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TRAILS AT CROWFOOT FINAL DRAINAGE REPORT

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TRAILS AT CROWFOOT
Town of Parker, Colorado



*This report for the Final design of **Trails at Crowfoot** was prepared by me or under my direct supervision in accordance with the provisions of the Town of Parker Storm Drainage and Enviromental Criteria Manual. I understand that the Town of Parker and its designated town authority do not and will not assume liability for drainage facilities designed by other.*

Signature

Colorado P.E. License No.

Seal and Date

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The following narrative and supporting calculations provide the drainage design associated with the *Trails at Crowfoot Final Drainage Report*. The report primarily addresses drainage concepts related to Pond and storm system infrastructure sizing.

I. INTRODUCTION

1. Location

The Trails at Crowfoot Development is located within the Town of Parker, Douglas County, Colorado. The boundary of the development spans several sections, all of which are located within Township 7 South, Range 66 west of the 5th principal meridian.

More specifically, the southwest quarter, and majority of the north half, of Section 4, the south half, and majority of the north half, of Section 5, the east half of Section 6, a small portion along the east edge of Section 8, the north half, and the north half of the southwest quarter, of Section 9.

On a broader scale, the site is bounded by Rueter-Hess Reservoir to the northwest, Stroh Road to the north, Lemon Gulch Way to the south and east, and Cherry Creek to the east. More easily put, a majority of the site itself is bounded by the city limits of Parker.

2. Proposed Development

The proposed site spans roughly 400 acres along the southwest edge of the Parker city limits. The topography of the site generally slopes from southwest to northeast and west to east for the Lemon Gulch Basin, with many ravines, valleys, rolling hills, and channels conveying stormwater runoff to the northeast, where it will ultimately converge with Cherry Creek. The site itself is situated on five, previously studied, regional sub catchment basins, Oak Gulch, West Stroh, North Crowfoot Valley, Scott Gulch, and Lemon Gulch. Oak Gulch and Lemon Gulch drainage basins encompass the majority of the site.

Little exists in terms of drainage or utility infrastructure in the area. Drainage wise, there are several CMP culvert crossings along North Crowfoot Valley Road to the east, Lemon Gulch Way to the west, and Stroh Road to the North. Utility wise, raw water and potable water lines run down Stroh Road along the northern boundary of the site. Water mains cross the western half of the site, of which they generally follow a connection road between Lemon Gulch Way and Stroh Road.

Existing vegetation on site is comprised of native grasses, shrubs, trees, and weedy species indigenous to the area.

The site in its current state contains Soil Groups B, C, and D with the following breakdown: 49.8% B, 38% C, and 12.2% D. [Ref 3]

3. Previous Studies

The regional sub catchment basins within the area have been analyzed by the Urban Drainage and Flood Control District (UDFCD). The foundation of the conceptual report was based upon, and compared against, the following Outfall Systems Planning (OSP) and Master Drainage studies:

1. Oak Gulch and Stroh Ranch Area Outfall Systems Planning – Final Design Report by Knight Piesold Consulting
2. Master Drainage Plan for Anthology by Harris Kocher Smith (HKS)
3. Scott Gulch and Lemon Gulch Watershed Outfall systems Planning – Final Design Report by CH2M Hill
4. Cherry Creek Corridor – Reservoir to Scott Road Major Drainageway Planning – Final Design Report by URS
5. Conceptual Drainage Report for Hess Ranch Development by Manhard Consulting

The previous OSPs provide CUHP/SWMM analyses regarding the regional sub catchment flows, recommendations for erosion mitigation, regional detention pond system sizing, and design alternatives, with cost breakdowns, for the various channels in the area.

The HKS master drainage report provides a master drainage plan, for what was at the time, the latest proposed land use plan within the area. It makes use of previous UDFCD studies to compile a master drainage plan for all of Anthology.

4. Proposed Development

The entire Trails at Crowfoot development consists of approximately 890 single family residential lots. The site also comprise of school, multi-family development, parks and mixed use. The intent of this Final drainage report is to size storm infrastructure for Trails at Crowfoot Development. The report addresses land use and the relevant percentage imperviousness for the site. Ponds and major drainage infrastructure were designed using the CUHP/SWMM methodology. The rational method presented in the Urban Drainage [Ref:1] and Town of Parker criteria [Ref: 2] was used for the interior street capacity and storm sewer design.

II. HISTORIC DRAINAGE

1. Major Basin and Sub Basin Description

The Trails at Crowfoot Development site encompasses a fraction of five much larger major basins: Oak Gulch, West Stroh, North Crowfoot Valley, Scott Gulch, and Lemon Gulch. The Trails at Crowfoot Development is mostly in the Lemon Gulch Basin and OS-2 basin with a portion in the Scott Gulch Basin. The sub basins in this section are taken from the Hess Ranch Conceptual Design [Ref. 4].

1. Scott Gulch

Scott Gulch is located along the southernmost point of the development boundary and is adjacent to the Lemon Gulch and OS-2 drainage basins. The latest development plan indicates that Scott Gulch will primarily consist of single family residential and open space **Note:** *A detention/water quality pond will be required for that portion of Basin 406 situated onsite. Coordination with the adjacent landowner will be required to discuss routing of historic release flows.*

2. Lemon Gulch

As a part of the Scott Gulch and Lemon Gulch OSP, Lemon Gulch makes up a large portion of the Trails at Crowfoot Development site. Lemon Gulch is centrally located within the development and is substantially larger than the other major basins that are contributed by the development area. The latest development plan indicates that Lemon Gulch will consist of single family residential and mixed use property, park space, open space, roadways, and a commercial development. A regional pond will capture runoff from the Trails development and release directly to Lemon Gulch.

2. Floodplain

According to the *Federal Emergency Management Agencies (FEMA) Flood Emergency Rate Map (FIRM)* [Ref. 5], proposed development area lies within “Zone X” which is described as an area determined to be outside the 500 year floodplain limits or shallow flooding areas with average depths of less than one foot or drainage areas less than one square mile.

There are no existing major irrigation facilities such as ditches and canals on the property or within 100-feet of the property.

Floodplain development permit will be required for all work within the Lemon Gulch Floodplain. It is anticipated that any work within Lemon Gulch will have no impact on the conveyance or flood capacity of Lemon Gulch.

III. DESIGN CRITERIA

1. List of References

This Final drainage report is in accordance with the *Storm Drainage and Environmental Criteria Manual* [Ref. 2] and *Urban Storm Drainage Criteria Manual, VOL 1, 2 &3* [Ref. 1 - UDFCD].

Along with these criteria manuals, this report also adheres to the general guidelines set forth by the *Hess Ranch Conceptual Drainage Report* [Ref. 5].

2. Hydrologic Criteria

For the major drainage infrastructure; the CUHP/SWMM methodology outlined in the UDSCM was used to establish peak flow rates at major design elements. The two design storms for major infrastructure are the 5 and 100 year. Pond release rates were established using the UDFCD methodology at the time the Phase II drainage report was approved in June 2017. The release rates have been maintained for the Phase III report.

For the street capacity, inlet and stormsewer design; the Rational Method was used to establish the peak flow rate at design points throughout the development. Per the SDECM [Ref. 2], rainfall intensity is determined using the one-hour rainfall depth, P_1 , in the USDCM [Ref. 1] Equation RA-3 as shown below:

$$I = \frac{28.5 P_1}{(10 + T_c)^{0.786}} \quad (\text{RA-3})$$

The 2-year storm event was determined to have a 0.99-inch 1-hour rainfall depth, and the 100-year storm event was determined to have a 2.60-inch 1-hour rainfall depth.

3. Hydraulic Criteria

The “*Urban Storm Drainage Criteria Manual, Volumes 1, 2, and 3*” (USDCM) [Ref. 1] and the “*Storm Drainage and Environmental Criteria Manual*” (SDECM) [Ref. 2] are the design guidelines for the design and analyses provided in this report. Inlets, street, and pipes are designed in this report, which utilizes the 2-year and 100-year design storm events respectively as the basis of the minor and major storm events. Urban Drainage and Flood Control District’s UD-Inlet.xls software is employed to evaluate the streets and inlets capacity. UDFCD’s UD-Sewer software is utilized for the hydraulic analysis of the storm sewer network. The hydraulic grade line from the UD-Sewer analysis is included in summary printout in the appendix and show on the construction drawings.

This report assumes on-grade inlets will be sized to intercept the 2-year design peak flow, and sump inlets will be sized to intercept up-to the 100-year design peak flow. 2-year inlets were assumed to be plugged for the major storm event. Street capacity and 100-year drainage infrastructure designed to meet criteria without the support of the 2-year infrastructure. The site inlets and street capacities are evaluated with UD-Inlet.xls in this report.

Major drainage infrastructure was designed using peak flows calculated from the CUHP/SWMM methodology. The software versions available from UDFCD used for the analysis are CUHP v.2.0.0 and SWMM 5.1. The sub-basins delineated for the rational method were aggregated into larger basins based on their pipe outfall to the drainage channel and Pond. Peak flows and volume from the CUHP/SWMM analysis are used for the design of Ponds, channel, and all culvert designs. The CUHP/SWMM summary results are included in the appendix.

The 5-year and 100- year storm events were analyzed for the channel design. The channel is a composite section utilizing a stable slope of 0.2% with sculpted concrete drop structures. The channel provides greater than the required 1.5' of freeboard. The channel design parameters assume a non-cohesive soil. The HEC-RAS analysis demonstrates the channel is stable and only requires protection at the locations of drop structures. HEC-RAS 5.0.3 was used for the analysis. The HEC-RAS analysis is included in the appendix.

The 6'x6' RCB culvert and large 48" RCP conveyance element associated with the channel utilize the CUHP/SWMM 100-year peak flow for design. The UD-Culvert spreadsheets are located in the appendix.

IV. DRAINAGE PLAN

1. General Concept

Trails at Crowfoot is delineated into 87 sub-basins and 6 off-site basins. Sub-basins with designations "A", "B" and "C" drain to Pond A. Sub-basins D1, D2, D6, D7, D8, D10 & D12 drain to Pond B. Sub-basins with designation "E" (E13 & E17 excluded) and sub-basins F6 and F8 drains to Pond D. Sub-basins D3, D4, D5, D9, D11 and designation "F" (F6 & F8 excluded) drain to Pond C.

2. Specific Details

The Crowfoot Gulch is a composite channel design. A channel slope of 0.002 ft/ft with drop structures was used to achieve a stabilized design. For the 100-year flow of 268 cfs, the channel cross section operates with a mean velocity of 3.5 fps and Froude number of 0.48. The bank full portion of the channel is sized for 70% of the 2-year flow. For 70% of the 2-year flow of 39 cfs, the bankfull section operates with a mean velocity of 2.4 fps and Froude number of 0.45. A HEC-RAS analysis for the 5 and 100-year peak flows demonstrates the drop structures provide adequate erosion control for the channel. The composite channel calculation and HEC-RAS analysis is included in the appendix.

Ponds were sized using the UD-Detention v3.07 software. Inflow hydrographs for each pond for the 5 and 100-year storm from the CUHP/SWM model were input into the UD-Detention software. The UD-Detention software was utilized to design the pond elements.

Pond A is a Town of Parker maintenance eligible regional facility with a drainage area of 174.5 acres. The weighted average imperviousness for the area is 37.6%. The pond provides full spectrum detention per UDFCD requirements. The UD-Detention spreadsheet was utilized to determine the WQCV and EURV. The CUHP/SWMM with calculated allowable release rates was utilized to determine the 100-year volume. The outlet discharges into Lemon Gulch. The overflow for Pond A is sized for the peak inflow of 278.8 cfs and discharges directly into Lemon Gulch.

The table on the following page summarizes the major basins and percent impervious from the CUHP/SWMM analysis used in the pond design.

POND A SWMM BASINS			
Design Point	AREA	% IMP.	WEIGHTED
ID	AC	%	%
A-1	18.6	50	5
A-2	25.3	50	7
A-3	12.4	45	3
A-4	11.2	36	2
B-1	40.6	37	9
B-2	39.5	47	11
OS-1	8.4	2	0
OS-2	8.4	2	0
OS-3	5.2	2	0
OS-5	4.8	2	0
TOTAL	174.5	-	38

The table below summarizes the Pond A design. Calculations for the design of Pond A are included in the appendix. The Pond A detailed design is shown in the construction drawings.

POND A	
Description	
Drainage Area (ACRES)	174.49
Percent Impervious (%)	37.55
WQCV Volume (AC-FT)	2.314
EURV Volume (including WQCV) (AC-FT)	6.12
EURV water surface (FT)	5995.39
100-YR Volume (including EURV) (AC-FT)	11.287
100-YR water surface (FT)	5997.19
Emergency Spillway Elevation (FT)	5997.19
100-YR Peak Inflow (CFS)	278.8
100-YR Peak Outflow (CFS)	197
100-YR Peak Allowable (CFS)	204.47

Pond A complies with CRS 37-92-602(8). The UD-Detention worksheet is included in the appendix.

Pond B is a sub-regional facility with a drainage area of 23 acres. The weighted average imperviousness for the area is 47.4%. The pond provides full spectrum detention per UDFCD requirements. The UD-Detention spreadsheet was utilized to determine the WQCV and EURV. The CUHP/SWMM with calculated allowable release rates was utilized to determine the 100-year volume. The outlet discharges into a pipe provided by the downstream development. Which ultimately discharges into Scott Gulch. The overflow for Pond B conveys the peak inflow of 39.8 cfs and discharges southeast into the future Bayou Gulch

Road. The flow will travel south down Bayou Gulch to the existing 20' Type R Inlet at the Cielo Subdivision.

The table below summarizes the Pond B design. Calculations for the design of Pond B are included in the appendix. The Pond B detailed design is shown in the construction drawings.

The table below summarizes the major basins and percent impervious from the CUHP/SWMM analysis used in the pond design.

POND B SWMM BASINS			
Design Point	AREA	% IMP.	WEIGHTED
ID	AC	%	%
C-1	23.2	47	47
TOTAL	23.2	-	47

The table below summarizes the Pond B design. Calculations for the design of Pond B are included in the appendix. The Pond B detailed design is shown in the construction drawings.

POND B	
Description	
Drainage Area (ACRES)	23.2
Percent Impervious (%)	47.36
WQCV Volume (AC-FT)	0.361
EURV Volume (including WQCV) (AC-FT)	1.051
EURV water surface (FT)	6092.88
100-YR Volume (including EURV) (AC-FT)	1.832
100-YR water surface (FT)	6093.98
Emergency Spillway Elevation (FT)	6094.38
100-YR Peak Inflow (CFS)	39.8
100-YR Peak Outflow (CFS)	22.2
100-YR Peak Allowable (CFS)	31.53

Pond B complies with CRS 37-92-602(8). The UD-Detention worksheet is included in the appendix.

Pond C is a maintenance eligible regional facility with a drainage area of 101.1 acres. The weighted average imperviousness for the area is 44.5%. The pond provides full spectrum detention per UDFCD requirements. The UD-Detention spreadsheet was utilized to determine the WQCV and EURV. The CUHP/SWMM with calculated allowable release rates was utilized to determine the 100-year volume. The outlet discharges to Cherry Creek and will comply with Cherry Creek Reservoir Control Regulations. The overflow for Pond C conveys the peak inflow of 204.8 cfs and discharges west to Cherry Creek.

The table on the following page summarizes the major basins and percent impervious from the CUHP/SWMM analysis used in the pond design.

POND C SWMM BASINS			
Design Point	AREA	% IMP.	WEIGHTED
ID	AC	%	%
E-1	79.5	48	38
F-2	18.9	38	7
OS-4	2.8	2	0
TOTAL	101.1	-	45

The table below summarizes the Pond C design. Calculations for the design of Pond C are included in the appendix. The Pond C detailed design is shown in the construction drawings.

POND C	
Description	
Drainage Area (ACRES)	101.09
Percent Impervious (%)	44.49
WQCV Volume (AC-FT)	1.495
EURV Volume (including WQCV) (AC-FT)	4.262
EURV water surface (FT)	5975.55
100-YR Volume (including EURV) (AC-FT)	8.444
100-YR water surface (FT)	5977.94
Emergency Spillway Elevation (FT)	5978.15
100-YR Peak Inflow (CFS)	204.8
100-YR Peak Outflow (CFS)	106.5
100-YR Peak Allowable (CFS)	111.36

Pond C complies with CRS 37-92-602(8). The UD-Detention worksheet is included in the appendix.

Pond D is a maintenance eligible regional facility with a drainage area of 50.2 acres. The weighted average imperviousness for the area is 55.4%. The pond provides full spectrum detention per UDFCD requirements. The UD-Detention spreadsheet was utilized to determine the WQCV and EURV. The CUHP/SWMM with calculated allowable release rates was utilized to determine the 100-year volume. The outlet discharges to Cherry Creek and will comply with Cherry Creek Reservoir Control Regulations. The overflow for Pond D conveys the peak inflow of 97.3 cfs and discharges west to Cherry Creek.

The table below summarizes the major basins and percent impervious from the CUHP/SWMM analysis used in the pond design.

POND D SWMM BASINS			
Design Point	AREA	% IMP.	WEIGHTED
ID	AC	%	%
D-1	20.7	48	20
F-1	29.5	55	32
TOTAL	50.2	-	52

The table below summarizes the Pond D design. Calculations for the design of Pond D are included in the appendix. The Pond D detailed design is shown in the construction drawings.

POND D	
Description	
Drainage Area (ACRES)	50.18
Percent Impervious (%)	51.42
WQCV Volume (AC-FT)	0.805
EURV Volume (including WQCV) (AC-FT)	2.447
EURV water surface (FT)	5991.2
100-YR Volume (including EURV) (AC-FT)	4.475
100-YR water surface (FT)	5993.16
Emergency Spillway Elevation (FT)	5993.48
100-YR Peak Inflow (CFS)	97.3
100-YR Peak Outflow (CFS)	52.2
100-YR Peak Allowable (CFS)	55.28

Pond D complies with CRS 37-92-602(8). The UD-Detention worksheet is included in the appendix.

The minor sub-basins are described in detail as follows. These basins were delineated for the Rational Method analysis used in the street capacity, inlet, and stormsewer design.

Sub-basin A1 primarily consists of the lots along Red Cosmos Terr. Surface runoff generally drains to the curb and gutter, which continues northerly to the on-grade inlet at Design Point 1A where it is piped to DP 1. 100-year storm street flows to sump inlet DP 1B. Emergency flow from DP 1B will overland to Crowfoot Gulch.

Sub-basin A2 primarily consists of the lots along Rose Mallow Street. Surface runoff generally drains to the curb and gutter to sump inlet at Design Point 1B where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1B will overland to Crowfoot Gulch.

Sub-basin A3 primarily consists of the lots along Rose Mallow Street. Surface runoff generally drains to the curb and gutter to sump inlet at Design Point 1C where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1C will overland to Crowfoot Gulch.

Sub-basin A4 primarily consists of the lots along Wild Lupine Street and Shasta Daisy Street. Surface runoff generally drains to the curb and gutter to sump inlet at Design Point 1D where

it is piped Crowfoot Gulch via swale. Emergency flow from DP 1D will overland to Crowfoot Gulch.

Sub-basin A5 primarily consists of the lots along Shasta Daisy Street and Scarlet Sage Ave. Surface runoff generally drains to the curb and gutter to sump inlet at Design Point 1E where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1E will overland to Crowfoot Gulch.

Sub-basin A6 primarily consists of the lots along Scarlet Sage Ln. Surface runoff generally drains to the curb and gutter, which continues westerly to the on-grade inlet at Design Point 1F where it is piped to sump inlet at DP 1N. 100-year storm street flows to sump inlet at DP 1N. Emergency flow from DP 1N will overland to Crowfoot Gulch via swale.

Sub-basin A7 primarily consists of the lots along Shasta Daisy Street and Scarlet Sage Ave. Surface runoff generally drains to the curb and gutter to on-grade inlet at design point 1G where it is piped to sump inlet at design point 1E. 100-year storm street flows to sump inlet at DP 1E. Emergency flow from DP 1E will overland to Crowfoot Gulch via swale.

Sub-basin A8 primarily consists of the lots along Wild Lupine Street. Surface runoff generally drains to the curb and gutter to the sump inlet at DP 1H. Emergency flow from DP 1H will overland to Crowfoot Gulch via swale.

Sub-basin A9 is located along Bayou Gulch Rd. Surface runoff generally drains to the curb and gutter to DP 1I where it runs westerly to Design Point 1J. Emergency flow from DP 1J will overland to Crowfoot Gulch.

Sub-basin A10 is located along Bayou Gulch Rd. Surface runoff generally drains to the curb and gutter to sump inlet at DP 1J. Emergency flow from DP 1J will overland to Crowfoot Gulch.

Sub-basin A11 primarily consists of the lots along Trefoil Ln. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1K. 100 Year flow from 1K will overland to sump inlet at Design Point 1B where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1B will overland to Crowfoot Gulch.

Sub-basin A12 primarily consists of the lots along Scarlet Sage Street and Scarlet Sage Ave. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1L. 100 Year flow from 1L will street flow to sump inlet at Design Point 1N where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1N will overland to Crowfoot Gulch.

Sub-basin A13 primarily consists of the lots along Scarlet Sage Ave. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1M. 100 Year flow from 1M will street flow to sump inlet at Design Point 1E where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1E will overland to Crowfoot Gulch.

Sub-basin A14 primarily consists of the lots along Wild Lupine Street. Surface runoff generally drains to the curb and gutter to the sump inlet at DP 1N. Emergency flow from DP 1N will overland to Crowfoot Gulch via swale.

Sub-basin A15 is located along Bayou Gulch Rd. Surface runoff generally drains to the curb and gutter to on-grade Inlet at DP 1O. Emergency flow from DP 1O will overland to Crowfoot Gulch.

Sub-basin A16 is located along N. Pinery Parkway. Surface runoff generally drains to the curb and gutter, which continues northerly to the on-grade inlet at Design Point 1P where it is piped to DP 1. 100-year storm street flows to sump inlet at DP 1B. Emergency flow from DP 1B will overland to Crowfoot Gulch.

Sub-basin A17 primarily consists of the lots along Red Cosmos Terr and Rose Mallow Street. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1Q. 100 Year flow from 1Q will street to sump inlet at Design Point 1B where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1B will overland to Crowfoot Gulch.

Sub-basin A18 primarily consists of the lots along Rose Mallow Street. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1R. 100 Year flow from 1R will street to sump inlet at Design Point 1B where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1B will overland to Crowfoot Gulch.

Sub-basin A19 primarily consists of the lots along Scarlet Sage Street. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1S. 100 Year flow from 1S will street to sump inlet at Design Point 1E where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1E will overland to Crowfoot Gulch.

Sub-basin A20 primarily consists of the lots along Scarlet Sage Street. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1T. 100 Year flow from 1T will street to sump inlet at Design Point 1E where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1E will overland to Crowfoot Gulch.

Sub-basin A21 primarily consists of the lots along Scarlet Sage lane. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1U. 100 Year flow from 1U will street flow to sump inlet at Design Point 1N where it is piped Crowfoot Gulch via swale. Emergency flow from DP 1N will overland to Crowfoot Gulch.

Sub-basin A22 primarily consists of the lots along Scarlet Sage Street. Surface runoff generally drains to the curb and gutter to on grade inlet at Design Point 1V. 100 Year flow from 1V will street flow to sump inlet at Design Point 1E where it is piped Crowfoot Gulch via pipe. Emergency flow from DP 1E will overland to Crowfoot Gulch.

Note:						
1) 0% slope indicates sump inlet.						
DIRECT FLOW						
BASIN ID	AREA	Imperviousness	Q ²	Q ¹⁰⁰	Street Type	Slope
	(AC)	%	(CFS)	(CFS)		%
A1	4.11	43.77	3.84	17.73	Local	2.00
A2	1.84	52.16	2.22	9.10	Local	0.00
A3	3.23	48.80	3.16	13.54	Local	0.00
A4	4.07	34.03	2.78	15.39	Local	0.00
A5	2.04	49.08	2.27	9.70	Local	0.00
A6	4.96	35.28	3.58	19.32	Local	1.50
A7	3.96	50.41	4.44	18.62	Local	4.00
A8	2.86	52.68	3.45	14.07	Local	0.00
A9	3.44	50.33	3.75	15.73	Arterial	2.00
A10	0.72	61.44	1.12	4.14	Arterial	0.00
A11	2.39	53.79	2.92	11.75	Local	2.00
A12	2.96	48.02	3.22	13.95	Local	1.50
A13	5.13	47.44	5.03	21.94	Local	5.00
A14	1.43	54.86	1.94	7.68	Local	0.00
A15	7.15	26.55	3.58	23.96	Arterial	0.00
A16	0.75	76.70	1.39	4.52	Local	2.00
A17	3.76	52.91	4.19	17.02	Local	2.00
A18	2.54	52.87	2.95	11.99	Local	2.00
A19	2.09	51.95	2.51	10.32	Local	4.00
A20	2.04	49.09	2.28	9.72	Local	2.00
A21	3.02	52.59	3.69	15.04	Local	1.50
A22	3.07	74.76	6.17	20.24	Local	2.50

Sub-basin B1 is located south west of the project along Rose Mallow Ave. Surface runoff generally overland flows to on-grade inlet at DP 2A. Emergency flow from 2A will street flow to sump inlet to DP to 2K.

Sub-basin B2 is located along Shasta Daisy Terrace. Surface runoff street flows to on-grade inlet at DP 2B. 100 Year flow from 2B will street flow to on-grade inlet at Design Point 2A. Emergency flow from 2A will street flow to sump inlet to DP 2K.

Sub-basin B3 is located along Shasta Daisy Street and Dames Rocket Ave. Surface runoff generally drains to the curb and gutter to on-grade inlet at DP 2C. 100-year flow from 2C runs northerly to N. Pinery Parkway to sump inlet at DP 2J. Emergency flow from DP 2J will overland to Crowfoot Gulch.

Sub-basin B4 primarily consists of the lots located along Shasta Daisy Street. Surface runoff generally drains to on grade inlet at Design Point 2D. 100 year and Emergency flow from DP 2D will street flow to sump inlet to DP 2J.

Sub-basin B5 primarily consists of the lots located along Rose Mallow Ave and Birds Foot Ave. Surface runoff generally drains to on grade inlet at Design Point 2E. Emergency flow from DP 2E will street flow to sump inlet to DP 2K.

Sub-basin B6 primarily consists of the lots located along Rose Mallow Ave and Birds Foot Ave. Surface runoff generally drains to on grade inlet at Design Point 2F. Emergency flow from DP 2F will street flow to sump inlet to DP 2K.

Sub-basin B7 primarily consists of the lots located along Rose Mallow Ave. Surface runoff generally drains to Design Point 2G. Flow from DP 2G will street flow to local sump inlet at Design Point 2I. Emergency flow from DP 2I will street flow to sump inlet to DP 2J.

Sub-basin B8 primarily consists of the lots located along N Pinery Parkway and Birds Foot Trail. Surface runoff generally drains to local sump inlet at Design Point 2H. Emergency flow from DP 2H will street flow to sump inlet to DP 2J.

Sub-basin B9 primarily consists of the lots located along Birds Foot Trail. Surface runoff generally drains to local sump inlet at Design Point 2I. Emergency flow from DP 2I will overland to sump inlet to DP 2J.

Sub-basin B10 is located along N Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 2J. Emergency flow from 2J will overland to Crowfoot Gulch.

Sub-basin B11 is located along N Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 2K. Emergency flow from 2K will overland to Crowfoot Gulch.

Sub-basin B12 is located along Shasta Daisy Street. Surface runoff generally drains to the curb and gutter to on-grade inlet at DP 2D. 100-year flow from 2D runs northerly to N. Pinery Parkway to sump inlet at DP 2J. Emergency flow from DP 2J will overland to Crowfoot Gulch.

Sub-basin B13 primarily consists of the lots located along Shasta Daisy Street and Birds Foot Trail. Surface runoff generally drains to on grade inlet at Design Point 2M. Emergency flow from DP 2M will street flow to sump inlet to DP 2K.

Sub-basin B14 primarily consists of the lots located along Shasta Daisy Street and Birds Foot Ave. Surface runoff generally drains to on grade inlet at Design Point 2N. Emergency flow from DP 2E will street flow to sump inlet to DP 2K.

Sub-basin B15 is located along Street Dames Rocket Street. Surface runoff generally drains to the curb and gutter to on-grade inlet at DP 2O. 100-year flow from 2O runs northerly to N. Pinery Parkway to sump inlet at DP 2J. Emergency flow from DP 2J will overland to Crowfoot Gulch.

Note:						
1) 0% slope indicates sump inlet.						
DIRECT FLOW						
BASIN ID	AREA	Imperviousness	Q2	Q100	Street Type	Slope
	(AC)	%	(CFS)	(CFS)		%
B1	21.00	23.33	8.48	62.92	Local	7.00
B2	3.13	51.76	3.82	15.75	Local	3.00
B3	4.92	50.31	5.58	23.45	Local	3.00
B4	2.51	58.47	3.16	12.02	Local	5.00
B5	3.19	53.20	3.88	15.72	Local	6.00
B6	3.19	53.20	3.88	15.72	Local	6.00
B7	5.76	49.66	5.79	24.54	Local	6.00
B8	4.93	46.94	4.95	21.81	Res. Blvd	0.00
B9	2.81	49.17	2.94	12.55	Local	0.00
B10	0.65	76.70	1.28	4.14	Res. Blvd	0.00
B11	0.84	76.70	1.59	5.15	Res. Blvd	0.00
B12	3.30	75.52	6.18	20.16	Local	3.00
B13	3.19	53.20	3.88	15.72	Local	2.00
B14	3.19	53.20	3.88	15.72	Local	2.00
B15	2.01	53.11	2.50	10.13	Local	1.00

Sub-basin C1 primarily consists of the lots located along Rose Mallow Ave. Surface runoff generally drains to sump inlet at Design Point 3A. Emergency flow from DP 3A overland flow to Crowfoot Gulch via swale.

Sub-basin D1 primarily consists of the lots located along Rose Mallow Ave. Surface runoff generally drains to sump inlet at Design Point 4A. Emergency flow from DP 4A will overland Pond B.

Sub-basin D2 primarily consists of the lots located along Rose Mallow Ave and Shasta Dais Terrace. Surface runoff generally drains to Design Point 4B. Flow from DP 4B street flows to sump inlet at Design Point 4J. Emergency flow from DP 4J will overland to Pond B.

Sub-basin D3 primarily consists of the lots located along Rose Mallow Trail. Surface runoff generally drains to Design Point 4C. Flow from DP 4C street flows to sump inlet at Design Point 4E. Emergency flow from DP 4E will street flow on N Pinery Parkway to Pond B.

Sub-basin D4 primarily consists of the lots located along Rose Mallow Trail. Surface runoff generally drains to Design Point 4D. Flow from DP 4D street flows to sump inlet at Design Point 4E. Emergency flow from DP 4E will street flow on N Pinery Parkway to Pond D.

Sub-basin D5 primarily consists of the lots located along Bayou Gulch Rd and N Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 4E. Emergency flow from DP 4E will street flow on N Pinery Parkway to Pond C.

Sub-basin D6 is located along Bayou Gulch Rd. Surface runoff generally drains to an on-grade inlet at Design Point 4F. Emergency flow from DP 4F will overland flow to Pond B.

Sub-basin D7 is located along Shasta Daisy Street. Surface runoff generally drains to on-grade inlet at Design Point 4G. Emergency flow from DP 4G will street flow to Pond B.

Sub-basin D8 primarily consists of the lots located along Shasta Daisy Street. Surface runoff generally drains to Design Point 4H. Flow from DP 4H street flows to on-grade inlet at Design Point 4F. Emergency flow from DP 4F will overland to Pond B.

Sub-basin D9 primarily consists of the lots located along N. Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 4I. Emergency flow from DP 4I street flow to Pond C via N Pinery Parkway.

Sub-basin D10 primarily consists of the lots located along Rose Mallow Ave. Surface runoff generally drains to sump inlet at Design Point 4J. Emergency flow from DP 4J will overland to Pond B.

Sub-basin D11 is located along N. Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 4K. Emergency flow from DP 4K will street flow on N. Pinery Parkway.

Sub-basin D12 is located along Bayou Gulch. Surface runoff generally drains to on-grade inlet at Design Point 4L. Emergency flow from DP 4L will overland to Pond B.

Note:						
1) 0% slope indicates sump inlet.						
DIRECT FLOW						
BASIN ID	AREA	Imperviousness	Q ₂	Q ₁₀₀	Street Type	Slope
	(AC)	%	(CFS)	(CFS)		%
C1	10.07	45.10	8.72	39.44	Local	0.00
D1	5.94	42.41	5.34	25.23	Local	0.00
D2	5.33	46.14	5.58	24.83	Local	5.00
D3	3.66	43.82	3.28	15.11	Local	5.00
D4	2.91	42.33	2.45	11.57	Local	3.00
D5	6.97	33.88	4.29	23.81	Arterial	0.00
D6	2.57	42.99	2.30	10.74	Arterial	6.00
D7	2.58	42.09	2.48	11.76	Local	4.00
D8	0.85	51.73	1.06	4.38	Local	5.00
D9	3.90	49.27	4.06	17.30	Arterial	0.00
D10	4.80	50.52	5.60	23.45	Local	0.00
D11	3.29	84.30	6.19	19.00	Arterial	0.00
D12	1.13	84.30	2.13	6.53	Arterial	1.50

Sub-basin E1 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 5A. Emergency flow from DP 5A street flow to Pond C via Street R.

Sub-basin E2 primarily consists of lots located along Beebalm Ave. Surface runoff generally drains to sump inlet at Design Point 5B. A swale formed between the sidewalk and the backyard portions of Basin E2 directs flow to Pond C. Emergency flow from DP 5B overland flows to Pond C.

Sub-basin E3 primarily consists of lots located along Alpine Phlox Lane and Beebalm Trail. Surface runoff generally drains to on-grade inlet at Design Point 5C. 100 Year and Emergency flow from DP 5C street flows to sump inlet at Design Point 5E.

Sub-basin E4 primarily consists of lots located along Beebalm Ave and Crownvetch Circle. Surface runoff generally drains to Design Point 5D where it street flows southerly sump inlet at Design Point 5E. Emergency flow from DP 5E overland flows to Pond C.

Sub-basin E5 primarily consists of lots located along Beebalm Ave. Surface runoff generally drains to sump inlet at Design Point 5E. Total inflow at Design Point 5E is 83.4 CFS. Sump inlet intercepts 42.1 CFS of the total flow, remaining flow overland to sump inlet at Design Point 5B. Emergency flow from DP 5E overland flows to Pond C.

Sub-basin E6 primarily consists of lots located along Alpine Phlox Lane. Surface runoff generally drains to on-grade inlet at Design Point 5F. 100 Year flow street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E7 primarily consists of lots located along Crownvetch Circle and Copper Mallow Trail. Surface runoff generally drains to sump inlet to Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E8 primarily consists of lots located along Beebalm Ave and Scarlet Sage Ave. Surface runoff generally drains to on-grade inlet at Design Point 5H. 100 Year discharge street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E9 primarily consists of lots located along Beebalm Ave and Field Mint Terrace. Surface runoff generally drains to on-grade inlet at Design Point 5I. 100 Year discharge street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E10 primarily consists of lots located along Beebalm Ave and Beebalm way. Surface runoff generally drains to Design Point 5J. Flow from 5J street flows to sump inlet at Design Point 5B. Emergency flow from DP 5B overland flows to Pond C.

Sub-basin E11 primarily consists of open space along Scarlet Sage Ave. Surface runoff generally drains to Design Point 5K. Flow from 5K street flows to on-grade inlet at Design Point 5P. 100 year flows from 5P will street flow to Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E12 primarily consists of open space along Scarlet Sage Ave. Surface runoff generally drains to Design Point 5L. Flow from 5L street flows to on-grade inlet at Design

Point 5P. 100 year flows from 5P will street flow to Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E13 primarily consists of open space along N. Pinery Parkway. Surface runoff generally drains to Design Point 5M. Flow from 5M street flows to on-grade inlet at Design Point 5Q. 100 year flows from 5Q will street flow to Design Point 6H via pipe and swale through basin F8. Emergency flow from DP 6H overland flows to Pond D.

Sub-basin E14 primarily consists of lots located along Alpine Phlox Street and Scarlet Sage Ave. Surface runoff generally drains to sump inlet at Design Point 5N. Emergency flow from DP 5N will street flow on Street E.

Sub-basin E15 primarily consists of lots located along Alpine Phlox Street and Copper Mallow Trail. Surface runoff generally drains to on-grade inlet at DP 5O. Flow from 5O street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E16 is located along Scarlet Sage Ave. Surface runoff generally drains to on-grade inlet at Design Point 5P. Flow from 5P street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E17 is located along N. Pinery Parkway and Scarlet Sage Ave. Surface runoff generally drains to on-grade inlet at Design Point 5Q. Flow from 5Q street flows to sump inlet at Design Point 6H. Emergency flow from DP 6H overland flows to Pond D.

Sub-basin E18 primarily consists of open space along CrownVetch Circle. Surface runoff generally drains to on-grade inlet at Design Point 5R. 100 year flows from 5R will street flow to sump inlet at DP 5E. Emergency flow from DP 5E overland flows to Pond C.

Sub-basin E19 primarily consists of lots located along Scarlet Sage Ave and Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 5S. 100 Year flow street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E20 primarily consists of lots located along Beebalm Ave and Field Mint Terrace. Surface runoff generally drains to sump inlet to Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E21 primarily consists of lots located along Scarlet Sage Ave and Coppermallow Trail. Surface runoff generally drains to on-grade inlet at Design Point 5U. 100 Year discharge street flows to sump inlet at Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E22 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 5V. Emergency flow from DP 5V street flow to Pond C via Beebalm Ave.

Sub-basin E23 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 5W. Emergency flow from DP 5W street flow to Pond C via Beebalm Ave.

Sub-basin E24 primarily consists of open space along Scarlet Sage Ave. Surface runoff generally drains to Design Point 5X. Flow from 5X street flows to on-grade inlet at Design Point 5L. 100 year flows from 5X will street flow to Design Point 5G. Emergency flow from DP 5G overland flows to Pond C.

Sub-basin E25 primarily consists of lots located along Beebalm Ave. Surface runoff generally drains to on grade inlet at DP 5Y. 100-year street flows from 5Y to sump inlet at Design Point 5N. Emergency flow from DP 5N will street flow on Street E.

Note:						
1) 0% slope indicates sump inlet.						
DIRECT FLOW						
BASIN ID	AREA	Imperviousness	Q ²	Q ¹⁰⁰	Street Type	Slope
	(AC)	%	(CFS)	(CFS)		%
E1	4.04	52.65	4.95	20.19	Local	2.70
E2	5.27	52.02	4.71	19.36	Local	0.00
E3	4.77	52.31	5.64	23.07	Local	3.00
E4	3.20	52.07	3.78	14.69	Local	4.00
E5	2.76	53.77	3.09	12.43	Local	0.00
E6	2.63	53.59	3.06	12.34	Local	1.00
E7	2.77	51.99	3.21	13.17	Local	0.00
E8	2.68	53.33	3.13	12.64	Local	2.00
E9	4.84	39.52	3.92	19.46	Local	2.00
E10	0.70	56.03	0.85	3.31	Local	1.00
E11	3.99	30.00	2.48	14.96	Local	1.00
E12	3.28	30.00	2.04	12.33	Local	6.00
E13	4.45	30.00	2.76	16.67	Local	1.00
E14	9.14	44.35	8.62	39.37	Local	0.00
E15	1.89	51.97	2.08	8.55	Local	2.00
E16	1.57	73.60	2.68	8.89	Local	6.00
E17	1.55	73.60	2.64	8.76	Local	1.00
E18	2.72	52.96	3.45	14.00	Local	1.50
E19	2.91	53.40	3.58	14.46	Local	1.20
E20	2.75	53.49	3.12	12.57	Local	2.00
E21	2.05	54.72	2.56	10.18	Local	2.00
E22	4.41	53.09	5.39	21.86	Local	2.70
E23	4.11	51.69	4.81	19.86	Local	2.70
E24	4.23	30.00	2.63	15.87	Local	2.00
E25	2.78	35.90	2.16	11.51	Local	2.00

Sub-basin F1 is located along Alpine Phlox Street and N. Pinery Parkway. Surface runoff generally drains to on-grade inlet at Design Point 6A. 100 Year discharge from 6A street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F2 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 6B. 100 Year discharge from 6B street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F3 is located along Scarlet Sage Ave and Sky Pilot Ave. Surface runoff generally drains to on-grade inlet at Design Point 6C. 100 Year discharge from 6C street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F4 primarily consists of lots located along Sky Pilot Ave. Surface runoff generally drains to Design Point 6D. 2 Year discharge from 6D street flows Design Point 6C. 100 Year discharge from 6D street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F5 primarily consists of lots located along N. Pinery Parkway. Surface runoff generally drains to on-grade inlet at Design Point 6E. 100 Year discharge from 6E street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F6 primarily consists of lots located along Beebalm Way. Surface runoff generally drains to sump inlet at Design Point 6F. Emergency flow from DP 6F overland flows to Pond C.

Sub-basin F7 is located along N. Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 6G. Emergency flow from DP 6G overland flows to Pond D.

Sub-basin F8 primarily consists of lots located along Beebalm Way. Surface runoff generally drains to sump inlet at Design Point 6H. Emergency flow from DP 6H overland flows to Pond C.

Sub-basin F9 is located along street E and N. Pinery Parkway. Surface runoff generally drains to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F10 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 6J. 100 Year discharge from 6J street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F11 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 6K. 100 Year discharge from 6K street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F12 is located along Alpine Phlox Street. Surface runoff generally drains to on-grade inlet at Design Point 6L. 100 Year discharge from 6L street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Sub-basin F13 primarily consists of lots located along Sky Pilot Lane. Surface runoff generally drains to Design Point 6M. 2 Year discharge from 6M street flows Design Point 6C. 100 Year discharge from 6M street flows to sump inlet at Design Point 6I. Emergency flow from DP 6I overland flows to Pond D.

Note:						
1) 0% slope indicates sump inlet.						
DIRECT FLOW						
BASIN ID	AREA	Imperviousness	Q ₂	Q ₁₀₀	Street Type	Slope
	(AC)	%	(CFS)	(CFS)		%
F1	1.71	90.64	4.59	13.55	Local	2.50
F2	1.77	93.50	4.96	14.53	Local	2.50
F3	3.60	19.77	1.47	12.47	Local	1.00
F4	3.79	53.06	4.56	18.47	Local	4.00
F5	4.58	46.86	4.46	19.66	Res. Blvd	4.00
F6	4.93	38.37	3.70	18.75	Local	0.00
F7	4.51	18.05	1.68	15.41	Res. Blvd	0.00
F8	7.93	34.99	5.57	30.18	Local	0.00
F9	1.28	66.27	1.75	6.18	Res. Blvd	0.00
F10	1.93	92.20	5.30	15.64	Local	2.50
F11	1.50	91.79	4.07	12.03	Local	2.50
F12	1.22	93.17	3.39	9.95	Local	2.50
F13	3.58	52.91	4.36	17.70	Local	4.00

Sub-basin OS10 is located in the South west of the site. Surface runoff will overland flow to DP 34. Flow from DP 34 is conveyed to the Crowfoot Gulch via DP A.

DIRECT FLOW						
BASIN ID	AREA	Imperviousness	Q ₂	Q ₁₀₀	Street Type	Slope
	(AC)	%	(CFS)	(CFS)		%
OS 10	5.37	2.00	0.30	16.40	N/A	5.00

Sub-basin OS 1 is located south west of the site. Surface runoff overland flows to Design Point A. Flow from DP A and is conveyed via pipe into the Crowfoot Gulch. This point was evaluated in the SWMM model. The Q100 peak flow for OS 1 is 19 cfs.

Sub-basin OS 2 is located south west of the site. . Surface runoff overland flows to the Crowfoot Gulch. This point was evaluated in the SWMM model. The Q100 peak flow for OS 2 is 9.06 cfs.

Sub-basin OS 8 is located south west of the site. . Surface runoff overland flows to the Crowfoot Gulch. This point was evaluated in the SWMM model. The Q100 peak flow for OS 8 is 8.04 cfs.

Sub-basin OS 3 is located south west of the site. Surface runoff overland flows to the Crowfoot Gulch. This point was evaluated in the SWMM model. The Q100 peak flow for OS 3 is 5.77 cfs.

Sub-basins OS 9 and OS11 are undeveloped and drain to their historic drainage pathways.

OS 9's surface runoff is conveyed to an existing culvert under Crowfoot Road.

OS 11 is located in the South west of the site. Surface runoff overland flows to the defunct irrigation ditch which acts as a berm. Flow that overtops this berm will fill the irrigation ditch. In the event the irrigation ditch becomes full and overtops, the runoff will flow to existing culvert downstream.

V. ENVIRONMENTAL PROTECTION CRITERIA

1. Erosion and Sediment Control Concept

Where possible native open space area will be maintained around the perimeter of the site and along/within the natural drainage ways. As planning areas develop, BMP erosion control plans shall be developed to control erosion and sediment at the construction site.

VI. CONCLUSIONS

1. Compliance with Standards

This Final Drainage Report for Trails at Crowfoot is prepared in general conformance with the "*Storm Drainage and Environmental Criteria Manual*" [Ref. 2] and the "*Urban Storm Drainage Criteria Manual, Volumes 1, 2, and 3*" [Ref. 1].

2. Summary of Concept

The report addresses drainage concepts related to pond and storm system infrastructure sizing. The site drains to three major basins. Surface flow is intercepted by on-grade and sump inlets and are piped to three separate ponds. The three ponds will capture and detain developed runoff before exiting the site, respective to the drainage basin.

VI. REFERENCES

1. **Urban Storm Drainage Criteria Manual, Volumes 1,2,3**, Urban Drainage and Flood Control District, prepared by Urban Drainage and Flood Control District, Latest Revisions.
2. **Storm Drainage and Environmental Criteria Manual**, Town of Parker, February 2014.
3. **Web Soil Survey**, <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>, United States Department of Agriculture – Natural Resources Conservation Service.
4. **First Creek Major Drainageway Plan Conceptual Design Report**, Moser and Associates Engineering, August 2010.
5. **Hess Ranch Conceptual Drainage Report**, Manhard Consulting, June 23, 2015.
6. **FIRM, Flood Insurance Rate Map**, Douglas County, Colorado, map number 08035CO181G, 08035CO182G, 08035CO183G, and 08035CO184G Federal Emergency Management Agency, March 16, 2016.
7. **Scott and Lemon Gulch Watersheds**, Outfall systems Planning, CH2MHILL, July 2006.

Appendix

I. Vicinity Map

II. Hydrologic Computations

- A. Land use assumptions
- B. Minor and major storm runoff computations for historic and developed runoff conditions
- C. EURV and water quality volume required (UD-Detention) and allowable release rates
- D. CUHP Analysis

III. Hydraulic Computations

- A. SWMM analysis
- B. Inlet and Street Capacity (UD-Inlet)
- C. Pipe Hydraulics (UD-Sewer)
- D. Culvert and Outlet Design (UD-Culvert)
- E. Pond A and B Design
- F. Composite Channel Section (UD-Channel)
- G. Channel Analysis (HEC-RAS)
- H. Hydraulic Structures

IV. Copies of graphs, tables, and nomographs

- A. FIRM
- B. Soils Report
- C. 1-Hour Rainfall Graph
- D. Excerpts from Adjacent Studies
 - Piney Creek MDP

V. Sub-basin Exhibit

Checklist of Drainage Report Requirements

Project Name: _____

____ Conceptual ____ Preliminary ____ Final

Initial Item or N/A	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
☐	COVER SHEET with title, date, applicant, preparer	X	X	X
☐	TABLE OF CONTENTS	X	X	X
☐	PE Certification and Seal		X	X
GENERAL LOCATION & DESCRIPTION				
☐	1 Township, range, section, quarter section	X	X	X
☐	2 Local streets within and adjacent to the subdivision	X	X	X
☐	3 Major drainage way and facilities	X	X	X
☐	4 Names of surrounding subdivisions	X	X	X
☐	5 Area in acres (verify with plat if available)	X	X	X
☐	6 Existing ground cover (trees, scrubs, etc.)	X	X	X
☐	7 Existing soil conditions	X	X	X
☐	8 Proposed land use	X	X	X
DRAINAGE BASINS AND SUB-BASINS				
Major Basin Description				
☐	9 Reference major drainage way planning study	X	X	X
☐	10 Reference flood hazard delineation report	X	X	X
☐	11 Reference FEMA flood insurance study	X	X	X
☐	12 Identify presence of regulatory floodplains/floodways at site. Discuss any proposed disturbance to floodplain.	X	X	X
☐	13 Supporting and labeled FEMA flood insurance map included (if applicable)		X	X
☐	14 Will a FEMA LOMR be required?		X	X
☐	15 Reference previous drainage studies affecting the site	X	X	X
☐	16 Coordination with surrounding subdivision plans	X	X	X
☐	17 Basin drainage characteristics - existing and planned land uses affecting the site	X	X	X
Site Sub-Basin Description				
☐	18.19 Discussion of historic drainage pattern of the property	X	X	X
☐	19 Discussion of off-site drainage flow patterns onto the site	X	X	X
☐	20 Supporting off-site delineation map included	X	X	X
☐	21 Identify presence or absence of any major drainageways on the site with total tributary area >130 acres	X	X	X
☐	22 Discussion of development of off-site basins and impact on site	X	X	X
DRAINAGE DESIGN CRITERIA				
Regulations				
☐	23 Discussion of compliance with the Town's floodplain ordinance	X	X	X
☐	Discussion of compliance with Town's Stream Preservation Standards			
☐	24 Stream Buffers in project area	X	X	X
☐	25 Permitted uses planned, if any	X	X	X
☐	26 Discussion of Minor or Major Modification requested	X	X	X
☐	27 Discussion of compliance with UD&FCD maintenance eligibility review	X	X	X
☐	Development Criteria Reference and Constraints			
☐	28 Discussion of previous drainage studies for the site	X	X	X

Checklist of Drainage Report Requirements

Project Name: _____

____ Conceptual ____ Preliminary ____ Final

Initial Item or N/A	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
[] 29	Complies with previous study/Does not comply (Discussion on changes from the previous study)	X	X	X
[] 30	Discussion of coordination with adjacent drainage studies	X	X	X
[] 31	Discussion of site drainage constraints (such as streets, utilities, existing structures, etc.)	X	X	X
Hydrology Criteria				
[] 32	Identify design rainfall event, frequency, and duration	X	X	X
[] 33	Identify runoff calculation method used	X	X	X
[] 34	Identify calculation method for detention storage requirement	X	X	X
[] 35	Identify calculation method for detention discharge	X	X	X
[] 36	Discussion and justification of criteria or methods not referenced by SDECM	X	X	X
Hydraulic Criteria				
[] 37	Identify street capacity references		X	X
[] 38	Identify other capacity references		X	X
[] 39	Identify detention pond outlet design method		X	X
[] 40	Identify check/ drop structure criteria used		X	X
[] 41	Discussion of drainage facility design criteria not referenced by SDECM		X	X
Variance from Criteria				
[] 42	Identify provision by section number for which a variance is requested	X	X	X
[] 43	Provide justification and discussion for each variance requested	X	X	X
DRAINAGE FACILITY DESIGN				
General Concept				
[] 44	Discussion of concept and proposed drainage patterns of the site	X	X	X
[] 45	Discussion of off-site runoff impacting the site	X	X	X
[] 46	Discussion of runoff impacting downstream properties		X	X
[] 47	Discussion of tables, charts, figures, drawing, etc. presented in the appendix	X	X	X
[] 48	Discussion of proposed drainage patterns	X	X	X
Specific Details				
[] 49	Discussion of drainage problems of the site	X	X	X
[] 50	Underdrains allowed in ROW only with Public Works Director approval		X	X
[] 51	Discussion of specific solutions at design points	X	X	X
Discussion of detention storage required for full-spectrum detention				
[] 52	Supporting labeled calculations for adequate storage volume requirement	X	X	X
[] 53	Supporting labeled calculations that detention pond will accommodate volume required	X	X	X
[] 54	Supporting labeled calculations for water surface elevations		X	X
[] 55	Supporting labeled calculations for minimum of one foot freeboard requirement		X	X
Discussion of outlet requirements				
[] 56	Water quality requirements are met - per SDECM Section 8.3		X	X
[] 57	Supporting labeled calculations for water quality orifice plate geometry and perforation sizing.			X
[] 58	Supporting labeled calculations for detention pond outlet staged release structure		X	X
[] 59	Supporting labeled calculations for detention pond outlet pipe capacity		X	X
[] 60	Supporting labeled calculations for sewer pipe outfall, design of riprap (match with grades, and downstream flowpath)			X
[] 61	Supporting labeled calculations for emergency overflow conditions		X	X
Discussion of storm sewer configuration				

Checklist of Drainage Report Requirements

Project Name: _____

____ Conceptual ____ Preliminary ____ Final

Initial Item or N/A	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
[] 62	Supporting labeled calculations for storm sewer capacity, type of flow, calculated pipe losses, and hydraulic grade line calculations		X	X
[] 63	Supporting labeled calculations for storm sewer inlet type and sizing calculations		X	X
[] 64	Supporting labeled calculations for storm sewer outlet conditions			X
[] 65	Supporting labeled calculations for conduit outlet protection design			X
	Discussion on channel design and soil erodibility within channel			
[] 66	Supporting labeled calculations for type of flow and velocity of flow		X	X
[] 67	Discussion on proposed channel lining/bank protection		X	X
[] 68	Supporting labeled calculations for freeboard requirement		X	X
[] 69	Supporting labeled calculations for water surface elevations		X	X
[] 70	Supporting labeled calculations for backwater analysis		X	X
[] 71	Supporting labeled calculations for sizing calculation for check structures			X
[] 72	Supporting labeled calculations for sizing calculation for drop structures			X
[] 73	Discussion of easements and tracts dedicated for drainage & maintenance purposes	X	X	X
[] 74	Discussion of maintenance and access aspects of the design		X	X
	Stormwater Utility Eligible Facilities			
[] 75	Identify stormwater facilities proposed for acceptance into the Stormwater Utility		X	X
	ENVIRONMENTAL PROTECTION CRITERIA			
	General			
[] 76	Identify wetland areas, jurisdictional status, and other "Waters of the U.S."	X	X	X
[] 77	Identify potential impacts to T & E species and presence of Habitat Protection Areas and Stream Restoration Areas	X	X	X
[] 78	Discuss compliance with State and Federal environmental permitting regulations	X	X	X
	Construction BMP Plan			
[] 79	Discussion of Construction BMP Requirements (per SDECM Section 8.2)	X	X	X
	Permanent BMP Plan			
[] 80	Discussion of Permanent BMP requirements (per SDECM Section 8.3)	X	X	X
[] 81	Supporting labeled calculations for WQCV requirements		X	X
[] 82	Supporting labeled calculations for storage volume requirements		X	X
[] 83	Supporting labeled calculations for outlet structure design		X	X
[] 84	Discussion of landscaping considerations for PBMP		X	X
[] 85	Discussion of maintenance and access aspects of the design		X	X
	CONCLUSIONS			
	Compliance with Standards			
[] 86	Town Ordinances		X	X
[] 87	Town SDECM		X	X
[] 88	Major drainage plans (UDECD Outfall Systems Plan)		X	X
[] 89	Town floodplain regulations		X	X
[] 90	Stream Preservation Standards		X	X
	Drainage Concept			
[] 91	Effectiveness of design to control storm runoff	X	X	X
[] 92	Discussion of maintenance responsibility for public and private drainage facilities		X	X
[] 93	Discuss impact of proposed development on the Major Drainage Planning Studies recommendations		X	X

Checklist of Drainage Report Requirements

Project Name: _____

____ Conceptual ____ Preliminary ____ Final

Initial Item or N/A	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
Sediment and Erosion Control Concept				
94	Effectiveness of erosion control plan		X	X
95	Suitability of site soils for development		X	X
96	Certification statement and PE seal and signature		X	X
REFERENCES				
97	List all drainage reports and technical information used	X	X	X
98	List all computer software used in analysis	X	X	X
APPENDICES				
Hydrologic Computations (Historic)				
99	Historic basin delineation, onsite and offsite	X	X	X
100	Runoff coefficient determination, including composite "C" calculation	X	X	X
101	Rational Method analysis for each basin, initial and major storm	X	X	X
102	Rational method analysis for each design point (i.e., routed cumulative flow), initial and major storm	X	X	X
103	Schematic figure illustrating routing for basins and design points	X	X	X
104	CUHP/UDSWM input and output data	X	X	X
105	Schematic figure illustrating routing of CUHP basins and UDSWM elements	X	X	X
Hydrologic Computations (Developed)				
106	Developed basin delineation, onsite and offsite	X	X	X
107	Runoff coefficient determination, including composite "C" calculation	X	X	X
108	Rational Method analysis for each basin, initial and major storm	X	X	X
109	Rational method analysis for each design point (i.e., routed cumulative flow), initial and major storm	X	X	X
110	Schematic figure illustrating routing for basins and design points	X	X	X
111	CUHP/UDSWM input and output data	X	X	X
112	Schematic figure illustrating routing of CUHP basins and UDSWM elements	X	X	X
Hydraulic Computations (Extended Detention Basin)				
113	Volume of storage required (WOCV, EURV and 100-year event)	X	X	X
114	Volume of designed detention pond (maximum volume)	X	X	X
115	Does maximum water surface elevation allow for one foot minimum freeboard requirement (may require profile of pond)		X	X
116	Inflow(s) energy dissipater (see hydraulic computations for storm sewer)		X	X
117	Forebay - volume and drain pipe/weir		X	X
Hydraulic Computation (EDB Outlet Structure)				
118	Calculation of Historic release rates based on UDFCD Volume 2, Storage Chapter	X	X	X
119	Calculation of allowable 100-year release rate based on UDFCD Volume 2, Storage Chapter	X	X	X
120	Water quality trash rack/screen geometry		X	X
121	Water quality trash rack/screen geometry and open area			X
122	Office or weir sizing for 100-year release rate			X
123	Office or weir placement for 100-year water surface elevation		X	X
124	Trash Rack (overflow) sizing calculation			X
125	Calculations for emergency overflow		X	X
126	Capacity, velocity, and Froude number calculations for outlet structure storm sewer pipe		X	X
127	Calculations for outlet protection for outlet structure pipe			X

Checklist of Drainage Report Requirements

Project Name: _____

_____ Conceptual _____ Preliminary _____ Final

Initial or N/A	Item No.	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
☐	128	Invert locations, slope, diameter (18-inch minimum), material (RCP only) and pipe classification for outlet structure storm sewer pipe			X
☐	129	Does the invert out of the outlet structure storm sewer pipe match grade and have a logical downstream flowpath		X	X
☐	130	Profile of outlet structure and outlet storm sewer pipe (may be included with profile of pond)			X
☐	131	Design procedure form included			X
	Hydraulic Computation (Storm Sewer Configuration)				
☐	132	Minimum pipe size 18-inch (RCP only) for lateral and main line		X	X
☐	133	Capacity calculations		X	X
☐	134	Pipe loss calculations		X	X
☐	135	Initial and Major Storm hydraulic grade line calculations (minor storm cannot surcharge storm sewer system)		X	X
☐	136	Inlet (or entrance condition) sizing and capacity calculations		X	X
☐	137	Velocity and Froude number calculation at pipe outlet		X	X
☐	138	Outlet protection design calculations			X
☐	139	Discharge of a storm sewer onto streets is prohibited		X	X
	Hydraulic Computation (Culverts)				
☐	140	Calculations for flow through structure		X	X
☐	141	Calculations for controlling condition (entrance or outlet)		X	X
☐	142	Capacity calculations (minimum 24-inch CMP or RCP within ROW or 18-inch minimum RCP or CMP for swales at driveways, trails and sidewalks)		X	X
☐	143	Velocity calculations (minimum of 3 fps during initial storm is recommended)		X	X
☐	144	Water surface or overtopping elevations calculated and compared to allowable overtopping (see SDECM Table 2.7)		X	X
	Hydraulic Computation (Bridges)				
☐	145	See UDFCD Volume 2, Hydraulic Structures Chapter		X	X
	Hydraulic Computation (Open Channels)				
☐	146	Calculation of developed flow through the channel		X	X
☐	147	Investigation of erodibility of soils in channel is required		X	X
☐	148	Calculations to document 100-year discharge flow parameters		X	X
☐	149	Backwater calculations		X	X
☐	150	Check structure design calculations		X	X
☐	151	Drop structure design calculations		X	X
☐	152	Riprap design calculations		X	X
☐	153	Calculations for all other proposed channel lining			X
	Hydraulic Computation (Streets)				
☐	154	Street classification			X
☐	155	Street capacity major and initial storm (see SDECM Section 2.5)			X
	Permanent BMP Calculations				
☐	156	Calculations for WQCV requirements		X	X
☐	157	Calculations for storage volume requirements		X	X
☐	158	Supporting labeled calculations for outlet structure design		X	X
☐	159	All other design calculations necessary for design of Permanent BMP		X	X
	HISTORIC CONDITIONS DRAINAGE DRAWING				
☐	160	24"x36" drawing - scale of 1"=100' to 1"=400'	X	X	X

Checklist of Drainage Report Requirements

Project Name: _____

____ Conceptual ____ Preliminary ____ Final

Initial or N/A	Item No.	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
	161	General location or vicinity map	X	X	X
	162	North arrow and scale	X	X	X
	163	Legend to define map symbols	X	X	X
	164	Title block in lower right hand corner	X	X	X
	165	Existing contours at appropriate contour interval	X	X	X
	166	Delineation of onsite basins and offsite basins impacting site	X	X	X
	167	Drainage flow paths and design points for accumulated flow	X	X	X
	168	Table showing routing and accumulation of flow at design points for initial and major event	X	X	X
	169	Existing drainage facilities	X	X	X
	170	Existing 100-year floodplains	X	X	X
	171	Stream Buffer areas	X	X	X
DRAINAGE DRAWING CONTENTS					
	172	24"x 36" drawing - scale of 1"=20' to 1"=200'	X	X	X
	173	General location or vicinity map	X	X	X
	174	North arrow and scale	X	X	X
	175	Legend to define map symbols	X	X	X
	176	Title block in lower right hand corner	X	X	X
	177	Existing contours at minimum 2 foot contour interval (dashed-shaded) extending minimum of 100' beyond property lines	X	X	X
	178	Proposed contours at minimum 2 foot contour interval (solid) extending minimum of 100' beyond property lines	X	X	X
	179	All property and lots lines shown	X	X	X
	180	All easements and tracts shown and labeled with purpose	X	X	X
	181	Streets shown (with ROW width, flowline, sidewalk, etc. for PDR and FDR)	X	X	X
	182	Existing drainage facilities shown with structures, ditches, drainageways, gutter flow, culverts, etc.	X	X	X
	183	Existing drainage facilities labeled with material, size, shape, slope, and location	X	X	X
	184	Stream Buffer areas	X	X	X
	185	Overall drainage area boundary shown (including any off-site basins)	X	X	X
	186	Drainage area sub-boundary shown	X	X	X
	187	Basin and sub-basin descriptor (which includes identification, area, runoff coefficients or flows)	X	X	X
	188	Directional flow arrows	X	X	X
	189	Table showing routing and accumulation of flow at design points for major & initial event	X	X	X
	190	Proposed type of street flow (detail if necessary)		X	X
	191	Drainage ditches, swales, gutter, and cross pans shown (Generally shown for CDR)	X	X	X
	192	Proposed storm sewer shown including size and type of pipe, inlets, manholes, outfall, riprap, etc. shown (Generally shown for CDR)	X	X	X
	193	Existing storm sewer shown including size and type of pipe, inlets, manholes, outfall, riprap, etc. labeled (if any)		X	X
	194	Proposed open drainage channels shown including drop and check structures, riprap, channel lining, side slope, channel slope, etc. shown (Generally shown for CDR)	X	X	X
	195	Existing open drainage channels shown including drop and check structures, riprap, channel lining, side slope, channel slope, etc.		X	X
	196	Detention pond with extent of pond delineated	X	X	X
	197	Shaded area of 100-year water surface shown for detention pond		X	X
	198	Table of volumes and release rates for water quality/detention facilities	X	X	X

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____ Conceptual ____ Preliminary ____ Final

Initial or N/A	Item No.	Description	Conceptual Drainage Report (CDR)	Preliminary Drainage Report (PDR)	Final Drainage Report (FDR)
☐	199	Detail information on EDB outlet structure			X
☐	200	Profile of EDB outlet structure showing water surface elevations, outlet pipe, water quality orifice plate, and discharge orifices			X
☐	201	Detail of water quality orifice plate showing size of perforations, number of rows, and spacing			X
☐	202	Detail information on Permanent BMPs			X
☐	203	Profile of Permanent BMP outlet structure showing water surface elevations, outlet pipe, water quality orifice plate, and discharge orifices			X
☐	204	Location and elevation (if known) for all existing and proposed utilities by of affecting the drainage design	X	X	X
☐	205	Routing of off-site flows thru the development (around detention basins, not through)	X	X	X
☐	206	Definition of flow path leaving the development through downstream properties to a major drainageway (if applicable)	X	X	X
☐	207	Location of all FEMA floodplains affecting the site (both existing and proposed)	X	X	X

Appendix

I. Vicinity Map

II. Hydrologic Computations

- A. Land use assumptions
- B. Minor and major storm runoff computations for historic and developed runoff conditions
- C. Pond Calculation

III. Hydraulic Computations

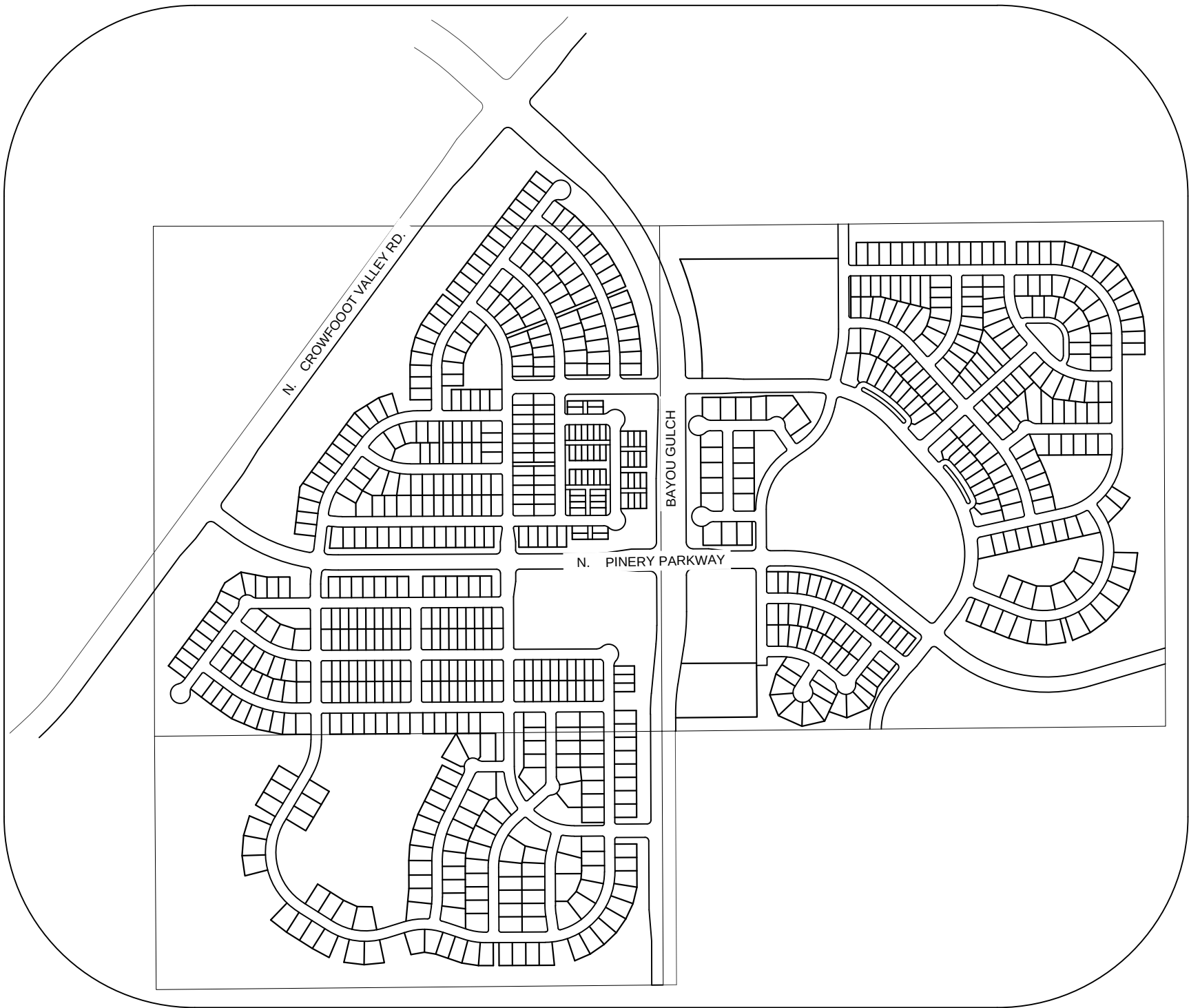
- A. CUHP & SWMM
- B. UD Inlet
- C. UD Sewer
- D. UD Channel
- E. UD Culvert
- F. HECRAS

IV. Copies of graphs, tables, and nomographs

- A. FIRM
- B. Soils Report
- C. 1-Hour Rainfall Data
- D. Excerpts from Adjacent Studies

V. Sub-basin Exhibit

I. Vicinity Map



VICINITY MAP

N.T.S.

II. Hydrologic Computations

A. Land use assumptions

1. Imperviousness & Composite C Calculations
2. SF-1-Time of Concentrations

B. Minor and major storm runoff computations for historic and developed runoff conditions

1. SF-2 2-Year Sub-Basin Rational Method Calculations
2. SF-2 100-Year Sub-Basin Ration Method Calculations

C. Pond Calculation

COMPOSITE BASIN COEFFICIENTS

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot

Project No. 254103

Soil Type B/C/D

Calculated By: MRS

Date: 1/31/2018

Soil Type B 49.80%

Land Use	Imp.	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.42	0.67
School	55%	0.49	0.51	0.72
Business	95%	0.85	0.88	0.92
Residential (Multi Family)	75%	0.67	0.70	0.82
Streets	100%	0.89	0.93	0.94
Paved	90%	0.80	0.84	0.90
Parks	10%	0.09	0.09	0.50
Open Space / Lawns	2%	0.02	0.02	0.46
Mixed Use	30%	0.27	0.28	0.60

Soil Type C/D 50.20%

Land Use	Imp.	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.44	0.71
School	55%	0.49	0.53	0.76
Business	95%	0.85	0.88	0.96
Residential (Multi Family)	75%	0.67	0.70	0.85
Streets	100%	0.89	0.92	0.96
Paved	90%	0.80	0.83	0.91
Parks	10%	0.09	0.14	0.55
Open Space / Lawns	2%	0.02	0.07	0.52
Mixed Use	30%	0.27	0.31	0.64

Composite Runoff Co-eff

Land Use	Imp.	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69
School	55%	0.49	0.52	0.74
Business	95%	0.85	0.88	0.94
Residential (Multi Family)	75%	0.67	0.70	0.84
Streets	100%	0.89	0.92	0.95
Paved	90%	0.80	0.83	0.91
Parks	10%	0.09	0.12	0.53
Open Space / Lawns	2%	0.02	0.05	0.49
Mixed Use	30%	0.27	0.30	0.62

R.O.W. Imperviousness Average Imperviousness Calculation for R.O.W. (Bayou Gulch Road)

Total Area 120.00 Sq.ft

Composite Calculations

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀
Lawns, Sandy Soil (2-7%)	2	0.02	0.05	0.49	16	0.3	0.00	0.01	0.07
Walks	90	0.80	0.83	0.91	32	24.0	0.21	0.22	0.24
Street	100	0.89	0.92	0.95	72	60.0	0.53	0.55	0.57
TOTAL					120.00	84.3	0.75	0.78	0.88

R.O.W. Imperviousness Average Imperviousness Calculation for R.O.W. (N Pinery Parkway)

Total Area 80.00 Sq.ft

Composite Calculations

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀
Lawns, Sandy Soil (2-7%)	2	0.02	0.05	0.49	16	0.4	0.00	0.01	0.10
Walks	90	0.80	0.83	0.91	30	33.8	0.30	0.31	0.34
Street	100	0.89	0.92	0.95	34	42.5	0.38	0.39	0.40
TOTAL					80.00	76.7	0.68	0.72	0.84

R.O.W. Imperviousness Average Imperviousness Calculation for R.O.W. (Residential Local)

Total Area 65.00 Sq.ft

Composite Calculations

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀
Lawns, Sandy Soil (2-7%)	2	0.02	0.05	0.49	16	0.5	0.00	0.01	0.12
Walks	90	0.80	0.83	0.91	15	20.8	0.18	0.19	0.21
Street	100	0.89	0.92	0.95	34	52.3	0.47	0.48	0.50
TOTAL					65.00	73.6	0.66	0.69	0.83

A1

Total Area		4.11 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.22	24.3	0.22	0.23	0.37
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	1.02	19.1	0.17	0.18	0.21
Open Space / Lawns	2%	0.02	0.05	0.49	0.87	0.4	0.00	0.01	0.10
TOTAL					4.11	43.8	0.39	0.42	0.69

A2

Total Area		1.84 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.38	33.7	0.30	0.32	0.52
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.46	18.4	0.16	0.17	0.21
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					1.84	52.2	0.46	0.49	0.72

A3

Total Area		3.23 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.28	31.8	0.28	0.30	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.74	16.9	0.15	0.16	0.19
Open Space / Lawns	2%	0.02	0.05	0.49	0.21	0.1	0.00	0.00	0.03
TOTAL					3.23	48.8	0.43	0.46	0.71

A4

Total Area		4.07 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.50	16.6	0.15	0.16	0.25
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.92	16.6	0.15	0.16	0.19
Open Space / Lawns	2%	0.02	0.05	0.49	1.65	0.8	0.01	0.02	0.20
TOTAL					4.07	34.0	0.30	0.33	0.64

A5

Total Area		2.04 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.25	27.5	0.24	0.26	0.42
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.59	21.3	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.20	0.2	0.00	0.00	0.05
TOTAL					2.04	49.1	0.44	0.47	0.71

A6

Total Area		4.96 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.44	22.1	0.20	0.21	0.34
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.84	12.5	0.11	0.12	0.14
Open Space / Lawns	2%	0.02	0.05	0.49	1.68	0.7	0.01	0.02	0.17
TOTAL					4.96	35.3	0.31	0.34	0.65

A7

Total Area		3.96 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.46	28.0	0.25	0.27	0.43
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.20	22.3	0.20	0.21	0.25
Open Space / Lawns	2%	0.02	0.05	0.49	0.30	0.2	0.00	0.00	0.04
TOTAL					3.96	50.4	0.45	0.48	0.72

A8

Total Area		2.86 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.09	32.9	0.29	0.31	0.50
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.77	19.8	0.18	0.18	0.22
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					2.86	52.7	0.47	0.50	0.73

A9

Total Area		3.44 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	2.02	49.5	0.44	0.46	0.51
Open Space / Lawns	2%	0.02	0.05	0.49	1.42	0.8	0.01	0.02	0.20
TOTAL					3.44	50.3	0.45	0.48	0.72

A10

Total Area		0.72 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	0.52	60.9	0.54	0.57	0.63
Open Space / Lawns	2%	0.02	0.05	0.49	0.20	0.6	0.01	0.01	0.14
TOTAL					0.72	61.4	0.55	0.58	0.77

A11

Total Area		2.39 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.66	31.2	0.28	0.30	0.48
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.74	22.6	0.20	0.21	0.25
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					2.39	53.8	0.48	0.51	0.73

A12

Total Area		2.96 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.01	30.5	0.27	0.29	0.47
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.70	17.3	0.15	0.16	0.19
Open Space / Lawns	2%	0.02	0.05	0.49	0.26	0.2	0.00	0.00	0.04
TOTAL					2.96	48.0	0.43	0.46	0.70

A13

Total Area		5.13 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	1.55	22.7	0.20	0.21	0.25
ROW	74%	0.66	0.69	0.83	1.67	24.0	0.21	0.22	0.27
Open Space / Lawns	2%	0.02	0.05	0.49	1.90	0.7	0.01	0.02	0.18
TOTAL					5.13	47.4	0.42	0.45	0.70

A14

Total Area		1.43 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.07	33.7	0.30	0.32	0.52
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	0.36	21.1	0.19	0.20	0.22
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					1.43	54.9	0.49	0.52	0.74

A15

Total Area		7.15 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	2.45	25.2	0.22	0.24	0.28
Open Space / Lawns	2%	0.02	0.05	0.49	4.70	1.3	0.01	0.03	0.32
TOTAL					7.15	26.5	0.24	0.27	0.61

A16

Total Area		0.75 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.75	76.7	0.68	0.72	0.84
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					0.75	76.7	0.68	0.72	0.84

A17

Total Area		3.76 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.82	33.8	0.30	0.32	0.52
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.94	19.1	0.17	0.18	0.21
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					3.76	52.9	0.47	0.50	0.73

A18

Total Area		2.54 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.84	32.6	0.29	0.31	0.50
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.70	20.2	0.18	0.19	0.23
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					2.54	52.9	0.47	0.50	0.73

A19

Total Area		2.09 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.58	34.1	0.30	0.33	0.52
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.51	17.9	0.16	0.17	0.20
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					2.09	51.9	0.46	0.49	0.72

A20

Total Area		2.04 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.15	25.3	0.22	0.24	0.39
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.65	23.5	0.21	0.22	0.26
Open Space / Lawns	2%	0.02	0.05	0.49	0.24	0.2	0.00	0.01	0.06
TOTAL					2.04	49.1	0.44	0.47	0.71

A21

Total Area		3.02 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.22	33.0	0.29	0.32	0.51
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.80	19.5	0.17	0.18	0.22
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					3.02	52.6	0.47	0.50	0.73

A22

Total Area		3.07 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	2.54	62.1	0.55	0.58	0.69
ROW	74%	0.66	0.69	0.83	0.53	12.7	0.11	0.12	0.14
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					3.07	74.8	0.67	0.70	0.83

B1

Total Area		21.00 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	5.62	12.0	0.11	0.12	0.18
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	2.88	10.1	0.09	0.09	0.11
Open Space / Lawns	2%	0.02	0.05	0.49	12.50	1.2	0.01	0.03	0.29
TOTAL					21.00	23.3	0.21	0.24	0.59

B2

Total Area		3.13 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.39	34.4	0.31	0.33	0.53
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.74	17.4	0.15	0.16	0.20
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					3.13	51.8	0.46	0.49	0.72

B3

Total Area		4.92 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.93	26.8	0.24	0.26	0.41
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.56	23.3	0.21	0.22	0.26
Open Space / Lawns	2%	0.02	0.05	0.49	0.43	0.2	0.00	0.00	0.04
TOTAL					4.92	50.3	0.45	0.48	0.72

B4

Total Area		2.51 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	1.14	34.0	0.30	0.32	0.38
ROW	77%	0.68	0.72	0.84	0.79	24.0	0.21	0.22	0.26
Open Space / Lawns	2%	0.02	0.05	0.49	0.59	0.5	0.00	0.01	0.11
TOTAL					2.51	58.5	0.52	0.55	0.76

B5

Total Area		3.19 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.28	32.1	0.29	0.31	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.92	21.1	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					3.19	53.2	0.47	0.50	0.73

B6

Total Area		3.19 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.28	32.1	0.29	0.31	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.92	21.1	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					3.19	53.2	0.47	0.50	0.73

B7

Total Area		5.76 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	3.57	27.9	0.25	0.27	0.43
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.69	21.6	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.50	0.2	0.00	0.00	0.04
TOTAL					5.76	49.7	0.44	0.47	0.71

B8

Total Area		4.93 acres			Composite Calculations				
Land Use	.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.13	19.4	0.17	0.19	0.30
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	1.74	27.1	0.24	0.25	0.30
Open Space / Lawns	2%	0.02	0.05	0.49	1.06	0.4	0.00	0.01	0.11
TOTAL					4.93	46.9	0.42	0.45	0.70

B9

Total Area		2.81 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.00	32.0	0.28	0.31	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.65	17.0	0.15	0.16	0.19
Open Space / Lawns	2%	0.02	0.05	0.49	0.16	0.1	0.00	0.00	0.03
TOTAL					2.81	49.2	0.44	0.47	0.71

B10

Total Area		0.65 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.65	76.7	0.68	0.72	0.84
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					0.65	76.7	0.68	0.72	0.84

B11

Total Area		0.84 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.84	76.7	0.68	0.72	0.84
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					0.84	76.7	0.68	0.72	0.84

B12

Total Area		3.30 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	2.30	52.3	0.47	0.49	0.58
ROW	77%	0.68	0.72	0.84	1.00	23.2	0.21	0.22	0.25
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					3.30	75.5	0.67	0.70	0.84

B13

Total Area		3.19 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.28	32.1	0.29	0.31	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.92	21.1	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					3.19	53.2	0.47	0.50	0.73

B14

Total Area		3.19 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.28	32.1	0.29	0.31	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.92	21.1	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					3.19	53.2	0.47	0.50	0.73

B15

Total Area		2.01 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.44	32.2	0.29	0.31	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.57	20.9	0.19	0.19	0.23
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					2.01	53.1	0.47	0.50	0.73

C1

Total Area		10.07 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	6.58	29.4	0.26	0.28	0.45
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	2.11	15.4	0.14	0.14	0.17
Open Space / Lawns	2%	0.02	0.05	0.49	1.38	0.3	0.00	0.01	0.07
TOTAL					10.07	45.1	0.40	0.43	0.69

D1

Total Area		5.94 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	4.20	31.8	0.28	0.30	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.83	10.3	0.09	0.10	0.12
Open Space / Lawns	2%	0.02	0.05	0.49	0.91	0.3	0.00	0.01	0.08
TOTAL					5.94	42.4	0.38	0.41	0.68

D2

Total Area		5.33 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	3.34	28.2	0.25	0.27	0.43
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.28	17.7	0.16	0.16	0.20
Open Space / Lawns	2%	0.02	0.05	0.49	0.71	0.3	0.00	0.01	0.07
TOTAL					5.33	46.1	0.41	0.44	0.70

D3

Total Area		3.66 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.05	25.2	0.22	0.24	0.39
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.90	18.2	0.16	0.17	0.20
Open Space / Lawns	2%	0.02	0.05	0.49	0.70	0.4	0.00	0.01	0.09
TOTAL					3.66	43.8	0.39	0.42	0.69

D4

Total Area		2.91 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.83	28.3	0.25	0.27	0.43
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.54	13.7	0.12	0.13	0.15
Open Space / Lawns	2%	0.02	0.05	0.49	0.54	0.4	0.00	0.01	0.09
TOTAL					2.91	42.3	0.38	0.41	0.68

D5

Total Area		6.97 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	2.70	32.7	0.29	0.30	0.34
Open Space / Lawns	2%	0.02	0.05	0.49	4.27	1.2	0.01	0.03	0.30
TOTAL					6.97	33.9	0.30	0.33	0.64

D6

Total Area		2.57 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	1.28	42.0	0.37	0.39	0.44
Open Space / Lawns	2%	0.02	0.05	0.49	1.29	1.0	0.01	0.02	0.25
TOTAL					2.57	43.0	0.38	0.41	0.68

D7

Total Area		2.58 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.29	22.5	0.20	0.22	0.35
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.67	19.1	0.17	0.18	0.21
Open Space / Lawns	2%	0.02	0.05	0.49	0.62	0.5	0.00	0.01	0.12
TOTAL					2.58	42.1	0.37	0.40	0.68

D8

Total Area		0.85 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.65	34.4	0.31	0.33	0.53
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.20	17.3	0.15	0.16	0.19
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					0.85	51.7	0.46	0.49	0.72

D9

Total Area		3.90 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	2.24	48.4	0.43	0.45	0.50
Open Space / Lawns	2%	0.02	0.05	0.49	1.66	0.9	0.01	0.02	0.21
TOTAL					3.90	49.3	0.44	0.47	0.71

D10

Total Area		4.80 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	3.87	36.3	0.32	0.35	0.56
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.93	14.2	0.13	0.13	0.16
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					4.80	50.5	0.45	0.48	0.72

D11

Total Area		3.29 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	3.29	84.3	0.75	0.78	0.88
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					3.29	84.3	0.75	0.78	0.88

D12

Total Area**1.13 acres****Composite Calculations**

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	84%	0.75	0.78	0.88	1.13	84.3	0.75	0.78	0.88
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					1.13	84.3	0.75	0.78	0.88

E1

Total Area**4.04 acres****Composite Calculations**

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
School	55%	0.49	0.52	0.74	3.51	47.8	0.43	0.45	0.64
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.26	4.7	0.04	0.04	0.05
Open Space / Lawns	2%	0.02	0.05	0.49	0.27	0.1	0.00	0.00	0.03
TOTAL					4.04	52.7	0.47	0.50	0.73

E2

Total Area**5.27 acres****Composite Calculations**

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	3.75	32.0	0.28	0.31	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.43	20.0	0.18	0.19	0.22
Open Space / Lawns	2%	0.02	0.05	0.49	0.09	0.0	0.00	0.00	0.01
TOTAL					5.27	52.0	0.46	0.49	0.72

E3

Total Area**4.77 acres****Composite Calculations**

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	3.55	33.5	0.30	0.32	0.51
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.22	18.8	0.17	0.18	0.21
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					4.77	52.3	0.47	0.50	0.72

E4

Total Area		3.20 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.41	33.9	0.30	0.32	0.52
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.79	18.2	0.16	0.17	0.20
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					3.20	52.1	0.46	0.49	0.72

E5

Total Area		2.76 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.91	31.2	0.28	0.30	0.48
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.85	22.6	0.20	0.21	0.25
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					2.76	53.8	0.48	0.51	0.73

E6

Total Area		2.63 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.84	31.5	0.28	0.30	0.48
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.79	22.1	0.20	0.21	0.25
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					2.63	53.6	0.48	0.51	0.73

E7

Total Area		2.77 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.10	34.0	0.30	0.32	0.52
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.68	18.0	0.16	0.17	0.20
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					2.77	52.0	0.46	0.49	0.72

E8

Total Area		2.68 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.90	31.9	0.28	0.30	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.78	21.4	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					2.68	53.3	0.47	0.51	0.73

E9

Total Area		4.84 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.04	19.0	0.17	0.18	0.29
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.12	17.1	0.15	0.16	0.19
Parks	10%	0.09	0.12	0.53	1.67	3.5	0.03	0.04	0.18
TOTAL					4.84	39.5	0.35	0.38	0.66

E10

Total Area		0.70 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.43	27.6	0.25	0.26	0.42
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.27	28.4	0.25	0.27	0.32
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					0.70	56.0	0.50	0.53	0.74

E11

Total Area		3.99 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.00	0.0	0.00	0.00	0.00
Mixed Use	30%	0.27	0.30	0.62	3.99	30.0	0.27	0.30	0.62
TOTAL					3.99	30.0	0.27	0.30	0.62

E12

Total Area		3.28 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.00	0.0	0.00	0.00	0.00
Mixed Use	30%	0.27	0.30	0.62	3.28	30.0	0.27	0.30	0.62
TOTAL					3.28	30.0	0.27	0.30	0.62

E13

Total Area		4.45 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.00	0.0	0.00	0.00	0.00
Mixed Use	30%	0.27	0.30	0.62	4.45	30.0	0.27	0.30	0.62
TOTAL					4.45	30.0	0.27	0.30	0.62

E14

Total Area		9.14 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	3.11	25.5	0.23	0.24	0.28
ROW	74%	0.66	0.69	0.83	2.24	18.0	0.16	0.17	0.20
Open Space / Lawns	2%	0.02	0.05	0.49	3.80	0.8	0.01	0.02	0.20
TOTAL					9.14	44.3	0.40	0.43	0.69

E15

Total Area		1.89 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.43	34.0	0.30	0.33	0.52
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.46	17.9	0.16	0.17	0.20
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					1.89	52.0	0.46	0.49	0.72

E16

Total Area		1.57 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.57	73.6	0.66	0.69	0.83
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					1.57	73.6	0.66	0.69	0.83

E17

Total Area		1.55 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.55	73.6	0.66	0.69	0.83
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					1.55	73.6	0.66	0.69	0.83

E18

Total Area		2.72 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.97	32.5	0.29	0.31	0.50
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.76	20.5	0.18	0.19	0.23
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					2.72	53.0	0.47	0.50	0.73

E19

Total Area		2.91 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.06	31.8	0.28	0.30	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.85	21.6	0.19	0.20	0.24
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					2.91	53.4	0.47	0.51	0.73

E20

Total Area		2.75 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.94	31.6	0.28	0.30	0.49
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.82	21.8	0.19	0.20	0.25
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					2.75	53.5	0.48	0.51	0.73

E21

Total Area		2.05 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	1.35	29.7	0.26	0.28	0.46
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.70	25.0	0.22	0.23	0.28
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					2.05	54.7	0.49	0.52	0.74

E22

Total Area		4.41 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
School	55%	0.49	0.52	0.74	3.90	48.6	0.43	0.46	0.65
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.26	4.3	0.04	0.04	0.05
Open Space / Lawns	2%	0.02	0.05	0.49	0.25	0.1	0.00	0.00	0.03
TOTAL					4.41	53.1	0.47	0.50	0.73

E23

Total Area**4.11 acres****Composite Calculations**

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
School	55%	0.49	0.52	0.74	2.84	38.0	0.34	0.36	0.51
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.75	13.4	0.12	0.13	0.15
Open Space / Lawns	2%	0.02	0.05	0.49	0.52	0.3	0.00	0.01	0.06
TOTAL					4.11	51.7	0.46	0.49	0.72

E24

Total Area**4.23 acres****Composite Calculations**

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.00	0.0	0.00	0.00	0.00
Mixed Use	30%	0.27	0.30	0.62	4.23	30.0	0.27	0.30	0.62
TOTAL					4.23	30.0	0.27	0.30	0.62

E25

Total Area**2.78 acres****Composite Calculations**

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.31	8.4	0.07	0.08	0.09
ROW	74%	0.66	0.69	0.83	1.00	26.5	0.24	0.25	0.30
Open Space / Lawns	2%	0.02	0.05	0.49	1.47	1.1	0.01	0.02	0.26
TOTAL					2.78	35.9	0.32	0.35	0.65

F1

Total Area 1.73 acres

Composite Calculations

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	1.42	77.9	0.70	0.72	0.77
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.29	12.7	0.11	0.12	0.14
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					1.71	90.6	0.81	0.84	0.91

F2

Total Area 1.77 acres

Composite Calculations

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	1.65	88.3	0.79	0.82	0.87
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.12	5.2	0.05	0.05	0.06
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					1.77	93.5	0.84	0.87	0.93

F3

Total Area 3.60 acres

Composite Calculations

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.89	18.3	0.16	0.17	0.21
Open Space / Lawns	2%	0.02	0.05	0.49	2.70	1.5	0.02	0.03	0.37
TOTAL					3.60	19.8	0.18	0.20	0.57

F4

Total Area 3.79 acres

Composite Calculations

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.57	30.6	0.27	0.29	0.47
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.15	22.4	0.20	0.21	0.25
Open Space / Lawns	2%	0.02	0.05	0.49	0.06	0.0	0.00	0.00	0.01
TOTAL					3.79	53.1	0.47	0.50	0.73

F5

Total Area 4.58 acres

Composite Calculations

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.18	21.4	0.19	0.20	0.33
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	1.49	25.1	0.22	0.23	0.27
Open Space / Lawns	2%	0.02	0.05	0.49	0.90	0.4	0.00	0.01	0.10
TOTAL					4.58	46.9	0.42	0.45	0.70

F6

Total Area**4.93 acres****Composite Calculations**

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.25	20.5	0.18	0.20	0.31
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	1.11	17.2	0.15	0.16	0.19
Open Space / Lawns	2%	0.02	0.05	0.49	1.58	0.6	0.01	0.01	0.16
TOTAL					4.93	38.4	0.34	0.37	0.66

F7

Total Area**4.51 acres****Composite Calculations**

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.97	16.5	0.15	0.15	0.18
Open Space / Lawns	2%	0.02	0.05	0.49	3.54	1.6	0.02	0.04	0.38
TOTAL					4.51	18.0	0.16	0.19	0.57

F8

Total Area**7.93 acres****Composite Calculations**

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.60	14.8	0.13	0.14	0.23
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	2.09	19.4	0.17	0.18	0.22
Open Space / Lawns	2%	0.02	0.05	0.49	3.24	0.8	0.01	0.02	0.20
TOTAL					7.93	35.0	0.31	0.34	0.64

F9

Total Area**1.28 acres****Composite Calculations**

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	1.10	66.0	0.59	0.62	0.72
Open Space / Lawns	2%	0.02	0.05	0.49	0.18	0.3	0.00	0.01	0.07
TOTAL					1.28	66.3	0.59	0.62	0.79

F10

Total Area		1.93 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	1.61	79.2	0.71	0.73	0.78
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.33	12.9	0.12	0.12	0.14
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					1.93	92.2	0.82	0.85	0.93

F11

Total Area		1.50 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	1.24	78.3	0.70	0.73	0.78
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	77%	0.68	0.72	0.84	0.26	13.5	0.12	0.13	0.15
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					1.50	91.8	0.82	0.85	0.92

F12

Total Area		1.22 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	1.11	86.9	0.78	0.80	0.86
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.10	6.3	0.06	0.06	0.07
Open Space / Lawns	2%	0.02	0.05	0.49	0.00	0.0	0.00	0.00	0.00
TOTAL					1.22	93.2	0.83	0.86	0.93

F13

Total Area		3.58 acres			Composite Calculations				
Land Use		C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	2.43	30.5	0.27	0.29	0.47
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	1.09	22.4	0.20	0.21	0.25
Open Space / Lawns	2%	0.02	0.05	0.49	0.06	0.0	0.00	0.00	0.01
TOTAL					3.58	52.9	0.47	0.50	0.73

OS1

Total Area		56.02 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.00	0.0	0.00	0.00	0.00
Open Space / Lawns	2%	0.02	0.05	0.49	56.02	2.0	0.02	0.05	0.49
TOTAL					56.02	2.0	0.02	0.05	0.49

OS2

Total Area		10.95 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.00	0.0	0.00	0.00	0.00
Open Space / Lawns	2%	0.02	0.05	0.49	10.95	2.0	0.02	0.05	0.49
TOTAL					10.95	2.0	0.02	0.05	0.49

OS3

Total Area		5.32 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.00	0.0	0.00	0.00	0.00
Open Space / Lawns	2%	0.02	0.05	0.49	5.32	2.0	0.02	0.05	0.49
TOTAL					5.32	2.0	0.02	0.05	0.49

OS4

Total Area		2.22 acres			Composite Calculations				
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Residential (Single Family)	45%	0.40	0.43	0.69	0.00	0.0	0.00	0.00	0.00
Business	95%	0.85	0.88	0.94	0.00	0.0	0.00	0.00	0.00
Residential (Multi Family)	75%	0.67	0.70	0.84	0.00	0.0	0.00	0.00	0.00
ROW	74%	0.66	0.69	0.83	0.00	0.0	0.00	0.00	0.00
Open Space / Lawns	2%	0.02	0.05	0.49	2.22	2.0	0.02	0.05	0.49
TOTAL					2.22	2.0	0.02	0.05	0.49

OS5

Total Area 19.19 acres

Composite Calculations

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Future Landuse (OSP)	36%	0.31	0.36	0.67	19.19	36.1	0.31	0.36	0.67
TOTAL					19.19	36.1	0.31	0.36	0.67

OS6

Total Area 17.33 acres

Composite Calculations

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Future Landuse (OSP)	34%	0.31	0.36	0.67	17.33	34.0	0.31	0.36	0.67
TOTAL					17.33	34.0	0.31	0.36	0.67

OS7

Total Area 29.69 acres

Composite Calculations

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Open Space / Lawns	2%	0.02	0.05	0.49	29.69	2.0	0.02	0.05	0.49
TOTAL					29.69	2.0	0.02	0.05	0.49

OS8

Total Area 5.02 acres

Composite Calculations

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Open Space / Lawns	2%	0.02	0.05	0.49	5.02	2.0	0.02	0.05	0.49
TOTAL					5.02	2.0	0.02	0.05	0.49

OS10

Total Area 5.37 acres

Composite Calculations

Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	C ₂	C ₅	C ₁₀₀
Open Space / Lawns	2%	0.02	0.05	0.49	5.37	2.0	0.02	0.05	0.49
TOTAL					5.37	2.0	0.02	0.05	0.49

II-B. MINOR AND MAJOR STORM RUNOFF COMPUTATIONS FOR DEVELOPED RUNOFF CONDITIONS

1. SF-2 2-Year Sub-Basin Rational Method Calculations
2. SF-2 100-Year Sub-Basin Rational Method
Calculations
3. Pond Calculation

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 1/31/2018

SUB-BASIN			INITIAL/OVERLAND			TRAVEL TIME				Tc CHECK			FINAL
DATA			(Ti)			(Ti)				(URBANIZED BASINS)			
BASIN	D.A.	C5	L	S	Ti	L	S	VEL.	Ti	COMP. Tc	TOTAL	MIN. Tc	
ID	(AC)		(FT)	(%)	(MIN)	(FT)	(%)	(FPS)	(MIN)	(MIN)	LENGTH(FT)	(MIN)	
A1	4.11	0.42	50	1.0	8.7	1050	4.0	4.0	4.4	13.0	1100.0	16.1	13.0
A2	1.84	0.49	50	1.0	7.7	750	4.4	4.1	3.0	10.7	800.0	14.4	10.7
A3	3.23	0.46	50	1.0	8.1	900	1.2	2.2	6.8	14.9	950.0	15.3	14.9
A4	4.07	0.33	50	1.0	9.8	880	2.0	2.8	5.2	15.0	930.0	15.2	15.0
A5	2.04	0.47	50	1.0	8.1	700	3.4	3.7	3.2	11.2	750.0	14.2	11.2
A6	4.96	0.34	50	1.0	9.6	1178	4.5	4.2	4.7	14.3	1228.0	16.8	14.3
A7	3.96	0.48	50	1.0	7.9	1000	4.5	4.2	3.9	11.8	1050.0	15.8	11.8
A8	2.86	0.50	50	1.0	7.6	540	1.9	2.7	3.4	11.0	590.0	13.3	11.0
A9	3.44	0.48	50	1.0	7.9	1300	5.2	4.6	4.8	12.7	1350.0	17.5	12.7
A10	0.72	0.58	50	1.0	6.6	427	3.5	3.7	1.9	8.5	477.0	12.7	8.5
A11	2.39	0.51	50	1.0	7.5	950	4.5	4.2	3.7	11.3	1000.0	15.6	11.3
A12	2.96	0.46	50	1.0	8.2	700	3.4	3.7	3.2	11.3	750.0	14.2	11.3
A13	5.13	0.45	50	1.0	8.2	890	1.7	2.5	5.9	14.1	940.0	15.2	14.1
A14	1.43	0.52	50	1.0	7.4	430	4.4	4.2	1.7	9.1	480.0	12.7	9.1
A15	7.15	0.27	50	1.0	10.6	1669	4.7	4.3	6.5	17.1	1719.0	19.6	17.1
A16	0.75	0.72	50	1.0	4.9	1100	3.8	3.9	4.7	9.6	1150.0	16.4	9.6
A17	3.76	0.50	50	1.0	7.6	1250	3.4	3.6	5.7	13.4	1300.0	17.2	13.4
A18	2.54	0.50	50	1.0	7.6	980	3.4	3.6	4.5	12.1	1030.0	15.7	12.1
A19	2.09	0.49	50	1.0	7.7	650	3.2	3.6	3.0	10.8	700.0	13.9	10.8
A20	2.04	0.47	50	1.0	8.1	830	4.8	4.4	3.2	11.2	880.0	14.9	11.2
A21	3.02	0.50	50	1.0	7.7	650	3.2	3.6	3.0	10.7	700.0	13.9	10.7
A22	3.07	0.70	50	1.0	5.1	400	2.5	3.2	2.1	7.2	450.0	12.5	7.2

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 1/31/2018

SUB-BASIN			INITIAL/OVERLAND			TRAVEL TIME				T _c CHECK			FINAL
DATA			(T _i)			(T _i)				(URBANIZED BASINS)			
BASIN	D.A.	C ₅	L	S	T _i	L	S	VEL.	T _i	COMP. T _c	TOTAL	MIN. T _c	
ID	(AC)		(FT)	(%)	(MIN)	(FT)	(%)	(FPS)	(MIN)	(MIN)	LENGTH(FT)	(MIN)	(MIN)
B1	21.00	0.24	50	1.0	11.0	1925	3.0	3.5	9.3	20.3	1975.0	21.0	20.3
B2	3.13	0.49	50	1.0	7.8	650	4.8	4.3	2.5	10.3	700.0	13.9	10.3
B3	4.92	0.48	50	1.0	7.9	770	3.4	3.6	3.5	11.4	820.0	14.6	11.4
B4	2.51	0.55	50	1.0	7.0	1000	2.0	2.8	5.9	12.9	1050.0	15.8	12.9
B5	3.19	0.50	50	1.0	7.6	720	3.1	3.5	3.5	11.1	770.0	14.3	11.1
B6	3.19	0.50	50	1.0	7.6	720	3.1	3.5	3.5	11.1	770.0	14.3	11.1
B7	5.76	0.47	50	1.0	8.0	1280	2.7	3.2	6.6	14.6	1330.0	17.4	14.6
B8	4.93	0.45	50	1.0	8.3	1100	3.9	3.9	4.6	12.9	1150.0	16.4	12.9
B9	2.81	0.47	50	1.0	8.0	850	2.0	2.8	5.0	13.1	900.0	15.0	13.1
B10	0.65	0.72	50	1.0	4.9	630	2.5	3.2	3.3	8.2	680.0	13.8	8.2
B11	0.84	0.72	50	1.0	4.9	750	2.3	3.0	4.2	9.1	800.0	14.4	9.1
B12	3.30	0.70	50	1.0	5.0	670	1.9	2.8	4.1	9.1	720.0	14.0	9.1
B13	3.19	0.50	50	1.0	7.6	720	3.1	3.5	3.5	11.1	770.0	14.3	11.1
B14	3.19	0.50	50	1.0	7.6	720	3.1	3.5	3.5	11.1	770.0	14.3	11.1
B15	2.01	0.50	50	1.0	7.6	530	2.5	3.1	2.9	10.4	580.0	13.2	10.4
C1	10.07	0.43	50	1.0	8.5	2100	5.0	4.5	7.8	16.3	2150.0	21.9	16.3

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot
 Project No. 254103
 Calculated By: MRS
 Date: 1/31/2018

SUB-BASIN			INITIAL/OVERLAND			TRAVEL TIME				T _c CHECK			FINAL
DATA			(T _i)			(T _i)				(URBANIZED BASINS)			
BASIN	D.A.	C ₅	L	S	T _i	L	S	VEL.	T _i	COMP. T _c	TOTAL	MIN. T _c	
ID	(AC)		(FT)	(%)	(MIN)	(FT)	(%)	(FPS)	(MIN)	(MIN)	LENGTH(FT)	(MIN)	T _c
D1	5.94	0.41	50	1.0	8.8	1150	4.9	4.4	4.4	13.2	1200.0	16.7	13.2
D2	5.33	0.44	50	1.0	8.4	800	5.3	4.6	2.9	11.3	850.0	14.7	11.3
D3	3.66	0.42	50	1.0	8.7	730	1.1	2.0	6.1	14.7	780.0	14.3	14.3
D4	2.91	0.41	50	1.0	8.8	890	1.0	2.0	7.4	16.2	940.0	15.2	15.2
D5	6.97	0.33	50	1.0	9.8	1570	2.4	3.0	8.6	18.4	1620.0	19.0	18.4
D6	2.57	0.41	50	1.0	8.7	950	2.4	3.1	5.1	13.9	1000.0	15.6	13.9
D7	2.58	0.40	50	1.0	8.9	620	5.0	4.5	2.3	11.2	670.0	13.7	11.2
D8	0.85	0.49	50	1.0	7.8	250	1.2	2.2	1.9	9.7	300.0	11.7	9.7
D9	3.90	0.47	50	1.0	8.0	700	1.3	2.2	5.3	13.4	750.0	14.2	13.4
D10	4.80	0.48	50	1.0	7.9	680	3.8	3.9	2.9	10.8	730.0	14.1	10.8
D11	3.29	0.78	50	1.0	4.0	1375	2.3	3.0	7.7	11.8	1425.0	17.9	11.8
D12	1.13	0.78	50	1.0	4.0	1376	2.3	3.0	7.7	11.8	1426.0	17.9	11.8
E1	4.04	0.50	50	1.0	7.6	870	5.9	4.8	3.0	10.7	920.0	15.1	10.7
E2	5.27	0.49	50	1.0	7.7	1800	0.5	1.4	21.2	28.9	1850.0	20.3	20.3
E3	4.77	0.50	50	1.0	7.7	750	2.9	3.4	3.7	11.4	800.0	14.4	11.4
E4	3.20	0.49	50	1.0	7.7	710	2.8	3.3	3.5	11.3	760.0	14.2	11.3
E5	2.76	0.51	50	1.0	7.5	1050	2.1	2.8	6.2	13.7	1100.0	16.1	13.7
E6	2.63	0.51	50	1.0	7.5	1020	3.0	3.5	4.9	12.4	1070.0	15.9	12.4
E7	2.77	0.49	50	1.0	7.7	870	3.1	3.5	4.1	11.8	920.0	15.1	11.8
E8	2.68	0.51	50	1.0	7.6	870	2.4	3.1	4.7	12.3	920.0	15.1	12.3
E9	4.84	0.38	50	1.0	9.2	709	1.3	2.2	5.4	14.5	759.0	14.2	14.2
E10	0.70	0.53	50	1.0	7.3	710	1.3	2.2	5.4	12.7	760.0	14.2	12.7
E11	3.99	0.30	50	1.0	10.2	711	1.3	2.2	5.4	15.7	761.0	14.2	14.2
E12	3.28	0.30	50	1.0	10.2	900	3.7	3.8	4.0	14.2	950.0	15.3	14.2
E13	4.45	0.30	50	1.0	10.2	713	1.3	2.2	5.4	15.7	763.0	14.2	14.2
E14	9.14	0.43	50	1.0	8.6	1080	3.7	3.8	4.7	13.3	1130.0	16.3	13.3
E15	1.89	0.49	50	1.0	7.7	715	1.3	2.2	5.4	13.2	765.0	14.3	13.2
E16	1.57	0.69	50	1.0	5.2	716	1.3	2.2	5.4	10.7	766.0	14.3	10.7
E17	1.55	0.69	50	1.0	5.2	717	1.3	2.2	5.5	10.7	767.0	14.3	10.7
E18	2.72	0.50	50	1.0	7.6	530	3.8	3.8	2.3	9.9	580.0	13.2	9.9
E19	2.91	0.51	50	1.0	7.6	770	3.9	3.9	3.3	10.9	820.0	14.6	10.9
E20	2.75	0.51	50	1.0	7.6	1080	2.5	3.2	5.7	13.2	1130.0	16.3	13.2
E21	2.05	0.52	50	1.0	7.4	721	2.6	3.2	3.7	11.1	771.0	14.3	11.1
E22	4.41	0.50	50	1.0	7.6	950	5.7	4.7	3.3	10.9	1000.0	15.6	10.9
E23	4.11	0.49	50	1.0	7.8	920	4.5	4.2	3.7	11.4	970.0	15.4	11.4
E24	4.23	0.30	50	1.0	10.2	900	3.7	3.8	4.0	14.2	950.0	15.3	14.2
E25	2.78	0.35	50	1.0	9.6	750	4.0	4.0	3.1	12.7	800.0	14.4	12.7

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 1/31/2018

SUB-BASIN			INITIAL/OVERLAND			TRAVEL TIME				T _c CHECK			FINAL
DATA			(T _i)			(T _i)				(URBANIZED BASINS)			
BASIN	D.A.	C ₅	L	S	T _i	L	S	VEL.	T _i	COMP. T _c	TOTAL	MIN. T _c	
ID	(AC)		(FT)	(%)	(MIN)	(FT)	(%)	(FPS)	(MIN)	(MIN)	LENGTH(FT)	(MIN)	(MIN)
F1	1.71	0.84	50	1.0	3.3	400	3.0	3.5	1.9	5.2	450.0	12.5	5.2
F2	1.77	0.87	50	1.0	3.0	510	4.3	4.1	2.0	5.0	560.0	13.1	5.0
F3	3.60	0.20	50	1.0	11.4	717	1.3	2.2	5.5	16.9	767.0	14.3	14.3
F4	3.79	0.50	50	1.0	7.6	850	3.8	3.8	3.7	11.3	900.0	15.0	11.3
F5	4.58	0.45	50	1.0	8.3	719	1.3	2.2	5.5	13.8	769.0	14.3	13.8
F6	4.93	0.37	50	1.0	9.3	1234	2.6	3.2	6.5	15.8	1284.0	17.1	15.8
F7	4.51	0.19	50	1.0	11.6	721	1.2	2.2	5.5	17.1	771.0	14.3	14.3
F8	7.93	0.34	50	1.0	9.7	1070	2.8	3.3	5.3	15.0	1120.0	16.2	15.0
F9	1.28	0.62	50	1.0	6.1	1708	3.2	3.6	8.0	14.0	1758.0	19.8	14.0
F10	1.93	0.85	50	1.0	3.1	520	4.4	4.2	2.1	5.2	570.0	13.2	5.2
F11	1.50	0.85	50	1.0	3.2	520	4.0	4.0	2.2	5.3	570.0	13.2	5.3
F12	1.22	0.86	50	1.0	3.0	510	4.3	4.1	2.0	5.1	560.0	13.1	5.1
F13	3.58	0.50	50	1.0	7.6	850	4.7	4.3	3.3	10.9	900.0	15.0	10.9
OS1	56.02	0.05	300	3.1	22.7	2240	5.5	4.7	8.0	30.6	2540.0	24.1	24.1
OS2	10.95	0.05	300	1.2	30.8	1334	1.2	2.2	10.1	40.9	1634.0	19.1	19.1
OS3	5.32	0.05	300	2.9	23.2	1037	2.9	3.3	5.2	28.4	1337.0	17.4	17.4
OS4	2.22	0.05	300	3.5	21.7	730	3.5	3.7	3.3	24.9	1030.0	15.7	15.7
OS10	5.37	0.05	300	4.2	20.4	305	4.2	4.1	1.2	21.6	605.0	13.4	13.4

NOTES:

$$T_i = (1.8 * (1.1 - C_s) * (L)^{0.5}) / (S^{0.33})$$

$$T_i = L / 60V \text{ (Velocity From Fig. 3-2)}$$

$$T_c \text{ Check} = 10 + L / 180$$

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision Trails at Crowfoot

Design Storm $\frac{100 \text{ Yr}}{100\text{-Year P1} = \frac{2.6}{2.6}}$ in.

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 4/9/2018

COMBINED BASINS	DIRECT RUNOFF								TOTAL RUNOFF								STREET		PIPE		TRAVEL TIME			REMARKS
	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C* A (Ac)	q (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C* A (Ac)	q (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tc (min)	
A1	1A	A1	4.11	0.69	13.0	2.82	6.3	17.7				13.0	2.82	6.3	17.7									
A1, 16	1P	A16	0.75	0.84	9.6	0.63	7.1	4.5				13.3	3.45	6.2	21.5	2.0	17.7				40.0	2.83	0.2	Street Flow to 1P
A11	1K	A11	2.39	0.73	11.3	1.75	6.7	11.7				11.3	1.75	6.7	11.7	2.0	21.5				400.0	2.83	2.4	Street Flow to DP 1
A11, 17	1Q	A17	3.76	0.73	13.4	2.73	6.2	17.0				13.4	4.49	6.2	27.9	2.0	11.7				40.0	2.83	0.2	Street Flow to 1Q
A1,11,16,17	1											15.6	7.93	5.8	45.9	2.0	27.9				40.0	2.83	0.2	Street Flow to DP 1
A18	1R	A18	2.54	0.73	12.1	1.85	6.5	12.0	1 @ 15" Type R Sump Inlet			12.1	1.85	6.5	12.0	2.0	45.9				340.0	2.83	2.0	Street Flow to 1B
A2, 18	1B	A2	1.84	0.72	10.7	1.33	6.8	9.1		42.1	18.5	17.6	7.72	5.5	42.1	2.0	12.0				40.0	2.83	0.2	Street Flow to 1B
A1,2,11,16,17,18	2								1 @ 15" Type R Sump Inlet			17.7	7.72	5.4	42.0			42.1	1.00	30.00	40.0	9.47	0.1	Piped to DP 2
A1,2,3,11,16,17,18	1C	A3	3.23	0.71	14.9	2.29	5.9	13.5		32.0	0.0	17.7	13.40	5.4	73.0			73.0	1.00	42.00	500.0	11.37	0.7	Piped to West Channel
A22	1V	A22	3.07	0.83	7.2	2.56	7.9	20.2				7.2	2.56	7.9	20.2	5.0	20.2				250.0	4.47	0.9	Street Flow to 1T
A13	1M	A13	5.13	0.70	14.1	3.61	6.1	21.9				14.1	6.17	6.1	37.5	5.0	37.5				250.0	4.47	0.9	Street Flow to 1T
A13,20	1T	A20	2.04	0.71	11.2	1.45	6.7	9.7				15.0	7.62	5.9	44.9	5.0	44.9				60.0	4.47	0.2	Street Flow to 1G
A7,13,20	1G	A7	3.96	0.72	11.8	2.84	6.6	18.6				15.3	10.45	5.9	61.2	5.0	61.2				520.0	4.47	1.9	Street Flow to 1E
A7,13,20	3	(Not Relevant in 100 Year Storm)																						
A19	1S	A19	2.09	0.72	10.8	1.51	6.8	10.3	1 @ 15" Type R Sump Inlet			10.8	1.51	6.8	10.3	1.5	10.3				225.0	2.45	1.5	Street Flow to 1E
A5,7,13,19,20	1E	A5	2.04	0.71	11.2	1.45	6.7	9.7		42.1	32.0	17.2	7.62	5.5	42.1			42.1	1.00	30.00	50.0	9.47	0.1	Piped to DP 4
A5,7,13,19,20	4								1 @ 15" Type R Sump Inlet			17.3	7.62	5.5	42.0			42.0	1.00	30.00	50.0	9.40	0.1	Piped to 1D
A4,5,7,13,19,20	1D	A4	4.07	0.64	15.0	2.60	5.9	15.4		42.1	0.0	17.3	16.01	5.5	88.3			88.3	1.00	30.00	40.0	11.67	0.1	Piped to 1H
A4,5,7,8,13,19,20	1H	A8	2.86	0.73	11.0	2.08	6.8	14.1	1 @ 10" Type R Sump Inlet	14.1	5.3	17.3	18.09	5.5	99.5			99.5	1.00	42.00	140.0	11.88	0.2	Piped to West Channel
A12	1L	A12	2.96	0.70	11.3	2.09	6.7	13.9				11.3	2.09	6.7	13.9	1.5	13.9				130.0	2.45	0.9	Street Flow to 1U
A12, 21	1U	A21	3.02	0.73	10.7	2.20	6.9	15.0				12.2	4.28	6.5	27.7	1.5	27.7				90.0	2.45	0.6	Street Flow to 1F
A6,12, 21	1F	A6	4.96	0.65	14.3	3.20	6.0	19.3				14.3	7.48	6.0	45.2	1.5	45.2				160.0	2.45	1.1	Street Flow to 1N
A6,12,14,21	1N	A14	1.43	0.74	9.1	1.05	7.3	7.7	2 @ 10" Type R Sump Inlet	49.8	0.0	15.4	8.54	5.8	49.8			49.8	1.00	36.00	150.0	10.33	0.2	Piped to West Channel
A15	1O	A15	7.15	0.61	17.1	4.33	5.5	24.0	1 @ 10" Type R Sump Inlet	24.0	0.0	17.1	4.33	5.5	24.0			24.0	1.00	24.00	100.0	8.12	0.2	Piped to 1J
A9	1I	A9	3.44	0.72	12.7	2.47	6.4	15.7				12.7	2.47	6.4	15.7	4.0	15.7				370.0	4.00	1.5	Street Flow to 1J
A9,10,15	1J	A10	0.72	0.77	8.5	0.55	7.5	4.1	1 @ 10" Type R Sump Inlet	18.3	0.0	17.3	7.35	5.5	40.5			40.5	1.00	24.00	10.0	9.49	0.0	Piped to West Channel

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision Trails at Crowfoot

Design Storm $\frac{100 \text{ Yr}}{100\text{-Year P1} = \frac{100}{2.6}}$ in.

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 4/9/2018

COMBINED BASINS	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE			TRAVEL TIME			REMARKS		
	Design Point	Area Design	Area (Ac)	Runoff Coeff.	Tc (min)	C* A (Ac)	i (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C* A (Ac)	i (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)			
OS10	O10	OS10	5.37	0.49	13.4	2.63	6.2	16.4	2 @ 10' Type R Sump Inlet			13.4	2.63	6.2	16.4	2.0	16.4					30.0	2.83	0.2	Street Flow to 3A	
C1	3A	C1	10.07	0.69	16.3	6.96	5.7	39.4		54.3	0.0	16.3	9.59	5.7	54.3			54.3	1.00	30.00	285.0	7.00	0.7	Piped to DP 19		
B15	2O	B15	2.01	0.73	10.4	1.47	6.9	10.1				10.4	1.47	6.9	10.1	5.0	10.1					225.0	4.47	0.8	Street Flow to 2L	
B3	2C	B3	4.92	0.72	11.4	3.52	6.7	23.4				11.4	4.99	6.7	33.2	5.0	33.2					225.0	4.47	0.8	Street Flow to 2C	
B3,12	2L	B12	3.30	0.84	9.1	2.76	7.3	20.2				12.3	7.75	6.5	50.1	5.0	50.1					225.0	4.47	0.8	Street Flow to 2D	
B3,4,12	2D	B4	2.51	0.76	12.9	1.90	6.3	12.0				13.1	9.65	6.3	60.5	3.5	60.5					1605.0	3.74	7.1	Street Flow to 2I	
B2	2B	B2	3.13	0.72	10.3	2.26	7.0	15.7	2 @ 15' Type R On-Grade Inlet			10.3	2.26	7.0	15.7	4.0	15.7					1230.0	4.00	5.1	Street Flow to 2A	
B1, B2	2A	B1	21.00	0.59	20.3	12.38	5.1	62.9		48.0	26.5	20.3	9.44	5.1	48.0											
B14	2N	B14	3.19	0.73	11.1	2.33	6.8	15.7				11.1	2.33	6.8	15.7	2.0	15.7					500.0	2.83	2.9	Street Flow to 2E	
B5, 14	50% of carryover flow from 2A - 26.52 = 13.25 CFS			2E	B5	3.19	0.73	11.1	2.33	6.8	15.7	2 @ 15' Type R On-Grade Inlet	34.8	6.8	20.6	15.15	5.0	76.4								
B5,14	6	(Not Relieved to 100 Year Storm)																								
B1,5,14,15	5											20.6	15.15	5.0	76.2											
B1,2,5,14,15,C1,OS10	19											21.6	24.74	4.9	121.4			76.2	2.00	36.00	900.0	14.78	1.0	Piped to DP 19		
B13	2M	B13	3.19	0.73	11.1	2.33	6.8	15.7				11.1	2.33	6.8	15.7			121.4	2.00	42.00	385.0	14.78	0.4	Piped to DP 2I		
B6, 13	50% of carryover flow from 2A - 6.82 = 3.4 CFS			2F	B6	3.19	0.73	11.1	2.33	6.8	15.7	2 @ 15' Type R On-Grade Inlet	29.1	2.7	14.0	4.77	6.1	29.1	2.0	15.7			500.0	2.83	2.9	Street Flow to 2F
B6	7	(Not Relieved to 100 Year Storm)																								
B6,13	8											14.1	4.77	6.1	29.0											
B7	2G	B7	5.76	0.71	14.6	4.11	6.0	24.5				14.6	4.11	6.0	24.5			29.0	2.00	36.00	200.0	15.08	0.2	Piped to DP 9		
B9	2I	B9	2.81	0.71	13.1	2.00	6.3	12.6	2 @ 15' Type R Sump Inlet	35.7	0.0	15.3	6.10	5.8	35.7	6.0	24.5					200.0	4.90	0.7	Street Flow to 2I	
B8	2H	B8	4.93	0.70	12.9	3.45	6.3	21.8		23.2	0.0	12.9	3.67	6.3	23.2				35.7	0.50	36.00	50.0	7.31	0.1	Piped to DP 9	
B6,7,8,9	9											15.4	14.54	5.8	84.8			23.2	0.50	30.00	50.0	6.55	0.1	Piped to DP 9		
B6,7,8,9,13	10											15.5	14.54	5.8	84.6			84.8	1.00	48.00	40.0	13.00	0.1	Piped to DP 10		
B3,4,12									2 @ 10' Type R Sump Inlet			20.3	10.20	5.1	51.8			84.6	1.00	48.00	10.0	12.98	0.0	Piped to West Channel		
B1,2,5,14,15,C1,OS10,B10	2I	B10	0.65	0.84	8.2	0.55	7.6	4.1		46.7	0.0	22.1	34.94	4.9	169.6			169.6	1.00	54.00	30.0	14.03	0.0	Piped to 18		
B1,2,5,14,15,C1,OS10,B10	18											22.1	34.94	4.8	169.4			169.4	1.00	54.00	30.0	14.03	0.0	Piped to 2K		
B3,4,12,11									1 @ 5' Type R Sump Inlet									169.4	1.00	54.00	30.0	14.03	0.0	Piped to 2K		
B1,2,5,14,15,C1,OS10,B10	2K	B11	0.84	0.84	9.1	0.71	7.3	5.2		5.2	0.0	22.1	35.65	4.8	172.8			172.8	1.00	54.00	50.0	14.00	0.1	Piped to West Channel		

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision Trails at Crowfoot

Design Storm 100 Yr
100-Year P1 = 2.6 in.

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 4/9/2018

COMBINED BASINS	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE			TRAVEL TIME			REMARKS	
	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C* A (Ac)	(in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C* A (Ac)	(in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)		
D2	4B	D2	5.33	0.70	11.3	3.71	6.7	24.8	2 @ 10' Type R Sump Inlet			11.3	3.71	6.7	24.8	6.00	24.8					375.0	4.90	1.3	Street Flow to 4I
D2, D10	4I	D10	4.80	0.72	10.8	3.44	6.8	23.5		45.7	0.0	12.6	7.15	6.4	45.7			45.7	1.00	36.00	20.0	10.14	0.0	Piped to DP 11	
D7	4G	D7	2.58	0.68	11.2	1.75	6.7	11.8	2 @ 10' Type R On-Grade Inlet	11.8	0.0	11.2	1.75	6.7	11.8			11.8	1.50	18.00	630.0	8.25	1.3	Piped to DP 11	
D2,7,10	11									12.6	8.90	6.4	56.8			56.8	1.50	36.00	20.0	12.37	0.0	Piped to 4A			
D1,2,7,10	4A	D1	5.94	0.68	13.2	4.03	6.3	25.2	1 @ 10' Type R Sump Inlet	25.2	0.0	13.2	12.93	6.3	80.9			80.9	1.50	36.00	30.0	13.13	0.0	Piped to Pond B	
D8	4H	D8	0.85	0.72	9.7	0.61	7.1	4.4	2 @ 10' Type R On-Grade Inlet			9.7	0.61	7.1	4.4	5.00	4.4				980.0	4.47	3.7	Street Flow to 4F	
D12	4L	D12	1.13	0.88	11.8	0.99	6.6	6.5		2.9	0.0	13.3	1.61	6.2	10.0			10.0	1.50	18.00	100.0	7.96	0.2	Piped to 4F	
D6,8,12	4F	D6	2.57	0.68	13.9	1.75	6.1	10.7	2 @ 15' Type R On-Grade Inlet	14.5	0.0	13.9	3.97	6.1	24.3			24.3	0.50	30.00	200.0	6.64	0.5	Piped to Pond B	
D3	4C	D3	3.66	0.69	14.3	2.51	6.0	15.1	2 @ 10' Type R Sump Inlet			14.3	2.51	6.0	15.1	5.0	15.1				40.0	4.47	0.1	Street Flow to 4D	
D3,4	4D	D4	2.91	0.68	15.2	1.97	5.9	11.6				15.2	4.48	5.9	26.3	3.0	26.3				1668.0	3.46	8.0	Street Flow to 4E	
D3,4,5	4E	D5	6.97	0.64	18.4	4.46	5.3	23.8	1 @ 10' Type R Sump Inlet	42.2	0.0	23.2	8.94	4.7	42.2			42.2	1.00	36.00	30.0	10.52	0.0	Piped to DP 12	
D9	4I	D9	3.90	0.71	13.4	2.78	6.2	17.3	1 @ 10' Type R Sump Inlet	17.3	0.0	13.4	2.78	6.2	17.3			17.3	1.00	24.00	30.0	8.07	0.1	Piped to DP 12	
D3,4,5,9	12											23.3	11.72	4.7	55.2			55.2	2.00	36.00	204.0	14.54	0.2	Piped to DP 13	
D11	4K	D11	3.29	0.88	11.8	2.89	6.6	19.0	1 @ 10' Type R Sump Inlet	19.0	0.0	11.8	2.89	6.6	19.0			19.0	1.00	24.00	30.0	8.02	0.1	Piped to DP 13	
D3,4,5,9,11	13											23.5	14.60	4.7	68.4			68.4	2.00	36.00	2650.0	9.00	4.9	Piped to Pond D	

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision Trails at Crowfoot

Design Storm $\frac{100 \text{ Yr}}{100\text{-Year P1} = \frac{2.6}{2.6}}$ in.

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 4/9/2018

COMBINED BASINS	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE		TRAVEL TIME			REMARKS		
	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C* <i>A</i> (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C* <i>A</i> (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)		Tc (min)	
E23	5W	E23	4.11	0.72	11.4	2.98	6.7	19.9				11.4	2.98	6.7	19.9	2.7	19.9					250.0	3.29	1.3	Street Flow to 5V
E22, 23	5V	E22	4.41	0.73	10.9	3.22	6.8	21.9				12.7	6.20	6.4	39.5	2.7	39.5					200.0	3.29	1.0	Street Flow to 5A
E1,22,23	5A	E1	4.04	0.73	10.7	2.94	6.9	20.2				13.7	9.15	6.2	56.3	2.7	56.3					570.0	3.29	2.9	Street Flow to 5C
E1,3, 22,23	5C	E3	4.77	0.72	11.4	3.45	6.7	23.1				16.6	12.60	5.6	70.9	2.7	70.9					270.0	3.29	1.4	Street Flow to 5D
E1,3,4, 22,23	5D	E4	3.20	0.69	11.3	2.19	6.7	14.7				18.0	14.79	5.4	80.0	1.0	80.0					956.0	2.00	8.0	Street Flow to 5E
E18	5R	E18	2.72	0.73	9.9	1.98	7.1	14.0	1 @ 15" Type R Sump Inlet			9.9	1.98	7.1	14.0	1.0	14.0	83.4	0.50	48.00		30.0	2.00	0.3	Street Flow to 5E
E1,3,4,5,18,22,23	5E	E5	2.76	0.73	13.7	2.02	6.2	12.4		42.1	41.3	25.9	9.31	4.4	41.3	1	41.34				30.0	2.00	0.3	Street Flow to 5B	
E25, 26	5Y	E25	2.78	0.65	12.7	1.81	6.4	11.5				12.7	1.81	6.4	11.5	3.5	11.5				30.0	9.00	0.1	Piped to Pond C	
E14,25,26	5N	E14	9.14	0.69	13.3	6.30	6.2	39.4	2 @ 10" Type R Sump Inlet	50.0	0.0	13.7	8.11	6.2	50.0			50.0	0.50	42.00	2400.0	8.22	4.9	Piped to DP 14	
E24	5X	E24	4.23	0.62	14.2	2.62	6.1	15.9				14.2	2.62	6.1	15.9	6.0	15.9					150.0	4.90	0.5	Street Flow to 5L
E12,24	5L	E12	3.28	0.62	14.2	2.04	6.1	12.3				14.7	4.66	6.0	27.7	6.0	27.7					50.0	4.90	0.2	Street Flow to 5P
E11	5K	E11	3.99	0.62	14.2	2.47	6.0	15.0				14.2	2.47	6.0	15.0	1.0	15.0					10.0	2.00	0.1	Overland to 5P
E11,12,14,16,24,25,26	5P	E16	1.57	0.83	10.7	1.30	6.8	8.9				14.9	8.43	5.9	49.9	1.0	49.9					340.0	2.00	2.8	Street Flow to 5S
E6	5F	E6	2.63	0.73	12.4	1.92	6.4	12.3				12.4	1.92	6.4	12.3	1.0	12.3					50.0	2.00	0.4	Street Flow to 5S
E6,11,12,14,16,24,25,26,19	5S	E19	2.91	0.73	10.9	2.12	6.8	14.5				17.7	12.47	5.4	67.9	1.0	67.9					288.0	2.00	2.4	Street Flow to 5H
E21	5U	E21	2.05	0.74	11.1	1.51	6.7	10.2				11.1	1.51	6.7	10.2	1.0	10.2					50.0	2.00	0.4	Street Flow to 5H
E6,8,11,12,14,16,21,24,25,26,19	5H	E8	2.68	0.73	12.3	1.95	6.5	12.6				20.1	15.94	5.1	81.3	1.0	81.3					660.0	2.00	5.5	Street Flow to DP 14
E9	5I	E9	4.84	0.66	14.2	3.22	6.1	19.5				14.2	3.22	6.1	19.5	1.0	19.5					30.0	2.00	0.3	Street Flow to DP 14
E10	5J	E10	0.70	0.74	12.7	0.52	6.4	3.3				12.7	0.52	6.4	3.3	1.0	3.3					300.0	2.00	2.5	Street Flow to DP 14
E6,8,10,11,12,14,16,21,24,9,19,E25,26	14											25.6	27.78	4.5	124.2	1.0	124.2					230.0	2.00	1.9	Street Flow to 5G
E15	5O	E15	1.89	0.72	13.2	1.37	6.3	8.6				13.2	1.37	6.3	8.6	1.0	8.6					500.0	2.00	4.2	Street Flow to 5G
E20	5T	E20	2.75	0.73	13.2	2.01	6.2	12.6	2 @ 15" Type R Sump Inlet			13.2	2.01	6.2	12.6	2.0	12.6					10.0	2.83	0.1	Street Flow to 5G
E7,15,20	5G	E7	2.77	0.72	11.8	2.01	6.6	13.2		86.1	21.4	27.5	5.38	5.5	29.6			142.3	0.50	48.00		30.0	9.11	0.1	Piped to Pond C
E1,3-10,11,12,14-16,18-26	15								2 @ 15" Type R Sump Inlet			27.6	33.17	4.3	142.1			142.1	0.50	60.00		280.0	10.66	0.4	Piped to Pond C
E1-12,14-16,18-26	5B	E2	5.27	0.72	20.3	3.81	5.1	19.4		77.7	0.0	27.5	18.11	4.3	77.7			77.7	0.60	60.00		30.0	11.70	0.0	Piped to Pond C

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 4/9/2018

Design Storm $\frac{100 \text{ Yr}}{100\text{-Year P1} = \frac{100 \text{ Yr}}{2.6} \text{ in.}}$

COMBINED BASINS	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE			TRAVEL TIME			REMARKS	
	Design Point	Area Design	Area (Ac)	Runoff Coeff.	Tc (min)	C* A (Ac)	f (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C* A (Ac)	f (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tc (min)		
F12	6L	F12	1.22	0.93	5.1	1.13	8.8	9.9				5.1	1.13	8.8	9.9	1.0	9.9					50.0	2.00	0.4	Street Flow to 6B
F2	6B	F2	1.77	0.93	5.0	1.65	8.8	14.5				5.5	2.78	8.6	23.9	1.0	23.9					130.0	2.00	1.1	Street Flow to 6K
F2,11,12	6K	F11	1.50	0.92	5.3	1.39	8.7	12.0				6.6	4.17	8.2	34.0	1.0	34.0					100.0	2.00	0.8	Street Flow to 6J
F2,10,11,12	6J	F10	1.93	0.93	5.2	1.79	8.7	15.6				7.4	5.96	7.9	46.8	1.0	46.8					100.0	2.00	0.8	Street Flow to 6A
F1,2,10,11,12	6A	F1	1.71	0.91	5.2	1.55	8.7	13.5				8.2	7.51	7.6	56.9	1.0	56.9					80.0	2.00	0.7	Street Flow to DP 16
F1,2,10,11,12	16											8.9	7.51	7.4	55.3	1.0	55.3					1025.0	2.00	8.5	Street Flow to 6E
F4	6D	F4	3.79	0.73	11.3	2.76	6.7	18.5				11.3	2.76	6.7	18.5	1.0	18.5					50.0	2.00	0.4	Street Flow to 6M
F4,13	6M	F13	3.58	0.73	10.9	2.60	6.8	17.7				11.7	5.36	6.6	35.4	1.0	35.4					50.0	2.00	0.4	Street Flow to 6C
F3,4,13	6C	F3	3.60	0.57	14.3	2.06	6.0	12.5				14.3	7.42	6.0	44.9	1.0	44.9					200.0	2.00	1.7	Street Flow to DP 17
F1,2,5,10,11,12	6E	F5	4.58	0.70	13.8	3.20	6.1	19.7				17.4	10.72	5.5	58.8	1.0	58.8					100.0	2.00	0.8	Street Flow to DP 17
F1,2,3,4,5,10,11,12,13	17								4 @ 15" Type R On-Grade Inlets			18.3	18.14	5.4	97.2	5.0	97.2					952.0	4.47	3.5	Street Flow to 6Ia
F1,2,3,4,5,10,11,12,13	6Ia									78.5	18.7	18.3	14.65	5.4	78.5	3.0	18.72					270.0	3.46	1.3	Street Flow to 6I & 6G
																									0.2 Piped to Pond D
F7	6G	F7	4.51	0.57	14.3	9.35 CFS from 6Ia 2.55	6.0	15.4	1 @ 10" Type R Sump Inlet	22.2	0.0	19.6	4.30	5.2	22.2			78.5	0.50	48.00		100.0	9.10	0.2	Piped to Pond D
F1,2,3,4,5,9,10,11,12,13	6I	F9	1.28	0.79	14.0	9.35 CFS from 6Ia 1.02	6.1	6.2	1 @ 10" Type R Sump Inlet	15.5	0.0	19.7	7.06	5.2	36.4							50.0	9.10	0.1	Piped to 6I
E13	5M	E13	4.45	0.62	14.2	2.76	6.0	16.7				14.2	2.76	6.0	16.7			36.4	0.50	36.00		100.0	9.10	0.2	Piped to Pond D
E17	5Q	E17	1.55	0.83	10.7	1.28	6.8	8.8				14.8	4.04	5.9	24.0	1.0	16.7					70.0	2.00	0.6	Street Flow to 5Q
F8	6H	F8	7.93	0.64	15.0	5.11	5.9	30.2	1 @ 15" Type R Sump Inlet	42.1	9.0	16.8	9.15	5.6	51.1			24.0	0.50	30.00		780.0	6.60	2.0	Piped/Overland Flow to 6H
												16.8	7.53	5.6	42.1										
F6	6F	F6	4.93	0.66	15.8	9.35 CFS from 6H 3.25	5.8	18.7	1 @ 10" Type R Sump Inlet	27.8	0.0	16.9	12.40	5.6	69.2			42.1	0.50	36.00		30.0	7.60	0.1	Piped to 6F
																		69.2	0.50	42.00		102.0	8.40	0.2	Piped to Pond C

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision Trails at Crowfoot

Design Storm 2 Yr
2-Year P1 = 0.99 in.

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 4/9/2018

COMBINED BASINS	DIRECT RUNOFF								TOTAL RUNOFF						STREET	PIPE		TRAVEL TIME			REMARKS			
	Design Point	Area Design.	Area (Ac)	Runoff Coef.	Tc (min)	C* A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C* A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)		Length (ft)	Velocity (fps)	Tt (min)
A1	1A	A1	4.11	0.39	13.0	1.60	2.4	3.8	1 @ 10' Type R On-Grade Inlet	3.8	0.0	13.0	1.60	2.4	3.8									
A1, 16	1P	A16	0.75	0.68	9.6	0.51	2.7	1.4	1 @ 5' Type R On-Grade Inlet	0.0	0.0	13.1	2.11	2.4	5.1		3.8	1.00	18.00	30.0	5.35	0.1	Piped to 1P	
A11	1K	A11	2.39	0.48	11.3	1.15	2.6	2.9	1 @ 10' Type R On-Grade Inlet	2.9	0.0	11.3	1.15	2.6	2.9		5.1	1.00	18.00	420.0	5.85	1.2	Piped to DP 1	
A11, 17	1Q	A17	3.76	0.47	13.4	1.77	2.4	4.2	1 @ 10' Type R On-Grade Inlet	4.2	0.0	13.4	2.91	2.4	6.9		2.9	1.00	18.00	30.0	5.04	0.1	Piped to 1Q	
A1,11,16,17	1											14.3	5.03	2.3	11.5		6.9	1.00	18.00	30.0	6.31	0.1	Piped to DP 1	
A18	1R	A18	2.54	0.47	12.1	1.19	2.5	3.0	1 @ 10' Type R On-Grade Inlet	3.0	0.0	12.1	1.19	2.5	3.0		11.5	1.00	24.00	340.0	7.20	0.8	Piped to DP 2	
A2, 18	1B	A2	1.84	0.46	10.7	0.85	2.6	2.2	1 @ 15' Type R Sump Inlet	2.2	0.0	12.3	2.04	2.5	5.0		3.0	1.00	1.50	40.0	5.07	0.1	Piped to 1B	
A1,2,11,16,17,18	2											15.1	7.07	2.2	15.8		5.0	1.00	30.00	40.0	5.65	0.1	Piped to DP 2	
A1,2,3,11,16,17,18	1C	A3	3.23	0.43	14.9	1.40	2.3	3.2	1 @ 15' Type R Sump Inlet	3.2	0.0	15.2	8.47	2.2	18.9		15.8	1.00	30.00	30.0	7.77	0.1	Piped to 1C	
A22	1V	A22	3.07	0.67	7.2	2.05	3.0	6.2	1 @ 15' Type R On-Grade Inlet	6.2	0.0	7.2	2.05	3.0	6.2		18.9	1.00	42.00	500.0	7.94	1.0	Piped to West Channel	
A13	1M	A13	5.13	0.42	14.1	2.17	2.3	5.0	1 @ 15' Type R On-Grade Inlet	4.7	0.0	14.1	4.22	2.3	9.8		6.2	1.00	18.00	250.0	6.28	0.7	Piped to 1M	
A7	1G	A7	3.96	0.45	11.8	1.78	2.5	4.4	1 @ 10' Type R On-Grade Inlet	4.4	0.0	11.8	1.78	2.5	4.4		9.8	1.00	18.00	40.0	5.85	0.1	Piped to 1T	
A7, 20	1T	A20	2.04	0.44	11.2	0.89	2.6	2.3	1 @ 10' Type R On-Grade Inlet	2.3	0.0	11.9	2.67	2.5	6.6		4.4	1.00	18.00	40.0	5.85	0.1	Piped to 1T	
A7,13,20	3											14.2	6.89	2.3	15.9		6.6	1.00	18.00	25.0	6.31	0.1	Piped to DP 3	
A19	1S	A19	2.09	0.46	10.8	0.97	2.6	2.5	1 @ 10' Type R On-Grade Inlet	2.5	0.0	10.8	0.97	2.6	2.5		15.9	1.00	24.00	572.0	7.45	1.3	Piped to DP 4	
A5, 19	1E	A5	2.04	0.44	11.2	0.89	2.6	2.3	2 @ 15' Type R Sump Inlet	2.3	0.0	11.5	1.85	2.5	4.7		2.5	1.00	18.00	225.0	5.00	0.8	Piped to 1E	
A5,7,13,19,20	4											15.5	8.74	2.2	19.3		4.7	1.00	30.00	50.0	5.52	0.2	Piped to 1D	
A4,5,7,13,19,20	1D	A4	4.07	0.30	15.0	1.24	2.3	2.8	1 @ 10' Type R Sump Inlet	2.8	0.0	15.6	9.98	2.2	22.0		19.3	1.00	30.00	50.0	7.87	0.1	Piped to 1D	
A4,5,7,8,13,19,20	1H	A8	2.86	0.47	11.0	1.34	2.6	3.5	1 @ 10' Type R Sump Inlet	3.5	0.0	15.7	11.32	2.2	24.9		22.0	1.00	42.00	40.0	8.02	0.1	Piped to 1H	
A12	1L	A12	2.96	0.43	11.3	1.26	2.5	3.2	1 @ 10' Type R On-Grade Inlet	3.2	0.0	11.3	1.26	2.5	3.2		24.9	1.00	42.00	140.0	8.37	0.3	Piped to West Channel	
A12, 21	1U	A21	3.02	0.47	10.7	1.41	2.6	3.7	1 @ 10' Type R On-Grade Inlet	3.7	0.0	11.8	2.68	2.5	6.7		3.2	1.00	18.00	130.0	5.18	0.4	Piped to 1U	
A6,12, 21	1F	A6	4.96	0.31	14.3	1.56	2.3	3.6	1 @ 10' Type R On-Grade Inlet	3.6	0.0	14.3	4.24	2.3	9.7		6.7	1.00	18.00	90.0	6.28	0.2	Piped to 1F	
A6,12,14,21	1N	A14	1.43	0.49	9.1	0.70	2.8	1.9	2 @ 10' Type R Sump Inlet	1.9	0.0	14.7	4.94	2.3	11.2		9.7	1.00	18.00	160.0	6.72	0.4	Piped to 1N	
A15	1O	A15	7.15	0.24	17.1	1.70	2.1	3.6	1 @ 10' Type R Sump Inlet	4.9	0.0	17.1	1.70	2.1	3.6		11.2	1.00	36.00	150.0	6.99	0.4	Piped to West Channel	
A9	1I	A9	3.44	0.45	12.7	1.54	2.4	3.7				12.7	1.54	2.4	3.7		3.6	1.00	24.00	100.0	5.23	0.3	Piped to 1J	
A9,10,15	1J	A10	0.72	0.55	8.5	0.39	2.8	1.1	1 @ 10' Type R Sump Inlet	4.5	0.0	17.4	3.64	2.1	7.6	4.0	3.7			370.0	4.00	1.5	Street Flow to 1J	
																	7.6	1.00	24.00	10.0	6.47	0.0	Piped to West Channel	

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Subdivision Trails at Crowfoot

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Project Name: Trails at Crowfoot
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COMBINED BASINS	DIRECT RUNOFF								TOTAL RUNOFF							STREET		PIPE		TRAVEL TIME		REMARKS		
	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C* A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C* A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)		Velocity (fps)	Tt (min)
OS10	O10	OS10	5.37	0.02	13.4	0.11	2.4	0.3	1 @ 15' Type R Sump Inlet	2.5	0.0	13.4	0.11	2.4	0.3	2.0	0.3				30.0	2.83	0.2	Street Flow to 3A
OS10, C1	3A	C1	10.07	0.40	16.3	4.04	2.2	8.7	1 @ 10' Type R On-Grade Inlet	2.5	0.0	16.3	4.15	2.2	9.0			9.0	1.00	18.00	285.0	6.00	0.8	Piped to DP 19
B15	2O	B15	2.01	0.47	10.4	0.95	2.6	2.5	1 @ 15' Type R On-Grade Inlet	5.6	0.0	10.4	0.95	2.6	2.5			2.5	1.00	18.00	225.0	6.00	0.6	Piped to 2A
B3	2C	B3	4.92	0.45	11.4	2.20	2.5	5.6	1 @ 15' Type R On-Grade Inlet	6.2	0.0	11.4	2.20	2.5	5.6			5.6	1.00	18.00	225.0	6.00	0.6	Piped to 2L
B3,12	2L	B12	3.30	0.67	9.1	2.22	2.8	6.2	1 @ 10' Type R On-Grade Inlet	3.2	0.0	12.1	4.43	2.5	11.0			11.0	1.00	18.00	225.0	6.75	0.6	Piped to 2D
B3,4,12	2D	B4	2.51	0.52	12.9	1.31	2.4	3.2	1 @ 10' Type R On-Grade Inlet	3.8	0.0	11.1	2.39	2.6	6.1			13.8	1.00	24.00	1037.0	7.45	2.3	Piped to DP 10
B2	2B	B2	3.13	0.46	10.3	1.44	2.7	3.8	2 @ 10' Type R On-Grade Inlet	8.5	0.0	20.3	6.78	1.9	13.1			6.1	2.00	18.00	1290.0	6.97	3.1	Piped to 2A
B1, B2	2A	B1	21.00	0.21	20.3	4.38	1.9	8.5	1 @ 10' Type R On-Grade Inlet	3.9	0.0	11.1	1.51	2.6	3.9			13.1	2.00	30.00	245.0	9.11	0.4	Piped to DP 5
B14	2N	B14	3.19	0.47	11.1	1.51	2.6	3.9	2 @ 15' Type R On-Grade Inlet	8.5	0.0	11.1	1.51	2.6	3.9			3.9	1.00	18.00	500.0	6.96	1.2	Piped to DP 6
B5, 14	2E	B5	3.19	0.47	11.1	1.51	2.6	3.9				12.2	3.02	2.5	7.4			3.9	2.00	36.00	50.0	6.50	0.1	Piped to DP 6
B5,14	6											20.7	9.79	1.9	18.7			7.4	1.00	18.00	80.0	6.42	0.2	Piped to DP 6
B1,2,3,4,5,12,14,15	5											21.2	13.94	1.9	26.3			18.7	2.00	36.00	300.0	10.00	0.5	Piped to DP 19
B1,2,3,4,5,12,14,15, OS10, C1	19								1 @ 10' Type R On-Grade Inlet	3.9	0.0	11.1	1.51	2.6	3.9			26.3	2.00	36.00	385.0	10.00	0.6	Piped to DP 2J
B13	2M	B13	3.19	0.47	11.1	1.51	2.6	3.9	2 @ 15' Type R On-Grade Inlet	3.9	0.0	11.1	1.51	2.6	3.9			3.9	1.00	18.00	510.0	6.96	1.2	Piped to DP 7
B6, 13	2F	B6	3.19	0.47	11.1	1.51	2.6	3.9				12.4	3.02	2.5	7.4			3.9	2.00	36.00	40.0	6.50	0.1	Piped to DP 7
B6,13	7											12.5	3.02	2.4	7.4			7.4	1.00	18.00	80.0	8.33	0.2	Piped to DP 8
B6,13	8								1 @ 15' Type R On-Grade Inlet	5.8	0.0	14.6	2.55	2.3	5.8			7.4	2.00	36.00	200.0	10.78	0.3	Piped to DP 9
B7	2G	B7	5.76	0.44	14.6	2.55	2.3	5.8	2 @ 15' Type R Sump Inlet	2.9	0.0	13.1	1.23	2.4	2.9			5.8	1.00	18.00	200.0	6.00	0.6	Piped to DP 9
B9	2I	B9	2.81	0.44	13.1	1.23	2.4	2.9	2 @ 10' Type R Sump Inlet	5.0	0.0	12.9	2.06	2.4	5.0			2.9	0.50	36.00	50.0	4.60	0.2	Piped to DP 9
B8	2H	B8	4.93	0.42	12.9	2.06	2.4	5.0				15.2	8.85	2.2	19.8			5.0	0.50	30.00	50.0	6.50	0.1	Piped to DP 9
B6,7,8,9,13	9											15.2	14.59	2.2	32.6			19.8	1.00	48.00	40.0	9.25	0.1	Piped to DP 10
B6,7,8,9,13,3,4,12	10								2 @ 10' Type R Sump Inlet	1.3	0.0	21.8	14.39	1.9	26.7			32.6	1.00	48.00	580.0	9.92	1.0	Piped to West Channel
B1,2,5,14,15, OS10, C1 B6,7,8,9,10,13	2J	B10	0.65	0.68	8.2	0.44	2.9	1.3	1 @ 5' Type R Sump Inlet	1.6	0.0	21.9	14.96	1.9	27.8			26.7	1.00	54.00	30.0	9.90	0.1	Piped to 2K
B1,2,5,14,15, OS10, C1 B6,7,8,9,10,13	2K	B11	0.84	0.68	9.1	0.57	2.8	1.6				27.8						27.8	1.00	54.00	50.0	10.00	0.1	Piped to West Channel

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision Trails at Crowfoot

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 4/9/2018

Design Storm 2 Yr
2-Year P1 = 0.99 in.

COMBINED BASINS	DIRECT RUNOFF								TOTAL RUNOFF								STREET		PIPE		TRAVEL TIME			REMARKS
	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C* A (Ac)	(in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-Over)	Tc (min)	C* A (Ac)	(in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
D2	4B	D2	5.33	0.41	11.3	2.19	2.5	5.6	1 @ 10" Type R On-Grade Inlet	5.6	0.0	11.3	2.19	2.5	5.6									
D2, D10	4J	D10	4.80	0.45	10.8	2.16	2.6	5.6	2 @ 10" Type R Sump Inlet	5.6	0.0	12.4	4.35	2.5	10.7			5.6	1.00	18.00	375.0	6.00	1.0	Piped to 4J
D7	4G	D7	2.58	0.37	11.2	0.97	2.6	2.5	2 @ 10" Type R On-Grade Inlet	3.0	0.0	11.2	0.97	2.6	2.5			10.7	1.00	36.00	20.0	6.70	0.0	Piped to DP 11
D2,7,10	11											13.1	5.31	2.4	12.7			2.5	1.50	18.00	630.0	5.30	2.0	Piped to DP 11
D1,2,7,10	4A	D1	5.94	0.38	13.2	2.24	2.4	5.3	1 @ 15" Type R Sump Inlet	5.9	0.0	13.2	7.55	2.4	18.0			12.7	1.50	36.00	20.0	6.80	0.0	Piped to 4A
D8	4H	D8	0.85	0.46	9.7	0.39	2.7	1.1				9.7	0.39	2.7	1.1			18.0	1.50	36.00	30.0	7.00	0.1	Piped to Pond B
D12	4L	D12	1.13	0.75	11.8	0.85	2.5	2.1	2 @ 10" Type R On-Grade Inlet	2.9	0.0	13.3	1.24	2.4	2.9	5.00	1.1	2.9	1.50	18.00	100.0	5.10	0.3	Piped to 4F
D6,8,12	4F	D6	2.57	0.38	13.9	0.99	2.3	2.3	2 @ 10" Type R On-Grade Inlet	3.0	0.0	13.9	2.23	2.3	5.2			5.2	0.50	30.00	200.0	6.90	0.5	Piped to Pond B
D3	4C	D3	3.66	0.39	14.3	1.43	2.3	3.3				14.3	1.43	2.3	3.3	5.0	3.3				40.0	4.47	0.1	Street Flow to 4D
D3,4	4D	D4	2.91	0.38	15.2	1.10	2.2	2.4				15.2	2.52	2.2	5.6	3.0	5.6				1668.0	3.46	8.0	Street Flow to 4E
D3,4,5	4E	D5	6.97	0.30	18.4	2.11	2.0	4.3	2 @ 10" Type R Sump Inlet	8.3	0.0	23.2	4.63	1.8	8.3			8.3	1.00	36.00	30.0	7.80	0.1	Piped to DP 2
D9	4I	D9	3.90	0.44	13.4	1.71	2.4	4.1	1 @ 10" Type R Sump Inlet	4.1	0.0	13.4	1.71	2.4	4.1			4.1	1.00	24.00	30.0	5.20	0.1	Piped to DP 2
D3,4,5,9	12											23.3	6.35	1.8	11.4			11.4	2.00	36.00	204.0	8.10	0.4	Piped to DP 13
D11	4K	D11	3.29	0.75	11.8	2.47	2.5	6.2	1 @ 10" Type R Sump Inlet	6.2	0.0	11.8	2.47	2.5	6.2			6.2	1.00	24.00	30.0	5.20	0.1	Piped to DP 13
D3,4,5,9,11	13											23.7	8.82	1.8	15.7			15.7	2.00	36.00	550.0	14.00	0.7	Piped to 16

STANDARD FORM SF-3
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Subdivision Trails at Crowfoot

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2-Year P1 = 0.99 in.

Project Name: Trails at Crowfoot
Project No. 254103
Calculated By: MRS
Date: 4/9/2018

COMBINED BASINS	DIRECT RUNOFF								TOTAL RUNOFF						STREET		PIPE		TRAVEL TIME			REMARKS		
	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C* <i>A</i> (Ac)	i (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-On)	Tc (min)	C* <i>A</i> (Ac)	i (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)		Velocity (fps)	Tc (min)
E23	5W	E23	4.11	0.46	11.4	1.90	2.5	4.8	1 @ 10' Type R On-Grade Inlet	4.8	0.6	11.4	1.90	2.5	4.8									
E22, 23	5V	E22	4.41	0.47	10.9	2.09	2.6	5.4	1 @ 15' Type R On-Grade Inlet	5.4	0.6	12.1	3.98	2.5	9.8			4.8	1.00	18.00	250.0	5.80	0.7	Piped to 5V
E1,22,23	5A	E1	4.04	0.47	10.7	1.90	2.6	4.9	2 @ 15' Type R On-Grade Inlet	4.9	0.6	12.6	5.88	2.4	14.3			9.8	1.00	18.00	200.0	6.70	0.5	Piped to 5A
E1,3, 22,23	5C	E3	4.77	0.47	11.4	2.22	2.5	5.6	1 @ 15' Type R On-Grade Inlet	5.6	0.0	13.9	8.09	2.3	18.8			14.3	1.00	24.00	570.0	7.50	1.3	Piped to 5C
E1,3,4, 22,23	5D	E4	3.20	0.46	11.3	1.48	2.6	3.8	1 @ 10' Type R On-Grade Inlet	3.8	0.6	14.5	9.57	2.3	21.9			18.8	1.00	24.00	270.0	8.05	0.6	Piped to 5D
E1,3,4,5,18,22,23	5E	E5	2.76	0.48	13.7	1.32	2.3	3.1	1 @ 15' Type R Sump Inlet	3.1	0.0	16.4	10.89	2.2	23.5			21.9	1.00	24.00	956.0	8.16	2.0	Piped to 5E
E25, 26	5Y	E25	2.78	0.32	12.7	0.89	2.4	2.2	1 @ 10' Type R On-Grade Inlet	2.2	0.0	12.7	0.89	2.4	2.2			23.5	0.50	48.00	30.0	5.30	0.1	Piped to Pond C
E14,25,26	5N	E14	9.14	0.40	13.3	3.62	2.4	8.6	2 @ 10' Type R Sump Inlet	8.6	0.0	13.3	4.52	2.4	10.7			2.2	1.00	18.00	220.0	6.60	0.6	Piped to 5N
E24	5X	E24	4.23	0.27	14.2	1.14	2.3	2.6				14.2	1.14	2.3	2.6			10.7	0.50	42.00	970.0	14.70	1.1	Piped to 5P
E12,24	5L	E12	3.28	0.27	14.2	0.89	2.3	2.0	1 @ 10' Type R On-Grade Inlet	4.6	0.0	14.7	2.03	2.3	4.6	6.0	2.6				150.0	4.90	0.5	Overland to 5L
E11	5K	E11	3.99	0.27	14.2	1.08	2.3	2.5				14.2	1.08	2.3	2.5			4.6	1.00	18.00	50.0	5.70	0.1	Piped to 5P
E11,12,14,16,24,25,26	5P	E16	1.57	0.66	10.7	1.03	2.6	2.7	1 @ 15' Type R On-Grade Inlet	4.8	0.0	14.3	2.11	2.3	4.8	1.0	2.5				10.0	2.00	0.1	Overland to 5P
E6	5F	E6	2.63	0.48	12.4	1.25	2.4	3.1	1 @ 10' Type R On-Grade Inlet	3.1	0.0	14.9	8.65	2.3	19.5			19.5	1.00	24.00	329.0	8.10	0.7	Piped to 5S
E6,11,12,14,16,24,25,26,19	5S	E19	2.91	0.47	10.9	1.38	2.6	3.6	1 @ 15' Type R On-Grade Inlet	3.6	0.0	12.4	1.25	2.4	3.1			3.1	1.00	18.00	50.0	5.10	0.2	Piped to 5S
E21	5U	E21	2.05	0.49	11.1	1.00	2.6	2.6	1 @ 10' Type R On-Grade Inlet	2.6	0.0	15.5	11.28	2.2	24.9			24.9	1.00	30.00	288.0	9.00	0.5	Piped to 5H
E6,8,11,12,14,16,21,24,25,26,19	5H	E8	2.68	0.47	12.3	1.27	2.5	3.1	1 @ 15' Type R On-Grade Inlet	3.1	0.0	11.1	1.00	2.6	2.6			2.6	1.00	18.00	50.0	4.90	0.2	Piped to 5H
E9	5I	E9	4.84	0.35	14.2	1.70	2.3	3.9	1 @ 15' Type R On-Grade Inlet	3.9	0.0	16.1	13.55	2.2	29.5			29.5	1.00	30.00	660.0	9.26	1.2	Piped to DP 14
E6,8,11,12,14,16,21,24,9,19 E25,26	14											17.3	15.25	2.1	32.0			3.9	1.00	18.00	30.0	5.50	0.1	Piped to DP 14
E20	5T	E20	2.75	0.48	13.2	1.31	2.4	3.1				13.2	1.31	2.4	3.1			32.0	1.00	30.00	280.0	9.40	0.5	Piped to DP 15
E7,20	5G	E7	2.77	0.46	11.8	1.28	2.5	3.2	2 @ 15' Type R Sump Inlet	6.2	0.0	13.3	2.59	2.4	6.2	2.0	3.1				10.0	2.83	0.1	Street Flow to 5G
E6,7,8,11,12,14,16,21,24,9,19 E20,25,26	15											17.7	17.85	2.1	37.0			6.2	0.50	48.00	30.0	6.60	0.1	Piped to DP 15
E15	5O	E15	1.89	0.46	13.2	0.87	2.4	2.1	1 @ 10' Type R On-Grade Inlet	2.1	0.0	13.2	0.87	2.4	2.1			37.0	0.50	60.00	280.0	5.30	0.9	Piped to Pond C
E15,18	5R	E18	2.72	0.47	9.9	1.28	2.7	3.4	1 @ 10' Type R On-Grade Inlet	3.4	0.0	14.9	2.16	2.3	4.9			2.1	1.00	18.00	500.0	4.90	1.7	Piped to 5R
E10	5J	E10	0.70	0.50	12.7	0.35	2.4	0.8				12.7	0.35	2.4	0.8			4.9	1.00	18.00	30.0	5.23	0.1	Piped to 5B
E2,10,15,18	5B	E2	5.27	0.46	20.3	2.44	1.9	4.7	2 @ 15' Type R Sump Inlet	5.4	0.0	20.3	4.94	1.9	9.6	1.0	0.8				300.0	2.00	2.5	Street Flow to 5B
																		9.6	0.60	90.00	30.0	5.30	0.1	Piped to Pond C

STANDARD FORM SF-3
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Project No. 254103
Calculated By: MRS
Date: 4/9/2018

COMBINED BASINS	DIRECT RUNOFF								TOTAL RUNOFF								STREET		PIPE		TRAVEL TIME			REMARKS
	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C* A (Ac)	(in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Carry-Over)	Tc (min)	C* A (Ac)	(in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
F12	6L	F12	1.22	0.83	5.1	1.01	3.3	3.4	1 @ 10' Type R On-Grade Inlet	3.4	0.0	5.1	1.01	3.3	3.4									
F2	6B	F2	1.77	0.84	5.0	1.48	3.4	5.0	1 @ 10' Type R On-Grade Inlet	5.0	0.0	5.2	2.49	3.3	8.3			3.4	1.00	18.00	50.0	5.30	0.2	Piped to 6B
F2,11,12	6K	F11	1.50	0.82	5.3	1.23	3.3	4.1	1 @ 10' Type R On-Grade Inlet	4.1	0.0	5.5	3.73	3.3	12.2			8.3	1.00	18.00	130.0	6.90	0.3	Piped to 6K
F2,10,11,12	6J	F10	1.93	0.82	5.2	1.59	3.3	5.3	1 @ 15' Type R On-Grade Inlet	5.3	0.0	5.8	5.32	3.2	17.2			8.3	1.00	18.00	100.0	6.90	0.2	Piped to 6J
F1,2,10,11,12	6A	F1	1.71	0.81	5.2	1.38	3.3	4.6	2 @ 15' Type R On-Grade Inlet	4.6	0.0	6.0	6.70	3.2	21.4			12.2	1.00	24.00	100.0	7.30	0.2	Piped to 6A
D3,4,5,9,11																		21.4	1.00	24.00	100.0	8.20	0.2	Piped to DP 16
F1,2,10,11,12	16											24.4	15.52	1.7	27.1			27.1	1.00	30.00	1025.0	9.20	1.9	Piped to 6E
F4	6D	F4	3.79	0.47	11.3	1.79	2.6	4.6	1 @ 10' Type R On-Grade Inlet	4.6	0.0	11.3	1.79	2.6	4.6			4.6	1.00	18.00	50.0	5.80	0.1	Piped to 6M
F4,13	6M	F13	3.58	0.47	10.9	1.68	2.6	4.4	1 @ 10' Type R On-Grade Inlet	4.4	0.0	11.4	3.47	2.5	8.8			8.8	1.00	18.00	50.0	6.70	0.1	Piped to 6C
F3,4,13	6C	F3	3.60	0.18	14.3	0.64	2.3	1.5	1 @ 10' Type R On-Grade Inlet	1.5	0.0	14.3	4.11	2.3	9.5			9.5	1.00	18.00	200.0	6.70	0.5	Piped to DP 17
D3,4,5,9,11																		29.3	1.00	30.00	100.0	9.33	0.2	Piped to DP 17
F1,2,3,4,5,9,10,11,12,13	17											26.4	21.54	1.7	36.0			36.0	1.00	30.00	1200.0	9.50	2.1	Piped to Pond D
D3,4,5,9,11																		1.8	0.50	48.00	200.0	6.50	0.5	Piped to 6G
F1,2,3,4,5,7,9,10,11,12,13	6G	F7	4.51	0.16	14.3	0.73	2.3	1.7	1 @ 10' Type R Sump Inlet	1.7	0.0	14.6	1.49	2.3	3.4			3.4	0.50	48.00	200.0	6.50	0.5	Piped to Pond D
E13	5M	E13	4.45	0.27	14.2	1.20	2.3	2.8	1 @ 10' Type R On-Grade Inlet	2.8	0.0	14.2	1.20	2.3	2.8			2.8	1.00	18.00	70.0	5.10	0.2	Piped to 5Q
E17	5Q	E17	1.55	0.66	10.7	1.01	2.6	2.6	1 @ 10' Type R On-Grade Inlet	2.6	0.0	14.5	2.21	2.3	5.1			5.1	0.50	30.00	780.0	6.50	2.0	Piped/Overland Flow to 6H
F8	6H	F8	7.93	0.31	15.0	2.48	2.2	5.6	1 @ 10' Type R Sump Inlet	4.5	0.0	16.5	4.69	2.1	10.1			10.1	0.50	36.00	30.0	9.10	0.1	Piped to 6F
F6	6F	F6	4.93	0.34	15.8	1.69	2.2	3.7	1 @ 10' Type R Sump Inlet	3.7	0.0	16.5	6.38	2.1	13.7			13.7	0.50	42.00	102.0	9.10	0.2	Piped to Channel

POND A	
<u>Description</u>	
Drainage Area (FT)	174.49
Percent Imperviousness (%)	37.56
WQCV (AC-FT)	2.52
EURV Volume (including WQVC) (AC-FT)	6.45
EURV Water Surface (FT)	5995.39
100-YR Volume (including EURV) (AC-FT)	11.29
100-year water surface elevation (FT)	5997.19
Emergency Spillway Crest Elevation (FT)	5997.19
100-year Peak Inflow (CFS)	278.84
100-year Peak Outflow (CFS)	197.00
100-year Peak Allowable (CFS)	204.47
POND B	
<u>Description</u>	
Drainage Area (FT)	23.2
Percent Imperviousness (%)	47.36
WQCV (AC-FT)	0.39
EURV Volume (including WQVC) (AC-FT)	1.10
EURV Water Surface (FT)	6092.90
100-YR Volume (including EURV) (AC-FT)	1.83
100-year water surface elevation (FT)	6094.01
Emergency Spillway Crest Elevation (FT)	6094.01
100-year Peak Inflow (CFS)	39.83
100-year Peak Outflow (CFS)	22.20
100-year Peak Allowable (CFS)	31.53
POND C	
<u>Description</u>	
Drainage Area (FT)	101.09
Percent Imperviousness (%)	44.49
WQCV (AC-FT)	1.61
EURV Volume (including WQVC) (AC-FT)	4.49
EURV Water Surface (FT)	5973.29
100-YR Volume (including EURV) (AC-FT)	8.46
100-year water surface elevation (FT)	5978.14
Emergency Spillway Crest Elevation (FT)	5978.14
100-year Peak Inflow (CFS)	204.00
100-year Peak Outflow (CFS)	106.53
100-year Peak Allowable (CFS)	111.36
POND D	
<u>Description</u>	
Drainage Area (FT)	50.18
Percent Imperviousness (%)	51.42
WQCV (AC-FT)	0.88
EURV Volume (including WQVC) (AC-FT)	2.61
EURV Water Surface (FT)	5991.65
100-YR Volume (including EURV) (AC-FT)	4.49
100-year water surface elevation (FT)	5993.55
Emergency Spillway Crest Elevation (FT)	5993.55
100-year Peak Inflow (CFS)	184.40
100-year Peak Outflow (CFS)	52.28

RIPRAP RUNDOWN

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot

Project No. 254103

Calculated By: MRS

Overflow Riprap Pond A

Inputs:

Q Overflow = 278.8 CFS
H = 0.85 FT
Z = 2.5
C = 3.0
L = 107.9 FT

Output:

Q Horizontal = 274.8 CFS
Q Sloping = 4.0 CFS
Q Total = 278.8 CFS

RipRap = Type M
D50 = 12 INCH
Riprap Thickness = 24.0 INCH

Horizontal Broad-Crested Weir:

$$Q = C_{BCW} L H^{1.5}$$

Sloping Broad-Crested Weir:

$$Q = \left(\frac{2}{5}\right) C_{BCW} Z H^{2.5}$$

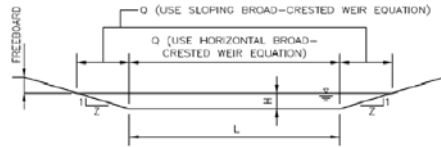
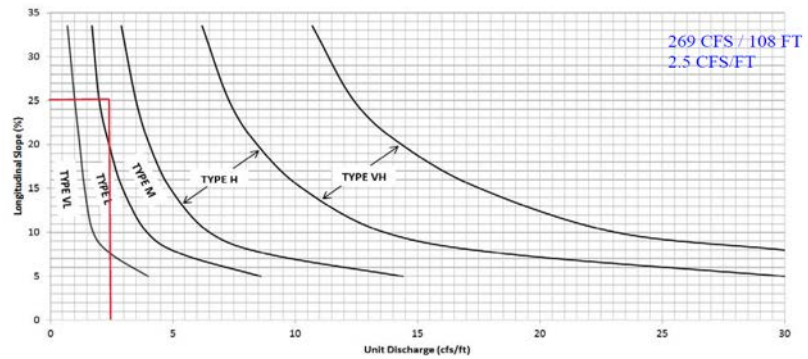


Figure 12-20. Sloping broad-crest weir



Overflow Riprap Pond B

Inputs:

Q Overflow = 39.8 CFS
H = 0.16 FT
Z = 2.5
C = 3.0
L = 81.1 FT

Output:

Q Horizontal = 39.7 CFS
Q Sloping = 0.1 CFS
Q Total = 39.8 CFS

RipRap = Type L
D50 = 9 INCH
Riprap Thickness = 18.0 INCH

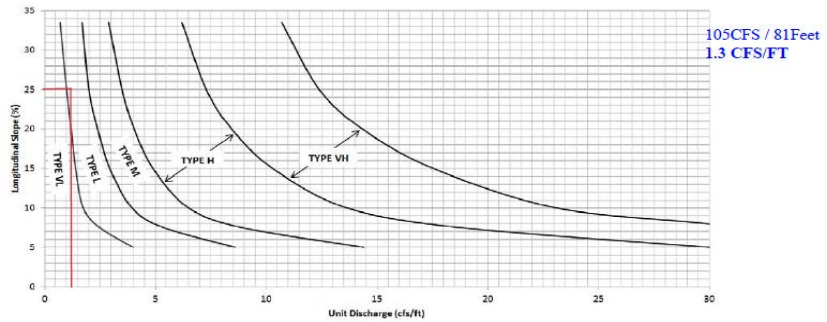


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

RIPRAP RUNDOWN

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot

Project No. 254103

Calculated By: MRS

Overflow Riprap Pond A

Overflow Riprap Pond C

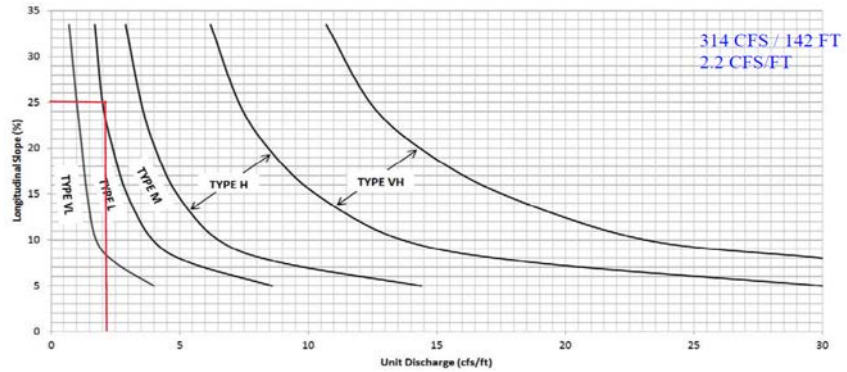
Inputs:

Q Overflow = 204.0 CFS
H = 0.48 FT
Z = 2.5
C = 3.0
L = 142.1 FT

Output:

Q Horizontal = 203.1 CFS
Q Sloping = 0.9 CFS
Q Total = 204.0 CFS

RipRap = Type M
D50 = 12 INCH
Riprap Thickness = 24.0 INCH



Overflow Riprap Pond D

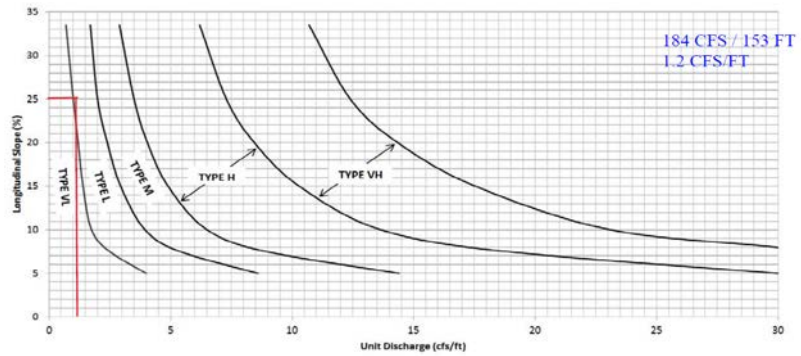
Inputs:

Q Overflow = 184.4 CFS
H = 0.40 FT
Z = 2.5
C = 3.0
L = 153.2 FT

Output:

Q Horizontal = 183.8 CFS
Q Sloping = 0.6 CFS
Q Total = 184.4 CFS

RipRap = Type L
D50 = 9 INCH
Riprap Thickness = 18.0 INCH



POND RELEASE RATES

Subdivision: Trails at Crowfoot

Project Name: Trails at Crowfoot

Project No. 254103

Calculated By: MRS

Date: 1/31/2018

POND A

Area (a)	174.49	acres			
Slope	3.4	%			
L ² / Area	4.36				
Unit Discharge @ 3% Slope for Type B Soil	1.24	/acre	Unit Discharge @ 3% Slope for Type C/D Soil	1.35	/acre
Unit Discharge @ 4% Slope for Type B Soil	1.31	/acre	Unit Discharge @ 4% Slope for Type C/D Soil	1.42	/acre
Interpolated Unit Discharge	1.25	/acre	Interpolated Unit Discharge	1.36	/acre
Total Interpolated Unit Discharge	1.30				
Release Rate	204.47	CFS			

POND B

Area (a)	23.2	acres			
Slope	5.7	%			
L ² / Area	2.27				
Unit Discharge > 4% Slope for Type B Soil	1.45	/acre	Unit Discharge > 4% Slope for Type C/D Soil	1.57	/acre
Total Interpolated Unit Discharge	1.51				
Release Rate	31.53	CFS			

POND C:

Area (a)	101.09	acres			
Slope	2.8	%			
L ² / Area	2.45				
Unit Discharge @ 2% Slope for Type B Soil	1.16	/acre	Unit Discharge @ 2% Slope for Type C/D Soil	1.26	/acre
Unit Discharge @ 3% Slope for Type B Soil	1.24	/acre	Unit Discharge @ 3% Slope for Type C/D Soil	1.35	/acre
Interpolated Unit Discharge	1.22	/acre	Interpolated Unit Discharge	1.33	/acre
Total Interpolated Unit Discharge	1.28				
Release Rate	111.36	CFS			

POND D:

Area (a)	50.18	acres			
Slope	2.8	%			
L ² / Area	4.53				
Unit Discharge @ 2% Slope for Type B Soil	1.16	/acre	Unit Discharge @ 2% Slope for Type C/D Soil	1.26	/acre
Unit Discharge @ 3% Slope for Type B Soil	1.24	/acre	Unit Discharge @ 3% Slope for Type C/D Soil	1.35	/acre
Interpolated Unit Discharge	1.22	/acre	Interpolated Unit Discharge	1.33	/acre
Total Interpolated Unit Discharge	1.28				
Release Rate	55.28	CFS			

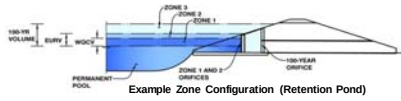
POND A

Pond A: Summary Sheet

UD-Detention, Version 3.07 (February 2017)

Project: Trails at Crowfoot

Basin ID: Pond A



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	174.49	acres
Watershed Length =	5,730	ft
Watershed Slope =	0.031	ft/ft
Watershed Imperviousness =	37.55%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	49.8%	percent
Percentage Hydrologic Soil Groups C/D =	50.2%	percent
Desired WQCV Drain Time =	40.0	hours

Location for 1-hr Rainfall Depths = Parker - The Pinery Country Club

Water Quality Capture Volume (WQCV)	2,520	acre-feet
Excess Urban Runoff Volume (EURV)	6,450	acre-feet
2-yr Runoff Volume ($P1 = 0.99$ in.)	4,569	acre-feet
5-yr Runoff Volume ($P1 = 1.39$ in.)	7,575	acre-feet
10-yr Runoff Volume ($P1 = 1.64$ in.)	10,709	acre-feet
25-yr Runoff Volume ($P1 = 1.98$ in.)	17,050	acre-feet
50-yr Runoff Volume ($P1 = 2.31$ in.)	21,830	acre-feet
100-yr Runoff Volume ($P1 = 2.6$ in.)	27,290	acre-feet
500-yr Runoff Volume ($P1 = 3.1$ in.)	36,288	acre-feet
Approximate 2-yr Detention Volume	4,276	acre-feet
Approximate 5-yr Detention Volume	7,131	acre-feet
Approximate 10-yr Detention Volume	9,077	acre-feet
Approximate 25-yr Detention Volume	10,695	acre-feet
Approximate 50-yr Detention Volume	11,605	acre-feet
Approximate 100-yr Detention Volume	13,646	acre-feet

Optional User Override

1-hr Precipitation	
0.99	inches
1.39	inches
1.64	inches
1.98	inches
2.31	inches
2.60	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	2,520	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3,931	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	7,195	acre-feet
Total Detention Basin Volume =	13,646	acre-ft ³
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_{bas}) =	user	

Initial Surcharge Area ($A_{(0)}$)	user	ft ²
Surcharge Volume Length ($L_{(0)}$)	user	ft
Surcharge Volume Width ($W_{(0)}$)	user	ft
Depth of Basin Floor ($H_{(1,000)}$)	user	ft
Length of Basin Floor ($L_{(1,000)}$)	user	ft
Width of Basin Floor ($W_{(1,000)}$)	user	ft
Area of Basin Floor ($A_{(1,000)}$)	user	ft ²
Volume of Basin Floor ($V_{(1,000)}$)	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

Calculated Total Basin Volume (V_{total}) = acre-feet

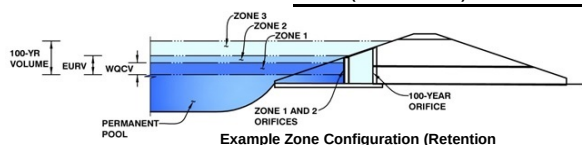
Depth Increment = [illegible]

Inflow hydrograph for 5 and 100 year input from CUHP/ SWMM used for pond design.

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: TRAILS AT CROWFOOT
Basin ID: POND A (STAGE 0 = 5990')



Example Zone Configuration (Retention)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.47	2.520	Orifice Plate
Zone 2 (EURV)	5.39	3.931	Circular Orifice
Zone 3 (100-year)	7.95	7.195	Weir&Pipe (Rect.)
		13.646	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 =	5.39	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	10.34	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	7.181E-02	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	1.74						
Orifice Area (sq. inches)	10.34	10.34						

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	3.47	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.39	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	2.52	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.03	N/A	ft ²
Vertical Orifice Centroid =	0.11	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.39	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	44.00	N/A	feet
Overflow Weir Slope =	4.00	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 ₁ =	6.39	N/A	feet
Over Flow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	8.66	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	126.99	N/A	ft ²
Overflow Grate Open Area w/ Debris =	63.50	N/A	ft ²

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

	Zone 3 Rectangular	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Rectangular Orifice Width =	48.00	N/A	inches
Rectangular Orifice Height =	44.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Rectangular	Not Selected	
Outlet Orifice Area =	14.67	N/A	ft ²
Outlet Orifice Centroid =	1.83	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	7.94	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	107.90	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

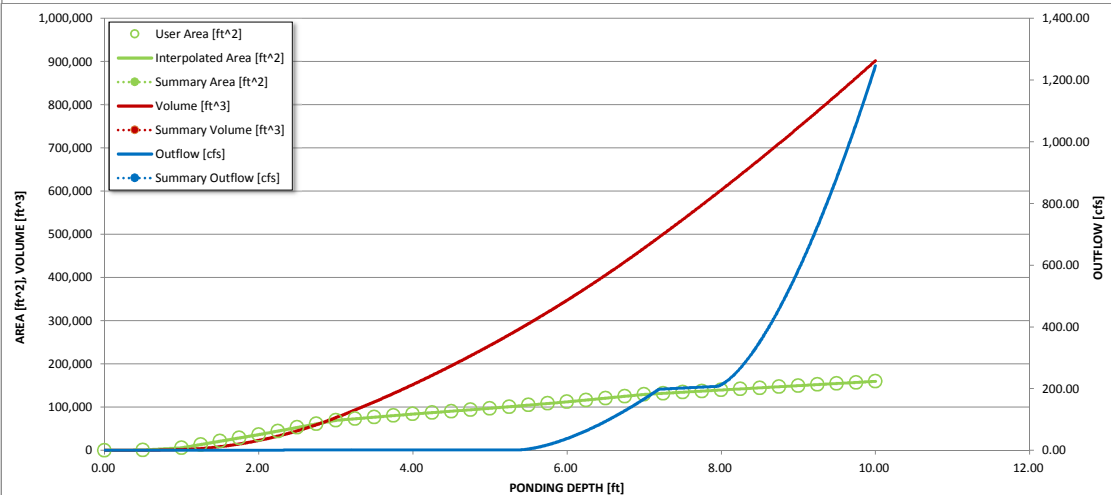
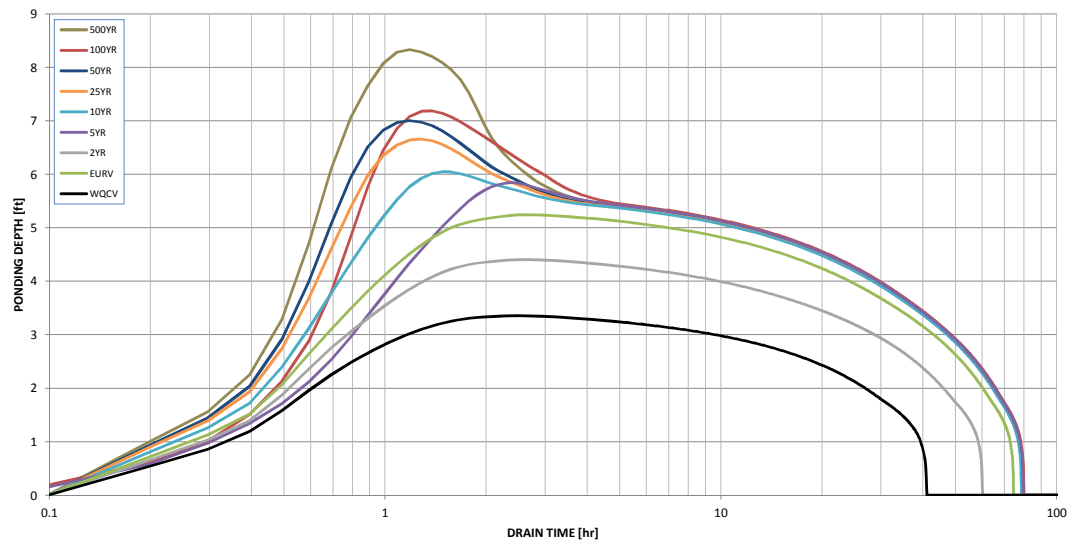
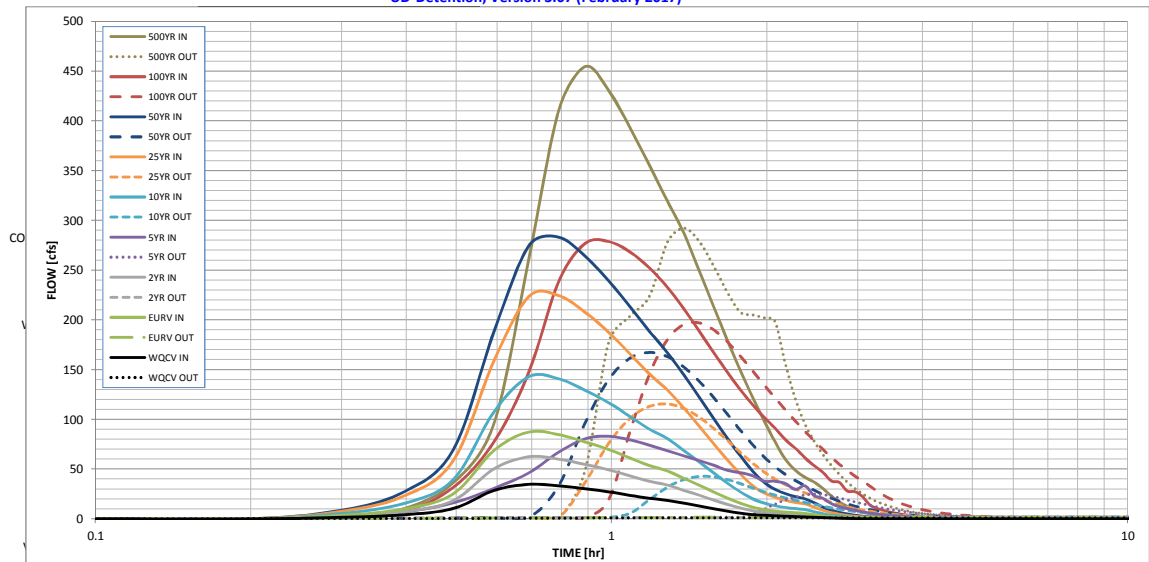
Spillway Design Flow Depth =	0.88	feet
Stage at Top of Freeboard =	9.82	feet
Basin Area at Top of Freeboard =	3.62	acres

Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	0.99	1.39	1.64	1.98	2.31	2.60	3.10
Calculated Runoff Volume (acre-ft) =	2.520	6.450	4.569	7.575	10.709	17.050	21.830	27.290	36.288
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	2.518	6.440	4.567	9.613	10.701	17.040	21.817	28.571	36.266
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.05	0.20	0.58	0.82	1.10	1.54
Predevelopment Peak Q (cfs) =	0.0	0.0	1.6	9.2	34.8	101.9	142.7	191.4	268.6
Peak Inflow Q (cfs) =	34.7	87.3	62.4	83.0	142.9	224.5	283.2	278.8	454.7
Peak Outflow Q (cfs) =	1.1	1.7	1.4	25.0	42.7	115.5	167.3	197.0	292.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.7	1.2	1.1	1.2	1.0	1.1
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.3	0.9	1.3	1.5	1.7
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) =	38	68	56	71	69	65	63	60	56
Time to Drain 99% of Inflow Volume (hours) =	40	72	58	76	75	73	72	71	68
Maximum Ponding Depth (ft) =	3.35	5.24	4.41	5.85	6.05	6.66	7.00	7.19	8.33
Area at Maximum Ponding Depth (acres) =	1.71	2.31	2.05	2.52	2.59	2.83	2.97	3.01	3.28
Maximum Volume Stored (acre-ft) =	2.314	6.120	4.291	7.569	8.080	9.733	10.748	11.287	14.906

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.

Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	USER	WORKBOOK	WORKBOOK	WORKBOOK	USER	WORKBOOK
	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]
5.92 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:11:50	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.30	0.00
Constant	0:17:46	1.48	3.45	2.57	1.63	5.18	7.24	8.23	1.85	10.26
0.844	0:23:41	4.06	9.81	7.16	6.78	15.37	22.74	26.81	7.53	36.32
	0:29:36	10.43	25.20	18.39	16.14	39.48	58.53	69.47	31.71	96.45
	0:35:31	28.63	68.99	50.41	30.82	107.86	159.41	188.77	77.69	260.40
	0:41:26	34.73	87.25	62.38	46.09	142.87	223.35	274.32	147.19	410.30
	0:47:22	33.29	84.67	60.11	67.04	140.80	224.53	283.21	238.41	454.73
	0:53:17	30.30	77.40	54.78	80.48	129.42	207.75	264.28	276.75	430.88
	0:59:12	27.24	69.78	49.36	83.04	116.81	187.66	239.31	278.84	393.12
	1:05:07	23.73	61.24	43.21	79.40	102.92	165.96	213.41	268.32	355.44
	1:11:02	20.65	53.56	37.74	74.05	90.14	145.49	188.45	252.12	319.47
	1:16:58	18.70	48.18	34.04	68.52	80.70	129.59	166.98	232.93	286.90
	1:22:53	15.61	40.61	28.56	63.30	68.58	111.12	144.42	210.82	248.68
	1:28:48	12.90	33.72	23.68	58.46	57.08	92.65	121.84	188.29	212.65
	1:34:43	10.15	26.90	18.79	53.83	45.90	75.09	100.37	166.76	179.08
	1:40:38	7.77	20.90	14.53	48.61	35.87	58.98	80.52	147.09	148.90
	1:46:34	5.74	15.73	10.87	46.54	27.20	45.11	63.39	129.80	122.34
	1:52:29	4.34	11.71	8.14	43.43	20.08	33.46	48.33	114.94	98.83
	1:58:24	3.52	9.35	6.54	37.91	15.90	26.17	36.60	102.26	77.72
	2:04:19	2.97	7.85	5.50	37.90	13.31	21.75	29.84	91.24	59.93
	2:10:14	2.59	6.81	4.78	35.52	11.51	18.71	25.41	79.59	48.87
	2:16:10	2.32	6.08	4.27	29.58	10.24	16.60	22.36	71.04	41.86
	2:22:05	2.13	5.56	3.91	33.23	9.34	15.09	20.16	61.59	37.07
	2:28:00	1.58	4.20	2.92	23.55	7.20	11.92	16.20	53.47	30.62
	2:33:55	1.14	3.03	2.12	20.68	5.19	8.60	11.82	46.90	23.18
	2:39:50	0.84	2.25	1.57	15.30	3.85	6.37	8.64	38.23	16.90
	2:45:46	0.63	1.67	1.16	12.41	2.86	4.72	6.45	36.63	12.45
	2:51:41	0.46	1.23	0.85	10.30	2.12	3.50	4.82	28.00	9.43
	2:57:36	0.33	0.89	0.61	8.58	1.53	2.54	3.56	27.34	7.10
	3:03:31	0.24	0.64	0.45	7.14	1.11	1.84	2.60	22.62	5.33
	3:09:26	0.16	0.45	0.31	5.93	0.79	1.32	1.93	14.44	3.99
	3:15:22	0.10	0.30	0.20	4.92	0.52	0.90	1.36	10.85	3.02
	3:21:17	0.06	0.17	0.12	4.12	0.31	0.55	0.89	8.61	2.18
	3:27:12	0.02	0.08	0.05	3.46	0.16	0.29	0.52	6.97	1.47
	3:33:07	0.01	0.02	0.01	2.91	0.05	0.11	0.25	5.69	0.90
	3:39:02	0.00	0.00	0.00	2.45	0.00	0.01	0.08	4.64	0.47
	3:44:58	0.00	0.00	0.00	2.06	0.00	0.00	0.00	3.77	0.18
	3:50:53	0.00	0.00	0.00	1.74	0.00	0.00	0.00	3.07	0.02
	3:56:48	0.00	0.00	0.00	1.47	0.00	0.00	0.00	2.51	0.00
	4:02:43	0.00	0.00	0.00	1.24	0.00	0.00	0.00	2.05	0.00
	4:08:38	0.00	0.00	0.00	1.06	0.00	0.00	0.00	1.67	0.00
	4:14:34	0.00	0.00	0.00	0.90	0.00	0.00	0.00	1.37	0.00
	4:20:29	0.00	0.00	0.00	0.77	0.00	0.00	0.00	1.13	0.00
	4:26:24	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.93	0.00
	4:32:19	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.78	0.00
	4:38:14	0.00	0.00	0.00	0.48	0.00	0.00	0.00	0.65	0.00
	4:44:10	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.55	0.00
	4:50:05	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.48	0.00
	4:56:00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.41	0.00
	5:01:55	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.36	0.00
	5:07:50	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.31	0.00
	5:13:46	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.27	0.00
	5:19:41	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.24	0.00
	5:25:36	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.21	0.00
	5:31:31	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.18	0.00
	5:37:26	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.17	0.00
	5:43:22	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.15	0.00
	5:49:17	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.13	0.00
	5:55:12	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.12	0.00
	6:01:07	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.11	0.00
	6:07:02	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.10	0.00
	6:12:58	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.09	0.00
	6:18:53	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.08	0.00
	6:24:48	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.08	0.00
	6:30:43	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.07	0.00
	6:36:38	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.07	0.00
	6:42:34	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.06	0.00
	6:48:29	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.06	0.00
	6:54:24	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05	0.00
	7:00:19	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05	0.00
	7:06:14	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.05	0.00

$$Q_{100} = 197.04 \text{ cfs}$$

100YR	100YR	100YR	100YR
Inflow Hydrograph I_1 - [cfs]	Inflow ₂ - [cfs]	Outflow ₁ - [cfs]	Outflow ₂ - [cfs]
0.00	0.00	0.00	0.00
0.00	0.30	0.00	0.15
0.30	1.85	0.15	0.27
1.85	7.53	0.27	0.35
7.53	31.71	0.35	0.42
31.71	77.69	0.42	0.72
77.69	147.19	0.72	0.96
147.19	238.41	0.96	1.25
238.41	276.75	1.25	1.56
276.75	278.84	1.56	19.09
278.84	268.32	19.09	87.75
268.32	252.12	87.75	145.53
252.12	232.93	145.53	180.22
232.93	210.82	180.22	195.55
210.82	188.29	195.55	197.04
188.29	166.76	197.04	189.81
166.76	147.09	189.81	177.76
147.09	129.80	177.76	163.58
129.80	114.94	163.58	148.95
114.94	102.26	148.95	134.87
102.26	91.24	134.87	121.82
91.24	79.59	121.82	109.60
79.59	71.04	109.60	98.34
71.04	61.59	98.34	88.07
61.59	53.47	88.07	78.66
53.47	46.90	78.66	69.99
46.90	38.23	69.99	61.90
38.23	36.63	61.90	54.90
36.63	28.00	54.90	48.65
28.00	27.34	48.65	43.03
27.34	22.62	43.03	38.36
22.62	14.44	38.36	33.40
14.44	10.85	33.40	28.44
10.85	8.61	28.44	24.17
8.61	6.97	24.17	20.62
6.97	5.69	20.62	17.66
5.69	4.64	17.66	15.20
4.64	3.77	15.20	13.14
3.77	3.07	13.14	11.41
3.07	2.51	11.41	9.94
2.51	2.05	9.94	8.70
2.05	1.67	8.70	7.64
1.67	1.37	7.64	6.75
1.37	1.13	6.75	5.98
1.13	0.93	5.98	5.32
0.93	0.78	5.32	4.76
0.78	0.65	4.76	4.27
0.65	0.55	4.27	3.86
0.55	0.48	3.86	3.50
0.48	0.41	3.50	3.19
0.41	0.36	3.19	2.92
0.36	0.31	2.92	2.69
0.31	0.27	2.69	2.49
0.27	0.24	2.49	2.32
0.24	0.21	2.32	2.17
0.21	0.18	2.17	2.04
0.18	0.17	2.04	1.93
0.17	0.15	1.93	1.84
0.15	0.13	1.84	1.76
0.13	0.12	1.76	1.72
0.12	0.11	1.72	1.69
0.11	0.10	1.69	1.69
0.10	0.09	1.69	1.68
0.09	0.08	1.68	1.68
0.08	0.07	1.68	1.68
0.07	0.07	1.68	1.68
0.07	0.06	1.68	1.68
0.06	0.06	1.68	1.68
0.06	0.05	1.68	1.68
0.05	0.05	1.68	1.68
0.05	0.05	1.68	1.67
0.05	0.00	1.67	1.67

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot

Project No. 254103

Calculated By: MRS

Volume= $\frac{1}{3} \times \text{Depth} \times (A+B+(A*B)^{0.5})$

A - Upper Surface

B - Lower Surface

Pond A

SWMM 100 Year Volume (AC-FT)	EURV(AC-FT)	WQCV	Release Rate (CFS)
V100			
11.29	6.45	2.52	197.0

Storage Curve							
STAGE	SURFACE AREA	A+B+(A*B) ^{.5}	1/3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft ²	ft ²	ft ²	ft	ft ³	ft ³	ac-ft
5990	0.00	0	0	0	0	0	0
5990.5	600.00	600	200	0.5	100	100	0.00
5991	5780	8,242	2,747	1	2,747	2,847	0.07
5992	36261	56,518	18,839	1	18,839	21,687	0.50
5993	69342	155,747	51,916	1	51,916	73,602	1.69
5994	83939	229,573	76,524	1	76,524	150,127	3.45
5995	97157	271,402	90,467	1	90,467	240,594	5.52
5996	112127	313,658	104,553	1	104,553	345,147	7.92
5997	129346	361,902	120,634	1	120,634	465,781	10.69
5998	139612	403,339	134,446	1	134,446	600,227	13.78
5999	149656	433,815	144,605	1	144,605	744,832	17.10
6000	159643	463,868	154,623	1	154,623	899,455	20.65

WQ ^{ELEV}	5993.47	FT	WQ ^{VOLUME}	2.52	AC-FT
EURV ^{ELEV}	5995.39	FT	EURV ^{VOLUME}	6.45	AC-FT
100YEAR ^{ELEV}	5997.19	FT	100YEAR ^{VOLUME}	11.29	AC-FT

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot

Project No. 254103

Calculated By: MRS

Volume= $\frac{1}{3} \times \text{Depth} \times (A+B+(A*B)^{0.5})$

A - Upper Surface

B - Lower Surface

Pond A

WQCV	SURCHARGE VOLUME	SURCHARGE DEPTH
(AC-FT)	(FT ³)	(FT)
2.52	329.31	0.50

Storage Curve							
STAGE	SURFACE AREA	$A+B+(A*B)^{0.5}$	$\frac{1}{3}$	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft ²	ft ²	ft ²	ft	ft ³	ft ³	ac-ft
5990	542.00	0	0	0	0	0	0
5990.5	726	1,895	632	0.5	316	316	0.01

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Sheet 1 of 4

Designer:

ASFUND KHAN

Company:

CVL Consultants

Date:

May 9, 2017

Project:

Trails at Crowfoot

Location:

Pond A

1. Basin Storage Volume A) Effective Imperviousness of Tributary Area, I_a B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) C) Contributing Watershed Area D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm E) Design Concept (Select EURV when also designing for flood control) F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$) G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN} / 0.43))$) H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) I) Predominant Watershed NRCS Soil Group 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: $EURV_{C/D} = 1.20 * i^{1.08}$	$I_a =$ 40.8 % $i =$ 0.408 Area = 151.230 ac $d_6 =$ in Choose One ☒ Water Quality Capture Volume (WQCV) ☐ Excess Urban Runoff Volume (EURV) $V_{DESIGN} =$ 2.291 ac-ft $V_{DESIGN\ OTHER} =$ ac-ft $V_{DESIGN\ USER} =$ ac-ft Choose One ☐ A ☐ B ☐ C / D WQCV selected. Soil group not required. EURV = ac-ft
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	$L : W =$ 2.0 : 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:	

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

Designer:ASFUND KHAN

Company:CVL Consultants

Date:May 9, 2017

Project:Trails at Crowfoot

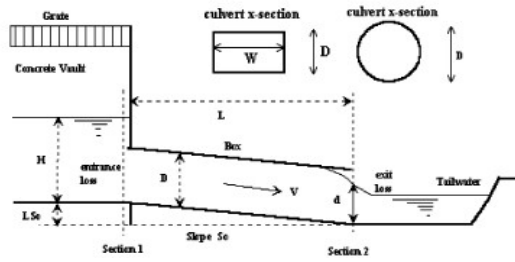
Location:Pond A

5. Forebay A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) B) Actual Forebay Volume C) Forebay Depth (D_{F} = 30 inch maximum) D) Forebay Discharge i) Undetained 100-year Peak Discharge ii) Forebay Discharge Design Flow (Q_{F} = 0.02 * Q_{100}) E) Forebay Discharge Design F) Discharge Pipe Size (minimum 8-inches) G) Rectangular Notch Width	V_{FMIN} = 0.069 ac-ft V_{F} = 0.069 ac-ft D_{F} = 24.0 in Q_{100} = 269.00 cfs Q_{F} = 5.38 cfs Choose One ☐ Berm With Pipe ☒ Wall with Rect. Notch ☐ Wall with V-Notch Weir

Calculated D_{p} = inCalculated W_{N} = 11.7 in

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: **Trails at Crowfoot**
 Basin ID: **Pond A (Q₁₀₀ = 197)**
 Status:



Design Information (Input):

Circular Culvert: Barrel Diameter in Inches
 Inlet Edge Type (choose from pull-down list)

D = inches
 1.5 : 1 Beveled Edge

OR:

Box Culvert: Barrel Height (Rise) in Feet
 Barrel Width (Span) in Feet
 Inlet Edge Type (choose from pull-down list)

Height (Rise) = ft.
 Width (Span) = ft.
 1.5 : 1 Bevel w/ 90 Deg. Headwall

Number of Barrels
 Inlet Elevation at Culvert Invert
 Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)
 Culvert Length in Feet
 Manning's Roughness
 Bend Loss Coefficient
 Exit Loss Coefficient

No =
 Inlet Elev = ft. elev.
 Slope = ft vert. / ft horiz.
 L = ft.
 n =
 K_b =
 K_x =

Design Information (calculated):

Entrance Loss Coefficient
 Friction Loss Coefficient
 Sum of All Loss Coefficients
 Orifice Inlet Condition Coefficient
 Minimum Energy Condition Coefficient

K_e =
 K_f =
 K_s =
 C_d =
 K_{E_{low}} =

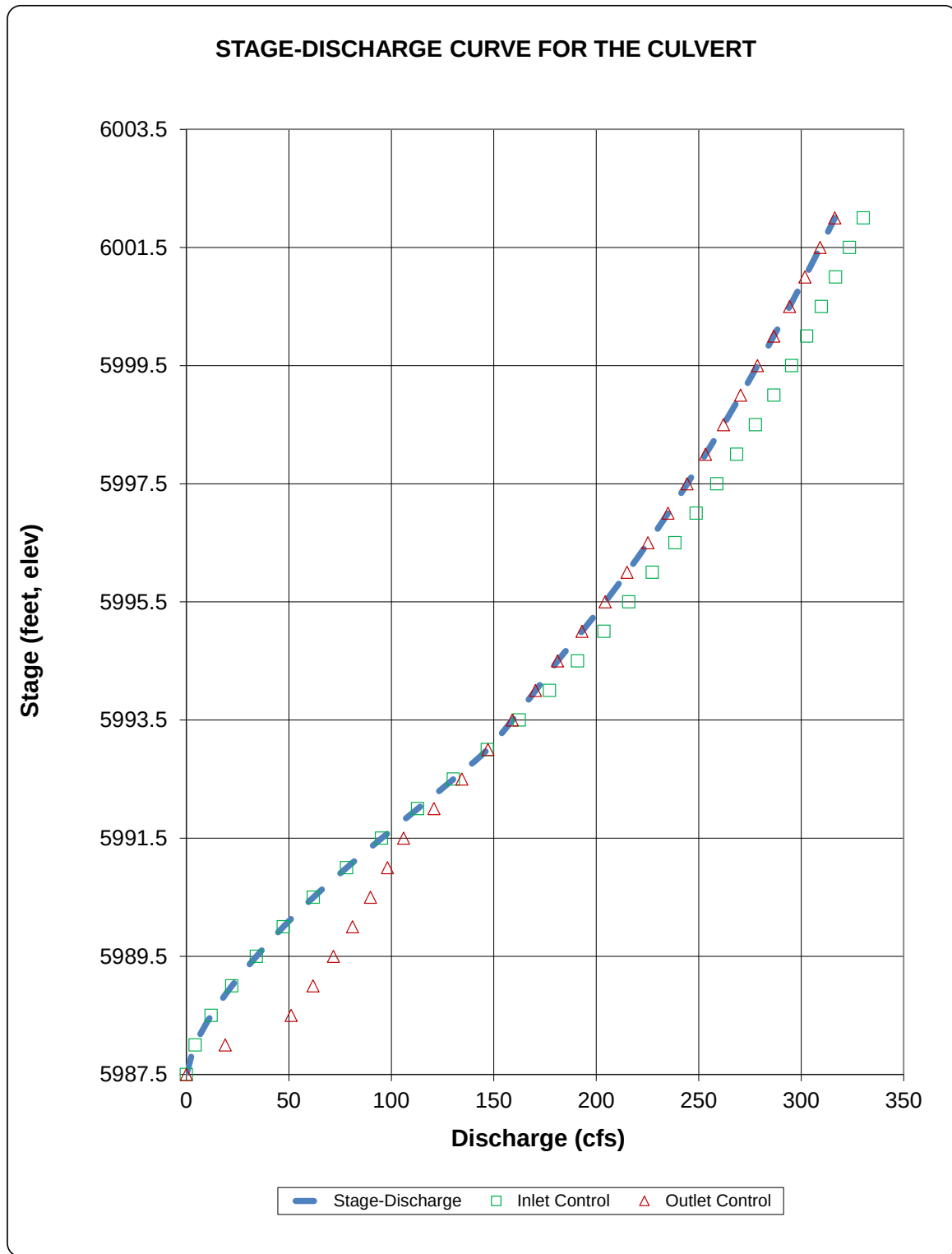
Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
5987.50	5987.96	0.00	0.00	0.00	No Flow (WS < inlet)	N/A
5988.00	5987.96	4.30	19.01	4.30	Min. Energy. Eqn.	INLET
5988.50	5987.96	12.10	51.15	12.10	Min. Energy. Eqn.	INLET
5989.00	5987.96	22.20	61.82	22.20	Min. Energy. Eqn.	INLET
5989.50	5987.96	34.20	71.78	34.20	Min. Energy. Eqn.	INLET
5990.00	5987.96	47.30	81.09	47.30	Regression Eqn.	INLET
5990.50	5987.96	62.00	89.88	62.00	Regression Eqn.	INLET
5991.00	5987.96	78.20	98.16	78.20	Regression Eqn.	INLET
5991.50	5987.96	95.30	106.05	95.30	Regression Eqn.	INLET
5992.00	5987.96	112.90	120.85	112.90	Regression Eqn.	INLET
5992.50	5987.96	130.30	134.43	130.30	Regression Eqn.	INLET
5993.00	5987.96	146.90	147.17	146.90	Regression Eqn.	INLET
5993.50	5987.96	162.50	159.07	159.07	Regression Eqn.	OUTLET
5994.00	5987.96	177.20	170.38	170.38	Regression Eqn.	OUTLET
5994.50	5987.96	190.90	181.12	181.12	Regression Eqn.	OUTLET
5995.00	5987.96	203.80	193.02	193.02	Regression Eqn.	OUTLET
5995.50	5987.96	215.90	204.33	204.33	Regression Eqn.	OUTLET
5996.00	5987.96	227.40	215.00	215.00	Regression Eqn.	OUTLET
5996.50	5987.96	238.40	225.22	225.22	Regression Eqn.	OUTLET
5997.00	5987.96	248.80	234.98	234.98	Regression Eqn.	OUTLET
5997.50	5987.96	258.80	244.36	244.36	Regression Eqn.	OUTLET
5998.00	5987.96	268.50	253.35	253.35	Regression Eqn.	OUTLET
5998.50	5987.96	277.70	262.08	262.08	Regression Eqn.	OUTLET
5999.00	5987.96	286.70	270.48	270.48	Regression Eqn.	OUTLET
5999.50	5987.96	295.40	278.63	278.63	Regression Eqn.	OUTLET
6000.00	5987.96	302.70	286.58	286.58	Orifice Eqn.	OUTLET
6000.50	5987.96	309.90	294.34	294.34	Orifice Eqn.	OUTLET
6001.00	5987.96	316.80	301.84	301.84	Orifice Eqn.	OUTLET
6001.50	5987.96	323.60	309.21	309.21	Orifice Eqn.	OUTLET
6002.00	5987.96	330.30	316.39	316.39	Orifice Eqn.	OUTLET

Processing Time: 05.37 Seconds

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

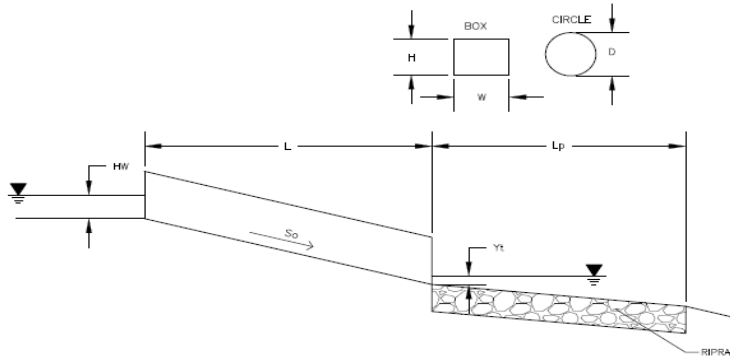
Project: Trails at Crowfoot
Basin ID: Pond A (Q100 = 197)



Determination of Culvert Headwater and Outlet Protection

Project: **TRAILS AT CROWFOOT**

Basin ID: **POND A OUTFALL (Q100 =197.0)**



Soil Type:

Choose One:

☐ Sandy

☒ Non-Sandy

Design Information (Input):

Design Discharge

Q = 197 cfs

Circular Culvert:

Barrel Diameter in Inches

D = inches

Inlet Edge Type (Choose from pull-down list)

Box Culvert:

Barrel Height (Rise) in Feet

Height (Rise) = 4 ft

Barrel Width (Span) in Feet

Width (Span) = 4 ft

Inlet Edge Type (Choose from pull-down list)

1.5 : 1 Bevel w/ 90 Deg. Headwall

Number of Barrels

No = 1

Inlet Elevation

Elev IN = 5987.5 ft

Outlet Elevation OR Slope

Elev OUT = 5986.85 ft

Culvert Length

L = 130 ft

Manning's Roughness

n = 0.013

Bend Loss Coefficient

k_b = 0

Exit Loss Coefficient

k_x = 1

Tailwater Surface Elevation

Elev Y_t = ft

Max Allowable Channel Velocity

V = 7 ft/s

Required Protection (Output):

Tailwater Surface Height

Y_t = 1.60 ft

Flow Area at Max Channel Velocity

A_t = 28.14 ft²

Culvert Cross Sectional Area Available

A = 16.00 ft²

Entrance Loss Coefficient

k_e = 0.20

Friction Loss Coefficient

k_f = 0.64

Sum of All Losses Coefficients

k_s = 1.84

Culvert Normal Depth

Y_n = 4.82 ft

Culvert Critical Depth

Y_c = 4.00 ft

Tailwater Depth for Design

d = 4.00 ft

Adjusted Diameter OR Adjusted Rise

H_a = - ft

Expansion Factor

1/(2*tan(θ)) = 1.23

Flow/Diameter^{2.5} OR Flow/(Span * Rise^{1.5})

Q/WH^{1.5} = 6.16 ft^{0.5}/s

Froude Number

Fr = -

Tailwater/Adjusted Diameter OR Tailwater/Adjusted Rise

Y_t/H = 0.40 **Pressure flow!**

Inlet Control Headwater

HW_i = 7.24 ft

Outlet Control Headwater

HW_o = 7.68 ft

Design Headwater Elevation

HW = 5,995.17 ft

Headwater/Diameter OR Headwater/Rise Ratio

HW/H = 1.92 **HW/H > 1.5!**

Minimum Theoretical Riprap Size

d₅₀ = 10 in

Nominal Riprap Size

d₅₀ = 12 in

UDFCD Riprap Type

Type = M

Length of Protection

L_p = 17 ft

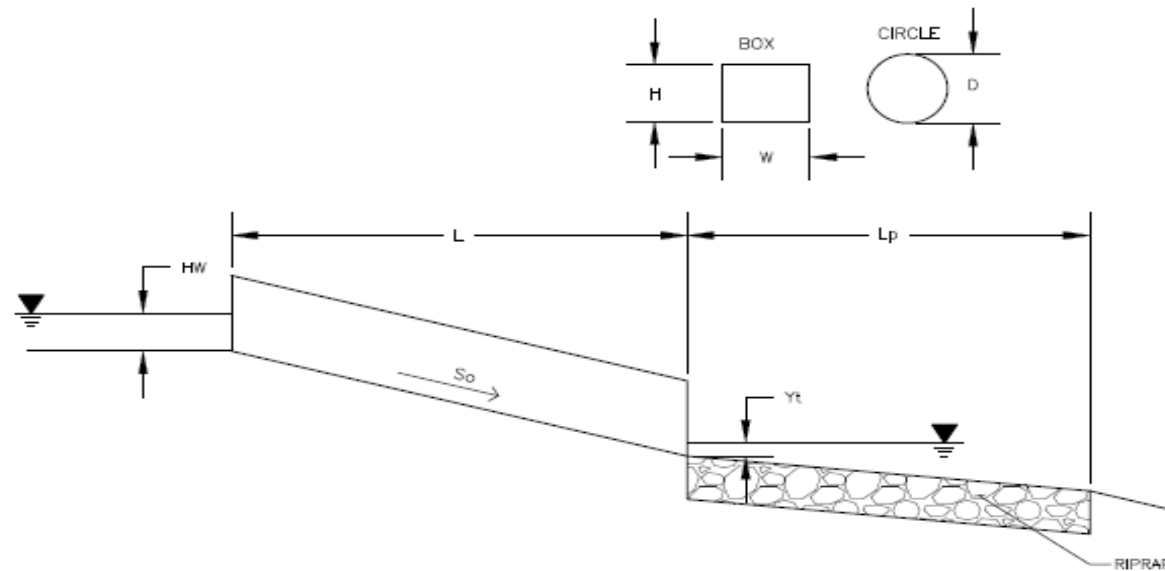
Width of Protection

T = 18 ft

Determination of Culvert Headwater and Outlet Protection

Project: **TRAILS AT CROWFOOT**

Basin ID: **POND A OUTFALL (Q100 =5892 CFS)**



Soil Type:

Choose One:

☐ Sandy

☒ Non-Sandy

Design Information (Input):

Design Discharge

Q = 5892 cfs

Circular Culvert:

Barrel Diameter in Inches

D = inches

Inlet Edge Type (Choose from pull-down list)

Box Culvert:

Barrel Height (Rise) in Feet

Height (Rise) = 4 ft

Barrel Width (Span) in Feet

Width (Span) = 4 ft

Inlet Edge Type (Choose from pull-down list)

1.5 : 1 Bevel w/ 90 Deg. Headwall

Number of Barrels

No = 1

Inlet Elevation

Elev IN = 5989.33 ft

Outlet Elevation OR Slope

So = 0.218 ft/ft

Culvert Length

L = 123 ft

Manning's Roughness

n = 0.013

Bend Loss Coefficient

k_b = 0

Exit Loss Coefficient

k_x = 1

Tailwater Surface Elevation

Elev Y_t = ft

Max Allowable Channel Velocity

V = 7 ft/s

Required Protection (Output):

Tailwater Surface Height

Y_t = 1.60 ft

Flow Area at Max Channel Velocity

A_t = 841.71 ft²

Culvert Cross Sectional Area Available

A = 16.00 ft²

Entrance Loss Coefficient

k_e = 0.20

Friction Loss Coefficient

k_f = 0.60

Sum of All Losses Coefficients

k_s = 1.80

Culvert Normal Depth

Y_n = 18.56 ft

Culvert Critical Depth

Y_c = 4.00 ft

Tailwater Depth for Design

d = 4.00 ft

Adjusted Diameter OR Adjusted Rise

H_a = - ft

Expansion Factor

$1/(2*\tan(\theta))$ = 1.00

Flow/Diameter^{2.5} OR Flow/(Span * Rise^{1.5})

$Q/WH^{1.5}$ = 184.13 ft^{0.5}/s

Froude Number

Fr = -

Tailwater/Adjusted Diameter OR Tailwater/Adjusted Rise

Y_t/H = 0.40 **Pressure flow!**

Inlet Control Headwater

HW_i = 3,792.98 ft

Outlet Control Headwater

HW_o = 3,773.74 ft

Design Headwater Elevation

HW = 9,782.31 ft

Headwater/Diameter OR Headwater/Rise Ratio

HW/H = 948.25 HW/H > 1.5!

Minimum Theoretical Riprap Size

d_{50} = 309 in

Nominal Riprap Size

d_{50} = - in

UDFCD Riprap Type

Type = Very Big

Length of Protection

L_p = 217 ft

Width of Protection

T = 221 ft

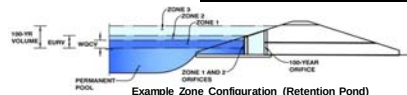
POND B

Pond B: Summary Sheet

UD-Detention, Version 3.07 (February 2017)

Project: Trails at Crowfoot

Basin ID: Pond B



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type :		EDB
Watershed Area :	23.20	acres
Watershed Length :	1,506	ft
Watershed Slope :	0.057	ft/ft
Watershed Imperviousness :	47.39%	percent
Percentage Hydrologic Soil Group A :	0.0%	percent
Percentage Hydrologic Soil Group B :	49.8%	percent
Percentage Hydrologic Soil Groups C/D :	50.2%	percent
Desired WQCV Drain Time :	40.0	hours
Location for 1-yr Rainfall Depths : Parker - The Pinery Country Club		
Water Quality Capture Volume (WQCV) =	0.335	acre-feet
Excess Urban Runoff Volume (EURV) =	1,102	acre-feet
2-yr Runoff Volume (P1 = 0.99) =	0.794	acre-feet
5-yr Runoff Volume (P1 = 1.24) =	1.274	acre-feet
10-yr Runoff Volume (P1 = 1.66) =	1.711	acre-feet
25-yr Runoff Volume (P1 = 1.98) =	2.135	acre-feet
50-yr Runoff Volume (P1 = 2.31) =	2,570	acre-feet
100-yr Runoff Volume (P1 = 2.6) =	3,883	acre-feet
500-yr Runoff Volume (P1 = 5.61) =	5,061	acre-feet
Approximate 2-yr Detention Volume =	0.744	acre-feet
Approximate 5-yr Detention Volume =	1.196	acre-feet
Approximate 10-yr Detention Volume =	1.490	acre-feet
Approximate 25-yr Detention Volume =	1.720	acre-feet
Approximate 50-yr Detention Volume =	1.858	acre-feet
Approximate 100-yr Detention Volume =	2.120	acre-feet

Stage-Storage Calculation

Zone 1 Volume (WQCV)	0.385	acre-foot
Zone 2 Volume (EURV - Zone 1)	0.717	acre-foot
Zone 3 Volume (100-year - Zones 1 & 2)	1.018	acre-foot
Total Detention Basin Volume	2.120	acre-foot
Initial Surge Volume (SVI)	user	ft ³
Initial Surge Depth (ISD)	user	ft
Total Available Detention Volume (V_{det})	user	ft ³
Depth of Trickle Channel (H_{TC})	user	ft
Depth of Trickle Channel (S_{TC})	user	ft
Slope of Main Basin Sides (S_{mb})	user	H:V
Basin Length-to-Width Ratio (R_{mb})	user	
Initial Surge Length (A_{SVI})	user	ft ²
Surge Volume Area (V_{SVI})	user	ft ²
Surge Volume Width (W_{SVI})	user	ft
Depth of Basin Floor (H_{bfl})	user	ft
Length of Basin Floor (L_{bfl})	user	ft
Width of Basin Floor (W_{bfl})	user	ft
Area of Basin Floor (A_{bfl})	user	ft ²
Volume of Basin Floor (V_{bfl})	user	ft ³
Depth of Main Basin (H_{mb})	user	ft
Length of Main Basin (L_{mb})	user	ft
Width of Main Basin (W_{mb})	user	ft
Area of Main Basin (A_{mb})	user	ft ²
Volume of Main Basin (V_{mb})	user	ft ³
Calculated Total Basin Volume (V_{btl})	user	acre-foot

Depth Increment =

[illegible]

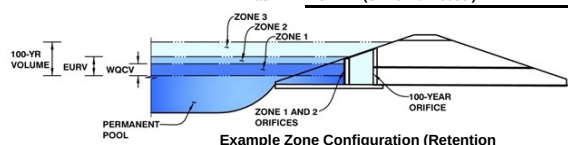
Inflow hydrographs for 5 and 100 year imported from CUHP/SWMM for pond design

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: TRAILS AT CROWFOOT

Basin ID: POND B (STAGE 0 = 6088')



Example Zone Configuration (Retention)

	Stage (ft)	one Volume (ac-ft)	Outlet Type
WQCV	3.46	0.385	Orifice Plate
EURV	4.88	0.717	Circular Orifice
3-year	6.38	1.018	Weir&Pipe (Restrict)
		2.120	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 =	4.88	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	1.43	sq. inches (diameter = 1-5/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	9.931E-03	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	1.73						
Orifice Area (sq. inches)	1.43	1.43						

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	3.46	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	4.88	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	2.22	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.03	N/A	ft ²
Vertical Orifice Centroid =	0.09	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H _o =	4.88	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	18.00	N/A	feet
Overflow Weir Slope =	4.00	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 _g =	5.88	N/A	feet
Over Flow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	27.31	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	51.95	N/A	ft ²
Overflow Grate Open Area w/ Debris =	25.98	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 =	0.55	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	14.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.90	N/A	ft ²
Outlet Orifice Centroid =	0.66	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.74	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	6.38	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	81.10	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

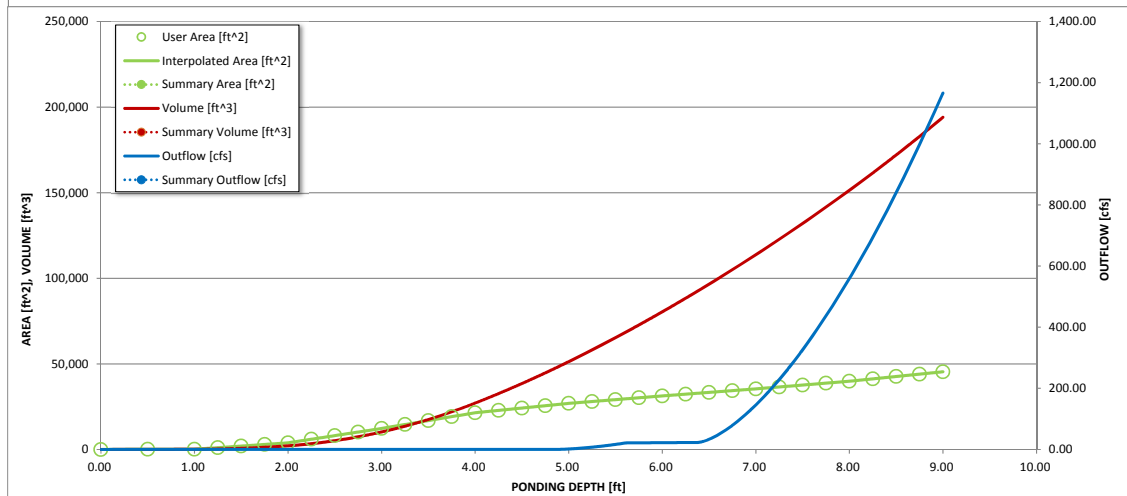
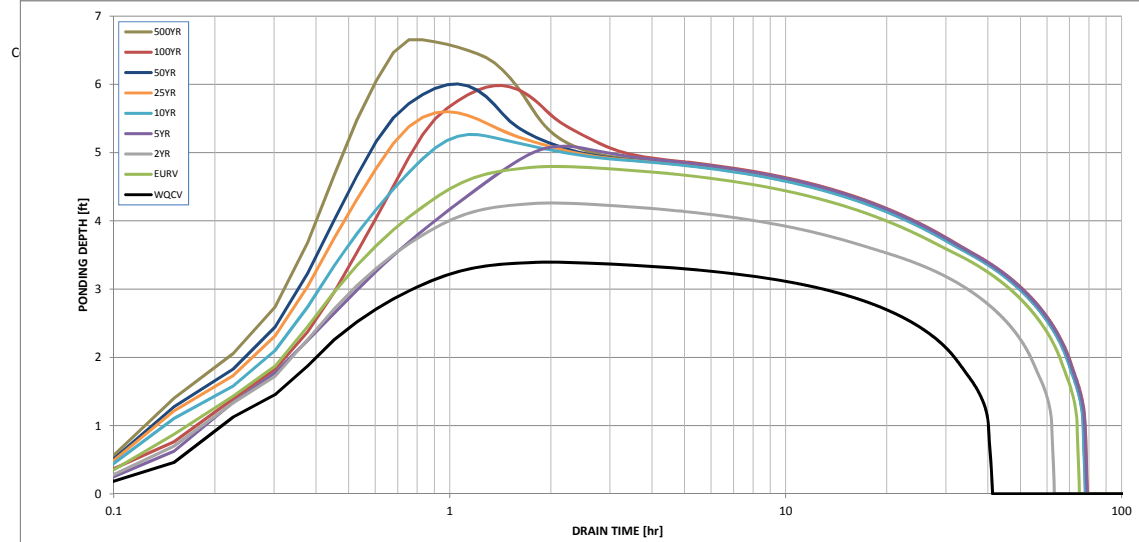
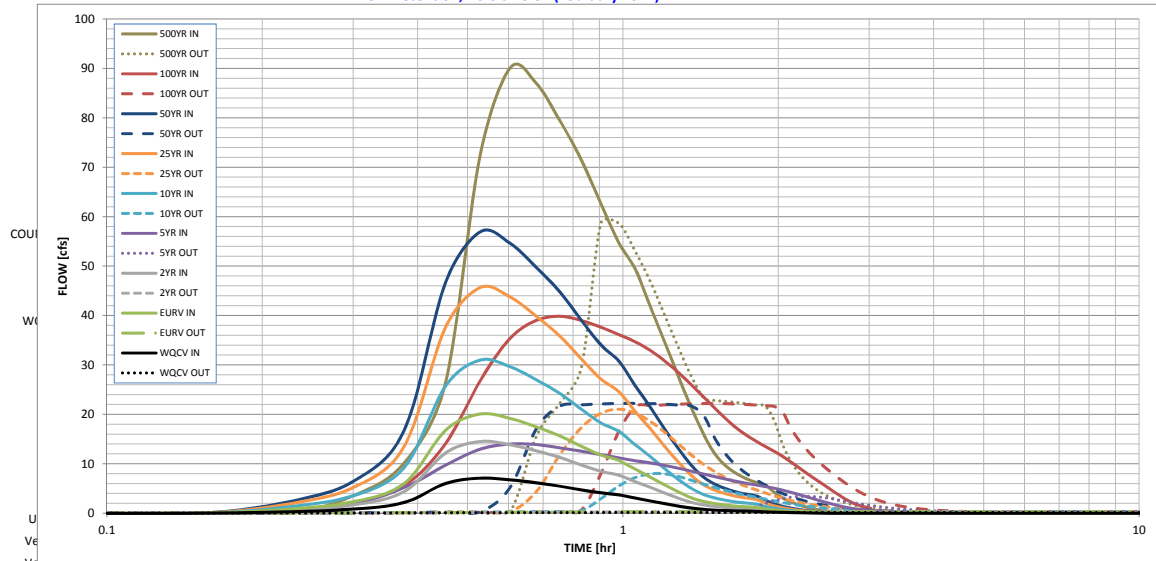
Spillway Design Flow Depth =	0.29	feet
Stage at Top of Freeboard =	7.67	feet
Basin Area at Top of Freeboard =	0.88	acres

Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	0.53	1.07	0.99	1.39	1.64	1.98	2.31	2.60	3.10
One-Hour Rainfall Depth (in) =	0.385	1.102	0.794	1.271	1.711	2.535	3.170	3.883	5.061
Calculated Runoff Volume (acre-ft) =									
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.385	1.102	0.794	1.494	1.710	2.533	3.169	4.019	5.059
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.07	0.28	0.78	1.09	1.44	2.01
Predevelopment Peak Q (cfs) =	0.0	0.0	0.3	1.7	6.4	18.0	25.2	33.4	46.7
Peak Inflow Q (cfs) =	7.1	20.1	14.5	14.0	31.0	45.7	56.9	39.8	90.1
Peak Outflow Q (cfs) =	0.1	0.3	0.3	3.4	8.0	21.0	22.2	22.2	58.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.0	1.2	1.2	0.9	0.7	1.3
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.1	0.4	0.4	0.4	0.4
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) =	38	68	58	70	68	65	63	62	58
Time to Drain 99% of Inflow Volume (hours) =	40	72	61	75	74	72	71	71	69
Maximum Ponding Depth (ft) =	3.39	4.80	4.26	5.09	5.26	5.60	6.01	5.98	6.65
Area at Maximum Ponding Depth (acres) =	0.36	0.59	0.53	0.63	0.64	0.68	0.72	0.72	0.78
Maximum Volume Stored (acre-ft) =	0.361	1.051	0.755	1.234	1.342	1.567	1.846	1.832	2.333

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	USER	WORKBOOK	WORKBOOK	WORKBOOK	USER	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]
4.53 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:04:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:09:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
Constant	0:13:35	0.32	0.88	0.64	0.54	1.34	1.95	2.41	0.70	3.67
1.103	0:18:07	0.85	2.38	1.73	1.98	3.65	5.34	6.63	2.22	10.29
	0:22:39	2.19	6.11	4.44	5.25	9.37	13.71	17.02	5.67	26.42
	0:27:11	6.02	16.78	12.19	9.73	25.72	37.63	46.68	14.08	72.40
	0:31:43	7.10	20.07	14.51	12.96	30.98	45.66	56.94	26.79	90.10
	0:36:14	6.76	19.18	13.86	13.99	29.65	43.77	54.63	35.38	86.98
	0:40:46	6.15	17.46	12.62	13.90	26.99	39.83	49.72	39.02	79.34
	0:45:18	5.48	15.64	11.28	13.22	24.22	35.81	44.74	39.83	71.50
	0:49:50	4.72	13.54	9.75	12.55	21.03	31.19	39.05	39.00	62.63
	0:54:22	4.12	11.78	8.49	11.87	18.27	27.15	34.04	37.64	54.73
	0:58:53	3.73	10.68	7.70	11.20	16.57	24.58	30.78	36.14	49.33
	1:03:25	3.06	8.86	6.36	10.61	13.80	20.53	25.74	34.68	41.44
	1:07:57	2.49	7.27	5.21	10.13	11.37	16.96	21.29	32.86	34.37
	1:12:29	1.90	5.65	4.02	9.65	8.89	13.34	16.81	30.70	27.32
	1:17:01	1.40	4.25	3.01	9.12	6.76	10.22	12.92	28.38	21.16
	1:21:32	1.02	3.08	2.17	8.53	4.95	7.56	9.60	25.90	15.86
	1:26:04	0.79	2.37	1.68	7.93	3.77	5.71	7.23	23.46	11.85
	1:30:36	0.65	1.94	1.38	7.36	3.07	4.63	5.84	21.16	9.50
	1:35:08	0.56	1.64	1.17	6.86	2.60	3.90	4.92	19.01	7.99
	1:39:40	0.49	1.44	1.03	6.42	2.27	3.41	4.29	17.19	6.94
	1:44:11	0.44	1.30	0.93	6.05	2.04	3.05	3.84	15.75	6.20
	1:48:43	0.41	1.19	0.85	5.71	1.87	2.80	3.52	14.56	5.68
	1:53:15	0.30	0.88	0.63	5.39	1.38	2.07	2.61	13.50	4.25
	1:57:47	0.22	0.64	0.46	5.08	1.01	1.51	1.89	12.53	3.08
	2:02:19	0.16	0.47	0.34	4.71	0.74	1.11	1.40	11.52	2.28
	2:06:50	0.12	0.35	0.25	4.25	0.55	0.82	1.04	10.38	1.69
	2:11:22	0.08	0.25	0.18	3.78	0.40	0.60	0.76	9.24	1.24
	2:15:54	0.06	0.18	0.13	3.33	0.28	0.43	0.54	8.16	0.89
	2:20:26	0.04	0.13	0.09	2.90	0.20	0.31	0.39	7.14	0.65
	2:24:58	0.03	0.09	0.06	2.50	0.14	0.21	0.27	6.17	0.46
	2:29:29	0.02	0.05	0.04	2.11	0.09	0.14	0.17	5.22	0.30
	2:34:01	0.01	0.03	0.02	1.75	0.05	0.07	0.10	4.30	0.17
	2:38:33	0.00	0.01	0.01	1.42	0.02	0.03	0.04	3.44	0.08
	2:43:05	0.00	0.00	0.00	1.15	0.00	0.01	0.01	2.65	0.02
	2:47:37	0.00	0.00	0.00	0.95	0.00	0.00	0.00	2.04	0.00
	2:52:08	0.00	0.00	0.00	0.80	0.00	0.00	0.00	1.60	0.00
	2:56:40	0.00	0.00	0.00	0.68	0.00	0.00	0.00	1.26	0.00
	3:01:12	0.00	0.00	0.00	0.58	0.00	0.00	0.00	1.00	0.00
	3:05:44	0.00	0.00	0.00	0.49	0.00	0.00	0.00	0.79	0.00
	3:10:16	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.62	0.00
	3:14:47	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.50	0.00
	3:19:19	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.40	0.00
	3:23:51	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.33	0.00
	3:28:23	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.27	0.00
	3:32:55	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.22	0.00
	3:37:26	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.18	0.00
	3:41:58	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.14	0.00
	3:46:30	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.11	0.00
	3:51:02	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.08	0.00
	3:55:34	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.05	0.00
	4:00:05	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00
	4:04:37	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00
	4:09:09	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	4:13:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:18:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:22:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:27:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:31:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:36:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:49:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:54:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:58:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:03:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:08:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:12:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:17:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:21:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:26:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Q100 = 22.19 cfs

[illegible]

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot

Project No. 254103

Calculated By: MRS

Pond B

SWMM 100 Year Volume (AC-FT) V100	EURV(AC-FT)	WQCV	Release Rate (CFS)
1.83	1.10	0.39	22.2

Storage Curve							
STAGE	SURFACE AREA	A+B+(A*B) ⁵	1/3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft ²	ft ²	ft ²	ft	ft ³	ft ³	ac-ft
6088	0.00	0	0	0	0	0	0
6088.5	181.00	181	60	0.5	30	30	0.00
6089	182.00	544	181	1	181	212	0.00
6090	3892	4,916	1,639	1	1,639	1,850	0.04
6091	12287	23,094	7,698	1	7,698	9,548	0.22
6092	21470	49,999	16,666	1	16,666	26,215	0.60
6093	26933	72,450	24,150	1	24,150	50,365	1.16
6094	31290	87,253	29,084	1	29,084	79,449	1.82
6095	35405	99,979	33,326	1	33,326	112,775	2.59
6096	39867	112,842	37,614	1	37,614	150,389	3.45
6097	45397	127,806	42,602	1	42,602	192,991	4.43

WQ _{ELEV}	6091.43	FT	WQ _{VOLUME}	0.39	AC-FT
EURV _{ELEV}	6092.90	FT	EURV _{VOLUME}	1.10	AC-FT
100YEAR _{ELEV}	6094.01	FT	100YEAR _{VOLUME}	1.83	AC-FT

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot

Project No. 254103

Calculated By: MRS

Pond B

WQCV	SURCHARGE VOLUME	SURCHARGE DEPTH
(AC-FT)	(FT ³)	(FT)
0.39	50.31	0.50

Storage Curve							
STAGE	SURFACE AREA	$A+B+(A*B)^{.5}$	1/3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft ²	ft ²	ft ²	ft	ft ³	ft ³	ac-ft
6089	96.00	0	0	0	0	0	0
6089.5	182	410	137	1	68	68	0.00

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016) Sheet 1 of 4UD-BMP (Version 3.06, November 2016) Sheet 1 of 4

Designer:	ASFUND KHAN
Company:	CVL Consultants
Date:	May 9, 2017
Project:	Trails at Crowfoot
Location:	Pond B (Forebay 1)

1. Basin Storage Volume
 - A) Effective Imperviousness of Tributary Area, I_a
 - B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)
 - C) Contributing Watershed Area
 - D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm
 - E) Design Concept
(Select EURV when also designing for flood control)
 - F) Design Volume (WQCV) Based on 40-hour Drain Time
$$(V_{\text{DESIGN}} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * \text{Area})$$
 - G) For Watersheds Outside of the Denver Region,
Water Quality Capture Volume (WQCV) Design Volume
$$(V_{\text{WQCV OTHER}} = (d_6 * (V_{\text{DESIGN}} / 0.43))$$
 - H) User Input of Water Quality Capture Volume (WQCV) Design Volume
(Only if a different WQCV Design Volume is desired)
 - I) Predominant Watershed NRCS Soil Group
 - J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $\text{EURV}_A = 1.68 * i^{1.28}$
For HSG B: $\text{EURV}_B = 1.36 * i^{1.08}$
For HSG C/D: $\text{EURV}_{C/D} = 1.20 * i^{1.08}$

$I_a =$ 47.4 %
 $i =$ 0.474
 Area = 23.200 ac
 $d_6 =$ _____ in

Choose One _____
☒ Water Quality Capture Volume (WQCV)
☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 0.385 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____
☐ A
☐ B
☐ C / D

EURV = _____ ac-ft

WQCV selected. Soil group not required.

$I_a =$ 47.4 %
 $i =$ 0.474
 Area = 23.200 ac
 $d_6 =$ _____ in

Choose One _____
☒ Water Quality Capture Volume (WQCV)
☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 0.385 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____
☐ A
☐ B
☐ C / D

EURV = _____ ac-ft

WQCV selected. Soil group not required.

$I_a =$ 47.4 %
 $i =$ 0.474
 Area = 23.200 ac
 $d_6 =$ _____ in

Choose One _____
☒ Water Quality Capture Volume (WQCV)
☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 0.385 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____
☐ A
☐ B
☐ C / D

EURV = _____ ac-ft

WQCV selected. Soil group not required.

$I_a =$ 47.4 %
 $i =$ 0.474
 Area = 23.200 ac
 $d_6 =$ _____ in

Choose One _____
☒ Water Quality Capture Volume (WQCV)
☐ Excess Urban Runoff Volume (EURV)

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Choose One _____
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☐ B
☐ C / D

EURV = _____ ac-ft

WQCV selected. Soil group not required.

$I_a =$ 47.4 %
 $i =$ 0.474
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Choose One _____
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☐ Excess Urban Runoff Volume (EURV)

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Choose One _____
☐ A
☐ B
☐ C / D

EURV = _____ ac-ft

WQCV selected. Soil group not required.

$I_a =$ 47.4 %
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☐ C / D

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Choose One _____
☒ Water Quality Capture Volume (WQCV)
☐ Excess Urban Runoff Volume (EURV)

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$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____
☐ A
☐ B
☐ C / D

EURV = _____ ac-ft

WQCV selected. Soil group not required.

$I_a =$ 47.4 %
 $i =$ 0.474
 Area = 23.200 ac
 $d_6 =$ _____ in

Choose One _____
☒ Water Quality Capture Volume (WQCV)
☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 0.385 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____
☐ A
☐ B
☐ C / D

EURV = _____ ac-ft

WQCV selected. Soil group not required.

$I_a =$ 47.4 %
 $i =$ 0.474
 Area = 23.200 ac
 $d_6 =$ _____ in

Choose One _____
☒ Water Quality Capture Volume (WQCV)
☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 0.385 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____
☐ A
☐ B
☐ C / D

EURV = _____ ac-ft

WQCV selected. Soil group not required.

$I_a =$ 47.4 %
 $i =$ 0.474
 Area = 23.200 ac
 $d_6 =$ _____ in

Choose One _____
☒ Water Quality Capture Volume (WQCV)
☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 0.385 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____
☐ A
☐ B
☐ C / D

EURV = _____ ac-ft

WQCV selected. Soil group not required.

$I_a =$ 47.4 %
 $i =$ 0.474
 Area = 23.200 ac
 $d_6 =$ _____ in

Choose One _____
☒ Water Quality Capture Volume (WQCV)
☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 0.385 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____
☐ A
☐ B
☐ C / D

EURV = _____ ac-ft

WQCV selected. Soil group not required.

$I_a =$ 47.4 %

$i =$ 0.474

Area = 23.200 ac

$d_6 =$ _____ in

Choose One _____

☒ Water Quality Capture Volume (WQCV)

☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 0.385 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____

☐ A

☐ B

☐ C / D

WQCV selected. Soil group not required.

EURV = _____ ac-ft

$I_a =$ 47.4 %

$i =$ 0.474

Area = 23.200 ac

$d_6 =$ _____ in

Choose One _____

☒ Water Quality Capture Volume (WQCV)

☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 0.385 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____

☐ A

☐ B

☐ C / D

WQCV selected. Soil group not required.

EURV = _____ ac-ft

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 $i =$ 0.474
 Area = 23.200 ac
 $d_6 =$ _____ in

Choose One _____
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☐ Excess Urban Runoff Volume (EURV)

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$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____
☐ A
☐ B
☐ C / D

EURV = _____ ac-ft

WQCV selected. Soil group not required.

$I_a =$ 47.4 %

$i =$ 0.474

Area = 23.200 ac

$d_6 =$ _____ in

Choose One _____

☒ Water Quality Capture Volume (WQCV)

☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 0.385 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____

☐ A

☐ B

☐ C / D

WQCV selected. Soil group not required.

EURV = _____ ac-ft

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.)

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.)

L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

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:

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

Designer:ASFUND KHAN

Company:CVL Consultants

Date:May 9, 2017

Project:Trails at Crowfoot

Location:Pond B (Forebay 1)

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 3% of the WQCV)

B) Actual Forebay Volume

C) Forebay Depth
(D_{F} = 18 inch maximum)

D) Forebay Discharge

i) Undetained 100-year Peak Discharge

ii) Forebay Discharge Design Flow
(Q_{F} = 0.02 * Q_{100})

E) Forebay Discharge Design

F) Discharge Pipe Size (minimum 8-inches)

G) Rectangular Notch Width

V_{FMIN} = 0.012 ac-ft

V_{F} = 0.012 ac-ft

D_{F} = 12.0 in

Q_{100} = 80.90 cfs

Q_{F} = 1.62 cfs

Choose One

☐ Berm With Pipe

☒ Wall with Rect. Notch

☐ Wall with V-Notch Weir

(flow too small for berm w/ pipe)

Calculated D_{p} = in

Calculated W_{N} = 8.2 in

6. Trickle Channel

A) Type of Trickle Channel

F) Slope of Trickle Channel

Choose One

☒ Concrete

☐ Soft Bottom

S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum)

B) Surface Area of Micropool (10 ft² minimum)

C) Outlet Type

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing
(Use UD-Detention)

E) Total Outlet Area

D_{M} = 2.5 ft

A_{M} = sq ft

Choose One

☐ Orifice Plate

☐ Other (Describe):

D_{orifice} = inches

A_{ot} = square inches

103

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Sheet 1 of 4

Designer:

ASFUND KHAN

Company:

CVL Consultants

Date:

May 9, 2017

Project:

Trails at Crowfoot

Location:

Pond B (Forebay 2)

1. Basin Storage Volume A) Effective Imperviousness of Tributary Area, I_a B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) C) Contributing Watershed Area D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm E) Design Concept (Select EURV when also designing for flood control) F) Design Volume (WQCV) Based on 40-hour Drain Time $(V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area))$ G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume $(V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN} / 0.43))$ H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) I) Predominant Watershed NRCS Soil Group 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: $EURV_{C/D} = 1.20 * i^{1.08}$	$I_a =$ 47.4 % $i =$ 0.474 $Area =$ 4.500 ac $d_6 =$ in Choose One ☒ Water Quality Capture Volume (WQCV) ☐ Excess Urban Runoff Volume (EURV) $V_{DESIGN} =$ 0.075 ac-ft $V_{DESIGN\ OTHER} =$ ac-ft $V_{DESIGN\ USER} =$ ac-ft Choose One ☐ A ☐ B ☐ C / D WQCV selected. Soil group not required. $EURV =$ ac-ft
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	$L : W =$ 2.0 : 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:	

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

Designer:ASFUND KHAN

Company:CVL Consultants

Date:May 9, 2017

Project:Trails at Crowfoot

Location:Pond B (Forebay 2)

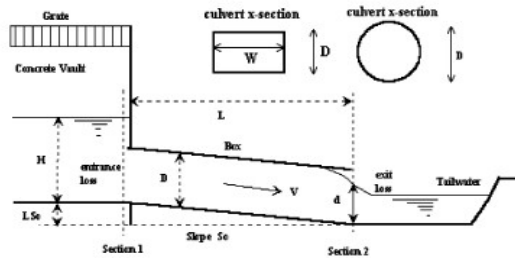
5. Forebay A) Minimum Forebay Volume ($V_{\text{FMIN}} = \underline{\hspace{1cm}2\%\hspace{1cm}}$ of the WQCV) B) Actual Forebay Volume C) Forebay Depth ($D_{\text{F}} = \underline{\hspace{1cm}18\hspace{1cm}}$ inch maximum) D) Forebay Discharge i) Undetained 100-year Peak Discharge ii) Forebay Discharge Design Flow ($Q_{\text{F}} = 0.02 * Q_{100}$) E) Forebay Discharge Design F) Discharge Pipe Size (minimum 8-inches) G) Rectangular Notch Width	$V_{\text{FMIN}} = \underline{\hspace{1cm}0.002\hspace{1cm}}$ ac-ft $V_{\text{F}} = \underline{\hspace{1cm}0.002\hspace{1cm}}$ ac-ft $D_{\text{F}} = \underline{\hspace{1cm}12.0\hspace{1cm}}$ in $Q_{100} = \underline{\hspace{1cm}24.30\hspace{1cm}}$ cfs $Q_{\text{F}} = \underline{\hspace{1cm}0.49\hspace{1cm}}$ cfs Choose One ☐ Berm With Pipe ☒ Wall with Rect. Notch ☐ Wall with V-Notch Weir (flow too small for berm w/ pipe) Calculated $D_{\text{p}} = \underline{\hspace{1cm}}\hspace{1cm}$ in Calculated $W_{\text{N}} = \underline{\hspace{1cm}4.2\hspace{1cm}}$ in
6. Trickle Channel A) Type of Trickle Channel F) Slope of Trickle Channel	Choose One ☒ Concrete ☐ Soft Bottom $S = \underline{\hspace{1cm}0.0050\hspace{1cm}}$ ft / ft
7. Micropool and Outlet Structure A) Depth of Micropool (2.5-feet minimum) B) Surface Area of Micropool (10 ft² minimum) C) Outlet Type D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) E) Total Outlet Area	$D_{\text{M}} = \underline{\hspace{1cm}2.5\hspace{1cm}}$ ft $A_{\text{M}} = \underline{\hspace{1cm}}\hspace{1cm}$ sq ft Choose One ☐ Orifice Plate ☐ Other (Describe): $D_{\text{orifice}} = \underline{\hspace{1cm}}\hspace{1cm}$ inches $A_{\text{ot}} = \underline{\hspace{1cm}}\hspace{1cm}$ square inches

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: **Trails at Crowfoot**

Basin ID: **Pond B ($Q_{100} = 22.2$ CFS)**

Status:



Design Information (Input):

Circular Culvert: Barrel Diameter in Inches
Inlet Edge Type (choose from pull-down list)

$D = 24$ inches
Square End with Headwall

OR:

Box Culvert: Barrel Height (Rise) in Feet
Barrel Width (Span) in Feet
Inlet Edge Type (choose from pull-down list)

Height (Rise) = ft.
Width (Span) = ft.

Square Edge w/ 30-78 deg. Flared Wingwall

Number of Barrels
Inlet Elevation at Culvert Invert
Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)
Culvert Length in Feet
Manning's Roughness
Bend Loss Coefficient
Exit Loss Coefficient

No = 1
Inlet Elev = 6087.45 ft. elev.
Outlet Elev = 6086.66 ft. elev.
 $L = 117$ ft.
 $n = 0.013$
 $K_b = 0$
 $K_x = 1$

Design Information (calculated):

Entrance Loss Coefficient
Friction Loss Coefficient
Sum of All Loss Coefficients
Orifice Inlet Condition Coefficient
Minimum Energy Condition Coefficient

$K_e = 0.50$
 $K_f = 1.44$
 $K_s = 2.94$
 $C_d = 0.86$
 $KE_{low} = 0.0121$

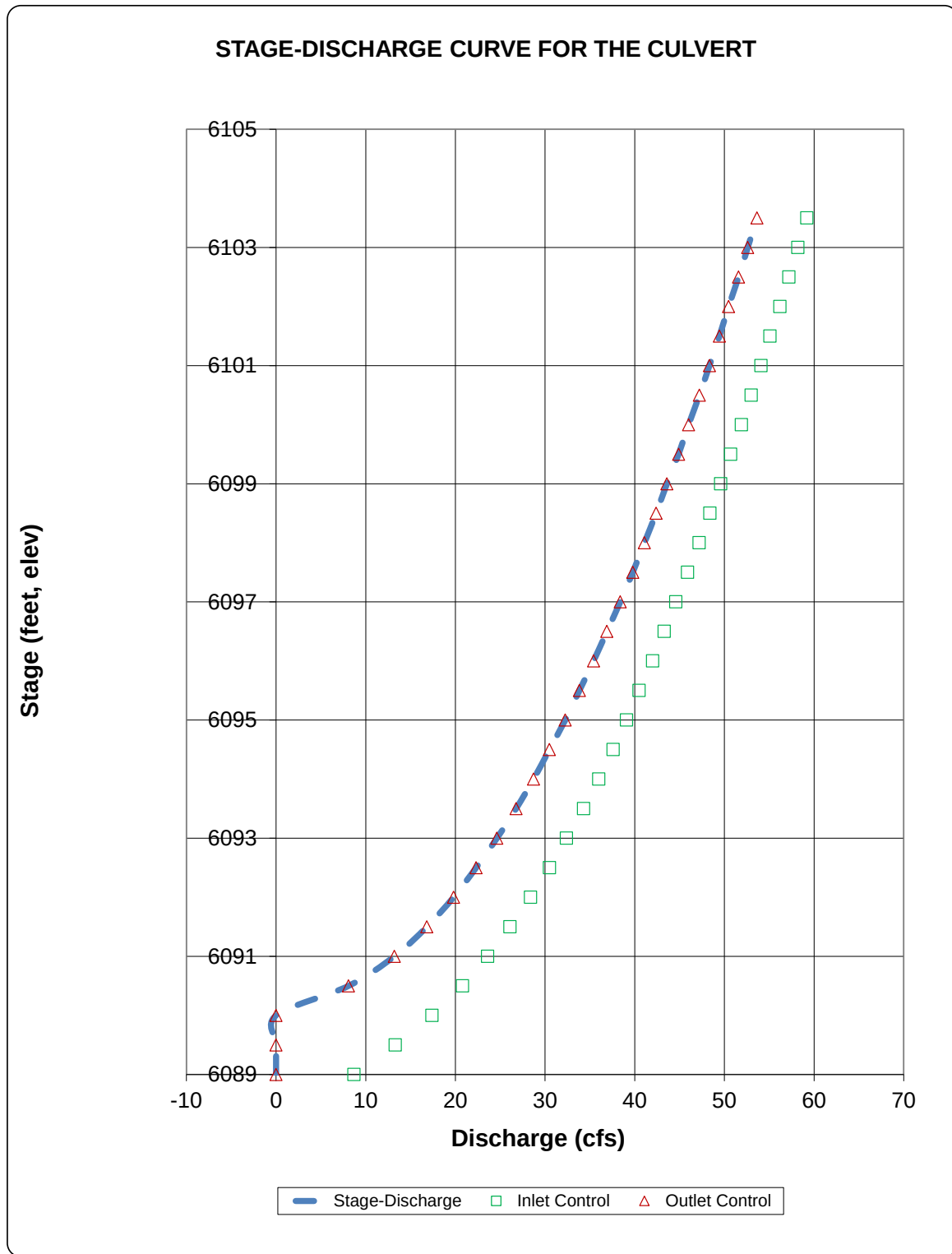
Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
6089.00	6090.20	8.70	0.00	0.00	Regression Eqn.	N/A
6089.50	6090.20	13.30	0.00	0.00	Regression Eqn.	N/A
6090.00	6090.20	17.40	0.00	0.00	Regression Eqn.	N/A
6090.50	6090.20	20.80	8.09	8.09	Regression Eqn.	OUTLET
6091.00	6090.20	23.60	13.20	13.20	Regression Eqn.	OUTLET
6091.50	6090.20	26.10	16.82	16.82	Regression Eqn.	OUTLET
6092.00	6090.20	28.40	19.80	19.80	Regression Eqn.	OUTLET
6092.50	6090.20	30.50	22.31	22.31	Regression Eqn.	OUTLET
6093.00	6090.20	32.40	24.63	24.63	Regression Eqn.	OUTLET
6093.50	6090.20	34.30	26.77	26.77	Orifice Eqn.	OUTLET
6094.00	6090.20	36.00	28.72	28.72	Orifice Eqn.	OUTLET
6094.50	6090.20	37.60	30.49	30.49	Orifice Eqn.	OUTLET
6095.00	6090.20	39.10	32.25	32.25	Orifice Eqn.	OUTLET
6095.50	6090.20	40.50	33.83	33.83	Orifice Eqn.	OUTLET
6096.00	6090.20	42.00	35.41	35.41	Orifice Eqn.	OUTLET
6096.50	6090.20	43.30	36.90	36.90	Orifice Eqn.	OUTLET
6097.00	6090.20	44.60	38.39	38.39	Orifice Eqn.	OUTLET
6097.50	6090.20	45.90	39.78	39.78	Orifice Eqn.	OUTLET
6098.00	6090.20	47.20	41.08	41.08	Orifice Eqn.	OUTLET
6098.50	6090.20	48.40	42.38	42.38	Orifice Eqn.	OUTLET
6099.00	6090.20	49.60	43.59	43.59	Orifice Eqn.	OUTLET
6099.50	6090.20	50.70	44.89	44.89	Orifice Eqn.	OUTLET
6100.00	6090.20	51.90	46.01	46.01	Orifice Eqn.	OUTLET
6100.50	6090.20	53.00	47.22	47.22	Orifice Eqn.	OUTLET
6101.00	6090.20	54.10	48.33	48.33	Orifice Eqn.	OUTLET
6101.50	6090.20	55.10	49.45	49.45	Orifice Eqn.	OUTLET
6102.00	6090.20	56.20	50.47	50.47	Orifice Eqn.	OUTLET
6102.50	6090.20	57.20	51.58	51.58	Orifice Eqn.	OUTLET
6103.00	6090.20	58.20	52.61	52.61	Orifice Eqn.	OUTLET
6103.50	6090.20	59.20	53.63	53.63	Orifice Eqn.	OUTLET

Processing Time: 00.38 Seconds

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Trails at Crowfoot
Basin ID: Pond B (Q100 = 22.2 CFS)



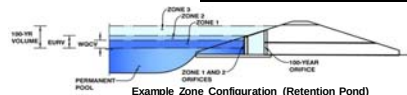
POND C

Pond C: Summary Sheet

UD-Detention, Version 3.07 (February 2017)

Project: Trails at Crowfoot

Basin ID: Pond C



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type:	EDB	
Watershed Area:	101.09	acres
Watershed Length:	3.580	ft
Watershed Slope:	0.029	ft/ft
Watershed Imperviousness:	44.49%	percent
Percentage Hydrologic Soil Group A:	0.0%	percent
Percentage Hydrologic Soil Group B:	49.8%	percent
Percentage Hydrologic Soil Groups C/D:	50.2%	percent
Desired WQCV Drain Time:	40.0	hours
Location for 1-hr Rainfall Depths:	Parker - The Pinery Country Club	
Water Quality Capture Volume (WQCV):	1.614	acre-feet
Excess Urban Runoff Volume (EURV):	4.488	acre-feet
2-yr Runoff Volume (P1 = 0.99):	3.220	acre-feet
5-yr Runoff Volume (P1 = 0.98):	5.203	acre-feet
10-yr Runoff Volume (P1 = 1.64):	7.090	acre-feet
25-yr Runoff Volume (P1 = 1.98):	10.704	acre-feet
50-yr Runoff Volume (P1 = 2.31):	13.473	acre-feet
100-yr Runoff Volume (P1 = 2.6):	16.595	acre-feet
500-yr Runoff Volume (P1 = 3.1):	21.752	acre-feet
Approximate 2-yr Detention Volume:	3.015	acre-feet
Approximate 5-yr Detention Volume:	4.894	acre-feet
Approximate 10-yr Detention Volume:	6.129	acre-feet
Approximate 25-yr Detention Volume:	7.111	acre-feet
Approximate 50-yr Detention Volume:	7.692	acre-feet
Approximate 100-yr Detention Volume:	8.847	acre-feet

Stage-Storage Calculation

Zone 1 Volume (V_{QVCV})	1,614	acre-foot
Zone 2 Volume (EURV - Zone 1)	2,874	acre-foot
Zone 3 Volume (100-year - Zones 1 & 2)	4,359	acre-foot
Total Detention Basin Volume	8,847	acre-foot
Initial Surge Volume (V_{SV})	USER	ft ³
Initial Surge Depth (SD_{SV})	USER	ft
Total Available Detention Depth (H_{DAV})	USER	ft
Depth of Trickle Channel (H_{TC})	USER	ft
Depth of Trickle Channel (SD_{TC})	USER	ft
Slope of Main Basin Sides (S_{MB})	USER	H:V
Basin Length-to-Width Ratio (R_{LMB})	USER	
Initial Surge Length (A_{SV})	USER	ft ²
Surcharge Volume Area (V_{DAV})	USER	ft ²
Surcharge Volume Width (W_{DAV})	USER	ft
Depth of Basin Floor (H_{LDAV})	USER	ft
Length of Basin Floor (L_{LDAV})	USER	ft
Width of Basin Floor (W_{LDAV})	USER	ft
Area of Basin Floor (A_{LDAV})	USER	ft ²
Volume of Basin Floor (V_{LDAV})	USER	ft ³
Depth of Main Basin (H_{MB})	USER	ft
Length of Main Basin (L_{MB})	USER	ft
Width of Main Basin (W_{MB})	USER	ft
Area of Main Basin (A_{MB})	USER	ft ²
Volume of Main Basin (V_{MB})	USER	ft ³
Calculated Total Basin Volume (V_{DAV})	USER	acre-foot

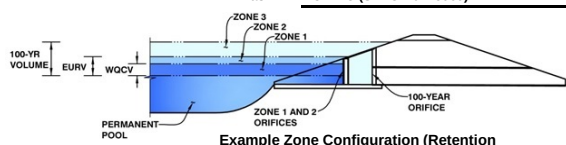
[illegible]

Inflow hydrographs for 5 and 100 year imported from CUHP/SWMM used for pond design.

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: TRAILS AT CROWFOOT
Basin ID: POND C (STAGE 0 = 5969)



Example Zone Configuration (Retention)

	Stage (ft)	One Volume (ac-ft)	Outlet Type
/QCV)	4.22	1.614	Orifice Plate
:URV)	6.55	2.874	Circular Orifice
-year)	9.15	4.359	Weir&Pipe (Restrict)
		8.847	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 =	6.55	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	5.75	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	3.993E-02	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	2.11						
Orifice Area (sq. inches)	5.75	5.75						

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	4.22	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	6.55	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	3.32	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.06	N/A	ft ²
Vertical Orifice Centroid =	0.14	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H _o =	6.55	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	18.00	N/A	feet
Overflow Weir Slope =	4.00	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 =	7.55	N/A	feet
Over Flow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.41	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	51.95	N/A	ft ²
Overflow Grate Open Area w/ Debris =	25.98	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 =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	36.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	35.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	7.01	N/A	ft ²
Outlet Orifice Centroid =	1.49	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.81	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.15	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	142.10	feet
Spillway End Slopes =	2.50	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

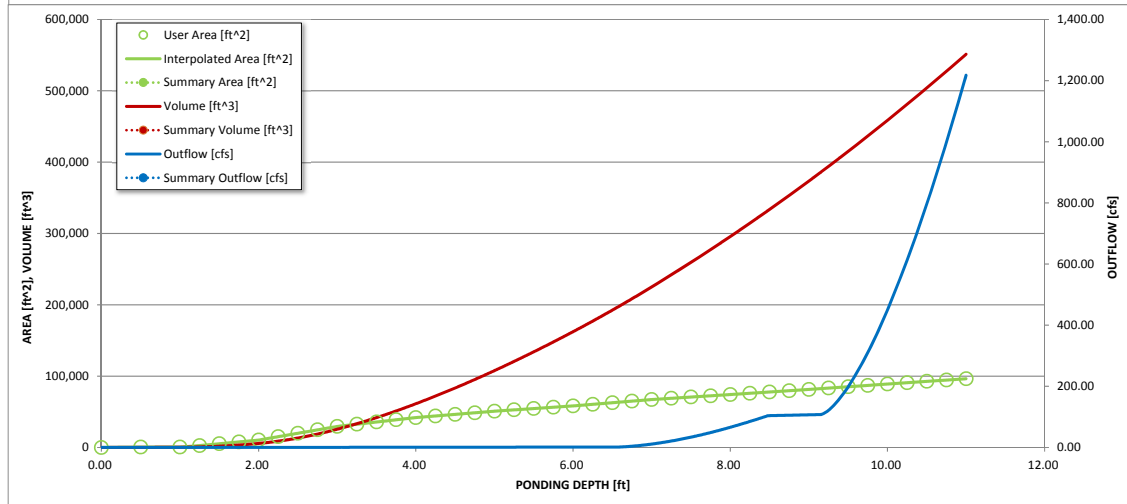
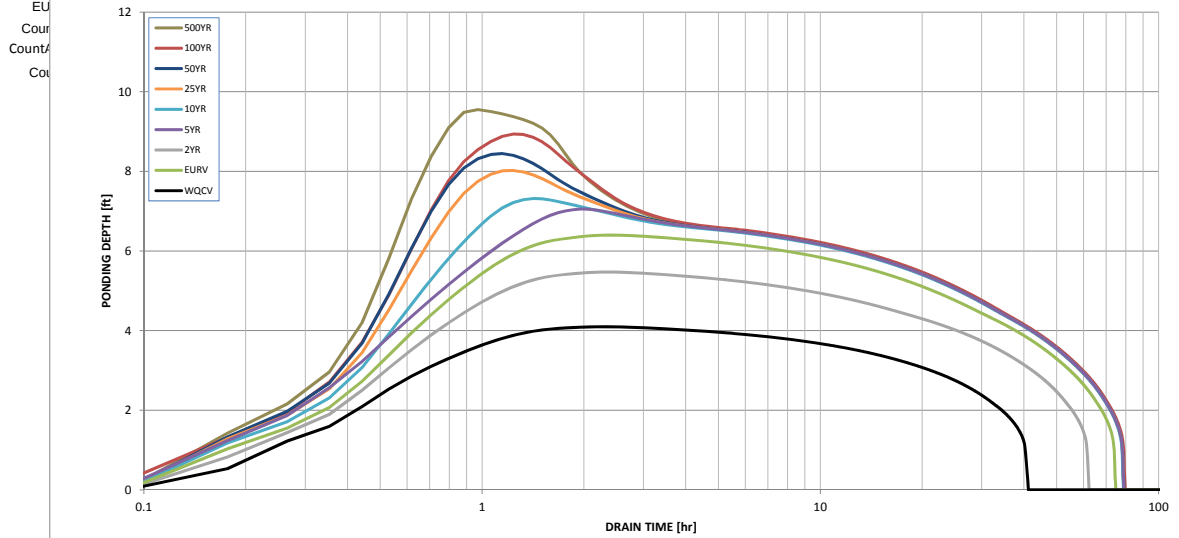
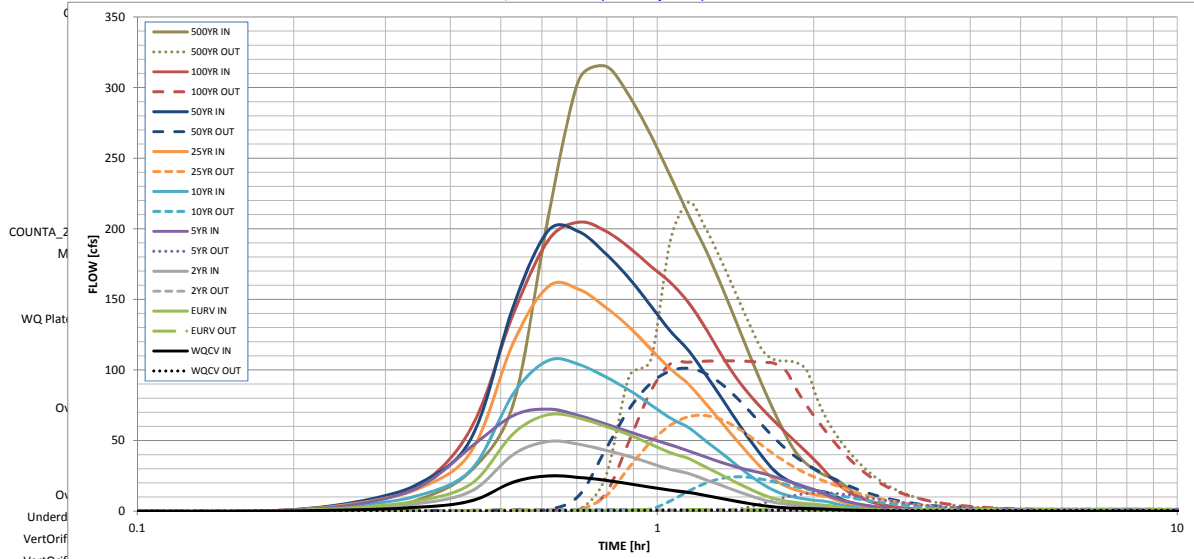
Spillway Design Flow Depth=	0.60	feet
Stage at Top of Freeboard =	10.75	feet
Basin Area at Top of Freeboard =	2.17	acres

Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	0.99	1.39	1.64	1.98	2.31	2.60	3.10
Calculated Runoff Volume (acre-ft) =	1.614	4.488	3.220	5.201	7.090	10.704	13.473	16.595	21.752
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.613	4.487	3.218	6.211	7.080	10.692	13.462	17.165	21.739
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.06	0.23	0.67	0.93	1.25	1.75
Predevelopment Peak Q (cfs) =	0.0	0.0	1.0	6.2	23.5	67.5	94.4	126.0	176.4
Peak Inflow Q (cfs) =	25.0	68.5	49.4	72.3	106.9	159.5	199.1	204.8	315.3
Peak Outflow Q (cfs) =	0.7	1.3	1.1	13.0	24.4	67.8	101.2	106.5	218.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.1	1.0	1.0	1.1	0.8	1.2
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.4	1.3	1.9	2.0	2.1
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) =	38	68	57	70	69	66	64	62	58
Time to Drain 99% of Inflow Volume (hours) =	40	72	60	75	75	73	72	71	69
Maximum Ponding Depth (ft) =	4.10	6.40	5.47	7.05	7.32	8.02	8.45	8.94	9.55
Area at Maximum Ponding Depth (acres) =	0.98	1.42	1.25	1.55	1.59	1.71	1.78	1.86	1.96
Maximum Volume Stored (acre-ft) =	1.495	4.262	3.040	5.243	5.651	6.822	7.554	8.444	9.628

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	USER	WORKBOOK	WORKBOOK	WORKBOOK	USER	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]
5.30 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:10:36	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.27	0.00
Constant	0:15:54	1.08	2.82	2.09	4.97	4.17	5.78	6.85	6.12	9.18
0.943	0:21:12	2.95	7.87	5.75	18.41	11.94	17.15	20.87	20.08	29.87
	0:26:30	7.57	20.20	14.76	46.57	30.65	44.07	53.68	60.97	77.41
	0:31:48	20.77	55.38	40.50	67.99	83.90	120.40	146.42	140.84	210.35
	0:37:06	25.00	68.47	49.41	72.29	106.88	159.47	199.10	192.31	305.51
	0:42:24	23.92	65.96	47.42	67.79	103.97	157.14	197.99	204.75	315.25
	0:47:42	21.77	60.11	43.15	61.81	95.13	144.44	182.54	198.49	294.17
	0:53:00	19.53	54.16	38.83	56.29	85.79	130.37	164.83	186.76	266.37
	0:58:18	16.96	47.40	33.90	51.33	75.34	114.86	145.49	173.47	237.51
	1:03:36	14.73	41.40	29.56	46.90	65.91	100.61	127.49	161.94	209.70
	1:08:54	13.36	37.35	26.72	42.74	59.25	90.07	113.87	147.75	185.79
	1:14:12	11.12	31.33	22.35	38.54	50.00	76.54	97.18	130.02	160.69
	1:19:30	9.16	25.97	18.49	34.62	41.54	63.70	80.95	111.29	135.55
	1:24:48	7.16	20.60	14.60	31.51	33.19	51.23	65.35	95.37	111.64
	1:30:06	5.43	15.93	11.23	29.06	25.82	40.03	51.20	82.84	89.54
	1:35:24	3.98	11.92	8.34	26.93	19.46	30.35	38.97	72.69	70.46
	1:40:42	3.03	8.92	6.28	24.44	14.46	22.41	28.79	63.84	53.70
	1:46:00	2.47	7.17	5.07	21.83	11.53	17.75	22.68	55.80	40.68
	1:51:18	2.09	6.03	4.27	19.30	9.68	14.86	18.93	48.28	33.18
	1:56:36	1.83	5.24	3.72	16.88	8.39	12.84	16.33	41.24	28.26
	2:01:54	1.64	4.69	3.33	14.36	7.49	11.43	14.51	34.38	24.87
	2:07:12	1.51	4.29	3.06	11.53	6.84	10.43	13.22	26.86	22.42
	2:12:30	1.11	3.21	2.27	9.12	5.18	8.04	10.31	20.24	18.02
	2:17:48	0.81	2.32	1.64	7.26	3.74	5.79	7.42	15.36	13.14
	2:23:06	0.60	1.72	1.21	5.83	2.77	4.30	5.51	11.72	9.61
	2:28:24	0.44	1.28	0.90	4.71	2.06	3.19	4.09	9.01	7.17
	2:33:42	0.32	0.94	0.66	3.80	1.52	2.36	3.03	6.95	5.35
	2:39:00	0.23	0.67	0.47	3.04	1.10	1.71	2.20	5.34	3.95
	2:44:18	0.16	0.49	0.34	2.41	0.79	1.24	1.59	4.12	2.88
	2:49:36	0.11	0.34	0.24	1.89	0.56	0.88	1.14	3.27	2.14
	2:54:54	0.07	0.22	0.15	1.49	0.37	0.59	0.76	2.66	1.51
	3:00:12	0.04	0.13	0.09	1.17	0.22	0.35	0.46	2.21	0.99
	3:05:30	0.01	0.06	0.04	0.90	0.10	0.17	0.23	1.82	0.58
	3:10:48	0.00	0.02	0.01	0.67	0.03	0.06	0.08	1.48	0.28
	3:16:06	0.00	0.00	0.00	0.49	0.00	0.00	0.00	1.19	0.08
	3:21:24	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.94	0.00
	3:26:42	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.74	0.00
	3:32:00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.59	0.00
	3:37:18	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.49	0.00
	3:42:36	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.43	0.00
	3:47:54	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.41	0.00
	3:53:12	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.39	0.00
	3:58:30	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.37	0.00
	4:03:48	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.36	0.00
	4:09:06	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.34	0.00
	4:14:24	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.33	0.00
	4:19:42	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.32	0.00
	4:25:00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.31	0.00
	4:30:18	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.29	0.00
	4:35:36	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.28	0.00
	4:40:54	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.27	0.00
	4:46:12	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.26	0.00
	4:51:30	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.24	0.00
	4:56:48	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.23	0.00
	5:02:06	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.22	0.00
	5:07:24	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.21	0.00
	5:12:42	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.19	0.00
	5:18:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.18	0.00
	5:23:18	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.17	0.00
	5:28:36	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.16	0.00
	5:33:54	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.14	0.00
	5:39:12	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.13	0.00
	5:44:30	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.12	0.00
	5:49:48	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.10	0.00
	5:55:06	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.09	0.00
	6:00:24	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.08	0.00
	6:05:42	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.07	0.00
	6:11:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.05	0.00
	6:16:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
	6:21:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot

Project No. 254103

Calculated By: MRS

Pond C

SWMM 100 Year Volume (AC-FT)	EURV(AC-FT)	WQCV	Release Rate (CFS)
V100			
9.40	4.49	1.59	106.7

Storage Curve							
STAGE	SURFACE AREA	$A+B+(A*B)^5$	1/3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft ²	ft ²	ft ²	ft	ft ³	ft ³	ac-ft
5970	81.00	0	0	0	0	0	0
5971	10352	11,349	3,783	1	3,783	3,783	0.09
5972	29478	57,299	19,100	1	19,100	22,882	0.53
5973	41945	106,586	35,529	1	35,529	58,411	1.34
5974	5974	63,749	21,250	1	21,250	79,661	1.83
5975	58274	82,906	27,635	1	27,635	107,296	2.46
5976	67198	188,049	62,683	1	62,683	169,979	3.90
5977	74199	212,009	70,670	1	70,670	240,649	5.52
5978	81363	233,260	77,753	1	77,753	318,402	7.31
5979	88920	255,341	85,114	1	85,114	403,516	9.26
5980	96372	277,863	92,621	1	92,621	496,137	11.39

WQ _{ELEV}	5974.43	FT	WQ _{VOLUME}	1.59	AC-FT
EURV _{ELEV}	5976.36	FT	EURV _{VOLUME}	4.49	AC-FT
100YEAR _{ELEV}	5979.06	FT	100YEAR _{VOLUME}	9.40	AC-FT

$$Q_{100} = 106.52$$

100YR	100YR	100YR	100YR
Inflow Hydrograph I_1 - [cfs]	Inflow ₂ - [cfs]	Outflow ₁ - [cfs]	Outflow ₂ - [cfs]
0.00	0.00	0.00	0.00
0.00	0.27	0.00	0.09
0.27	6.12	0.09	0.22
6.12	20.08	0.22	0.27
20.08	60.97	0.27	0.47
60.97	140.84	0.47	0.61
140.84	192.31	0.61	0.96
192.31	204.75	0.96	1.23
204.75	198.49	1.23	12.30
198.49	186.76	12.30	49.92
186.76	173.47	49.92	85.02
173.47	161.94	85.02	104.42
161.94	147.75	104.42	105.52
147.75	130.02	105.52	106.22
130.02	111.29	106.22	106.52
111.29	95.37	106.52	106.46
95.37	82.84	106.46	106.09
82.84	72.69	106.09	105.49
72.69	63.84	105.49	104.69
63.84	55.80	104.69	99.51
55.80	48.28	99.51	85.72
48.28	41.24	85.72	74.20
41.24	34.38	74.20	64.28
34.38	26.86	64.28	55.43
26.86	20.24	55.43	47.36
20.24	15.36	47.36	40.21
15.36	11.72	40.21	34.19
11.72	9.01	34.19	28.98
9.01	6.95	28.98	24.65
6.95	5.34	24.65	21.04
5.34	4.12	21.04	18.04
4.12	3.27	18.04	15.53
3.27	2.66	15.53	13.46
2.66	2.21	13.46	11.73
2.21	1.82	11.73	10.28
1.82	1.48	10.28	9.06
1.48	1.19	9.06	8.01
1.19	0.94	8.01	7.11
0.94	0.74	7.11	6.34
0.74	0.59	6.34	5.67
0.59	0.49	5.67	5.10
0.49	0.43	5.10	4.60
0.43	0.41	4.60	4.17
0.41	0.39	4.17	3.80
0.39	0.37	3.80	3.48
0.37	0.36	3.48	3.20
0.36	0.34	3.20	2.96
0.34	0.33	2.96	2.75
0.33	0.32	2.75	2.56
0.32	0.31	2.56	2.39
0.31	0.29	2.39	2.24
0.29	0.28	2.24	2.11
0.28	0.27	2.11	1.99
0.27	0.26	1.99	1.89
0.26	0.24	1.89	1.79
0.24	0.23	1.79	1.71
0.23	0.22	1.71	1.64
0.22	0.21	1.64	1.57
0.21	0.19	1.57	1.51
0.19	0.18	1.51	1.46
0.18	0.17	1.46	1.41
0.17	0.16	1.41	1.38
0.16	0.14	1.38	1.35
0.14	0.13	1.35	1.33
0.13	0.12	1.33	1.32
0.12	0.10	1.32	1.32
0.10	0.09	1.32	1.32
0.09	0.08	1.32	1.32
0.08	0.07	1.32	1.32
0.07	0.05	1.32	1.32
0.05	0.04	1.32	1.32
0.04	0.03	1.32	1.32
0.03	0.00	1.32	1.32

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot

Project No. 254103

Calculated By: MRS

Pond C

WQCV	SURCHARGE VOLUME	SURCHARGE DEPTH
(AC-FT)	(FT ³)	(FT)
1.61	210.39	0.50

Storage Curve							
STAGE	SURFACE AREA	A+B+(A*B) ^{.5}	1/3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft ²	ft ²	ft ²	ft	ft ³	ft ³	ac-ft
5970	371.00	0	0	0	0	0	0
5970.5	525.4	1,338	446	1	223	223	0.01

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016) Sheet 1 of 4

UD-BMP (Version 3.06, November 2016) Sheet 1 of 4

Designer:	ASFUND KHAN
Company:	CVL Consultants
Date:	May 9, 2017
Project:	Trails at Crowfoot
Location:	Pond C (Forebay 1)

1. Basin Storage Volume
 - A) Effective Imperviousness of Tributary Area, I_a
 - B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)
 - C) Contributing Watershed Area
 - D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm
 - E) Design Concept
(Select EURV when also designing for flood control)
 - F) Design Volume (WQCV) Based on 40-hour Drain Time
$$(V_{\text{DESIGN}} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * \text{Area})$$
 - G) For Watersheds Outside of the Denver Region,
Water Quality Capture Volume (WQCV) Design Volume
$$(V_{\text{WQCV OTHER}} = (d_6 * (V_{\text{DESIGN}} / 0.43))$$
 - H) User Input of Water Quality Capture Volume (WQCV) Design Volume
(Only if a different WQCV Design Volume is desired)
 - I) Predominant Watershed NRCS Soil Group
 - J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $\text{EURV}_A = 1.68 * i^{1.28}$
For HSG B: $\text{EURV}_B = 1.36 * i^{1.08}$
For HSG C/D: $\text{EURV}_{C/D} = 1.20 * i^{1.08}$

$I_a =$ 45.9 %

$i =$ 0.459

Area = 79.650 ac

$d_6 =$ _____ in

Choose One _____

☒ Water Quality Capture Volume (WQCV)

☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 1.297 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____

☐ A

☐ B

☐ C / D

WQCV selected. Soil group not required.

EURV = _____ ac-ft

$I_a =$ 45.9 %

$i =$ 0.459

Area = 79.650 ac

$d_6 =$ _____ in

Choose One _____

☒ Water Quality Capture Volume (WQCV)

☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 1.297 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____

☐ A

☐ B

☐ C / D

WQCV selected. Soil group not required.

EURV = _____ ac-ft

$I_a =$ 45.9 %

$i =$ 0.459

Area = 79.650 ac

$d_6 =$ _____ in

Choose One _____

☒ Water Quality Capture Volume (WQCV)

☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 1.297 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____

☐ A

☐ B

☐ C / D

WQCV selected. Soil group not required.

EURV = _____ ac-ft

$I_a =$ 45.9 %

$i =$ 0.459

Area = 79.650 ac

$d_6 =$ _____ in

Choose One _____

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Choose One _____

☐ A

☐ B

☐ C / D

WQCV selected. Soil group not required.

EURV = _____ ac-ft

$I_a =$ 45.9 %

$i =$ 0.459

Area = 79.650 ac

$d_6 =$ _____ in

Choose One _____

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WQCV selected. Soil group not required.

EURV = _____ ac-ft

$I_a =$ 45.9 %

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Choose One _____

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$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____

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WQCV selected. Soil group not required.

EURV = _____ ac-ft

$I_a =$ 45.9 %

$i =$ 0.459

Area = 79.650 ac

$d_6 =$ _____ in

Choose One _____

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Choose One _____

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WQCV selected. Soil group not required.

EURV = _____ ac-ft

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Area = 79.650 ac

$d_6 =$ _____ in

Choose One _____

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$d_6 =$ _____ in

Choose One _____

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Area = 79.650 ac

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Choose One _____

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☐ B

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WQCV selected. Soil group not required.

EURV = _____ ac-ft

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$i =$ 0.459

Area = 79.650 ac

$d_6 =$ _____ in

Choose One _____

☒ Water Quality Capture Volume (WQCV)

☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 1.297 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____

☐ A

☐ B

☐ C / D

WQCV selected. Soil group not required.

EURV = _____ ac-ft

$I_a =$ 45.9 %

$i =$ 0.459

Area = 79.650 ac

$d_6 =$ _____ in

Choose One _____

☒ Water Quality Capture Volume (WQCV)

☐ Excess Urban Runoff Volume (EURV)

$V_{\text{DESIGN}} =$ 1.297 ac-ft

$V_{\text{DESIGN OTHER}} =$ _____ ac-ft

$V_{\text{DESIGN USER}} =$ _____ ac-ft

Choose One _____

☐ A

☐ B

☐ C / D

WQCV selected. Soil group not required.

EURV = _____ ac-ft

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.)

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.)

L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

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:

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

Designer:ASFUND KHAN

Company:CVL Consultants

Date:May 9, 2017

Project:Trails at Crowfoot

Location:Pond C (Forebay 1)

5. Forebay A) Minimum Forebay Volume $V_{\text{FMIN}} =$3% of the WQCV B) Actual Forebay Volume C) Forebay Depth $(D_{\text{F}} =$30$\text{ inch maximum})$ D) Forebay Discharge i) Undetained 100-year Peak Discharge ii) Forebay Discharge Design Flow $(Q_{\text{F}} = 0.02 * Q_{100})$ E) Forebay Discharge Design Choose One ☐ Berm With Pipe ☒ Wall with Rect. Notch ☐ Wall with V-Notch Weir F) Discharge Pipe Size (minimum 8-inches) G) Rectangular Notch Width	$V_{\text{FMIN}} =$0.039 ac-ft $V_{\text{F}} =$0.039 ac-ft $D_{\text{F}} =$12.0 in $Q_{100} =$270.00 cfs $Q_{\text{F}} =$5.40 cfs Calculated $D_{\text{p}} =$ in Calculated $W_{\text{N}} =$ 21.9 in
6. Trickle Channel A) Type of Trickle Channel F) Slope of Trickle Channel	Choose One ☒ Concrete ☐ Soft Bottom $S =$0.0050 ft / ft
7. Micropool and Outlet Structure A) Depth of Micropool (2.5-feet minimum) B) Surface Area of Micropool (10 ft² minimum) C) Outlet Type Choose One ☐ Orifice Plate ☐ Other (Describe): D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) E) Total Outlet Area	$D_{\text{M}} =$2.5 ft $A_{\text{M}} =$$\text{ sq ft}$ $D_{\text{orifice}} =$ inches $A_{\text{ot}} =$ square inches

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Sheet 1 of 4

Designer:

ASFUND KHAN

Company:

CVL Consultants

Date:

May 9, 2017

Project:

Trails at Crowfoot

Location:

Pond C (Forebay 2)

1. Basin Storage Volume A) Effective Imperviousness of Tributary Area, I_a B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) C) Contributing Watershed Area D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm E) Design Concept (Select EURV when also designing for flood control) F) Design Volume (WQCV) Based on 40-hour Drain Time $(V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area))$ G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume $(V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN} / 0.43)))$ H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) I) Predominant Watershed NRCS Soil Group 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: $EURV_{C/D} = 1.20 * i^{1.08}$	$I_a =$ 45.9 % $i =$ 0.459 Area = 18.850 ac $d_6 =$ in Choose One ☒ Water Quality Capture Volume (WQCV) ☐ Excess Urban Runoff Volume (EURV) $V_{DESIGN} =$ 0.307 ac-ft $V_{DESIGN\ OTHER} =$ ac-ft $V_{DESIGN\ USER} =$ ac-ft Choose One ☐ A ☐ B ☐ C / D WQCV selected. Soil group not required. $EURV =$ ac-ft
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	$L : W =$ 2.0 : 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:	

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

Designer:ASFUND KHAN

Company:CVL Consultants

Date:May 9, 2017

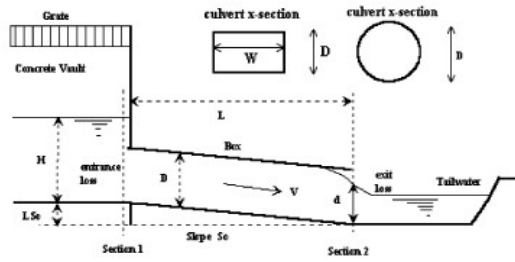
Project:Trails at Crowfoot

Location:Pond C (Forebay 2)

5. Forebay A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) B) Actual Forebay Volume C) Forebay Depth (D_{F} = 18 inch maximum) D) Forebay Discharge i) Undetained 100-year Peak Discharge ii) Forebay Discharge Design Flow (Q_{F} = 0.02 * Q_{100}) E) Forebay Discharge Design F) Discharge Pipe Size (minimum 8-inches) G) Rectangular Notch Width	V_{FMIN} = 0.009 ac-ft V_{F} = 0.009 ac-ft D_{F} = 12.0 in Q_{100} = 69.20 cfs Q_{F} = 1.38 cfs Choose One ☐ Berm With Pipe ☒ Wall with Rect. Notch ☐ Wall with V-Notch Weir (flow too small for berm w/ pipe) Calculated D_{p} = in Calculated W_{N} = 7.4 in
6. Trickle Channel A) Type of Trickle Channel F) Slope of Trickle Channel	Choose One ☒ Concrete ☐ Soft Bottom S = 0.0050 ft / ft
7. Micropool and Outlet Structure A) Depth of Micropool (2.5-feet minimum) B) Surface Area of Micropool (10 ft² minimum) C) Outlet Type D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) E) Total Outlet Area	D_{M} = 2.5 ft A_{M} = sq ft Choose One ☐ Orifice Plate ☐ Other (Describe): D_{orifice} = inches A_{ot} = square inches

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: **Trails at Crowfoot**
 Basin ID: **Pond C (Q₁₀₀ = 106.5)**
 Status: _____



Design Information (Input):

Circular Culvert: Barrel Diameter in Inches
 Inlet Edge Type (choose from pull-down list)

D = inches
 Grooved End with Headwall

OR:

Box Culvert: Barrel Height (Rise) in Feet
 Barrel Width (Span) in Feet
 Inlet Edge Type (choose from pull-down list)

Height (Rise) = ft.
 Width (Span) = ft.

Square Edge w/ 30-78 deg. Flared Wingwall

Number of Barrels
 Inlet Elevation at Culvert Invert
 Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)
 Culvert Length in Feet
 Manning's Roughness
 Bend Loss Coefficient
 Exit Loss Coefficient

No =
 Inlet Elev = ft. elev.
 Outlet Elev = ft. elev.
 L = ft.
 n =
 K_B =
 K_x =

Design Information (calculated):

Entrance Loss Coefficient
 Friction Loss Coefficient
 Sum of All Loss Coefficients
 Orifice Inlet Condition Coefficient
 Minimum Energy Condition Coefficient

K_e =
 K_f =
 K_s =
 C_d =
 K_{E_{low}} =

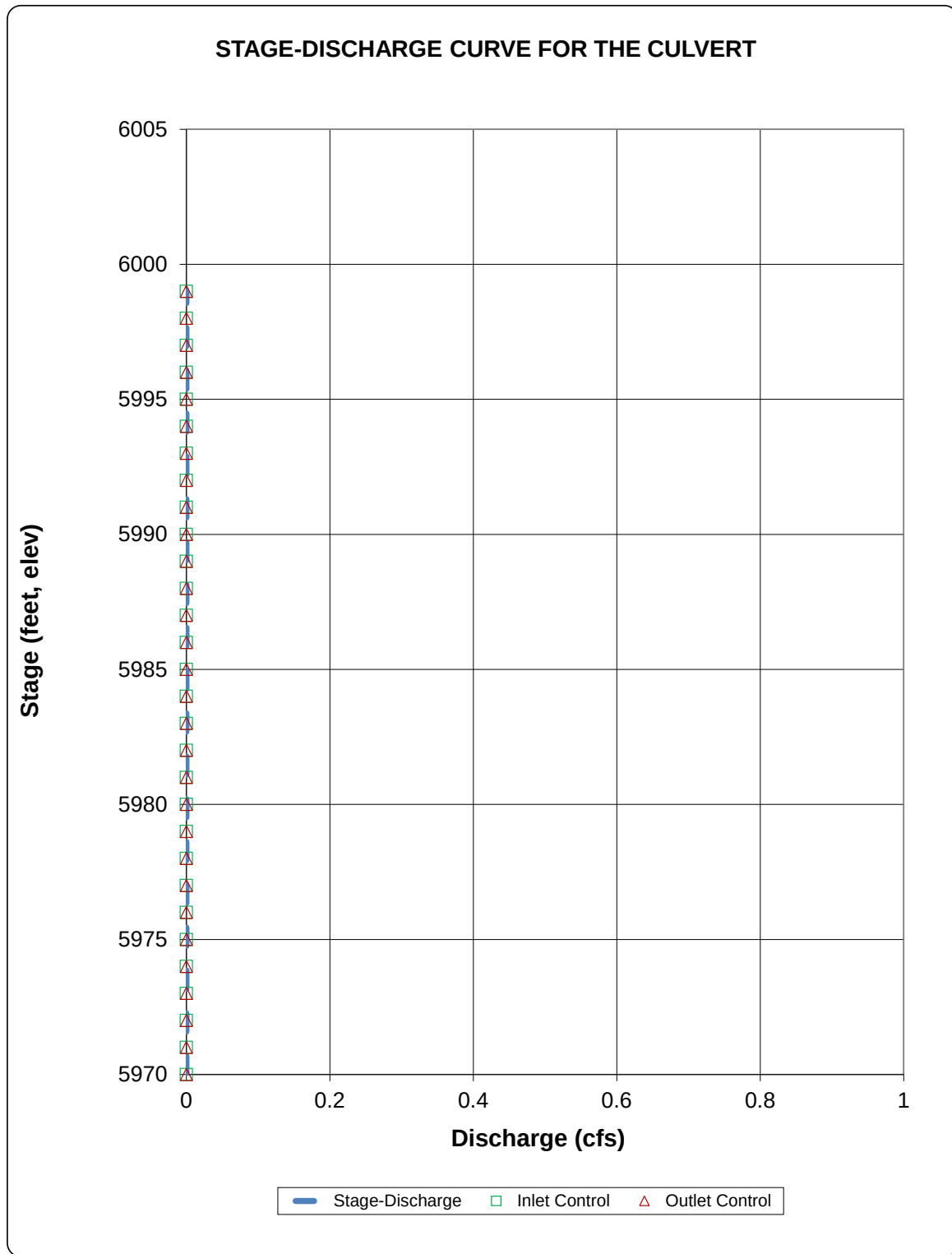
Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
5970.00	5971.33	0.00	0.00	0.00	Regression Eqn.	N/A
5971.00	5971.33	0.00	0.00	0.00	Regression Eqn.	N/A
5972.00	5971.33	0.00	0.00	0.00	Regression Eqn.	N/A
5973.00	5971.33	0.00	0.00	0.00	Regression Eqn.	N/A
5974.00	5971.33	0.00	0.00	0.00	Regression Eqn.	N/A
5975.00	5971.33	0.00	0.00	0.00	Regression Eqn.	N/A
5976.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5977.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5978.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5979.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5980.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5981.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5982.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5983.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5984.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5985.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5986.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5987.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5988.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5989.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5990.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5991.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5992.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5993.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5994.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5995.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5996.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5997.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5998.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A
5999.00	5971.33	0.00	0.00	0.00	Orifice Eqn.	N/A

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CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

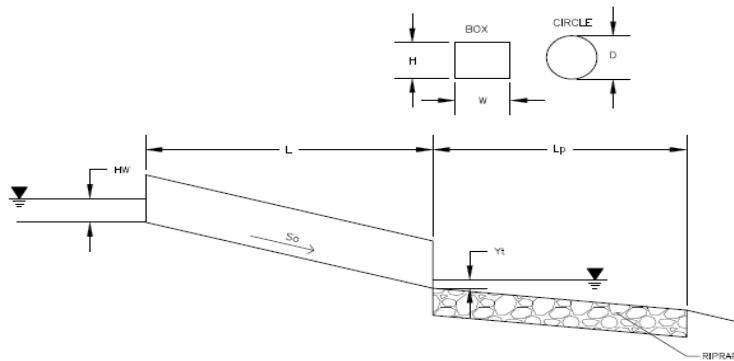
Project: Trails at Crowfoot
Basin ID: Pond C (Q100 = 106.5)



Determination of Culvert Headwater and Outlet Protection

Project: **TRAILS AT CROWFOOT**

Basin ID: **POND C OUTFALL**



Soil Type:

Choose One:

☒ Sandy

☐ Non-Sandy

Design Information (Input):

Design Discharge

Q = 106.5 cfs

Circular Culvert:

Barrel Diameter in Inches

D = 36 inches

Inlet Edge Type (Choose from pull-down list)

1.5 : 1 Beveled Edge

Box Culvert:

Barrel Height (Rise) in Feet

Height (Rise) =

Barrel Width (Span) in Feet

Width (Span) =

Inlet Edge Type (Choose from pull-down list)

Number of Barrels

No = 1

Inlet Elevation

Elev IN = 5966.5 ft

Outlet Elevation **OR** Slope

Elev OUT = 5966 ft

Culvert Length

L = 63 ft

Manning's Roughness

n = 0.013

Bend Loss Coefficient

k_b = 0

Exit Loss Coefficient

k_x = 1

Tailwater Surface Elevation

Elev Y_t =

Max Allowable Channel Velocity

V = 5 ft/s

Required Protection (Output):

Tailwater Surface Height

Y_t = 1.20 ft

Flow Area at Max Channel Velocity

A_v = 21.30 ft²

Culvert Cross Sectional Area Available

A = 7.07 ft²

Entrance Loss Coefficient

k_e = 0.20

Friction Loss Coefficient

k_f = 0.45

Sum of All Losses Coefficients

k_s = 1.65

Culvert Normal Depth

Y_n = 0.98 ft

Culvert Critical Depth

Y_c = 2.92 ft

Tailwater Depth for Design

d = 2.96 ft

Adjusted Diameter **OR** Adjusted Rise

D_a =

Expansion Factor

1/(2*tan(θ)) = 1.85

Flow/Diameter^{2.5} **OR** Flow/(Span * Rise^{1.5})

Q/D^{2.5} = 6.83 ft^{0.5}/s

Froude Number

Fr =

Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise

Y_t/D = 0.40 **Pressure flow!**

Inlet Control Headwater

HW_i = 8.24 ft

Outlet Control Headwater

HW_o = 8.29

Design Headwater Elevation

HW = 5,974.79 ft

Headwater/Diameter **OR** Headwater/Rise Ratio

HW/D = 2.76 **HW/D > 1.5!**

Minimum Theoretical Riprap Size

d₅₀ = 17 in

Nominal Riprap Size

d₅₀ = 18 in

UDFCD Riprap Type

Type = H

Length of Protection

L_p = 29 ft

Width of Protection

T = 19 ft

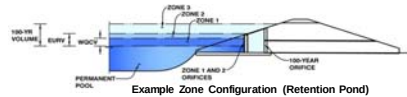
Pond D

Pond D: Summary Info

UD-Detention, Version 3.07 (February 2017)

Project: Trails at Crowfoot

Basin ID: Pond D



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type:	EDB	
Watershed Area =	50.18	acres
Watershed Length =	3,350	ft
Watershed Slope =	0.029	ft/ft
Watershed Imperviousness =	51.42%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	49.8%	percent
Percentage Hydrologic Soil Groups C/D =	50.2%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths:	Parker - The Pinery Country Club	
Water Quality Capture Volume (WQCV) =	0.879	acre-feet
Excess Urban Runoff Volume (EURV) =	2.605	acre-feet
		Optional User Override 1-hr Precipitation
2-yr Runoff Volume (P1 = 0.99) in =	1.889	acre-feet
10-yr Runoff Volume (P1 = 1.39) in =	2.687	acre-feet
15-yr Runoff Volume (P1 = 1.58) in =	3.069	acre-feet
25-yr Runoff Volume (P1 = 1.91) in =	3.723	acre-feet
50-yr Runoff Volume (P1 = 2.28) in =	5.098	acre-feet
100-yr Runoff Volume (P1 = 2.6) in =	8.626	acre-feet
500-yr Runoff Volume (P1 = 3.1) in =	11.158	acre-feet
Approximate 2-yr Detention Volume =	1.770	acre-feet
Approximate 2-yr Detention Volume =	2.811	acre-feet
Approximate 10-yr Detention Volume =	3.479	acre-feet
Approximate 25-yr Detention Volume =	3.992	acre-feet
Approximate 50-yr Detention Volume =	4.307	acre-feet
Approximate 100-yr Detention Volume =	4.868	acre-feet

Stage-Storage Calculation

Zone 1 Volume (V_{QVCV})	0.879	acre-foot
Zone 2 Volume (EURV - Zone 1)	1.726	acre-foot
Zone 3 Volume (100-year - Zones 1 & 2)	2.253	acre-foot
Total Detention Basin Volume	4.858	acre-foot
Initial Surge Volume (V_{SV})	user	ft ³
Initial Surge Depth (SD)	user	ft
Total Available Detention Depth (H_{DAV})	user	ft
Depth of Trickle Channel (H_{TC})	user	ft
Depth of Trickle Channel (SD_{TC})	user	ft
Slope of Main Basin Sides (S_{MB})	user	H:V
Basin Length-to-Width Ratio (R_{LMB})	user	
Initial Surge Length (A_{SV})	user	ft ²
Surge Volume Area (V_{DAV})	user	ft ²
Surge Volume Width (W_{DAV})	user	ft
Depth of Basin Floor (H_{BF})	user	ft
Length of Basin Floor (L_{BF})	user	ft
Width of Basin Floor (W_{BF})	user	ft
Area of Basin Floor (A_{BF})	user	ft ²
Volume of Basin Floor (V_{BF})	user	ft ³
Depth of Main Basin (H_{MB})	user	ft
Length of Main Basin (L_{MB})	user	ft
Width of Main Basin (W_{MB})	user	ft
Area of Main Basin (A_{MB})	user	ft ²
Volume of Main Basin (V_{MB})	user	ft ³
Calculated Total Basin Volume (V_{DAV})	user	acre-foot

[illegible]

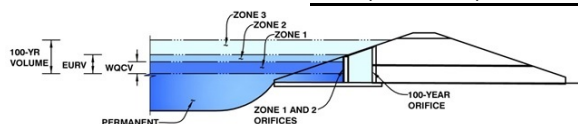
Inflow hydrograph
for 5 and 100-year
entered from
CUHP/SWMM to
design pond

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: **TRAILS AT CROWFOOT**

Basin ID: **POND D (STAGE 0 = 5985')**



Example Zone Configuration (Retention)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.83	0.879	Orifice Plate
Zone 2 (EURV)	6.20	1.726	Circular Orifice
Zone 3 (100-year)	8.48	2.253	Weir&Pipe (Restrict)
		4.858	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 =	6.20	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	3.14	sq. inches (diameter = 2 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	2.181E-02	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	1.92						
Orifice Area (sq. inches)	3.14	3.14						

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	3.83	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	6.20	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	3.10	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.05	N/A	ft ²
Vertical Orifice Centroid =	0.13	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.20	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	9.00	N/A	feet
Overflow Weir Slope =	4.00	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 ₁ =	7.20	N/A	feet
Over Flow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.47	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	25.98	N/A	ft ²
Overflow Grate Open Area w/ Debris =	12.99	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 =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	20.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	3.48	N/A	ft ²
Outlet Orifice Centroid =	0.94	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.91	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	8.48	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	154.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

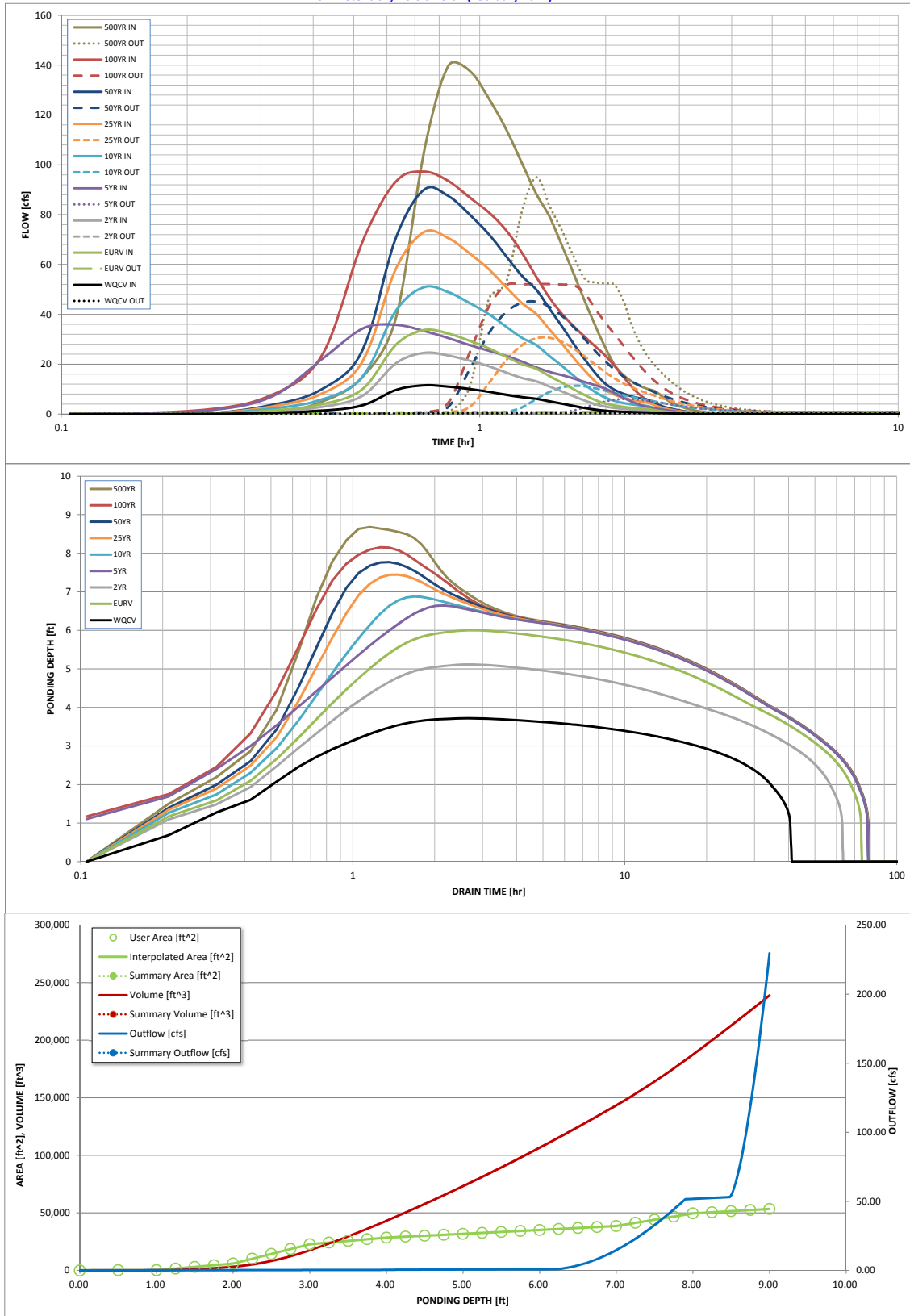
Spillway Design Flow Depth =	0.38	feet
Stage at Top of Freeboard =	9.86	feet
Basin Area at Top of Freeboard =	1.23	acres

Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	0.53	1.07	0.99	1.39	1.64	1.98	2.31	2.60	3.10
One-Hour Rainfall Depth (in) =	0.879	2.605	1.889	2.987	3.958	5.723	7.098	8.626	11.158
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.878	2.603	1.888	3.446	3.956	5.719	7.088	8.879	11.146
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.05	0.18	0.54	0.76	1.02	1.43
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	2.4	9.2	27.2	38.1	51.2	72.0
Peak Inflow Q (cfs) =	11.5	33.7	24.6	35.8	50.9	73.0	90.0	97.3	139.6
Peak Outflow Q (cfs) =	0.3	0.8	0.7	6.1	11.4	30.6	45.1	52.2	95.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.5	1.2	1.1	1.2	1.0	1.3
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.4	1.1	1.7	2.0	2.0
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) =	38	67	58	70	69	67	65	62	59
Time to Drain 99% of Inflow Volume (hours) =	40	72	61	75	75	73	72	71	70
Maximum Ponding Depth (ft) =	3.72	6.00	5.11	6.65	6.88	7.45	7.77	8.16	8.68
Area at Maximum Ponding Depth (acres) =	0.62	0.81	0.74	0.86	0.88	1.00	1.08	1.15	1.20
Maximum Volume Stored (acre-ft) =	0.805	2.447	1.761	2.979	3.187	3.706	4.048	4.475	5.084

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	USER	WORKBOOK	WORKBOOK	WORKBOOK	USER	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]
6.30 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:06:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
Hydrograph	0:12:36	0.00	0.00	0.00	1.09	0.00	0.00	0.00	1.43	0.00
Constant	0:18:54	0.51	1.44	1.06	6.67	2.12	2.93	3.51	7.36	5.02
0.793	0:25:12	1.37	3.94	2.89	22.11	5.88	8.28	10.05	23.73	14.95
	0:31:30	3.52	10.12	7.42	34.32	15.11	21.26	25.81	69.40	38.43
	0:37:48	9.68	27.77	20.36	35.81	41.43	58.23	70.65	93.32	104.96
	0:44:06	11.54	33.72	24.57	33.37	50.92	73.03	90.02	97.32	139.65
	0:50:24	11.02	32.33	23.52	30.51	48.96	70.67	87.57	93.61	137.83
	0:56:42	10.03	29.42	21.41	27.71	44.58	64.53	80.12	86.96	126.75
	1:03:00	8.97	26.45	19.22	25.44	40.15	58.17	72.25	81.00	114.41
	1:09:18	7.76	23.05	16.70	23.39	35.11	51.00	63.46	73.87	100.84
	1:15:36	6.76	20.07	14.51	21.11	30.65	44.59	55.52	64.83	88.33
	1:21:54	6.12	18.17	13.16	18.72	27.67	40.15	49.90	55.02	79.05
	1:28:12	5.07	15.17	10.97	16.88	23.18	33.78	42.11	46.48	67.23
	1:34:30	4.15	12.53	9.04	15.60	19.21	28.04	34.99	40.03	55.96
	1:40:48	3.21	9.87	7.08	14.25	15.21	22.33	27.95	35.09	45.03
	1:47:06	2.40	7.56	5.39	12.86	11.74	17.32	21.75	30.89	35.20
	1:53:24	1.74	5.59	3.96	11.55	8.76	13.01	16.39	27.07	26.71
	1:59:42	1.34	4.23	3.01	10.25	6.57	9.71	12.18	23.52	19.70
	2:06:00	1.10	3.42	2.45	8.43	5.29	7.76	9.71	19.26	15.60
	2:12:18	0.93	2.89	2.07	6.54	4.45	6.52	8.15	14.90	13.05
	2:18:36	0.82	2.52	1.81	4.91	3.88	5.67	7.07	10.91	11.28
	2:24:54	0.74	2.26	1.62	3.69	3.47	5.06	6.31	7.66	10.04
	2:31:12	0.68	2.07	1.49	2.86	3.17	4.63	5.76	5.47	9.15
	2:37:30	0.50	1.53	1.10	2.27	2.36	3.48	4.37	4.00	7.07
	2:43:48	0.37	1.11	0.80	1.78	1.71	2.51	3.15	2.89	5.09
	2:50:06	0.27	0.82	0.59	1.37	1.27	1.86	2.34	2.05	3.78
	2:56:24	0.20	0.61	0.44	1.05	0.94	1.39	1.74	1.47	2.81
	3:02:42	0.14	0.44	0.32	0.80	0.69	1.02	1.28	1.10	2.08
	3:09:00	0.10	0.32	0.23	0.61	0.49	0.73	0.92	0.83	1.50
	3:15:18	0.07	0.23	0.16	0.44	0.36	0.53	0.67	0.62	1.09
	3:21:36	0.05	0.16	0.11	0.31	0.25	0.37	0.47	0.45	0.78
	3:27:54	0.03	0.10	0.07	0.21	0.16	0.24	0.31	0.30	0.52
	3:34:12	0.01	0.06	0.04	0.13	0.09	0.14	0.18	0.19	0.31
	3:40:30	0.00	0.02	0.02	0.07	0.04	0.07	0.09	0.10	0.15
	3:46:48	0.00	0.01	0.00	0.03	0.01	0.02	0.03	0.04	0.05
	3:53:06	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	3:59:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:12:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:18:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:24:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:37:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:43:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:49:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:56:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:02:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:08:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:21:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:27:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:33:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:46:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:52:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:59:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:05:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:11:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:18:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:24:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:30:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:36:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:43:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:49:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:55:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:02:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:08:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:14:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:21:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:27:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:33:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$Q_{100} = 52.19 \text{ cfs}$$

Inflow Hydrograph I_1 - [cfs]	Inflow ₂ - [cfs]	Outflow ₁ - [cfs]	Outflow ₂ - [cfs]
0.00	0.02	0.00	0.02
0.02	1.43	0.02	0.11
1.43	7.36	0.11	0.14
7.36	23.73	0.14	0.24
23.73	69.40	0.24	0.32
69.40	93.32	0.32	0.56
93.32	97.32	0.56	0.77
97.32	93.61	0.77	4.47
93.61	86.96	4.47	24.55
86.96	81.00	24.55	42.93
81.00	73.87	42.93	51.67
73.87	64.83	51.67	52.03
64.83	55.02	52.03	52.19
55.02	46.48	52.19	52.16
46.48	40.03	52.16	51.98
40.03	35.09	51.98	51.68
35.09	30.89	51.68	48.32
30.89	27.07	48.32	42.06
27.07	23.52	42.06	36.73
23.52	19.26	36.73	31.95
19.26	14.90	31.95	27.43
14.90	10.91	27.43	23.15
10.91	7.66	23.15	19.36
7.66	5.47	19.36	15.92
5.47	4.00	15.92	13.10
4.00	2.89	13.10	10.85
2.89	2.05	10.85	9.03
2.05	1.47	9.03	7.57
1.47	1.10	7.57	6.40
1.10	0.83	6.40	5.46
0.83	0.62	5.46	4.69
0.62	0.45	4.69	4.06
0.45	0.30	4.06	3.53
0.30	0.19	3.53	3.09
0.19	0.10	3.09	2.72
0.10	0.04	2.72	2.41
0.04	0.01	2.41	2.15
0.01	0.00	2.15	1.93
0.00	0.00	1.93	1.74
0.00	0.00	1.74	1.59
0.00	0.00	1.59	1.45
0.00	0.00	1.45	1.34
0.00	0.00	1.34	1.24
0.00	0.00	1.24	1.16
0.00	0.00	1.16	1.09
0.00	0.00	1.09	1.02

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot

Project No. 254103

Calculated By: MRS

Pond D

SWMM 100 Year Volume (AC-FT)	EURV(AC-FT)	WQCV	Release Rate (CFS)
V100			
4.49	2.61	0.88	52.3

Storage Curve							
STAGE	SURFACE AREA	A+B+(A*B) ⁻⁵	1/3	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft ²	ft ²	ft ²	ft	ft ³	ft ³	ac-ft
5986	77.00	0	0	0	0	0	0
5987	5948	6,702	2,234	1	2,234	2,234	0.05
5988	22697	40,264	13,421	1	13,421	15,655	0.36
5989	28487	76,612	25,537	1	25,537	41,193	0.95
5990	31739	90,295	30,098	1	30,098	71,291	1.64
5991	35091	100,203	33,401	1	33,401	104,692	2.40
5992	38544	110,412	36,804	1	36,804	141,496	3.25
5993	49506	131,732	43,911	1	43,911	185,407	4.26
5994	53361	154,264	51,421	1	51,421	236,828	5.44

WQ _{ELEV}	5988.89	FT	WQ _{VOLUME}	0.88	AC-FT
EURV _{ELEV}	5991.24	FT	EURV _{VOLUME}	2.61	AC-FT
100YEAR _{ELEV}	5993.19	FT	100YEAR _{VOLUME}	4.49	AC-FT

DETENTION POND SIZING

Subdivisi Trails at Crowfoot

Project Name: Trails at Crowfoot

Project No. 254103

Calculated By: MRS

Pond D

WQCV	SURCHARGE VOLUME	SURCHARGE DEPTH
(AC-FT)	(FT ³)	(FT)
0.88	114.87	0.50

Storage Curve							
STAGE	SURFACE AREA	$A+B+(A*B)^{.5}$	$1/3$	ΔH	VOLUME	CUMULATIVE VOLUME	CUMULATIVE VOLUME
ft	ft ²	ft ²	ft ²	ft	ft ³	ft ³	ac-ft
5986	77.00	0	0	0	0	0	0
5986.5	5948	6,702	2,234	1	1,117	1,117	0.03

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Sheet 1 of 4

Designer:ASFUND KHAN

Company:CVL Consultants

Date:May 9, 2017

Project:Trails at Crowfoot

Location:Pond D (Forebay 1)

1. Basin Storage Volume A) Effective Imperviousness of Tributary Area, I_a B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) C) Contributing Watershed Area D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm E) Design Concept (Select EURV when also designing for flood control) F) Design Volume (WQCV) Based on 40-hour Drain Time $(V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area))$ G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume $(V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN} / 0.43))$ H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) I) Predominant Watershed NRCS Soil Group 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: $EURV_{C/D} = 1.20 * i^{1.08}$	$I_a = 55.2\%$ $i = 0.552$ Area = 23.580 ac $d_6 =$ in Choose One ☒ Water Quality Capture Volume (WQCV) ☐ Excess Urban Runoff Volume (EURV) $V_{DESIGN} = 0.434$ ac-ft $V_{DESIGN\ OTHER} =$ ac-ft $V_{DESIGN\ USER} =$ ac-ft Choose One ☐ A ☐ B ☐ C / D WQCV selected. Soil group not required. EURV = ac-ft
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	$L : W = 2.0 : 1$
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:	

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

Designer:ASFUND KHAN

Company:CVL Consultants

Date:May 9, 2017

Project:Trails at Crowfoot

Location:Pond D (Forebay 1)

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 3% of the WQCV)

B) Actual Forebay Volume

C) Forebay Depth
(D_{F} = 18 inch maximum)

D) Forebay Discharge

i) Undetained 100-year Peak Discharge

ii) Forebay Discharge Design Flow
(Q_{F} = 0.02 * Q_{100})

E) Forebay Discharge Design

F) Discharge Pipe Size (minimum 8-inches)

G) Rectangular Notch Width

V_{FMIN} = 0.013 ac-ft

V_{F} = 0.013 ac-ft

D_{F} = 12.0 in

Q_{100} = 82.70 cfs

Q_{F} = 1.65 cfs

Choose One

☐ Berm With Pipe

☒ Wall with Rect. Notch

☐ Wall with V-Notch Weir

(flow too small for berm w/ pipe)

Calculated D_{p} = in

Calculated W_{N} = 8.4 in

6. Trickle Channel

A) Type of Trickle Channel

F) Slope of Trickle Channel

Choose One

☒ Concrete

☐ Soft Bottom

S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum)

B) Surface Area of Micropool (10 ft² minimum)

C) Outlet Type

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing
(Use UD-Detention)

E) Total Outlet Area

D_{M} = 2.5 ft

A_{M} = sq ft

Choose One

☐ Orifice Plate

☐ Other (Describe):

D_{orifice} = inches

A_{ot} = square inches

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Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Sheet 1 of 4

Designer:ASFUND KHAN

Company:CVL Consultants

Date:May 9, 2017

Project:Trails at Crowfoot

Location:Pond D (Forebay 2)

1. Basin Storage Volume A) Effective Imperviousness of Tributary Area, I_a B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) C) Contributing Watershed Area D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm E) Design Concept (Select EURV when also designing for flood control) F) Design Volume (WQCV) Based on 40-hour Drain Time $(V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area))$ G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume $(V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN} / 0.43)))$ H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) I) Predominant Watershed NRCS Soil Group 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: $EURV_{C/D} = 1.20 * i^{1.08}$	$I_a =$ 55.2 % $i =$ 0.552 Area = 23.660 ac $d_6 =$ in Choose One ☒ Water Quality Capture Volume (WQCV) ☐ Excess Urban Runoff Volume (EURV) $V_{DESIGN} =$ 0.436 ac-ft $V_{DESIGN\ OTHER} =$ ac-ft $V_{DESIGN\ USER} =$ ac-ft Choose One ☐ A ☐ B ☐ C / D WQCV selected. Soil group not required. EURV = ac-ft
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	$L : W =$ 2.0 : 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:	

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

Designer:ASFUND KHAN

Company:CVL Consultants

Date:May 9, 2017

Project:Trails at Crowfoot

Location:Pond D (Forebay 2)

5. Forebay A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) B) Actual Forebay Volume C) Forebay Depth (D_{F} = 18 inch maximum) D) Forebay Discharge i) Undetained 100-year Peak Discharge ii) Forebay Discharge Design Flow (Q_{F} = 0.02 * Q_{100}) E) Forebay Discharge Design F) Discharge Pipe Size (minimum 8-inches) G) Rectangular Notch Width	V_{FMIN} = 0.013 ac-ft V_{F} = 0.013 ac-ft D_{F} = 12.0 in Q_{100} = 78.50 cfs Q_{F} = 1.57 cfs Choose One ☐ Berm With Pipe ☒ Wall with Rect. Notch ☐ Wall with V-Notch Weir (flow too small for berm w/ pipe) Calculated D_{p} = in Calculated W_{N} = 8.1 in
6. Trickle Channel A) Type of Trickle Channel F) Slope of Trickle Channel	Choose One ☒ Concrete ☐ Soft Bottom S = 0.0050 ft / ft
7. Micropool and Outlet Structure A) Depth of Micropool (2.5-feet minimum) B) Surface Area of Micropool (10 ft² minimum) C) Outlet Type D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) E) Total Outlet Area	D_{M} = 2.5 ft A_{M} = sq ft Choose One ☐ Orifice Plate ☐ Other (Describe): D_{orifice} = inches A_{ot} = square inches

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Sheet 1 of 4

Designer:ASFUND KHAN

Company:CVL Consultants

Date:May 9, 2017

Project:Trails at Crowfoot

Location:Pond D (Forebay 3)

1. Basin Storage Volume A) Effective Imperviousness of Tributary Area, I_a B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) C) Contributing Watershed Area D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm E) Design Concept (Select EURV when also designing for flood control) F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$) G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN} / 0.43))$) H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) I) Predominant Watershed NRCS Soil Group 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: $EURV_{C/D} = 1.20 * i^{1.08}$	$I_a =$ 55.2 % $i =$ 0.552 Area = 5.800 ac $d_6 =$ in Choose One ☒ Water Quality Capture Volume (WQCV) ☐ Excess Urban Runoff Volume (EURV) $V_{DESIGN} =$ 0.107 ac-ft $V_{DESIGN\ OTHER} =$ ac-ft $V_{DESIGN\ USER} =$ ac-ft Choose One ☐ A ☐ B ☐ C / D WQCV selected. Soil group not required. EURV = ac-ft
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 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:	

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

Designer:ASFUND KHAN

Company:CVL Consultants

Date:May 9, 2017

Project:Trails at Crowfoot

Location:Pond D (Forebay 3)

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 2% of the WQCV)

B) Actual Forebay Volume

C) Forebay Depth
(D_{F} = 18 inch maximum)

D) Forebay Discharge

i) Undetained 100-year Peak Discharge

ii) Forebay Discharge Design Flow
(Q_{F} = 0.02 * Q_{100})

E) Forebay Discharge Design

F) Discharge Pipe Size (minimum 8-inches)

G) Rectangular Notch Width

V_{FMIN} = 0.002 ac-ft

V_{F} = 0.002 ac-ft

D_{F} = 12.0 in

Q_{100} = 36.40 cfs

Q_{F} = 0.73 cfs

Choose One

☐ Berm With Pipe

☒ Wall with Rect. Notch

☐ Wall with V-Notch Weir

(flow too small for berm w/ pipe)

Calculated D_{p} = in

Calculated W_{N} = 5.0 in

6. Trickle Channel

A) Type of Trickle Channel

F) Slope of Trickle Channel

Choose One

☒ Concrete

☐ Soft Bottom

S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum)

B) Surface Area of Micropool (10 ft² minimum)

C) Outlet Type

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing
(Use UD-Detention)

E) Total Outlet Area

D_{M} = 2.5 ft

A_{M} = sq ft

Choose One

☐ Orifice Plate

☐ Other (Describe):

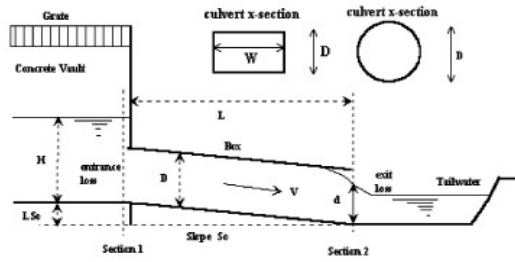
D_{orifice} = inches

A_{ot} = square inches

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CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: **Trails at Crowfoot**
 Basin ID: **Pond D ($Q_{100} = 52.2$ CFS)**
 Status: _____



Design Information (Input):

Circular Culvert: Barrel Diameter in Inches
 Inlet Edge Type (choose from pull-down list)

$D =$ inches
 1.5 : 1 Beveled Edge

OR:

Box Culvert: Barrel Height (Rise) in Feet
 Barrel Width (Span) in Feet
 Inlet Edge Type (choose from pull-down list)

Height (Rise) = ft.
 Width (Span) = ft.
 1.5 : 1 Bevel w/ 90 Deg. Headwall

Number of Barrels
 Inlet Elevation at Culvert Invert
 Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)
 Culvert Length in Feet
 Manning's Roughness
 Bend Loss Coefficient
 Exit Loss Coefficient

No =
 Inlet Elev = ft. elev.
 Outlet Elev = ft. elev.
 L = ft.
 n =
 $K_b =$
 $K_x =$

Design Information (calculated):

Entrance Loss Coefficient
 Friction Loss Coefficient
 Sum of All Loss Coefficients
 Orifice Inlet Condition Coefficient
 Minimum Energy Condition Coefficient

$K_e =$
 $K_f =$
 $K_s =$
 $C_d =$
 $KE_{low} =$

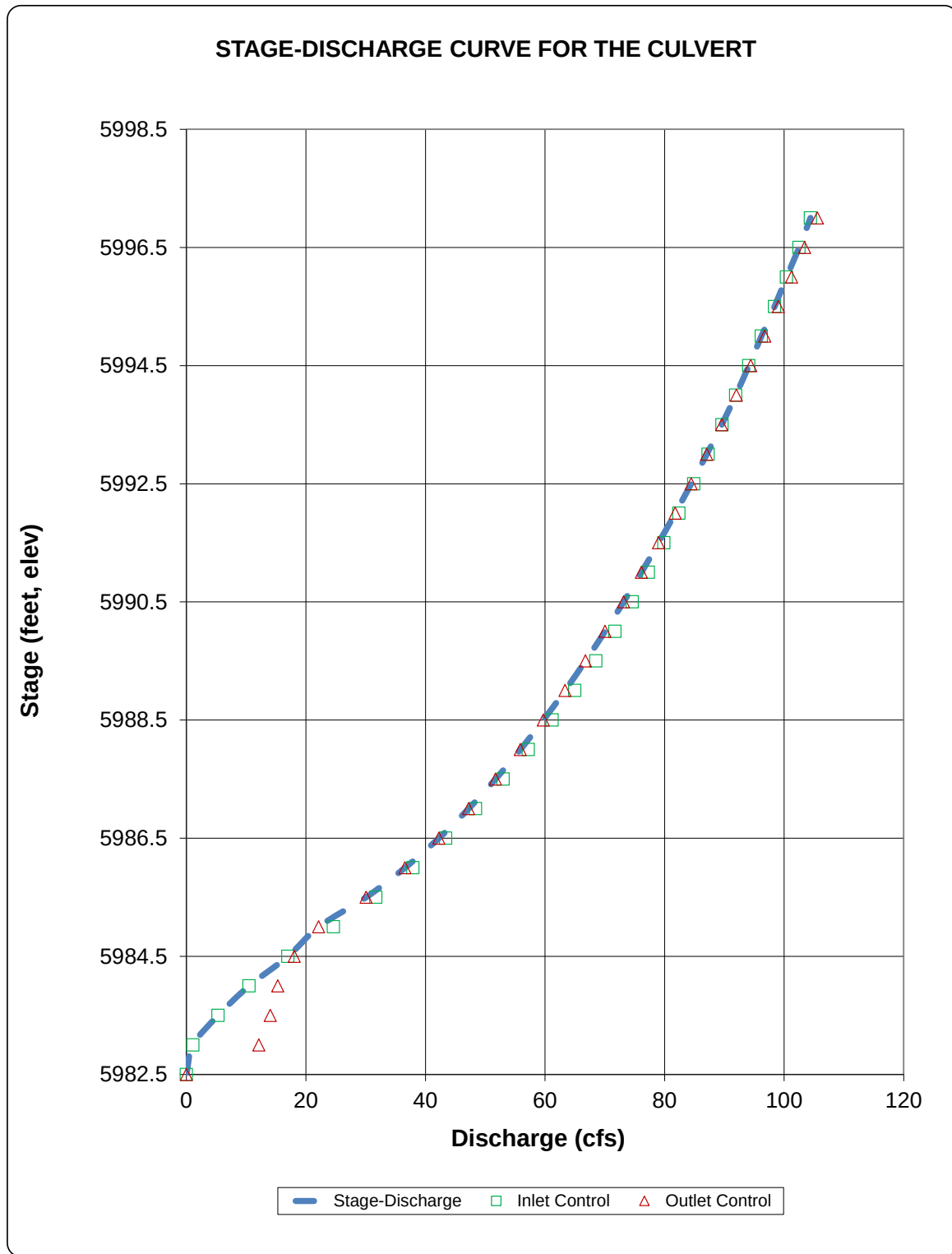
Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
5982.50	5971.33	0.00	0.00	0.00	No Flow (WS < inlet)	N/A
5983.00	5971.33	1.10	12.14	1.10	Min. Energy. Eqn.	INLET
5983.50	5971.33	5.30	14.03	5.30	Min. Energy. Eqn.	INLET
5984.00	5971.33	10.50	15.29	10.50	Regression Eqn.	INLET
5984.50	5971.33	17.00	18.07	17.00	Regression Eqn.	INLET
5985.00	5971.33	24.60	22.13	22.13	Regression Eqn.	OUTLET
5985.50	5971.33	31.70	30.08	30.08	Regression Eqn.	OUTLET
5986.00	5971.33	37.90	36.57	36.57	Regression Eqn.	OUTLET
5986.50	5971.33	43.40	42.23	42.23	Regression Eqn.	OUTLET
5987.00	5971.33	48.40	47.22	47.22	Regression Eqn.	OUTLET
5987.50	5971.33	53.00	51.71	51.71	Regression Eqn.	OUTLET
5988.00	5971.33	57.20	55.87	55.87	Regression Eqn.	OUTLET
5988.50	5971.33	61.20	59.72	59.72	Regression Eqn.	OUTLET
5989.00	5971.33	65.00	63.34	63.34	Regression Eqn.	OUTLET
5989.50	5971.33	68.50	66.76	66.76	Regression Eqn.	OUTLET
5990.00	5971.33	71.70	70.02	70.02	Regression Eqn.	OUTLET
5990.50	5971.33	74.60	73.14	73.14	Orifice Eqn.	OUTLET
5991.00	5971.33	77.30	76.12	76.12	Orifice Eqn.	OUTLET
5991.50	5971.33	79.90	78.99	78.99	Orifice Eqn.	OUTLET
5992.00	5971.33	82.40	81.77	81.77	Orifice Eqn.	OUTLET
5992.50	5971.33	84.90	84.45	84.45	Orifice Eqn.	OUTLET
5993.00	5971.33	87.30	87.05	87.05	Orifice Eqn.	OUTLET
5993.50	5971.33	89.60	89.57	89.57	Orifice Eqn.	OUTLET
5994.00	5971.33	91.90	92.02	91.90	Orifice Eqn.	INLET
5994.50	5971.33	94.10	94.42	94.10	Orifice Eqn.	INLET
5995.00	5971.33	96.20	96.76	96.20	Orifice Eqn.	INLET
5995.50	5971.33	98.40	99.02	98.40	Orifice Eqn.	INLET
5996.00	5971.33	100.40	101.25	100.40	Orifice Eqn.	INLET
5996.50	5971.33	102.50	103.42	102.50	Orifice Eqn.	INLET
5997.00	5971.33	104.40	105.56	104.40	Orifice Eqn.	INLET

Processing Time: 00.60 Seconds

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

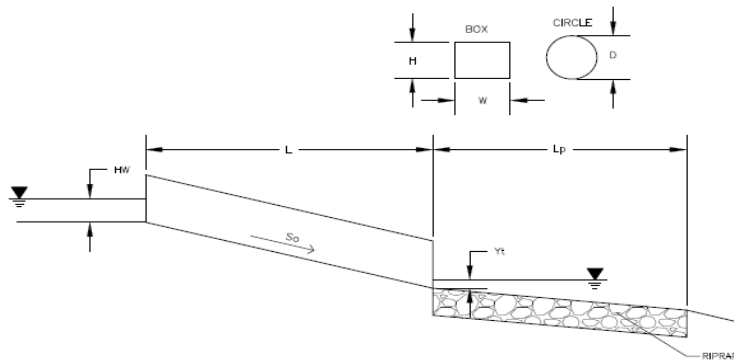
Project: Trails at Crowfoot
Basin ID: Pond D (Q100 = 52.2 CFS)



Determination of Culvert Headwater and Outlet Protection

Project: **TRAILS AT CROWFOOT**

Basin ID: **POND D**



Soil Type:

Choose One:

☐ Sandy

☒ Non-Sandy

Design Information (Input):

Design Discharge

Q = 52.2 cfs

Circular Culvert:

Barrel Diameter in Inches

D = 30 inches

Inlet Edge Type (Choose from pull-down list)

1.5 : 1 Beveled Edge

Box Culvert:

Barrel Height (Rise) in Feet

Height (Rise) =

Barrel Width (Span) in Feet

Width (Span) =

Inlet Edge Type (Choose from pull-down list)

Number of Barrels

No = 1

Inlet Elevation

Elev IN = 5982.5 ft

Outlet Elevation OR Slope

Elev OUT = 5982 ft

Culvert Length

L = 59 ft

Manning's Roughness

n = 0.013

Bend Loss Coefficient

k_b = 0

Exit Loss Coefficient

k_x = 1

Tailwater Surface Elevation

Elev Y_t =

Max Allowable Channel Velocity

V = 7 ft/s

Required Protection (Output):

Tailwater Surface Height

Y_t = 1.00 ft

Flow Area at Max Channel Velocity

A_v = 7.46 ft²

Culvert Cross Sectional Area Available

A = 4.91 ft²

Entrance Loss Coefficient

k_e = 0.20

Friction Loss Coefficient

k_f = 0.54

Sum of All Losses Coefficients

k_s = 1.74

Culvert Normal Depth

Y_n = 1.43 ft

Culvert Critical Depth

Y_c = 2.33 ft

Tailwater Depth for Design

d = 2.41 ft

Adjusted Diameter OR Adjusted Rise

D_a =

Expansion Factor

$1/(2*\tan(\theta))$ = 2.24

Flow/Diameter^{2.5} OR Flow/(Span * Rise^{1.5})

$Q/D^{2.5}$ = 5.28 ft^{0.5}/s

Froude Number

Fr =

Tailwater/Adjusted Diameter OR Tailwater/Adjusted Rise

Y_t/D = 0.40 **Pressure flow!**

Inlet Control Headwater

HW_i = 4.92 ft

Outlet Control Headwater

HW_o = 4.97

Design Headwater Elevation

HW = 5,987.47 ft

Headwater/Diameter OR Headwater/Rise Ratio

HW/D = 1.99 **HW/D > 1.5!**

Minimum Theoretical Riprap Size

d_{50} = 11 in

Nominal Riprap Size

d_{50} = 12 in

UDFCD Riprap Type

Type = M

Length of Protection

L_p = 12 ft

Width of Protection

T = 8 ft

III Hydraulic Computations

- A. CUHP & SWMM
- B. UD Inlet
- C. UD Sewer
- D. UD Channel
- E. UD Culvert
- F. HECRAS

III. Hydraulic Computations

1. CUHP & SWMM

A. 5 & 100 YEAR CUHP

B. 5 & 100 YEAR SWMM

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

Catchment Name/ID	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A-1	0.088	0.110	36.9	4.62	19.2	3.27	7.7	24	67,569	0.82	55,537	35.0	12	55,389	0.64
A-2	0.089	0.125	28.3	4.23	14.7	2.99	7.0	42	91,663	0.81	74,351	35.0	20	74,116	0.78
A-3	0.092	0.085	35.0	3.80	18.2	2.68	6.3	17	44,914	0.74	33,409	35.0	8	33,317	0.61
A-4	0.097	0.071	45.2	3.97	23.5	2.80	6.6	12	41,041	0.63	26,038	40.0	5	25,987	0.44
B-1	0.097	0.125	37.5	5.12	19.5	3.62	8.5	51	147,305	0.63	92,744	40.0	21	92,504	0.51
B-2	0.090	0.149	32.5	5.21	16.9	3.68	8.7	57	143,319	0.78	111,099	35.0	27	110,851	0.68
C-1	0.090	0.117	37.3	4.85	19.4	3.42	8.1	29	84,224	0.77	65,273	35.0	14	65,107	0.60
D-1	0.090	0.112	30.7	4.13	16.0	2.92	6.9	32	75,241	0.78	58,646	35.0	15	58,410	0.71
E-1	0.090	0.204	27.9	5.87	14.5	4.15	9.8	134	288,530	0.78	224,255	35.0	61	223,789	0.77
F-1	0.087	0.139	32.2	4.94	16.7	3.49	8.2	43	106,935	0.86	91,663	35.0	22	91,429	0.74
F-2	0.095	0.093	31.0	3.71	16.1	2.62	6.2	29	68,440	0.66	45,031	35.0	12	44,838	0.62
OS-1	0.157	0.067	46.6	3.89	24.2	2.75	6.5	8	30,492	0.24	7,263	40.0	2	7,248	0.22
OS-2	0.157	0.067	53.1	4.23	27.6	2.99	7.0	7	30,456	0.24	7,254	40.0	2	7,242	0.19
OS-3	0.157	0.054	51.9	3.64	27.0	2.58	6.1	5	18,840	0.24	4,486	40.0	1	4,475	0.20
OS-4	0.157	0.041	94.8	4.45	49.3	3.15	7.4	1	10,019	0.24	2,386	45.0	0	2,383	0.11
OS-5	0.157	0.053	29.9	2.71	15.5	1.91	4.5	8	17,823	0.24	4,244	35.0	2	4,180	0.32

Summary of CUHP Input Parameters (Version 2.0.0)

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression		Horton's Infiltration			DCIA Level and Fractions			Percent Eff. Imperv.
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in./hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	
A-1	A-1	R5	0.029	0.252	0.466	0.015	51.2	0.35	0.10	3.75	0.55	0.0018	0.00	0.86	0.23	49.42
A-2	A-2	R5	0.039	0.238	0.369	0.015	50.3	0.35	0.10	3.75	0.55	0.0018	0.00	0.85	0.23	48.53
A-3	A-3	R5	0.019	0.192	0.299	0.015	44.8	0.35	0.10	3.75	0.55	0.0018	0.00	0.82	0.21	42.96
A-4	A-4	R5	0.018	0.177	0.338	0.015	36.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.72	0.19	33.78
B-1	B-1	R5	0.063	0.285	0.464	0.015	35.6	0.35	0.10	3.75	0.55	0.0018	0.00	0.71	0.19	33.37
B-2	B-2	R5	0.062	0.289	0.556	0.015	47.4	0.35	0.10	3.75	0.55	0.0018	0.00	0.84	0.22	45.55
C-1	C-1	R5	0.036	0.303	0.429	0.015	47.4	0.35	0.10	3.75	0.55	0.0018	0.00	0.84	0.22	45.54
D-1	D-1	R5	0.032	0.204	0.387	0.015	47.7	0.35	0.10	3.75	0.55	0.0018	0.00	0.84	0.22	45.90
E-1	E-1	R5	0.124	0.365	0.621	0.015	47.5	0.35	0.10	3.75	0.55	0.0018	0.00	0.84	0.22	45.72
F-1	F-1	R5	0.046	0.292	0.509	0.015	54.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.87	0.25	52.36
F-2	F-2	R5	0.029	0.169	0.290	0.015	37.9	0.35	0.10	3.75	0.55	0.0018	0.00	0.76	0.19	35.79
OS-1	OS-1	R5	0.013	0.110	0.215	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.04	0.02	1.60
OS-2	OS-2	R5	0.013	0.130	0.237	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.04	0.02	1.60
OS-3	OS-3	R5	0.008	0.106	0.177	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.00	0.02	1.58
OS-4	OS-4	R5	0.004	0.157	0.233	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.00	0.02	1.58
OS-5	OS-5	R5	0.008	0.056	0.101	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.00	0.02	1.58

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

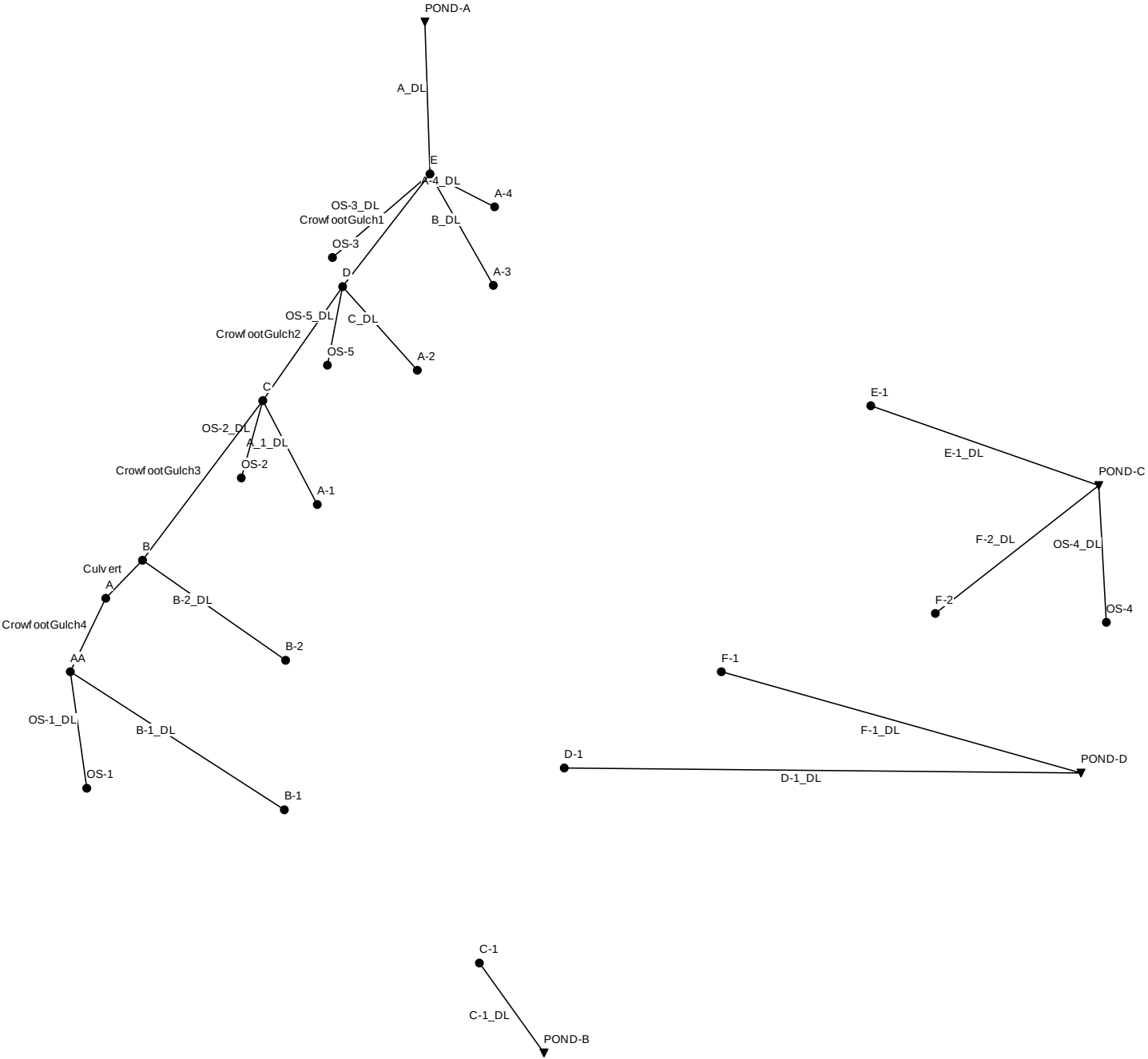
Catchment Name/ID	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A-1	0.088	0.111	36.5	4.61	19.0	3.26	7.7	24	67,569	2.13	144,005	45.0	33	143,677	1.75
A-2	0.089	0.126	28.0	4.22	14.6	2.98	7.0	42	91,663	2.12	194,338	40.0	53	193,670	2.10
A-3	0.091	0.086	34.5	3.79	17.9	2.67	6.3	17	44,914	2.05	92,110	45.0	22	91,851	1.76
A-4	0.096	0.072	44.2	3.95	23.0	2.79	6.6	12	41,041	1.94	79,606	45.0	16	79,452	1.42
B-1	0.096	0.128	36.7	5.09	19.1	3.60	8.5	52	147,305	1.93	285,013	45.0	67	284,323	1.65
B-2	0.090	0.150	32.1	5.19	16.7	3.67	8.6	58	143,319	2.08	298,553	45.0	75	297,886	1.89
C-1	0.090	0.118	36.8	4.83	19.1	3.41	8.1	30	84,224	2.08	175,432	45.0	40	174,979	1.72
D-1	0.090	0.113	30.3	4.12	15.8	2.91	6.9	32	75,241	2.09	157,067	40.0	41	156,390	1.96
E-1	0.090	0.206	27.6	5.85	14.3	4.13	9.8	135	288,530	2.09	601,656	40.0	169	600,032	2.13
F-1	0.087	0.140	31.9	4.93	16.6	3.48	8.2	43	106,935	2.17	231,771	45.0	57	231,139	1.94
F-2	0.095	0.094	30.4	3.69	15.8	2.61	6.2	29	68,440	1.96	134,360	40.0	35	133,739	1.88
OS-1	0.156	0.067	46.6	3.88	24.2	2.74	6.5	8	30,492	1.53	46,526	50.0	10	46,432	1.17
OS-2	0.156	0.067	53.1	4.22	27.6	2.98	7.0	7	30,456	1.53	46,471	50.0	9	46,392	1.06
OS-3	0.156	0.054	51.8	3.64	27.0	2.57	6.1	5	18,840	1.53	28,746	50.0	6	28,674	1.08
OS-4	0.156	0.040	94.8	4.44	49.3	3.14	7.4	1	10,019	1.53	15,287	65.0	2	15,273	0.68
OS-5	0.156	0.052	29.9	2.70	15.5	1.91	4.5	8	17,823	1.53	27,196	40.0	8	26,785	1.59

Summary of CUHP Input Parameters (Version 2.0.0)

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			Percent Eff. Imperv.
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in./hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	
A-1	A-1	R100	0.029	0.252	0.466	0.015	51.2	0.35	0.10	3.75	0.55	0.0018	0.00	0.86	0.23	50.15
A-2	A-2	R100	0.039	0.238	0.369	0.015	50.3	0.35	0.10	3.75	0.55	0.0018	0.00	0.85	0.23	49.27
A-3	A-3	R100	0.019	0.192	0.299	0.015	44.8	0.35	0.10	3.75	0.55	0.0018	0.00	0.82	0.21	43.74
A-4	A-4	R100	0.018	0.177	0.338	0.015	36.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.72	0.19	34.73
B-1	B-1	R100	0.063	0.285	0.464	0.015	35.6	0.35	0.10	3.75	0.55	0.0018	0.00	0.71	0.19	34.33
B-2	B-2	R100	0.062	0.289	0.556	0.015	47.4	0.35	0.10	3.75	0.55	0.0018	0.00	0.84	0.22	46.31
C-1	C-1	R100	0.036	0.303	0.429	0.015	47.4	0.35	0.10	3.75	0.55	0.0018	0.00	0.84	0.22	46.30
D-1	D-1	R100	0.032	0.204	0.387	0.015	47.7	0.35	0.10	3.75	0.55	0.0018	0.00	0.84	0.22	46.66
E-1	E-1	R100	0.124	0.365	0.621	0.015	47.5	0.35	0.10	3.75	0.55	0.0018	0.00	0.84	0.22	46.48
F-1	F-1	R100	0.046	0.292	0.509	0.015	54.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.87	0.25	53.06
F-2	F-2	R100	0.029	0.169	0.290	0.015	37.9	0.35	0.10	3.75	0.55	0.0018	0.00	0.76	0.19	36.67
OS-1	OS-1	R100	0.013	0.110	0.215	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.04	0.02	1.77
OS-2	OS-2	R100	0.013	0.130	0.237	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.04	0.02	1.77
OS-3	OS-3	R100	0.008	0.106	0.177	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.00	0.02	1.76
OS-4	OS-4	R100	0.004	0.157	0.233	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.00	0.02	1.76
OS-5	OS-5	R100	0.008	0.056	0.101	0.020	2.0	0.35	0.10	3.75	0.55	0.0018	0.00	0.00	0.02	1.76

TRAILS AT CROWFOOT SWMM SCHEMATIC

01/01/2005 00:05:00



TRAILS AT CROWFOOT SWMM SUMMARY 5-YEAR EVENT

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

```
-----
WARNING 08: elevation drop exceeds length for Conduit A_DL
WARNING 08: elevation drop exceeds length for Conduit C-1_DL
WARNING 08: elevation drop exceeds length for Conduit E-1_DL
WARNING 08: elevation drop exceeds length for Conduit F-1_DL
WARNING 04: minimum elevation drop used for Conduit C_DL
WARNING 04: minimum elevation drop used for Conduit B_DL
WARNING 04: minimum elevation drop used for Conduit B-2_DL
WARNING 04: minimum elevation drop used for Conduit B-1_DL
WARNING 04: minimum elevation drop used for Conduit OS-1_DL
WARNING 04: minimum elevation drop used for Conduit A_1_DL
WARNING 04: minimum elevation drop used for Conduit OS-2_DL
WARNING 04: minimum elevation drop used for Conduit OS-3_DL
WARNING 04: minimum elevation drop used for Conduit A-4_DL
WARNING 04: minimum elevation drop used for Conduit OS-5_DL
WARNING 08: elevation drop exceeds length for Conduit D-1_DL
WARNING 08: elevation drop exceeds length for Conduit F-2_DL
WARNING 08: elevation drop exceeds length for Conduit OS-4_DL
WARNING 02: maximum depth increased for Node E
WARNING 02: maximum depth increased for Node D
WARNING 02: maximum depth increased for Node C
WARNING 02: maximum depth increased for Node B
WARNING 02: maximum depth increased for Node A
WARNING 02: maximum depth increased for Node AA
```

```
*****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*****
```

***** Analysis Options *****

```
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date ..... 01/01/2005 00:00:00
Ending Date ..... 01/02/2005 06:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:05:00
Routing Time Step ..... 30.00 sec
```

```
*****
Flow Routing Continuity      Volume      Volume
                             acre-feet    10^6 gal
*****
Dry Weather Inflow .....      0.000      0.000
```

TRAILS AT CROWFOOT SWMM SUMMARY 5-YEAR EVENT

Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	20.689	6.742
External Outflow	20.796	6.777
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.516	

Highest Flow Instability Indexes

All links are stable.

***** Routing Time Step Summary *****

Minimum Time Step	:	30.00	sec
Average Time Step	:	30.00	sec
Maximum Time Step	:	30.00	sec
Percent in Steady State	:	0.00	
Average Iterations per Step	:	1.00	
Percent Not Converging	:	0.00	

***** Node Depth Summary *****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
E	JUNCTION	0.14	1.87	6003.87	0 00:58	1.87
A-1	JUNCTION	0.00	0.00	6004.74	0 00:00	0.00
A-4	JUNCTION	0.00	0.00	6002.00	0 00:00	0.00
A-3	JUNCTION	0.00	0.00	6002.00	0 00:00	0.00
B-1	JUNCTION	0.00	0.00	6007.80	0 00:00	0.00
B-2	JUNCTION	0.00	0.00	6007.00	0 00:00	0.00
A-2	JUNCTION	0.00	0.00	6003.40	0 00:00	0.00
D	JUNCTION	0.14	1.88	6005.27	0 00:53	1.88
C-1	JUNCTION	0.00	0.00	6095.00	0 00:00	0.00
C	JUNCTION	0.12	1.74	6006.48	0 00:50	1.74
E-1	JUNCTION	0.00	0.00	5980.00	0 00:00	0.00
F-1	JUNCTION	0.00	0.00	6010.00	0 00:00	0.00
B	JUNCTION	0.10	1.64	6008.64	0 00:37	1.63
A	JUNCTION	0.06	1.16	6008.66	0 00:48	1.09
AA	JUNCTION	0.06	1.29	6009.09	0 00:40	1.29
OS-1	JUNCTION	0.00	0.00	6007.80	0 00:00	0.00
OS-2	JUNCTION	0.00	0.00	6004.74	0 00:00	0.00
OS-3	JUNCTION	0.00	0.00	6002.00	0 00:00	0.00
OS-5	JUNCTION	0.00	0.00	6003.40	0 00:00	0.00

TRAILS AT CROWFOOT SWMM SUMMARY 5-YEAR EVENT

D-1	JUNCTION	0.00	0.00	6010.00	0	00:00	0.00
F-2	JUNCTION	0.00	0.00	5980.00	0	00:00	0.00
OS-4	JUNCTION	0.00	0.00	5980.00	0	00:00	0.00
POND-A	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
POND-B	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
POND-C	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
POND-D	OUTFALL	0.00	0.00	0.00	0	00:00	0.00

Node Inflow Summary

Total Inflow Volume Node gal	Flow Balance Error Percent	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	10^6
E	0.000	JUNCTION	0.00	83.23	0 00:58	0	
3.14							
A-1	0.000	JUNCTION	11.86	11.86	0 00:35	0.414	
0.414							
A-4	0.000	JUNCTION	5.01	5.01	0 00:40	0.194	
0.194							
A-3	0.000	JUNCTION	7.60	7.60	0 00:35	0.249	
0.249							
B-1	0.000	JUNCTION	20.87	20.87	0 00:40	0.692	
0.692							
B-2	0.000	JUNCTION	26.81	26.81	0 00:35	0.829	
0.829							
A-2	0.000	JUNCTION	19.60	19.60	0 00:35	0.554	
0.554							
D	0.000	JUNCTION	0.00	73.01	0 00:53	0	
2.66							
C-1	0.000	JUNCTION	14.00	14.00	0 00:35	0.487	
0.487							
C	0.000	JUNCTION	0.00	58.29	0 00:50	0	
2.07							
E-1	0.000	JUNCTION	61.42	61.42	0 00:35	1.67	
1.67							
F-1	0.000	JUNCTION	21.73	21.73	0 00:35	0.684	
0.684							
B	0.000	JUNCTION	0.00	49.11	0 00:37	0	
1.58							
A	0.000	JUNCTION	0.00	25.55	0 00:48	0	
0.746							
AA	0.000	JUNCTION	0.00	22.69	0 00:40	0	
0.746							
OS-1	0.000	JUNCTION	1.82	1.82	0 00:40	0.0542	
0.0542							

TRAILS AT CROWFOOT SWMM SUMMARY 5-YEAR EVENT

OS-2		JUNCTION	1.62	1.62	0	00:40	0.0542
0.0542	0.000						
OS-3		JUNCTION	1.02	1.02	0	00:40	0.0335
0.0335	0.000						
OS-5		JUNCTION	1.55	1.55	0	00:35	0.0313
0.0313	0.000						
D-1		JUNCTION	14.66	14.66	0	00:35	0.437
0.437	0.000						
F-2		JUNCTION	11.64	11.64	0	00:35	0.335
0.335	0.000						
OS-4		JUNCTION	0.31	0.31	0	00:45	0.0178
0.0178	0.000						
POND-A		OUTFALL	0.00	83.23	0	00:58	0
3.14	0.000						
POND-B		OUTFALL	0.00	14.00	0	00:35	0
0.487	0.000						
POND-C		OUTFALL	0.00	73.35	0	00:35	0
2.03	0.000						
POND-D		OUTFALL	0.00	36.39	0	00:35	0
1.12	0.000						

***** Node Flooding Summary *****

No nodes were flooded.

***** Outfall Loading Summary *****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
POND-A	61.22	6.35	83.23	3.141
POND-B	13.58	4.44	14.00	0.487
POND-C	20.81	12.06	73.35	2.027
POND-D	12.67	10.95	36.39	1.121
System	27.07	33.80	178.01	6.776

***** Link Flow Summary *****

Link	Type	Maximum Flow CFS	Time of Max Occurrence days hr:min	Maximum Veloc ft/sec	Max/ Full Flow	Max/ Full Depth
A_DL	DUMMY	83.23	0 00:58			
C-1_DL	DUMMY	14.00	0 00:35			
E-1_DL	DUMMY	61.42	0 00:35			

TRAILS AT CROWFOOT SWMM SUMMARY 5-YEAR EVENT

F-1_DL	DUMMY	21.73	0	00:35			
CrowfootGulch4	CHANNEL	25.55	0	00:48	1.62	0.04	0.25
Culvert	CONDUIT	24.70	0	00:48	5.77	0.11	0.18
CrowfootGulch2	CHANNEL	57.33	0	00:55	1.74	0.08	0.36
C_DL	DUMMY	19.60	0	00:35			
B_DL	DUMMY	7.60	0	00:35			
B-2_DL	DUMMY	26.81	0	00:35			
B-1_DL	DUMMY	20.87	0	00:40			
OS-1_DL	DUMMY	1.82	0	00:40			
A_1_DL	DUMMY	11.86	0	00:35			
OS-2_DL	DUMMY	1.62	0	00:40			
OS-3_DL	DUMMY	1.02	0	00:40			
A-4_DL	DUMMY	5.01	0	00:40			
CrowfootGulch1	CHANNEL	72.27	0	00:58	1.83	0.10	0.39
OS-5_DL	DUMMY	1.55	0	00:35			
CrowfootGulch3	CHANNEL	46.30	0	00:50	1.77	0.07	0.33
D-1_DL	DUMMY	14.66	0	00:35			
F-2_DL	DUMMY	11.64	0	00:35			
OS-4_DL	DUMMY	0.31	0	00:45			

***** Conduit Surcharge Summary *****

No conduits were surcharged.

Analysis begun on: Thu Apr 05 11:47:11 2018
Analysis ended on: Thu Apr 05 11:47:11 2018
Total elapsed time: < 1 sec

TRAILS AT CROWFOOT SWMM SUMMARY 100-YEAR EVENT

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

```

-----
WARNING 08: elevation drop exceeds length for Conduit A_DL
WARNING 08: elevation drop exceeds length for Conduit C-1_DL
WARNING 08: elevation drop exceeds length for Conduit E-1_DL
WARNING 08: elevation drop exceeds length for Conduit F-1_DL
WARNING 04: minimum elevation drop used for Conduit C_DL
WARNING 04: minimum elevation drop used for Conduit B_DL
WARNING 04: minimum elevation drop used for Conduit B-2_DL
WARNING 04: minimum elevation drop used for Conduit B-1_DL
WARNING 04: minimum elevation drop used for Conduit OS-1_DL
WARNING 04: minimum elevation drop used for Conduit A_1_DL
WARNING 04: minimum elevation drop used for Conduit OS-2_DL
WARNING 04: minimum elevation drop used for Conduit OS-3_DL
WARNING 04: minimum elevation drop used for Conduit A-4_DL
WARNING 04: minimum elevation drop used for Conduit OS-5_DL
WARNING 08: elevation drop exceeds length for Conduit D-1_DL
WARNING 08: elevation drop exceeds length for Conduit F-2_DL
WARNING 08: elevation drop exceeds length for Conduit OS-4_DL
WARNING 02: maximum depth increased for Node E
WARNING 02: maximum depth increased for Node D
WARNING 02: maximum depth increased for Node C
WARNING 02: maximum depth increased for Node B
WARNING 02: maximum depth increased for Node A
WARNING 02: maximum depth increased for Node AA

```

```

*****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*****

```

***** Analysis Options *****

```

Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date ..... 01/01/2005 00:00:00
Ending Date ..... 01/02/2005 06:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:05:00
Routing Time Step ..... 30.00 sec

```

*****	Volume	Volume
Flow Routing Continuity	acre-feet	10^6 gal
*****	-----	-----
Dry Weather Inflow	0.000	0.000

TRAILS AT CROWFOOT SWMM SUMMARY 100-YEAR EVENT

Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	58.554	19.081
External Outflow	58.660	19.115
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.181	

Highest Flow Instability Indexes

All links are stable.

***** Routing Time Step Summary *****

Minimum Time Step	:	30.00	sec
Average Time Step	:	30.00	sec
Maximum Time Step	:	30.00	sec
Percent in Steady State	:	0.00	
Average Iterations per Step	:	1.00	
Percent Not Converging	:	0.00	

***** Node Depth Summary *****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
E	JUNCTION	0.21	3.02	6005.02	0 00:57	3.01
A-1	JUNCTION	0.00	0.00	6004.74	0 00:00	0.00
A-4	JUNCTION	0.00	0.00	6002.00	0 00:00	0.00
A-3	JUNCTION	0.00	0.00	6002.00	0 00:00	0.00
B-1	JUNCTION	0.00	0.00	6007.80	0 00:00	0.00
B-2	JUNCTION	0.00	0.00	6007.00	0 00:00	0.00
A-2	JUNCTION	0.00	0.00	6003.40	0 00:00	0.00
D	JUNCTION	0.21	3.03	6006.42	0 00:53	3.02
C-1	JUNCTION	0.00	0.00	6095.00	0 00:00	0.00
C	JUNCTION	0.18	2.73	6007.48	0 00:52	2.73
E-1	JUNCTION	0.00	0.00	5980.00	0 00:00	0.00
F-1	JUNCTION	0.00	0.00	6010.00	0 00:00	0.00
B	JUNCTION	0.15	2.49	6009.49	0 00:45	2.49
A	JUNCTION	0.12	1.91	6009.41	0 00:46	1.91
AA	JUNCTION	0.12	1.91	6009.72	0 00:45	1.91
OS-1	JUNCTION	0.00	0.00	6007.80	0 00:00	0.00
OS-2	JUNCTION	0.00	0.00	6004.74	0 00:00	0.00
OS-3	JUNCTION	0.00	0.00	6002.00	0 00:00	0.00
OS-5	JUNCTION	0.00	0.00	6003.40	0 00:00	0.00

TRAILS AT CROWFOOT SWMM SUMMARY 100-YEAR EVENT

D-1	JUNCTION	0.00	0.00	6010.00	0	00:00	0.00
F-2	JUNCTION	0.00	0.00	5980.00	0	00:00	0.00
OS-4	JUNCTION	0.00	0.00	5980.00	0	00:00	0.00
POND-A	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
POND-B	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
POND-C	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
POND-D	OUTFALL	0.00	0.00	0.00	0	00:00	0.00

Node Inflow Summary

Total Inflow Volume Node gal	Flow Balance Error Percent	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	10^6
E	0.000	JUNCTION	0.00	280.45	0 00:56	0	
9.3							
A-1	0.000	JUNCTION	32.59	32.59	0 00:45	1.07	
1.07							
A-4	0.000	JUNCTION	16.11	16.11	0 00:45	0.594	
0.594							
A-3	0.000	JUNCTION	21.76	21.76	0 00:45	0.687	
0.687							
B-1	0.000	JUNCTION	66.84	66.84	0 00:45	2.13	
2.13							
B-2	0.000	JUNCTION	74.73	74.73	0 00:45	2.23	
2.23							
A-2	0.000	JUNCTION	53.08	53.08	0 00:40	1.45	
1.45							
D	0.000	JUNCTION	0.00	240.76	0 00:53	0	
7.8							
C-1	0.000	JUNCTION	39.86	39.86	0 00:45	1.31	
1.31							
C	0.000	JUNCTION	0.00	188.03	0 00:52	0	
6.15							
E-1	0.000	JUNCTION	169.18	169.18	0 00:40	4.49	
4.49							
F-1	0.000	JUNCTION	57.15	57.15	0 00:45	1.73	
1.73							
B	0.000	JUNCTION	0.00	150.81	0 00:45	0	
4.7							
A	0.000	JUNCTION	0.00	76.45	0 00:46	0	
2.47							
AA	0.000	JUNCTION	0.00	76.61	0 00:45	0	
2.47							
OS-1	0.000	JUNCTION	9.80	9.80	0 00:50	0.347	
0.347							

TRAILS AT CROWFOOT SWMM SUMMARY 100-YEAR EVENT

OS-2		JUNCTION	8.90	8.90	0	00:50	0.347
0.347	0.000						
OS-3		JUNCTION	5.59	5.59	0	00:50	0.214
0.214	0.000						
OS-5		JUNCTION	7.82	7.82	0	00:40	0.2
0.2	0.000						
D-1		JUNCTION	40.63	40.63	0	00:40	1.17
1.17	0.000						
F-2		JUNCTION	35.39	35.39	0	00:40	1
1	0.000						
OS-4		JUNCTION	1.87	1.87	0	01:05	0.114
0.114	0.000						
POND-A		OUTFALL	0.00	280.45	0	00:56	0
9.3	0.000						
POND-B		OUTFALL	0.00	39.86	0	00:45	0
1.31	0.000						
POND-C		OUTFALL	0.00	206.09	0	00:40	0
5.6	0.000						
POND-D		OUTFALL	0.00	97.76	0	00:40	0
2.9	0.000						

***** Node Flooding Summary *****

No nodes were flooded.

***** Outfall Loading Summary *****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
POND-A	61.83	18.62	280.45	9.303
POND-B	13.83	11.71	39.86	1.309
POND-C	22.75	30.49	206.09	5.603
POND-D	12.92	27.78	97.76	2.899
System	27.83	88.60	592.52	19.114

***** Link Flow Summary *****

Link	Type	Maximum Flow CFS	Time of Max Occurrence days hr:min	Maximum Veloc ft/sec	Max/ Full Flow	Max/ Full Depth
A_DL	DUMMY	280.45	0 00:56			
C-1_DL	DUMMY	39.86	0 00:45			
E-1_DL	DUMMY	169.18	0 00:40			

TRAILS AT CROWFOOT SWMM SUMMARY 100-YEAR EVENT

F-1_DL	DUMMY	57.15	0	00:45			
CrowfootGulch4	CHANNEL	76.45	0	00:46	1.73	0.11	0.39
Culvert	CONDUIT	76.47	0	00:46	8.21	0.35	0.39
CrowfootGulch2	CHANNEL	187.29	0	00:55	2.33	0.27	0.56
C_DL	DUMMY	53.08	0	00:40			
B_DL	DUMMY	21.76	0	00:45			
B-2_DL	DUMMY	74.73	0	00:45			
B-1_DL	DUMMY	66.84	0	00:45			
OS-1_DL	DUMMY	9.80	0	00:50			
A_1_DL	DUMMY	32.59	0	00:45			
OS-2_DL	DUMMY	8.90	0	00:50			
OS-3_DL	DUMMY	5.59	0	00:50			
A-4_DL	DUMMY	16.11	0	00:45			
CrowfootGulch1	CHANNEL	239.82	0	00:57	2.53	0.34	0.62
OS-5_DL	DUMMY	7.82	0	00:40			
CrowfootGulch3	CHANNEL	147.90	0	00:52	2.18	0.21	0.51
D-1_DL	DUMMY	40.63	0	00:40			
F-2_DL	DUMMY	35.39	0	00:40			
OS-4_DL	DUMMY	1.87	0	01:05			

 Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Thu Apr 05 11:45:55 2018
 Analysis ended on: Thu Apr 05 11:45:55 2018
 Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

WARNING 08: elevation drop exceeds length for Conduit A_DL
 WARNING 08: elevation drop exceeds length for Conduit C-1_DL
 WARNING 08: elevation drop exceeds length for Conduit E-1_DL
 WARNING 08: elevation drop exceeds length for Conduit F-1_DL
 WARNING 04: minimum elevation drop used for Conduit C_DL
 WARNING 04: minimum elevation drop used for Conduit B_DL
 WARNING 04: minimum elevation drop used for Conduit B-2_DL
 WARNING 04: minimum elevation drop used for Conduit B-1_DL
 WARNING 04: minimum elevation drop used for Conduit OS-1_DL
 WARNING 04: minimum elevation drop used for Conduit A_1_DL
 WARNING 04: minimum elevation drop used for Conduit OS-2_DL
 WARNING 04: minimum elevation drop used for Conduit OS-3_DL
 WARNING 04: minimum elevation drop used for Conduit A-4_DL
 WARNING 04: minimum elevation drop used for Conduit OS-5_DL
 WARNING 08: elevation drop exceeds length for Conduit D-1_DL
 WARNING 08: elevation drop exceeds length for Conduit F-2_DL
 WARNING 08: elevation drop exceeds length for Conduit OS-4_DL
 WARNING 02: maximum depth increased for Node E
 WARNING 02: maximum depth increased for Node D
 WARNING 02: maximum depth increased for Node C
 WARNING 02: maximum depth increased for Node B
 WARNING 02: maximum depth increased for Node A
 WARNING 02: maximum depth increased for Node AA

NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.

Analysis Options

Flow Units CFS

Process Models:

Rainfall/Runoff NO

RDII NO

Snowmelt NO

Groundwater NO

Flow Routing YES

Ponding Allowed NO

Water Quality NO

Flow Routing Method KINWAVE

Starting Date 01/01/2005 00:00:00

Ending Date 01/02/2005 06:00:00

Antecedent Dry Days 0.0

Report Time Step 00:05:55

Routing Time Step 30.00 sec

	Volume	Volume
Flow Routing Continuity	acre-feet	10 ⁶ gal
	-----	-----
Dry Weather Inflow	0.000	0.000

POND A: UDFCD 100-YEAR SWMM W/ 5.92 MINUTE TIME STEP

Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	58.554	19.081
External Outflow	58.660	19.115
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.181	

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	30.00	sec
Average Time Step	:	30.00	sec
Maximum Time Step	:	30.00	sec
Percent in Steady State	:	0.00	
Average Iterations per Step	:	1.00	
Percent Not Converging	:	0.00	

Node Depth Summary

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
E	JUNCTION	0.21	3.02	6005.02	0 00:57	3.02
A-1	JUNCTION	0.00	0.00	6004.74	0 00:00	0.00
A-4	JUNCTION	0.00	0.00	6002.00	0 00:00	0.00
A-3	JUNCTION	0.00	0.00	6002.00	0 00:00	0.00
B-1	JUNCTION	0.00	0.00	6007.80	0 00:00	0.00
B-2	JUNCTION	0.00	0.00	6007.00	0 00:00	0.00
A-2	JUNCTION	0.00	0.00	6003.40	0 00:00	0.00
D	JUNCTION	0.21	3.03	6006.42	0 00:53	3.03
C-1	JUNCTION	0.00	0.00	6095.00	0 00:00	0.00
C	JUNCTION	0.18	2.73	6007.48	0 00:52	2.73
E-1	JUNCTION	0.00	0.00	5980.00	0 00:00	0.00
F-1	JUNCTION	0.00	0.00	6010.00	0 00:00	0.00
B	JUNCTION	0.15	2.49	6009.49	0 00:45	2.49
A	JUNCTION	0.12	1.91	6009.41	0 00:46	1.91
AA	JUNCTION	0.12	1.91	6009.72	0 00:45	1.91
OS-1	JUNCTION	0.00	0.00	6007.80	0 00:00	0.00
OS-2	JUNCTION	0.00	0.00	6004.74	0 00:00	0.00
OS-3	JUNCTION	0.00	0.00	6002.00	0 00:00	0.00
OS-5	JUNCTION	0.00	0.00	6003.40	0 00:00	0.00

POND A: UDFCD 100-YEAR SWMM W/ 5.92 MINUTE TIME STEP

D-1	JUNCTION	0.00	0.00	6010.00	0	00:00	0.00
F-2	JUNCTION	0.00	0.00	5980.00	0	00:00	0.00
OS-4	JUNCTION	0.00	0.00	5980.00	0	00:00	0.00
POND-A	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
POND-B	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
POND-C	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
POND-D	OUTFALL	0.00	0.00	0.00	0	00:00	0.00

Node Inflow Summary

Total Inflow Volume Node gal	Flow Balance Error Percent	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	10^6
E	0.000	JUNCTION	0.00	280.45	0 00:56	0	
9.3							
A-1	0.000	JUNCTION	32.59	32.59	0 00:45	1.07	
1.07							
A-4	0.000	JUNCTION	16.11	16.11	0 00:45	0.594	
0.594							
A-3	0.000	JUNCTION	21.76	21.76	0 00:45	0.687	
0.687							
B-1	0.000	JUNCTION	66.84	66.84	0 00:45	2.13	
2.13							
B-2	0.000	JUNCTION	74.73	74.73	0 00:45	2.23	
2.23							
A-2	0.000	JUNCTION	53.08	53.08	0 00:40	1.45	
1.45							
D	0.000	JUNCTION	0.00	240.76	0 00:53	0	
7.8							
C-1	0.000	JUNCTION	39.86	39.86	0 00:45	1.31	
1.31							
C	0.000	JUNCTION	0.00	188.03	0 00:52	0	
6.15							
E-1	0.000	JUNCTION	169.18	169.18	0 00:40	4.49	
4.49							
F-1	0.000	JUNCTION	57.15	57.15	0 00:45	1.73	
1.73							
B	0.000	JUNCTION	0.00	150.81	0 00:45	0	
4.7							
A	0.000	JUNCTION	0.00	76.45	0 00:46	0	
2.47							
AA	0.000	JUNCTION	0.00	76.61	0 00:45	0	
2.47							
OS-1	0.000	JUNCTION	9.80	9.80	0 00:50	0.347	
0.347							

POND A: UDFCD 100-YEAR SWMM W/ 5.92 MINUTE TIME STEP

OS-2		JUNCTION	8.90	8.90	0	00:50	0.347
0.347	0.000						
OS-3		JUNCTION	5.59	5.59	0	00:50	0.214
0.214	0.000						
OS-5		JUNCTION	7.82	7.82	0	00:40	0.2
0.2	0.000						
D-1		JUNCTION	40.63	40.63	0	00:40	1.17
1.17	0.000						
F-2		JUNCTION	35.39	35.39	0	00:40	1
1	0.000						
OS-4		JUNCTION	1.87	1.87	0	01:05	0.114
0.114	0.000						
POND-A		OUTFALL	0.00	280.45	0	00:56	0
9.3	0.000						
POND-B		OUTFALL	0.00	39.86	0	00:45	0
1.31	0.000						
POND-C		OUTFALL	0.00	206.09	0	00:40	0
5.6	0.000						
POND-D		OUTFALL	0.00	97.76	0	00:40	0
2.9	0.000						

Node Flooding Summary

No nodes were flooded.

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
POND-A	61.83	18.62	280.45	9.303
POND-B	13.83	11.71	39.86	1.309
POND-C	22.75	30.49	206.09	5.603
POND-D	12.92	27.78	97.76	2.899
System	27.83	88.60	592.52	19.114

Link Flow Summary

Link	Type	Maximum Flow CFS	Time of Max Occurrence days hr:min	Maximum Veloc ft/sec	Max/ Full Flow	Max/ Full Depth
A_DL	DUMMY	280.45	0 00:56			
C-1_DL	DUMMY	39.86	0 00:45			
E-1_DL	DUMMY	169.18	0 00:40			

POND A: UDFCD 100-YEAR SWMM W/ 5.92 MINUTE TIME STEP

F-1_DL	DUMMY	57.15	0	00:45			
CrowfootGulch4	CHANNEL	76.45	0	00:46	1.73	0.11	0.39
Culvert	CONDUIT	76.47	0	00:46	8.21	0.35	0.39
CrowfootGulch2	CHANNEL	187.29	0	00:55	2.33	0.27	0.56
C_DL	DUMMY	53.08	0	00:40			
B_DL	DUMMY	21.76	0	00:45			
B-2_DL	DUMMY	74.73	0	00:45			
B-1_DL	DUMMY	66.84	0	00:45			
OS-1_DL	DUMMY	9.80	0	00:50			
A_1_DL	DUMMY	32.59	0	00:45			
OS-2_DL	DUMMY	8.90	0	00:50			
OS-3_DL	DUMMY	5.59	0	00:50			
A-4_DL	DUMMY	16.11	0	00:45			
CrowfootGulch1	CHANNEL	239.82	0	00:57	2.53	0.34	0.62
OS-5_DL	DUMMY	7.82	0	00:40			
CrowfootGulch3	CHANNEL	147.90	0	00:52	2.18	0.21	0.51
D-1_DL	DUMMY	40.63	0	00:40			
F-2_DL	DUMMY	35.39	0	00:40			
OS-4_DL	DUMMY	1.87	0	01:05			

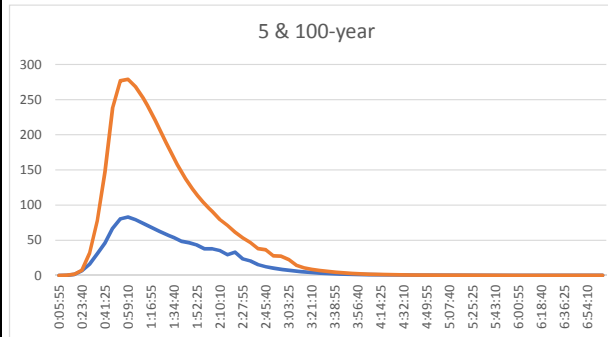
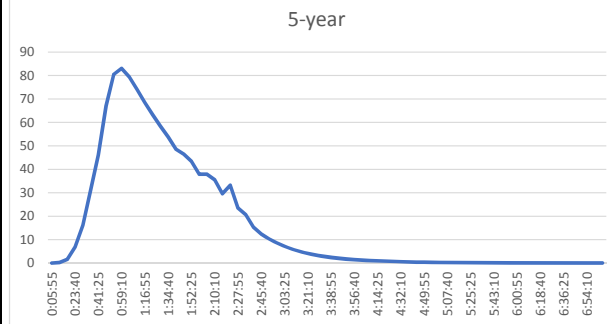
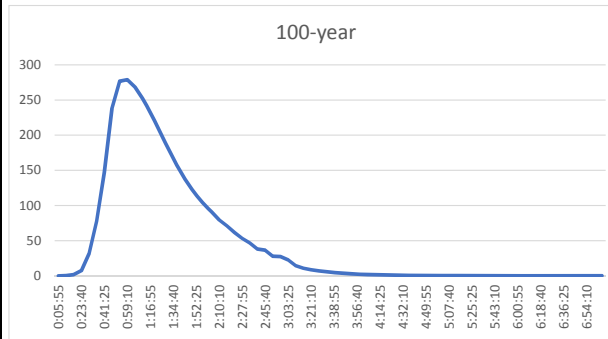
 Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Mon Apr 09 17:16:30 2018
 Analysis ended on: Mon Apr 09 17:16:30 2018
 Total elapsed time: < 1 sec

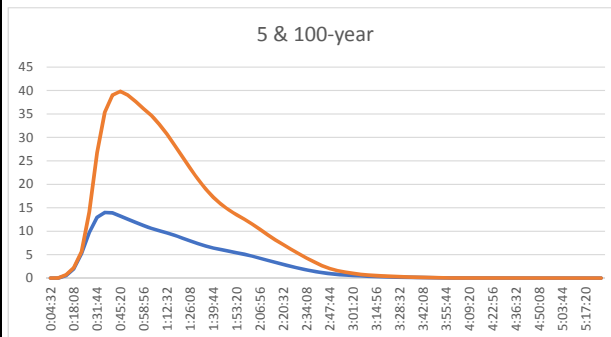
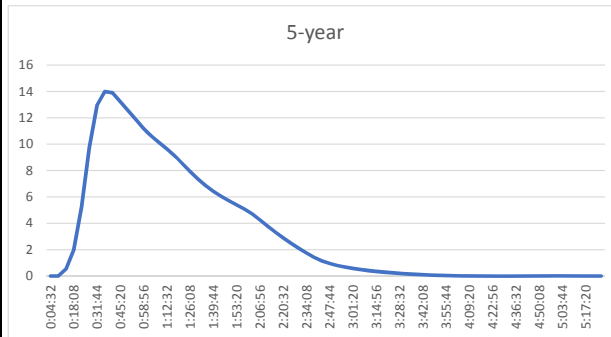
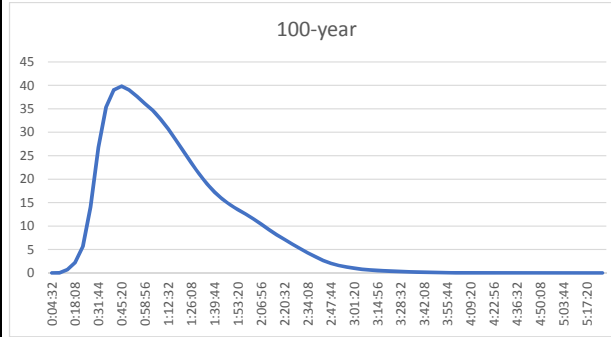
SWMM OUTPUT AT NODE POND-A

POND A INFLOW HYDROGRAPH			
TIME INTERVAL		5.92	MINUTES
5-YEAR		100-YEAR	
TIME	INFLOW	TIME	INFLOW
HOURS	CFS	HOURS	CFS
0:05:55	0	0:05:55	0
0:11:50	0.22	0:11:50	0.3
0:17:45	1.63	0:17:45	1.85
0:23:40	6.78	0:23:40	7.53
0:29:35	16.14	0:29:35	31.71
0:35:30	30.82	0:35:30	77.69
0:41:25	46.09	0:41:25	147.19
0:47:20	67.04	0:47:20	238.41
0:53:15	80.48	0:53:15	276.75
0:59:10	83.04	0:59:10	278.84
1:05:05	79.4	1:05:05	268.32
1:11:00	74.05	1:11:00	252.12
1:16:55	68.52	1:16:55	232.93
1:22:50	63.3	1:22:50	210.82
1:28:45	58.46	1:28:45	188.29
1:34:40	53.83	1:34:40	166.76
1:40:35	48.61	1:40:35	147.09
1:46:30	46.54	1:46:30	129.8
1:52:25	43.43	1:52:25	114.94
1:58:20	37.91	1:58:20	102.26
2:04:15	37.9	2:04:15	91.24
2:10:10	35.52	2:10:10	79.59
2:16:05	29.58	2:16:05	71.04
2:22:00	33.23	2:22:00	61.59
2:27:55	23.55	2:27:55	53.47
2:33:50	20.68	2:33:50	46.9
2:39:45	15.3	2:39:45	38.23
2:45:40	12.41	2:45:40	36.63
2:51:35	10.3	2:51:35	28
2:57:30	8.58	2:57:30	27.34
3:03:25	7.14	3:03:25	22.62
3:09:20	5.93	3:09:20	14.44
3:15:15	4.92	3:15:15	10.85
3:21:10	4.12	3:21:10	8.61
3:27:05	3.46	3:27:05	6.97
3:33:00	2.91	3:33:00	5.69
3:38:55	2.45	3:38:55	4.64
3:44:50	2.06	3:44:50	3.77
3:50:45	1.74	3:50:45	3.07
3:56:40	1.47	3:56:40	2.51
4:02:35	1.24	4:02:35	2.05
4:08:30	1.06	4:08:30	1.67
4:14:25	0.9	4:14:25	1.37
4:20:20	0.77	4:20:20	1.13
4:26:15	0.65	4:26:15	0.93
4:32:10	0.56	4:32:10	0.78
4:38:05	0.48	4:38:05	0.65
4:44:00	0.42	4:44:00	0.55
4:49:55	0.37	4:49:55	0.48
4:55:50	0.32	4:55:50	0.41
5:01:45	0.28	5:01:45	0.36
5:07:40	0.25	5:07:40	0.31
5:13:35	0.22	5:13:35	0.27
5:19:30	0.2	5:19:30	0.24
5:25:25	0.18	5:25:25	0.21
5:31:20	0.16	5:31:20	0.18
5:37:15	0.14	5:37:15	0.17
5:43:10	0.13	5:43:10	0.15
5:49:05	0.12	5:49:05	0.13
5:55:00	0.11	5:55:00	0.12
6:00:55	0.1	6:00:55	0.11
6:06:50	0.09	6:06:50	0.1
6:12:45	0.08	6:12:45	0.09
6:18:40	0.08	6:18:40	0.08
6:24:35	0.07	6:24:35	0.08
6:30:30	0.07	6:30:30	0.07
6:36:25	0.06	6:36:25	0.07
6:42:20	0.06	6:42:20	0.06
6:48:15	0.05	6:48:15	0.06
6:54:10	0.05	6:54:10	0.05
7:00:05	0.05	7:00:05	0.05
7:06:00	0.04	7:06:00	0.05



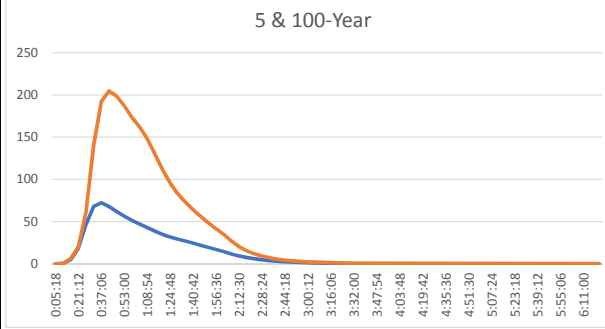
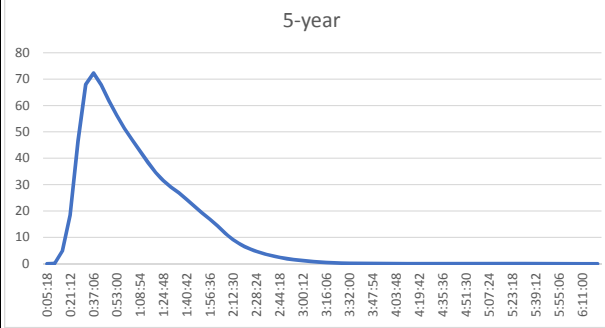
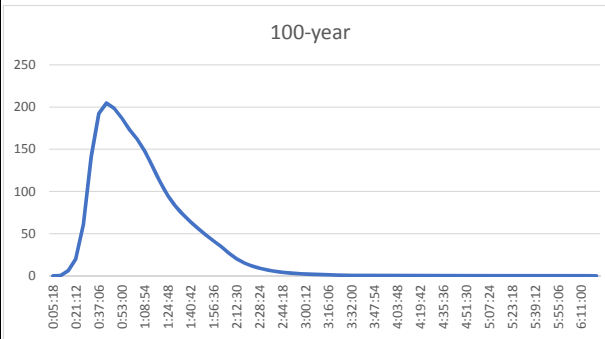
SWMM OUTPUT AT NODE POND-B

POND B INFLOW HYDROGRAPH			
TIME INTERVAL		4.53	MINUTES
5-YEAR		100-YEAR	
TIME	INFLOW	TIME	INFLOW
HOURS	CFS	HOURS	CFS
0:04:32	0	0:04:32	0
0:09:04	0	0:09:04	0.03
0:13:36	0.54	0:13:36	0.7
0:18:08	1.98	0:18:08	2.22
0:22:40	5.25	0:22:40	5.67
0:27:12	9.73	0:27:12	14.08
0:31:44	12.96	0:31:44	26.79
0:36:16	13.99	0:36:16	35.38
0:40:48	13.9	0:40:48	39.02
0:45:20	13.22	0:45:20	39.83
0:49:52	12.55	0:49:52	39
0:54:24	11.87	0:54:24	37.64
0:58:56	11.2	0:58:56	36.14
1:03:28	10.61	1:03:28	34.68
1:08:00	10.13	1:08:00	32.86
1:12:32	9.65	1:12:32	30.7
1:17:04	9.12	1:17:04	28.38
1:21:36	8.53	1:21:36	25.9
1:26:08	7.93	1:26:08	23.46
1:30:40	7.36	1:30:40	21.16
1:35:12	6.86	1:35:12	19.01
1:39:44	6.42	1:39:44	17.19
1:44:16	6.05	1:44:16	15.75
1:48:48	5.71	1:48:48	14.56
1:53:20	5.39	1:53:20	13.5
1:57:52	5.08	1:57:52	12.53
2:02:24	4.71	2:02:24	11.52
2:06:56	4.25	2:06:56	10.38
2:11:28	3.78	2:11:28	9.24
2:16:00	3.33	2:16:00	8.16
2:20:32	2.9	2:20:32	7.14
2:25:04	2.5	2:25:04	6.17
2:29:36	2.11	2:29:36	5.22
2:34:08	1.75	2:34:08	4.3
2:38:40	1.42	2:38:40	3.44
2:43:12	1.15	2:43:12	2.65
2:47:44	0.95	2:47:44	2.04
2:52:16	0.8	2:52:16	1.6
2:56:48	0.68	2:56:48	1.26
3:01:20	0.58	3:01:20	1
3:05:52	0.49	3:05:52	0.79
3:10:24	0.41	3:10:24	0.62
3:14:56	0.35	3:14:56	0.5
3:19:28	0.29	3:19:28	0.4
3:24:00	0.24	3:24:00	0.33
3:28:32	0.2	3:28:32	0.27
3:33:04	0.16	3:33:04	0.22
3:37:36	0.13	3:37:36	0.18
3:42:08	0.1	3:42:08	0.14
3:46:40	0.07	3:46:40	0.11
3:51:12	0.05	3:51:12	0.08
3:55:44	0.04	3:55:44	0.05
4:00:16	0.02	4:00:16	0.03
4:04:48	0.01	4:04:48	0.02
4:09:20	0.01	4:09:20	0.01
4:13:52	0	4:13:52	0
4:18:24	0	4:18:24	0
4:22:56	0	4:22:56	0
4:27:28	0	4:27:28	0
4:32:00	0	4:32:00	0
4:36:32	0	4:36:32	0
4:41:04	0	4:41:04	0
4:45:36	0	4:45:36	0
4:50:08	0	4:50:08	0
4:54:40	0	4:54:40	0
4:59:12	0	4:59:12	0
5:03:44	0	5:03:44	0
5:08:16	0	5:08:16	0
5:12:48	0	5:12:48	0
5:17:20	0	5:17:20	0
5:21:52	0	5:21:52	0
5:26:24	0	5:26:24	0



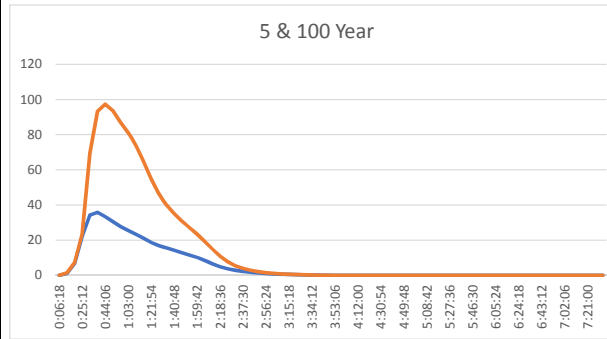
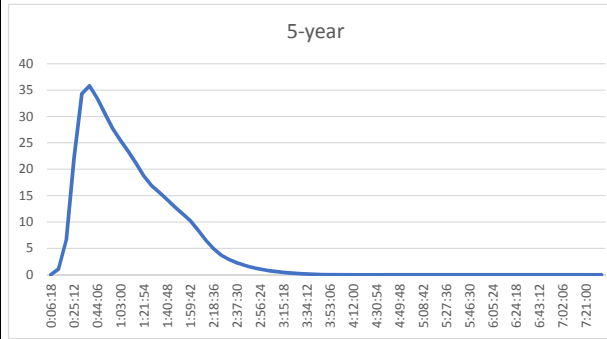
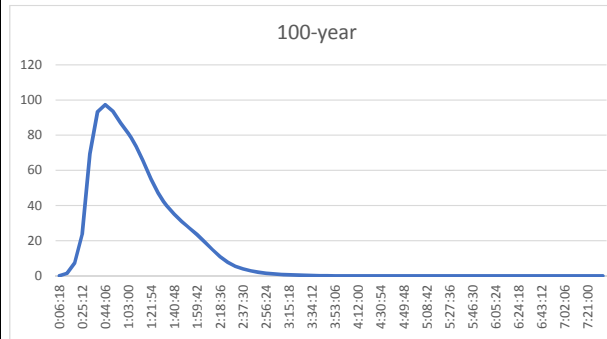
SWMM OUTPUT AT NODE POND-C

POND C INFLOW HYDROGRAPH			
TIME INTERVAL		5.30	MINUTES
5-YEAR		100-YEAR	
TIME	INFLOW	TIME	INFLOW
HOURS	CFS	HOURS	CFS
0:05:18	0	0:05:18	0
0:10:36	0.08	0:10:36	0.27
0:15:54	4.97	0:15:54	6.12
0:21:12	18.41	0:21:12	20.08
0:26:30	46.57	0:26:30	60.97
0:31:48	67.99	0:31:48	140.84
0:37:06	72.29	0:37:06	192.31
0:42:24	67.79	0:42:24	204.75
0:47:42	61.81	0:47:42	198.49
0:53:00	56.29	0:53:00	186.76
0:58:18	51.33	0:58:18	173.47
1:03:36	46.9	1:03:36	161.94
1:08:54	42.74	1:08:54	147.75
1:14:12	38.54	1:14:12	130.02
1:19:30	34.62	1:19:30	111.29
1:24:48	31.51	1:24:48	95.37
1:30:06	29.06	1:30:06	82.84
1:35:24	26.93	1:35:24	72.69
1:40:42	24.44	1:40:42	63.84
1:46:00	21.83	1:46:00	55.8
1:51:18	19.3	1:51:18	48.28
1:56:36	16.88	1:56:36	41.24
2:01:54	14.36	2:01:54	34.38
2:07:12	11.53	2:07:12	26.86
2:12:30	9.12	2:12:30	20.24
2:17:48	7.26	2:17:48	15.36
2:23:06	5.83	2:23:06	11.72
2:28:24	4.71	2:28:24	9.01
2:33:42	3.8	2:33:42	6.95
2:39:00	3.04	2:39:00	5.34
2:44:18	2.41	2:44:18	4.12
2:49:36	1.89	2:49:36	3.27
2:54:54	1.49	2:54:54	2.66
3:00:12	1.17	3:00:12	2.21
3:05:30	0.9	3:05:30	1.82
3:10:48	0.67	3:10:48	1.48
3:16:06	0.49	3:16:06	1.19
3:21:24	0.35	3:21:24	0.94
3:26:42	0.23	3:26:42	0.74
3:32:00	0.15	3:32:00	0.59
3:37:18	0.1	3:37:18	0.49
3:42:36	0.07	3:42:36	0.43
3:47:54	0.06	3:47:54	0.41
3:53:12	0.06	3:53:12	0.39
3:58:30	0.06	3:58:30	0.37
4:03:48	0.05	4:03:48	0.36
4:09:06	0.05	4:09:06	0.34
4:14:24	0.05	4:14:24	0.33
4:19:42	0.05	4:19:42	0.32
4:25:00	0.05	4:25:00	0.31
4:30:18	0.04	4:30:18	0.29
4:35:36	0.04	4:35:36	0.28
4:40:54	0.04	4:40:54	0.27
4:46:12	0.04	4:46:12	0.26
4:51:30	0.04	4:51:30	0.24
4:56:48	0.03	4:56:48	0.23
5:02:06	0.03	5:02:06	0.22
5:07:24	0.03	5:07:24	0.21
5:12:42	0.03	5:12:42	0.19
5:18:00	0.03	5:18:00	0.18
5:23:18	0.02	5:23:18	0.17
5:28:36	0.02	5:28:36	0.16
5:33:54	0.02	5:33:54	0.14
5:39:12	0.02	5:39:12	0.13
5:44:30	0.02	5:44:30	0.12
5:49:48	0.01	5:49:48	0.1
5:55:06	0.01	5:55:06	0.09
6:00:24	0.01	6:00:24	0.08
6:05:42	0.01	6:05:42	0.07
6:11:00	0.01	6:11:00	0.05
6:16:18	0	6:16:18	0.04
6:21:36	0	6:21:36	0.03



SWMM OUTPUT AT NODE POND-D

POND D INFLOW HYDROGRAPH			
TIME INTERVAL		6.30	MINUTES
5-YEAR		100-YEAR	
TIME	INFLOW	TIME	INFLOW
HOURS	CFS	HOURS	CFS
0:06:18	0	0:06:18	0.02
0:12:36	1.09	0:12:36	1.43
0:18:54	6.67	0:18:54	7.36
0:25:12	22.11	0:25:12	23.73
0:31:30	34.32	0:31:30	69.4
0:37:48	35.81	0:37:48	93.32
0:44:06	33.37	0:44:06	97.32
0:50:24	30.51	0:50:24	93.61
0:56:42	27.71	0:56:42	86.96
1:03:00	25.44	1:03:00	81
1:09:18	23.39	1:09:18	73.87
1:15:36	21.11	1:15:36	64.83
1:21:54	18.72	1:21:54	55.02
1:28:12	16.88	1:28:12	46.48
1:34:30	15.6	1:34:30	40.03
1:40:48	14.25	1:40:48	35.09
1:47:06	12.86	1:47:06	30.89
1:53:24	11.55	1:53:24	27.07
1:59:42	10.25	1:59:42	23.52
2:06:00	8.43	2:06:00	19.26
2:12:18	6.54	2:12:18	14.9
2:18:36	4.91	2:18:36	10.91
2:24:54	3.69	2:24:54	7.66
2:31:12	2.86	2:31:12	5.47
2:37:30	2.27	2:37:30	4
2:43:48	1.78	2:43:48	2.89
2:50:06	1.37	2:50:06	2.05
2:56:24	1.05	2:56:24	1.47
3:02:42	0.8	3:02:42	1.1
3:09:00	0.61	3:09:00	0.83
3:15:18	0.44	3:15:18	0.62
3:21:36	0.31	3:21:36	0.45
3:27:54	0.21	3:27:54	0.3
3:34:12	0.13	3:34:12	0.19
3:40:30	0.07	3:40:30	0.1
3:46:48	0.03	3:46:48	0.04
3:53:06	0.01	3:53:06	0.01
3:59:24	0	3:59:24	0
4:05:42	0	4:05:42	0
4:12:00	0	4:12:00	0
4:18:18	0	4:18:18	0
4:24:36	0	4:24:36	0
4:30:54	0	4:30:54	0
4:37:12	0	4:37:12	0
4:43:30	0	4:43:30	0
4:49:48	0	4:49:48	0
4:56:06	0	4:56:06	0
5:02:24	0	5:02:24	0
5:08:42	0	5:08:42	0
5:15:00	0	5:15:00	0
5:21:18	0	5:21:18	0
5:27:36	0	5:27:36	0
5:33:54	0	5:33:54	0
5:40:12	0	5:40:12	0
5:46:30	0	5:46:30	0
5:52:48	0	5:52:48	0
5:59:06	0	5:59:06	0
6:05:24	0	6:05:24	0
6:11:42	0	6:11:42	0
6:18:00	0	6:18:00	0
6:24:18	0	6:24:18	0
6:30:36	0	6:30:36	0
6:36:54	0	6:36:54	0
6:43:12	0	6:43:12	0
6:49:30	0	6:49:30	0
6:55:48	0	6:55:48	0
7:02:06	0	7:02:06	0
7:08:24	0	7:08:24	0
7:14:42	0	7:14:42	0
7:21:00	0	7:21:00	0
7:27:18	0	7:27:18	0
7:33:36	0	7:33:36	0

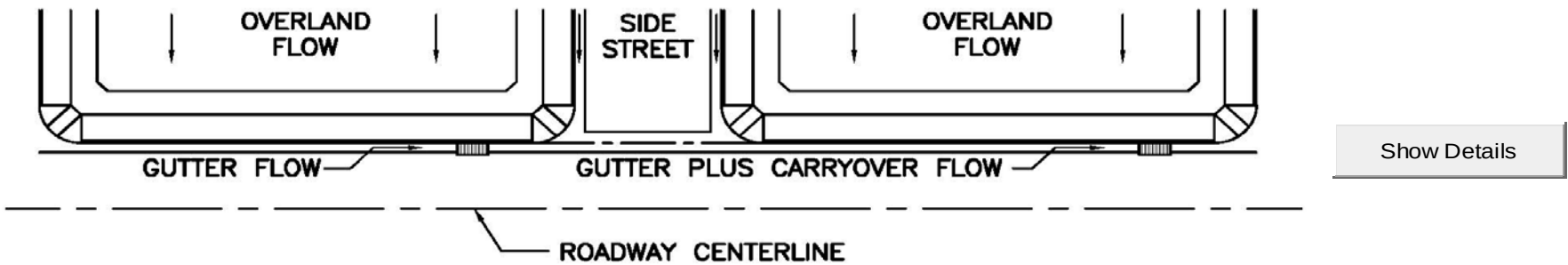


III. Hydraulic Computations

2. Inlet and Street Capacity UD Inlet

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1A



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
3.8	17.7

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs
Total Design Peak Flow, Q =

Minor Storm	Major Storm
3.8	17.7

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)		
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)		
Project:	Trails at Crowfoot	
Inlet ID:	DP 1A	

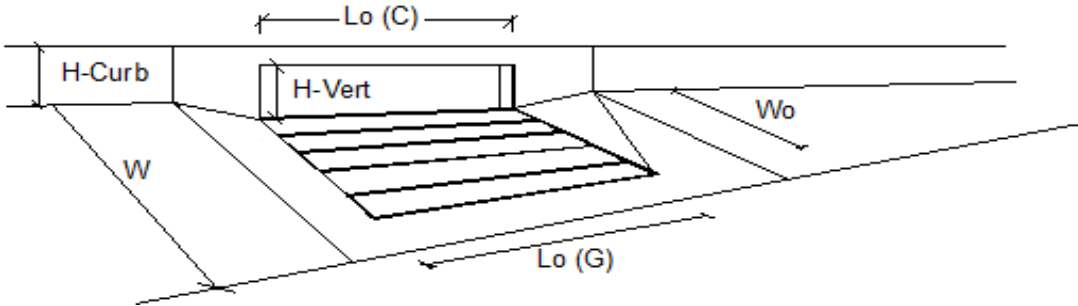
The diagram illustrates the cross-section of a street gutter. Key parameters include: T_{BACK} (width of backflow), S_{BACK} (backflow slope), T , T_{MAX} , T_{CROWN} (widths from curb to crown), T_x (width to flow line), W (gutter width), Q_w (flow in gutter), Q_x (flow in street), S_x (street slope), S_w (gutter slope), H_{CURB} (curb height), d (depth at curb), y (depth at crown), a (depth at gutter), and d_c (depth at crown). The flow is shown moving from the gutter into the street towards the 'Street Crown'.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.020$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><tr><td>☐</td><td>☒</td><td>check = yes</td></tr></table>	☐	☒	check = yes	
☐	☒	check = yes			
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>4.8</td><td>156.5</td></tr></table> cfs		Minor Storm	Major Storm	4.8	156.5
Minor Storm	Major Storm				
4.8	156.5				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1A



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	3.84	10.14	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	7.6	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	57	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1B



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
2.2	60.6

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)

Overland Flow =

Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years

Return Period One-Hour Precipitation, P_1 = inches

C_1 =

C_2 =

C_3 =

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =

User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs

Total Design Peak Flow, Q =

Minor Storm	Major Storm
2.2	60.6

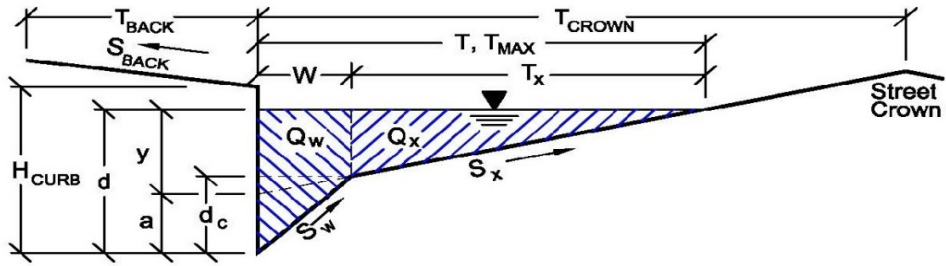
 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 1B



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line
Distance from Curb Face to Street Crown
Gutter Width
Street Transverse Slope
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
Allow Flow Depth at Street Crown (leave blank for no)

MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

T_{BACK}	=	18.0	ft
S_{BACK}	=	0.020	ft/ft
n_{BACK}	=	0.020	
H_{CURB}	=	4.00	inches
T_{CROWN}	=	17.0	ft
W	=	2.00	ft
S_x	=	0.020	ft/ft
S_w	=	0.083	ft/ft
S_o	=	0.000	ft/ft
n_{STREET}	=	0.016	

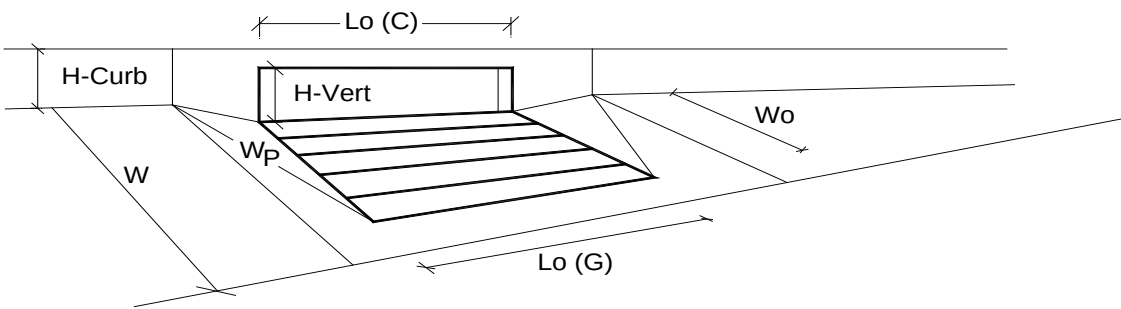
	Minor Storm	Major Storm	
T_{MAX}	17.0	17.0	ft
d_{MAX}	4.0	12.0	inches

☐ ☒ check = yes

	Minor Storm	Major Storm	
Q_{allow}	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = DP 1B



Design Information (Input)		MINOR	MAJOR	
Type of Inlet		CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		1	1	
Water Depth at Flowline (outside of local depression)		6.0	12.0	inches
				☒ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		15.00	15.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
		9.7	42.1	cfs
Q PEAK REQUIRED =		2.2	60.6	cfs

WARNING: Inlet Capacity less than Q Peak for MAJOR Storm

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1C



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

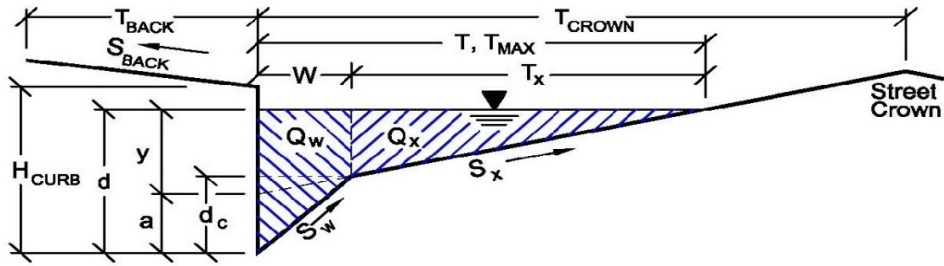
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (inches/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

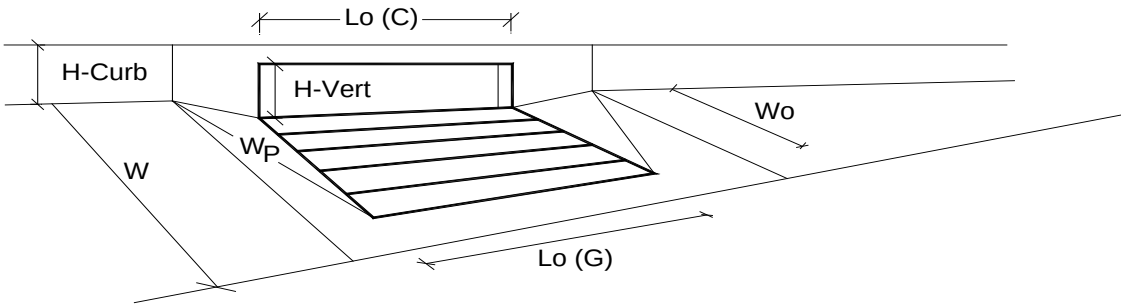
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	18.5	cfs
Total Design Peak Flow, Q =	3.2	32.0	cfs

<--- FILL IN THIS SECTION OR...
FILL IN THE SECTIONS BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)					
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)					
Project:	Trails at Crowfoot				
Inlet ID:	DP 1C				
					
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>SUMP</td><td>SUMP</td></tr></tbody></table> cfs		Minor Storm	Major Storm	SUMP	SUMP
Minor Storm	Major Storm				
SUMP	SUMP				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = DP 1C

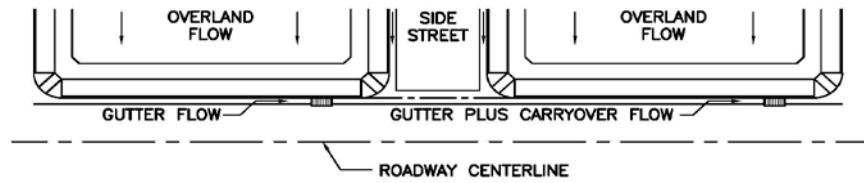


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1	1	
Water Depth at Flowline (outside of local depression)	6.0	12.0	inches
Grate Information	MINOR	MAJOR	☒ Override Depths
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
Curb Opening Information	MINOR	MAJOR	
Length of a Unit Curb Opening	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)	MINOR	MAJOR	
Q_a =	9.7	42.1	cfs
Q_{PEAK REQUIRED} =	3.2	32.0	cfs

Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1D



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
2.8	15.4

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + I_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	32.0

 cfs

Total Design Peak Flow, Q =

2.8	47.4

 cfs

<---
FILL IN THIS SECTION
OR...

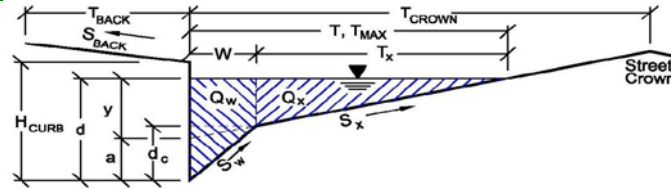
FILL IN THE SECTIONS
BELOW.
<---

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

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

Project:
Inlet ID:

Trails at Crowfoot
DP 1D



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)
Height of Curb at Gutter Flow Line
Distance from Curb Face to Street Crown
Gutter Width
Street Transverse Slope
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 18.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$
 $H_{CURB} = 4.00$ inches
 $T_{CROWN} = 17.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_D = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	4.0	12.0	inches
	☐	☒	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

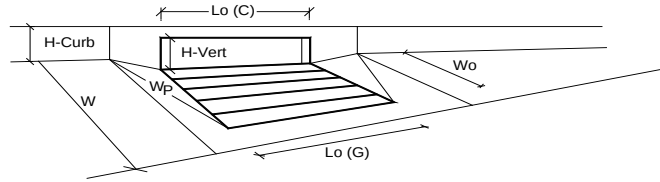
$Q_{allow} =$ Minor Storm Major Storm
SUMP SUMP cfs

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

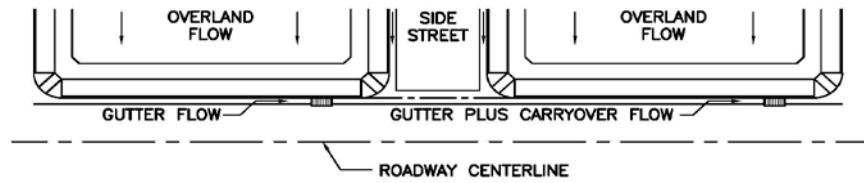
Project = Trails at Crowfoot
Inlet ID = DP 1D



Design Information (Input)		MINOR		MAJOR		
Type of Inlet		CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		$a_{local} =$	5.00	5.00	inches	
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1		
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	12.0	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)		$C_l (G) =$	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		$L_o (C) =$	15.00	15.00	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)		$C_l (C) =$	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		
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR		
		$Q_a =$	9.7	42.1	cfs	
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm		$Q_{PEAK REQUIRED} =$	2.8	47.4	cfs	

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1E



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
2.3	74.1

 cfs

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + I_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches

	Minor Storm	Major Storm
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

2.3	74.1

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

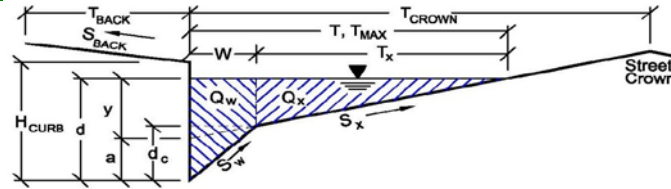
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Crowfoot

Inlet ID:

DP 1E



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 18.0$ 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

$H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 17.0$ 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)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm
$T_{MAX} =$	17.0	17.0

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm
$d_{MAX} =$	4.0	12.0

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

	Minor Storm	Major Storm
	SUMP	SUMP

cfs

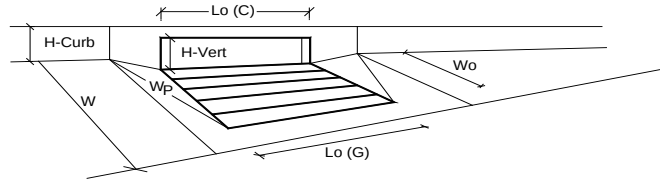
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot

Inlet ID = DP 1E



Design Information (Input)

Type of Inlet

Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

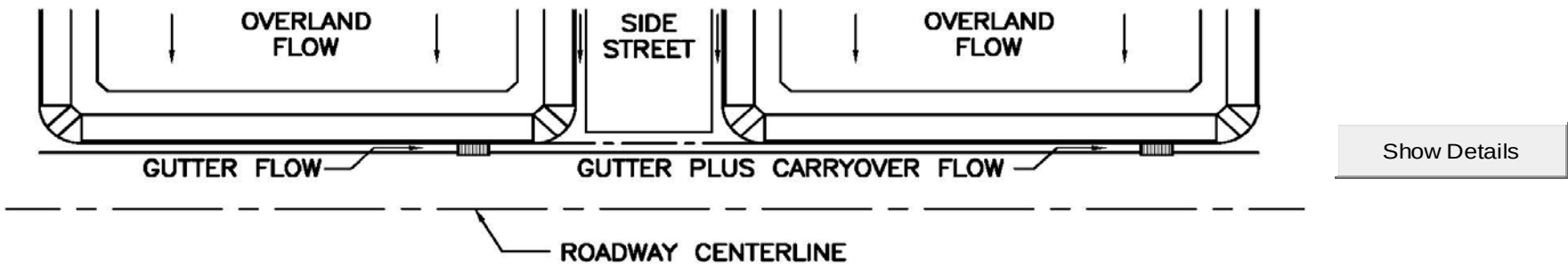
	MINOR	MAJOR	
Inlet Type =	CDOT Type R Curb Opening		
a_{local} =	5.00	5.00	inches
No =	1	1	
Ponding Depth =	6.0	12.0	inches
	☒ Override Depths		
	MINOR	MAJOR	
$L_o (G)$ =	N/A	N/A	feet
W_o =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
$C_l (G)$ =	N/A	N/A	
$C_w (G)$ =	N/A	N/A	
$C_o (G)$ =	N/A	N/A	
	MINOR	MAJOR	
$L_o (C)$ =	15.00	15.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
$C_l (C)$ =	0.10	0.10	
$C_w (C)$ =	3.60	3.60	
$C_o (C)$ =	0.67	0.67	
	MINOR	MAJOR	
Q_a =	9.7	42.1	cfs
$Q_{PEAK REQUIRED}$ =	2.3	74.1	cfs

Total Inlet Interception Capacity (assumes clogged condition)

WARNING: Inlet Capacity less than Q Peak for MAJOR Storm

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1F



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)

Overland Flow =

Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years

Return Period One-Hour Precipitation, P_1 = inches

C_1 =

C_2 =

C_3 =

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =

User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

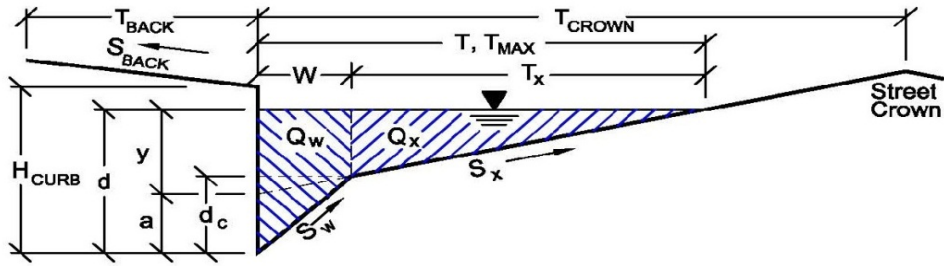
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b = cfs

Total Design Peak Flow, Q = cfs

Minor Storm	Major Storm
3.6	45.2

<---
FILL IN THIS SECTION
OR...

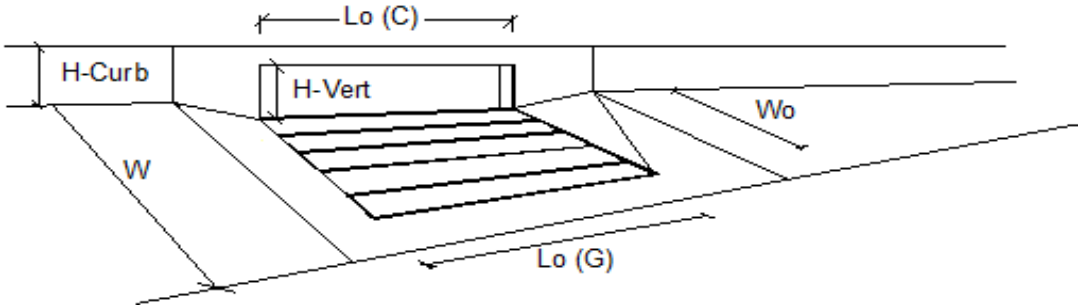
FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)					
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)					
Project:	Trails at Crowfoot				
Inlet ID:	DP 1F				
					
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.015$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>17.0</td><td>17.0</td></tr></tbody></table> ft	Minor Storm	Major Storm	17.0	17.0
Minor Storm	Major Storm				
17.0	17.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>4.0</td><td>12.0</td></tr></tbody></table> inches	Minor Storm	Major Storm	4.0	12.0
Minor Storm	Major Storm				
4.0	12.0				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>4.1</td><td>162.5</td></tr></tbody></table> cfs		Minor Storm	Major Storm	4.1	162.5
Minor Storm	Major Storm				
4.1	162.5				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

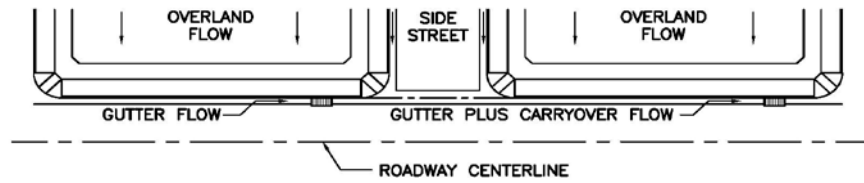
Inlet ID: DP 1F



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'				
Total Inlet Interception Capacity	$Q =$	3.60	14.60	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	30.5	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	32	%

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Trails at Crowfoot
Inlet ID: DP 1G



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
4.4	18.6

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + I_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

4.4	18.6

 cfs

<---
FILL IN THIS SECTION
OR...

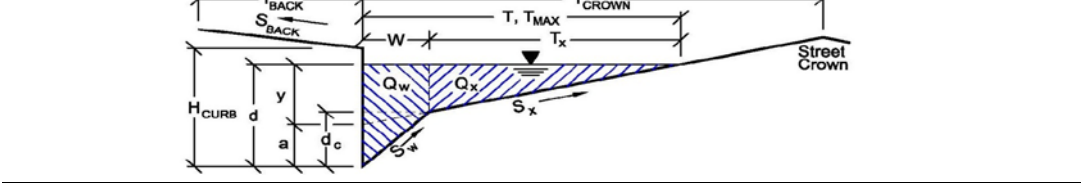
FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
1	100
2	200
3	300
4	400
5	500
6	600
7	700
8	800
9	900
10	1000
11	1100
12	1200
13	1300
14	1400
15	1500
16	1600
17	1700
18	1800
19	1900
20	2000
21	2100
22	2200
23	2300
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26	2600
27	2700
28	2800
29	2900
30	3000
31	3100
32	3200
33	3300
34	3400
35	3500
36	3600
37	3700
38	3800
39	3900
40	4000
41	4100
42	4200
43	4300
44	4400
45	4500
46	4600
47	4700
48	4800
49	4900
50	5000
51	5100
52	5200
53	5300
54	5400
55	5500
56	5600
57	5700
58	5800
59	5900
60	6000
61	6100
62	6200
63	6300
64	6400
65	6500
66	6600
67	6700
68	6800
69	6900
70	7000
71	7100
72	7200
73	7300
74	7400
75	7500
76	7600
77	7700
78	7800
79	7900
80	8000
81	8100
82	8200
83	8300
84	8400
85	8500
86	8600
87	8700
88	8800
89	8900
90	9000
91	9100
92	9200
93	9300
94	9400
95	9500
96	9600
97	9700
98	9800
99	9900
100	10000

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

Trails at Crowfoot

DP IG



Gutter Geometry (Enter data in the blue cells)

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) $n_{\text{BACK}} = 0.020$

Distance from Curb Face to Street Crown $T_{CROWN} = 17.0$ 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) $n_{\text{STREET}} = 0.016$

Max. Allowable Spread for Minor & Major Storm	$I_{MAX} =$	17.0	17.0	ft
Max. Allowable Depth for Minor & Major Storm	$d =$			ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for No)	☐	☒	check = yes

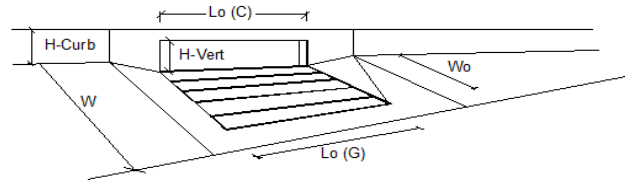
MAJOR STORM Allowable Capacity is based on Depth Criterion $Q_{allow} = 6.8 \times 127.1 \text{ cfs}$

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 1G



Design Information (Input)

Type of Inlet
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')
Total Number of Units in the Inlet (Grate or Curb Opening)
Length of a Single Unit Inlet (Grate or Curb Opening)
Width of a Unit Grate (cannot be greater than W from Q-Allow)
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a_{LOCAL} =	5.0	5.0	inches
No =	1	1	
L_o =	10.00	10.00	ft
W_o =	N/A	N/A	ft
C_r-G =	N/A	N/A	
C_r-C =	0.10	0.10	

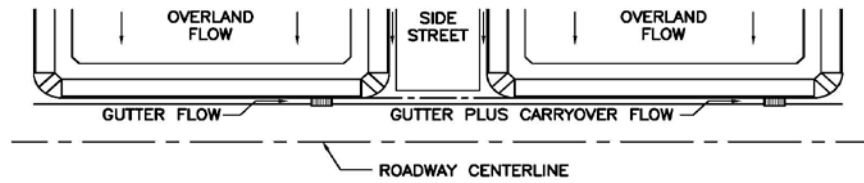
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'

Total Inlet Interception Capacity
Total Inlet Carry-Over Flow (flow bypassing inlet)
Capture Percentage = Q_a/Q_o =

	MINOR	MAJOR	
Q =	4.40	10.62	cfs
Q_b =	0.0	8.0	cfs
C% =	100	57	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1H



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

* Q_{Known} =

Minor Storm	Major Storm
3.5	14.1

 cfs

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + I_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches

	Minor Storm	Major Storm
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	5.3

 cfs

Total Design Peak Flow, Q =

3.5	19.4

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

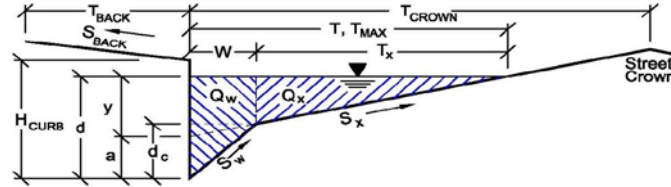
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Crowfoot

Inlet ID:

DP 1H



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 18.0$ 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

$H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 17.0$ 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)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm	
$d_{MAX} =$	4.0	12.0	inches

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

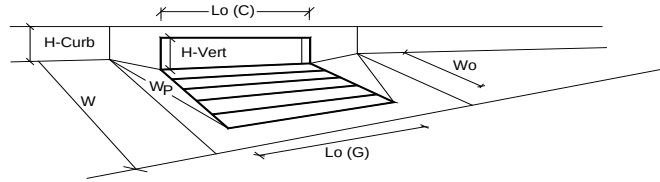
	Minor Storm	Major Storm	
	SUMP	SUMP	cfs

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = DP 1H



Design Information (Input)

Type of Inlet
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')
Number of Unit Inlets (Grate or Curb Opening)
Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate
Width of a Unit Grate
Area Opening Ratio for a Grate (typical values 0.15-0.90)
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)
Grate Weir Coefficient (typical value 2.15 - 3.60)
Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening
Height of Vertical Curb Opening in Inches
Height of Curb Orifice Throat in Inches
Angle of Throat (see USDCM Figure ST-5)
Side Width for Depression Pan (typically the gutter width of 2 feet)
Clogging Factor for a Single Curb Opening (typical value 0.10)
Curb Opening Weir Coefficient (typical value 2.3-3.7)
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

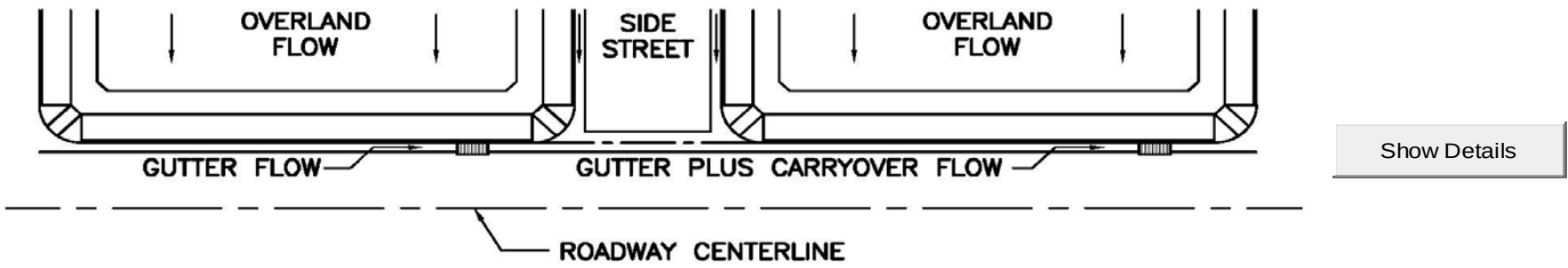
Total Inlet Interception Capacity (assumes clogged condition)

Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

	MINOR	MAJOR	
Inlet Type =	CDOT Type R Curb Opening		
a_{local} =	5.00	5.00	inches
No =	1	1	
Ponding Depth =	6.0	12.0	inches
	☒ Override Depths		
	MINOR	MAJOR	
$L_o (G)$ =	N/A	N/A	feet
W_o =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
$C_l (G)$ =	N/A	N/A	
$C_w (G)$ =	N/A	N/A	
$C_o (G)$ =	N/A	N/A	
	MINOR	MAJOR	
$L_o (C)$ =	10.00	10.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
$C_l (C)$ =	0.10	0.10	
$C_w (C)$ =	3.60	3.60	
$C_o (C)$ =	0.67	0.67	
	MINOR	MAJOR	
Q_a =	8.3	27.5	cfs
$Q_{PEAK REQUIRED}$ =	3.5	19.4	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 13



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

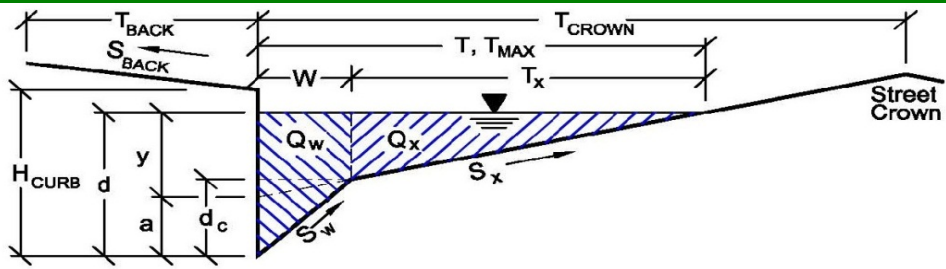
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	4.5	18.3	cfs

<--- FILL IN THIS SECTION OR...
FILL IN THE SECTIONS BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: 1J



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 19.0$ 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
 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ ft

Gutter Width
 $W = 2.50$ 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)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 6.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ Minor Storm ☒ Major Storm check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

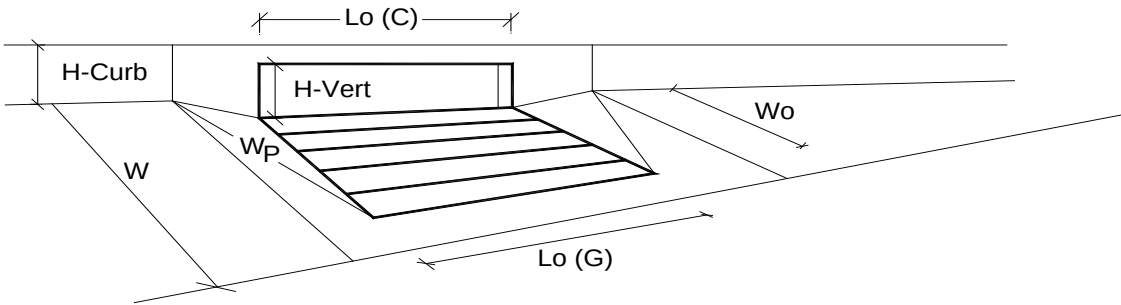
$Q_{allow} =$

Minor Storm	Major Storm
SUMP	SUMP

 cfs

INLET IN A SUMP OR SAG LOCATION

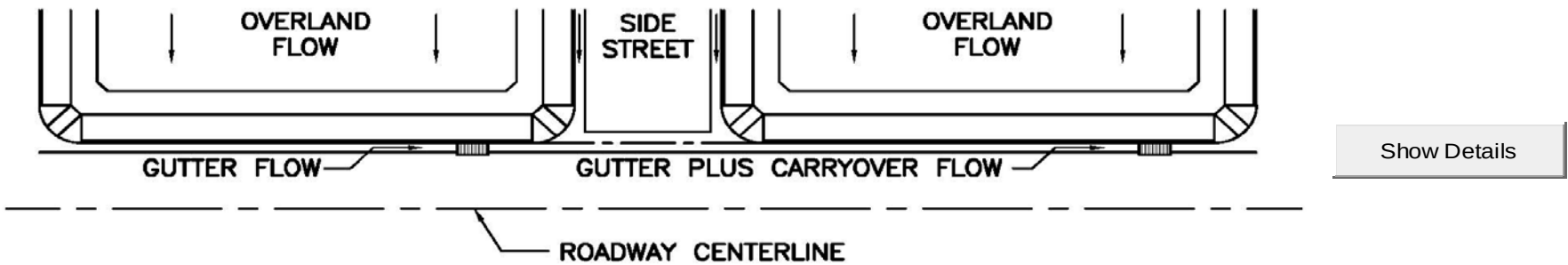
Project = Trails at Crowfoot
Inlet ID = 1J



Design Information (Input)		MINOR	MAJOR	
Type of Inlet		CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		1	1	
Water Depth at Flowline (outside of local depression)		6.0	12.0	inches
				☒ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		10.00	10.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.50	2.50	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
		7.2	25.5	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)		4.5	18.3	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1K



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =		
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =		
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0
Total Design Peak Flow, Q =	2.9	11.8

<--- FILL IN THIS SECTION OR...

FILL IN THE SECTIONS BELOW.

<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	DP 1K

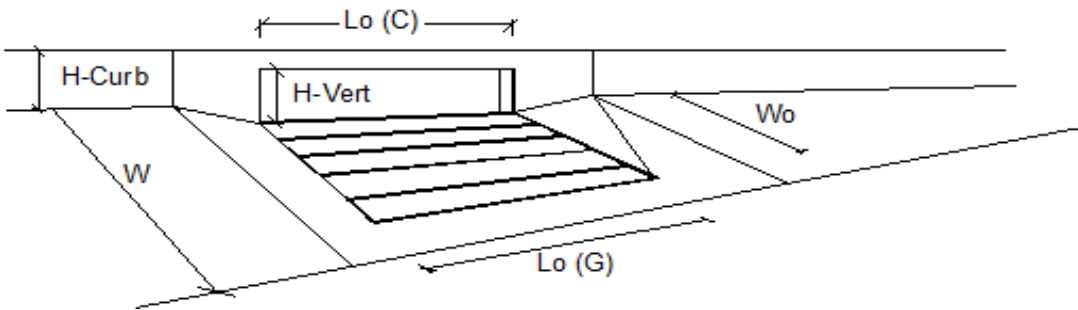
The diagram illustrates the cross-section of a street gutter. Key parameters include: T_{BACK} (width of backflow), S_{BACK} (backflow slope), T_x , T_{MAX} , T_{CROWN} (widths from curb to various points), W (gutter width), H_{CURB} (curb height), d (depth at curb), y (depth at distance a), a (distance from curb face to gutter flowline), d_c (depth at gutter flowline), Q_w (flow in gutter), Q_x (flow at distance x), S_x (street slope), S_w (gutter cross slope), and S_o (street longitudinal slope). The 'Street Crown' is indicated on the right side.

Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.020$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 17.0 & 17.0 \end{matrix}$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 4.0 & 12.0 \end{matrix}$ inches
Allow Flow Depth at Street Crown (leave blank for no)	☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	

	Minor Storm	Major Storm
$Q_{allow} =$	4.8	156.5
	cfs	

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 1K



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'				
Total Inlet Interception Capacity	$Q =$	2.90	8.40	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	3.3	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	72	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1L



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

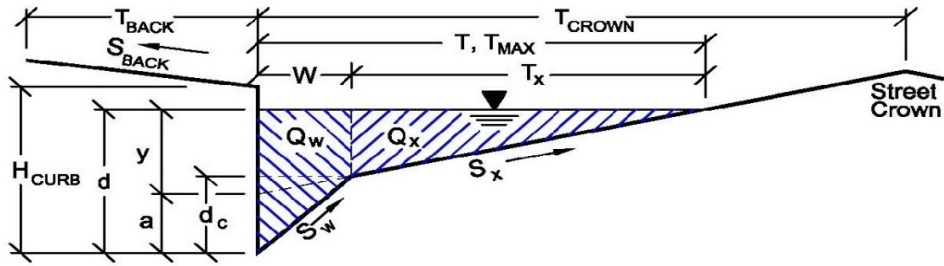
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	3.2	14.0	cfs

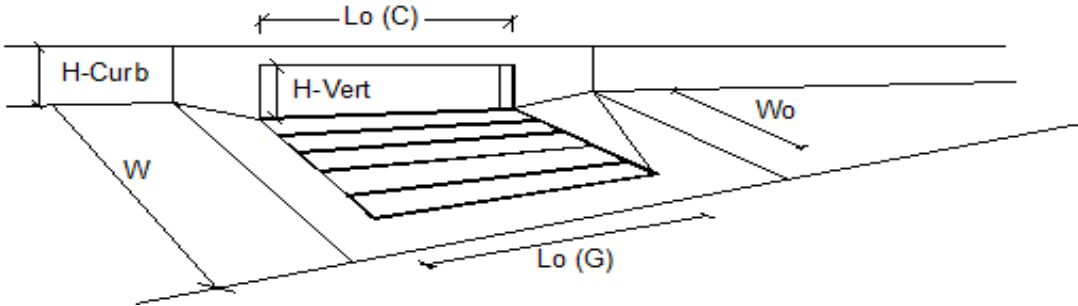
<--- FILL IN THIS SECTION OR...
FILL IN THE SECTIONS BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)					
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)					
Project:	Trails at Crowfoot				
Inlet ID:	DP 1L				
					
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.015$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>4.1</td><td>162.5</td></tr></tbody></table> cfs		Minor Storm	Major Storm	4.1	162.5
Minor Storm	Major Storm				
4.1	162.5				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

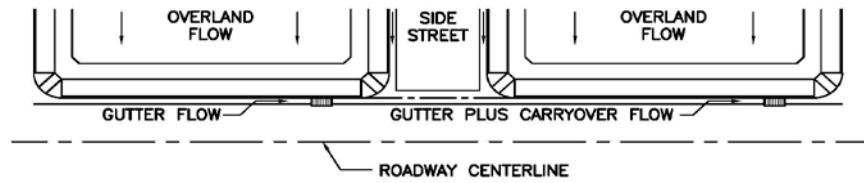
Inlet ID: DP 1L



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	3.20	9.02	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	4.9	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	65	%

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Trails at Crowfoot
Inlet ID: DP 1M



Show Details

Design Flow: ONLY if already determined through other methods:

(local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
5.0	37.5

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + P_1)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches

	Minor Storm	Major Storm
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

5.0	37.5

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

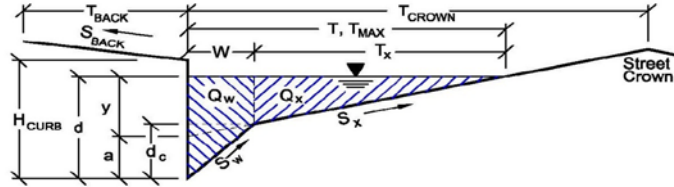
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Crowfoot

Inlet ID:

DP 1M



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 18.0$ 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

$H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 17.0$ 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

$S_o = 0.050$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm	
$d_{MAX} =$	4.0	12.0	inches

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

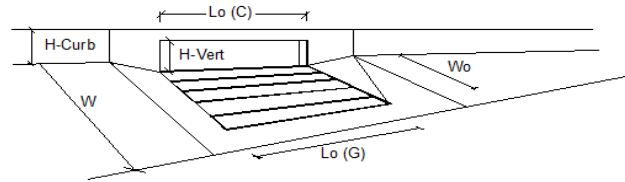
	Minor Storm	Major Storm	
$Q_{allow} =$	7.6	118.9	cfs

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 1M



Design Information (Input)

Type of Inlet
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')
Total Number of Units in the Inlet (Grate or Curb Opening)
Length of a Single Unit Inlet (Grate or Curb Opening)
Width of a Unit Grate (cannot be greater than W from Q-Allow)
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a_{LOCAL} =	5.0	5.0	inches
No =	2	2	
L_o =	10.00	10.00	ft
W_o =	N/A	N/A	ft
C_r-G =	N/A	N/A	
C_r-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'

Total Inlet Interception Capacity
Total Inlet Carry-Over Flow (flow bypassing inlet)
Capture Percentage = Q_a/Q_o =

	MINOR	MAJOR	
Q =	5.00	25.49	cfs
Q_b =	0.0	12.0	cfs
C% =	100	68	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1N



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

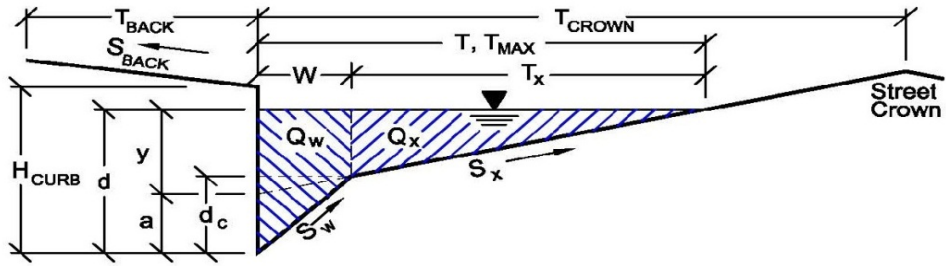
Minor Storm	Major Storm
Design Storm Return Period, T_r =	years
Return Period One-Hour Precipitation, P_1 =	inches
C_1 =	
C_2 =	
C_3 =	
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =	
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0 0.0 cfs
Total Design Peak Flow, Q =	1.9 49.8 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 1N



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line
Distance from Curb Face to Street Crown
Gutter Width
Street Transverse Slope
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
Allow Flow Depth at Street Crown (leave blank for no)

MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$T_{BACK} = 18.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 4.00$ inches
 $T_{CROWN} = 17.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.000$ ft/ft
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm
T_{MAX}	17.0	17.0
d_{MAX}	4.0	12.0

☐ ☒ check = yes

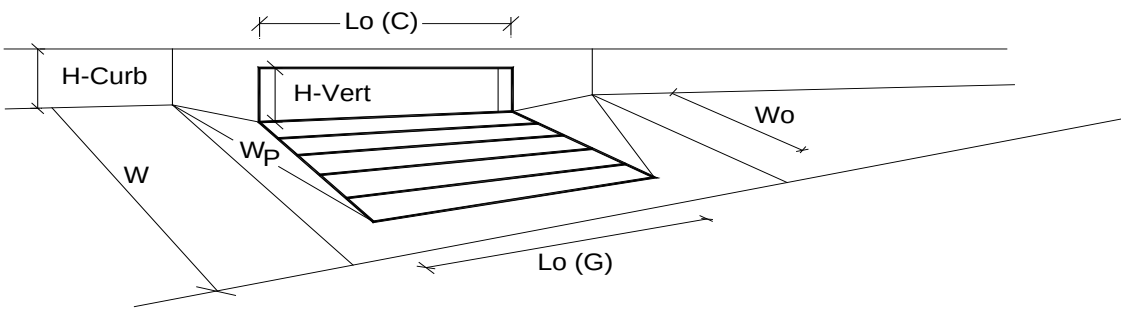
$Q_{allow} =$

Minor Storm	Major Storm
SUMP	SUMP

 cfs

INLET IN A SUMP OR SAG LOCATION

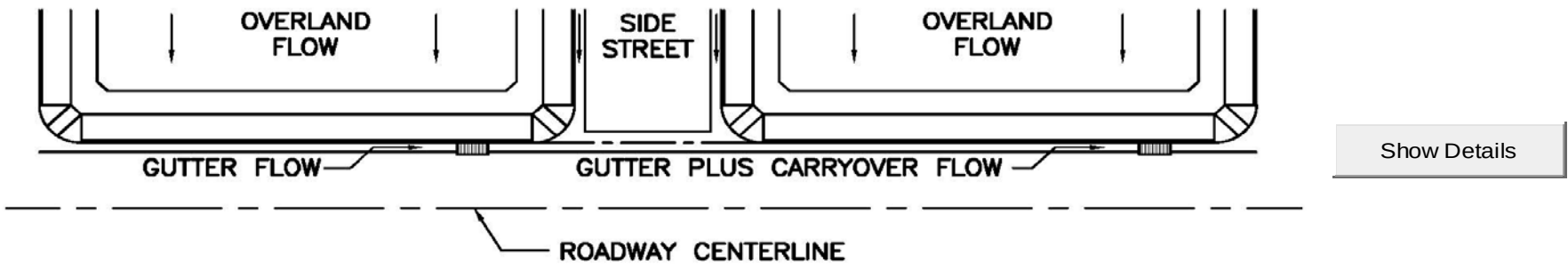
Project = Trails at Crowfoot
Inlet ID = DP 1N



Design Information (Input)		MINOR	MAJOR	
Type of Inlet		CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		2	2	
Water Depth at Flowline (outside of local depression)		6.0	12.0	inches
				☒ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		10.00	10.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
		14.4	56.8	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)		1.9	49.8	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 10



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
3.6	24.0

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs

Total Design Peak Flow, Q =

Minor Storm	Major Storm
3.6	24.0

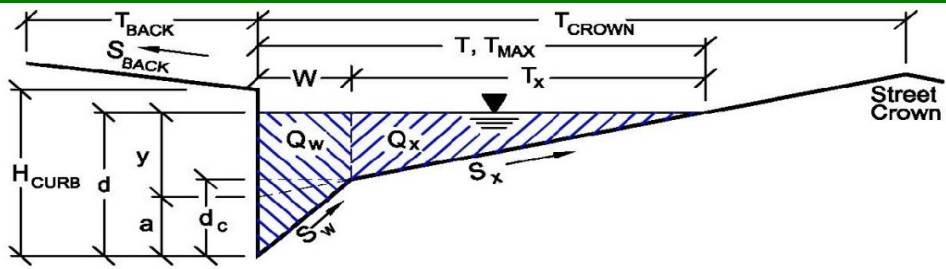
 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 10



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line
Distance from Curb Face to Street Crown
Gutter Width
Street Transverse Slope
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
Allow Flow Depth at Street Crown (leave blank for no)

MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$T_{BACK} = 18.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 4.00$ inches
 $T_{CROWN} = 17.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.000$ ft/ft
 $n_{STREET} = 0.016$

$T_{MAX} = 17.0$ ft
 $d_{MAX} = 4.0$ inches

☐ ☒ check = yes

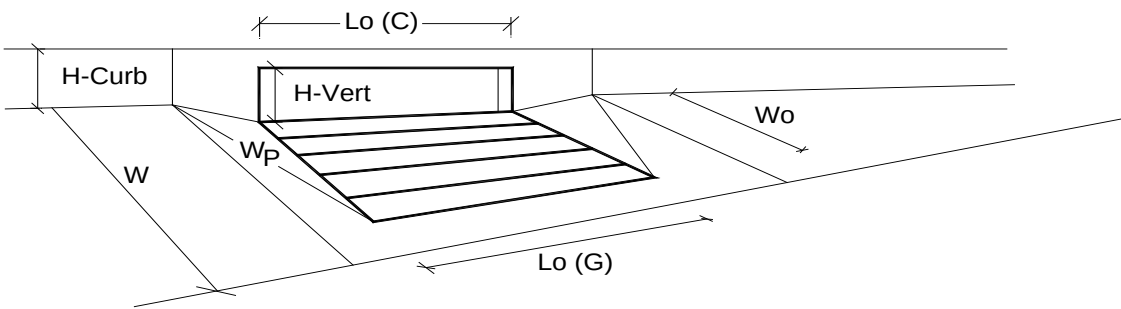
$Q_{allow} =$

Minor Storm	Major Storm
SUMP	SUMP

 cfs

INLET IN A SUMP OR SAG LOCATION

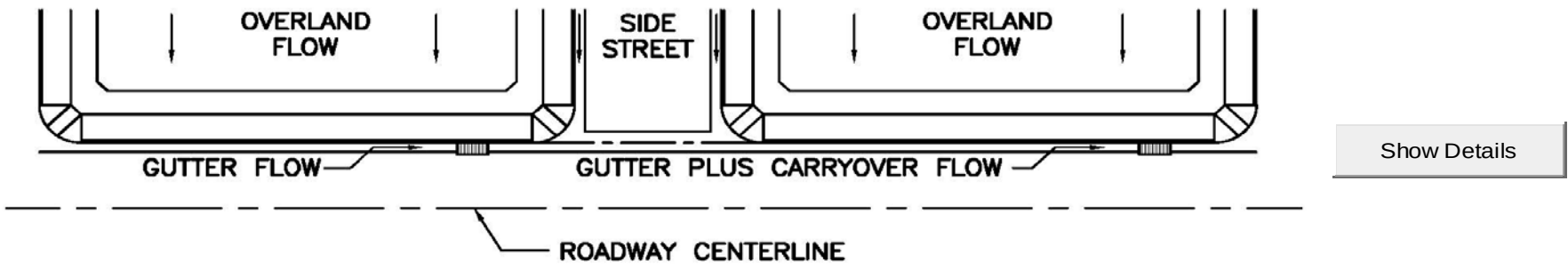
Project = Trails at Crowfoot
Inlet ID = DP 10



Design Information (Input)		MINOR		MAJOR	
Type of Inlet		Inlet Type = CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a _{local} = 5.00	5.00	inches	
Number of Unit Inlets (Grate or Curb Opening)		No = 1	1		
Water Depth at Flowline (outside of local depression)		Ponding Depth = 6.0	12.0	inches	
		☒ Override Depths			
Grate Information		MINOR		MAJOR	
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		
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
		Q _a = 8.3	27.5	cfs	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)		Q _{PEAK} REQUIRED = 3.6	24.0	cfs	

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1P



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

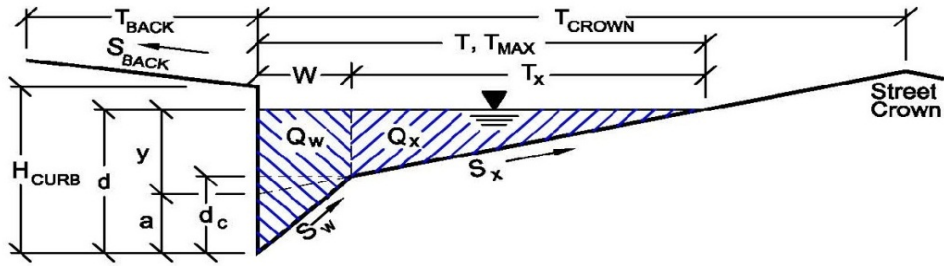
NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	1.4	21.5	cfs

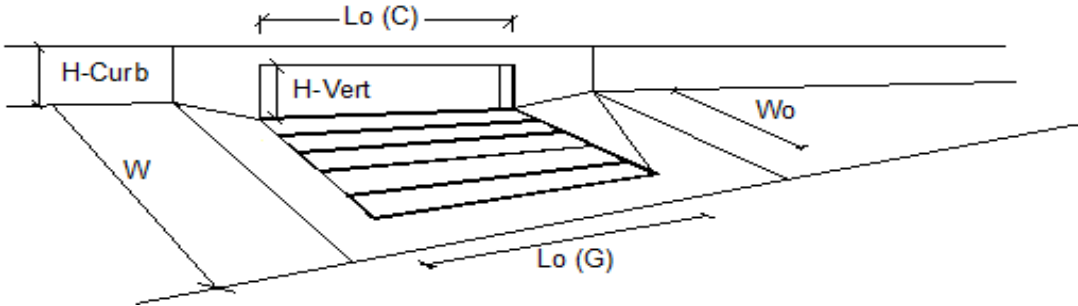
<--- FILL IN THIS SECTION OR...
FILL IN THE SECTIONS BELOW.
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ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)					
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)					
Project:	Trails at Crowfoot				
Inlet ID:	DP 1P				
					
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.020$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>4.8</td><td>156.5</td></tr></tbody></table> cfs		Minor Storm	Major Storm	4.8	156.5
Minor Storm	Major Storm				
4.8	156.5				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

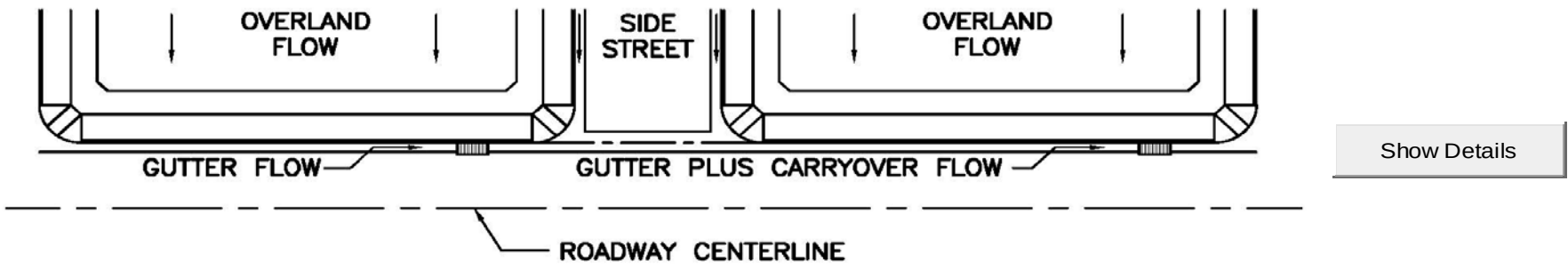
Inlet ID: DP 1P



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	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 from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_rG =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_rC =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	1.40	5.70	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	15.8	cfs
Capture Percentage = Q_a/Q_o =	C% =	100	26	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1Q



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
4.2	27.9

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)

Overland Flow =

Channel Flow =

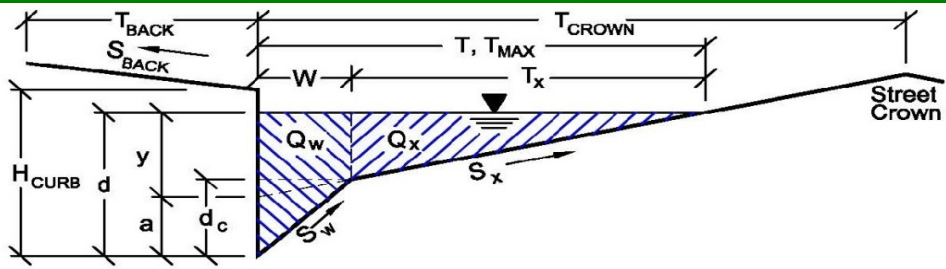
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =		
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =		
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0
Total Design Peak Flow, Q =	4.2	27.9

<---
FILL IN THIS SECTION
OR...
FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 1Q

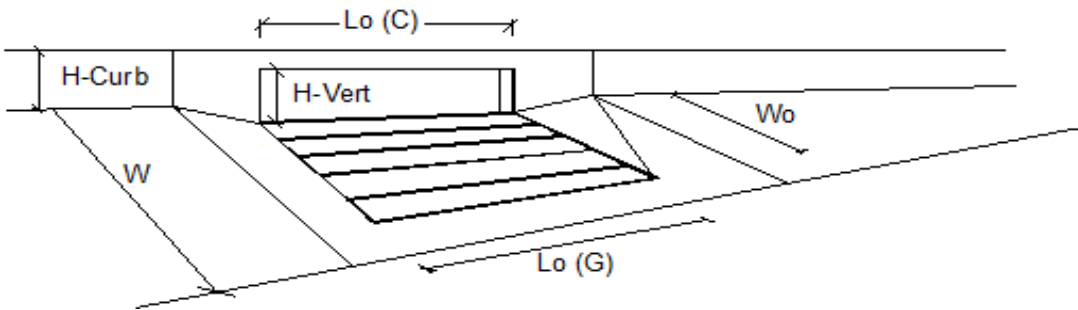


Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$				
Height of Curb at Gutter Flow Line	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.020$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$T_{MAX} = 17.0$ ft</td><td>$T_{MAX} = 17.0$ ft</td></tr></table>	Minor Storm	Major Storm	$T_{MAX} = 17.0$ ft	$T_{MAX} = 17.0$ ft
Minor Storm	Major Storm				
$T_{MAX} = 17.0$ ft	$T_{MAX} = 17.0$ ft				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$d_{MAX} = 4.0$ inches</td><td>$d_{MAX} = 12.0$ inches</td></tr></table>	Minor Storm	Major Storm	$d_{MAX} = 4.0$ inches	$d_{MAX} = 12.0$ inches
Minor Storm	Major Storm				
$d_{MAX} = 4.0$ inches	$d_{MAX} = 12.0$ inches				
Allow Flow Depth at Street Crown (leave blank for no)	<table><tr><td>☐</td><td>☒</td><td>check = yes</td></tr></table>	☐	☒	check = yes	
☐	☒	check = yes			
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>4.8</td><td>156.5</td></tr></table> cfs		Minor Storm	Major Storm	4.8	156.5
Minor Storm	Major Storm				
4.8	156.5				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1Q



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_{rG} =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_{rC} =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	4.20	12.23	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	15.7	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	44	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1R



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =		
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =		
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0
Total Design Peak Flow, Q =	3.0	12.0

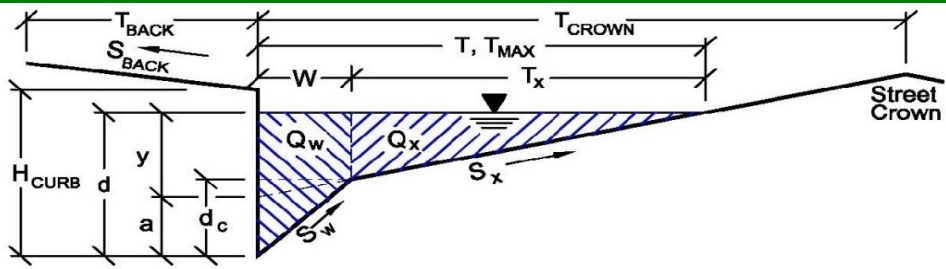
<--- FILL IN THIS SECTION OR...

FILL IN THE SECTIONS BELOW.

<---

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

Project: Trails at Crowfoot
Inlet ID: DP 1R

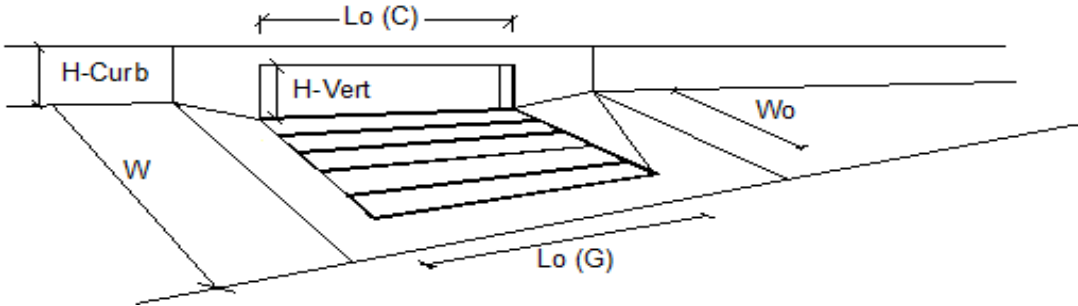


Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$
Height of Curb at Gutter Flow Line	$H_{CURB} = 4.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.020$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = 17.0$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = 4.0$ inches
Allow Flow Depth at Street Crown (leave blank for no)	☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
$Q_{allow} = 4.8$ cfs	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

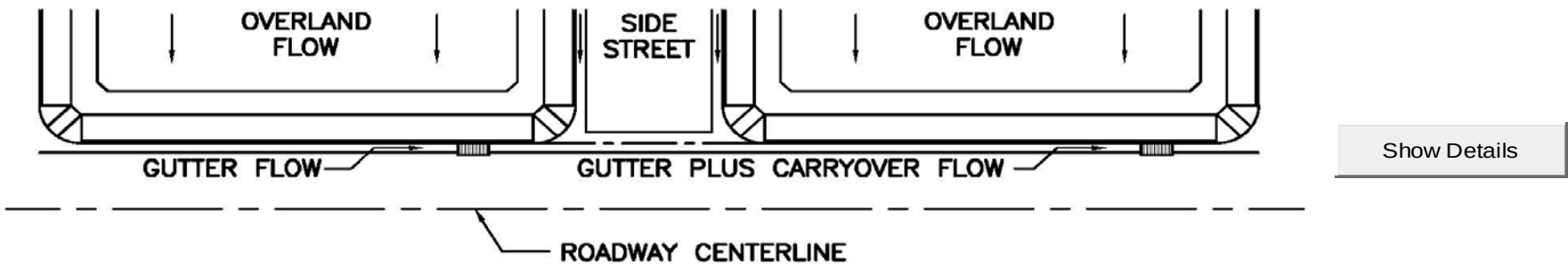
Inlet ID: DP 1R



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	N_o =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_rG =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_rC =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	3.00	8.49	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	3.5	cfs
Capture Percentage = Q_a/Q_o =	$C\%$ =	100	71	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1S



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
2.5	10.3

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)

Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs

Total Design Peak Flow, Q =

Minor Storm	Major Storm
2.5	10.3

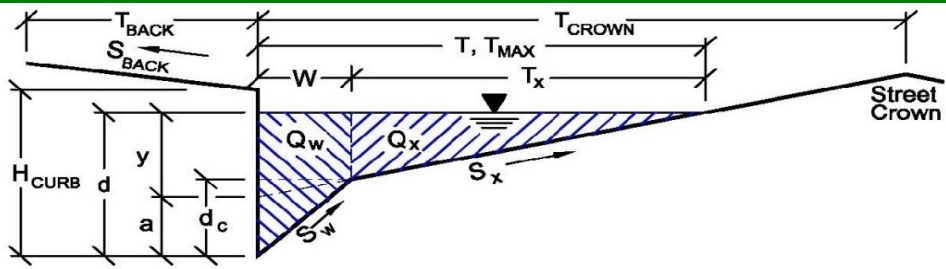
 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 1S

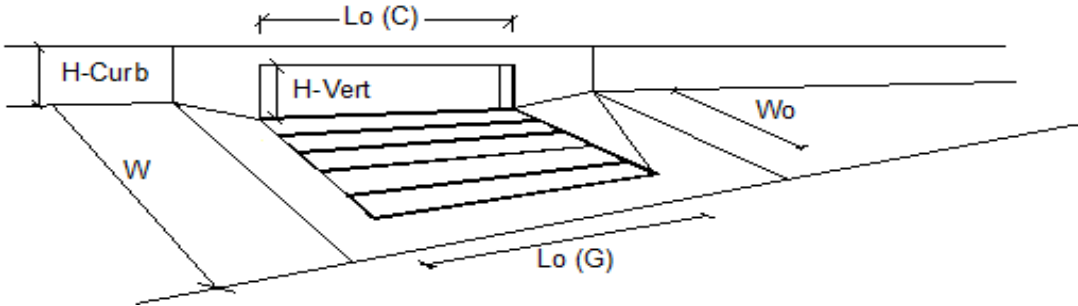


Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$
Height of Curb at Gutter Flow Line	$H_{CURB} = 4.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = 17.0$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = 4.0$ inches
Allow Flow Depth at Street Crown (leave blank for no)	☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	$Q_{allow} = 6.8$ cfs
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	$Q_{allow} = 127.1$ cfs

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1S



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'				
Total Inlet Interception Capacity	$Q =$	2.50	13.26	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	-2.9	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	128	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1T



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
2.3	37.6

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

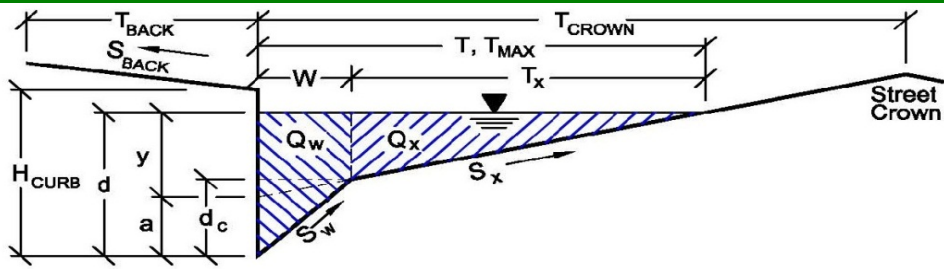
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =		
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =		
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0
Total Design Peak Flow, Q =	2.3	37.6

<---
FILL IN THIS SECTION
OR...
FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 1T

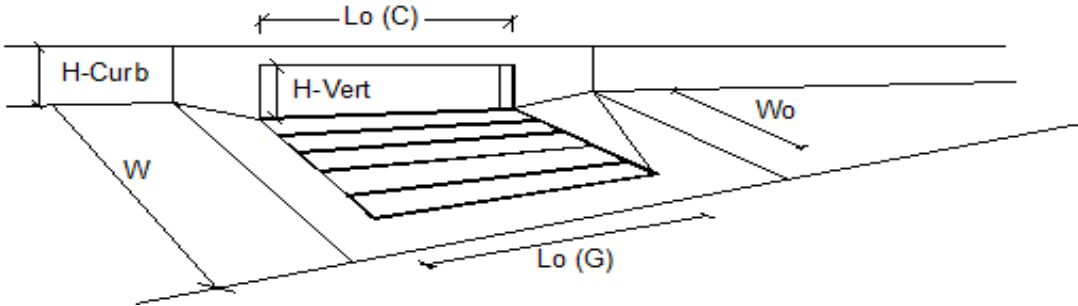


Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$				
Height of Curb at Gutter Flow Line	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.020$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><tr><td>☐</td><td>☒</td><td>check = yes</td></tr></table>	☐	☒	check = yes	
☐	☒	check = yes			
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>4.8</td><td>156.5</td></tr></table> cfs		Minor Storm	Major Storm	4.8	156.5
Minor Storm	Major Storm				
4.8	156.5				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 1T



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	2.30	13.74	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	23.9	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	37	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1U



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

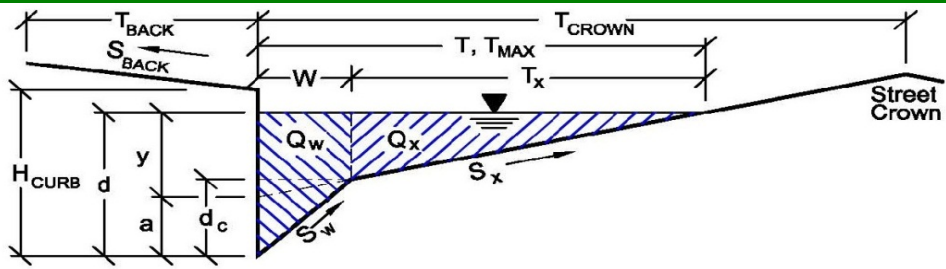
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	3.7	27.7	cfs

<--- FILL IN THIS SECTION OR...
FILL IN THE SECTIONS BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 1U



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 18.0$ 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
 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ 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
 $S_o = 0.015$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 4.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

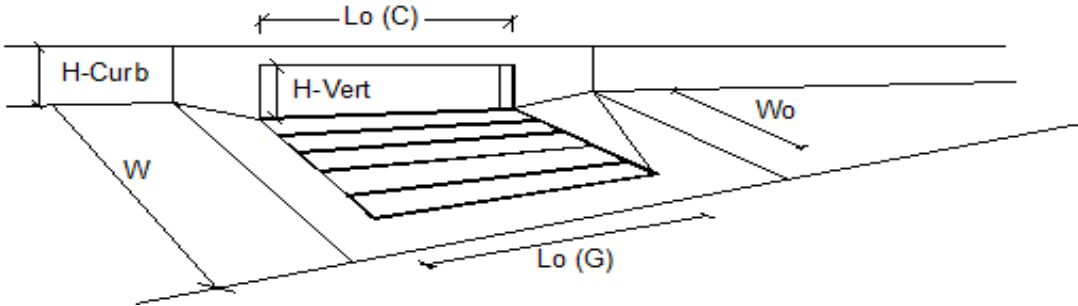
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$Q_{allow} = 4.1$ cfs (Minor Storm) 162.5 cfs (Major Storm)

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

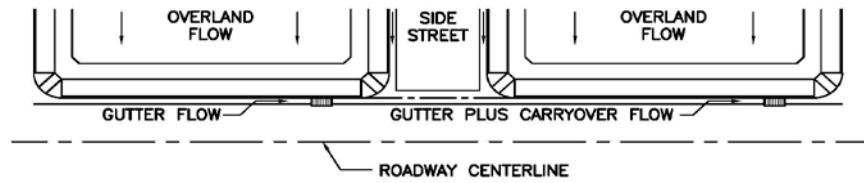
Inlet ID: DP 1U



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	3.70	12.07	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	15.6	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	44	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 1V



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
6.2	20.2

 cfs

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + I_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

6.2	20.2

 cfs

<---
FILL IN THIS SECTION
OR...

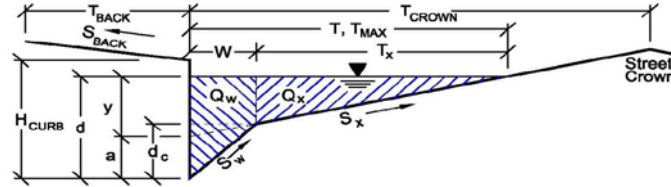
FILL IN THE SECTIONS
BELOW.
<---

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

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

Project:
Inlet ID:

Trails at Crowfoot
DP 1V



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)
Height of Curb at Gutter Flow Line
Distance from Curb Face to Street Crown
Gutter Width
Street Transverse Slope
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 18.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$
 $H_{CURB} = 4.00$ inches
 $T_{CROWN} = 17.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_D = 0.050$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	4.0	12.0	inches
	☐	☒	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

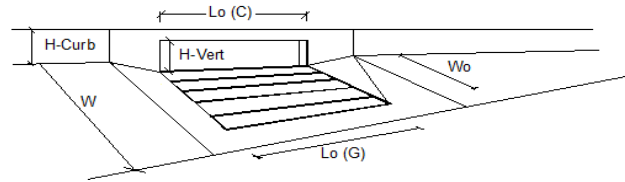
Minor Storm	Major Storm	
7.6	118.9	cfs

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 1V



Design Information (Input)

Type of Inlet
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')
Total Number of Units in the Inlet (Grate or Curb Opening)
Length of a Single Unit Inlet (Grate or Curb Opening)
Width of a Unit Grate (cannot be greater than W from Q-Allow)
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a_{LOCAL} =	5.0	5.0	inches
No =	1	1	
L_o =	15.00	15.00	ft
W_o =	N/A	N/A	ft
C_r-G =	N/A	N/A	
C_r-C =	0.10	0.10	

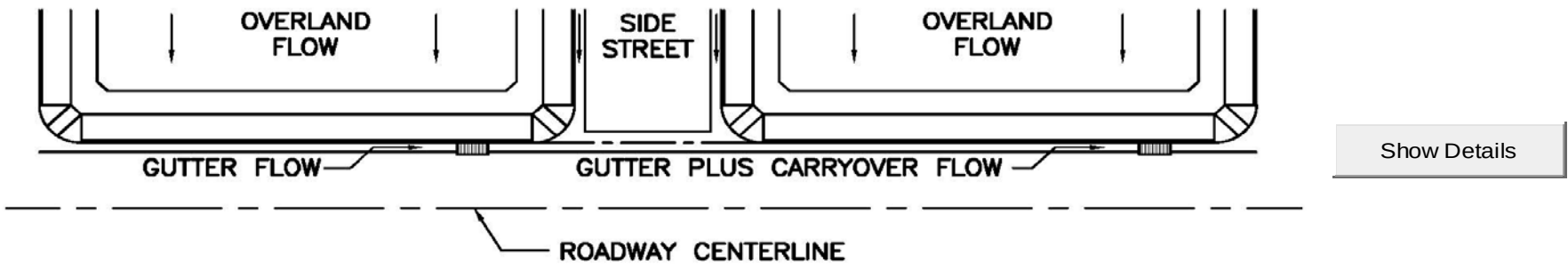
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'

Total Inlet Interception Capacity
Total Inlet Carry-Over Flow (flow bypassing inlet)
Capture Percentage = Q_a/Q_o =

	MINOR	MAJOR	
Q =	6.20	15.21	cfs
Q_b =	0.0	5.0	cfs
C% =	100	75	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2A



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =		
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =		
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0
Total Design Peak Flow, Q =	8.5	74.4

<--- FILL IN THIS SECTION OR...

FILL IN THE SECTIONS BELOW.

<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	2A

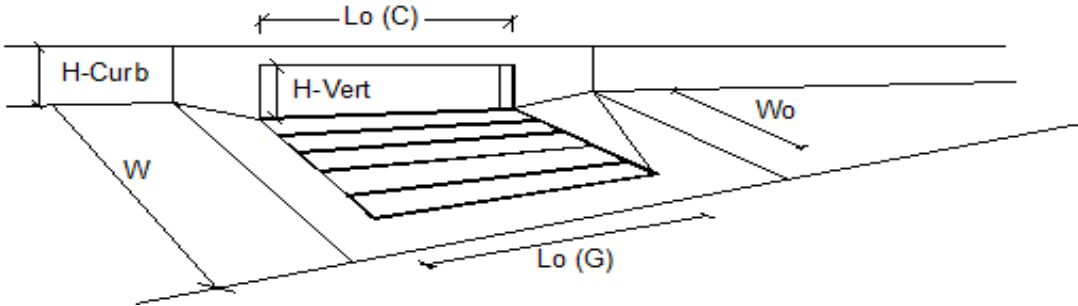
The diagram illustrates the cross-section of a street gutter. Key parameters include: T_{BACK} (width of backflow), S_{BACK} (backflow slope), T_x (width to crown), T_{MAX} (maximum width), T_{CROWN} (width to crown), W (gutter width), H_{CURB} (curb height), d (depth at curb), y (depth at distance x), a (depth at distance x), d_c (depth at curb), Q_w (flow in gutter), Q_x (flow at distance x), S_x (street slope), and S_w (gutter slope). The street crown is indicated on the right.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.070$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion	$Q_{allow} = 9.0$ cfs				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2A



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	8.50	47.95	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	26.5	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	64	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2B



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

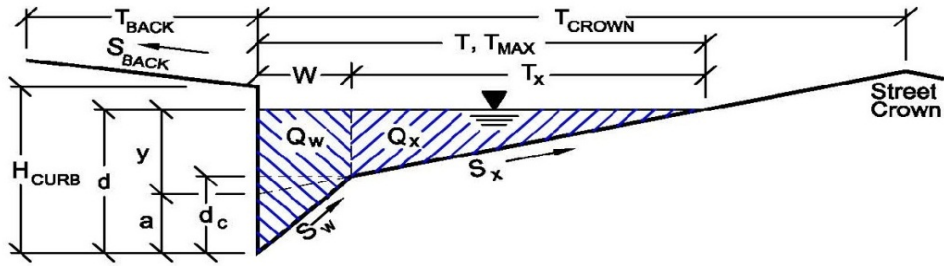
Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Minor Storm	Major Storm
Design Storm Return Period, T_r =	years
Return Period One-Hour Precipitation, P_1 =	inches
C_1 =	
C_2 =	
C_3 =	
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =	
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0 cfs
Total Design Peak Flow, Q =	3.8 cfs

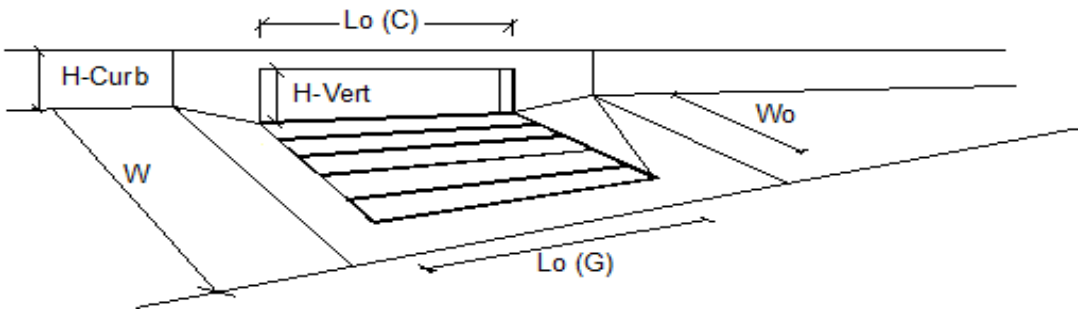
<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)					
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)					
Project:	Trails at Crowfoot				
Inlet ID:	2B				
					
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.030$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>5.9</td><td>138.6</td></tr></tbody></table> cfs		Minor Storm	Major Storm	5.9	138.6
Minor Storm	Major Storm				
5.9	138.6				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

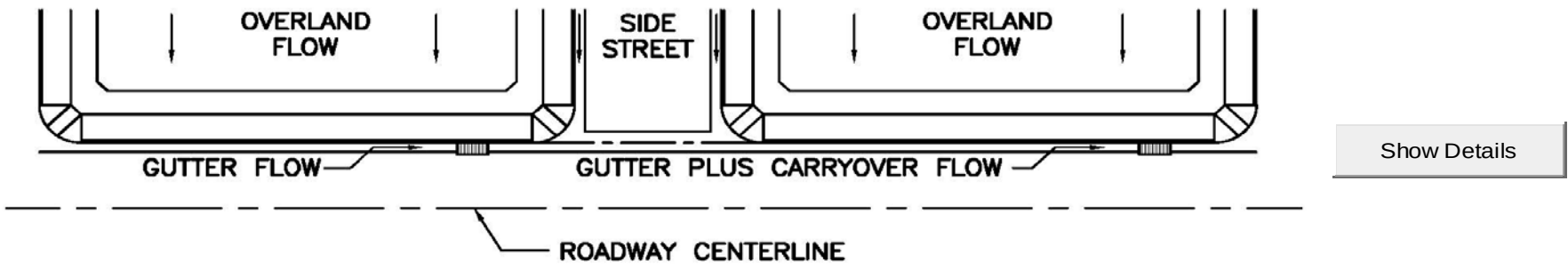
Project: Trails at Crowfoot
Inlet ID: 2B



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} =	5.0	5.0	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 =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _r G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _r C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	3.80	9.77	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b =	0.0	6.0	cfs
Capture Percentage = Q _a /Q _o =	C% =	100	62	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2C



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

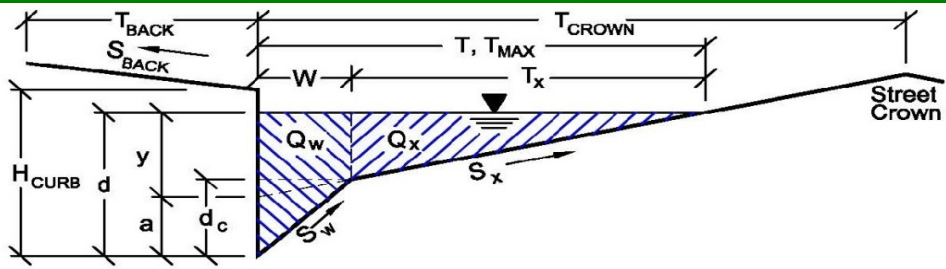
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	5.6	33.2	cfs

<--- FILL IN THIS SECTION OR...
FILL IN THE SECTIONS BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: 2C



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 18.0$ 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
 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ 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
 $S_o = 0.030$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 4.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

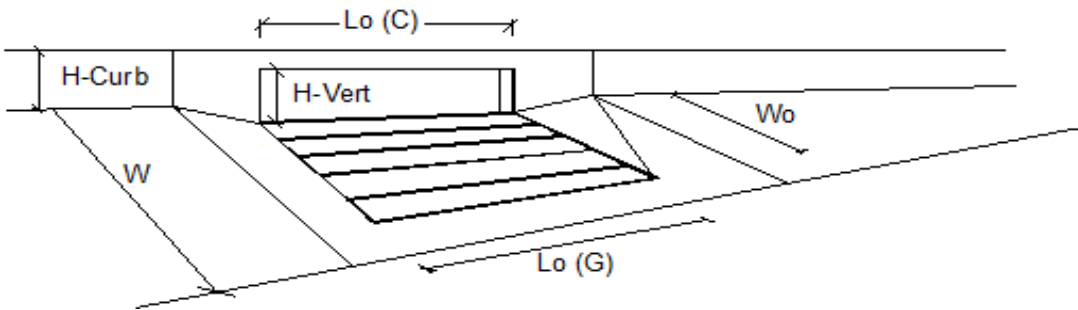
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$Q_{allow} = 5.9$ cfs (Minor Storm) 138.6 cfs (Major Storm)

INLET ON A CONTINUOUS GRADE

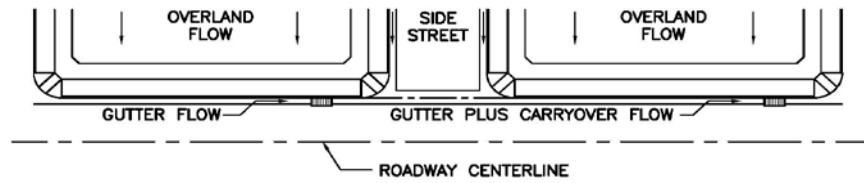
Project: Trails at Crowfoot
Inlet ID: 2C



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} =	5.0	5.0	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 =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _r G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _r C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	5.60	18.84	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b =	0.0	14.4	cfs
Capture Percentage = Q _a /Q _o =	C% =	100	57	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
 Inlet ID: 2D



Design Flow: ONLY if already determined through other methods:
 (local peak flow for 1/2 of street OR grass-lined channel):

* Q_{Known} =

Minor Storm	Major Storm
3.2	60.5

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
 Percent Imperviousness = %
 NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + I_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
 User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

3.2	60.5

 cfs

<---
 FILL IN THIS SECTION
 OR...

FILL IN THE SECTIONS
 BELOW.
 <---

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

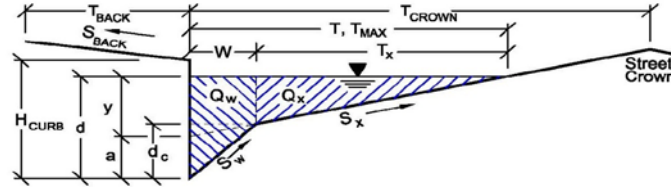
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Crowfoot

Inlet ID:

2D



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 18.0$ 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

$H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 17.0$ 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

$S_o = 0.050$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm	
$d_{MAX} =$	4.0	12.0	inches

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

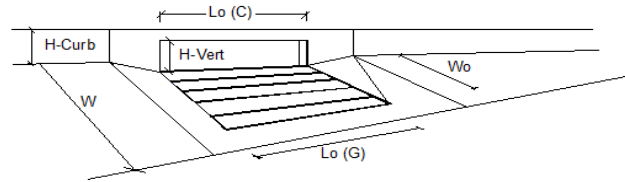
	Minor Storm	Major Storm	
$Q_{allow} =$	7.6	118.9	cfs

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: 2D



Design Information (Input)

Type of Inlet
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')
Total Number of Units in the Inlet (Grate or Curb Opening)
Length of a Single Unit Inlet (Grate or Curb Opening)
Width of a Unit Grate (cannot be greater than W from Q-Allow)
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a_{LOCAL} =	5.0	5.0	inches
No =	1	1	
L_o =	10.00	10.00	ft
W_o =	N/A	N/A	ft
C_r-G =	N/A	N/A	
C_r-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'

Total Inlet Interception Capacity
Total Inlet Carry-Over Flow (flow bypassing inlet)
Capture Percentage = Q_a/Q_o =

	MINOR	MAJOR	
Q =	3.20	16.91	cfs
Q_b =	0.0	43.6	cfs
C% =	100	28	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2E



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
3.9	28.4

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)

Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	13.3

 cfs

Total Design Peak Flow, Q =

Minor Storm	Major Storm
3.9	41.7

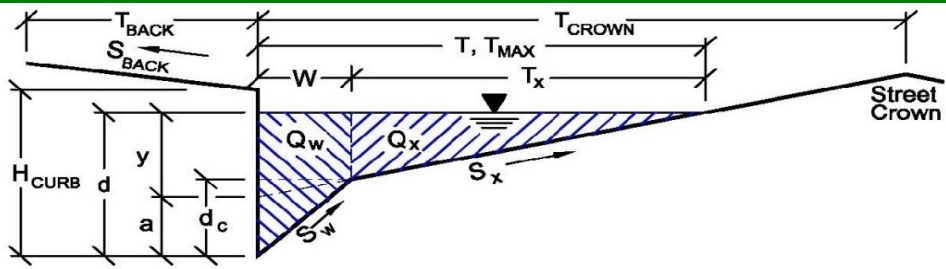
 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: 2E



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 18.0$ 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
 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ 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
 $S_o = 0.060$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 4.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

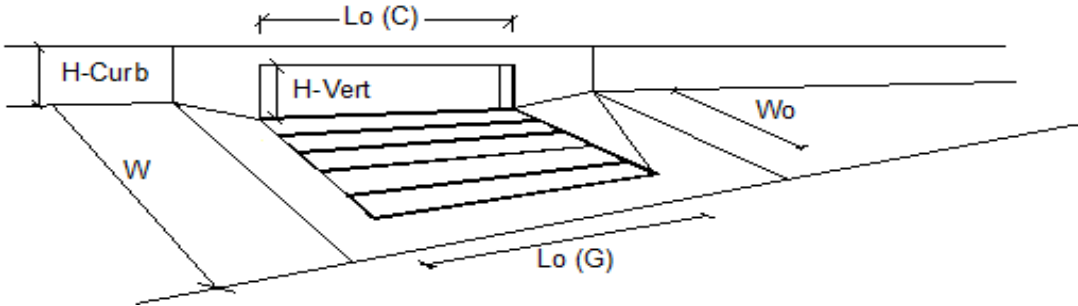
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$Q_{allow} = 8.3$ cfs (Minor Storm) 112.6 cfs (Major Storm)

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

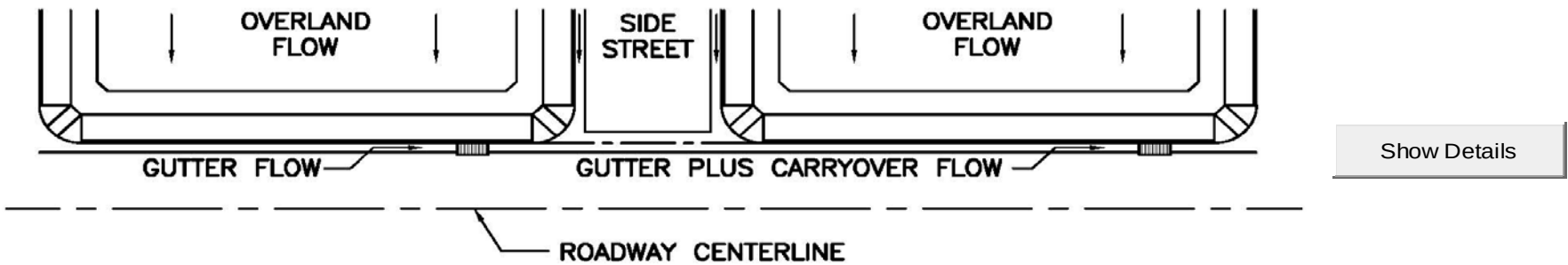
Inlet ID: 2E



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L _o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _r G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _r C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	3.90	34.82	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b =	0.0	6.8	cfs
Capture Percentage = Q _a /Q _o =	C% =	100	84	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2F



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
3.9	28.4

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	3.4

 cfs
Total Design Peak Flow, Q =

Minor Storm	Major Storm
3.9	31.8

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	2F

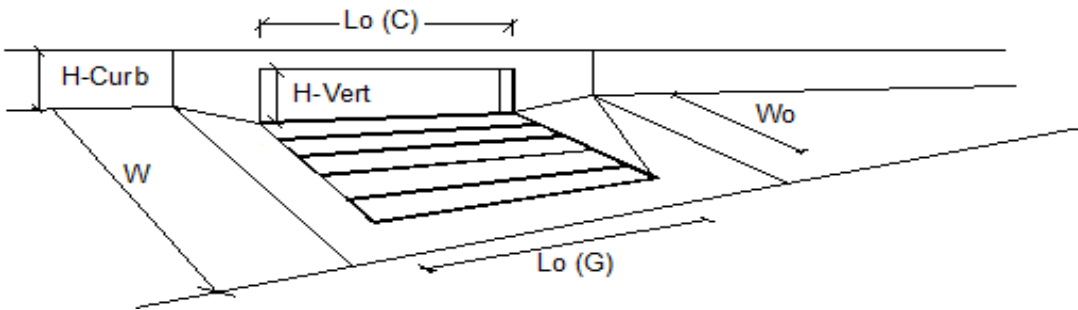
The diagram illustrates the cross-section of a street gutter. Key parameters include: T_{BACK} (width of backflow), S_{BACK} (backflow slope), T_x (width to point x), T_{MAX} (maximum width), T_{CROWN} (width to crown), W (gutter width), H_{CURB} (curb height), d (depth at curb), y (depth at point x), a (depth at gutter line), d_c (depth at crown), Q_w (width flow), Q_x (depth flow), S_x (slope to point x), S_w (gutter slope), and S_o (street slope). The 'Street Crown' is indicated on the right side.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.060$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>8.3</td><td>112.6</td></tr></tbody></table> cfs		Minor Storm	Major Storm	8.3	112.6
Minor Storm	Major Storm				
8.3	112.6				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2F



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	3.90	29.09	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	2.7	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	91	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2G



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

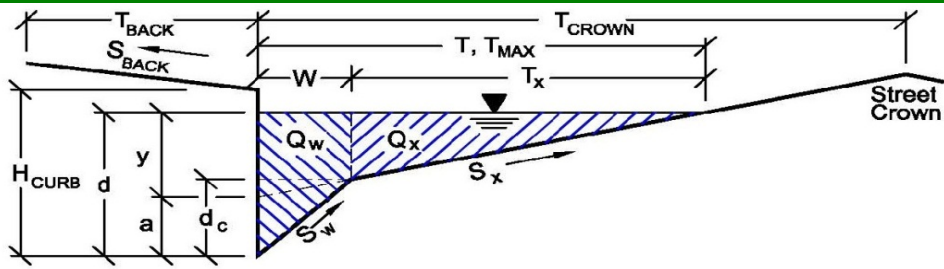
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	5.8	24.5	cfs

<--- FILL IN THIS SECTION OR...<--- FILL IN THE SECTIONS BELOW.<---

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

Project: Trails at Crowfoot
Inlet ID: 2G



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 18.0$ 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
 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ 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
 $S_o = 0.060$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 4.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

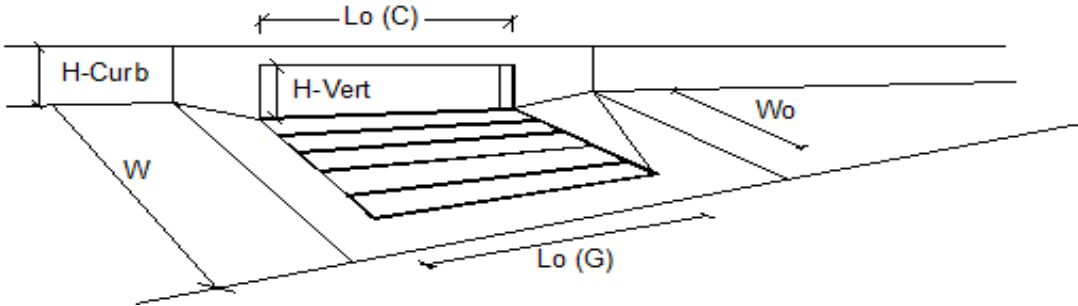
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$Q_{allow} = 8.3$ cfs (Minor Storm) 112.6 cfs (Major Storm)

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2G



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} =	5.0	5.0	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 =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _r G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _r C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	5.80	16.85	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b =	0.0	7.7	cfs
Capture Percentage = Q _a /Q _o =	C% =	100	69	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2H



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
5.0	21.8

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	1.4

 cfs
Total Design Peak Flow, Q =

Minor Storm	Major Storm
5.0	23.2

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

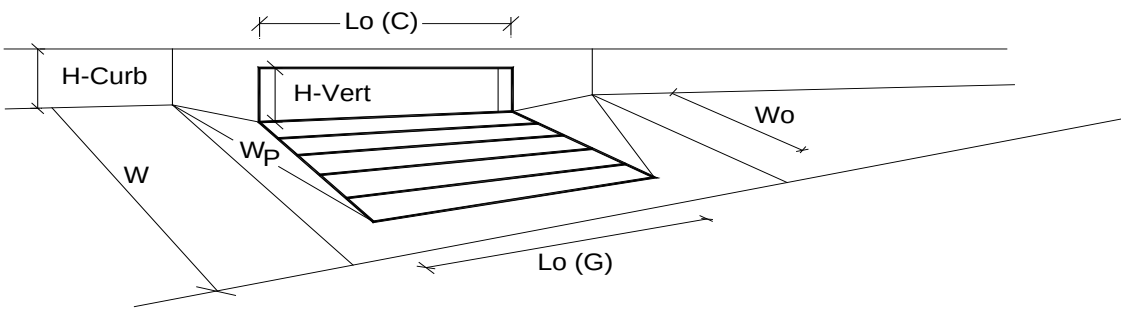
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)		
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)		
Project:	Trails at Crowfoot	
Inlet ID:	2H	

The diagram illustrates the cross-section of a street gutter. Key parameters include: T_{BACK} (width of backflow), S_{BACK} (backflow slope), T_x , T_{MAX} , T_{CROWN} (widths from curb to various points), W (gutter width), H_{CURB} (curb height), d (depth at curb), y (depth at distance a), a (distance from curb face to gutter flowline), d_c (depth at gutter flowline), Q_w (flow in gutter), Q_x (flow at distance x), S_x (street slope), S_w (gutter cross slope), and S_o (street longitudinal slope). The 'Street Crown' is indicated on the right side.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><tr><td>☐</td><td>☒</td><td>check = yes</td></tr></table>	☐	☒	check = yes	
☐	☒	check = yes			
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>SUMP</td><td>SUMP</td></tr></table> cfs		Minor Storm	Major Storm	SUMP	SUMP
Minor Storm	Major Storm				
SUMP	SUMP				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = 2H



Design Information (Input)		MINOR	MAJOR	
Type of Inlet		CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		2	2	
Water Depth at Flowline (outside of local depression)		6.0	8.0	inches
				☒ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		10.00	10.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
		14.4	29.9	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)		5.0	23.2	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 21



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

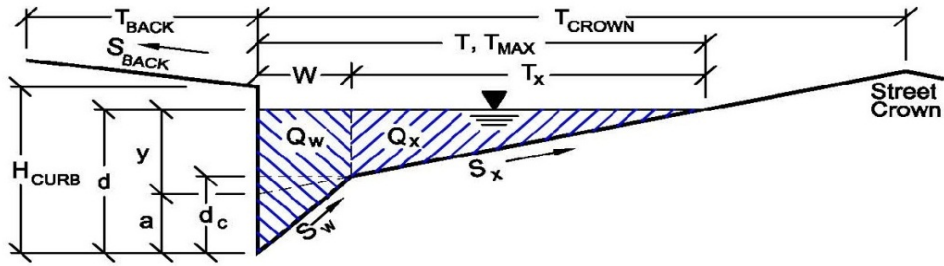
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

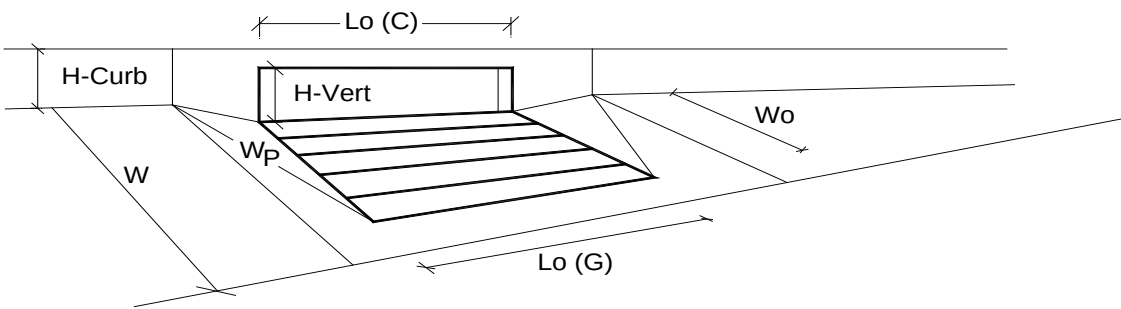
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	2.9	35.7	cfs

<--- FILL IN THIS SECTION OR...
FILL IN THE SECTIONS BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)					
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)					
Project:	Trails at Crowfoot				
Inlet ID:	2I				
					
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>SUMP</td><td>SUMP</td></tr></tbody></table> cfs		Minor Storm	Major Storm	SUMP	SUMP
Minor Storm	Major Storm				
SUMP	SUMP				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = 2I

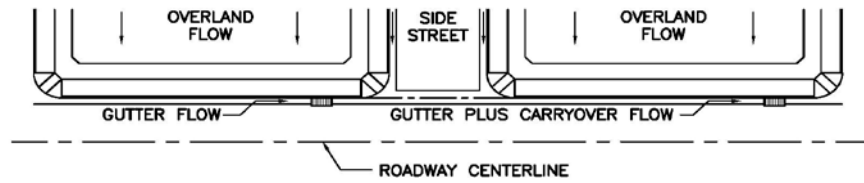


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	2	2	
Water Depth at Flowline (outside of local depression)	6.0	8.0	inches
☒ Override Depths			
Grate Information	MINOR	MAJOR	
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
Curb Opening Information	MINOR	MAJOR	
Length of a Unit Curb Opening	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)	MINOR	MAJOR	
Q_a =	19.9	41.4	cfs
Q_{PEAK REQUIRED} =	2.9	35.7	cfs

Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2J



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
1.3	51.8

 cfs

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + P_1)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

1.3	51.8

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

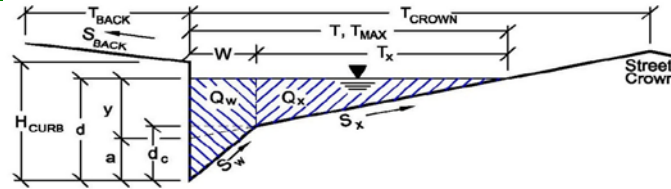
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Crowfoot

Inlet ID:

2J



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 18.0$ 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

$H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 17.0$ 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)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm
$T_{MAX} =$	17.0	17.0

 ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm
$d_{MAX} =$	4.0	12.0

 inches

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

	Minor Storm	Major Storm
	SUMP	SUMP

 cfs

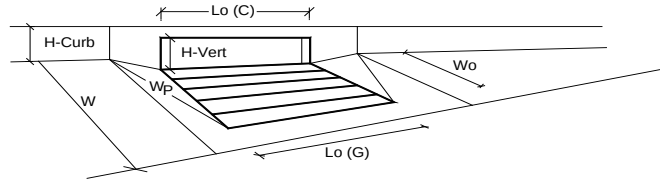
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot

Inlet ID = 2J



Design Information (Input)

Type of Inlet

Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

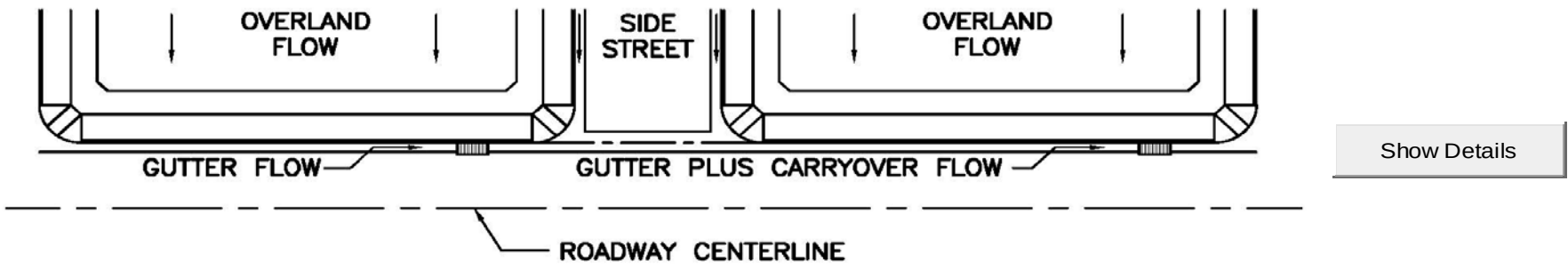
	MINOR	MAJOR	
Inlet Type =	CDOT Type R Curb Opening		
a_{local} =	5.00	5.00	inches
No =	2	2	
Ponding Depth =	6.0	12.0	inches
	☒ Override Depths		
	MINOR	MAJOR	
$L_o (G)$ =	N/A	N/A	feet
W_o =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
$C_l (G)$ =	N/A	N/A	
$C_w (G)$ =	N/A	N/A	
$C_o (G)$ =	N/A	N/A	
	MINOR	MAJOR	
$L_o (C)$ =	10.00	10.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
$C_l (C)$ =	0.10	0.10	
$C_w (C)$ =	3.60	3.60	
$C_o (C)$ =	0.67	0.67	
	MINOR	MAJOR	
Q_a =	14.4	56.8	cfs
$Q_{PEAK REQUIRED}$ =	1.3	51.8	cfs

Total Inlet Interception Capacity (assumes clogged condition)

Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2K



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
1.6	5.2

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)

Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs

Total Design Peak Flow, Q =

Minor Storm	Major Storm
1.6	5.2

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

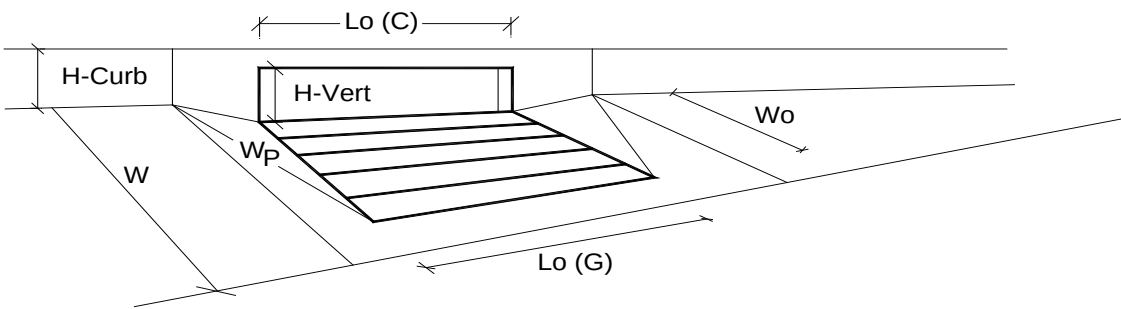
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	2K

The diagram illustrates the cross-section of a street gutter. Key parameters include: T_{BACK} (width of backflow), S_{BACK} (backflow slope), T_x (width to crown), T_{MAX} (maximum width), T_{CROWN} (width to crown), W (gutter width), H_{CURB} (curb height), d (depth at curb), y (depth at distance x), a (depth at distance x), d_c (depth at curb), Q_w (width flow), Q_x (depth flow), S_x (slope to crown), S_w (width slope), and S_o (street slope). The street crown is indicated on the right.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><tr><td>☐</td><td>☒</td><td>check = yes</td></tr></table>	☐	☒	check = yes	
☐	☒	check = yes			
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$Q_{allow} = \text{SUMP}$</td><td>$Q_{allow} = \text{SUMP}$</td></tr></table> cfs	Minor Storm	Major Storm	$Q_{allow} = \text{SUMP}$	$Q_{allow} = \text{SUMP}$
Minor Storm	Major Storm				
$Q_{allow} = \text{SUMP}$	$Q_{allow} = \text{SUMP}$				

INLET IN A SUMP OR SAG LOCATION

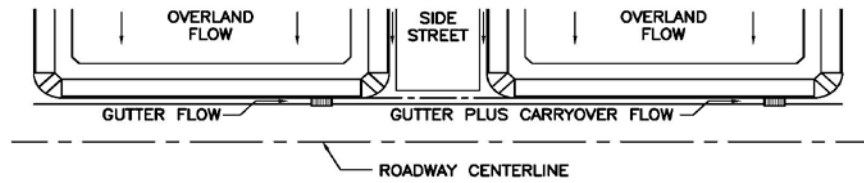
Project = Trails at Crowfoot
Inlet ID = 2K



Design Information (Input)		MINOR	MAJOR	
Type of Inlet		CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		1	1	
Water Depth at Flowline (outside of local depression)		6.0	12.0	inches
				☒ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		5.00	5.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
		5.4	13.2	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)		1.6	5.2	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2L



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
6.2	50.1

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + I_c)^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

6.2	50.1

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

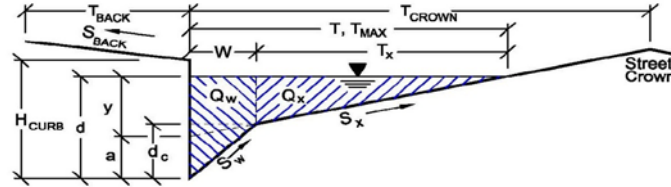
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Crowfoot

Inlet ID:

2L



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 18.0$ 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

$H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 17.0$ 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

$S_o = 0.030$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm	
$d_{MAX} =$	4.0	12.0	inches

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

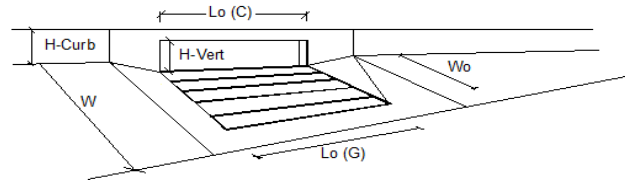
	Minor Storm	Major Storm	
$Q_{allow} =$	5.9	138.6	cfs

WARNING: MINOR STORM max. allowable capacity is less than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: 2L



Design Information (Input)

Type of Inlet
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')
Total Number of Units in the Inlet (Grate or Curb Opening)
Length of a Single Unit Inlet (Grate or Curb Opening)
Width of a Unit Grate (cannot be greater than W from Q-Allow)
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a_{LOCAL} =	5.0	5.0	inches
No =	1	1	
L_o =	15.00	15.00	ft
W_o =	N/A	N/A	ft
C_r-G =	N/A	N/A	
C_r-C =	0.10	0.10	

Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR STORM'

Total Inlet Interception Capacity
Total Inlet Carry-Over Flow (flow bypassing inlet)
Capture Percentage = Q_a/Q_o =

	MINOR	MAJOR	
Q =	6.20	22.42	cfs
Q_b =	0.0	27.7	cfs
C% =	100	45	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2M



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b = cfs
Total Design Peak Flow, Q = cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	2M

The diagram illustrates the cross-section of a street gutter. It shows the curb height H_{CURB} , the gutter width W , and the street transverse slope S_x . The gutter flow is divided into two sections: Q_w (width T_{BACK} , slope S_{BACK}) and Q_x (width T_x , slope S_x). The total gutter width is T , and the maximum allowable spread is T_{MAX} . The distance from the curb face to the street crown is T_{CROWN} . The gutter cross slope is S_w , and the street longitudinal slope is S_o . The gutter depth at the curb is d , and the gutter depth at the street crown is d_c . The gutter flow is Q , and the street flow is Q_s .

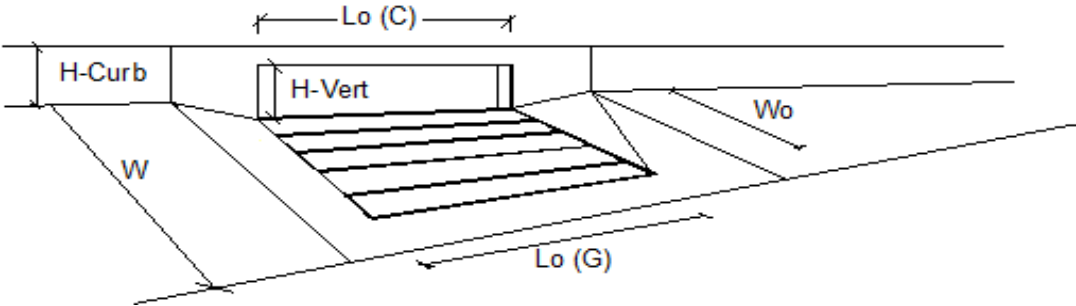
Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$
Height of Curb at Gutter Flow Line	$H_{CURB} = 4.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.020$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = 17.0$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = 4.0$ inches
Allow Flow Depth at Street Crown (leave blank for no)	☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	

	Minor Storm	Major Storm
$Q_{allow} =$	4.8	156.5
	cfs	

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2M



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	3.90	9.62	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	6.1	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	61	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 2N



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b = cfs
Total Design Peak Flow, Q = cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	2N

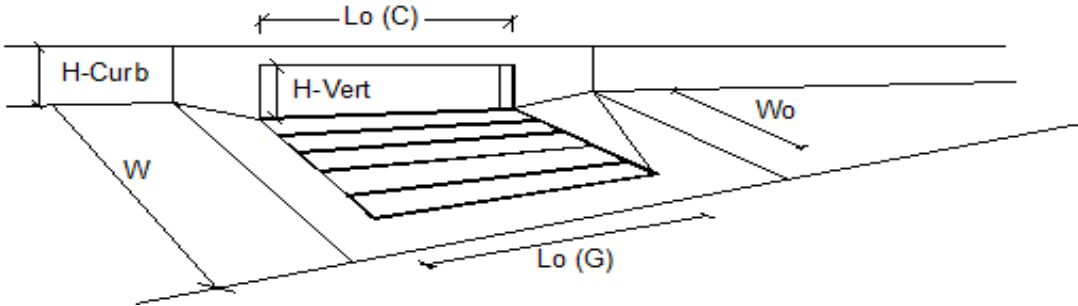
The diagram illustrates the cross-section of a gutter and street. Key parameters include: T_{BACK} (back-slope length), S_{BACK} (back-slope), H_{CURB} (curb height), d (distance from curb face to gutter flow line), y (gutter depth), a (gutter width), d_c (curb depth), W (gutter width), T_{CROWN} (distance from curb face to street crown), T_x (distance from curb face to point x), T_{MAX} (maximum allowable spread), Q_w (flow in gutter), Q_x (flow at point x), S_x (street slope), S_w (gutter cross slope), S_o (street longitudinal slope), and Street Crown.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.020$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><tr><td>☐</td><td>☒</td><td>check = yes</td></tr></table>	☐	☒	check = yes	
☐	☒	check = yes			
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>4.8</td><td>156.5</td></tr></table> cfs		Minor Storm	Major Storm	4.8	156.5
Minor Storm	Major Storm				
4.8	156.5				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 2N



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	3.90	9.62	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	6.1	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	61	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 20



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
2.5	10.1

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)

Overland Flow =

Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years

Return Period One-Hour Precipitation, P_1 = inches

C_1 =

C_2 =

C_3 =

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =

User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

2.5	10.1

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	20

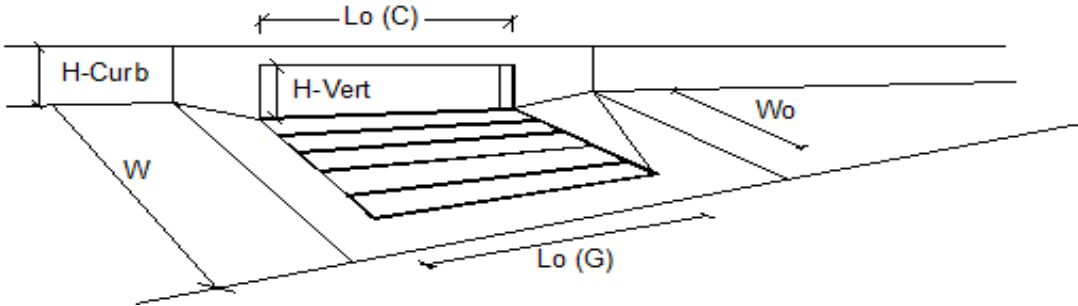
The diagram illustrates the cross-section of a gutter and street. Key parameters include: T_{BACK} (back-slope length), S_{BACK} (back-slope), H_{CURB} (curb height), d (distance from curb face to gutter flow line), y (gutter depth), a (gutter width), d_c (distance from gutter flow line to street crown), W (gutter width), T_{CROWN} (crown length), T_x (street width), S_x (street slope), Q_w (gutter flow), Q_x (street flow), and S_w (gutter cross slope). The street crown is indicated on the right.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.010$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$Q_{allow} = 3.4$</td><td>$Q_{allow} = 132.7$</td></tr></tbody></table> cfs	Minor Storm	Major Storm	$Q_{allow} = 3.4$	$Q_{allow} = 132.7$
Minor Storm	Major Storm				
$Q_{allow} = 3.4$	$Q_{allow} = 132.7$				

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

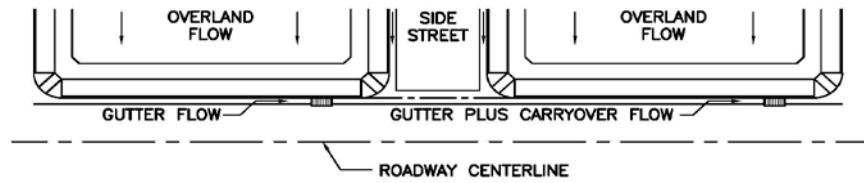
Inlet ID: 20



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	N_o =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_rG =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_rC =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	2.50	7.61	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	2.5	cfs
Capture Percentage = Q_a/Q_o =	C% =	100	75	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 3A



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
8.7	54.3

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + P_1)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

8.7	54.3

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

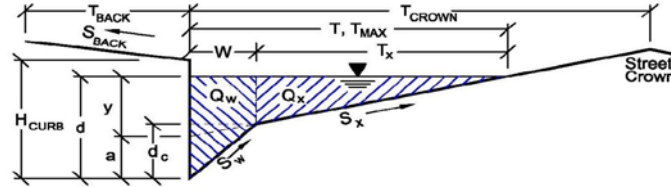
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Crowfoot

Inlet ID:

3A



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)
 Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 18.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

 $H_{CURB} = 4.00$ inches
 $T_{CROWN} = 17.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_D = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	4.0	12.0	inches
	☐	☒	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

Minor Storm	Major Storm
SUMP	SUMP

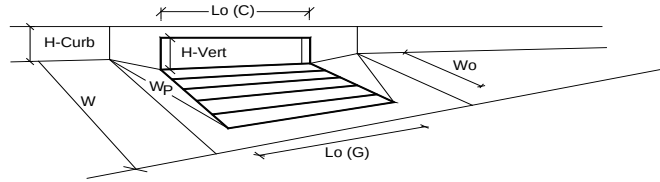
 cfs

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = 3A



Design Information (Input)

Type of Inlet
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')
Number of Unit Inlets (Grate or Curb Opening)
Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate
Width of a Unit Grate
Area Opening Ratio for a Grate (typical values 0.15-0.90)
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)
Grate Weir Coefficient (typical value 2.15 - 3.60)
Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening
Height of Vertical Curb Opening in Inches
Height of Curb Orifice Throat in Inches
Angle of Throat (see USDCM Figure ST-5)
Side Width for Depression Pan (typically the gutter width of 2 feet)
Clogging Factor for a Single Curb Opening (typical value 0.10)
Curb Opening Weir Coefficient (typical value 2.3-3.7)
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

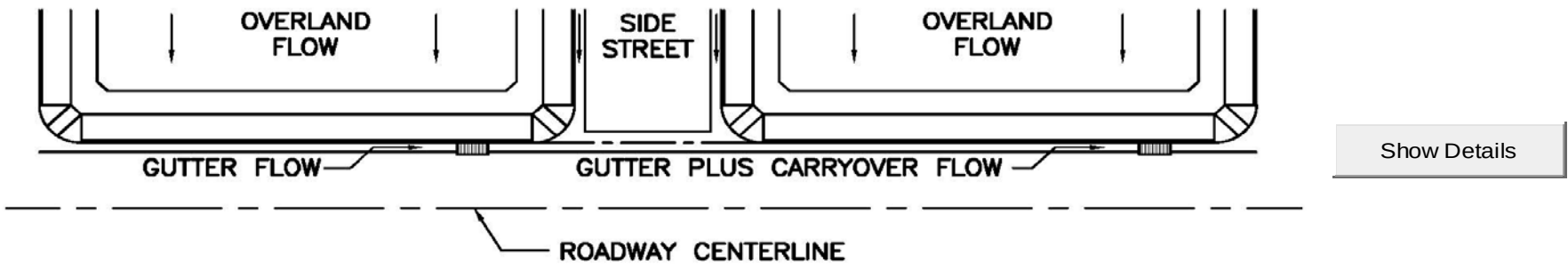
Total Inlet Interception Capacity (assumes clogged condition)

Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

	MINOR	MAJOR	
Inlet Type =	CDOT Type R Curb Opening		
a_{local} =	5.00	5.00	inches
No =	2	2	
Ponding Depth =	6.0	12.0	inches
	☒ Override Depths		
	MINOR	MAJOR	
L_0 (G) =	N/A	N/A	feet
W_0 =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
C_1 (G) =	N/A	N/A	
C_w (G) =	N/A	N/A	
C_o (G) =	N/A	N/A	
	MINOR	MAJOR	
L_0 (C) =	10.00	10.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
C_1 (C) =	0.10	0.10	
C_w (C) =	3.60	3.60	
C_o (C) =	0.67	0.67	
	MINOR	MAJOR	
Q_a =	14.4	56.8	cfs
$Q_{PEAK REQUIRED}$ =	8.7	54.3	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4A



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

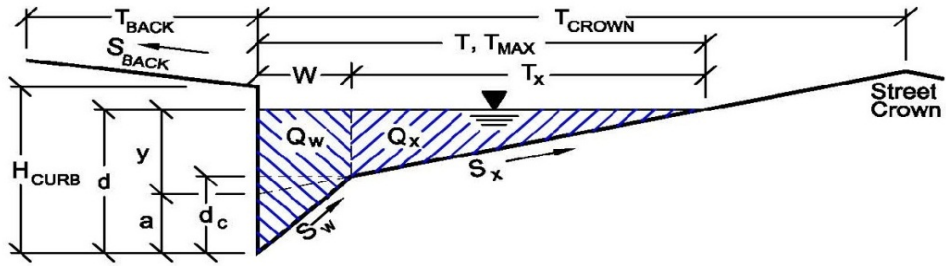
Minor Storm	Major Storm
Design Storm Return Period, T_r =	years
Return Period One-Hour Precipitation, P_1 =	inches
C_1 =	
C_2 =	
C_3 =	
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =	
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0 0.0 cfs
Total Design Peak Flow, Q =	5.3 25.2 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: 4A



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 18.0$ 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
 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ 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)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 4.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

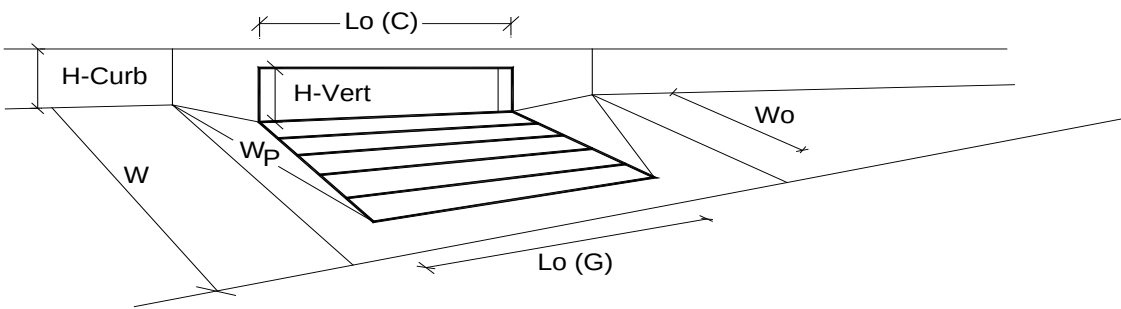
$Q_{allow} =$

Minor Storm	Major Storm
SUMP	SUMP

 cfs

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = 4A



Design Information (Input)		MINOR	MAJOR	
Type of Inlet		CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		1	1	
Water Depth at Flowline (outside of local depression)		6.0	12.0	inches
				☒ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		10.00	10.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
		8.3	27.5	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)		5.3	25.2	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4B



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

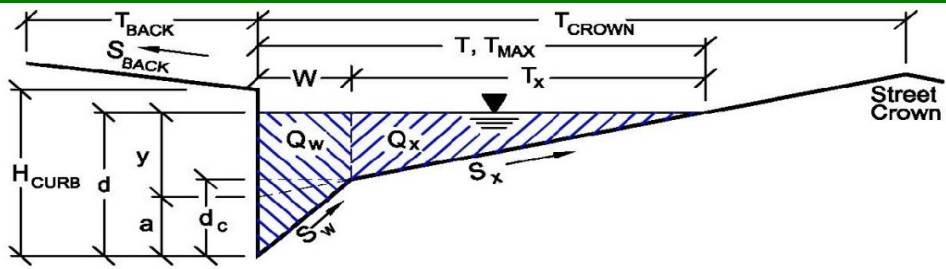
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Minor Storm	Major Storm
Design Storm Return Period, T_r =	years
Return Period One-Hour Precipitation, P_1 =	inches
C_1 =	
C_2 =	
C_3 =	
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =	
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0 0.0 cfs
Total Design Peak Flow, Q =	5.6 24.8 cfs

<---
FILL IN THIS SECTION
OR...
FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: 4B

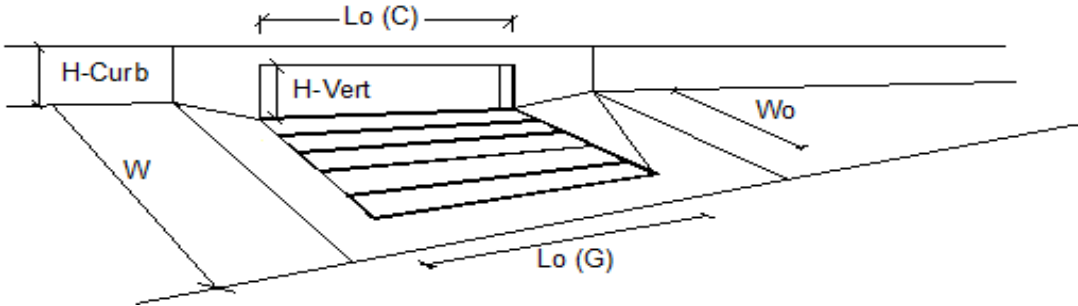


Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$
Height of Curb at Gutter Flow Line	$H_{CURB} = 4.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.060$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = 17.0$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = 4.0$ inches
Allow Flow Depth at Street Crown (leave blank for no)	☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm
MAJOR STORM Allowable Capacity is based on Depth Criterion	$Q_{allow} = 8.3$ 112.6 cfs
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 4B

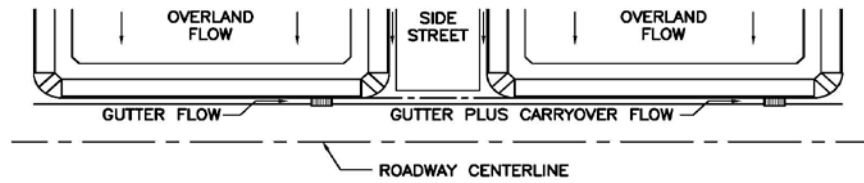


Warning 1

Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	N_o =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_rG =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_rC =	0.20	0.20	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	5.60	16.52	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	8.3	cfs
Capture Percentage = Q_a/Q_o =	C% =	100	67	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
 Inlet ID: 4E



Show Details

Design Flow: ONLY if already determined through other methods:
 (local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
8.3	42.2

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
 Percent Imperviousness = %
 NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + P_1)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
 User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

8.3	42.2

 cfs

<---
 FILL IN THIS SECTION
 OR...

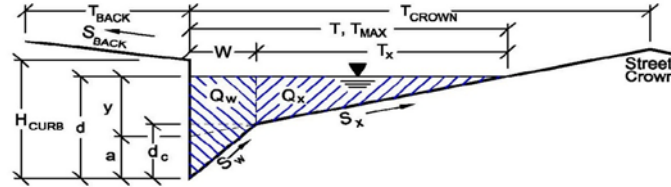
FILL IN THE SECTIONS
 BELOW.
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ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project:
Inlet ID:

Trails at Crowfoot
4E



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)
Height of Curb at Gutter Flow Line
Distance from Curb Face to Street Crown
Gutter Width
Street Transverse Slope
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 18.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$
 $H_{CURB} = 4.00$ inches
 $T_{CROWN} = 17.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
Allow Flow Depth at Street Crown (leave blank for no)

Minor Storm Major Storm
 $T_{MAX} = 17.0$ ft
 $d_{MAX} = 4.0$ inches
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

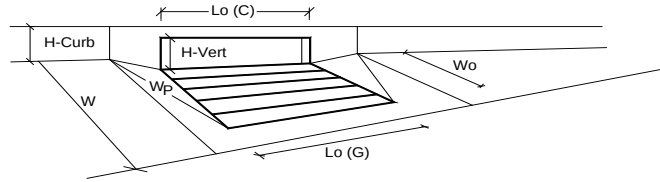
Minor Storm Major Storm
 $Q_{allow} = \text{SUMP}$ cfs

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot

Inlet ID = 4E



Design Information (Input)

Type of Inlet

Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

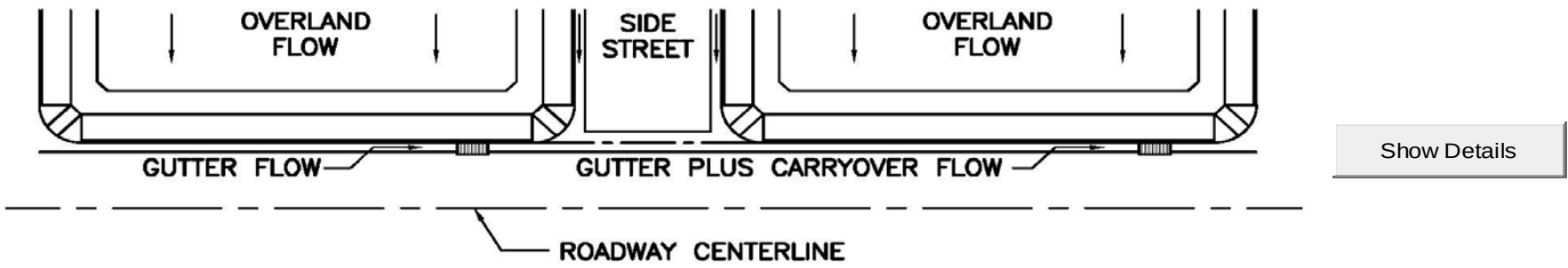
Total Inlet Interception Capacity (assumes clogged condition)

Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

	MINOR	MAJOR	
Inlet Type =	CDOT Type R Curb Opening		
a_{local} =	5.00	5.00	inches
No =	2	2	
Ponding Depth =	6.0	12.0	inches
	☒ Override Depths		
	MINOR	MAJOR	
$L_o (G)$ =	N/A	N/A	feet
W_o =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
$C_l (G)$ =	N/A	N/A	
$C_w (G)$ =	N/A	N/A	
$C_o (G)$ =	N/A	N/A	
	MINOR	MAJOR	
$L_o (C)$ =	10.00	10.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
$C_l (C)$ =	0.10	0.10	
$C_w (C)$ =	3.60	3.60	
$C_o (C)$ =	0.67	0.67	
	MINOR	MAJOR	
Q_a =	14.4	56.8	cfs
$Q_{PEAK REQUIRED}$ =	8.3	42.2	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4F



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

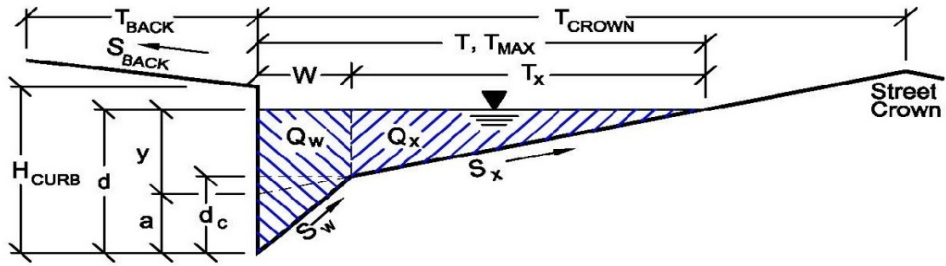
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	2.9	24.3	cfs

<--- FILL IN THIS SECTION OR...
FILL IN THE SECTIONS BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: 4F



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 19.0$ 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
 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ ft

Gutter Width
 $W = 2.50$ 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
 $S_o = 0.060$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 6.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

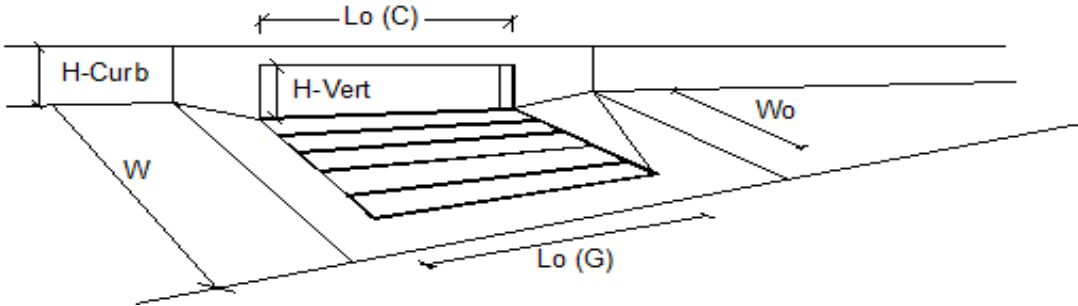
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$Q_{allow} = 12.2$ cfs (Minor Storm) 91.0 cfs (Major Storm)

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 4F



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_{rG} =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_{rC} =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	2.90	24.05	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	0.3	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	99	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 4G



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
2.5	11.8

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

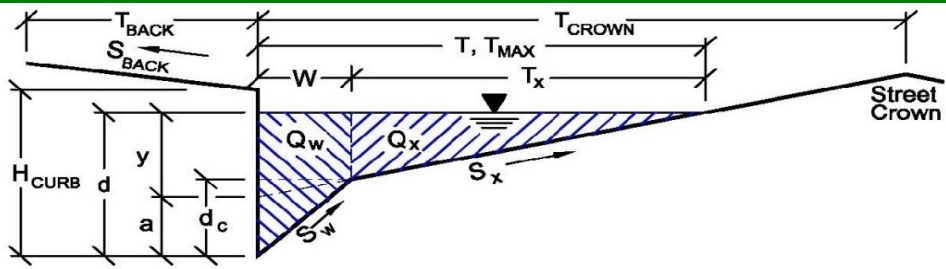
	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =		
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =		
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0
Total Design Peak Flow, Q =	2.5	11.8

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
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ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

Project: Trails at Crowfoot
Inlet ID: DP 4G



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 18.0$ 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
 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ 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)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 4.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

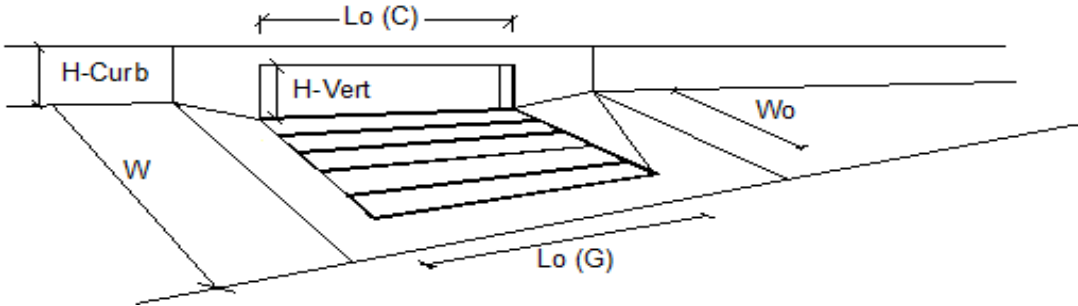
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$Q_{allow} = 6.8$ cfs (Minor Storm) 127.1 cfs (Major Storm)

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

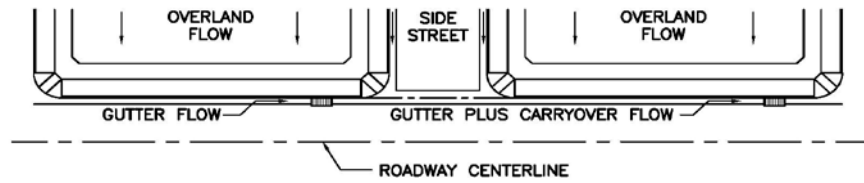
Inlet ID: DP 4G



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_{rG} =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_{rC} =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	2.50	11.63	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	0.1	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	99	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
 Inlet ID: 4I



Show Details

Design Flow: ONLY if already determined through other methods:
 (local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
4.1	17.3

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
 Percent Imperviousness = %
 NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + I_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
 User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

4.1	17.3

 cfs

<---
 FILL IN THIS SECTION
 OR...

FILL IN THE SECTIONS
 BELOW.
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ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

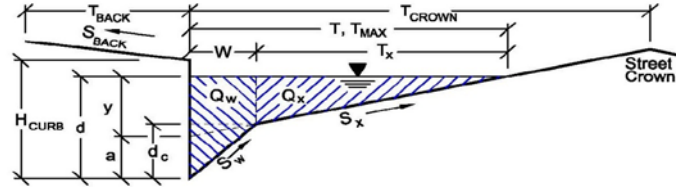
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Crowfoot

Inlet ID:

4I



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 18.0$ 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

$H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 17.0$ 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)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

Minor Storm: $T_{MAX} = 17.0$ ft
Major Storm: $T_{MAX} = 17.0$ ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Minor Storm: $d_{MAX} = 4.0$ inches
Major Storm: $d_{MAX} = 12.0$ inches

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$ Minor Storm: SUMP, Major Storm: SUMP cfs

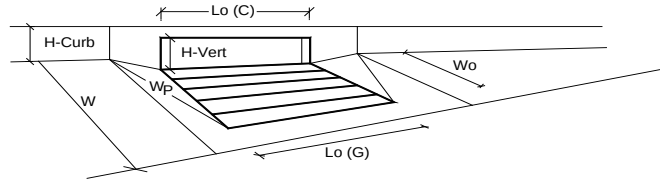
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot

Inlet ID = 4I



Design Information (Input)

Type of Inlet

Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

Total Inlet Interception Capacity (assumes clogged condition)

Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

	MINOR	MAJOR	
Inlet Type =	CDOT Type R Curb Opening		
a_{local} =	5.00	5.00	inches
No =	1	1	
Ponding Depth =	6.0	12.0	inches
	☒ Override Depths		
	MINOR	MAJOR	
$L_o (G)$ =	N/A	N/A	feet
W_o =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
$C_l (G)$ =	N/A	N/A	
$C_w (G)$ =	N/A	N/A	
$C_o (G)$ =	N/A	N/A	
	MINOR	MAJOR	
$L_o (C)$ =	10.00	10.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
$C_l (C)$ =	0.10	0.10	
$C_w (C)$ =	3.60	3.60	
$C_o (C)$ =	0.67	0.67	
	MINOR	MAJOR	
Q_a =	8.3	27.5	cfs
$Q_{PEAK REQUIRED}$ =	4.1	17.3	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4J



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

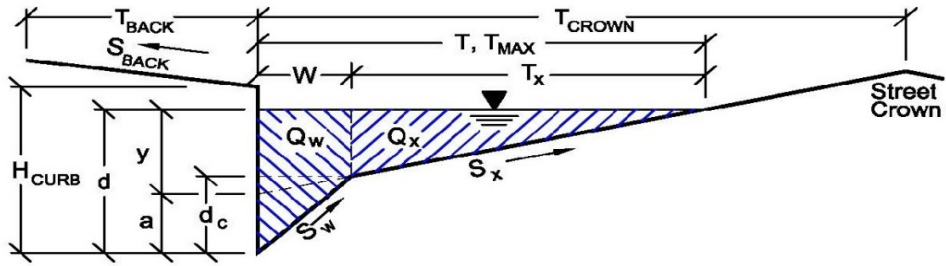
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	5.6	45.7	cfs

<--- FILL IN THIS SECTION OR...
FILL IN THE SECTIONS BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: 4J



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb $T_{BACK} = 18.0$ 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 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown $T_{CROWN} = 17.0$ 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) $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm $T_{MAX} = 17.0$ Minor Storm 17.0 Major Storm ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm $d_{MAX} = 4.0$ Minor Storm 12.0 Major Storm inches

Allow Flow Depth at Street Crown (leave blank for no) ☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

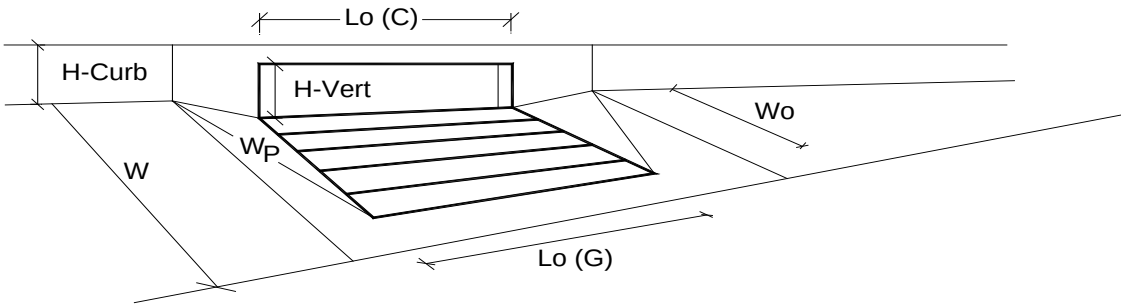
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$Q_{allow} =$ Minor Storm **SUMP** Major Storm **SUMP** cfs

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = 4J



Design Information (Input)		MINOR	MAJOR	
Type of Inlet		CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		2	2	
Water Depth at Flowline (outside of local depression)		6.0	12.0	inches
				☒ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		10.00	10.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
		14.4	56.8	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)		5.6	45.7	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4K



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

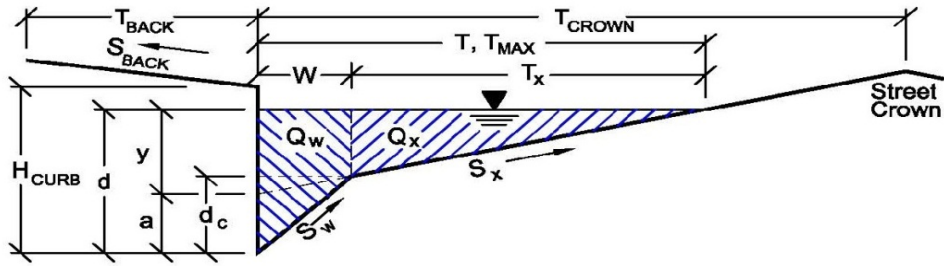
Rainfall Information: Intensity i (inches/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	6.2	19.0	cfs

<--- FILL IN THIS SECTION OR...

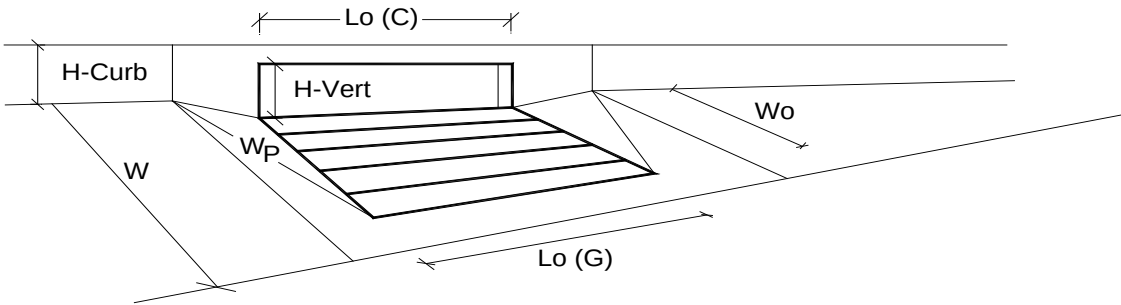
FILL IN THE SECTIONS BELOW.

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ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)					
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)					
Project:	Trails at Crowfoot				
Inlet ID:	4K				
					
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>SUMP</td><td>SUMP</td></tr></tbody></table> cfs		Minor Storm	Major Storm	SUMP	SUMP
Minor Storm	Major Storm				
SUMP	SUMP				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = 4K



Design Information (Input)		MINOR	MAJOR	
Type of Inlet		CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		1	1	
Water Depth at Flowline (outside of local depression)		6.0	12.0	inches
				☒ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		10.00	10.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
Q_a =		8.3	27.5	cfs
Q_{PEAK REQUIRED} =		6.2	19.0	cfs

Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 4L



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
2.1	10.0

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

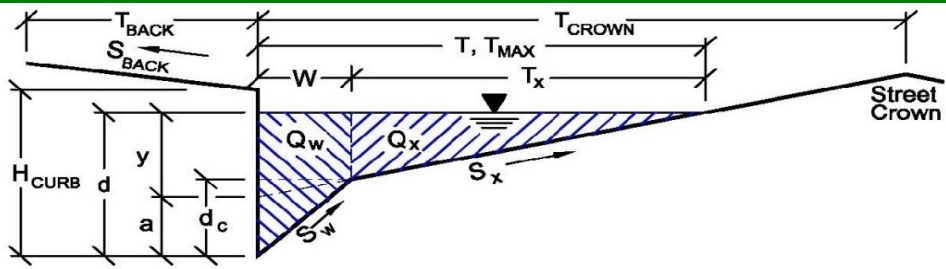
	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =		
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =		
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0
	cfs	cfs
Total Design Peak Flow, Q =	2.1	10.0
	cfs	cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: 4L



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 18.0$ 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
 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ 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
 $S_o = 0.015$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 4.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

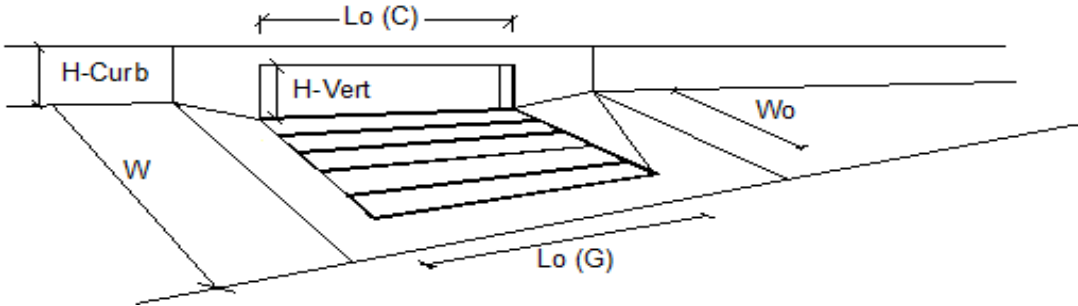
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$Q_{allow} = 4.1$ cfs (Minor Storm) 137.8 cfs (Major Storm)

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 4L



Warning 1

Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_rG =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_rC =	0.20	0.20	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	2.10	10.00	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	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5A



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

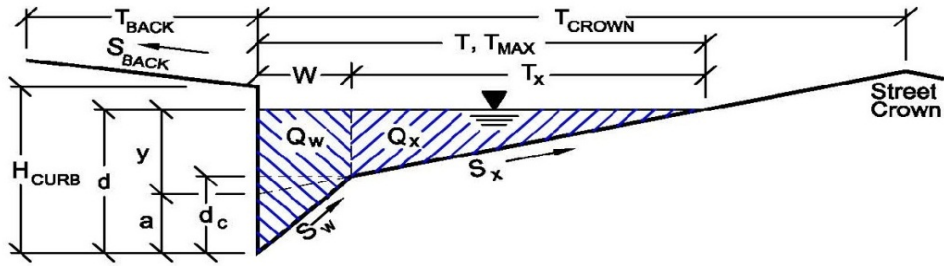
Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inches/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b = cfs
Total Design Peak Flow, Q = cfs

<---
FILL IN THIS SECTION
OR...

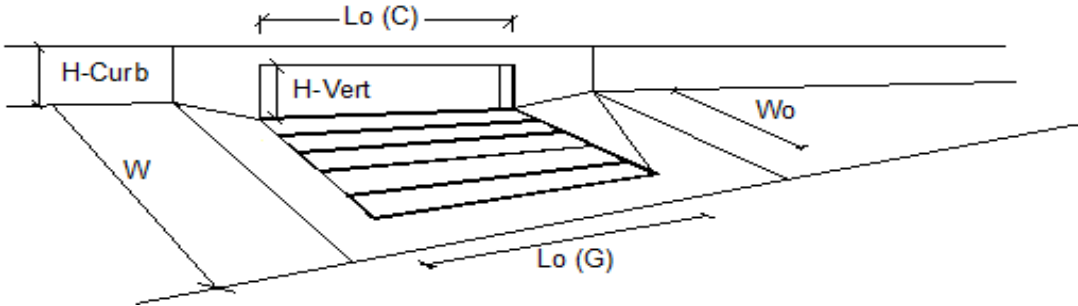
FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)					
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)					
Project:	Trails at Crowfoot				
Inlet ID:	DP 5A				
					
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.027$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>17.0</td><td>17.0</td></tr></tbody></table> ft	Minor Storm	Major Storm	17.0	17.0
Minor Storm	Major Storm				
17.0	17.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>4.0</td><td>12.0</td></tr></tbody></table> inches	Minor Storm	Major Storm	4.0	12.0
Minor Storm	Major Storm				
4.0	12.0				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>5.6</td><td>142.4</td></tr></tbody></table> cfs		Minor Storm	Major Storm	5.6	142.4
Minor Storm	Major Storm				
5.6	142.4				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

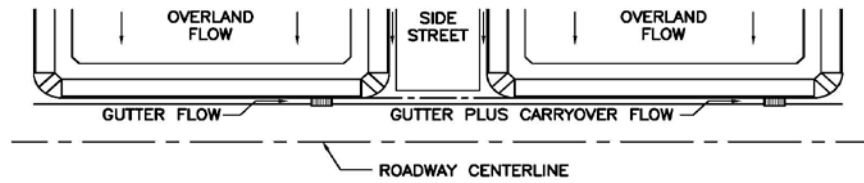
Inlet ID: DP 5A



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	4.90	39.98	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	16.3	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	71	%

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Trails at Crowfoot
Inlet ID: 5B



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
5.4	77.7

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + P_1)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

5.4	77.7

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

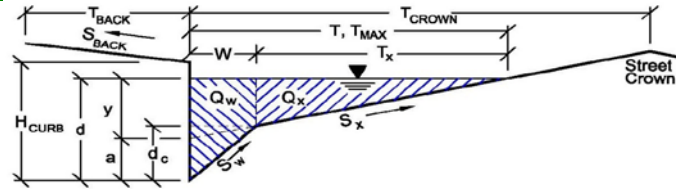
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Crowfoot

Inlet ID:

5B



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 18.0$ 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

$H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 17.0$ 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)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm	
$d_{MAX} =$	4.0	12.0	inches

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

	Minor Storm	Major Storm	
	SUMP	SUMP	cfs

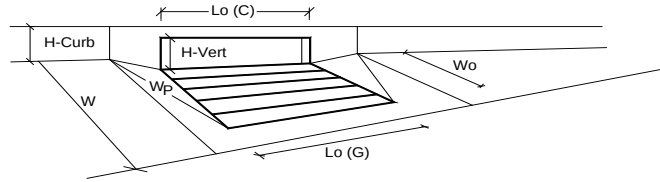
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot

Inlet ID = 5B



Design Information (Input)

Type of Inlet

Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

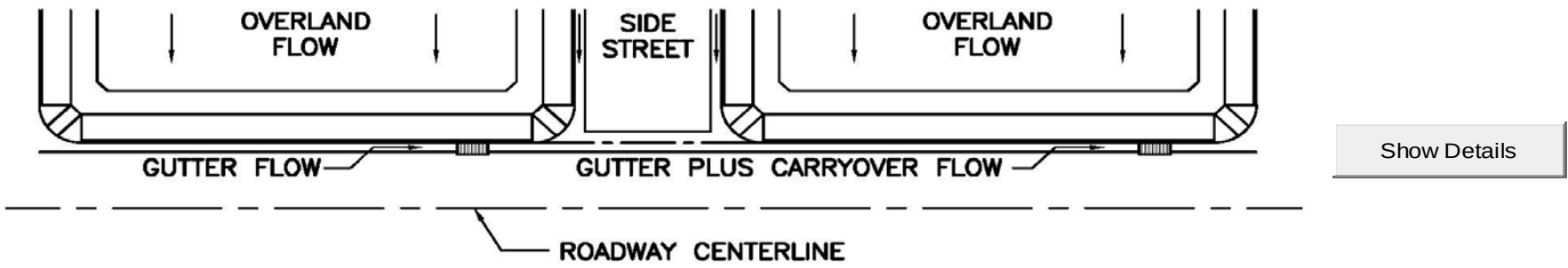
	MINOR	MAJOR	
Inlet Type =	CDOT Type R Curb Opening		
a_{local} =	5.00	5.00	inches
No =	2	2	
Ponding Depth =	6.0	12.0	inches
	☒ Override Depths		
	MINOR	MAJOR	
L_0 (G) =	N/A	N/A	feet
W_0 =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
C_1 (G) =	N/A	N/A	
C_w (G) =	N/A	N/A	
C_o (G) =	N/A	N/A	
	MINOR	MAJOR	
L_0 (C) =	15.00	15.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
C_1 (C) =	0.10	0.10	
C_w (C) =	3.60	3.60	
C_o (C) =	0.67	0.67	
	MINOR	MAJOR	
Q_a =	19.9	86.1	cfs
$Q_{PEAK REQUIRED}$ =	5.4	77.7	cfs

Total Inlet Interception Capacity (assumes clogged condition)

Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5C



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

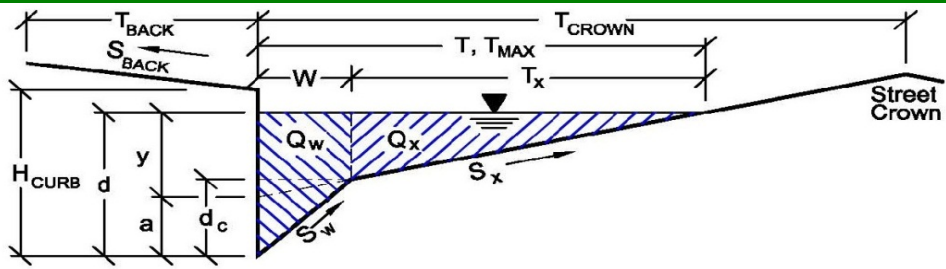
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =		
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =		
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0
Total Design Peak Flow, Q =	5.6	70.9

<--- FILL IN THIS SECTION OR...
FILL IN THE SECTIONS BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 5C

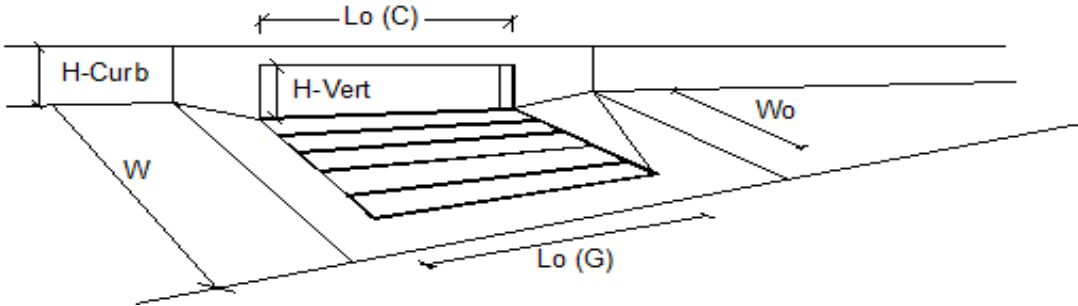


Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$
Height of Curb at Gutter Flow Line	$H_{CURB} = 4.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.030$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = 17.0$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = 4.0$ inches
Allow Flow Depth at Street Crown (leave blank for no)	☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
$Q_{allow} = 5.9$ cfs	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

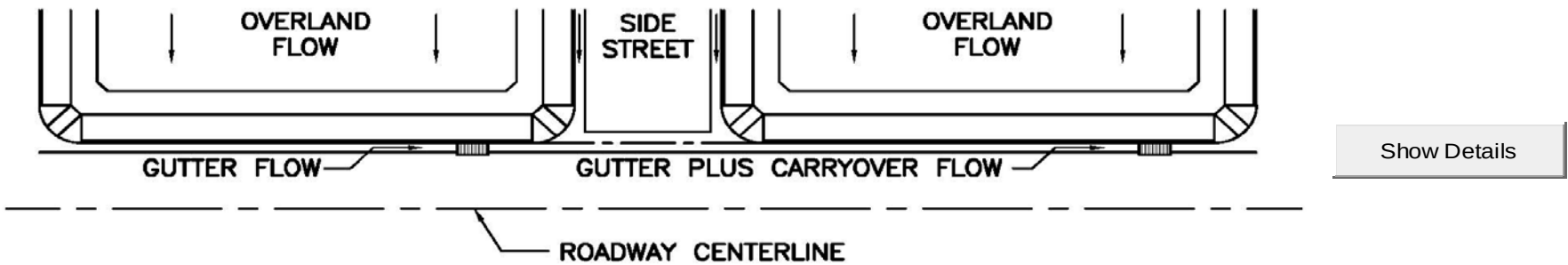
Inlet ID: DP 5C



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	5.60	25.77	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	45.1	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	36	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5D



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
3.8	80.0

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs
Total Design Peak Flow, Q =

Minor Storm	Major Storm
3.8	80.0

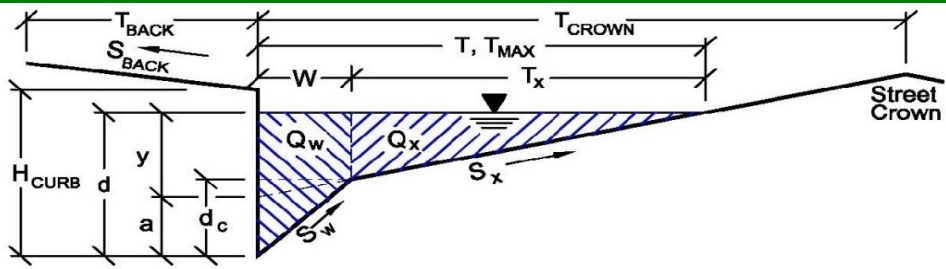
 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 5D



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 18.0$ 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
 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ 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)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 4.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

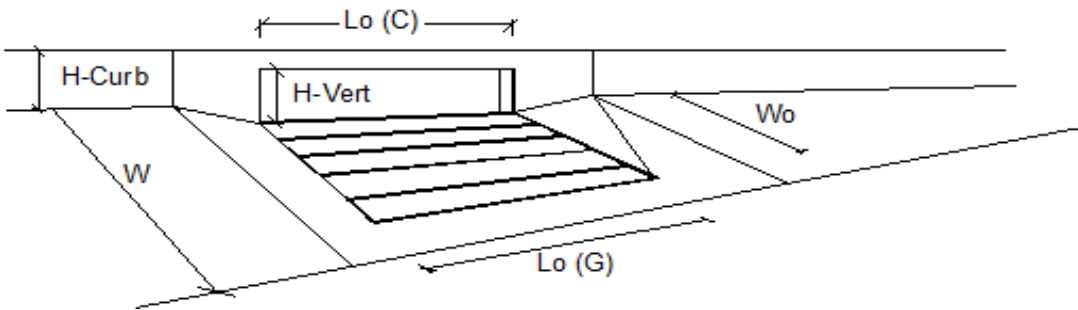
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$Q_{allow} = 6.8$ cfs (Minor Storm) 127.1 cfs (Major Storm)

INLET ON A CONTINUOUS GRADE

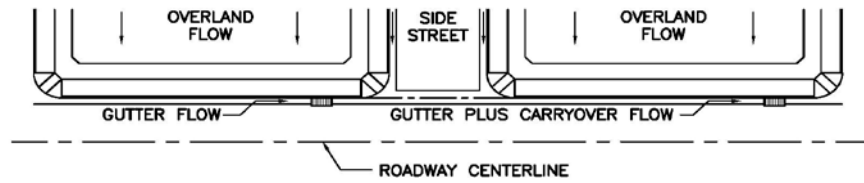
Project: Trails at Crowfoot
Inlet ID: DP 5D



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} =	5.0	5.0	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 =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _r G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _r C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	3.80	18.60	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b =	0.0	61.4	cfs
Capture Percentage = Q _a /Q _o =	C% =	100	23	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 5E



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
3.1	83.4

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + I_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

3.1	83.4

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

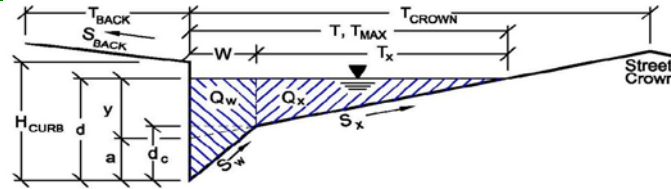
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Crowfoot

Inlet ID:

5E



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 18.0$ 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

$H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 17.0$ 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)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm	
$d_{MAX} =$	4.0	12.0	inches

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

	Minor Storm	Major Storm	
	SUMP	SUMP	cfs

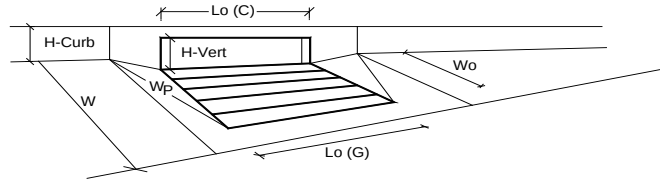
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot

Inlet ID = 5E



Design Information (Input)

Type of Inlet

Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

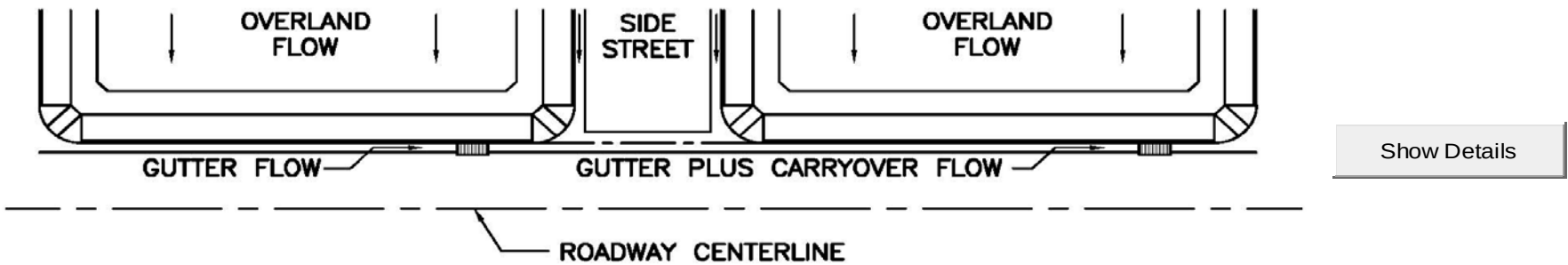
	MINOR	MAJOR	
Inlet Type =	CDOT Type R Curb Opening		
a_{local} =	5.00	5.00	inches
No =	1	1	
Ponding Depth =	6.0	12.0	inches
	MINOR	MAJOR	☒ Override Depths
L_o (G) =	N/A	N/A	feet
W_o =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
C_l (G) =	N/A	N/A	
C_w (G) =	N/A	N/A	
C_o (G) =	N/A	N/A	
	MINOR	MAJOR	
L_o (C) =	15.00	15.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
C_l (C) =	0.10	0.10	
C_w (C) =	3.60	3.60	
C_o (C) =	0.67	0.67	
	MINOR	MAJOR	
Q_a =	9.7	42.1	cfs
$Q_{PEAK REQUIRED}$ =	3.1	83.4	cfs

Total Inlet Interception Capacity (assumes clogged condition)

WARNING: Inlet Capacity less than Q Peak for MAJOR Storm

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5F



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
3.1	12.3

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)

Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inches/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs
Total Design Peak Flow, Q =

Minor Storm	Major Storm
3.1	12.3

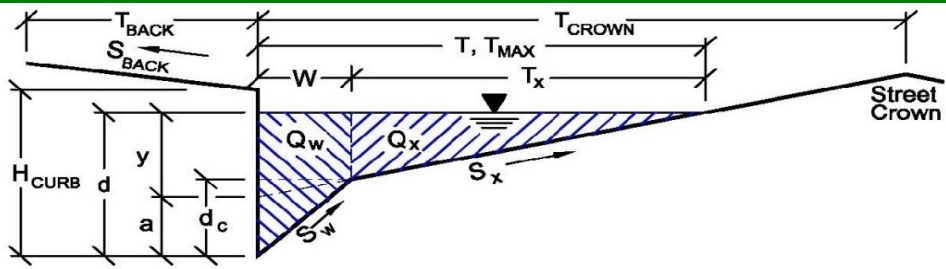
 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 5F

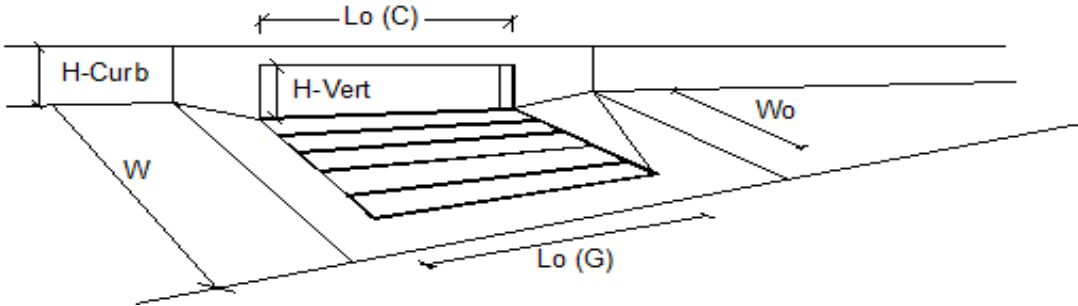


Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$				
Height of Curb at Gutter Flow Line	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.010$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>17.0</td><td>17.0</td></tr></tbody></table> ft	Minor Storm	Major Storm	17.0	17.0
Minor Storm	Major Storm				
17.0	17.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>4.0</td><td>12.0</td></tr></tbody></table> inches	Minor Storm	Major Storm	4.0	12.0
Minor Storm	Major Storm				
4.0	12.0				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>3.4</td><td>132.7</td></tr></tbody></table> cfs	Minor Storm	Major Storm	3.4	132.7
Minor Storm	Major Storm				
3.4	132.7				

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5F



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	3.10	8.39	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	4.0	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	68	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 5G



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inches/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =		
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =		
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0
Total Design Peak Flow, Q =	6.2	107.5

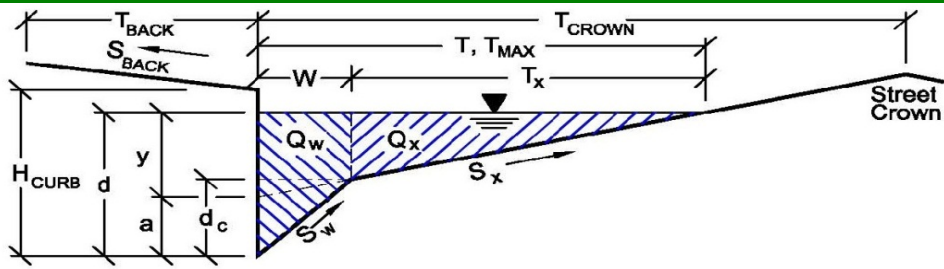
<--- FILL IN THIS SECTION OR...

FILL IN THE SECTIONS BELOW.

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

Project: Trails at Crowfoot
Inlet ID: 5G



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 18.0$ 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
 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ 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)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 4.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

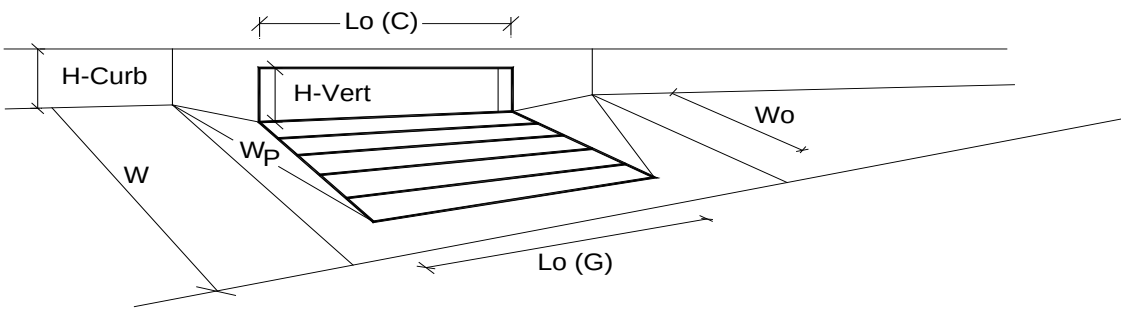
$Q_{allow} =$

Minor Storm	Major Storm
SUMP	SUMP

 cfs

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = 5G

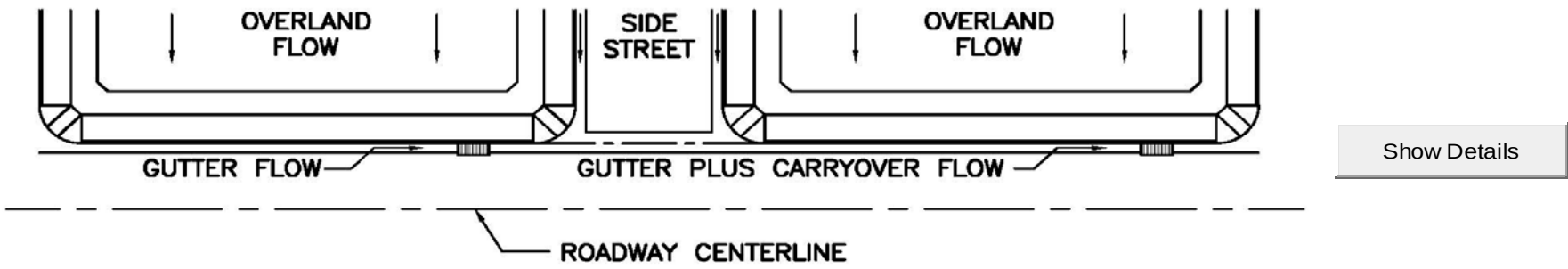


Design Information (Input)		MINOR	MAJOR	
Type of Inlet		CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		2	2	
Water Depth at Flowline (outside of local depression)		6.0	12.0	inches
				☒ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		15.00	15.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
		19.9	86.1	cfs
Q PEAK REQUIRED		6.2	107.5	cfs

WARNING: Inlet Capacity less than Q Peak for MAJOR Storm

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5H



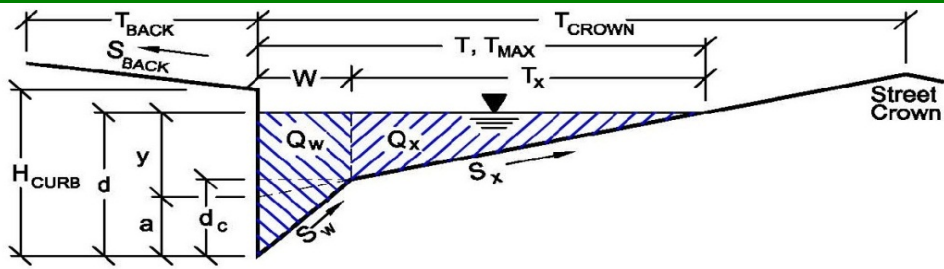
Design Flow: ONLY if already determined through other methods: (local peak flow for 1/2 of street OR grass-lined channel):		Minor Storm		Major Storm	
		*Q _{Known} =		3.1 81.3 cfs	
* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.					
Geographic Information: (Enter data in the blue cells):					
Site Type: ☐ Site is Urban ☐ Site is Non-Urban		Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median		Subcatchment Area = Acres Percent Imperviousness = % NRCS Soil Type = A, B, C, or D	
		Slope (ft/ft)		Length (ft)	
		Overland Flow =		Channel Flow =	
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$					
		Design Storm Return Period, T_r =		years	
		Return Period One-Hour Precipitation, P_1 =		inches	
		C_1 =			
		C_2 =			
		C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =					
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =					
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =		0.0		0.0 cfs	
Total Design Peak Flow, Q =		3.1		81.3 cfs	

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 5H

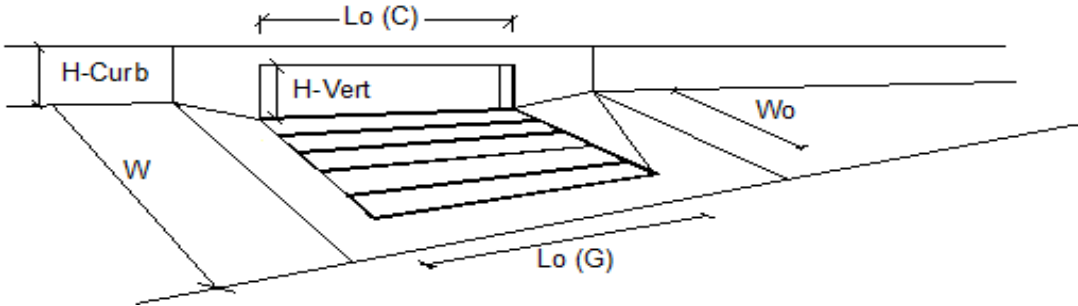


Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$
Height of Curb at Gutter Flow Line	$H_{CURB} = 4.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.020$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = 17.0$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = 4.0$ inches
Allow Flow Depth at Street Crown (leave blank for no)	☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	Minor Storm Major Storm
MAJOR STORM Allowable Capacity is based on Depth Criterion	$Q_{allow} = 4.8$ 156.5 cfs
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5H



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	3.10	26.87	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	54.4	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	33	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 51



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

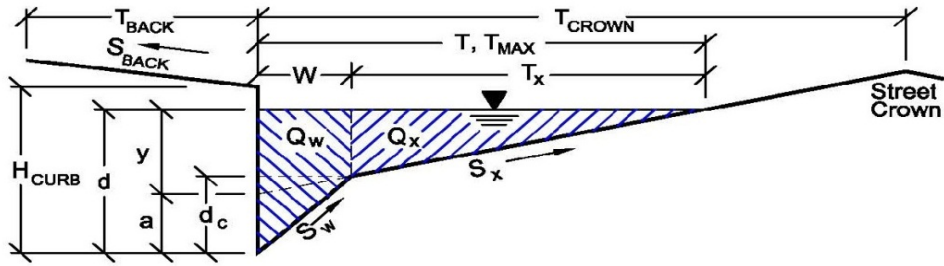
Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b = cfs
Total Design Peak Flow, Q = cfs

<---
FILL IN THIS SECTION
OR...

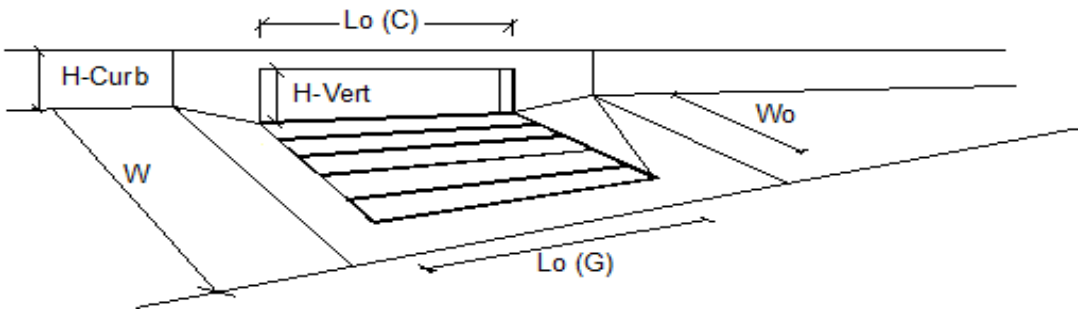
FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)					
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)					
Project:	Trails at Crowfoot				
Inlet ID:	DP 5I				
					
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.020$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>17.0</td><td>17.0</td></tr></tbody></table> ft	Minor Storm	Major Storm	17.0	17.0
Minor Storm	Major Storm				
17.0	17.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>4.0</td><td>12.0</td></tr></tbody></table> inches	Minor Storm	Major Storm	4.0	12.0
Minor Storm	Major Storm				
4.0	12.0				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>4.8</td><td>156.5</td></tr></tbody></table> cfs		Minor Storm	Major Storm	4.8	156.5
Minor Storm	Major Storm				
4.8	156.5				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

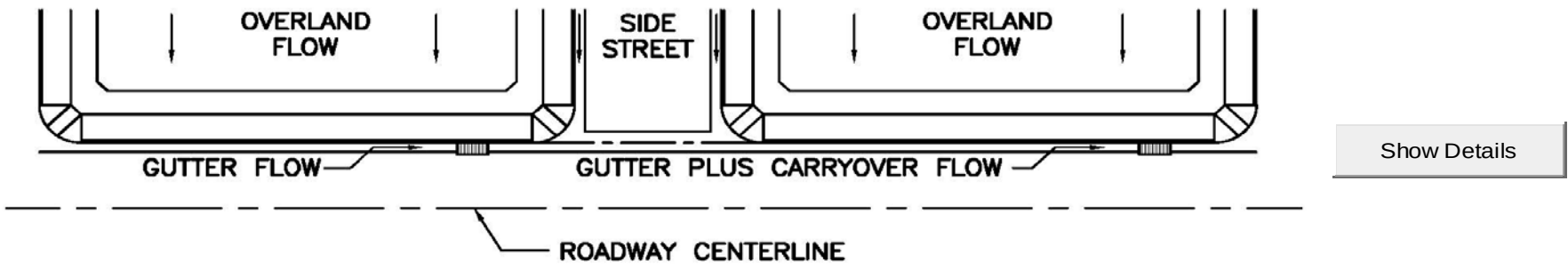
Inlet ID: DP 5I



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	3.90	14.42	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	5.0	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	74	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5L



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Minor Storm

Major Storm

***Q_{Known}** = 4.6 27.7 cfs

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

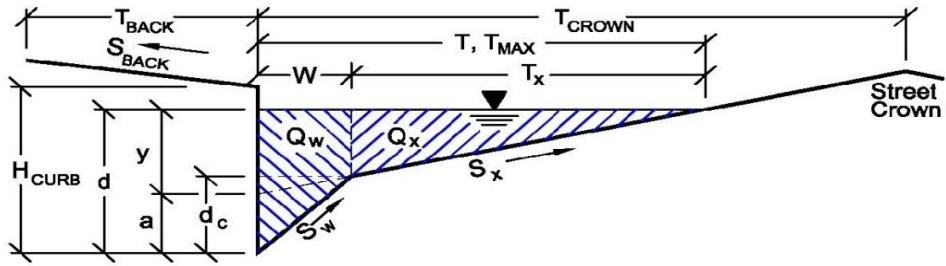
Minor Storm	Major Storm
Design Storm Return Period, T_r =	years
Return Period One-Hour Precipitation, P_1 =	inches
C_1 =	
C_2 =	
C_3 =	
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =	
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0 0.0 cfs
Total Design Peak Flow, Q =	4.6 27.7 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 5L



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb $T_{BACK} = 18.0$ 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 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown $T_{CROWN} = 17.0$ 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 $S_o = 0.060$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020) $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm $T_{MAX} = 17.0$ ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm $d_{MAX} = 4.0$ inches

Allow Flow Depth at Street Crown (leave blank for no) ☐ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

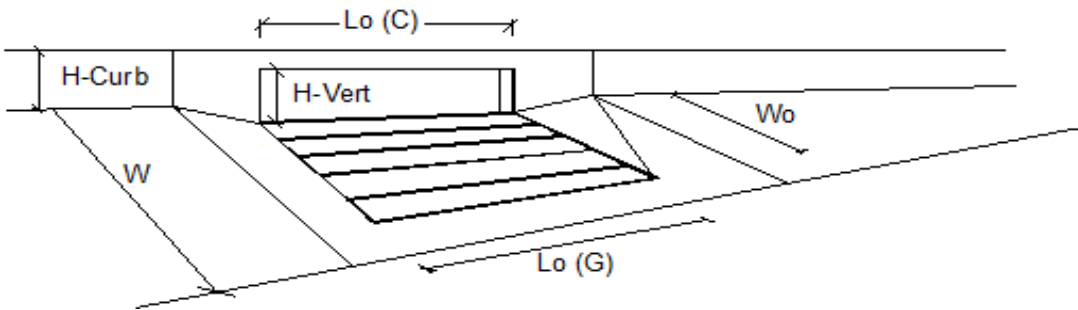
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$Q_{allow} = 8.3$ cfs

INLET ON A CONTINUOUS GRADE

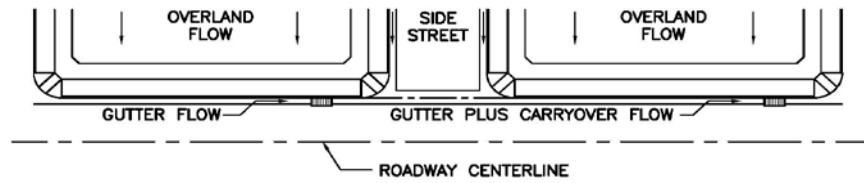
Project: Trails at Crowfoot
Inlet ID: DP 5L



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L _o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _r G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _r C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	4.60	26.12	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b =	0.0	1.6	cfs
Capture Percentage = Q _a /Q _o =	C% =	100	94	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 5N



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
8.6	50.0

 cfs

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + P_1)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

8.6	50.0

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

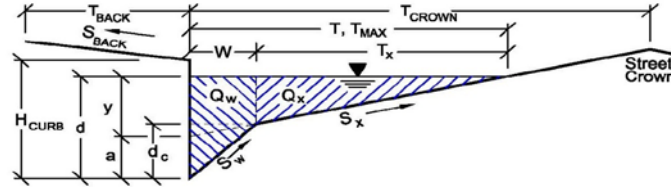
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Trails at Crowfoot

Inlet ID:

5N



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

$T_{BACK} = 18.0$ 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

$H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown

$T_{CROWN} = 17.0$ 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)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm	
$d_{MAX} =$	4.0	12.0	inches

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

	Minor Storm	Major Storm	
	SUMP	SUMP	cfs

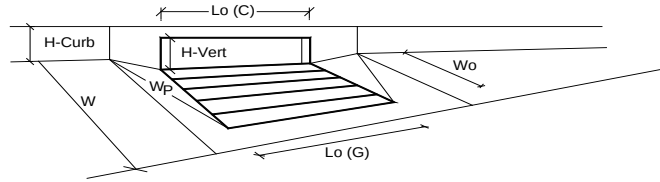
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot

Inlet ID = 5N



Design Information (Input)

Type of Inlet

Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

	MINOR	MAJOR	
Inlet Type =	CDOT Type R Curb Opening		
a_{local} =	5.00	5.00	inches
No =	2	2	
Ponding Depth =	6.0	12.0	inches
	MINOR	MAJOR	☒ Override Depths
L_0 (G) =	N/A	N/A	feet
W_0 =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
C_1 (G) =	N/A	N/A	
C_w (G) =	N/A	N/A	
C_o (G) =	N/A	N/A	
	MINOR	MAJOR	
L_0 (C) =	10.00	10.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
C_1 (C) =	0.10	0.10	
C_w (C) =	3.60	3.60	
C_o (C) =	0.67	0.67	
	MINOR	MAJOR	
Q_a =	14.4	56.8	cfs
$Q_{PEAK REQUIRED}$ =	8.6	50.0	cfs

Total Inlet Interception Capacity (assumes clogged condition)

Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 50



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)

Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b = cfs

Total Design Peak Flow, Q = cfs

<---
FILL IN THIS SECTION
OR...
FILL IN THE SECTIONS
BELOW.
<---

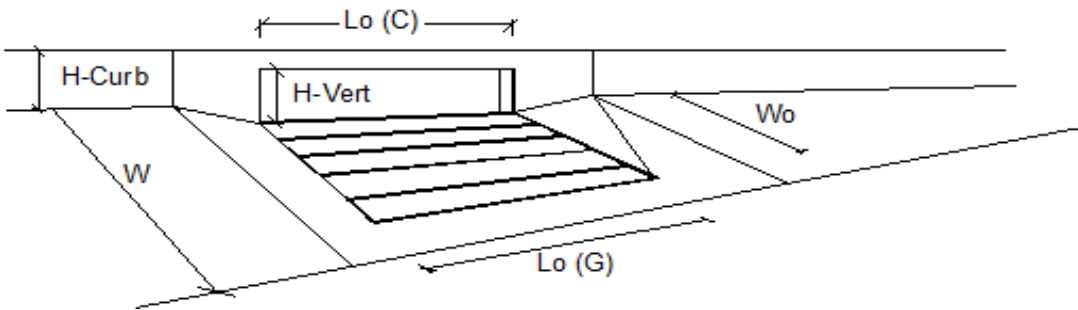
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)		
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)		
Project:	Trails at Crowfoot	
Inlet ID:	DP 50	

The diagram illustrates the cross-section of a street gutter. Key parameters include: T_{BACK} (width of backflow), S_{BACK} (backflow slope), T_x (width to crown), T_{MAX} (maximum width), T_{CROWN} (width to crown), W (gutter width), H_{CURB} (curb height), d (depth at curb), y (depth at distance x), a (depth at distance x), d_c (depth at curb), Q_w (flow in gutter), Q_x (flow at distance x), S_x (street slope), and S_w (gutter slope). The 'Street Crown' is indicated on the right side.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.020$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><tr><td>☐</td><td>☒</td><td>check = yes</td></tr></table>	☐	☒	check = yes	
☐	☒	check = yes			
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>4.8</td><td>156.5</td></tr></table> cfs		Minor Storm	Major Storm	4.8	156.5
Minor Storm	Major Storm				
4.8	156.5				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 50



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} =	5.0	5.0	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 =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _r G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _r C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	2.10	7.11	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b =	0.0	1.4	cfs
Capture Percentage = Q _a /Q _o =	C% =	100	83	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5P



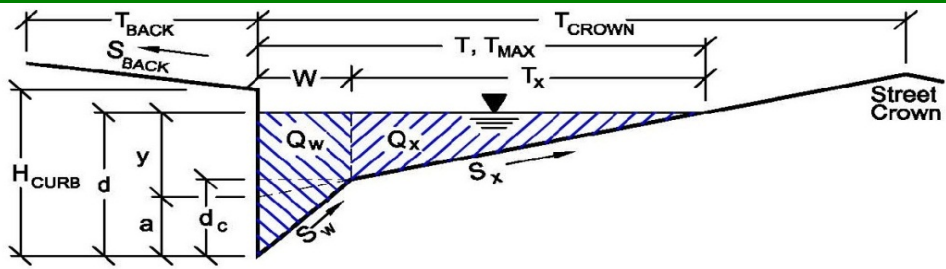
Design Flow: ONLY if already determined through other methods: (local peak flow for 1/2 of street OR grass-lined channel):		Minor Storm		Major Storm	
		*Q _{Known} =		4.8 49.9 cfs	
* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.					
Geographic Information: (Enter data in the blue cells):					
Site Type: ☐ Site is Urban ☐ Site is Non-Urban		Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median			
		Subcatchment Area = Acres			
		Percent Imperviousness = %			
		NRCS Soil Type = A, B, C, or D			
		Slope (ft/ft) Length (ft)			
		Overland Flow =			
		Channel Flow =			
Rainfall Information: Intensity i (inches/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$					
		Minor Storm		Major Storm	
		Design Storm Return Period, T_r =		years	
		Return Period One-Hour Precipitation, P_1 =		inches	
		C_1 =			
		C_2 =			
		C_3 =			
		User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
		User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
		Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =		0.0 0.0 cfs	
		Total Design Peak Flow, Q =		4.8 49.9 cfs	

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 5P



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line
Distance from Curb Face to Street Crown
Gutter Width
Street Transverse Slope
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

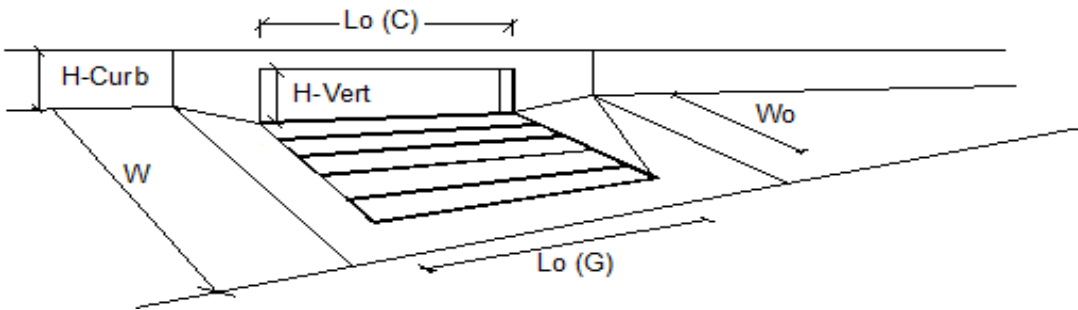
Max. Allowable Spread for Minor & Major Storm
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
Allow Flow Depth at Street Crown (leave blank for no)

MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

T_{BACK}	=	18.0	ft
S_{BACK}	=	0.020	ft/ft
n_{BACK}	=	0.020	
H_{CURB}	=	4.00	inches
T_{CROWN}	=	17.0	ft
W	=	2.00	ft
S_x	=	0.020	ft/ft
S_w	=	0.083	ft/ft
S_o	=	0.060	ft/ft
n_{STREET}	=	0.016	
T_{MAX}	=	17.0	ft
d_{MAX}	=	4.0	inches
		☐	☒ check = yes
Q_{allow}	=	8.3	112.6 cfs

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 5P



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_{rG} =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_{rC} =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'				
Total Inlet Interception Capacity	$Q =$	4.80	38.71	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	11.2	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	78	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 5R



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
3.4	14.0

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

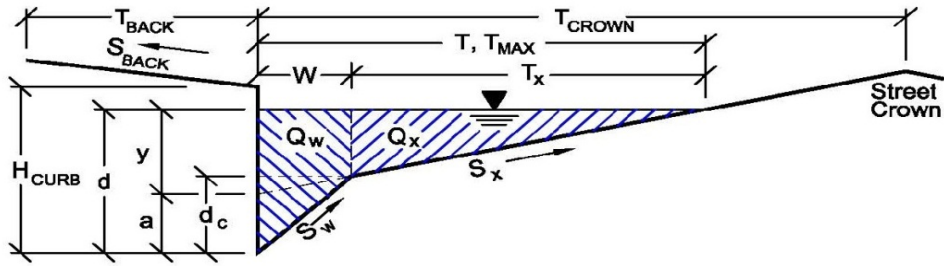
NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

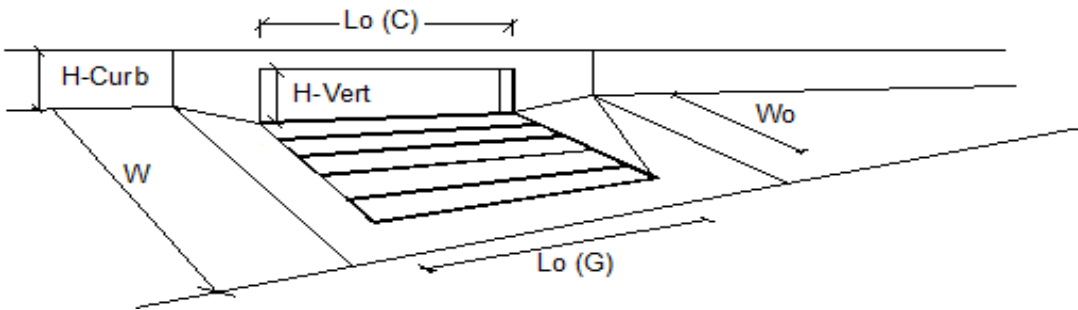
	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =		
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =		
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0
Total Design Peak Flow, Q =	3.4	14.0

<---
FILL IN THIS SECTION
OR...
FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)					
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)					
Project:	Trails at Crowfoot				
Inlet ID:	5R				
					
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.015$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>4.1</td><td>162.5</td></tr></tbody></table> cfs		Minor Storm	Major Storm	4.1	162.5
Minor Storm	Major Storm				
4.1	162.5				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: 5R



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} =	5.0	5.0	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 =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _r G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _r C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	3.40	9.04	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b =	0.0	5.0	cfs
Capture Percentage = Q _a /Q _o =	C% =	100	65	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5S



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
3.6	67.9

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)

Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs

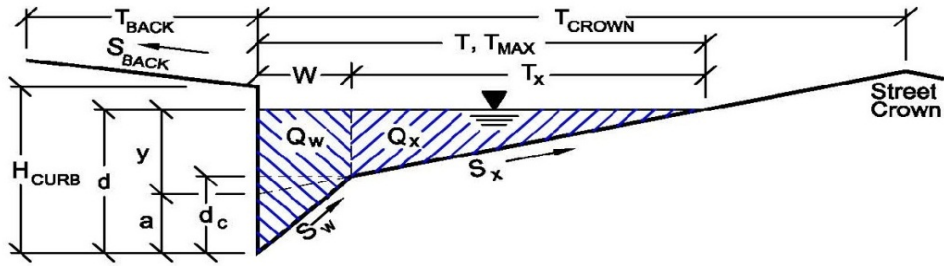
Total Design Peak Flow, Q =

Minor Storm	Major Storm
3.6	67.9

 cfs

<---
FILL IN THIS SECTION
OR...

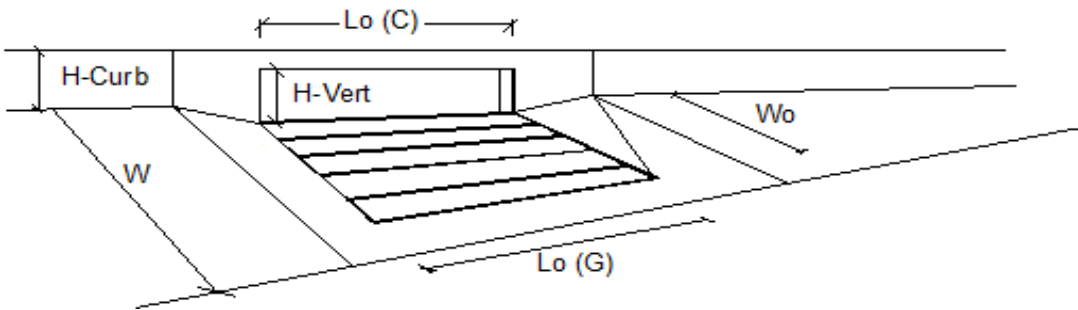
FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	DP 5S
	
Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.012$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 17.0 & 17.0 \end{matrix}$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 4.0 & 12.0 \end{matrix}$ inches
Allow Flow Depth at Street Crown (leave blank for no)	☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
$Q_{allow} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 3.7 & 145.3 \end{matrix}$ cfs	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5S



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	3.60	16.94	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	51.0	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	25	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5U



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
2.6	10.2

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs
Total Design Peak Flow, Q =

Minor Storm	Major Storm
2.6	10.2

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)		
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)		
Project:	Trails at Crowfoot	
Inlet ID:	DP 5U	

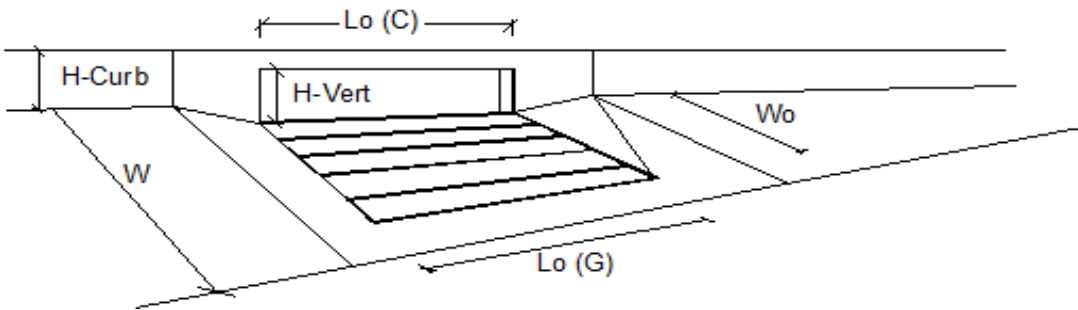
The diagram illustrates the cross-section of a street gutter. Key parameters labeled include: T_{BACK} (width of backflow), S_{BACK} (backflow slope), T_x , T_{MAX} , T_{CROWN} (widths from curb to various points), W (gutter width), H_{CURB} (curb height), d (depth at curb), y (depth at distance a), a (distance from curb face to gutter flowline), d_c (depth at gutter flowline), Q_w (flow in gutter), Q_x (flow at distance x), S_x (street slope), S_w (gutter cross slope), and S_o (street longitudinal slope). The 'Street Crown' is indicated on the right side.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.020$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><tr><td>☐</td><td>☒</td><td>check = yes</td></tr></table>	☐	☒	check = yes	
☐	☒	check = yes			
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>4.8</td><td>156.5</td></tr></table> cfs		Minor Storm	Major Storm	4.8	156.5
Minor Storm	Major Storm				
4.8	156.5				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 5U



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	2.60	7.82	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	2.4	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	77	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5V



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
5.4	39.5

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)

Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs

Total Design Peak Flow, Q =

Minor Storm	Major Storm
5.4	39.5

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	DP 5V

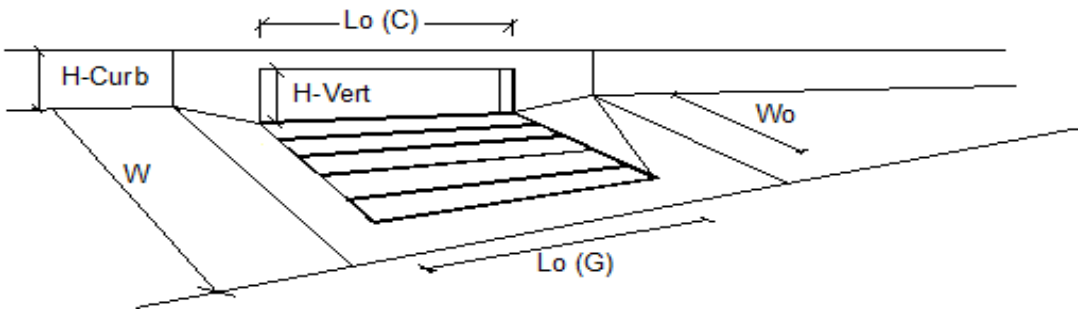
The diagram illustrates the cross-section of a gutter and street. Key parameters include: T_{BACK} (width of gutter behind curb), S_{BACK} (slope behind curb), H_{CURB} (height of curb), d (distance from curb face to gutter flow line), y (height of gutter flow line), a (width of gutter), d_c (depth of gutter), W (width of gutter), T_x (width of gutter at depth x), T_{MAX} (maximum width of gutter), T_{CROWN} (width of gutter at street crown), Q_w (flow in gutter), Q_x (flow at depth x), S_x (slope at depth x), and S_w (gutter cross slope). The street crown is also indicated.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.027$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion	$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>5.6</td><td>142.4</td></tr></tbody></table> cfs	Minor Storm	Major Storm	5.6	142.4
Minor Storm	Major Storm				
5.6	142.4				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

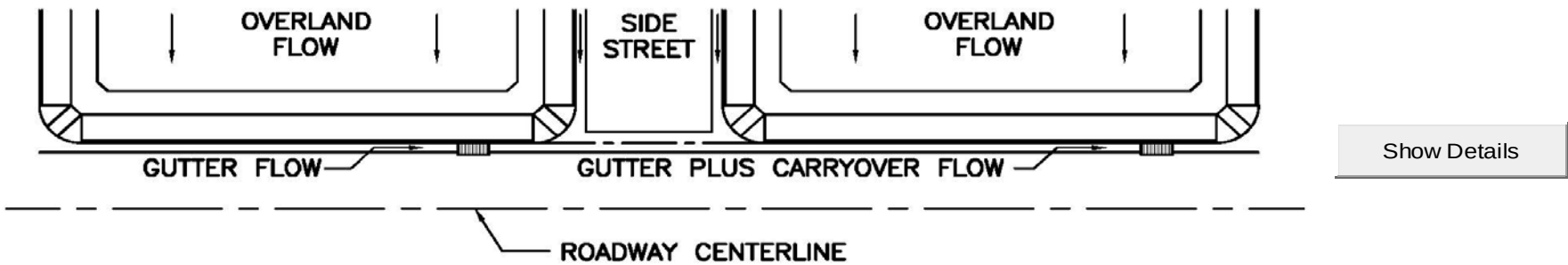
Inlet ID: DP 5V



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	5.40	20.25	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	19.3	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	51	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5W



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

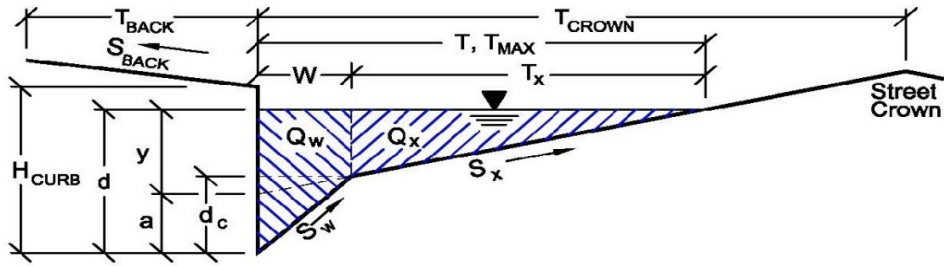
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =			cfs
Total Design Peak Flow, Q =			cfs

<--- FILL IN THIS SECTION OR...

FILL IN THE SECTIONS BELOW.

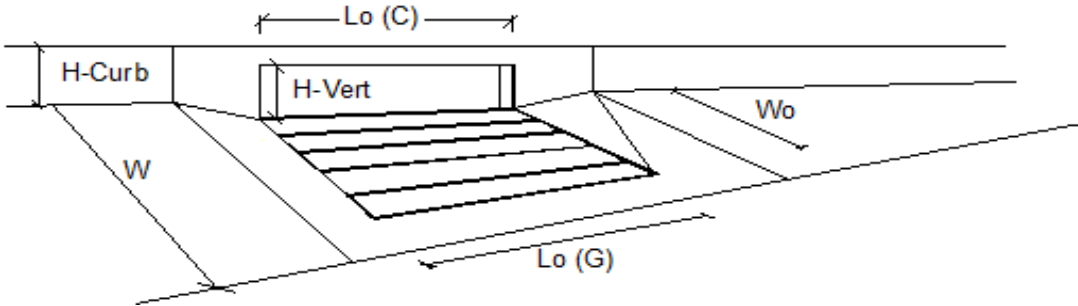
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ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)					
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)					
Project:	Trails at Crowfoot				
Inlet ID:	DP 5W				
					
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.027$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>17.0</td><td>17.0</td></tr></tbody></table> ft	Minor Storm	Major Storm	17.0	17.0
Minor Storm	Major Storm				
17.0	17.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>4.0</td><td>12.0</td></tr></tbody></table> inches	Minor Storm	Major Storm	4.0	12.0
Minor Storm	Major Storm				
4.0	12.0				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>5.6</td><td>142.4</td></tr></tbody></table> cfs		Minor Storm	Major Storm	5.6	142.4
Minor Storm	Major Storm				
5.6	142.4				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

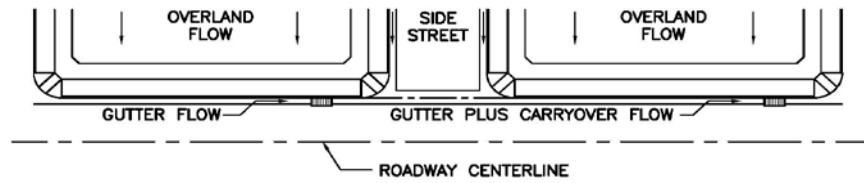
Inlet ID: DP 5W



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	4.77	10.77	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	9.1	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	99	54	%

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Trails at Crowfoot
Inlet ID: DP 5Y



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm	Major Storm
2.2	11.5

 cfs

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

Geographic Information: (Enter data in the blue cells):

Site Type:
☐ Site is Urban
☐ Site is Non-Urban

Flows Developed For:
☐ Street Inlets
☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + I_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0	0.0

 cfs

Total Design Peak Flow, Q =

2.2	11.5

 cfs

<---
FILL IN THIS SECTION
OR...

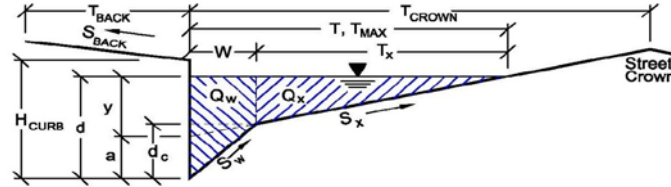
FILL IN THE SECTIONS
BELOW.
<---

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

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

Project:
Inlet ID:

Trails at Crowfoot
DP 5Y



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)
Height of Curb at Gutter Flow Line
Distance from Curb Face to Street Crown
Gutter Width
Street Transverse Slope
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
Street Longitudinal Slope - Enter 0 for sump condition
Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 18.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$
 $H_{CURB} = 4.00$ inches
 $T_{CROWN} = 17.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.020$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft
$d_{MAX} =$	4.0	12.0	inches
	☐	☒	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

Minor Storm	Major Storm
4.8	156.5

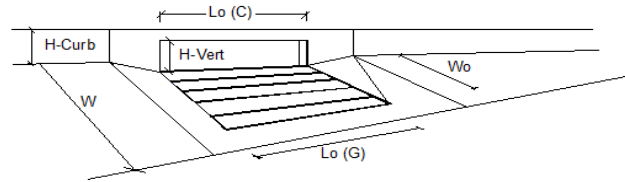
 cfs

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 5Y



Design Information (Input)

Type of Inlet
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')
Total Number of Units in the Inlet (Grate or Curb Opening)
Length of a Single Unit Inlet (Grate or Curb Opening)
Width of a Unit Grate (cannot be greater than W from Q-Allow)
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a_{LOCAL} =	5.0	5.0	inches
No =	1	1	
L_o =	10.00	10.00	ft
W_o =	N/A	N/A	ft
C_r-G =	N/A	N/A	
C_r-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'

Total Inlet Interception Capacity
Total Inlet Carry-Over Flow (flow bypassing inlet)
Capture Percentage = Q_a/Q_o =

	MINOR	MAJOR	
Q =	2.20	8.31	cfs
Q_b =	0.0	3.2	cfs
C% =	100	72	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6M



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
2.8	16.7

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs
Total Design Peak Flow, Q =

Minor Storm	Major Storm
2.8	16.7

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

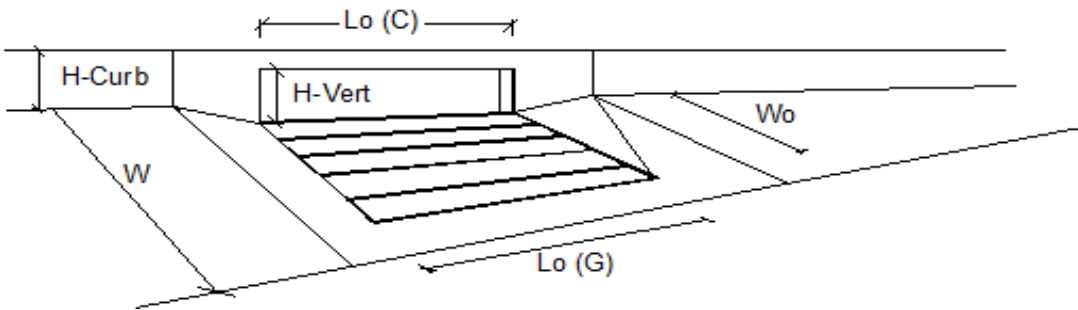
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	DP 6M

The diagram illustrates the cross-section of a street gutter. Key parameters include: T_{BACK} (width of backflow), S_{BACK} (backflow slope), T , T_{MAX} , T_{CROWN} (widths from curb to crown), T_x (width to flow line), W (gutter width), Q_w (flow in gutter), Q_x (flow in street), S_x (street slope), S_w (gutter slope), S_o (street slope), H_{CURB} (curb height), d (depth at curb), y (depth at gutter line), a (depth at gutter line), and d_c (depth at gutter line). The 'Street Crown' is indicated on the right.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.010$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>17.0</td><td>17.0</td></tr></tbody></table> ft	Minor Storm	Major Storm	17.0	17.0
Minor Storm	Major Storm				
17.0	17.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>4.0</td><td>12.0</td></tr></tbody></table> inches	Minor Storm	Major Storm	4.0	12.0
Minor Storm	Major Storm				
4.0	12.0				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>3.4</td><td>132.7</td></tr></tbody></table> cfs		Minor Storm	Major Storm	3.4	132.7
Minor Storm	Major Storm				
3.4	132.7				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 6M



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	2.80	9.62	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	7.0	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	58	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5Q



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
2.6	24.0

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs
Total Design Peak Flow, Q =

Minor Storm	Major Storm
2.6	24.0

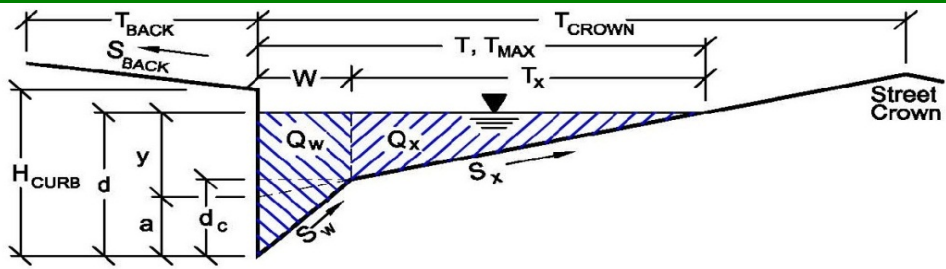
 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

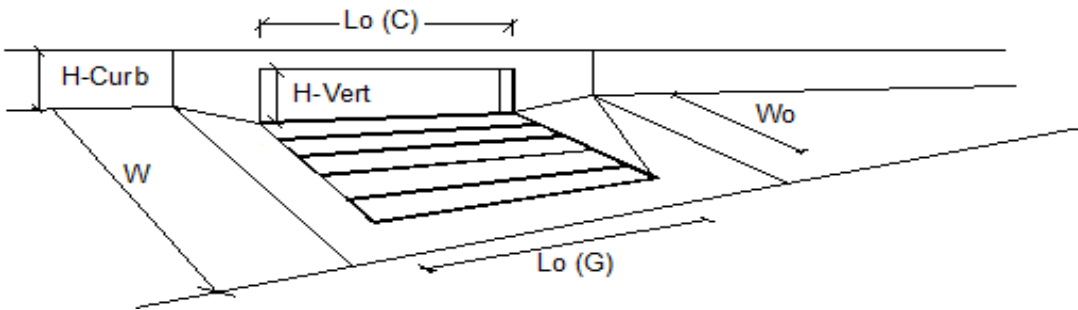
Project: Trails at Crowfoot
Inlet ID: DP 5Q



Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.010$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = 17.0$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = 4.0$ inches
Allow Flow Depth at Street Crown (leave blank for no)	☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	$Q_{allow} = 3.4$ cfs
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	$Q_{allow} = 132.7$ cfs

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 5Q



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	2.60	11.22	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	12.7	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	47	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 5Q



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
2.6	24.0

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs
Total Design Peak Flow, Q =

Minor Storm	Major Storm
2.6	24.0

 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

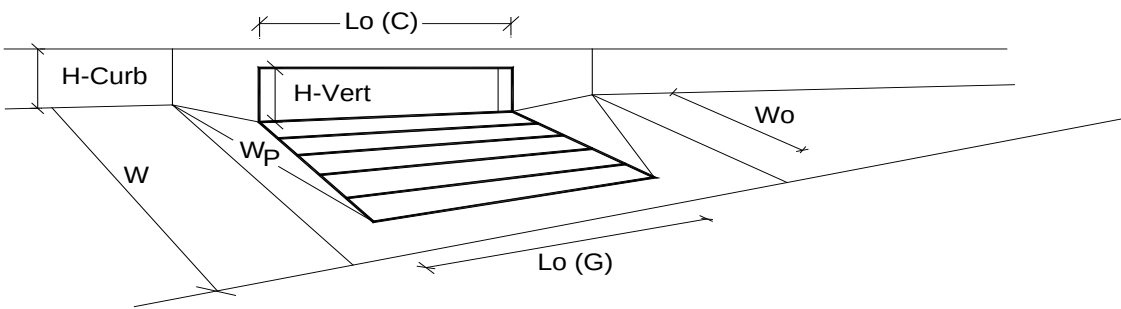
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	DP 5Q

The diagram illustrates the gutter geometry for a street section. It shows a cross-section with a curb on the left and a street crown on the right. Key parameters labeled include: T_{BACK} (width of backflow), S_{BACK} (backflow slope), T_x , T_{MAX} , T_{CROWN} (widths at different points), W (gutter width), H_{CURB} (curb height), d (depth from curb face to gutter line), y (depth from gutter line to crown), a (depth from gutter line to crown at street edge), d_c (depth from gutter line to crown at curb), Q_w (flow in gutter), Q_x (flow in street), S_x (street slope), S_w (gutter slope), and S_o (street slope). The area of flow in the gutter is shaded blue.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>SUMP</td><td>SUMP</td></tr></tbody></table> cfs		Minor Storm	Major Storm	SUMP	SUMP
Minor Storm	Major Storm				
SUMP	SUMP				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = DP 5Q



Design Information (Input)		MINOR		MAJOR	
Type of Inlet		Inlet Type = CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a _{local} = 5.00	5.00	inches	
Number of Unit Inlets (Grate or Curb Opening)		No = 1	1		
Water Depth at Flowline (outside of local depression)		Ponding Depth = 6.0	12.0	inches	
		☒ Override Depths			
Grate Information		MINOR		MAJOR	
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) = 15.00	15.00	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		
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
		Q _a = 9.7	42.1	cfs	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)		Q _{PEAK} REQUIRED = 2.6	24.0	cfs	

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6A



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =		
Return Period One-Hour Precipitation, P_1 =		
C_1 =		
C_2 =		
C_3 =		
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =		
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =		
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0
Total Design Peak Flow, Q =	4.6	58.9

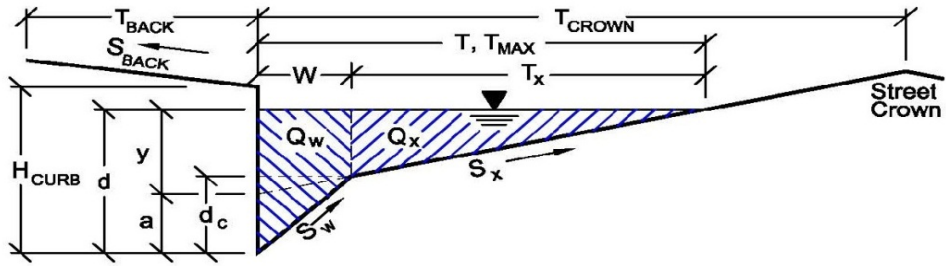
<--- FILL IN THIS SECTION OR...

FILL IN THE SECTIONS BELOW.

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

Project: Trails at Crowfoot
Inlet ID: DP 6A



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 18.0$ 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
 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ 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
 $S_o = 0.025$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 4.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

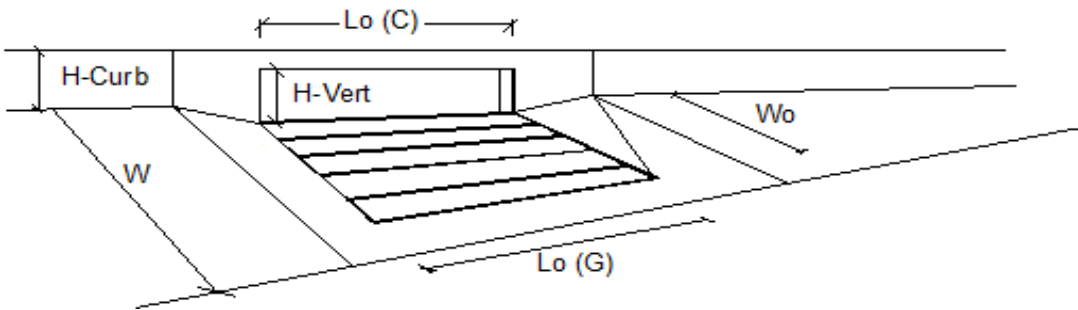
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$Q_{allow} = 5.4$ cfs (Minor Storm) 146.4 cfs (Major Storm)

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 6A



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L _o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _r G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _r C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	4.60	40.78	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b =	0.0	18.1	cfs
Capture Percentage = Q _a /Q _o =	C% =	100	69	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6B



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

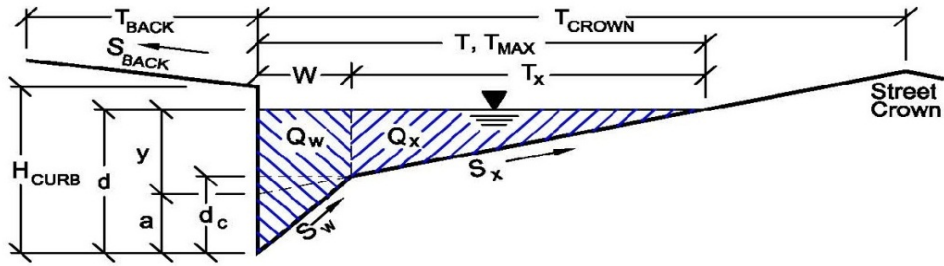
Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inches/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b = cfs
Total Design Peak Flow, Q = cfs

<---
FILL IN THIS SECTION
OR...

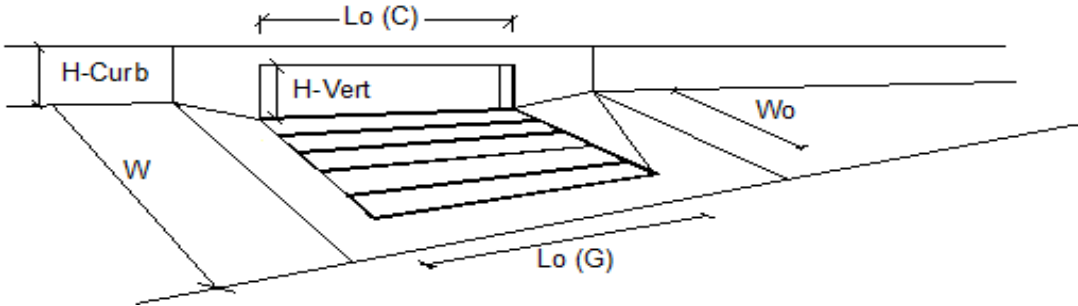
FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)					
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)					
Project:	Trails at Crowfoot				
Inlet ID:	DP 6B				
					
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.025$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>5.4</td><td>146.4</td></tr></tbody></table> cfs		Minor Storm	Major Storm	5.4	146.4
Minor Storm	Major Storm				
5.4	146.4				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 6B



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_{r-G} =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_{r-C} =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	4.94	11.59	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.1	12.3	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	99	48	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6C



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity i (inches/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	1.5	44.9	cfs

<--- FILL IN THIS SECTION OR...

FILL IN THE SECTIONS BELOW.

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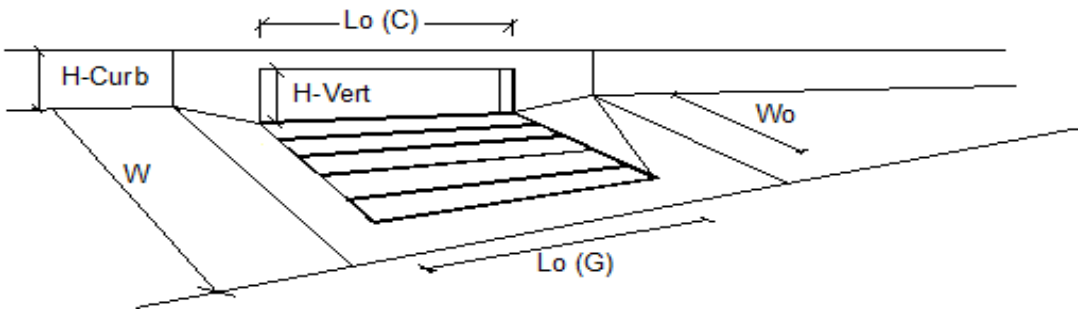
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	DP 6C

The diagram illustrates the cross-section of a street gutter. Key parameters include: T_{BACK} (width of backflow), S_{BACK} (backflow slope), T_x , T_{MAX} , T_{CROWN} (widths from curb to various points), W (gutter width), H_{CURB} (curb height), d (depth at curb), y (depth at distance a), a (distance from curb face), d_c (depth at crown), Q_w , Q_x (flow rates), S_x (street slope), S_w (gutter cross slope), and 'Street Crown'.

Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.010$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 17.0 & 17.0 \end{matrix}$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = \begin{matrix} 4.0 & 12.0 \end{matrix}$ inches
Allow Flow Depth at Street Crown (leave blank for no)	☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
$Q_{allow} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 3.4 & 132.7 \end{matrix}$ cfs	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 6C

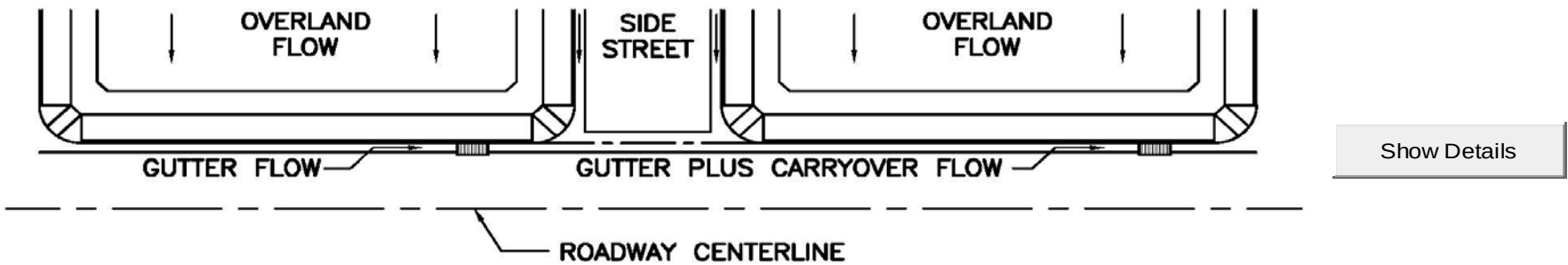


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L _o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _r G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _r C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	1.50	14.39	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b =	0.0	30.5	cfs
Capture Percentage = Q _a /Q _o =	C% =	100	32	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot

Inlet ID: DP 6D



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*Q_{Known} =

Minor Storm

Major Storm

4.6

18.5

cfs

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

Geographic Information: (Enter data in the blue cells):

Site Type:

Site is Urban

Site is Non-Urban

Flows Developed For:

Street Inlets

Area Inlets in a Median

Subcatchment Area =

Acres

Percent Imperviousness =

%

NRCS Soil Type =

A, B, C, or D

Overland Flow =

Slope (ft/ft)

Length (ft)

Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r =

years

Return Period One-Hour Precipitation, P_1 =

inches

C_1 =

C_2 =

C_3 =

User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =

User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

0.0

0.0

cfs

Total Design Peak Flow, Q =

4.6

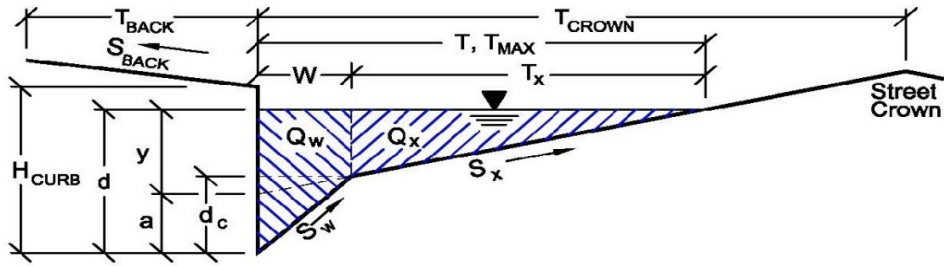
18.5

cfs

<---
FILL IN THIS SECTION
OR...

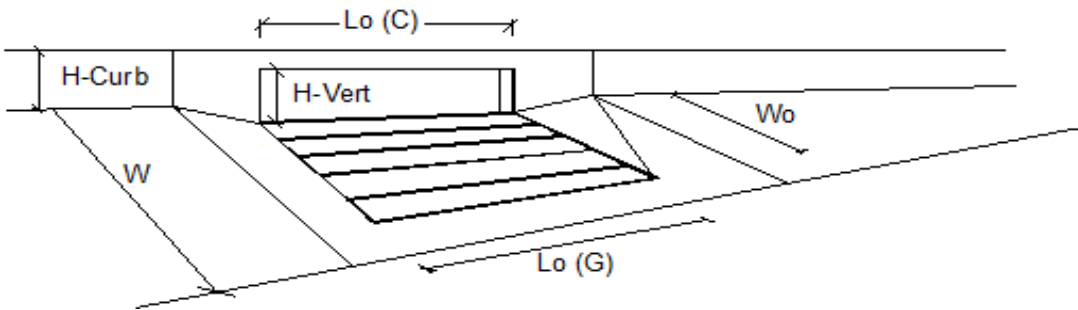
FILL IN THE SECTIONS
BELOW.
<---

380

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)					
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)					
Project:	Trails at Crowfoot				
Inlet ID:	DP 6D				
					
Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>17.0</td><td>17.0</td></tr></tbody></table> ft	Minor Storm	Major Storm	17.0	17.0
Minor Storm	Major Storm				
17.0	17.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>4.0</td><td>12.0</td></tr></tbody></table> inches	Minor Storm	Major Storm	4.0	12.0
Minor Storm	Major Storm				
4.0	12.0				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>6.8</td><td>127.1</td></tr></tbody></table> cfs		Minor Storm	Major Storm	6.8	127.1
Minor Storm	Major Storm				
6.8	127.1				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 6D



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_{rG} =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_{rC} =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'				
Total Inlet Interception Capacity	$Q =$	4.59	10.59	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	7.9	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	57	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6E



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

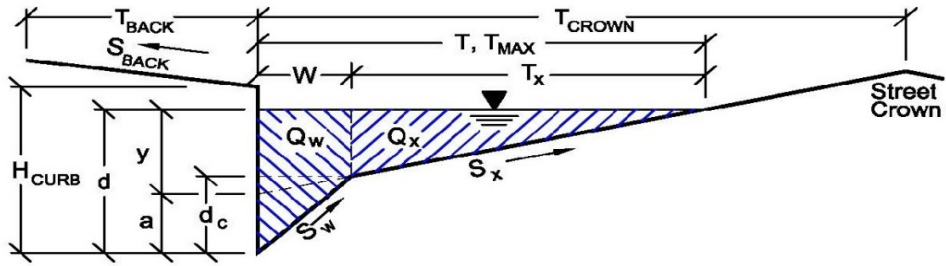
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	4.5	58.8	cfs

<--- FILL IN THIS SECTION OR...
FILL IN THE SECTIONS BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 6E



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 18.0$ 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
 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ 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)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 4.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

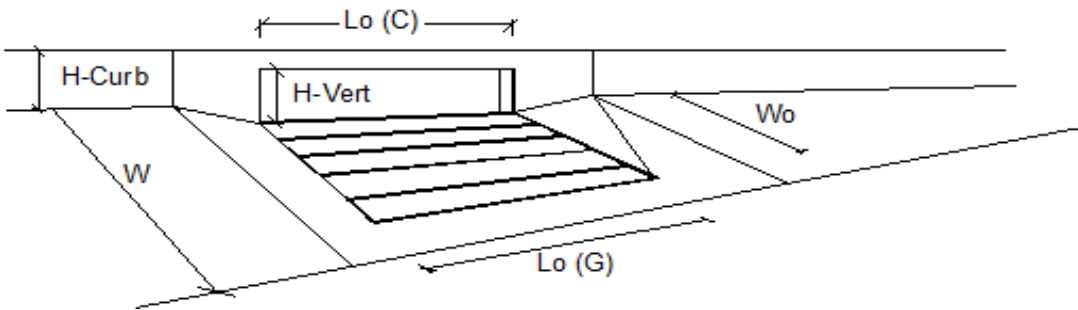
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$Q_{allow} = 6.8$ cfs (Minor Storm) 127.1 cfs (Major Storm)

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 6E



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	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 =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_{rG} =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_{rC} =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'				
Total Inlet Interception Capacity	Q =	4.50	16.62	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	42.2	cfs
Capture Percentage = Q_a/Q_o =	C% =	100	28	%

Diagram illustrating the difference between gutter flow and gutter plus carryover flow. The diagram shows a cross-section of a roadway with a centerline and two sides. On the left, "GUTTER FLOW" is shown as water flowing only within the gutter. On the right, "GUTTER PLUS CARRYOVER FLOW" is shown as water flowing from the gutter onto the adjacent "SIDE STREET" and "OVERLAND FLOW" areas. A "ROADWAY CENTERLINE" is indicated by a dashed line. A "Show Details" button is present on the right.

Design Flow: ONLY if already determined through other methods: (local peak flow for 1/2 of street OR grass-lined channel):		*Q _{Known} = <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 50px; text-align: center;">3.7</td> <td style="width: 50px; text-align: center;">18.7</td> </tr> </table> cfs	3.7	18.7						
3.7	18.7									
* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.										
Geographic Information: (Enter data in the blue cells):										
Site Type: _____ ☐ Site is Urban ☐ Site is Non-Urban	Flows Developed For: _____ ☐ Street Inlets ☐ Area Inlets in a Median	Subcatchment Area = _____ Acres Percent Imperviousness = _____ % NRCS Soil Type = _____ A, B, C, or D								
		<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <th style="width: 50px;">Slope (ft/ft)</th> <th style="width: 50px;">Length (ft)</th> </tr> </table>	Slope (ft/ft)	Length (ft)						
Slope (ft/ft)	Length (ft)									
		<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 50px;">Overland Flow =</td> <td style="width: 50px;"></td> </tr> <tr> <td>Channel Flow =</td> <td></td> </tr> </table>	Overland Flow =		Channel Flow =					
Overland Flow =										
Channel Flow =										
Rainfall Information: Intensity I (inches/hr) = $C_1 * P_1 / (C_2 + I_c)^{C_3}$										
	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <th style="width: 50px;">Minor Storm</th> <th style="width: 50px;">Major Storm</th> </tr> </table>	Minor Storm	Major Storm							
Minor Storm	Major Storm									
Design Storm Return Period, T _r =	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr><td style="width: 50px;"></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>									years
Return Period One-Hour Precipitation, P ₁ =	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr><td style="width: 50px;"></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>									inches
C ₁ =	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr><td style="width: 50px;"></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>									
C ₂ =	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr><td style="width: 50px;"></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>									
C ₃ =	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr><td style="width: 50px;"></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>									
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr><td style="width: 50px;"></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>									
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C ₅ =	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr><td style="width: 50px;"></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>									
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 50px; text-align: center;">0.0</td> <td style="width: 50px; text-align: center;">9.0</td> </tr> </table>	0.0	9.0	cfs						
0.0	9.0									
Total Design Peak Flow, Q =		<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 50px; text-align: center;">3.7</td> <td style="width: 50px; text-align: center;">27.7</td> </tr> </table> cfs	3.7	27.7						
3.7	27.7									

FILL IN THE SECTIONS
BELOW.

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	6F

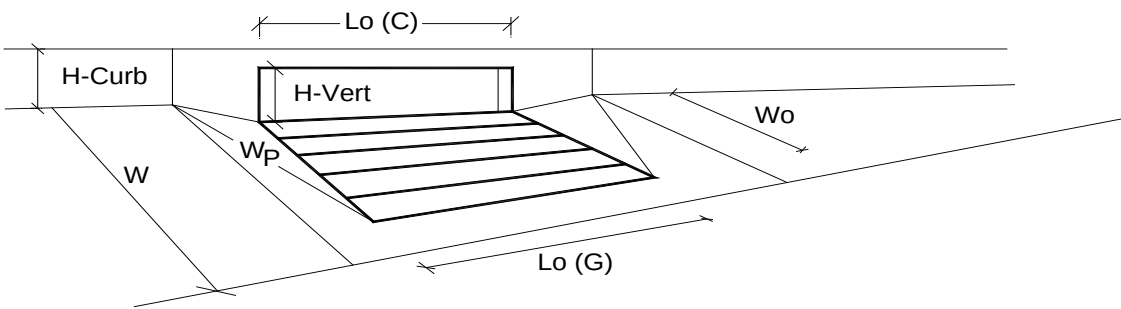
The diagram illustrates the cross-section of a street gutter. It shows the gutter width W , the distance from the curb face to the street crown T_{CROWN} , and the maximum allowable spread T_{MAX} . The gutter depth is H_{CURB} . The side slope behind the curb is S_{BACK} and the gutter cross slope is S_x . The flow depth at the curb is d and the flow depth at the street crown is d_c . The flow area is divided into Q_w (width) and Q_x (depth). The street longitudinal slope is S_o . The diagram also shows the gutter flow line and the street crown.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></tbody></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></tbody></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

$Q_{allow} =$	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>SUMP</td><td>SUMP</td></tr></tbody></table> cfs	Minor Storm	Major Storm	SUMP	SUMP
Minor Storm	Major Storm				
SUMP	SUMP				

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = 6F



Design Information (Input)		MINOR	MAJOR	
Type of Inlet		CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		1	1	
Water Depth at Flowline (outside of local depression)		6.0	12.0	inches
				☒ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		15.00	15.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
Q_a =		9.7	42.1	cfs
Q_{PEAK REQUIRED} =		3.7	27.7	cfs

Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 6G



Design Flow: ONLY if already determined through other methods: (local peak flow for 1/2 of street OR grass-lined channel):		Minor Storm		Major Storm	
		*Q _{Known} =		1.7	15.4
				cfs	
* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.					
Geographic Information: (Enter data in the blue cells):					
Site Type:		Flows Developed For:		Subcatchment Area =	
☐ Site is Urban		☐ Street Inlets		Acres	
☐ Site is Non-Urban		☐ Area Inlets in a Median		Percent Imperviousness =	
				%	
				NRCS Soil Type =	
				A, B, C, or D	
				Slope (ft/ft)	
				Length (ft)	
				Overland Flow =	
				Channel Flow =	
Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$					
		Design Storm Return Period, T_r =		Minor Storm	
		Return Period One-Hour Precipitation, P_1 =		Major Storm	
		C_1 =		years	
		C_2 =		inches	
		C_3 =			
		User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
		User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
		Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =		0.0	9.4
				cfs	
		Total Design Peak Flow, Q =		1.7	24.8
				cfs	

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

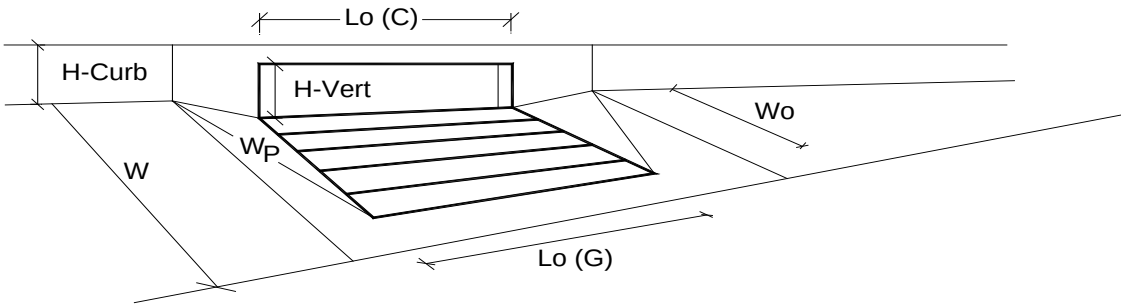
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	6G

The diagram illustrates the gutter geometry for a street section. It shows a cross-section with a curb on the left and a street crown on the right. Key dimensions and variables include: T_{BACK} (spread behind curb), S_{BACK} (side slope behind curb), H_{CURB} (height of curb), d (distance from curb face to gutter flow line), y (gutter width), a (street transverse slope), d_c (gutter cross slope), W (gutter width), T_x (spread at distance x), T_{MAX} (maximum spread), T_{CROWN} (spread at crown), Q_w (flow in gutter), Q_x (flow at distance x), S_x (street longitudinal slope), and S_w (gutter cross slope).

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><tr><td>☐</td><td>☒</td><td>check = yes</td></tr></table>	☐	☒	check = yes	
☐	☒	check = yes			
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>SUMP</td><td>SUMP</td></tr></table> cfs		Minor Storm	Major Storm	SUMP	SUMP
Minor Storm	Major Storm				
SUMP	SUMP				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = 6G



Design Information (Input)		MINOR	MAJOR	
Type of Inlet		CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		1	1	
Water Depth at Flowline (outside of local depression)		6.0	12.0	inches
				☒ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		10.00	10.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
		8.3	27.5	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)		1.7	24.8	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 6H



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

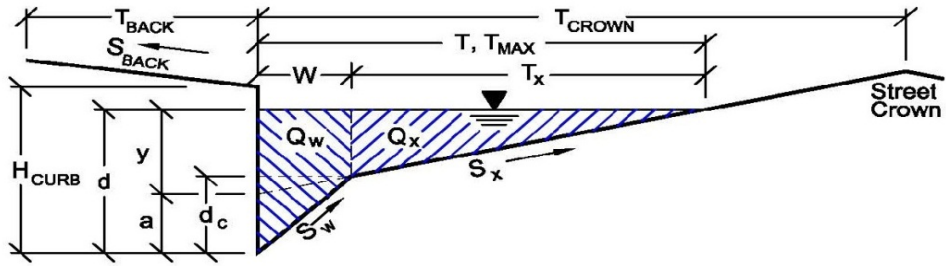
Minor Storm	Major Storm
Design Storm Return Period, T_r =	years
Return Period One-Hour Precipitation, P_1 =	inches
C_1 =	
C_2 =	
C_3 =	
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =	
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0 0.0 cfs
Total Design Peak Flow, Q =	4.5 48.4 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: 6H



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 18.0$ 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
 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ 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)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 4.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ Minor Storm ☒ Major Storm check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

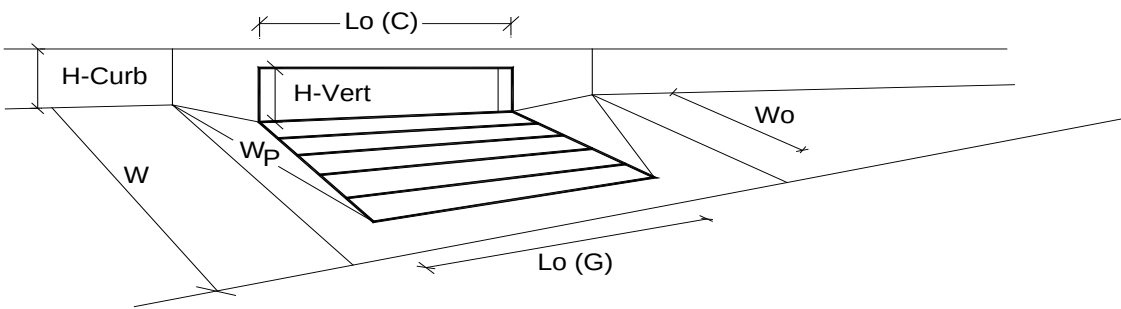
$Q_{allow} =$

Minor Storm	Major Storm
SUMP	SUMP

 cfs

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = 6H



Design Information (Input)		MINOR	MAJOR	
Type of Inlet		CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		1	1	
Water Depth at Flowline (outside of local depression)		6.0	12.0	inches
				☒ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		15.00	15.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
Q_a =		9.7	42.1	cfs
Q_{PEAK REQUIRED} =		4.5	48.4	cfs

WARNING: Inlet Capacity less than Q Peak for MAJOR Storm

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 61



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type:

☐ Site is Urban

☐ Site is Non-Urban

Flows Developed For:

☐ Street Inlets

☐ Area Inlets in a Median

Subcatchment Area = Acres

Percent Imperviousness = %

NRCS Soil Type = A, B, C, or D

Slope (ft/ft)	Length (ft)
Overland Flow =	
Channel Flow =	

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Minor Storm	Major Storm
Design Storm Return Period, T_r =	years
Return Period One-Hour Precipitation, P_1 =	inches
C_1 =	
C_2 =	
C_3 =	
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =	
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0 9.4 cfs
Total Design Peak Flow, Q =	1.8 15.5 cfs

<---
FILL IN THIS SECTION
OR...
FILL IN THE SECTIONS
BELOW.
<---

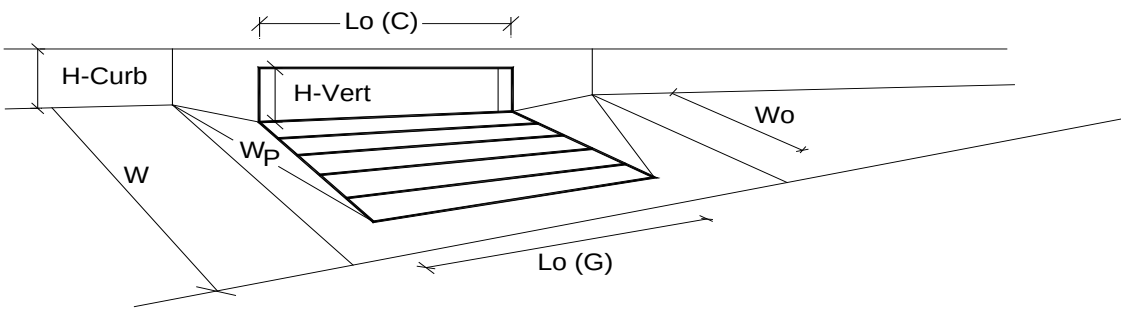
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	6I

The diagram illustrates the cross-section of a street gutter. Key parameters include: T_{BACK} (backspread), S_{BACK} (backslope), T_x , T_{MAX} , T_{CROWN} (spreads), W (gutter width), H_{CURB} (curb height), d (depth at curb), y (depth at distance a), a (distance from curb face), d_c (depth at crown), Q_w (flow at curb), Q_x (flow at distance x), S_x (street slope), S_w (gutter slope), and S_o (street crown slope). The 'Street Crown' is indicated on the right side.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$T_{MAX} = 17.0$</td><td>$T_{MAX} = 17.0$</td></tr></table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>$d_{MAX} = 4.0$</td><td>$d_{MAX} = 12.0$</td></tr></table> inches	Minor Storm	Major Storm	$d_{MAX} = 4.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 4.0$	$d_{MAX} = 12.0$				
Allow Flow Depth at Street Crown (leave blank for no)	<table><tr><td>☐</td><td>☒</td><td>check = yes</td></tr></table>	☐	☒	check = yes	
☐	☒	check = yes			
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><tr><td>Minor Storm</td><td>Major Storm</td></tr><tr><td>SUMP</td><td>SUMP</td></tr></table> cfs		Minor Storm	Major Storm	SUMP	SUMP
Minor Storm	Major Storm				
SUMP	SUMP				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET IN A SUMP OR SAG LOCATION

Project = Trails at Crowfoot
Inlet ID = 6I



Design Information (Input)		MINOR		MAJOR	
Type of Inlet		Inlet Type = CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a _{local} = 5.00	5.00	inches	
Number of Unit Inlets (Grate or Curb Opening)		No = 1	1		
Water Depth at Flowline (outside of local depression)		Ponding Depth = 6.0	12.0	inches	
		☒ Override Depths			
Grate Information		MINOR		MAJOR	
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		
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
		Q _a = 8.3	27.5	cfs	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)		Q _{PEAK} REQUIRED = 1.8	15.5	cfs	

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: 61a



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
3.4	97.2

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

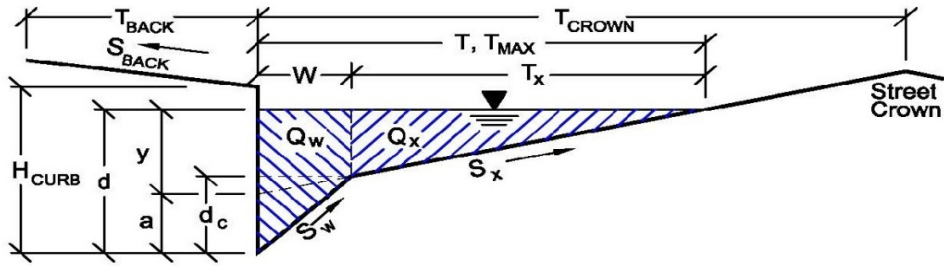
 cfs
Total Design Peak Flow, Q =

Minor Storm	Major Storm
3.4	97.2

 cfs

<---
FILL IN THIS SECTION
OR...

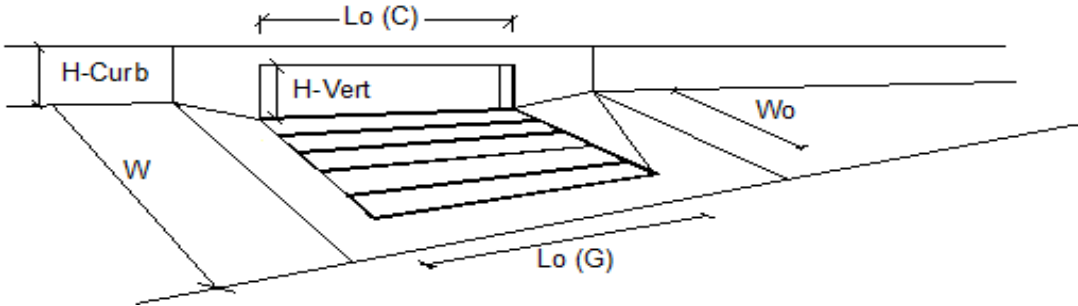
FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	61a
	
Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.055$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 17.0 & 17.0 \end{matrix}$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = \begin{matrix} 4.0 & 12.0 \end{matrix}$ inches
Allow Flow Depth at Street Crown (leave blank for no)	☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
$Q_{allow} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 7.9 & 115.5 \end{matrix}$ cfs	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: 61a



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	4	4	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_rG =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_rC =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	3.40	78.50	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	18.7	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	81	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6J



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
5.3	46.8

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)

Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =

Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

 cfs

Total Design Peak Flow, Q =

Minor Storm	Major Storm
5.3	46.8

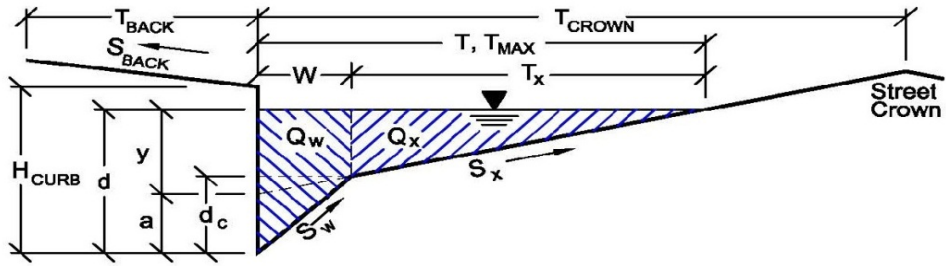
 cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 6J

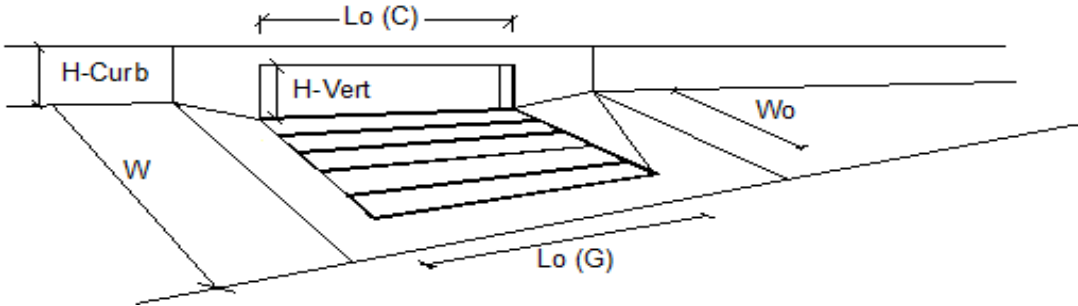


Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$
Height of Curb at Gutter Flow Line	$H_{CURB} = 4.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.025$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = 17.0$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = 4.0$ inches
Allow Flow Depth at Street Crown (leave blank for no)	☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
$Q_{allow} = 5.4$ cfs	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

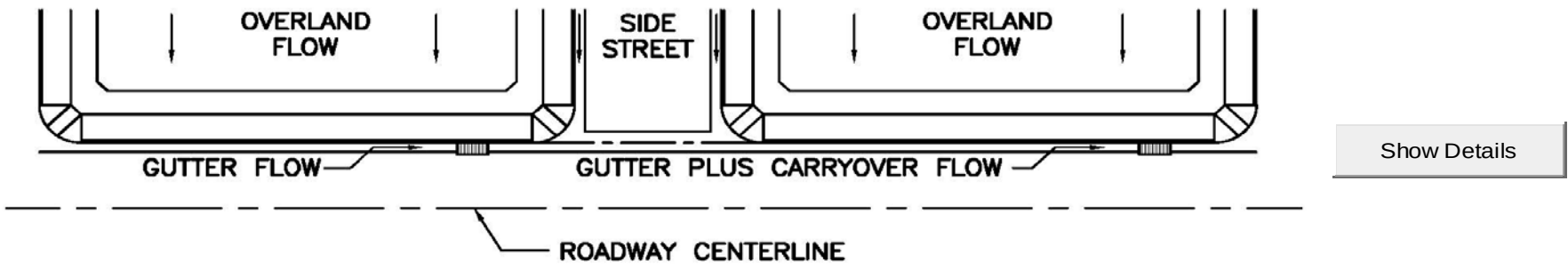
Inlet ID: DP 6J



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_{rG} =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_{rC} =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	5.30	21.67	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	25.1	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	46	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6K



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b = cfs
Total Design Peak Flow, Q = cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	DP 6K

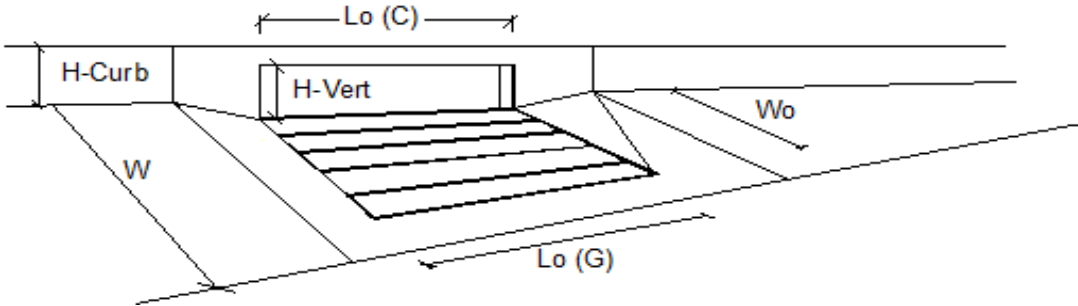
The diagram illustrates the cross-section of a street gutter. Key parameters include: T_{BACK} (width of backflow), S_{BACK} (backflow slope), T , T_{MAX} , T_{CROWN} (widths from curb to crown), T_x (width to flow line), W (gutter width), Q_w (flow in gutter), Q_x (flow in street), S_x (street slope), S_w (gutter slope), H_{CURB} (curb height), d (depth from curb face to gutter bottom), y (depth from gutter bottom to flow line), a (depth from gutter bottom to street crown), and d_c (depth from gutter bottom to curb face). The 'Street Crown' is indicated on the right.

Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.025$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>17.0</td><td>17.0</td></tr></tbody></table> ft	Minor Storm	Major Storm	17.0	17.0
Minor Storm	Major Storm				
17.0	17.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>4.0</td><td>12.0</td></tr></tbody></table> inches	Minor Storm	Major Storm	4.0	12.0
Minor Storm	Major Storm				
4.0	12.0				
Allow Flow Depth at Street Crown (leave blank for no)	<table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>☐</td><td>☒</td></tr></tbody></table> check = yes	Minor Storm	Major Storm	☐	☒
Minor Storm	Major Storm				
☐	☒				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
$Q_{allow} =$ <table><thead><tr><th>Minor Storm</th><th>Major Storm</th></tr></thead><tbody><tr><td>5.4</td><td>146.4</td></tr></tbody></table> cfs		Minor Storm	Major Storm	5.4	146.4
Minor Storm	Major Storm				
5.4	146.4				
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'					

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 6K



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{LOCAL} =$	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	$W_o =$	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_{rG} =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_{rC} =$	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	$Q =$	4.10	13.32	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b =$	0.0	20.7	cfs
Capture Percentage = $Q_a/Q_o =$	$C\% =$	100	39	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6L



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***Q_{Known}** =

Minor Storm	Major Storm
3.4	10.0

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =

Minor Storm	Major Storm
0.0	0.0

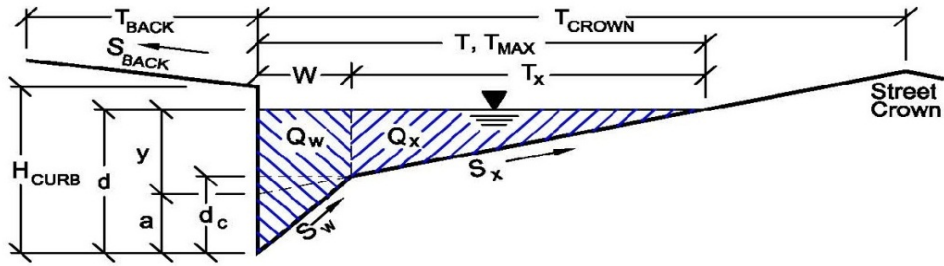
 cfs
Total Design Peak Flow, Q =

Minor Storm	Major Storm
3.4	10.0

 cfs

<---
FILL IN THIS SECTION
OR...

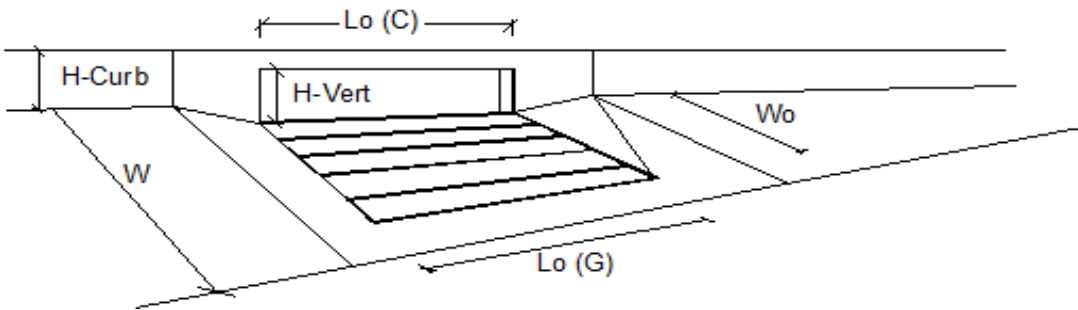
FILL IN THE SECTIONS
BELOW.
<---

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)	
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)	
Project:	Trails at Crowfoot
Inlet ID:	DP 6L
	
Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 18.0$ 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	$H_{CURB} = 4.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_o = 0.025$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 17.0 & 17.0 \end{matrix}$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 4.0 & 12.0 \end{matrix}$ inches
Allow Flow Depth at Street Crown (leave blank for no)	☐ ☒ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
$Q_{allow} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 5.4 & 146.4 \end{matrix}$ cfs	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot

Inlet ID: DP 6L



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	5.0	5.0	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 =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_{rG} =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_{rC} =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'				
Total Inlet Interception Capacity	Q =	3.40	7.77	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	2.2	cfs
Capture Percentage = Q_a/Q_o =	C% =	100	78	%

DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Trails at Crowfoot
Inlet ID: DP 6M



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

***If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: ☐ Site is Urban ☐ Site is Non-Urban

Flows Developed For: ☐ Street Inlets ☐ Area Inlets in a Median

Subcatchment Area = Acres
Percent Imperviousness = %
NRCS Soil Type = A, B, C, or D

Slope (ft/ft) Length (ft)
Overland Flow =
Channel Flow =

Rainfall Information: Intensity i (inch/hr) = $C_1 \cdot P_1 / (C_2 + i_c)^{C_3}$

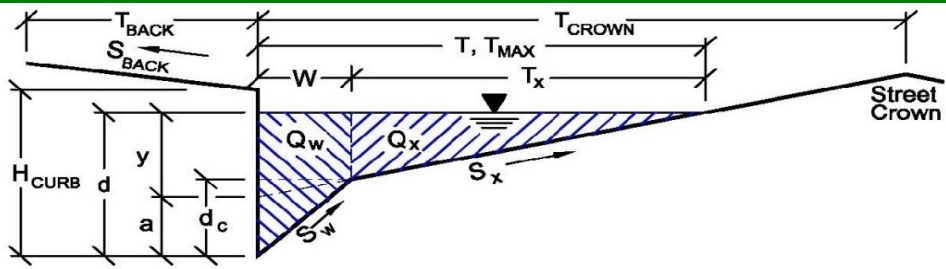
Design Storm Return Period, T_r = years
Return Period One-Hour Precipitation, P_1 = inches
 C_1 =
 C_2 =
 C_3 =
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b = cfs
Total Design Peak Flow, Q = cfs

<---
FILL IN THIS SECTION
OR...

FILL IN THE SECTIONS
BELOW.
<---

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

Project: Trails at Crowfoot
Inlet ID: DP 6M



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 $T_{BACK} = 18.0$ 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
 $H_{CURB} = 4.00$ inches

Distance from Curb Face to Street Crown
 $T_{CROWN} = 17.0$ 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)
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 $T_{MAX} = 17.0$ ft (Minor Storm) 17.0 ft (Major Storm)

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 $d_{MAX} = 4.0$ inches (Minor Storm) 12.0 inches (Major Storm)

Allow Flow Depth at Street Crown (leave blank for no)
☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

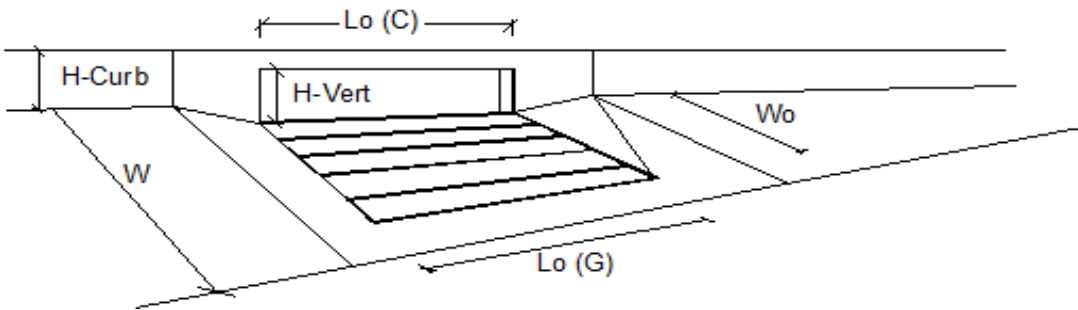
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

$Q_{allow} = 6.8$ cfs (Minor Storm) 127.1 cfs (Major Storm)

INLET ON A CONTINUOUS GRADE

Project: Trails at Crowfoot
Inlet ID: DP 6M



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} =	5.0	5.0	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 =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _r G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _r C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	4.40	13.74	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b =	0.0	21.6	cfs
Capture Percentage = Q _a /Q _o =	C% =	100	39	%

III. Hydraulic Computations

3. UD SEWER

POND A

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
4/17/2017 10:31:44
AM

UDSewer Results Summary

Project Title: Hess Ranch Pond A_1
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6031.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall Pond A-	6032.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

415

1										
SDMH 28	6043.63	18.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 9	6047.67	18.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 135	6047.92	15.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 10	6047.70	5.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 11	6046.41	9.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 134	6046.43	9.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 78	6046.27	2.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 13	6047.20	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 133	6048.93	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 14	6049.10	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 132	6051.42	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 15	6051.91	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 131	6056.08	5.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 130	6057.13	5.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 129	6057.60	5.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 128	6058.47	5.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 127	6058.69	1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 76	6058.50	1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 77	6058.60	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 11	6051.73	4.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 75	6051.24	2.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
416										

Outfall Pond A-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.94	
SDMH 28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.94	Surface Water Present (Downstream)
SDIN 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.94	
SDMH 135	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.83	
SDIN 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.04	
SDMH 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.85	
SDMH 134	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.85	
SDIN 78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95	
SDMH 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.90	
SDMH 133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.90	
SDMH 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.90	
SDMH 132	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.90	
SDMH 15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.90	
SDMH 131	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05	
SDMH 130	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05	
SDMH 129	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05	
SDMH 128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05	
SDMH 127	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39	
SDIN 76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39	
SDIN 77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.84	
SDIN 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.19	
SDIN 75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.92	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 28	258.00	6031.49	1.1	6034.33	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 9	156.00	6034.52	3.0	6039.20	0.013	0.94	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 135	28.00	6039.89	2.0	6040.45	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 10	6.00	6040.65	2.0	6040.77	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 11	31.00	6040.74	2.0	6041.36	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 134	16.00	6041.55	2.0	6041.87	0.013	0.20	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 78	8.00	6042.17	1.0	6042.25	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 13	56.00	6042.07	2.0	6043.19	0.013	0.08	0.00	CIRCULAR	0.00 in	0.00 in
SDMH 133	84.00	6043.38	2.0	6045.06	0.013	0.83	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 14	24.00	6045.26	1.5	6045.62	0.013	0.46	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 132	113.00	6045.82	1.0	6046.95	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 15	25.00	6047.14	1.0	6047.39	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in

SDMH 131	212.00	6047.65	1.8	6051.47	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 130	72.00	6051.67	1.0	6052.39	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 129	46.00	6052.58	1.0	6053.04	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 128	84.00	6053.20	0.6	6053.70	0.013	0.07	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 127	22.00	6053.88	2.8	6054.50	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 76	25.00	6054.70	1.0	6054.95	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 77	52.00	6053.99	1.0	6054.51	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 11	25.00	6047.69	1.0	6047.94	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 75	52.00	6047.25	1.0	6047.77	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 28	70.14	9.92	16.74	5.88	12.78	8.43	1.68	Supercritical	18.94	0.00	
SDIN 9	115.84	16.39	16.74	5.88	9.85	12.08	2.78	Supercritical	18.94	0.00	
SDMH 135	58.16	11.85	16.12	5.89	10.69	10.08	2.19	Supercritical	15.83	0.00	
SDIN 10	58.16	11.85	8.88	4.14	5.97	7.27	2.17	Supercritical	5.04	0.00	
SDMH 11	32.08	10.21	13.47	5.43	9.13	8.98	2.11	Supercritical	9.85	0.00	
SDMH 134	32.08	10.21	13.47	5.43	9.13	8.98	2.11	Supercritical	9.85	0.00	
SDIN 78	10.53	5.96	7.83	4.00	6.52	5.11	1.42	Supercritical	2.95	0.00	
SDMH 13	14.90	8.43	12.20	5.41	8.61	8.27	1.95	Supercritical	6.90	0.00	
SDMH 133	32.08	10.21	11.18	4.81	7.56	8.14	2.12	Supercritical	6.90	0.00	
SDMH 14	27.78	8.84	11.18	4.81	8.15	7.34	1.84	Supercritical	6.90	0.00	
SDMH 132	22.68	7.22	11.18	4.81	9.08	6.34	1.49	Supercritical	6.90	0.00	
SDMH 15	22.68	7.22	11.18	4.81	9.08	6.34	1.49	Supercritical	6.90	0.00	
SDMH 131	14.13	8.00	10.38	4.79	7.44	7.33	1.89	Supercritical	5.05	0.00	
SDMH 130	10.53	5.96	10.38	4.79	8.78	5.90	1.38	Supercritical	5.05	0.00	
SDMH 129	10.53	5.96	10.38	4.79	8.78	5.90	1.38	Supercritical	5.05	0.00	
SDMH 128	8.16	4.62	10.38	4.79	10.25	4.86	1.02	Supercritical	5.05	0.00	
SDMH 127	17.62	9.97	5.30	3.20	3.42	5.95	2.35	Supercritical	1.39	0.00	
SDIN 76	10.53	5.96	5.30	3.20	4.42	4.13	1.43	Supercritical	1.39	0.00	
SDIN 77	10.53	5.96	8.99	4.35	7.52	5.49	1.41	Supercritical	3.84	0.00	

SDIN 11	10.53	5.96	9.41	4.48	7.89	5.62	1.40	Supercritical	4.19	0.00	
SDIN 75	10.53	5.96	7.79	3.98	6.48	5.10	1.42	Supercritical	2.92	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDMH 28	18.94	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDIN 9	18.94	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 135	15.83	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
SDIN 10	5.04	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 11	9.85	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 134	9.85	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 78	2.95	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 13	6.90	CIRCULAR	0.00 in	0.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 133	6.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 14	6.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 132	6.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 15	6.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 131	5.05	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 130	5.05	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 129	5.05	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 128	5.05	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 127	1.39	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 76	1.39	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 77	3.84	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 11	4.19	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 75	2.92	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6031.50

	Invert Elev.	Downstream	HGL	EGL

		Manhole Losses							
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 28	6031.49	6034.33	0.00	0.00	6032.56	6035.72	6033.66	2.60	6036.26
SDIN 9	6034.52	6039.20	0.10	0.00	6035.83	6040.59	6037.61	3.53	6041.13
SDMH 135	6039.89	6040.45	0.01	0.00	6040.89	6041.79	6042.05	0.28	6042.33
SDIN 10	6040.65	6040.77	0.00	0.00	6042.30	6042.30	6042.33	0.01	6042.34
SDMH 11	6040.74	6041.36	0.20	0.00	6041.99	6042.48	6042.75	0.19	6042.94
SDMH 134	6041.55	6041.87	0.03	0.00	6042.51	6043.30	6043.56	0.00	6043.56
SDIN 78	6042.17	6042.25	0.06	0.00	6043.57	6043.57	6043.62	0.00	6043.62
SDMH 13	6042.07	6043.19	0.02	0.00	6043.32	6044.21	6043.85	0.81	6044.66
SDMH 133	6043.38	6045.06	0.06	0.00	6044.27	6045.99	6045.04	1.31	6046.35
SDMH 14	6045.26	6045.62	0.03	0.00	6046.03	6046.55	6046.78	0.14	6046.91
SDMH 132	6045.82	6046.95	0.00	0.00	6046.58	6047.88	6047.20	1.04	6048.24
SDMH 15	6047.14	6047.39	0.00	0.00	6047.90	6048.32	6048.52	0.16	6048.68
SDMH 131	6047.65	6051.47	0.01	0.00	6048.33	6052.33	6049.11	3.58	6052.69
SDMH 130	6051.67	6052.39	0.01	0.00	6052.40	6053.25	6052.94	0.67	6053.61
SDMH 129	6052.58	6053.04	0.01	0.00	6053.31	6053.90	6053.85	0.41	6054.26
SDMH 128	6053.20	6053.70	0.01	0.00	6054.05	6054.56	6054.42	0.50	6054.92
SDMH 127	6053.88	6054.50	0.00	0.00	6054.90	6054.94	6054.92	0.18	6055.10
SDIN 76	6054.70	6054.95	0.01	0.00	6055.07	6055.39	6055.33	0.22	6055.55
SDIN 77	6053.99	6054.51	0.10	0.00	6054.66	6055.26	6055.08	0.47	6055.55
SDIN 11	6047.69	6047.94	0.12	0.00	6048.44	6048.72	6048.84	0.20	6049.04
SDIN 75	6047.25	6047.77	0.06	0.00	6048.20	6048.42	6048.30	0.37	6048.67

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_{fi} ^ 2/(2*g)
- Lateral loss = V_{fo} ^ 2/(2*g)- Junction Loss K * V_{fi} ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 28	258.00	4.00	6.00	6.67	0.00	1.62	0.00	16.60	10.13	5.97	492.27	Sewer Too Shallow
SDIN 9	156.00	4.00	6.00	6.67	16.22	9.94	5.78	14.94	9.30	5.14	486.03	
SDMH 135	28.00	3.50	6.00	6.08	14.06	8.57	4.99	13.44	8.26	4.68	68.36	
SDIN 10	6.00	3.50	6.00	6.08	13.04	8.06	4.48	12.36	7.72	4.14	13.11	
SDMH 11	31.00	3.00	4.00	5.50	13.36	7.76	4.93	9.10	5.63	2.80	53.03	
SDMH 134	16.00	3.00	4.00	5.50	8.72	5.44	2.61	8.12	5.14	2.31	18.53	
SDIN 78	8.00	2.50	4.00	4.92	8.02	4.80	2.55	7.54	4.56	2.31	7.43	
SDMH 13	56.00	2.50	4.00	4.92	8.22	4.90	2.65	7.52	4.55	2.30	52.79	
SDMH 133	84.00	3.00	4.00	5.50	6.64	4.40	1.57	6.74	4.45	1.62	76.88	Sewer Too Shallow
SDMH 14	24.00	3.00	4.00	5.50	6.34	4.25	1.42	5.96	4.06	1.23	20.43	Sewer Too Shallow
SDMH 132	113.00	3.00	4.00	5.50	5.56	3.86	1.03	7.94	5.05	2.22	105.74	Sewer Too Shallow
SDMH 15	25.00	3.00	4.00	5.50	7.56	4.86	2.03	8.04	5.10	2.27	26.62	
SDMH 131	212.00	2.50	4.00	4.92	8.01	4.80	2.55	8.72	5.15	2.90	215.65	
SDMH 130	72.00	2.50	4.00	4.92	8.32	4.95	2.70	8.98	5.28	3.03	76.45	
SDMH 129	46.00	2.50	4.00	4.92	8.60	5.09	2.84	8.62	5.10	2.85	48.50	
SDMH 128	84.00	2.50	4.00	4.92	8.31	4.95	2.70	9.04	5.31	3.06	89.53	
SDMH 127	22.00	2.50	4.00	4.92	8.67	5.13	2.88	7.88	4.73	2.48	22.08	
SDIN 76	25.00	2.50	4.00	4.92	7.48	4.53	2.28	6.60	4.09	1.84	20.72	Sewer Too Shallow
SDIN 77	52.00	2.50	4.00	4.92	8.46	5.02	2.77	7.68	4.63	2.38	50.57	
SDIN 11	25.00	2.50	4.00	4.92	7.94	4.76	2.51	7.08	4.33	2.08	22.30	
SDIN 75	52.00	2.50	4.00	4.92	7.84	4.71	2.46	6.44	4.01	1.76	43.92	Sewer Too Shallow

Total earth volume for sewer trenches = 2011 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
4/16/2017 1:17:57
PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond A (Basin A-1) 100 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6031.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall Pond A-	6032.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

423

1										
SDMH 28	6043.63	73.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 9	6047.67	73.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 135	6047.92	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 10	6047.70	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Local Contribution						Total Design Flow				Comment
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Outfall Pond A-1	0.00	0.00	0.00	0.00	0.00	6.21	11.75	0.42	73.00	
SDMH 28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.00	Surface Water Present (Downstream)
SDIN 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.00	
SDMH 135	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	
SDIN 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 28	258.00	6031.49	1.1	6034.33	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 9	156.00	6034.52	3.0	6039.20	0.013	0.94	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 135	28.00	6039.89	2.0	6040.45	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 10	6.00	6040.65	2.0	6040.77	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 28	70.14	9.92	36.00	10.33	36.00	10.33	0.00	Pressurized	73.00	258.00	
SDIN 9	115.84	16.39	32.35	10.91	20.73	17.32	2.56	Supercritical Jump	73.00	88.63	
SDMH	58.16	11.85	26.07	9.30	18.92	12.91	1.96	Supercritical	42.10	0.00	

135											
SDIN 10	58.16	11.85	26.07	9.30	18.92	12.91	1.96	Supercritical	42.10	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDMH 28	73.00	CIRCULAR	36.00 in	36.00 in	42.00 in	42.00 in	36.00 in	36.00 in	7.07	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDIN 9	73.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 135	42.10	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
SDIN 10	42.10	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6031.50

Element Name	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 28	6031.49	6034.33	0.00	0.00	6034.49	6037.57	6036.15	3.07	6039.22
SDIN 9	6034.52	6039.20	1.56	0.00	6039.12	6041.90	6040.78	2.96	6043.74
SDMH 135	6039.89	6040.45	0.06	0.00	6041.95	6042.90	6044.05	0.00	6044.05
SDIN 10	6040.65	6040.77	0.06	0.00	6042.96	6043.67	6044.81	0.00	6044.81

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_{fi}² / (2*g)

- Lateral loss = $V_{fo}^2 / (2 * g) - \text{Junction Loss } K * V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 28	258.00	4.00	6.00	6.67	0.00	1.62	0.00	16.60	10.13	5.97	492.27	Sewer Too Shallow
SDIN 9	156.00	4.00	6.00	6.67	16.22	9.94	5.78	14.94	9.30	5.14	486.03	
SDMH 135	28.00	3.50	6.00	6.08	14.06	8.57	4.99	13.44	8.26	4.68	68.36	
SDIN 10	6.00	3.50	6.00	6.08	13.04	8.06	4.48	12.36	7.72	4.14	13.11	

Total earth volume for sewer trenches = 1060 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
4/17/2017 10:47:50
AM

UDSewer Results Summary

Project Title: Trails at Crowfooot Pond A_1
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6016.10

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond A Outfall	6015.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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A-2 2 Year										
MH 17 SWR 17 - 1	6030.00	22.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 7	6043.12	22.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 138	6043.43	19.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 4	6043.44	16.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 137	6043.94	4.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 5	6043.64	2.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 136	6046.73	2.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 74	6046.74	2.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 5	6045.30	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 139	6047.23	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 6	6048.13	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 7	6048.86	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 8	6051.46	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 9	6057.28	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 141	6058.25	7.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 10	6070.26	6.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 8	6069.90	6.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 71	6057.89	2.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 140	6059.95	5.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 72	6059.77	5.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 73	6042.94	2.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time	Gutter Time	Basin Tc	Intensity (in/hr)	Local Contrib	Coeff. Area	Intensity (in/hr)	Manhole Tc	Peak Flow	Comment

	(min)	(min)	(min)		(cfs)			(min)	(cfs)	
Pond A Outfall A-2 2 Year	0.00	0.00	0.00	0.00	0.00	5.34	4.14	1.21	22.10	Surface Water Present (Upstream)
MH 17 SWR 17 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.10	Surface Water Present (Downstream)
SDIN 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.10	
SDMH 138	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.26	
SDMH 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.64	
SDMH 137	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.67	
SDIN 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.27	
SDMH 136	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.51	
SDIN 74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.51	
SDMH 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.13	
SDMH 139	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.13	
SDMH 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.13	
SDMH 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.13	
SDMH 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.13	
SDMH 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.13	
SDMH 141	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.21	
SDMH 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.77	
SDIN 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.77	
SDIN 71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.28	
SDMH 140	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.01	
SDIN 72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.01	
SDIN 73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
MH 17 SWR 17 - 1	227.00	6015.10	3.7	6023.50	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 7	136.00	6024.97	3.7	6030.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 138	10.00	6030.60	4.0	6031.00	0.013	0.20	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 4	25.00	6031.40	4.0	6032.40	0.013	1.61	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 137	54.00	6032.64	4.0	6034.80	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 5	26.00	6034.99	3.5	6035.90	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 136	218.00	6036.25	2.8	6042.35	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 74	52.00	6042.55	1.0	6043.07	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 5	123.00	6033.38	4.0	6038.30	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in

SDMH 139	66.00	6038.50	4.0	6041.14	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 6	50.00	6041.35	3.5	6043.10	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 7	65.00	6043.30	2.0	6044.60	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 8	93.00	6044.80	2.5	6047.12	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 9	116.00	6047.34	4.0	6051.98	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 141	57.00	6052.29	2.7	6053.83	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 10	278.00	6054.03	4.0	6065.15	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 8	18.00	6065.36	2.0	6065.72	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 71	18.00	6054.13	2.0	6054.49	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 140	50.00	6052.17	4.0	6054.17	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 72	25.00	6054.37	2.0	6054.87	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 73	28.00	6031.75	4.0	6032.87	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
MH 17 SWR 17 - 1	128.64	18.20	18.14	6.19	10.10	13.61	3.09	Supercritical	22.10	0.00	
SDIN 7	128.64	18.20	18.14	6.19	10.10	13.61	3.09	Supercritical	22.10	0.00	
SDMH 138	133.76	18.92	16.88	5.92	9.23	13.45	3.21	Supercritical	19.26	0.00	
SDMH 4	133.76	18.92	15.64	5.65	8.57	12.89	3.20	Supercritical	16.64	0.00	
SDMH 137	82.26	16.76	8.54	4.05	4.85	9.07	3.02	Supercritical	4.67	0.00	
SDIN 5	76.94	15.67	5.90	3.33	3.54	6.98	2.74	Supercritical	2.27	0.00	
SDMH 136	17.62	9.97	7.20	3.80	4.59	7.07	2.39	Supercritical	2.51	0.00	
SDIN 74	10.53	5.96	7.20	3.80	5.98	4.89	1.43	Supercritical	2.51	0.00	
SDMH 5	45.37	14.44	15.65	6.05	8.84	12.50	2.99	Supercritical	13.13	0.00	
SDMH 139	45.37	14.44	15.65	6.05	8.84	12.50	2.99	Supercritical	13.13	0.00	
SDMH 6	42.44	13.51	15.65	6.05	9.16	11.91	2.79	Supercritical	13.13	0.00	
SDMH 7	32.08	10.21	15.65	6.05	10.69	9.70	2.07	Supercritical	13.13	0.00	
SDMH 8	35.87	11.42	15.65	6.05	10.05	10.53	2.33	Supercritical	13.13	0.00	
SDMH 9	45.37	14.44	15.65	6.05	8.84	12.50	2.99	Supercritical	13.13	0.00	
SDMH 141	17.31	9.79	12.48	5.52	8.10	9.35	2.29	Supercritical	7.21	0.00	
SDMH 10	21.07	11.92	12.08	5.37	7.02	10.62	2.83	Supercritical	6.77	0.00	
SDIN 8	14.90	8.43	12.08	5.37	8.51	8.23	1.96	Supercritical	6.77	0.00	
SDIN 71	14.90	8.43	6.85	3.69	4.76	6.10	2.02	Supercritical	2.28	0.00	
SDMH 140	21.07	11.92	10.33	4.77	5.97	9.77	2.86	Supercritical	5.01	0.00	
SDIN 72	14.90	8.43	10.33	4.77	7.19	7.60	2.00	Supercritical	5.01	0.00	
SDIN 73	82.26	16.76	6.55	3.51	3.78	7.77	2.95	Supercritical	2.78	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).

- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
MH 17 SWR 17 - 1	22.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDIN 7	22.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 138	19.26	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 4	16.64	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 137	4.67	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDIN 5	2.27	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 136	2.51	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 74	2.51	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 5	13.13	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 139	13.13	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 6	13.13	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 7	13.13	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 8	13.13	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 9	13.13	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 141	7.21	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 10	6.77	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 8	6.77	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 71	2.28	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 140	5.01	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 72	5.01	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 73	2.78	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6016.10

Invert Elev.		Downstream Manhole Losses		HGL		EGL			
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss	Lateral Loss	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss	Upstream (ft)

			(ft)	(ft)				(ft)	
MH 17 SWR 17 - 1	6015.10	6023.50	0.00	0.00	6016.10	6025.01	6018.82	6.79	6025.61
SDIN 7	6024.97	6030.00	0.01	0.00	6025.81	6031.51	6028.69	3.42	6032.11
SDMH 138	6030.60	6031.00	0.02	0.00	6031.53	6034.06	6034.18	0.00	6034.18
SDMH 4	6031.40	6032.40	0.14	0.00	6034.20	6034.55	6034.70	0.00	6034.70
SDMH 137	6032.64	6034.80	0.00	0.00	6034.68	6035.51	6034.70	1.07	6035.77
SDIN 5	6034.99	6035.90	0.00	0.00	6035.52	6036.39	6036.04	0.52	6036.56
SDMH 136	6036.25	6042.35	0.00	0.00	6036.63	6042.95	6037.40	5.77	6043.17
SDIN 74	6042.55	6043.07	0.04	0.00	6043.05	6043.67	6043.42	0.47	6043.89
SDMH 5	6033.38	6038.30	0.36	0.00	6034.91	6039.60	6036.54	3.63	6040.17
SDMH 139	6038.50	6041.14	0.01	0.00	6039.62	6042.44	6041.66	1.35	6043.01
SDMH 6	6041.35	6043.10	0.01	0.00	6042.46	6044.40	6044.32	0.66	6044.97
SDMH 7	6043.30	6044.60	0.01	0.00	6044.42	6045.90	6045.65	0.82	6046.47
SDMH 8	6044.80	6047.12	0.01	0.00	6045.92	6048.42	6047.35	1.64	6048.99
SDMH 9	6047.34	6051.98	0.01	0.00	6048.44	6053.28	6050.50	3.35	6053.85
SDMH 141	6052.29	6053.83	0.34	0.00	6053.62	6054.87	6054.32	1.02	6055.34
SDMH 10	6054.03	6065.15	0.01	0.00	6054.88	6066.16	6056.37	10.24	6066.60
SDIN 8	6065.36	6065.72	0.30	0.00	6066.46	6066.73	6067.12	0.05	6067.17
SDIN 71	6054.13	6054.49	0.03	0.00	6055.34	6055.34	6055.38	0.04	6055.42
SDMH 140	6052.17	6054.17	0.01	0.00	6053.29	6055.03	6054.15	1.23	6055.38
SDIN 72	6054.37	6054.87	0.16	0.00	6055.20	6055.73	6055.87	0.22	6056.08
SDIN 73	6031.75	6032.87	0.00	0.00	6034.17	6034.17	6034.18	0.01	6034.19

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_{fi} ^ 2/(2*g)
- Lateral loss = V_{fo} ^ 2/(2*g)- Junction Loss K * V_{fi} ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
MH 17 SWR 17 - 1	227.00	4.00	6.00	6.67	0.00	0.73	0.00	11.00	7.33	3.17	245.77	Sewer Too Shallow
SDIN 7	136.00	4.00	6.00	6.67	8.06	5.87	1.70	24.24	13.95	9.79	528.43	Sewer Too Shallow
SDMH 138	10.00	4.00	6.00	6.67	23.04	13.35	9.19	22.86	13.26	9.10	57.41	
SDMH 4	25.00	4.00	6.00	6.67	22.06	12.86	8.70	20.08	11.87	7.71	124.60	
SDMH 137	54.00	3.50	6.00	6.08	20.10	11.59	8.01	16.78	9.93	6.35	208.66	

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SDIN 5	26.00	3.50	6.00	6.08	16.40	9.74	6.16	13.98	8.53	4.95	73.84	
SDMH 136	218.00	2.50	4.00	4.92	14.89	8.24	5.99	8.26	4.92	2.67	372.79	
SDIN 74	52.00	2.50	4.00	4.92	7.86	4.72	2.47	6.84	4.21	1.96	45.27	Sewer Too Shallow
SDMH 5	123.00	3.00	4.00	5.50	19.12	10.64	7.81	13.00	7.58	4.75	366.01	
SDMH 139	66.00	3.00	4.00	5.50	12.60	7.38	4.55	11.18	6.67	3.84	119.75	
SDMH 6	50.00	3.00	4.00	5.50	10.76	6.46	3.63	9.06	5.61	2.78	70.84	
SDMH 7	65.00	3.00	4.00	5.50	8.66	5.41	2.58	7.52	4.84	2.01	72.14	
SDMH 8	93.00	3.00	4.00	5.50	7.13	4.65	1.82	7.68	4.92	2.09	93.86	Sewer Too Shallow
SDMH 9	116.00	3.00	4.00	5.50	7.24	4.70	1.87	9.60	5.88	3.05	135.73	Sewer Too Shallow
SDMH 141	57.00	2.50	4.00	4.92	9.48	5.53	3.28	8.34	4.96	2.71	63.04	
SDMH 10	278.00	2.50	4.00	4.92	7.94	4.76	2.51	9.72	5.65	3.40	305.04	
SDIN 8	18.00	2.50	4.00	4.92	9.30	5.44	3.19	7.86	4.72	2.47	18.98	
SDIN 71	18.00	2.50	4.00	4.92	7.74	4.66	2.41	6.30	3.94	1.69	14.92	Sewer Too Shallow
SDMH 140	50.00	2.50	4.00	4.92	9.72	5.65	3.40	11.06	6.32	4.07	68.59	
SDIN 72	25.00	2.50	4.00	4.92	10.66	6.12	3.87	9.30	5.44	3.19	32.36	
SDIN 73	28.00	3.50	6.00	6.08	21.86	12.47	8.89	18.64	10.86	7.28	126.30	

Total earth volume for sewer trenches = 3144 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
2/7/2018 11:01:11
AM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond A (Basin A-2)
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.99
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6015.10

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond A Outfall	6015.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

434

A-2_2 Year										
SDMH 17	6030.00	24.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 7	6043.12	24.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 138	6043.43	22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 4	6043.44	19.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 5	6045.81	15.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 139	6047.47	15.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 6	6048.15	15.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 7	6048.86	15.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 8	6051.46	15.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 9	6057.28	15.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 140	6059.94	4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 72	6059.64	4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 141	6058.24	15.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 71	6058.33	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 50	6065.69	9.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 10	6070.26	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 8	6069.77	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 67	6068.81	6.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 115	6068.94	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 65	6077.01	6.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 116	6076.82	6.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 137	6043.94	4.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 136	6046.41	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 74	6046.53	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
									435	

SDIN 5	6043.64	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 73	6042.94	2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution					Total Design Flow				Comment
	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Pond A Outfall A-2_2 Year	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.90	Surface Water Present (Upstream)
SDMH 17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.90	Surface Water Present (Downstream)
SDIN 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.90	
SDMH 138	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.00	
SDMH 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.30	
SDMH 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.90	
SDMH 139	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.90	
SDMH 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.90	
SDMH 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.90	
SDMH 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.90	
SDMH 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.90	
SDMH 140	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.40	
SDIN 72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.40	
SDMH 141	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.90	
SDIN 71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.30	
SDMH 50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.80	
SDMH 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
SDIN 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
SDMH 67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.20	
SDIN 115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
SDMH 65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.20	
SDIN 116	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.20	
SDMH 137	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.70	
SDMH 136	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
SDIN 74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
SDIN 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.30	
SDIN 73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.80	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 17	237.00	6014.97	3.6	6023.50	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 7	136.00	6024.97	3.7	6030.00	0.013	0.83	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 138	10.00	6030.60	4.0	6031.00	0.013	0.20	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 4	25.00	6031.40	4.0	6032.40	0.013	1.61	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 5	123.00	6033.38	4.0	6038.30	0.013	1.00	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 139	66.00	6038.50	4.0	6041.14	0.013	0.16	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 6	50.00	6041.35	3.5	6043.10	0.013	0.16	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 7	65.00	6043.30	2.0	6044.60	0.013	0.16	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 8	93.00	6044.80	2.5	6047.12	0.013	0.16	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 9	117.00	6047.30	4.0	6051.98	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 140	50.00	6052.17	4.0	6054.17	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 72	25.00	6054.37	2.0	6054.87	0.013	1.00	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 141	57.00	6052.29	2.7	6053.83	0.013	1.00	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 71	18.00	6054.13	2.0	6054.49	0.013	1.00	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 50	216.00	6053.95	4.3	6063.24	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 10	61.00	6063.44	2.8	6065.15	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 8	18.00	6065.36	2.0	6065.72	0.013	1.00	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 67	54.00	6063.42	1.9	6064.45	0.013	1.00	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 115	27.00	6064.71	1.0	6064.98	0.013	1.00	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 65	187.00	6064.71	3.9	6072.00	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 116	48.00	6072.20	2.0	6073.16	0.013	1.00	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 137	54.00	6032.64	4.0	6034.80	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 136	218.00	6036.25	2.8	6042.35	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 74	52.00	6042.55	1.0	6043.07	0.013	1.00	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 5	25.00	6035.03	3.5	6035.90	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 73	28.00	6031.75	4.0	6032.87	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

Full Flow Capacity		Critical Flow		Normal Flow							
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 17	126.89	17.95	19.31	6.45	10.81	13.94	3.05	Supercritical	24.90	0.00	
SDIN 7	128.64	18.20	19.31	6.45	10.74	14.08	3.09	Supercritical	24.90	0.00	
SDMH 138	133.76	18.92	18.10	6.18	9.87	13.97	3.21	Supercritical	22.00	0.00	
SDMH 4	133.76	18.92	16.90	5.92	9.24	13.46	3.21	Supercritical Jump	19.30	3.22	

SDMH 5	45.37	14.44	17.25	6.58	9.81	13.17	2.96	Supercritical	15.90	0.00	
SDMH 139	45.37	14.44	17.25	6.58	9.81	13.17	2.96	Supercritical	15.90	0.00	
SDMH 6	42.44	13.51	17.25	6.58	10.18	12.54	2.76	Supercritical	15.90	0.00	
SDMH 7	32.08	10.21	17.25	6.58	11.94	10.19	2.03	Supercritical	15.90	0.00	
SDMH 8	35.87	11.42	17.25	6.58	11.19	11.07	2.30	Supercritical	15.90	0.00	
SDMH 9	45.37	14.44	17.25	6.58	9.81	13.17	2.96	Supercritical	15.90	0.00	
SDMH 140	21.07	11.92	9.65	4.56	5.58	9.42	2.86	Supercritical Jump	4.40	8.57	
SDIN 72	14.90	8.43	9.65	4.56	6.70	7.34	2.01	Supercritical	4.40	0.00	
SDMH 141	37.27	11.86	17.25	6.58	10.95	11.39	2.40	Supercritical	15.90	0.00	
SDIN 71	14.90	8.43	6.88	3.70	4.78	6.11	2.02	Supercritical Jump	2.30	15.85	
SDMH 50	21.84	12.36	14.49	6.43	8.45	12.02	2.87	Supercritical	9.80	0.00	
SDMH 10	17.62	9.97	7.18	3.80	4.58	7.06	2.39	Supercritical Jump	2.50	4.29	
SDIN 8	14.90	8.43	7.18	3.80	4.99	6.26	2.02	Supercritical	2.50	0.00	
SDMH 67	14.52	8.22	11.55	5.18	8.22	7.89	1.92	Supercritical Jump	6.20	10.63	
SDIN 115	10.53	5.96	7.18	3.80	5.97	4.88	1.43	Supercritical	2.50	0.00	
SDMH 65	20.80	11.77	11.55	5.18	6.74	10.27	2.81	Supercritical	6.20	0.00	
SDIN 116	14.90	8.43	11.55	5.18	8.10	8.04	1.97	Supercritical	6.20	0.00	
SDMH 137	82.26	16.76	8.57	4.06	4.87	9.09	3.02	Supercritical	4.70	0.00	
SDMH 136	17.62	9.97	7.18	3.80	4.58	7.06	2.39	Supercritical	2.50	0.00	
SDIN 74	10.53	5.96	7.18	3.80	5.97	4.88	1.43	Supercritical	2.50	0.00	
SDIN 5	76.94	15.67	5.94	3.34	3.56	7.00	2.74	Supercritical	2.30	0.00	
SDIN 73	82.26	16.76	6.57	3.52	3.79	7.79	2.95	Supercritical Jump	2.80	5.02	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDMH 17	24.90	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDIN 7	24.90	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 138	22.00	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 4	19.30	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	

SDMH 5	15.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 139	15.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 6	15.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 7	15.90	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
SDMH 8	15.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 9	15.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 140	4.40	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 72	4.40	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 141	15.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 71	2.30	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 50	9.80	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 10	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 8	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 67	6.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 115	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 65	6.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 116	6.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 137	4.70	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 136	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 74	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 5	2.30	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDIN 73	2.80	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6015.10

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 17	6014.97	6023.50	0.00	0.00	6015.87	6025.11	6018.89	6.87	6025.75
SDIN 7	6024.97	6030.00	0.16	0.00	6025.86	6031.61	6028.94	3.31	6032.25
SDMH 138	6030.60	6031.00	0.03	0.00	6031.64	6034.30	6034.46	0.00	6034.46
SDMH 4	6031.40	6032.40	0.19	0.00	6034.53	6034.53	6034.64	0.09	6034.73
SDMH 5	6033.38	6038.30	0.40	0.00	6034.92	6039.74	6036.89	3.52	6040.41
SDMH	6038.50	6041.14	0.06	0.00	6039.80	6042.58	6042.01	1.24	6043.25

139									
SDMH 6	6041.35	6043.10	0.06	0.00	6042.64	6044.54	6044.64	0.57	6045.21
SDMH 7	6043.30	6044.60	0.06	0.00	6044.60	6046.04	6045.91	0.80	6046.71
SDMH 8	6044.80	6047.12	0.06	0.00	6046.10	6048.56	6047.63	1.60	6049.23
SDMH 9	6047.30	6051.98	0.02	0.00	6048.58	6053.42	6050.81	3.28	6054.09
SDMH 140	6052.17	6054.17	0.00	0.00	6054.00	6054.97	6054.09	1.20	6055.30
SDIN 72	6054.37	6054.87	0.10	0.00	6055.07	6055.67	6055.76	0.23	6056.00
SDMH 141	6052.29	6053.83	0.40	0.00	6053.82	6055.27	6055.22	0.72	6055.94
SDIN 71	6054.13	6054.49	0.03	0.00	6055.94	6055.95	6055.97	0.01	6055.97
SDMH 50	6053.95	6063.24	0.02	0.00	6055.29	6064.45	6056.90	8.19	6065.09
SDMH 10	6063.44	6065.15	0.00	0.00	6065.06	6065.75	6065.09	0.88	6065.97
SDIN 8	6065.36	6065.72	0.03	0.00	6065.78	6066.32	6066.38	0.16	6066.54
SDMH 67	6063.42	6064.45	0.19	0.00	6065.09	6065.41	6065.28	0.55	6065.83
SDIN 115	6064.71	6064.98	0.03	0.00	6065.81	6065.81	6065.86	0.05	6065.91
SDMH 65	6064.71	6072.00	0.01	0.00	6065.42	6072.96	6066.91	6.47	6073.38
SDIN 116	6072.20	6073.16	0.19	0.00	6073.15	6074.12	6073.88	0.66	6074.54
SDMH 137	6032.64	6034.80	0.00	0.00	6034.71	6035.51	6034.73	1.04	6035.77
SDMH 136	6036.25	6042.35	0.00	0.00	6036.63	6042.95	6037.40	5.77	6043.17
SDIN 74	6042.55	6043.07	0.03	0.00	6043.05	6043.67	6043.42	0.48	6043.89
SDIN 5	6035.03	6035.90	0.00	0.00	6035.52	6036.40	6036.08	0.48	6036.57
SDIN 73	6031.75	6032.87	0.00	0.00	6034.45	6034.45	6034.46	0.01	6034.46

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_{fi} ^ 2/(2*g)
- Lateral loss = V_{fo} ^ 2/(2*g)- Junction Loss K * V_{fi} ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 17	237.00	4.00	6.00	6.67	0.00	0.87	0.00	11.00	7.33	3.17	260.49	Sewer Too Shallow
SDIN 7	136.00	4.00	6.00	6.67	8.06	5.87	1.70	24.24	13.95	9.79	528.43	Sewer Too Shallow
SDMH 138	10.00	4.00	6.00	6.67	23.04	13.35	9.19	22.86	13.26	9.10	57.41	

SDMH 4	25.00	4.00	6.00	6.67	22.06	12.86	8.70	20.08	11.87	7.71	124.60	
SDMH 5	123.00	3.00	4.00	5.50	19.12	10.64	7.81	14.02	8.09	5.26	381.70	
SDMH 139	66.00	3.00	4.00	5.50	13.62	7.89	5.06	11.66	6.91	4.08	131.27	
SDMH 6	50.00	3.00	4.00	5.50	11.24	6.70	3.87	9.10	5.63	2.80	73.45	
SDMH 7	65.00	3.00	4.00	5.50	8.70	5.43	2.60	7.52	4.84	2.01	72.34	
SDMH 8	93.00	3.00	4.00	5.50	7.13	4.65	1.82	7.68	4.92	2.09	93.86	Sewer Too Shallow
SDMH 9	117.00	3.00	4.00	5.50	7.32	4.74	1.91	9.60	5.88	3.05	137.53	Sewer Too Shallow
SDMH 140	50.00	2.50	4.00	4.92	9.72	5.65	3.40	11.04	6.31	4.06	68.48	
SDIN 72	25.00	2.50	4.00	4.92	10.64	6.11	3.86	9.04	5.31	3.06	31.76	
SDMH 141	57.00	3.00	4.00	5.50	8.98	5.57	2.74	7.82	4.99	2.16	65.95	
SDIN 71	18.00	2.50	4.00	4.92	7.72	4.65	2.40	7.18	4.38	2.13	15.89	
SDMH 50	216.00	2.50	4.00	4.92	8.08	4.83	2.58	4.92	2.99	0.74	149.21	Sewer Too Shallow
SDMH 10	61.00	2.50	4.00	4.92	0.00	2.79	0.54	9.72	5.65	3.40	50.40	Sewer Too Shallow
SDIN 8	18.00	2.50	4.00	4.92	9.30	5.44	3.19	7.60	4.59	2.34	18.64	
SDMH 67	54.00	2.50	4.00	4.92	0.00	2.81	0.56	8.22	4.90	2.65	37.89	Sewer Too Shallow
SDIN 115	27.00	2.50	4.00	4.92	7.70	4.64	2.39	7.42	4.50	2.25	24.23	
SDMH 65	187.00	2.50	4.00	4.92	7.71	4.64	2.39	9.52	5.55	3.30	198.69	
SDIN 116	48.00	2.50	4.00	4.92	9.12	5.35	3.10	6.82	4.20	1.95	46.48	Sewer Too Shallow
SDMH 137	54.00	3.50	6.00	6.08	20.10	11.59	8.01	16.78	9.93	6.35	208.66	
SDMH 136	218.00	2.50	4.00	4.92	14.89	8.24	5.99	7.62	4.60	2.35	362.53	
SDIN 74	52.00	2.50	4.00	4.92	7.22	4.40	2.15	6.42	4.00	1.75	41.61	Sewer Too Shallow
SDIN 5	25.00	3.50	6.00	6.08	16.33	9.71	6.12	13.98	8.53	4.95	70.74	
SDIN 73	28.00	3.50	6.00	6.08	21.86	12.47	8.89	18.64	10.86	7.28	126.30	

Total earth volume for sewer trenches = 3379 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
1/25/2018 2:46:45
PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond A (Basin A-2)
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6015.10

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond A Outfall	6015.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

442

A-2_100 Year										
SDMH 17	6030.00	94.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 7	6043.12	94.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 138	6043.43	82.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 4	6043.44	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 137	6043.94	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 5	6043.64	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 73	6042.94	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond A Outfall A-2_100 Year	0.00	0.00	0.00	0.00	0.00	7.94	11.85	0.30	94.13	Surface Water Present (Upstream)
SDMH 17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.13	Surface Water Present (Downstream)
SDIN 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.13	
SDMH 138	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.87	
SDMH 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	
SDMH 137	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	
SDIN 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	
SDIN 73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 17	237.00	6014.97	3.6	6023.50	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 7	136.00	6024.97	3.7	6030.00	0.013	0.83	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 138	10.00	6030.60	4.0	6031.00	0.013	0.20	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 4	25.00	6031.40	4.0	6032.40	0.013	1.61	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 137	54.00	6032.64	4.0	6034.80	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 5	25.00	6035.03	3.5	6035.90	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in

SDIN 73	28.00	6031.75	4.0	6032.87	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 17	126.89	17.95	34.43	13.52	23.08	19.66	2.69	Supercritical	94.13	0.00	Velocity is Too High
SDIN 7	128.64	18.20	34.43	13.52	22.87	19.87	2.73	Supercritical Jump	94.13	44.95	Velocity is Too High
SDMH 138	133.76	18.92	33.54	12.08	20.51	19.93	2.97	Supercritical	82.87	0.00	Velocity is Too High
SDMH 4	133.76	18.92	25.36	7.91	13.87	16.76	3.18	Pressurized	42.10	25.00	
SDMH 137	82.26	16.76	26.07	9.30	15.21	16.85	2.97	Pressurized	42.10	54.00	
SDIN 5	76.94	15.67	26.07	9.30	15.83	16.03	2.75	Pressurized	42.10	25.00	
SDIN 73	82.26	16.76	26.07	9.30	15.21	16.85	2.97	Pressurized	42.10	28.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft ²)	Comment
SDMH 17	94.13	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDIN 7	94.13	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 138	82.87	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 4	42.10	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 137	42.10	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
SDIN 5	42.10	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
SDIN 73	42.10	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6015.10

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 17	6014.97	6023.50	0.00	0.00	6016.89	6026.37	6022.89	6.32	6029.21
SDIN 7	6024.97	6030.00	2.29	0.00	6028.74	6032.87	6031.49	4.21	6035.71
SDMH 138	6030.60	6031.00	0.43	0.00	6033.30	6036.34	6038.47	0.00	6038.47
SDMH 4	6031.40	6032.40	0.89	0.00	6038.81	6038.91	6039.36	0.10	6039.46
SDMH 137	6032.64	6034.80	0.06	0.00	6038.97	6039.53	6040.11	0.57	6040.67
SDIN 5	6035.03	6035.90	1.51	0.00	6041.04	6041.30	6042.18	0.26	6042.44
SDIN 73	6031.75	6032.87	0.06	0.00	6037.39	6037.68	6038.53	0.29	6038.82

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 17	237.00	4.00	6.00	6.67	0.00	0.87	0.00	11.00	7.33	3.17	260.49	Sewer Too Shallow
SDIN 7	136.00	4.00	6.00	6.67	8.06	5.87	1.70	24.24	13.95	9.79	528.43	Sewer Too Shallow
SDMH 138	10.00	4.00	6.00	6.67	23.04	13.35	9.19	22.86	13.26	9.10	57.41	
SDMH 4	25.00	4.00	6.00	6.67	22.06	12.86	8.70	20.08	11.87	7.71	124.60	
SDMH 137	54.00	3.50	6.00	6.08	20.10	11.59	8.01	16.78	9.93	6.35	208.66	
SDIN 5	25.00	3.50	6.00	6.08	16.33	9.71	6.12	13.98	8.53	4.95	70.74	
SDIN 73	28.00	3.50	6.00	6.08	21.86	12.47	8.89	18.64	10.86	7.28	126.30	

Total earth volume for sewer trenches = 1377 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.

- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: $(\text{equivalent diameter in inches}/12)+1$ inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
4/17/2017 11:04:35
AM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond A_3
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6007.41

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond A (A-3)	6009.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
										447

SDMH 16	6017.00	11.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 1	6024.71	11.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 1	6025.08	9.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 2	6033.08	9.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 3	6037.45	6.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 142	6043.65	3.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 70	6043.47	3.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 69	6037.27	3.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 3	6032.90	3.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution					Total Design Flow				Comment
	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Pond A (A-3)	0.00	0.00	0.00	0.00	0.00	2.66	4.21	0.95	11.20	
SDMH 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.20	
SDIN 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.20	
SDMH 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.74	
SDMH 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.74	
SDMH 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.71	
SDMH 142	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.22	
SDIN 70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.22	
SDIN 69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.69	
SDIN 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.58	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation			Loss Coefficients			Given Dimensions		
		Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 16	130.00	6006.41	4.3	6012.00	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 1	128.00	6012.97	3.0	6016.81	0.013	0.94	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 1	9.00	6019.00	1.9	6019.17	0.013	0.11	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 2	162.00	6019.38	5.0	6027.48	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 3	87.00	6027.70	5.0	6032.05	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in

SDMH 142	124.00	6032.44	6.1	6040.00	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 70	25.00	6040.00	1.0	6040.25	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 69	25.00	6032.37	1.0	6032.62	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 3	25.00	6027.68	1.0	6027.93	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 16	85.28	17.37	13.45	5.25	7.34	12.03	3.22	Supercritical	11.20	0.00	
SDIN 1	71.24	14.51	13.45	5.25	8.04	10.58	2.70	Supercritical	11.20	0.00	
SDMH 1	14.52	8.22	14.45	6.41	10.79	8.81	1.79	Supercritical	9.74	0.00	
SDMH 2	23.55	13.33	14.45	6.41	8.07	12.70	3.12	Supercritical Jump	9.74	9.02	
SDMH 3	23.55	13.33	12.03	5.35	6.58	11.49	3.18	Supercritical	6.71	0.00	
SDMH 142	26.01	14.72	8.20	4.11	4.28	10.02	3.52	Supercritical	3.22	0.00	
SDIN 70	10.53	5.96	8.20	4.11	6.83	5.24	1.42	Supercritical	3.22	0.00	
SDIN 69	10.53	5.96	8.80	4.30	7.36	5.43	1.41	Supercritical	3.69	0.00	
SDIN 3	10.53	5.96	8.67	4.25	7.23	5.39	1.41	Supercritical Jump	3.58	18.28	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft ²)	Comment
SDMH 16	11.20	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDIN 1	11.20	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 1	9.74	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 2	9.74	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 3	6.71	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 142	3.22	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 70	3.22	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 69	3.69	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 3	3.58	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6007.41

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 16	6006.41	6012.00	0.00	0.00	6007.41	6013.12	6009.27	4.28	6013.55
SDIN 1	6012.97	6016.81	0.08	0.00	6013.64	6017.93	6015.38	2.98	6018.36
SDMH 1	6019.00	6019.17	0.05	0.00	6019.90	6020.62	6021.10	0.00	6021.10
SDMH 2	6019.38	6027.48	0.62	0.00	6021.25	6028.68	6021.73	7.60	6029.32
SDMH 3	6027.70	6032.05	0.01	0.00	6028.70	6033.05	6030.30	3.20	6033.50
SDMH 142	6032.44	6040.00	0.00	0.00	6033.05	6040.68	6034.35	6.60	6040.95
SDIN 70	6040.00	6040.25	0.07	0.00	6040.87	6040.93	6041.01	0.18	6041.20
SDIN 69	6032.37	6032.62	0.09	0.00	6033.48	6033.48	6033.59	0.09	6033.67
SDIN 3	6027.68	6027.93	0.08	0.00	6029.34	6029.36	6029.41	0.02	6029.43

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = $Bend\ K * V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g) - Junction\ Loss\ K * V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 16	130.00	3.50	6.00	6.08	0.00	3.88	0.30	8.50	5.79	2.21	140.81	Sewer Too Shallow
SDIN 1	128.00	3.50	6.00	6.08	6.56	4.82	1.24	14.30	8.69	5.11	235.00	Sewer Too Shallow
SDMH 1	9.00	2.50	4.00	4.92	10.92	6.25	4.00	11.32	6.45	4.20	13.62	
SDMH 2	162.00	2.50	4.00	4.92	10.90	6.24	3.99	10.70	6.14	3.89	234.59	
SDMH 3	87.00	2.50	4.00	4.92	10.26	5.92	3.67	10.30	5.94	3.69	117.15	450

SDMH 142	124.00	2.50	4.00	4.92	9.53	5.56	3.31	6.80	4.19	1.94	124.29	Sewer Too Shallow
SDIN 70	25.00	2.50	4.00	4.92	6.80	4.19	1.94	5.94	3.76	1.51	18.64	Sewer Too Shallow
SDIN 69	25.00	2.50	4.00	4.92	9.66	5.62	3.37	8.80	5.19	2.94	28.96	
SDIN 3	25.00	2.50	4.00	4.92	10.30	5.94	3.69	9.44	5.51	3.26	31.79	

Total earth volume for sewer trenches = 945 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
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UDSewer Results Summary

Project Title: Trails at Crowfoot Pond A (Basin A-3)_100 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6006.38

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond A (A-3)	6009.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
										452

SDMH 16	6017.00	49.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 1	6024.71	49.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution					Total Design Flow				Comment
	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Pond A (A-3)	0.00	0.00	0.00	0.00	0.00	4.17	11.93	0.21	49.80	
SDMH 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.80	
SDIN 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.80	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation			Loss Coefficients			Given Dimensions		
		Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 16	130.00	6006.41	4.3	6012.00	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 1	128.00	6012.97	3.0	6016.81	0.013	0.94	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity		Critical Flow		Normal Flow						
	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 16	85.28	17.37	27.56	10.55	16.47	18.04	3.02	Supercritical	49.80	0.00	Velocity is Too High
SDIN 1	71.24	14.51	27.56	10.55	18.48	15.70	2.42	Supercritical Jump	49.80	29.94	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing		Calculated		Used			Comment
			Rise	Span	Rise	Span	Rise	Span	Area (ft ²)	
										453

SDMH 16	49.80	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
SDIN 1	49.80	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6006.38

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 16	6006.41	6012.00	0.00	0.00	6007.78	6014.30	6012.84	3.19	6016.03
SDIN 1	6012.97	6016.81	1.50	0.00	6015.93	6019.11	6017.53	3.31	6020.84

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = $Bend\ K * V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g) - Junction\ Loss\ K * V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 16	130.00	3.50	6.00	6.08	0.00	3.88	0.30	8.50	5.79	2.21	140.81	Sewer Too Shallow
SDIN 1	128.00	3.50	6.00	6.08	6.56	4.82	1.24	14.30	8.69	5.11	235.00	Sewer Too Shallow

Total earth volume for sewer trenches = 376 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.

- Six inches for pipes less than 60 inches.
- Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
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Run Date:
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UDSewer Results Summary

Project Title: Trails at Crowfoot Pond A (Pond A-4)_100 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6003.47

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall Pond	6003.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

456

A_4										
SDIN 63	6008.84	7.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 62	6008.36	3.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall Pond A_4	0.00	0.00	0.00	0.00	0.00	0.65	11.69	0.48	7.60	Surface Water Present (Upstream)
SDIN 63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.60	Surface Water Present (Downstream)
SDIN 62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.70	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDIN 63	31.00	6003.74	0.5	6003.89	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 62	119.00	6004.10	0.5	6004.69	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDIN 63	47.29	6.69	10.42	4.48	9.76	4.91	1.14	Supercritical	7.60	0.00	
SDIN 62	29.08	5.92	7.58	3.80	7.23	4.06	1.10	Supercritical	3.70	0.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
										457

	(cfs)									
SDIN 63	7.60	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDIN 62	3.70	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6003.47

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 63	6003.74	6003.89	0.00	0.00	6004.55	6004.76	6004.92	0.15	6005.07
SDIN 62	6004.10	6004.69	0.00	0.00	6004.98	6005.32	6005.07	0.48	6005.55

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 63	31.00	4.00	6.00	6.67	0.00	0.45	0.00	7.90	5.78	1.62	24.07	Sewer Too Shallow
SDIN 62	119.00	3.50	6.00	6.08	7.99	5.54	1.95	6.08	4.46	0.88	124.26	Sewer Too Shallow

Total earth volume for sewer trenches = 148 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.

- Six inches for pipes less than 60 inches.
- Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
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Run Date:
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UDSewer Results Summary

Project Title: Trails at Crowfoot Pond A (Pond A-4)_100 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6003.47

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall Pond	6003.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

460

A_4										
SDIN 63	6008.84	40.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 62	6008.36	23.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall Pond A_4	0.00	0.00	0.00	0.00	0.00	3.36	12.04	0.09	40.45	Surface Water Present (Upstream)
SDIN 63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.45	Surface Water Present (Downstream)
SDIN 62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.96	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDIN 63	31.00	6003.74	0.5	6003.89	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 62	119.00	6004.10	0.5	6004.69	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDIN 63	47.29	6.69	24.85	7.77	25.62	7.52	0.94	Subcritical	40.45	0.00	
SDIN 62	29.08	5.92	20.00	6.89	20.75	6.62	0.93	Subcritical	23.96	0.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
										461

	(cfs)									
SDIN 63	40.45	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDIN 62	23.96	CIRCULAR	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6003.47

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 63	6003.74	6003.89	0.00	0.00	6005.81	6006.04	6006.74	0.16	6006.90
SDIN 62	6004.10	6004.69	0.02	0.00	6006.55	6006.85	6006.92	0.37	6007.29

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_{fi}² / (2*g)
- Lateral loss = V_{fo}² / (2*g) - Junction Loss K * V_{fi}² / (2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 63	31.00	4.00	6.00	6.67	0.00	0.45	0.00	7.90	5.78	1.62	24.07	Sewer Too Shallow
SDIN 62	119.00	3.50	6.00	6.08	7.99	5.54	1.95	6.08	4.46	0.88	124.26	Sewer Too Shallow

Total earth volume for sewer trenches = 148 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.

- Six inches for pipes less than 60 inches.
- Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
1/31/2018 2:03:43
PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond A

Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2

Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97

Rainfall Constant "A": 28.5

Rainfall Constant "B": 10

Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20

Maximum Rural Overland Len. (ft): 500

Maximum Urban Overland Len. (ft): 300

Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00

Maximum Depth to Rise Ratio: 0.90

Maximum Flow Velocity (fps): 18.0

Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6035.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall Pond	6035.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

B_1										
SDMH 18	6044.50	32.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 19	6050.60	32.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 20	6056.97	32.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 21	6060.17	32.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 22	6062.64	13.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 23	6065.28	13.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 24	6080.45	13.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 25	6093.46	13.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 26	6102.93	13.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 119	6104.21	13.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 18	6103.96	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 118	6106.06	11.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 117	6108.22	11.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 116	6111.82	11.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 115	6122.01	5.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 81	6121.83	5.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 82	6111.63	6.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 27	6061.72	19.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 16	6061.71	4.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 125	6063.23	7.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 124	6068.85	7.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 29	6071.44	7.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 20	6071.27	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 121	6080.32	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDMH 120	6092.75	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 80	6092.18	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 14	6060.71	2.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 12	6041.77	27.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 13	6041.77	26.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 217	6041.70	26.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 170	6058.00	26.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 165	6077.85	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 164	6076.95	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 163	6080.63	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 162	6082.43	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 161	6084.63	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 126	6087.46	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 30	6090.01	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 122	6105.99	13.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 31	6108.58	8.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 24	6108.41	8.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 114	6108.33	6.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 113	6112.90	6.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 112	6126.77	6.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 111	6134.72	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 84	6134.23	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 110	6139.55	3.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 83	6139.37	3.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN	6089.84	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

22										
SDMH 109	6094.45	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 108	6102.34	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 85	6101.89	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 215	6071.00	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 106	6074.72	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution					Total Design Flow				Comment
	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Outfall Pond B_1	0.00	0.00	0.00	0.00	0.00	14.19	4.26	0.81	60.40	
SDMH 18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.60	
SDMH 19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.60	
SDMH 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.60	
SDMH 21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.60	
SDMH 22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.80	
SDMH 23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.80	
SDMH 24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.80	
SDMH 25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.80	
SDMH 26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.80	
SDMH 119	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.80	
SDIN 18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.20	
SDMH 118	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.00	
SDMH 117	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.00	
SDMH 116	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.00	
SDMH 115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.58	
SDIN 81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.58	
SDIN 82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.20	
SDMH 27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.80	
SDIN 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.95	
SDMH 125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.40	
SDMH 124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.40	
SDMH 29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.90	
SDIN 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDMH 121	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDMH 120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	

SDIN 80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDIN 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.94	
SDIN 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.80	
SDIN 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.70	
SDMH 217	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.30	
SDMH 170	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.30	
SDMH 165	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 164	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 163	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 162	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 161	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 126	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.73	
SDMH 122	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.11	
SDMH 31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.48	
SDIN 24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.48	
SDMH 114	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.15	
SDMH 113	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.15	
SDMH 112	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.15	
SDMH 111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
SDIN 84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
SDMH 110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.82	
SDIN 83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.82	
SDIN 22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDMH 109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDMH 108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDIN 85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	
SDMH 215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	
SDIN 106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 18	225.00	6033.47	2.0	6037.97	0.013	0.29	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 19	143.00	6038.21	3.0	6042.50	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 20	150.00	6042.75	3.7	6048.30	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 21	76.00	6048.59	3.7	6051.40	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 22	58.00	6053.50	4.0	6055.82	0.013	0.20	0.00	CIRCULAR	0.00 in	0.00 in
SDMH 23	61.00	6056.03	4.0	6058.47	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 24	350.00	6058.67	4.0	6072.67	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in

SDMH 25	300.00	6072.87	4.0	6084.87	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 26	226.00	6084.97	4.8	6095.82	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 119	50.00	6096.01	4.0	6098.01	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 18	41.00	6098.30	2.0	6099.12	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 118	48.00	6098.29	5.0	6100.69	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 117	53.00	6100.89	5.0	6103.54	0.013	0.20	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 116	93.00	6103.73	5.0	6108.38	0.013	0.20	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 115	275.00	6108.59	3.5	6118.21	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 81	18.00	6118.48	1.0	6118.66	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 82	25.00	6108.58	1.0	6108.83	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 27	44.00	6050.60	2.5	6051.70	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 16	26.00	6053.54	1.0	6053.80	0.013	1.00	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 125	41.00	6055.35	3.5	6056.78	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 124	129.00	6056.95	4.5	6062.75	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 29	39.00	6062.92	5.5	6065.06	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 20	26.00	6065.35	2.0	6065.87	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 121	300.00	6063.05	4.0	6075.05	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 120	254.00	6075.21	5.0	6087.91	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 80	36.00	6088.11	2.0	6088.83	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 14	9.00	6053.00	1.0	6053.09	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 12	24.00	6033.11	1.9	6033.57	0.013	0.03	0.00	CIRCULAR	48.00 in	48.00 in
SDIN 13	53.00	6034.38	0.8	6034.80	0.013	0.05	0.00	CIRCULAR	48.00 in	48.00 in
SDMH 217	60.00	6034.99	2.1	6036.25	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
SDMH 170	424.00	6038.40	2.5	6049.00	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
SDMH 165	280.00	6054.10	4.0	6065.30	0.013	0.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 164	90.00	6065.56	1.0	6066.46	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 163	214.00	6066.56	1.0	6068.70	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 162	82.00	6068.93	1.0	6069.75	0.013	0.09	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 161	91.00	6071.02	3.5	6074.20	0.013	0.09	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 126	102.00	6075.37	4.0	6079.45	0.013	0.09	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 30	39.00	6079.62	6.0	6081.96	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 122	237.00	6082.13	6.0	6096.35	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 31	39.00	6096.52	6.0	6098.86	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 24	26.00	6099.05	2.0	6099.57	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 114	311.00	6096.65	2.0	6102.87	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 113	350.00	6103.07	1.5	6108.32	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 112	350.00	6108.62	3.5	6120.87	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 111	248.00	6121.68	3.5	6130.36	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 84	36.00	6130.56	1.0	6130.92	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 110	345.00	6121.08	3.5	6133.15	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 83	7.00	6133.35	1.0	6133.42	0.013	1.06	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 22	26.00	6082.25	2.0	6082.77	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 109	300.00	6079.75	3.5	6090.25	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

SDMH 108	253.00	6090.46	3.0	6098.05	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 85	36.00	6098.25	1.0	6098.61	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 215	351.00	6050.89	3.7	6063.88	0.013	0.12	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 106	109.00	6064.07	4.0	6068.43	0.013	0.24	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 18	94.58	13.38	22.23	7.11	14.58	12.14	2.24	Supercritical	32.60	0.00	
SDMH 19	115.84	16.39	22.23	7.11	13.06	14.08	2.77	Supercritical	32.60	0.00	
SDMH 20	128.64	18.20	22.23	7.11	12.36	15.19	3.08	Supercritical	32.60	0.00	
SDMH 21	128.64	18.20	22.23	7.11	12.36	15.19	3.08	Supercritical	32.60	0.00	
SDMH 22	21.07	11.92	16.51	8.13	10.62	12.71	2.61	Supercritical	13.80	0.00	
SDMH 23	45.37	14.44	16.05	6.18	9.08	12.67	2.98	Supercritical	13.80	0.00	
SDMH 24	45.37	14.44	16.05	6.18	9.08	12.67	2.98	Supercritical	13.80	0.00	
SDMH 25	45.37	14.44	16.05	6.18	9.08	12.67	2.98	Supercritical	13.80	0.00	
SDMH 26	49.70	15.82	16.05	6.18	8.65	13.54	3.27	Supercritical	13.80	0.00	
SDMH 119	45.37	14.44	16.05	6.18	9.08	12.67	2.98	Supercritical	13.80	0.00	
SDIN 18	32.08	10.21	7.50	3.82	5.12	6.52	2.10	Supercritical	3.20	0.00	
SDMH 118	23.55	13.33	15.24	6.89	8.65	13.10	3.08	Supercritical	11.00	0.00	
SDMH 117	23.55	13.33	15.24	6.89	8.65	13.10	3.08	Supercritical	11.00	0.00	
SDMH 116	23.55	13.33	15.24	6.89	8.65	13.10	3.08	Supercritical	11.00	0.00	
SDMH 115	19.70	11.15	10.93	4.97	6.55	9.59	2.66	Supercritical	5.58	0.00	
SDIN 81	10.53	5.96	10.93	4.97	9.31	6.05	1.36	Supercritical	5.58	0.00	
SDIN 82	10.53	5.96	11.55	5.18	9.93	6.20	1.34	Pressurized	6.20	25.00	
SDMH 27	105.74	14.96	17.13	5.97	10.55	11.46	2.54	Supercritical Jump	19.80	18.18	
SDIN 16	41.13	8.38	8.80	4.12	7.03	5.65	1.55	Supercritical	4.95	0.00	
SDMH 125	125.12	17.70	10.28	4.45	5.94	9.70	2.92	Supercritical	7.40	0.00	
SDMH 124	141.87	20.07	10.28	4.45	5.59	10.59	3.29	Supercritical	7.40	0.00	
SDMH 29	156.84	22.19	10.63	4.53	5.49	11.59	3.63	Supercritical	7.90	0.00	
SDIN 20	58.16	11.85	7.77	3.85	5.25	6.73	2.15	Supercritical	3.88	0.00	
SDMH 121	21.07	11.92	9.04	4.37	5.23	9.09	2.86	Supercritical	3.88	0.00	
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SDMH 120	23.55	13.33	9.04	4.37	4.94	9.85	3.20	Supercritical	3.88	0.00	
SDIN 80	14.90	8.43	9.04	4.37	6.27	7.09	2.02	Supercritical	3.88	0.00	
SDIN 14	41.13	8.38	6.74	3.57	5.43	4.85	1.53	Supercritical	2.94	0.00	
SDIN 12	198.53	15.80	18.73	6.12	12.13	11.14	2.32	Supercritical	27.80	0.00	
SDIN 13	128.82	10.25	18.34	6.05	14.83	8.09	1.51	Supercritical	26.70	0.00	
SDMH 217	146.19	15.19	18.95	6.24	12.06	11.51	2.39	Supercritical	26.30	0.00	
SDMH 170	159.51	16.58	18.95	6.24	11.54	12.25	2.60	Supercritical	26.30	0.00	
SDMH 165	133.76	18.92	16.64	5.86	9.10	13.34	3.20	Supercritical	18.73	0.00	
SDMH 164	66.88	9.46	16.64	5.86	13.03	8.12	1.60	Supercritical	18.73	0.00	
SDMH 163	66.88	9.46	16.64	5.86	13.03	8.12	1.60	Supercritical	18.73	0.00	
SDMH 162	66.88	9.46	16.64	5.86	13.03	8.12	1.60	Supercritical	18.73	0.00	
SDMH 161	125.12	17.70	16.64	5.86	9.41	12.72	3.00	Supercritical	18.73	0.00	
SDMH 126	133.76	18.92	16.64	5.86	9.10	13.34	3.20	Supercritical	18.73	0.00	
SDMH 30	100.74	20.52	17.60	6.26	8.76	15.70	3.82	Supercritical	18.73	0.00	
SDMH 122	100.74	20.52	14.60	5.53	7.31	14.17	3.80	Supercritical	13.11	0.00	
SDMH 31	100.74	20.52	11.63	4.82	5.88	12.48	3.76	Supercritical	8.48	0.00	
SDIN 24	58.16	11.85	11.63	4.82	7.74	8.45	2.20	Supercritical	8.48	0.00	
SDMH 114	14.90	8.43	11.50	5.16	8.06	8.03	1.97	Supercritical	6.15	0.00	
SDMH 113	12.90	7.30	11.50	5.16	8.75	7.21	1.69	Supercritical	6.15	0.00	
SDMH 112	19.70	11.15	11.50	5.16	6.91	9.85	2.65	Supercritical	6.15	0.00	
SDMH 111	19.70	11.15	7.18	3.80	4.33	7.64	2.67	Supercritical	2.50	0.00	
SDIN 84	10.53	5.96	7.18	3.80	5.97	4.88	1.43	Supercritical	2.50	0.00	
SDMH 110	19.70	11.15	8.97	4.34	5.37	8.63	2.68	Supercritical	3.82	0.00	
SDIN 83	10.53	5.96	8.97	4.34	7.50	5.48	1.41	Supercritical	3.82	0.00	
SDIN 22	58.16	11.85	7.77	3.85	5.25	6.73	2.15	Supercritical	3.88	0.00	
SDMH 109	19.70	11.15	9.04	4.37	5.42	8.67	2.68	Supercritical Jump	3.88	4.29	
SDMH 108	18.24	10.32	9.04	4.37	5.64	8.20	2.48	Supercritical	3.88	0.00	
SDIN 85	10.53	5.96	9.04	4.37	7.56	5.51	1.41	Supercritical	3.88	0.00	
SDMH 215	43.63	13.89	12.85	5.26	7.40	10.94	2.89	Supercritical	9.00	0.00	

SDIN 106	45.37	14.44	12.85	5.26	7.25	11.25	3.00	Supercritical	9.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			Comment
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	
SDMH 18	32.60	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDMH 19	32.60	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 20	32.60	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 21	32.60	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 22	13.80	CIRCULAR	0.00 in	0.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 23	13.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 24	13.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 25	13.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 26	13.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 119	13.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 18	3.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 118	11.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 117	11.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 116	11.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 115	5.58	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 81	5.58	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 82	6.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 27	19.80	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDIN 16	4.95	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 125	7.40	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 124	7.40	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 29	7.90	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDIN 20	3.88	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 121	3.88	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 120	3.88	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 80	3.88	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 14	2.94	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDIN 12	27.80	CIRCULAR	48.00 in	48.00 in	24.00 in	24.00 in	48.00 in	48.00 in	12.57	
SDIN 13	26.70	CIRCULAR	48.00 in	48.00 in	27.00 in	27.00 in	48.00 in	48.00 in	12.57	
SDMH 217	26.30	CIRCULAR	42.00 in	42.00 in	24.00 in	24.00 in	42.00 in	42.00 in	9.62	
SDMH 170	26.30	CIRCULAR	42.00 in	42.00 in	24.00 in	24.00 in	42.00 in	42.00 in	9.62	
SDMH 165	18.73	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	

SDMH 164	18.73	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 163	18.73	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 162	18.73	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 161	18.73	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 126	18.73	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 30	18.73	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 122	13.11	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 31	8.48	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDIN 24	8.48	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 114	6.15	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 113	6.15	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 112	6.15	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 111	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 84	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 110	3.82	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 83	3.82	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 22	3.88	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 109	3.88	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 108	3.88	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 85	3.88	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 215	9.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 106	9.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6035.00

Element Name	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 18	6033.47	6037.97	0.00	0.00	6035.00	6039.82	6036.98	3.63	6040.61
SDMH 19	6038.21	6042.50	0.02	0.00	6039.84	6044.35	6042.38	2.76	6045.14
SDMH 20	6042.75	6048.30	0.02	0.00	6044.37	6050.15	6047.36	3.58	6050.94
SDMH 21	6048.59	6051.40	0.02	0.00	6050.17	6053.25	6053.20	0.84	6054.04
SDMH 22	6053.50	6055.82	0.19	0.00	6054.39	6057.20	6056.89	1.33	6058.22
SDMH 23	6056.03	6058.47	0.01	0.00	6057.21	6059.81	6059.28	1.12	6060.40
SDMH 24	6058.67	6072.67	0.03	0.00	6059.84	6074.01	6061.92	12.68	6074.60

SDMH 25	6072.87	6084.87	0.01	0.00	6074.02	6086.21	6076.12	10.68	6086.80
SDMH 26	6084.97	6095.82	0.01	0.00	6086.22	6097.16	6088.54	9.21	6097.75
SDMH 119	6096.01	6098.01	0.40	0.00	6097.55	6099.35	6099.26	0.68	6099.94
SDIN 18	6098.30	6099.12	0.02	0.00	6099.94	6099.94	6099.96	0.09	6100.05
SDMH 118	6098.29	6100.69	0.03	0.00	6099.38	6101.96	6101.68	1.02	6102.70
SDMH 117	6100.89	6103.54	0.12	0.00	6102.08	6104.81	6104.28	1.27	6105.55
SDMH 116	6103.73	6108.38	0.12	0.00	6104.93	6109.65	6107.12	3.27	6110.39
SDMH 115	6108.59	6118.21	0.01	0.00	6109.66	6119.12	6110.56	8.94	6119.50
SDIN 81	6118.48	6118.66	0.20	0.00	6119.33	6119.57	6119.82	0.13	6119.95
SDIN 82	6108.58	6108.83	0.25	0.00	6110.45	6110.54	6110.64	0.09	6110.73
SDMH 27	6050.60	6051.70	0.12	0.00	6054.04	6054.04	6054.16	0.05	6054.21
SDIN 16	6053.54	6053.80	0.02	0.00	6054.13	6054.53	6054.62	0.18	6054.80
SDMH 125	6055.35	6056.78	0.00	0.00	6055.84	6057.64	6057.30	0.64	6057.94
SDMH 124	6056.95	6062.75	0.00	0.00	6057.64	6063.61	6059.15	4.76	6063.91
SDMH 29	6062.92	6065.06	0.00	0.00	6063.61	6065.95	6065.46	0.81	6066.26
SDIN 20	6065.35	6065.87	0.01	0.00	6065.96	6066.52	6066.49	0.26	6066.75
SDMH 121	6063.05	6075.05	0.10	0.00	6063.71	6075.80	6064.77	11.33	6076.10
SDMH 120	6075.21	6087.91	0.00	0.00	6075.81	6088.66	6077.13	11.83	6088.96
SDIN 80	6088.11	6088.83	0.10	0.00	6088.76	6089.58	6089.41	0.47	6089.88
SDIN 14	6053.00	6053.09	0.01	0.00	6054.20	6054.20	6054.22	0.01	6054.23
SDIN 12	6033.11	6033.57	0.00	0.00	6035.00	6035.83	6036.05	0.00	6036.05
SDIN 13	6034.38	6034.80	0.00	0.00	6035.83	6036.33	6036.63	0.27	6036.90
SDMH 217	6034.99	6036.25	0.01	0.00	6036.33	6037.83	6038.05	0.38	6038.43
SDMH 170	6038.40	6049.00	0.01	0.00	6039.36	6050.58	6041.69	9.49	6051.18
SDMH 165	6054.10	6065.30	0.03	0.00	6054.86	6066.69	6057.62	9.60	6067.22
SDMH 164	6065.56	6066.46	0.11	0.00	6066.80	6067.85	6067.67	0.71	6068.38
SDMH 163	6066.56	6068.70	0.11	0.00	6067.96	6070.09	6068.67	1.95	6070.62
SDMH 162	6068.93	6069.75	0.01	0.00	6070.10	6071.14	6071.04	0.63	6071.67
SDMH 161	6071.02	6074.20	0.01	0.00	6071.80	6075.59	6074.31	1.81	6076.12
SDMH	6075.37	6079.45	0.01	0.00	6076.13	6080.84	6078.89	2.48	6081.37

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SDMH 30	6079.62	6081.96	0.01	0.00	6080.85	6083.82	6084.18	0.00	6084.18
SDMH 122	6082.13	6096.35	0.01	0.00	6083.83	6097.57	6085.86	12.19	6098.04
SDMH 31	6096.52	6098.86	0.00	0.00	6097.57	6099.83	6099.43	0.76	6100.19
SDIN 24	6099.05	6099.57	0.06	0.00	6099.89	6100.54	6100.80	0.10	6100.90
SDMH 114	6096.65	6102.87	0.25	0.00	6097.82	6103.83	6098.32	5.92	6104.24
SDMH 113	6103.07	6108.32	0.01	0.00	6103.84	6109.28	6104.61	5.08	6109.69
SDMH 112	6108.62	6120.87	0.01	0.00	6109.29	6121.83	6110.70	11.54	6122.24
SDMH 111	6121.68	6130.36	0.00	0.00	6122.04	6130.96	6122.95	8.24	6131.18
SDIN 84	6130.56	6130.92	0.04	0.00	6131.06	6131.52	6131.43	0.32	6131.74
SDMH 110	6121.08	6133.15	0.10	0.00	6121.92	6133.90	6122.68	11.51	6134.19
SDIN 83	6133.35	6133.42	0.08	0.00	6133.97	6134.17	6134.44	0.02	6134.46
SDIN 22	6082.25	6082.77	0.01	0.00	6084.17	6084.17	6084.19	0.01	6084.20
SDMH 109	6079.75	6090.25	0.10	0.00	6081.39	6091.00	6081.47	9.83	6091.30
SDMH 108	6090.46	6098.05	0.00	0.00	6091.01	6098.80	6091.97	7.13	6099.10
SDIN 85	6098.25	6098.61	0.10	0.00	6098.90	6099.36	6099.35	0.31	6099.66
SDMH 215	6050.89	6063.88	0.02	0.00	6051.51	6064.95	6053.37	12.01	6065.38
SDIN 106	6064.07	6068.43	0.03	0.00	6064.98	6069.50	6066.64	3.29	6069.93

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_{fi} ^ 2/(2*g)
- Lateral loss = V_{fo} ^ 2/(2*g)- Junction Loss K * V_{fi} ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 18	225.00	4.00	6.00	6.67	0.00	2.91	0.00	11.06	7.36	3.20	305.57	Sewer Too Shallow
SDMH 19	143.00	4.00	6.00	6.67	10.58	7.12	2.96	14.20	8.93	4.77	331.18	
SDMH 20	150.00	4.00	6.00	6.67	13.70	8.68	4.52	15.34	9.50	5.34	423.38	
												475

SDMH 21	76.00	4.00	6.00	6.67	14.76	9.22	5.05	15.54	9.60	5.44	227.34	
SDMH 22	58.00	2.50	4.00	4.92	12.84	7.21	4.96	13.14	7.36	5.11	111.98	
SDMH 23	61.00	3.00	4.00	5.50	12.22	7.19	4.36	12.62	7.39	4.56	117.70	
SDMH 24	350.00	3.00	4.00	5.50	12.22	7.19	4.36	14.56	8.36	5.53	760.75	
SDMH 25	300.00	3.00	4.00	5.50	14.16	8.16	5.33	16.18	9.17	6.34	792.31	
SDMH 26	226.00	3.00	4.00	5.50	15.98	9.07	6.24	13.22	7.69	4.86	563.08	
SDMH 119	50.00	3.00	4.00	5.50	12.84	7.50	4.67	11.40	6.78	3.95	93.29	
SDIN 18	41.00	3.00	4.00	5.50	10.82	6.49	3.66	8.68	5.42	2.59	57.05	
SDMH 118	48.00	2.50	4.00	4.92	11.34	6.46	4.21	10.24	5.91	3.66	69.54	
SDMH 117	53.00	2.50	4.00	4.92	9.84	5.71	3.46	8.86	5.22	2.97	62.52	
SDMH 116	93.00	2.50	4.00	4.92	8.48	5.03	2.78	6.38	3.98	1.73	82.71	Sewer Too Shallow
SDMH 115	275.00	2.50	4.00	4.92	5.97	3.78	1.53	7.10	4.34	2.09	210.75	Sewer Too Shallow
SDIN 81	18.00	2.50	4.00	4.92	6.56	4.07	1.82	5.84	3.71	1.46	13.05	Sewer Too Shallow
SDIN 82	25.00	2.50	4.00	4.92	5.98	3.78	1.53	5.10	3.34	1.09	16.35	Sewer Too Shallow
SDMH 27	44.00	4.00	6.00	6.67	17.14	10.40	6.24	18.04	10.85	6.69	164.16	
SDIN 16	26.00	3.50	6.00	6.08	14.86	8.97	5.39	14.32	8.70	5.12	69.20	
SDMH 125	41.00	4.00	6.00	6.67	10.75	7.21	3.04	10.90	7.28	3.12	79.92	
SDMH 124	129.00	4.00	6.00	6.67	10.57	7.12	2.95	10.20	6.93	2.77	240.34	
SDMH 29	39.00	4.00	6.00	6.67	9.87	6.77	2.60	10.76	7.21	3.05	72.20	
SDIN 20	26.00	3.50	6.00	6.08	10.68	6.88	3.30	9.30	6.19	2.61	42.08	
SDMH 121	300.00	2.50	4.00	4.92	11.10	6.34	4.09	10.04	5.81	3.56	421.52	
SDMH 120	254.00	2.50	4.00	4.92	9.72	5.65	3.40	9.18	5.38	3.13	303.67	
SDIN 80	36.00	2.50	4.00	4.92	8.78	5.18	2.93	6.20	3.89	1.64	32.50	Sewer Too Shallow
SDIN 14	9.00	3.50	6.00	6.08	15.94	9.51	5.93	13.74	8.41	4.83	24.66	
SDIN 12	24.00	5.00	6.00	7.83	0.00	3.35	0.00	13.40	9.12	3.78	46.85	Sewer Too Shallow
SDIN 13	53.00	5.00	6.00	7.83	11.79	8.31	2.98	10.94	7.89	2.55	130.74	
SDMH 217	60.00	4.50	6.00	7.25	11.06	7.66	2.91	8.40	6.33	1.58	117.02	Sewer Too Shallow
SDMH 170	424.00	4.50	6.00	7.25	0.00	4.18	0.00	15.50	9.88	5.13	933.41	Sewer Too Shallow
SDMH 165	280.00	4.00	6.00	6.67	0.00	4.73	0.57	23.10	13.38	9.22	956.74	Sewer Too Shallow
SDMH 164	90.00	4.00	6.00	6.67	22.58	13.12	8.96	18.98	11.32	7.16	440.32	

SDMH 163	214.00	4.00	6.00	6.67	18.78	11.22	7.06	21.86	12.76	8.60	1007.80	
SDMH 162	82.00	4.00	6.00	6.67	21.40	12.53	8.37	23.36	13.51	9.35	451.88	
SDMH 161	91.00	4.00	6.00	6.67	20.83	12.25	8.08	18.86	11.26	7.10	411.29	
SDMH 126	102.00	4.00	6.00	6.67	16.52	10.09	5.93	14.02	8.84	4.68	309.84	
SDMH 30	39.00	3.50	6.00	6.08	14.18	8.63	5.05	14.60	8.84	5.26	101.70	
SDMH 122	237.00	3.50	6.00	6.08	14.26	8.67	5.09	17.78	10.43	6.85	733.51	
SDMH 31	39.00	3.50	6.00	6.08	17.44	10.26	6.68	17.94	10.51	6.93	139.94	
SDIN 24	26.00	3.50	6.00	6.08	17.56	10.32	6.74	16.18	9.63	6.05	86.57	
SDMH 114	311.00	2.50	4.00	4.92	18.18	9.88	7.63	10.42	6.00	3.75	746.65	
SDMH 113	350.00	2.50	4.00	4.92	10.02	5.80	3.55	8.66	5.12	2.87	413.00	
SDMH 112	350.00	2.50	4.00	4.92	8.06	4.82	2.57	11.30	6.44	4.19	440.97	
SDMH 111	248.00	2.50	4.00	4.92	9.68	5.63	3.38	8.22	4.90	2.65	276.42	
SDIN 84	36.00	2.50	4.00	4.92	7.82	4.70	2.45	6.12	3.85	1.60	29.68	Sewer Too Shallow
SDMH 110	345.00	2.50	4.00	4.92	10.89	6.24	3.99	12.30	6.94	4.69	558.02	
SDIN 83	7.00	2.50	4.00	4.92	11.90	6.74	4.49	11.40	6.49	4.24	11.38	
SDIN 22	26.00	3.50	6.00	6.08	14.02	8.55	4.97	12.64	7.86	4.28	60.83	
SDMH 109	300.00	2.50	4.00	4.92	14.92	8.25	6.00	7.90	4.74	2.49	506.25	
SDMH 108	253.00	2.50	4.00	4.92	7.48	4.53	2.28	8.08	4.83	2.58	235.11	
SDIN 85	36.00	2.50	4.00	4.92	7.68	4.63	2.38	6.06	3.82	1.57	29.20	Sewer Too Shallow
SDMH 215	351.00	3.00	4.00	5.50	13.21	7.69	4.86	13.24	7.70	4.87	744.37	
SDIN 106	109.00	3.00	4.00	5.50	12.86	7.51	4.68	11.58	6.87	4.04	205.71	

Total earth volume for sewer trenches = 15814 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
1/31/2018 2:08:19
PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond A
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6034.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall Pond	6035.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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B_1										
SDMH 18	6044.50	84.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 19	6050.60	84.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 20	6056.97	84.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 21	6060.17	84.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 27	6060.88	84.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 16	6061.71	23.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 125	6063.23	29.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 124	6068.85	29.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 29	6071.44	29.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 20	6071.27	29.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 14	6060.71	35.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 12	6041.77	172.80	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 13	6041.77	169.40	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 217	6041.70	121.40	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 170	6058.00	121.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 165	6077.85	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 164	6076.95	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 163	6080.63	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 162	6082.43	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 161	6084.63	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 123	6087.46	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 30	6090.01	76.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 22	6089.84	34.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 122	6105.99	48.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDMH 31	6105.99	48.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 34	6108.41	48.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 215	6073.00	54.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 106	6074.85	54.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution					Total Design Flow				Comment
	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Outfall Pond B_1	0.00	0.00	0.00	0.00	0.00	21.63	11.91	0.23	257.60	
SDMH 18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.80	
SDMH 19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.80	
SDMH 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.80	
SDMH 21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.80	
SDMH 27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.80	
SDIN 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.20	
SDMH 125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.10	
SDMH 124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.10	
SDMH 29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.10	
SDIN 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.10	
SDIN 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.70	
SDIN 12	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	172.80	Surface Water Present (Downstream)
SDIN 13	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	169.40	
SDMH 217	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	121.40	
SDMH 170	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	121.40	
SDMH 165	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDMH 164	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDMH 163	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDMH 162	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDMH 161	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDMH 123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDMH 30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	
SDIN 22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.80	
SDMH 122	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.00	
SDMH 31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.00	
SDIN 34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.00	

SDMH 215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.30	
SDIN 106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.30	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 18	169.00	6033.14	2.0	6036.52	0.013	0.29	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 19	143.00	6038.21	3.0	6042.50	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 20	150.00	6042.75	3.7	6048.30	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 21	76.00	6048.59	3.7	6051.40	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 27	44.00	6051.70	2.5	6052.80	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 16	26.00	6053.54	1.0	6053.80	0.013	1.00	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 125	41.00	6055.35	3.5	6056.78	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 124	129.00	6056.95	4.5	6062.75	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 29	39.00	6062.92	5.5	6065.06	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 20	26.00	6065.35	2.0	6065.87	0.013	1.00	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 14	9.00	6053.00	1.0	6053.09	0.013	1.00	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 12	23.00	6033.13	1.9	6033.57	0.013	0.03	0.00	CIRCULAR	48.00 in	48.00 in
SDIN 13	53.00	6034.38	0.8	6034.80	0.013	0.07	0.00	CIRCULAR	48.00 in	48.00 in
SDMH 217	50.00	6035.00	2.5	6036.25	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
SDMH 170	424.00	6038.40	2.5	6049.00	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
SDMH 165	280.00	6054.10	4.0	6065.30	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 164	90.00	6065.56	1.0	6066.46	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 163	214.00	6066.56	1.0	6068.70	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 162	82.00	6068.93	1.0	6069.75	0.013	0.09	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 161	91.00	6071.02	3.5	6074.20	0.013	0.09	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 123	102.00	6075.37	4.0	6079.45	0.013	0.09	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 30	39.00	6080.44	4.0	6082.00	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 22	26.00	6082.25	2.0	6082.77	0.013	1.00	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 122	237.00	6084.51	5.0	6096.36	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 31	39.00	6096.91	5.0	6098.86	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 34	26.00	6099.05	2.0	6099.57	0.013	1.00	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 215	351.00	6050.89	3.7	6063.88	0.013	0.12	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 106	109.00	6064.07	4.0	6068.43	0.013	0.24	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow							
Element	Flow	Velocity	Depth	Velocity	Depth	Velocity	Froude	Flow	Flow	Surcharged	Comment	

Name	(cfs)	(fps)	(in)	(fps)	(in)	(fps)	Number	Condition	(cfs)	Length (ft)	
SDMH 18	94.58	13.38	33.73	12.32	26.62	15.14	1.83	Supercritical	84.80	0.00	
SDMH 19	115.84	16.39	33.73	12.32	22.88	17.90	2.46	Supercritical	84.80	0.00	
SDMH 20	128.64	18.20	33.73	12.32	21.33	19.44	2.82	Supercritical	84.80	0.00	Velocity is Too High
SDMH 21	128.64	18.20	33.73	12.32	21.33	19.44	2.82	Supercritical	84.80	0.00	Velocity is Too High
SDMH 27	105.74	14.96	33.73	12.32	24.40	16.63	2.17	Pressurized	84.80	44.00	
SDIN 16	41.13	8.38	19.67	6.80	16.12	8.63	1.46	Pressurized	23.20	26.00	
SDMH 125	76.94	15.67	22.07	7.52	12.79	14.58	2.86	Supercritical	29.10	0.00	
SDMH 124	87.24	17.77	22.07	7.52	11.93	15.99	3.27	Supercritical	29.10	0.00	
SDMH 29	96.45	19.65	22.07	7.52	11.30	17.20	3.63	Supercritical	29.10	0.00	
SDIN 20	58.16	11.85	22.07	7.52	15.01	11.85	2.11	Pressurized	29.10	26.00	
SDIN 14	41.13	8.38	24.33	8.37	21.60	9.43	1.28	Pressurized	35.70	9.00	
SDIN 12	198.53	15.80	44.89	14.14	34.64	17.80	1.91	Supercritical	172.80	0.00	
SDIN 13	128.82	10.25	48.00	13.48	48.00	13.48	0.00	Pressurized	169.40	53.00	
SDMH 217	159.51	16.58	39.10	13.01	27.42	18.25	2.28	Pressurized	121.40	50.00	Velocity is Too High
SDMH 170	159.51	16.58	39.10	13.01	27.42	18.25	2.28	Supercritical	121.40	0.00	Velocity is Too High
SDMH 165	133.76	18.92	32.81	11.30	19.50	19.55	3.01	Supercritical	76.40	0.00	Velocity is Too High
SDMH 164	66.88	9.46	36.00	10.81	36.00	10.81	0.00	Pressurized	76.40	90.00	
SDMH 163	66.88	9.46	36.00	10.81	36.00	10.81	0.00	Pressurized	76.40	214.00	
SDMH 162	66.88	9.46	36.00	10.81	36.00	10.81	0.00	Pressurized	76.40	82.00	
SDMH 161	125.12	17.70	32.81	11.30	20.32	18.58	2.78	Pressurized	76.40	91.00	Velocity is Too High
SDMH 123	133.76	18.92	32.81	11.30	19.50	19.55	3.01	Supercritical Jump	76.40	6.54	Velocity is Too High
SDMH 30	133.76	18.92	32.81	11.30	19.50	19.55	3.01	Supercritical Jump	76.40	26.98	Velocity is Too High
SDIN 22	58.16	11.85	24.04	8.25	16.72	12.38	2.05	Pressurized	34.80	26.00	
SDMH 122	50.72	16.15	23.72	15.31	18.61	18.37	2.59	Supercritical	48.00	0.00	Velocity is Too High
SDMH 31	50.72	16.15	23.72	15.31	18.61	18.37	2.59	Supercritical	48.00	0.00	Velocity is Too High
SDIN 34	32.08	10.21	24.00	15.28	24.00	15.28	0.00	Pressurized	48.00	26.00	
SDMH	79.11	16.12	28.17	11.35	18.25	17.36	2.70	Supercritical	54.30	0.00	

215											
SDIN 106	45.37	14.44	24.00	17.28	24.00	17.28	0.00	Pressurized	54.30	109.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft ²)	Comment
SDMH 18	84.80	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 19	84.80	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 20	84.80	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 21	84.80	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 27	84.80	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDIN 16	23.20	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
SDMH 125	29.10	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
SDMH 124	29.10	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
SDMH 29	29.10	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
SDIN 20	29.10	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
SDIN 14	35.70	CIRCULAR	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	4.91	
SDIN 12	172.80	CIRCULAR	48.00 in	48.00 in	48.00 in	48.00 in	48.00 in	48.00 in	12.57	
SDIN 13	169.40	CIRCULAR	48.00 in	48.00 in	54.00 in	54.00 in	48.00 in	48.00 in	12.57	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 217	121.40	CIRCULAR	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	9.62	
SDMH 170	121.40	CIRCULAR	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	9.62	
SDMH	76.40	CIRCULAR	36.00	36.00	30.00	30.00	36.00	36.00	7.07	

165			in	in	in	in	in	in		
SDMH 164	76.40	CIRCULAR	36.00 in	36.00 in	42.00 in	42.00 in	36.00 in	36.00 in	7.07	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 163	76.40	CIRCULAR	36.00 in	36.00 in	42.00 in	42.00 in	36.00 in	36.00 in	7.07	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 162	76.40	CIRCULAR	36.00 in	36.00 in	42.00 in	42.00 in	36.00 in	36.00 in	7.07	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 161	76.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 123	76.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 30	76.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDIN 22	34.80	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
SDMH 122	48.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 31	48.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDIN 34	48.00	CIRCULAR	24.00 in	24.00 in	30.00 in	30.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 215	54.30	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
SDIN 106	54.30	CIRCULAR	24.00 in	24.00 in	27.00 in	27.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.

- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6034.50

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 18	6033.14	6036.52	0.00	0.00	6035.36	6039.33	6038.91	2.77	6041.69
SDMH 19	6038.21	6042.50	0.11	0.00	6040.12	6045.31	6045.09	2.58	6047.67
SDMH 20	6042.75	6048.30	0.11	0.00	6045.42	6051.11	6050.39	3.07	6053.47
SDMH 21	6048.59	6051.40	0.11	0.00	6051.22	6054.21	6056.23	0.34	6056.57
SDMH 27	6051.70	6052.80	2.23	0.00	6056.57	6057.28	6058.80	0.71	6059.51
SDIN 16	6053.54	6053.80	0.35	0.00	6059.51	6059.59	6059.86	0.08	6059.94
SDMH 125	6055.35	6056.78	0.03	0.00	6057.30	6059.14	6059.71	0.00	6059.71
SDMH 124	6056.95	6062.75	0.03	0.00	6059.17	6064.59	6061.91	3.56	6065.47
SDMH 29	6062.92	6065.06	0.03	0.00	6064.62	6067.91	6068.45	0.00	6068.45
SDIN 20	6065.35	6065.87	0.55	0.00	6068.45	6068.58	6069.00	0.13	6069.13
SDIN 14	6053.00	6053.09	0.82	0.00	6059.51	6059.58	6060.33	0.07	6060.40
SDIN 12	6033.13	6033.57	0.00	0.00	6036.53	6037.31	6040.11	0.30	6040.42
SDIN 13	6034.38	6034.80	0.20	0.00	6038.38	6039.11	6041.20	0.73	6041.93
SDMH 217	6035.00	6036.25	0.12	0.00	6039.58	6040.31	6042.05	0.72	6042.78
SDMH 170	6038.40	6049.00	0.12	0.00	6040.68	6052.26	6045.86	9.03	6054.89
SDMH 165	6054.10	6065.30	0.15	0.00	6055.72	6068.03	6061.66	8.36	6070.02
SDMH 164	6065.56	6066.46	1.81	0.00	6070.02	6071.19	6071.83	1.17	6073.01
SDMH 163	6066.56	6068.70	1.81	0.00	6073.01	6075.80	6074.82	2.79	6077.61
SDMH 162	6068.93	6069.75	0.16	0.00	6075.96	6077.03	6077.78	1.07	6078.85
SDMH 161	6071.02	6074.20	0.16	0.00	6077.20	6078.38	6079.01	1.19	6080.20
SDMH 123	6075.37	6079.45	0.16	0.00	6078.55	6082.18	6080.36	3.81	6084.17
SDMH 30	6080.44	6082.00	1.81	0.00	6084.17	6084.73	6085.98	0.74	6086.72
SDIN 22	6082.25	6082.77	0.78	0.00	6086.72	6086.90	6087.50	0.19	6087.68
SDMH	6084.51	6096.36	0.18	0.00	6086.06	6098.34	6091.30	10.68	6101.98

122									
SDMH 31	6096.91	6098.86	0.18	0.00	6098.52	6100.84	6103.70	0.78	6104.48
SDIN 34	6099.05	6099.57	3.62	0.00	6104.48	6105.64	6108.10	1.16	6109.27
SDMH 215	6050.89	6063.88	0.23	0.00	6052.49	6066.23	6057.10	11.13	6068.23
SDIN 106	6064.07	6068.43	1.11	0.00	6067.34	6072.32	6070.71	6.25	6076.96

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 18	169.00	4.00	6.00	6.67	0.00	3.24	0.00	13.96	8.81	4.65	293.17	Sewer Too Shallow
SDMH 19	143.00	4.00	6.00	6.67	10.58	7.12	2.96	14.20	8.93	4.77	331.18	
SDMH 20	150.00	4.00	6.00	6.67	13.70	8.68	4.52	15.34	9.50	5.34	423.38	
SDMH 21	76.00	4.00	6.00	6.67	14.76	9.22	5.05	15.54	9.60	5.44	227.34	
SDMH 27	44.00	4.00	6.00	6.67	14.94	9.30	5.14	14.16	8.91	4.75	124.34	
SDIN 16	26.00	3.50	6.00	6.08	13.18	8.13	4.55	14.32	8.70	5.12	63.53	
SDMH 125	41.00	3.50	6.00	6.08	9.57	6.33	2.74	11.40	7.24	3.66	70.34	
SDMH 124	129.00	3.50	6.00	6.08	11.07	7.08	3.49	10.70	6.89	3.31	230.57	
SDMH 29	39.00	3.50	6.00	6.08	10.37	6.73	3.14	11.26	7.17	3.59	69.22	
SDIN 20	26.00	3.50	6.00	6.08	10.68	6.88	3.30	9.30	6.19	2.61	42.08	
SDIN 14	9.00	3.50	6.00	6.08	14.26	8.67	5.09	13.74	8.41	4.83	22.55	
SDIN 12	23.00	5.00	6.00	7.83	0.00	3.33	0.00	13.40	9.12	3.78	44.84	Sewer Too Shallow
SDIN 13	53.00	5.00	6.00	7.83	11.79	8.31	2.98	10.94	7.89	2.55	130.74	
SDMH 217	50.00	4.50	6.00	7.25	11.04	7.65	2.90	8.40	6.33	1.58	97.41	Sewer Too Shallow
SDMH 170	424.00	4.50	6.00	7.25	0.00	4.18	0.00	15.50	9.88	5.13	933.41	Sewer Too Shallow
SDMH 165	280.00	4.00	6.00	6.67	0.00	4.73	0.57	23.10	13.38	9.22	956.74	Sewer Too Shallow
SDMH 164	90.00	4.00	6.00	6.67	22.58	13.12	8.96	18.98	11.32	7.16	440.32	
											486	

SDMH 163	214.00	4.00	6.00	6.67	18.78	11.22	7.06	21.86	12.76	8.60	1007.80	
SDMH 162	82.00	4.00	6.00	6.67	21.40	12.53	8.37	23.36	13.51	9.35	451.88	
SDMH 161	91.00	4.00	6.00	6.67	20.83	12.25	8.08	18.86	11.26	7.10	411.29	
SDMH 123	102.00	4.00	6.00	6.67	16.52	10.09	5.93	14.02	8.84	4.68	309.84	
SDMH 30	39.00	4.00	6.00	6.67	12.04	7.85	3.69	14.02	8.84	4.68	95.37	
SDIN 22	26.00	3.50	6.00	6.08	14.02	8.55	4.97	12.64	7.86	4.28	60.83	
SDMH 122	237.00	3.00	4.00	5.50	10.00	6.08	3.25	18.26	10.21	7.38	594.25	
SDMH 31	39.00	3.00	4.00	5.50	17.16	9.66	6.83	13.26	7.71	4.88	104.44	
SDIN 34	26.00	3.00	4.00	5.50	12.88	7.52	4.69	16.68	9.42	6.59	66.48	
SDMH 215	351.00	3.50	6.00	6.08	12.71	7.90	4.32	16.74	9.91	6.33	960.24	
SDIN 106	109.00	3.00	4.00	5.50	16.86	9.51	6.68	11.84	7.00	4.17	268.77	

Total earth volume for sewer trenches = 8832 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
2/7/2018 2:15:20 PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond A Outfall-2 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.99
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5986.85

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond A Outfall	5996.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
									488	

Outlet Pipe 1	5997.87	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond A Outfall	0.00	0.00	0.00	0.00	0.00	0.86	1.87	21.67	1.60	
Outlet Pipe 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Outlet Pipe 1	130.00	5986.85	0.5	5987.50	0.013	0.03	0.00	BOX	4.00 ft	4.00 ft

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Outlet Pipe 1	129.67	8.10	2.05	2.34	2.04	2.35	1.01	Supercritical	1.60	0.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Outlet Pipe 1	1.60	BOX	4.00 ft	4.00 ft	1.50 ft	1.50 ft	4.00 ft	4.00 ft	16.00	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5986.85

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Outlet Pipe 1	5986.85	5987.50	0.00	0.00	5987.02	5987.67	5987.11	0.65	5987.76

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
Outlet Pipe 1	130.00	5.00	6.00	7.83	15.30	10.07	4.73	17.74	11.29	5.95	495.30	

Total earth volume for sewer trenches = 495 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
2/7/2018 2:13:28 PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond A Outfall-100 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5986.85

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond A Outfall	5996.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
									491	

Outlet Pipe 1	5997.87	197.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution					Total Design Flow				Comment
	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Pond A Outfall	0.00	0.00	0.00	0.00	0.00	16.47	11.96	0.18	197.00	
Outlet Pipe 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	197.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation			Loss Coefficients			Given Dimensions		
		Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Outlet Pipe 1	130.00	5986.85	0.5	5987.50	0.013	0.03	0.00	BOX	4.00 ft	4.00 ft

Sewer Flow Summary:

Element Name	Full Flow Capacity		Critical Flow		Normal Flow				Flow (cfs)	Surcharged Length (ft)	Comment
	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition			
Outlet Pipe 1	129.67	8.10	48.00	12.31	48.00	12.31	0.00	Pressurized	197.00	130.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing		Calculated		Used			Comment
			Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	
Outlet Pipe 1	197.00	BOX	4.00 ft	4.00 ft	6.50 ft	6.50 ft	4.00 ft	4.00 ft	16.00	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5986.85

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Outlet Pipe 1	5986.85	5987.50	0.00	0.00	5990.85	5992.35	5993.20	1.50	5994.70

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
Outlet Pipe 1	130.00	5.00	6.00	7.83	15.30	10.07	4.73	17.74	11.29	5.95	495.30	

Total earth volume for sewer trenches = 495 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

POND B

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
4/17/2017 11:21:33
AM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond D_1
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6096.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond B Outfall	6097.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

495

(BAsin D-1)										
SDMH 159	6109.07	12.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 96	6126.88	12.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 39	6127.17	12.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 38	6127.62	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 37	6128.41	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 36	6129.15	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 35	6129.80	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 99	6130.33	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 34	6130.48	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 33	6129.43	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 32	6122.51	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 28	6123.80	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 98	6128.49	5.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 27	6145.65	5.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 97	6145.47	5.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 30	6126.90	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution					Total Design Flow				Comment
	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Pond B Outfall (BAsin D-1)	0.00	0.00	0.00	0.00	0.00	2.94	4.32	0.62	12.69	
SDMH 159	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.69	Surface Water Present (Downstream)
SDIN 96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.69	
SDMH 39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.69	

SDMH 38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDIN 28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	
SDMH 98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.58	
SDMH 27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.58	
SDIN 97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.58	
SDIN 30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.60	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 159	67.00	6097.00	3.8	6099.55	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 96	181.00	6100.82	4.0	6108.06	0.013	0.73	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 39	26.00	6108.25	3.0	6109.03	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 38	62.00	6109.20	4.0	6111.68	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 37	74.00	6111.72	2.6	6113.64	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 36	73.00	6113.82	0.5	6114.18	0.013	0.08	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 35	65.00	6114.38	0.5	6114.70	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 99	54.00	6115.40	0.5	6115.67	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 34	26.00	6115.83	0.8	6116.04	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 33	61.00	6116.16	0.8	6116.65	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 32	211.00	6116.77	0.8	6118.46	0.013	0.08	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 28	34.00	6118.70	1.3	6119.14	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 98	103.00	6109.25	5.1	6114.50	0.013	0.11	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 27	303.00	6114.67	6.3	6133.76	0.013	0.11	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 97	10.00	6133.95	2.0	6134.15	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 30	8.00	6109.23	1.0	6109.31	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length	Comment

										(ft)	
SDMH 159	130.37	18.44	13.58	5.20	7.59	11.70	3.10	Supercritical	12.69	0.00	
SDIN 96	133.76	18.92	13.58	5.20	7.49	11.92	3.18	Supercritical	12.69	0.00	
SDMH 39	115.84	16.39	13.58	5.20	8.05	10.76	2.76	Supercritical	12.69	0.00	
SDMH 38	133.76	18.92	5.87	3.30	3.40	7.32	2.94	Supercritical	2.48	0.00	
SDMH 37	36.58	11.64	6.58	3.55	4.23	6.64	2.36	Supercritical	2.48	0.00	
SDMH 36	16.04	5.11	6.58	3.55	6.38	3.70	1.06	Supercritical	2.48	0.00	
SDMH 35	7.45	4.21	7.15	3.79	7.15	3.79	1.00	Supercritical	2.48	0.00	
SDMH 99	7.45	4.21	7.15	3.79	7.15	3.79	1.00	Supercritical	2.48	0.00	
SDMH 34	9.42	5.33	7.15	3.79	6.30	4.50	1.28	Supercritical	2.48	0.00	
SDMH 33	9.42	5.33	7.15	3.79	6.30	4.50	1.28	Supercritical	2.48	0.00	
SDMH 32	9.42	5.33	7.15	3.79	6.30	4.50	1.28	Supercritical	2.48	0.00	
SDIN 28	12.01	6.80	7.15	3.79	5.55	5.35	1.63	Supercritical	2.48	0.00	
SDMH 98	23.79	13.46	10.93	4.97	5.93	10.99	3.23	Supercritical	5.58	0.00	
SDMH 27	26.44	14.96	10.93	4.97	5.61	11.86	3.59	Supercritical	5.58	0.00	
SDIN 97	14.90	8.43	10.93	4.97	7.63	7.82	1.99	Supercritical	5.58	0.00	
SDIN 30	22.68	7.22	10.03	4.50	8.12	5.98	1.50	Supercritical	5.60	0.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			Comment
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft ²)	
SDMH 159	12.69	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDIN 96	12.69	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 39	12.69	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 38	2.48	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 37	2.48	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 36	2.48	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 35	2.48	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 99	2.48	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 34	2.48	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 33	2.48	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 32	2.48	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 28	2.48	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 98	5.58	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 27	5.58	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 97	5.58	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

SDIN 30	5.60	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6096.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 159	6097.00	6099.55	0.00	0.00	6097.64	6100.68	6099.76	1.34	6101.10
SDIN 96	6100.82	6108.06	0.04	0.00	6101.44	6109.19	6103.65	5.96	6109.61
SDMH 39	6108.25	6109.03	0.00	0.00	6109.19	6110.51	6110.72	0.00	6110.72
SDMH 38	6109.20	6111.68	0.00	0.00	6110.71	6112.17	6110.72	1.62	6112.34
SDMH 37	6111.72	6113.64	0.00	0.00	6112.17	6114.19	6112.75	1.63	6114.38
SDMH 36	6113.82	6114.18	0.00	0.00	6114.35	6114.73	6114.56	0.36	6114.92
SDMH 35	6114.38	6114.70	0.00	0.00	6114.97	6115.30	6115.19	0.32	6115.52
SDMH 99	6115.40	6115.67	0.00	0.00	6116.00	6116.27	6116.22	0.27	6116.49
SDMH 34	6115.83	6116.04	0.00	0.00	6116.36	6116.64	6116.67	0.19	6116.86
SDMH 33	6116.16	6116.65	0.00	0.00	6116.69	6117.25	6117.00	0.47	6117.47
SDMH 32	6116.77	6118.46	0.00	0.00	6117.30	6119.06	6117.61	1.67	6119.28
SDIN 28	6118.70	6119.14	0.04	0.00	6119.16	6119.74	6119.61	0.35	6119.96
SDMH 98	6109.25	6114.50	0.02	0.00	6110.53	6115.41	6111.62	4.18	6115.79
SDMH 27	6114.67	6133.76	0.02	0.00	6115.43	6134.67	6117.32	17.73	6135.05
SDIN 97	6133.95	6134.15	0.20	0.00	6134.88	6135.31	6135.54	0.00	6135.54
SDIN 30	6109.23	6109.31	0.00	0.00	6110.63	6110.63	6110.72	0.01	6110.73

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

	Downstream	Upstream	

Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 159	67.00	4.00	6.00	6.67	0.00	0.83	0.00	17.04	10.35	6.19	125.88	Sewer Too Shallow
SDIN 96	181.00	4.00	6.00	6.67	14.50	9.08	4.92	35.64	19.65	15.49	1396.99	
SDMH 39	26.00	4.00	6.00	6.67	35.26	19.46	15.30	34.28	18.97	14.81	313.57	
SDMH 38	62.00	4.00	6.00	6.67	33.94	18.80	14.64	29.88	16.77	12.61	640.50	
SDMH 37	74.00	3.00	4.00	5.50	30.81	16.49	13.65	28.54	15.35	12.52	641.28	
SDMH 36	73.00	3.00	4.00	5.50	28.19	15.18	12.35	28.94	15.55	12.72	588.18	
SDMH 35	65.00	2.50	4.00	4.92	29.05	15.32	13.07	29.70	15.64	13.39	543.32	
SDMH 99	54.00	2.50	4.00	4.92	28.30	14.94	12.69	28.82	15.20	12.95	427.74	
SDMH 34	26.00	2.50	4.00	4.92	28.50	15.04	12.79	28.38	14.98	12.73	204.26	
SDMH 33	61.00	2.50	4.00	4.92	28.14	14.86	12.61	25.06	13.32	11.07	423.36	
SDMH 32	211.00	2.50	4.00	4.92	24.82	13.20	10.95	7.60	4.59	2.34	735.65	
SDIN 28	34.00	2.50	4.00	4.92	7.12	4.35	2.10	8.82	5.20	2.95	32.75	
SDMH 98	103.00	2.50	4.00	4.92	35.35	18.46	16.21	27.48	14.53	12.28	993.75	
SDMH 27	303.00	2.50	4.00	4.92	27.14	14.36	12.11	23.28	12.43	10.18	1904.85	
SDIN 97	10.00	2.50	4.00	4.92	22.90	12.24	9.99	22.14	11.86	9.61	50.65	
SDIN 30	8.00	3.00	4.00	5.50	34.88	18.52	15.69	34.18	18.17	15.34	92.34	

Total earth volume for sewer trenches = 9115 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
4/15/2017 7:44:52
PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond D_1
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6097.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond B Outfall	6097.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

501

(Basin D-1)										
SDMH 159	6109.07	80.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 96	6126.88	80.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 39	6127.17	56.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 38	6127.62	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 37	6128.41	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 36	6129.15	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 35	6129.80	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 99	6130.33	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 34	6130.48	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 33	6129.43	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 32	6122.51	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 28	6123.80	11.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 30	6126.90	45.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution					Total Design Flow				Comment
	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Pond B Outfall (Basin D-1)	0.00	0.00	0.00	0.00	0.00	6.72	12.04	0.10	80.90	
SDMH 159	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.90	Surface Water Present (Downstream)
SDIN 96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.90	
SDMH 39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.80	
SDMH 38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDMH 37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDMH 36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDMH 35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDMH 99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	

SDMH 34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDMH 33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDMH 32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDIN 28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	
SDIN 30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.70	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation			Loss Coefficients			Given Dimensions		
		Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 159	67.00	6097.00	3.8	6099.55	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 96	181.00	6100.82	4.0	6108.06	0.013	0.73	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 39	26.00	6108.25	3.0	6109.03	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 38	62.00	6109.20	4.0	6111.68	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 37	74.00	6111.72	2.6	6113.64	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 36	73.00	6113.82	0.5	6114.18	0.013	0.08	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 35	65.00	6114.38	0.5	6114.70	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 99	54.00	6115.40	0.5	6115.67	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 34	26.00	6115.83	0.8	6116.04	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 33	61.00	6116.16	0.8	6116.65	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 32	211.00	6116.77	0.8	6118.46	0.013	0.08	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 28	34.00	6118.70	1.3	6119.14	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 30	8.00	6109.23	1.0	6109.31	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity		Critical Flow		Normal Flow						
	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 159	130.37	18.44	33.34	11.84	20.53	19.43	2.89	Supercritical	80.90	0.00	Velocity is Too High
SDIN 96	133.76	18.92	33.34	11.84	20.20	19.82	2.98	Supercritical	80.90	0.00	Velocity is Too High
SDMH 39	115.84	16.39	29.30	9.22	17.80	16.31	2.67	Supercritical	56.80	0.00	
SDMH 38	133.76	18.92	13.08	5.09	7.23	11.66	3.17	Supercritical Jump	11.80	42.23	
SDMH 37	36.58	11.64	14.80	5.80	9.37	10.38	2.40	Supercritical Jump	11.80	7.35	
SDMH 36	16.04	5.11	14.80	5.80	15.30	5.58	0.94	Subcritical	11.80	0.00	
SDMH 35	7.45	4.21	18.00	6.68	18.00	6.68	0.00	Pressurized	11.80	65.00	
										503	

SDMH 99	7.45	4.21	18.00	6.68	18.00	6.68	0.00	Pressurized	11.80	54.00	
SDMH 34	9.42	5.33	18.00	6.68	18.00	6.68	0.00	Pressurized	11.80	26.00	
SDMH 33	9.42	5.33	18.00	6.68	18.00	6.68	0.00	Pressurized	11.80	61.00	
SDMH 32	9.42	5.33	18.00	6.68	18.00	6.68	0.00	Pressurized	11.80	211.00	
SDIN 28	12.01	6.80	15.67	7.23	14.48	7.75	1.21	Pressurized	11.80	34.00	
SDIN 30	22.68	7.22	24.00	14.55	24.00	14.55	0.00	Pressurized	45.70	8.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			Comment
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	
SDMH 159	80.90	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDIN 96	80.90	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 39	56.80	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 38	11.80	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 37	11.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 36	11.80	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 35	11.80	CIRCULAR	18.00 in	18.00 in	24.00 in	24.00 in	18.00 in	18.00 in	1.77	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 99	11.80	CIRCULAR	18.00 in	18.00 in	24.00 in	24.00 in	18.00 in	18.00 in	1.77	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 34	11.80	CIRCULAR	18.00 in	18.00 in	21.00 in	21.00 in	18.00 in	18.00 in	1.77	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDMH 33	11.80	CIRCULAR	18.00 in	18.00 in	21.00 in	21.00 in	18.00 in	18.00 in	1.77	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

SDMH 32	11.80	CIRCULAR	18.00 in	18.00 in	21.00 in	21.00 in	18.00 in	18.00 in	1.77	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDIN 28	11.80	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 30	45.70	CIRCULAR	24.00 in	24.00 in	33.00 in	33.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6097.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 159	6097.00	6099.55	0.00	0.00	6098.97	6102.33	6103.18	1.32	6104.50
SDIN 96	6100.82	6108.06	1.48	0.00	6103.81	6110.84	6108.60	4.41	6113.01
SDMH 39	6108.25	6109.03	0.05	0.00	6110.89	6112.86	6113.86	0.00	6113.86
SDMH 38	6109.20	6111.68	0.06	0.00	6113.88	6113.88	6113.92	0.03	6113.95
SDMH 37	6111.72	6113.64	0.01	0.00	6113.89	6114.87	6114.11	1.29	6115.40
SDMH 36	6113.82	6114.18	0.02	0.00	6115.05	6115.48	6115.57	0.37	6115.94
SDMH 35	6114.38	6114.70	0.03	0.00	6115.88	6116.69	6116.57	0.82	6117.38
SDMH 99	6115.40	6115.67	0.03	0.00	6116.90	6117.58	6117.59	0.68	6118.27
SDMH 34	6115.83	6116.04	0.03	0.00	6117.61	6117.94	6118.30	0.33	6118.63
SDMH 33	6116.16	6116.65	0.03	0.00	6117.97	6118.74	6118.67	0.77	6119.43
SDMH 32	6116.77	6118.46	0.06	0.00	6118.79	6121.44	6119.49	2.65	6122.14
SDIN 28	6118.70	6119.14	0.91	0.00	6122.36	6122.78	6123.05	0.43	6123.48
SDIN 30	6109.23	6109.31	0.16	0.00	6113.02	6113.02	6114.52	1.79	6116.31

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 159	67.00	4.00	6.00	6.67	0.00	0.83	0.00	17.04	10.35	6.19	125.88	Sewer Too Shallow
SDIN 96	181.00	4.00	6.00	6.67	14.50	9.08	4.92	35.64	19.65	15.49	1396.99	
SDMH 39	26.00	4.00	6.00	6.67	35.26	19.46	15.30	34.28	18.97	14.81	313.57	
SDMH 38	62.00	4.00	6.00	6.67	33.94	18.80	14.64	29.88	16.77	12.61	640.50	
SDMH 37	74.00	3.00	4.00	5.50	30.81	16.49	13.65	28.54	15.35	12.52	641.28	
SDMH 36	73.00	3.00	4.00	5.50	28.19	15.18	12.35	28.94	15.55	12.72	588.18	
SDMH 35	65.00	2.50	4.00	4.92	29.05	15.32	13.07	29.70	15.64	13.39	543.32	
SDMH 99	54.00	2.50	4.00	4.92	28.30	14.94	12.69	28.82	15.20	12.95	427.74	
SDMH 34	26.00	2.50	4.00	4.92	28.50	15.04	12.79	28.38	14.98	12.73	204.26	
SDMH 33	61.00	2.50	4.00	4.92	28.14	14.86	12.61	25.06	13.32	11.07	423.36	
SDMH 32	211.00	2.50	4.00	4.92	24.82	13.20	10.95	7.60	4.59	2.34	735.65	
SDIN 28	34.00	2.50	4.00	4.92	7.12	4.35	2.10	8.82	5.20	2.95	32.75	
SDIN 30	8.00	3.00	4.00	5.50	34.88	18.52	15.69	34.18	18.17	15.34	92.34	

Total earth volume for sewer trenches = 6166 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
4/17/2017 11:23:24
AM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond B (Basin D-2)_100 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6097.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall Pond	6090.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

507

D_2										
SDIN 98	6096.03	5.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall Pond D_2	0.00	0.00	0.00	0.00	0.00	0.45	11.49	0.71	5.20	Surface Water Present (Upstream)
SDIN 98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.20	Surface Water Present (Downstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDIN 98	71.00	6090.00	2.0	6091.42	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDIN 98	32.08	10.21	9.65	4.40	6.53	7.51	2.12	Pressurized	5.20	71.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDIN 98	5.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.

- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6097.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 98	6090.00	6091.42	0.00	0.00	6097.00	6097.04	6097.04	0.04	6097.08

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 98	71.00	3.00	4.00	5.50	0.00	0.92	0.00	8.22	5.19	2.36	46.66	Sewer Too Shallow

Total earth volume for sewer trenches = 47 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
2/7/2018 2:20:22 PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond B Outfall- 2 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.99
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6088.34

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond B Outfall	6090.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
									510	

Outlet Pipe 1	6096.40	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POND B OUTLET	6093.43	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond B Outfall	0.00	0.00	0.00	0.00	0.00	0.07	2.77	9.16	0.20	
Outlet Pipe 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	
POND B OUTLET	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	

Sewer Input Summary:

	Elevation				Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Outlet Pipe 1	35.00	6086.67	0.5	6086.84	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in
POND B OUTLET	81.00	6087.05	0.5	6087.45	0.013	0.29	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Outlet Pipe 1	16.04	5.11	1.83	1.82	1.88	1.75	0.95	Subcritical	0.20	0.00	Velocity is Too Low
POND B OUTLET	16.04	5.11	1.83	1.82	1.88	1.75	0.95	Subcritical	0.20	0.00	Velocity is Too Low

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment

	(cfs)									
Outlet Pipe 1	0.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
POND B OUTLET	0.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6088.34

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Outlet Pipe 1	6086.67	6086.84	0.00	0.00	6088.34	6088.34	6088.34	0.00	6088.34
POND B OUTLET	6087.05	6087.45	0.00	0.00	6088.34	6088.34	6088.34	0.00	6088.34

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = $Bend\ K * V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g) - Junction\ Loss\ K * V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
Outlet Pipe 1	35.00	3.00	4.00	5.50	7.25	4.71	1.88	18.12	10.14	7.31	79.25	Sewer Too Shallow
POND B OUTLET	81.00	3.00	4.00	5.50	17.71	9.94	7.11	10.96	6.56	3.73	203.22	

Total earth volume for sewer trenches = 282 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:

- Four inches for pipes less than 33 inches.
- Six inches for pipes less than 60 inches.
- Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
2/7/2018 2:21:50 PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond B Outfall- 100 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6088.34

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond B Outfall	6090.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
									514	

Outlet Pipe 1	6096.40	22.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POND B OUTLET	6093.43	22.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond B Outfall	0.00	0.00	0.00	0.00	0.00	1.84	12.05	0.08	22.20	
Outlet Pipe 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.20	
POND B OUTLET	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.20	

Sewer Input Summary:

	Elevation				Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Outlet Pipe 1	35.00	6086.67	0.5	6086.84	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in
POND B OUTLET	81.00	6087.05	0.5	6087.45	0.013	0.29	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Outlet Pipe 1	16.04	5.11	24.00	7.07	24.00	7.07	0.00	Pressurized	22.20	35.00	
POND B OUTLET	16.04	5.11	24.00	7.07	24.00	7.07	0.00	Pressurized	22.20	81.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment

Outlet Pipe 1	22.20	CIRCULAR	24.00 in	24.00 in	30.00 in	30.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
POND B OUTLET	22.20	CIRCULAR	24.00 in	24.00 in	30.00 in	30.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6088.34

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Outlet Pipe 1	6086.67	6086.84	0.00	0.00	6088.67	6089.00	6089.44	0.34	6089.78
POND B OUTLET	6087.05	6087.45	0.22	0.00	6089.23	6090.00	6090.00	0.78	6090.78

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = $Bend\ K * V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g) - Junction\ Loss\ K * V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

	Downstream	Upstream	516

Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
Outlet Pipe 1	35.00	3.00	4.00	5.50	7.25	4.71	1.88	18.12	10.14	7.31	79.25	Sewer Too Shallow
POND B OUTLET	81.00	3.00	4.00	5.50	17.71	9.94	7.11	10.96	6.56	3.73	203.22	

Total earth volume for sewer trenches = 282 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

POND C

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
1/25/2018 5:40:08
PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond C(Basin E)
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5977.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall Pond	5973.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

E_1										
SDMH 51	5985.25	37.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 52	5987.60	32.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 53	5988.26	32.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 54	5993.21	29.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 55	6002.90	29.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 56	6008.45	29.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 43	6008.29	3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 57	6008.48	28.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 86	6008.34	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 58	6016.70	24.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 160	6018.22	3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 87	6018.05	3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 59	6016.97	24.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 44	6016.80	3.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 60	6028.21	19.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 45	6028.03	4.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 62	6034.14	10.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 63	6039.11	10.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 152	6047.43	10.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 64	6051.09	10.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 89	6048.72	10.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 151	6048.08	10.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 66	6047.43	10.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 150	6046.71	10.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDMH 67	6046.02	10.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 68	6045.80	10.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 144	6046.43	2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 145	6048.27	2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 105	6048.13	2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 47	6045.63	4.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 46	6045.63	4.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 90	6028.63	4.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 104	6028.45	4.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 42	5988.16	3.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 40	5985.07	6.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution					Total Design Flow				Comment
	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Outfall Pond E_1	0.00	0.00	0.00	0.00	0.00	8.51	4.35	0.52	37.00	Surface Water Present (Upstream)
SDMH 51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.00	Surface Water Present (Downstream)
SDMH 52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.00	
SDMH 53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.00	
SDMH 54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.50	
SDMH 55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.50	
SDMH 56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.50	
SDIN 43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10	
SDMH 57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.30	
SDIN 86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.60	
SDMH 58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.90	
SDMH 160	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10	
SDIN 87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10	
SDMH 59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.90	
SDIN 44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.60	

SDMH 60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.50	
SDIN 45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.80	
SDMH 62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.70	
SDMH 63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.70	
SDMH 152	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.70	
SDMH 64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.70	
SDMH 89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.70	
SDMH 151	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.70	
SDMH 66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.70	
SDMH 150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.70	
SDMH 67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.70	
SDMH 68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.70	
SDMH 144	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.20	
SDMH 145	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.20	
SDIN 105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.20	
SDIN 47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30	
SDIN 46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30	
SDMH 90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.60	
SDIN 104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.60	
SDIN 42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.90	
SDIN 40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 51	92.00	5975.95	1.0	5976.87	0.013	0.03	0.00	CIRCULAR	48.00 in	48.00 in
SDMH 52	237.00	5977.07	2.0	5981.81	0.013	0.73	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 53	38.00	5982.01	2.5	5982.96	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 54	146.00	5983.14	3.5	5988.25	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 55	281.00	5988.47	3.5	5998.30	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 56	169.00	5998.49	2.5	6002.71	0.013	0.23	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 43	9.00	6003.01	2.6	6003.24	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 57	38.00	6002.91	2.0	6003.67	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 86	7.00	6003.87	1.0	6003.94	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 58	263.00	6003.86	2.0	6009.12	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 160	36.00	6009.29	5.0	6011.09	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 87	8.00	6011.28	3.0	6011.52	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 59	38.00	6009.31	5.0	6011.21	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 44	9.00	6011.39	3.0	6011.66	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 60	298.00	6011.34	3.7	6022.37	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in

SDIN 45	9.00	6022.66	2.1	6022.85	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 62	258.00	6022.45	2.3	6028.38	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 63	99.00	6028.53	2.5	6031.00	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 152	139.00	6031.10	1.6	6033.32	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 64	63.00	6033.47	1.0	6034.10	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 89	132.00	6034.22	1.2	6035.80	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 151	50.00	6035.90	1.0	6036.40	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 66	51.00	6036.59	1.0	6037.10	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 150	56.00	6037.24	1.0	6037.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 67	55.00	6037.95	1.0	6038.50	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 68	40.00	6038.60	1.0	6039.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 144	50.00	6041.70	2.2	6042.80	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 145	72.00	6043.00	1.5	6044.08	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 105	8.00	6044.28	1.0	6044.36	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 47	9.00	6039.16	0.5	6039.20	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 46	26.00	6039.17	0.5	6039.30	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 90	97.00	6022.67	1.0	6023.64	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 104	9.00	6023.84	1.0	6023.93	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 42	9.00	5983.41	1.0	5983.50	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 40	9.00	5977.17	1.6	5977.31	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 51	144.03	11.46	21.74	6.69	16.59	9.60	1.68	Supercritical	37.00	0.00	
SDMH 52	94.58	13.38	22.02	7.06	14.43	12.08	2.24	Supercritical	32.00	0.00	
SDMH 53	105.74	14.96	22.02	7.06	13.58	13.11	2.52	Supercritical	32.00	0.00	
SDMH 54	125.12	17.70	21.10	6.85	11.90	14.48	3.00	Supercritical	29.50	0.00	
SDMH 55	125.12	17.70	21.10	6.85	11.90	14.48	3.00	Supercritical	29.50	0.00	
SDMH 56	105.74	14.96	21.10	6.85	13.00	12.82	2.53	Supercritical	29.50	0.00	
SDIN 43	16.98	9.61	8.04	4.06	5.21	7.31	2.31	Pressurized	3.10	9.00	
SDMH 57	94.58	13.38	20.65	6.75	13.50	11.69	2.26	Supercritical	28.30	0.00	
SDIN 86	10.53	5.96	7.33	3.84	6.09	4.94	1.43	Pressurized	2.60	7.00	
SDMH 58	94.58	13.38	19.31	6.45	12.61	11.28	2.26	Supercritical	24.90	0.00	
SDMH 160	23.55	13.33	8.04	4.06	4.41	9.23	3.19	Supercritical Jump	3.10	10.98	
SDIN 87	18.24	10.32	8.04	4.06	5.02	7.70	2.48	Supercritical	3.10	0.00	
SDMH 59	149.54	21.16	19.31	6.45	9.94	15.68	3.59	Supercritical	24.90	0.00	
SDIN 44	18.24	10.32	8.69	4.26	5.42	8.03	2.48	Pressurized	3.60	9.00	

SDMH 60	128.64	18.20	16.99	5.94	9.47	13.13	3.09	Supercritical	19.50	0.00	
SDIN 45	15.26	8.64	10.10	4.70	6.93	7.65	2.06	Supercritical Jump	4.80	3.39	
SDMH 62	101.43	14.35	12.43	4.94	7.90	9.32	2.42	Supercritical	10.70	0.00	
SDMH 63	105.74	14.96	12.43	4.94	7.73	9.60	2.52	Supercritical	10.70	0.00	
SDMH 152	84.59	11.97	12.43	4.94	8.65	8.19	2.02	Supercritical	10.70	0.00	
SDMH 64	66.88	9.46	12.43	4.94	9.74	6.93	1.61	Supercritical	10.70	0.00	
SDMH 89	73.26	10.36	12.43	4.94	9.30	7.40	1.76	Supercritical	10.70	0.00	
SDMH 151	66.88	9.46	12.43	4.94	9.74	6.93	1.61	Supercritical	10.70	0.00	
SDMH 66	66.88	9.46	12.43	4.94	9.74	6.93	1.61	Supercritical	10.70	0.00	
SDMH 150	66.88	9.46	12.43	4.94	9.74	6.93	1.61	Supercritical	10.70	0.00	
SDMH 67	66.88	9.46	12.43	4.94	9.74	6.93	1.61	Supercritical	10.70	0.00	
SDMH 68	66.88	9.46	12.43	4.94	9.74	6.93	1.61	Supercritical	10.70	0.00	
SDMH 144	15.62	8.84	6.72	3.65	4.56	6.24	2.12	Supercritical	2.20	0.00	
SDMH 145	12.90	7.30	6.72	3.65	5.03	5.45	1.75	Supercritical	2.20	0.00	
SDIN 105	10.53	5.96	6.72	3.65	5.58	4.71	1.43	Supercritical	2.20	0.00	
SDIN 47	29.08	5.92	8.19	3.96	7.80	4.24	1.10	Supercritical	4.30	0.00	
SDIN 46	29.08	5.92	8.19	3.96	7.80	4.24	1.10	Supercritical	4.30	0.00	
SDMH 90	22.68	7.22	9.05	4.24	7.33	5.66	1.50	Supercritical	4.60	0.00	
SDIN 104	10.53	5.96	9.88	4.63	8.32	5.76	1.39	Supercritical	4.60	0.00	
SDIN 42	41.13	8.38	7.79	3.86	6.24	5.27	1.54	Supercritical	3.90	0.00	
SDIN 40	84.59	11.97	9.38	4.23	6.60	6.99	1.99	Supercritical	6.20	0.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing		Calculated		Used			Comment
			Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	
SDMH 51	37.00	CIRCULAR	48.00 in	48.00 in	30.00 in	30.00 in	48.00 in	48.00 in	12.57	
SDMH 52	32.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDMH 53	32.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 54	29.50	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 55	29.50	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 56	29.50	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDIN 43	3.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

SDMH 57	28.30	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDIN 86	2.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 58	24.90	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 160	3.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 87	3.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 59	24.90	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDIN 44	3.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 60	19.50	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDIN 45	4.80	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 62	10.70	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 63	10.70	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 152	10.70	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 64	10.70	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 89	10.70	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 151	10.70	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 66	10.70	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 150	10.70	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 67	10.70	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 68	10.70	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 144	2.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 145	2.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 105	2.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 47	4.30	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDIN 46	4.30	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 90	4.60	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 104	4.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 42	3.90	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDIN 40	6.20	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5977.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 51	5975.95	5976.87	0.00	0.00	5977.33	5978.68	5978.76	0.61	5979.38

SDMH 52	5977.07	5981.81	0.23	0.00	5978.91	5983.64	5980.54	3.88	5984.42
SDMH 53	5982.01	5982.96	0.42	0.00	5984.06	5985.39	5985.81	0.00	5985.81
SDMH 54	5983.14	5988.25	0.01	0.00	5985.40	5990.01	5987.38	3.35	5990.74
SDMH 55	5988.47	5998.30	0.01	0.00	5990.02	6000.06	5992.71	8.08	6000.79
SDMH 56	5998.49	6002.71	0.06	0.00	6000.12	6004.47	6002.12	3.08	6005.20
SDIN 43	6003.01	6003.24	0.00	0.00	6005.15	6005.16	6005.20	0.01	6005.21
SDMH 57	6002.91	6003.67	0.33	0.00	6004.80	6005.65	6006.16	0.00	6006.16
SDIN 86	6003.87	6003.94	0.04	0.00	6006.17	6006.17	6006.20	0.00	6006.20
SDMH 58	6003.86	6009.12	0.01	0.00	6005.66	6010.73	6006.89	4.49	6011.37
SDMH 160	6009.29	6011.09	0.00	0.00	6011.33	6011.76	6011.38	0.64	6012.02
SDIN 87	6011.28	6011.52	0.06	0.00	6011.82	6012.52	6012.62	0.00	6012.62
SDMH 59	6009.31	6011.21	0.25	0.00	6010.98	6013.71	6013.96	0.00	6013.96
SDIN 44	6011.39	6011.66	0.09	0.00	6013.98	6013.99	6014.04	0.01	6014.05
SDMH 60	6011.34	6022.37	0.01	0.00	6013.72	6023.79	6014.81	9.52	6024.33
SDIN 45	6022.66	6022.85	0.01	0.00	6024.23	6024.23	6024.34	0.01	6024.35
SDMH 62	6022.45	6028.38	0.05	0.00	6023.83	6029.42	6024.45	5.34	6029.80
SDMH 63	6028.53	6031.00	0.00	0.00	6029.42	6032.04	6030.60	1.82	6032.42
SDMH 152	6031.10	6033.32	0.00	0.00	6032.04	6034.36	6032.86	1.88	6034.74
SDMH 64	6033.47	6034.10	0.00	0.00	6034.36	6035.14	6035.03	0.49	6035.52
SDMH 89	6034.22	6035.80	0.00	0.00	6035.14	6036.84	6035.84	1.37	6037.22
SDMH 151	6035.90	6036.40	0.00	0.00	6036.84	6037.44	6037.46	0.36	6037.82
SDMH 66	6036.59	6037.10	0.00	0.00	6037.44	6038.14	6038.15	0.37	6038.52
SDMH 150	6037.24	6037.80	0.00	0.00	6038.14	6038.84	6038.80	0.42	6039.22
SDMH 67	6037.95	6038.50	0.00	0.00	6038.84	6039.54	6039.51	0.41	6039.92
SDMH 68	6038.60	6039.00	0.00	0.00	6039.54	6040.04	6040.16	0.26	6040.42
SDMH 144	6041.70	6042.80	0.00	0.00	6042.08	6043.36	6042.69	0.88	6043.57
SDMH 145	6043.00	6044.08	0.00	0.00	6043.42	6044.64	6043.88	0.97	6044.85
SDIN 105	6044.28	6044.36	0.03	0.00	6044.75	6044.92	6045.09	0.04	6045.13
SDIN 47	6039.16	6039.20	0.02	0.00	6040.38	6040.38	6040.43	0.01	6040.44
SDIN 46	6039.17	6039.30	0.02	0.00	6040.38	6040.38	6040.43	0.02	6040.45
SDMH 90	6022.67	6023.64	0.04	0.00	6024.34	6024.39	6024.38	0.30	6024.67
SDIN 104	6023.84	6023.93	0.14	0.00	6024.53	6024.75	6025.05	0.04	6025.09
SDIN 42	5983.41	5983.50	0.01	0.00	5985.81	5985.81	5985.82	0.00	5985.82
SDIN 40	5977.17	5977.31	0.02	0.00	5979.37	5979.37	5979.39	0.00	5979.40

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_{fi} ^ 2/(2*g)
- Lateral loss = V_{fo} ^ 2/(2*g)- Junction Loss K * V_{fi} ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 51	92.00	5.00	6.00	7.83	0.00	0.00	0.00	13.76	9.30	3.96	139.03	Sewer Too Shallow
SDMH 52	237.00	4.00	6.00	6.67	14.36	9.01	4.85	9.58	6.62	2.46	531.77	
SDMH 53	38.00	4.00	6.00	6.67	9.18	6.42	2.26	8.60	6.13	1.97	60.68	Sewer Too Shallow
SDMH 54	146.00	4.00	6.00	6.67	8.24	5.95	1.79	7.92	5.79	1.63	214.46	Sewer Too Shallow
SDMH 55	281.00	4.00	6.00	6.67	7.49	5.58	1.41	7.20	5.43	1.27	383.26	Sewer Too Shallow
SDMH 56	169.00	4.00	6.00	6.67	6.83	5.25	1.08	9.48	6.57	2.41	252.86	Sewer Too Shallow
SDIN 43	9.00	2.50	4.00	4.92	10.39	5.99	3.74	9.60	5.59	3.34	11.65	
SDMH 57	38.00	4.00	6.00	6.67	9.08	6.37	2.21	7.62	5.64	1.48	57.56	Sewer Too Shallow
SDIN 86	7.00	2.50	4.00	4.92	8.72	5.15	2.90	8.30	4.94	2.69	7.27	
SDMH 58	263.00	4.00	6.00	6.67	7.24	5.45	1.29	13.16	8.41	4.25	501.98	Sewer Too Shallow
SDMH 160	36.00	2.50	4.00	4.92	14.32	7.95	5.70	13.76	7.67	5.42	78.98	
SDIN 87	8.00	2.50	4.00	4.92	13.38	7.48	5.23	12.56	7.07	4.82	15.42	
SDMH 59	38.00	4.00	6.00	6.67	12.78	8.22	4.06	9.52	6.59	2.43	77.52	
SDIN 44	9.00	2.50	4.00	4.92	10.66	6.12	3.87	9.78	5.68	3.43	12.03	
SDMH 60	298.00	4.00	6.00	6.67	9.25	6.46	2.29	9.68	6.67	2.51	504.90	
SDIN 45	9.00	2.50	4.00	4.92	10.60	6.09	3.84	9.86	5.72	3.47	12.04	
SDMH 62	258.00	4.00	6.00	6.67	9.53	6.60	2.43	9.52	6.59	2.43	439.65	
SDMH 63	99.00	4.00	6.00	6.67	9.23	6.45	2.28	14.22	8.94	4.78	217.28	
SDMH 152	139.00	4.00	6.00	6.67	14.03	8.85	4.68	26.22	14.94	10.78	689.17	
SDMH 64	63.00	4.00	6.00	6.67	25.92	14.79	10.63	31.98	17.82	13.66	548.69	
SDMH 89	132.00	4.00	6.00	6.67	31.75	17.71	13.54	23.84	13.75	9.59	1077.36	
SDMH 151	50.00	4.00	6.00	6.67	23.64	13.65	9.49	21.36	12.51	8.35	278.19	
SDMH 66	51.00	4.00	6.00	6.67	20.98	12.32	8.16	18.66	11.16	7.00	230.21	
SDMH 150	56.00	4.00	6.00	6.67	18.38	11.02	6.86	15.82	9.74	5.58	200.86	
SDMH 67	55.00	4.00	6.00	6.67	15.52	9.59	5.43	13.04	8.35	4.19	152.16	
SDMH 68	40.00	4.00	6.00	6.67	12.84	8.25	4.09	11.60	7.63	3.47	90.02	

SDMH 144	50.00	2.50	4.00	4.92	7.70	4.64	2.39	6.76	4.17	1.92	42.70	Sewer Too Shallow
SDMH 145	72.00	2.50	4.00	4.92	6.36	3.97	1.72	7.88	4.73	2.48	60.68	Sewer Too Shallow
SDIN 105	8.00	2.50	4.00	4.92	7.48	4.53	2.28	7.04	4.31	2.06	6.85	
SDIN 47	9.00	3.50	6.00	6.08	11.79	7.44	3.85	11.36	7.22	3.64	17.38	
SDIN 46	26.00	3.50	6.00	6.08	11.76	7.42	3.84	11.16	7.12	3.54	49.58	
SDMH 90	97.00	3.00	4.00	5.50	10.08	6.12	3.29	8.98	5.57	2.74	130.42	
SDIN 104	9.00	2.50	4.00	4.92	9.08	5.33	3.08	8.54	5.06	2.81	9.79	
SDIN 42	9.00	3.50	6.00	6.08	8.20	5.64	2.06	7.82	5.45	1.87	11.56	Sewer Too Shallow
SDIN 40	9.00	4.00	6.00	6.67	14.17	8.92	4.75	13.52	8.59	4.43	23.76	

Total earth volume for sewer trenches = 7138 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
1/25/2018 5:46:22
PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond C(Basin E)

Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100

Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60

Rainfall Constant "A": 28.5

Rainfall Constant "B": 10

Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20

Maximum Rural Overland Len. (ft): 500

Maximum Urban Overland Len. (ft): 300

Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00

Maximum Depth to Rise Ratio: 0.90

Maximum Flow Velocity (fps): 18.0

Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5979.06

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall Pond	5973.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

E_1										
SDMH 51	5985.25	142.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 52	5987.60	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 53	5988.26	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 54	5993.21	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 55	6002.90	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 56	6008.45	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 57	6008.48	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 58	6016.70	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 59	6016.97	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 60	6028.21	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 62	6034.14	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 63	6039.11	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 152	6047.43	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 64	6051.09	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 65	6049.38	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 89	6048.72	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 151	6048.08	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 66	6047.43	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 150	6046.71	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 67	6046.02	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 68	6045.80	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 47	6045.63	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 46	6045.63	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 40	5985.07	86.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Local Contribution						Total Design Flow				Comment
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Outfall Pond E_1	0.00	0.00	0.00	0.00	0.00	11.86	12.00	0.14	142.30	Surface Water Present (Upstream)
SDMH 51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	142.30	Surface Water Present (Downstream)
SDMH 52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 152	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 151	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDMH 68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	
SDIN 47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.00	
SDIN 46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.00	
SDIN 40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.10	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 51	92.00	5975.95	1.0	5976.87	0.013	0.03	0.00	CIRCULAR	48.00 in	48.00 in
SDMH 52	237.00	5977.07	2.0	5981.81	0.013	0.73	0.00	CIRCULAR	36.00 in	36.00 in

SDMH 53	38.00	5982.01	2.5	5982.96	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 54	146.00	5983.14	3.5	5988.25	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 55	281.00	5988.47	3.5	5998.30	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 56	169.00	5998.49	2.5	6002.71	0.013	0.23	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 57	38.00	6002.91	2.0	6003.67	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 58	263.00	6003.86	2.0	6009.12	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 59	38.00	6009.31	5.0	6011.21	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 60	298.00	6011.34	3.7	6022.37	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 62	258.00	6022.45	2.3	6028.38	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 63	99.00	6028.53	2.5	6031.00	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 152	139.00	6031.10	1.6	6033.32	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 64	63.00	6033.47	1.0	6034.10	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 65	81.00	6034.29	1.0	6035.10	0.013	1.19	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 89	51.00	6035.29	1.0	6035.80	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 151	50.00	6035.90	1.0	6036.40	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 66	51.00	6036.59	1.0	6037.10	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 150	56.00	6037.24	1.0	6037.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 67	55.00	6037.95	1.0	6038.50	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 68	40.00	6038.60	1.0	6039.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 47	9.00	6039.16	0.5	6039.20	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 46	26.00	6039.17	0.5	6039.30	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
SDIN 40	9.00	5977.17	1.6	5977.31	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 51	144.03	11.46	42.37	12.12	38.83	13.07	1.24	Supercritical	142.30	0.00	
SDMH 52	94.58	13.38	27.61	8.59	18.61	13.57	2.16	Supercritical Jump	50.00	166.71	
SDMH 53	105.74	14.96	27.61	8.59	17.42	14.75	2.44	Supercritical Jump	50.00	25.59	
SDMH 54	125.12	17.70	27.61	8.59	15.83	16.71	2.94	Supercritical	50.00	0.00	
SDMH 55	125.12	17.70	27.61	8.59	15.83	16.71	2.94	Supercritical	50.00	0.00	
SDMH 56	105.74	14.96	27.61	8.59	17.42	14.75	2.44	Supercritical	50.00	0.00	
SDMH 57	94.58	13.38	27.61	8.59	18.61	13.57	2.16	Supercritical Jump	50.00	34.46	
SDMH	94.58	13.38	27.61	8.59	18.61	13.57	2.16	Supercritical	50.00	0.00	

58											
SDMH 59	149.54	21.16	27.61	8.59	14.34	19.05	3.55	Supercritical Jump	50.00	11.41	Velocity is Too High
SDMH 60	128.64	18.20	27.61	8.59	15.58	17.06	3.03	Supercritical	50.00	0.00	
SDMH 62	101.43	14.35	27.61	8.59	17.85	14.30	2.33	Supercritical Jump	50.00	35.65	
SDMH 63	105.74	14.96	27.61	8.59	17.42	14.75	2.44	Supercritical	50.00	0.00	
SDMH 152	84.59	11.97	27.61	8.59	19.91	12.46	1.89	Supercritical	50.00	0.00	
SDMH 64	66.88	9.46	27.61	8.59	23.21	10.38	1.41	Supercritical	50.00	0.00	
SDMH 65	66.88	9.46	27.61	8.59	23.21	10.38	1.41	Pressurized	50.00	81.00	
SDMH 89	66.88	9.46	27.61	8.59	23.21	10.38	1.41	Supercritical	50.00	0.00	
SDMH 151	66.88	9.46	27.61	8.59	23.21	10.38	1.41	Supercritical	50.00	0.00	
SDMH 66	66.88	9.46	27.61	8.59	23.21	10.38	1.41	Supercritical	50.00	0.00	
SDMH 150	66.88	9.46	27.61	8.59	23.21	10.38	1.41	Supercritical	50.00	0.00	
SDMH 67	66.88	9.46	27.61	8.59	23.21	10.38	1.41	Supercritical	50.00	0.00	
SDMH 68	66.88	9.46	27.61	8.59	23.21	10.38	1.41	Supercritical	50.00	0.00	
SDIN 47	29.08	5.92	20.44	7.02	21.44	6.66	0.91	Pressurized	25.00	9.00	
SDIN 46	29.08	5.92	20.44	7.02	21.44	6.66	0.91	Pressurized	25.00	26.00	
SDIN 40	84.59	11.97	36.00	12.18	36.00	12.18	0.00	Pressurized	86.10	9.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDMH 51	142.30	CIRCULAR	48.00 in	48.00 in	48.00 in	48.00 in	48.00 in	48.00 in	12.57	
SDMH 52	50.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 53	50.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 54	50.00	CIRCULAR	36.00	36.00	27.00	27.00	36.00	36.00	7.07	

			in	in	in	in	in	in		
SDMH 55	50.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDMH 56	50.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 57	50.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 58	50.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 59	50.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 60	50.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDMH 62	50.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 63	50.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 152	50.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 64	50.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 65	50.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 89	50.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 151	50.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 66	50.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 150	50.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 67	50.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 68	50.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDIN 47	25.00	CIRCULAR	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	4.91	
SDIN 46	25.00	CIRCULAR	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	4.91	
SDIN 40	86.10	CIRCULAR	36.00 in	36.00 in	42.00 in	42.00 in	36.00 in	36.00 in	7.07	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.

- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5979.06

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 51	5975.95	5976.87	0.00	0.00	5979.19	5980.40	5981.84	0.85	5982.68
SDMH 52	5977.07	5981.81	0.57	0.00	5982.47	5984.11	5983.25	2.01	5985.26
SDMH 53	5982.01	5982.96	1.03	0.00	5985.51	5985.51	5986.28	0.17	5986.46
SDMH 54	5983.14	5988.25	0.04	0.00	5985.55	5990.55	5988.79	2.90	5991.70
SDMH 55	5988.47	5998.30	0.04	0.00	5990.59	6000.60	5994.12	7.63	6001.75
SDMH 56	5998.49	6002.71	0.18	0.00	6000.78	6005.01	6003.32	2.84	6006.16
SDMH 57	6002.91	6003.67	1.03	0.00	6006.41	6006.59	6007.18	0.19	6007.38
SDMH 58	6003.86	6009.12	0.04	0.00	6006.63	6011.42	6008.27	4.30	6012.57
SDMH 59	6009.31	6011.21	1.03	0.00	6012.82	6013.51	6013.59	1.06	6014.66
SDMH 60	6011.34	6022.37	0.04	0.00	6013.55	6024.67	6017.16	8.66	6025.82
SDMH 62	6022.45	6028.38	1.03	0.00	6026.07	6030.68	6026.84	4.98	6031.83
SDMH 63	6028.53	6031.00	0.09	0.00	6030.77	6033.30	6033.36	1.09	6034.45
SDMH 152	6031.10	6033.32	0.06	0.00	6033.36	6035.62	6035.17	1.60	6036.77
SDMH 64	6033.47	6034.10	0.09	0.00	6035.71	6036.40	6037.08	0.47	6037.55
SDMH 65	6034.29	6035.10	0.92	0.00	6037.70	6038.15	6038.47	0.45	6038.93
SDMH 89	6035.29	6035.80	0.04	0.00	6038.19	6038.19	6038.98	0.27	6039.25
SDMH 151	6035.90	6036.40	0.09	0.00	6038.27	6038.70	6039.51	0.34	6039.85
SDMH 66	6036.59	6037.10	0.09	0.00	6038.79	6039.40	6040.20	0.35	6040.55
SDMH 150	6037.24	6037.80	0.09	0.00	6039.49	6040.10	6040.85	0.40	6041.25
SDMH 67	6037.95	6038.50	0.09	0.00	6040.19	6040.80	6041.56	0.39	6041.95
SDMH 68	6038.60	6039.00	0.04	0.00	6040.84	6041.30	6042.21	0.24	6042.45
SDIN 47	6039.16	6039.20	0.53	0.00	6042.58	6042.61	6042.98	0.03	6043.01
SDIN 46	6039.17	6039.30	0.53	0.00	6042.58	6042.67	6042.98	0.10	6043.08
SDIN 40	5977.17	5977.31	3.04	0.00	5983.44	5983.59	5985.75	0.15	5985.90

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 51	92.00	5.00	6.00	7.83	0.00	0.00	0.00	13.76	9.30	3.96	139.03	Sewer Too Shallow
SDMH 52	237.00	4.00	6.00	6.67	14.36	9.01	4.85	9.58	6.62	2.46	531.77	
SDMH 53	38.00	4.00	6.00	6.67	9.18	6.42	2.26	8.60	6.13	1.97	60.68	Sewer Too Shallow
SDMH 54	146.00	4.00	6.00	6.67	8.24	5.95	1.79	7.92	5.79	1.63	214.46	Sewer Too Shallow
SDMH 55	281.00	4.00	6.00	6.67	7.49	5.58	1.41	7.20	5.43	1.27	383.26	Sewer Too Shallow
SDMH 56	169.00	4.00	6.00	6.67	6.83	5.25	1.08	9.48	6.57	2.41	252.86	Sewer Too Shallow
SDMH 57	38.00	4.00	6.00	6.67	9.08	6.37	2.21	7.62	5.64	1.48	57.56	Sewer Too Shallow
SDMH 58	263.00	4.00	6.00	6.67	7.24	5.45	1.29	13.16	8.41	4.25	501.98	Sewer Too Shallow
SDMH 59	38.00	4.00	6.00	6.67	12.78	8.22	4.06	9.52	6.59	2.43	77.52	
SDMH 60	298.00	4.00	6.00	6.67	9.25	6.46	2.29	9.68	6.67	2.51	504.90	
SDMH 62	258.00	4.00	6.00	6.67	9.53	6.60	2.43	9.52	6.59	2.43	439.65	
SDMH 63	99.00	4.00	6.00	6.67	9.23	6.45	2.28	14.22	8.94	4.78	217.28	
SDMH 152	139.00	4.00	6.00	6.67	14.03	8.85	4.68	26.22	14.94	10.78	689.17	
SDMH 64	63.00	4.00	6.00	6.67	25.92	14.79	10.63	31.98	17.82	13.66	548.69	
SDMH 65	81.00	4.00	6.00	6.67	31.60	17.63	13.47	26.56	15.11	10.95	709.00	
SDMH 89	51.00	4.00	6.00	6.67	26.18	14.92	10.76	23.84	13.75	9.59	340.10	
SDMH 151	50.00	4.00	6.00	6.67	23.64	13.65	9.49	21.36	12.51	8.35	278.19	
SDMH 66	51.00	4.00	6.00	6.67	20.98	12.32	8.16	18.66	11.16	7.00	230.21	
SDMH 150	56.00	4.00	6.00	6.67	18.38	11.02	6.86	15.82	9.74	5.58	200.86	
SDMH 67	55.00	4.00	6.00	6.67	15.52	9.59	5.43	13.04	8.35	4.19	152.16	
SDMH 68	40.00	4.00	6.00	6.67	12.84	8.25	4.09	11.60	7.63	3.47	90.02	
SDIN 47	9.00	3.50	6.00	6.08	11.79	7.44	3.85	11.36	7.22	3.64	17.38	
SDIN 46	26.00	3.50	6.00	6.08	11.76	7.42	3.84	11.16	7.12	3.54	49.58	
SDIN 40	9.00	4.00	6.00	6.67	14.17	8.92	4.75	13.52	8.59	4.43	23.76	

Total earth volume for sewer trenches = 6710 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.

- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: $(\text{equivalent diameter in inches}/12)+1$ inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 Run Date: 4/9/2018 3:27:21 PM	UDSewer Results Summary Project Title: Trails at Crowfoot Pond E (Basin E-2) 2 Year Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5977.94

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall Pond E_1	5973.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 49	5985.24	23.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 48	5986.93	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 47	5987.92	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 46	5988.63	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 157	5990.48	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 45	5989.97	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 158	5990.68	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 44	5991.38	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 43	5993.65	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 42	6001.13	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 64	6000.95	3.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 41	6018.88	18.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 40	6031.08	14.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 34	6030.90	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 35	6030.90	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 156	6031.76	9.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 155	6035.77	9.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 65	6035.58	5.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 154	6044.01	4.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 153	6045.71	4.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 66	6045.58	4.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 36	6018.70	5.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 38	5985.06	3.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution					Total Design Flow				Comment
	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Outfall Pond E_1	0.00	0.00	0.00	0.00	0.00	5.32	4.42	0.31	23.50	Surface Water Present (Upstream)
SDMH 49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.50	Surface Water Present (Downstream)
SDMH 48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 157	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 158	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDMH 42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.89	
SDIN 64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.78	
SDMH 41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.85	
SDMH 40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.28	
SDIN 34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
SDIN 35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	
SDMH 156	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.80	
SDMH 155	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.80	
SDIN 65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.39	
SDMH 154	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.81	
SDMH 153	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.81	
SDIN 66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.81	
SDIN 36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.64	
SDIN 38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.09	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 49	90.00	5975.97	1.0	5976.87	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 48	172.00	5977.07	2.0	5980.51	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 47	97.00	5980.71	1.5	5982.16	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 46	69.00	5982.37	1.5	5983.40	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 157	67.00	5983.60	1.5	5984.60	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 45	64.00	5984.79	1.5	5985.75	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 158	70.00	5985.77	1.5	5986.82	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 44	60.00	5986.82	1.5	5987.72	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 43	97.00	5987.93	1.5	5989.38	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 42	178.00	5989.57	3.5	5995.80	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 64	9.00	5996.41	1.0	5996.50	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 41	366.00	5995.98	5.0	6014.28	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 40	500.00	6014.22	2.4	6026.22	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 34	25.00	6026.52	2.0	6027.02	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 35	9.00	6026.52	2.0	6026.70	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 156	54.00	6026.42	2.0	6027.50	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 155	151.00	6027.62	3.3	6032.60	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 65	9.00	6032.81	0.5	6032.85	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 154	164.00	6032.80	4.0	6039.36	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 153	56.00	6039.58	5.0	6042.38	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 66	7.00	6042.58	1.0	6042.65	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 36	9.00	6014.58	1.0	6014.67	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 38	9.00	5977.17	1.6	5977.31	0.013	0.38	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 49	41.13	8.38	19.80	6.84	16.25	8.66	1.46	Supercritical	23.50	0.00	
SDMH 48	32.08	10.21	20.06	7.81	14.55	10.99	1.92	Supercritical	21.89	0.00	
SDMH 47	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 46	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 157	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 45	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 158	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 44	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 43	27.78	8.84	20.06	7.81	16.06	9.80	1.58	Supercritical	21.89	0.00	
SDMH 42	42.44	13.51	20.06	7.81	12.22	13.61	2.68	Supercritical	21.89	0.00	
SDIN 64	22.68	7.22	8.17	4.00	6.63	5.35	1.50	Supercritical Jump	3.78	1.50	
SDMH 41	50.72	16.15	18.75	7.16	10.13	14.95	3.30	Supercritical	18.85	0.00	
SDMH 40	35.14	11.19	16.34	6.27	10.65	10.61	2.27	Supercritical	14.28	0.00	
SDIN 34	14.90	8.43	7.18	3.80	4.99	6.26	2.02	Supercritical Jump	2.50	9.35	
SDIN 35	14.90	8.43	7.18	3.80	4.99	6.26	2.02	Pressurized	2.50	9.00	
SDMH 156	32.08	10.21	13.43	5.42	9.10	8.97	2.11	Supercritical	9.80	0.00	
SDMH 155	41.21	13.12	13.43	5.42	7.97	10.75	2.72	Supercritical	9.80	0.00	
SDIN 65	7.45	4.21	10.74	4.90	11.35	4.59	0.90	Subcritical	5.39	0.00	
SDMH 154	21.07	11.92	10.12	4.70	5.85	9.66	2.86	Supercritical	4.81	0.00	
SDMH 153	23.55	13.33	10.12	4.70	5.52	10.47	3.20	Supercritical	4.81	0.00	
SDIN 66	10.53	5.96	10.12	4.70	8.54	5.83	1.38	Supercritical	4.81	0.00	
SDIN 36	22.68	7.22	10.06	4.51	8.16	5.99	1.50	Supercritical Jump	5.64	7.91	
SDIN 38	28.69	9.13	7.36	3.78	5.32	5.97	1.88	Supercritical	3.09	4.46	

Jump

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft ²)	Comment
SDMH 49	23.50	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
SDMH 48	21.89	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
SDMH 47	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 46	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 157	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 45	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 158	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 44	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 43	21.89	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 42	21.89	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
SDIN 64	3.78	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 41	18.85	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 40	14.28	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 34	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 35	2.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 156	9.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 155	9.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 65	5.39	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 154	4.81	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
										543

SDMH 153	4.81	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 66	4.81	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 36	5.64	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 38	3.09	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5977.94

Element Name	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 49	5975.97	5976.87	0.00	0.00	5977.94	5978.52	5978.49	0.76	5979.25
SDMH 48	5977.07	5980.51	0.04	0.00	5978.56	5982.18	5980.16	2.97	5983.13
SDMH 47	5980.71	5982.16	0.08	0.00	5982.26	5983.83	5983.53	1.24	5984.78
SDMH 46	5982.37	5983.40	0.08	0.00	5983.91	5985.07	5985.19	0.82	5986.02
SDMH 157	5983.60	5984.60	0.08	0.00	5985.15	5986.27	5986.42	0.79	5987.22
SDMH 45	5984.79	5985.75	0.08	0.00	5986.35	5987.42	5987.62	0.75	5988.37
SDMH 158	5985.77	5986.82	0.08	0.00	5987.50	5988.49	5988.60	0.84	5989.44
SDMH 44	5986.82	5987.72	0.08	0.00	5988.57	5989.39	5989.65	0.69	5990.34
SDMH 43	5987.93	5989.38	0.08	0.00	5989.47	5991.05	5990.75	1.24	5992.00
SDMH 42	5989.57	5995.80	0.08	0.00	5991.13	5997.47	5993.47	4.95	5998.42
SDIN 64	5996.41	5996.50	0.03	0.00	5998.42	5998.42	5998.45	0.00	5998.45
SDMH 41	5995.98	6014.28	0.03	0.00	5997.50	6015.84	6000.30	16.34	6016.64
SDMH 40	6014.22	6026.22	0.02	0.00	6015.86	6027.58	6016.85	11.34	6028.19
SDIN 34	6026.52	6027.02	0.04	0.00	6028.20	6028.20	6028.23	0.01	6028.25
									544

SDIN 35	6026.52	6026.70	0.04	0.00	6028.20	6028.21	6028.23	0.01	6028.24
SDMH 156	6026.42	6027.50	0.20	0.00	6027.78	6028.62	6028.43	0.65	6029.08
SDMH 155	6027.62	6032.60	0.20	0.00	6028.82	6033.72	6030.08	4.10	6034.18
SDIN 65	6032.81	6032.85	0.19	0.00	6034.21	6034.23	6034.37	0.02	6034.39
SDMH 154	6032.80	6039.36	0.01	0.00	6033.73	6040.20	6034.74	5.81	6040.55
SDMH 153	6039.58	6042.38	0.01	0.00	6040.21	6043.22	6041.74	1.83	6043.57
SDIN 66	6042.58	6042.65	0.15	0.00	6043.37	6043.49	6043.82	0.02	6043.84
SDIN 36	6014.58	6014.67	0.07	0.00	6016.65	6016.66	6016.70	0.00	6016.71
SDIN 38	5977.17	5977.31	0.01	0.00	5979.24	5979.24	5979.25	0.00	5979.25

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 49	90.00	3.50	6.00	6.08	0.00	0.00	0.00	15.24	9.16	5.58	127.82	Sewer Too Shallow
SDMH 48	172.00	3.00	4.00	5.50	15.34	8.75	5.92	11.84	7.00	4.17	385.14	
SDMH 47	97.00	3.00	4.00	5.50	11.45	6.81	3.98	10.52	6.34	3.51	157.15	
SDMH 46	69.00	3.00	4.00	5.50	10.11	6.14	3.31	9.46	5.81	2.98	95.79	
SDMH 157	67.00	3.00	4.00	5.50	9.07	5.62	2.79	10.76	6.46	3.63	94.98	
SDMH 45	64.00	3.00	4.00	5.50	10.38	6.27	3.44	7.44	4.80	1.97	80.37	Sewer Too Shallow
SDMH 158	70.00	3.00	4.00	5.50	7.40	4.78	1.95	6.72	4.44	1.61	67.43	Sewer Too Shallow
SDMH 44	60.00	3.00	4.00	5.50	6.72	4.44	1.61	6.32	4.24	1.41	53.69	Sewer Too Shallow
SDMH 43	97.00	3.00	4.00	5.50	5.91	4.04	1.21	7.54	4.85	2.02	89.79	Sewer Too Shallow

SDMH 42	178.00	3.00	4.00	5.50	7.16	4.66	1.83	9.66	5.91	3.08	208.28	Sewer Too Shallow
SDIN 64	9.00	3.00	4.00	5.50	8.44	5.30	2.47	7.90	5.03	2.20	10.08	
SDMH 41	366.00	3.00	4.00	5.50	9.30	5.73	2.90	8.20	5.18	2.35	443.77	
SDMH 40	500.00	3.00	4.00	5.50	8.32	5.24	2.41	8.72	5.44	2.61	586.64	
SDIN 34	25.00	2.50	4.00	4.92	8.62	5.10	2.85	7.26	4.42	2.17	23.90	
SDIN 35	9.00	2.50	4.00	4.92	8.62	5.10	2.85	7.90	4.74	2.49	9.01	
SDMH 156	54.00	3.00	4.00	5.50	8.32	5.24	2.41	7.52	4.84	2.01	58.48	
SDMH 155	151.00	3.00	4.00	5.50	7.29	4.73	1.89	5.50	3.75	0.92	118.49	Sewer Too Shallow
SDIN 65	9.00	2.50	4.00	4.92	5.43	3.51	1.26	4.96	3.27	1.02	5.57	Sewer Too Shallow
SDMH 154	164.00	2.50	4.00	4.92	5.44	3.51	1.26	8.80	5.19	2.94	141.62	Sewer Too Shallow
SDMH 153	56.00	2.50	4.00	4.92	8.36	4.97	2.72	6.16	3.87	1.62	48.56	Sewer Too Shallow
SDIN 66	7.00	2.50	4.00	4.92	5.76	3.67	1.42	5.36	3.47	1.22	4.58	Sewer Too Shallow
SDIN 36	9.00	3.00	4.00	5.50	7.60	4.88	2.05	7.06	4.61	1.78	8.99	Sewer Too Shallow
SDIN 38	9.00	3.00	4.00	5.50	15.15	8.66	5.82	14.50	8.33	5.50	22.83	

Total earth volume for sewer trenches = 2843 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 Run Date: 4/9/2018 3:06:39 PM	UDSewer Results Summary Project Title: Trails at Crowfoot Pond C (Basin E-2) Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5977.94

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond C Outfall	5974.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 49	5985.24	41.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 38	5985.06	41.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

		Local Contribution				Total Design Flow				Comment
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Pond C Outfall	0.00	0.00	0.00	0.00	0.00	3.43	12.02	0.11	41.30	Surface Water Present (Upstream)
SDMH 49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.30	Surface Water Present (Downstream)
SDIN 38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.30	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 49	88.00	5975.99	1.0	5976.87	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 38	9.00	5977.17	1.6	5977.31	0.013	0.38	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 49	22.68	7.22	24.00	13.15	24.00	13.15	0.00	Pressurized	41.30	88.00	
SDIN 38	28.69	9.13	24.00	13.15	24.00	13.15	0.00	Pressurized	41.30	9.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft ²)	Comment
SDMH 49	41.30	CIRCULAR	24.00 in	24.00 in	33.00 in	33.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDIN 38	41.30	CIRCULAR	24.00 in	24.00 in	30.00 in	30.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5977.94

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 49	5975.99	5976.87	0.00	0.00	5977.99	5980.91	5980.67	2.92	5983.59
SDIN 38	5977.17	5977.31	1.02	0.00	5981.93	5982.23	5984.61	0.30	5984.91

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 49	88.00	3.00	4.00	5.50	0.00	0.00	0.00	15.74	8.95	6.12	122.97	Sewer Too Shallow
SDIN 38	9.00	3.00	4.00	5.50	15.15	8.66	5.82	14.50	8.33	5.50	22.83	

Total earth volume for sewer trenches = 146 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 Run Date: 4/9/2018 3:46:46 PM	UDSewer Results Summary Project Title: Trails at Crowfoot Pond E Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5977.94

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall Pond E_1	5973.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 39	5984.90	9.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 50	5985.08	4.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 143	5986.08	4.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 68	5985.74	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 95	5992.44	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 94	5995.66	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 93	5998.30	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 92	6001.45	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 91	6005.56	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 103	6006.38	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

		Local Contribution				Total Design Flow					
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment	
Outfall Pond E_1	0.00	0.00	0.00	0.00	0.00	2.21	4.35	0.51	9.60	Surface Water Present (Upstream)	
SDIN 39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.60	Surface Water Present (Downstream)	
SDMH 50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.90		
SDMH 143	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.90		
SDIN 68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.40		
SDMH 95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08		

SDMH 94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	
SDMH 93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	
SDMH 92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	
SDMH 91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	
SDIN 103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDIN 39	60.00	5976.00	1.0	5976.60	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
SDMH 50	25.00	5976.83	0.5	5976.95	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 143	36.00	5977.17	0.5	5977.35	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 68	17.00	5977.56	2.0	5977.90	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 95	161.00	5977.97	4.6	5985.38	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 94	68.00	5985.58	5.0	5988.98	0.013	0.11	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 93	54.00	5989.20	5.0	5991.90	0.013	0.11	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 92	64.00	5992.12	5.0	5995.32	0.013	0.11	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 91	144.00	5995.50	5.0	6002.70	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 103	9.00	6002.90	1.0	6002.99	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

		Full Flow Capacity		Critical Flow		Normal Flow					
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDIN 39	41.13	8.38	12.41	5.01	9.86	6.83	1.56	Supercritical	9.60	0.00	
SDMH 50	7.45	4.21	10.21	4.73	10.65	4.50	0.92	Subcritical	4.90	0.00	

SDMH 143	7.45	4.21	10.21	4.73	10.65	4.50	0.92	Subcritical	4.90	0.00	
SDIN 68	14.90	8.43	8.44	4.18	5.85	6.83	2.02	Supercritical	3.40	0.00	
SDMH 95	22.59	12.78	6.53	3.59	3.69	7.98	3.03	Supercritical	2.08	0.00	
SDMH 94	23.55	13.33	6.53	3.59	3.62	8.22	3.16	Supercritical	2.08	0.00	
SDMH 93	23.55	13.33	6.53	3.59	3.62	8.22	3.16	Supercritical	2.08	0.00	
SDMH 92	23.55	13.33	6.53	3.59	3.62	8.22	3.16	Supercritical	2.08	0.00	
SDMH 91	23.55	13.33	6.53	3.59	3.62	8.22	3.16	Supercritical	2.08	0.00	
SDIN 103	10.53	5.96	6.53	3.59	5.42	4.64	1.43	Supercritical	2.08	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft ²)	Comment
SDIN 39	9.60	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
SDMH 50	4.90	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 143	4.90	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 68	3.40	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 95	2.08	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 94	2.08	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 93	2.08	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 92	2.08	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 91	2.08	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 103	2.08	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.

- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5977.94

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 39	5976.00	5976.60	0.00	0.00	5977.94	5977.94	5978.03	0.11	5978.14
SDMH 50	5976.83	5976.95	0.01	0.00	5977.97	5978.00	5978.15	0.07	5978.22
SDMH 143	5977.17	5977.35	0.01	0.00	5978.02	5978.26	5978.37	0.19	5978.56
SDIN 68	5977.56	5977.90	0.08	0.00	5978.33	5978.60	5978.77	0.10	5978.87
SDMH 95	5977.97	5985.38	0.00	0.00	5978.28	5985.92	5979.27	6.85	5986.12
SDMH 94	5985.58	5988.98	0.00	0.00	5985.93	5989.52	5986.93	2.79	5989.72
SDMH 93	5989.20	5991.90	0.00	0.00	5989.53	5992.44	5990.55	2.09	5992.64
SDMH 92	5992.12	5995.32	0.00	0.00	5992.45	5995.86	5993.47	2.59	5996.06
SDMH 91	5995.50	6002.70	0.00	0.00	5995.87	6003.24	5996.85	6.59	6003.44
SDIN 103	6002.90	6002.99	0.03	0.00	6003.35	6003.53	6003.69	0.05	6003.73

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = $Bend\ K * V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g) - Junction\ Loss\ K * V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

	Downstream	Upstream	
			556

Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 39	60.00	3.50	6.00	6.08	0.00	0.00	0.00	15.10	9.09	5.51	84.04	Sewer Too Shallow
SDMH 50	25.00	2.50	4.00	4.92	15.65	8.62	6.37	15.76	8.67	6.42	66.29	
SDMH 143	36.00	2.50	4.00	4.92	15.32	8.45	6.20	16.96	9.27	7.02	100.31	
SDIN 68	17.00	2.50	4.00	4.92	16.54	9.06	6.81	15.18	8.38	6.13	45.92	
SDMH 95	161.00	2.50	4.00	4.92	15.71	8.65	6.40	13.62	7.60	5.35	381.52	
SDMH 94	68.00	2.50	4.00	4.92	13.22	7.40	5.15	12.86	7.22	4.97	132.11	
SDMH 93	54.00	2.50	4.00	4.92	12.42	7.00	4.75	12.30	6.94	4.69	96.26	
SDMH 92	64.00	2.50	4.00	4.92	11.86	6.72	4.47	11.76	6.67	4.42	106.21	
SDMH 91	144.00	2.50	4.00	4.92	11.40	6.49	4.24	5.22	3.40	1.15	157.80	Sewer Too Shallow
SDIN 103	9.00	2.50	4.00	4.92	0.00	3.20	0.95	6.28	3.93	1.68	5.14	Sewer Too Shallow

Total earth volume for sewer trenches = 1176 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program: UDSEWER Math Model Interface 2.1.1.4 Run Date: 4/9/2018 3:45:21 PM	UDSewer Results Summary Project Title: Trails at Crowfoot Pond C (Basin E-3) Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5977.94

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond C (Basin E) Outfall	5974.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 39	5984.90	77.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

		Local Contribution				Total Design Flow				Comment
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Pond C (Basin E) Outfall	0.00	0.00	0.00	0.00	0.00	6.44	12.07	0.06	77.70	Surface Water Present (Upstream)
SDIN 39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	77.70	Surface Water Present (Downstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDIN 39	60.00	5976.00	1.0	5976.60	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element	Flow	Velocity	Depth	Velocity	Depth	Velocity	Froude	Flow	Flow	Surcharged	Comment
											559

Name	(cfs)	(fps)	(in)	(fps)	(in)	(fps)	Number	Condition	(cfs)	Length (ft)	
SDIN 39	41.13	8.38	30.00	15.83	30.00	15.83	0.00	Pressurized	77.70	60.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDIN 39	77.70	CIRCULAR	30.00 in	30.00 in	42.00 in	42.00 in	30.00 in	30.00 in	4.91	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5977.94

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 39	5976.00	5976.60	0.00	0.00	5978.50	5980.64	5982.39	2.14	5984.53

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 39	60.00	3.50	6.00	6.08	0.00	0.00	0.00	15.10	9.09	5.51	84.04	Sewer Too Shallow

Total earth volume for sewer trenches = 84 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
1/3/2018 1:46:02 PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond D (Basin F-2a)

Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2

Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97

Rainfall Constant "A": 28.5

Rainfall Constant "B": 10

Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20

Maximum Rural Overland Len. (ft): 500

Maximum Urban Overland Len. (ft): 300

Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00

Maximum Depth to Rise Ratio: 0.90

Maximum Flow Velocity (fps): 18.0

Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5980.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	5977.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN	5997.40	13.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

58										
SDIN 57	5997.40	10.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 6 (AREA INLET)	5993.02	5.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 4 (AREA INLET)	6009.10	5.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 177	6020.00	5.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 105	6028.02	5.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 106	6027.26	2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 89	6027.03	2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 88	6027.85	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	3.24	4.22	0.92	13.70	Surface Water Present (Upstream)
SDIN 58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.70	Surface Water Present (Downstream)
SDIN 57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.10	
SDIN 6 (AREA INLET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.40	
SDIN 4 (AREA INLET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.40	
SDMH 177	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.40	
SDMH 105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.40	
SDMH 106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.80	
SDIN 89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.80	
SDIN 88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.60	

Sewer Input Summary:

	Elevation				Loss Coefficients			Given Dimensions		
Element	Sewer	Downstream	Slope	Upstream	Mannings	Bend	Lateral	Cross	Rise	Span

Name	Length (ft)	Invert (ft)	(%)	Invert (ft)	n	Loss	Loss	Section	(ft or in)	(ft or in)
SDIN 58	241.00	5974.91	4.6	5986.00	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 57	34.00	5986.88	3.0	5987.90	0.013	0.29	0.00	CIRCULAR	0.00 in	0.00 in
SDIN 6 (AREA INLET)	44.00	5987.89	2.9	5989.17	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 4 (AREA INLET)	395.00	5989.52	4.2	6006.11	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 177	204.00	6006.30	4.9	6016.30	0.013	0.09	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 105	90.00	6016.50	5.5	6021.45	0.013	0.29	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 106	100.00	6021.67	1.2	6022.87	0.013	0.46	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 89	11.00	6023.07	1.0	6023.18	0.013	1.06	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 88	9.00	6022.64	3.1	6022.92	0.013	0.83	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDIN 58	48.65	15.49	15.99	6.16	8.71	13.30	3.20	Supercritical Jump	13.70	72.87	
SDIN 57	18.24	10.32	14.69	6.54	9.56	10.59	2.34	Supercritical	10.10	0.00	
SDIN 6 (AREA INLET)	38.63	12.30	9.84	4.45	6.06	8.67	2.55	Supercritical	5.40	0.00	
SDIN 4 (AREA INLET)	46.49	14.80	9.84	4.45	5.52	9.88	3.06	Supercritical	5.40	0.00	
SDMH 177	50.21	15.98	9.84	4.45	5.31	10.44	3.30	Supercritical	5.40	0.00	
SDMH 105	53.20	16.93	9.84	4.45	5.16	10.88	3.49	Supercritical	5.40	0.00	
SDMH 106	24.85	7.91	7.00	3.67	5.44	5.24	1.63	Supercritical	2.80	0.00	
SDIN 89	22.68	7.22	7.00	3.67	5.69	4.91	1.49	Supercritical	2.80	0.00	
SDIN 88	18.54	10.49	7.33	3.84	4.55	7.40	2.51	Supercritical	2.60	0.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft ²)	Comment
SDIN 58	13.70	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 57	10.10	CIRCULAR	0.00 in	0.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 6 (AREA INLET)	5.40	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 4 (AREA INLET)	5.40	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 177	5.40	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 105	5.40	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 106	2.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 89	2.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 88	2.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5980.00

Element Name	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 58	5974.91	5986.00	0.00	0.00	5980.00	5987.33	5980.30	7.63	5987.92
SDIN 57	5986.88	5987.90	0.15	0.00	5987.68	5989.12	5989.42	0.37	5989.79
SDIN 6 (AREA INLET)	5987.89	5989.17	0.00	0.00	5989.74	5989.99	5989.79	0.51	5990.30
SDIN 4 (AREA INLET)	5989.52	6006.11	0.00	0.00	5989.99	6006.93	5991.50	15.74	6007.24
SDMH 177	6006.30	6016.30	0.00	0.00	6006.93	6017.12	6008.44	8.99	6017.43
SDMH 105	6016.50	6021.45	0.01	0.00	6017.13	6022.27	6018.77	3.81	6022.58
SDMH 106	6021.67	6022.87	0.01	0.00	6022.50	6023.45	6022.58	1.08	6023.66
SDIN 89	6023.07	6023.18	0.01	0.00	6023.54	6023.76	6023.92	0.05	6023.97
SDIN 88	6022.64	6022.92	0.03	0.00	6023.02	6023.77	6023.87	0.00	6023.87

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.

- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 58	241.00	3.00	4.00	5.50	0.00	3.63	0.80	21.80	11.98	9.15	660.14	Sewer Too Shallow
SDIN 57	34.00	2.50	4.00	4.92	20.54	11.06	8.81	18.50	10.04	7.79	132.79	
SDIN 6 (AREA INLET)	44.00	3.00	4.00	5.50	18.01	10.09	7.26	6.70	4.43	1.60	97.27	Sewer Too Shallow
SDIN 4 (AREA INLET)	395.00	3.00	4.00	5.50	6.00	4.08	1.25	5.50	3.57	0.74	278.72	Sewer Too Shallow
SDMH 177	204.00	3.00	4.00	5.50	0.00	3.38	0.55	6.40	4.28	1.45	148.63	Sewer Too Shallow
SDMH 105	90.00	3.00	4.00	5.50	6.00	4.08	1.25	12.14	7.15	4.32	121.48	Sewer Too Shallow
SDMH 106	100.00	3.00	4.00	5.50	11.70	6.93	4.10	7.78	4.97	2.14	141.47	
SDIN 89	11.00	3.00	4.00	5.50	7.38	4.77	1.94	6.70	4.43	1.60	10.57	Sewer Too Shallow
SDIN 88	9.00	2.50	4.00	4.92	10.26	5.92	3.67	9.36	5.47	3.22	11.35	

Total earth volume for sewer trenches = 1602 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
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Model Interface
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Run Date:
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UDSewer Results Summary

Project Title: Trails at Crowfoot Pond D (Basin F-2a)
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100

Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97

Rainfall Constant "A": 28.5

Rainfall Constant "B": 10

Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20

Maximum Rural Overland Len. (ft): 500

Maximum Urban Overland Len. (ft): 300

Used UDFCD Tc. Maximum: Yes

Size Constraints

Minimum Sewer Size (in): 18.00

Maximum Depth to Rise Ratio: 0.90

Maximum Flow Velocity (fps): 18.0

Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5979.06

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	5977.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN	5997.40	69.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

567

58										
SDIN 57	5997.40	42.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 6 (AREA INLET)	5993.50	29.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 4 (AREA INLET)	6009.10	26.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 171	6020.00	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 105	6028.02	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 106	6027.26	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 89	6027.03	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution					Total Design Flow				Comment
	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Outfall	0.00	0.00	0.00	0.00	0.00	15.63	4.43	0.28	69.20	Surface Water Present (Upstream)
SDIN 58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.20	Surface Water Present (Downstream)
SDIN 57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.10	
SDIN 6 (AREA INLET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.90	
SDIN 4 (AREA INLET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.60	
SDMH 171	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.00	
SDMH 105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.00	
SDMH 106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.00	
SDIN 89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation			Loss Coefficients			Given Dimensions		
		Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Manning's n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDIN 58	241.00	5974.81	3.4	5983.00	0.013	0.03	0.00	CIRCULAR	30.00 568	30.00

									in	in
SDIN 57	34.00	5987.02	2.0	5987.70	0.013	0.29	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 6 (AREA INLET)	44.00	5987.89	2.9	5989.17	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 4 (AREA INLET)	395.00	5989.52	4.2	6006.11	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 171	204.00	6006.30	4.9	6016.30	0.013	0.09	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 105	90.00	6016.50	5.5	6021.45	0.013	0.29	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 106	100.00	6021.67	1.2	6022.87	0.013	0.46	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 89	11.00	6023.07	1.0	6023.18	0.013	1.06	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDIN 58	75.84	15.45	29.25	14.19	22.51	17.51	2.28	Pressurized	69.20	241.00	
SDIN 57	32.08	10.21	24.00	13.40	24.00	13.40	0.00	Pressurized	42.10	34.00	
SDIN 6 (AREA INLET)	38.63	12.30	22.33	9.82	15.86	13.58	2.22	Pressurized	29.90	44.00	
SDIN 4 (AREA INLET)	46.49	14.80	21.59	8.93	13.01	15.29	2.89	Supercritical Jump	26.60	43.80	
SDMH 171	50.21	15.98	20.82	8.29	11.69	15.80	3.20	Supercritical	24.00	0.00	
SDMH 105	53.20	16.93	20.82	8.29	11.30	16.50	3.41	Supercritical	24.00	0.00	
SDMH 106	24.85	7.91	20.82	8.29	18.97	9.01	1.24	Pressurized	24.00	100.00	
SDIN 89	22.68	7.22	24.00	7.64	24.00	7.64	0.00	Pressurized	24.00	11.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft ²)	Comment
SDIN 58	69.20	CIRCULAR	30.00	30.00	30.00	30.00	30.00	30.00	4.91	

			in	in	in	in	in	in		
SDIN 57	42.10	CIRCULAR	24.00 in	24.00 in	27.00 in	27.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
SDIN 6 (AREA INLET)	29.90	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDIN 4 (AREA INLET)	26.60	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
SDMH 171	24.00	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
SDMH 105	24.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 106	24.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDIN 89	24.00	CIRCULAR	24.00 in	24.00 in	27.00 in	27.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5979.06

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 58	5974.81	5983.00	0.00	0.00	5979.06	5985.88	5982.15	6.82	5988.97
SDIN 57	5987.02	5987.70	0.81	0.00	5989.02	5990.19	5991.81	1.17	5992.98
SDIN 6 (AREA	5987.89	5989.17	0.07	0.00	5991.64	5992.41	5993.05	0.76	5993.81

570

INLET)									
SDIN 4 (AREA INLET)	5989.52	6006.11	0.06	0.00	5992.76	6007.91	5993.87	15.28	6009.15
SDMH 171	6006.30	6016.30	0.08	0.00	6007.99	6018.03	6011.16	7.95	6019.10
SDMH 105	6016.50	6021.45	0.26	0.00	6018.30	6023.18	6021.67	2.58	6024.25
SDMH 106	6021.67	6022.87	0.42	0.00	6023.76	6024.88	6024.67	1.12	6025.79
SDIN 89	6023.07	6023.18	0.96	0.00	6025.84	6025.97	6026.75	0.12	6026.87

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 58	241.00	3.50	6.00	6.08	0.00	3.95	0.36	27.30	15.19	11.61	1011.98	Sewer Too Shallow
SDIN 57	34.00	3.00	4.00	5.50	19.76	10.96	8.13	18.40	10.28	7.45	131.78	
SDIN 6 (AREA INLET)	44.00	3.00	4.00	5.50	18.01	10.09	7.26	7.66	4.91	2.08	100.07	
SDIN 4 (AREA INLET)	395.00	3.00	4.00	5.50	6.96	4.56	1.73	5.50	3.57	0.74	301.48	Sewer Too Shallow
SDMH 171	204.00	3.00	4.00	5.50	0.00	3.38	0.55	6.40	4.28	1.45	148.63	Sewer Too Shallow
SDMH 105	90.00	3.00	4.00	5.50	6.00	4.08	1.25	12.14	7.15	4.32	121.48	Sewer Too Shallow
SDMH 106	100.00	3.00	4.00	5.50	11.70	6.93	4.10	7.78	4.97	2.14	141.47	
SDIN 89	11.00	3.00	4.00	5.50	7.38	4.77	1.94	6.70	4.43	1.60	10.57	Sewer Too Shallow

Total earth volume for sewer trenches = 1967 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches

- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
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Model Interface
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Run Date:
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UDSewer Results Summary

Project Title: Trails at Crowfoot Pond C Outfall - 2 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.99
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5966.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond C Outfall	5969.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
									573	

Pond C Outfall Pipe	5977.94	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond C Outfall	0.00	0.00	0.00	0.00	0.00	0.31	3.19	6.01	1.00	
Pond C Outfall Pipe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pond C Outfall Pipe	51.00	5966.09	0.8	5966.50	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pond C Outfall Pipe	59.82	8.46	3.71	2.60	3.24	3.17	1.31	Supercritical	1.00	0.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pond C Outfall Pipe	1.00	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.

- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5966.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pond C Outfall Pipe	5966.09	5966.50	0.00	0.00	5966.36	5966.81	5966.52	0.40	5966.91

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = $Bend\ K * V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g) - Junction\ Loss\ K * V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

Element Name					Downstream			Upstream				
	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
Pond C Outfall Pipe	51.00	4.00	6.00	6.67	0.00	3.92	0.00	20.88	12.27	8.11	149.67	Sewer Too Shallow

Total earth volume for sewer trenches = 150 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
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Run Date:
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UDSewer Results Summary

Project Title: Trails at Crowfoot Pond C Outfall - 100 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5966.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond C Outfall	5969.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
									576	

Pond C Outfall Pipe	5977.94	106.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond C Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	106.50	
Pond C Outfall Pipe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	106.50	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pond C Outfall Pipe	51.00	5966.09	0.8	5966.50	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pond C Outfall Pipe	59.82	8.46	36.00	15.07	36.00	15.07	0.00	Pressurized	106.50	51.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pond C Outfall Pipe	106.50	CIRCULAR	36.00 in	36.00 in	48.00 in	48.00 in	36.00 in	36.00 in	7.07	Existing height is smaller than the suggested

										height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5966.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pond C Outfall Pipe	5966.09	5966.50	0.00	0.00	5969.09	5970.39	5972.62	1.29	5973.91

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
Pond C Outfall Pipe	51.00	4.00	6.00	6.67	0.00	3.92	0.00	20.88	12.27	8.11	149.67	Sewer Too Shallow

Total earth volume for sewer trenches = 150 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches

- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

POND D

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
1/31/2018 2:25:32
PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond D (Pond F-1)

Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2

Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97

Rainfall Constant "A": 28.5

Rainfall Constant "B": 10

Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20

Maximum Rural Overland Len. (ft): 500

Maximum Urban Overland Len. (ft): 300

Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00

Maximum Depth to Rise Ratio: 0.90

Maximum Flow Velocity (fps): 18.0

Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5993.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	5988.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH	6006.86	36.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

581

84										
SDMH 83	6017.46	36.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 82	6026.89	36.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 102	6030.61	36.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 81	6032.85	36.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 80	6037.91	9.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 79	6038.44	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 54	6038.24	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 100	6040.84	8.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 95	6040.65	4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 101	6046.30	4.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 94	6046.11	4.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 78	6033.64	29.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 93	6033.43	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 76	6041.85	27.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 75	6049.80	27.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 74	6057.40	27.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 103	6064.52	27.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 73	6066.22	27.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 72	6067.73	21.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 52	6067.41	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 53	6067.41	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 96	6070.85	17.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 71	6075.57	12.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 102	6075.25	4.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDMH 70	6079.46	8.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 100	6079.14	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 101	6070.53	5.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 12	6074.01	15.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 104	6079.25	15.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 69	6081.25	11.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 48	6081.31	4.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 90	6081.91	8.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 92	6078.84	6.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution					Total Design Flow				Comment
	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Outfall	0.00	0.00	0.00	0.00	0.00	8.42	4.28	0.74	36.00	Surface Water Present (Upstream)
SDMH 84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.00	Surface Water Present (Downstream)
SDMH 83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.00	
SDMH 82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.00	
SDMH 102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.00	
SDMH 81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.00	
SDMH 80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.50	
SDMH 79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	
SDIN 54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	
SDMH 100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.80	
SDIN 95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.40	
SDMH 101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.60	
SDIN 94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.60	

SDMH 78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.30	
SDIN 93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.50	
SDMH 76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.10	
SDMH 75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.10	
SDMH 74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.10	
SDMH 103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.10	
SDMH 73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.10	
SDMH 72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.40	
SDIN 52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.30	
SDIN 53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.30	
SDMH 96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.20	
SDMH 71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.20	
SDIN 102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.10	
SDMH 70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.30	
SDIN 100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	
SDIN 101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.30	
SDMH 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.70	
SDMH 104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.70	
SDMH 69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.40	
SDIN 48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.10	
SDIN 90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.30	
SDIN 92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 84	227.00	5989.92	4.0	5999.00	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 83	183.00	5999.88	4.0	6007.20	0.013	0.38	0.00	CIRCULAR	36.00 in	36.00 in

SDMH 82	179.00	6008.24	4.0	6015.40	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 102	147.00	6016.21	3.8	6021.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 81	153.00	6022.55	1.6	6025.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 80	201.00	6026.10	3.5	6033.13	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 79	44.00	6033.31	3.0	6034.63	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 54	10.00	6034.83	1.0	6034.93	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 100	92.00	6033.35	4.0	6037.03	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 95	10.00	6037.22	1.0	6037.32	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 101	138.00	6037.23	4.0	6042.75	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 94	9.00	6042.95	1.0	6043.04	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 78	49.00	6025.53	1.7	6026.36	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 93	11.00	6027.04	2.0	6027.26	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDMH 76	382.00	6027.36	2.0	6035.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 75	184.00	6036.02	2.0	6039.70	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 74	174.00	6040.84	4.0	6047.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 103	168.00	6048.08	4.0	6054.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 73	50.00	6055.00	4.0	6057.00	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 72	53.00	6057.88	4.0	6060.00	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 52	16.00	6060.84	1.0	6061.00	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 53	18.00	6060.82	1.0	6061.00	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 96	127.00	6060.62	4.0	6065.70	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 71	191.00	6065.90	2.5	6070.67	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 102	16.00	6070.87	1.0	6071.03	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 70	158.00	6070.85	3.1	6075.75	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 100	16.00	6075.99	1.0	6076.15	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
SDIN 101	16.00	6065.90	1.0	6066.06	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
SDMH 12	187.00	6057.22	4.0	6064.70	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 104	175.00	6064.95	3.0	6070.20	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 69	170.00	6070.39	1.3	6072.60	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 48	120.00	6073.78	1.2	6075.22	0.013	0.83	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 90	51.00	6074.44	1.4	6075.15	0.013	0.83	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 92	64.00	6074.58	1.0	6075.22	0.013	0.83	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity		Critical Flow		Normal Flow						
	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 84	133.76	18.92	23.41	7.40	12.76	16.05	3.20	Supercritical Jump	36.00	15.63	
SDMH 83	133.76	18.92	23.41	7.40	12.76	16.05	3.20	Supercritical	36.00	0.00	

SDMH 82	133.76	18.92	23.41	7.40	12.76	16.05	3.20	Supercritical	36.00	0.00	
SDMH 102	130.37	18.44	23.41	7.40	12.93	15.76	3.12	Supercritical	36.00	0.00	
SDMH 81	84.59	11.97	23.41	7.40	16.40	11.49	1.98	Supercritical	36.00	0.00	
SDMH 80	42.44	13.51	13.22	5.36	7.72	10.89	2.81	Supercritical	9.50	0.00	
SDMH 79	18.24	10.32	5.51	3.27	3.49	6.23	2.44	Supercritical	1.50	0.00	
SDIN 54	10.53	5.96	5.51	3.27	4.59	4.22	1.43	Supercritical	1.50	0.00	
SDMH 100	21.07	11.92	13.78	6.06	8.11	11.39	2.79	Supercritical	8.80	0.00	
SDIN 95	10.53	5.96	9.65	4.56	8.11	5.69	1.39	Supercritical Jump	4.40	7.24	
SDMH 101	21.07	11.92	9.88	4.63	5.71	9.54	2.86	Supercritical	4.60	0.00	
SDIN 94	10.53	5.96	9.88	4.63	8.32	5.76	1.39	Supercritical	4.60	0.00	
SDMH 78	87.20	12.34	21.03	6.83	14.38	11.12	2.07	Supercritical	29.30	0.00	
SDIN 93	14.90	8.43	9.77	4.59	6.79	7.38	2.01	Pressurized	4.50	11.00	
SDMH 76	94.58	13.38	20.19	6.64	13.19	11.55	2.26	Supercritical	27.10	0.00	
SDMH 75	94.58	13.38	20.19	6.64	13.19	11.55	2.26	Supercritical	27.10	0.00	
SDMH 74	133.76	18.92	20.19	6.64	10.99	14.83	3.21	Supercritical	27.10	0.00	
SDMH 103	133.76	18.92	20.19	6.64	10.99	14.83	3.21	Supercritical	27.10	0.00	
SDMH 73	133.76	18.92	20.19	6.64	10.99	14.83	3.21	Supercritical	27.10	0.00	
SDMH 72	45.37	14.44	19.86	7.70	11.60	14.23	2.89	Supercritical	21.40	0.00	
SDIN 52	22.68	7.22	6.33	3.48	5.16	4.64	1.49	Supercritical	2.30	0.00	
SDIN 53	22.68	7.22	6.33	3.48	5.16	4.64	1.49	Supercritical	2.30	0.00	
SDMH 96	45.37	14.44	17.94	6.83	10.24	13.44	2.95	Supercritical	17.20	0.00	
SDMH 71	16.65	9.42	15.86	7.40	11.44	10.29	2.00	Supercritical	12.20	0.00	
SDIN 102	22.68	7.22	8.52	4.10	6.91	5.48	1.50	Supercritical	4.10	0.00	
SDMH 70	18.54	10.49	13.39	5.89	8.44	10.20	2.44	Supercritical	8.30	0.00	
SDIN 100	10.53	5.96	10.32	4.77	8.73	5.88	1.38	Supercritical	5.00	0.00	
SDIN 101	22.68	7.22	9.74	4.43	7.89	5.89	1.50	Supercritical Jump	5.30	3.52	
SDMH 12	133.76	18.92	15.17	5.55	8.33	12.68	3.19	Supercritical	15.70	0.00	
SDMH 104	115.84	16.39	15.17	5.55	8.95	11.45	2.77	Supercritical	15.70	0.00	
SDMH 69	76.25	10.79	12.85	5.04	9.41	7.75	1.83	Supercritical	11.40	0.00	
SDIN 48	24.85	7.91	8.52	4.10	6.59	5.85	1.64	Supercritical	4.10	0.00	
SDIN 90	79.13	11.19	10.90	4.59	7.87	7.26	1.88	Supercritical	8.30	0.00	
SDIN 92	22.68	7.22	10.57	4.65	8.57	6.15	1.50	Supercritical	6.20	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDMH 84	36.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 83	36.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 82	36.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 102	36.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 81	36.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDMH 80	9.50	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 79	1.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 54	1.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 100	8.80	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 95	4.40	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 101	4.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 94	4.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 78	29.30	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDIN 93	4.50	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDMH 76	27.10	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 75	27.10	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
SDMH 74	27.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 103	27.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 73	27.10	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
SDMH 72	21.40	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
SDIN 52	2.30	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 53	2.30	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 96	17.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 71	12.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 102	4.10	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 70	8.30	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 100	5.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
SDIN 101	5.30	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDMH 12	15.70	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 104	15.70	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDMH 69	11.40	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDIN 48	4.10	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
SDIN 90	8.30	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDIN 92	6.20	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5993.50

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 84	5989.92	5999.00	0.00	0.00	5993.50	6000.95	5993.90	7.90	6001.80
SDMH 83	5999.88	6007.20	0.15	0.00	6001.10	6009.15	6004.95	5.06	6010.00
SDMH 82	6008.24	6015.40	0.04	0.00	6009.30	6017.35	6013.31	4.90	6018.20
SDMH 102	6016.21	6021.80	0.04	0.00	6017.39	6023.75	6021.15	3.45	6024.60
SDMH 81	6022.55	6025.00	0.02	0.00	6023.92	6026.95	6025.97	1.83	6027.80
SDMH 80	6026.10	6033.13	0.19	0.00	6027.14	6034.23	6028.58	6.10	6034.68
SDMH 79	6033.31	6034.63	0.00	0.00	6034.67	6035.09	6034.68	0.58	6035.26
SDIN 54	6034.83	6034.93	0.01	0.00	6035.21	6035.39	6035.49	0.07	6035.56
SDMH 100	6033.35	6037.03	0.51	0.00	6034.74	6038.18	6036.04	2.71	6038.75
SDIN 95	6037.22	6037.32	0.13	0.00	6038.78	6038.79	6038.88	0.01	6038.89
SDMH 101	6037.23	6042.75	0.01	0.00	6038.18	6043.57	6039.12	4.79	6043.91
SDIN 94	6042.95	6043.04	0.14	0.00	6043.71	6043.86	6044.16	0.04	6044.20
SDMH 78	6025.53	6026.36	0.01	0.00	6026.96	6028.11	6028.65	0.19	6028.84
SDIN 93	6027.04	6027.26	0.13	0.00	6028.87	6028.89	6028.97	0.02	6028.99
SDMH 76	6027.36	6035.00	0.01	0.00	6028.46	6036.68	6030.53	6.84	6037.37
SDMH 75	6036.02	6039.70	0.02	0.00	6037.12	6041.38	6039.19	2.88	6042.07
SDMH 74	6040.84	6047.80	0.03	0.00	6041.76	6049.48	6045.17	5.00	6050.17
SDMH 103	6048.08	6054.80	0.03	0.00	6049.51	6056.48	6052.41	4.76	6057.17
SDMH 73	6055.00	6057.00	0.02	0.00	6056.50	6058.68	6059.33	0.04	6059.37
SDMH 72	6057.88	6060.00	0.95	0.00	6059.63	6061.66	6061.99	0.58	6062.58
SDIN 52	6060.84	6061.00	0.01	0.00	6062.58	6062.58	6062.59	0.00	6062.59
SDIN 53	6060.82	6061.00	0.01	0.00	6062.58	6062.58	6062.59	0.00	6062.59
SDMH 96	6060.62	6065.70	0.02	0.00	6061.68	6067.19	6064.28	3.64	6067.92
SDMH 71	6065.90	6070.67	0.04	0.00	6067.23	6071.99	6068.49	4.35	6072.84
SDIN 102	6070.87	6071.03	0.03	0.00	6072.85	6072.85	6072.88	0.00	6072.88
SDMH 70	6070.85	6075.75	0.02	0.00	6072.01	6076.87	6073.17	4.23	6077.40
SDIN 100	6075.99	6076.15	0.16	0.00	6077.44	6077.44	6077.57	0.02	6077.59
SDIN 101	6065.90	6066.06	0.06	0.00	6067.93	6067.93	6067.98	0.00	6067.98
SDMH 12	6057.22	6064.70	0.00	0.00	6058.69	6065.96	6060.41	6.03	6066.44
SDMH 104	6064.95	6070.20	0.00	0.00	6065.97	6071.46	6067.73	4.21	6071.94

SDMH 69	6070.39	6072.60	0.00	0.00	6071.47	6073.67	6072.11	1.96	6074.06
SDIN 48	6073.78	6075.22	0.02	0.00	6074.33	6075.93	6074.86	1.33	6076.19
SDIN 90	6074.44	6075.15	0.02	0.00	6075.09	6076.06	6075.91	0.48	6076.39
SDIN 92	6074.58	6075.22	0.05	0.00	6075.29	6076.10	6075.88	0.55	6076.44

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 84	227.00	4.00	6.00	6.67	0.00	0.00	0.00	13.72	8.69	4.53	295.91	Sewer Too Shallow
SDMH 83	183.00	4.00	6.00	6.67	11.96	7.81	3.65	18.52	11.09	6.93	569.93	
SDMH 82	179.00	4.00	6.00	6.67	16.44	10.05	5.89	20.98	12.32	8.16	743.43	
SDMH 102	147.00	4.00	6.00	6.67	19.35	11.51	7.34	15.62	9.64	5.48	547.95	
SDMH 81	153.00	4.00	6.00	6.67	14.12	8.89	4.72	13.70	8.68	4.52	406.31	
SDMH 80	201.00	3.00	4.00	5.50	12.51	7.34	4.51	8.56	5.36	2.53	314.47	
SDMH 79	44.00	2.50	4.00	4.92	8.70	5.14	2.89	7.12	4.35	2.10	41.94	
SDIN 54	10.00	2.50	4.00	4.92	6.72	4.15	1.90	6.12	3.85	1.60	7.50	Sewer Too Shallow
SDMH 100	92.00	2.50	4.00	4.92	8.62	5.10	2.85	7.12	4.35	2.10	87.10	
SDIN 95	10.00	2.50	4.00	4.92	6.74	4.16	1.91	6.16	3.87	1.62	7.54	Sewer Too Shallow
SDMH 101	138.00	2.50	4.00	4.92	6.72	4.15	1.90	6.60	4.09	1.84	107.46	Sewer Too Shallow
SDIN 94	9.00	2.50	4.00	4.92	6.20	3.89	1.64	5.64	3.61	1.36	6.24	Sewer Too Shallow
SDMH 78	49.00	4.00	6.00	6.67	12.65	8.16	3.99	12.56	8.11	3.95	114.41	
SDIN 93	11.00	2.50	4.00	4.92	12.70	7.14	4.89	11.84	6.71	4.46	19.40	
SDMH 76	382.00	4.00	6.00	6.67	10.56	7.11	2.95	11.70	7.68	3.52	769.43	
SDMH 75	184.00	4.00	6.00	6.67	9.66	6.66	2.50	18.20	10.93	6.77	520.67	
SDMH 74	174.00	4.00	6.00	6.67	15.92	9.79	5.63	17.20	10.43	6.27	592.85	
SDMH 103	168.00	4.00	6.00	6.67	16.64	10.15	5.99	17.44	10.55	6.39	597.11	
SDMH 73	50.00	4.00	6.00	6.67	17.04	10.35	6.19	16.44	10.05	5.89	172.99	

SDMH 72	53.00	3.00	4.00	5.50	15.68	8.92	6.09	14.46	8.31	5.48	138.17	
SDIN 52	16.00	3.00	4.00	5.50	12.78	7.47	4.64	11.82	6.99	4.16	30.46	
SDIN 53	18.00	3.00	4.00	5.50	12.82	7.49	4.66	11.82	6.99	4.16	34.35	
SDMH 96	127.00	3.00	4.00	5.50	13.22	7.69	4.86	9.30	5.73	2.90	217.21	
SDMH 71	191.00	2.50	4.00	4.92	9.41	5.50	3.25	9.30	5.44	3.19	225.07	
SDIN 102	16.00	3.00	4.00	5.50	8.40	5.28	2.45	7.44	4.80	1.97	17.34	Sewer Too Shallow
SDMH 70	158.00	2.50	4.00	4.92	8.94	5.26	3.01	6.92	4.25	2.00	151.58	
SDIN 100	16.00	2.50	4.00	4.92	6.44	4.01	1.76	5.48	3.53	1.28	11.18	Sewer Too Shallow
SDIN 101	16.00	3.00	4.00	5.50	8.90	5.53	2.70	7.94	5.05	2.22	18.55	
SDMH 12	187.00	4.00	6.00	6.67	16.00	9.83	5.67	16.62	10.14	5.98	622.37	
SDMH 104	175.00	4.00	6.00	6.67	16.12	9.89	5.73	16.10	9.88	5.72	571.77	
SDMH 69	170.00	4.00	6.00	6.67	15.72	9.69	5.53	15.30	9.48	5.32	525.64	
SDIN 48	120.00	3.00	4.00	5.50	13.94	8.05	5.22	11.18	6.67	3.84	237.49	
SDIN 90	51.00	4.00	6.00	6.67	11.63	7.65	3.48	11.52	7.59	3.43	107.33	
SDIN 92	64.00	3.00	4.00	5.50	8.34	5.25	2.42	6.24	4.20	1.37	64.20	Sewer Too Shallow

Total earth volume for sewer trenches = 8895 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
1/31/2018 2:21:56
PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond D (Pond F-1)
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5993.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Outfall	5988.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH	6006.86	68.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

591

84										
SDMH 83	6017.46	68.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 82	6026.89	68.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 102	6030.61	68.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 81	6032.85	68.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 78	6033.64	68.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 76	6041.85	68.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 75	6049.80	68.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 74	6057.40	68.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 103	6064.52	68.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 73	6066.22	68.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 12	6074.01	68.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 104	6079.25	68.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 92	6078.84	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDMH 69	6081.25	55.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 48	6081.31	17.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 90	6081.91	42.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Outfall	0.00	0.00	0.00	0.00	0.00	5.81	11.77	0.39	68.40	Surface Water Present (Upstream)
SDMH 84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	Surface Water Present (Downstream)
SDMH 83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	
SDMH 82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	

SDMH 102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	
SDMH 81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	
SDMH 78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	
SDMH 76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	
SDMH 75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	
SDMH 74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	
SDMH 103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	
SDMH 73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	
SDMH 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	
SDMH 104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	
SDIN 92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.00	
SDMH 69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.20	
SDIN 48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.30	
SDIN 90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDMH 84	227.00	5989.92	4.0	5999.00	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 83	183.00	5999.88	4.0	6007.20	0.013	0.38	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 82	179.00	6008.24	4.0	6015.40	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 102	147.00	6016.21	3.8	6021.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 81	153.00	6022.55	1.6	6025.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 78	49.00	6025.53	1.7	6026.36	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 76	382.00	6027.36	2.0	6035.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 75	184.00	6036.02	2.0	6039.70	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 74	174.00	6040.84	4.0	6047.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 103	168.00	6048.08	4.0	6054.80	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 73	50.00	6055.00	4.0	6057.00	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 12	187.00	6057.22	4.0	6064.70	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDMH 104	175.00	6064.95	3.0	6070.20	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 92	64.00	6074.58	1.0	6075.22	0.013	1.00	0.00	CIRCULAR	24.00 in	24.00 in

SDMH 69	170.00	6070.39	1.3	6072.60	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 48	120.00	6073.78	1.2	6075.22	0.013	1.00	0.00	CIRCULAR	24.00 in	24.00 in
SDIN 90	51.00	6074.44	1.4	6075.15	0.013	1.00	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity		Critical Flow		Normal Flow						
	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDMH 84	133.76	18.92	31.63	10.40	18.24	19.03	3.06	Supercritical Jump	68.40	19.63	Velocity is Too High
SDMH 83	133.76	18.92	31.63	10.40	18.24	19.03	3.06	Supercritical	68.40	0.00	Velocity is Too High
SDMH 82	133.76	18.92	31.63	10.40	18.24	19.03	3.06	Supercritical	68.40	0.00	Velocity is Too High
SDMH 102	130.37	18.44	31.63	10.40	18.52	18.67	2.98	Supercritical	68.40	0.00	Velocity is Too High
SDMH 81	84.59	11.97	31.63	10.40	24.55	13.32	1.73	Supercritical	68.40	0.00	
SDMH 78	87.20	12.34	31.63	10.40	24.01	13.66	1.81	Supercritical	68.40	0.00	
SDMH 76	94.58	13.38	31.63	10.40	22.69	14.58	2.02	Supercritical	68.40	0.00	
SDMH 75	94.58	13.38	31.63	10.40	22.69	14.58	2.02	Supercritical	68.40	0.00	
SDMH 74	133.76	18.92	31.63	10.40	18.24	19.03	3.06	Supercritical	68.40	0.00	Velocity is Too High
SDMH 103	133.76	18.92	31.63	10.40	18.24	19.03	3.06	Supercritical	68.40	0.00	Velocity is Too High
SDMH 73	133.76	18.92	31.63	10.40	18.24	19.03	3.06	Supercritical	68.40	0.00	Velocity is Too High
SDMH 12	133.76	18.92	31.63	10.40	18.24	19.03	3.06	Supercritical Jump	68.40	18.33	Velocity is Too High
SDMH 104	115.84	16.39	31.63	10.40	19.90	17.06	2.59	Supercritical	68.40	0.00	
SDIN 92	22.68	7.22	18.82	7.19	16.81	8.09	1.26	Supercritical	19.00	0.00	
SDMH 69	76.25	10.79	28.93	9.07	22.70	11.75	1.63	Supercritical Jump	55.20	36.23	
SDIN 48	24.85	7.91	17.99	6.85	14.74	8.55	1.48	Supercritical Jump	17.30	82.06	
SDIN 90	79.13	11.19	25.39	7.92	18.70	11.37	1.80	Supercritical	42.20	0.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
SDMH 84	68.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 83	68.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 82	68.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 102	68.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 81	68.40	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
SDMH 78	68.40	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 76	68.40	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 75	68.40	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDMH 74	68.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 103	68.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 73	68.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 12	68.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDMH 104	68.40	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
SDIN 92	19.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
SDMH 69	55.20	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
SDIN 48	17.30	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
SDIN 90	42.20	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5993.50

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDMH 84	5989.92	5999.00	0.00	0.00	5993.50	6001.64	5994.95	8.36	6003.31
SDMH 83	5999.88	6007.20	0.55	0.00	6002.19	6009.84	6007.02	4.49	6011.51
SDMH 82	6008.24	6015.40	0.16	0.00	6010.00	6018.04	6015.38	4.33	6019.71
SDMH 102	6016.21	6021.80	0.16	0.00	6018.20	6024.44	6023.17	2.95	6026.11
SDMH 81	6022.55	6025.00	0.07	0.00	6024.60	6027.64	6027.35	1.96	6029.31
SDMH 78	6025.53	6026.36	0.07	0.00	6027.71	6029.00	6030.42	0.25	6030.67
SDMH 76	6027.36	6035.00	0.07	0.00	6029.25	6037.64	6032.55	6.76	6039.31
SDMH 75	6036.02	6039.70	0.12	0.00	6037.91	6042.34	6041.21	2.80	6044.01

595

SDMH 74	6040.84	6047.80	0.16	0.00	6042.50	6050.44	6047.98	4.13	6052.11
SDMH 103	6048.08	6054.80	0.16	0.00	6050.60	6057.44	6055.22	3.89	6059.11
SDMH 73	6055.00	6057.00	0.12	0.00	6057.55	6060.69	6062.14	0.00	6062.14
SDMH 12	6057.22	6064.70	0.07	0.00	6060.76	6067.34	6062.22	6.80	6069.01
SDMH 104	6064.95	6070.20	0.07	0.00	6067.41	6072.84	6071.13	3.38	6074.51
SDIN 92	6074.58	6075.22	0.57	0.00	6075.98	6076.79	6077.00	0.60	6077.59
SDMH 69	6070.39	6072.60	0.05	0.00	6073.61	6075.01	6074.56	1.73	6076.29
SDIN 48	6073.78	6075.22	0.47	0.00	6076.29	6076.72	6076.76	0.69	6077.45
SDIN 90	6074.44	6075.15	0.55	0.00	6075.99	6077.27	6078.00	0.24	6078.24

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_{fi} ^ 2/(2*g)
- Lateral loss = V_{fo} ^ 2/(2*g)- Junction Loss K * V_{fi} ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDMH 84	227.00	4.00	6.00	6.67	0.00	0.00	0.00	13.72	8.69	4.53	295.91	Sewer Too Shallow
SDMH 83	183.00	4.00	6.00	6.67	11.96	7.81	3.65	18.52	11.09	6.93	569.93	
SDMH 82	179.00	4.00	6.00	6.67	16.44	10.05	5.89	20.98	12.32	8.16	743.43	
SDMH 102	147.00	4.00	6.00	6.67	19.35	11.51	7.34	15.62	9.64	5.48	547.95	
SDMH 81	153.00	4.00	6.00	6.67	14.12	8.89	4.72	13.70	8.68	4.52	406.31	
SDMH 78	49.00	4.00	6.00	6.67	12.65	8.16	3.99	12.56	8.11	3.95	114.41	
SDMH 76	382.00	4.00	6.00	6.67	10.56	7.11	2.95	11.70	7.68	3.52	769.43	
SDMH 75	184.00	4.00	6.00	6.67	9.66	6.66	2.50	18.20	10.93	6.77	520.67	
SDMH 74	174.00	4.00	6.00	6.67	15.92	9.79	5.63	17.20	10.43	6.27	592.85	
SDMH 103	168.00	4.00	6.00	6.67	16.64	10.15	5.99	17.44	10.55	6.39	597.11	
SDMH 73	50.00	4.00	6.00	6.67	17.04	10.35	6.19	16.44	10.05	5.89	172.99	
SDMH 12	187.00	4.00	6.00	6.67	16.00	9.83	5.67	16.62	10.14	5.98	622.37	
SDMH 104	175.00	4.00	6.00	6.67	16.12	9.89	5.73	16.10	9.88	5.72	571.77	
SDIN 92	64.00	3.00	4.00	5.50	8.34	5.25	2.42	6.24	4.20	1.37	64.20	Sewer Too Shallow

SDMH 69	170.00	4.00	6.00	6.67	15.72	9.69	5.53	15.30	9.48	5.32	525.64	
SDIN 48	120.00	3.00	4.00	5.50	13.94	8.05	5.22	11.18	6.67	3.84	237.49	
SDIN 90	51.00	4.00	6.00	6.67	11.63	7.65	3.48	11.52	7.59	3.43	107.33	

Total earth volume for sewer trenches = 7460 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
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Run Date:
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UDSewer Results Summary

Project Title: Pond D (Basin F3a) 2 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.97
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5991.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond D (Basin	5991.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

598

F3) 100 Year										
SDIN 60	5994.85	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 59	5994.81	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond D (Basin F3) 100 Year	0.00	0.00	0.00	0.00	0.00	0.96	3.55	3.60	3.40	
SDIN 60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.40	
SDIN 59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDIN 60	104.00	5988.54	1.4	5990.00	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 59	53.00	5990.27	1.0	5990.80	0.013	0.29	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDIN 60	79.13	11.19	6.90	3.59	5.09	5.58	1.82	Supercritical	3.40	0.00	
SDIN 59	41.13	8.38	5.24	3.13	4.28	4.20	1.49	Supercritical	1.80	0.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft ²)	Comment
										599

	(cfs)									
SDIN 60	3.40	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
SDIN 59	1.80	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5991.00

Element Name	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 60	5988.54	5990.00	0.00	0.00	5991.00	5991.00	5991.00	0.04	5991.04
SDIN 59	5990.27	5990.80	0.00	0.00	5991.01	5991.24	5991.04	0.35	5991.39

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Downstream			Upstream			Volume (cu. yd)	Comment
					Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)		
SDIN 60	104.00	4.00	6.00	6.67	0.00	3.90	0.00	7.70	5.68	1.52	123.55	Sewer Too Shallow
SDIN 59	53.00	3.50	6.00	6.08	7.66	5.37	1.79	6.52	4.80	1.22	61.40	Sewer Too Shallow

Total earth volume for sewer trenches = 185 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.

Program:
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Model Interface
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Run Date:
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UDSewer Results Summary

Project Title: Pond D (Basin F3) 100 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5991.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond D (Basin	5991.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

601

F3) 100 Year										
SDIN 60	5994.85	36.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 59	5994.81	22.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond D (Basin F3) 100 Year	0.00	0.00	0.00	0.00	0.00	3.08	11.82	0.34	36.40	
SDIN 60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.40	
SDIN 59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDIN 60	104.00	5988.54	1.4	5990.00	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
SDIN 59	53.00	5990.27	1.0	5990.80	0.013	0.29	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDIN 60	79.13	11.19	23.54	7.43	17.15	10.96	1.83	Supercritical	36.40	0.00	
SDIN 59	41.13	8.38	19.23	6.68	15.70	8.54	1.47	Supercritical	22.20	0.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
										602

	(cfs)									
SDIN 60	36.40	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
SDIN 59	22.20	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5991.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 60	5988.54	5990.00	0.00	0.00	5991.00	5991.96	5991.84	0.98	5992.82
SDIN 59	5990.27	5990.80	0.09	0.00	5992.57	5992.57	5992.91	0.21	5993.12

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 60	104.00	4.00	6.00	6.67	0.00	3.90	0.00	7.70	5.68	1.52	123.55	Sewer Too Shallow
SDIN 59	53.00	3.50	6.00	6.08	7.66	5.37	1.79	6.52	4.80	1.22	61.40	Sewer Too Shallow

Total earth volume for sewer trenches = 185 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.

- Six inches for pipes less than 60 inches.
- Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
5/8/2017 2:51:34
PM

UDSewer Results Summary

Project Title: Pond D (Basin F3b) 100 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5993.50

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond D (Basin	5991.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

605

F3) 100 Year										
SDIN 83	5997.00	78.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SDIN 81	5997.00	39.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution					Total Design Flow				Comment
	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	
Pond D (Basin F3) 100 Year	0.00	0.00	0.00	0.00	0.00	6.61	11.87	0.28	78.50	Surface Water Present (Upstream)
SDIN 83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	78.50	Surface Water Present (Downstream)
SDIN 81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.25	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation			Loss Coefficients			Given Dimensions		
		Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
SDIN 83	104.00	5988.54	1.4	5990.00	0.013	0.03	0.00	CIRCULAR	48.00 in	48.00 in
SDIN 81	53.00	5990.47	2.0	5991.53	0.013	0.11	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity		Critical Flow		Normal Flow						
	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
SDIN 83	170.42	13.56	32.19	8.76	22.88	13.28	1.92	Supercritical Jump	78.50	86.68	
SDIN 81	94.58	13.38	24.47	7.67	16.17	12.76	2.21	Supercritical Jump	39.25	28.23	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft ²)	Comment
SDIN 83	78.50	CIRCULAR	48.00 in	48.00 in	36.00 in	36.00 in	48.00 in	48.00 in	12.57	
SDIN 81	39.25	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5993.50

		Invert Elev.		Downstream Manhole Losses		HGL		EGL	
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
SDIN 83	5988.54	5990.00	0.00	0.00	5993.50	5993.72	5994.11	0.26	5994.36
SDIN 81	5990.47	5991.53	0.05	0.00	5993.94	5993.94	5994.42	0.17	5994.58

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = $Bend\ K * V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g) - Junction\ Loss\ K * V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
SDIN 83	104.00	5.00	6.00	7.83	0.00	3.98	0.00	11.00	7.92	2.58	184.35	Sewer Too Shallow
SDIN 81	53.00	4.00	6.00	6.67	11.06	7.36	3.20	8.94	6.30	2.14	95.43	

Total earth volume for sewer trenches = 280 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: $(\text{equivalent diameter in inches}/12)+1$ inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
2/7/2018 2:30:59 PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond D - 2 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 2
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.99
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5982.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond D Outfall	5985.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
									609	

Outlet Pipe 1	5993.16	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond D Outfall	0.00	0.00	0.00	0.00	0.00	0.18	2.72	9.65	0.50	
Outlet Pipe 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Outlet Pipe 1	59.00	5981.97	0.9	5982.50	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Outlet Pipe 1	39.02	7.95	2.74	2.24	2.38	2.75	1.32	Supercritical	0.50	0.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Outlet Pipe 1	0.50	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics were calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 5982.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Outlet Pipe 1	5981.97	5982.50	0.00	0.00	5982.17	5982.73	5982.28	0.52	5982.81

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * $V_{fi}^2 / (2 * g)$
- Lateral loss = $V_{fo}^2 / (2 * g)$ - Junction Loss K * $V_{fi}^2 / (2 * g)$.
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft

The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
Outlet Pipe 1	59.00	3.50	6.00	6.08	0.00	4.57	0.99	19.82	11.45	7.87	151.47	Sewer Too Shallow

Total earth volume for sewer trenches = 151 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
 - Four inches for pipes less than 33 inches.
 - Six inches for pipes less than 60 inches.
 - Eight inches for all larger sizes.

Program:
UDSEWER Math
Model Interface
2.1.1.4
Run Date:
2/7/2018 2:29:06 PM

UDSewer Results Summary

Project Title: Trails at Crowfoot Pond D - 100 Year
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.60
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 5982.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Pond D Outfall	5985.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
									612	

Outlet Pipe 1	5993.16	52.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Pond D Outfall	0.00	0.00	0.00	0.00	0.00	4.34	12.04	0.09	52.20	
Outlet Pipe 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.20	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Outlet Pipe 1	59.00	5981.97	0.9	5982.50	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Outlet Pipe 1	39.02	7.95	30.00	10.63	30.00	10.63	0.00	Pressurized	52.20	59.00	

- A Froude number of 0 indicates that pressurized flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Outlet Pipe 1	52.20	CIRCULAR	30.00 in	30.00 in	36.00 in	36.00 in	30.00 in	30.00 in	4.91	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width.

III. Hydraulic Computations

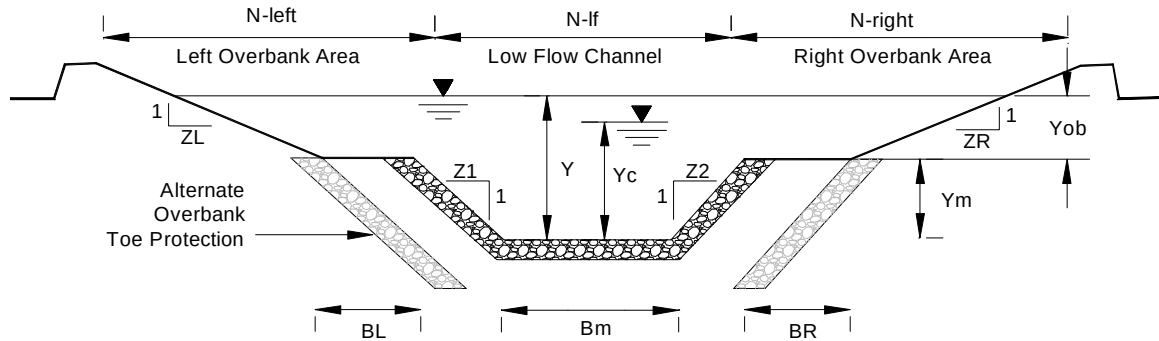
4. UD Channel

5. UD Culvert

Capacity Analysis of Composite Channel

Project: **Trails at Crowfoot**

Channel ID: **West Channel (100-YR 268 CFS/70% of 2-YR 39 CFS)**



Design Information (Input)

Channel Invert Slope	So =	0.00200 ft/ft	Left Overbank Bottom Width	BL =	8.00 ft
Low Flow Channel Bottom Width	Bm =	10.00 ft	Left Overbank Side Slope	ZL =	4.00 ft/ft
Low Flow Channel Left Side Slope	Z1 =	4.00 ft/ft	Left Overbank Manning's n	n-left =	0.0400
Low Flow Channel Right Side Slope	Z2 =	4.00 ft/ft	Right Overbank Bottom Width	BR =	8.00 ft
Low Flow Channel Manning's Nn for Qd	n-lf =	0.0250	Right Overbank Side Slope	ZR =	4.00 ft/ft
Low Flow Channel Manning's Nn for Q100	n-m-Q100 =	0.0250	Right Overbank Manning's n	n-right =	0.0400
(See USDCM Vol. II, n vs. Depth Graph)					
Low Flow Channel Bank-full depth	Ym =	1.15 ft	Overbank Flow Depth Yob (Y - Ym)	Yob =	1.50 ft

Low Flow Channel Condition for Qd

Top width	Tlf =	19.2 ft
Flow area	Alf =	16.8 sq ft
Wetted perimeter	Plf =	19.5 ft
Discharge (Calculated)	Qlf =	40.5 cfs
Velocity	Vlf =	2.4 fps
Froude number	Fr-lf =	0.45
Qd Critical Velocity	Vlfc =	4.36 fps
Qd Critical Depth	Ylfc =	0.72 ft

Left Overbank Flow Condition for Q100

Top width	TL =	14.0 ft
Flow area	AL =	16.5000 sq ft
Wetted perimeter	PL =	14.1800 ft
Discharge	QL =	30.4 cfs
Velocity	VL =	1.8 fps
Froude number	FrL =	0.30
100-Yr. Critical Velocity	VLc =	4.5 fps
100-Yr. Critical Depth in Overbanks	YLc =	0.7 ft

Low Flow Channel Flow Condition for Q100

Top width	Tm =	19.2 ft
Flow area	Am =	45.6 sq ft
Wetted perimeter	Pm =	19.5 ft
Discharge	Qm =	214.2 cfs
Velocity	Vm =	4.7 fps
Froude number	FrM =	0.54
100-Yr. Critical Velocity	Vmc =	7.1 fps
100-Yr. Critical Depth	Ymc =	1.8 ft

Right Overbank Flow Condition for Q100

Top width	TR =	14.0 ft
Flow area	AR =	16.5000 sq ft
Wetted perimeter	PR =	14.1800 ft
Discharge	QR =	30.4 cfs
Velocity	VR =	1.8 fps
Froude number	FrR =	0.30
100-Yr. Critical Velocity	VRc =	4.5 fps
100-Yr. Critical Depth in Overbanks	YRc =	0.7 ft

Composite Cross-Section Flow Condition for Q100

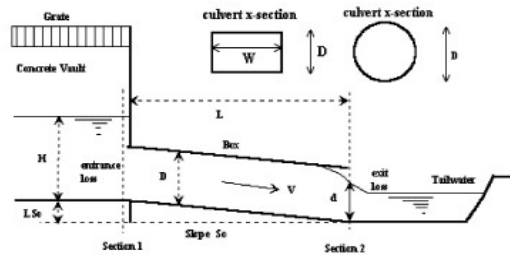
Top width	T =	47.2 ft	Discharge	Q =	275.0 cfs
Channel Depth Y	Y =	2.65 ft	Velocity	V =	3.5 fps
Flow area	A =	78.6 sq ft	Froude number	Fr =	0.48
Wetted perimeter	P =	47.9 ft	100-Yr. Critical Velocity	Vc =	6.0 fps
Cross-Sectional Manning's n (Calculated)	n =	0.0265	100-Yr. Critical Depth in Overbanks	Yc =	0.76 ft

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: **Trails at Crowfooot**

Basin ID: **6'x6' RCB (Q₁₀₀ = 268 CFS)**

Status:



Design Information (Input):

Circular Culvert: Barrel Diameter in Inches

Inlet Edge Type (choose from pull-down list)

D = inches

Grooved End with Headwall

OR:

Box Culvert: Barrel Height (Rise) in Feet

Barrel Width (Span) in Feet

Inlet Edge Type (choose from pull-down list)

Height (Rise) = ft.

Width (Span) = ft.

1.5 : 1 Bevel w/ 90 Deg. Headwall

Number of Barrels

Inlet Elevation at Culvert Invert

Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)

Culvert Length in Feet

Manning's Roughness

Bend Loss Coefficient

Exit Loss Coefficient

No =

Inlet Elev = ft. elev.

Outlet Elev = ft. elev.

L = ft.

n =

K_b =

K_x =

Design Information (calculated):

Entrance Loss Coefficient

Friction Loss Coefficient

Sum of All Loss Coefficients

Orifice Inlet Condition Coefficient

Minimum Energy Condition Coefficient

K_e =

K_f =

K_s =

C_d =

KE_{low} =

Calculations of Culvert Capacity (output):

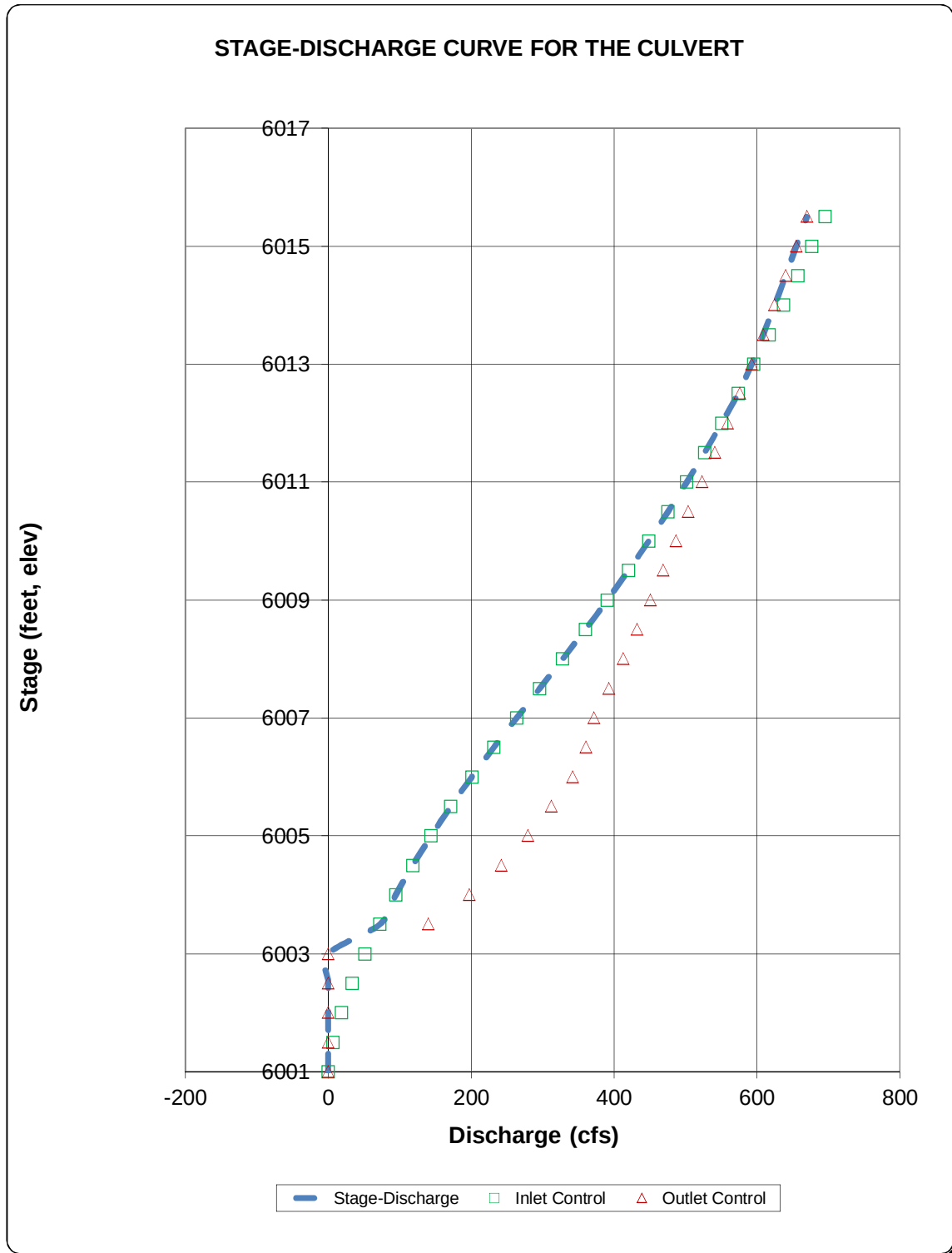
Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
6001.00	6003.00	0.00	0.00	0.00	No Flow (WS < inlet)	N/A
6001.50	6003.00	6.50	0.00	0.00	Min. Energy Eqn.	N/A
6002.00	6003.00	18.20	0.00	0.00	Min. Energy Eqn.	N/A
6002.50	6003.00	33.40	0.00	0.00	Min. Energy Eqn.	N/A
6003.00	6003.00	51.40	0.00	0.00	Min. Energy Eqn.	N/A
6003.50	6003.00	71.90	139.70	71.90	Min. Energy Eqn.	INLET
6004.00	6003.00	94.50	197.55	94.50	Min. Energy Eqn.	INLET
6004.50	6003.00	118.20	241.96	118.20	Regression Eqn.	INLET
6005.00	6003.00	143.90	279.37	143.90	Regression Eqn.	INLET
6005.50	6003.00	171.50	312.35	171.50	Regression Eqn.	INLET
6006.00	6003.00	200.80	342.16	200.80	Regression Eqn.	INLET
6006.50	6003.00	231.60	360.88	231.60	Regression Eqn.	INLET
6007.00	6003.00	263.50	371.67	263.50	Regression Eqn.	INLET
6007.50	6003.00	295.80	392.54	295.80	Regression Eqn.	INLET
6008.00	6003.00	328.00	412.60	328.00	Regression Eqn.	INLET
6008.50	6003.00	359.60	431.91	359.60	Regression Eqn.	INLET
6009.00	6003.00	390.40	450.58	390.40	Regression Eqn.	INLET
6009.50	6003.00	420.00	468.65	420.00	Regression Eqn.	INLET
6010.00	6003.00	448.40	486.18	448.40	Regression Eqn.	INLET
6010.50	6003.00	475.60	503.64	475.60	Regression Eqn.	INLET
6011.00	6003.00	501.60	522.66	501.60	Regression Eqn.	INLET
6011.50	6003.00	526.60	540.99	526.60	Regression Eqn.	INLET
6012.00	6003.00	550.40	558.73	550.40	Regression Eqn.	INLET
6012.50	6003.00	573.40	575.93	573.40	Regression Eqn.	INLET
6013.00	6003.00	595.50	592.64	592.64	Regression Eqn.	OUTLET
6013.50	6003.00	616.80	608.86	608.86	Regression Eqn.	OUTLET
6014.00	6003.00	637.30	624.69	624.69	Regression Eqn.	OUTLET
6014.50	6003.00	657.30	640.12	640.12	Regression Eqn.	OUTLET
6015.00	6003.00	676.60	655.18	655.18	Regression Eqn.	OUTLET
6015.50	6003.00	695.30	669.90	669.90	Regression Eqn.	OUTLET

Processing Time: 04.71 Seconds

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

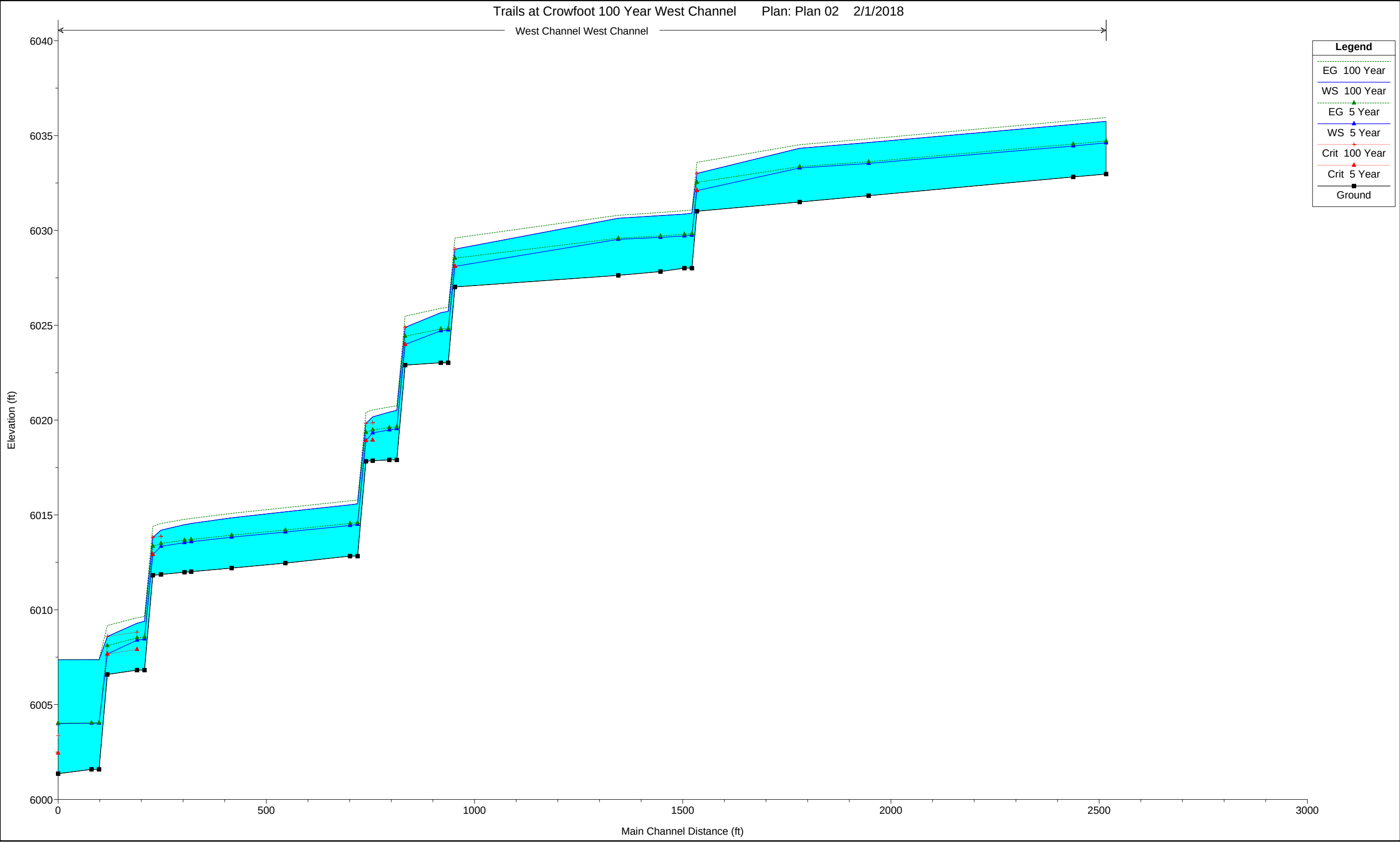
Project: Trails at Crowfoot

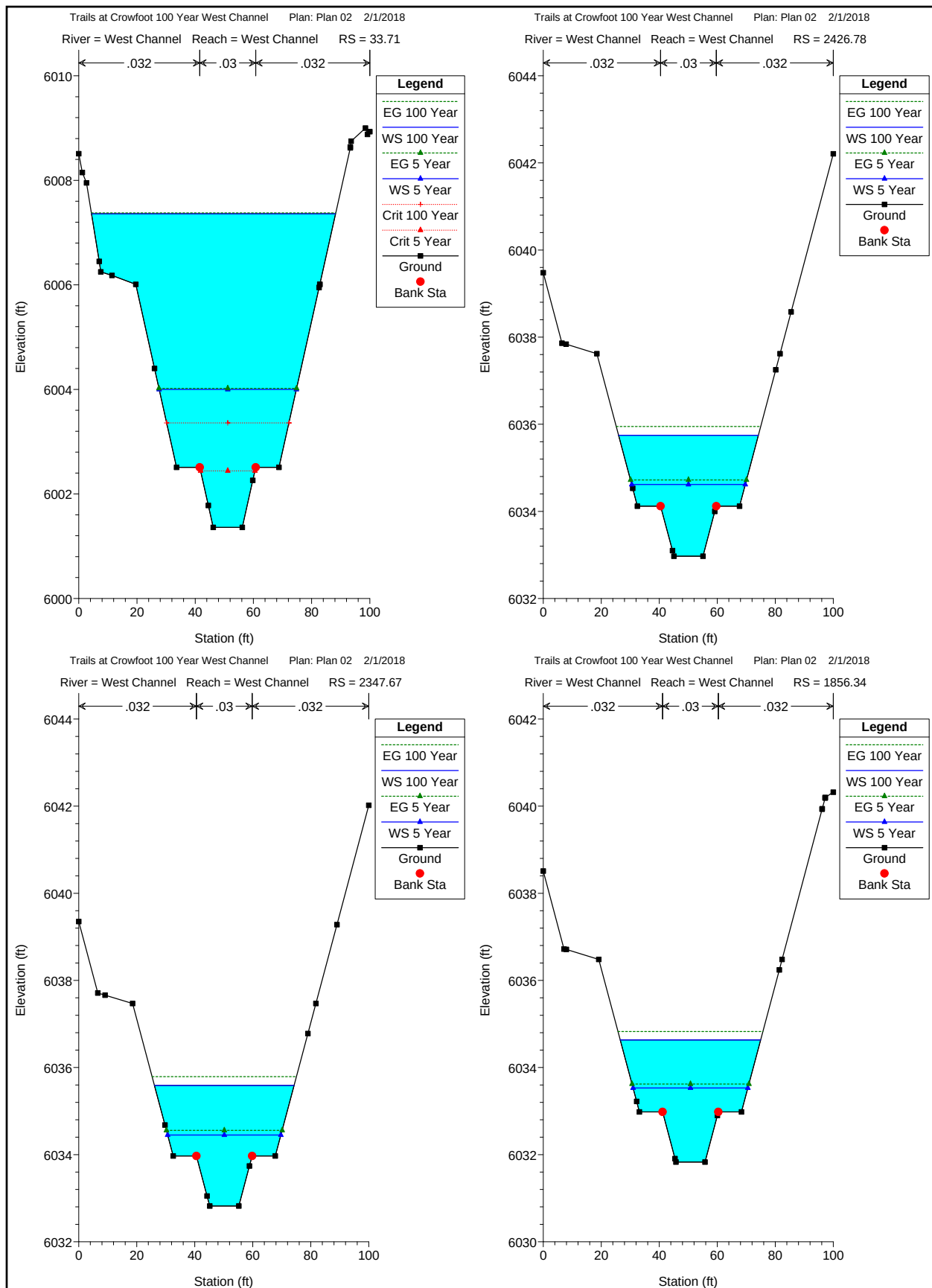
Basin ID: 6'x6' RCB (Q100 = 268 CFS)

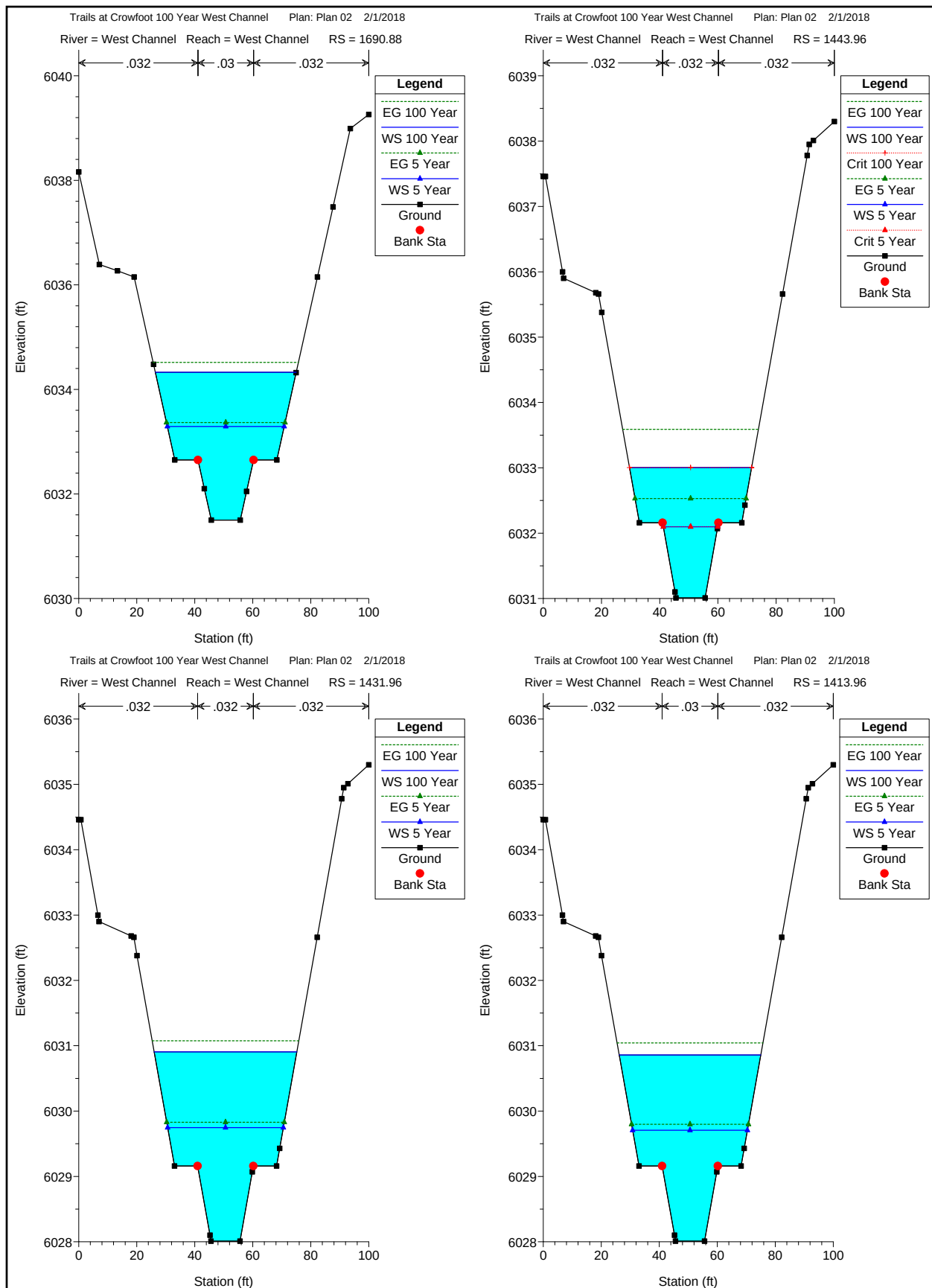


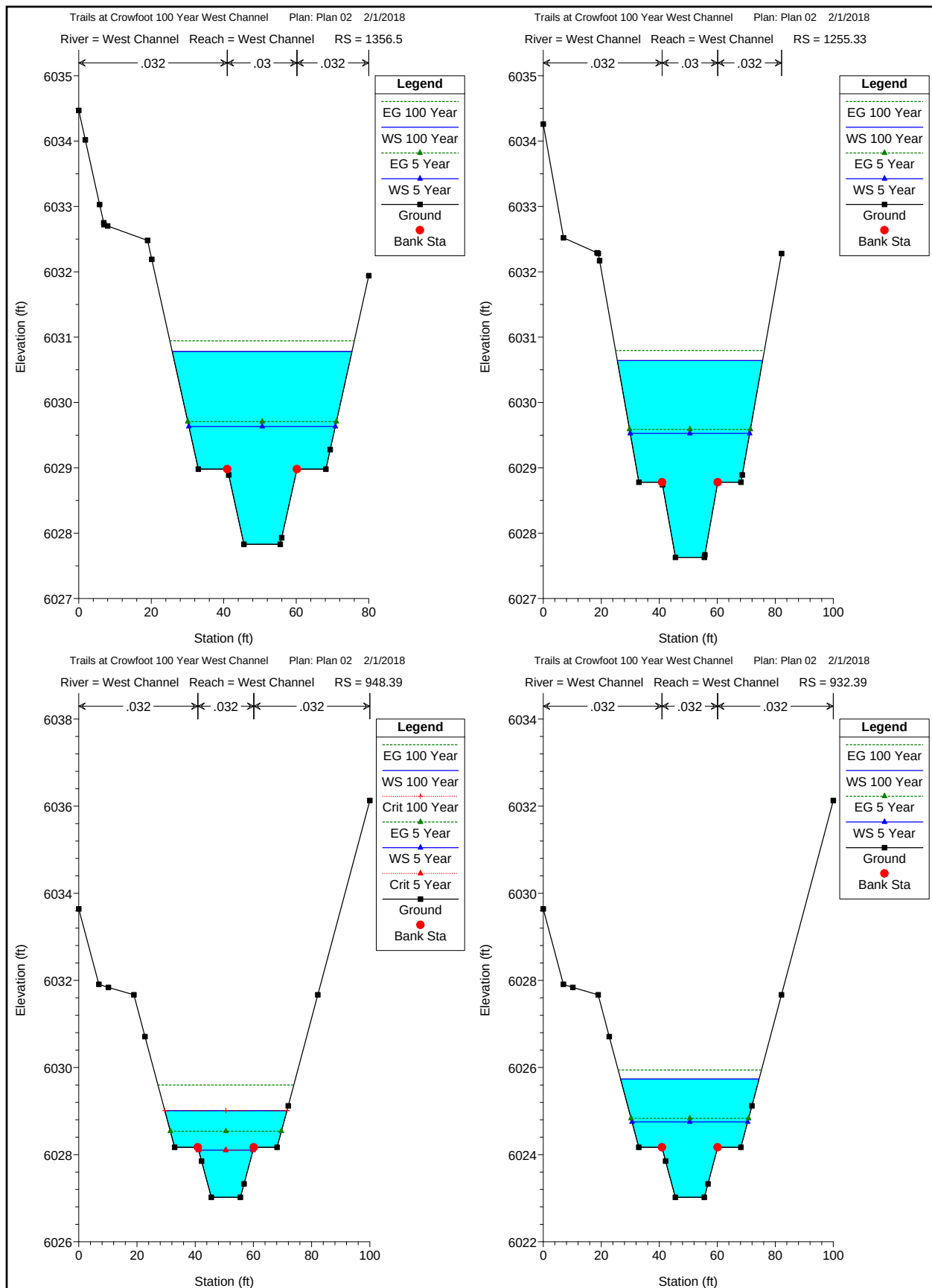
III. Hydraulic Computations

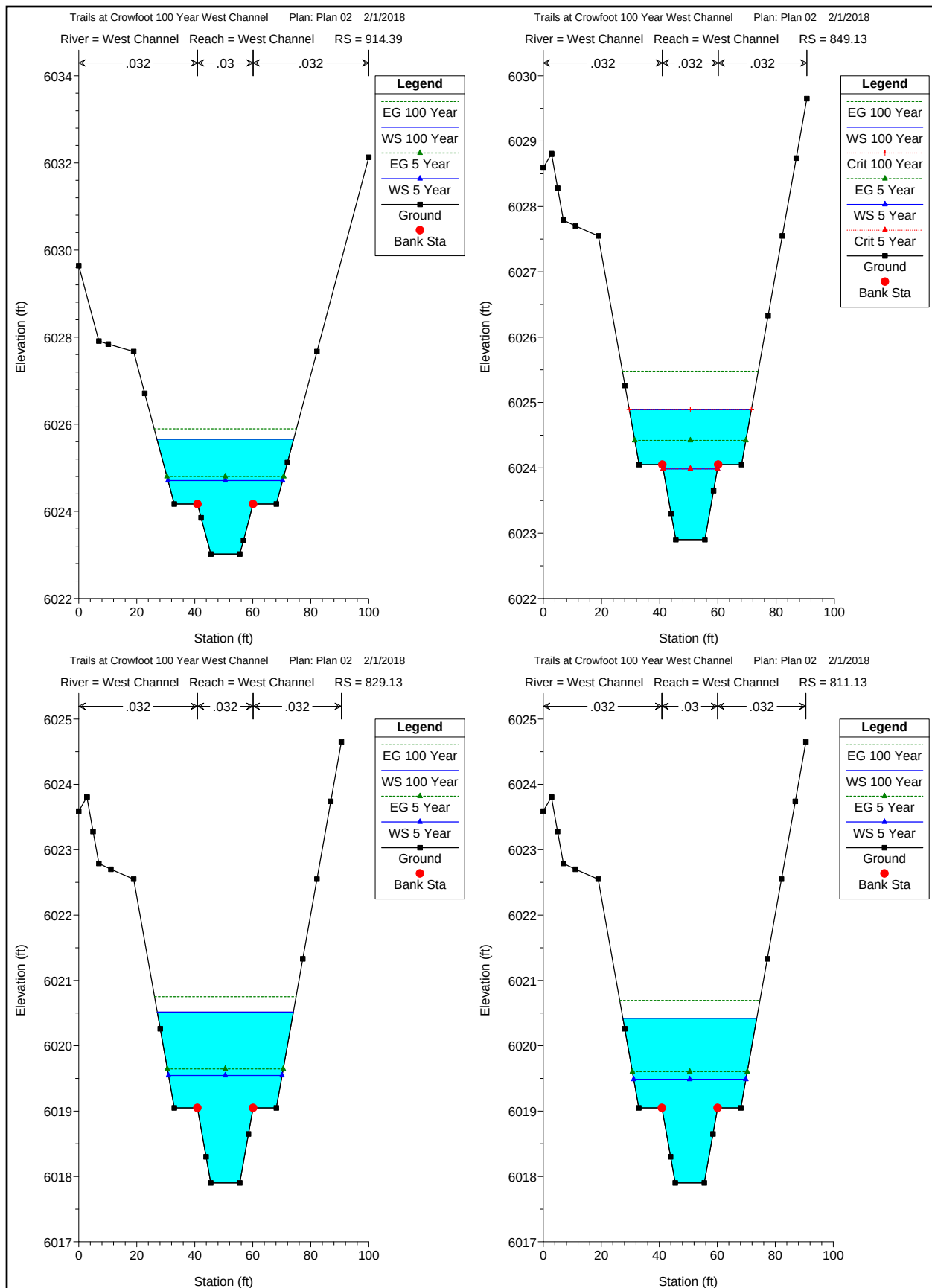
. HECRAS Analysis

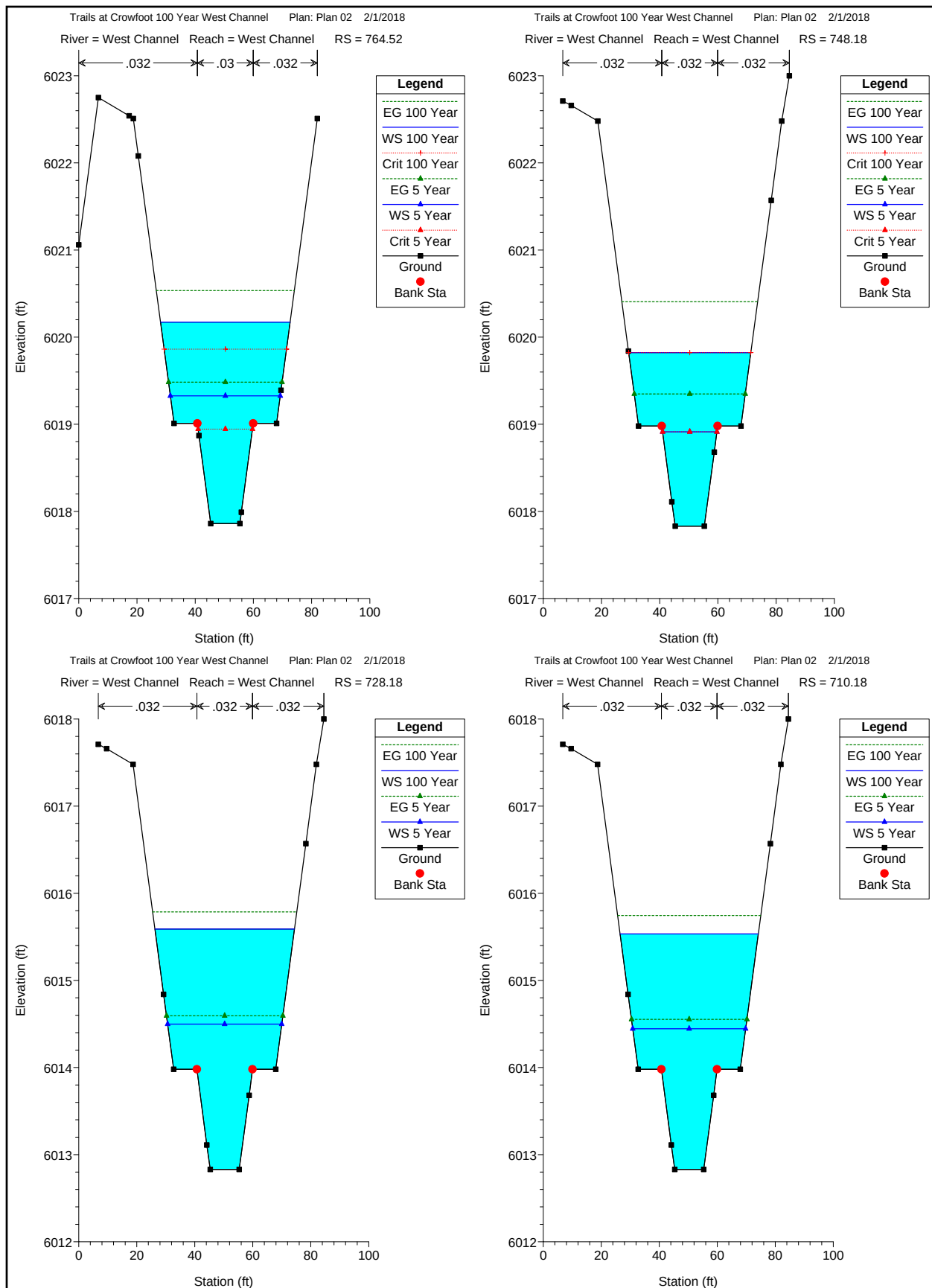


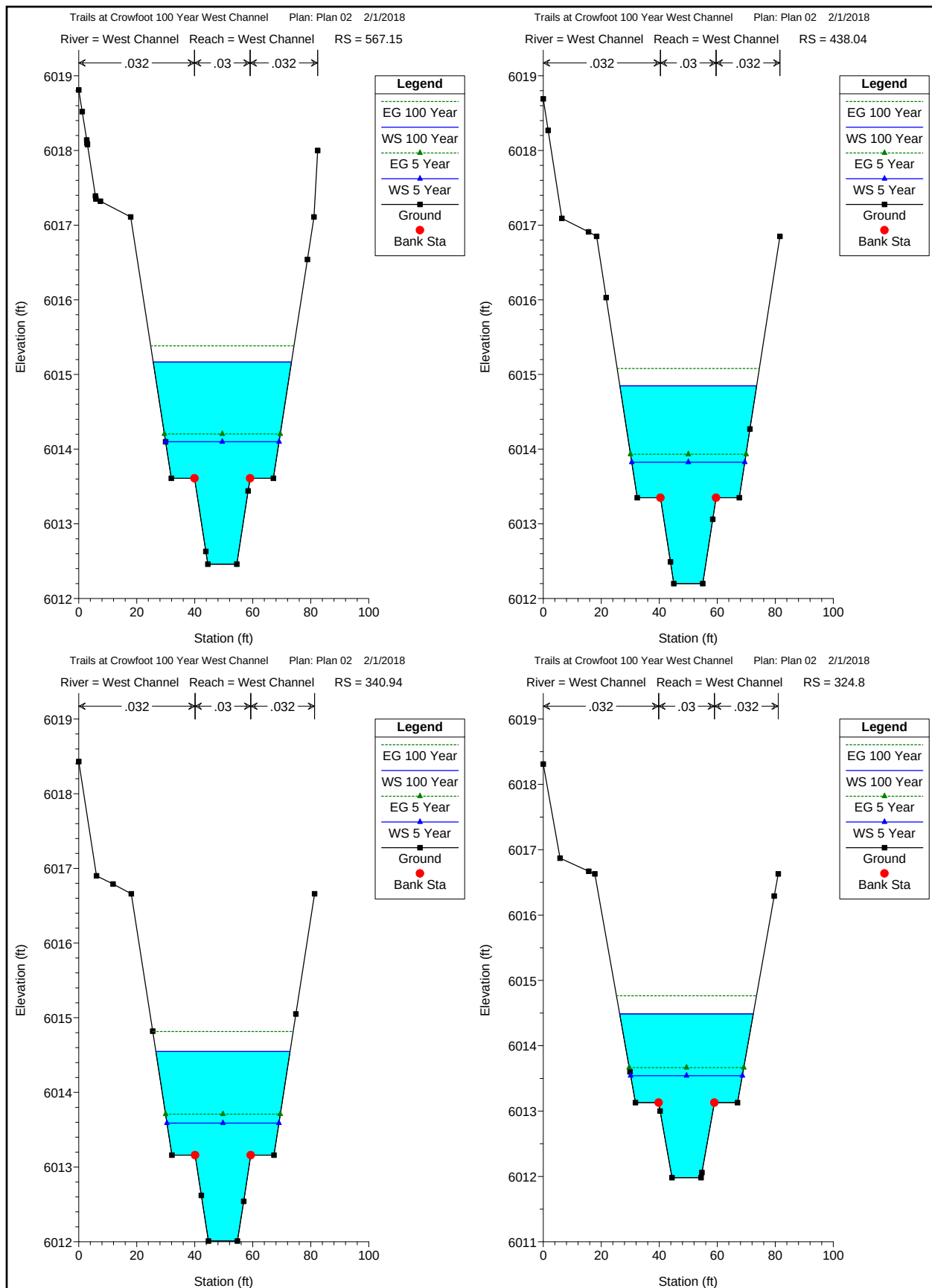


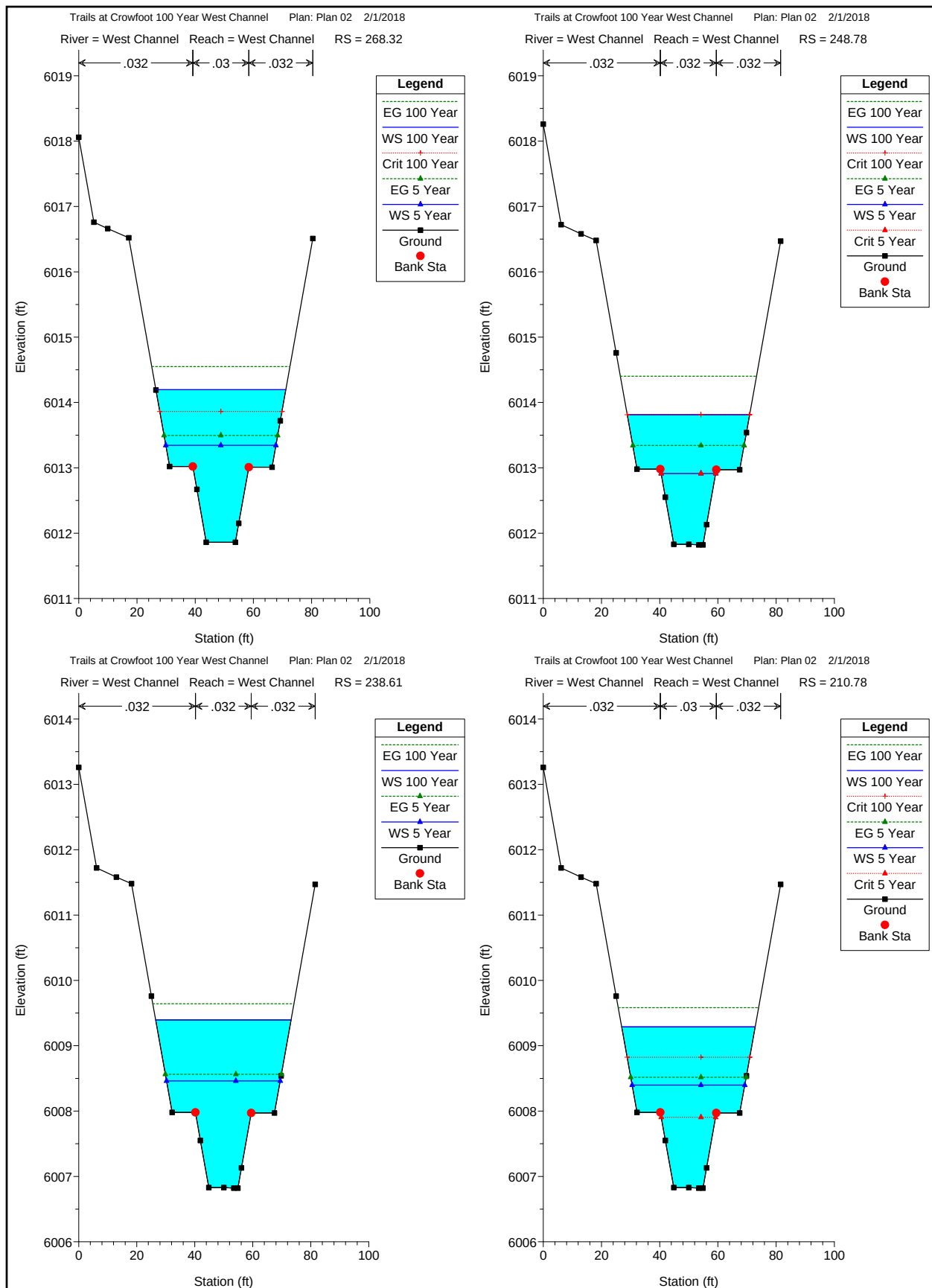


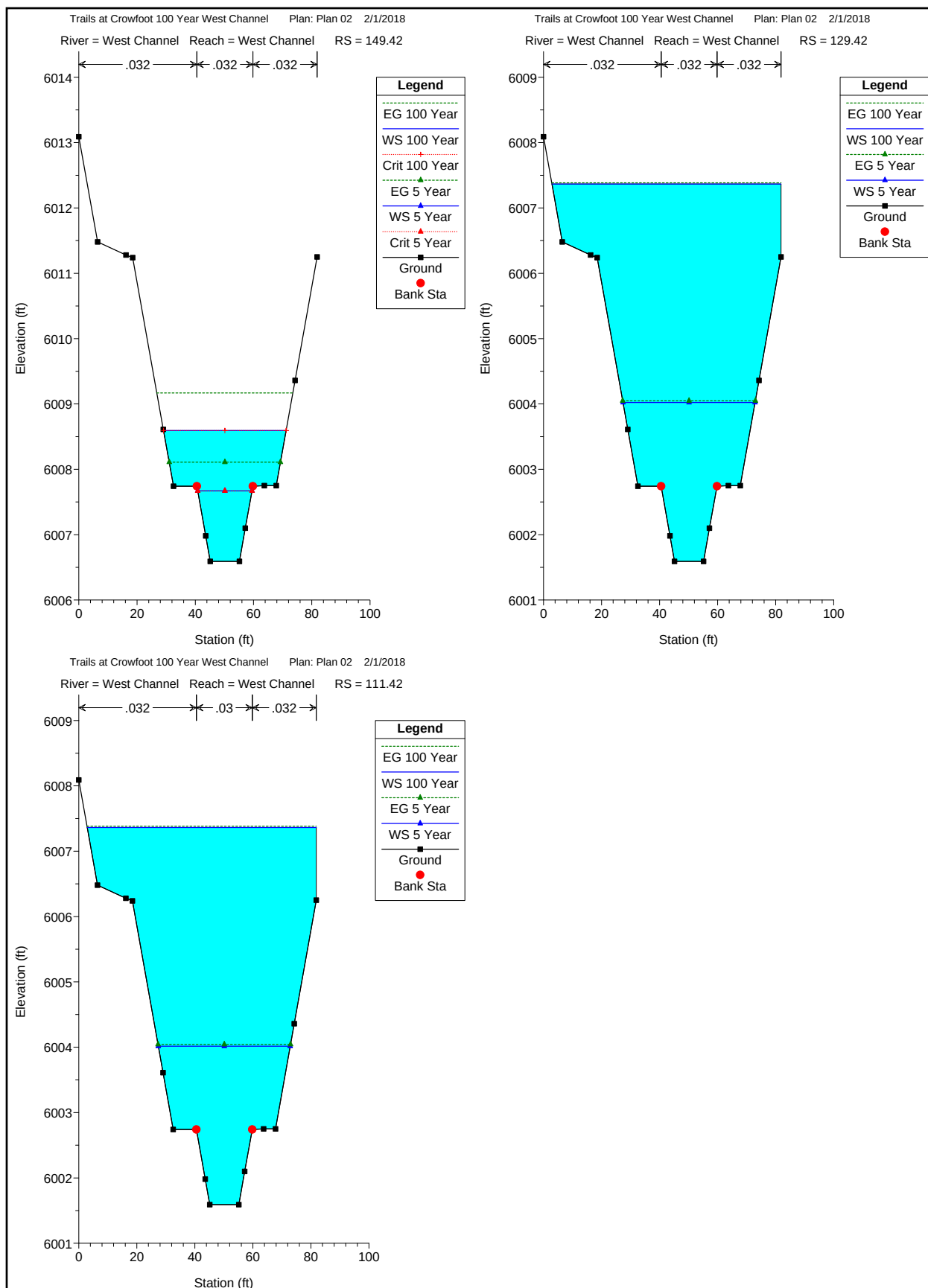












HEC-RAS Plan: Trails at Crowfoot River: West Channel Reach: West Channel

Reach	River Sta	Profile	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Shear LOB (lb/sq ft)	Shear Chan (lb/sq ft)	Shear ROB (lb/sq ft)	Froude # Chl
West Channel	2426.78	100 Year	43.68	193.01	43.76	0.15	0.30	0.15	0.45
West Channel	2426.78	5 Year	5.42	71.39	5.42	0.06	0.17	0.06	0.41
West Channel	2347.67	100 Year	43.66	193.19	43.60	0.15	0.31	0.15	0.45
West Channel	2347.67	5 Year	5.23	71.76	5.23	0.06	0.18	0.06	0.42
West Channel	1856.34	100 Year	44.07	192.28	44.10	0.15	0.30	0.15	0.44
West Channel	1856.34	5 Year	5.95	70.33	5.95	0.05	0.15	0.05	0.38
West Channel	1690.88	100 Year	44.44	191.55	44.45	0.15	0.29	0.15	0.43
West Channel	1690.88	5 Year	6.82	68.59	6.82	0.05	0.12	0.05	0.34
West Channel	1443.96	100 Year	30.50	219.48	30.47	0.45	1.08	0.45	0.89
West Channel	1443.96	5 Year		82.23			0.86		1.02
West Channel	1431.96	100 Year	47.37	185.76	47.32	0.15	0.29	0.15	0.40
West Channel	1431.96	5 Year	6.67	68.90	6.66	0.06	0.15	0.06	0.36
West Channel	1413.96	100 Year	44.74	191.02	44.69	0.14	0.28	0.14	0.42
West Channel	1413.96	5 Year	5.92	70.40	5.91	0.05	0.15	0.05	0.38
West Channel	1356.5	100 Year	46.07	188.38	46.00	0.13	0.25	0.13	0.40
West Channel	1356.5	5 Year	6.95	68.34	6.94	0.05	0.12	0.05	0.33
West Channel	1255.33	100 Year	46.80	186.80	46.85	0.12	0.23	0.12	0.38
West Channel	1255.33	5 Year	7.75	66.72	7.76	0.04	0.10	0.04	0.30
West Channel	948.39	100 Year	30.40	219.63	30.42	0.45	1.08	0.45	0.90
West Channel	948.39	5 Year		82.23			0.86		1.02
West Channel	932.39	100 Year	44.76	190.86	44.83	0.18	0.36	0.18	0.46
West Channel	932.39	5 Year	6.60	69.03	6.60	0.06	0.16	0.06	0.36
West Channel	914.39	100 Year	41.70	196.99	41.76	0.18	0.36	0.18	0.50
West Channel	914.39	5 Year	5.83	70.57	5.83	0.05	0.15	0.05	0.39
West Channel	849.13	100 Year	30.44	219.56	30.44	0.45	1.08	0.45	0.90
West Channel	849.13	5 Year		82.23			0.86		1.02
West Channel	829.13	100 Year	43.27	193.92	43.26	0.20	0.41	0.20	0.50
West Channel	829.13	5 Year	5.71	70.80	5.71	0.06	0.19	0.06	0.41
West Channel	811.13	100 Year	39.82	200.81	39.82	0.21	0.42	0.21	0.55
West Channel	811.13	5 Year	4.76	72.70	4.76	0.06	0.19	0.06	0.44
West Channel	764.52	100 Year	36.07	208.26	36.12	0.27	0.57	0.27	0.66
West Channel	764.52	5 Year	3.35	75.53	3.35	0.07	0.26	0.07	0.53
West Channel	748.18	100 Year	30.45	219.57	30.43	0.45	1.08	0.45	0.89
West Channel	748.18	5 Year		82.23			0.86		1.02
West Channel	728.18	100 Year	45.45	189.60	45.40	0.17	0.34	0.17	0.44
West Channel	728.18	5 Year	5.95	70.33	5.95	0.06	0.18	0.06	0.39
West Channel	710.18	100 Year	44.63	191.23	44.59	0.18	0.36	0.18	0.46
West Channel	710.18	5 Year	5.35	71.53	5.35	0.06	0.20	0.06	0.42
West Channel	567.15	100 Year	42.74	194.95	42.75	0.17	0.33	0.17	0.47
West Channel	567.15	5 Year	5.34	71.55	5.34	0.06	0.17	0.06	0.41
West Channel	438.04	100 Year	41.88	196.74	41.83	0.18	0.36	0.18	0.49
West Channel	438.04	5 Year	5.19	71.85	5.19	0.06	0.18	0.06	0.42
West Channel	340.94	100 Year	40.07	200.32	40.06	0.20	0.41	0.20	0.54
West Channel	340.94	5 Year	4.66	72.90	4.66	0.06	0.20	0.06	0.45

HEC-RAS Plan: Trails at Crowfoot River: West Channel Reach: West Channel (Continued)

Reach	River Sta	Profile	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Shear LOB (lb/sq ft)	Shear Chan (lb/sq ft)	Shear ROB (lb/sq ft)	Froude # Chl
West Channel	324.8	100 Year	39.65	201.24	39.56	0.21	0.43	0.21	0.55
West Channel	324.8	5 Year	4.48	73.27	4.48	0.06	0.21	0.06	0.46
West Channel	268.32	100 Year	36.08	207.79	36.57	0.26	0.55	0.26	0.65
West Channel	268.32	5 Year	3.40	75.24	3.59	0.06	0.25	0.07	0.52
West Channel	248.78	100 Year	30.10	219.60	30.74	0.45	1.08	0.46	0.90
West Channel	248.78	5 Year		82.23			0.85		1.02
West Channel	238.61	100 Year	42.27	195.35	42.83	0.21	0.43	0.21	0.52
West Channel	238.61	5 Year	5.52	71.00	5.71	0.06	0.19	0.06	0.41
West Channel	210.78	100 Year	38.63	202.65	39.17	0.22	0.46	0.22	0.57
West Channel	210.78	5 Year	4.52	73.00	4.71	0.06	0.20	0.06	0.45
West Channel	149.42	100 Year	30.83	219.29	30.33	0.45	1.06	0.44	0.89
West Channel	149.42	5 Year		82.23			0.87		1.03
West Channel	129.42	100 Year	69.24	138.80	72.40	0.01	0.03	0.02	0.10
West Channel	129.42	5 Year	11.80	58.77	11.66	0.02	0.05	0.02	0.17
West Channel	111.42	100 Year	67.00	143.37	70.09	0.01	0.03	0.02	0.10
West Channel	111.42	5 Year	11.22	59.91	11.09	0.02	0.04	0.02	0.17
West Channel	33.71	100 Year	70.92	140.81	68.71	0.01	0.02	0.01	0.09
West Channel	33.71	5 Year	12.24	57.75	12.24	0.02	0.03	0.02	0.15

HEC-RAS Plan: Trails at Crowfoot River: West Channel Reach: West Channel

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
West Channel	2426.78	100 Year	280.45	6032.97	6035.75		6035.95	0.001978	4.02	84.61	48.19	0.45
West Channel	2426.78	5 Year	82.23	6032.97	6034.62		6034.72	0.002009	2.71	35.25	39.14	0.41
West Channel	2347.67	100 Year	280.45	6032.82	6035.59		6035.79	0.002001	4.03	84.28	48.16	0.45
West Channel	2347.67	5 Year	82.23	6032.82	6034.45		6034.56	0.002109	2.76	34.62	39.05	0.42
West Channel	1856.34	100 Year	280.45	6031.83	6034.63		6034.83	0.001898	3.96	85.85	48.41	0.44
West Channel	1856.34	5 Year	82.23	6031.83	6033.53		6033.62	0.001719	2.57	37.32	39.58	0.38
West Channel	1690.88	100 Year	280.45	6031.50	6034.33		6034.52	0.001820	3.91	87.12	48.60	0.43
West Channel	1690.88	5 Year	82.23	6031.50	6033.29		6033.37	0.001330	2.36	40.95	40.31	0.34
West Channel	1443.96	100 Year	280.45	6031.01	6033.00	6033.00	6033.59	0.010175	6.65	49.32	41.94	0.89
West Channel	1443.96	5 Year	82.23	6031.01	6032.10	6032.10	6032.53	0.016684	5.27	15.61	18.70	1.02
West Channel	1431.96	100 Year	280.45	6028.01	6030.91		6031.08	0.001784	3.69	90.45	49.17	0.40
West Channel	1431.96	5 Year	82.23	6028.01	6029.75		6029.83	0.001720	2.46	38.81	39.89	0.36
West Channel	1413.96	100 Year	280.45	6028.01	6030.86		6031.04	0.001762	3.87	88.13	48.80	0.42
West Channel	1413.96	5 Year	82.23	6028.01	6029.71		6029.80	0.001734	2.58	37.20	39.56	0.38
West Channel	1356.5	100 Year	280.45	6027.83	6030.78		6030.94	0.001512	3.67	92.99	49.57	0.40
West Channel	1356.5	5 Year	82.23	6027.83	6029.63		6029.71	0.001286	2.33	41.46	40.41	0.33
West Channel	1255.33	100 Year	280.45	6027.63	6030.64		6030.80	0.001375	3.56	96.14	50.08	0.38
West Channel	1255.33	5 Year	82.23	6027.63	6029.53		6029.59	0.001001	2.14	45.34	41.18	0.30
West Channel	948.39	100 Year	280.45	6027.02	6029.01	6029.01	6029.60	0.010231	6.67	49.23	41.96	0.90
West Channel	948.39	5 Year	82.23	6027.02	6028.10	6028.10	6028.54	0.016830	5.28	15.56	18.68	1.02
West Channel	932.39	100 Year	280.45	6023.02	6025.73		6025.94	0.002389	4.07	81.71	47.75	0.46
West Channel	932.39	5 Year	82.23	6023.02	6024.75		6024.83	0.001749	2.47	38.58	39.86	0.36
West Channel	914.39	100 Year	280.45	6023.02	6025.66		6025.90	0.002481	4.34	78.16	47.15	0.50
West Channel	914.39	5 Year	82.23	6023.02	6024.71		6024.80	0.001773	2.60	36.90	39.52	0.39
West Channel	849.13	100 Year	280.45	6022.90	6024.89	6024.89	6025.48	0.010238	6.67	49.22	41.94	0.90
West Channel	849.13	5 Year	82.23	6022.90	6023.98	6023.98	6024.42	0.016876	5.29	15.55	18.68	1.02
West Channel	829.13	100 Year	280.45	6017.90	6020.52		6020.75	0.002837	4.32	76.97	46.94	0.50
West Channel	829.13	5 Year	82.23	6017.90	6019.55		6019.65	0.002252	2.69	35.22	39.17	0.41
West Channel	811.13	100 Year	280.45	6017.90	6020.42		6020.69	0.003073	4.66	72.52	46.18	0.55
West Channel	811.13	5 Year	82.23	6017.90	6019.49		6019.60	0.002417	2.89	32.92	38.70	0.44
West Channel	764.52	100 Year	280.45	6017.86	6020.17	6019.86	6020.54	0.004564	5.32	63.13	44.52	0.66
West Channel	764.52	5 Year	82.23	6017.86	6019.33	6018.94	6019.48	0.003593	3.30	28.32	37.74	0.53
West Channel	748.18	100 Year	280.45	6017.83	6019.82	6019.82	6020.41	0.010169	6.65	49.33	41.97	0.89
West Channel	748.18	5 Year	82.23	6017.83	6018.91	6018.91	6019.35	0.016827	5.28	15.56	18.67	1.02
West Channel	728.18	100 Year	280.45	6012.83	6015.59		6015.79	0.002217	3.97	83.85	48.10	0.44
West Channel	728.18	5 Year	82.23	6012.83	6014.50		6014.59	0.002092	2.63	36.16	39.36	0.39
West Channel	710.18	100 Year	280.45	6012.83	6015.53		6015.75	0.002431	4.10	81.21	47.66	0.46
West Channel	710.18	5 Year	82.23	6012.83	6014.44		6014.55	0.002469	2.78	34.04	38.93	0.42
West Channel	567.15	100 Year	280.45	6012.46	6015.17		6015.38	0.002221	4.18	81.26	47.66	0.47
West Channel	567.15	5 Year	82.23	6012.46	6014.10		6014.20	0.002057	2.73	34.95	39.11	0.41
West Channel	438.04	100 Year	280.45	6012.20	6014.85		6015.08	0.002457	4.32	78.43	47.16	0.49
West Channel	438.04	5 Year	82.23	6012.20	6013.83		6013.93	0.002148	2.77	34.40	39.00	0.42
West Channel	340.94	100 Year	280.45	6012.01	6014.55		6014.82	0.002974	4.61	73.32	46.28	0.54
West Channel	340.94	5 Year	82.23	6012.01	6013.59		6013.71	0.002475	2.91	32.62	38.62	0.45
West Channel	324.8	100 Year	280.45	6011.98	6014.49		6014.77	0.003140	4.69	71.98	46.09	0.55
West Channel	324.8	5 Year	82.23	6011.98	6013.54		6013.67	0.002612	2.96	31.98	38.53	0.46
West Channel	268.32	100 Year	280.45	6011.86	6014.20	6013.86	6014.55	0.004375	5.25	64.03	44.64	0.65
West Channel	268.32	5 Year	82.23	6011.86	6013.34		6013.50	0.003399	3.24	28.90	37.83	0.52
West Channel	248.78	100 Year	280.45	6011.82	6013.81	6013.81	6014.40	0.010247	6.66	49.24	42.03	0.90
West Channel	248.78	5 Year	82.23	6011.82	6012.91	6012.91	6013.34	0.016645	5.26	15.64	18.75	1.02
West Channel	238.61	100 Year	280.45	6006.82	6009.39		6009.64	0.003067	4.43	74.98	46.69	0.52
West Channel	238.61	5 Year	82.23	6006.82	6008.46		6008.56	0.002309	2.71	34.93	39.20	0.41
West Channel	210.78	100 Year	280.45	6006.82	6009.29	6008.82	6009.58	0.003394	4.82	70.10	45.84	0.57
West Channel	210.78	5 Year	82.23	6006.82	6008.40	6007.91	6008.52	0.002516	2.93	32.45	38.69	0.45

HEC-RAS Plan: Trails at Crowfoot River: West Channel Reach: West Channel (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
West Channel	149.42	100 Year	280.45	6006.59	6008.59	6008.59	6009.17	0.009956	6.60	49.71	42.08	0.89
West Channel	149.42	5 Year	82.23	6006.59	6007.67	6007.67	6008.11	0.017111	5.31	15.48	18.68	1.03
West Channel	129.42	100 Year	280.45	6001.59	6007.37		6007.39	0.000084	1.31	274.19	78.92	0.10
West Channel	129.42	5 Year	82.23	6001.59	6004.02		6004.05	0.000341	1.42	68.53	45.52	0.17
West Channel	111.42	100 Year	280.45	6001.59	6007.36		6007.38	0.000079	1.36	274.00	78.91	0.10
West Channel	111.42	5 Year	82.23	6001.59	6004.02		6004.04	0.000315	1.45	68.22	45.47	0.17
West Channel	33.71	100 Year	280.45	6001.36	6007.36	6003.36	6007.38	0.000067	1.28	294.61	83.84	0.09
West Channel	33.71	5 Year	82.23	6001.36	6004.00	6002.44	6004.02	0.000213	1.27	78.16	47.16	0.15

Design Parameter	Design Value
Maximum 100-year depth outside of bankfull channel	5 ft
Roughness values	Per Table 8-5
Maximum 5-year velocity, main channel (within bankfull channel width) (ft/s)	5 ft/s
Maximum 100-year velocity, main channel (within bankfull channel width) (ft/s)	7 ft/s
Froude No., 5-year, main channel (within bankfull channel width)	0.7
Froude No., 100-year, main channel (within bankfull channel width)	0.8
Maximum shear stress, 100-year, main channel (within bankfull channel width)	1.2 lb/sf

IV. Copies of graphs, tables, and nomographs used

- A. FIRM
- B. Soils
- C. 1-Hour Rainfall Data
- D. Excerpts from adjacent Studies

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables shown on this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Floodway Data table shown on this FIRM.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, NINGS12
National Geodetic Survey
SSM/C-3 #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

Base map information shown on this FIRM was provided by the Douglas County GIS Department and the Town of Castle Rock GIS Department. Additional input was provided by the City of Lone Tree and Town of Parker. These data are current as of 2010.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

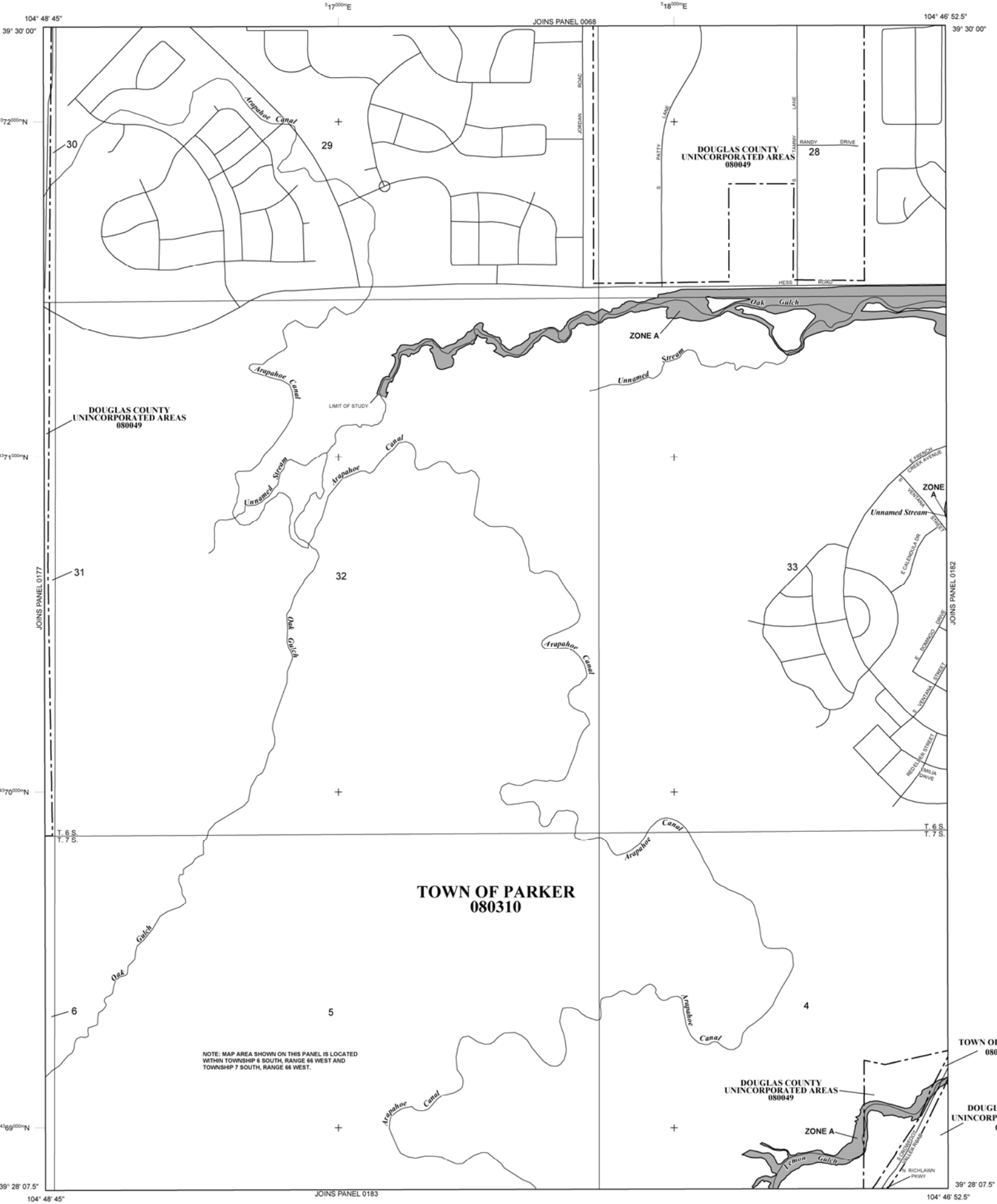
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfip>.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently deteriorated. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

Base Flood Elevation line and value; elevation in feet*

Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

Cross section line

Transsect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere

1000-meter Universal Transverse Mercator grid values, zone 13

Bench mark (see explanation in Notes to Users section of this FIRM)

River Mile

MAP REPOSITORIES

Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

PANEL 0181G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 181 OF 495
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0181	G
PARKER, TOWN OF	080310	0181	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 08035C0181G

MAP REVISED MARCH 16, 2016

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables shown on this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Floodway Data table shown on this FIRM.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, NINGS12
National Geodetic Survey
SSM/C-3 #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

Base map information shown on this FIRM was provided by the Douglas County GIS Department and the Town of Castle Rock GIS Department. Additional input was provided by the City of Lone Tree and Town of Parker. These data are current as of 2010.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

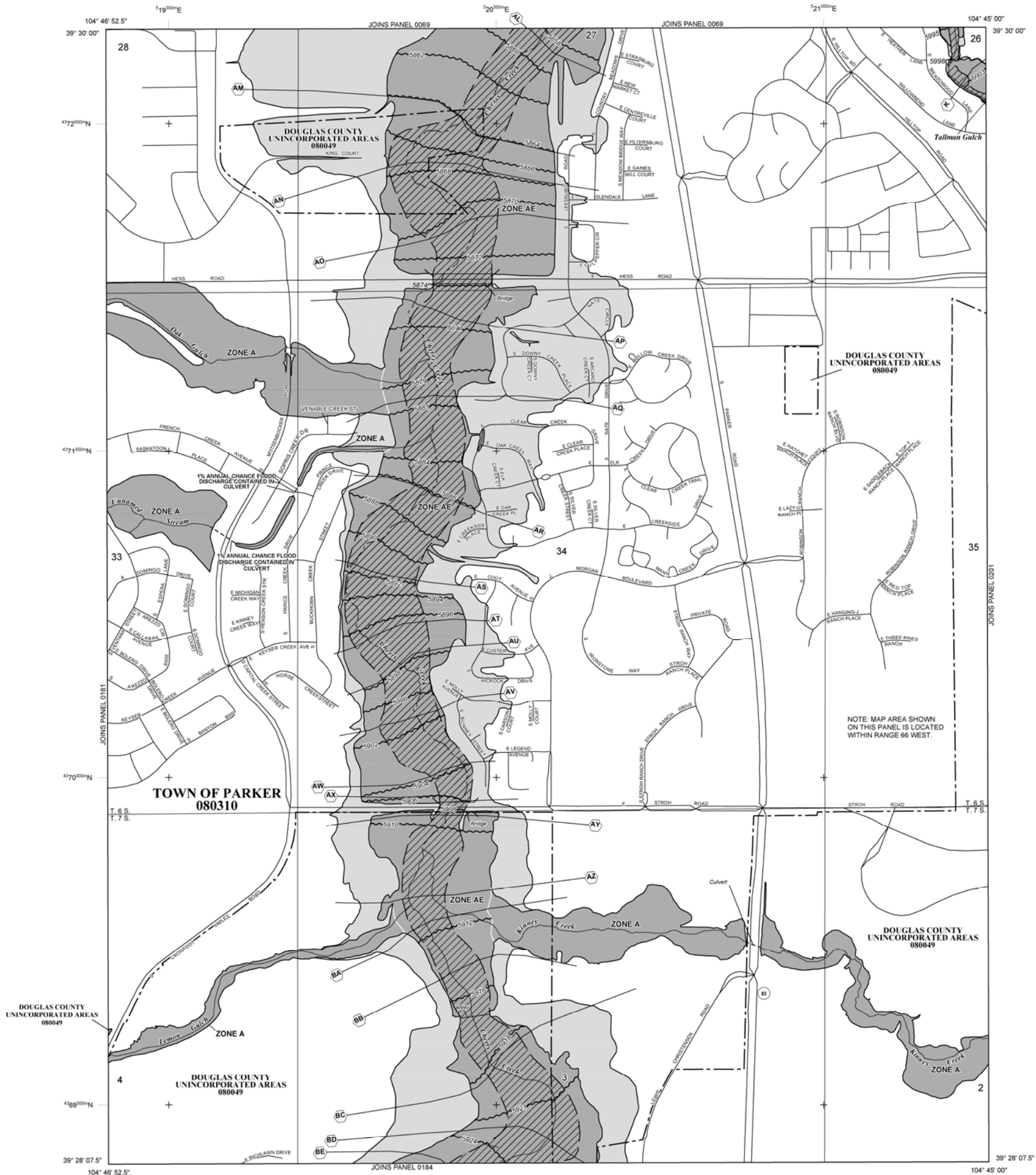
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations** and **floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unreviewed streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfp>.



LEGEND

- SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**
The 1% annual chance flood (100-year flood), also known as the **base flood**, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The **Base Flood Elevation** is the water-surface elevation of the 1% annual chance flood.
- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
- FLOODWAY AREAS IN ZONE AE**
- The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.
- OTHER FLOOD AREAS**
- ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- OTHER AREAS**
- ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- ZONE D** Areas in which flood hazards are undetermined, but possible.
- COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**
- OTHERWISE PROTECTED AREAS (OPAs)**
- CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- Base Flood Elevation line and value; elevation in feet*
- Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

Cross section line

Transsect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere

1000-meter Universal Transverse Mercator grid values, zone 13

Bench mark (see explanation in Notes to Users section of this FIRM (p.16))

River Mile

MAP REPOSITORIES

Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000
150 0 150 300
FEET
METERS

NFIP

PANEL 0182G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 182 OF 495
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0182	G
PARKER, TOWN OF	080310	0182	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08035C0182G

MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables shown on this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Floodway Data table shown on this FIRM.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, NINGS12
National Geodetic Survey
SSM/C-3 #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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Base map information shown on this FIRM was provided by the Douglas County GIS Department and the Town of Castle Rock GIS Department. Additional input was provided by the City of Lone Tree and Town of Parker. These data are current as of 2010.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

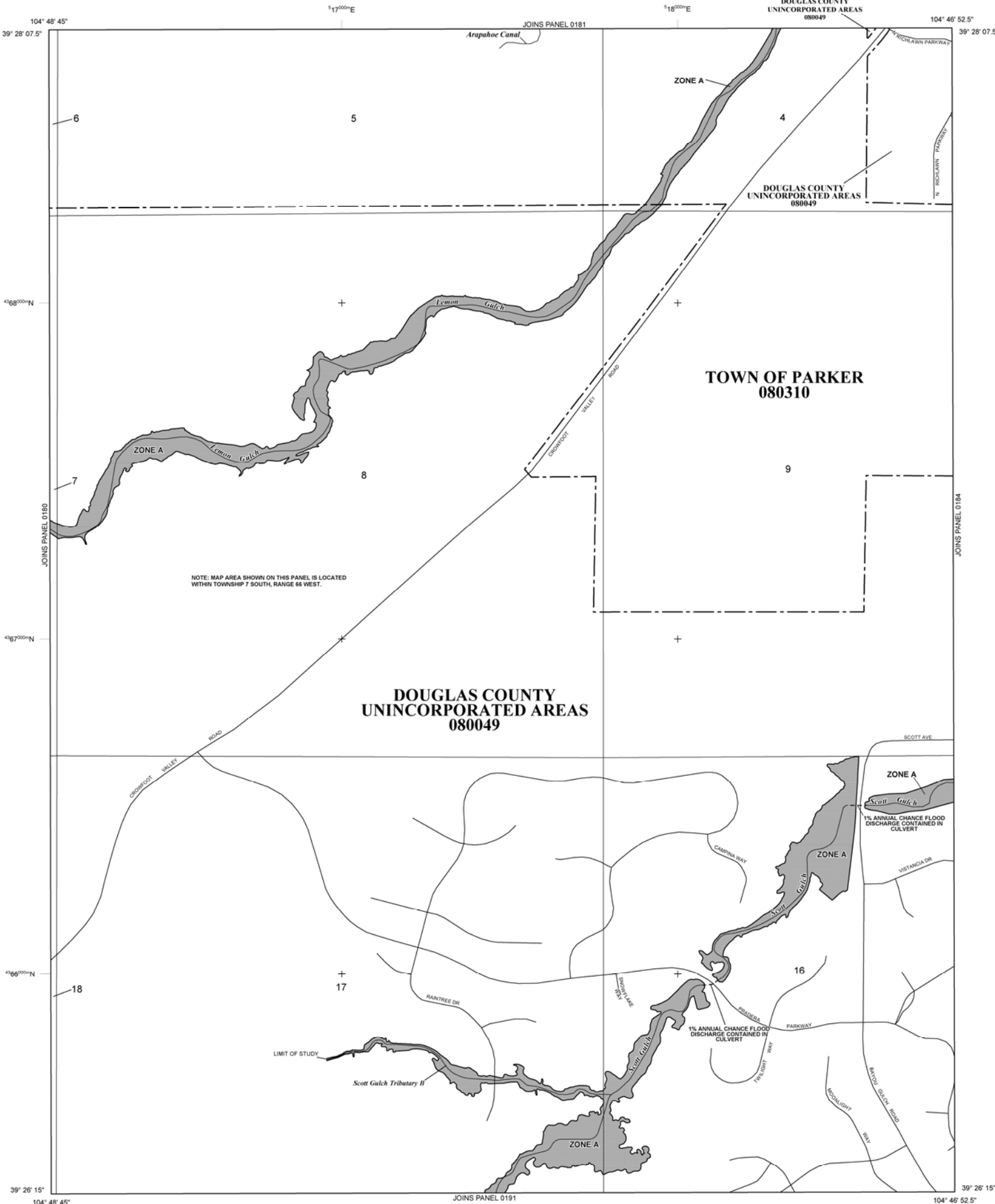
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

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LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD
The 1% annual chance flood (100-year flood), also known as the **base flood**, is the flood that has a 1% chance of being equaled or exceeded in any given year. The **Special Flood Hazard Area** is the area subject to flooding by the 1% annual chance flood. Areas of **Special Flood Hazard** include Zones A, AE, AH, AO, AR, A99, V, and VE. The **Base Flood Elevation** is the water-surface elevation of the 1% annual chance flood.

- ZONE A** No Base Flood Elevations determined.
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- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
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- ZONE AR** Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently destroyed. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- Base Flood Elevation line and value; elevation in feet*
- Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

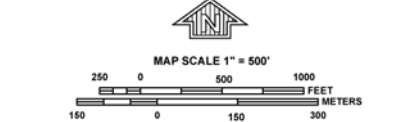
- Cross section line
- Transect line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
- 1000-meter Universal Transverse Mercator grid values, zone 13
- Bench mark (see explanation in Notes to Users section of this FIRM)
- River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index
EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
SEPTEMBER 30, 2005
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision.

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NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0183G

FIRM
FLOOD INSURANCE RATE MAP
DOUGLAS COUNTY,
COLORADO
AND INCORPORATED AREAS

PANEL 183 OF 495
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:			
COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0183	G
PARKER, TOWN OF	080310	0183	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.



MAP NUMBER
08035C0183G
MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

NOTES TO USERS

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NGS Information Services
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National Geodetic Survey
SSM/C-3 #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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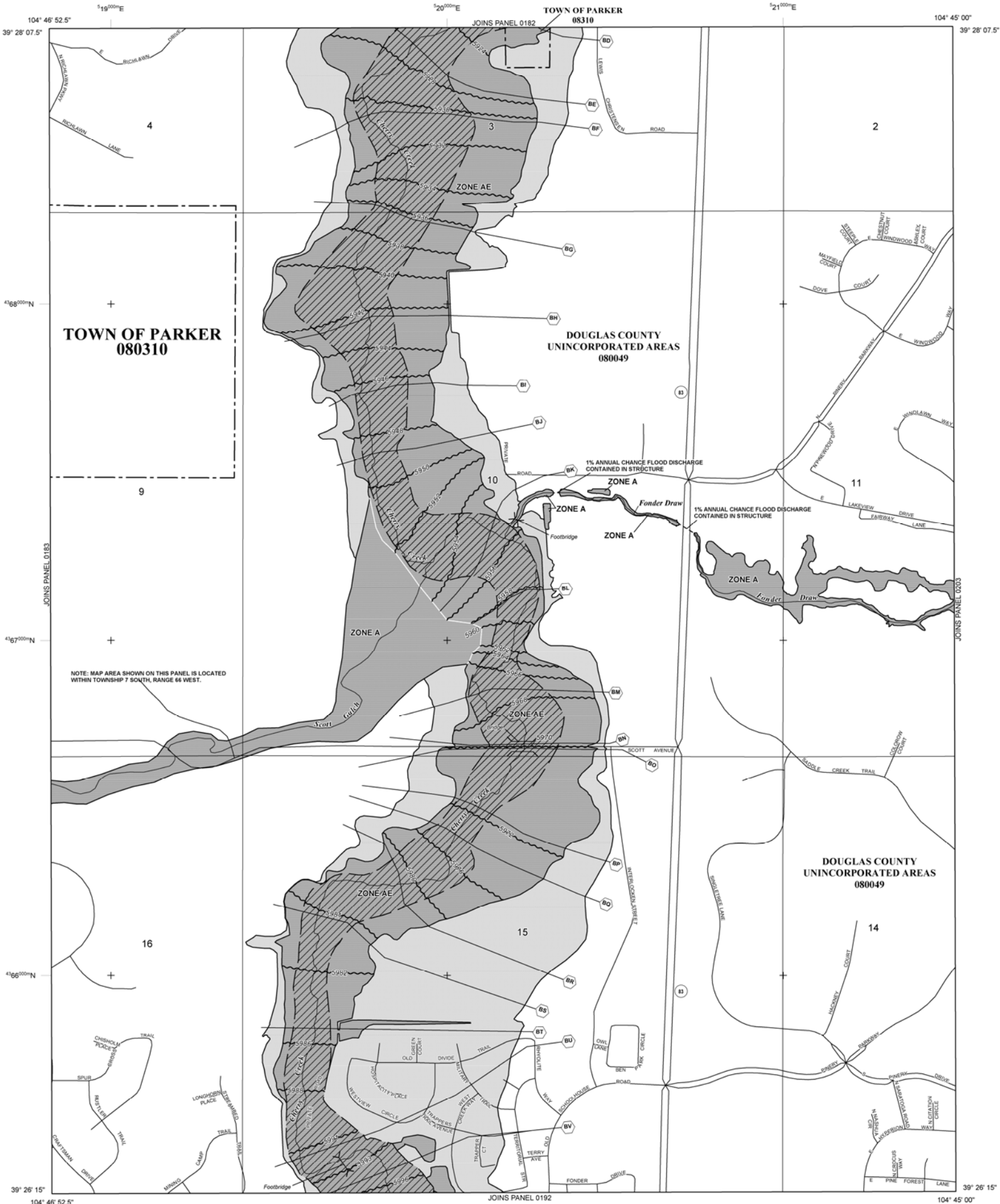
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LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD
The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
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- ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
Base Flood Elevation line and value; elevation in feet*
(EL 987)
Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A Cross section line

23 Transsect line

45° 02' 08", 93° 02' 12" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere

1698700m N 1000-meter Universal Transverse Mercator grid values, zone 13

DX5510 X Bench mark (see explanation in Notes to Users section of this FIRM)

* M1.5 River Mile

MAP REPOSITORIES

Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision.

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MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0184G

FIRM
FLOOD INSURANCE RATE MAP
DOUGLAS COUNTY,
COLORADO
AND INCORPORATED AREAS

PANEL 184 OF 495
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0184	G
PARKER, TOWN OF	080310	0184	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

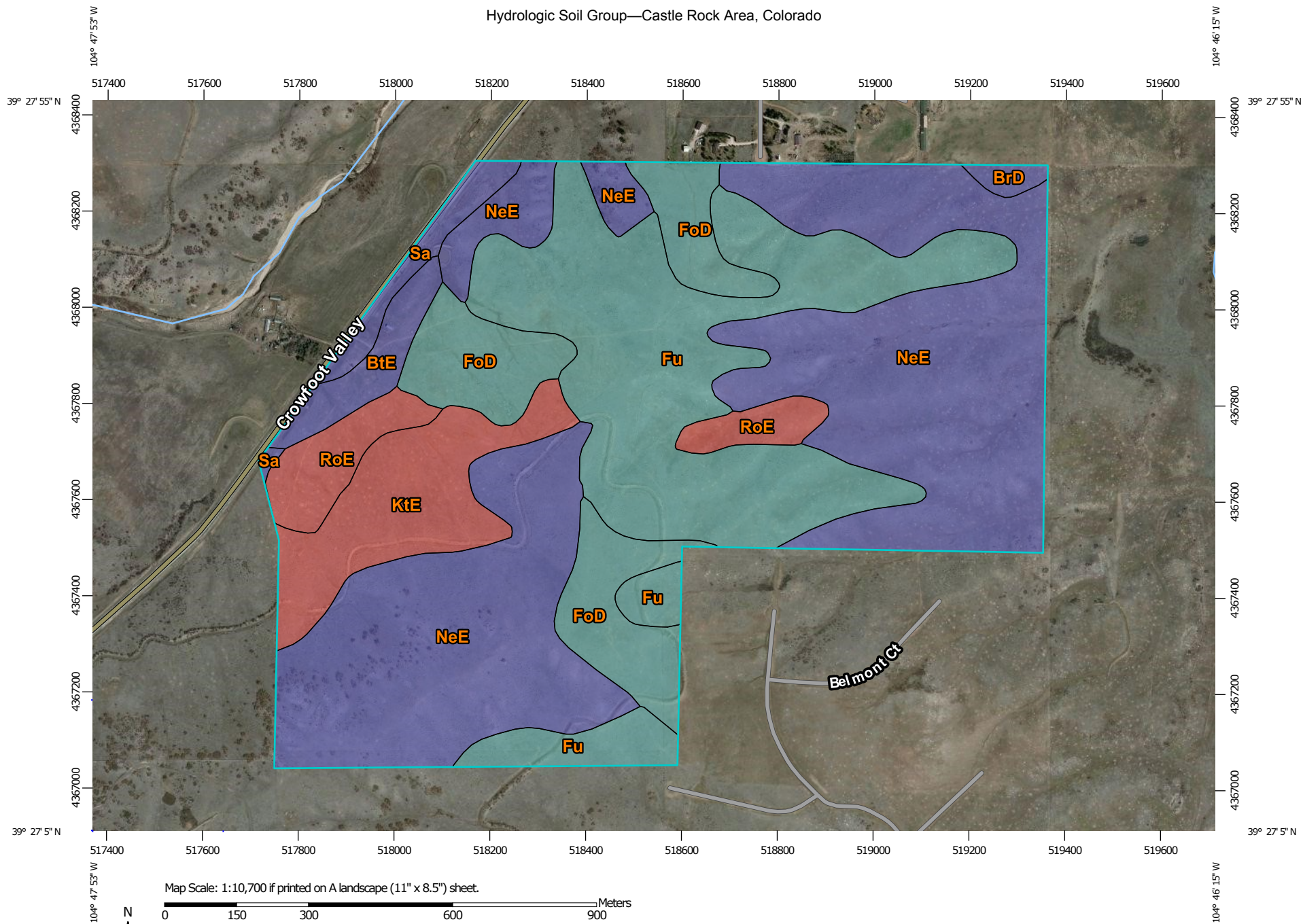


MAP NUMBER
08035C0184G

MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

Hydrologic Soil Group—Castle Rock Area, Colorado



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

9/23/2019
Page 1 of 4

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 1:20,000.

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: <http://websoilsurvey.nrcs.usda.gov>
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: Castle Rock Area, Colorado
Survey Area Data: Version 8, Sep 23, 2014

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

Date(s) aerial images were photographed: Mar 16, 2012—Apr 13, 2012

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

Hydrologic Soil Group— Summary by Map Unit — Castle Rock Area, Colorado (CO622)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BrD	Bresser sandy loam, 3 to 9 percent slopes	B	2.1	0.5%
BtE	Bresser-Truckton sandy loams, 5 to 25 percent slopes	B	9.1	2.4%
FoD	Fondis clay loam, 3 to 9 percent slopes	C	41.3	10.7%
Fu	Fondis-Kutch association	C	105.5	27.3%
KtE	Kutch sandy loam, 5 to 20 percent slopes	D	30.5	7.9%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	B	174.1	45.0%
RoE	Renohill sandy loam, reddish variant, 5 to 20 percent slopes	D	16.5	4.3%
Sa	Sampson loam	B	7.5	1.9%
Totals for Area of Interest			386.5	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

TABLE 5.1
ONE-HOUR POINT RAINFALL

Frequency of Design Event (yr)	One-hour Point Rainfall, P_1 (in)
2	0.99
5	1.39
10	1.64
25	1.98
50	2.31
100	2.60

5.3 FLOOD HYDROLOGY OVERVIEW

Various methods exist to determine appropriate flood peaks or hydrographs for storm drainage planning and design. Methods for determining flood peaks or hydrographs are the Rational Method, the Colorado Urban Hydrograph Procedure (CUHP), and Urban Drainage Stormwater Management (UDSWM) model. The Town of Parker discourages the use of computer models other than CUHP and UDSWM since these programs are preferred, if not required, by UDFCD for studies involving major drainageways where UDFCD approval is sought or where maintenance eligibility is requested.

The three methods are briefly described in this section, and a discussion of their applicability to the Town of Parker is discussed. UDSWM is mostly used to combine and route the hydrographs generated using CUHP.

In general, the Rational Method is the most widely used and accepted technique for determining peak flows in urban areas for small basins. Within the constraints outlined in the MANUAL, use of the Rational Method provides a relatively simple but effective way to analyze storm runoff.

CUHP is somewhat more complicated than the Rational Method. It allows a manual computation of a runoff hydrograph which may be used for further hydraulic routing through channels and/or detention ponds. Historically, CUHP is best used in urban areas for which runoff coefficients have been derived. However, recent improvements by UDFCD include consideration for different soil types, thus CUHP is now more applicable to rural areas. The reader is referred to UDFCD for the latest version of CUHP.

UDSWM is a computer model that generates runoff hydrographs and routes and combines these hydrographs. UDSWM is a modified version of the Runoff Block of the Environmental Protection Agency's Storm Water Management Model (SWMM). It has been modified to be used in conjunction with CUHP. Table 5.2 herein provides guidance on selecting the appropriate method for a given project.

Conceptual Drainage Report

***Hess Ranch Development
Parker, Colorado***

CODE: SRD01

Prepared For:

SDI Inc.
5105 DTC Parkway, Suite 240
Greenwood Village, Colorado 80111
Contact: Gary Hunter
720-482-7707

Prepared By:



7442 South Tucson Way, Suite 190-A
Centennial, Colorado 80112
Contact: Russell Burrows, P.E.
303-708-0500

Initially Submitted: November 25, 2014
Revised: February 15, 2015
Updated: June 1, 2015

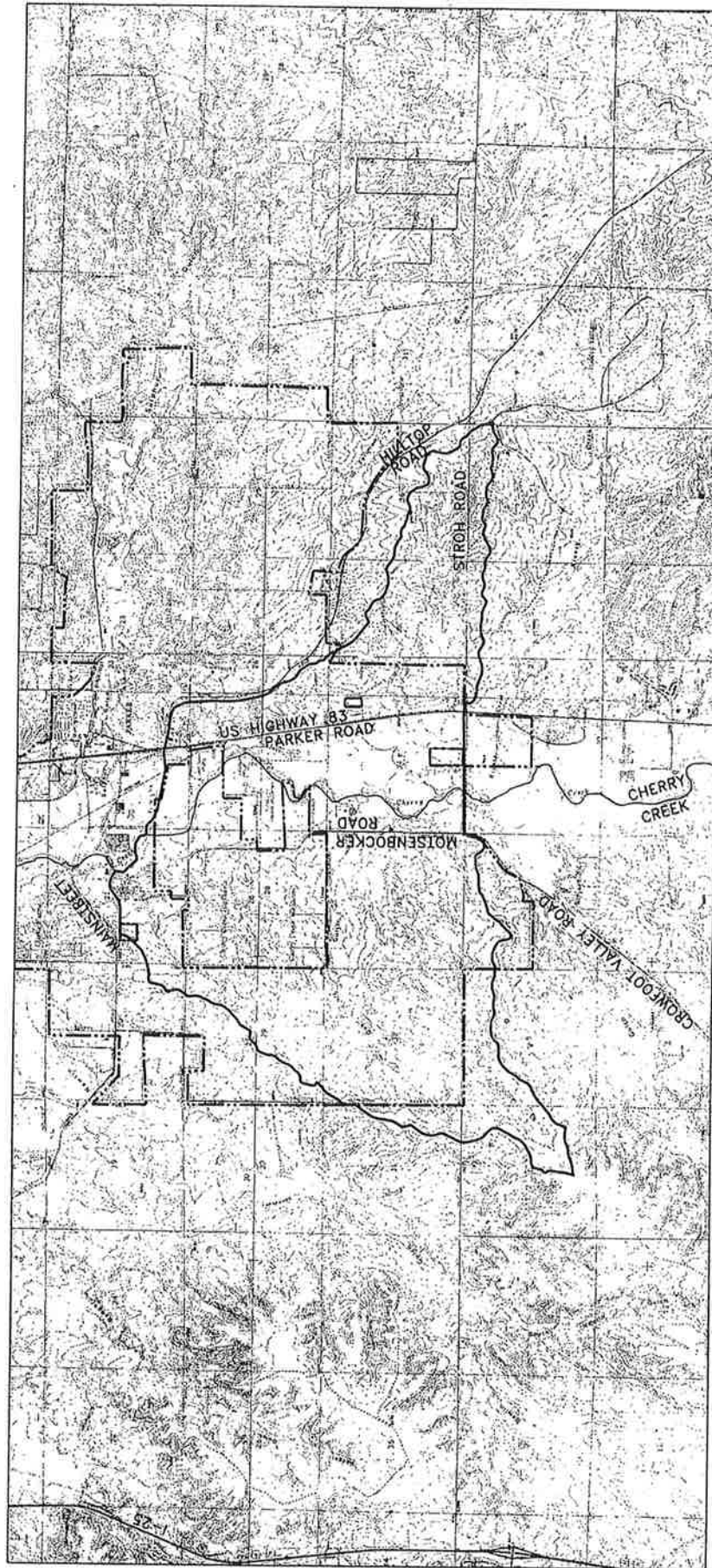


APPENDIX D

Excerpts from Oak Gulch & Stroh Ranch Area Outfall Systems Planning

OAK GULCH AND STROH RANCH AREA OUTFALL SYSTEMS PLANNING

PRELIMINARY DESIGN REPORT



Prepared by:

Knight Piesold
CONSULTING

1050 17th Street, Suite 500
Denver, Colorado 80202-0500

TOWN OF PARKER DOUGLAS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
FEBRUARY 2003

II. STUDY AREA DESCRIPTION

A.

General

The Oak Gulch and Stroh Ranch study area is located in Douglas County and partially within the southern portion of the Town of Parker. It encompasses the tributary areas on both the east and west sides of Cherry Creek between Main Street on the north and Stroh Road on the south. The area contains several major drainageways, including Oak Gulch, smaller unnamed drainageways, and direct flow areas that discharge along a 3.0-mile reach of Cherry Creek. Cherry Creek flows from south to north through the study area. Figures II-1 and II-2 show the general location of the study area and existing facilities in the study area, respectively.

Presently, a portion of the 7.7 mi² (4,955-acre) study area lies within the corporate limits of the Town of Parker; those areas that are not within the corporate limits are under the jurisdiction of Douglas County. It should be noted that, in the future, much of the study area might eventually be annexed into the Town of Parker.

At the time of this study, the area comprised a mixture of residential, commercial, and open areas. The residential areas range from low-density with several acres per residence to high-density with as many as six units per acre. The open areas include native open space, undeveloped land, parks, greenbelts, soil farms (agricultural), and the Cherry Creek floodplain. There are also many areas that are presently being developed for various residential densities and commercial sites, and several more areas have already been proposed for development.

The major arterial roads through the study area include Parker Road (State Highway 83), Mosenbocker Road, and Stroh Road. Several other collector and local roads, both paved and unpaved, are also within the study area.

B. Topography

The study area generally slopes toward Cherry Creek from both the east and west sides. West of Cherry Creek, slopes typically range from 2 to 4 percent in the upper reaches of the catchments, from 1 to 2 percent in the middle reaches, and are generally less than 1 percent in the lower reaches near the Cherry Creek floodplain. East of Cherry Creek, slopes are typically 3 to 6 percent in the upper reaches, 1 to 3 percent in the middle reaches, and less than 1 percent in the lower reaches. The topography, represented by 25-foot contour intervals, is shown on Figure II-3.

C.

Soil Characteristics

Soil classifications throughout the study area were determined from the Soil Survey of Castle Rock Area, Colorado (Reference 1). Areas with common hydrologic soil properties were delineated based on their Hydrologic Soils Group classifications; these areas are shown on Figure II-4. The study area contains all four Hydrologic Soils Group classifications but primarily comprises Type B (moderately high infiltration and moderately low runoff potential) and Type C (moderately low infiltration and moderately high runoff potential) soils. There are, however, small areas of Type A (high infiltration and low runoff potential) and Type D (low infiltration and high runoff potential) soils. In general, those areas west of Cherry Creek have predominantly Type C soils while those areas east of Cherry Creek have predominantly Type B soils.

D.

Catchment Imperviousness

The study area was divided into regions of similar hydrologic response based on the existing and proposed future imperviousness. For purposes of this study, four categories of imperviousness were used to generalize the entire study area. Areas with similar imperviousness under existing conditions were outlined from aerial photography of the project area; these areas are shown on Figure II-5. Areas with similar imperviousness for the proposed future conditions were outlined based on information from submitted drainage reports for various developments as well as from discussions with representatives of Parker and the County; these areas are shown on Figure II-6. The imperviousness values used to represent the four distinct areas were developed from Table RO-3 and Figures RO-3 through RO-5 of the Manual. The following values were used:

- 95 percent impervious for areas with many structures, buildings, large paved areas such as parking lots, or other impervious structures typical for commercial or industrial-type developments
- 45 percent impervious for areas intermixed with pervious and impervious features; typical for residential or business areas with open space, lawns, or greenbelts situated among buildings, houses, or other structures
- 40 percent for the West Stroh and North Crowfoot Valley catchments, due to Town of Parker accepted plans in this area
- 18 percent impervious for areas with fewer structures and more open space, typical for rural residential areas with large lots, few houses, roadways or other structures
- 2 percent impervious for generally open areas; typical for open space, parks, or undeveloped land with only an occasional roadway, rock outcropping, or other impervious feature.

E.

Sub-Catchment Descriptions

The study area was divided into eight major catchments, which were further divided into 91 sub-catchments. The catchment and sub-catchment boundaries are shown on Figures II-3 through II-6. These boundaries were developed based on topography, existing drainage facilities, aerial photography, and field observations. The sub-catchment delineation of Oak Gulch and the two unnamed tributaries immediately south of Oak Gulch were obtained from the Flood Hazard Area Delineation (FHAD) for Oak Gulch and Lemon Gulch (Reference 7). Since Oak Gulch is the only previously named tributary in the study area, the major catchments were assigned convenient names for identification in this report.

Oak Gulch Catchment

The Oak Gulch Catchment is located on the west side of Cherry Creek in the southwest portion of the study area. The 1.8-mi² (1,142-acre) tributary area comprises 16 sub-catchments. Presently, this area is in a relatively native condition and generally undeveloped. However, the Master Drainage Plan for Stroth Ranch provides extensive development plans that primarily include residential developments, a golf course, and some commercial sites (Reference 8 and 43). This master drainage plan calls for six detention basins and channel improvements. Runoff generated from this catchment culminates at an 11-foot-wide by 8-foot-high reinforced concrete box (RCB) culvert that passes under Motesbocker Road. From Motesbocker Road to the outfall into Cherry Creek, there is an improved drainage way with existing check structures and an on-site retention pond.

West Stroth Catchment

The West Stroth Catchment is located on the west side of Cherry Creek immediately south of Oak Gulch. The 1.0-mi² (664-acre) tributary area comprises 13 sub-catchments. This area is presently in a relatively native condition and undeveloped. However, development plans for the portion between Motesbocker Road and Cherry Creek have been prepared through Stroth Ranch Filing No. 9 (Reference 9). Additionally, development plans for the area west of Motesbocker Road have been prepared through Stroth Ranch Filing No. 12 (Reference 10), Stroth Ranch Filing No. 13 (Reference 11), and Stroth Ranch Filing Nos. 17, 18, and 19 (Reference 12). An existing regional detention basin is located adjacent to Motesbocker Road. This pond has a maximum storage capacity of 80.90 acre-feet, which includes 11.48 acre-feet for water quality and discharges at a peak rate of 516 cfs for the 100-year storm event (References 13 and 14). The discharge from the detention basin passes under Motesbocker Road through a 48-inch reinforced concrete pipe (RCP) culvert that carries the frequent low flows and a 10-foot by 10-foot RCB culvert for additional flows. The RCB culvert is also intended to be used as a pedestrian crossing. Although not constructed at the time of this report, improvements to the drainage way between Motesbocker Road and Cherry Creek have been designed through Stroth Ranch Filing No. 9.

North Crowfoot Valley Catchment

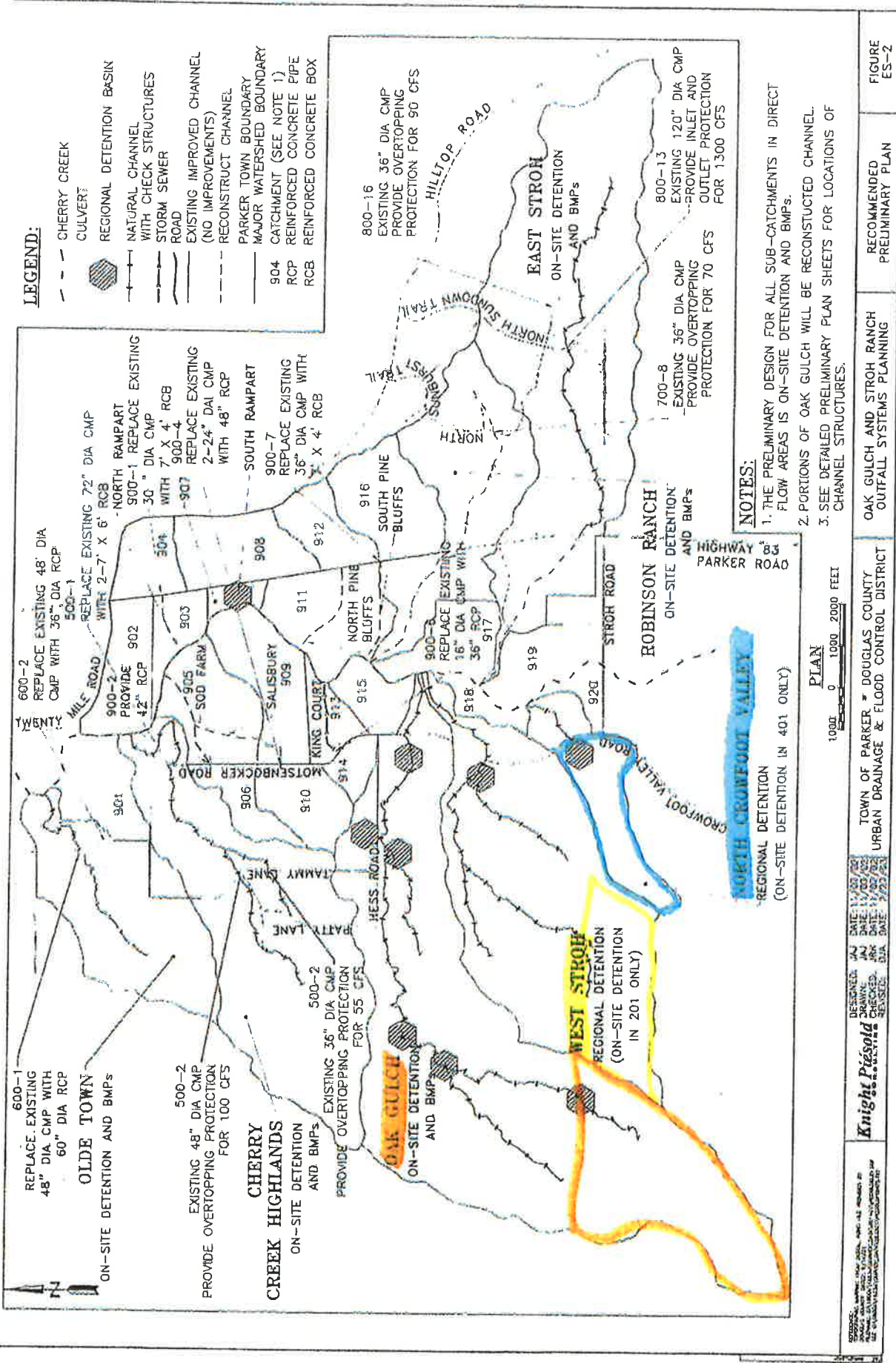
The North Crowfoot Valley Catchment is located on the west side of Cherry Creek immediately south of the West Stroth Catchment. The 0.2-mi² (132-acre) tributary area comprises two sub-catchments. This area is presently in a relatively native condition and undeveloped. However, development plans for the portion between Motesbocker Road and Cherry Creek have been prepared through Stroth Ranch Filing No. 9 (Reference 9). Additionally, development plans for the area west of Motesbocker Road have been prepared through Stroth Ranch Filing No. 13 (Reference 11) and Stroth Ranch Filing Nos. 17, 18, and 19 (Reference 12). An existing regional detention basin is located immediately adjacent to Motesbocker Road. This pond has a maximum storage capacity of 12.15 acre-feet, which includes 1.54 acre-feet for water quality, and discharges at a rate of 72 cfs for the 100-year storm event (References 13 and 14). The discharge from the detention basin passes under Motesbocker Road through a 30-inch RCP culvert. Although not constructed at the time of this report, improvements to the drainage way between Motesbocker Road and Cherry Creek have been designed through Stroth Ranch Filing No. 9.

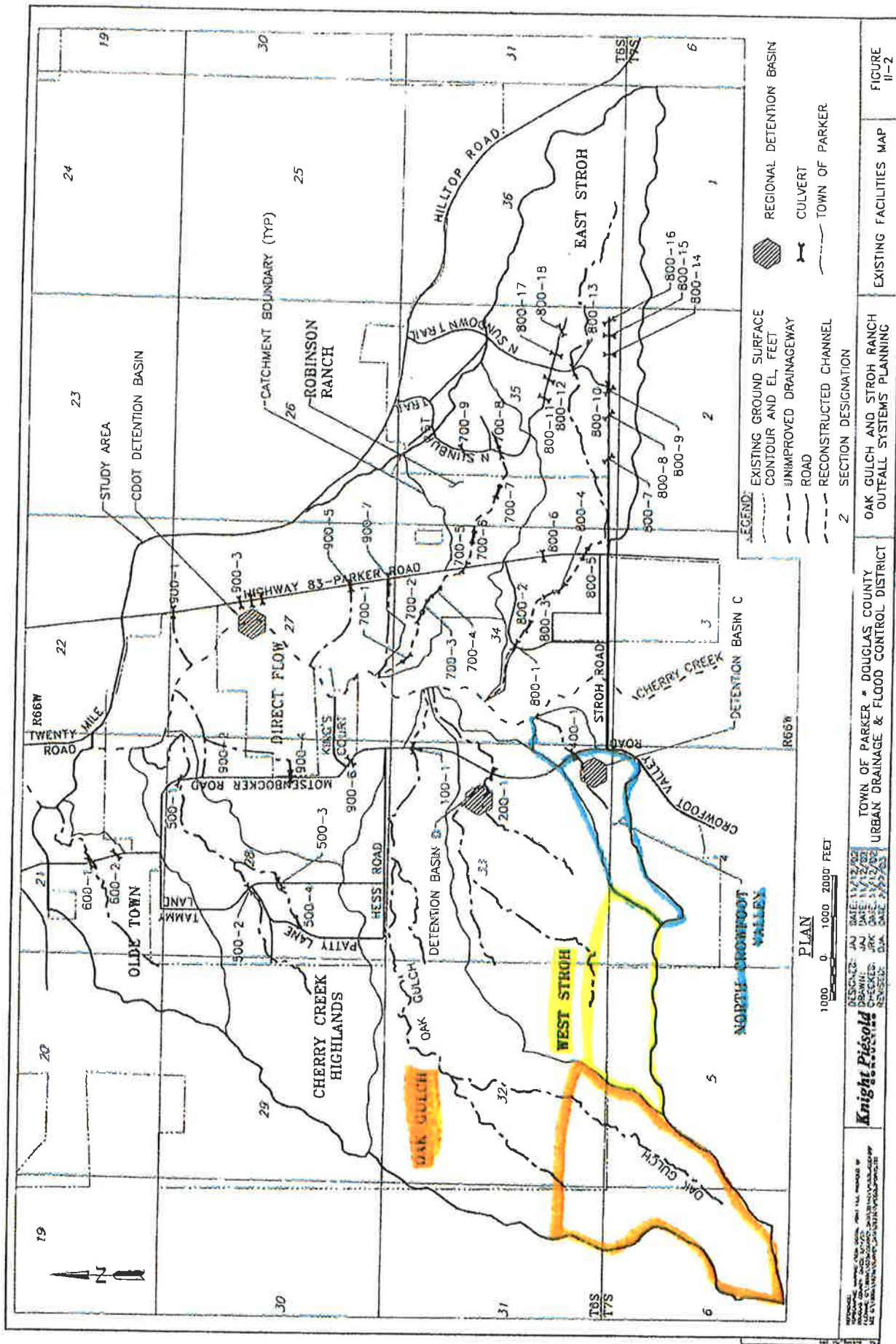
Cherry Creek Highlands Catchment

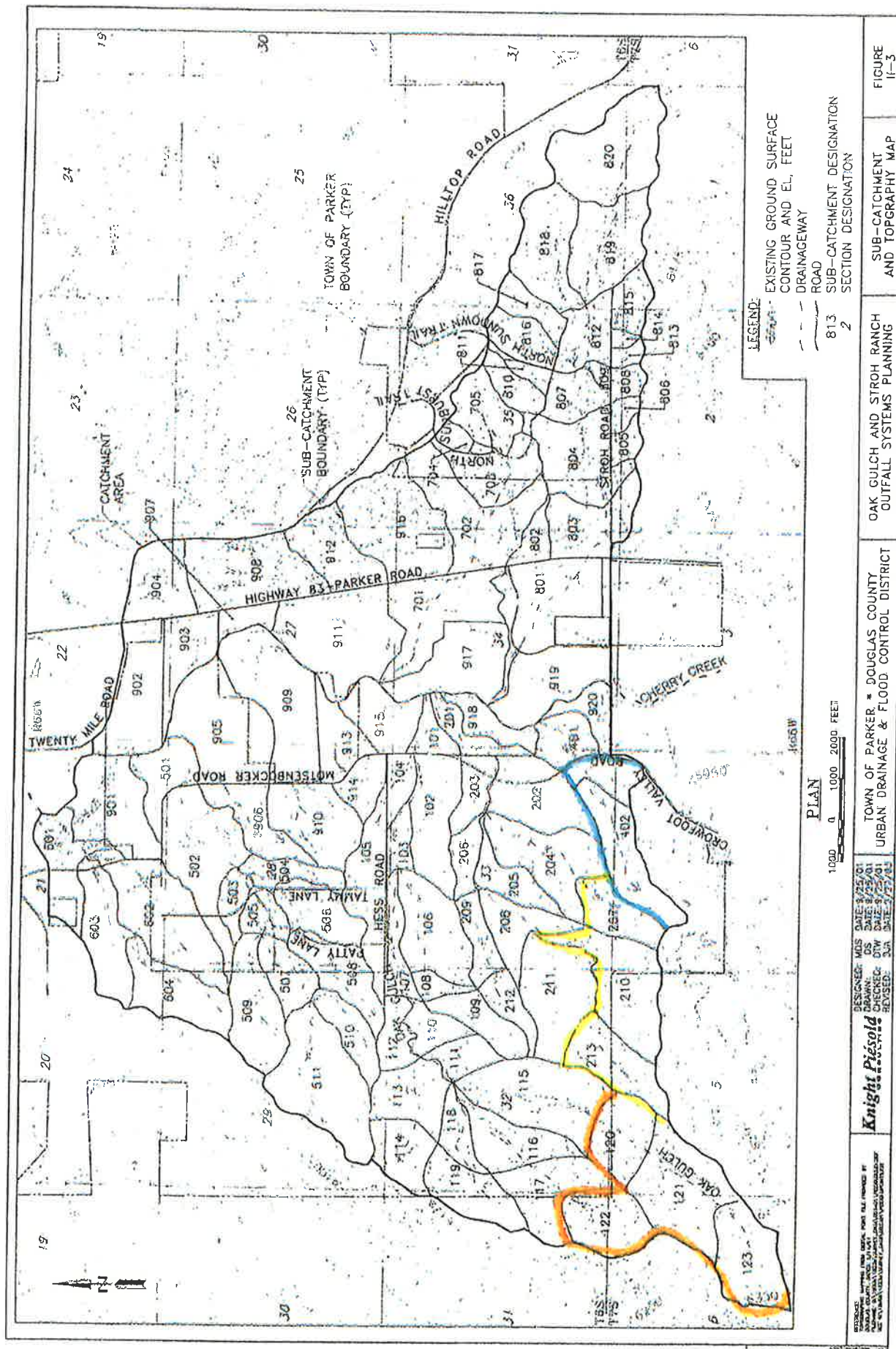
The Cherry Creek Highlands Catchment is located on the west side of Cherry Creek immediately north of Oak Gulch. The 0.9-mi² (601-acre) tributary area comprises 11 sub-catchments. A portion of this area comprises the Cherry Creek Highlands development, which is an existing residential neighborhood in which each residence occupies several acres of land. The remaining portion is primarily in a native condition and undeveloped. At the time of this study, no further development plans existed. However, development is expected to continue in a manner similar to the Cherry Creek Highlands development for the upper portion of the catchment and may include a small area of commercial or light industrial development adjacent to Motesbocker Road. Two distinct drainage ways convey runoff from the upper reaches of the catchment. Runoff from the south reach passes under Patty Lane through a 36-inch corrugated metal pipe (CMP) culvert and then under Tammy Lane through another 36-inch CMP culvert. Runoff from the north reach passes under Tammy Lane through a 48-inch CMP culvert. Discharge from these two reaches merges into a single drainage way that passes under Motesbocker Road through a 72-inch CMP culvert and finally discharges into Cherry Creek.

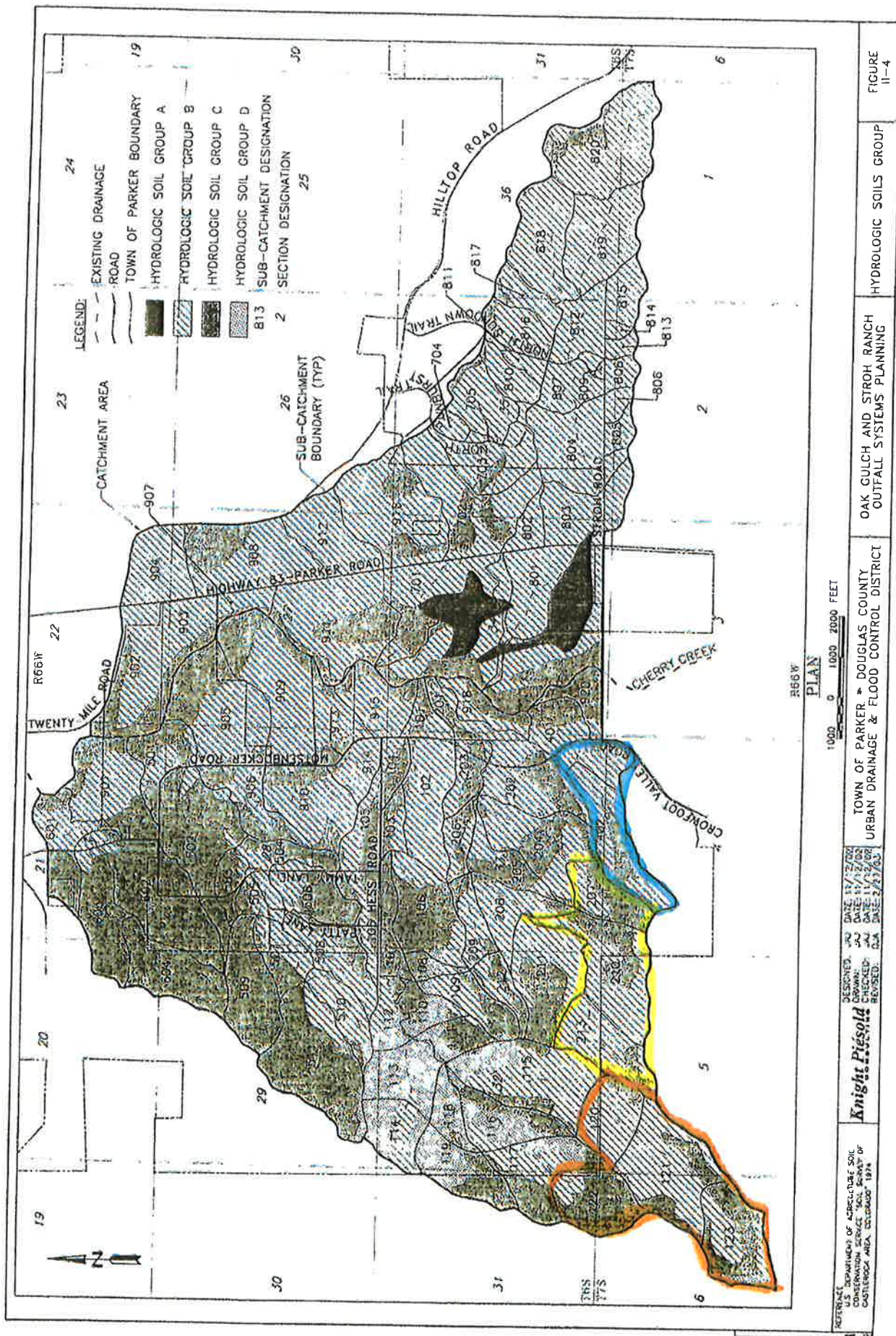
Olde Town Catchment

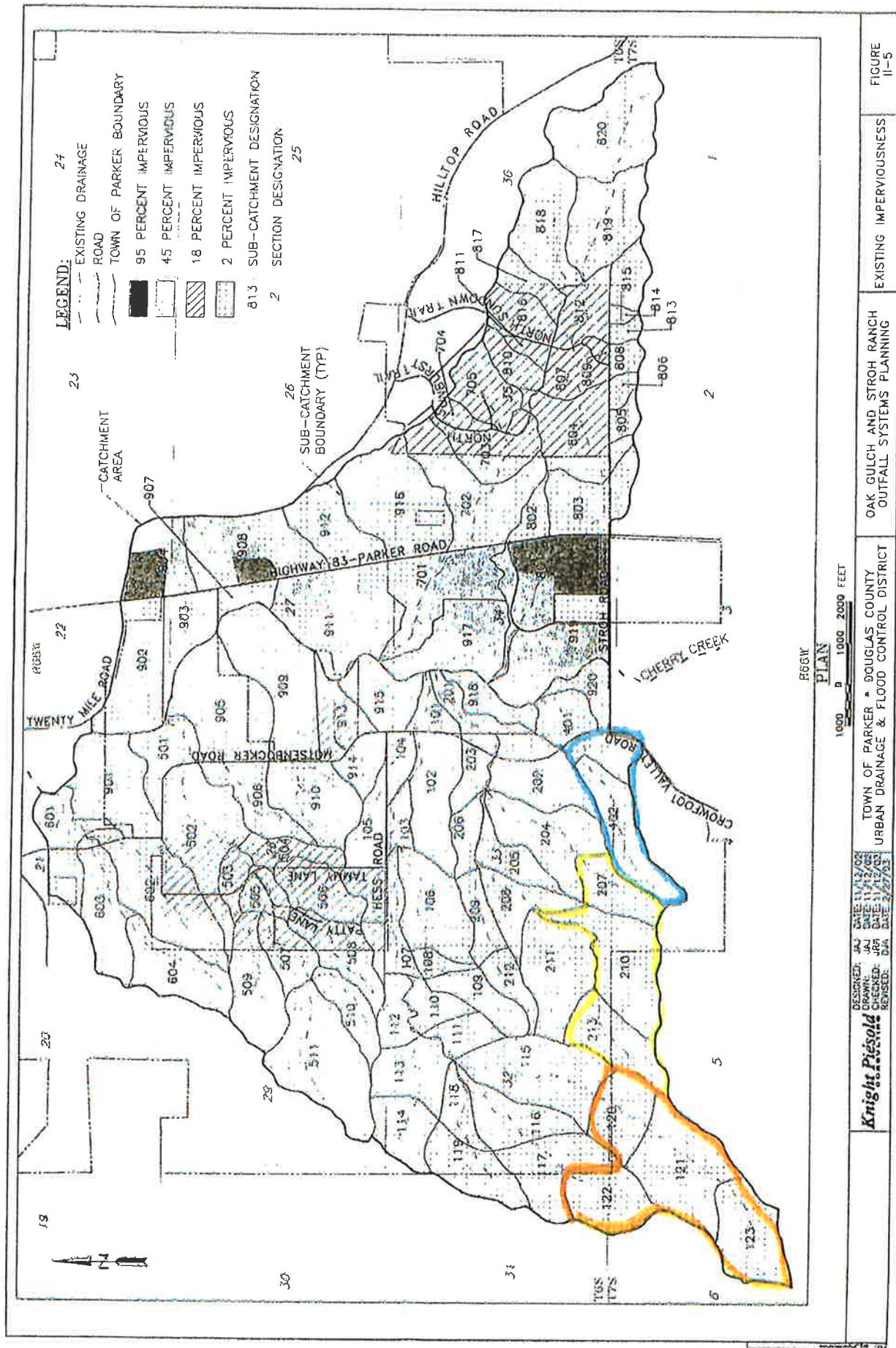
The Olde Town Catchment is located on the west side of Cherry Creek immediately north of the Cherry Creek Highlands Catchment. The 0.5-mi² (306-acre) tributary comprises four sub-catchments. A small portion of this catchment comprises the Cherry Creek Highlands neighborhood. The remaining area is primarily in a native condition and undeveloped. MME Engineering, Inc. has prepared drainage plans for the portion west of Motesbocker Road (Reference 15). This portion of the catchment includes high-density residential neighborhoods. Two distinct drainage ways convey runoff from the upper portions of the catchment. Runoff from these areas passes under Motesbocker Road separately through two 48-inch CMP











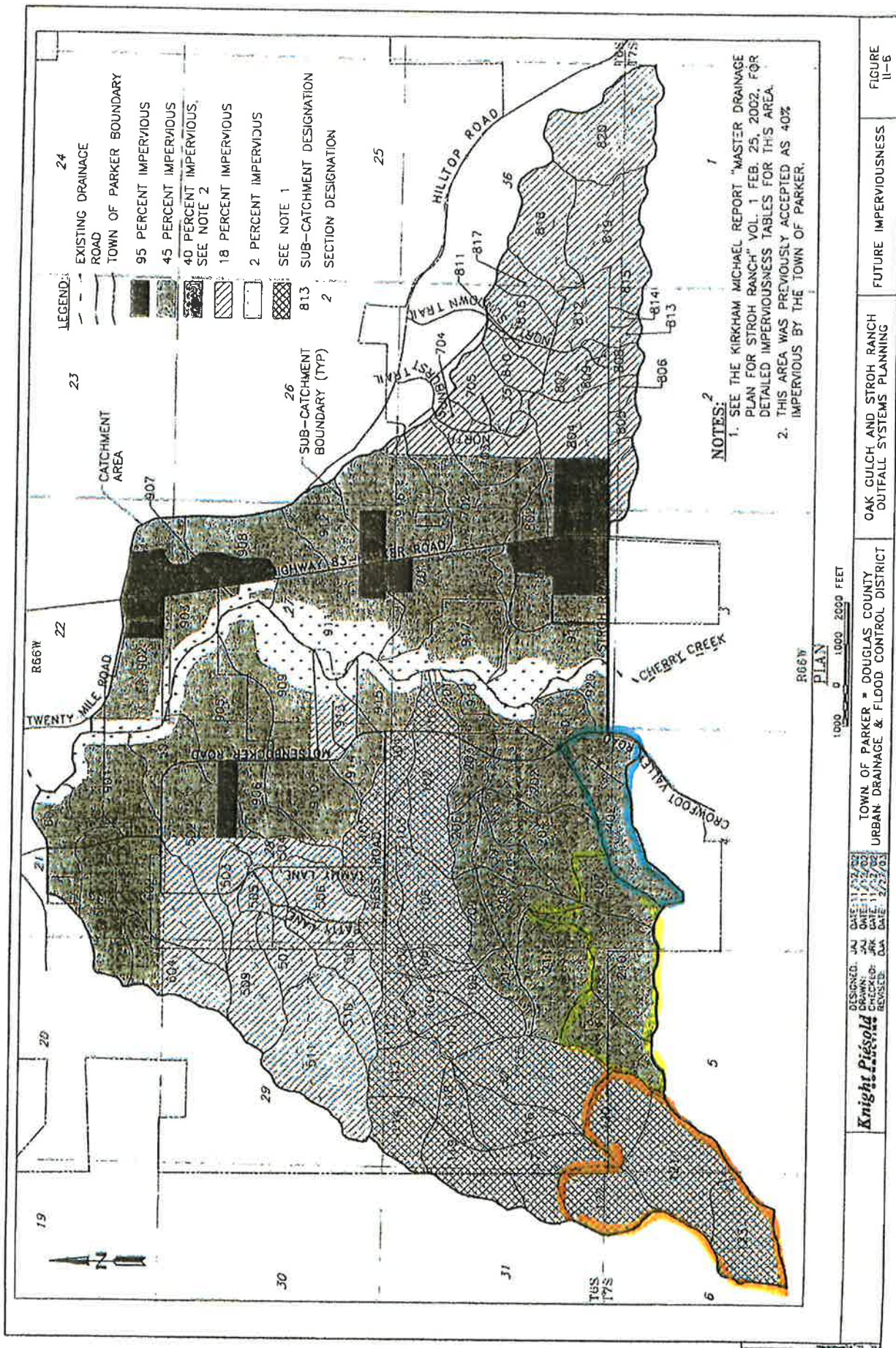


TABLE III-1

CUHP SUB-CATCHMENT PARAMETERS
EXISTING IMPERVIOUS CONDITIONS

Catchment ID	Area (acres)	Length (mi)	Centroid Length (mi)	Percent Imperv.	Slope (ft/ft)	t_p (min)	Previous Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/day)	Final Rate (in/hr)
101	16.1	0.0252	NOTE 1	2.0	NOTE 1	18.70	0.35	0.05	4.05	0.0018	0.57
102	72.4	0.1131	NOTE 1	2.0	NOTE 1	31.70	0.35	0.05	4.26	0.0018	0.56
103	19.0	0.0297	NOTE 1	2.0	NOTE 1	23.00	0.35	0.05	3.41	0.0018	0.53
104	17.2	0.0289	NOTE 1	2.0	NOTE 1	16.50	0.35	0.05	4.05	0.0018	0.57
105	73.7	0.1152	NOTE 1	2.0	NOTE 1	31.60	0.35	0.05	4.05	0.0018	0.57
106	72.2	0.1128	NOTE 1	2.0	NOTE 1	32.30	0.35	0.05	3.26	0.0018	0.52
107	34.3	0.0536	NOTE 1	2.0	NOTE 1	35.20	0.35	0.05	3.35	0.0018	0.52
108	13.0	0.0203	NOTE 1	2.0	NOTE 1	18.00	0.35	0.05	3.60	0.0018	0.52
109	37.6	0.0588	NOTE 1	2.0	NOTE 1	24.20	0.35	0.05	3.60	0.0018	0.54
110	28.0	0.0438	NOTE 1	2.0	NOTE 1	21.60	0.35	0.05	3.03	0.0018	0.50
111	25.0	0.0406	NOTE 1	2.0	NOTE 1	21.40	0.35	0.05	3.03	0.0018	0.50
112	24.6	0.0384	NOTE 1	2.0	NOTE 1	25.50	0.35	0.05	3.15	0.0018	0.51
113	57.3	0.0855	NOTE 1	2.0	NOTE 1	21.40	0.35	0.05	3.15	0.0018	0.51
114	42.7	0.0667	NOTE 1	2.0	NOTE 1	20.40	0.35	0.05	3.15	0.0018	0.51
115	108.5	0.1685	NOTE 1	2.0	NOTE 1	33.50	0.35	0.05	3.64	0.0018	0.54
116	58.6	0.0916	NOTE 1	2.0	NOTE 1	34.20	0.35	0.05	3.39	0.0018	0.53
117	77.7	0.1214	NOTE 1	2.0	NOTE 1	23.70	0.35	0.05	3.39	0.0018	0.53
118	21.9	0.0342	NOTE 1	2.0	NOTE 1	21.30	0.35	0.05	3.00	0.0018	0.50
119	57.5	0.0898	NOTE 1	2.0	NOTE 1	22.30	0.35	0.05	3.00	0.0018	0.50
120	56.3	0.0860	NOTE 1	2.0	NOTE 1	20.80	0.35	0.05	4.22	0.0018	0.58
121	109.1	0.1705	NOTE 1	2.0	NOTE 1	28.30	0.35	0.05	3.96	0.0018	0.56
122	51.4	0.0803	NOTE 1	2.0	NOTE 1	22.10	0.35	0.05	3.30	0.0018	0.52
123	58.4	0.1068	NOTE 1	2.0	NOTE 1	51.70	0.35	0.05	3.54	0.0018	0.54

NOTE 1: Parameters from Slope Master Plan, see Reference 43, except existing imperviousness.
NOTE 2: This information was not supplied with the Kirkham Michael Report. Runoff was calculated by CUHP using the rational method for these areas, so this information is not strictly necessary.

TABLE III-1 (CONTINUED)

CUHP SUB-CATCHMENT PARAMETERS
EXISTING IMPERVIOUS CONDITIONS

Catchment ID	Area (acres)	Length (mi)	Centroid Length (mi)	Percent Imperv.	Slope (ft/ft)	t_p (min)	Previous Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/day)	Final Rate (in/hr)
501	58.5	0.0928	0.271	2.0	0.036	50.79	0.40	0.05	4.07	0.0018	0.57
502	72.9	0.1138	0.402	2.0	0.039	53.72	0.40	0.05	3.85	0.0018	0.56
503	44.6	0.0698	0.123	2.0	0.032	56.14	0.40	0.05	3.53	0.0018	0.54
504	105.4	0.1846	0.309	8.4	0.028	N/A	0.40	0.05	3.15	0.0018	0.51
505	30.4	0.0475	0.134	18.0	0.040	41.61	0.40	0.05	3.15	0.0018	0.51
506	23.9	0.0374	0.248	18.0	0.032	61.73	0.40	0.05	3.45	0.0018	0.53
507	46.9	0.0780	0.284	18.0	0.050	33.18	0.40	0.05	4.05	0.0018	0.57
508	37.4	0.0584	0.239	18.0	0.053	57.36	0.40	0.05	3.60	0.0018	0.54
509	56.1	0.0877	0.205	10.0	0.044	48.85	0.40	0.05	3.90	0.0018	0.56
510	71.3	0.1114	0.252	10.0	0.036	68.68	0.40	0.05	4.05	0.0018	0.57
511	37.4	0.0585	0.383	6.8	0.061	58.70	0.40	0.05	3.00	0.0018	0.50
512	124.4	0.1944	0.258	2.0	0.048	57.53	0.40	0.05	4.20	0.0018	0.58
513	124.4	0.1944	0.339	2.0	0.044	N/A	0.40	0.05	3.15	0.0018	0.51
601	57.5	0.0898	0.208	2.0	0.040	69.91	0.40	0.05	3.60	0.0018	0.54
602	113.9	0.1778	0.388	6.8	0.028	N/A	0.40	0.05	3.08	0.0018	0.51
603	66.5	0.1039	0.689	3.41	0.025	93.45	0.40	0.05	3.15	0.0018	0.51
604	68.2	0.1060	0.290	2.0	0.041	67.94	0.40	0.05	3.00	0.0018	0.50
701	95.0	0.1485	0.458	38.4	0.021	N/A	0.36	0.05	4.30	0.0018	0.66
702	102.3	0.1599	0.672	5.2	0.054	N/A	0.40	0.05	4.13	0.0018	0.58
703	59.6	0.0931	0.443	13.2	0.071	43.26	0.40	0.05	4.35	0.0018	0.59
704	10.1	0.0157	0.163	18.0	0.056	24.39	0.40	0.05	4.50	0.0018	0.60

TABLE III-2

**CUHP SUB-CATCHMENT PARAMETERS
FUTURE IMPERVIOUS CONDITIONS**

Catchment ID	Area (acres)	Area (mi ²)	Length (mi)	Centroid Length (mi)	Percent Imperv.	Slope (ft/ft)	t _c (min)	PerVIOUS Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/sec)	Final Rate (in/hr)
101	18.1	0.0252	NOTE 1	NOTE 1	21.0	NOTE 1	18.70	0.35	0.05	4.05	0.0018	0.57
102	72.4	0.1131	NOTE 1	NOTE 1	20.7	NOTE 1	31.70	0.35	0.05	4.26	0.0018	0.58
103	18.0	0.0287	NOTE 1	NOTE 1	2.0	NOTE 1	23.00	0.35	0.05	3.41	0.0018	0.53
104	17.2	0.0289	NOTE 1	NOTE 1	55.0	NOTE 1	16.50	0.35	0.05	4.05	0.0018	0.57
105	73.7	0.1152	NOTE 1	NOTE 1	25.2	NOTE 1	31.80	0.35	0.05	4.05	0.0018	0.57
106	72.2	0.1128	NOTE 1	NOTE 1	24.5	NOTE 1	32.30	0.35	0.05	3.28	0.0018	0.52
107	34.3	0.0538	NOTE 1	NOTE 1	9.1	NOTE 1	35.20	0.35	0.05	3.36	0.0018	0.52
108	13.0	0.0203	NOTE 1	NOTE 1	20.6	NOTE 1	18.00	0.35	0.05	3.60	0.0018	0.54
109	37.6	0.0588	NOTE 1	NOTE 1	24.2	NOTE 1	24.20	0.35	0.05	3.60	0.0018	0.54
110	28.0	0.0438	NOTE 1	NOTE 1	26.3	NOTE 1	21.60	0.35	0.05	3.03	0.0018	0.50
111	26.0	0.0405	NOTE 1	NOTE 1	27.0	NOTE 1	21.40	0.35	0.05	3.03	0.0018	0.50
112	24.6	0.0384	NOTE 1	NOTE 1	30.0	NOTE 1	25.60	0.35	0.05	3.15	0.0018	0.51
113	57.3	0.0855	NOTE 1	NOTE 1	40.7	NOTE 1	21.40	0.35	0.05	3.15	0.0018	0.51
114	42.7	0.0687	NOTE 1	NOTE 1	30.0	NOTE 1	20.40	0.35	0.05	3.15	0.0018	0.51
115	108.5	0.1685	0.850	0.350	27.3	NOTE 1	33.90	0.35	0.05	3.54	0.0018	0.54
116	58.6	0.0816	NOTE 1	NOTE 1	19.3	NOTE 1	34.20	0.35	0.05	3.39	0.0018	0.53
117	77.7	0.1214	NOTE 1	NOTE 1	24.8	NOTE 1	23.70	0.35	0.05	3.39	0.0018	0.53
118	21.9	0.0342	NOTE 1	NOTE 1	32.7	NOTE 1	21.30	0.35	0.05	3.00	0.0018	0.50
119	57.5	0.0898	NOTE 1	NOTE 1	24.9	NOTE 1	22.30	0.35	0.05	3.00	0.0018	0.50
120	56.3	0.0880	NOTE 1	NOTE 1	32	NOTE 1	20.80	0.35	0.05	4.22	0.0018	0.58
121	109.1	0.1705	0.69	0.28	24.5	NOTE 1	26.30	0.35	0.05	3.56	0.0018	0.53
122	51.4	0.0803	NOTE 1	NOTE 1	21.5	NOTE 1	22.10	0.35	0.05	3.30	0.0018	0.52
123	68.4	0.1069	NOTE 1	NOTE 1	19.5	NOTE 1	51.70	0.35	0.05	3.45	0.0018	0.54
201	25.0	0.0380	0.626	0.304	40.0*	0.017	28.40	0.35	0.05	3.88	0.0018	0.56
202	72.4	0.1131	0.623	0.284	40.0	0.030	28.30	0.35	0.05	3.59	0.0018	0.57
203	32.2	0.0503	0.424	0.202	40.0	0.022	22.40	0.35	0.05	3.99	0.0018	0.57
204	84.8	0.1325	0.740	0.362	40.0	0.028	31.70	0.35	0.05	3.88	0.0018	0.56
205	36.0	0.0562	0.693	0.384	40.0	0.029	30.30	0.35	0.05	3.56	0.0018	0.54
206	23.3	0.0384	0.426	0.202	40.0	0.015	22.50	0.35	0.05	3.89	0.0018	0.56
207	44.0	0.0687	0.472	0.227	40.0	0.048	23.80	0.35	0.05	3.87	0.0018	0.54
208	47.2	0.0738	0.514	0.241	40.0	0.040	25.10	0.35	0.05	4.31	0.0018	0.59
209	29.8	0.0466	0.472	0.237	40.0	0.042	23.90	0.35	0.05	3.99	0.0018	0.57
210	93.8	0.1468	0.920	0.460	40.0	0.032	N/A	0.35	0.05	4.11	0.0018	0.57
211	89.6	0.1400	0.883	0.345	40.0	0.044	28.40	0.35	0.05	3.72	0.0018	0.55
212	23.5	0.0387	0.380	0.148	40.0	0.046	21.20	0.35	0.05	3.69	0.0018	0.55
213	62.1	0.0971	0.586	0.252	40.0	0.039	27.20	0.35	0.05	4.23	0.0018	0.58

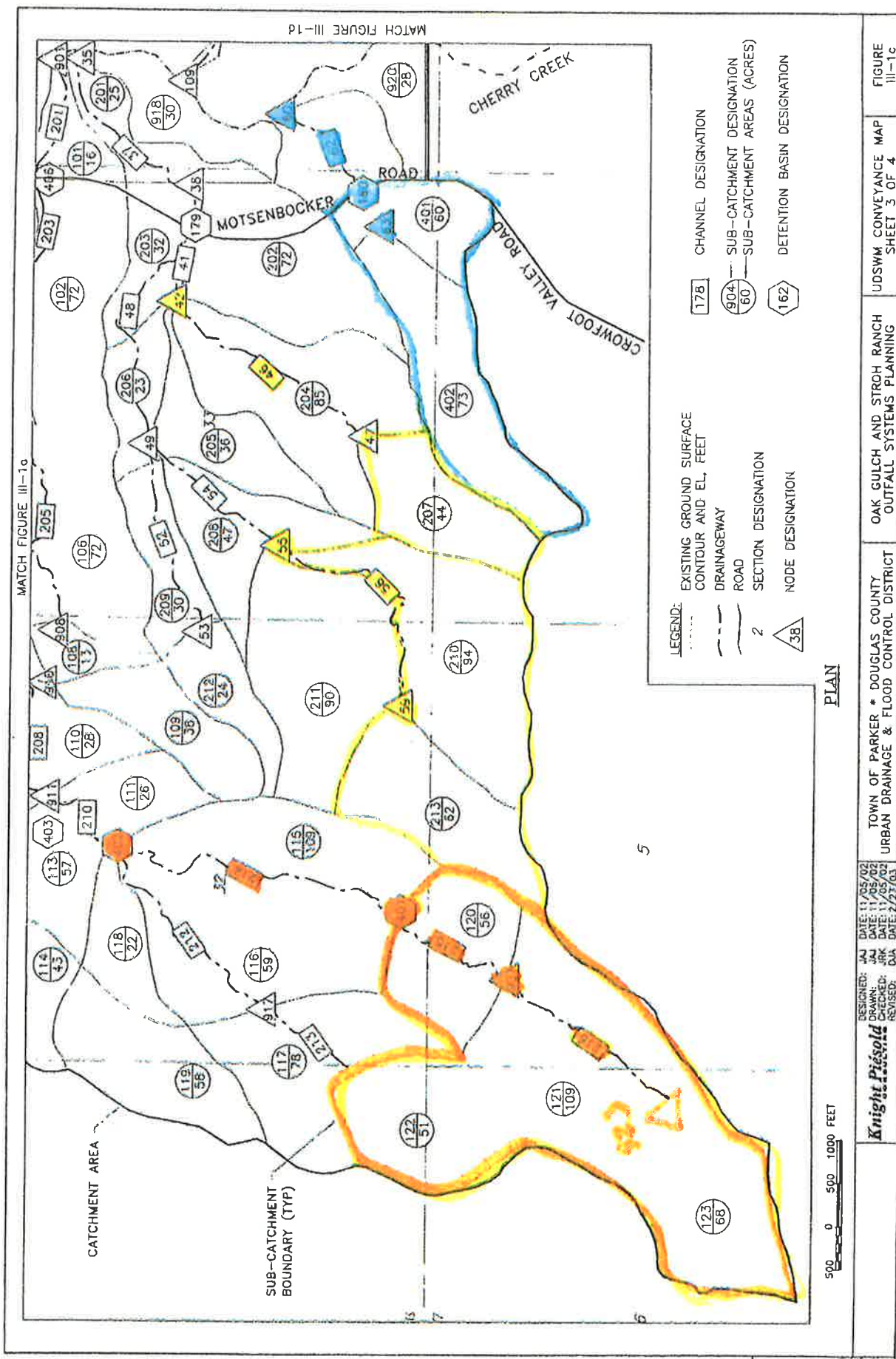
NOTE 1 This information was not supplied with the Kirkham Michael Report. Runoff was calculated by CUHP using the rational method for these areas, so this information is not strictly necessary.

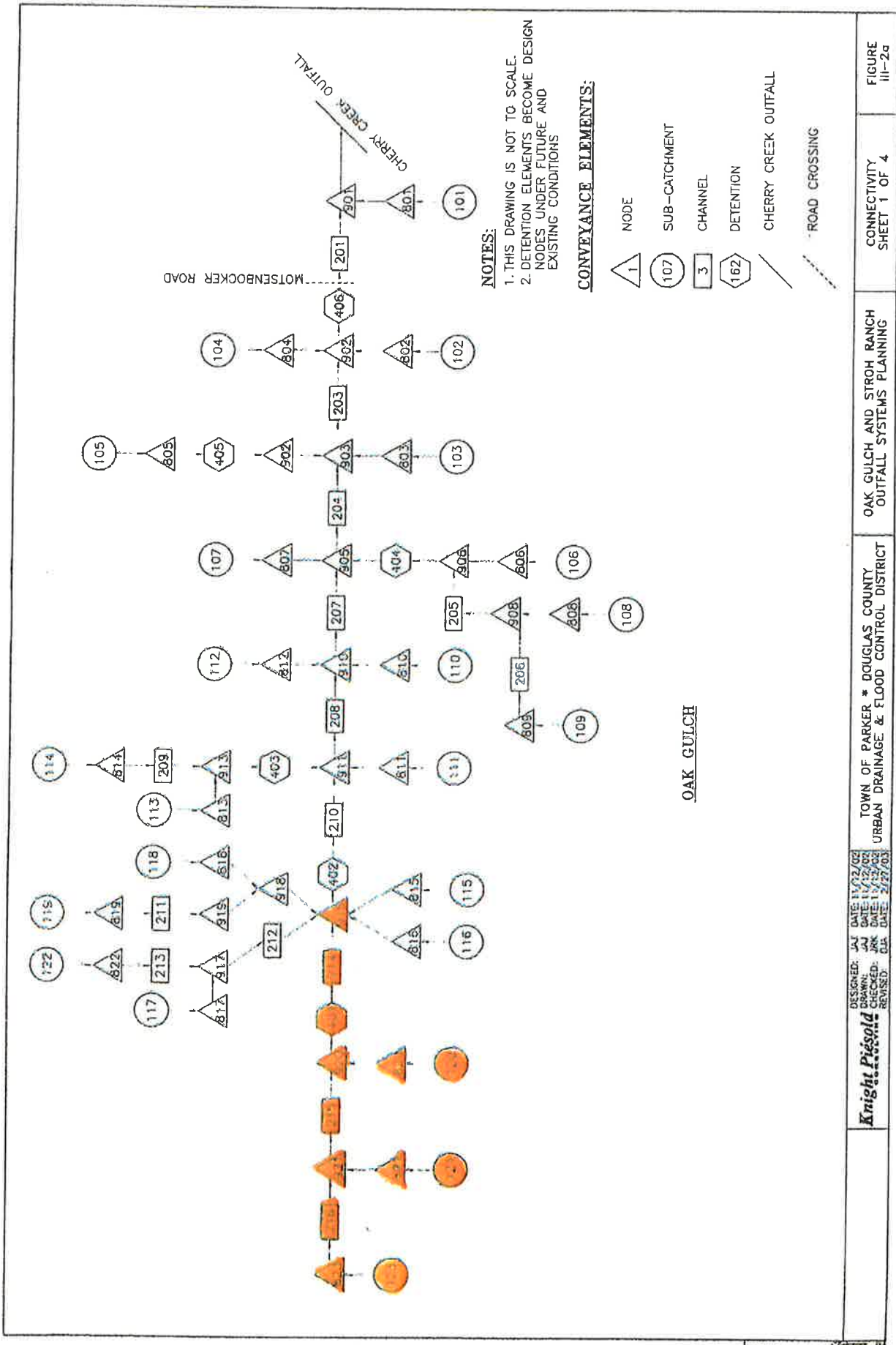
TABLE III-2 (CONTINUED)

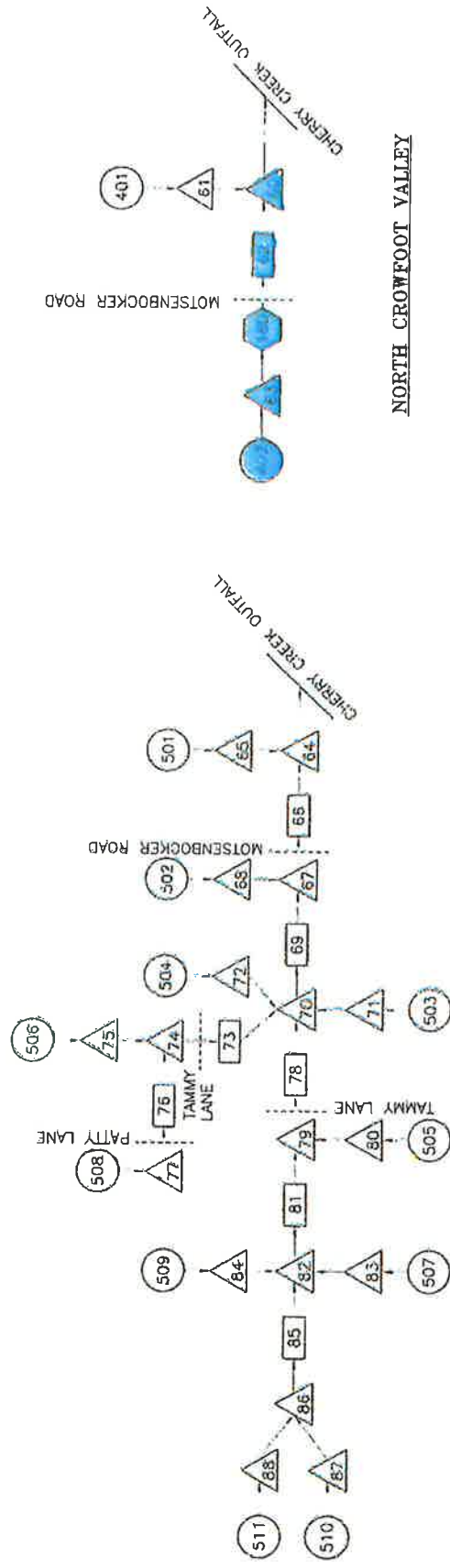
**CUHP SUB-CATCHMENT PARAMETERS
FUTURE IMPERVIOUS CONDITIONS**

Catchment ID	Area (acres)	Area (mi ²)	Length (mi)	Centroid Length (mi)	Percent Imperv.	Slope (ft/ft)	t _c (min)	PerVIOUS Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/sec)	Final Rate (in/hr)
501	59.6	0.0859	0.544	0.271	40.0*	0.038	25.90	0.35	0.05	4.07	0.0018	0.57
502	72.9	0.1139	0.838	0.402	40.0	0.039	34.60	0.35	0.05	3.85	0.0018	0.56
503	44.6	0.0686	0.426	0.123	36.4	0.032	22.50	0.36	0.05	3.53	0.0018	0.54
504	105.4	0.1646	0.786	0.309	44.2	0.028	N/A	0.37	0.06	3.15	0.0018	0.51
505	20.0	0.0312	0.337	0.134	18.0	0.040	28.83	0.40	0.05	3.15	0.0018	0.51
506	30.4	0.0475	0.477	0.248	18.0	0.032	39.27	0.40	0.05	3.45	0.0018	0.53
507	23.9	0.0374	0.284	0.136	18.0	0.050	24.27	0.40	0.05	4.05	0.0018	0.57
508	49.9	0.0780	0.468	0.239	18.0	0.039	37.47	0.40	0.05	3.60	0.0018	0.54
509	37.4	0.0594	0.398	0.206	18.0	0.044	32.60	0.40	0.05	3.50	0.0018	0.56
510	56.1	0.0877	0.581	0.252	18.0	0.036	40.57	0.40	0.06	4.05	0.0018	0.57
511	71.3	0.1114	0.655	0.383	18.0	0.061	34.72	0.40	0.05	3.00	0.0018	0.50
512	37.4	0.0585	0.535	0.258	18.0	0.048	34.36	0.40	0.05	4.20	0.0018	0.58
513	124.4	0.1944	0.803	0.359	18.0	0.044	N/A	0.40	0.05	3.15	0.0018	0.51
601	57.5	0.0899	0.555	0.208	36.4	0.040	26.28	0.38	0.05	3.60	0.0018	0.54
602	113.9	0.1779	0.869	0.388	31.5	0.028	N/A	0.38	0.05	3.08	0.0018	0.51
603	66.5	0.1039	0.669	0.341	45.0	0.025	30.22	0.35	0.05	3.15	0.0018	0.51
604	68.2	0.1066	0.636	0.290	28.8	0.041	35.61	0.38	0.05	3.00	0.0018	0.50
701	95.0	0.1485	0.754	0.459	45.7	0.021	N/A	0.36	0.06	4.30	0.00153	0.66
702	102.3	0.1589	0.872	0.259	39.6	0.054	N/A	0.36	0.05	4.13	0.0018	0.58
703	59.6	0.0931	0.443	0.150	26.1	0.071	26.72	0.39	0.05	4.35	0.0018	0.59
704	10.1	0.0157	0.153	0.078	18.0	0.056	20.77	0.40	0.05	4.50	0.0018	0.60
705	47.8	0.0747	0.409	0.186	18.0	0.060	28.70	0.40	0.05	4.35	0.0018	0.59

* 40.0% imperviousness used for West Stroh and North Crowfoot Valley catchments per previously planned and accepted drainage designs

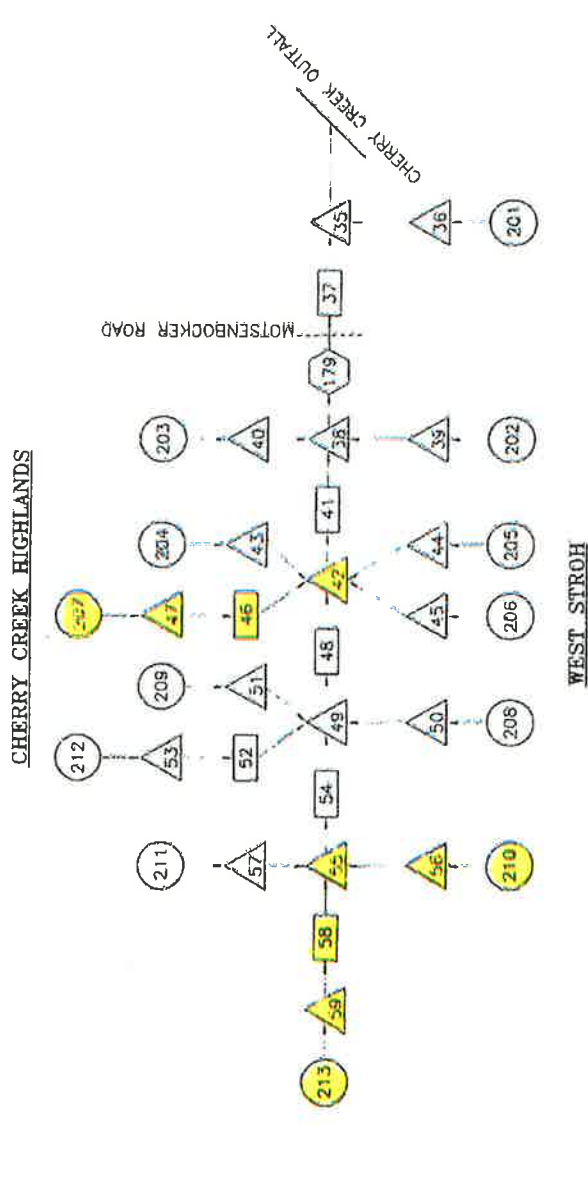
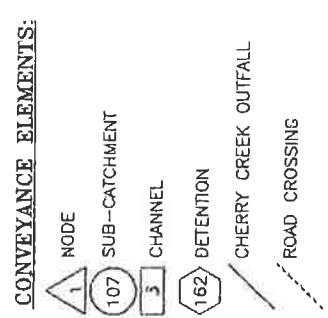






NOTES:

1. SUB-CATCHMENTS 901, 915, 918 AND 920 ARE DIRECT FLOW CATCHMENTS ADJACENT TO CHERRY CREEK. CONNECTIVITY DIAGRAMS AND UDSWM MODELING ARE NOT APPROPRIATE FOR THESE SUB-CATCHMENTS.
2. THIS DRAWING IS NOT TO SCALE.



DESIGNED: JAL DATE: 11/13/02 CHECKED: JAL DATE: 11/13/02 REVIEWED: DLA DATE: 2/27/03	Knight Piésold	TOWN OF PARKER * DOUGLAS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OAK GULCH AND STROH RANCH OUTFALL SYSTEMS PLANNING	CONNECTIVITY SHEET 2 OF 4	FIGURE III-2b

FIGURE II-3a
PEAK FLOW PROFILES
4616 OAK GULCH

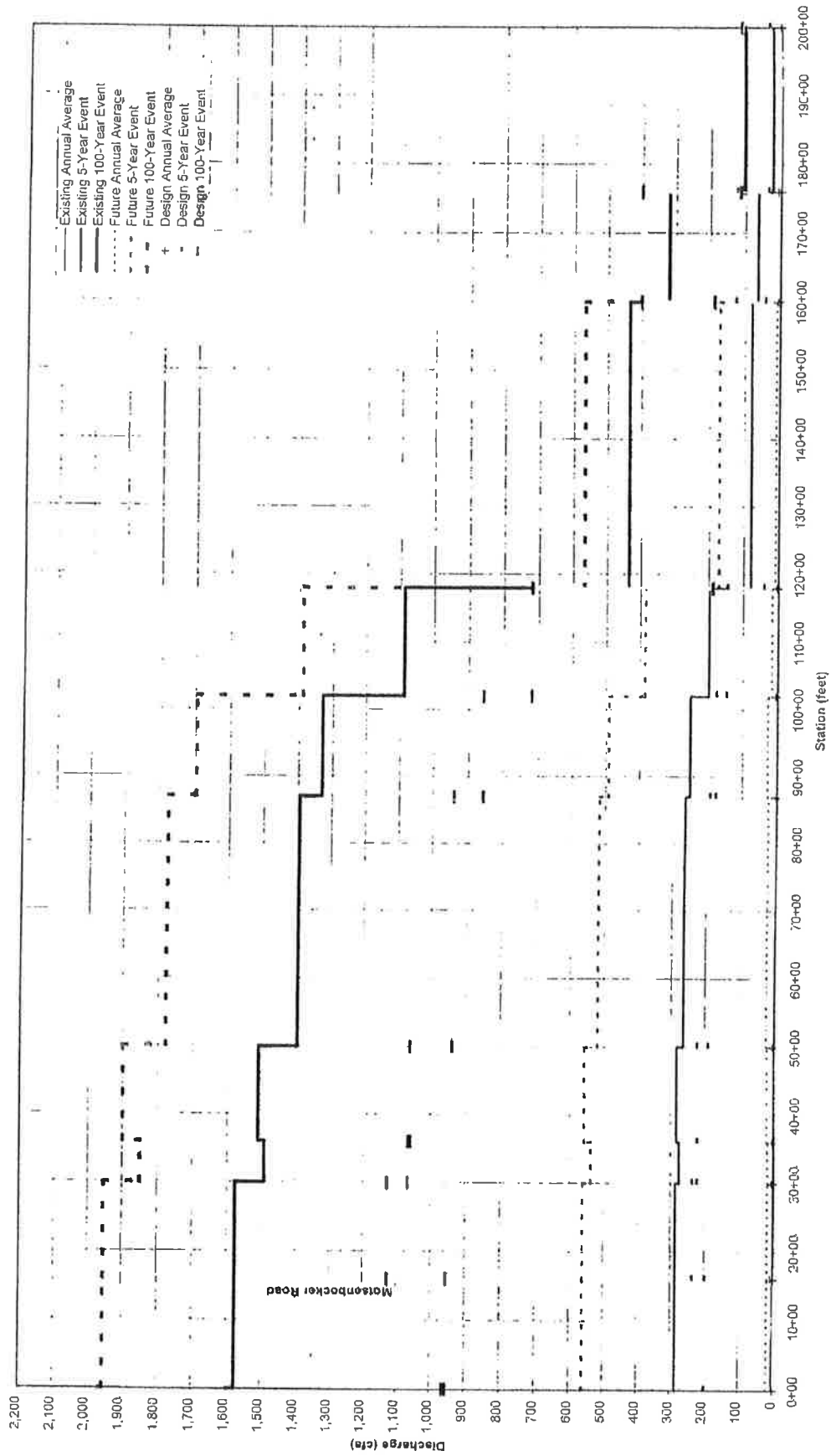


FIGURE III-3b
PEAK FLOW PROFILES
4816.1 WEST STROH

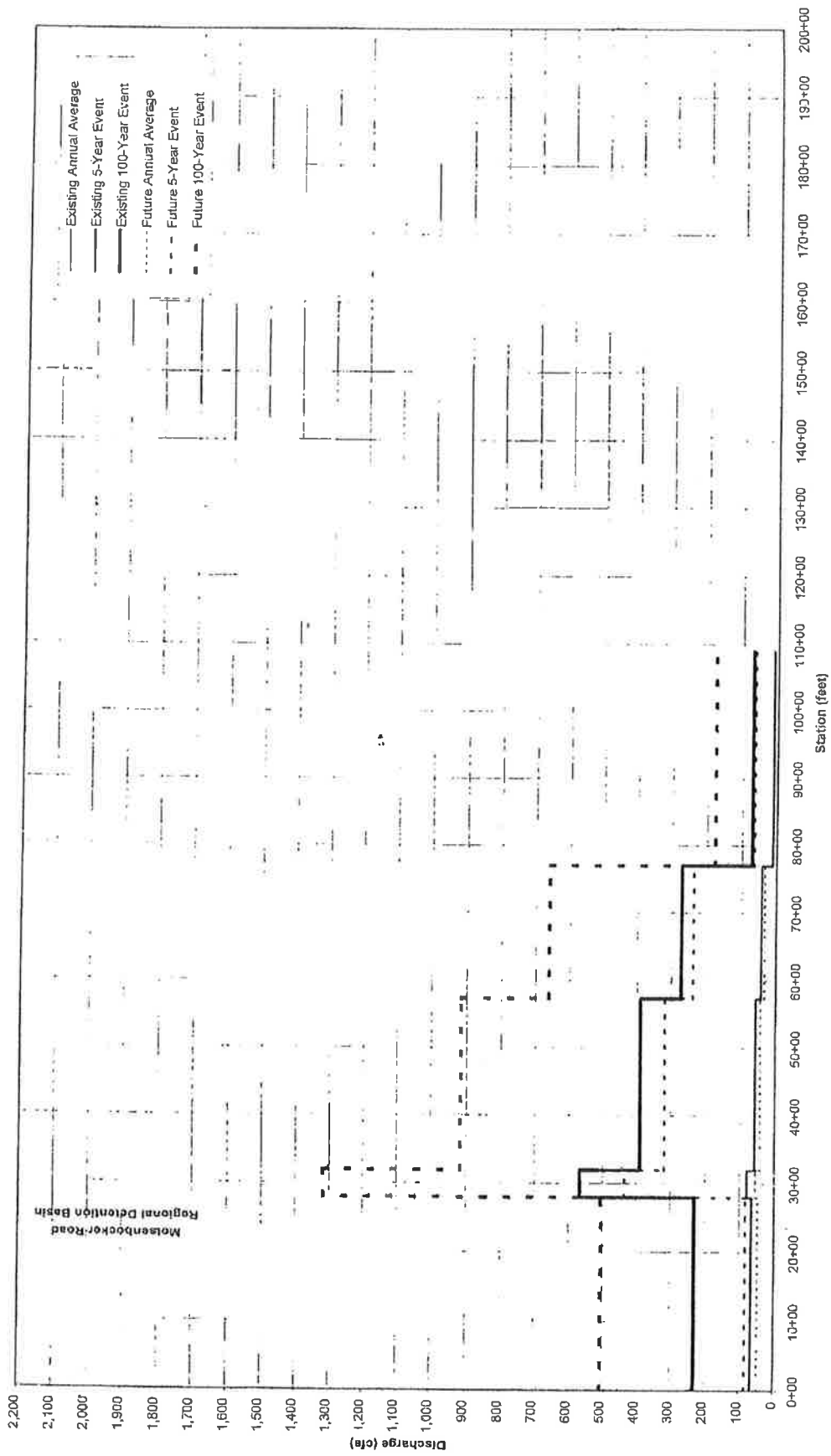


FIGURE III-3c

PEAK FLOW PROFILES
4600-11.3 NORTH CROWFOOT VALLEY

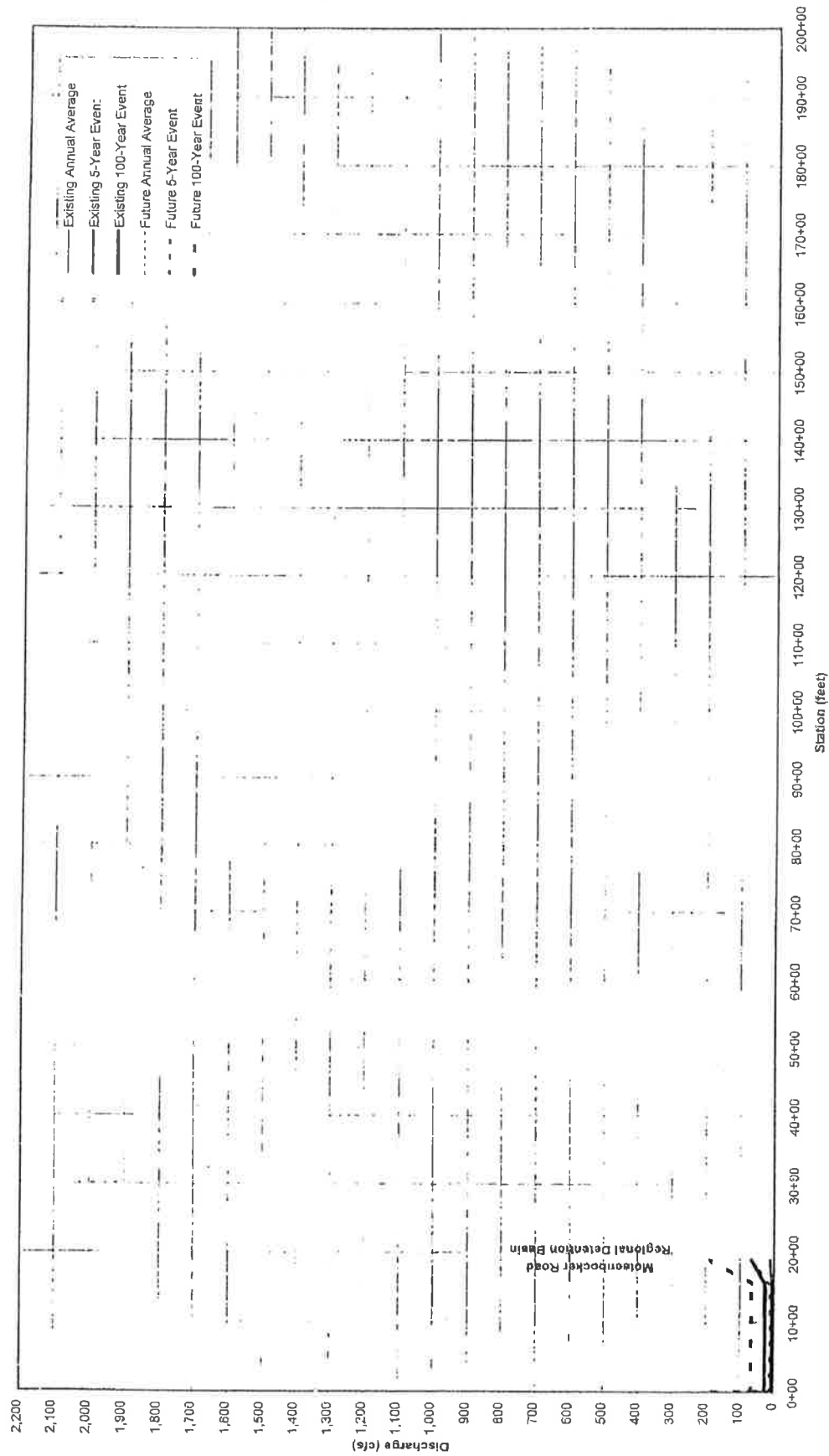


FIGURE III-4a

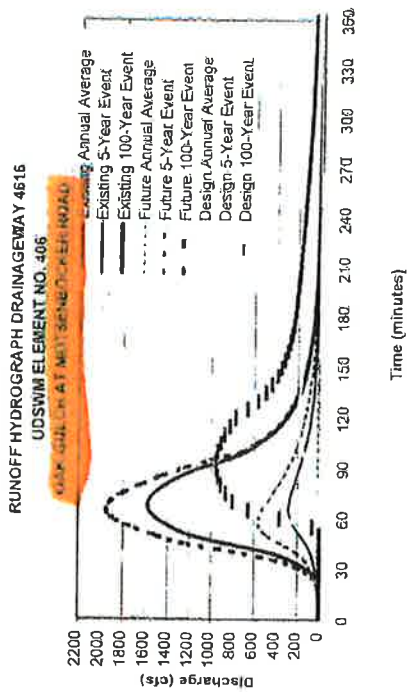


FIGURE III-4c

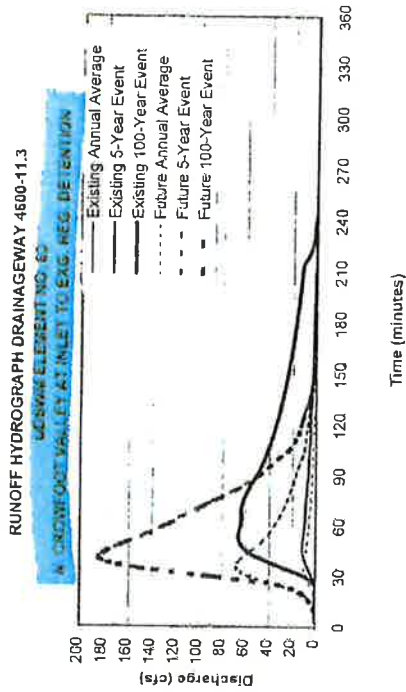


FIGURE III-4b

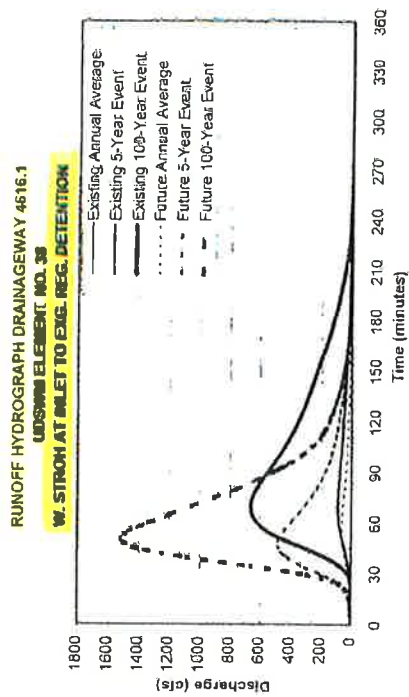
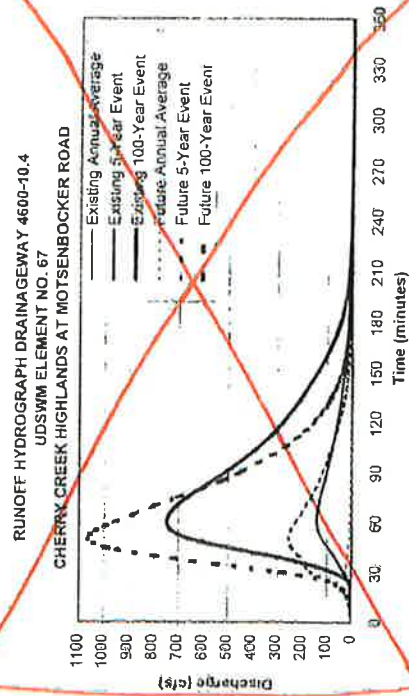


FIGURE III-4d



APPENDIX E

Excerpts from Scott & Lemon Gulch Watersheds Outfall Systems Planning

OUTFALL SYSTEMS
PLANNING-
PRELIMINARY DESIGN
REPORT

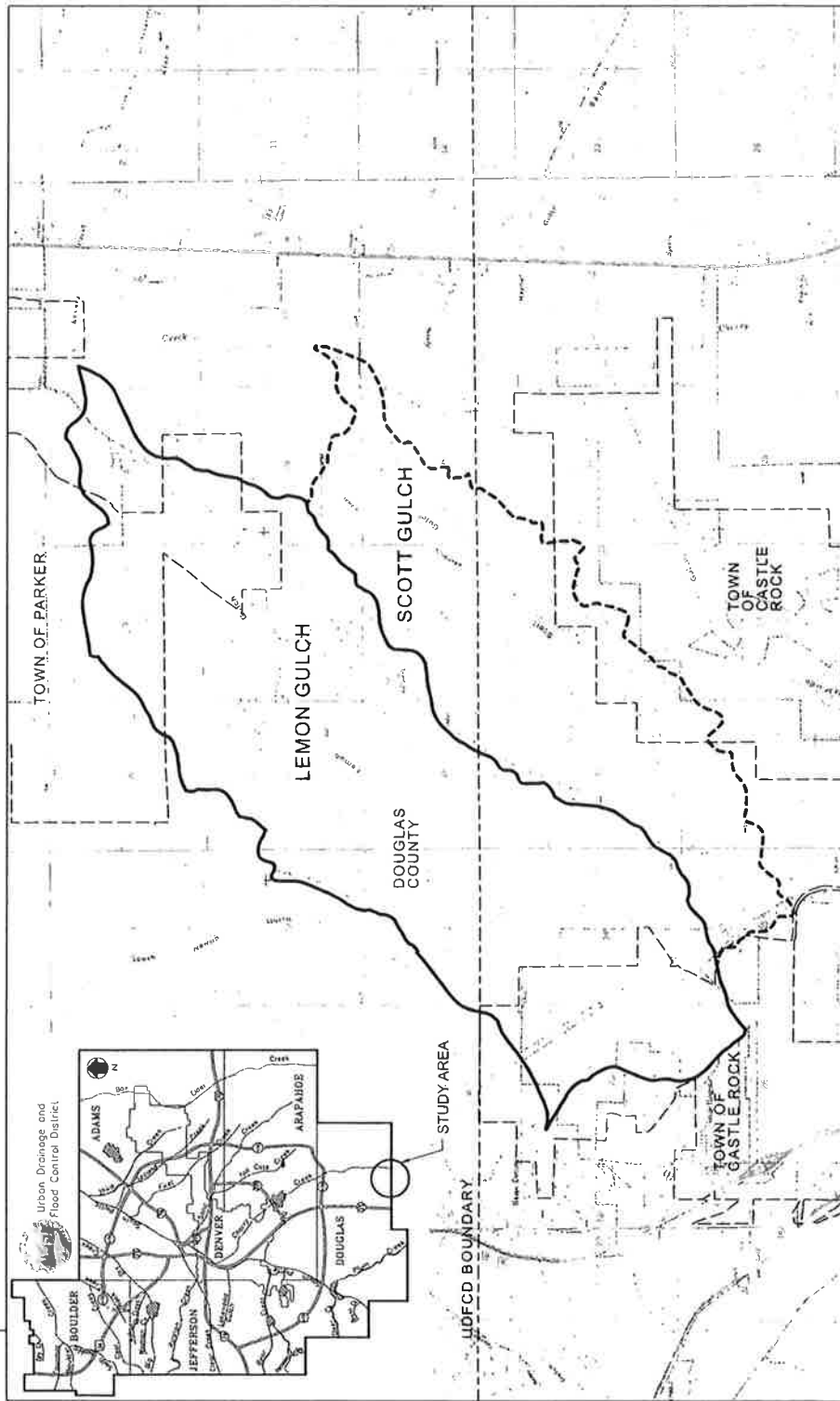
SCOTT AND LEMON GULCH WATERSHEDS

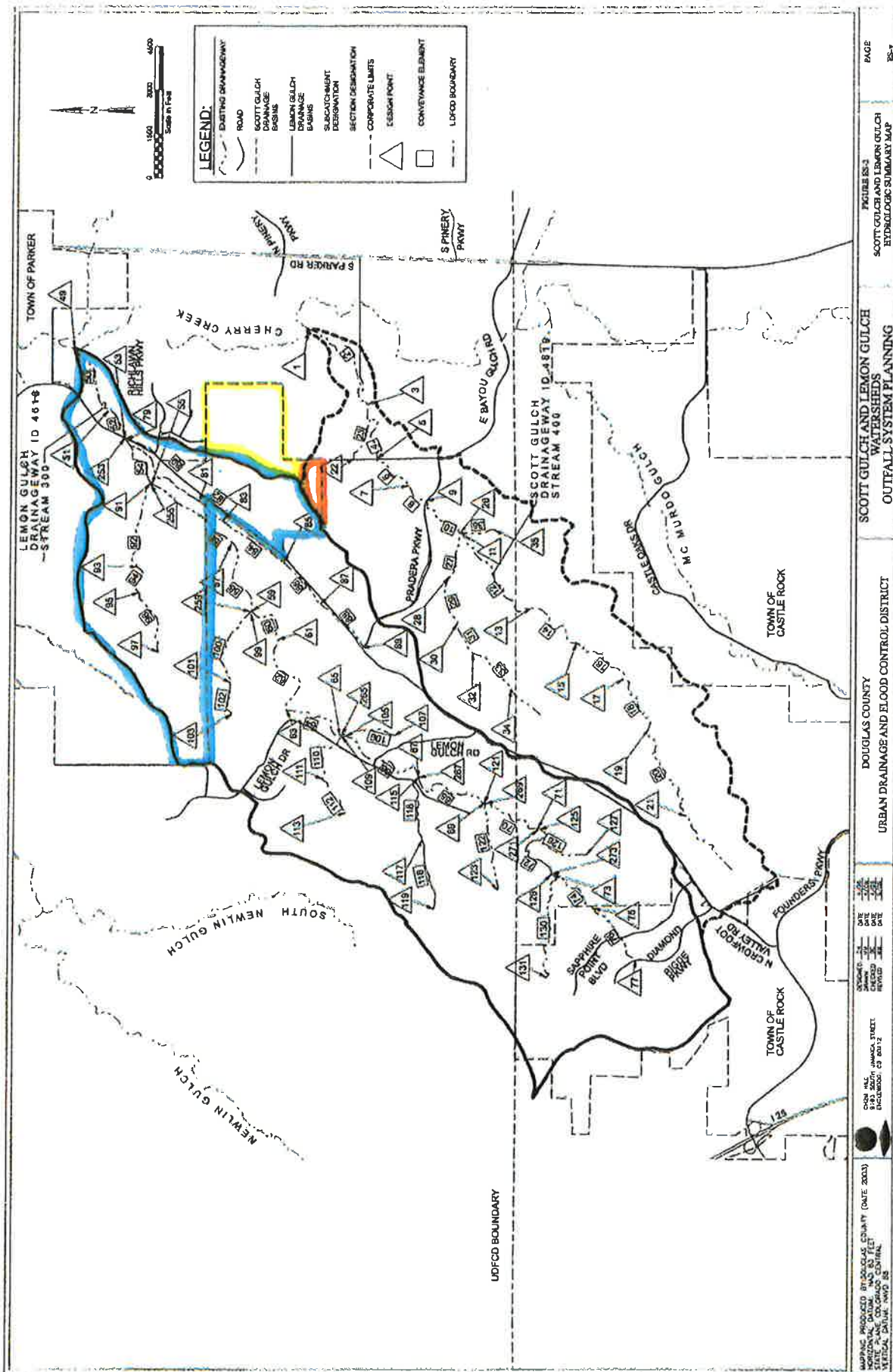
PREPARED FOR:
URBAN DRAINAGE AND
FLOOD CONTROL DISTRICT

DOUGLAS COUNTY

PREPARED BY
CH2M-HILL
DENVER, CO

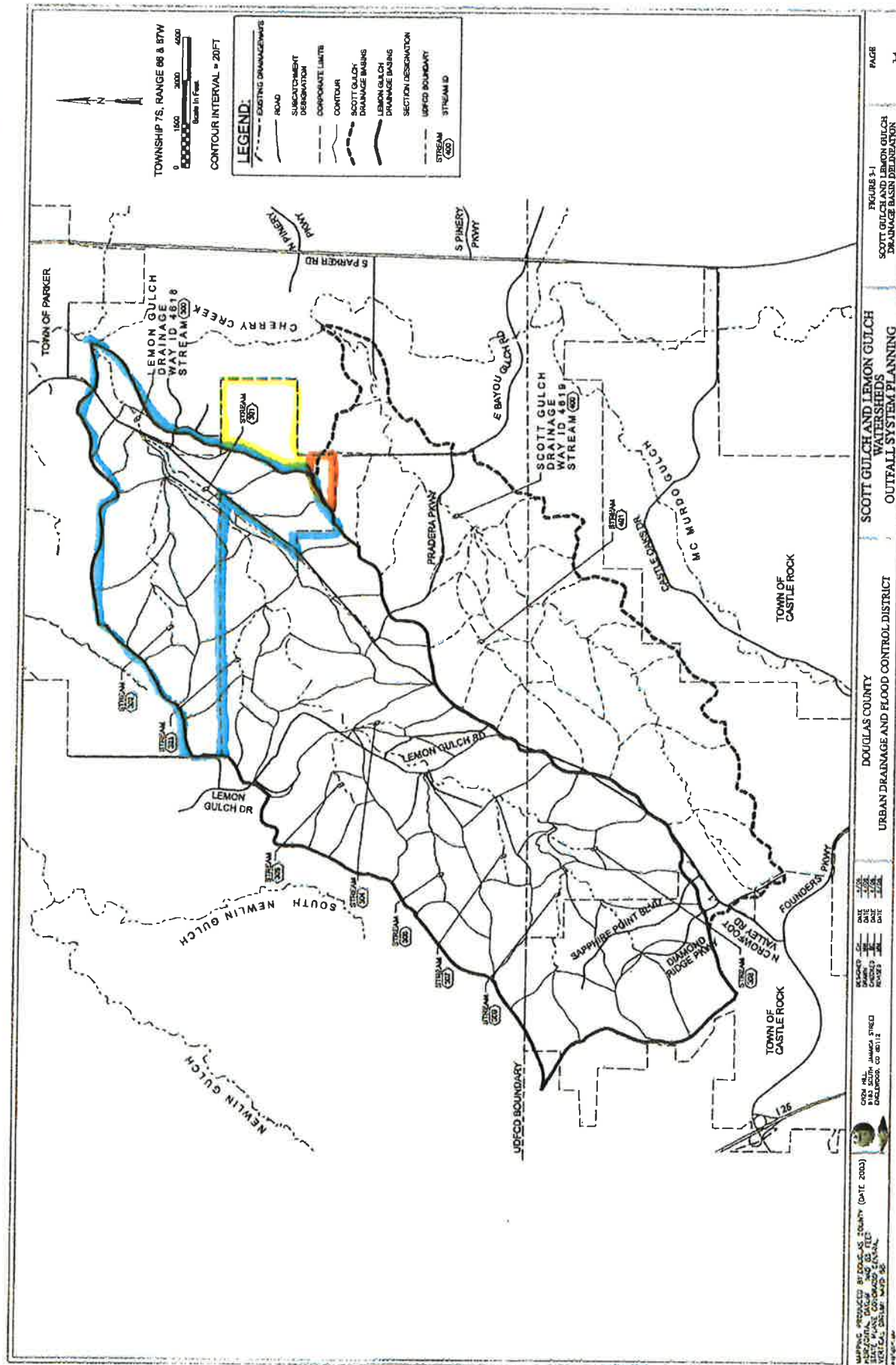
JULY 2006





course, and a single family community averaging just over one dwelling unit per acre. Much of the infrastructure planned for Pradera development has been constructed including a regional detention facility and stream stabilization measures.

The Canyons development is planned for the upper portion of the watershed and is not yet under construction. Density for the development will consist of one home per acre. The lower portion of the watershed is zoned as a Community Separator Area and open space. The Douglas County Master Plan indicates that there is potential for development in the community separator area, however, the allowed density will be restricted.



STREAM 400
DRAINAGE TO 010

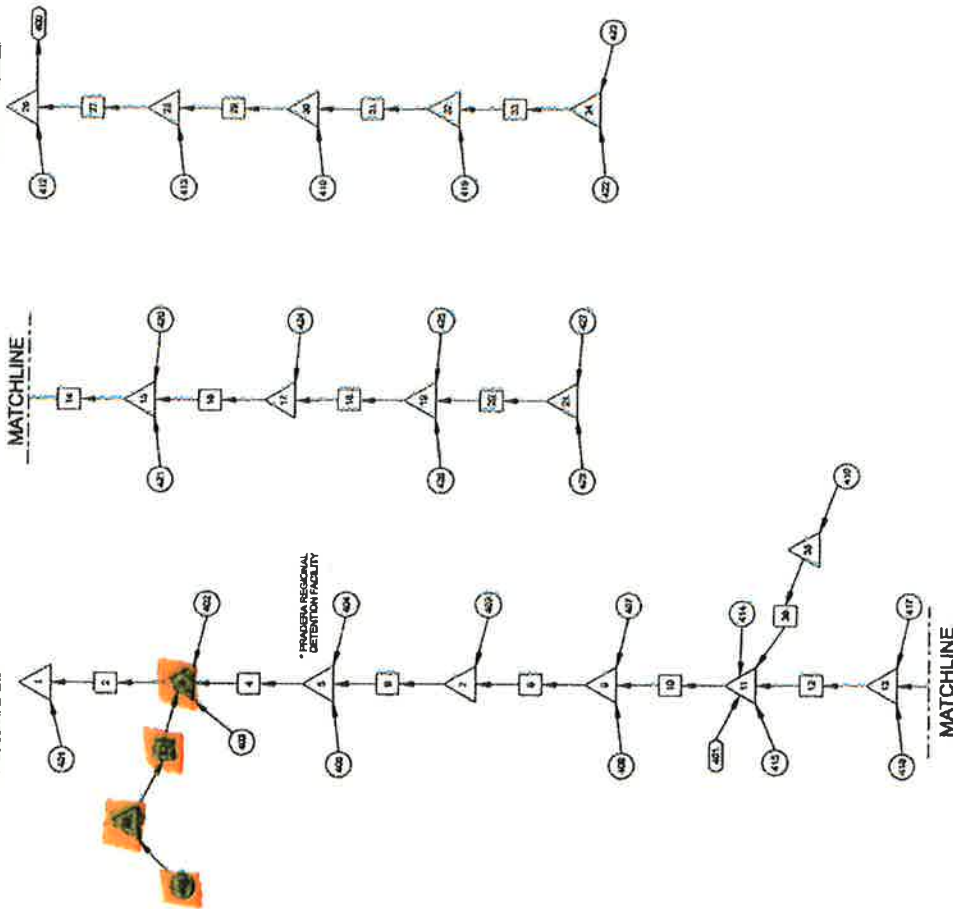


TABLE A-2

CUHP SUBWATERSHED CHARACTERISTICS
FUTURE IMPERVIOUS CONDITION

'Subcatchment ID	Area (acres)	Area (mi ²)	Length (mi)	Centroid Length (mi)	Percent Imperv.	Slope (ft/ft)	t _c (min)	Pervious Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/day)	Final Rate (in/hr)
LEMON GULCH DRAINAGEWAY ID 4618												
301	33	0.051	0.61	0.32	50.4%	0.015	27.8	0.35	0.05	4.41	9.0018	0.59
302	56	0.092	0.81	0.43	43.0%	0.035	29.0	0.35	0.05	4.30	9.0018	0.59
303	36	0.061	0.73	0.37	19.1%	0.031	70.3	0.40	0.05	4.31	9.0018	0.59
304	45	0.077	0.53	0.32	45.0%	0.049	18.5	0.35	0.05	4.29	9.0018	0.59
305	107	0.158	1.04	0.43	38.1%	0.020	0.43	0.35	0.05	4.03	9.0018	0.62
306	53	0.082	0.65	0.46	41.9%	0.025	28.9	0.35	0.05	4.39	9.0018	0.59
307	98	0.153	0.78	0.46	34.0%	0.033	0.35	0.35	0.05	3.68	9.0018	0.59
308	43	0.067	0.81	0.42	37.0%	0.016	33.8	0.35	0.05	4.58	9.0018	0.59
309	105	0.166	0.84	0.47	37.0%	0.031	0.35	0.35	0.05	3.62	9.0018	0.59
310	153	0.255	0.94	0.50	41.0%	0.038	0.35	0.35	0.05	4.34	9.0018	0.59
311	30	0.047	0.41	0.07	37.0%	0.045	22.0	0.35	0.05	3.57	9.0018	0.53
312	72	0.112	0.62	0.35	37.0%	0.040	21.9	0.35	0.05	4.42	9.0018	0.53
313	57	0.152	0.82	0.29	28.9%	0.029	0.35	0.35	0.05	3.90	9.0018	0.57
314	97	0.088	0.53	0.48	37.0%	0.012	25.5	0.35	0.05	4.29	9.0018	0.59
315	124	0.194	0.83	0.48	37.0%	0.026	0.35	0.35	0.05	3.95	9.0018	0.56
316	83	0.137	0.82	0.32	37.0%	0.036	28.5	0.35	0.05	4.38	9.0018	0.56
317	38	0.153	0.62	0.30	20.3%	0.044	0.35	0.35	0.05	3.95	9.0018	0.56
318	67	0.138	0.78	0.36	8.7%	0.037	88.5	0.40	0.05	3.15	9.0018	0.51
319	121	0.169	0.75	0.38	26.9%	0.031	26.5	0.35	0.05	4.06	9.0018	0.57
320	37	0.057	0.56	0.24	35.7%	0.032	0.35	0.35	0.05	3.09	9.0018	0.51
321	91	0.142	0.95	0.56	28.4%	0.039	0.35	0.35	0.05	4.32	9.0018	0.53
322	54	0.064	0.41	0.18	29.6%	0.049	22.0	0.35	0.05	3.88	9.0018	0.53
323	67	0.105	0.49	0.22	19.6%	0.049	45.7	0.40	0.05	3.00	9.0018	0.50
324	84	0.131	0.75	0.40	18.4%	0.049	58.8	0.40	0.05	3.81	9.0018	0.51
325	73	0.114	0.60	0.41	18.1%	0.030	62.3	0.40	0.05	3.93	9.0018	0.57
326	107	0.168	0.88	0.37	17.3%	0.043	0.40	0.40	0.05	3.48	9.0018	0.53
327	74	0.116	1.04	0.57	7.6%	0.015	124.4	0.40	0.05	3.08	9.0018	0.51
328	116	0.181	0.71	0.32	2.0%	0.050	0.40	0.40	0.05	3.51	9.0018	0.53
329	51	0.080	0.51	0.24	10.0%	0.051	45.0	0.40	0.05	3.00	9.0018	0.50
330	67	0.105	0.64	0.38	5.0%	0.044	55.1	0.40	0.05	3.00	9.0018	0.50
331	30	0.047	0.38	0.19	2.0%	0.056	36.1	0.40	0.05	3.64	9.0018	0.54
332	124	0.195	1.01	0.63	7.5%	0.031	0.40	0.40	0.05	3.08	9.0018	0.51
333	65	0.102	0.61	0.30	2.6%	0.046	53.1	0.40	0.05	3.00	9.0018	0.50
334	49	0.076	0.80	0.37	2.0%	0.014	107.0	0.40	0.05	3.23	9.0018	0.52
335	89	0.139	0.88	0.55	2.2%	0.027	86.9	0.40	0.05	3.40	9.0018	0.53
336	13	0.030	0.36	0.19	2.0%	0.041	40.0	0.40	0.05	3.00	9.0018	0.50
337	60	0.094	0.60	0.35	13.8%	0.043	53.7	0.40	0.05	3.00	9.0018	0.50
338	116	0.182	0.98	0.61	4.3%	0.021	0.40	0.40	0.05	3.03	9.0018	0.50

Italicized Subcatchment IDs indicate all values were adopted from the FHAD. The values for depression storage, initial and final infiltration, and decay rate were adopted from the FHAD for all subcatchments.

TABLE A-2 (CONTINUED)

CUHP SUBWATERSHED CHARACTERISTICS
FUTURE IMPERVIOUS CONDITION

'Subcatchment ID	Area (acres)	Area (mi ²)	Length (mi)	Centroid Length (mi)	Percent Imperv.	Slope (ft/ft)	t _c (min)	Pervious Depression Storage (in)	Impervious Depression Storage (in)	Initial Rate (in/hr)	Decay Coef. (1/day)	Final Rate (in/hr)
LEMON GULCH (CONTINUED)												
339	44	0.065	0.70	0.37	2.1%	0.022	79.9	0.40	0.05	3.04	0.0018	0.50
340	63	0.099	0.66	0.33	13.3%	0.030	66.9	0.40	0.05	3.01	0.0018	0.50
341	106	0.166	0.59	0.30	25.9%	0.043	0.35	0.35	0.05	3.02	0.0018	0.50
342	99	0.155	0.64	0.31	12.7%	0.039	0.40	0.40	0.05	3.03	0.0018	0.50
343	95	0.148	0.62	0.35	27.0%	0.035	0.35	0.35	0.05	3.03	0.0018	0.50
344	82	0.128	0.63	0.46	32.0%	0.030	34.3	0.35	0.05	3.03	0.0018	0.50
345	76	0.119	0.62	0.38	32.0%	0.030	23.7	0.35	0.05	3.03	0.0018	0.50
346	65	0.132	0.60	0.33	31.8%	0.041	27.7	0.35	0.05	3.03	0.0018	0.50
347	102	0.159	0.61	0.33	9.4%	0.038	0.40	0.40	0.05	3.03	0.0018	0.50
348	41	0.064	0.58	0.33	31.7%	0.048	20.7	0.35	0.05	3.03	0.0018	0.50
349	108	0.169	0.66	0.30	30.7%	0.033	22.9	0.35	0.05	3.03	0.0018	0.50
350	109	0.170	1.04	0.61	30.7%	0.033	0.35	0.35	0.05	3.03	0.0018	0.50
351	109	0.170	1.04	0.61	30.7%	0.033	0.35	0.35	0.05	3.03	0.0018	0.50
352	28	0.043	0.49	0.34	32.6%	0.038	18.5	0.35	0.05	3.03	0.0018	0.50
353	92	0.143	0.85	0.47	33.4%	0.036	0.35	0.35	0.05	3.03	0.0018	0.50
354	95	0.086	0.68	0.47	34.0%	0.039	32.2	0.35	0.05	3.03	0.0018	0.50
355	91	0.143	1.01	0.65	33.1%	0.027	0.35	0.35	0.05	3.03	0.0018	0.50
356	123	0.192	1.16	0.74	27.7%	0.025	0.35	0.35	0.05	3.03	0.0018	0.50
357	86	0.134	0.61	0.23	32.0%	0.040	28.0	0.35	0.05	3.03	0.0018	0.50
358	125	0.196	0.69	0.39	33.7%	0.040	0.35	0.35	0.05	3.03	0.0018	0.50
359	110	0.173	0.67	0.38	34.0%	0.046	0.35	0.35	0.05	3.00	0.0018	0.50
360	96	0.150	0.93	0.50	34.0%	0.037	0.35	0.35	0.05	3.03	0.0018	0.50
361	94	0.146	0.86	0.46	35.0%	0.035	0.35	0.35	0.05	3.00	0.0018	0.50
SCOTT GULCH DRAINAGEWAY ID 4618												
401	70	0.110	0.82	0.52	9.3%	0.016	25.9	0.40	0.05	4.58	0.0014	0.73
402	47	0.074	0.63	0.33	20.1%	0.030	21.2	0.35	0.05	4.29	0.0016	0.65
403	70	0.110	0.62	0.25	20.0%	0.035	24.2	0.35	0.05	4.16	0.0016	0.63
404	44	0.065	0.53	0.26	20.2%	0.021	23.9	0.35	0.05	3.83	0.0017	0.58
405	134	0.210	0.57	0.53	21.0%	0.047	0.35	0.35	0.05	4.04	0.0018	0.58
406	90	0.140	0.67	0.27	24.9%	0.046	23.3	0.35	0.05	3.87	0.0018	0.56
407	102	0.160	0.68	0.32	28.7%	0.040	0.35	0.35	0.05	3.70	0.0018	0.55
408	31	0.048	0.52	0.31	24.6%	0.057	21.2	0.35	0.05	3.79	0.0018	0.55
409	134	0.210	1.10	0.63	21.9%	0.045	0.35	0.35	0.05	3.61	0.0018	0.56
410	90	0.140	0.57	0.28	11.9%	0.045	20.7	0.40	0.05	3.86	0.0018	0.56
411	51	0.075	0.58	0.26	18.4%	0.039	22.0	0.40	0.05	3.32	0.0018	0.52
412	90	0.143	0.55	0.29	18.0%	0.049	0.40	0.40	0.05	3.44	0.0018	0.53
413	102	0.160	0.59	0.49	10.7%	0.036	0.40	0.40	0.05	3.82	0.0018	0.55

FIGURE A-4

PEAK FLOW PROFILES
LEMON GULCH
ST-HAR 305
(DRAINAGEWAY ID 4618)

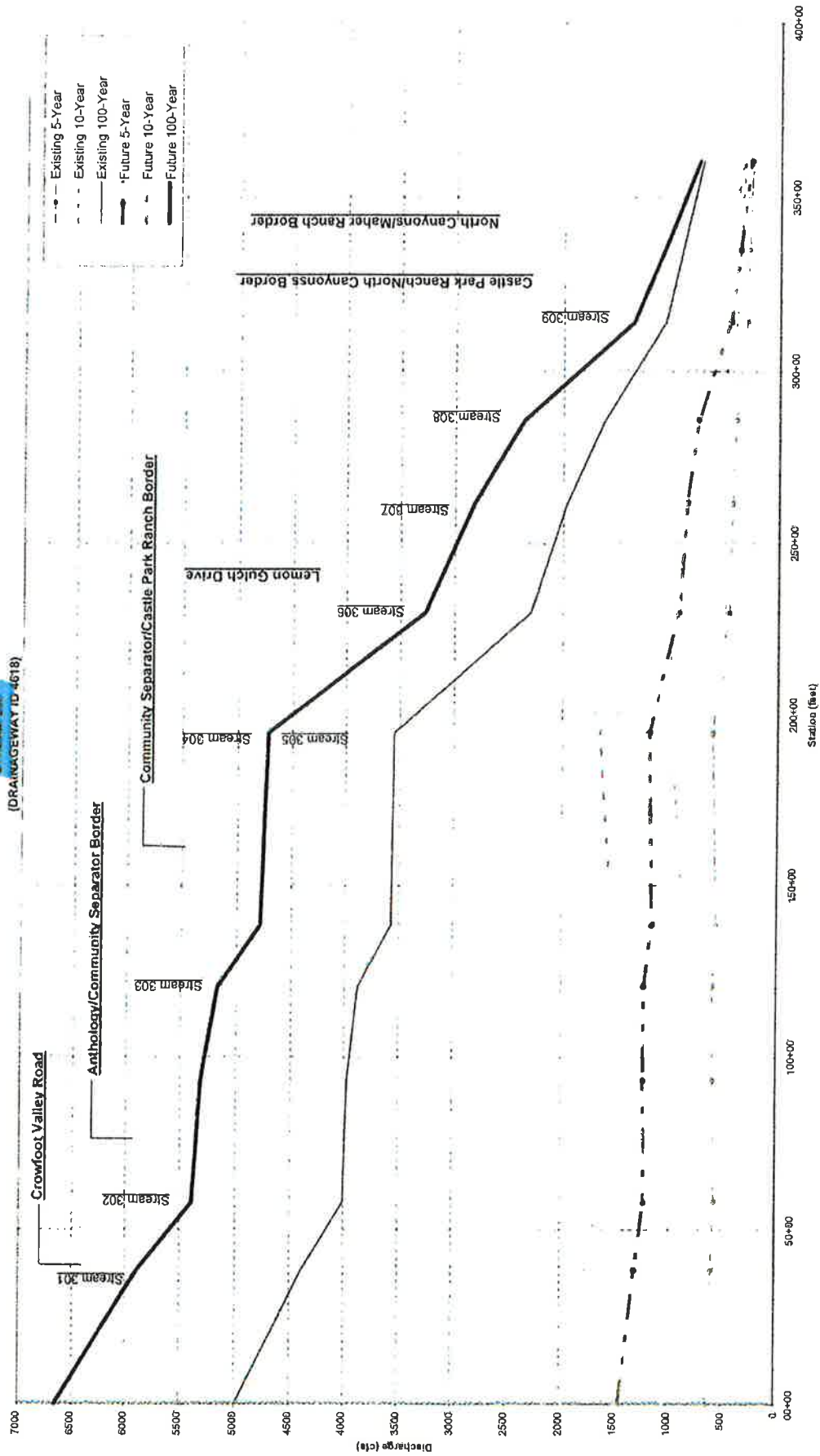
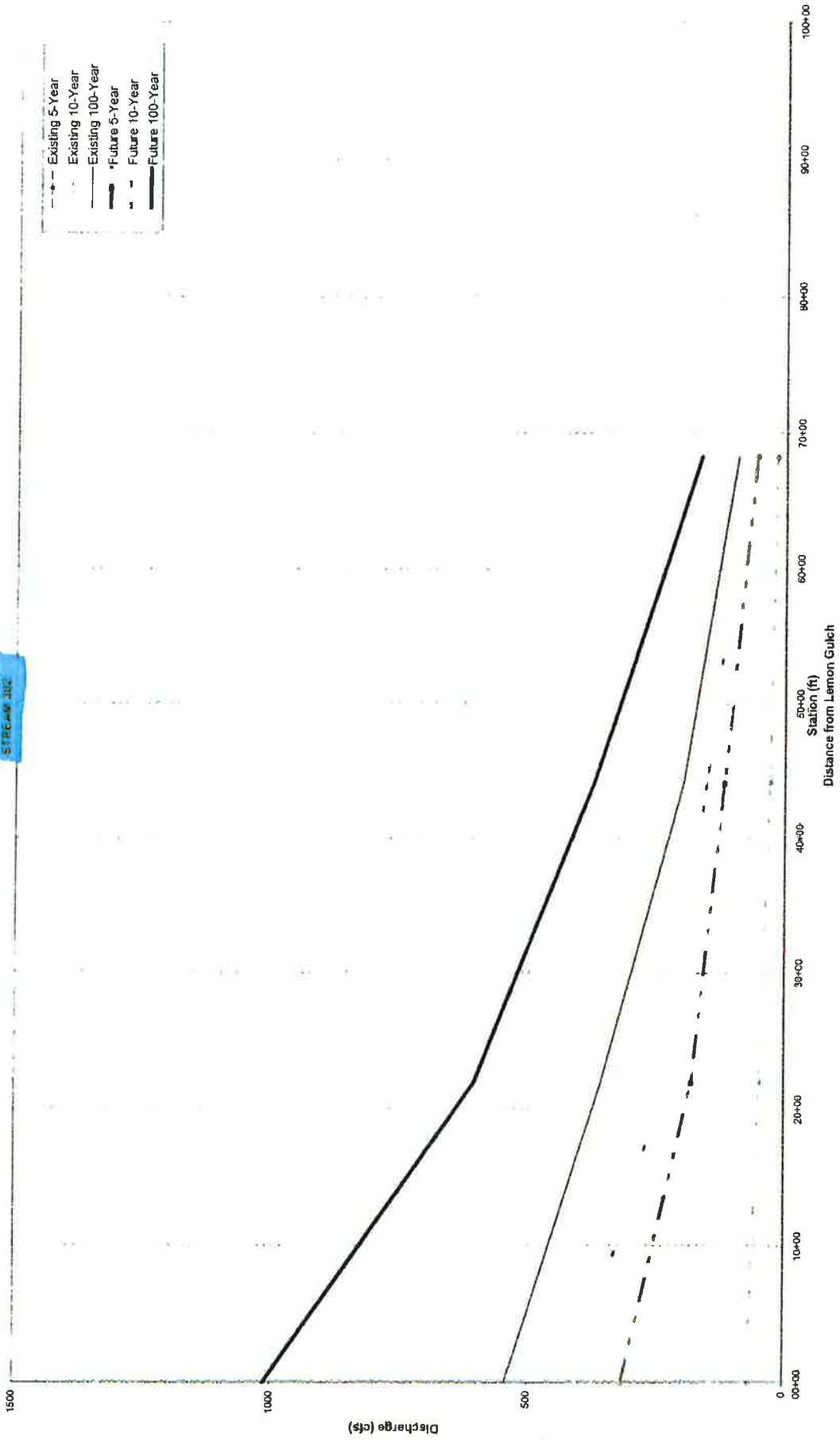


FIGURE A-6

PEAK FLOW PROFILES

LEMON GULCH

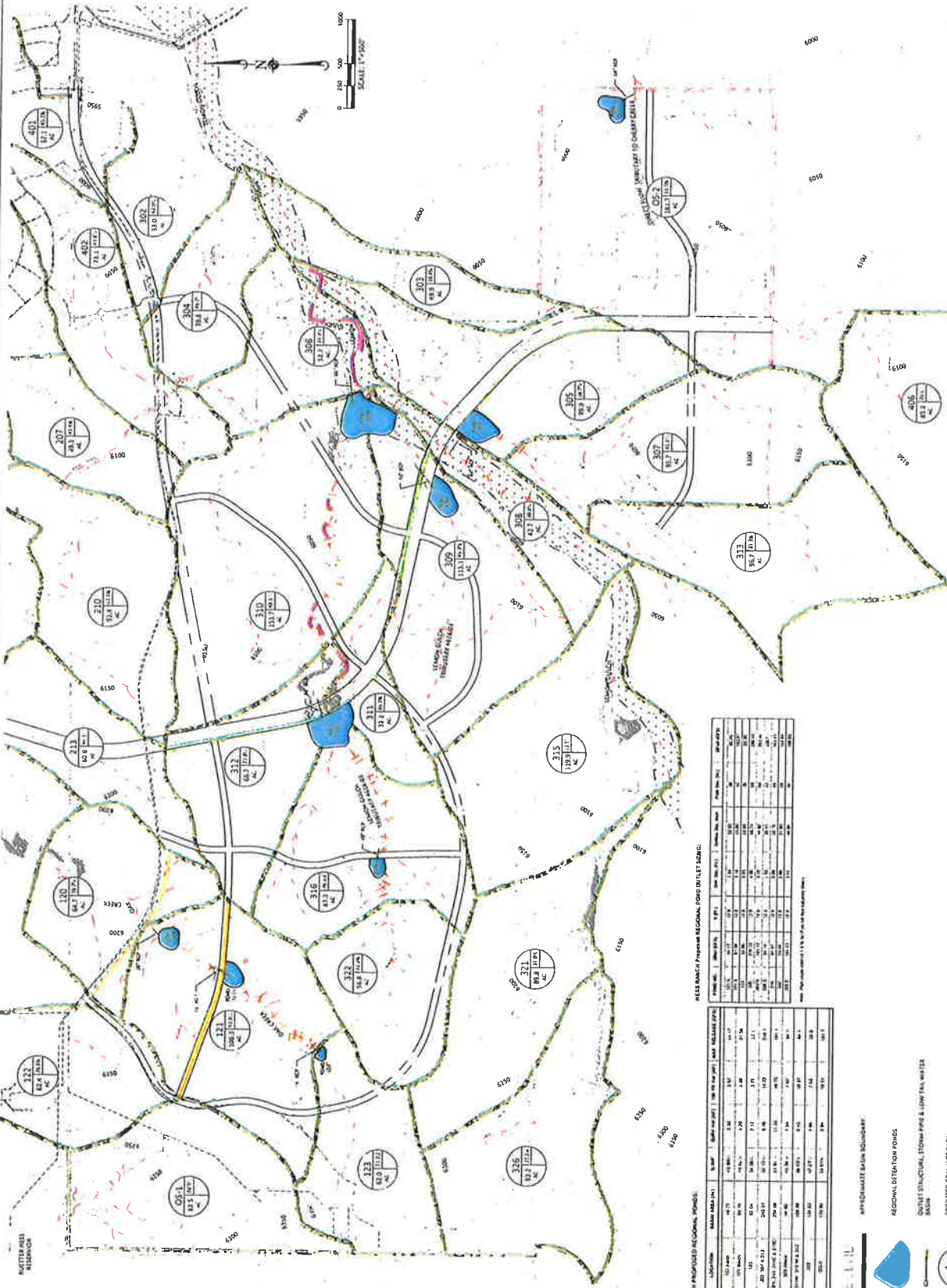
SITE A-44 302



APPENDIX F

Basin Maps



[illegible][illegible]

APPROPRIATE SINK LOCATIONS

REGIONAL DRAINAGE PATTERN

CONCENTRIC CIRCULAR DRAINAGE & LOW FLOW VELOCITY

PROPOSED DRAINAGE BASIN

WATER DIVISION

C + 1 IMPERVIOUSNESS

OUTFALL SYSTEMS
PLANNING-
PRELIMINARY DESIGN
REPORT

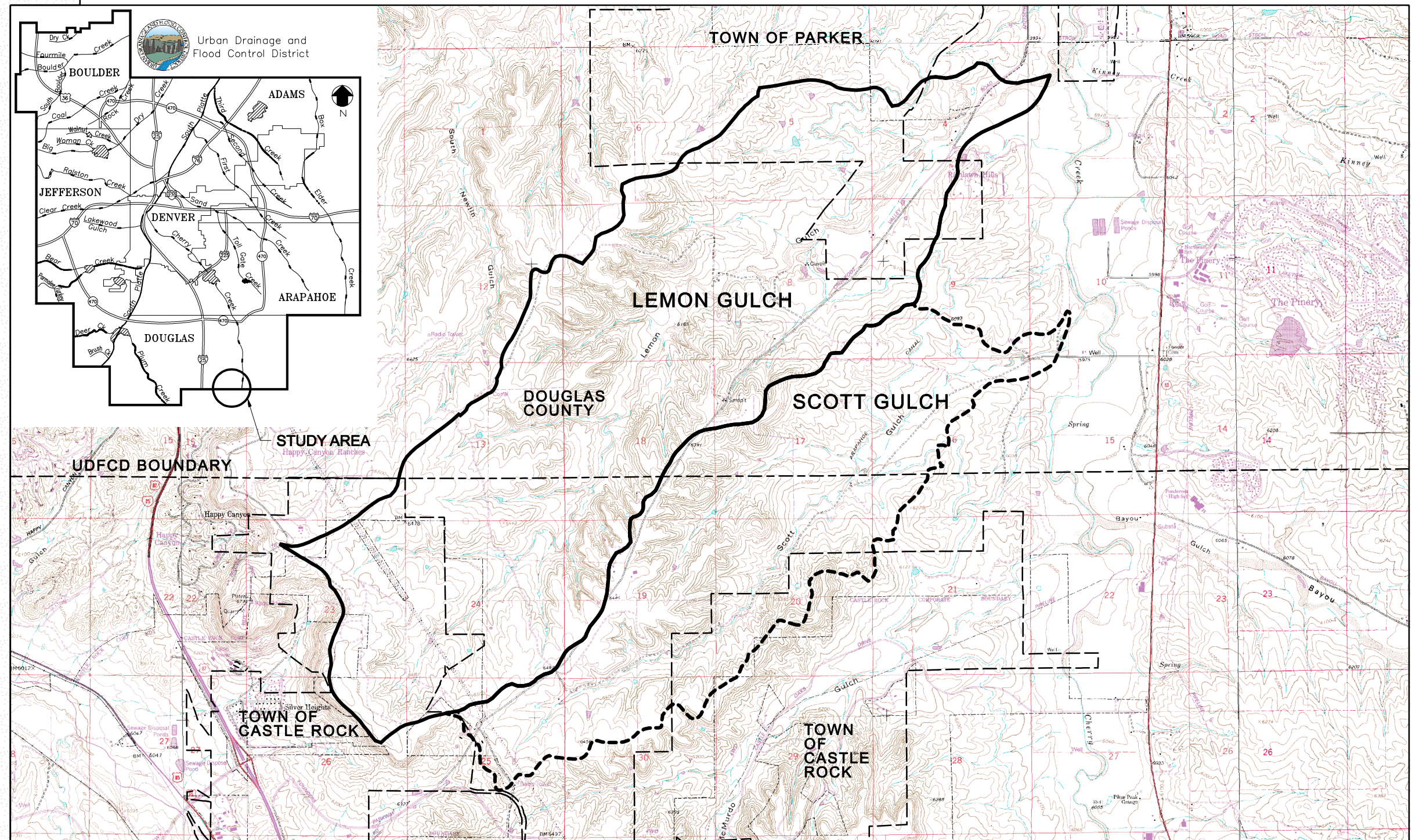
SCOTT AND LEMON GULCH WATERSHEDS

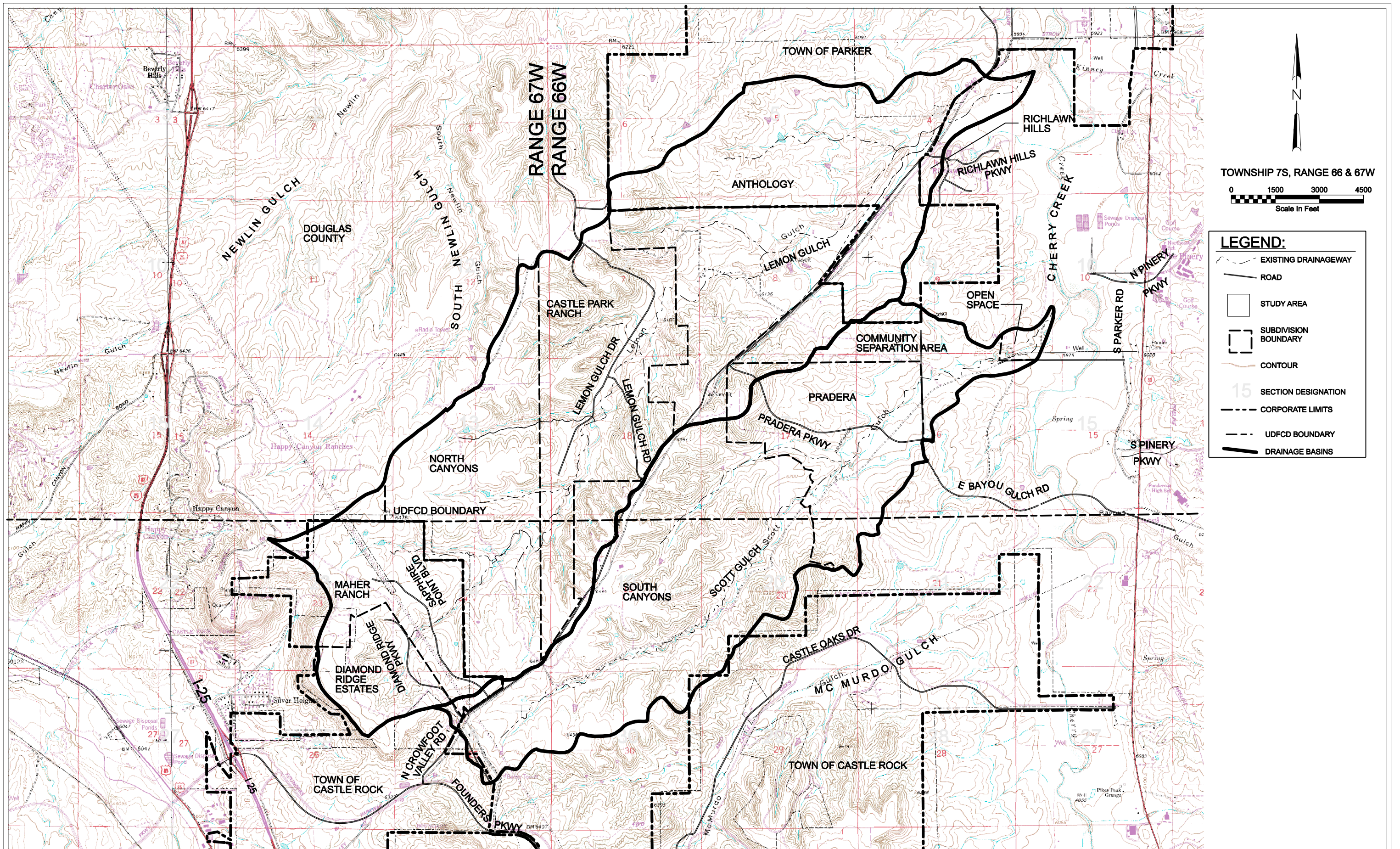
PREPARED FOR:
URBAN DRAINAGE AND
FLOOD CONTROL DISTRICT

DOUGLAS COUNTY

PREPARED BY
CH2MHILL
DENVER, CO

JULY 2006





MAPPING PRODUCED BY: DOUGLAS COUNTY (DATE 2003)
 HORIZONTAL DATUM: NAD 83 FEET
 STATE PLANE COLORADO CENTRAL
 VERTICAL DATUM: NAVD 88



CH2M HILL
 9193 SOUTH JAMAICA STREET
 ENGLEWOOD, CO 80112

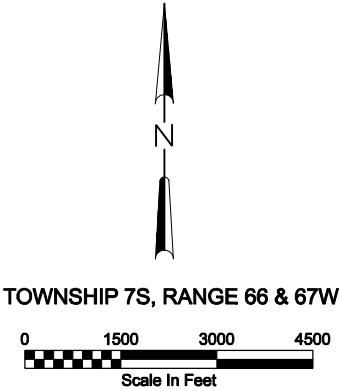
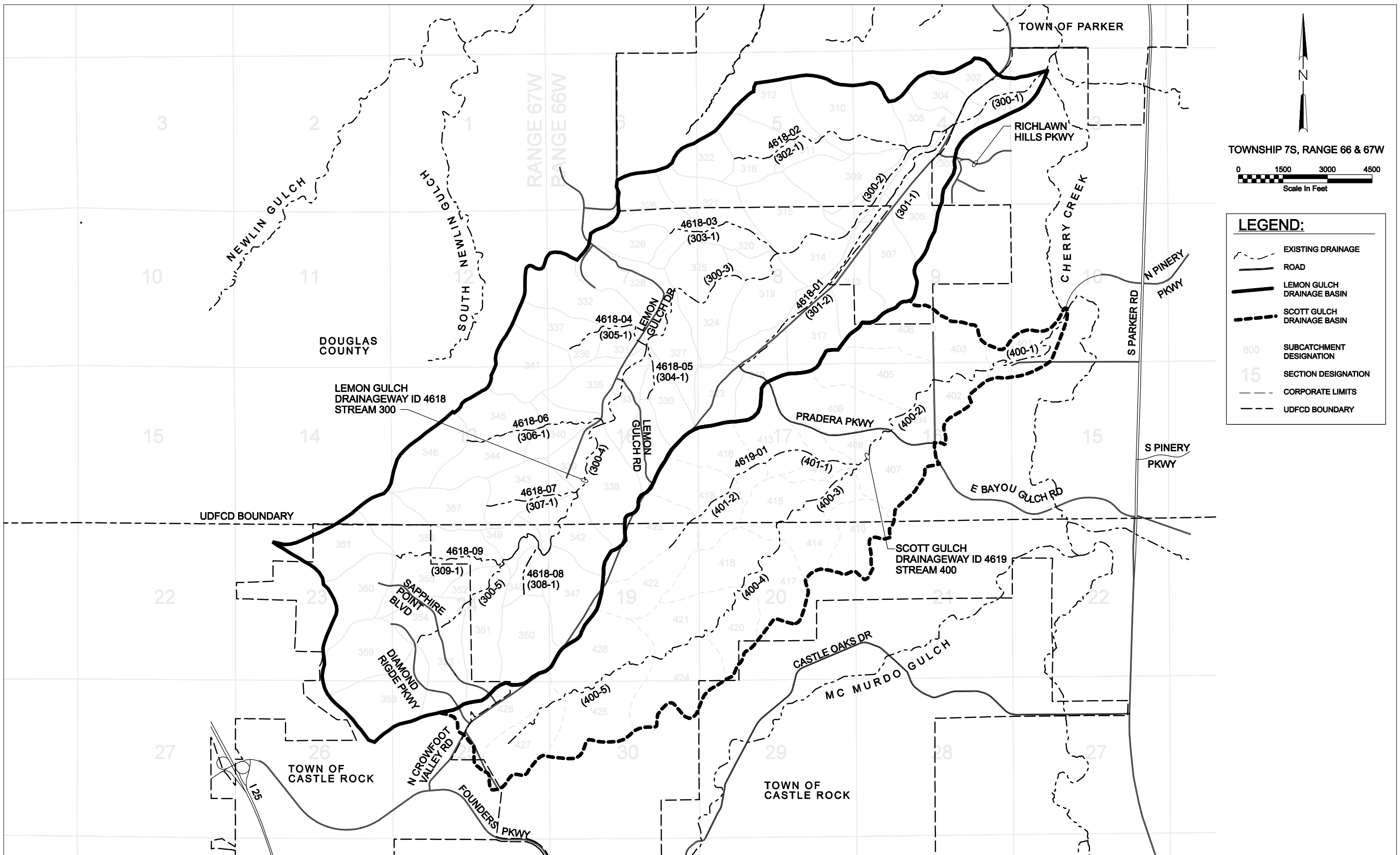
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DRAWN	MM	DATE	4/06
CHECKED	BC	DATE	4/06
REVISED	MM	DATE	6/06

DOUGLAS COUNTY
 URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

SCOTT GULCH AND LEMON GULCH
 WATERSHEDS
 OUTFALL SYSTEM PLANNING

FIGURE ES-1
 SCOTT GULCH AND LEMON GULCH
 VICINITY MAP

PAGE
 ES-iv
 679



LEGEND:

- EXISTING DRAINAGE
- ROAD
- LEMON GULCH DRAINAGE BASIN
- SCOTT GULCH DRAINAGE BASIN
- 800 SUBCATCHMENT DESIGNATION
- 15 SECTION DESIGNATION
- CORPORATE LIMITS
- UDFCD BOUNDARY

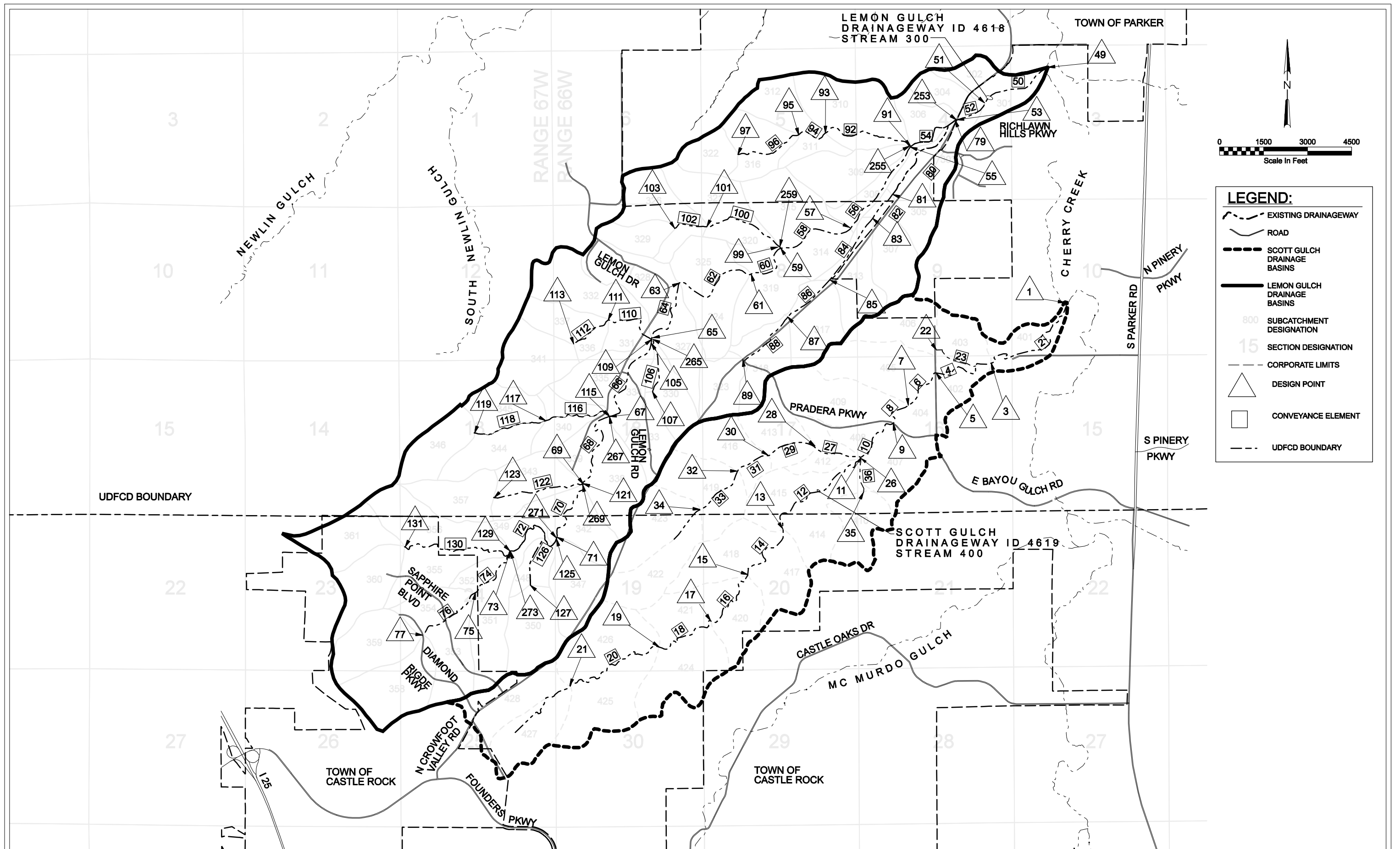


TABLE A-1

CUHP SUBWATERSHED CHARACTERISTICS
EXISTING IMPERVIOUS CONDITION

Area	Length	Centroid Length	Percent Imperv.	Slope	t _c	Pervious Depression Storage	Impervious Depression Storage	Initial Rate	Decay Coef.	Final Rate
(mi ²)	(mi)	(mi)	(%)	(ft/ft)	(min)	(in)	(in)	(in/hr)	(1/sec)	(in/hr)
0.051	0.61	0.32	2.0%	0.015	84.8	0.40	0.05	4.41	0.0018	0.59
0.092	0.81	0.43	2.0%	0.035	31.5	0.40	0.05	4.30	0.0018	0.59
0.061	0.73	0.37	2.0%	0.031	70.3	0.40	0.05	4.31	0.0018	0.59
0.077	0.53	0.32	2.0%	0.049	21.0	0.40	0.05	4.29	0.0018	0.59
0.158	1.04	0.43	2.0%	0.020		0.40	0.05	4.03	0.0016	0.62
0.083	0.65	0.46	2.0%	0.025	70.9	0.40	0.05	4.39	0.0018	0.59
0.153	0.78	0.46	2.0%	0.033		0.40	0.05	3.88	0.0017	0.59
0.067	0.81	0.42	2.0%	0.016	105.0	0.40	0.05	4.58	0.0016	0.69
0.166	0.84	0.47	2.0%	0.031		0.40	0.05	3.62	0.0018	0.54
0.255	0.94	0.50	2.0%	0.038		0.40	0.05	4.34	0.0018	0.59
0.047	0.41	0.07	2.0%	0.045	18.1	0.40	0.05	3.51	0.0018	0.53
0.112	0.62	0.35	2.0%	0.040	24.0	0.40	0.05	4.42	0.0018	0.59
0.152	0.82	0.49	2.0%	0.029		0.40	0.05	3.90	0.0018	0.57
0.088	0.53	0.29	2.0%	0.012	83.8	0.40	0.05	4.29	0.0018	0.59
0.194	0.83	0.48	2.0%	0.026		0.40	0.05	3.96	0.0018	0.56
0.137	0.62	0.32	2.0%	0.036	59.6	0.40	0.05	4.38	0.0018	0.59
0.153	0.62	0.30	2.0%	0.044		0.40	0.05	3.95	0.0018	0.56
0.136	0.78	0.36	2.0%	0.037	68.5	0.40	0.05	3.15	0.0018	0.51
0.189	0.75	0.38	2.0%	0.031		0.40	0.05	4.06	0.0018	0.57
0.057	0.56	0.24	2.0%	0.032	58.2	0.40	0.05	3.09	0.0018	0.51
0.142	0.95	0.56	2.0%	0.039		0.40	0.05	4.32	0.0018	0.59
0.084	0.41	0.18	2.0%	0.049	40.0	0.40	0.05	3.88	0.0018	0.56
0.105	0.49	0.22	2.0%	0.046	45.7	0.40	0.05	3.00	0.0018	0.50
0.131	0.75	0.40	2.0%	0.049	58.8	0.40	0.05	3.81	0.0018	0.55
0.114	0.60	0.41	2.0%	0.030	62.3	0.40	0.05	3.99	0.0018	0.57
0.168	0.68	0.37	2.0%	0.043		0.40	0.05	3.49	0.0018	0.53
0.116	1.04	0.57	2.0%	0.016	124.0	0.40	0.05	3.09	0.0018	0.51
0.181	0.71	0.32	2.0%	0.050		0.40	0.05	3.51	0.0018	0.53
0.080	0.51	0.24	2.0%	0.051	45.0	0.40	0.05	3.00	0.0018	0.50
0.105	0.64	0.38	2.0%	0.044	55.1	0.40	0.05	3.00	0.0018	0.50
0.047	0.38	0.19	2.0%	0.056	36.1	0.40	0.05	3.64	0.0018	0.54
0.195	1.01	0.63	2.0%	0.031		0.40	0.05	3.08	0.0018	0.51
0.102	0.61	0.30	2.0%	0.046	53.1	0.40	0.05	3.00	0.0018	0.50
0.076	0.80	0.37	2.0%	0.014	107.0	0.40	0.05	3.23	0.0018	0.52
0.139	0.88	0.55	2.0%	0.027	86.9	0.40	0.05	3.40	0.0018	0.53
0.030	0.36	0.19	2.0%	0.041	40.0	0.40	0.05	3.00	0.0018	0.50
0.094	0.60	0.35	2.0%	0.043	53.7	0.40	0.05	3.00	0.0018	0.50
0.182	0.98	0.61	2.0%	0.021		0.40	0.05	3.03	0.0018	0.50

TABLE A-1 (CONTINUED)

CUHP SUBWATERSHED CHARACTERISTICS
EXISTING IMPERVIOUS CONDITION

¹ Subcatchment ID	Area	Area	Length	Centroid Length	Percent Imperv.	Slope	t _c	Pervious Depression Storage	Impervious Depression Storage	Initial Rate	Decay Coef.	Final Rate
	(acres)	(mi ²)	(mi)	(mi)	(%)	(ft/ft)	(min)	(in)	(in)	(in/hr)	(1/sec)	(in/hr)
LEMON GULCH (CONTINUED)												
339	44	0.069	0.70	0.37	2.0%	0.022	79.9	0.40	0.05	3.04	0.0018	0.50
340	63	0.099	0.66	0.33	2.0%	0.030	66.9	0.40	0.05	3.01	0.0018	0.50
341	106	0.166	0.59	0.30	2.0%	0.043		0.40	0.05	3.00	0.0018	0.50
342	99	0.155	0.64	0.31	2.0%	0.039		0.40	0.05	3.00	0.0018	0.50
343	95	0.149	0.62	0.35	2.0%	0.035		0.40	0.05	3.00	0.0018	0.50
344	82	0.128	0.83	0.46	2.0%	0.030	78.9	0.40	0.05	3.00	0.0018	0.50
345	76	0.119	0.62	0.38	2.0%	0.038	25.7	0.40	0.05	3.00	0.0018	0.50
346	85	0.132	0.60	0.26	2.3%	0.041	55.3	0.40	0.05	3.00	0.0018	0.50
347	102	0.159	0.61	0.33	2.0%	0.038		0.40	0.05	3.00	0.0018	0.50
348	41	0.064	0.58	0.33	2.0%	0.048	22.8	0.40	0.05	3.00	0.0018	0.50
349	45	0.071	0.58	0.38	2.0%	0.040	24.0	0.40	0.05	3.00	0.0018	0.50
350	108	0.169	0.66	0.30	2.0%	0.033		0.40	0.05	3.00	0.0018	0.50
351	109	0.170	1.04	0.61	2.0%	0.028		0.40	0.05	3.00	0.0018	0.50
352	28	0.043	0.49	0.34	2.0%	0.039	20.9	0.40	0.05	3.00	0.0018	0.50
353	92	0.143	0.85	0.47	10.2%	0.036		0.40	0.05	3.00	0.0018	0.50
354	55	0.086	0.68	0.47	8.1%	0.039	25.7	0.40	0.05	3.00	0.0018	0.50
355	91	0.143	1.01	0.65	3.1%	0.027		0.40	0.05	3.00	0.0018	0.50
356	123	0.192	1.16	0.74	8.6%	0.025		0.40	0.05	3.00	0.0018	0.50
357	86	0.134	0.61	0.23	2.0%	0.040	56.4	0.40	0.05	3.00	0.0018	0.50
358	125	0.196	0.69	0.39	33.5%	0.040		0.35	0.05	3.00	0.0018	0.50
359	110	0.173	0.67	0.36	30.7%	0.046		0.35	0.05	3.00	0.0018	0.50
360	96	0.150	0.93	0.50	2.5%	0.037		0.40	0.05	3.00	0.0018	0.50
361	94	0.146	0.86	0.46	10.2%	0.035		0.40	0.05	3.00	0.0018	0.50
SCOTT GULCH (DRAINAGEWAY ID 4619)												
401	70	0.110	0.82	0.52	2.0%	0.016	26.4	0.40	0.05	4.59	0.0014	0.73
402	47	0.074	0.63	0.33	2.0%	0.030	23.2	0.40	0.05	4.29	0.0016	0.65
403	70	0.110	0.62	0.25	2.0%	0.035	25.0	0.40	0.05	4.16	0.0016	0.63
404	44	0.069	0.53	0.26	2.0%	0.021	24.8	0.40	0.05	3.83	0.0017	0.59
405	134	0.210	0.97	0.53	2.0%	0.047		0.40	0.05	4.04	0.0018	0.58
406	90	0.140	0.67	0.27	2.0%	0.046	25.3	0.40	0.05	3.87	0.0018	0.56
407	102	0.160	0.68	0.32	2.0%	0.040		0.40	0.05	3.70	0.0018	0.55
408	31	0.049	0.52	0.31	2.0%	0.057	23.0	0.40	0.05	3.79	0.0018	0.55
409	134	0.210	1.10	0.63	2.0%	0.045		0.40	0.05	3.61	0.0018	0.55
410	90	0.140	0.57	0.28	2.0%	0.045	21.1	0.40	0.05	3.86	0.0018	0.56
412	51	0.079	0.58	0.26	2.0%	0.039	22.8	0.40	0.05	3.32	0.0018	0.52
413	90	0.141	0.55	0.29	2.0%	0.049		0.40	0.05	3.44	0.0018	0.53
414	102	0.160	0.99	0.49	2.0%	0.036		0.40	0.05	3.82	0.0018	0.55

TABLE A-2

CUHP SUBWATERSHED CHARACTERISTICS
FUTURE IMPERVIOUS CONDITION

¹ Subcatchment ID	Area	Area	Length	Centroid Length	Percent Imperv.	Slope	t _c	Pervious Depression Storage	Impervious Depression Storage	Initial Rate	Decay Coef.	Final Rate
	(acres)	(mi ²)	(mi)	(mi)	(%)	(ft/ft)	(min)	(in)	(in)	(in/hr)	(1/sec)	(in/hr)
LEMON GULCH (DRAINAGEWAY ID 4618)												
301	33	0.051	0.61	0.32	30.4%	0.015	27.8	0.35	0.05	4.41	0.0018	0.59
302	59	0.092	0.81	0.43	43.0%	0.035	29.0	0.35	0.05	4.30	0.0018	0.59
303	39	0.061	0.73	0.37	19.1%	0.031	70.3	0.40	0.05	4.31	0.0018	0.59
304	49	0.077	0.53	0.32	45.0%	0.049	18.3	0.35	0.05	4.29	0.0018	0.59
305	101	0.158	1.04	0.43	36.1%	0.020		0.35	0.05	4.03	0.0016	0.62
306	53	0.083	0.65	0.46	41.9%	0.025	28.9	0.35	0.05	4.39	0.0018	0.59
307	98	0.153	0.78	0.46	34.0%	0.033		0.35	0.05	3.88	0.0017	0.59
308	43	0.067	0.81	0.42	37.0%	0.016	33.8	0.35	0.05	4.58	0.0016	0.69
309	106	0.166	0.84	0.47	37.0%	0.031		0.35	0.05	3.62	0.0018	0.54
310	163	0.255	0.94	0.50	41.0%	0.038		0.35	0.05	4.34	0.0018	0.59
311	30	0.047	0.41	0.07	37.0%	0.045	22.0	0.35	0.05	3.51	0.0018	0.53
312	72	0.112	0.62	0.35	37.0%	0.040	21.9	0.35	0.05	4.42	0.0018	0.59
313	97	0.152	0.82	0.49	28.9%	0.029		0.35	0.05	3.90	0.0018	0.57
314	57	0.088	0.53	0.29	37.0%	0.012	25.5	0.35	0.05	4.29	0.0018	0.59
315	124	0.194	0.83	0.48	37.0%	0.026		0.35	0.05	3.96	0.0018	0.56
316	88	0.137	0.62	0.32	37.0%	0.036	28.5	0.35	0.05	4.38	0.0018	0.59
317	98	0.153	0.62	0.30	20.3%	0.044		0.35	0.05	3.95	0.0018	0.56
318	87	0.136	0.78	0.36	8.7%	0.037	68.5	0.40	0.05	3.15	0.0018	0.51
319	121	0.189	0.75	0.38	25.9%	0.031		0.35	0.05	4.06	0.0018	0.57
320	37	0.057	0.56	0.24	35.7%	0.032	26.5	0.35	0.05	3.09	0.0018	0.51
321	91	0.142	0.95	0.56	28.4%	0.039		0.35	0.05	4.32	0.0018	0.59
322	54	0.084	0.41	0.18	29.6%	0.049	22.0	0.35	0.05	3.88	0.0018	0.56
323	67	0.105	0.49	0.22	19.6%	0.046	45.7	0.40	0.05	3.00	0.0018	0.50
324	84	0.131	0.75	0.40	18.4%	0.049	58.8	0.40	0.05	3.81	0.0018	0.55
325	73	0.114	0.60	0.41	18.1%	0.030	62.3	0.40	0.05	3.99	0.0018	0.57
326	107	0.168	0.68	0.37	17.3%	0.043		0.40	0.05	3.49	0.0018	0.53
327	74	0.116	1.04	0.57	7.6%	0.016	124.4	0.40	0.05	3.09	0.0018	0.51
328	116	0.181	0.71	0.32	2.0%	0.050		0.40	0.05	3.51	0.0018	0.53
329	51	0.080	0.51	0.24	10.0%	0.051	45.0	0.40	0.05	3.00	0.0018	0.50
330	67	0.105	0.64	0.38	5.0%	0.044	55.1	0.40	0.05	3.00	0.0018	0.50
331	30	0.047	0.38	0.19	2.0%	0.056	36.1	0.40	0.05	3.64	0.0018	0.54
332	124	0.195	1.01	0.63	7.5%	0.031		0.40	0.05	3.08	0.0018	0.51
333	65	0.102	0.61	0.30	2.6%	0.046	53.1	0.40	0.05	3.00	0.0018	0.50
334	49	0.076	0.80	0.37	2.0%	0.014	107.0	0.40	0.05	3.23	0.0018	0.52
335	89	0.139	0.88	0.55	2.2%	0.027	86.9	0.40	0.05	3.40	0.0018	0.53
336	19	0.030	0.36	0.19	2.0%	0.041	40.0	0.40	0.05	3.00	0.0018	0.50
337	60	0.094	0.60	0.35	13.8%	0.043	53.7	0.40	0.05	3.00	0.0018	0.50
338	116	0.182	0.98	0.61	4.3%	0.021		0.40	0.05	3.03	0.0018	0.50

TABLE A-2 (CONTINUED)

CUHP SUBWATERSHED CHARACTERISTICS
FUTURE IMPERVIOUS CONDITION

¹ Subcatchment ID	Area	Area	Length	Centroid Length	Percent Imperv.	Slope	t _c	Pervious Depression Storage	Impervious Depression Storage	Initial Rate	Decay Coef.	Final Rate
	(acres)	(mi ²)	(mi)	(mi)	(%)	(ft/ft)	(min)	(in)	(in)	(in/hr)	(1/sec)	(in/hr)
LEMON GULCH (CONTINUED)												
339	44	0.069	0.70	0.37	2.1%	0.022	79.9	0.40	0.05	3.04	0.0018	0.50
340	63	0.099	0.66	0.33	13.3%	0.030	66.9	0.40	0.05	3.01	0.0018	0.50
341	106	0.166	0.59	0.30	25.9%	0.043		0.35	0.05	3.00	0.0018	0.50
342	99	0.155	0.64	0.31	12.7%	0.039		0.40	0.05	3.00	0.0018	0.50
343	95	0.149	0.62	0.35	27.0%	0.035		0.35	0.05	3.00	0.0018	0.50
344	82	0.128	0.83	0.46	32.0%	0.030	34.3	0.35	0.05	3.00	0.0018	0.50
345	76	0.119	0.62	0.38	32.0%	0.038	23.7	0.35	0.05	3.00	0.0018	0.50
346	85	0.132	0.60	0.26	31.8%	0.041	27.7	0.35	0.05	3.00	0.0018	0.50
347	102	0.159	0.61	0.33	9.4%	0.038		0.40	0.05	3.00	0.0018	0.50
348	41	0.064	0.58	0.33	31.7%	0.048	20.7	0.35	0.05	3.00	0.0018	0.50
349	45	0.071	0.58	0.38	31.8%	0.040	22.9	0.35	0.05	3.00	0.0018	0.50
350	108	0.169	0.66	0.30	30.7%	0.033		0.35	0.05	3.00	0.0018	0.50
351	109	0.170	1.04	0.61	30.7%	0.028		0.35	0.05	3.00	0.0018	0.50
352	28	0.043	0.49	0.34	32.6%	0.039	18.6	0.35	0.05	3.00	0.0018	0.50
353	92	0.143	0.85	0.47	33.4%	0.036		0.35	0.05	3.00	0.0018	0.50
354	55	0.086	0.68	0.47	34.0%	0.039	32.2	0.35	0.05	3.00	0.0018	0.50
355	91	0.143	1.01	0.65	33.1%	0.027		0.35	0.05	3.00	0.0018	0.50
356	123	0.192	1.16	0.74	27.7%	0.025		0.35	0.05	3.00	0.0018	0.50
357	86	0.134	0.61	0.23	32.0%	0.040	28.0	0.35	0.05	3.00	0.0018	0.50
358	125	0.196	0.69	0.39	33.7%	0.040		0.35	0.05	3.00	0.0018	0.50
359	110	0.173	0.67	0.36	34.0%	0.046		0.35	0.05	3.00	0.0018	0.50
360	96	0.150	0.93	0.50	34.0%	0.037		0.35	0.05	3.00	0.0018	0.50
361	94	0.146	0.86	0.46	35.0%	0.035		0.35	0.05	3.00	0.0018	0.50
SCOTT GULCH (DRAINAGEWAY ID 4618)												
401	70	0.110	0.82	0.52	9.9%	0.016	25.9	0.40	0.05	4.59	0.0014	0.73
402	47	0.074	0.63	0.33	20.1%	0.030	21.2	0.35	0.05	4.29	0.0016	0.65
403	70	0.110	0.62	0.25	20.0%	0.035	24.2	0.35	0.05	4.16	0.0016	0.63
404	44	0.069	0.53	0.26	20.2%	0.021	23.9	0.35	0.05	3.83	0.0017	0.59
405	134	0.210	0.97	0.53	21.0%	0.047		0.35	0.05	4.04	0.0018	0.58
406	90	0.140	0.67	0.27	24.9%	0.046	23.3	0.35	0.05	3.87	0.0018	0.56
407	102	0.160	0.68	0.32	28.7%	0.040		0.35	0.05	3.70	0.0018	0.55
408	31	0.049	0.52	0.31	24.6%	0.057	21.2	0.35	0.05	3.79	0.0018	0.55
409	134	0.210	1.10	0.63	21.9%	0.045		0.35	0.05	3.61	0.0018	0.55
410	90	0.140	0.57	0.28	11.9%	0.045	20.7	0.40	0.05	3.86	0.0018	0.56
412	51	0.079	0.58	0.26	18.4%	0.039	22.0	0.40	0.05	3.32	0.0018	0.52
413	90	0.141	0.55	0.29	18.0%	0.049		0.40	0.05	3.44	0.0018	0.53
414	102	0.160	0.99	0.49	10.7%	0.036		0.40	0.05	3.82	0.0018	0.55

Italicized Subcatchment IDs indicate all values were adopted from the FHAD. The values for depression storage, initial and final infiltration, and decay rate were adopted from the FHAD for all subcatchments.