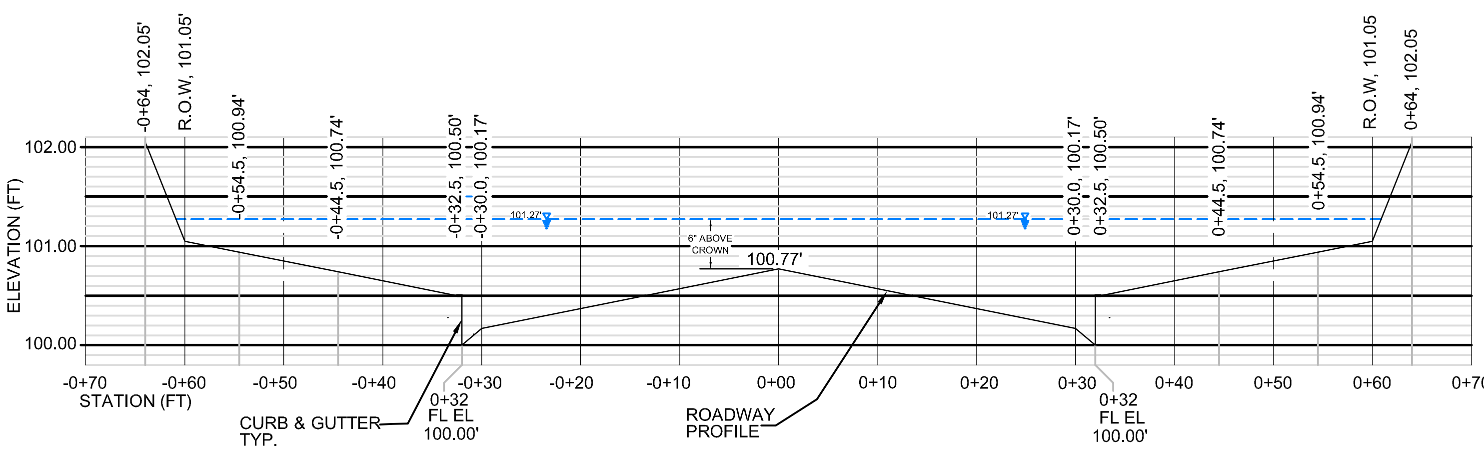
FIGURE 8-10

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

SCALE: NTS
REVISED MARCH 2007



MINOR STORM
MINOR ARTERIAL
VERTICAL CURB WITH 6" OF WATER ABOVE FL



MAJOR STORM
MINOR ARTERIAL
VERTICAL CURB WITH 6" OF WATER ABOVE CROWN

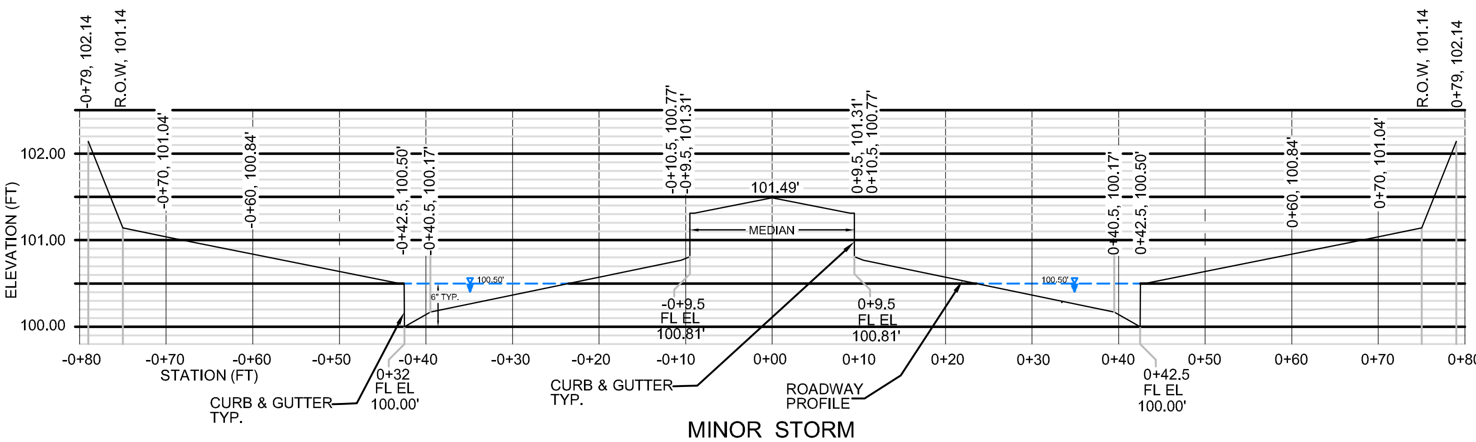
City of Greeley Colorado
Great. From the Ground Up.

STANDARD ROADWAY SECTION

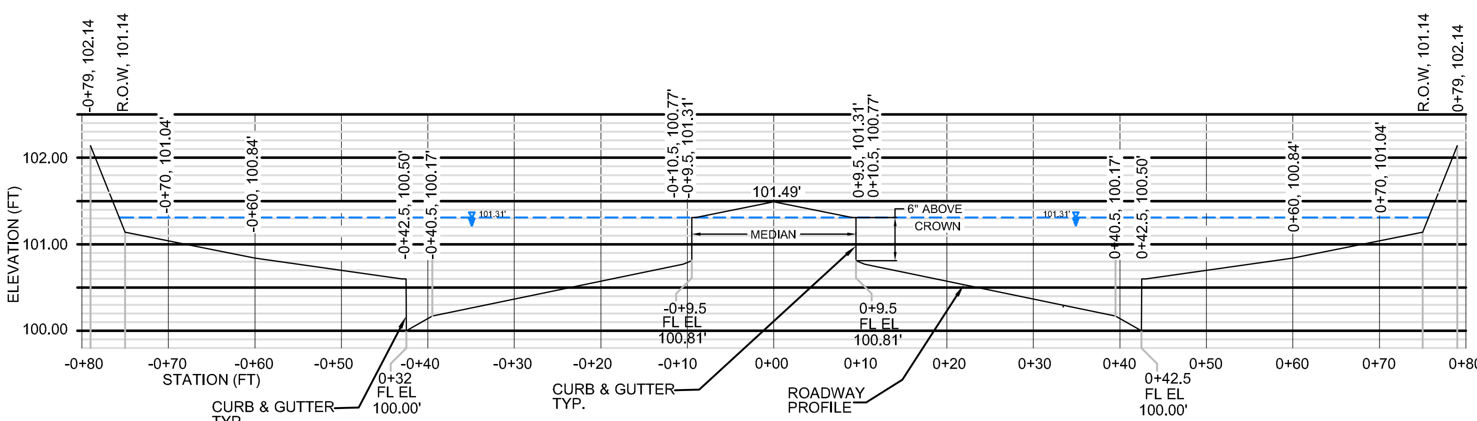
FIGURE 8-11

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

SCALE: NTS
REVISED MARCH 2007



MINOR STORM
MAJOR ARTERIAL
VERTICAL CURB WITH 6" OF WATER ABOVE FL



MAJOR STORM
MAJOR ARTERIAL
VERTICAL CURB WITH 6" OF WATER ABOVE CROWN

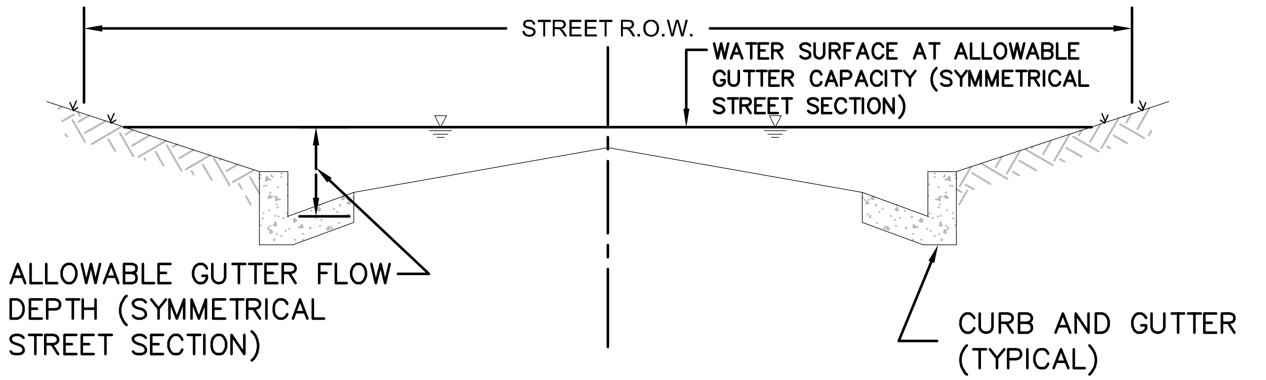
City of Greeley Colorado
Great. From the Ground Up.

STANDARD ROADWAY SECTION

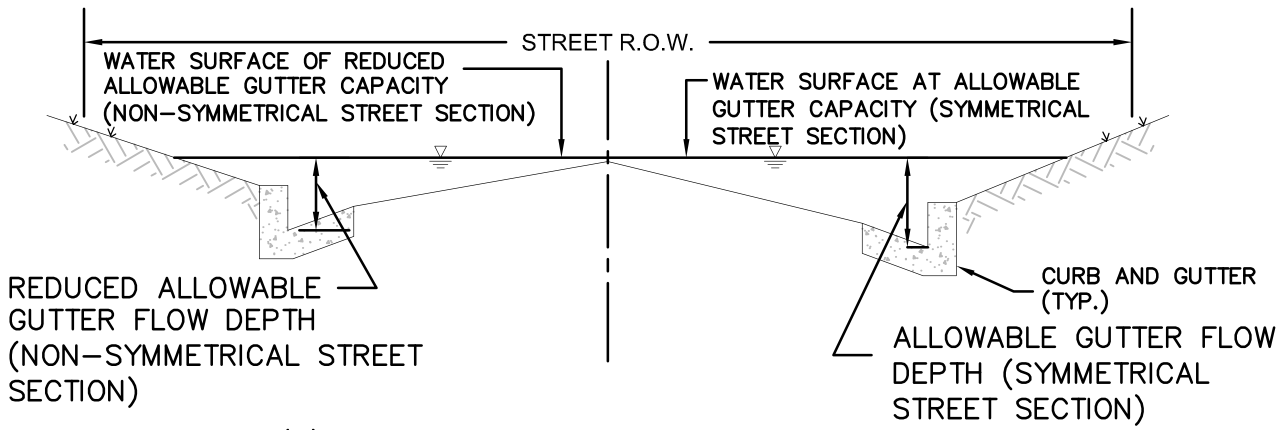
FIGURE 8-12

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

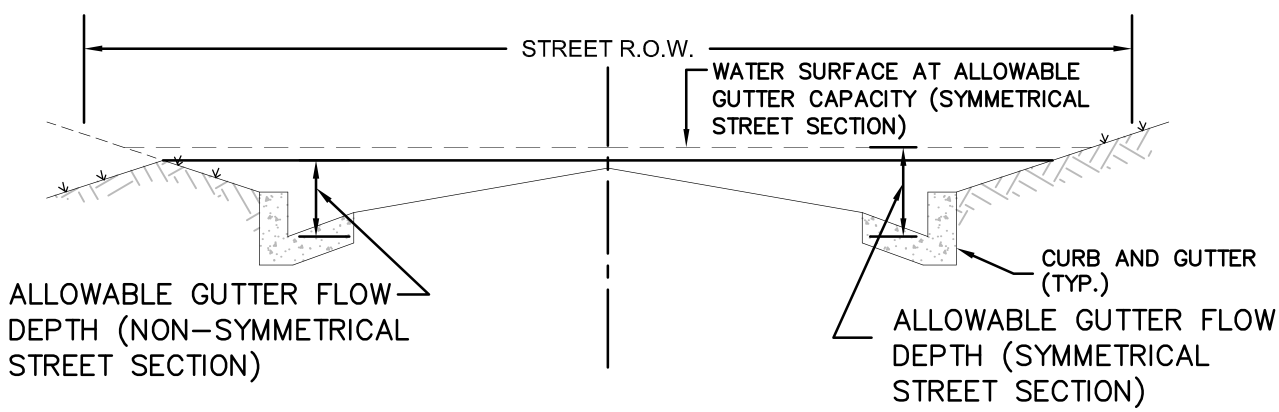
SCALE: NTS
REVISED MARCH 2007



(a) SYMMETRICAL STREET SECTION



(b) NON-SYMMETRICAL STREET SECTION I



(c) NON-SYMMETRICAL STREET SECTION II

NOTE: FOR NON-SYMMETRICAL STREET SECTION, ADJUST THE TOTAL GUTTER CAPACITY BY REDUCING THE ALLOWABLE GUTTER CAPACITY FOR THE GUTTER WITH THE HIGHER FLOWLINE OR FOR THE ENTIRE SECTION WHEN PROPERTY LINE SLOPES ARE DIFFERENT.

ADJUSTMENT FOR GUTTER CAPACITY WITH NON-SYMMETRICAL STREET SECTION MAJOR STORM

FIGURE 8-13

City of Greeley Colorado
Great. From the Ground Up.

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

SCALE: NTS
REVISED MARCH 2007