FINAL DRAINAGE REPORT FOR SOPRESSA EAST ADDITION FILING NO. 1

OCTOBER 2019

Revised May 2020

Prepared for:

CHALLENGER HOMES
8605 EXPLORER DRIVE #250
COLORADO SPRINGS, CO 80920

Prepared By:

CATAMOUNT ENGINEERING
PO BOX 221
Woodland Park, CO 80866
719-426-2124

JOB NUMBER:18-169

FINAL DRAINAGE REPORT FOR
SOPPRESSA EAST ADDITION FILING NO. 1

Engineer's Statement:

This report and plan for the drainage design of SOPRESSA EAST ADDITION FILING NO. 1 was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

_____ _____

David L. Mijares, Colorado PE #40510 Date

For and on behalf of Catamount Engineering

Developer's Statement:

CHALLENGER HOMES hereby certifies that the drainage facilities for SOPRESSA EAST ADDITION FILING NO. 1 shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of SOPRESSA EAST ADDITION FILING NO. 1 guarantee that final drainage design review will absolve CHALLENGER HOMES and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

CHALLENGER HOMES

Name of Developer

_____

Authorized Signature Date

_____

Printed Name

_____

Title

_____

_____

_____

Address

City of Colorado Springs Only:

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

_____ _____

For City Engineer Date

CONDITIONS:

FINAL DRAINAGE REPORT FOR
SOPPRESSA EAST ADDITION FILING NO. 1

PURPOSE

The purpose of this drainage report is to identify existing drainage patterns and establish outfall scenarios from the proposed development. The site is contained within the Cottonwood Creek Drainage Basin and outfalls to the Sopressa Lane Storm Sewer System installed with the Cumbre Vista and Woodmen Vista Developments, and designed in the Sopressa Lane Storm Sewer report, by Matrix Design Group, Inc, dated July 2007. The parcel was previously studied in the "Final Drainage Report for Woodmen Vista Filing No. 1 & 2 and Amendment to the Master Development Drainage Report for Cumbre Vista Subdivision", by Matrix Design Group, Inc.", approved November 16, 2007. Development of Sopressa East Addition Filing No. 1 requires development of water quality and full spectrum detention.

GENERAL LOCATION AND DESCRIPTION

The Sopressa East Addition development is located within the SE ¼ of Section 16 Township 13 South and Range 65 West of the 6th principal meridian. The proposed residential filing contains approximately 8.893 acres to be developed within the City of Colorado Springs and currently completing annexation. The proposed development is bounded to the north by a gravel portion of existing Sopressa Road and the Cumbre Vista subdivision, to the east by rural residential(unplatted) lots within El Paso County, to the South by the Lodge at Black Forest Subdivision (multi-family residential), and to the east by both the Woodmen Vistas residential subdivision Filing No. 2 and 3 unplatted rural residential lots within El Paso County.

The proposed residential development consists of 70 PUD residential lots, roadway infrastructure, and, greenspace. An existing residence within the southwest portion of the development within an unplatted County parcel will be demolished and included in the redevelopment area.

Existing soils on the site consist of Blakeland Loamy Sand (Hydrologic Group 'A') and Stapleton-Bernal sandy loams (Hydrologic Group 'B'). Soils have been identified as determined by the Natural Resources Conservation Service Web Soil Survey. Hydrologic Group 'B' soils have been used in hydrologic calculations. The easterly portion of the parcel sits on the physical boundary between the Cottonwood Creek and Sand Creek basins, while the parcel is located within the political boundary of the Cottonwood Creek basin. The parcel is divided by a predominant ridge with the southerly and westerly portions draining overland to the west and into rear yard swales constructed with development of the Woodmen Vista Filing No. 2 subdivision; and northerly portions of the site draining overland south to unimproved Sopressa Road.

Existing vegetation on the site consist of moderate cover of native shrubs and grasses throughout the majority of the site. Cover is limited in the portion of the site where the existing county residence was demolished in preparation of development and within the northeasterly portion of the site.

No portion of the development is contained within a FEMA designated floodplain per FIRM panel 08041C0529 G, effective December 07, 2018.

EXISTING DRAINAGE

The parcel was previously studied in the Final Drainage Report for Woodmen Vista Filing No. 1 & 2 and Amendment to the Master Development Drainage Report for Cumbre Vista Subdivision" and the analysis has been accepted for this report.

The report indicates 3 historic basins within the Sopressa East Addition Filing No. 1 development. Basin OS-1 (7.17 acres, Q_5=8.4 cfs, Q_{100}=18.7 cfs) contains the northern and eastern portion of the development and a portion of the rural residential lots east of the parcel. Basin OS-1 drains directly to existing gravel portions of Sopressa Lane. Runoff is collected within a 15' D10R inlet (catch basin #1/Woodmen Vista-FDR) located within Sopressa Lane.

Basin OS-2 (3.21 acres, Q_5=2.4 cfs, Q_{100}=5.1 cfs) contains the central westerly portion of the development and the 3 unplatted residential lots west of the development. Basin OS-2 drains into rear yards and is directed along lot line swales constructed with the development of the Woodmen Vista Subdivision to Crestone Peak Trail and then west along Sopressa Lane to Inlet #2/Woodmen Vista FDR.

Basin OS-3 (4.31 acres, Q_5=3.0 cfs, Q_{100}=6.3 cfs) drains into rear yards and is directed along lot line swales constructed with the development of the Cumbre Vista Subdivision to Crestone Peak Trail and then west along Sopressa Lane to Inlet #2/Woodmen Vista FDR. A City Standard D-21 Curb inlet was installed coincident with the lot line between lots 10 and 11, Woodmen Vista Filing No. 2 per the Woodmen Vista FDR to accept off-site flows from Basin OS-3.

The Woodmen Vista FDR/Cumbre Vista MDDP Amendment states that the 30" RCP constructed per the Sopressa Lane Storm Sewer Plans is designed to accommodate the developed flows from off-site sub-basins and that since future developed conditions are less than those under the interim developed conditions, design points within the Woodmen Vista subdivision will remain unchanged and assume that adjacent developments discharge flows onto Woodmen Vista.

DEVELOPED DRAINAGE BASINS

The intent of the proposed development is to follow closely to historic drainage patterns while satisfying current City of Colorado Springs development and water quality criteria. The area of the site proposed for impervious development will be contained within the parking/private roadway section and private on-site storm sewer system conveying flows to through full spectrum detention basin and water quality facilities prior to outfall offsite.

Development of the site includes 70 residential lots, roadway and utility infrastructure to be constructed in 1 filing. Due to substantial grade within the site the parcel will drain to two private extended detention basins for water quality and full spectrum detention. EDB A will accept and detain flows from developed basins within the development.

Generated storm runoff will be conveyed in on-site private crowned and curbed roadway sections. Flows will be collected in type 'R' inlets and conveyed in private HDPE storm sewer to outfall within proposed full-spectrum detention basins prior to release off-site. Due to the parcel being located on the physical ridge between Major drainage basins no off-site flows enter the site.

'A Basins'

BASIN	AREA	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Type R Inlet
A1	0.04	0.1	0.2	0.2	0.3	0.3	0.3	5'
A2	0.12	0.3	0.4	0.4	0.6	0.6	0.8	5'
A3	0.30	0.3	0.5	0.6	0.8	1.0	1.1	5'
A4	0.43	1.1	1.5	1.8	2.2	2.5	2.9	15' INLET 1
A5	1.29	2.0	2.6	3.3	4.1	4.8	5.6	5'
A6	0.37	0.8	1.0	1.2	1.5	1.8	2.0	5'
A7	1.36	2.2	3.0	3.7	4.6	5.4	6.2	5'
A8	1.59	3.0	4.0	5.0	6.1	7.1	8.1	5'
A9	0.28	0.4	0.5	0.7	0.8	1.0	1.1	FES
A10	0.59	1.4	1.8	2.2	2.7	3.2	3.6	10'
A11	0.57	0.1	0.3	0.6	1.1	1.4	1.8	EDB A

Flows collected within 'A' designated basin inlets will be conveyed in a private storm sewer system located predominantly within the street ROW which outfalls to private extended detention basin 'A'. Manning's equation calculations are provided in the appendix of this report. Hydraulic Grade Line Calculations will be developed in an addendum with storm sewer design.

Basin A1 consists of the easterly portion of the northeasterly private roadway and will sheetflow to the roadway curb and gutter and be collected in a private 5' Type R at grade inlet. Flows will be conveyed in a private 12" HDPE storm sewer to Pipe Design Point 1.

Basin A2 consists of the westerly portion of the northeasterly private roadway, proposed parking, and landscape area. Runoff will sheetflow to the roadway curb and gutter and collected in a private 5' Type R at grade inlet. Pipe Design Point 1 (Q_5=0.5 cfs and Q_{100}=1.1) will be conveyed in a private 12" HDPE storm sewer to Pipe Design Point 2.

Basin A3 consists of the northerly residential lots and landscape area. Runoff will sheetflow to the north and be collected within private area drains. Pipe Design Point 2 (Q_5=0.9 cfs and Q_{100}=2.0) will be conveyed in a private 12" HDPE storm sewer to EDB A.

Basin A4 consists of the northerly portion of the development containing landscaped area and existing Sorpresa Roadway right of way. Runoff will sheetflow to the Sorpresa roadway curb and gutter and be conveyed west to the existing 15' D-10-R inlet (Inlet 1 per the Woodmen Vistas FDR). Flows will be conveyed in the existing 48" public RCP to the water quality /detention facility constructed with the MDDP for the Cumbre Vista development sized to accept developed flows from this basin.

Basin A5 consists of the easterly portion of the easterly private roadway and residential 'A' lots and will sheetflow to the roadway curb and gutter. Flows conveyed in the curb and gutter section will be collected in a private 5' Type R sump inlet. Flows will be conveyed in a private 15" HDPE storm sewer to Pipe Design Point 4. In a failed inlet condition emergency overflow will be conveyed west within the roadway section to the 10' sump inlet adjacent to proposed EDB A.

Basin A6 consists of the westerly portion of the easterly private roadway and front yards of residential 'B' lots and will sheetflow to the roadway curb and gutter. Flows conveyed in the curb and gutter will be collected in a private 5' Type R sump inlet. Pipe Design Point 4 (Q_5=3.5 cfs and Q_{100}=7.3) will be conveyed in a private 15" HDPE storm sewer to Pipe Design Point 5. In a failed inlet condition emergency overflow will be conveyed west within the roadway section to the 10' sump inlet adjacent to proposed EDB A.

Basin A7 consists of the roadways and residential lots within the central portion of the development and will sheetflow to the roadway curb and gutter. Flows conveyed in the curb and gutter will be collected in a private 5' Type R sump inlet. Pipe Design Point 5 (Q_5=6.4 cfs and Q_{100}=13.3) will be conveyed in a private 18" HDPE storm sewer to Pipe Design Point 6. In a failed inlet condition emergency overflow will be conveyed west within the roadway section to the 10' sump inlet adjacent to proposed EDB A.

Basin A8 consists of the westerly portion of the westerly north-south private roadway and front yards of residential 'B' lots and will sheetflow to the roadway curb and gutter. Flows conveyed in the curb and gutter will be collected in a private 5' Type R sump inlet. Pipe Design Point 6 (Q_5=10.5 cfs and Q_{100}=21.8) will be conveyed in a private 24" HDPE storm sewer to Pipe Design Point 7. In a failed inlet condition emergency overflow will be conveyed west within the roadway section to the 10' sump inlet adjacent to proposed EDB A.

Basin A9 consists of the easterly portion of residential 'B' lots 66-70. Runoff will sheetflow to a rear yard swale and be conveyed to a 12" FES and HDPE storm along the northerly lot line of Lot 70 and outfall to the proposed 5' sump inlet and Pipe Design Point 6. Swale design and 12" storm pipe headwater calculations are included in the appendix. In a failed inlet condition emergency overflow will be conveyed west within the roadway section to the 10' sump inlet adjacent to proposed EDB A.

Basin A10 consists of residential lots and roadway within the northern portion of the development. Generated runoff will sheetflow to the roadway curb and gutter. Flows conveyed in the curb and gutter will be collected in a private 10' Type R sump inlet. Pipe Design Point 7 (Q_5=12.0 cfs and Q_{100}=24.8) will be conveyed in a private 24" HDPE storm sewer to extended detention basin A at Design Point A1. In a failed inlet condition emergency overflow will overtop the curb and be conveyed directly to the adjacent EDB. The inlet size was increased to mitigate possibility of failed upstream inlets and local inlet clogging.

Basin A11 consists of landscaped area and the proposed extended detention basin. and will sheetflow directly to proposed private full spectrum extended detention basin A at Design Point A1.

Design Point A1 (Q_2=11.6 cfs, Q_5=15.7 cfs, Q_{10}=19.9 cfs, Q_{25}=24.8 cfs, Q_{50}=29.3 cfs, and Q_{100}=33.9 cfs) represents the site contribution to extended detention basin A.

'B Basins'

BASIN	AREA	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Type R Inlet
B1	1.62	2.7	3.6	4.5	5.5	6.4	7.4	10'
B2	0.28	0.4	0.6	0.7	0.9	1.1	1.3	Area Drains

Flows collected within 'B' designated basin inlets will be conveyed in a private storm sewer system within proposed roadway sections and adjacent Ski Lane easement easterly and northerly to proposed extended detention basin A. Manning's equation calculations are provided in the appendix of this report. Hydraulic Grade Line Calculations will be developed in an amendment to the Final Drainage Report at time of storm sewer submittal.

Basin B1 consisting of proposed private roadway and residential lots within the southwesterly portion of the development will sheetflow to the roadway curb and gutter and be collected in a private 10' Type R at grade inlet at design point 8. Flows will be conveyed in a private 15" to extended detention basin B at Design Point B1. Emergency overflow in a failed inlet condition will be directed to the lot line between lots 10 and, Woodmen Vista Filing No. 2 because "flow conveyed along the lot line between lot 10 and 11 coincides with an existing adjacent low point a City Standard D-21 curb opening is proposed to allow flow to enter the street unimpeded" per the Woodmen Vista FDR. The inlet size was increased from 5' to 10' to provide excess capacity in the case of a clogged inlet condition.

Basin B2 consisting of rear yards of lots within the southwest portion of the development adjacent to existing El Paso County residential lots. The rear portions of lots will drain north to a proposed private 8" HDPE storm pipe with atrium inlets located along alternating property lines. Runoff collected will be conveyed east in the proposed 8" HDPE to confluence with the proposed 15" HDPE at storm sewer design point 8. Pipe Design Point 8 (Q_5=3.4 cfs and

Q_{100}=7.6) will be conveyed in a private 15" HDPE storm sewer to extended detention basin A at Design Point A1

'C Basins'

Basin C1 (0.31 Acres, Q_2=0.1 cfs, Q_5=0.2 cfs, Q_{10}=0.3 cfs, Q_{25}=0.6 cfs, Q_{50}=0.7 cfs, and Q_{100}=1.0 cfs) represents the westerly limits of the development. Basin C1 will contain landscaped area and walls and sheetflow westerly into the Woodmen Vistas subdivision.

EXTENDED DETENTION BASINS

The parcel proposes to develop 8.893 acres within the Cottonwood Creek Drainage requiring development of water quality treatment and full-spectrum detention per the criteria of the City of Colorado Springs Drainage Criteria Manual Volume 2. The overall site exhibits a 50.6% effective imperviousness per the LID IRF calculation.

EDB A
The proposed Extended Detention Basin located in the northerly portion of the development has 48.41 tributary acres of development with an average imperviousness of 50.6%. Full spectrum pond development requires 0.146 acre-ft of water quality capture volume ponding to an elevation of 6974.99, an EURV volume of 0.329-acre ft, and a total volume of 0.786 acre-ft ponding to an elevation of 6978.08 providing full spectrum detention including the 100-YR event.

Runoff generated within the site will be conveyed to the pond through storm sewer systems or as direct sheetflow. The storm sewer systems will outfall directly to 6" concrete forebays with baffle providing adequate protection at discharge point. The concrete forebays require a total volume of 131 cubic feet of volume (2% of the design WQCV). The forebay will be constructed of a concrete slab with sides conforming to the pond slopes and 1' wall with a 4.2" rectangular notch which outfalls to the proposed trickle channel at the downstream end.

The pond will be constructed with 4:1 minimum side slopes to be vegetated per the final landscape plan. A 2' wide by 6" deep concrete trickle channel with a 0.5% longitudinal slope will convey low flows across the pond bottom to the micropool/outlet structure. The trickle channel will outfall to a 10' long by 4' wide by 2.5' deep concrete micropool. The micropool will provide a surface area of 20 square feet and an initial surcharge volume of 13.4 cubic feet utilizing an 8" initial surcharge depth.

The outlet structure will consist of a concrete box with orifice plate and screen providing water quality outlet and weir with trash rack for larger storm outfall. The pond will outfall through a private 18" HDPE pipe system to existing storm sewer within Sopressa Drive sized to accept developed flows from the parcel. The storm system conveys flows directly to Cottonwood Creek.

The emergency spillway will consist of a 10' weir along the northerly end of the pond at an elevation of 6980.00. The weir will convey developed undetained flows a depth of 0.78' and consist of 24" depth of type M soil riprap.

Outfall from the extended detention basin of Q_2=0.1 cfs, Q_5=0.2 cfs, Q_{10}=2.7 cfs, Q_{25}=7.5 cfs, Q_{50}=8.6 cfs, and Q_{100}=9.0 will be conveyed in private and public 18" RCP to the existing 30" RCP stub constructed for parcel outfall.

4-STEP PROCESS

RUNOFF REDUCTION

The development addresses Low Impact Development strategies primarily through the utilization of landscape swales within sides and rear of proposed residential lots and directing runoff from buildings and walkways through swales with minimal longitudinal grade prior to outfall to street collection and storm conveyance systems. The IRF Spreadsheet has been provided.

TREAT AND SLOW RELEASE

On-site flow is directed to the on-site private proposed full spectrum extended detention basins constructed with development of the project which outfall to outfalls specified in the MDDP amendment. The extended detention basin provides Water Quality Capture Volume required and attenuates release of flows to approximate historic runoff.

CHANNEL STABILIZATION

The ultimate recipient of runoff from the site is Cottonwood Creek. Flows generated within the site are tributary to proposed full spectrum extended detention basins constructed on site. Fees are due with parcel development to assist in basin wide channel improvements. The parcel was anticipated in the overall Master Development Drainage Plan for the Cumbre Vista development and outfalls to existing storm sewer systems. Runoff from the site is conveyed in approximately 4,300 LF of public storm sewer system prior to protected outfall within the Cottonwood Creek drainage.

SOURCE CONTROLS

A Grading, Erosion Control, and Stormwater Quality Plan and narrative will be approved by City of Colorado Springs prior to any soil disturbance. The erosion control plan will include specific source control BMP's as well as defined overall site management practices for the construction period. The grading narrative will address materials storage and spill containment during construction operations. No permanent sources of erosion are anticipated with the residential development.

COST ESTIMATE

Private Improvements Non-reimbursable

5' Type R Inlet	6	EA	@$	3,800/EA	$	22,800
10' Type R Inlet	2	EA	@$	5,500/EA	$	11,000
Type 1 MH	2	EA	@$	3,000/EA	$	6,000
12" HDPE	161	LF	@$	25/LF	$	4,025
15" HDPE	995	LF	@$	30/LF	$	29,850
18" HDPE	31	LF	@$	38/LF	$	1,178
24" HDPE	68	LF	@$	50/LF	$	3,400
WATER QUALITY POND	1	EA	@$	25,000/EA	$	25,000
			SUBTOTAL		**$**	**103,253**
			10% CONTINGENCY		*$*	*10,325*
			TOTAL		**$**	**113,578**

Public Improvements Non-reimbursable

Type 1 MH	2	EA	@$	3,000/EA	$	6,000
18" HDPE	325	LF	@$	31/LF	$	10,075
			SUBTOTAL		**$**	**16,075**
			10% CONTINGENCY		*$*	*1,608*
			TOTAL		**$**	**17,683**

DRAINAGE FEE CALCULATION

Sopressa East Addition Filing No. 1 contains 8.883 acres to be platted within the Cottonwood Creek Drainage Basin. (2020 FEES)

COTTONWOOD CREEK

8.833 Acres X $ 14,356/Acre =	$ 126,806.55(Drainage Fee)
8.833 Acres X $ 1,175/Acre =	$ 10,378.78 (Bridge Fee)
8.833 Acres X $ 752/Acre =	$ 6,680.02 (Surcharge)

DRAINAGE METHODOLOGY

This drainage report was prepared in accordance to the criteria established in the City of Colorado Springs/El Paso County Drainage Criteria Manual Volumes 1 and 2, as revised May 2014.

The rational method for drainage basin study areas of less than 100 acres was utilized in the analysis. For the Rational Method, flows were calculated for the 2, 5, 10, 25, 50, and 100-year recurrence intervals. The average runoff coefficients, 'C' values, are taken from Table 6-6 and the Intensity-Duration-Frequency curves are taken from Figure 6-5 of the City Drainage Criteria Manual. Time of concentration for overland flow and storm drain or gutter flow are calculated per Section 3.2 of the City Drainage Criteria Manual. Calculations for the Rational Method are shown in the Appendix of this report.

Urban Drainage and Flood Control District methodology was utilized for determination of street capacity, inlet sizing, and extended detention basin design. UD-Inlet Version 4.05 was utilized in street capacity and inlet sizing calculations. UD-Culvert Version 3.05 was utilized in developing preliminary pipe sizing. Details and analysis of final storm drain conveyance and collection system will be developed in an addendum to the final drainage report submitted with Private Storm Sewer Plans for Sopressa East Addition Filing No. 1 Subdivision. Preliminary sizing calculations were provided in the appendix of this report. UD-Detention version 3.07 was utilized in development of extended detention basin and outfall. Calculations are included in the appendix of this report.

SUMMARY

Development of Sopressa East Addition Filing No. 1 will require that flows be treated for water quality and be detained to historic levels prior to release from the site. Site runoff and storm drain and appurtenances will not adversely affect the downstream and surrounding developments. This report is in general conformance with all previously approved reports which included this site. Facilities will be owned or maintained by the Home Owner's Association.

REFERENCES:

City of Colorado Springs Engineering Division Drainage Criteria Manual Volumes 1 and 2, revised May 2014

"Cottonwood Creek Drainage Basin Planning Study" prepared by Ayers and Associates, Inc. dated June 2000.

"Cottonwood Creek Drainage Basin Planning Study" prepared by URS Consultants, Inc. dated June 9, 1994.

"Master Development Drainage Report for Cumbre Vista Subdivision & Preliminary/Final Drainage Report for Cumbre Vista Filing No. 1" prepared by Matrix Design Group, Inc. dated July 2005.

"Final Drainage Report for Woodmen Vista Filing No. 1 and 2 & Amendment to the Master Development Drainage Report for Cumbre Vista Subdivision", by Matrix Design Group, Inc. dated November 2007.

Natural Resources Conservation Service Web Soil Survey

APPENDIX

CATAMOUNT ENGINEERING PO BOX 692 DIVIDE, CO 80814 (719) 426-2124	**SORPRESA**	SCALE: NTS	DATE: 05/27/20
	VICINITY MAP	JOB NO.: 18–169	SHEET: 1 OF 1

National Flood Hazard Layer FIRMette

FEMA

38°56'56.77"N

104°42'47.10"W

104°42'9.64"W

38°56'28.79"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

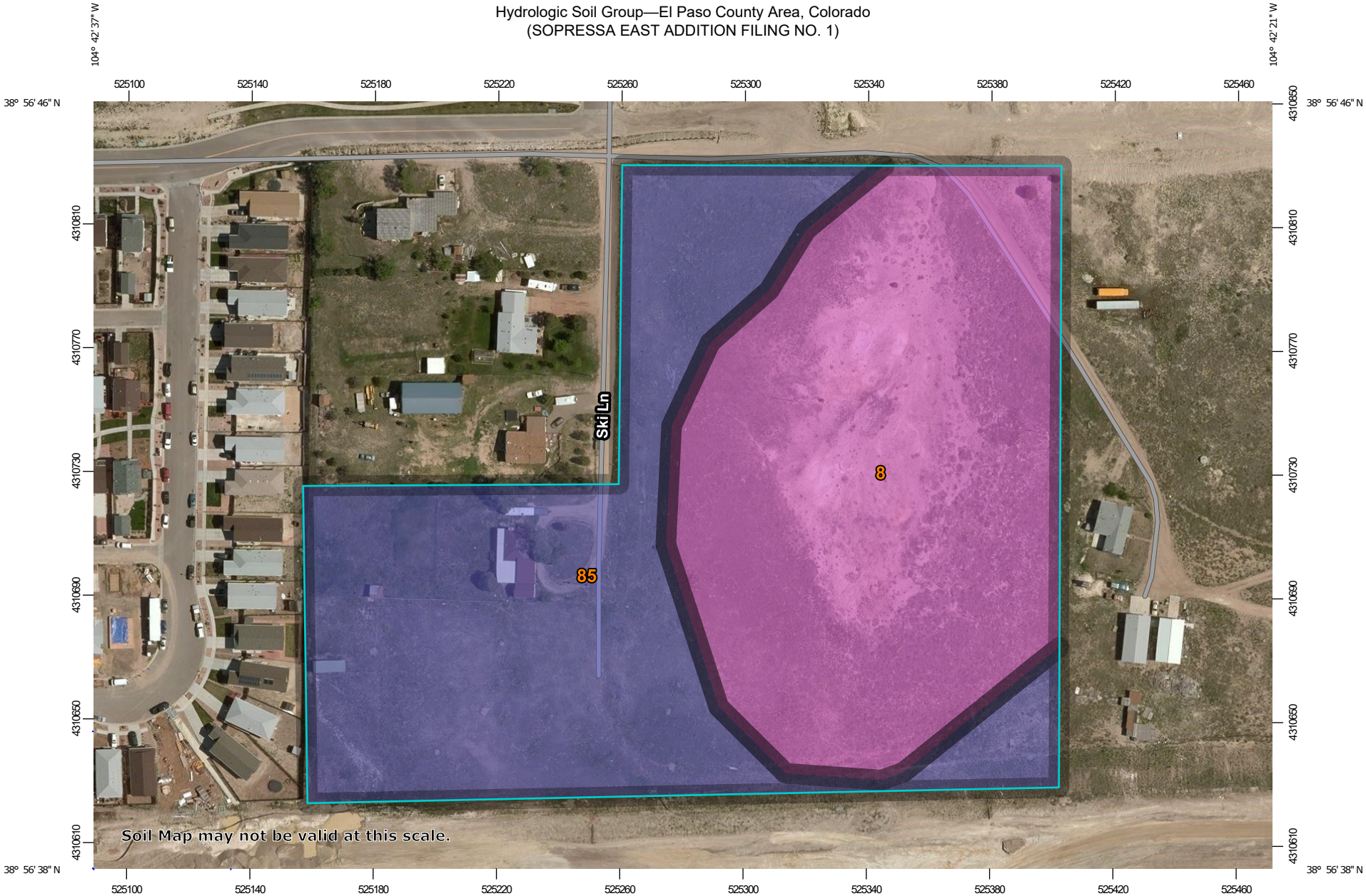
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/6/2019 at 12:11:42 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Hydrologic Soil Group—El Paso County Area, Colorado
(SOPRESSA EAST ADDITION FILING NO. 1)



Map Scale: 1:1,750 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	5.1	52.0%
85	Stapleton-Bernal sandy loams, 3 to 20 percent slopes	B	4.7	48.0%
Totals for Area of Interest			**9.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

HYDROLOGIC AND HYDRAULIC CALCULATIONS

PROPOSED DRAINAGE DESIGN - RATIONAL ANALYSIS

											CONVEYANCE TC						TT	INTENSITY						TOTAL FLOWS					
BASIN	**AREA TOTAL (Acres)**	**C_2**	**C_5**	**C_{10}**	**C_{25}**	**C_{50}**	**C_{100}**	**Length (ft)**	**Height (ft)**	**TI (min)**	**Length (ft)**	**Height (ft)**	**C_V**	**Slope (%)**	**Velocity (fps)**	**TC (min)**	**TOTAL (min)**	**I_2 (in/hr)**	**I_5 (in/hr)**	**I_{10} (in/hr)**	**I_{25} (in/hr)**	**I_{50} (in/hr)**	**I_{100} (in/hr)**	**Q_2 (c.f.s.)**	**Q_5 (c.f.s.)**	**Q_{10} (c.f.s.)**	**Q_{25} (c.f.s.)**	**Q_{50} (c.f.s.)**	**Q_{100} (c.f.s.)**
A1	0.04	**0.89**	**0.90**	**0.92**	**0.94**	**0.95**	**0.96**	15	1	0.7	50	4	20	8.0%	5.7	0.1	5.0	4.1	5.2	6.0	6.9	7.8	8.7	**0.1**	**0.2**	**0.2**	**0.3**	**0.3**	**0.3**
Residential 1/8 acre	*0.00*	*0.41*	*0.45*	*0.49*	*0.54*	*0.57*	*0.59*										*MIN*												
Pavement	*0.04*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
A2	0.12	**0.54**	**0.58**	**0.62**	**0.67**	**0.70**	**0.72**	52	3	3.8	71	3	20	4.2%	4.1	0.3	5.0	4.1	5.2	6.0	6.9	7.8	8.7	**0.3**	**0.4**	**0.4**	**0.6**	**0.6**	**0.8**
Landscape	*0.05*	*0.05*	*0.12*	*0.20*	*0.30*	*0.34*	*0.39*										*MIN*												
Pavement	*0.07*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
A3	0.30	**0.34**	**0.38**	**0.43**	**0.49**	**0.52**	**0.55**	91	2.5	8.8	146	2	20	1.4%	2.3	1.0	9.9	3.3	4.1	4.8	5.5	6.2	7.0	**0.3**	**0.5**	**0.6**	**0.8**	**1.0**	**1.1**
Landscape	*0.06*	*0.05*	*0.12*	*0.20*	*0.30*	*0.34*	*0.39*																						
Residential 1/8 acre	*0.24*	*0.41*	*0.45*	*0.49*	*0.54*	*0.57*	*0.59*																						
A4	0.43	**0.64**	**0.66**	**0.70**	**0.75**	**0.77**	**0.79**	55	3	3.3	307	7	20	2.3%	3.0	1.7	5.0	4.1	5.2	6.0	6.9	7.7	8.7	**1.1**	**1.5**	**1.8**	**2.2**	**2.5**	**2.9**
Landscape	*0.13*	*0.05*	*0.12*	*0.20*	*0.30*	*0.34*	*0.39*										*MIN*												
Pavement	*0.30*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
A5	1.29	**0.47**	**0.51**	**0.55**	**0.59**	**0.62**	**0.64**	100	2	8.5	435	11	20	2.5%	3.2	2.3	10.8	3.2	4.0	4.7	5.4	6.0	6.7	**2.0**	**2.6**	**3.3**	**4.1**	**4.8**	**5.6**
Residential 1/8 acre	*1.12*	*0.41*	*0.45*	*0.49*	*0.54*	*0.57*	*0.59*																						
Pavement	*0.17*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
A6	0.37	**0.57**	**0.60**	**0.63**	**0.67**	**0.69**	**0.71**	50	1	5.1	435	11	20	2.5%	3.2	2.3	7.4	3.7	4.6	5.3	6.1	6.9	7.7	**0.8**	**1.0**	**1.2**	**1.5**	**1.8**	**2.0**
Residential 1/8 acre	*0.25*	*0.41*	*0.45*	*0.49*	*0.54*	*0.57*	*0.59*																						
Pavement	*0.12*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
A7	1.36	**0.48**	**0.52**	**0.56**	**0.60**	**0.63**	**0.65**	87	2	7.4	375	8	20	2.1%	2.9	2.1	9.6	3.3	4.2	4.9	5.6	6.3	7.0	**2.2**	**3.0**	**3.7**	**4.6**	**5.4**	**6.2**
Residential 1/8 acre	*1.15*	*0.41*	*0.45*	*0.49*	*0.54*	*0.57*	*0.59*																						
Pavement	*0.21*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
A8	1.59	**0.54**	**0.57**	**0.60**	**0.65**	**0.67**	**0.69**	87	2	6.8	230	4.1	20	1.8%	2.7	1.4	8.2	3.5	4.4	5.2	5.9	6.6	7.4	**3.0**	**4.0**	**5.0**	**6.1**	**7.1**	**8.1**
Residential 1/8 acre	*1.17*	*0.41*	*0.45*	*0.49*	*0.54*	*0.57*	*0.59*																						
Pavement	*0.42*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
A9	0.28	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	55	2	5.7	764	14	20	1.8%	2.7	4.7	10.4	3.2	4.1	4.8	5.4	6.1	6.8	**0.4**	**0.5**	**0.7**	**0.8**	**1.0**	**1.1**
Residential 1/8 acre	*0.28*	*0.41*	*0.45*	*0.49*	*0.54*	*0.57*	*0.59*																						
Pavement	*0.00*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						

Calculated by: DLM

Date: 5/27/2020

PROPOSED DRAINAGE DESIGN - RATIONAL ANALYSIS

											CONVEYANCE TC						TT	INTENSITY						TOTAL FLOWS					
BASIN	**AREA TOTAL (Acres)**	**C_2**	**C_5**	**C_{10}**	**C_{25}**	**C_{50}**	**C_{100}**	**Length (ft)**	**Height (ft)**	**TI (min)**	**Length (ft)**	**Height (ft)**	**C_V**	**Slope (%)**	**Velocity (fps)**	**TC (min)**	**TOTAL (min)**	**I_2 (in/hr)**	**I_5 (in/hr)**	**I_{10} (in/hr)**	**I_{25} (in/hr)**	**I_{50} (in/hr)**	**I_{100} (in/hr)**	**Q_2 (c.f.s.)**	**Q_5 (c.f.s.)**	**Q_{10} (c.f.s.)**	**Q_{25} (c.f.s.)**	**Q_{50} (c.f.s.)**	**Q_{100} (c.f.s.)**
A10	0.59	**0.61**	**0.64**	**0.68**	**0.72**	**0.74**	**0.77**	45	1	4.3	302	4.5	20	1.5%	2.4	2.1	6.4	3.8	4.8	5.6	6.4	7.2	8.1	**1.4**	**1.8**	**2.2**	**2.7**	**3.2**	**3.6**
Landscape	*0.20*	*0.05*	*0.12*	*0.20*	*0.30*	*0.34*	*0.39*																						
Pavement	*0.39*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
A11	0.57	**0.05**	**0.12**	**0.20**	**0.30**	**0.34**	**0.39**	40	8	4.2	73	0.5	7	0.7%	0.6	2.1	6.3	3.9	4.8	5.6	6.4	7.2	8.1	**0.1**	**0.3**	**0.6**	**1.1**	**1.4**	**1.8**
Landscape	*0.57*	*0.05*	*0.12*	*0.20*	*0.30*	*0.34*	*0.39*																						
B1	1.62	**0.52**	**0.55**	**0.59**	**0.63**	**0.65**	**0.67**	100	2	7.9	429	7	20	1.6%	2.6	2.8	10.7	3.2	4.0	4.7	5.4	6.0	6.8	**2.7**	**3.6**	**4.5**	**5.5**	**6.4**	**7.4**
Residential 1/8 acre	*1.26*	*0.41*	*0.45*	*0.49*	*0.54*	*0.57*	*0.59*																						
Pavement	*0.36*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
B2	0.28	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	50	2	5.3	256	2.5	20	1.0%	2.0	2.2	7.4	3.7	4.6	5.3	6.1	6.9	7.7	**0.4**	**0.6**	**0.7**	**0.9**	**1.1**	**1.3**
Residential 1/8 acre	*0.28*	*0.41*	*0.45*	*0.49*	*0.54*	*0.57*	*0.59*																						
Pavement	*0.00*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
C1	0.31	**0.05**	**0.12**	**0.20**	**0.30**	**0.34**	**0.39**	42	16	3.4	165	2.5	7	1.5%	0.9	3.2	6.6	3.8	4.7	5.5	6.3	7.1	8.0	**0.1**	**0.2**	**0.3**	**0.6**	**0.7**	**1.0**
Landscape	*0.31*	*0.05*	*0.12*	*0.20*	*0.30*	*0.34*	*0.39*																						

Calculated by: DLM

Date: 5/27/2020

		WEIGHTED						TT	INTENSITY						TOTAL FLOWS					
DESIGN POINT	**AREA TOTAL (Acres)**	**C_2**	**C_5**	**C_{10}**	**C_{25}**	**C_{50}**	**C_{100}**	**TOTAL (min)**	**I_2 (in/hr)**	**I_5 (in/hr)**	**I_{10} (in/hr)**	**I_{25} (in/hr)**	**I_{50} (in/hr)**	**I_{100} (in/hr)**	**Q_2 (c.f.s.)**	**Q_5 (c.f.s.)**	**Q_{10} (c.f.s.)**	**Q_{25} (c.f.s.)**	**Q_{50} (c.f.s.)**	**Q_{100} (c.f.s.)**
1	**0.16**	**0.63**	**0.66**	**0.70**	**0.74**	**0.76**	**0.78**	**5.0**	4.1	5.2	6.0	6.9	7.8	8.7	**0.4**	**0.5**	**0.7**	**0.8**	**0.9**	**1.1**
BASIN A1	0.04	0.89	0.90	0.92	0.94	0.95	0.96	5.0												
BASIN A2	0.12	0.54	0.58	0.62	0.67	0.70	0.72	5.0												
2	**0.46**	**0.44**	**0.48**	**0.52**	**0.58**	**0.61**	**0.63**	**9.9**	3.3	4.1	4.8	5.5	6.2	7.0	**0.7**	**0.9**	**1.2**	**1.5**	**1.7**	**2.0**
BASIN A3	0.30	0.34	0.38	0.43	0.49	0.52	0.55	9.9												
DP-1	0.16	0.63	0.66	0.70	0.74	0.76	0.78	5.0												
4	**1.66**	**0.49**	**0.53**	**0.57**	**0.61**	**0.64**	**0.65**	**10.8**	3.2	4.0	4.7	5.4	6.0	6.7	**2.6**	**3.5**	**4.4**	**5.4**	**6.4**	**7.3**
BASIN A5	1.29	0.47	0.51	0.55	0.59	0.62	0.64	10.8												
BASIN A6	0.37	0.57	0.60	0.63	0.67	0.69	0.71	7.4												
5	**3.02**	**0.49**	**0.52**	**0.56**	**0.61**	**0.63**	**0.65**	**10.8**	3.2	4.0	4.7	5.4	6.0	6.7	**4.7**	**6.4**	**7.9**	**9.8**	**11.5**	**13.3**
BASIN A7	1.36	0.48	0.52	0.56	0.60	0.63	0.65	9.6												
DP-4	1.66	0.49	0.53	0.57	0.61	0.64	0.65	10.8												
6	**4.89**	**0.50**	**0.53**	**0.57**	**0.62**	**0.64**	**0.66**	**10.8**	3.2	4.0	4.7	5.4	6.0	6.7	**7.8**	**10.5**	**13.1**	**16.1**	**18.9**	**21.8**
BASIN A8	1.59	0.54	0.57	0.60	0.65	0.67	0.69	8.2												
BASIN A9	0.28	0.41	0.45	0.49	0.54	0.57	0.59	10.4												
DP-5	3.02	0.49	0.52	0.56	0.61	0.63	0.65	10.8												
7	**5.48**	**0.51**	**0.55**	**0.58**	**0.63**	**0.65**	**0.67**	**10.8**	3.2	4.0	4.7	5.4	6.0	6.7	**9.0**	**12.0**	**15.0**	**18.4**	**21.6**	**24.8**
BASIN A10	0.59	0.61	0.64	0.68	0.72	0.74	0.77	6.4												
DP-6	4.89	0.50	0.53	0.57	0.62	0.64	0.66	10.8												
A1	**7.95**	**0.45**	**0.49**	**0.53**	**0.58**	**0.61**	**0.63**	**10.8**	3.2	4.0	4.7	5.4	6.0	6.7	**11.6**	**15.7**	**19.9**	**24.8**	**29.3**	**33.9**
BASIN A11	0.57	0.05	0.12	0.20	0.30	0.34	0.39	6.3												
DP-7	5.48	0.51	0.55	0.58	0.63	0.65	0.67	10.8												
DP-8	1.90	0.41	0.45	0.49	0.54	0.57	0.59	10.7												
8	**1.90**	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	**10.7**	3.2	4.0	4.7	5.4	6.0	6.8	**2.5**	**3.4**	**4.4**	**5.5**	**6.5**	**7.6**
BASIN B1	1.62	0.52	0.55	0.59	0.63	0.65	0.67	10.7												
BASIN B2	0.28	0.41	0.45	0.49	0.54	0.57	0.59	7.4												
9	**8.41**								**POND ROUTED**						**0.1**	**0.2**	**2.7**	**7.5**	**8.6**	**9.0**
POND A OUTLET									SEE UD DENTENTION											

Calculated by: DLM

Date: 5/27/2020

DRAINAGE MAP

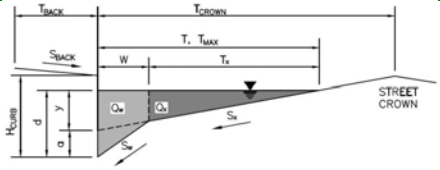
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **SOPRESSA EAST ADDITION FILING NO. 1**

Inlet ID: **BASIN A1**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

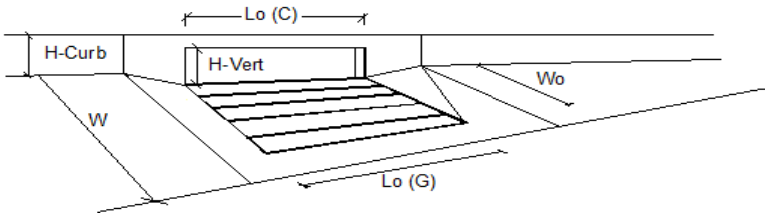
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.6**	**12.6**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	1.0	1.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.2**	**0.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

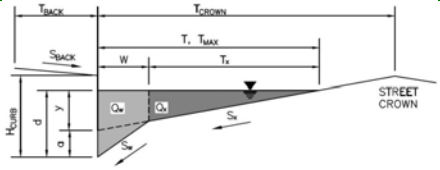
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **SOPRESSA EAST ADDITION FILING NO. 1**

Inlet ID: **BASIN A2**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

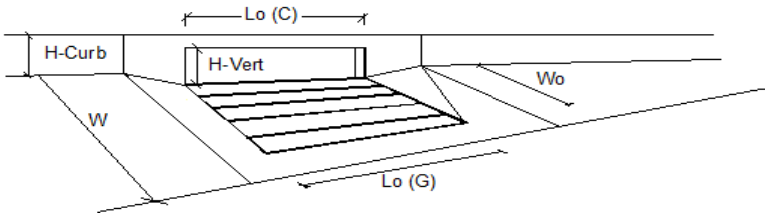
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**12.6**	**36.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	1.0	1.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.4**	**0.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**95**	**%**

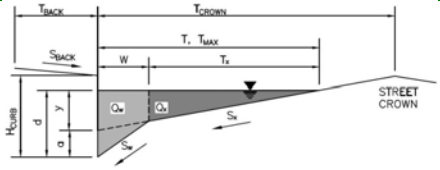
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **SOPRESSA EAST ADDITION FILING NO. 1**

Inlet ID: **BASIN A5**



Gutter Geometry (Enter data in the blue cells)

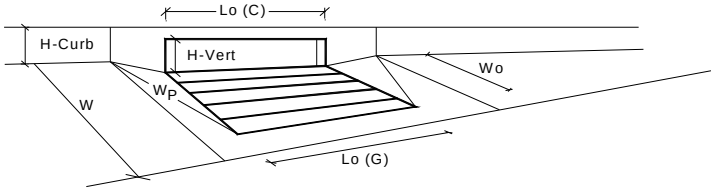
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	1.00	1.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.0	8.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.25	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.64	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**3.5**	**8.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	2.6	5.6	cfs

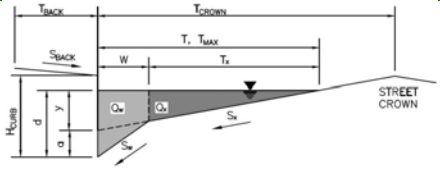
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **SOPRESSA EAST ADDITION FILING NO. 1**

Inlet ID: **BASIN A6**



Gutter Geometry (Enter data in the blue cells)

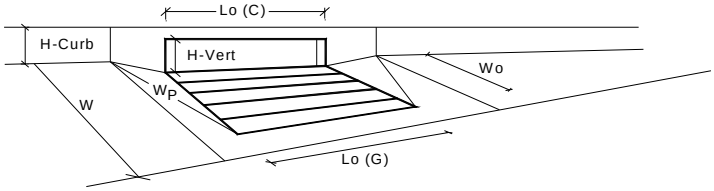
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	1.00	1.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.0	8.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.25	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.64	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**3.5**	**8.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	1.0	2.0	cfs

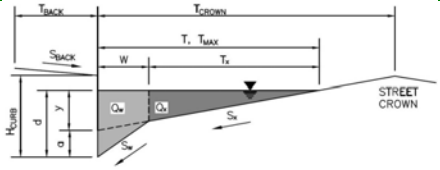
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **SOPRESSA EAST ADDITION FILING NO. 1**

Inlet ID: **BASIN A7**



Gutter Geometry (Enter data in the blue cells)

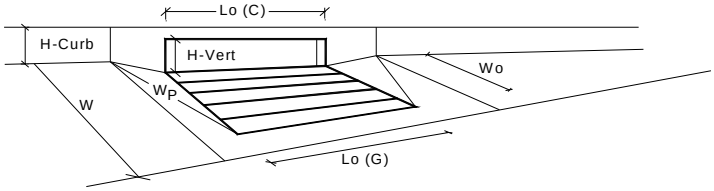
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.0	5.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	1.00	1.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.0	8.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.25	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.64	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**3.5**	**8.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	3.0	6.2	cfs

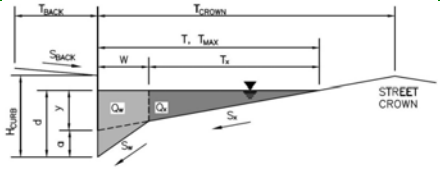
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **SOPRESSA EAST ADDITION FILING NO. 1**

Inlet ID: **BASIN A8**



Gutter Geometry (Enter data in the blue cells)

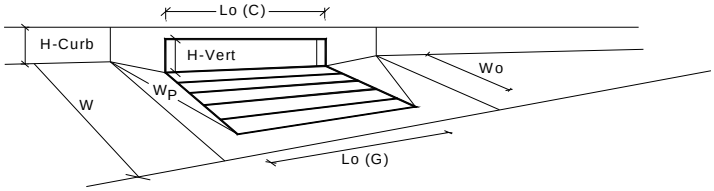
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	1.00	1.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	8.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.77	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**5.4**	**8.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	4.0	8.1	cfs

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, May 27 2020

Basin A9 Swale

Triangular

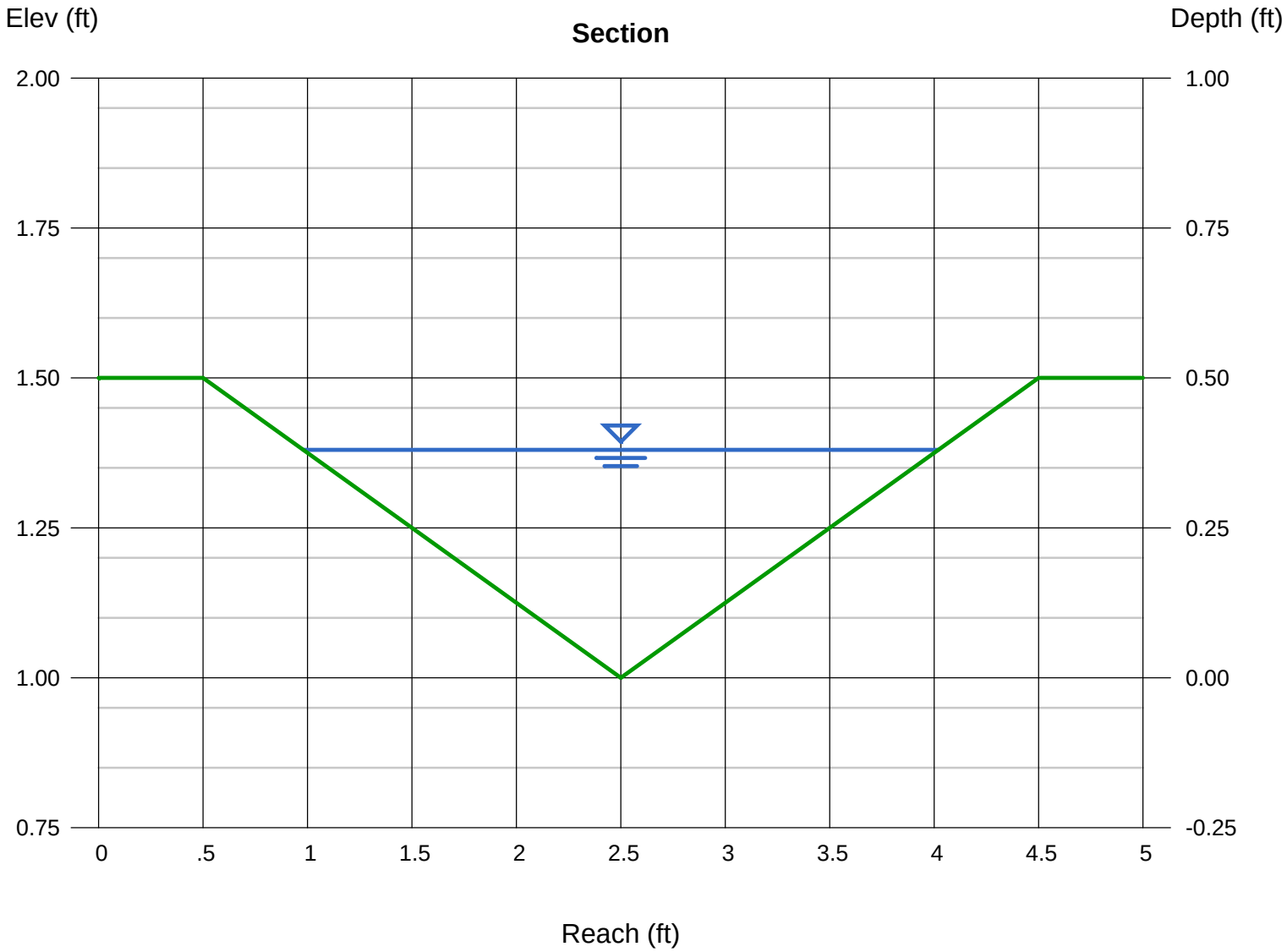
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.10

Highlighted

Depth (ft)	= 0.38
Q (cfs)	= 1.100
Area (sqft)	= 0.58
Velocity (ft/s)	= 1.90
Wetted Perim (ft)	= 3.13
Crit Depth, Yc (ft)	= 0.35
Top Width (ft)	= 3.04
EGL (ft)	= 0.44



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, May 27 2020

Basin A9 Culvert Entrance

Invert Elev Dn (ft)	=	99.00
Pipe Length (ft)	=	20.00
Slope (%)	=	10.00
Invert Elev Up (ft)	=	101.00
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0018, 2, 0.0292, 0.74, 0.2

Embankment

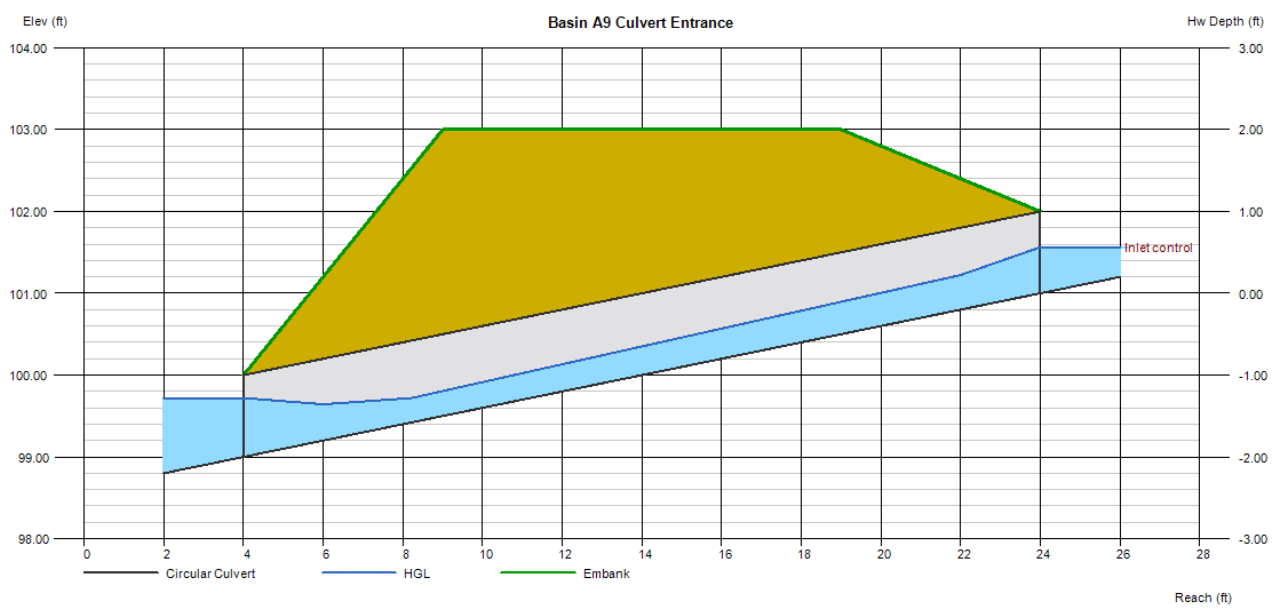
Top Elevation (ft)	=	103.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	10.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	1.50
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	1.10
Qpipe (cfs)	=	1.10
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	1.82
Veloc Up (ft/s)	=	3.30
HGL Dn (ft)	=	99.72
HGL Up (ft)	=	101.44
Hw Elev (ft)	=	101.56
Hw/D (ft)	=	0.56
Flow Regime	=	Inlet Control



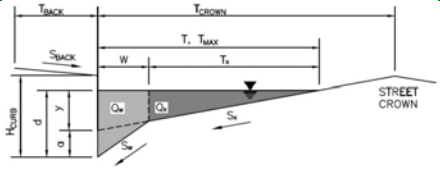
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **SOPRESSA EAST ADDITION FILING NO. 1**

Inlet ID: **BASIN A10**



Gutter Geometry (Enter data in the blue cells)

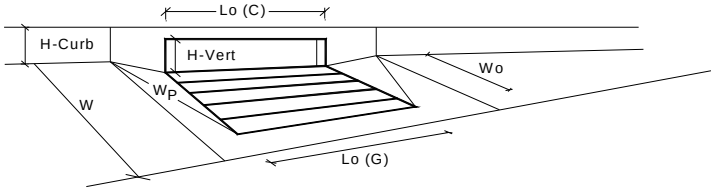
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	1.00	1.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.0	8.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.25	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.47	0.75	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.87	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**5.0**	**16.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	1.8	3.6	cfs

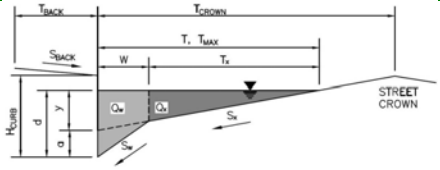
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **SOPRESSA EAST ADDITION FILING NO. 1**

Inlet ID: **BASIN B1**



Gutter Geometry (Enter data in the blue cells)

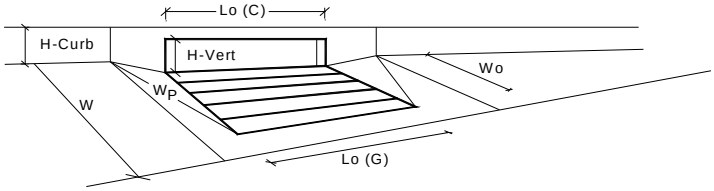
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	8.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.5	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

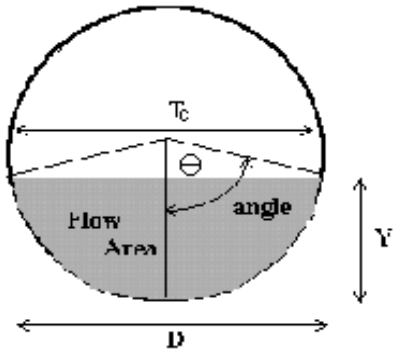
Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	1.00	1.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.5	8.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.29	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.52	0.75	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.90	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**6.6**	**16.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	3.6	7.4	cfs

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

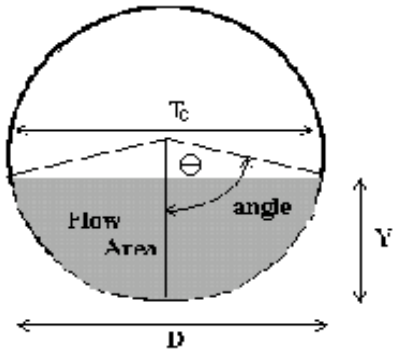
Project: **SOPRESSA EAST ADDITION FILING NO. 1**
Pipe ID: **Pipe Design Point 1**



Design Information (Input)			
Pipe Invert Slope	So =	0.0050	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	12.00	inches
Design discharge	**Q =**	**1.10**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	0.79	sq ft
Full-flow wetted perimeter	Pf =	3.14	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	2.53	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.49	radians
Flow area	An =	0.35	sq ft
Top width	Tn =	1.00	ft
Wetted perimeter	Pn =	1.49	ft
Flow depth	Yn =	0.46	ft
Flow velocity	Vn =	3.10	fps
Discharge	Qn =	1.10	cfs
Percent Full Flow	Flow =	43.5%	of full flow
Normal Depth Froude Number	Fr_n =	0.92	subcritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.45	radians
Critical flow area	Ac =	0.33	sq ft
Critical top width	Tc =	0.99	ft
Critical flow depth	Yc =	0.44	ft
Critical flow velocity	Vc =	3.29	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

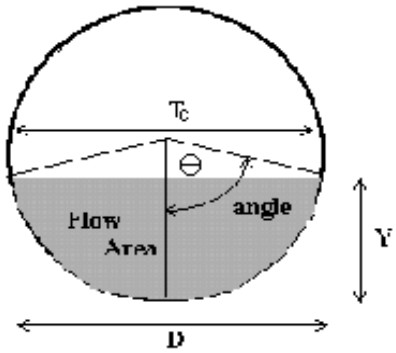
Project: **SOPRESSA EAST ADDITION FILING NO. 1**
Pipe ID: **Pipe Design Point 2**



Design Information (Input)			
Pipe Invert Slope	So =	0.0050	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	12.00	inches
Design discharge	**Q =**	**2.00**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	0.79	sq ft
Full-flow wetted perimeter	Pf =	3.14	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	2.53	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.92	radians
Flow area	An =	0.56	sq ft
Top width	Tn =	0.94	ft
Wetted perimeter	Pn =	1.92	ft
Flow depth	Yn =	0.67	ft
Flow velocity	Vn =	3.57	fps
Discharge	Qn =	2.00	cfs
Percent Full Flow	Flow =	79.1%	of full flow
Normal Depth Froude Number	Fr_n =	0.81	subcritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.78	radians
Critical flow area	Ac =	0.50	sq ft
Critical top width	Tc =	0.98	ft
Critical flow depth	Yc =	0.60	ft
Critical flow velocity	Vc =	4.04	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

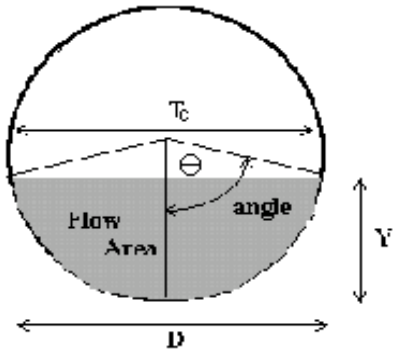
Project: **SOPRESSA EAST ADDITION FILING NO. 1**
Pipe ID: **Pipe Design Point 4**



Design Information (Input)			
Pipe Invert Slope	So =	0.0200	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	15.00	inches
Design discharge	**Q =**	**7.30**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.23	sq ft
Full-flow wetted perimeter	Pf =	3.93	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	9.16	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.93	radians
Flow area	An =	0.88	sq ft
Top width	Tn =	1.17	ft
Wetted perimeter	Pn =	2.41	ft
Flow depth	Yn =	0.84	ft
Flow velocity	Vn =	8.29	fps
Discharge	Qn =	7.30	cfs
Percent Full Flow	Flow =	79.7%	of full flow
Normal Depth Froude Number	Fr_n =	1.68	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.38	radians
Critical flow area	Ac =	1.13	sq ft
Critical top width	Tc =	0.86	ft
Critical flow depth	Yc =	1.08	ft
Critical flow velocity	Vc =	6.49	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

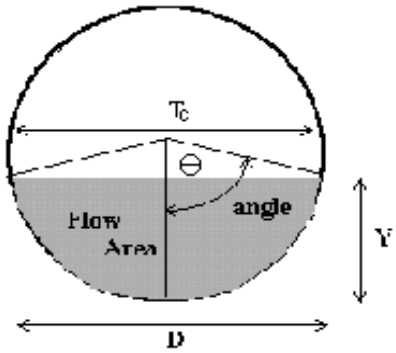
Project: **SOPRESSA EAST ADDITION FILING NO. 1**
Pipe ID: **Pipe Design Point 5**



Design Information (Input)			
Pipe Invert Slope	So =	0.0200	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	18.00	inches
Design discharge	**Q =**	**13.30**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	14.90	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.06	radians
Flow area	An =	1.40	sq ft
Top width	Tn =	1.32	ft
Wetted perimeter	Pn =	3.10	ft
Flow depth	Yn =	1.11	ft
Flow velocity	Vn =	9.53	fps
Discharge	Qn =	13.30	cfs
Percent Full Flow	Flow =	89.3%	of full flow
Normal Depth Froude Number	Fr_n =	1.63	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.52	radians
Critical flow area	Ac =	1.68	sq ft
Critical top width	Tc =	0.87	ft
Critical flow depth	Yc =	1.36	ft
Critical flow velocity	Vc =	7.89	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

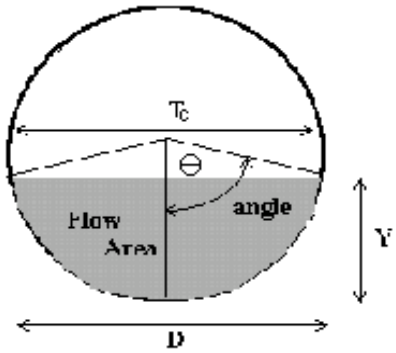
Project: **SOPRESSA EAST ADDITION FILING NO. 1**
Pipe ID: **Pipe Design Point 6**



Design Information (Input)			
Pipe Invert Slope	So =	0.0200	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	**Q =**	**21.80**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	32.08	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.78	radians
Flow area	An =	1.99	sq ft
Top width	Tn =	1.96	ft
Wetted perimeter	Pn =	3.56	ft
Flow depth	Yn =	1.21	ft
Flow velocity	Vn =	10.98	fps
Discharge	Qn =	21.80	cfs
Percent Full Flow	Flow =	68.0%	of full flow
Normal Depth Froude Number	Fr_n =	1.92	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.30	radians
Critical flow area	Ac =	2.80	sq ft
Critical top width	Tc =	1.49	ft
Critical flow depth	Yc =	1.67	ft
Critical flow velocity	Vc =	7.79	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

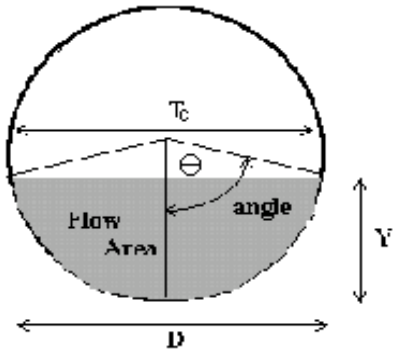
Project: **SOPRESSA EAST ADDITION FILING NO. 1**
Pipe ID: **Pipe Design Point 7**



Design Information (Input)			
Pipe Invert Slope	So =	0.0300	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	**Q =**	**24.80**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	39.29	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.72	radians
Flow area	An =	1.88	sq ft
Top width	Tn =	1.98	ft
Wetted perimeter	Pn =	3.45	ft
Flow depth	Yn =	1.15	ft
Flow velocity	Vn =	13.23	fps
Discharge	Qn =	24.80	cfs
Percent Full Flow	Flow =	63.1%	of full flow
Normal Depth Froude Number	Fr_n =	2.39	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.43	radians
Critical flow area	Ac =	2.92	sq ft
Critical top width	Tc =	1.31	ft
Critical flow depth	Yc =	1.76	ft
Critical flow velocity	Vc =	8.48	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

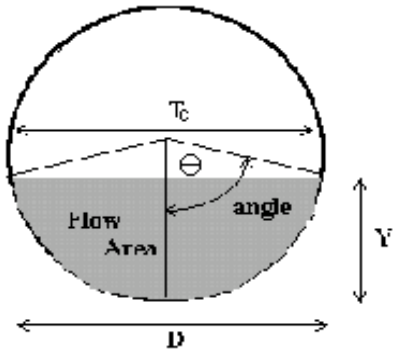
Project: **SOPRESSA EAST ADDITION FILING NO. 1**
Pipe ID: **Pipe Design Point 8**



Design Information (Input)			
Pipe Invert Slope	So =	0.0150	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	15.00	inches
Design discharge	**Q =**	**7.60**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.23	sq ft
Full-flow wetted perimeter	Pf =	3.93	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	7.93	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.18	radians
Flow area	An =	1.03	sq ft
Top width	Tn =	1.03	ft
Wetted perimeter	Pn =	2.72	ft
Flow depth	Yn =	0.98	ft
Flow velocity	Vn =	7.36	fps
Discharge	Qn =	7.60	cfs
Percent Full Flow	Flow =	95.8%	of full flow
Normal Depth Froude Number	Fr_n =	1.29	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.42	radians
Critical flow area	Ac =	1.14	sq ft
Critical top width	Tc =	0.82	ft
Critical flow depth	Yc =	1.09	ft
Critical flow velocity	Vc =	6.67	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

Project: **SOPRESSA EAST ADDITION FILING NO. 1**
Pipe ID: **Pipe Design Point B1**



Design Information (Input)			
Pipe Invert Slope	So =	0.0150	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	15.00	inches
Design discharge	**Q =**	**7.40**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.23	sq ft
Full-flow wetted perimeter	Pf =	3.93	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	7.93	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.13	radians
Flow area	An =	1.01	sq ft
Top width	Tn =	1.06	ft
Wetted perimeter	Pn =	2.66	ft
Flow depth	Yn =	0.96	ft
Flow velocity	Vn =	7.34	fps
Discharge	Qn =	7.40	cfs
Percent Full Flow	Flow =	93.3%	of full flow
Normal Depth Froude Number	Fr_n =	1.33	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.40	radians
Critical flow area	Ac =	1.13	sq ft
Critical top width	Tc =	0.85	ft
Critical flow depth	Yc =	1.08	ft
Critical flow velocity	Vc =	6.55	fps
Critical Depth Froude Number	Fr_c =	1.00	

Worksheet Protected

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	2-Year Event	1.19	inches
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer: David Mijares
Company: Catamount Engineering
Date: May 27, 2020
Project: SOPRESSA EAST ADDITION FILING NO. 1 AND 2
Location:

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	A1	A2	A3	A5	A6	A7	A8	A9	A10	A11	B1	B2		
Receiving Pervious Area Soil Type	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand		
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	0.040	0.120	0.300	1.290	0.370	1.360	1.590	0.280	0.590	0.570	1.620	0.280		
Directly Connected Impervious Area (DCIA, acres)	0.040	0.070	0.000	0.170	0.120	0.210	0.420	0.000	0.390	0.000	0.360	0.000		
Unconnected Impervious Area (UIA, acres)	0.000	0.000	0.120	0.490	0.160	0.530	0.530	0.120	0.000	0.000	0.630	0.140		
Receiving Pervious Area (RPA, acres)	0.000	0.000	0.120	0.630	0.090	0.620	0.640	0.160	0.000	0.570	0.630	0.140		
Separate Pervious Area (SPA, acres)	0.000	0.050	0.060	0.000	0.000	0.000	0.000	0.000	0.200	0.000	0.000	0.000		
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C	C	C	C	C	C	C	C	C	C		

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	0.040	0.120	0.300	1.290	0.370	1.360	1.590	0.280	0.590	0.570	1.620	0.280		
Directly Connected Impervious Area (DCIA, %)	100.0%	58.3%	0.0%	13.2%	32.4%	15.4%	26.4%	0.0%	66.1%	0.0%	22.2%	0.0%		
Unconnected Impervious Area (UIA, %)	0.0%	0.0%	40.0%	38.0%	43.2%	39.0%	33.3%	42.9%	0.0%	0.0%	38.9%	50.0%		
Receiving Pervious Area (RPA, %)	0.0%	0.0%	40.0%	48.8%	24.3%	45.6%	40.3%	57.1%	0.0%	100.0%	38.9%	50.0%		
Separate Pervious Area (SPA, %)	0.0%	41.7%	20.0%	0.0%	0.0%	0.0%	0.0%	0.0%	33.9%	0.0%	0.0%	0.0%		
A_R (RPA / UIA)	0.000	0.000	1.000	1.286	0.563	1.170	1.208	1.333	0.000	0.000	1.000	1.000		
I_a Check	1.000	1.000	0.500	0.440	0.640	0.460	0.450	0.430	1.000	1.000	0.500	0.500		
f / I for 2-Year Event:	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6		
f / I for 5-Year Event:	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
f / I for 100-Year Event:	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		
f / I for Optional User Defined Storm CUHP:														
IRF for 2-Year Event:	1.00	1.00	0.68	0.66	0.74	0.66	0.66	0.65	1.00	1.00	0.68	0.68		
IRF for 5-Year Event:	1.00	1.00	0.89	0.88	0.91	0.88	0.88	0.88	1.00	1.00	0.89	0.89		
IRF for 100-Year Event:	1.00	1.00	0.91	0.90	0.93	0.91	0.90	0.90	1.00	1.00	0.91	0.91		
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I_{total}	100.0%	58.3%	40.0%	51.2%	75.7%	54.4%	59.7%	42.9%	66.1%	0.0%	61.1%	50.0%		
Effective Imperviousness for 2-Year Event:	100.0%	58.3%	27.2%	38.1%	64.4%	41.3%	48.4%	27.9%	66.1%	0.0%	48.7%	34.0%		
Effective Imperviousness for 5-Year Event:	100.0%	58.3%	35.6%	46.6%	72.0%	49.8%	55.8%	37.6%	66.1%	0.0%	56.8%	44.5%		
Effective Imperviousness for 100-Year Event:	100.0%	58.3%	36.5%	47.5%	72.8%	50.7%	56.6%	38.6%	66.1%	0.0%	57.7%	45.6%		
Effective Imperviousness for Optional User Defined Storm CUHP:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

This line only for WQCV Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	0.0%	0.4%	9.1%	7.1%	3.6%	6.6%	5.2%	10.1%	0.1%	N/A	5.4%	8.8%	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	**53.5%**
Total Site Effective Imperviousness for 2-Year Event:	**42.9%**
Total Site Effective Imperviousness for 5-Year Event:	**49.8%**
Total Site Effective Imperviousness for 100-Year Event:	**50.6%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.
** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

Design Procedure Form: Extended Detention Basin (EDB)

Designer:
Company: CATAMOUNT ENGINEERING
Date: May 27, 2020
Project: SOPRESSA EAST FILING NO. 1
Location:

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 53.5 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.535
C) Contributing Watershed Area	Area = 8.410 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV) ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= 0.151 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$)	$V_{DESIGN\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A ( ) B ( ) C / D — **WQCV selected. Soil group not required.**
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	EURV = ____ ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.5 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	Concrete Forebay with baffle dissapator.

Design Procedure Form: Extended Detention Basin (EDB)

Designer:
Company: CATAMOUNT ENGINEERING
Date: May 27, 2020
Project: SOPRESSA EAST FILING NO. 1
Location:

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 2% of the WQCV)	V_{FMIN} = 0.003 ac-ft
B) Actual Forebay Volume	V_F = ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 12.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 24.80 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 0.50 cfs
E) Forebay Discharge Design	Choose One: Berm With Pipe; (●) Wall with Rect. Notch; Wall with V-Notch Weir — (flow too small for berm w/ pipe)
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 4.2 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One: (●) Concrete; Soft Bottom
F) Slope of Trickle Channel	S = 0.0100 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 20 sq ft
C) Outlet Type	Choose One: (●) Orifice Plate; Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = inches
E) Total Outlet Area	A_{ot} = square inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer:
Company: CATAMOUNT ENGINEERING
Date: May 27, 2020
Project: SOPRESSA EAST FILING NO. 1
Location:

8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 6.7 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	
Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer:
Company: CATAMOUNT ENGINEERING
Date: May 27, 2020
Project: SOPRESSA EAST FILING NO. 1
Location:

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping: B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	
11. Vegetation	Choose One ○ Irrigated ○ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

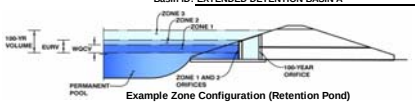
Notes:

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: SORPRESSA EAAST ADDITION FILING NO. 1

Basin ID: EXTENDED DETENTION BASIN A



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**	
Watershed Area =	8.41	acres
Watershed Length =	646	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	50.60%	percent
Percentage Hydrologic Soil Group A =	52.0%	percent
Percentage Hydrologic Soil Group B =	48.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building	
Water Quality Capture Volume (WQCV) =	0.146	acre-feet
Excess Urban Runoff Volume (EURV) =	0.475	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.351	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.470	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.607	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	0.803	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	0.977	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	1.193	acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	1.664	acre-feet
Approximate 2-yr Detention Volume =	0.330	acre-feet
Approximate 5-yr Detention Volume =	0.443	acre-feet
Approximate 10-yr Detention Volume =	0.563	acre-feet
Approximate 25-yr Detention Volume =	0.650	acre-feet
Approximate 50-yr Detention Volume =	0.702	acre-feet
Approximate 100-yr Detention Volume =	0.786	acre-feet

Optional User Override 1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
	inches

Stage-Storage Calculation

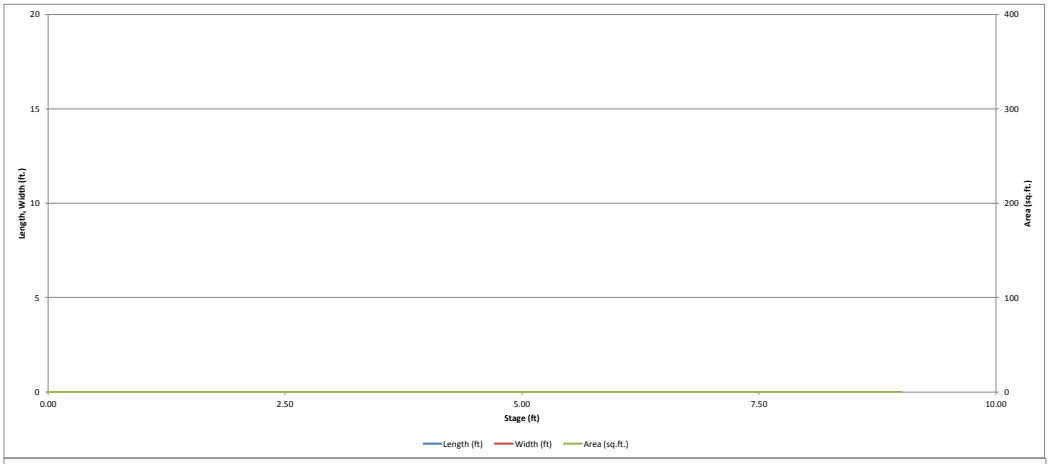
Zone 1 Volume (WQCV) =	0.146	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.329	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.312	acre-feet
Total Detention Basin Volume =	0.786	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

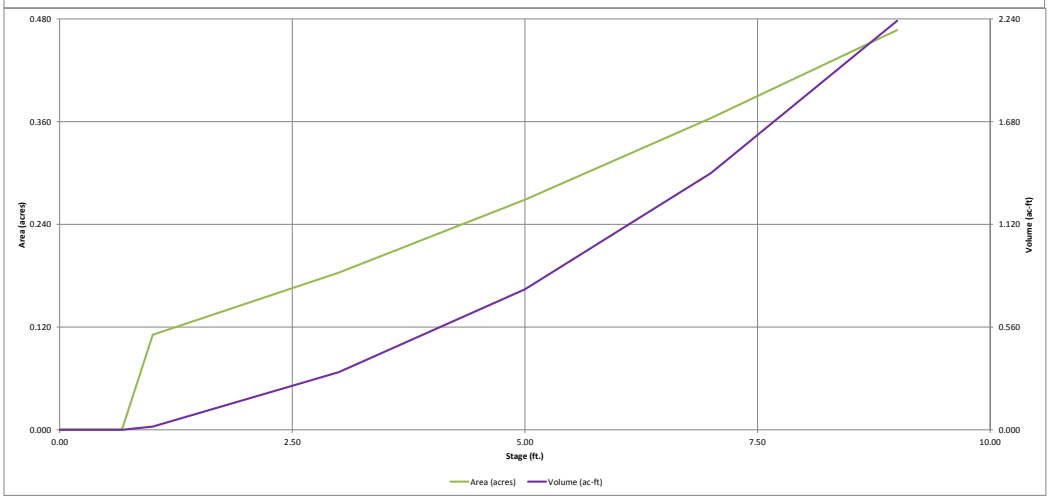
Depth Increment = 1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	20	0.000		
ISV	--	0.67	--	--	--	20	0.000	13	0.000
6974	--	1.00	--	--	--	4,830	0.111	766	0.018
6976	--	3.00	--	--	--	7,997	0.184	13,640	0.313
6978	--	5.00	--	--	--	11,703	0.269	33,340	0.765
6980	--	7.00	--	--	--	15,857	0.364	60,900	1.398
6982	--	9.00	--	--	--	20,330	0.467	97,087	2.229

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



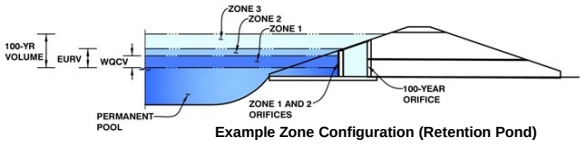


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: SORPRESSA EAST ADDITION FILING NO. 1

Basin ID: EXTENDED DETENTION BASIN A



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.99	0.146	Orifice Plate
Zone 2 (EURV)	3.81	0.329	Orifice Plate
Zone 3 (100-year)	5.08	0.312	Weir&Pipe (Restrict)
		0.786	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.81	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	15.20	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.27	2.54					
Orifice Area (sq. inches)	0.92	0.92	1.23					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.81	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.81	N/A	feet
Over Flow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	14.07	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	11.20	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.60	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	8.30		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.80	N/A	ft^2
Outlet Orifice Centroid =	0.40	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.49	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	10.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

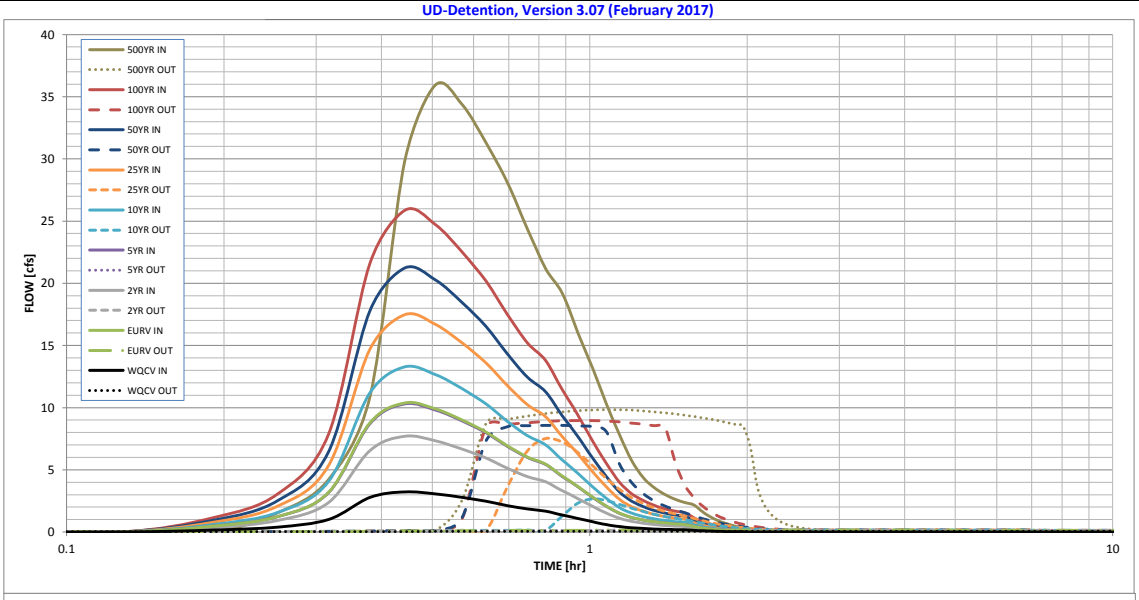
Spillway Design Flow Depth=	0.78	feet
Stage at Top of Freeboard =	8.78	feet
Basin Area at Top of Freeboard =	0.46	acres

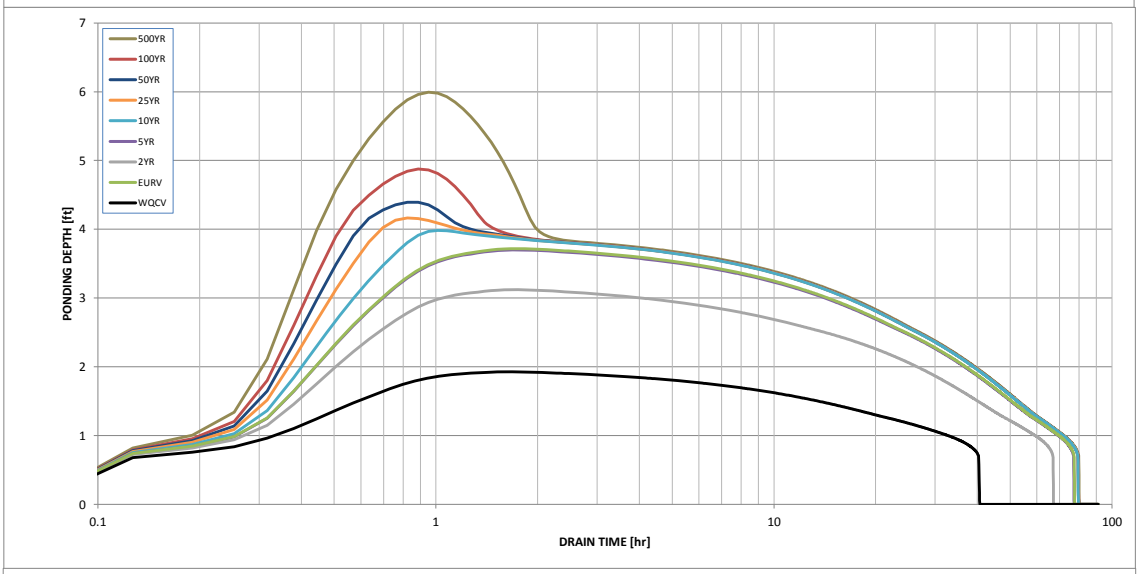
Routed Hydrograph Results

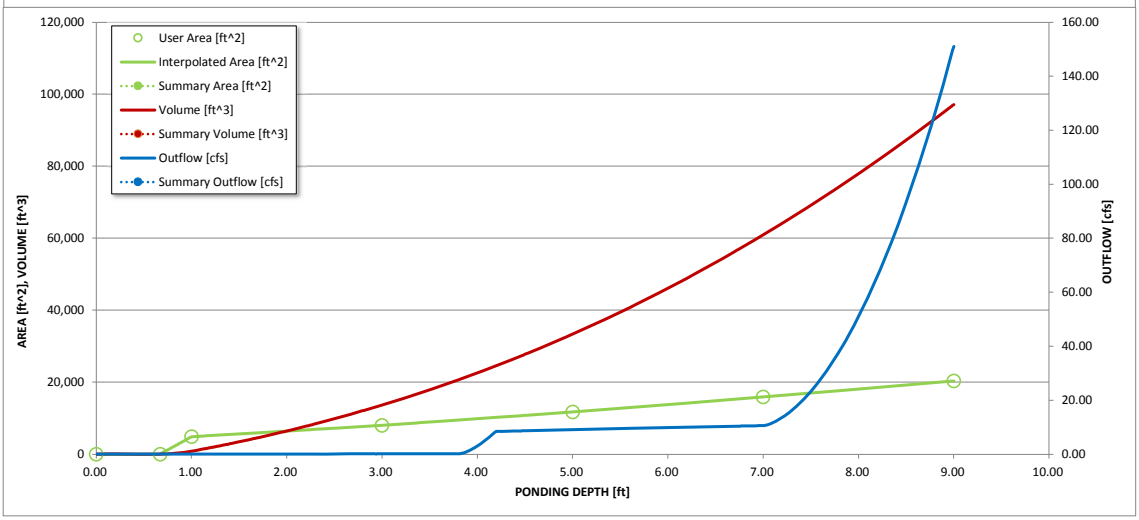
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.14
Calculated Runoff Volume (acre-ft) =	0.146	0.475	0.351	0.470	0.607	0.803	0.977	1.193	1.664
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.145	0.473	0.350	0.470	0.607	0.802	0.976	1.193	1.663
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.15	0.47	0.76	1.18	1.99
Predevelopment Peak Q (cfs) =	0.0	0.0	0.1	0.2	1.3	3.9	6.4	9.9	16.7
Peak Inflow Q (cfs) =	3.2	10.4	7.7	10.3	13.3	17.5	21.2	25.9	35.9
Peak Outflow Q (cfs) =	0.1	0.2	0.1	0.2	2.7	7.5	8.6	9.0	9.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	2.1	1.9	1.3	0.9	0.6
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.2	0.7	0.7	0.8	0.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	72	63	71	72	70	68	65	61
Time to Drain 99% of Inflow Volume (hours) =	**40**	75	66	75	77	76	75	75	73
Maximum Ponding Depth (ft) =	1.93	3.72	3.12	3.70	3.98	4.17	4.39	4.88	5.99
Area at Maximum Ponding Depth (acres) =	0.14	0.21	0.19	0.21	0.23	0.23	0.24	0.26	0.32
Maximum Volume Stored (acre-ft) =	0.136	0.454	0.335	0.450	0.513	0.555	0.609	0.731	1.055

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
3.80 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:03:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:07:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:11:24	0.15	0.46	0.35	0.46	0.59	0.77	0.93	1.13	1.55
1.315	0:15:12	0.39	1.24	0.93	1.23	1.58	2.08	2.52	3.06	4.23
	0:19:00	1.01	3.19	2.38	3.17	4.07	5.35	6.47	7.87	10.87
	0:22:48	2.77	8.78	6.54	8.71	11.19	14.69	17.77	21.60	29.84
	0:26:36	3.23	10.38	7.70	10.30	13.27	17.48	21.22	25.87	35.93
	0:30:24	3.07	9.90	7.34	9.82	12.66	16.70	20.28	24.73	34.38
	0:34:12	2.79	9.01	6.68	8.94	11.53	15.20	18.46	22.52	31.30
	0:38:00	2.47	8.03	5.95	7.97	10.29	13.59	16.52	20.17	28.08
	0:41:48	2.11	6.92	5.11	6.87	8.88	11.75	14.30	17.48	24.38
	0:45:36	1.85	6.04	4.46	5.99	7.74	10.23	12.45	15.20	21.18
	0:49:24	1.67	5.47	4.04	5.42	7.01	9.27	11.28	13.78	19.21
	0:53:12	1.36	4.50	3.31	4.46	5.78	7.67	9.35	11.44	15.99
	0:57:00	1.09	3.66	2.69	3.63	4.72	6.27	7.66	9.39	13.17
	1:00:48	0.82	2.81	2.05	2.78	3.63	4.85	5.94	7.31	10.30
	1:04:36	0.59	2.08	1.51	2.06	2.70	3.62	4.46	5.51	7.82
	1:08:24	0.44	1.51	1.10	1.50	1.96	2.62	3.22	4.00	5.73
	1:12:12	0.34	1.17	0.86	1.16	1.52	2.02	2.48	3.07	4.36
	1:16:00	0.28	0.97	0.71	0.96	1.25	1.66	2.04	2.52	3.56
	1:19:48	0.24	0.82	0.60	0.81	1.06	1.41	1.73	2.13	3.01
	1:23:36	0.21	0.72	0.53	0.72	0.93	1.24	1.52	1.87	2.63
	1:27:24	0.19	0.65	0.48	0.65	0.84	1.12	1.36	1.68	2.36
	1:31:12	0.18	0.60	0.44	0.60	0.77	1.03	1.26	1.54	2.17
	1:35:00	0.13	0.44	0.32	0.44	0.57	0.75	0.92	1.13	1.60
	1:38:48	0.10	0.32	0.24	0.32	0.42	0.55	0.68	0.83	1.17
	1:42:36	0.07	0.24	0.17	0.23	0.31	0.41	0.50	0.61	0.86
	1:46:24	0.05	0.17	0.13	0.17	0.22	0.30	0.37	0.45	0.63
	1:50:12	0.04	0.12	0.09	0.12	0.16	0.21	0.26	0.32	0.46
	1:54:00	0.03	0.09	0.06	0.09	0.11	0.15	0.19	0.23	0.33
	1:57:48	0.02	0.06	0.04	0.06	0.08	0.11	0.13	0.17	0.24
	2:01:36	0.01	0.04	0.03	0.04	0.05	0.07	0.09	0.11	0.16
	2:05:24	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.07	0.10
	2:09:12	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05
	2:13:00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02
	2:16:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:20:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:24:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:28:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:32:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:39:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:43:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:47:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:51:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:54:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:58:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:02:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:06:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:13:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:17:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:21:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:29:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:32:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:36:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:44:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:48:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:51:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:59:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:03:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:07:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:14:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:18:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:22:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:26:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:29:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:33:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

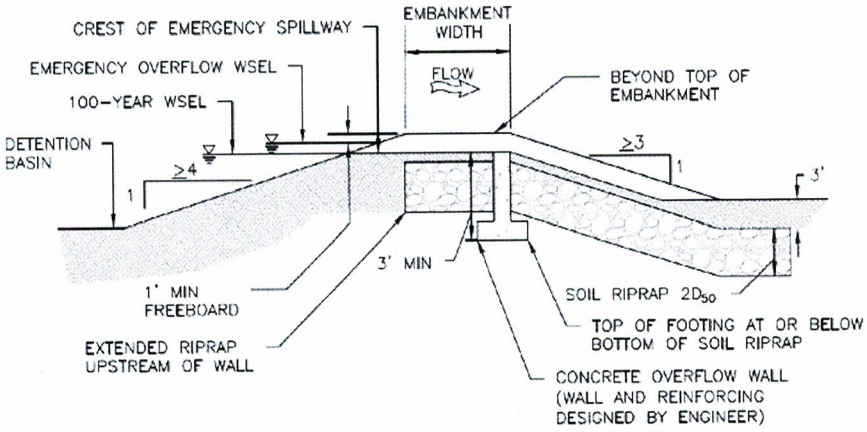
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

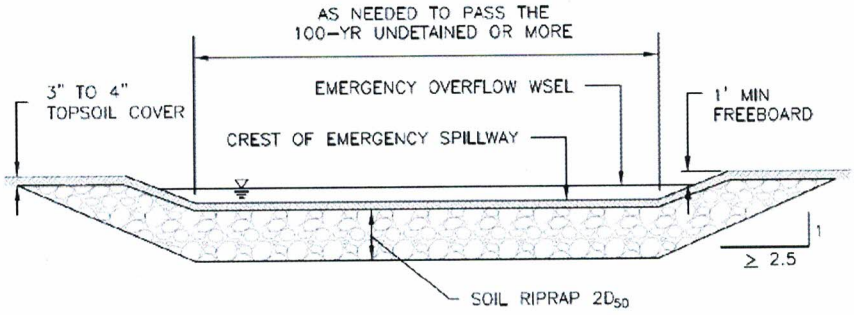
For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

EXTENDED DETENTION BASIN 'A'



EMERGENCY SPILLWAY PROFILE



EMERGENCY SPILLWAY SECTION AND SPILLWAY CHANNEL

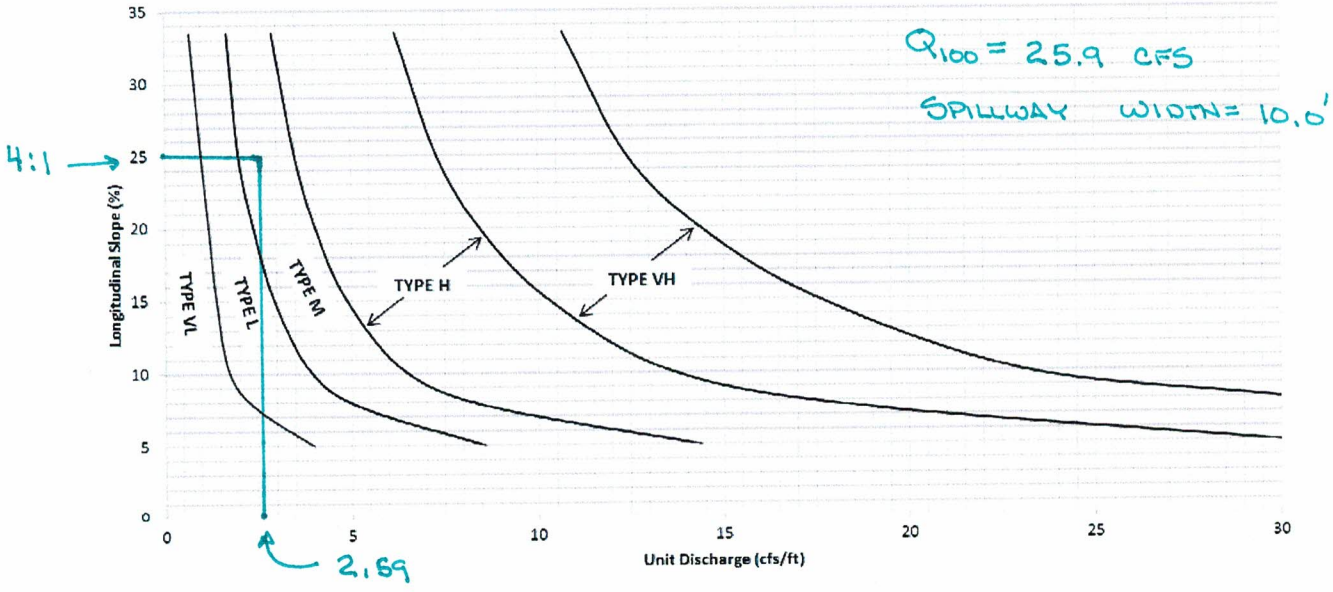
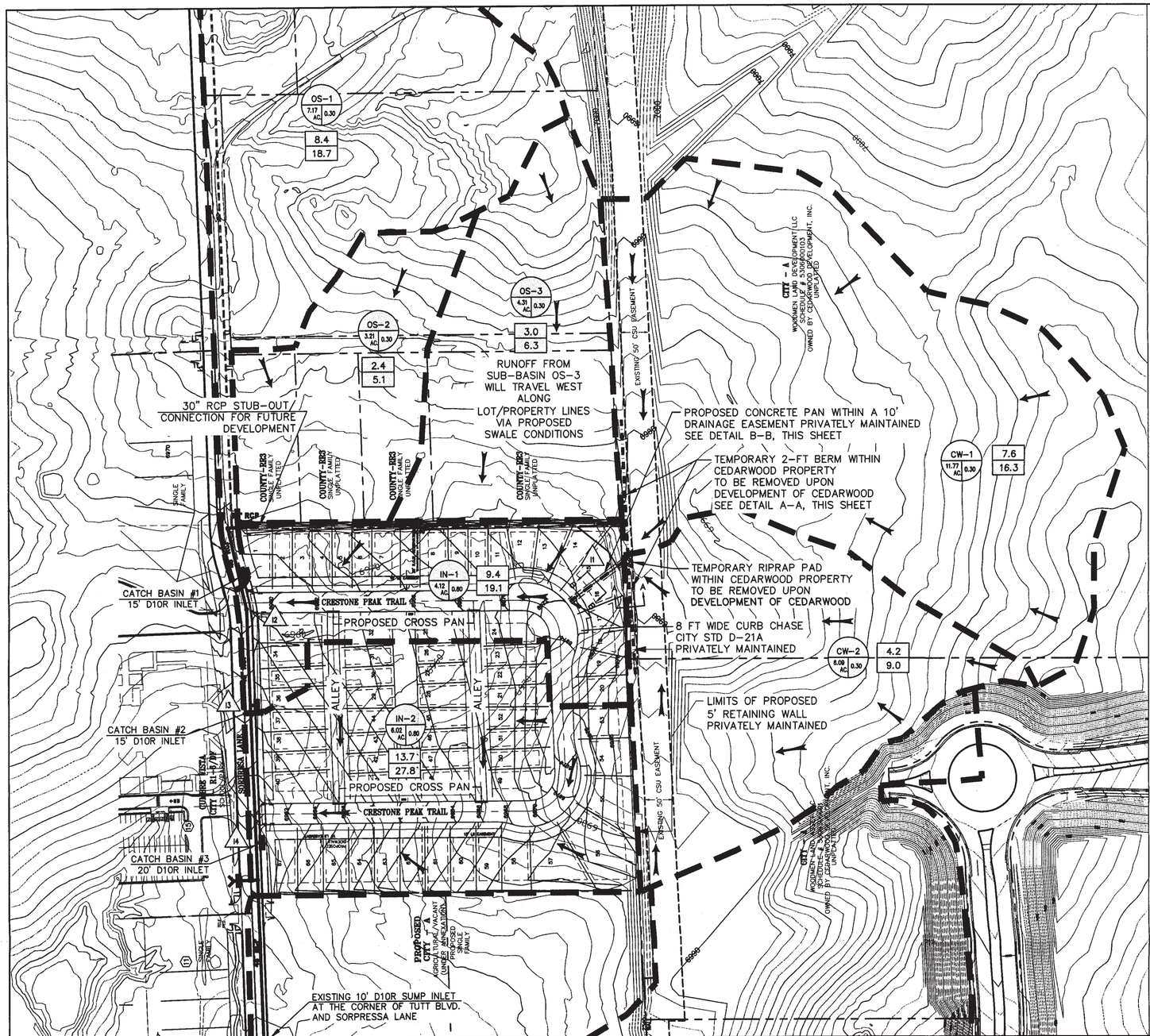
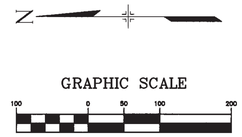
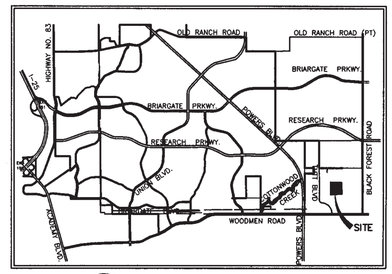


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

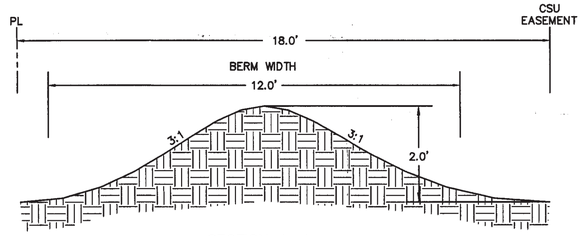
USE 2' DEPTH OF TYPE 'M' SOIL RIPRAP.







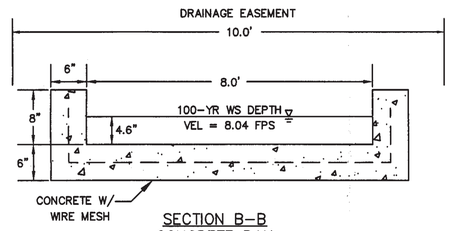
VICINITY MAP



SECTION A-A
TWO FOOT BERM
NTS

LEGEND

- PROPERTY LINE
- EASEMENT LINE
- DRAINAGE BASIN BOUNDARY
- PROPOSED BERM
- PROPOSED DIVERSION SWALE
- 6520 PROPOSED CONTOUR
- 6520 EXISTING CONTOUR
- PROPOSED FLOW DIRECTION ARROW
- DP DESIGN POINT
- XX-1 BASIN DESIGNATION
- 99.99 / AC 99.99 "C" COEFFICIENT (100 YR)
- BASIN AREA (ACRES)
- 99.99 5-YEAR FLOWRATE
- 99.99 100-YEAR FLOWRATE



SECTION B-B
CONCRETE PAN
NTS

NOTES:
1)STORM SEWER SYSTEM CONSTRUCTED PER SORPRESSA LANE STORM SEWER PLANS, DATED MAY 2006 REVISED JULY 2007

ROUTED SURFACE FLOWS
DESIGN POINT SUMMARY

DESIGN POINT	TRIBUTARY SUB-BASINS	Q_5 (cfs)	Q_{100} (cfs)
I1	CW1, CW2	11.6	24.7
I2	DP I1, IN1	18.2	38.1
I3	OS1(fb), DP I2	19.0	43.5
I4	DP I2(fb), IN2	18.5	47.5

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	BY

REVISIONS

NAME: S:\05.206.001\dwg\DRAINAGE\DR01.dwg
PCP: Matrix.ctb
PLOT DATE: Thu Nov 15, 2007 3:33pm
By: gerrit_slotter

BENCHMARK DATA(ELEV.) 6901.818'
(DATUM) FIMS
(DESCRIPTION/LOCATION) SEE RIGHT

BENCHMARK:

FIMS 2" DIAMETER ALUMINUM CAP STAMPED "CSU FIMS CONTROL BG16" ON THE NORTHEAST CORNER OF THE CONCRETE BASE FOR ELECTRIC VAULT #FBBX-1, 260 FEET NORTH OF THE NORTH EDGE OF WOODMEN ROAD.

ELEV: 6901.818'

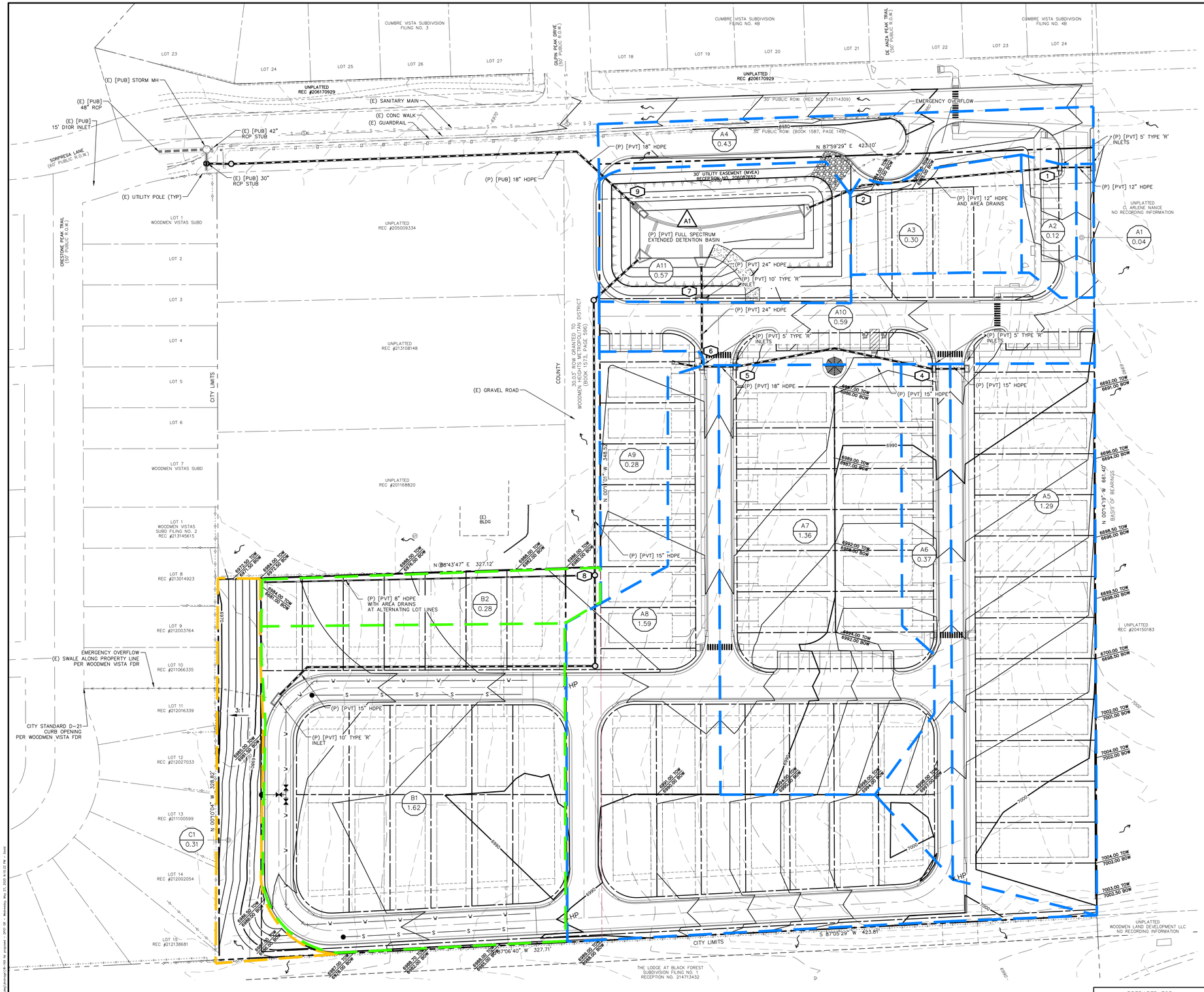
Matrix Design Group, Inc.
Integrated Design Solutions
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

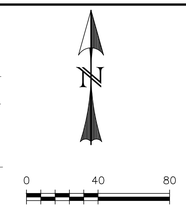
WOODMEN VISTA FILING NO. 1 & 2

FINAL DRAINAGE REPORT

INTERIM DEVELOPED CONDITIONS DRAINAGE MAP

DESIGNED BY: ZDH
DRAWN BY: ZDH
CHECKED BY: GES
SCALE HORIZ: 1"=100' VERT: N/A
DATE ISSUED: JULY 2007
SHEET NO. 1 OF 2 SHEETS
DR01



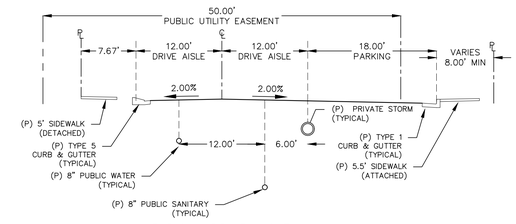


PROPOSED DRAINAGE BASINS

BASIN	AREA (ACRES)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
A1	0.04	0.1	0.2	0.2	0.3	0.3	0.3
A2	0.12	0.3	0.4	0.4	0.6	0.6	0.8
A3	0.30	0.3	0.5	0.6	0.8	1.0	1.1
A4	0.43	1.1	1.5	1.8	2.2	2.5	2.9
A5	1.29	2.0	2.6	3.3	4.1	4.8	5.6
A6	0.37	0.8	1.0	1.2	1.5	1.8	2.0
A7	1.36	2.2	3.0	3.7	4.6	5.4	6.2
A8	1.59	3.0	4.0	5.0	6.1	7.1	8.1
A9	0.28	0.4	0.5	0.7	0.8	1.0	1.1
A10	0.59	1.4	1.8	2.2	2.7	3.2	3.6
A11	0.57	0.1	0.3	0.6	1.1	1.4	1.8
B1	1.62	2.7	3.6	4.5	5.5	6.4	7.4
B2	0.28	0.4	0.6	0.7	0.9	1.1	1.3
C1	0.31	0.1	0.2	0.3	0.6	0.7	1.0

PROPOSED DESIGN POINTS

DESIGN POINT	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
1	0.4	0.5	0.7	0.8	0.9	1.1
2	0.7	0.9	1.2	1.5	1.7	2.0
4	2.6	3.5	4.4	5.4	6.4	7.3
5	4.7	6.4	7.9	9.8	11.5	13.3
6	7.8	10.5	13.1	16.1	18.9	21.8
7	9.0	12.0	15.0	18.4	21.6	24.8
8	2.5	3.4	4.4	5.5	6.5	7.6
A1	11.6	15.7	19.9	24.8	29.3	33.9
9	0.1	0.2	2.7	7.5	8.6	9.0



TYPICAL DRIVE AISLE

N.T.S.

LEGEND

EXISTING	(E)
FUTURE	(F)
PROPOSED	(P)
CURB AND GUTTER	C&G
EASEMENT	ESMT
BOUNDARY	
RIGHT-OF-WAY	
LOT LINE	
EASEMENT	
SETBACK	
(E) CONTOUR, INDEX	5970
(E) CONTOUR	
(E) STORM SEWER, INLET, MH	
(P) CONTOUR, INDEX	5970
(P) CONTOUR	
(P) FENCE	
(P) STORM SEWER, INLET, MH	
BASIN BOUNDARY	

PREPARED FOR:

CHALLENGER HOMES

8605 EXPLORER DRIVE
#250
COLORADO SPRINGS, CO 80920
(719) 598-5192

CATAMOUNT ENGINEERING
321 W. HENRIETTA AVE WOODLAND PARK, CO 80866
PO BOX 221 (719)426-2124

SOPRESSA EAST ADDITION FILING NO. 1

PROPOSED DRAINAGE CONDITIONS

CHECKED BY: DLM	DRAWN BY: DBM
SCALE: 1"=40'	DATE: 10/01/19
JOB NUMBER	SHEET
18-169	1 OF 1