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September 26, 2025

Mr. Chris Elliott
E5X Management
7353 S. Alton Way, Suite A-100
Englewood, CO 80112

Re: Spring Hill Update
Erie, CO
LSC #180812

Dear Mr. Elliott:

In response to your request, LSC Transportation Consultants, Inc. has prepared this traffic impact analysis for the proposed Spring Hill development. As shown on Figure 1, the site is located west of WCR 3 and south of State Highway (SH) 52 in the Town of Erie. A copy of the approved Town of Erie Transportation Impact Analysis (TIA) Base Assumption Form for this project has been attached for reference.

REPORT CONTENTS

The report contains the following: the existing roadway and traffic conditions in the vicinity of the site including the lane geometries, traffic controls, posted speed limits, etc.; the existing weekday peak-hour traffic volumes; the existing daily traffic volumes in the area; the typical weekday site-generated traffic volume projections for the site; the assignment of the projected traffic volumes to the area roadways; the projected short-term and long-term background and resulting total traffic volumes on the area roadways; the site's projected traffic impacts; and any recommended roadway improvements to mitigate the site's traffic impacts.

LAND USE AND ACCESS

The site is currently undeveloped. It is proposed to include 412 single-family homes, 70 townhome dwelling units, 150 duplex dwelling units, and a 400-student elementary school. In the future the 9-acre parcel located just southwest of SH 52/WCR 3 is planned to be developed with up to 80,000 square feet of commercial space.

Full movement access is proposed directly to SH 52 aligning with the existing Erie North Water Reclamation Facility access. Two full movement access points are proposed from Weld County Road (WCR) 3 and cross access is proposed to the Morgan Hill residential development south of the site. An additional right-in/right-out access is proposed to WCR 3 just south of SH 52 for the future commercial parcel.

ROADWAY AND TRAFFIC CONDITIONS

Area Roadways

The major roadways in the site's vicinity are shown on Figure 1 and are described below.

- **State Highway (SH) 52** is an east-west, two-lane principal arterial roadway north of the site. It is classified as Regional Highway (R-A) by CDOT. The speed limit in the vicinity of the site is 55 mph. The long-term plan assumes four lanes in the future but CDOT has said they have no plans or funding for additional through lanes at this time. The 2030 analysis assumes two through lanes and the 2050 analysis assumes four through lanes.

- **E. County Line Road** is a north-south, two-lane minor arterial roadway west of the site. Its intersection with SH 52 is traffic signal controlled. The posted speed limit in the vicinity of the site is 50 mph.

- **WCR 3** is a north-south, two-lane minor arterial roadway east of the site. Its intersection with SH 52 is unsignalized but is planned to be reconstructed as a modern roundabout in the future through coordination with the Shores on Plum Creek in Frederick to the north. The posted speed limit in the vicinity of the site is 45 mph.

Existing Traffic Conditions

Figure 3 shows the existing lane geometries, traffic controls, and traffic volumes in the site's vicinity on a typical weekday. The weekday peak-hour traffic volumes and daily traffic counts are from the attached traffic counts conducted by Counter Measures in September and August 2025 except for the average daily traffic volume on SH 52 which is based on CDOT data.

2030 and 2050 Background Traffic

Figure 4 shows the estimated 2030 background traffic. The 2030 background traffic volumes are based an annual growth rate of about 2.7 percent as required by the Town in the approved base assumption form. The background volumes also assume additional traffic due to partial buildout of the Shores on Plum Creek development proposed north of SH 52.

Figure 5 shows the estimated 2050 background traffic. The 2050 background traffic volumes are based an annual growth rate of about 2.7 percent as required by the Town in the approved base assumption form. The background volumes also assume additional traffic due to full buildout of the Shores on Plum Creek development proposed north of SH 52.

Existing, 2030, and 2050 Background Levels of Service

Level of service (LOS) is a quantitative measure of the level of congestion or delay at an intersection. Level of service is indicated on a scale from "A" to "F." LOS A is indicative of little congestion or delay and LOS F is indicative of a high level of congestion or delay. Attached are specific level of service definitions for signalized and unsignalized intersections.

The intersections in Figures 3, 4, and 5 were analyzed to determine the existing, 2030 background, and 2050 background levels of service. Table 1 shows the level of service analysis results. The level of service reports are attached.

1. **SH 52/E. County Line Road:** This existing traffic signal controlled intersection currently operates at an overall LOS "D" during the morning and afternoon peak-hours. During the morning peak-hour the northbound left-turn lane currently operates at LOS "E" and the shared southbound through and right-turn lane currently operates at LOS "F". During the afternoon peak-hour the shared northbound through and right-turn lane currently operates at LOS "E". By 2030 this intersection is expected to operate an overall LOS "E" during the morning peak-hour and LOS "D" during the afternoon peak-hour. During the morning peak-hour the shared westbound through and right-turn lane, the northbound left-turn lane, and the shared southbound through and right-turn lane are projected to operate at LOS "F". During the afternoon peak-hour the shared eastbound through lane, the shared northbound through and right-turn lane, and the shared southbound through and right-turn lane are projected to operate at LOS "F". By 2050 it was assumed that SH 52 will be widened to provide two eastbound and westbound left-turn lanes and that right-turn lanes will be added on all approaches. Based on the projected 2050 background volumes and lane geometry shown in Figure 5 this intersection is expected to operate at an overall LOS "C" during the morning peak-hour and LOS "D" during the afternoon peak-hour.

2. **SH 52/Existing Erie North Water Reclamation Facility Access/Site Access:** The southbound approach at this unsignalized intersection currently operates at LOS "E" during the morning peak-hour and LOS "B" during the afternoon peak-hour. By 2030, the southbound approach is expected to continue to operate at LOS "E" during the morning peak-hour and operate at LOS "D" during the afternoon peak-hour. By 2050 the southbound approach is expected to operate at LOS "F" during the morning peak-hour and LOS "E" during the afternoon peak-hour.

3. **SH 52/WCR 3:** The northbound left-turn movement at this unsignalized intersection currently operates at LOS "F" during both morning and afternoon peak-hours. All other movements currently operate at LOS "C" or better during the peak-hours. This intersection is planned to be reconstructed as a two-lane modern roundabout. It is expected to operate at an overall LOS "A" during the peak-hours based on the 2030 background traffic volumes and an overall LOS "B" during the peak-hours based on the 2050 background traffic volumes.

4. **WCR 3/WCR 12:** All movements at this unsignalized intersection currently operate at LOS "B" or better during both morning and afternoon peak-hours and are expected to do so through 2050.

5. **WCR 3/Future Commercial Right-In/Right-Out Only Site Access:** This intersection was analyzed only in the total traffic scenarios.

6. **WCR 3/North Full-Movement Site Access:** This intersection was analyzed only in the total traffic scenarios.

7. **WCR 3/South Site Full-Movement Access:** This intersection was analyzed only in the total traffic scenarios.

TRIP GENERATION

Table 2 shows the estimated average weekday, morning peak-hour, and afternoon peak-hour trip generation for the proposed site based on the rates from *Trip Generation, 12th Edition, 2025* by the Institute of Transportation Engineers (ITE).

The residential portion of the site is projected to generate about 5,191 vehicle-trips on the average weekday, with about half entering and half exiting the site during a 24-hour period. During the morning peak-hour, which generally occurs for one hour between 6:30 and 8:30 a.m., about 104 vehicles would enter and about 289 vehicles would exit the site. During the afternoon peak-hour, which generally occurs for one hour between 4:00 and 6:00 p.m., about 302 vehicles would enter and about 194 vehicles would exit the site.

The elementary school portion of the site is projected to generate about 908 total vehicle-trips on the average weekday, with about half entering and half exiting the site during a 24-hour period. During the morning peak-hour, which generally occurs for one hour between 6:30 and 8:30 a.m., about 158 vehicles would enter and about 134 vehicles would exit the site. During the afternoon peak-hour, which generally occurs for one hour between 4:00 and 6:00 p.m., about 29 vehicles would enter and about 35 vehicles would exit the site. About 40 percent of the trips generated by the elementary school are estimated to be internal to the Spring Hill and/or Morgan Hill developments.

The future commercial portion of the site is projected to generate about 5,230 vehicle-trips on the average weekday, with about half entering and half exiting the site during a 24-hour period. During the morning peak-hour, which generally occurs for one hour between 6:30 and 8:30 a.m., about 79 vehicles would enter and about 48 vehicles would exit the site. During the afternoon peak-hour, which generally occurs for one hour between 4:00 and 6:00 p.m., about 187 vehicles would enter and about 194 vehicles would exit the site. Table 2 shows the number of commercial-related trips that are assumed to be internal to the Spring Hill development. The internal trips were estimated using the NCHRP 684 Internal Trip Capture Estimation Tool. Based on the Pass-By Data and Rate Tables/2025 Pass-By Tables for ITE TripGen Appendices about 40 percent of the total external trips were assumed to be passby trips.

At buildout the Spring Hill development is projected to generate about 7,959 new external vehicle-trips on the average weekday, with about half entering and half exiting the site.

TRIP DISTRIBUTION

Figure 6 shows the estimated directional distribution of the primary site-generated traffic volumes on the area roadways. The estimates were based on the location of the site with respect to the regional population, employment, and activity centers and the site's proposed land use and access plan.

TRIP ASSIGNMENT

Figure 7a shows the estimated residential site-generated traffic volumes for the site on the area roadways, which were determined by applying the residential directional distribution percentages (from Figure 6) to the external residential trip generation estimates (from Table 2).

Figure 7b shows the estimated primary commercial site-generated traffic volumes for the site on the area roadways, which were determined by applying the commercial directional distribution percentages (from Figure 6) to the new external commercial trip generation estimates (from Table 2).

Figure 7c shows the estimated passby commercial site-generated traffic volumes. The passby trips were assigned based on the existing traffic patterns adjacent to the site and assume about 90 percent of the passby trips are from SH 52 and 10 percent of the passby trips are from WCR 3.

Figure 7d shows the estimated school site-generated traffic volumes for the site on the area roadways, which were determined by applying the school directional distribution percentages (from Figure 6) to the external school trip generation estimates (from Table 2).

2030 AND 2050 TOTAL TRAFFIC

Figure 8 shows the estimated 2030 total traffic which is the sum of the 2030 background traffic volumes (from Figure 4), the residential site-generated traffic (from Figure 7a), and the school site-generated traffic (from Figure 7d). Figure 8 also shows the recommended 2030 lane geometry and traffic control.

Figure 9 shows the estimated 2050 total traffic which is the sum of the 2050 background traffic volumes (from Figure 5), the residential site-generated traffic (from Figure 7a), the primary commercial site-generated traffic (from Figure 7b), the passby generated traffic (from Figure 7c), and the school site-generated traffic (from Figure 7d). Figure 9 also shows the recommended 2050 lane geometry and traffic control.

PROJECTED LEVELS OF SERVICE

The intersections in Figures 8 and 9 were analyzed to determine the 2030 and 2050 total levels of service. Table 1 shows the level of service analysis results. The level of service reports are attached.

1. **SH 52/E. County Line Road:** Based on the 2030 total traffic volumes shown in Figure 8 this intersection is expected to operate an overall LOS “F” during the morning peak-hour and LOS “E” during the afternoon peak-hour assuming no improvements. By 2050 it was assumed that SH 52 will be widened to provide two eastbound and westbound left-turn lanes and that right-turn lanes will be added on all approaches. Based on the projected 2050 total volumes and lane geometry shown in Figure 9 this intersection is expected to operate at an overall LOS “C” during the morning peak-hour and LOS “D” during the afternoon peak-hour.

2. **SH 52/Existing Erie North Water Reclamation Facility Access/Site Access:** The northbound and southbound approaches at this intersection are expected to operate at LOS "F" during the morning and afternoon peak-hours if it remains stop-sign controlled. If it is converted to traffic signal control it is expected to operate at an overall LOS "A" during the peak-hours through 2050.

3. **SH 52/WCR 3:** This intersection is planned to be reconstructed as a two-land modern roundabout. It is expected to operate at an overall LOS "A" during the peak-hours based on the 2030 total traffic volumes and an overall LOS "C" during the peak-hours based on the 2050 total traffic volumes.

4. **WCR 3/WCR 12:** All movements at this unsignalized intersection are expected to operate at LOS "C" or better during both morning and afternoon peak-hours through 2050.

5. **WCR 3/Future Commercial Right-In/Right-Out Only Site Access:** All movements at this future unsignalized intersection are expected to operate at LOS "B" or better during both morning and afternoon peak-hours through 2050.

6. **WCR 3/North Full Movement Site Access:** All movements at this future unsignalized intersection are expected to operate at LOS "C" or better during both morning and afternoon peak-hours through 2050.

7. **WCR 3/South Site Full Movement Access:** All movements at this future unsignalized intersection are expected to operate at LOS "C" or better during both morning and afternoon peak-hours through 2050.

TRAFFIC SIGNAL WARRANT ANALYSIS

The proposed full movement site access to SH 52 (#2) and the proposed north full movement site access to WCR 3 (#6) were analyzed to determine if the projected morning and afternoon peak-hour volumes would meet the thresholds criteria for Eight-Hour, Four-Hour, and/or Peak-hour Vehicular Volume Traffic Signal Warrants in the *2023 Manual on Uniform Traffic Control Devices, 11th Edition* (MUTCD). The signal warrant analysis was based on the 2030 and 2050 total traffic peak-hour traffic volumes. Off-peak-hour volumes were estimated by LSC based on the peak-hour volume and on 24-hour counts conducted by CDOT on SH 52 east of SH 287 and the ITE Vehicle Time of Day Distribution Data.

SH 52/Existing Erie North Water Reclamation Facility Access/Site Access (#2)

As shown on Table 3 the intersection of SH 52/Existing Erie North Water Reclamation Facility Access/Site Access (#2) is estimated to meet the thresholds for the Eight-Hour Vehicular Volume Traffic Signal Warrants based on Condition B-The Interruption of Continuous Traffic with the 70% factor applied for a posted speed limit above 40 mph for only two hours of the day. None of the hours analyzed are anticipated to meet the thresholds for Condition A-Minimum Vehicular Volume or the thresholds for a combination of Condition A and Condition B. In order for this warrant to be met another six hours of the day would need to meet the Eight-Hour threshold for Condition B or eight hours of the day would need to meet the 56% threshold for Condition A.

As shown on Table 3 only two hours of the day are estimated to meet the thresholds for both the Four-Hour Vehicular Volume Traffic Signal Warrants. In order for this warrant to be met another two hours of the day would need to meet the Four-Hour threshold.

Based on the 2030 and 2050 total traffic volumes one hour of the day is expected to meet the criteria for the Peak-Hour Traffic Signal, however, this warrant should only be applied in unusual cases such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.

WCR 3/North Full-Movement Site Access (#6)

As shown on Table 4 none of the vehicular volume warrants are expected to be met at the intersection of WCR 3/North Full Movement Site Access (#6) based on the 2030 total traffic volumes which assume only the residential and the school sites within Spring Hill have been developed. All three vehicular volume traffic signal warrants are expected to be met based on the 2050 total traffic volumes which assume the commercial parcel has been fully developed. Although multiple traffic signal warrants are expected to be met at this intersection it is expected to operate at a satisfactory level of service as a two-way, stop-sign controlled intersection through 2050.

95th PERCENTILE QUEUE LENGTH

The estimated 2030 and 2050 95th percentile queue lengths for the intersections in the study area are shown in Table 5. Table 5 also shows the recommended turn lane lengths based on the CDOT *State Highway Access Code* and Town of Erie standards.

RECOMMENDED IMPROVEMENTS

Table 6 summarizes the recommended improvements in both 2030 and 2050.

CONCLUSIONS AND RECOMMENDATIONS

Trip Generation

1. The residential portion of the site is projected to generate about 5,191 total vehicle-trips on the average weekday, with about half entering and half exiting the site during a 24-hour period. During the morning peak-hour, about 104 vehicles would enter and about 289 vehicles would exit the site. During the afternoon peak-hour, about 302 vehicles would enter and about 194 vehicles would exit the site. A portion of these trips were assumed to be internal to the site. The internal residential trips were balanced with the estimated internal trips to and from the school site and the future commercial site.

2. The elementary school portion of the site is projected to generate about 908 total vehicle-trips on the average weekday, with about half entering and half exiting the site during a 24-hour period. During the morning peak-hour, about 158 vehicles would enter and about 134 vehicles would exit the site. During the afternoon peak-hour, about 29 vehicles would enter and about 35 vehicles would exit the site. About 40 percent of the trips generated by

the elementary school are estimated to be internal to the Spring Hill and/or Morgan Hill developments.

3. The future commercial portion of the site is projected to generate about 5,230 vehicle-trips on the average weekday, with about half entering and half exiting the site during a 24-hour period. During the morning peak-hour about 79 vehicles would enter and about 48 vehicles would exit the site. During the afternoon peak-hour about 187 vehicles would enter and about 194 vehicles would exit the site. Table 2 shows the number of commercial related trips that are assumed to be internal to the Spring Hill development. The internal trips were estimated using the NCHRP 684 Internal Trip Capture Estimation Tool. Based on the Pass-By Data and Rate Tables/2025 Pass-By Tables for ITE TripGen Appendices about 40 percent of the total external trips were assumed to be passby trips.

Projected Levels of Service

4. The intersection of SH 52/County Line Road (#1) is expected to operate an overall LOS "F" during the morning peak-hour and LOS "E" during the afternoon peak-hour assuming no improvements. By 2050 it was assumed that SH 52 will be widened to provide two eastbound and westbound left-turn lanes and that right-turn lanes will be added on all approaches. Based on the projected 2050 total volumes and lane geometry shown in Figure 9 this intersection is expected to operate at an overall LOS "C" during the morning peak-hour and LOS "D" during the afternoon peak-hour.

5. The northbound and southbound approaches at the SH 52/Existing Erie North Water Reclamation Facility Access/Site Access (#2) are expected to operate at LOS "F" during the morning and afternoon peak-hours if it remains stop-sign controlled. If it is converted to traffic signal control it is expected to operate at an overall LOS "A" during the peak-hours through 2050, however, this intersection is not expected to meet any of the vehicular volume traffic signal warrants.

6. The intersection of SH 52/WCR 3 is planned to be reconstructed as a two-lane modern roundabout. It is expected to operate at an overall LOS "C" or better during the peak-hours through 2050.

7. The intersection of WCR 3/WCR 12 is projected to continue to operate at a satisfactory level of service (LOS "C" or better) during the peak-hours through 2050 as a two-way-stop sign controlled intersection.

8. The proposed site access points to WCR 3 are all expected to operate at acceptable levels of service (LOS "C" or better) during the peak-hours through 2050 as two-way-stop sign controlled intersections. The north full movement site access point is expected to meet multiple traffic signal warrants by 2050, however, the satisfaction of warrants does not indicate that a traffic signal must be installed. The decision to require a traffic signal to be installed rests with the Town of Erie.

Recommended Improvements

9. The recommended improvements are shown in Figures 8 and 9 and detailed in Tables 5 and 6.

* * * * *

We trust our findings will assist you in gaining approval of the proposed Spring Hill development. Please contact me if you have any questions or need further assistance.

Sincerely,

LSC TRANSPORTATION CONSULTANTS, INC.

By_____
Christopher S. McGranahan, P.E.
Principal/President

CSM/wc

Enclosures: Tables 1 - 6
Figures 1 - 9
Approved Base Assumptions form
Traffic Count Reports
Level of Service Definitions
Level of Service Reports
Queuing Reports

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Table 1 (Page 1 of 2)
Intersection Levels of Service Analysis
Spring Hill Update
Erie, CO
LSC #180812; September, 2025

Intersection No. & Location	Traffic Control	Existing Traffic Level of Service AM	Existing Traffic Level of Service PM	2030 Background Level of Service AM	2030 Background Level of Service PM	2030 Total Level of Service AM	2030 Total Level of Service PM	2050 Background Level of Service AM	2050 Background Level of Service PM	2050 Total Level of Service AM	2050 Total Level of Service PM
1) SH 52/E. County Line Road	Signalized										
EB Left		C	B	C	B	C	C	C	B	C	B
EB Through		B	D	B	F	B	F	B	D	B	D
EB Right		B	B	B	B	B	B	B	B	B	B
WB Left		A	C	B	D	B	D	B	D	B	E
WB Through/Right or Through		D	C	F	C	F	C	C	C	D	C
WB Right		--	--	--	--	--	--	B	B	B	B
NB Left		E	C	F	D	F	D	D	D	D	D
NB Through/Right or Through		D	E	D	F	D	F	D	E	D	E
NB Right		--	--	--	--	--	--	C	D	D	D
SB Left		D	D	D	F	D	F	D	F	D	F
SB Through/Right or Through		F	D	F	D	F	D	D	D	D	D
SB Right		--	--	--	--	--	--	D	C	D	D
Entire Intersection Delay (sec /veh)		51.9	38.4	70.6	51.1	90.4	62.5	30.0	41.3	32.6	50.8
Entire Intersection LOS		D	D	E	D	F	E	C	D	C	D
2) SH 52/Site Access/ Erie North Water Reclamation Facility Access	TWSC										
NB Approach		--	--	--	--	F	F	--	--	--	--
EB Left/Through or Left		A	A	B	A	B	A	C	B	--	--
WB Left		--	--	--	--	A	B	--	--	--	--
SB Approach		E	B	E	D	F	F	F	E	--	--
Critical Movement Delay		37.4	13.3	37.4	31.5	>240	>240	71.7	42.5	--	--
	Signalized										
EB Left		--	--	--	--	--	--	--	--	A	A
EB Through		--	--	--	--	--	--	--	--	A	A
EB Right		--	--	--	--	--	--	--	--	A	A
WB Left		--	--	--	--	--	--	--	--	A	A
WB Through/Right		--	--	--	--	--	--	--	--	A	A
NB Approach		--	--	--	--	--	--	--	--	C	C
SB Approach		--	--	--	--	--	--	--	--	C	C
Entire Intersection Delay (sec /veh)		--	--	--	--	--	--	--	--	4.8	4.4
Entire Intersection LOS		--	--	--	--	--	--	--	--	A	A

Table 1 (Page 2 of 2)
Intersection Levels of Service Analysis
Spring Hill Update
Erie, CO
LSC #180812; September, 2025

Intersection No. & Location	Traffic Control	Existing Traffic Level of Service AM	Existing Traffic Level of Service PM	2030 Background Level of Service AM	2030 Background Level of Service PM	2030 Total Level of Service AM	2030 Total Level of Service PM	2050 Background Level of Service AM	2050 Background Level of Service PM	2050 Total Level of Service AM	2050 Total Level of Service PM
3) SH 52/CR 3	TWSC										
NB Left		F	F	--	--	--	--	--	--	--	--
NB Right		B	C	--	--	--	--	--	--	--	--
WB Left/Through		A	B	--	--	--	--	--	--	--	--
Critical Movement Delay		108.3	100.0	--	--	--	--	--	--	--	--
	Roundabout										
EB Approach		--	--	A	A	A	B	A	C	B	D
WB Approach		--	--	A	A	A	A	C	B	D	C
NB Approach		--	--	A	B	A	B	A	B	A	C
SB Approach		--	--	B	A	B	A	C	A	C	B
Entire Intersection Delay (sec /veh)		--	--	7.8	8.1	8.8	10.0	13.9	14.1	18.6	24.5
Entire Intersection LOS		--	--	A	A	A	A	B	B	C	C
4) CR 3/CR 12	TWSC										
NB Approach or Left		A	A	A	A	A	A	A	A	A	A
EB Approach		B	B	B	B	B	B	B	B	B	B
WB Approach		B	B	B	B	B	B	B	B	C	C
SB Approach or Left		A	A	A	A	A	A	A	A	A	A
Critical Movement Delay		11.0	10.6	11.1	11.1	14.1	12.5	13.3	13.1	18.6	15.4
5) CR 3/Commercial RIRO Access	TWSC										
EB Right		--	--	--	--	--	--	--	--	B	B
Critical Movement Delay		--	--	--	--	--	--	--	--	10.2	10.4
6) CR 3/North Full Movement Site Access	TWSC										
NB Left		--	--	--	--	A	A	--	--	A	A
EB Left		--	--	--	--	B	B	--	--	C	C
EB Right		--	--	--	--	A	A	--	--	B	B
Critical Movement Delay		--	--	--	--	12.4	12.4	--	--	16.1	23.1
7) CR 3/South Full Movement Site Access	TWSC										
NB Left		--	--	--	--	A	A	--	--	A	A
EB Left		--	--	--	--	B	B	--	--	C	C
EB Right		--	--	--	--	B	A	--	--	B	A
Critical Movement Delay		--	--	--	--	14.5	13.6	--	--	17.5	16.7

Table 2
ESTIMATED TRAFFIC GENERATION
Spring Hill Update
Erie, CO
LSC #180812; September, 2025

		Trip Generation Rates [1]					Vehicle-Trips Generated				
		Average	AM Peak-Hour		PM Peak-Hour		Average	AM Peak-Hour		PM Peak-Hour	
Trip Generating Category	Quantity	Weekday	In	Out	In	Out	Weekday	In	Out	In	Out
CURRENTLY PROPOSED RESIDENTIAL LAND USE											
Single Family Housing [2]	412 DU [3]	9.09	0.189	0.511	0.577	0.353	3,745	78	211	238	146
Duplexes [4]	150 DU	6.57	0.118	0.352	0.291	0.219	986	18	53	44	33
Townhomes [4]	70 DU	6.57	0.118	0.352	0.291	0.219	460	8	25	20	15
						Total Residential Trips =	**5,191**	**104**	**289**	**302**	**194**
CURRENTLY PROPOSED SCHOOL LAND USE											
Elementary School [5]	400 Students	2.27	0.394	0.336	0.074	0.086	908	158	134	29	35
						School Related Internal Trips [6]: school to residential uses=	363	63	54	12	14
						resdential to school uses =	363	54	63	14	12
						External School Trips (Total School Trips - School to Residential Internal Trips)	**545**	**95**	**80**	**17**	**21**
CURRENTLY PROPOSED COMMERCIAL LAND USE											
Commercial [7]	80.0 KSF [8]	65.38	0.986	0.604	2.332	2.428	5,230	79	48	187	194
						Commercial Related Internal Trips [9]: commercial to residential uses =	345	3	2	12	42
						residential to commercial uses =	345	2	3	42	12
						External Commercial Trips (Total Commercial Trips - Commercial to Residential Internal Trips)=	**4,885**	**76**	**46**	**175**	**152**
						Passby Trips [10] =	1,954	24	24	65	65
						Primary Commercial Trips (External Commercial Trips - Passby Trips)=	**2,931**	**52**	**22**	**110**	**87**
						Total Trips (Residential + School + Commercial) =	**11,329**	**341**	**471**	**518**	**423**
						Total Internal Trips =	**1,416**	**122**	**122**	**80**	**80**
						Total Passby Trips =	**1,954**	**24**	**24**	**65**	**65**
						Total New External Trips (Total Trips - Internal Trips - Passby Trips) =	**7,959**	**195**	**325**	**373**	**278**

Notes:
(1) Source: *Trip Generation*, Institute of Transportation Engineers, 12th Edition, 2025
(2) ITE Land Use No. 210 - Single-Family Detached Housing
(3) DU = dwelling units
(4) ITE Land Use No. 215 - Single-Family Attached Housing
(5) ITE Land Use No. 520 - Elementary School
(6) Assumes 40% of school trips are internal to the site. The internal school trips were then balanced with the internal residential trips
(7) ITE Land Use No. 821 - Shopping Center (40-150k)
(8) KSF = 1,000 square feet
(9) See NCHRP 684 Internal Trip Capture Estimation Tool
(10) 40% of the external commercial trips were assumed to be pass-by trips based on the Pass-By Data and Rate Tables/2025 Pass-By Tables for ITE TripGen Appe

Table 3
Intersection #2 - SH 52/Site Access/Erie North Water Reclamation Facility Access
Spring Hill
Erie, CO
LSC #180812; September, 2025

	Traffic Volume (vph)[2]			Warrant Analysis[1]																	
				Warrant 1: Eight Hour Vehicular Volume Evaluation												Warrant 2: Four Hour Vehicular Volume Evaluation			Warrant 3: Peak Hour Vehicular Volume Evaluation		
				Warrant Thresholds						Warrant Threshold Met?							Warrant Threshold Met?			Warrant Threshold Met?	
				Condition A (70%)		Condition B (70%)		Combination of A & B		Minor 1 Leg			Minor 2 Leg			70% Warrant Threshold Minor Minimum	Minor 1 Leg	Minor 2 Leg	70% Warrant Threshold Minor Minimum	Minor 1 Leg	Minor 2 Leg
	Major[3]	Minor 1[4]	Minor 2[4]	Major	Minor	Major	Minor	Major	Minor	A	B	A & B[5]	A	B	A & B[5]						
2030 Total Traffic																					
12-1 AM	44	3	0	420	105	630	53	504	42	No	No	No	No	No	No	Low Vol	No	No	Low Vol	No	No
1-2 AM	55	1	0	420	105	630	53	504	42	No	No	No	No	No	No	Low Vol	No	No	Low Vol	No	No
2-3 AM	41	1	0	420	105	630	53	504	42	No	No	No	No	No	No	Low Vol	No	No	Low Vol	No	No
3-4 AM	68	3	0	420	105	630	53	504	42	No	No	No	No	No	No	Low Vol	No	No	Low Vol	No	No
4-5 AM	284	9	0	420	105	630	53	504	42	No	No	No	No	No	No	273	No	No	Low Vol	No	No
5-6 AM	863	19	0	420	105	630	53	504	42	No	No	No	No	No	No	71	No	No	147	No	No
6-7 AM	1498	45	2	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
7-8 AM	1967	75	2	420	105	630	53	504	42	No	Yes	Yes	No	No	No	60	Yes	No	75	Yes	No
8-9 AM	1887	63	2	420	105	630	53	504	42	No	Yes	Yes	No	No	No	60	Yes	No	75	No	No
9-10 AM	1426	48	2	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
10-11 AM	1522	46	2	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
11-12 PM	1584	43	2	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
12-1 PM	1713	39	3	420	105	630	53	504	42	No	No	No	No	No	No	60	No	No	75	No	No
1-2 PM	1490	39	3	420	105	630	53	504	42	No	No	No	No	No	No	60	No	No	75	No	No
2-3 PM	1828	43	3	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
3-4 PM	2039	47	3	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
4-5 PM	2117	51	3	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
5-6 PM	1821	44	3	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
6-7 PM	813	40	3	420	105	630	53	504	42	No	No	No	No	No	No	78	No	No	157	No	No
7-8 PM	490	30	2	420	105	630	53	504	42	No	No	No	No	No	No	170	No	No	286	No	No
8-9 PM	374	22	1	420	105	630	53	504	42	No	No	No	No	No	No	228	No	No	356	No	No
9-10 PM	264	17	1	420	105	630	53	504	42	No	No	No	No	No	No	283	No	No	Low Vol	No	No
10-11 PM	155	9	0	420	105	630	53	504	42	No	No	No	No	No	No	Low Vol	No	No	Low Vol	No	No
11-12 AM	99	5	0	420	105	630	53	504	42	No	No	No	No	No	No	Low Vol	No	No	Low Vol	No	No
Numbers of hours the thresholds are are met										**0**	**2**	**10**	**0**	**0**	**0**		**2**	**0**		**1**	**0**
Warrant met?										**YES[5]**							**No**			**Yes**	
2050 Total Traffic																					
12-1 AM	64	3	0	420	105	630	53	504	42	No	No	No	No	No	No	Low Vol	No	No	Low Vol	No	No
1-2 AM	82	1	0	420	105	630	53	504	42	No	No	No	No	No	No	Low Vol	No	No	Low Vol	No	No
2-3 AM	59	1	0	420	105	630	53	504	42	No	No	No	No	No	No	Low Vol	No	No	Low Vol	No	No
3-4 AM	100	3	0	420	105	630	53	504	42	No	No	No	No	No	No	Low Vol	No	No	Low Vol	No	No
4-5 AM	420	9	0	420	105	630	53	504	42	No	No	No	No	No	No	205	No	No	328	No	No
5-6 AM	1282	19	0	420	105	630	53	504	42	No	No	No	No	No	No	60	No	No	76	No	No
6-7 AM	2223	45	2	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
7-8 AM	2920	75	2	420	105	630	53	504	42	No	Yes	Yes	No	No	No	60	Yes	No	75	Yes	No
8-9 AM	2800	63	2	420	105	630	53	504	42	No	Yes	Yes	No	No	No	60	Yes	No	75	No	No
9-10 AM	2114	48	2	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
10-11 AM	2259	46	2	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
11-12 PM	2349	43	2	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
1-2 PM	2586	39	3	420	105	630	53	504	42	No	No	No	No	No	No	60	No	No	75	No	No
2-3 PM	2245	39	3	420	105	630	53	504	42	No	No	No	No	No	No	60	No	No	75	No	No
3-4 PM	2752	43	3	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
4-5 PM	3065	47	3	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
5-6 PM	3176	51	3	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
6-7 PM	2728	44	3	420	105	630	53	504	42	No	No	Yes	No	No	No	60	No	No	75	No	No
7-8 PM	1204	40	3	420	105	630	53	504	42	No	No	No	No	No	No	60	No	No	80	No	No
8-9 PM	721	30	2	420	105	630	53	504	42	No	No	No	No	No	No	96	No	No	192	No	No
9-10 PM	548	22	1	420	105	630	53	504	42	No	No	No	No	No	No	148	No	No	263	No	No
10-11 PM	387	17	1	420	105	630	53	504	42	No	No	No	No	No	No	222	No	No	348	No	No
11-12 AM	227	9	0	420	105	630	53	504	42	No	No	No	No	No	No	302	No	No	Low Vol	No	No
Numbers of hours the thresholds are are met										**0**	**2**	**10**	**0**	**0**			**2**	**0**		**1**	**0**
Warrant met?										**YES[5]**							**No**			**Yes**	

Notes:
(1) Thresholds are based on 2 or more lanes on the major approach and one lane on the minor approach with the 70% factor applied for a posted speed limit above 40 mph
(2) Off peak hour traffic volumes are estimates by LSC based on 24-hour count data by CDOT on SH 52 east of SH 287 and ITE Vehicle Time of Day Distribution Data
(3) The major street traffic includes all movements (left, through, and right)
(4) The minor street traffic includes all of left, through, and right-turn volumes from the minor street
(5) A combination of A and B may be used after adequate trail of other remedial measures when the major street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

Source: LSC Transportation Consultants, Inc.

Table 4
Intersection #6 - WCR 3/North Full-Movement Site Access
Spring Hill
Erie, CO
LSC #180812; September, 2025

	Traffic Volume (vph)[2]		Warrant Analysis[1]																
			Warrant 1: Eight Hour Vehicular Volume Evaluation													Warrant 2: Four Hour Vehicular Volume		Warrant 3: Peak Hour Vehicular Volume	
			Warrant Thresholds								Warrant Threshold Met?								
							Combination of A & B												
			Condition A (70%)		Condition B (70%)		Condition A (56%)		Condition B (56%)		Minor Leg					70% Warrant Threshold Minor Minimum	Warrant Threshold Met? Minor Leg	70% Warrant Threshold Minor Minimum	Warrant Threshold Met? Minor Leg
	Major[3]	Minor[4]	Major	Minor	Major	Minor	Major	Minor	Major	Minor	A (70%)	B (70%)	A (56%)	B (56%)	A (56%) & B (56%)[5]				
2030 Total Traffic																			
12-1 AM	97	64	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
1-2 AM	54	3	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
2-3 AM	53	1	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
3-4 AM	74	1	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
4-5 AM	112	2	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
5-6 AM	129	8	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
6-7 AM	161	17	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
7-8 AM	443	39	420	105	630	53	336	84	504	42	No	No	No	No	No	194	No	314	No
8-9 AM	560	64	420	105	630	53	336	84	504	42	No	No	No	Yes	No	144	No	259	No
9-10 AM	521	54	420	105	630	53	336	84	504	42	No	No	No	Yes	No	158	No	273	No
10-11 AM	484	40	420	105	630	53	336	84	504	42	No	No	No	No	No	173	No	290	No
11-12 PM	444	39	420	105	630	53	336	84	504	42	No	No	No	No	No	193	No	314	No
12-1 PM	337	42	420	105	630	53	336	84	504	42	No	No	No	No	No	247	No	378	No
1-2 PM	371	32	420	105	630	53	336	84	504	42	No	No	No	No	No	230	No	357	No
2-3 PM	410	32	420	105	630	53	336	84	504	42	No	No	No	No	No	210	No	334	No
3-4 PM	410	35	420	105	630	53	336	84	504	42	No	No	No	No	No	210	No	334	No
4-5 PM	495	39	420	105	630	53	336	84	504	42	No	No	No	No	No	168	No	283	No
5-6 PM	561	42	420	105	630	53	336	84	504	42	No	No	No	No	No	144	No	259	No
6-7 PM	549	36	420	105	630	53	336	84	504	42	No	No	No	No	No	148	No	263	No
7-8 PM	419	33	420	105	630	53	336	84	504	42	No	No	No	No	No	206	No	329	No
8-9 PM	300	25	420	105	630	53	336	84	504	42	No	No	No	No	No	265	No	400	No
9-10 PM	217	18	420	105	630	53	336	84	504	42	No	No	No	No	No	307	No	Low Vol	No
10-11 PM	167	14	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
11-12 AM	92	7	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
Numbers of hours the thresholds are are met											**0**	**0**			**0**		**0**		**0**
Warrant met?											**No**						**No**		**Yes**
2050 Total Traffic																			
12-1 AM	124	105	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
1-2 AM	69	6	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
2-3 AM	69	3	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
3-4 AM	96	3	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
4-5 AM	144	4	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
5-6 AM	170	10	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
6-7 AM	212	34	420	105	630	53	336	84	504	42	No	No	No	No	No	309	No	Low Vol	No
7-8 AM	588	55	420	105	630	53	336	84	504	42	No	No	No	Yes	No	134	No	249	No
8-9 AM	737	105	420	105	630	53	336	84	504	42	No	Yes	Yes	Yes	Yes	93	Yes	185	No
9-10 AM	703	115	420	105	630	53	336	84	504	42	Yes	Yes	Yes	Yes	Yes	99	Yes	199	No
10-11 AM	669	146	420	105	630	53	336	84	504	42	Yes	Yes	Yes	Yes	Yes	109	Yes	214	No
11-12 PM	623	214	420	105	630	53	336	84	504	42	Yes	No	Yes	Yes	Yes	123	Yes	235	No
12-1 PM	483	174	420	105	630	53	336	84	504	42	Yes	No	Yes	No	No	174	Yes	290	No
1-2 PM	525	169	420	105	630	53	336	84	504	42	Yes	No	Yes	Yes	Yes	156	Yes	271	No
2-3 PM	572	170	420	105	630	53	336	84	504	42	Yes	No	Yes	Yes	Yes	140	Yes	255	No
3-4 PM	569	167	420	105	630	53	336	84	504	42	Yes	No	Yes	Yes	Yes	141	Yes	256	No
4-5 PM	681	167	420	105	630	53	336	84	504	42	Yes	Yes	Yes	Yes	Yes	106	Yes	209	No
5-6 PM	776	174	420	105	630	53	336	84	504	42	Yes	Yes	Yes	Yes	Yes	85	Yes	170	Yes
6-7 PM	759	169	420	105	630	53	336	84	504	42	Yes	Yes	Yes	Yes	Yes	88	Yes	176	No
7-8 PM	581	150	420	105	630	53	336	84	504	42	Yes	No	Yes	Yes	Yes	137	Yes	252	No
8-9 PM	412	129	420	105	630	53	336	84	504	42	No	No	Yes	No	No	209	No	333	No
9-10 PM	295	111	420	105	630	53	336	84	504	42	No	No	No	No	No	268	No	Low Vol	No
10-11 PM	235	81	420	105	630	53	336	84	504	42	No	No	No	No	No	298	No	Low Vol	No
11-12 AM	129	68	420	105	630	53	336	84	504	42	No	No	No	No	No	Low Vol	No	Low Vol	No
Numbers of hours the thresholds are are met											**11**	**6**	**13**	**12**	**11**		**12**		**1**
Warrant met?											**Yes**						**Yes**		**Yes**

Notes:
(1) Thresholds are based on 2 or more lanes on the major approach and one lane on the minor approach with the 70% factor applied for a posted speed limit above 40 mph
(2) Off peak hour traffic volumes are estimates by LSC based on 24-hour count data by LSC on WCR 3 and ITE Vehicle Time of Day Distribution Data
(3) The major street traffic includes all movements (left, through, and right)
(4) The minor street traffic includes only the left-turn volumes from the minor street
(5) A combination of A and B may be used after adequate trail of other alternatives that could cause less delay and inconvenicnes to traffic has failed to solve the traffic problem.

Source: LSC Transportation Consultants, Inc.

Table 5
95th Percentile Queue Lengths
Spring Hill Update
Erie, CO
LSC #180812; September, 2025

Intersection No. & Location	Posted Speed Limit (mph)	Existing Lane Lengths (feet)	Recommended Lane Lengths (feet)	95th Percentile Queue Length 2030 Total AM Peak (feet)	95th Percentile Queue Length 2030 Total PM Peak (feet)	95th Percentile Queue Length 2050 Total AM Peak (feet)	95th Percentile Queue Length 2050 Total PM Peak (feet)
1) SH 52/E. County Line Road							
EB Left	55	360	503	25	46	40	73
EB Through	55	- - -	- - -	422	1188	298	793
EB Right	55	460	378	0	0	2	22
WB Left	55	530	563	42	108	66	235
WB Through/Right or Through	55	- - -	- - -	1492	630	833	317
WB Right	55	- - -	378	--	--	42	41
NB Left	50	115	490	152	101	163	131
NB Through/Right or Through	50	- - -	- - -	248	512	254	553
NB Right	50	- - -	320	--	--	33	61
SB Left	50	90	526	119	204	177	325
SB Through/Right or Through	50	- - -	- - -	417	262	224	303
SB Right	50	- - -	320	--	--	220	19
2) SH 52/Site Access/Existing Access							
EB Left	55	- - -	408	--	--	1	1
EB Through	55	- - -	- - -	--	--	137	287
EB Right	55	- - -	378	--	--	6	8
WB Left	55	- - -	408	--	--	4	10
WB Through/Right	55	- - -	- - -	--	--	324	155
NB Approach	30	- - -	- - -	--	--	75	53
SB Approach	30	- - -	- - -	--	--	0	1

Table 6
Recommended Improvements
Spring Hill Update
Erie, CO
LSC #180812; September, 2025

Inter-section No.	Intersection Location	Recommended Improvements by 2030 (1)	Responsibility	Recommended Improvements by 2050 (1)	Responsibility
SH 52				Widen to provide 2 through lanes in each direction	Others
1	SH 52/ E. County Line Road			EB LT - extend existing lane to 503 feet and a 222 foot transition taper	Others
				WB LT - extend existing lane to 563 feet and a 222 foot transition taper	Others
				WB RT - construct lane - 1 @ 378 feet and 222-foot transition taper	Others
				NB LT - extend existing lane to 490 feet and a 180 foot transition taper	Others
				NB RT - construct lane - 1 @ 320 feet and 180-foot transition taper	Others
				SB LT - extend existing lane to 526 feet and a 180 foot transition taper	Others
				SB RT - construct lane - 1 @ 320 feet and 180-foot transition taper	Others
2	SH 52/ Erie North Water Reclamation Facility Access/ Full-Movement Site Access	EB LT - construct lane - 1 @ 408 feet and 222-foot transition taper	Applicant	Traffic signalization if/when warranted	Applicant
		EB RT - construct lane - 1 @ 378 feet and 222-foot transition taper	Applicant		
		WB LT - construct lane - 1 @ 408 feet and 222-foot transition taper	Applicant		
3	SH 52/WCR 3	Reconstruct as 2-lane modern roundabout	Applicant/Others	Potentially expand roundabout to provide slip lanes	Applicant/Others
4	WCR 3/WCR 12			NB LT - construct lane - 1 @ 100 feet and 144-foot transition taper	Applicant/Others
				NB RT - construct lane - 1 @ 100 feet and 144-foot transition taper	Others
				SB LT - construct lane - 1 @ 100 feet and 144-foot transition taper	Applicant/Others
5	WCR 3/Future Commercial Right-in/Right-out Access			SB RT - construct lane - 1 @ 100 feet and 144-foot transition taper	Applicant
6	WCR 3/North Full-Movement Site Access	EB RT - construct lane - 1 @ 50 feet and 120-foot transition taper	Applicant		
		NB LT - construct lane - 1 @ 100 feet and 144-foot transition taper	Applicant		
		SB RT - construct lane - 1 @ 100 feet and 144-foot transition taper	Applicant		
7	WCR 3/South Full-Movement Site Access	EB RT - construct lane - 1 @ 50 feet and 120-foot transition taper	Applicant		
		NB LT - construct lane - 1 @ 100 feet and 144-foot transition taper	Applicant		
		SB RT - construct lane - 1 @ 100 feet and 144-foot transition taper	Applicant		

(1) A transition taper of 18.5:1 was used for SH 52 based on a posted speed limit of 55 mph. An appropriate redirect taper for 55 mph is 55:1
A transition taper of 15:1 was used for E. County Line Road based on a posted speed limit of 50 mph. An appropriate redirect taper for 50 mph is 50:1
A transition taper of 13.5:1 was used for WCR 3 and WCR 12 based on a posted speed limit of 45 mph. An appropriate redirect taper for 45 mph is 45:1
A transition taper of 10:1 was used for all collector roadways based on a posted speed of 35 mph. An appropriate redirect taper for 35 mph is 20:1

Figure 1

Vicinity Map

Spring Hill Update (LSC #180812)

LSC TRANSPORTATION CONSULTANTS, INC.

Approximate Scale
Scale: NTS

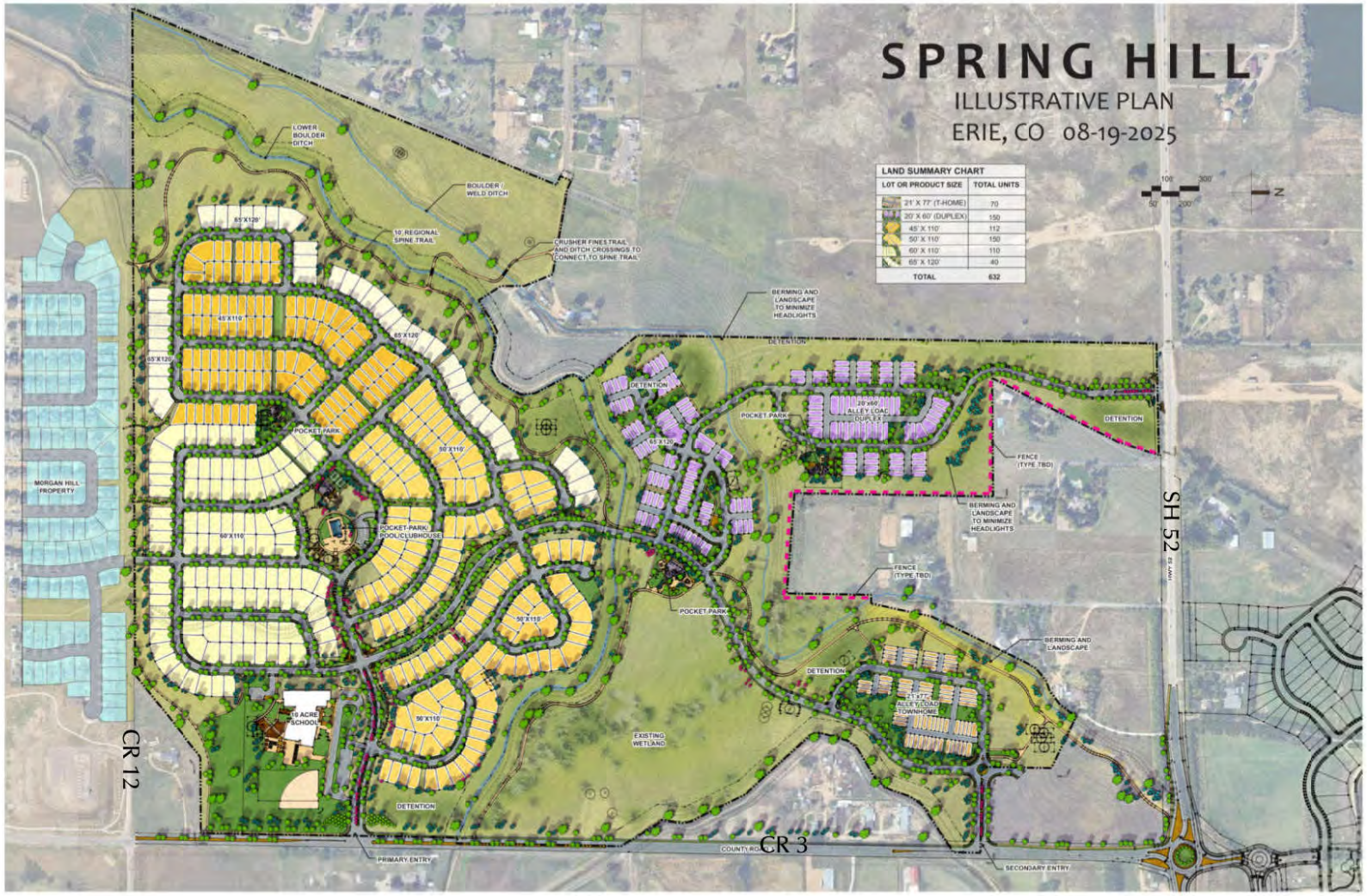


Figure 2

Site Plan

Spring Hill Update (LSC #180812)

LEGEND:

= Stop Sign

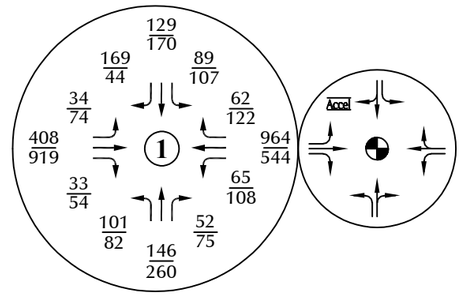
= Traffic Signal

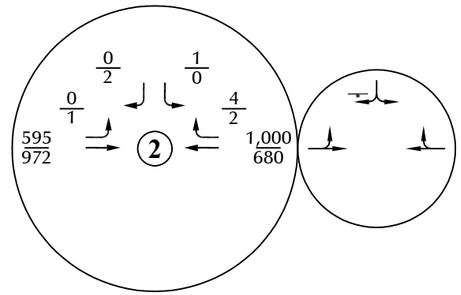
= Speed Limit

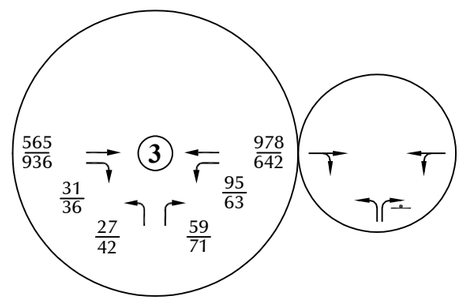
26/35 = AM Peak Hour Traffic / PM Peak Hour Traffic

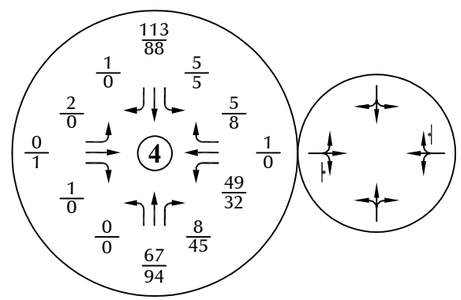
1,000 = Average Daily Traffic

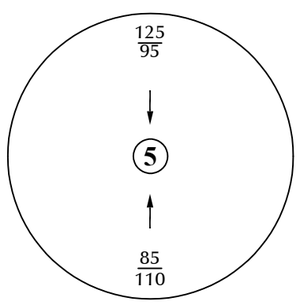
Approximate Scale
Scale: 1"=1,000'

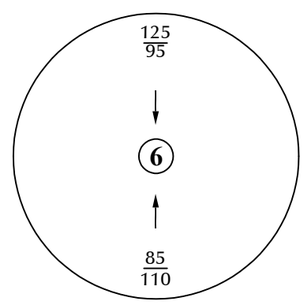


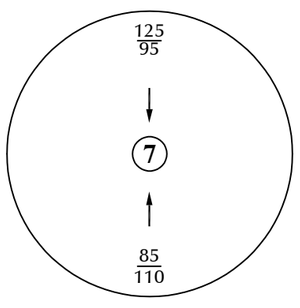












Note: Average daily traffic on SH 52 from CDOT Straight Line Diagram.
All other counts by Counter Measures in August and September, 2025.

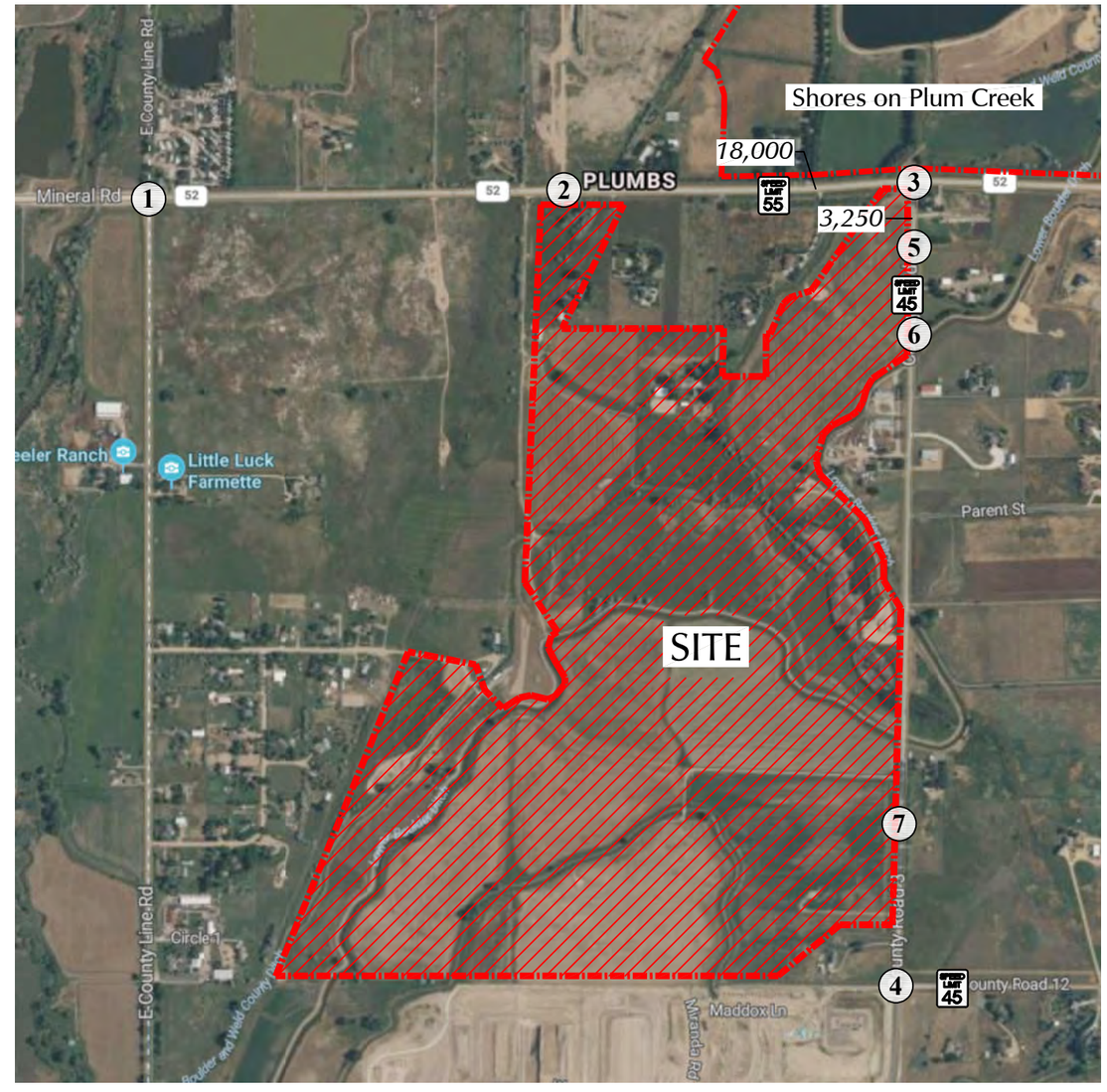


Figure 3

Existing Traffic, Lane Geometry and Traffic Control

Spring Hill Update (LSC #180812)

LSC TRANSPORTATION CONSULTANTS, INC.

LEGEND:

= Stop Sign

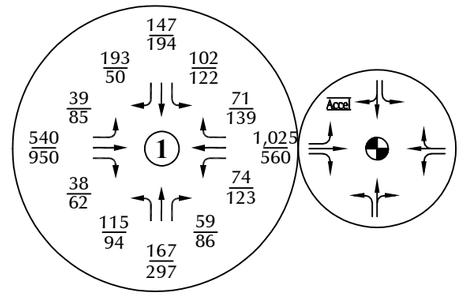
= Traffic Signal

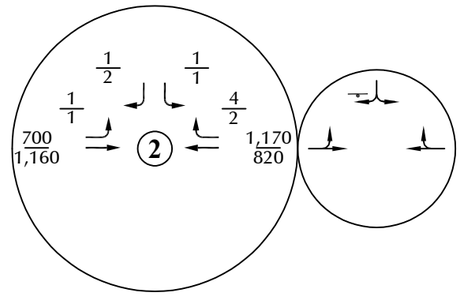
= Modern Roundabout

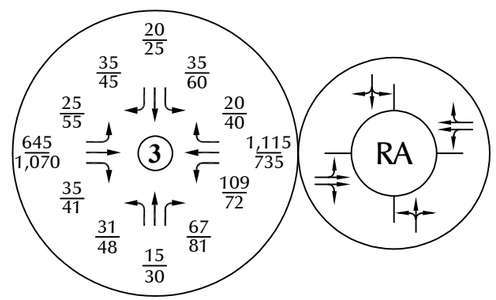
26/35 = AM Peak Hour Traffic / PM Peak Hour Traffic

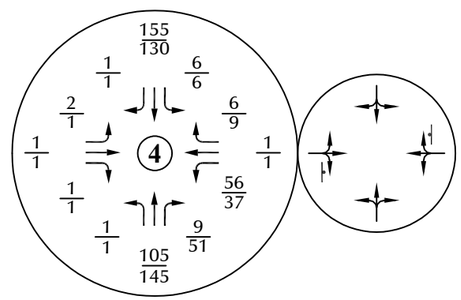
1,000 = Average Daily Traffic

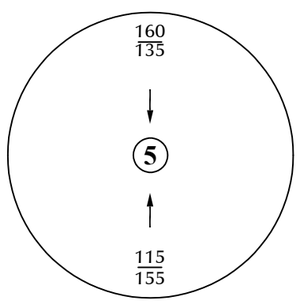
Approximate Scale
Scale: 1"=1,000'

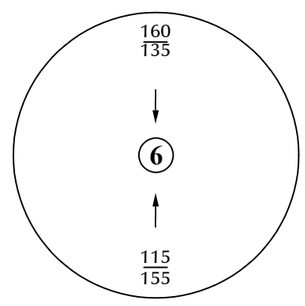


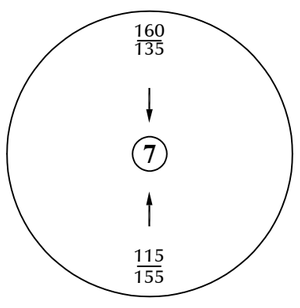












Note: Assumes 2.7 percent annual growth rate as required by the Town in the approved base assumptions form. It also assumes partial buildout of Shores at Plum Creek north of SH 52.

Figure 4

Year 2030 Background Traffic, Lane Geometry and Traffic Control

Spring Hill Update (LSC #180812)

LSC TRANSPORTATION CONSULTANTS, INC.

LEGEND:

= Stop Sign

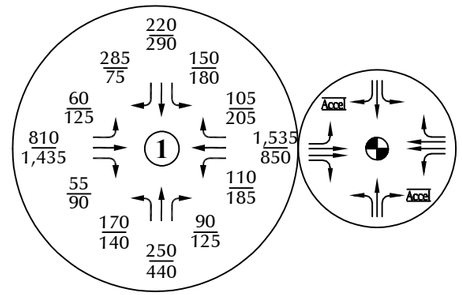
= Traffic Signal

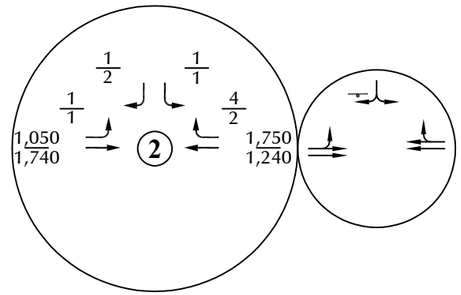
= Modern Roundabout

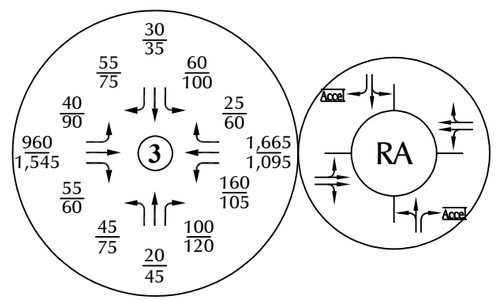
26/35 = AM Peak Hour Traffic / PM Peak Hour Traffic

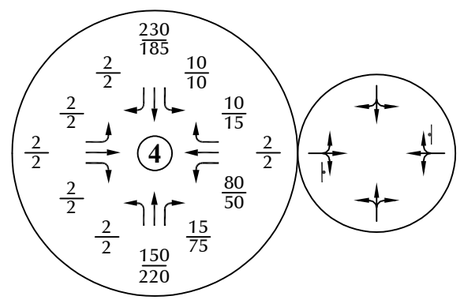
1,000 = Average Daily Traffic

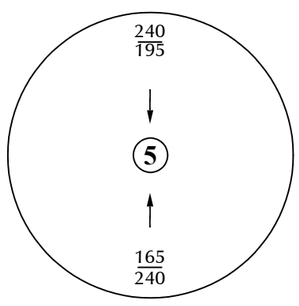
Approximate Scale
Scale: 1"=1,000'

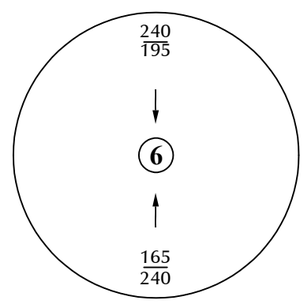


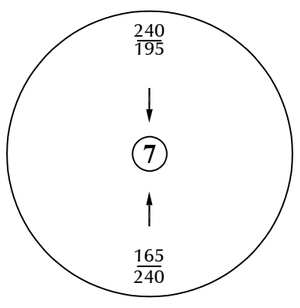












Note: Assumes 2.7 percent annual growth rate as required by the Town in the approved base assumptions form. It also assumes full buildout of Shores at Plum Creek north of SH 52.

Figure 5

Year 2050 Background Traffic, Lane Geometry and Traffic Control

Spring Hill Update (LSC #180812)

LSC TRANSPORTATION CONSULTANTS, INC.

Approximate Scale
Scale: 1"=2,000'

LEGEND:

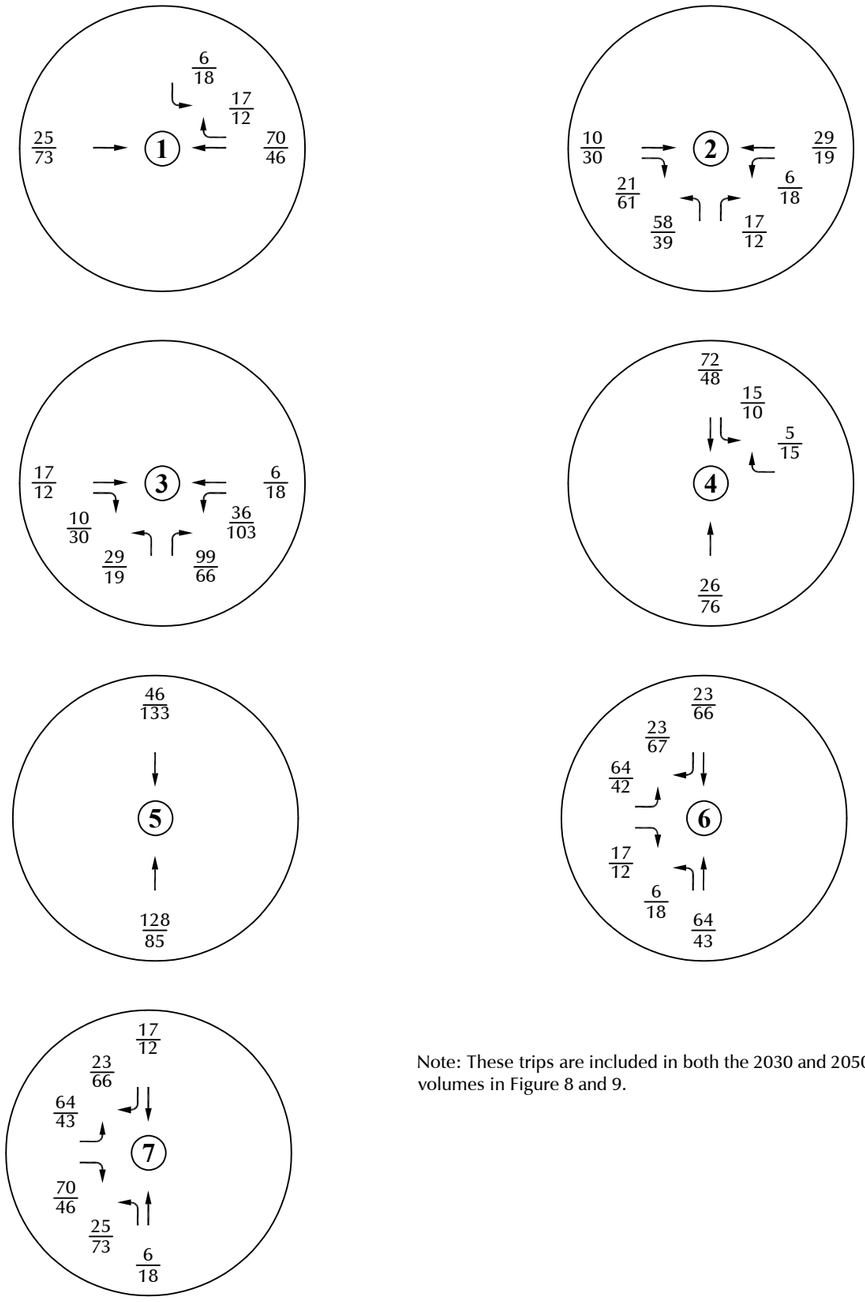
5%
5%
5%

= Residential External Trip Percent Directional Distribution / School External Trip Percent Directional Distribution / Primary Commercial External Trip Percent Directional Distribution

Figure 6

Directional Distribution of External Site-Generated Traffic

Spring Hill Update (LSC #180812)



Note: These trips are included in both the 2030 and 2050 total traffic volumes in Figure 8 and 9.

LEGEND:

$\frac{26}{35}$ = $\frac{\text{AM Peak Hour Traffic}}{\text{PM Peak Hour Traffic}}$

1,000 = Average Daily Traffic

Approximate Scale
Scale: 1"=1,000'

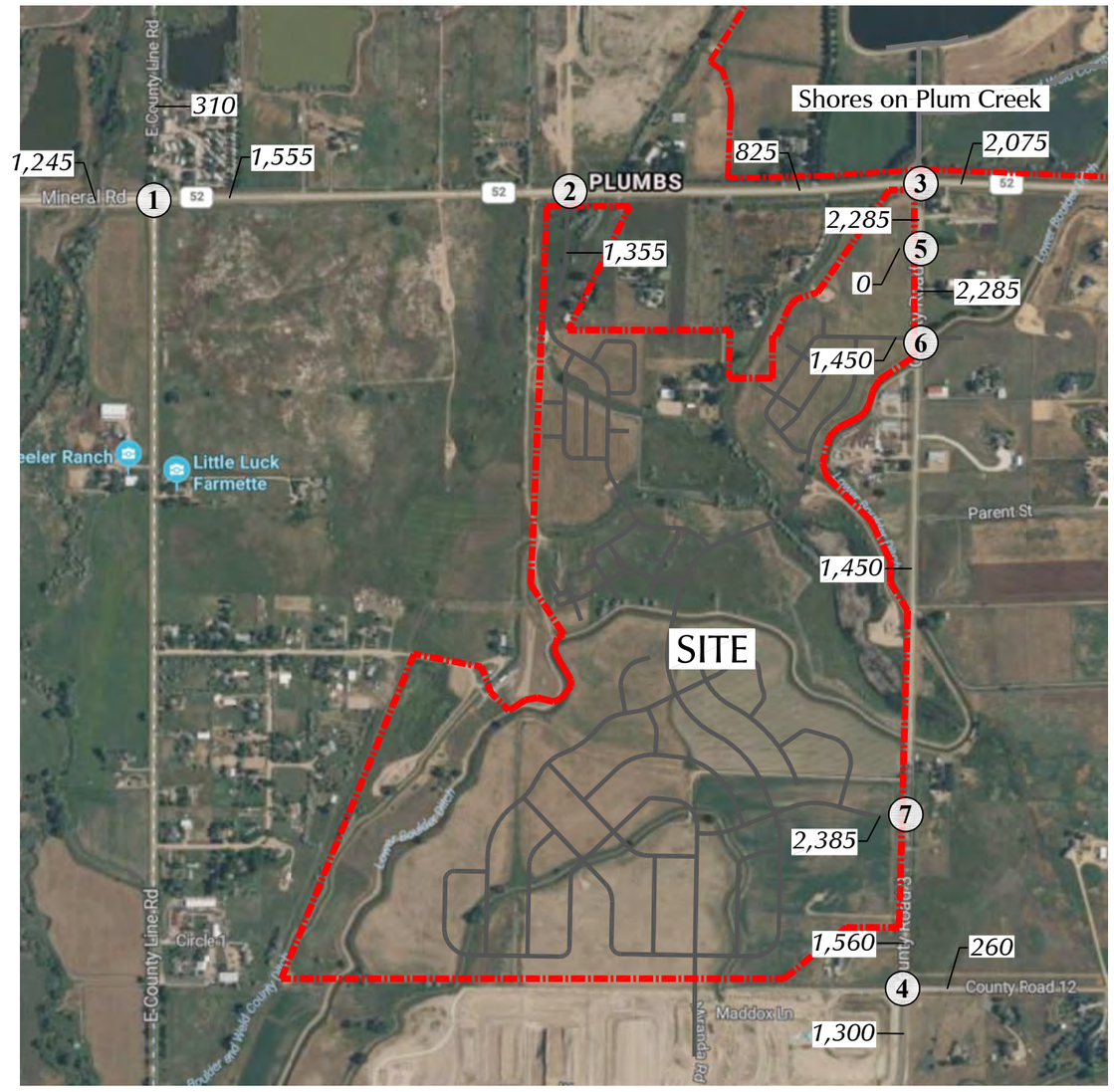
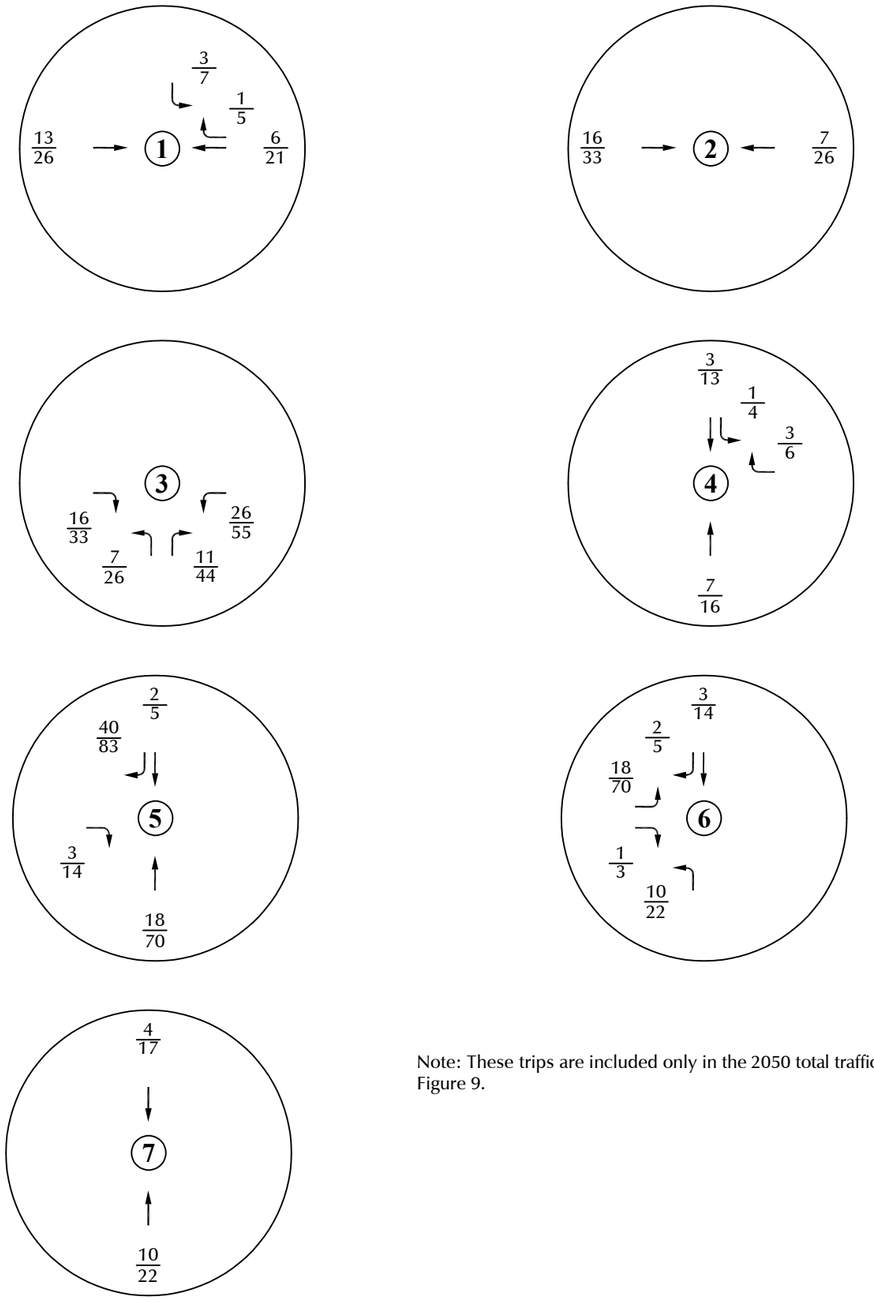


Figure 7a

Assignment of Residential Site-Generated Traffic

Spring Hill Update (LSC #180812)

LSC TRANSPORTATION CONSULTANTS, INC.



Note: These trips are included only in the 2050 total traffic volumes in Figure 9.

LEGEND:

26/35 = AM Peak Hour Traffic / PM Peak Hour Traffic

1,000 = Average Daily Traffic

Approximate Scale
Scale: 1"=1,000'

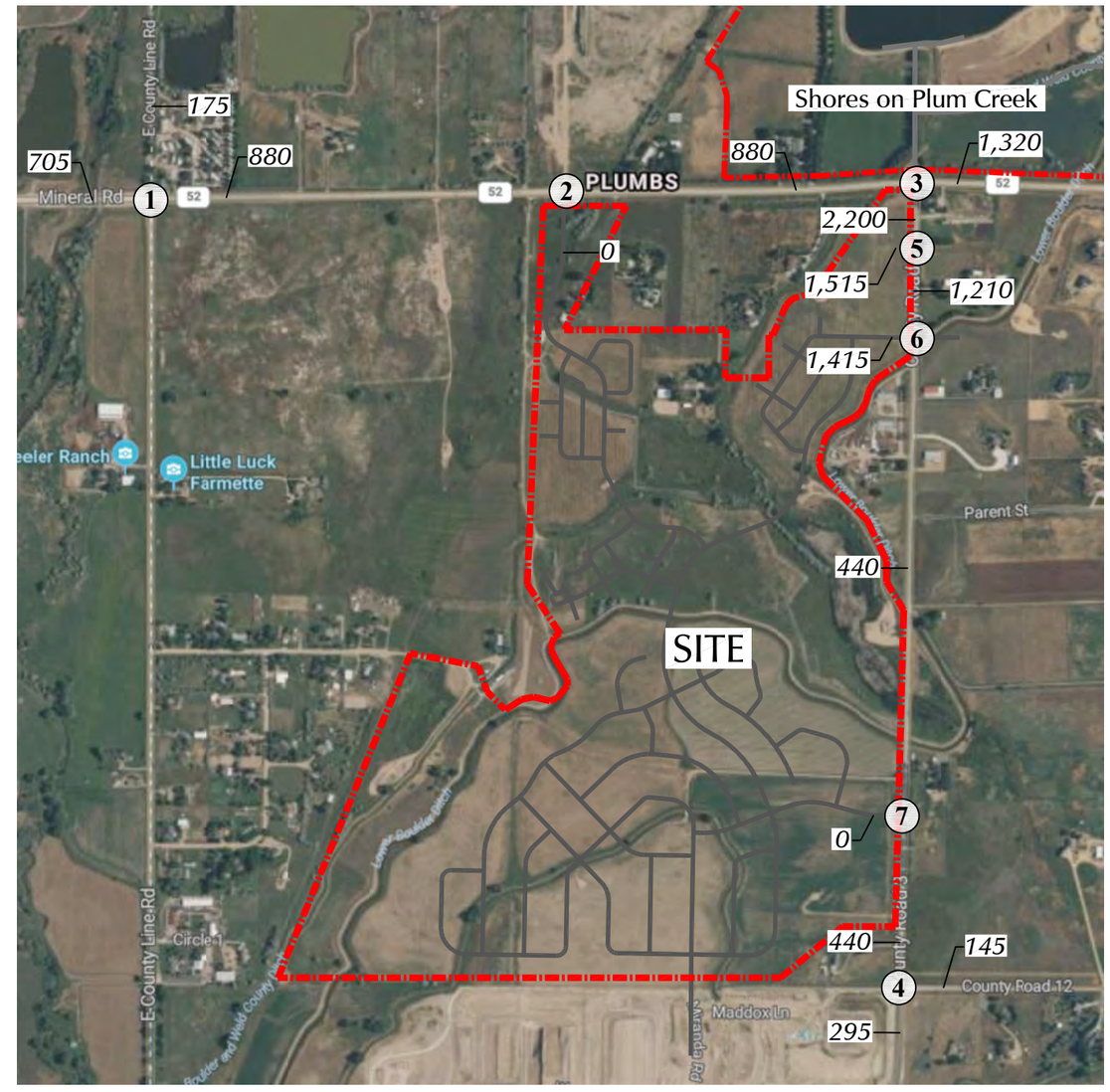
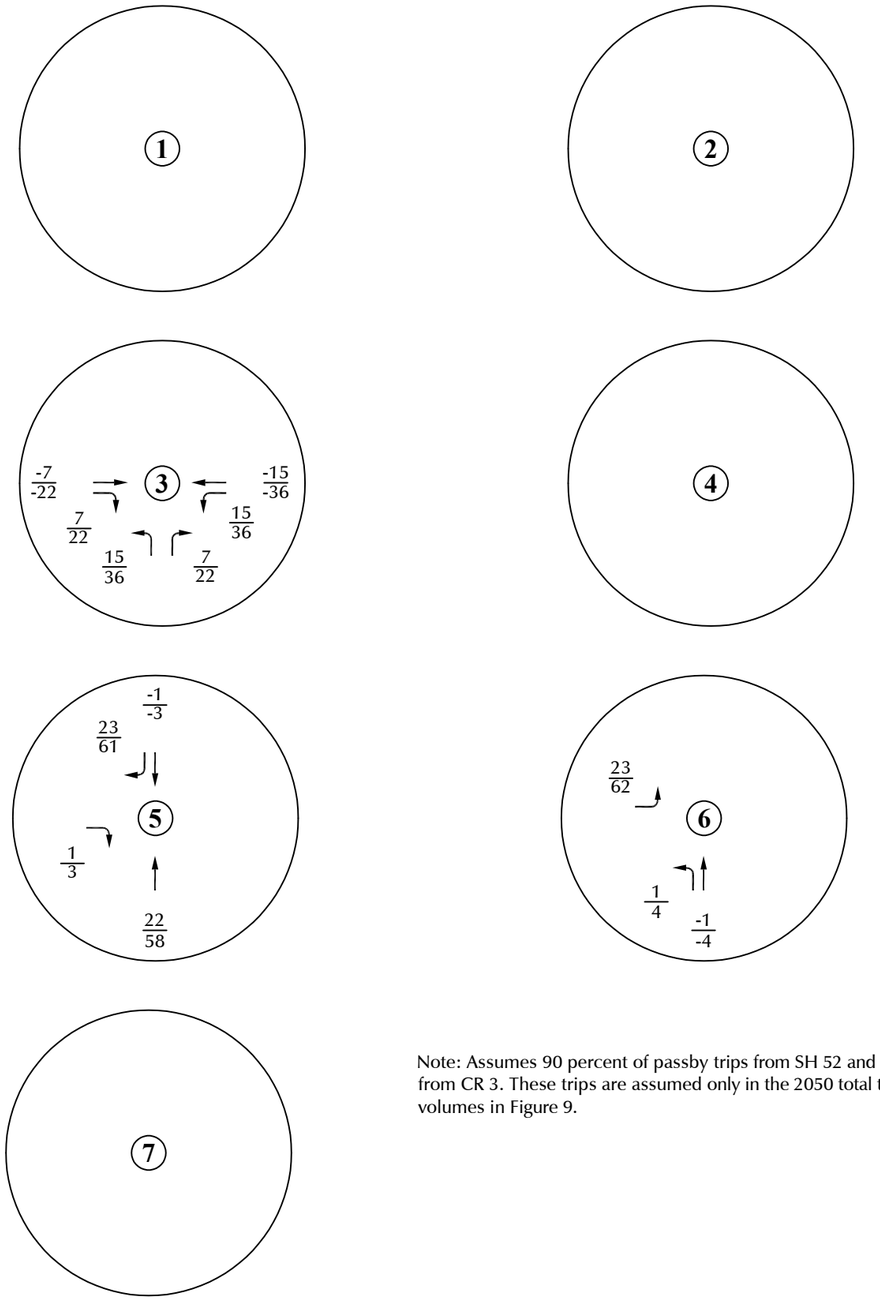


Figure 7b

Assignment of Primary Commercial Site-Generated Traffic

Spring Hill Update (LSC #180812)

LSC TRANSPORTATION CONSULTANTS, INC.



Note: Assumes 90 percent of passby trips from SH 52 and 10 percent from CR 3. These trips are assumed only in the 2050 total traffic volumes in Figure 9.

LEGEND:

$\frac{26}{35}$ = $\frac{\text{AM Peak Hour Traffic}}{\text{PM Peak Hour Traffic}}$

1,000 = Average Daily Traffic

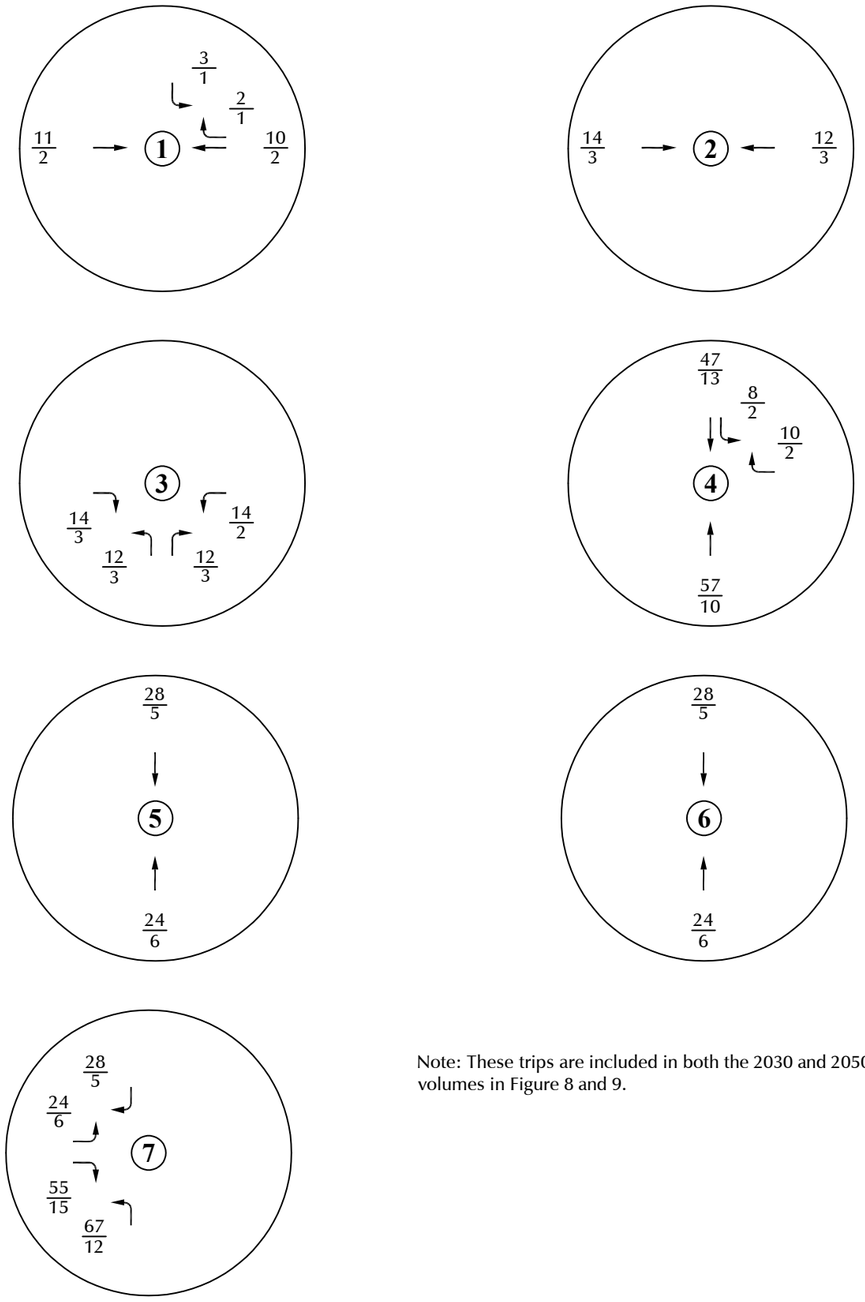
Approximate Scale
Scale: 1"=1,000'

Figure 7c

Assignment of Passby Commercial Site-Generated Traffic

Spring Hill Update (LSC #180812)

LSC TRANSPORTATION CONSULTANTS, INC.



Note: These trips are included in both the 2030 and 2050 total traffic volumes in Figure 8 and 9.

LEGEND:

26/35 = AM Peak Hour Traffic / PM Peak Hour Traffic

1,000 = Average Daily Traffic

Approximate Scale
Scale: 1"=1,000'

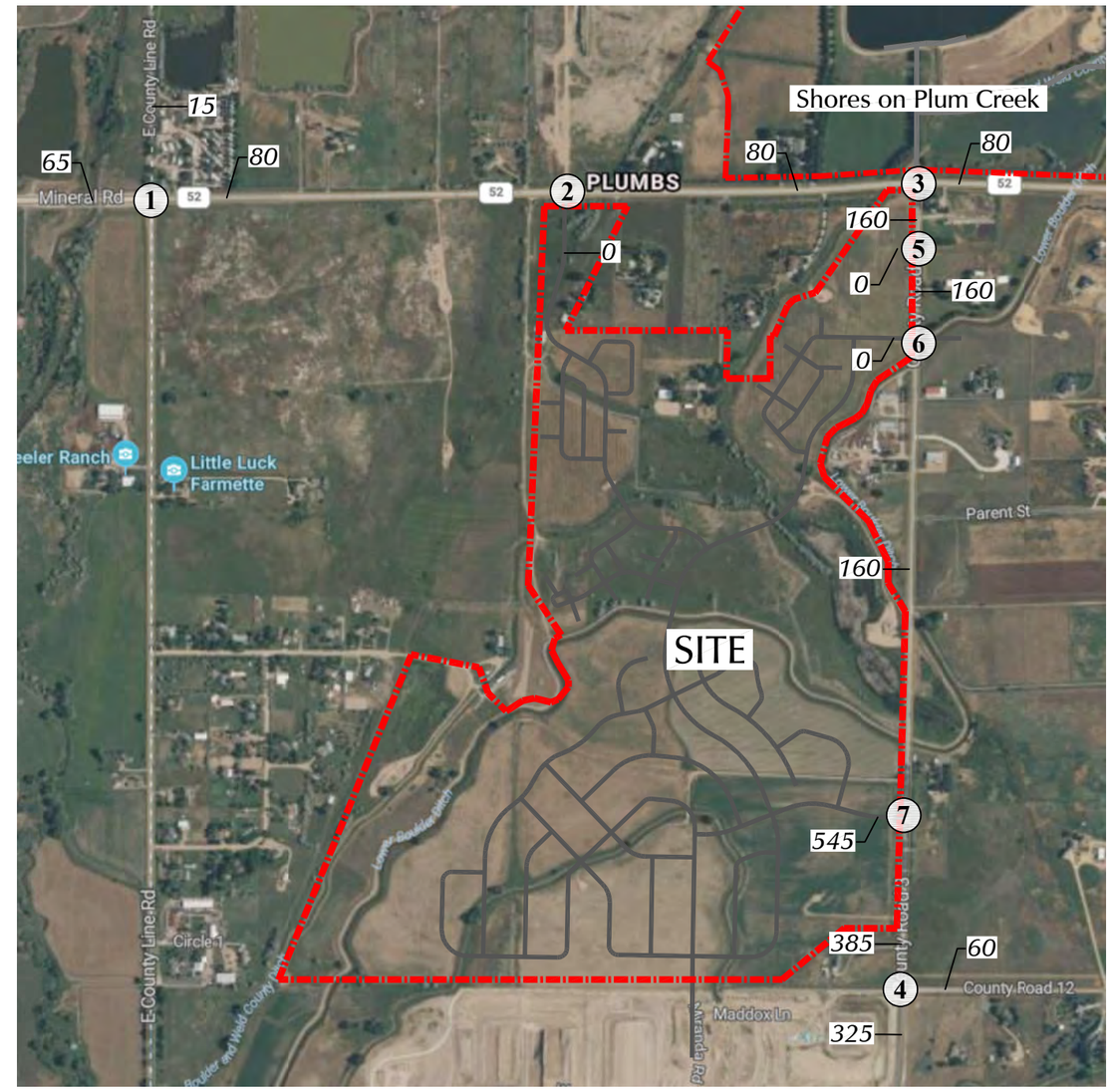


Figure 7d

Assignment of External School Site-Generated Traffic

Spring Hill Update (LSC #180812)

LSC TRANSPORTATION CONSULTANTS, INC.

LEGEND:

= Stop Sign

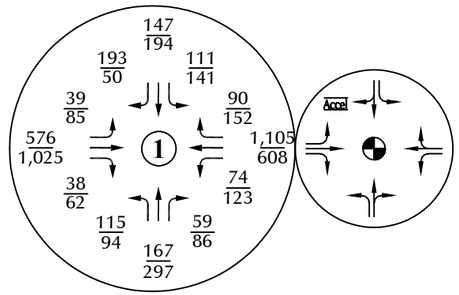
= Traffic Signal

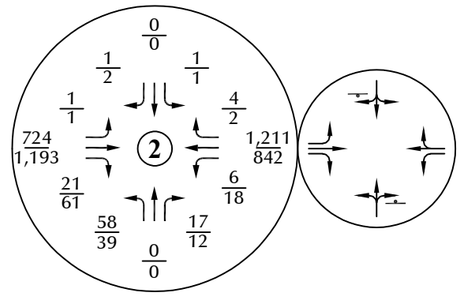
= Modern Roundabout

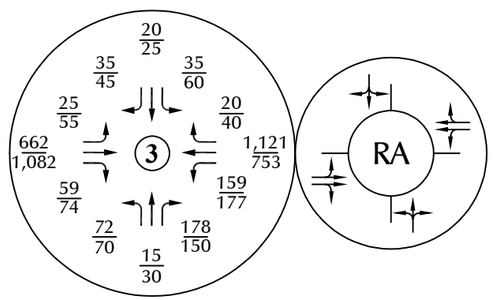
26/35 = AM Peak Hour Traffic / PM Peak Hour Traffic

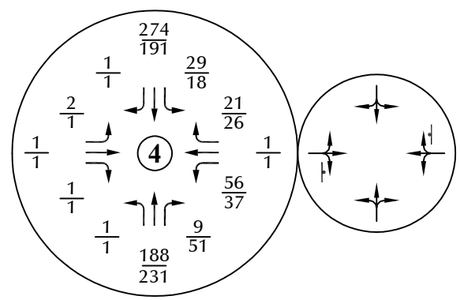
1,000 = Average Daily Traffic

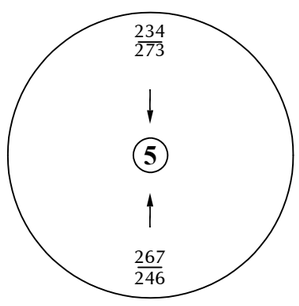
Approximate Scale
Scale: 1"=1,000'

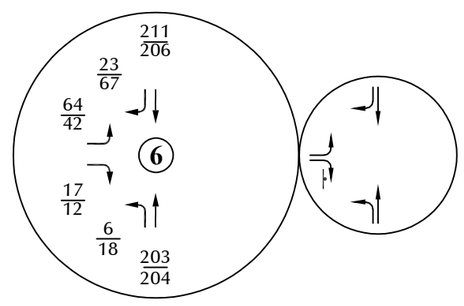


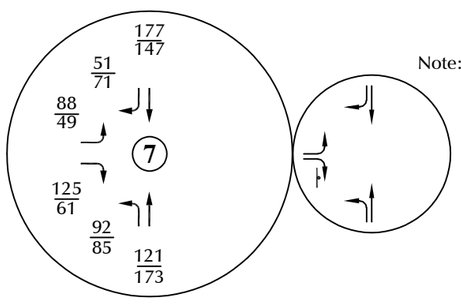












Note: These volumes are the sum of the volumes in Figures 4, 7a and 7d.

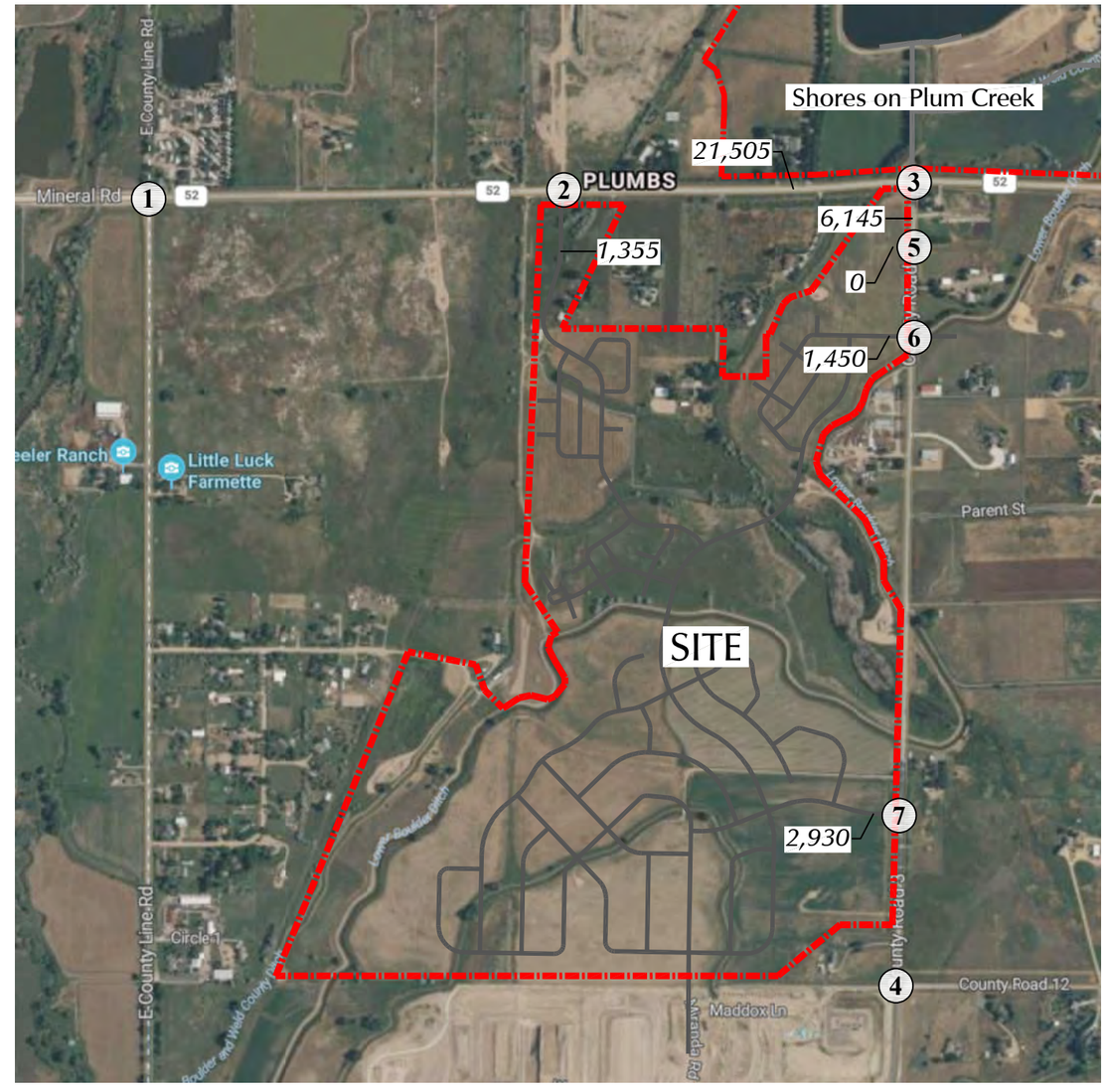


Figure 8

Year 2030 Total Traffic, Lane Geometry and Traffic Control

Spring Hill Update (LSC #180812)

LSC TRANSPORTATION CONSULTANTS, INC.

LEGEND:

= Stop Sign

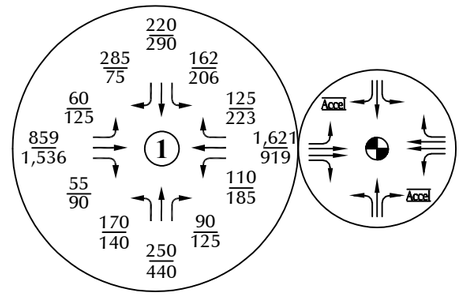
= Traffic Signal

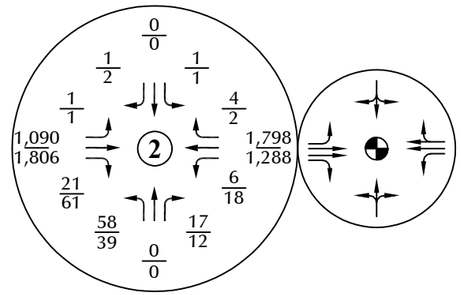
= Modern Roundabout

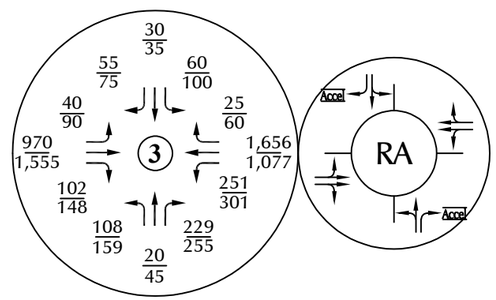
26/35 = AM Peak Hour Traffic / PM Peak Hour Traffic

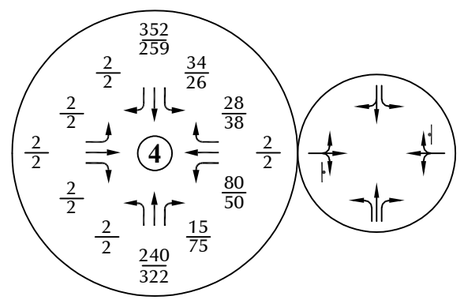
1,000 = Average Daily Traffic

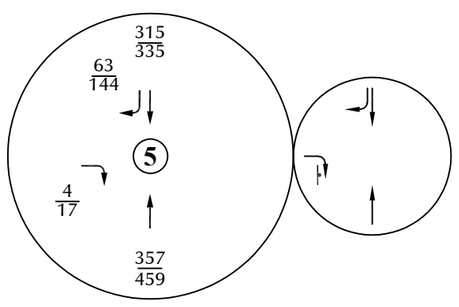
Approximate Scale
Scale: 1"=1,000'

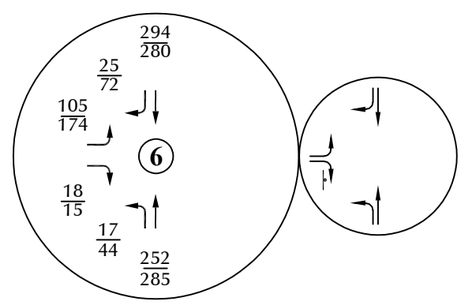


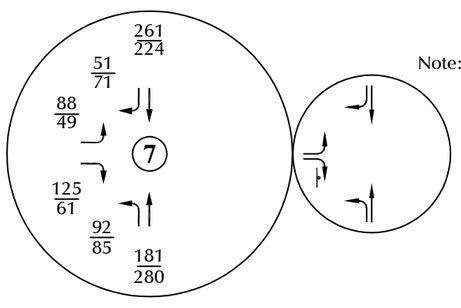












Note: These volumes are the sum of the volumes in Figures 4, 7a, 7b, 7c and 7d.

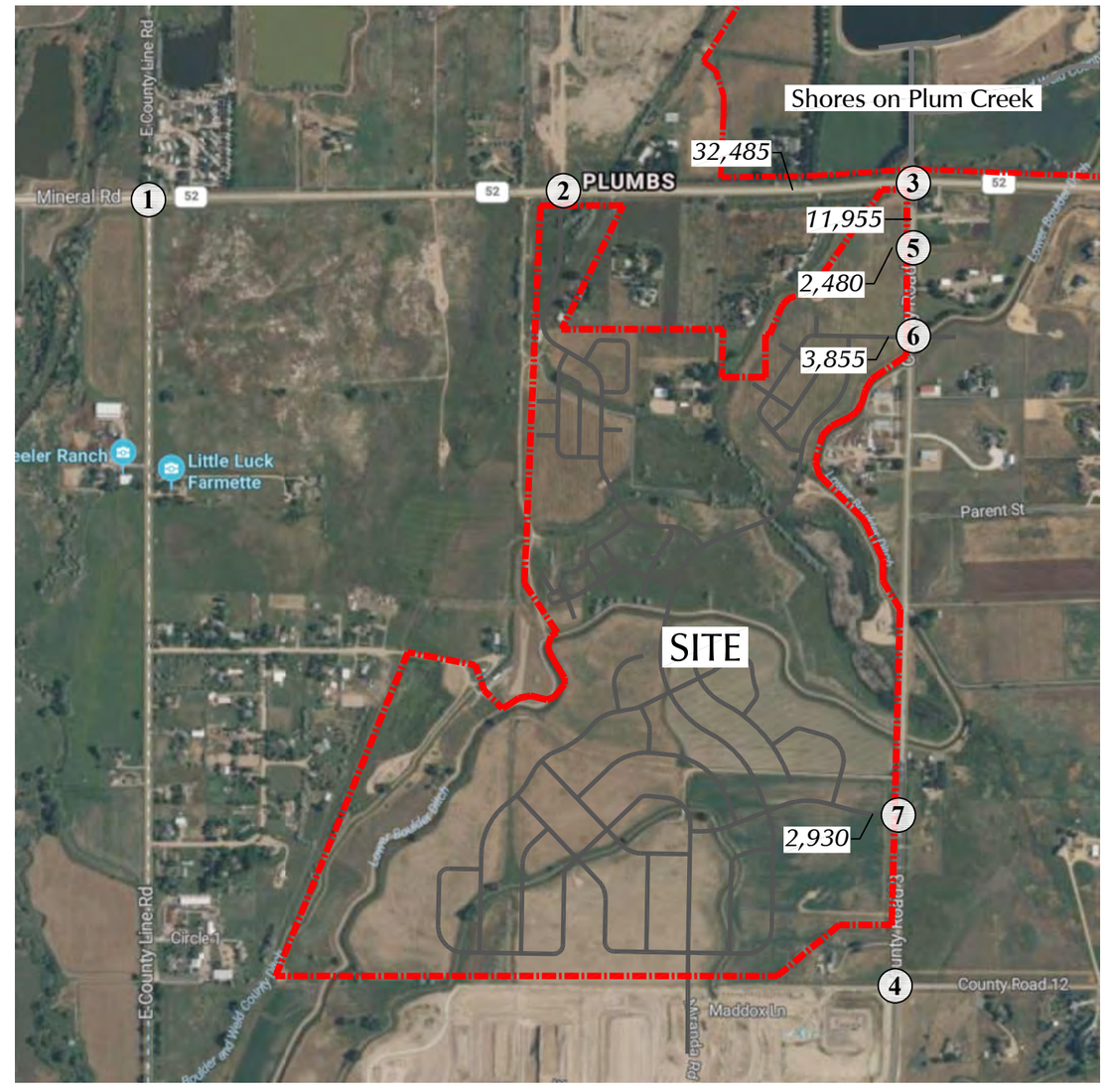


Figure 9

Year 2050 Total Traffic, Lane Geometry and Traffic Control

Spring Hill Update (LSC #180812)

LSC TRANSPORTATION CONSULTANTS, INC.

Town of Erie - Transportation Impact Analysis (TIA)

Base Assumptions Form

GENERAL INFORMATION				
Project Name: Parkdale North				
Project Location: Adjacent to future Coal Creek Blvd. alignment south of Arapahoe Road				
TIA ASSUMPTIONS				
Muni Code Applicability (TIA Warrant):	1-Hour Vol. Exceeds 100 Trips *Est. 1-Hour Vol: >100*	AADT Exceeds 250 *Est. AADT: >250*	Other:	
Study Area Boundaries	North: Arapahoe Rd South: SH 7	East: Coal Creek Blvd. and Old County Line Road	West: N. 119th Street	
Study Years	Short Range: 2030	Long Range: 2050		
Future Traffic Growth Rates	Use 2.7% annual growth per Town TMP per Town feedback.	Growth Rate Reference(s): TMP and staff feedback		
Study Intersections	1. N. 119th St/Arapahoe Rd	5. Coal Creek Blvd./Monroe Street		
	2. N. 119th St/Lancaster St	6. Coal Creek Blvd./SH 7		
	3. N. 119th Street/SH 7	7. County Line Road/Arapahoe Rd		
	4. N. 119th Street/Shay Dr	8. Arapahoe Road/Quest Drive		
		9. County Line Road/Main Street		
Time Period(s) For Study	AM Peak Hour: 6:30 – 8:30 AM PM Peak Hour: 4:00 – 6:00 PM	72-hour counts will be provided as appropriate.		
ITE Trip Generation Rates	210 – Single-Family Detached Housing 215 – Single-Family Attached Housing	520 – Elementary School		
Trip Adjustment Factors	Background Trips: Depending on how the analysis is completed – trips generated by existing buildout of Parkdale can be subtracted	Transit Investments: None assumed to maintain a conservative analysis	Captive Market: 40% school trips internal to site – support will be provided for whatever % is used.	
Trip Distribution Rational (Attach Diagram)	See Figure 6 from prior Parkdale North TIA by LSC			
Mode Split Assumptions	Assumed to be primarily passenger vehicles to maintain a conservative analysis.			
Committed Roadway Improvements	Applicant to connect missing section of Caol Creek Boulevard. Intersection improvements at site access intersections.			
Other Traffic Studies (Less than 2 Years Old)	Prior Parkdale TIAs			
Areas Requiring Special Study				
Is the project within 1/2 mile of a State Highway?	**Yes X_____ No_____**			

Date: September 10, 2025_____

Signature - Project Traffic Engineer: _____

Signature - Town of Erie Staff: _____

COUNTER MEASURES INC

1889 YORK ST
DENVER COLORADO
303-333-7409

N/S STREET: CONSTRUCTION ENTRANCE
E/W STREET: HWY 52
CITY: ERIE
COUNTY: HWY 52

File Name : CONST. ENTRANCE HWY 52
Site Code : 00000020
Start Date : 8/20/2025
Page No : 1

Groups Printed- Unshifted

	CONSTRUCTION ENTRANCE SOUTHBOUND				HWY 52 WESTBOUND				NO ACCESS NORTHBOUND				HWY 52 EASTBOUND				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:30 AM	0	0	0	0	0	247	0	0	0	0	0	0	0	110	0	0	357
06:45 AM	0	0	0	0	0	232	0	0	0	0	0	0	0	130	0	0	362
Total	0	0	0	0	0	479	0	0	0	0	0	0	0	240	0	0	719
07:00 AM	0	0	0	0	0	249	0	0	0	0	0	0	0	150	0	0	399
07:15 AM	0	0	0	0	0	244	1	0	0	0	0	0	0	152	0	0	397
07:30 AM	1	0	0	0	0	253	1	0	0	0	0	0	0	135	0	0	390
07:45 AM	0	0	0	0	0	228	2	1	0	0	0	0	0	150	0	0	381
Total	1	0	0	0	0	974	4	1	0	0	0	0	0	587	0	0	1567
08:00 AM	0	0	0	0	0	215	3	0	0	0	0	0	0	135	0	0	353
08:15 AM	0	0	0	0	0	265	0	0	0	0	0	0	0	119	0	0	384
Total	0	0	0	0	0	480	3	0	0	0	0	0	0	254	0	0	737
04:00 PM	0	0	0	0	0	184	0	0	0	0	0	0	0	272	0	0	456
04:15 PM	0	0	0	0	0	168	0	0	0	0	0	0	1	249	0	0	418
04:30 PM	0	0	2	0	0	150	2	0	0	0	0	0	0	250	0	0	404
04:45 PM	0	0	0	0	0	166	0	0	0	0	0	0	0	264	0	0	430
Total	0	0	2	0	0	668	2	0	0	0	0	0	1	1035	0	0	1708
05:00 PM	0	0	0	0	0	151	0	0	0	0	0	0	0	263	0	0	414
05:15 PM	0	0	0	0	0	174	0	0	0	0	0	0	0	280	0	0	454
05:30 PM	0	0	0	0	0	151	0	0	0	0	0	0	0	262	0	0	413
05:45 PM	0	0	0	0	0	140	0	0	0	0	0	0	0	244	0	0	384
Total	0	0	0	0	0	616	0	0	0	0	0	0	0	1049	0	0	1665
Grand Total	1	0	2	0	0	3217	9	1	0	0	0	0	1	3165	0	0	6396
Apprch %	33.3	0	66.7	0	0	99.7	0.3	0	0	0	0	0	0	100	0	0	
Total %	0	0	0	0	0	50.3	0.1	0	0	0	0	0	0	49.5	0	0	

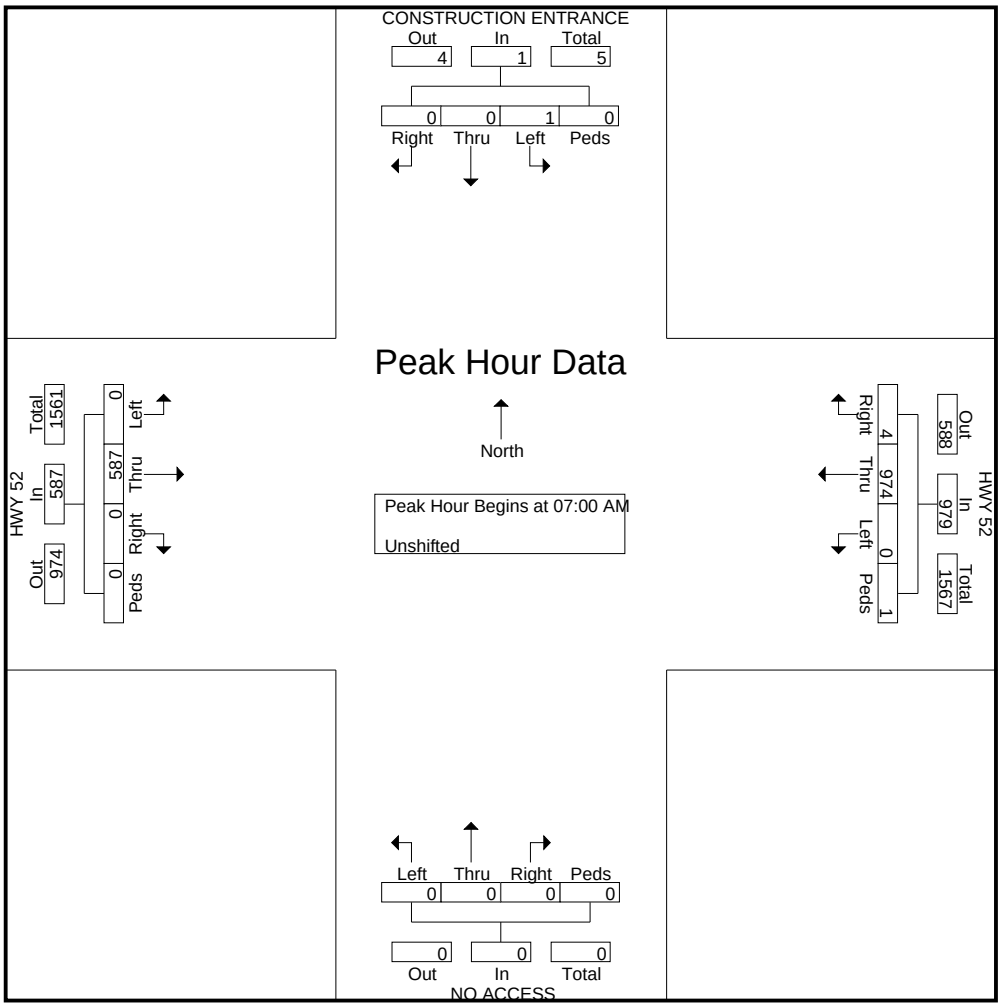
COUNTER MEASURES INC

1889 YORK ST
DENVER COLORADO
303-333-7409

N/S STREET: CONSTRUCTION ENTRANCE
E/W STREET: HWY 52
CITY: ERIE
COUNTY: HWY 52

File Name : CONST. ENTRANCE HWY 52
Site Code : 00000020
Start Date : 8/20/2025
Page No : 2

	CONSTRUCTION ENTRANCE SOUTHBOUND					HWY 52 WESTBOUND					NO ACCESS NORTHBOUND					HWY 52 EASTBOUND					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	0	0	0	0	0	249	0	0	249	0	0	0	0	0	0	150	0	0	150	**399**
07:15 AM	0	0	0	0	0	0	244	1	0	245	0	0	0	0	0	0	**152**	0	0	**152**	397
07:30 AM	**1**	0	0	0	**1**	0	**253**	1	0	**254**	0	0	0	0	0	0	135	0	0	135	390
07:45 AM	0	0	0	0	0	0	228	**2**	**1**	231	0	0	0	0	0	0	150	0	0	150	381
Total Volume	1	0	0	0	1	0	974	4	1	979	0	0	0	0	0	0	587	0	0	587	1567
% App. Total	100	0	0	0		0	99.5	0.4	0.1		0	0	0	0		0	100	0	0		
PHF	.250	.000	.000	.000	.250	.000	.962	.500	.250	.964	.000	.000	.000	.000	.000	.000	.965	.000	.000	.965	.982



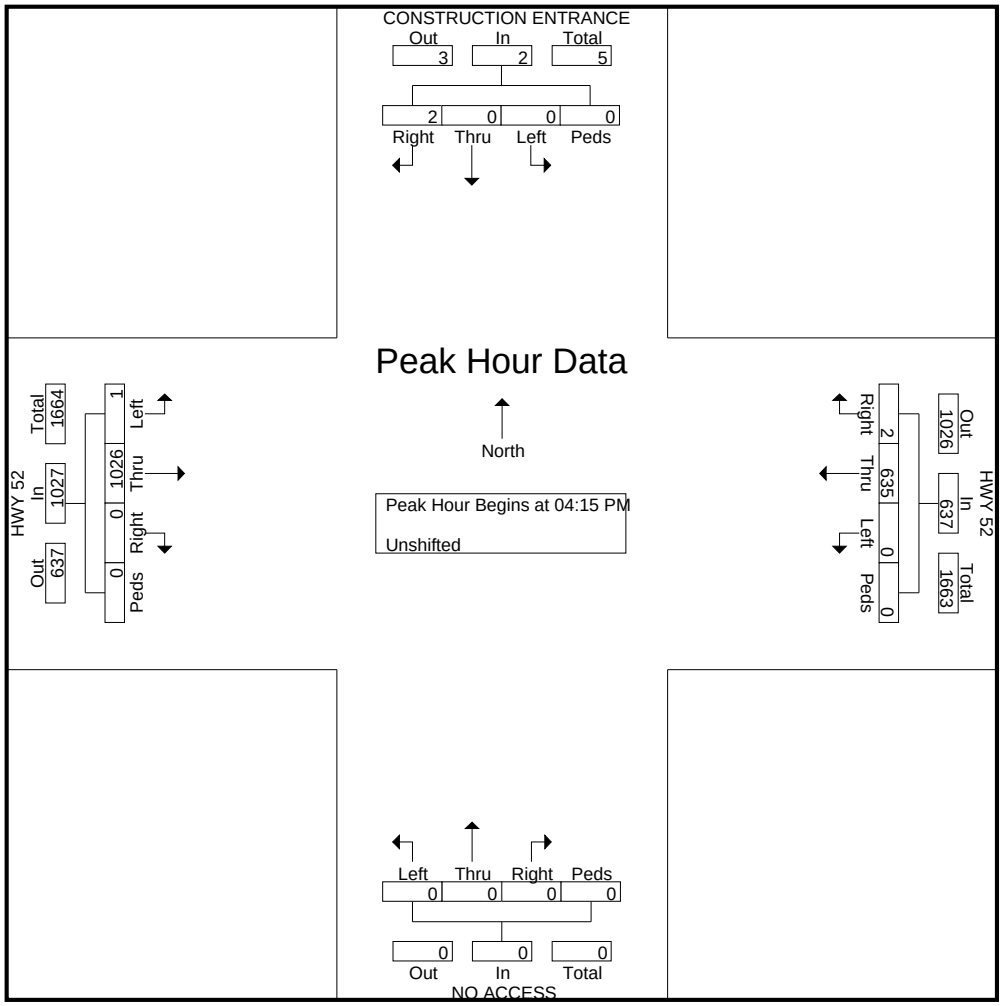
COUNTER MEASURES INC

1889 YORK ST
DENVER COLORADO
303-333-7409

N/S STREET: CONSTRUCTION ENTRANCE
E/W STREET: HWY 52
CITY: ERIE
COUNTY: HWY 52

File Name : CONST. ENTRANCE HWY 52
Site Code : 00000020
Start Date : 8/20/2025
Page No : 3

	CONSTRUCTION ENTRANCE SOUTHBOUND					HWY 52 WESTBOUND					NO ACCESS NORTHBOUND					HWY 52 EASTBOUND					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:15 PM to 05:00 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	0	0	0	0	0	0	**168**	0	0	**168**	0	0	0	0	0	**1**	249	0	0	250	418
04:30 PM	0	0	**2**	0	**2**	0	150	**2**	0	152	0	0	0	0	0	0	250	0	0	250	404
04:45 PM	0	0	0	0	0	0	166	0	0	166	0	0	0	0	0	0	**264**	0	0	**264**	**430**
05:00 PM	0	0	0	0	0	0	151	0	0	151	0	0	0	0	0	0	263	0	0	263	414
Total Volume	0	0	2	0	2	0	635	2	0	637	0	0	0	0	0	1	1026	0	0	1027	1666
% App. Total	0	0	100	0		0	99.7	0.3	0		0	0	0	0		0.1	99.9	0	0		
PHF	.000	.000	.250	.000	.250	.000	.945	.250	.000	.948	.000	.000	.000	.000	.000	.250	.972	.000	.000	.973	.969



COUNTER MEASURES INC

1889 YORK ST
DENVER COLORADO
303-333-7409

N/S STREET: CR 3
E/W STREET: CR 12
CITY: ERIE
COUNTY: WELD

File Name : cr 3 cr 12
Site Code : 00000005
Start Date : 8/19/2025
Page No : 1

Groups Printed- Unshifted

	CR 3 SOUTHBOUND				CR 12 WESTBOUND				CR 3 NORTHBOUND				CONST ENTRANCE EASTBOUND				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:30 AM	0	7	0	1	3	0	1	0	0	12	0	0	0	0	0	0	24
06:45 AM	0	8	1	0	4	0	1	0	0	14	2	0	0	0	0	0	30
Total	0	15	1	1	7	0	2	0	0	26	2	0	0	0	0	0	54
07:00 AM	3	14	0	0	6	0	1	0	0	14	0	0	1	0	0	0	39
07:15 AM	1	13	1	0	10	1	3	0	0	14	2	0	0	0	0	0	45
07:30 AM	1	38	0	0	18	0	1	0	0	14	2	0	1	0	1	0	76
07:45 AM	0	48	0	0	15	0	0	1	0	25	4	1	0	0	0	0	94
Total	5	113	1	0	49	1	5	1	0	67	8	1	2	0	1	0	254
08:00 AM	4	22	0	0	14	0	2	0	0	21	8	0	0	0	0	0	71
08:15 AM	0	28	0	0	10	0	1	0	0	13	1	0	0	0	0	0	53
Total	4	50	0	0	24	0	3	0	0	34	9	0	0	0	0	0	124
04:00 PM	2	13	0	0	7	0	1	0	0	20	11	0	0	0	0	0	54
04:15 PM	0	27	0	0	5	0	3	0	0	21	12	0	0	1	0	0	69
04:30 PM	4	19	0	0	10	0	4	0	0	21	8	1	0	0	0	0	67
04:45 PM	1	20	0	0	9	0	0	0	0	30	14	0	0	0	0	0	74
Total	7	79	0	0	31	0	8	0	0	92	45	1	0	1	0	0	264
05:00 PM	0	22	0	1	8	0	1	0	0	22	11	0	0	0	0	0	65
05:15 PM	3	26	0	0	5	0	6	0	0	19	6	0	0	0	0	0	65
05:30 PM	1	29	0	0	5	0	4	0	0	22	8	0	0	0	0	0	69
05:45 PM	3	28	0	0	6	0	3	0	0	17	3	0	0	0	0	0	60
Total	7	105	0	1	24	0	14	0	0	80	28	0	0	0	0	0	259
Grand Total	23	362	2	2	135	1	32	1	0	299	92	2	2	1	1	0	955
Apprch %	5.9	93.1	0.5	0.5	79.9	0.6	18.9	0.6	0	76.1	23.4	0.5	50	25	25	0	
Total %	2.4	37.9	0.2	0.2	14.1	0.1	3.4	0.1	0	31.3	9.6	0.2	0.2	0.1	0.1	0	

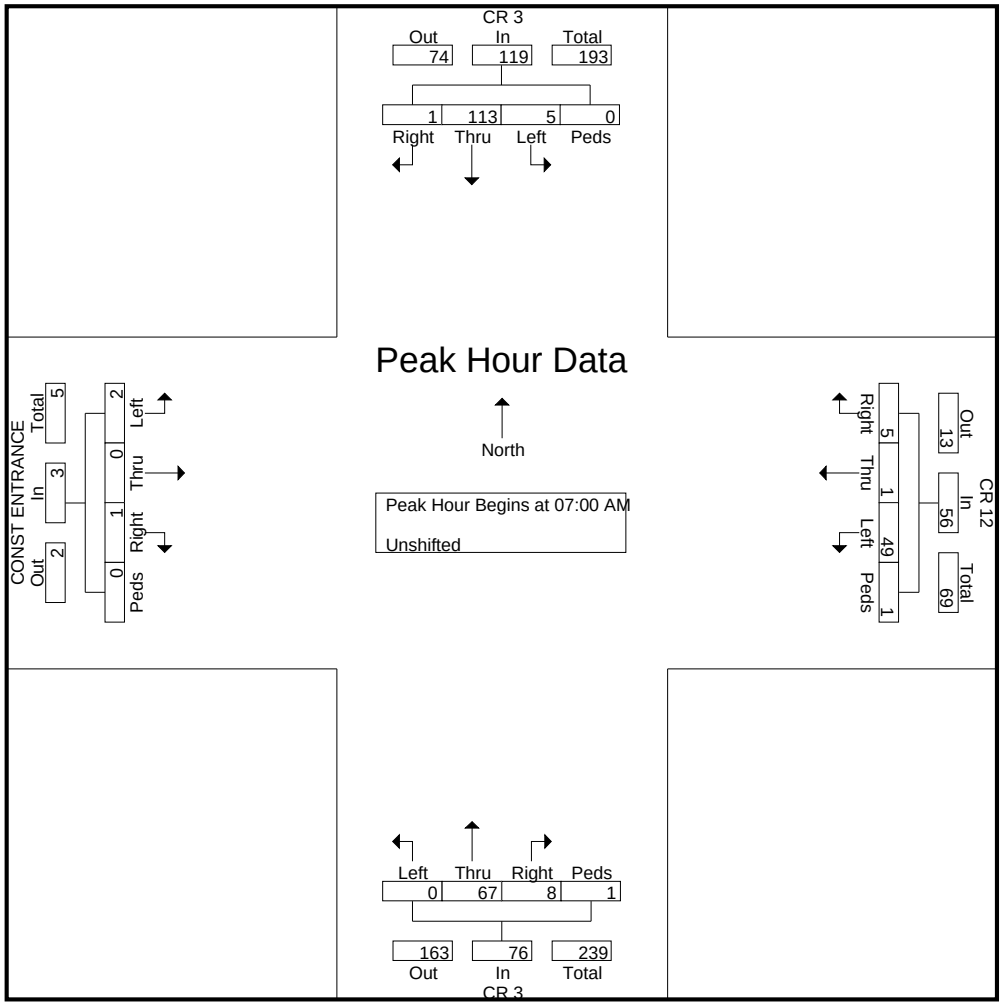
COUNTER MEASURES INC

1889 YORK ST
DENVER COLORADO
303-333-7409

N/S STREET: CR 3
E/W STREET: CR 12
CITY: ERIE
COUNTY: WELD

File Name : cr 3 cr 12
Site Code : 00000005
Start Date : 8/19/2025
Page No : 2

	CR 3 SOUTHBOUND					CR 12 WESTBOUND					CR 3 NORTHBOUND					CONST ENTRANCE EASTBOUND					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	**3**	14	0	0	17	6	0	1	0	7	0	14	0	0	14	**1**	0	0	0	1	39
07:15 AM	1	13	**1**	0	15	10	**1**	**3**	0	14	0	14	2	0	16	0	0	0	0	0	45
07:30 AM	1	38	0	0	39	**18**	0	1	0	**19**	0	14	2	0	16	1	0	**1**	0	**2**	76
07:45 AM	0	**48**	0	0	**48**	15	0	0	**1**	16	0	**25**	**4**	**1**	**30**	0	0	0	0	0	**94**
Total Volume	5	113	1	0	119	49	1	5	1	56	0	67	8	1	76	2	0	1	0	3	254
% App. Total	4.2	95	0.8	0		87.5	1.8	8.9	1.8		0	88.2	10.5	1.3		66.7	0	33.3	0		
PHF	.417	.589	.250	.000	.620	.681	.250	.417	.250	.737	.000	.670	.500	.250	.633	.500	.000	.250	.000	.375	.676



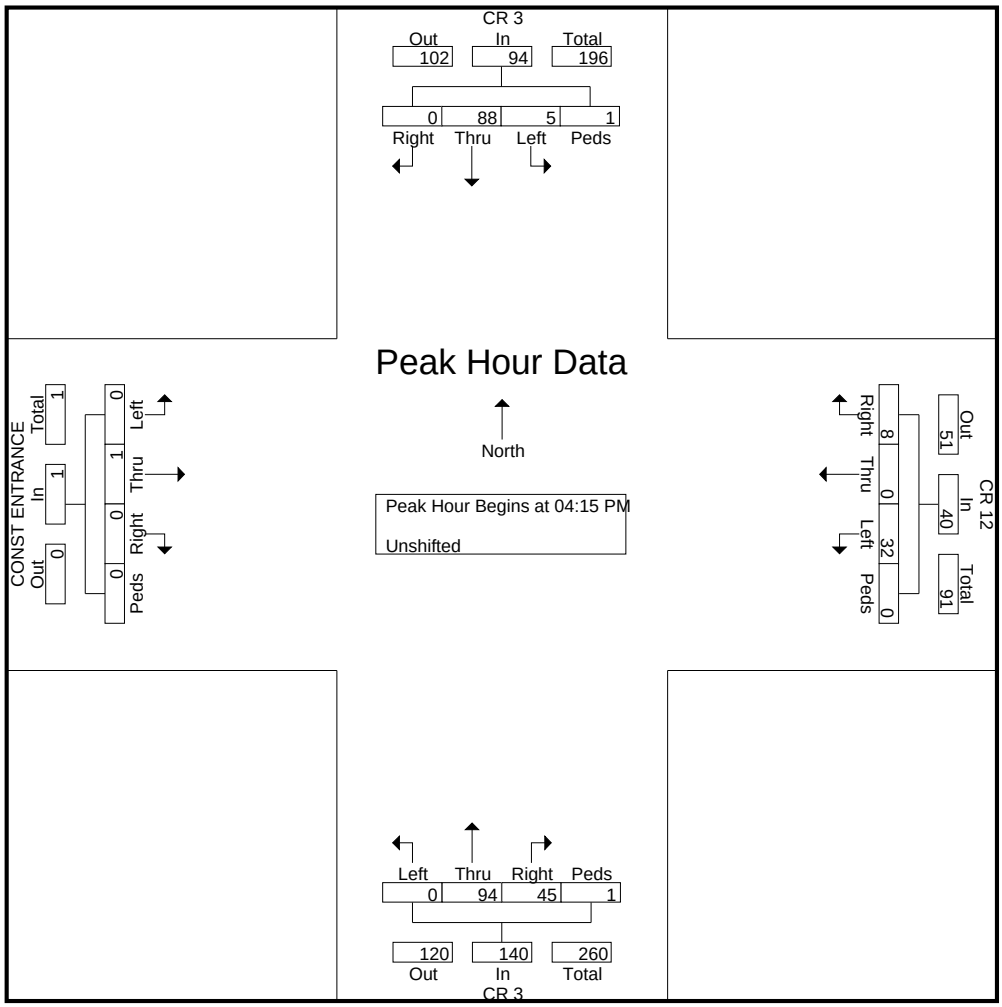
COUNTER MEASURES INC

1889 YORK ST
DENVER COLORADO
303-333-7409

N/S STREET: CR 3
E/W STREET: CR 12
CITY: ERIE
COUNTY: WELD

File Name : cr 3 cr 12
Site Code : 00000005
Start Date : 8/19/2025
Page No : 3

	CR 3 SOUTHBOUND					CR 12 WESTBOUND					CR 3 NORTHBOUND					CONST ENTRANCE EASTBOUND					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:15 PM to 05:00 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	0	**27**	0	0	**27**	5	0	3	0	8	0	21	12	0	33	0	**1**	0	0	**1**	69
04:30 PM	**4**	19	0	0	23	**10**	0	**4**	0	**14**	0	21	8	**1**	30	0	0	0	0	0	67
04:45 PM	1	20	0	0	21	9	0	0	0	9	0	**30**	**14**	0	**44**	0	0	0	0	0	**74**
05:00 PM	0	22	0	**1**	23	8	0	1	0	9	0	22	11	0	33	0	0	0	0	0	65
Total Volume	5	88	0	1	94	32	0	8	0	40	0	94	45	1	140	0	1	0	0	1	275
% App. Total	5.3	93.6	0	1.1		80	0	20	0		0	67.1	32.1	0.7		0	100	0	0		
PHF	.313	.815	.000	.250	.870	.800	.000	.500	.000	.714	.000	.783	.804	.250	.795	.000	.250	.000	.000	.250	.929



COUNTER MEASURES INC

1889 YORK ST
DENVER COLORADO
303-333-7409

N/S STREET: CR 3
E/W STREET: HWY 52
CITY: ERIE
COUNTY: WELD

File Name : CR 3 HWY 52
Site Code : 00000008
Start Date : 8/19/2025
Page No : 1

Groups Printed- Unshifted

	NO ACCESS SOUTHBOUND				HWY 52 WESTBOUND				CR 3 NORTHBOUND				HWY 52 EASTBOUND				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:30 AM	0	0	0	0	6	264	0	0	1	0	13	0	0	122	1	0	407
06:45 AM	0	0	0	0	31	190	0	0	8	0	8	0	0	114	26	0	377
Total	0	0	0	0	37	454	0	0	9	0	21	0	0	236	27	0	784
07:00 AM	0	0	0	0	7	243	0	0	6	0	9	0	0	133	9	0	407
07:15 AM	0	0	0	0	11	264	0	2	5	0	15	0	0	134	6	0	437
07:30 AM	0	0	0	0	36	227	0	0	6	1	15	0	0	155	6	0	446
07:45 AM	0	0	0	0	41	244	0	0	10	0	20	0	0	143	10	0	468
Total	0	0	0	0	95	978	0	2	27	1	59	0	0	565	31	0	1758
08:00 AM	0	0	0	0	13	206	0	0	8	0	18	0	0	154	6	0	405
08:15 AM	0	0	0	0	20	227	0	0	5	1	19	0	1	123	8	0	404
Total	0	0	0	0	33	433	0	0	13	1	37	0	1	277	14	0	809
04:00 PM	0	0	0	0	6	158	0	0	8	0	18	0	0	251	7	0	448
04:15 PM	0	0	0	0	14	176	0	0	10	3	12	0	0	225	11	0	451
04:30 PM	0	0	0	0	15	165	0	0	9	0	16	0	0	241	9	0	455
04:45 PM	0	0	0	0	20	143	0	1	14	0	19	0	0	222	7	0	426
Total	0	0	0	0	55	642	0	1	41	3	65	0	0	939	34	0	1780
05:00 PM	0	0	0	0	14	158	0	0	9	0	24	0	0	248	9	0	462
05:15 PM	0	0	0	0	28	130	0	0	18	0	11	0	0	204	7	0	398
05:30 PM	0	0	0	0	18	159	0	0	14	0	11	0	0	216	17	0	435
05:45 PM	0	0	0	0	19	120	0	0	18	2	9	0	0	193	16	0	377
Total	0	0	0	0	79	567	0	0	59	2	55	0	0	861	49	0	1672
Grand Total	0	0	0	0	299	3074	0	3	149	7	237	0	1	2878	155	0	6803
Apprch %	0	0	0	0	8.9	91.1	0	0.1	37.9	1.8	60.3	0	0	94.9	5.1	0	
Total %	0	0	0	0	4.4	45.2	0	0	2.2	0.1	3.5	0	0	42.3	2.3	0	

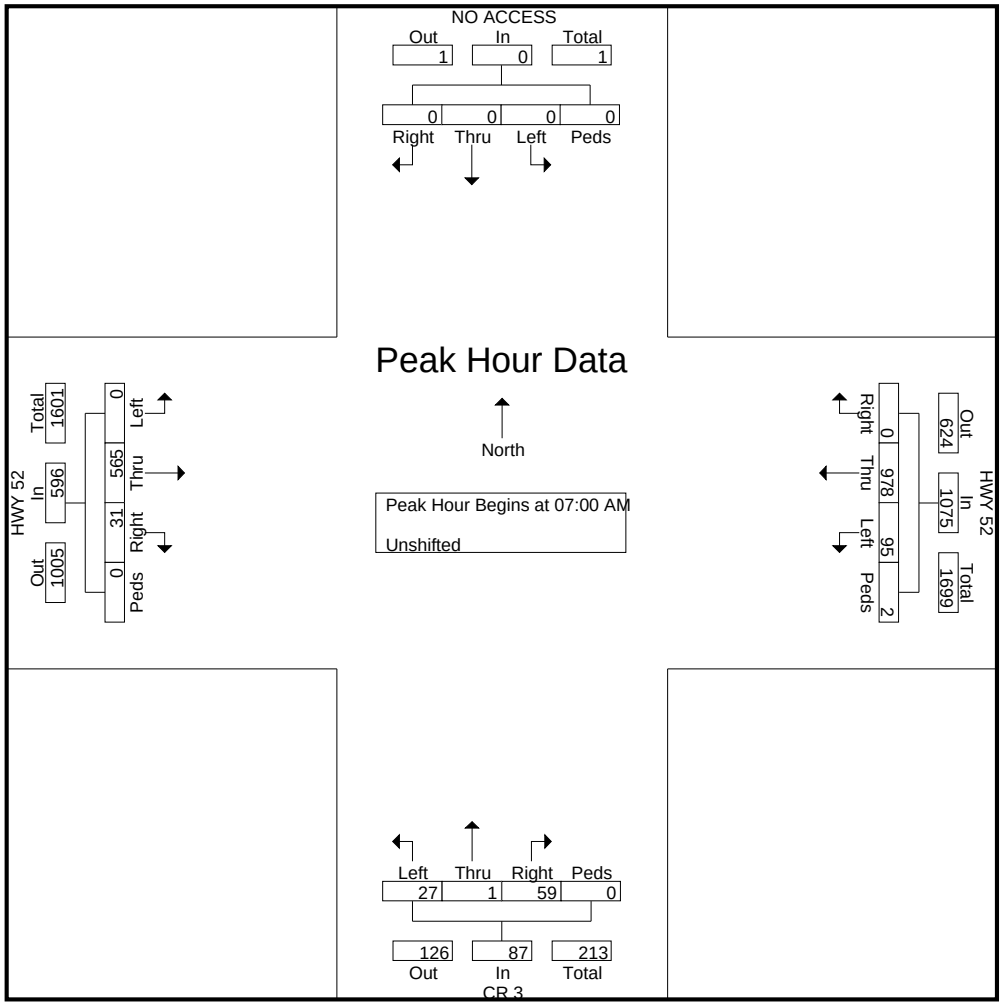
COUNTER MEASURES INC

1889 YORK ST
DENVER COLORADO
303-333-7409

N/S STREET: CR 3
E/W STREET: HWY 52
CITY: ERIE
COUNTY: WELD

File Name : CR 3 HWY 52
Site Code : 00000008
Start Date : 8/19/2025
Page No : 2

	NO ACCESS SOUTHBOUND					HWY 52 WESTBOUND					CR 3 NORTHBOUND					HWY 52 EASTBOUND					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	0	0	0	0	7	243	0	0	250	6	0	9	0	15	0	133	9	0	142	407
07:15 AM	0	0	0	0	0	11	**264**	0	**2**	277	5	0	15	0	20	0	134	6	0	140	437
07:30 AM	0	0	0	0	0	36	227	0	0	263	6	**1**	15	0	22	0	**155**	6	0	**161**	446
07:45 AM	0	0	0	0	0	**41**	244	0	0	**285**	**10**	0	**20**	0	**30**	0	143	**10**	0	153	**468**
Total Volume	0	0	0	0	0	95	978	0	2	1075	27	1	59	0	87	0	565	31	0	596	1758
% App. Total	0	0	0	0		8.8	91	0	0.2		31	1.1	67.8	0		0	94.8	5.2	0		
PHF	.000	.000	.000	.000	.000	.579	.926	.000	.250	.943	.675	.250	.738	.000	.725	.000	.911	.775	.000	.925	.939



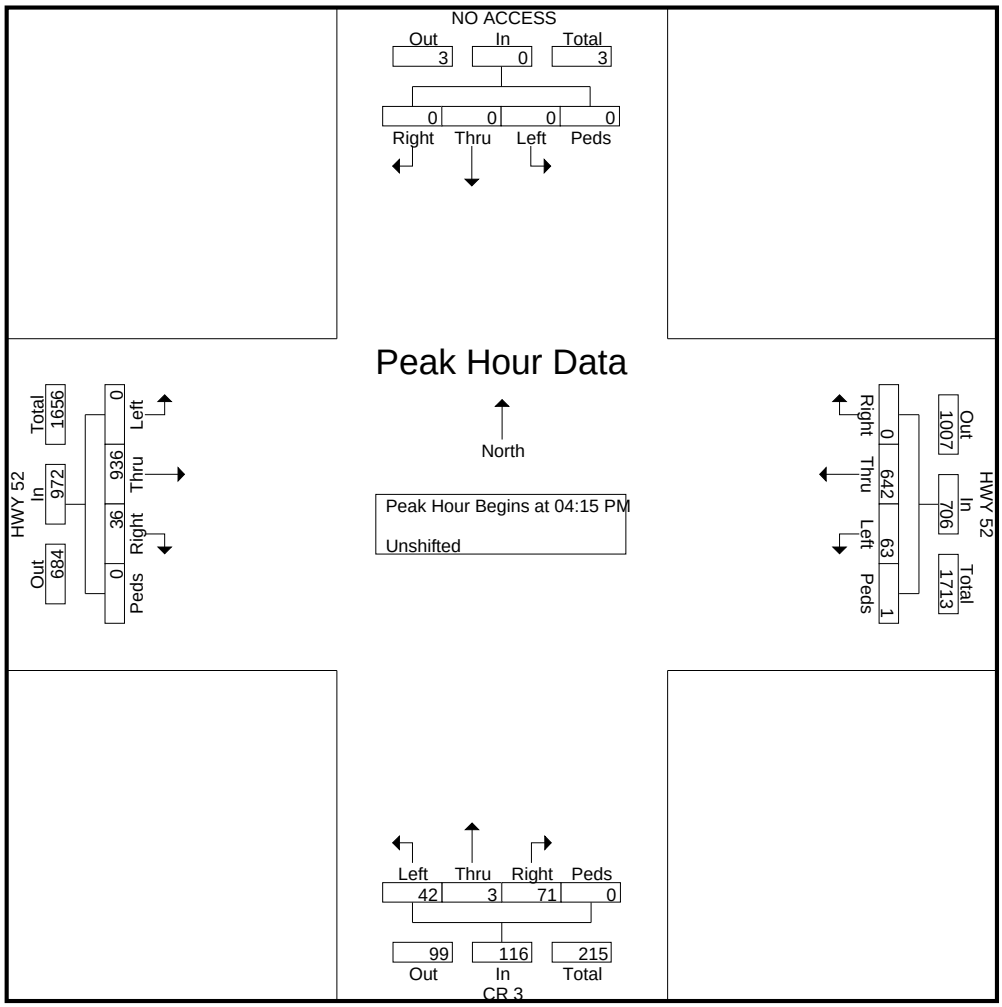
COUNTER MEASURES INC

1889 YORK ST
DENVER COLORADO
303-333-7409

N/S STREET: CR 3
E/W STREET: HWY 52
CITY: ERIE
COUNTY: WELD

File Name : CR 3 HWY 52
Site Code : 00000008
Start Date : 8/19/2025
Page No : 3

	NO ACCESS SOUTHBOUND					HWY 52 WESTBOUND					CR 3 NORTHBOUND					HWY 52 EASTBOUND					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	0	0	0	0	0	14	**176**	0	0	**190**	10	**3**	12	0	25	0	225	**11**	0	236	451
04:30 PM	0	0	0	0	0	15	165	0	0	180	9	0	16	0	25	0	241	9	0	250	455
04:45 PM	0	0	0	0	0	**20**	143	0	**1**	164	**14**	0	19	0	**33**	0	222	7	0	229	426
05:00 PM	0	0	0	0	0	14	158	0	0	172	9	0	**24**	0	33	0	**248**	9	0	**257**	**462**
Total Volume	0	0	0	0	0	63	642	0	1	706	42	3	71	0	116	0	936	36	0	972	1794
% App. Total	0	0	0	0		8.9	90.9	0	0.1		36.2	2.6	61.2	0		0	96.3	3.7	0		
PHF	.000	.000	.000	.000	.000	.788	.912	.000	.250	.929	.750	.250	.740	.000	.879	.000	.944	.818	.000	.946	.971



COUNTER MEASURES INC

1889 YORK ST
DENVER COLORADO
303-333-7409

N/S STREET: NE COUNTY LINE RD
E/W STREET: HWY 52
CITY: ERIE
COUNTY: WELD

File Name : NE COUNTY LINE RD HWY52
Site Code : 00000005
Start Date : 9/3/2025
Page No : 1

Groups Printed- Unshifted

	NE COUNTY LINE RD SOUTHBOUND				HWY 52 WESTBOUND				NE COUNTY LINE RD NORTHBOUND				HWY 52 EASTBOUND				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:30 AM	17	24	13	0	8	215	12	0	8	16	17	0	10	68	1	0	409
06:45 AM	28	20	20	0	15	223	10	0	7	14	11	0	12	100	5	0	465
Total	45	44	33	0	23	438	22	0	15	30	28	0	22	168	6	0	874
07:00 AM	29	31	32	0	9	214	3	0	11	30	3	0	2	94	10	0	468
07:15 AM	5	36	27	0	12	247	12	0	14	28	10	0	16	80	5	0	492
07:30 AM	26	23	47	0	16	254	14	0	27	43	18	0	11	107	9	0	595
07:45 AM	27	42	45	0	11	233	16	0	29	32	14	0	4	112	8	0	573
Total	87	132	151	0	48	948	45	0	81	133	45	0	33	393	32	0	2128
08:00 AM	24	39	42	0	19	233	13	0	29	47	9	0	12	91	9	0	567
08:15 AM	12	25	35	0	19	244	19	0	16	24	11	0	7	98	7	0	517
Total	36	64	77	0	38	477	32	0	45	71	20	0	19	189	16	0	1084
04:00 PM	25	37	5	0	11	145	35	0	23	66	10	0	32	259	22	0	670
04:15 PM	28	45	10	0	26	111	28	0	16	59	18	0	30	227	10	0	608
04:30 PM	19	41	6	0	28	156	31	0	14	53	14	0	24	248	12	0	646
04:45 PM	24	49	7	0	24	122	43	0	18	51	9	0	22	235	16	0	620
Total	96	172	28	0	89	534	137	0	71	229	51	0	108	969	60	0	2544
05:00 PM	31	30	9	0	21	138	36	0	19	62	26	0	26	222	10	0	630
05:15 PM	27	39	11	0	25	161	28	0	21	72	13	0	13	238	8	0	656
05:30 PM	28	47	14	0	32	141	24	0	26	66	18	0	15	226	12	0	649
05:45 PM	21	54	10	0	30	104	34	0	16	60	18	0	20	233	24	0	624
Total	107	170	44	0	108	544	122	0	82	260	75	0	74	919	54	0	2559
Grand Total	371	582	333	0	306	2941	358	0	294	723	219	0	256	2638	168	0	9189
Apprch %	28.8	45.3	25.9	0	8.5	81.6	9.9	0	23.8	58.5	17.7	0	8.4	86.2	5.5	0	
Total %	4	6.3	3.6	0	3.3	32	3.9	0	3.2	7.9	2.4	0	2.8	28.7	1.8	0	

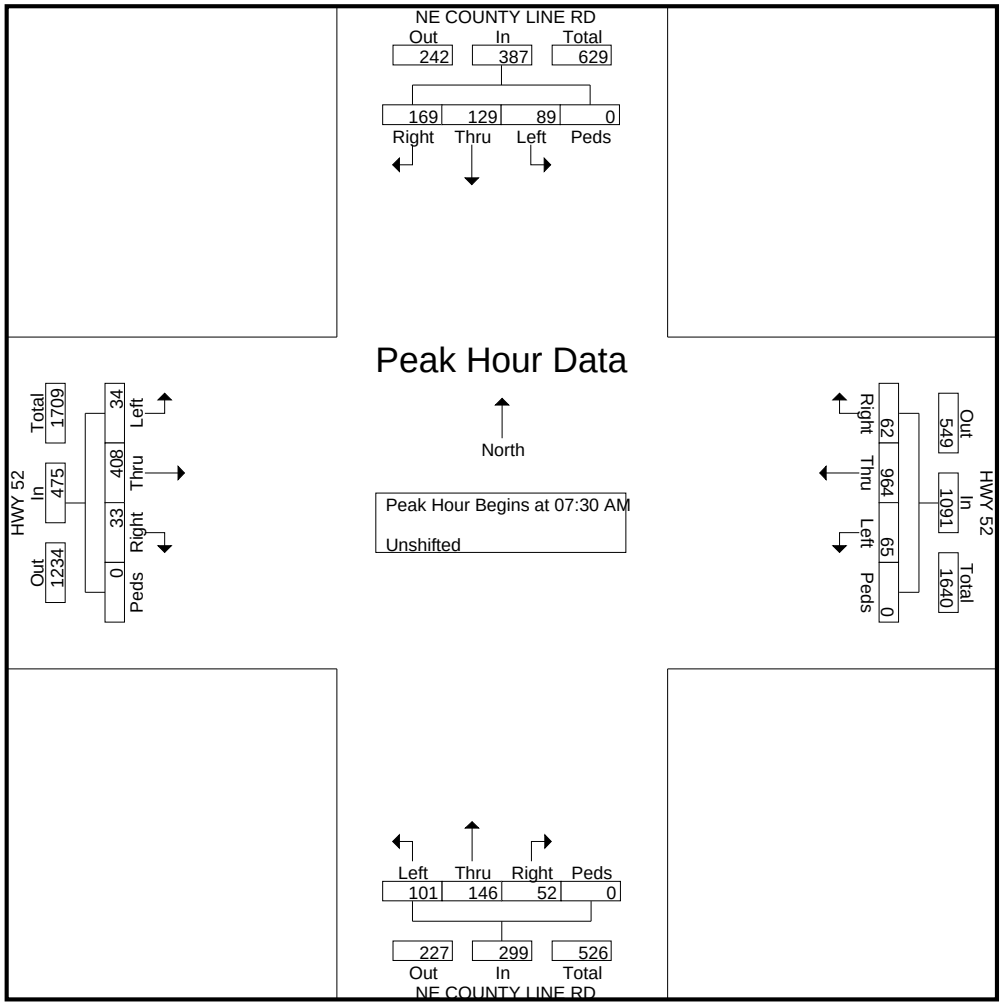
COUNTER MEASURES INC

1889 YORK ST
DENVER COLORADO
303-333-7409

N/S STREET: NE COUNTY LINE RD
E/W STREET: HWY 52
CITY: ERIE
COUNTY: WELD

File Name : NE COUNTY LINE RD HWY52
Site Code : 00000005
Start Date : 9/3/2025
Page No : 2

	NE COUNTY LINE RD SOUTHBOUND					HWY 52 WESTBOUND					NE COUNTY LINE RD NORTHBOUND					HWY 52 EASTBOUND					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	26	23	**47**	0	96	16	**254**	14	0	**284**	27	43	**18**	0	**88**	11	107	**9**	0	**127**	**595**
07:45 AM	**27**	**42**	45	0	**114**	11	233	16	0	260	**29**	32	14	0	75	4	**112**	8	0	124	573
08:00 AM	24	39	42	0	105	**19**	233	13	0	265	29	**47**	9	0	85	**12**	91	9	0	112	567
08:15 AM	12	25	35	0	72	19	244	**19**	0	282	16	24	11	0	51	7	98	7	0	112	517
Total Volume	89	129	169	0	387	65	964	62	0	1091	101	146	52	0	299	34	408	33	0	475	2252
% App. Total	23	33.3	43.7	0		6	88.4	5.7	0		33.8	48.8	17.4	0		7.2	85.9	6.9	0		
PHF	.824	.768	.899	.000	.849	.855	.949	.816	.000	.960	.871	.777	.722	.000	.849	.708	.911	.917	.000	.935	.946



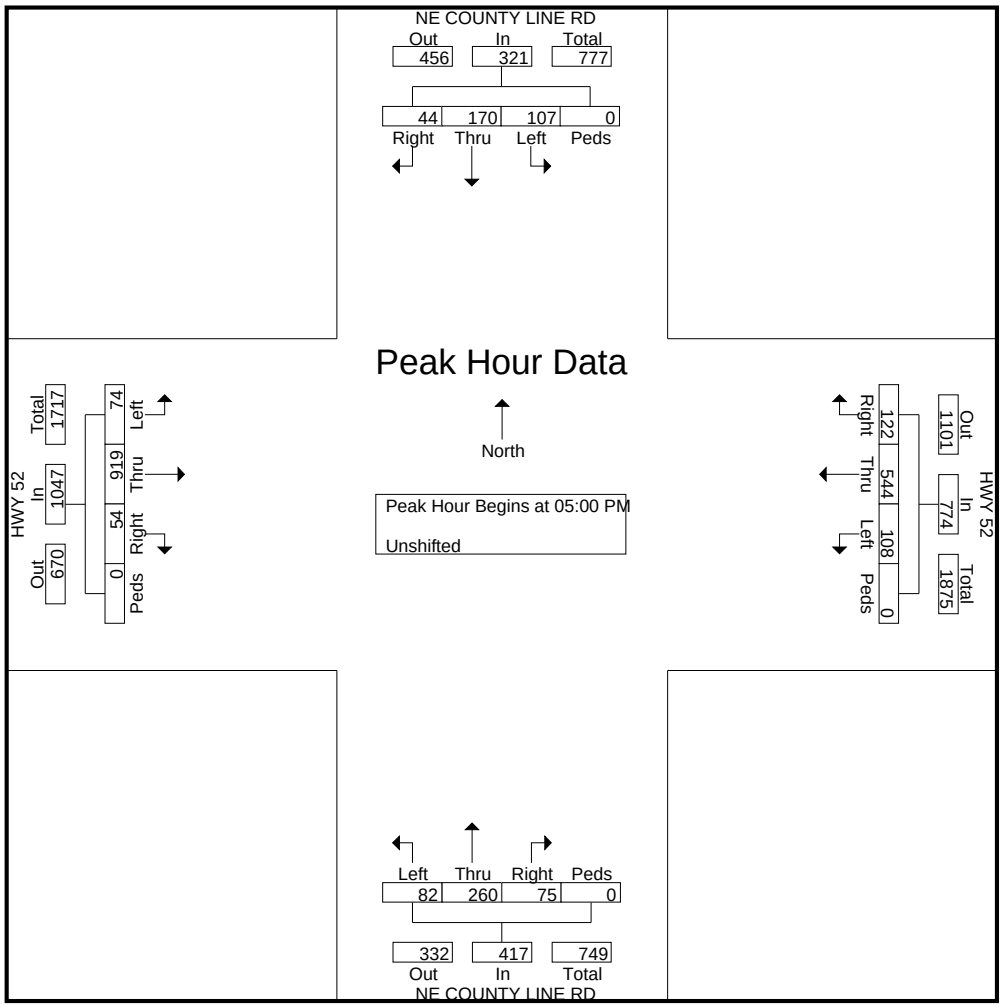
COUNTER MEASURES INC

1889 YORK ST
DENVER COLORADO
303-333-7409

N/S STREET: NE COUNTY LINE RD
E/W STREET: HWY 52
CITY: ERIE
COUNTY: WELD

File Name : NE COUNTY LINE RD HWY52
Site Code : 00000005
Start Date : 9/3/2025
Page No : 3

	NE COUNTY LINE RD SOUTHBOUND					HWY 52 WESTBOUND					NE COUNTY LINE RD NORTHBOUND					HWY 52 EASTBOUND					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	**31**	30	9	0	70	21	138	**36**	0	195	19	62	**26**	0	107	**26**	222	10	0	258	630
05:15 PM	27	39	11	0	77	25	**161**	28	0	**214**	21	**72**	13	0	106	13	**238**	8	0	259	**656**
05:30 PM	28	47	**14**	0	**89**	**32**	141	24	0	197	**26**	66	18	0	**110**	15	226	12	0	253	649
05:45 PM	21	**54**	10	0	85	30	104	34	0	168	16	60	18	0	94	20	233	**24**	0	**277**	624
Total Volume	107	170	44	0	321	108	544	122	0	774	82	260	75	0	417	74	919	54	0	1047	2559
% App. Total	33.3	53	13.7	0		14	70.3	15.8	0		19.7	62.4	18	0		7.1	87.8	5.2	0		
PHF	.863	.787	.786	.000	.902	.844	.845	.847	.000	.904	.788	.903	.721	.000	.948	.712	.965	.563	.000	.945	.975



SPRING HILL UPDATE
Location: CR 3 S-O HWY 52
City: ERIE
County: WELD
Direction: NORTH/SOUTH

COUNTER MEASURES, INC.
TRAFFIC AND TRANSPORTATION FIELD DATA

Site Code:2508303
Site Code:2508303
Start Date: 08192025 8/19/2025
End Date: 08192025 8/20/2025
Longitude: 0.000000
Longitude: 0.000000

8/19/2025	NORTH	SOUTH	
Time			Total
12:00 AM	*	*	0
1:00	*	*	0
2:00	*	*	0
3:00	*	*	0
4:00	*	*	0
5:00	*	*	0
6:00	19	28	47
7:00	48	121	169
8:00	84	113	197
9:00	78	103	181
10:00	71	91	162
11:00	66	78	144
12:00 PM	77	63	140
1:00	83	71	154
2:00	89	78	167
3:00	96	69	165
4:00	114	84	198
5:00	159	80	239
6:00	123	107	230
7:00	86	88	174
8:00	60	61	121
9:00	51	39	90
10:00	42	30	72
11:00	21	18	39
Total	1367	1322	2689
Percent	50.8%	49.2%	
AM Peak	8:00	7:00	8:00
Volume	84	121	197
PM Peak	5:00	6:00	5:00
Volume	159	107	239

SPRING HILL UPDATE
Location: CR 3 S-O HWY 52
City: ERIE
County: WELD
Direction: NORTH/SOUTH

COUNTER MEASURES, INC.
TRAFFIC AND TRANSPORTATION FIELD DATA

Site Code:2508303
Site Code:2508303
Start Date: 08192025 8/19/2025
End Date: 08192025 8/20/2025
Longitude: 0.000000
Longitude: 0.000000

8/20/2025	NORTH	SOUTH		
Time				Total
12:00 AM	17	14		31
1:00	10	7		17
2:00	9	9		18
3:00	11	16		27
4:00	18	20		38
5:00	20	24		44
6:00	27	32		59
7:00	53	112		165
8:00	80	106		186
9:00	72	108		180
10:00	76	84		160
11:00	70	72		142
12:00 PM	72	66		138
1:00	0	0		0
2:00	0	0		0
3:00	0	0		0
4:00	0	0		0
5:00	0	0		0
6:00	0	0		0
7:00	*	*		0
8:00	*	*		0
9:00	*	*		0
10:00	*	*		0
11:00	*	*		0
Total	535	670		1205
Percent	44.4%	55.6%		
AM Peak	8:00	7:00		8:00
Volume	80	112		186
PM Peak	12:00 PM	12:00 PM		12:00 PM
Volume	72	66		138
Grand Total	1902	1992		3894
Percent	48.8%	51.2%		
ADT		ADT: 2,859	AADT: 2,859	

NCHRP 684 Internal Trip Capture Estimation Tool			
Project Name:	Spring Hill Update	**Organization:**	LSC Transportation Consultants, Inc.
Project Location:	Erie, CO	**Performed By:**	KDF
Scenario Description:	Buildout	**Date:**	9/18/2025
Analysis Year:	2045	**Checked By:**	
Analysis Period:	**AM Street Peak Hour**	**Date:**	

Table 1-A: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips[3]		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail				127	79	48
Restaurant				0		
Cinema/Entertainment				0		
Residential				393	104	289
Hotel				0		
All Other Land Uses[2]				292	158	134
				812	341	471

Table 2-A: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.[4]	% Transit	% Non-Motorized	Veh. Occ.[4]	% Transit	% Non-Motorized
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						
All Other Land Uses[2]						

Table 3-A: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-A: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		0	0	2	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	3	0	0		0
Hotel	0	0	0	0	0	

Table 5-A: Computations Summary

	Total	Entering	Exiting
All Person-Trips	812	341	471
Internal Capture Percentage	1%	1%	1%
External Vehicle-Trips[5]	802	336	466
External Transit-Trips[6]	0	0	0
External Non-Motorized Trips[6]	0	0	0

Table 6-A: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	4%	4%
Restaurant	N/A	N/A
Cinema/Entertainment	N/A	N/A
Residential	2%	1%
Hotel	N/A	N/A

[1]Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

[2]Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

[3]Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

[4]Enter vehicle occupancy assumed in Table 1-A vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made to Tables 5-A, 9-A (O and D). Enter transit, non-motorized percentages that will result with proposed mixed-use project complete.

[5]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A.

[6]Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

Project Name:	Spring Hill Update
Analysis Period:	**AM Street Peak Hour**

Table 7-A: Conversion of Vehicle-Trip Ends to Person-Trip Ends

Land Use	Table 7-A (D): Entering Trips			Table 7-A (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.00	0	0	1.00	0	0
Retail	1.00	79	79	1.00	48	48
Restaurant	1.00	0	0	1.00	0	0
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.00	104	104	1.00	289	289
Hotel	1.00	0	0	1.00	0	0

Table 8-A (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	14		6	0	7	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	6	3	58	0		0
Hotel	0	0	0	0	0	

Table 8-A (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		25	0	0	0	0
Retail	0		0	0	2	0
Restaurant	0	6		0	5	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	13	0	0		0
Hotel	0	3	0	0	0	

Table 9-A (D): Internal and External Trips Summary (Entering Trips)

Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	0	0	0	0	0	0
Retail	3	76	79	76	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	2	102	104	102	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	158	158	158	0	0

Table 9-A (O): Internal and External Trips Summary (Exiting Trips)

Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	0	0	0	0	0	0
Retail	2	46	48	46	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	3	286	289	286	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	134	134	134	0	0

[1]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A

[2]Person-Trips

[3]Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator

*Indicates computation that has been rounded to the nearest whole number.

NCHRP 684 Internal Trip Capture Estimation Tool			
Project Name:	Spring Hill Update	**Organization:**	LSC Transportation Consultants, Inc.
Project Location:	Erie, CO	**Performed By:**	KDF
Scenario Description:	Buildout	**Date:**	9/18/2025
Analysis Year:	2045	**Checked By:**	
Analysis Period:	**PM Street Peak Hour**	**Date:**	

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips[3]		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail				381	187	194
Restaurant				0		
Cinema/Entertainment				0		
Residential				495	302	193
Hotel				0		
All Other Land Uses[2]				64	29	35
				940	518	422

Table 2-P: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.[4]	% Transit	% Non-Motorized	Veh. Occ.[4]	% Transit	% Non-Motorized
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						
All Other Land Uses[2]						

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		1320	1320		1320	
Retail					1320	
Restaurant					1320	
Cinema/Entertainment					1320	
Residential		1320	1320			
Hotel					1320	

Table 4-P: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		0	0	42	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	12	0	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary

	Total	Entering	Exiting
All Person-Trips	940	518	422
Internal Capture Percentage	11%	10%	13%
External Vehicle-Trips[5]	832	464	368
External Transit-Trips[6]	0	0	0
External Non-Motorized Trips[6]	0	0	0

Table 6-P: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	6%	22%
Restaurant	N/A	N/A
Cinema/Entertainment	N/A	N/A
Residential	14%	6%
Hotel	N/A	N/A

[1]Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

[2]Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

[3]Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

[4]Enter vehicle occupancy assumed in Table 1-P vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be

[5]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P.

[6]Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

Project Name:	Spring Hill Update
Analysis Period:	**3**

Table 7-P: Conversion of Vehicle-Trip Ends to Person-Trip Ends

Land Use	Table 7-P (D): Entering Trips			Table 7-P (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.00	0	0	1.00	0	0
Retail	1.00	187	187	1.00	194	194
Restaurant	1.00	0	0	1.00	0	0
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.00	302	302	1.00	193	193
Hotel	1.00	0	0	1.00	0	0

Table 8-P (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	4		56	8	42	10
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	8	54	27	0		6
Hotel	0	0	0	0	0	

Table 8-P (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		10	0	0	12	0
Retail	0		0	0	139	0
Restaurant	0	94		0	48	0
Cinema/Entertainment	0	7	0		12	0
Residential	0	12	0	0		0
Hotel	0	4	0	0	0	

Table 9-P (D): Internal and External Trips Summary (Entering Trips)

Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	0	0	0	0	0	0
Retail	12	175	187	175	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	42	260	302	260	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	29	29	29	0	0

Table 9-P (O): Internal and External Trips Summary (Exiting Trips)

Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	0	0	0	0	0	0
Retail	42	152	194	152	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	12	181	193	181	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	35	35	35	0	0

[1]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

[2]Person-Trips

[3]Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator

*Indicates computation that has been rounded to the nearest whole number.

LEVEL OF SERVICE DEFINITIONS

From *Highway Capacity Manual*, Transportation Research Board

SIGNALIZED INTERSECTION LEVEL OF SERVICE (LOS)

LOS	Average Vehicle Delay sec/vehicle	Operational Characteristics
A	<10 seconds	Describes operations with low control delay, up to 10 sec/veh. This LOS occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.
B	10 to 20 seconds	Describes operations with control delay greater than 10 seconds and up to 20 sec/veh. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.
C	20 to 35 seconds	Describes operations with control delay greater than 20 and up to 35 sec/veh. These higher delays may result from only fair progression, longer cycle length, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles, and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.
D	35 to 55 seconds	Describes operations with control delay greater than 35 and up to 55 sec/veh. At LOS D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, and high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	55 to 80 seconds	Describes operations with control delay greater than 55 and up to 80 sec/veh. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent.
F	>80 seconds	Describes operations with control delay in excess of 80 sec/veh. This level, considered unacceptable to most drivers, often occurs with over-saturation, that is, when arrival flow rates exceed the capacity of lane groups. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.

LEVEL OF SERVICE DEFINITIONS

From *Highway Capacity Manual*, Transportation Research Board

UNSIGNALIZED INTERSECTION LEVEL OF SERVICE (LOS)

Applicable to Two-Way Stop Control, All-Way Stop Control, and Roundabouts

LOS	Average Vehicle Control Delay	Operational Characteristics
A	<10 seconds	Normally, vehicles on the stop-controlled approach only have to wait up to 10 seconds before being able to clear the intersection. Left-turning vehicles on the uncontrolled street do not have to wait to make their turn.
B	10 to 15 seconds	Vehicles on the stop-controlled approach will experience delays before being able to clear the intersection. The delay could be up to 15 seconds. Left-turning vehicles on the uncontrolled street may have to wait to make their turn.
C	15 to 25 seconds	Vehicles on the stop-controlled approach can expect delays in the range of 15 to 25 seconds before clearing the intersection. Motorists may begin to take chances due to the long delays, thereby posing a safety risk to through traffic. Left-turning vehicles on the uncontrolled street will now be required to wait to make their turn causing a queue to be created in the turn lane.
D	25 to 35 seconds	This is the point at which a traffic signal may be warranted for this intersection. The delays for the stop-controlled intersection are not considered to be excessive. The length of the queue may begin to block other public and private access points.
E	35 to 50 seconds	The delays for all critical traffic movements are considered to be unacceptable. The length of the queues for the stop-controlled approaches as well as the left-turn movements are extremely long. There is a high probability that this intersection will meet traffic signal warrants. The ability to install a traffic signal is affected by the location of other existing traffic signals. Consideration may be given to restricting the accesses by eliminating the left-turn movements from and to the stop-controlled approach.
F	>50 seconds	The delay for the critical traffic movements are probably in excess of 100 seconds. The length of the queues are extremely long. Motorists are selecting alternative routes due to the long delays. The only remedy for these long delays is installing a traffic signal or restricting the accesses. The potential for accidents at this intersection are extremely high due to motorist taking more risky chances. If the median permits, motorists begin making two-stage left-turns.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	34	408	33	65	964	101	146	89	129
Future Volume (vph)	34	408	33	65	964	101	146	89	129
Turn Type	pm+pt	NA	Perm	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2		1	6	3	8	7	4
Permitted Phases	2		2	6		8		4	
Detector Phase	5	2	2	1	6	3	8	7	4
Switch Phase									
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	5.0	10.0	5.0	10.0
Minimum Split (s)	10.0	20.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
Total Split (s)	10.0	75.0	75.0	10.0	75.0	10.0	25.0	10.0	25.0
Total Split (%)	8.3%	62.5%	62.5%	8.3%	62.5%	8.3%	20.8%	8.3%	20.8%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Min	None	Min
Act Effct Green (s)	72.0	68.0	68.0	73.0	70.1	25.0	20.0	25.0	20.0
Actuated g/C Ratio	0.62	0.59	0.59	0.63	0.60	0.22	0.17	0.22	0.17
v/c Ratio	0.26	0.39	0.04	0.12	0.97	0.76	0.65	0.47	0.94
Control Delay	11.7	14.6	0.1	7.7	43.5	70.3	53.4	44.9	78.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.7	14.6	0.1	7.7	43.5	70.3	53.4	44.9	78.2
LOS	B	B	A	A	D	E	D	D	E
Approach Delay		13.4			41.4		59.1		70.6
Approach LOS		B			D		E		E

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 116	
Natural Cycle: 110	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.97	
Intersection Signal Delay: 42.8	Intersection LOS: D
Intersection Capacity Utilization 89.7%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: E County Line Rd & SH 52

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	34	408	33	65	964	62	101	146	52	89	129	169
Future Volume (veh/h)	34	408	33	65	964	62	101	146	52	89	129	169
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	36	429	35	68	1015	65	106	154	55	94	136	178
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	122	1089	923	553	1027	66	136	222	79	205	124	162
Arrive On Green	0.03	0.58	0.58	0.04	0.59	0.59	0.04	0.17	0.17	0.04	0.17	0.17
Sat Flow, veh/h	1781	1870	1585	1781	1739	111	1781	1316	470	1781	735	962
Grp Volume(v), veh/h	36	429	35	68	0	1080	106	0	209	94	0	314
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1850	1781	0	1786	1781	0	1697
Q Serve(g_s), s	0.9	14.7	1.1	1.8	0.0	68.0	5.0	0.0	13.1	5.0	0.0	20.0
Cycle Q Clear(g_c), s	0.9	14.7	1.1	1.8	0.0	68.0	5.0	0.0	13.1	5.0	0.0	20.0
Prop In Lane	1.00		1.00	1.00		0.06	1.00		0.26	1.00		0.57
Lane Grp Cap(c), veh/h	122	1089	923	553	0	1093	136	0	302	205	0	287
V/C Ratio(X)	0.30	0.39	0.04	0.12	0.00	0.99	0.78	0.00	0.69	0.46	0.00	1.10
Avail Cap(c_a), veh/h	145	1105	937	561	0	1093	136	0	302	205	0	287
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.0	13.4	10.6	9.9	0.0	23.8	43.3	0.0	46.3	40.1	0.0	49.2
Incr Delay (d2), s/veh	1.3	0.2	0.0	0.1	0.0	24.2	24.6	0.0	6.7	1.6	0.0	81.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	5.5	0.4	0.6	0.0	31.9	1.5	0.0	6.1	2.3	0.0	14.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.3	13.6	10.6	10.0	0.0	48.0	67.8	0.0	53.0	41.7	0.0	130.5
LnGrp LOS	C	B	B	A	A	D	E	A	D	D	A	F
Approach Vol, veh/h		500			1148			315			408	
Approach Delay, s/veh		14.6			45.8			58.0			110.0	
Approach LOS		B			D			E			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.5	74.0	10.0	25.0	8.5	75.0	10.0	25.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	70.0	5.0	20.0	5.0	70.0	5.0	20.0
Max Q Clear Time (g_c+I1), s	3.8	16.7	7.0	22.0	2.9	70.0	7.0	15.1
Green Ext Time (p_c), s	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.4

Intersection Summary	
HCM 6th Ctrl Delay	51.9
HCM 6th LOS	D

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	595	1000	4	1	0
Future Vol, veh/h	0	595	1000	4	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	607	1020	4	1	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1024	0	-	0	1629	1022
Stage 1	-	-	-	-	1022	-
Stage 2	-	-	-	-	607	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	678	-	-	-	112	287
Stage 1	-	-	-	-	347	-
Stage 2	-	-	-	-	544	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	678	-	-	-	112	287
Mov Cap-2 Maneuver	-	-	-	-	112	-
Stage 1	-	-	-	-	347	-
Stage 2	-	-	-	-	544	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	37.4
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	678	-	-	-	112
HCM Lane V/C Ratio	-	-	-	-	0.009
HCM Control Delay (s)	0	-	-	-	37.4
HCM Lane LOS	A	-	-	-	E
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	2.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	565	31	95	978	27	59
Future Vol, veh/h	565	31	95	978	27	59
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	90
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	601	33	101	1040	29	63

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	634	0	1860	618
Stage 1	-	-	-	-	618	-
Stage 2	-	-	-	-	1242	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	949	-	81	489
Stage 1	-	-	-	-	538	-
Stage 2	-	-	-	-	272	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	949	-	61	489
Mov Cap-2 Maneuver	-	-	-	-	61	-
Stage 1	-	-	-	-	538	-
Stage 2	-	-	-	-	203	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	43.2
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	61	489	-	-	949	-
HCM Lane V/C Ratio	0.471	0.128	-	-	0.106	-
HCM Control Delay (s)	108.3	13.4	-	-	9.2	0
HCM Lane LOS	F	B	-	-	A	A
HCM 95th %tile Q(veh)	1.8	0.4	-	-	0.4	-

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	0	1	49	1	5	0	67	8	5	113	1
Future Vol, veh/h	2	0	1	49	1	5	0	67	8	5	113	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	68	68	68	68	68	68	68	68	68	68	68	68
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	0	1	72	1	7	0	99	12	7	166	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	290	292	167	286	286	105	167	0	0	111	0	0
Stage 1	181	181	-	105	105	-	-	-	-	-	-	-
Stage 2	109	111	-	181	181	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	662	619	877	666	623	949	1411	-	-	1479	-	-
Stage 1	821	750	-	901	808	-	-	-	-	-	-	-
Stage 2	896	804	-	821	750	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	653	616	877	663	620	949	1411	-	-	1479	-	-
Mov Cap-2 Maneuver	653	616	-	663	620	-	-	-	-	-	-	-
Stage 1	821	746	-	901	808	-	-	-	-	-	-	-
Stage 2	887	804	-	816	746	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.1	11	0	0.3
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1411	-	-	714	681	1479	-	-
HCM Lane V/C Ratio	-	-	-	0.006	0.119	0.005	-	-
HCM Control Delay (s)	0	-	-	10.1	11	7.4	0	-
HCM Lane LOS	A	-	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.4	0	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	74	919	54	108	544	82	260	107	170
Future Volume (vph)	74	919	54	108	544	82	260	107	170
Turn Type	pm+pt	NA	Perm	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2		1	6	3	8	7	4
Permitted Phases	2		2	6		8		4	
Detector Phase	5	2	2	1	6	3	8	7	4
Switch Phase									
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	5.0	10.0	5.0	10.0
Minimum Split (s)	10.0	20.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
Total Split (s)	10.0	70.0	70.0	10.0	70.0	10.0	30.0	10.0	30.0
Total Split (%)	8.3%	58.3%	58.3%	8.3%	58.3%	8.3%	25.0%	8.3%	25.0%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Min	None	Min
Act Effct Green (s)	65.4	60.3	60.3	66.6	62.8	28.6	23.6	29.9	26.0
Actuated g/C Ratio	0.57	0.53	0.53	0.58	0.55	0.25	0.21	0.26	0.23
v/c Ratio	0.25	0.95	0.06	0.77	0.68	0.33	0.90	0.73	0.52
Control Delay	11.0	45.8	0.1	52.4	23.1	36.0	70.9	62.7	44.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.0	45.8	0.1	52.4	23.1	36.0	70.9	62.7	44.3
LOS	B	D	A	D	C	D	E	E	D
Approach Delay		41.0			27.2		64.0		50.4
Approach LOS		D			C		E		D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 114.2	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.95	
Intersection Signal Delay: 41.8	Intersection LOS: D
Intersection Capacity Utilization 95.2%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 1: E County Line Rd & SH 52

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	74	919	54	108	544	122	82	260	75	107	170	44
Future Volume (veh/h)	74	919	54	108	544	122	82	260	75	107	170	44
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	76	938	55	110	555	124	84	265	77	109	173	45
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	327	989	838	173	789	176	256	288	84	163	296	77
Arrive On Green	0.04	0.53	0.53	0.04	0.53	0.53	0.04	0.21	0.21	0.04	0.21	0.21
Sat Flow, veh/h	1781	1870	1585	1781	1480	331	1781	1393	405	1781	1431	372
Grp Volume(v), veh/h	76	938	55	110	0	679	84	0	342	109	0	218
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1811	1781	0	1798	1781	0	1803
Q Serve(g_s), s	2.2	53.8	1.9	3.2	0.0	31.8	4.2	0.0	21.1	5.0	0.0	12.4
Cycle Q Clear(g_c), s	2.2	53.8	1.9	3.2	0.0	31.8	4.2	0.0	21.1	5.0	0.0	12.4
Prop In Lane	1.00		1.00	1.00		0.18	1.00		0.23	1.00		0.21
Lane Grp Cap(c), veh/h	327	989	838	173	0	965	256	0	372	163	0	373
V/C Ratio(X)	0.23	0.95	0.07	0.64	0.00	0.70	0.33	0.00	0.92	0.67	0.00	0.58
Avail Cap(c_a), veh/h	334	1071	908	173	0	1037	256	0	396	163	0	397
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.8	25.3	13.1	26.0	0.0	19.8	34.1	0.0	44.1	37.8	0.0	40.6
Incr Delay (d2), s/veh	0.4	16.0	0.0	7.5	0.0	2.0	0.7	0.0	25.5	9.9	0.0	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	24.8	0.6	1.7	0.0	12.2	1.8	0.0	11.6	2.7	0.0	5.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	16.2	41.3	13.1	33.5	0.0	21.8	34.9	0.0	69.6	47.7	0.0	42.6
LnGrp LOS	B	D	B	C	A	C	C	A	E	D	A	D
Approach Vol, veh/h		1069			789			426			327	
Approach Delay, s/veh		38.0			23.5			62.7			44.3	
Approach LOS		D			C			E			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.0	65.0	10.0	28.5	9.5	65.5	10.0	28.5
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	65.0	5.0	25.0	5.0	65.0	5.0	25.0
Max Q Clear Time (g_c+I1), s	5.2	55.8	6.2	14.4	4.2	33.8	7.0	23.1
Green Ext Time (p_c), s	0.0	4.2	0.0	0.7	0.0	4.4	0.0	0.3

Intersection Summary	
HCM 6th Ctrl Delay	38.4
HCM 6th LOS	D

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	972	680	2	0	2
Future Vol, veh/h	1	972	680	2	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	1002	701	2	0	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	703	0	-	0	1706	702
Stage 1	-	-	-	-	702	-
Stage 2	-	-	-	-	1004	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	895	-	-	-	100	438
Stage 1	-	-	-	-	491	-
Stage 2	-	-	-	-	354	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	895	-	-	-	100	438
Mov Cap-2 Maneuver	-	-	-	-	100	-
Stage 1	-	-	-	-	490	-
Stage 2	-	-	-	-	354	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	13.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	895	-	-	-	438
HCM Lane V/C Ratio	0.001	-	-	-	0.005
HCM Control Delay (s)	9	0	-	-	13.3
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	3.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	936	36	63	642	42	71
Future Vol, veh/h	936	36	63	642	42	71
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	90
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	965	37	65	662	43	73

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1002	0	1776	984
Stage 1	-	-	-	-	984	-
Stage 2	-	-	-	-	792	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	691	-	91	301
Stage 1	-	-	-	-	362	-
Stage 2	-	-	-	-	446	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	691	-	77	301
Mov Cap-2 Maneuver	-	-	-	-	77	-
Stage 1	-	-	-	-	362	-
Stage 2	-	-	-	-	380	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1	50.2
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	77	301	-	-	691	-
HCM Lane V/C Ratio	0.562	0.243	-	-	0.094	-
HCM Control Delay (s)	100	20.8	-	-	10.8	0
HCM Lane LOS	F	C	-	-	B	A
HCM 95th %tile Q(veh)	2.4	0.9	-	-	0.3	-

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	1	0	32	0	8	0	94	45	5	88	0
Future Vol, veh/h	0	1	0	32	0	8	0	94	45	5	88	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	1	0	34	0	9	0	101	48	5	95	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	235	254	95	231	230	125	95	0	0	149	0	0
Stage 1	105	105	-	125	125	-	-	-	-	-	-	-
Stage 2	130	149	-	106	105	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	720	650	962	724	670	926	1499	-	-	1432	-	-
Stage 1	901	808	-	879	792	-	-	-	-	-	-	-
Stage 2	874	774	-	900	808	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	711	647	962	721	667	926	1499	-	-	1432	-	-
Mov Cap-2 Maneuver	711	647	-	721	667	-	-	-	-	-	-	-
Stage 1	901	805	-	879	792	-	-	-	-	-	-	-
Stage 2	866	774	-	895	805	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.6	10.1	0	0.4
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1499	-	-	647	754	1432	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.057	0.004	-	-
HCM Control Delay (s)	0	-	-	10.6	10.1	7.5	0	-
HCM Lane LOS	A	-	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.2	0	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	39	540	38	74	1025	115	167	102	147
Future Volume (vph)	39	540	38	74	1025	115	167	102	147
Turn Type	pm+pt	NA	Perm	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2		1	6	3	8	7	4
Permitted Phases	2		2	6		8		4	
Detector Phase	5	2	2	1	6	3	8	7	4
Switch Phase									
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	5.0	10.0	5.0	10.0
Minimum Split (s)	10.0	20.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
Total Split (s)	10.0	70.0	70.0	10.0	70.0	10.0	30.0	10.0	30.0
Total Split (%)	8.3%	58.3%	58.3%	8.3%	58.3%	8.3%	25.0%	8.3%	25.0%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Min	None	Min
Act Effct Green (s)	69.1	65.2	65.2	69.1	65.2	28.8	23.7	28.8	23.7
Actuated g/C Ratio	0.59	0.56	0.56	0.59	0.56	0.25	0.20	0.25	0.20
v/c Ratio	0.30	0.55	0.04	0.20	1.12	0.86	0.64	0.50	0.93
Control Delay	14.4	19.7	0.1	10.1	93.5	84.8	49.2	42.3	71.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	19.7	0.1	10.1	93.5	84.8	49.2	42.3	71.0
LOS	B	B	A	B	F	F	D	D	E
Approach Delay		18.2			88.2		61.2		64.4
Approach LOS		B			F		E		E

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 116.8	
Natural Cycle: 150	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.12	
Intersection Signal Delay: 63.7	Intersection LOS: E
Intersection Capacity Utilization 99.9%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 1: E County Line Rd & SH 52

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	39	540	38	74	1025	71	115	167	59	102	147	193
Future Volume (veh/h)	39	540	38	74	1025	71	115	167	59	102	147	193
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	41	568	40	78	1079	75	121	176	62	107	155	203
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	116	1010	856	406	947	66	136	278	98	238	155	203
Arrive On Green	0.03	0.54	0.54	0.04	0.55	0.55	0.04	0.21	0.21	0.04	0.21	0.21
Sat Flow, veh/h	1781	1870	1585	1781	1729	120	1781	1321	465	1781	735	962
Grp Volume(v), veh/h	41	568	40	78	0	1154	121	0	238	107	0	358
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1849	1781	0	1787	1781	0	1697
Q Serve(g_s), s	1.2	23.8	1.4	2.3	0.0	65.0	5.0	0.0	14.4	5.0	0.0	25.0
Cycle Q Clear(g_c), s	1.2	23.8	1.4	2.3	0.0	65.0	5.0	0.0	14.4	5.0	0.0	25.0
Prop In Lane	1.00		1.00	1.00		0.06	1.00		0.26	1.00		0.57
Lane Grp Cap(c), veh/h	116	1010	856	406	0	1012	136	0	376	238	0	357
V/C Ratio(X)	0.35	0.56	0.05	0.19	0.00	1.14	0.89	0.00	0.63	0.45	0.00	1.00
Avail Cap(c_a), veh/h	136	1024	868	411	0	1012	136	0	376	238	0	357
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	28.5	18.0	12.9	13.7	0.0	26.9	42.3	0.0	42.7	37.6	0.0	46.9
Incr Delay (d2), s/veh	1.8	0.7	0.0	0.2	0.0	75.1	46.5	0.0	3.4	1.3	0.0	48.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	9.3	0.5	0.8	0.0	45.6	2.8	0.0	6.5	2.5	0.0	14.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.3	18.7	12.9	13.9	0.0	102.0	88.8	0.0	46.1	39.0	0.0	94.9
LnGrp LOS	C	B	B	B	A	F	F	A	D	D	A	F
Approach Vol, veh/h		649			1232			359			465	
Approach Delay, s/veh		19.1			96.4			60.5			82.0	
Approach LOS		B			F			E			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.6	69.1	10.0	30.0	8.7	70.0	10.0	30.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	65.0	5.0	25.0	5.0	65.0	5.0	25.0
Max Q Clear Time (g_c+I1), s	4.3	25.8	7.0	27.0	3.2	67.0	7.0	16.4
Green Ext Time (p_c), s	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.7

Intersection Summary	
HCM 6th Ctrl Delay	70.6
HCM 6th LOS	E

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	700	1170	4	1	1
Future Vol, veh/h	1	700	1170	4	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	714	1194	4	1	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1198	0	-	0	1912	1196
Stage 1	-	-	-	-	1196	-
Stage 2	-	-	-	-	716	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	583	-	-	-	75	227
Stage 1	-	-	-	-	287	-
Stage 2	-	-	-	-	484	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	583	-	-	-	75	227
Mov Cap-2 Maneuver	-	-	-	-	75	-
Stage 1	-	-	-	-	286	-
Stage 2	-	-	-	-	484	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	37.4
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	583	-	-	-	113
HCM Lane V/C Ratio	0.002	-	-	-	0.018
HCM Control Delay (s)	11.2	0	-	-	37.4
HCM Lane LOS	B	A	-	-	E
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Intersection Delay, s/veh	7.8
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	750	1323	120	95
Demand Flow Rate, veh/h	766	1349	122	97
Vehicles Circulating, veh/h	177	78	766	1362
Vehicles Exiting, veh/h	1282	738	177	65
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	6.2	8.5	6.4	11.6
Approach LOS	A	A	A	B

Lane	Left	Right	Left	Right	Left	Bypass	Left
Designated Moves	LT	TR	LT	TR	LT	R	LTR
Assumed Moves	LT	TR	LT	TR	LT	R	LTR
RT Channelized						Yield	
Lane Util	0.470	0.530	0.470	0.530	1.000		1.000
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535		2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.328	72	4.328
Entry Flow, veh/h	360	406	634	715	50	650	97
Cap Entry Lane, veh/h	1147	1222	1256	1329	740	0.980	446
Entry HV Adj Factor	0.980	0.979	0.981	0.981	0.974	71	0.975
Flow Entry, veh/h	353	398	622	701	49	637	95
Cap Entry, veh/h	1124	1197	1232	1304	721	0.111	435
V/C Ratio	0.314	0.332	0.505	0.538	0.068	6.9	0.217
Control Delay, s/veh	6.2	6.2	8.4	8.6	5.7	A	11.6
LOS	A	A	A	A	A	0	B
95th %tile Queue, veh	1	1	3	3	0		1

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	1	1	56	1	6	1	105	9	6	155	1
Future Vol, veh/h	2	1	1	56	1	6	1	105	9	6	155	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	68	68	68	92	92	92	68	92	92	92	92	68
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	1	1	61	1	7	1	114	10	7	168	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	308	309	169	305	304	119	169	0	0	124	0	0
Stage 1	183	183	-	121	121	-	-	-	-	-	-	-
Stage 2	125	126	-	184	183	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	644	605	875	647	609	933	1409	-	-	1463	-	-
Stage 1	819	748	-	883	796	-	-	-	-	-	-	-
Stage 2	879	792	-	818	748	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	636	601	875	642	605	933	1409	-	-	1463	-	-
Mov Cap-2 Maneuver	636	601	-	642	605	-	-	-	-	-	-	-
Stage 1	818	744	-	882	795	-	-	-	-	-	-	-
Stage 2	871	791	-	811	744	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.4	11.1	0.1	0.3
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1409	-	-	672	661	1463	-	-
HCM Lane V/C Ratio	0.001	-	-	0.009	0.104	0.004	-	-
HCM Control Delay (s)	7.6	0	-	10.4	11.1	7.5	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.3	0	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	85	950	32	123	560	94	297	122	194
Future Volume (vph)	85	950	32	123	560	94	297	122	194
Turn Type	pm+pt	NA	Perm	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2		1	6	3	8	7	4
Permitted Phases	2		2	6		8		4	
Detector Phase	5	2	2	1	6	3	8	7	4
Switch Phase									
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	5.0	10.0	5.0	10.0
Minimum Split (s)	10.0	20.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
Total Split (s)	10.0	65.0	65.0	15.0	70.0	10.0	30.0	10.0	30.0
Total Split (%)	8.3%	54.2%	54.2%	12.5%	58.3%	8.3%	25.0%	8.3%	25.0%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Min	None	Min
Act Effct Green (s)	65.0	60.0	60.0	73.4	65.9	30.0	25.0	30.0	25.0
Actuated g/C Ratio	0.55	0.50	0.50	0.62	0.55	0.25	0.21	0.25	0.21
v/c Ratio	0.30	1.03	0.04	0.65	0.71	0.45	1.01	0.91	0.64
Control Delay	12.2	67.5	0.1	35.9	24.4	40.3	94.5	93.6	50.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.2	67.5	0.1	35.9	24.4	40.3	94.5	93.6	50.0
LOS	B	E	A	D	C	D	F	F	D
Approach Delay		61.1			26.1		83.8		64.5
Approach LOS		E			C		F		E

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 118.9	
Natural Cycle: 110	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.03	
Intersection Signal Delay: 55.0	Intersection LOS: D
Intersection Capacity Utilization 101.1%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 1: E County Line Rd & SH 52

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	85	950	32	123	560	139	94	297	86	122	194	50
Future Volume (veh/h)	85	950	32	123	560	139	94	297	86	122	194	50
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	87	969	33	126	571	142	96	303	88	124	198	51
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	297	967	820	154	764	190	240	300	87	139	309	80
Arrive On Green	0.04	0.52	0.52	0.05	0.53	0.53	0.04	0.22	0.22	0.04	0.22	0.22
Sat Flow, veh/h	1781	1870	1585	1781	1446	360	1781	1393	405	1781	1434	369
Grp Volume(v), veh/h	87	969	33	126	0	713	96	0	391	124	0	249
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1806	1781	0	1798	1781	0	1804
Q Serve(g_s), s	2.6	60.0	1.2	4.0	0.0	35.7	4.9	0.0	25.0	5.0	0.0	14.6
Cycle Q Clear(g_c), s	2.6	60.0	1.2	4.0	0.0	35.7	4.9	0.0	25.0	5.0	0.0	14.6
Prop In Lane	1.00		1.00	1.00		0.20	1.00		0.23	1.00		0.20
Lane Grp Cap(c), veh/h	297	967	820	154	0	954	240	0	387	139	0	389
V/C Ratio(X)	0.29	1.00	0.04	0.82	0.00	0.75	0.40	0.00	1.01	0.89	0.00	0.64
Avail Cap(c_a), veh/h	302	967	820	216	0	1012	240	0	387	139	0	389
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	17.7	28.0	13.8	28.4	0.0	21.3	34.7	0.0	45.5	41.0	0.0	41.4
Incr Delay (d2), s/veh	0.5	29.3	0.0	15.3	0.0	2.9	1.1	0.0	48.1	46.1	0.0	3.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	31.0	0.4	2.2	0.0	13.9	2.1	0.0	15.8	2.8	0.0	6.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	18.2	57.4	13.8	43.7	0.0	24.2	35.8	0.0	93.6	87.0	0.0	44.9
LnGrp LOS	B	F	B	D	A	C	D	A	F	F	A	D
Approach Vol, veh/h		1089			839			487			373	
Approach Delay, s/veh		52.9			27.2			82.2			58.9	
Approach LOS		D			C			F			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.0	65.0	10.0	30.0	9.7	66.3	10.0	30.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	60.0	5.0	25.0	5.0	65.0	5.0	25.0
Max Q Clear Time (g_c+I1), s	6.0	62.0	6.9	16.6	4.6	37.7	7.0	27.0
Green Ext Time (p_c), s	0.1	0.0	0.0	0.7	0.0	4.6	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	51.1
HCM 6th LOS	D

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	1160	820	2	1	2
Future Vol, veh/h	1	1160	820	2	1	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	1196	845	2	1	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	847	0	-	0	2044	846
Stage 1	-	-	-	-	846	-
Stage 2	-	-	-	-	1198	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	790	-	-	-	62	362
Stage 1	-	-	-	-	421	-
Stage 2	-	-	-	-	286	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	790	-	-	-	62	362
Mov Cap-2 Maneuver	-	-	-	-	62	-
Stage 1	-	-	-	-	419	-
Stage 2	-	-	-	-	286	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	31.5
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	790	-	-	-	139
HCM Lane V/C Ratio	0.001	-	-	-	0.022
HCM Control Delay (s)	9.6	0	-	-	31.5
HCM Lane LOS	A	A	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Intersection Delay, s/veh	8.1
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	1210	879	164	134
Demand Flow Rate, veh/h	1234	896	168	137
Vehicles Circulating, veh/h	165	148	1254	898
Vehicles Exiting, veh/h	870	1188	145	146
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.9	6.6	11.1	8.0
Approach LOS	A	A	B	A

Lane	Left	Right	Left	Right	Left	Bypass	Left
Designated Moves	LT	TR	LT	TR	LT	R	LTR
Assumed Moves	LT	TR	LT	TR	LT	R	LTR
RT Channelized						Yield	
Lane Util	0.470	0.530	0.470	0.530	1.000		1.000
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535		2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.328	86	4.328
Entry Flow, veh/h	580	654	421	475	82	411	137
Cap Entry Lane, veh/h	1160	1234	1178	1252	489	0.980	662
Entry HV Adj Factor	0.980	0.981	0.981	0.981	0.980	84	0.982
Flow Entry, veh/h	569	641	413	466	80	403	134
Cap Entry, veh/h	1137	1210	1156	1228	479	0.209	650
V/C Ratio	0.500	0.530	0.357	0.379	0.168	12.3	0.207
Control Delay, s/veh	8.8	8.9	6.6	6.6	9.9	B	8.0
LOS	A	A	A	A	A	1	A
95th %tile Queue, veh	3	3	2	2	1		1

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	1	1	37	1	9	1	145	51	6	130	1
Future Vol, veh/h	1	1	1	37	1	9	1	145	51	6	130	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	1	1	40	1	10	1	156	55	6	140	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	344	366	141	340	339	184	141	0	0	211	0	0
Stage 1	153	153	-	186	186	-	-	-	-	-	-	-
Stage 2	191	213	-	154	153	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	610	562	907	614	582	858	1442	-	-	1360	-	-
Stage 1	849	771	-	816	746	-	-	-	-	-	-	-
Stage 2	811	726	-	848	771	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	600	559	907	610	579	858	1442	-	-	1360	-	-
Mov Cap-2 Maneuver	600	559	-	610	579	-	-	-	-	-	-	-
Stage 1	848	767	-	815	745	-	-	-	-	-	-	-
Stage 2	800	725	-	842	767	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.5	11.1	0	0.3
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1442	-	-	658	645	1360	-	-
HCM Lane V/C Ratio	0.001	-	-	0.005	0.078	0.005	-	-
HCM Control Delay (s)	7.5	0	-	10.5	11.1	7.7	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.3	0	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	39	576	38	74	1105	115	167	111	147
Future Volume (vph)	39	576	38	74	1105	115	167	111	147
Turn Type	pm+pt	NA	Perm	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2		1	6	3	8	7	4
Permitted Phases	2		2	6		8		4	
Detector Phase	5	2	2	1	6	3	8	7	4
Switch Phase									
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	5.0	10.0	5.0	10.0
Minimum Split (s)	10.0	20.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
Total Split (s)	10.0	70.0	70.0	10.0	70.0	10.0	30.0	10.0	30.0
Total Split (%)	8.3%	58.3%	58.3%	8.3%	58.3%	8.3%	25.0%	8.3%	25.0%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Min	None	Min
Act Effct Green (s)	69.1	65.2	65.2	69.1	65.2	28.8	23.7	28.8	23.7
Actuated g/C Ratio	0.59	0.56	0.56	0.59	0.56	0.25	0.20	0.25	0.20
v/c Ratio	0.30	0.58	0.04	0.21	1.22	0.86	0.64	0.54	0.93
Control Delay	14.4	20.6	0.1	10.3	134.5	84.8	49.2	44.5	71.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	20.6	0.1	10.3	134.5	84.8	49.2	44.5	71.0
LOS	B	C	A	B	F	F	D	D	E
Approach Delay		19.0			127.3		61.2		64.5
Approach LOS		B			F		E		E

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 116.8	
Natural Cycle: 150	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.22	
Intersection Signal Delay: 82.5	Intersection LOS: F
Intersection Capacity Utilization 102.0%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 1: E County Line Rd & SH 52

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	39	576	38	74	1105	90	115	167	59	111	147	193
Future Volume (veh/h)	39	576	38	74	1105	90	115	167	59	111	147	193
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	41	606	40	78	1163	95	121	176	62	117	155	203
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	116	1010	856	381	934	76	136	278	98	238	155	203
Arrive On Green	0.03	0.54	0.54	0.04	0.55	0.55	0.04	0.21	0.21	0.04	0.21	0.21
Sat Flow, veh/h	1781	1870	1585	1781	1706	139	1781	1321	465	1781	735	962
Grp Volume(v), veh/h	41	606	40	78	0	1258	121	0	238	117	0	358
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1845	1781	0	1787	1781	0	1697
Q Serve(g_s), s	1.2	26.2	1.4	2.3	0.0	65.0	5.0	0.0	14.4	5.0	0.0	25.0
Cycle Q Clear(g_c), s	1.2	26.2	1.4	2.3	0.0	65.0	5.0	0.0	14.4	5.0	0.0	25.0
Prop In Lane	1.00		1.00	1.00		0.08	1.00		0.26	1.00		0.57
Lane Grp Cap(c), veh/h	116	1010	856	381	0	1010	136	0	376	238	0	357
V/C Ratio(X)	0.35	0.60	0.05	0.20	0.00	1.25	0.89	0.00	0.63	0.49	0.00	1.00
Avail Cap(c_a), veh/h	136	1024	868	386	0	1010	136	0	376	238	0	357
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	28.5	18.6	12.9	14.2	0.0	26.9	42.3	0.0	42.7	38.9	0.0	46.9
Incr Delay (d2), s/veh	1.8	1.0	0.0	0.3	0.0	118.7	46.5	0.0	3.4	1.6	0.0	48.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	10.3	0.5	0.8	0.0	57.7	2.8	0.0	6.5	0.8	0.0	14.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.3	19.5	12.9	14.5	0.0	145.5	88.8	0.0	46.1	40.5	0.0	94.9
LnGrp LOS	C	B	B	B	A	F	F	A	D	D	A	F
Approach Vol, veh/h		687			1336			359			475	
Approach Delay, s/veh		19.8			137.9			60.5			81.5	
Approach LOS		B			F			E			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.6	69.1	10.0	30.0	8.7	70.0	10.0	30.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	65.0	5.0	25.0	5.0	65.0	5.0	25.0
Max Q Clear Time (g_c+I1), s	4.3	28.2	7.0	27.0	3.2	67.0	7.0	16.4
Green Ext Time (p_c), s	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.7

Intersection Summary	
HCM 6th Ctrl Delay	90.4
HCM 6th LOS	F

Intersection	
Int Delay, s/veh	19.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	724	21	6	1211	4	58	0	17	1	0	1
Future Vol, veh/h	1	724	21	6	1211	4	58	0	17	1	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	200	-	200	200	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	98	98	85	85	98	98	85	85	85	98	85	98
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	739	25	7	1236	4	68	0	20	1	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1240	0	0	764	0	0	1994	1995	739	2016	2018	1238
Stage 1	-	-	-	-	-	-	741	741	-	1252	1252	-
Stage 2	-	-	-	-	-	-	1253	1254	-	764	766	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	562	-	-	849	-	-	~ 45	60	417	43	58	214
Stage 1	-	-	-	-	-	-	408	423	-	211	244	-
Stage 2	-	-	-	-	-	-	211	243	-	396	412	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	562	-	-	849	-	-	~ 44	59	417	41	57	214
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 44	59	-	41	57	-
Stage 1	-	-	-	-	-	-	407	422	-	211	242	-
Stage 2	-	-	-	-	-	-	208	241	-	376	411	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.1	$ 462.8	58.8
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	55	562	-	-	849	-	-	69
HCM Lane V/C Ratio	1.604	0.002	-	-	0.008	-	-	0.03
HCM Control Delay (s)	$ 462.8	11.4	-	-	9.3	-	-	58.8
HCM Lane LOS	F	B	-	-	A	-	-	F
HCM 95th %tile Q(veh)	8.2	0	-	-	0	-	-	0.1

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Intersection Delay, s/veh	8.8
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	794	1383	282	95
Demand Flow Rate, veh/h	810	1410	288	97
Vehicles Circulating, veh/h	231	123	784	1468
Vehicles Exiting, veh/h	1334	756	257	65
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	6.9	9.6	8.7	13.0
Approach LOS	A	A	A	B

Lane	Left	Right	Left	Right	Left	Bypass	Left
Designated Moves	LT	TR	LT	TR	LT	R	LTR
Assumed Moves	LT	TR	LT	TR	LT	R	LTR
RT Channelized						Yield	
Lane Util	0.470	0.530	0.470	0.530	1.000		1.000
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535		2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.328	193	4.328
Entry Flow, veh/h	381	429	663	747	95	638	97
Cap Entry Lane, veh/h	1091	1167	1205	1279	729	0.980	408
Entry HV Adj Factor	0.979	0.981	0.981	0.981	0.976	189	0.975
Flow Entry, veh/h	373	421	650	733	93	626	95
Cap Entry, veh/h	1069	1145	1182	1255	711	0.302	398
V/C Ratio	0.349	0.368	0.550	0.584	0.130	9.7	0.238
Control Delay, s/veh	6.9	6.8	9.5	9.7	6.5	A	13.0
LOS	A	A	A	A	A	1	B
95th %tile Queue, veh	2	2	3	4	0		1

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	1	1	56	1	21	1	188	9	29	274	1
Future Vol, veh/h	2	1	1	56	1	21	1	188	9	29	274	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	68	68	68	92	92	92	68	92	92	92	92	68
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	1	1	61	1	23	1	204	10	32	298	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	586	579	299	575	574	209	299	0	0	214	0	0
Stage 1	363	363	-	211	211	-	-	-	-	-	-	-
Stage 2	223	216	-	364	363	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	422	426	741	429	429	831	1262	-	-	1356	-	-
Stage 1	656	625	-	791	728	-	-	-	-	-	-	-
Stage 2	780	724	-	655	625	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	400	414	741	417	417	831	1262	-	-	1356	-	-
Mov Cap-2 Maneuver	400	414	-	417	417	-	-	-	-	-	-	-
Stage 1	655	608	-	790	727	-	-	-	-	-	-	-
Stage 2	757	723	-	634	608	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13	14.1	0.1	0.7
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1262	-	-	456	482	1356	-	-
HCM Lane V/C Ratio	0.001	-	-	0.013	0.176	0.023	-	-
HCM Control Delay (s)	7.9	0	-	13	14.1	7.7	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.6	0.1	-	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	64	17	6	203	211	23
Future Vol, veh/h	64	17	6	203	211	23
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	100	-	-	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	70	18	7	221	229	25

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	464	229	254	0	-	0
Stage 1	229	-	-	-	-	-
Stage 2	235	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	556	810	1311	-	-	-
Stage 1	809	-	-	-	-	-
Stage 2	804	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	553	810	1311	-	-	-
Mov Cap-2 Maneuver	553	-	-	-	-	-
Stage 1	805	-	-	-	-	-
Stage 2	804	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.8	0.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1311	-	553	810	-	-
HCM Lane V/C Ratio	0.005	-	0.126	0.023	-	-
HCM Control Delay (s)	7.8	-	12.4	9.5	-	-
HCM Lane LOS	A	-	B	A	-	-
HCM 95th %tile Q(veh)	0	-	0.4	0.1	-	-

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	88	125	92	121	177	51
Future Vol, veh/h	88	125	92	121	177	51
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	100	-	-	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	96	136	100	132	192	55

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	524	192	247	0	-	0
Stage 1	192	-	-	-	-	-
Stage 2	332	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	514	850	1319	-	-	-
Stage 1	841	-	-	-	-	-
Stage 2	727	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	475	850	1319	-	-	-
Mov Cap-2 Maneuver	475	-	-	-	-	-
Stage 1	777	-	-	-	-	-
Stage 2	727	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.9	3.4	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1319	-	475	850	-	-
HCM Lane V/C Ratio	0.076	-	0.201	0.16	-	-
HCM Control Delay (s)	8	-	14.5	10	-	-
HCM Lane LOS	A	-	B	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.7	0.6	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	85	1025	32	123	608	94	297	141	194
Future Volume (vph)	85	1025	32	123	608	94	297	141	194
Turn Type	pm+pt	NA	Perm	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2		1	6	3	8	7	4
Permitted Phases	2		2	6		8		4	
Detector Phase	5	2	2	1	6	3	8	7	4
Switch Phase									
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	5.0	10.0	5.0	10.0
Minimum Split (s)	10.0	20.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
Total Split (s)	10.0	65.0	65.0	15.0	70.0	10.0	30.0	10.0	30.0
Total Split (%)	8.3%	54.2%	54.2%	12.5%	58.3%	8.3%	25.0%	8.3%	25.0%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Min	None	Min
Act Effct Green (s)	65.0	60.0	60.0	73.4	65.9	30.0	25.0	30.0	25.0
Actuated g/C Ratio	0.55	0.50	0.50	0.62	0.55	0.25	0.21	0.25	0.21
v/c Ratio	0.35	1.11	0.04	0.65	0.77	0.45	1.01	1.05	0.64
Control Delay	13.6	94.8	0.1	35.9	27.1	40.3	94.5	130.1	50.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.6	94.8	0.1	35.9	27.1	40.3	94.5	130.1	50.0
LOS	B	F	A	D	C	D	F	F	D
Approach Delay		86.1			28.4		83.8		79.3
Approach LOS		F			C		F		E

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 118.9	
Natural Cycle: 120	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.11	
Intersection Signal Delay: 67.2	Intersection LOS: E
Intersection Capacity Utilization 106.1%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 1: E County Line Rd & SH 52

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	85	1025	32	123	608	152	94	297	86	141	194	50
Future Volume (veh/h)	85	1025	32	123	608	152	94	297	86	141	194	50
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	87	1046	33	126	620	155	96	303	88	144	198	51
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	255	967	820	154	763	191	240	300	87	139	309	80
Arrive On Green	0.04	0.52	0.52	0.05	0.53	0.53	0.04	0.22	0.22	0.04	0.22	0.22
Sat Flow, veh/h	1781	1870	1585	1781	1444	361	1781	1393	405	1781	1434	369
Grp Volume(v), veh/h	87	1046	33	126	0	775	96	0	391	144	0	249
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1805	1781	0	1798	1781	0	1804
Q Serve(g_s), s	2.6	60.0	1.2	4.0	0.0	41.1	4.9	0.0	25.0	5.0	0.0	14.6
Cycle Q Clear(g_c), s	2.6	60.0	1.2	4.0	0.0	41.1	4.9	0.0	25.0	5.0	0.0	14.6
Prop In Lane	1.00		1.00	1.00		0.20	1.00		0.23	1.00		0.20
Lane Grp Cap(c), veh/h	255	967	820	154	0	954	240	0	387	139	0	389
V/C Ratio(X)	0.34	1.08	0.04	0.82	0.00	0.81	0.40	0.00	1.01	1.04	0.00	0.64
Avail Cap(c_a), veh/h	260	967	820	216	0	1012	240	0	387	139	0	389
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	19.7	28.0	13.8	28.4	0.0	22.6	34.7	0.0	45.5	42.8	0.0	41.4
Incr Delay (d2), s/veh	0.8	53.5	0.0	15.3	0.0	4.9	1.1	0.0	48.1	86.6	0.0	3.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	37.5	0.4	2.2	0.0	16.5	2.1	0.0	15.8	4.8	0.0	6.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.5	81.5	13.8	43.7	0.0	27.5	35.8	0.0	93.6	129.4	0.0	44.9
LnGrp LOS	C	F	B	D	A	C	D	A	F	F	A	D
Approach Vol, veh/h		1166			901			487			393	
Approach Delay, s/veh		75.0			29.7			82.2			75.9	
Approach LOS		E			C			F			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.0	65.0	10.0	30.0	9.7	66.3	10.0	30.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	60.0	5.0	25.0	5.0	65.0	5.0	25.0
Max Q Clear Time (g_c+I1), s	6.0	62.0	6.9	16.6	4.6	43.1	7.0	27.0
Green Ext Time (p_c), s	0.1	0.0	0.0	0.7	0.0	4.9	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	62.5
HCM 6th LOS	E

Intersection	
Int Delay, s/veh	11.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	1193	61	18	842	2	39	0	12	1	0	2
Future Vol, veh/h	1	1193	61	18	842	2	39	0	12	1	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	200	-	200	200	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	85	85	97	97	85	85	85	97	85	97
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	1230	72	21	868	2	46	0	14	1	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	870	0	0	1302	0	0	2144	2144	1230	2186	2215	869
Stage 1	-	-	-	-	-	-	1232	1232	-	911	911	-
Stage 2	-	-	-	-	-	-	912	912	-	1275	1304	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	775	-	-	532	-	-	~ 35	49	217	33	44	351
Stage 1	-	-	-	-	-	-	217	249	-	328	353	-
Stage 2	-	-	-	-	-	-	328	353	-	205	230	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	775	-	-	532	-	-	~ 34	47	217	30	42	351
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 34	47	-	30	42	-
Stage 1	-	-	-	-	-	-	217	249	-	328	339	-
Stage 2	-	-	-	-	-	-	313	339	-	191	230	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	$ 440.9	53.7
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	42	775	-	-	532	-	-	77
HCM Lane V/C Ratio	1.429	0.001	-	-	0.04	-	-	0.04
HCM Control Delay (s)	$ 440.9	9.7	-	-	12	-	-	53.7
HCM Lane LOS	F	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	6	0	-	-	0.1	-	-	0.1

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Intersection Delay, s/veh	10.0
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	1256	1005	258	134
Demand Flow Rate, veh/h	1281	1026	263	137
Vehicles Circulating, veh/h	276	171	1266	1051
Vehicles Exiting, veh/h	912	1200	291	146
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	11.1	7.6	14.3	9.4
Approach LOS	B	A	B	A

Lane	Left	Right	Left	Right	Left	Bypass	Left
Designated Moves	LT	TR	LT	TR	LT	R	LTR
Assumed Moves	LT	TR	LT	TR	LT	R	LTR
RT Channelized						Yield	
Lane Util	0.470	0.530	0.470	0.530	1.000		1.000
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535		2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.328	158	4.328
Entry Flow, veh/h	602	679	482	544	105	406	137
Cap Entry Lane, veh/h	1047	1123	1153	1228	484	0.980	581
Entry HV Adj Factor	0.980	0.980	0.980	0.980	0.985	155	0.982
Flow Entry, veh/h	590	666	473	533	103	398	134
Cap Entry, veh/h	1027	1101	1131	1203	477	0.390	570
V/C Ratio	0.575	0.605	0.418	0.443	0.217	16.7	0.236
Control Delay, s/veh	11.0	11.2	7.5	7.6	10.7	C	9.4
LOS	B	B	A	A	B	2	A
95th %tile Queue, veh	4	4	2	2	1		1

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	1	1	37	1	26	1	231	51	18	191	1
Future Vol, veh/h	1	1	1	37	1	26	1	231	51	18	191	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	1	1	40	1	28	1	248	55	19	205	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	536	549	206	523	522	276	206	0	0	303	0	0
Stage 1	244	244	-	278	278	-	-	-	-	-	-	-
Stage 2	292	305	-	245	244	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	455	443	835	465	459	763	1365	-	-	1258	-	-
Stage 1	760	704	-	728	680	-	-	-	-	-	-	-
Stage 2	716	662	-	759	704	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	431	435	835	457	451	763	1365	-	-	1258	-	-
Mov Cap-2 Maneuver	431	435	-	457	451	-	-	-	-	-	-	-
Stage 1	759	692	-	727	679	-	-	-	-	-	-	-
Stage 2	688	661	-	744	692	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12	12.5	0	0.7
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1365	-	-	516	546	1258	-	-
HCM Lane V/C Ratio	0.001	-	-	0.006	0.126	0.015	-	-
HCM Control Delay (s)	7.6	0	-	12	12.5	7.9	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.4	0	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	42	12	18	204	206	67
Future Vol, veh/h	42	12	18	204	206	67
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	100	-	-	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	46	13	20	222	224	73

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	486	224	297	0	-	0
Stage 1	224	-	-	-	-	-
Stage 2	262	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	540	815	1264	-	-	-
Stage 1	813	-	-	-	-	-
Stage 2	782	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	531	815	1264	-	-	-
Mov Cap-2 Maneuver	531	-	-	-	-	-
Stage 1	800	-	-	-	-	-
Stage 2	782	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.8	0.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1264	-	531	815	-	-
HCM Lane V/C Ratio	0.015	-	0.086	0.016	-	-
HCM Control Delay (s)	7.9	-	12.4	9.5	-	-
HCM Lane LOS	A	-	B	A	-	-
HCM 95th %tile Q(veh)	0	-	0.3	0	-	-

Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	49	61	85	173	147	71
Future Vol, veh/h	49	61	85	173	147	71
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	100	-	-	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	53	66	92	188	160	77

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	532	160	237	0	-	0
Stage 1	160	-	-	-	-	-
Stage 2	372	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	508	885	1330	-	-	-
Stage 1	869	-	-	-	-	-
Stage 2	697	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	473	885	1330	-	-	-
Mov Cap-2 Maneuver	473	-	-	-	-	-
Stage 1	809	-	-	-	-	-
Stage 2	697	-	-	-	-	-

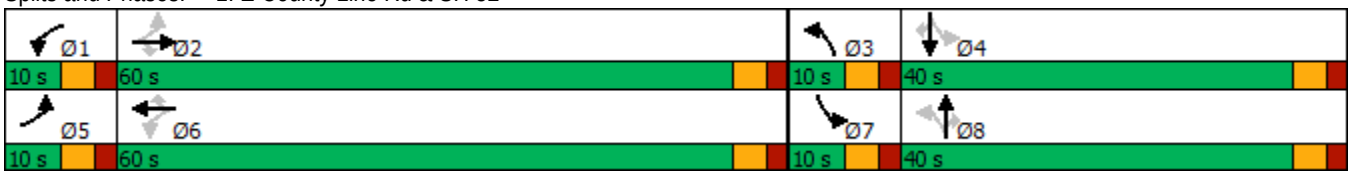
Approach	EB	NB	SB
HCM Control Delay, s	11.3	2.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1330	-	473	885	-	-
HCM Lane V/C Ratio	0.069	-	0.113	0.075	-	-
HCM Control Delay (s)	7.9	-	13.6	9.4	-	-
HCM Lane LOS	A	-	B	A	-	-
HCM 95th %tile Q(veh)	0.2	-	0.4	0.2	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	810	55	110	1535	105	170	250	90	150	220	285
Future Volume (vph)	60	810	55	110	1535	105	170	250	90	150	220	285
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	15.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	10.0	20.0	20.0	10.0	20.0	20.0	10.0	20.0	20.0	10.0	20.0	20.0
Total Split (s)	10.0	60.0	60.0	10.0	60.0	60.0	10.0	40.0	40.0	10.0	40.0	40.0
Total Split (%)	8.3%	50.0%	50.0%	8.3%	50.0%	50.0%	8.3%	33.3%	33.3%	8.3%	33.3%	33.3%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Min	Min	None	Min	Min
Act Effct Green (s)	56.1	51.0	51.0	57.4	53.6	53.6	25.0	19.9	19.9	25.0	19.9	19.9
Actuated g/C Ratio	0.55	0.50	0.50	0.57	0.53	0.53	0.25	0.20	0.20	0.25	0.20	0.20
v/c Ratio	0.39	0.48	0.07	0.35	0.86	0.13	0.77	0.72	0.24	0.76	0.64	0.75
Control Delay	17.1	18.0	0.4	12.9	28.5	3.5	55.2	50.6	6.6	56.2	46.4	36.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.1	18.0	0.4	12.9	28.5	3.5	55.2	50.6	6.6	56.2	46.4	36.7
LOS	B	B	A	B	C	A	E	D	A	E	D	D
Approach Delay		16.9			26.0			44.3			44.4	
Approach LOS		B			C			D			D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 101.5	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 29.4	Intersection LOS: C
Intersection Capacity Utilization 84.7%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: E County Line Rd & SH 52



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	810	55	110	1535	105	170	250	90	150	220	285
Future Volume (veh/h)	60	810	55	110	1535	105	170	250	90	150	220	285
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	63	853	58	116	1616	111	179	263	95	158	232	300
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	164	1751	781	358	1779	793	249	410	348	248	410	348
Arrive On Green	0.04	0.49	0.49	0.05	0.50	0.50	0.05	0.22	0.22	0.05	0.22	0.22
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	63	853	58	116	1616	111	179	263	95	158	232	300
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	1.8	16.7	2.0	3.3	43.4	3.9	5.0	13.3	5.2	5.0	11.5	19.0
Cycle Q Clear(g_c), s	1.8	16.7	2.0	3.3	43.4	3.9	5.0	13.3	5.2	5.0	11.5	19.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	164	1751	781	358	1779	793	249	410	348	248	410	348
V/C Ratio(X)	0.38	0.49	0.07	0.32	0.91	0.14	0.72	0.64	0.27	0.64	0.57	0.86
Avail Cap(c_a), veh/h	178	1876	837	358	1876	837	249	628	533	248	628	533
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.8	17.6	13.9	13.4	23.8	14.0	37.0	36.9	33.8	35.7	36.2	39.2
Incr Delay (d2), s/veh	1.5	0.2	0.0	0.5	6.8	0.1	9.5	1.7	0.4	5.3	1.2	9.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	6.0	0.7	1.2	17.2	1.3	2.5	5.9	1.9	1.6	5.1	7.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	24.2	17.8	14.0	13.9	30.6	14.1	46.5	38.6	34.2	41.0	37.5	48.2
LnGrp LOS	C	B	B	B	C	B	D	D	C	D	D	D
Approach Vol, veh/h		974			1843			537			690	
Approach Delay, s/veh		18.0			28.5			40.5			42.9	
Approach LOS		B			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.0	56.3	10.0	27.8	9.2	57.1	10.0	27.8
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	55.0	5.0	35.0	5.0	55.0	5.0	35.0
Max Q Clear Time (g_c+I1), s	5.3	18.7	7.0	21.0	3.8	45.4	7.0	15.3
Green Ext Time (p_c), s	0.0	6.0	0.0	1.9	0.0	6.7	0.0	1.5

Intersection Summary	
HCM 6th Ctrl Delay	30.0
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	1050	1750	4	1	1
Future Vol, veh/h	1	1050	1750	4	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	200	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	1071	1786	4	1	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1790	0	-	0	2326	895
Stage 1	-	-	-	-	1788	-
Stage 2	-	-	-	-	538	-
Critical Hdwy	4.14	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.22	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	342	-	-	-	31	284
Stage 1	-	-	-	-	119	-
Stage 2	-	-	-	-	549	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	342	-	-	-	31	284
Mov Cap-2 Maneuver	-	-	-	-	31	-
Stage 1	-	-	-	-	119	-
Stage 2	-	-	-	-	549	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	71.7
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	342	-	-	-	56
HCM Lane V/C Ratio	0.003	-	-	-	0.036
HCM Control Delay (s)	15.6	-	-	-	71.7
HCM Lane LOS	C	-	-	-	F
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Intersection Delay, s/veh	13.9
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	1123	1968	175	155
Demand Flow Rate, veh/h	1145	2007	178	158
Vehicles Circulating, veh/h	271	114	1150	2028
Vehicles Exiting, veh/h	1855	1106	206	93
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.9	17.6	3.4	15.7
Approach LOS	A	C	A	C

Lane	Left	Right	Bypass	Left	Right	Left	Bypass	Left	Bypass
Designated Moves	LT	TR	R	LT	TR	LT	R	LT	R
Assumed Moves	LT	TR	R	LT	TR	LT	R	LT	R
RT Channelized			Yield				Free		Free
Lane Util	0.470	0.530		0.470	0.530	1.000		1.000	
Follow-Up Headway, s	2.667	2.535		2.667	2.535	2.535		2.535	
Critical Headway, s	4.645	4.328	60	4.645	4.328	4.328	108	4.328	60
Entry Flow, veh/h	510	575	1118	943	1064	70	1938	98	1938
Cap Entry Lane, veh/h	1052	1128	0.980	1215	1289	534	0.980	253	0.980
Entry HV Adj Factor	0.980	0.980	59	0.981	0.980	0.980	106	0.983	59
Flow Entry, veh/h	500	564	1096	925	1043	69	1900	96	1900
Cap Entry, veh/h	1031	1106	0.054	1192	1263	523	0.056	249	0.031
V/C Ratio	0.485	0.510	3.7	0.776	0.825	0.131	0.0	0.387	0.0
Control Delay, s/veh	9.2	9.1	A	16.4	18.7	8.6	A	25.2	A
LOS	A	A	0	C	C	A	0	D	0
95th %tile Queue, veh	3	3		8	10	0		2	

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	2	2	80	2	10	2	150	15	10	230	2
Future Vol, veh/h	2	2	2	80	2	10	2	150	15	10	230	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	68	68	68	92	92	92	68	92	92	92	92	68
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	3	3	87	2	11	3	163	16	11	250	3

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	458	459	252	454	452	171	253	0	0	179	0	0
Stage 1	274	274	-	177	177	-	-	-	-	-	-	-
Stage 2	184	185	-	277	275	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	513	499	787	516	503	873	1312	-	-	1397	-	-
Stage 1	732	683	-	825	753	-	-	-	-	-	-	-
Stage 2	818	747	-	729	683	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	500	493	787	507	497	873	1312	-	-	1397	-	-
Mov Cap-2 Maneuver	500	493	-	507	497	-	-	-	-	-	-	-
Stage 1	730	677	-	823	751	-	-	-	-	-	-	-
Stage 2	803	745	-	717	677	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11.5	13.3	0.1	0.3
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1312	-	-	566	531	1397	-	-
HCM Lane V/C Ratio	0.002	-	-	0.016	0.188	0.008	-	-
HCM Control Delay (s)	7.8	0	-	11.5	13.3	7.6	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.7	0	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	125	1435	90	185	850	205	140	440	125	180	290	75
Future Volume (vph)	125	1435	90	185	850	205	140	440	125	180	290	75
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	15.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	10.0	20.0	20.0	10.0	20.0	20.0	10.0	20.0	20.0	10.0	20.0	20.0
Total Split (s)	10.0	59.0	59.0	15.0	64.0	64.0	11.0	35.0	35.0	11.0	35.0	35.0
Total Split (%)	8.3%	49.2%	49.2%	12.5%	53.3%	53.3%	9.2%	29.2%	29.2%	9.2%	29.2%	29.2%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Min	Min	None	Min	Min
Act Effct Green (s)	57.4	52.4	52.4	67.4	57.4	57.4	35.7	29.7	29.7	35.7	29.7	29.7
Actuated g/C Ratio	0.49	0.44	0.44	0.57	0.49	0.49	0.30	0.25	0.25	0.30	0.25	0.25
v/c Ratio	0.44	0.93	0.12	0.89	0.50	0.24	0.58	0.96	0.27	1.20	0.63	0.16
Control Delay	18.1	43.1	2.8	66.1	21.9	2.9	40.4	77.5	10.8	169.6	46.8	3.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.1	43.1	2.8	66.1	21.9	2.9	40.4	77.5	10.8	169.6	46.8	3.4
LOS	B	D	A	E	C	A	D	E	B	F	D	A
Approach Delay		39.0			25.4			58.3			81.4	
Approach LOS		D			C			E			F	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 118.1	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.20	
Intersection Signal Delay: 43.8	Intersection LOS: D
Intersection Capacity Utilization 99.7%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 1: E County Line Rd & SH 52

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	125	1435	90	185	850	205	140	440	125	180	290	75
Future Volume (veh/h)	125	1435	90	185	850	205	140	440	125	180	290	75
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	128	1464	92	189	867	209	143	449	128	184	296	77
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	302	1585	707	217	1703	760	269	476	403	169	476	403
Arrive On Green	0.04	0.45	0.45	0.08	0.48	0.48	0.05	0.25	0.25	0.05	0.25	0.25
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	128	1464	92	189	867	209	143	449	128	184	296	77
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	4.6	45.2	4.0	6.8	19.6	9.2	6.0	27.4	7.6	6.0	16.3	4.4
Cycle Q Clear(g_c), s	4.6	45.2	4.0	6.8	19.6	9.2	6.0	27.4	7.6	6.0	16.3	4.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	302	1585	707	217	1703	760	269	476	403	169	476	403
V/C Ratio(X)	0.42	0.92	0.13	0.87	0.51	0.28	0.53	0.94	0.32	1.09	0.62	0.19
Avail Cap(c_a), veh/h	302	1649	735	234	1802	804	269	482	409	169	482	409
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.8	30.4	19.0	27.5	20.9	18.2	33.8	42.6	35.2	40.4	38.4	34.0
Incr Delay (d2), s/veh	0.9	9.0	0.1	26.8	0.2	0.2	2.0	27.2	0.4	93.8	2.4	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	19.3	1.4	4.2	7.4	3.2	3.0	15.6	2.9	6.3	7.5	1.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	18.7	39.4	19.0	54.4	21.1	18.4	35.8	69.8	35.6	134.2	40.9	34.2
LnGrp LOS	B	D	B	D	C	B	D	E	D	F	D	C
Approach Vol, veh/h		1684			1265			720			557	
Approach Delay, s/veh		36.7			25.6			57.0			70.8	
Approach LOS		D			C			E			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.9	56.9	11.0	34.6	10.0	60.8	11.0	34.6
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	54.0	6.0	30.0	5.0	59.0	6.0	30.0
Max Q Clear Time (g_c+I1), s	8.8	47.2	8.0	18.3	6.6	21.6	8.0	29.4
Green Ext Time (p_c), s	0.1	4.7	0.0	1.3	0.0	6.8	0.0	0.2

Intersection Summary	
HCM 6th Ctrl Delay	41.3
HCM 6th LOS	D

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	1740	1240	2	1	2
Future Vol, veh/h	1	1740	1240	2	1	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	200	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	1794	1278	2	1	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1280	0	-	0	2178	640
Stage 1	-	-	-	-	1279	-
Stage 2	-	-	-	-	899	-
Critical Hdwy	4.14	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.22	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	538	-	-	-	39	418
Stage 1	-	-	-	-	225	-
Stage 2	-	-	-	-	358	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	538	-	-	-	39	418
Mov Cap-2 Maneuver	-	-	-	-	39	-
Stage 1	-	-	-	-	225	-
Stage 2	-	-	-	-	358	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	42.5
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	538	-	-	-	99
HCM Lane V/C Ratio	0.002	-	-	-	0.031
HCM Control Delay (s)	11.7	-	-	-	42.5
HCM Lane LOS	B	-	-	-	E
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Intersection Delay, s/veh	14.1
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	1761	1308	247	216
Demand Flow Rate, veh/h	1796	1334	252	221
Vehicles Circulating, veh/h	252	234	1838	1341
Vehicles Exiting, veh/h	1231	1730	147	227
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	17.5	10.8	11.6	8.6
Approach LOS	C	B	B	A

Lane	Left	Right	Bypass	Left	Right	Left	Bypass	Left	Bypass
Designated Moves	LT	TR	R	LT	TR	LT	R	LT	R
Assumed Moves	LT	TR	R	LT	TR	LT	R	LT	R
RT Channelized			Yield				Free		Free
Lane Util	0.470	0.530		0.470	0.530	1.000		1.000	
Follow-Up Headway, s	2.667	2.535		2.667	2.535	2.535		2.535	
Critical Headway, s	4.645	4.328	63	4.645	4.328	4.328	126	4.328	79
Entry Flow, veh/h	815	918	1188	627	707	126	1938	142	1938
Cap Entry Lane, veh/h	1071	1146	0.980	1088	1164	298	0.980	454	0.980
Entry HV Adj Factor	0.980	0.981	62	0.981	0.981	0.977	124	0.981	77
Flow Entry, veh/h	799	901	1164	615	693	123	1900	139	1900
Cap Entry, veh/h	1049	1124	0.053	1068	1142	291	0.065	445	0.041
V/C Ratio	0.761	0.801	3.5	0.576	0.607	0.423	0.0	0.313	0.0
Control Delay, s/veh	17.2	18.6	A	10.7	10.9	23.3	A	13.3	A
LOS	C	C	0	B	B	C	0	B	0
95th %tile Queue, veh	8	9		4	4	2		1	

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	2	2	50	2	15	2	220	75	10	185	2
Future Vol, veh/h	2	2	2	50	2	15	2	220	75	10	185	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	2	2	54	2	16	2	237	81	11	199	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	513	544	200	506	505	278	201	0	0	318	0	0
Stage 1	222	222	-	282	282	-	-	-	-	-	-	-
Stage 2	291	322	-	224	223	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	472	446	841	477	470	761	1371	-	-	1242	-	-
Stage 1	780	720	-	725	678	-	-	-	-	-	-	-
Stage 2	717	651	-	779	719	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	456	441	841	470	464	761	1371	-	-	1242	-	-
Mov Cap-2 Maneuver	456	441	-	470	464	-	-	-	-	-	-	-
Stage 1	778	713	-	724	677	-	-	-	-	-	-	-
Stage 2	698	650	-	767	712	-	-	-	-	-	-	-

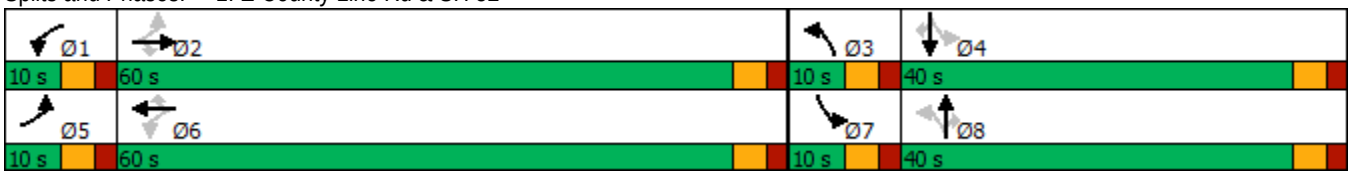
Approach	EB	WB	NB	SB
HCM Control Delay, s	11.9	13.1	0.1	0.4
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1371	-	-	531	514	1242	-	-
HCM Lane V/C Ratio	0.002	-	-	0.012	0.14	0.009	-	-
HCM Control Delay (s)	7.6	0	-	11.9	13.1	7.9	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.5	0	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	859	55	110	1621	125	170	250	90	162	220	285
Future Volume (vph)	60	859	55	110	1621	125	170	250	90	162	220	285
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	15.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	10.0	20.0	20.0	10.0	20.0	20.0	10.0	20.0	20.0	10.0	20.0	20.0
Total Split (s)	10.0	60.0	60.0	10.0	60.0	60.0	10.0	40.0	40.0	10.0	40.0	40.0
Total Split (%)	8.3%	50.0%	50.0%	8.3%	50.0%	50.0%	8.3%	33.3%	33.3%	8.3%	33.3%	33.3%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Min	Min	None	Min	Min
Act Effct Green (s)	58.2	53.1	53.1	59.3	55.5	55.5	25.1	20.0	20.0	25.1	20.0	20.0
Actuated g/C Ratio	0.56	0.51	0.51	0.57	0.54	0.54	0.24	0.19	0.19	0.24	0.19	0.19
v/c Ratio	0.40	0.50	0.07	0.37	0.90	0.15	0.80	0.73	0.24	0.85	0.64	0.76
Control Delay	17.5	18.2	0.4	13.3	31.0	4.7	58.6	51.7	6.5	69.3	47.2	37.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.5	18.2	0.4	13.3	31.0	4.7	58.6	51.7	6.5	69.3	47.2	37.9
LOS	B	B	A	B	C	A	E	D	A	E	D	D
Approach Delay		17.2			28.2			46.0			48.6	
Approach LOS		B			C			D			D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 103.4	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.90	
Intersection Signal Delay: 31.2	Intersection LOS: C
Intersection Capacity Utilization 87.8%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: E County Line Rd & SH 52



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	859	55	110	1621	125	170	250	90	162	220	285
Future Volume (veh/h)	60	859	55	110	1621	125	170	250	90	162	220	285
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	63	904	58	116	1706	132	179	263	95	171	232	300
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	151	1778	793	344	1804	805	245	408	346	244	408	346
Arrive On Green	0.04	0.50	0.50	0.05	0.51	0.51	0.05	0.22	0.22	0.05	0.22	0.22
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	63	904	58	116	1706	132	179	263	95	171	232	300
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	1.8	18.2	2.0	3.4	48.5	4.8	5.0	13.6	5.3	5.0	11.8	19.5
Cycle Q Clear(g_c), s	1.8	18.2	2.0	3.4	48.5	4.8	5.0	13.6	5.3	5.0	11.8	19.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	151	1778	793	344	1804	805	245	408	346	244	408	346
V/C Ratio(X)	0.42	0.51	0.07	0.34	0.95	0.16	0.73	0.64	0.27	0.70	0.57	0.87
Avail Cap(c_a), veh/h	164	1832	817	344	1832	817	245	614	520	244	614	520
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.5	17.9	13.8	13.6	24.9	14.1	38.3	37.9	34.7	38.1	37.2	40.2
Incr Delay (d2), s/veh	1.8	0.2	0.0	0.6	10.8	0.1	10.6	1.7	0.4	8.7	1.2	9.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	6.6	0.7	1.2	20.1	1.6	2.7	6.1	2.0	2.4	5.3	8.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	26.3	18.1	13.9	14.2	35.6	14.2	48.9	39.6	35.1	46.8	38.4	50.0
LnGrp LOS	C	B	B	B	D	B	D	D	D	D	D	D
Approach Vol, veh/h		1025			1954			537			703	
Approach Delay, s/veh		18.3			32.9			41.9			45.4	
Approach LOS		B			C			D			D	

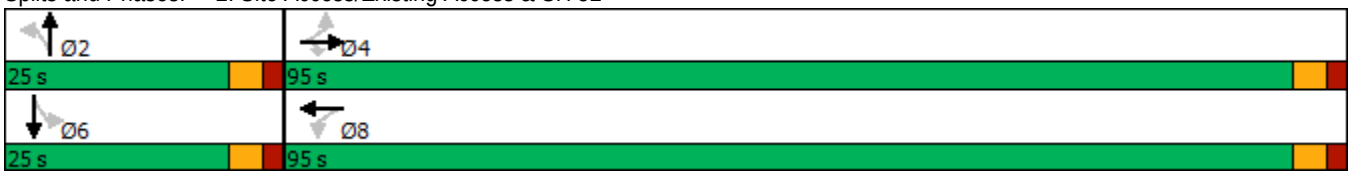
Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.0	58.4	10.0	28.3	9.2	59.2	10.0	28.3
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	5.0	55.0	5.0	35.0	5.0	55.0	5.0	35.0
Max Q Clear Time (g_c+I1), s	5.4	20.2	7.0	21.5	3.8	50.5	7.0	15.6
Green Ext Time (p_c), s	0.0	6.4	0.0	1.8	0.0	3.7	0.0	1.5

Intersection Summary	
HCM 6th Ctrl Delay	32.6
HCM 6th LOS	C

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	1	1090	21	6	1798	58	0	1	0
Future Volume (vph)	1	1090	21	6	1798	58	0	1	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4			8		2		6
Permitted Phases	4		4	8		2		6	
Detector Phase	4	4	4	8	8	2	2	6	6
Switch Phase									
Minimum Initial (s)	15.0	15.0	15.0	15.0	15.0	5.0	5.0	5.0	5.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	95.0	95.0	95.0	95.0	95.0	25.0	25.0	25.0	25.0
Total Split (%)	79.2%	79.2%	79.2%	79.2%	79.2%	20.8%	20.8%	20.8%	20.8%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0		0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0		5.0		5.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)	42.8	42.8	42.8	42.8	42.8		8.9		8.9
Actuated g/C Ratio	0.69	0.69	0.69	0.69	0.69		0.14		0.14
v/c Ratio	0.01	0.46	0.02	0.02	0.76		0.38		0.01
Control Delay	3.0	5.0	1.5	3.3	8.7		28.9		0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	3.0	5.0	1.5	3.3	8.7		28.9		0.0
LOS	A	A	A	A	A		C		A
Approach Delay		5.0			8.7		28.9		
Approach LOS		A			A		C		

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 62.4	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.76	
Intersection Signal Delay: 7.8	Intersection LOS: A
Intersection Capacity Utilization 64.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: Site Access/Existing Access & SH 52



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	1090	21	6	1798	4	58	0	17	1	0	1
Future Volume (veh/h)	1	1090	21	6	1798	4	58	0	17	1	0	1
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	1	1112	23	7	1835	4	63	0	18	1	0	1
Peak Hour Factor	0.98	0.98	0.92	0.92	0.98	0.98	0.92	0.92	0.92	0.98	0.92	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	243	2555	1140	427	2616	6	221	6	31	152	26	78
Arrive On Green	0.72	0.72	0.72	0.72	0.72	0.72	0.09	0.00	0.09	0.09	0.00	0.09
Sat Flow, veh/h	252	3554	1585	496	3638	8	1078	63	326	539	279	818
Grp Volume(v), veh/h	1	1112	23	7	896	943	81	0	0	2	0	0
Grp Sat Flow(s),veh/h/ln	252	1777	1585	496	1777	1869	1466	0	0	1637	0	0
Q Serve(g_s), s	0.1	6.9	0.2	0.3	15.4	15.4	2.6	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	15.5	6.9	0.2	7.2	15.4	15.4	2.8	0.0	0.0	0.1	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.00	0.78		0.22	0.50		0.50
Lane Grp Cap(c), veh/h	243	2555	1140	427	1278	1344	258	0	0	256	0	0
V/C Ratio(X)	0.00	0.44	0.02	0.02	0.70	0.70	0.31	0.00	0.00	0.01	0.00	0.00
Avail Cap(c_a), veh/h	484	5954	2656	901	2977	3131	661	0	0	668	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	8.7	3.1	2.2	4.6	4.3	4.3	23.3	0.0	0.0	22.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.1	0.0	0.0	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.2	0.0	0.0	0.6	0.6	1.0	0.0	0.0	0.0	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	8.7	3.2	2.2	4.6	5.0	5.0	23.9	0.0	0.0	22.0	0.0	0.0
LnGrp LOS	A	A	A	A	A	A	C	A	A	C	A	A
Approach Vol, veh/h		1136			1846			81			2	
Approach Delay, s/veh		3.2			5.0			23.9			22.0	
Approach LOS		A			A			C			C	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		10.1		43.6		10.1		43.6				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		20.0		90.0		20.0		90.0				
Max Q Clear Time (g_c+I1), s		4.8		17.5		2.1		17.4				
Green Ext Time (p_c), s		0.3		9.0		0.0		21.2				

Intersection Summary	
HCM 6th Ctrl Delay	4.8
HCM 6th LOS	A

Intersection	
Intersection Delay, s/veh	18.6
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	1184	2056	380	155
Demand Flow Rate, veh/h	1208	2097	387	158
Vehicles Circulating, veh/h	370	182	1162	2186
Vehicles Exiting, veh/h	1914	1118	305	93
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	10.2	26.1	3.8	19.4
Approach LOS	B	D	A	C

Lane	Left	Right	Bypass	Left	Right	Left	Bypass	Left	Bypass
Designated Moves	LT	TR	R	LT	TR	LT	R	LT	R
Assumed Moves	LT	TR	R	LT	TR	LT	R	LT	R
RT Channelized			Yield				Free		Free
Lane Util	0.470	0.530		0.470	0.530	1.000		1.000	
Follow-Up Headway, s	2.667	2.535		2.667	2.535	2.535		2.535	
Critical Headway, s	4.645	4.328	111	4.645	4.328	4.328	249	4.328	60
Entry Flow, veh/h	516	581	1011	986	1111	138	1938	98	1938
Cap Entry Lane, veh/h	960	1037	0.980	1142	1217	529	0.980	221	0.980
Entry HV Adj Factor	0.979	0.981	109	0.980	0.981	0.983	244	0.983	59
Flow Entry, veh/h	505	570	991	966	1090	136	1900	96	1900
Cap Entry, veh/h	941	1017	0.110	1119	1193	520	0.128	218	0.031
V/C Ratio	0.537	0.560	4.6	0.864	0.913	0.261	0.0	0.443	0.0
Control Delay, s/veh	10.9	10.8	A	23.7	28.3	10.7	A	31.3	A
LOS	B	B	0	C	D	B	0	D	0
95th %tile Queue, veh	3	4		12	15	1		2	

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	2	2	80	2	28	2	240	15	34	352	2
Future Vol, veh/h	2	2	2	80	2	28	2	240	15	34	352	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	100	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	68	68	68	92	92	92	68	92	92	92	92	68
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	3	3	87	2	30	3	261	16	37	383	3

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	750	742	385	729	727	261	386	0	0	277	0	0
Stage 1	459	459	-	267	267	-	-	-	-	-	-	-
Stage 2	291	283	-	462	460	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	328	344	663	338	351	778	1172	-	-	1286	-	-
Stage 1	582	566	-	738	688	-	-	-	-	-	-	-
Stage 2	717	677	-	580	566	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	306	333	663	326	340	778	1172	-	-	1286	-	-
Mov Cap-2 Maneuver	306	333	-	326	340	-	-	-	-	-	-	-
Stage 1	580	550	-	736	686	-	-	-	-	-	-	-
Stage 2	685	675	-	558	550	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.5	18.6	0.1	0.7
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1172	-	-	386	383	1286	-	-
HCM Lane V/C Ratio	0.003	-	-	0.023	0.312	0.029	-	-
HCM Control Delay (s)	8.1	-	-	14.5	18.6	7.9	-	-
HCM Lane LOS	A	-	-	B	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	1.3	0.1	-	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑	↑	↱
Traffic Vol, veh/h	0	4	0	357	315	63
Future Vol, veh/h	0	4	0	357	315	63
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	200
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	4	0	388	342	68

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	342	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.22	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.318	-	-	-	-
Pot Cap-1 Maneuver	0	701	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	701	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.2	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	701	-	-
HCM Lane V/C Ratio	-	0.006	-	-
HCM Control Delay (s)	-	10.2	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0	-	-

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	105	18	17	252	294	25
Future Vol, veh/h	105	18	17	252	294	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	100	-	-	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	114	20	18	274	320	27

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	630	320	347	0	-	0
Stage 1	320	-	-	-	-	-
Stage 2	310	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	446	721	1212	-	-	-
Stage 1	736	-	-	-	-	-
Stage 2	744	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	439	721	1212	-	-	-
Mov Cap-2 Maneuver	439	-	-	-	-	-
Stage 1	725	-	-	-	-	-
Stage 2	744	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	15.2	0.5	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1212	-	439	721	-	-
HCM Lane V/C Ratio	0.015	-	0.26	0.027	-	-
HCM Control Delay (s)	8	-	16.1	10.1	-	-
HCM Lane LOS	A	-	C	B	-	-
HCM 95th %tile Q(veh)	0	-	1	0.1	-	-

Intersection	
Int Delay, s/veh	4.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	88	125	92	181	261	51
Future Vol, veh/h	88	125	92	181	261	51
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	100	-	-	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	96	136	100	197	284	55

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	681	284	339	0	-	0
Stage 1	284	-	-	-	-	-
Stage 2	397	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	416	755	1220	-	-	-
Stage 1	764	-	-	-	-	-
Stage 2	679	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	382	755	1220	-	-	-
Mov Cap-2 Maneuver	382	-	-	-	-	-
Stage 1	701	-	-	-	-	-
Stage 2	679	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	13.6	2.8	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1220	-	382	755	-	-
HCM Lane V/C Ratio	0.082	-	0.25	0.18	-	-
HCM Control Delay (s)	8.2	-	17.5	10.8	-	-
HCM Lane LOS	A	-	C	B	-	-
HCM 95th %tile Q(veh)	0.3	-	1	0.7	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	125	1536	90	185	919	223	140	440	125	206	290	75
Future Volume (vph)	125	1536	90	185	919	223	140	440	125	206	290	75
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	15.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	10.0	20.0	20.0	10.0	20.0	20.0	10.0	20.0	20.0	10.0	20.0	20.0
Total Split (s)	10.0	59.0	59.0	15.0	64.0	64.0	11.0	35.0	35.0	11.0	35.0	35.0
Total Split (%)	8.3%	49.2%	49.2%	12.5%	53.3%	53.3%	9.2%	29.2%	29.2%	9.2%	29.2%	29.2%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Min	Min	None	Min	Min
Act Effct Green (s)	59.0	54.0	54.0	69.0	59.0	59.0	35.9	29.9	29.9	35.9	29.9	29.9
Actuated g/C Ratio	0.49	0.45	0.45	0.58	0.49	0.49	0.30	0.25	0.25	0.30	0.25	0.25
v/c Ratio	0.48	0.98	0.12	0.90	0.54	0.26	0.59	0.97	0.27	1.39	0.64	0.16
Control Delay	19.5	51.9	2.8	69.7	22.5	2.9	41.2	79.3	10.8	240.9	47.4	3.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.5	51.9	2.8	69.7	22.5	2.9	41.2	79.3	10.8	240.9	47.4	3.4
LOS	B	D	A	E	C	A	D	E	B	F	D	A
Approach Delay		47.1			25.8			59.6			111.3	
Approach LOS		D			C			E			F	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 119.9	
Natural Cycle: 110	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.39	
Intersection Signal Delay: 51.0	Intersection LOS: D
Intersection Capacity Utilization 103.9%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 1: E County Line Rd & SH 52

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	125	1536	90	185	919	223	140	440	125	206	290	75
Future Volume (veh/h)	125	1536	90	185	919	223	140	440	125	206	290	75
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	128	1567	92	189	938	228	143	449	128	210	296	77
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	283	1599	713	213	1747	779	259	468	396	160	468	396
Arrive On Green	0.04	0.45	0.45	0.08	0.49	0.49	0.05	0.25	0.25	0.05	0.25	0.25
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	128	1567	92	189	938	228	143	449	128	210	296	77
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	4.7	52.1	4.1	8.2	21.9	10.2	6.0	28.4	7.9	6.0	16.9	4.6
Cycle Q Clear(g_c), s	4.7	52.1	4.1	8.2	21.9	10.2	6.0	28.4	7.9	6.0	16.9	4.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	283	1599	713	213	1747	779	259	468	396	160	468	396
V/C Ratio(X)	0.45	0.98	0.13	0.89	0.54	0.29	0.55	0.96	0.32	1.31	0.63	0.19
Avail Cap(c_a), veh/h	283	1599	713	213	1747	779	259	468	396	160	468	396
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	18.3	32.5	19.3	34.2	21.1	18.1	35.9	44.4	36.7	41.6	40.1	35.5
Incr Delay (d2), s/veh	1.1	17.9	0.1	32.9	0.3	0.2	2.5	31.5	0.5	177.9	2.8	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	24.1	1.4	4.3	8.3	3.5	1.0	16.6	3.0	9.7	7.8	1.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	19.4	50.3	19.3	67.1	21.4	18.3	38.5	76.0	37.2	219.5	42.9	35.7
LnGrp LOS	B	D	B	E	C	B	D	E	D	F	D	D
Approach Vol, veh/h		1787			1355			720			583	
Approach Delay, s/veh		46.5			27.2			61.6			105.6	
Approach LOS		D			C			E			F	

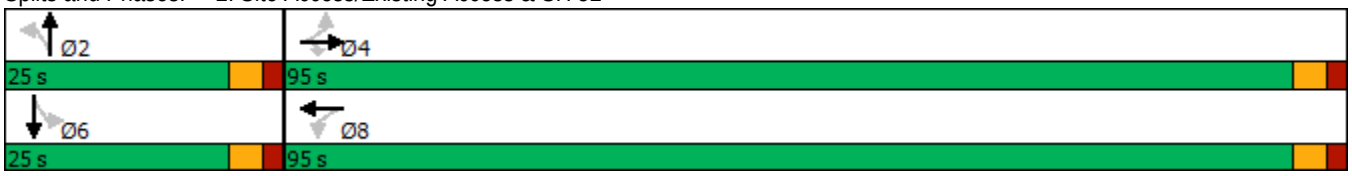
Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	59.0	11.0	35.0	10.0	64.0	11.0	35.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	54.0	6.0	30.0	5.0	59.0	6.0	30.0
Max Q Clear Time (g_c+I1), s	10.2	54.1	8.0	18.9	6.7	23.9	8.0	30.4
Green Ext Time (p_c), s	0.0	0.0	0.0	1.3	0.0	7.5	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	50.8
HCM 6th LOS	D

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	1	1806	61	18	1288	39	0	1	0
Future Volume (vph)	1	1806	61	18	1288	39	0	1	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4			8		2		6
Permitted Phases	4		4	8		2		6	
Detector Phase	4	4	4	8	8	2	2	6	6
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	95.0	95.0	95.0	95.0	95.0	25.0	25.0	25.0	25.0
Total Split (%)	79.2%	79.2%	79.2%	79.2%	79.2%	20.8%	20.8%	20.8%	20.8%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0		0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0		5.0		5.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)	42.3	42.3	42.3	42.3	42.3		7.7		7.7
Actuated g/C Ratio	0.70	0.70	0.70	0.70	0.70		0.13		0.13
v/c Ratio	0.00	0.75	0.06	0.16	0.54		0.28		0.01
Control Delay	3.0	7.9	0.9	6.3	5.1		25.7		0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	3.0	7.9	0.9	6.3	5.1		25.7		0.0
LOS	A	A	A	A	A		C		A
Approach Delay		7.7			5.2		25.7		
Approach LOS		A			A		C		

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 60.6	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 7.0	Intersection LOS: A
Intersection Capacity Utilization 64.2%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: Site Access/Existing Access & SH 52



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	1806	61	18	1288	2	39	0	12	1	0	2
Future Volume (veh/h)	1	1806	61	18	1288	2	39	0	12	1	0	2
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	1	1862	66	20	1328	2	42	0	13	1	0	2
Peak Hour Factor	0.97	0.97	0.92	0.92	0.97	0.97	0.92	0.92	0.92	0.97	0.92	0.97
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	368	2632	1174	237	2696	4	195	13	30	105	25	92
Arrive On Green	0.74	0.74	0.74	0.74	0.74	0.74	0.09	0.00	0.09	0.09	0.00	0.09
Sat Flow, veh/h	412	3554	1585	246	3641	5	986	152	352	248	284	1064
Grp Volume(v), veh/h	1	1862	66	20	648	682	55	0	0	3	0	0
Grp Sat Flow(s),veh/h/ln	412	1777	1585	246	1777	1869	1490	0	0	1596	0	0
Q Serve(g_s), s	0.1	16.5	0.7	2.8	8.6	8.6	1.4	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	8.7	16.5	0.7	19.3	8.6	8.6	1.9	0.0	0.0	0.1	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.00	0.76		0.24	0.33		0.67
Lane Grp Cap(c), veh/h	368	2632	1174	237	1316	1384	239	0	0	221	0	0
V/C Ratio(X)	0.00	0.71	0.06	0.08	0.49	0.49	0.23	0.00	0.00	0.01	0.00	0.00
Avail Cap(c_a), veh/h	704	5533	2468	438	2766	2910	615	0	0	615	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	4.8	4.1	2.0	9.3	3.1	3.1	25.0	0.0	0.0	24.2	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.4	0.0	0.2	0.3	0.3	0.5	0.0	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.4	0.0	0.1	0.2	0.3	0.7	0.0	0.0	0.0	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	4.8	4.4	2.1	9.5	3.4	3.3	25.5	0.0	0.0	24.2	0.0	0.0
LnGrp LOS	A	A	A	A	A	A	C	A	A	C	A	A
Approach Vol, veh/h		1929			1350			55			3	
Approach Delay, s/veh		4.4			3.4			25.5			24.2	
Approach LOS		A			A			C			C	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	10.0	47.8	10.0	47.8
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	20.0	90.0	20.0	90.0
Max Q Clear Time (g_c+I1), s	3.9	18.5	2.1	21.3
Green Ext Time (p_c), s	0.2	24.3	0.0	11.3

Intersection Summary	
HCM 6th Ctrl Delay	4.4
HCM 6th LOS	A

Intersection	
Intersection Delay, s/veh	24.5
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	1841	1491	473	216
Demand Flow Rate, veh/h	1878	1520	482	221
Vehicles Circulating, veh/h	458	322	1827	1615
Vehicles Exiting, veh/h	1299	1719	353	227
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	34.4	16.0	18.2	12.0
Approach LOS	D	C	C	B

Lane	Left	Right	Bypass	Left	Right	Left	Bypass	Left	Bypass
Designated Moves	LT	TR	R	LT	TR	LT	R	LT	R
Assumed Moves	LT	TR	R	LT	TR	LT	R	LT	R
RT Channelized			Yield				Free		Free
Lane Util	0.470	0.530		0.470	0.530	1.000		1.000	
Follow-Up Headway, s	2.667	2.535		2.667	2.535	2.535		2.535	
Critical Headway, s	4.645	4.328	156	4.645	4.328	4.328	268	4.328	79
Entry Flow, veh/h	809	913	963	714	806	214	1938	142	1938
Cap Entry Lane, veh/h	886	962	0.980	1004	1080	300	0.980	360	0.980
Entry HV Adj Factor	0.981	0.980	153	0.981	0.980	0.982	263	0.981	77
Flow Entry, veh/h	794	895	944	701	790	210	1900	139	1900
Cap Entry, veh/h	869	943	0.162	985	1059	295	0.138	353	0.041
V/C Ratio	0.913	0.949	5.4	0.711	0.746	0.712	0.0	0.395	0.0
Control Delay, s/veh	34.9	39.1	A	15.7	16.4	41.0	A	18.7	A
LOS	D	E	1	C	C	E	0	C	0
95th %tile Queue, veh	13	16		6	7	5		2	

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	2	2	50	2	38	2	322	75	26	259	2
Future Vol, veh/h	2	2	2	50	2	38	2	322	75	26	259	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	100	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	2	2	54	2	41	2	346	81	28	278	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	747	766	279	687	686	346	280	0	0	427	0	0
Stage 1	335	335	-	350	350	-	-	-	-	-	-	-
Stage 2	412	431	-	337	336	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	329	333	760	361	370	697	1283	-	-	1132	-	-
Stage 1	679	643	-	666	633	-	-	-	-	-	-	-
Stage 2	617	583	-	677	642	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	302	324	760	351	360	697	1283	-	-	1132	-	-
Mov Cap-2 Maneuver	302	324	-	351	360	-	-	-	-	-	-	-
Stage 1	678	627	-	665	632	-	-	-	-	-	-	-
Stage 2	578	582	-	656	626	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.4	15.4	0	0.7
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1283	-	-	389	444	1132	-	-
HCM Lane V/C Ratio	0.002	-	-	0.017	0.218	0.025	-	-
HCM Control Delay (s)	7.8	-	-	14.4	15.4	8.3	-	-
HCM Lane LOS	A	-	-	B	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.8	0.1	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑	↑	↱
Traffic Vol, veh/h	0	17	0	459	335	144
Future Vol, veh/h	0	17	0	459	335	144
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	200
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	18	0	499	364	157

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	364	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.22	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.318	-	-	-	-
Pot Cap-1 Maneuver	0	681	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	681	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.4	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	681	-	-
HCM Lane V/C Ratio	-	0.027	-	-
HCM Control Delay (s)	-	10.4	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.1	-	-

Intersection	
Int Delay, s/veh	5.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	174	15	44	285	280	72
Future Vol, veh/h	174	15	44	285	280	72
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	100	-	-	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	189	16	48	310	304	78

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	710	304	382	0	-	0
Stage 1	304	-	-	-	-	-
Stage 2	406	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	400	736	1176	-	-	-
Stage 1	748	-	-	-	-	-
Stage 2	673	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	384	736	1176	-	-	-
Mov Cap-2 Maneuver	384	-	-	-	-	-
Stage 1	717	-	-	-	-	-
Stage 2	673	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	22.1	1.1	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1176	-	384	736	-	-
HCM Lane V/C Ratio	0.041	-	0.493	0.022	-	-
HCM Control Delay (s)	8.2	-	23.1	10	-	-
HCM Lane LOS	A	-	C	B	-	-
HCM 95th %tile Q(veh)	0.1	-	2.6	0.1	-	-

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	49	61	85	280	224	71
Future Vol, veh/h	49	61	85	280	224	71
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	100	-	-	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	53	66	92	304	243	77

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	731	243	320	0	-	0
Stage 1	243	-	-	-	-	-
Stage 2	488	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	389	796	1240	-	-	-
Stage 1	797	-	-	-	-	-
Stage 2	617	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	360	796	1240	-	-	-
Mov Cap-2 Maneuver	360	-	-	-	-	-
Stage 1	738	-	-	-	-	-
Stage 2	617	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.9	1.9	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1240	-	360	796	-	-
HCM Lane V/C Ratio	0.075	-	0.148	0.083	-	-
HCM Control Delay (s)	8.1	-	16.7	9.9	-	-
HCM Lane LOS	A	-	C	A	-	-
HCM 95th %tile Q(veh)	0.2	-	0.5	0.3	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	41	606	40	78	1258	121	238	117	358
v/c Ratio	0.30	0.58	0.04	0.21	1.22	0.86	0.64	0.54	0.93
Control Delay	14.4	20.6	0.1	10.3	134.5	84.8	49.2	44.5	71.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	20.6	0.1	10.3	134.5	84.8	49.2	44.5	71.0
Queue Length 50th (ft)	11	306	0	22	~1227	71	160	69	238
Queue Length 95th (ft)	25	422	0	42	#1492	#152	248	119	#417
Internal Link Dist (ft)		1293			2713		924		671
Turn Bay Length (ft)	360		465	530		115		90	
Base Capacity (vph)	138	1040	932	372	1031	140	394	216	405
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.58	0.04	0.21	1.22	0.86	0.60	0.54	0.88

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	87	1046	33	126	775	96	391	144	249
v/c Ratio	0.35	1.11	0.04	0.65	0.77	0.45	1.01	1.05	0.64
Control Delay	13.6	94.8	0.1	35.9	27.1	40.3	94.5	130.1	50.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.6	94.8	0.1	35.9	27.1	40.3	94.5	130.1	50.0
Queue Length 50th (ft)	25	~930	0	43	451	55	~305	~92	170
Queue Length 95th (ft)	46	#1188	0	108	630	101	#512	#204	262
Internal Link Dist (ft)		1293			2713		924		671
Turn Bay Length (ft)	360		465	530		115		90	
Base Capacity (vph)	246	940	853	210	1016	214	387	137	387
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	1.11	0.04	0.60	0.76	0.45	1.01	1.05	0.64

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	63	904	58	116	1706	132	179	263	95	171	232	300
v/c Ratio	0.40	0.50	0.07	0.37	0.90	0.15	0.80	0.73	0.24	0.85	0.64	0.76
Control Delay	17.5	18.2	0.4	13.3	31.0	4.7	58.6	51.7	6.5	69.3	47.2	37.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.5	18.2	0.4	13.3	31.0	4.7	58.6	51.7	6.5	69.3	47.2	37.9
Queue Length 50th (ft)	15	194	0	29	527	7	95	168	0	91	145	124
Queue Length 95th (ft)	40	298	2	66	#833	42	#163	254	33	#177	224	220
Internal Link Dist (ft)		1293			2713			924			671	
Turn Bay Length (ft)	360		465	530		200	115			90		
Base Capacity (vph)	157	1899	899	316	1899	899	224	636	612	200	636	612
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.48	0.06	0.37	0.90	0.15	0.80	0.41	0.16	0.85	0.36	0.49

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	1	1112	23	7	1839	81	2
v/c Ratio	0.01	0.46	0.02	0.02	0.76	0.38	0.01
Control Delay	3.0	5.0	1.5	3.3	8.7	28.9	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.0	5.0	1.5	3.3	8.7	28.9	0.0
Queue Length 50th (ft)	0	74	0	1	175	21	0
Queue Length 95th (ft)	1	137	6	4	324	75	0
Internal Link Dist (ft)		2713			2280	440	378
Turn Bay Length (ft)	200		200	200			
Base Capacity (vph)	173	3539	1583	432	3539	490	532
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.31	0.01	0.02	0.52	0.17	0.00

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	128	1567	92	189	938	228	143	449	128	210	296	77
v/c Ratio	0.48	0.98	0.12	0.90	0.54	0.26	0.59	0.97	0.27	1.39	0.64	0.16
Control Delay	19.5	51.9	2.8	69.7	22.5	2.9	41.2	79.3	10.8	240.9	47.4	3.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.5	51.9	2.8	69.7	22.5	2.9	41.2	79.3	10.8	240.9	47.4	3.4
Queue Length 50th (ft)	43	617	0	95	256	0	79	345	11	~164	206	0
Queue Length 95th (ft)	73	#793	22	#235	317	41	131	#553	61	#325	303	19
Internal Link Dist (ft)		1293			2713			924			671	
Turn Bay Length (ft)	360		465	530		200	115			90		
Base Capacity (vph)	267	1593	772	209	1741	894	243	465	477	151	465	477
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.98	0.12	0.90	0.54	0.26	0.59	0.97	0.27	1.39	0.64	0.16

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	1	1862	66	20	1330	55	3
v/c Ratio	0.00	0.75	0.06	0.16	0.54	0.28	0.01
Control Delay	3.0	7.9	0.9	6.3	5.1	25.7	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.0	7.9	0.9	6.3	5.1	25.7	0.0
Queue Length 50th (ft)	0	161	0	2	87	12	0
Queue Length 95th (ft)	1	287	8	10	155	53	1
Internal Link Dist (ft)		2713			2280	440	378
Turn Bay Length (ft)	200		200	200			
Base Capacity (vph)	326	3539	1583	177	3539	500	549
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.53	0.04	0.11	0.38	0.11	0.01

Intersection Summary

Spring Hill

Phase II Drainage Report

JUNE 2025

Approved For One Year From This Date

_____

_____ _____

City Engineer **Date**

_____ _____

Water Department **Date**

PREPARED FOR:

ME ERIE, LLC.

CENTENNIAL, CO 80112

PREPARED BY: Westwood

Westwood

Phase II Drainage Report

Spring Hill

Erie, Colorado

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Date: June 2025

*I hereby certify that this **Phase II Drainage Report** for the design of **Spring Hill** was prepared by me (or under my direct supervision) in accordance with the provisions of the Town of Erie Standards and Specifications for Design and Construction for the owners therof. I understand that the Town of Erie does not and will not assume liability for drainage facilities designed by others, including the designs presented in this report.*

_____

Registered Professional Engineer

_____

Signature

_____

Colorado P.E. License No.

_____

Seal and Date

TOWN ACCEPTANCE

This report has been reviewed and found to be in general compliance with the *Town of Erie Standards and Specification for Design and Construction* and other Town requirements. **THE ACCURACY AND VALIDITY OF THE ENGINEERING DESIGN, DETAILS, DIMENSIONS, QUALITIES, AND CONCEPTS IN THIS REPORT REMAINS THE SOLE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOOSE STAMP AND SIGNATURE APPEAR HEAREON**.

Accepted by: _____ _____

Town Engineer Date

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Table 18: Basin D Design Point Summary 25
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The following narrative and supporting calculations provide the drainage design associated with the *Spring Hill Phase II Drainage Report*. The report primarily addresses drainage concepts related to conceptual drainage and pond and storm system infrastructure sizing. This report will contain all required information per Town of Erie Engineering Standards and Specifications, 2025, for a Phase II Drainage Report. Additional design aspects such as storm pipe sizing, overflow paths, and more will be completed in the Phase III drainage report.

I. GENERAL LOCATION AND DESCRIPTION

The purpose of this report is to describe the preliminary design of the Spring Hill subdivision development. This report covers all aspects of design except for channel design; please refer to the *Spring Hill Conceptual Drainage Channel Design Memorandum June 2025* for details on the channel design.

A. LOCATION

The Spring Hill Property is located in the East half of Section 6, Township 1 North, Range 68 West of the 6th Principal Meridian, Weld County, Colorado. More generally, the site occupies approximately the northeastern quarter of the land located between East County Line Road and County Road 3 to the West and East, respectively, and Highway 52 and County Road 12 to the North and South, respectively. The East boundary of the site lies approximately 3 miles to the West of Interstate 25.

The overall site is bounded on the North by Highway 52 and large lot County residential parcels. The site is bounded on the East by Weld County Road 3 and large lot County residential parcels, Highview Ranch Planned Unit Development (PUD). The Park Lands Estates Subdivision is located to the Southeast of the site. The South edge of the property is bounded by undeveloped agricultural land, which is the future Morgan Hill subdivision. The site is bounded on the West by unplanted agricultural land and the Westview Estates Subdivision.

VICINITY MAP
SCALE: 1"=2,000'

FIGURE 1: VICINITY MAP

B. DESCRIPTION OF PROPERTY

The overall Spring Hill Farm Property consists of approximately 313 acres along the northern end of Erie city limits and is currently undeveloped agricultural land and isolated farmhouse lots. Most of the land surrounding Spring Hill is undeveloped, agricultural land and large lots.

An existing drainageway (Reach BC 110) runs through the site, beginning in the east central area and traveling to the west. It exits the site through the central western portion. In addition to this drainageway, several irrigation ditches traverse the property, including the Lower Boulder Ditch, which traverses the central and western portion of the site. After looping offsite, the Lower Boulder Ditch crosses Weld County Road 3 (WCR 3) and defines the eastern property boundary for roughly 2000 feet before again traveling under WCR 3 and traveling offsite. The Boulder & Weld County Ditch enters the site near the southwest corner and travels generally to the northeast before exiting the site and crossing Highway 52 near the northeast property corner. The Cottonwood Extension Ditch enters the site near the southwest corner and moves in a half-circle before exiting the site near the southeast corner. Most of the site is currently used for farming, and is accordingly covered with different types of crops, depending on the time of year. There are also native grasses and vegetation occupying some portions of the property.

The area south of the Lower Boulder Ditch (Southern Parcel) generally slopes to the north, west and east at grades ranging from approximately one percent to almost ten percent. The highest point on the land is located on the southern property line near the middle. From here, a small ridge extends across the property to the northeast, thus splitting the runoff in roughly an east-west split. The existing terrain in the area north of the Lower Boulder Ditch (Northern Parcel)

generally slopes to the northwest, with an existing drainageway that flows to the northwest, and is tributary to Coal Creek. Most of the land is fairly flat, having grades of one to three percent. However, there are some portions of the site that have higher slopes, some reaching above six percent. These steeper sections of land tend to be on either side of the major drainageway that runs through the property, particularly on its north and east banks. Other steep grades can be found along the slopes of the various irrigation ditches that traverse the property. Spring Hill is presently used primarily for farming but is also partially covered with native vegetation.

Based on information provided in the USDA's Web Soil Survey [Ref 2], there are three soil types on the Southern Parcel: First, there is a large area of Olney fine sandy loam with one to three percent slopes (hydrologic soil group B). This soil type is located all along the east and southeast portions of the land, and there is also a small amount on the western edge of the property. Next, there is a large area occupied by Otero sandy loams with one to nine percent slopes (hydrologic soil group A). These Otero sandy loams occupy over half the total surface of the property and are in the central and south regions of the land. A small area of Aquolls and Aquepts (hydrologic soil group D) can be found in the extreme northwest of the property.

There are three soil types representing two different hydrologic soil groups on the Northern Parcel: Most of the site is occupied by Olney fine sandy loam with one to five percent slopes (Hydrologic Soil Group B). A thin strip of Otero sandy loam with 3 to 5 percent slopes (Hydrologic Soil Group A) traverses the property from the southeast to the northwest, closely matching the path of the drainageway that travels through the property. Finally, a thin strip of Aquolls and Aquepts (Hydrologic Soil Group D) is located just to the south of the Otero sandy loam strip that traverses the property.

The Spring Hill development is planned to be developed for single and multi-family residential lots, schoolyards, and parks. There two prominent wetlands on the central eastern portion of the site, which add up to a total of about 12.6 acres. Neither of these wetlands will be developed on or utilized as part of the drainage design. Please see Appendix A for the wetlands map.

II. DRAINAGE BASINS

Spring Hill is built on a large sub-catchment basin and receives varying annual precipitation; it is necessary to analyze historic precipitation and landscape data to design proper drainage facilities. The pre-developed site has an existing channel, from which the location will be utilized to design a new channel to carry runoff through and off the site. This development will build around the proposed channel which will be designed in well as around the existing Lower Boulder, & Boulder & Weld County irrigation ditches.

A. MAJOR BASIN DESCRIPTION

Merrick & Company has completed a Phase I drainage study (in the form of an outfall systems planning, or OSP report) for the Town of Erie [Ref 3]. This OSP proposes an outfall system for

the Boulder Creek watershed to effectively manage stormwater during both the major (100-year) and minor (10-year) storm events, based on the assumption that the imperviousness of the contributing watersheds will increase appreciably in the future. The location of the Spring Hill site in relation to the OSP can be found in Appendix A to this report. The site is within the "Boulder Creek Tributaries" region of the OSP. This area encompasses the offsite basins tributary to the project as shown on the included Phase I Drainage Plan. The OSP identifies an offsite regional detention facility just south of Weld County Road 12.

According to the *Federal Emergency Management Agencies (FEMA) Flood Emergency Rate Map (FIRM),* the proposed development area lies almost entirely within “Zone X” which is described as an area determined to be outside of 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. A small portion of Proposed Pond E exists within “Zone A” which is defined as an area subject to inundation by the 1-percent-annual-chance-flood event generally determined using approximate methodologies, due to that sections’ proximity to the 500-year Boulder Creek floodplain. The section within Zone A does not have any lots and is therefore not relevant for flood insurance issuances.

About 2/3 of the property is planned to be single family lots while 1/3 will be multi-family residential. Refer to the drainage maps in the appendices for additional zoning information.

The Spring Hill development exists on two MHFD defined major basins, designated UDFCD_ID’s Boulder Creek (3001) and 3003, respectively. These are shown in Figures 2 - 4. Basin 3003 encapsulates an elongated narrow area spanning from the intersection of County Road 8 & County Road 5 north-westwards to the intersection of Panama Gulch and Boulder Creek. Boulder Creek (3001)1 major basin covers the entirety of the vicinity of Boulder Creek as it meanders north-west from the town of Boulder itself 20 miles and joins with Dry Creek to become St. Vrain River near Highway 119. Five detention ponds will be designed to capture runoff to discharge to the designed channel built along BC110 drainageway.

The northwestern corner of the site is partially encompassed by the Boulder Creek Floodplain limits. A CLOMR will be submitted at the time of the Phase III Drainage Report to verify no proposed improvements will impact the floodplain. A CLOMR will only be required if the floodplain is impacted, and it will be required to be approved by FEMA prior to construction of these improvements.

There are no on-site existing lakes or ponds which either influence or may be influenced by the local drainage.

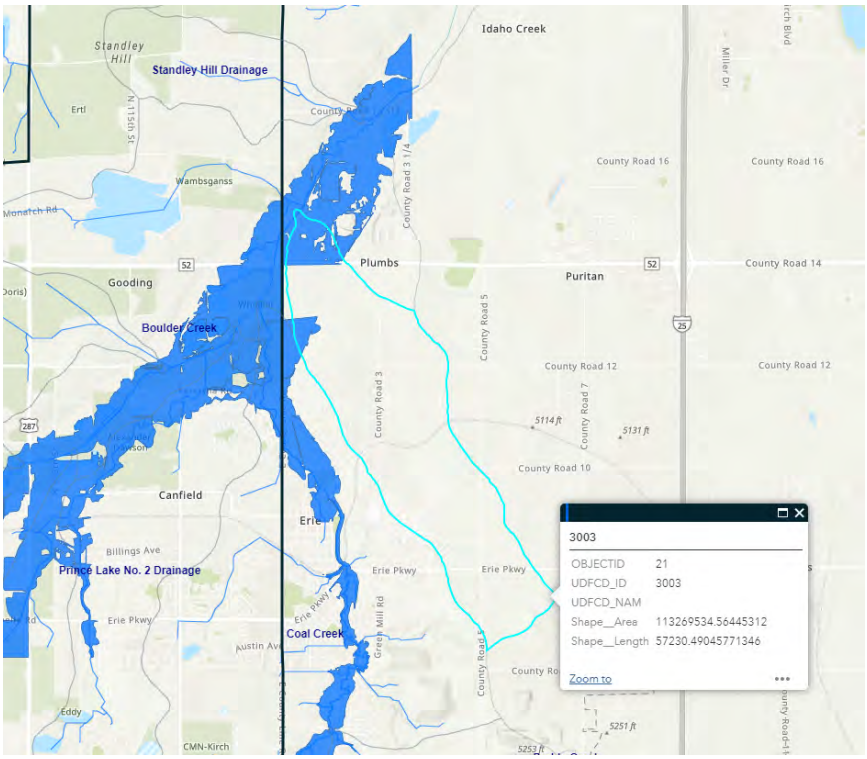


FIGURE 3: UDFCD_ID 3003 MHFD MAJOR BASIN

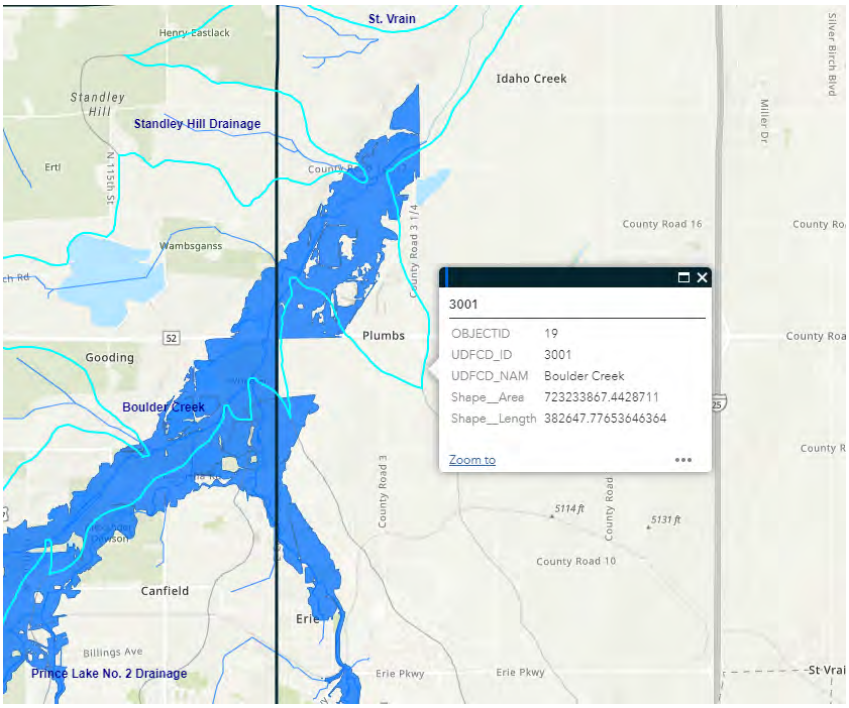


FIGURE 2: BOULDER CREEK MHFD MAJOR BASIN CLOSE UP (UDFCD_ID 3001)

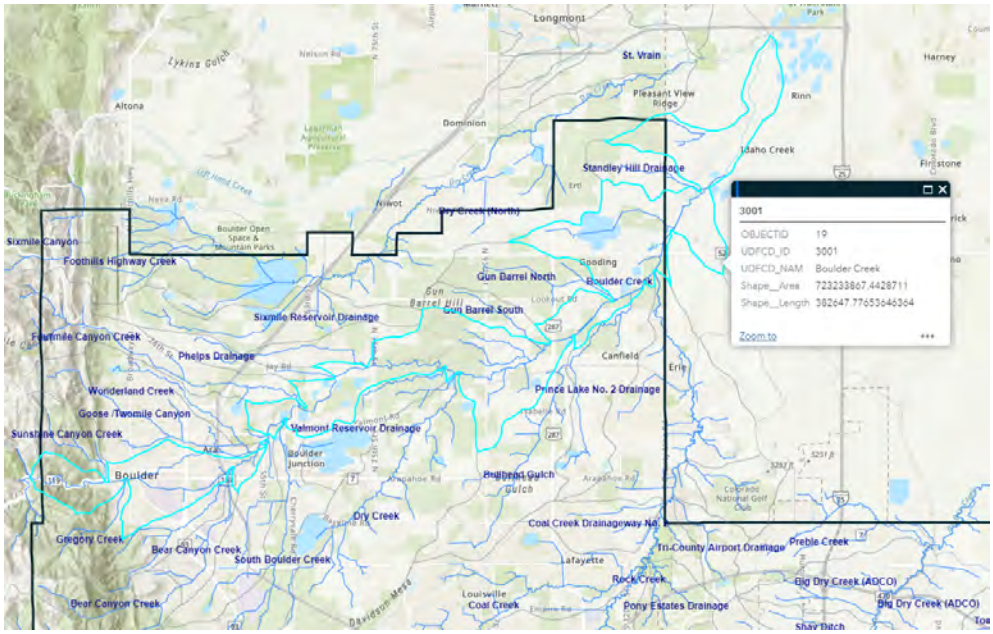


FIGURE 4: BOULDER CREEK MHFD BASIN (UDFCD_ID 3001)

B. SUB-BASIN DESCRIPTION

The Merrick & Company Phase I Drainage Study also specifies the drainageway that traverses the Spring Hill property as a regional drainageway (Reach BC 110). Currently the drainageway consists of a small natural low-flow channel with flat field overbanks. This drainageway may require improvements for ultimate stabilization. The OSP has proposed differing levels of channel improvements depending upon the area the channel is passing through. The improved channel, as per the OSP recommendations, would consist of a grass lined channel with drop structures, ditch overflows, and a spreader weir. The channel that will be designed as part of the conceptual drainage report for this site will have improvements. New specifications will include a grass lined channel with buried riprap, a trickle channel, a maintenance access path, and grouted boulder drop structures. Additional channel design specs can be found in the technical memorandum to be submitted following this report. Refer to Appendix A for excerpt pages from the preliminary design presented in Reference 3.

Downstream flow patterns are dictated by Reach BC110 channel, shown in the OSP maps. The newly designed channel will occupy the same space as the existing channel with additional improvements to account for increased peak flow stormwater runoff values from the additional impervious areas. The increased peak flows will be safely conveyed from the site to Boulder Creek without affecting downstream properties.

III. DRAINAGE DESIGN CRITERIA

A. DESIGN CONSTRAINTS

This drainage design acknowledges the OSP [Ref 3] for location and history of Reach BC110 and will attempt to utilize as many recommendations as possible in redesigning the channel. However, improvements along with the recommendations from the OSP are necessary, as the peak outflow going through the channel will increase significantly due to the increased imperviousness from the development.

Adjacent properties will not impact or be impacted by this development. Runoff from the site will be conveyed to onsite ponds where the water will be treated and released into the channel at historic rates. From there, the runoff goes off-site through the proposed channel to its ultimate outfall into Boulder Creek.

Adjacent collector and arterial streets to the property, such as Highway 52 and County Road 3 act as boundaries to the site but have their own existing water flow paths and designed outfalls. They will not be utilized or affected by the development. Existing structures only are present directly outside of the designated property boundary and therefore will not be affected. There are significant utility lines on the project, but these will be avoided with the storm sewer placement.

As mentioned in section I.B., there are two prominent wetlands on the central eastern portion of the site, which add up to a total of about 12.6 acres. Neither of these wetlands will be developed on or utilized as part of the drainage design. Please see Appendix A for the wetlands map.

B. HYDROLOGICAL CRITERIA

Spring Hill is classified as a Residential Land Use zone, and therefore will use the 2-year as the initial storm and 100-year as the major storm (See Table 800-1 in Reference 5, also listed on the next page). One-hour rainfall depths for Spring Hill were pulled from Section 800 of the Town of Erie Engineering Standards ([Ref 5], also listed on the next page). From this table, the 2-year 0.81-inch rainfall depth was used for the minor storm and the 100-year 2.68-inch rainfall depth was used for the major storm. Peak flow runoff for Spring Hill is calculated using the UDFCD SF-1, SF-2 form, which utilize a modified rational method.

TABLE 1: DESIGN STORM RETURN PERIODS

TABLE 800-1
DESIGN STORM RETURN PERIODS

Land Use or Zoning	Design Storm Return Period	
	Initial Storm	Major Storm
Residential	2-year	100-year
Commercial and Business	5-year	100-year
Public Building Areas	5-year	100-year
Parks, Greenbelts, etc.	2-year	100-year

TABLE 2: ONE-HOUR RAINFALL DEPTH

Table 800-2
TOWN OF ERIE
ONE-HOUR RAINFALL DEPTH

Design Storm	Rainfall Depth (in.)
2-Year	0.81
5-Year	1.11
10-Year	1.39
25-Year	1.84
50-Year	2.24
100-Year	2.68
500-Year	3.89

C. HYDRAULIC CRITERIA

The "Urban Storm Drainage Criteria Manual, Volumes 1, 2, and 3" (USDCM) [Ref. 1] and the "Town of Erie Engineering Standards and Specifications" [Ref. 5] are the design guidelines for the design and analyses provided in this report. Inlets and streets 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. UD-Detention_V4.04 was used to size detention ponds.

In the Phase III drainage report, SewerGEMS software will be used to determine the Hydraulic Grade Line and to size pipes for the storm sewer networks. A general location for the storm-sewer pipe network as well as inlet locations are presented in this report and in the drainage maps.

For inlet design purposes, the street capacities & inlet calculations for the minor and major storms are made based on the criteria specified in Tables 800-7 & 800-8 within the Town of Erie Engineering Standards and Specifications, as can be seen on the next page.

TABLE 3: ALLOWABLE PAVEMENT ENCROACHMENT

TABLE 800-7
ALLOWABLE PAVEMENT ENCROACHMENT AND DEPTH OF FLOW FOR INITIAL STORM RUNOFF

Street Classification	Maximum Encroachment*
Local	No curb overtopping; flow may spread to crown of street.
Collector	No curb overtopping; flow spread must leave the equivalent of one 10-foot driving lane clear of water.
Arterials	No curb overtopping; flow spread must leave the equivalent of two 10-foot driving lanes clear of water - one lane in each direction.
Freeways	No encroachment is allowed on any traffic lane.

* Where no curbing exists, encroachment will not extend past property lines.

The storm sewer system will commence at the point where the maximum allowable encroachment occurs.

TABLE 4: ALLOWABLE FLOW DEPTHS

TABLE 800-8
ALLOWABLE DEPTH OF FLOW AND INUNDATED AREA FOR MAJOR STORM RUNOFF

Street Classification	Allowable Depth and Inundated Areas
Local & Collector	Residential dwellings and public, commercial, and industrial buildings shall be no less than 12 inches above the 100-year flood at the ground line or lowest water entry of the building. The depth of water over the gutter flow line must not exceed 12 inches.
Arterial & Freeway	Residential dwellings and public, commercial, and industrial buildings must be no less than 12 inches above the 100-year flood at the ground line or lowest water entry of the building. The depth of water must not exceed the street crown to allow operation of emergency vehicles. The depth of water over gutter flow line must not exceed twelve (12).inches

D. ADAPTATIONS FROM CRITERIA

There are no adaptions from the UDFCD and Town of Erie Criteria.

IV. DRAINAGE FACILITY DESIGN

The aim of this drainage plan is to direct runoff less than or equal to the 100-year storm event of 2.68-inches over 1-hour safely from the site into the detention ponds. The site will be divided into multiple "sub-basins", where the rational method can be applied to calculate time of concentration and Q_{peak} values for the storm event runoff. Water will flow overland and street flow to sump-inlets at local low points, which tie into a proposed storm-sewer system. On-grade inlets will be placed in necessary sub-basins where a downstream sump-inlet would otherwise be overloaded, or the street capacity busts. Additional water conveyance infrastructure such as channel modifications and culverts will be discussed in the section or in referenced reports.

A. GENERAL CONCEPT

Spring Hill development consists of a total 634 lots; 415 single family residential and 217 multi-family residential lots. The site has a delegated school area, and multiple parks and trails. The Spring Hill development is subdivided into 5 sub-catchment areas, each of which feed to individual detention ponds. Sub-basins with designations "A" drain to Pond A, sub-basins with designations "B" drain to Pond B, etc. The site is delineated into 99 sub-basins and 3 off-site basins. The detention ponds will release water to the regional channel at a modified rate using restrictor plates. Off-site undeveloped areas will be routed around the site using swales and culverts, bypassing the ponds and going directly into the channel.

Spring Hill will utilize the existing location of Reach BC110 to make modifications to the conveyance channel to carry water off the site. Downstream developments are already built around this drainageway, so they will not be impacted by runoff from the Spring Hill development. The proposed channel design will have a HEC model completed for floodplain analysis within the *Spring Hill Conceptual Drainage Report March 2021*.

Ponds were designed with MHFD-Detention software. The rational method SF-1, SF-2, SF-3 presented in the UDFCD criteria was used for the interior street capacity, inlet, and storm sewer design. HY-8 was used for culvert design. Bentley software FlowMaster was used for swale design. Calculations completed for this report can be seen in Appendix A & B.

There two prominent wetlands on the central eastern portion of the site, which add up to a total of about 12.6 acres. Neither of these wetlands will be developed on or utilized as part of the drainage design, therefore, there will be no necessary wetland mitigation or replacement. Please see Appendix A for the wetlands map.

The existing site does not have any existing drainage problems with the current undeveloped areas. Reach BC110 adequately carries existing ground stormwater runoff off-site.

B. SPECIFIC DETAILS

One dilemma this site encountered was with the storm network and irrigation ditch crossings. Due to water rights issues, both the Lower Boulder Ditch and the Boulder and Weld County Ditch are unmodifiable. In order to get water from the outfall of Pond B to the designed channel, the outfall pipe must pass under the ditch completely. The pipes crown will be lowered greater than 18" beneath the ditch invert elevation to avoid the irrigation ditch.

The Cottonwood Extension ditch enters the site from the south-west end, flows in a semi-circle through the southern edge, and then exits through the south-east end. In order to develop this section of the site, the ditch will be rerouted through a storm-pipe eastward to meet up with the ditch as it loops back-around. The section of the existing ditch in the developed area will be graded over.

Best Management Practices (BMPs) will be implemented onsite where lots partially drain towards open spaces (Type B Lots). The open spaces behind those lots are in place to capture the runoff from the backyards or back of lots and treat it for water quality before it is conveyed via swale to an onsite pond or channel.

Aspects of the design like pipe sizing, easements, and drainage tracts will discussed and designed in the Phase III drainage report.

Maintenance access trails will be provided for all detention ponds. The ponds are designed according to section 814 in the Town of Erie Engineering Standards and Specifications [Ref 5], and will have adequate freeboard, embankment slopes, trickle flow channels, outlet configurations, embankment protection, and release rates. Operations and maintenance responsibility for all on-site infrastructure will be the responsibility of the Metro District.

Pond A is a sub-regional facility with a drainage area of 56.40 acres. The weighted average imperviousness is 55.0%. On all ponds, the weighted average impervious value has been rounded up to the nearest 5% to allow for appropriate sizing for any changes that may occur during the Phase III Drainage Report. The pond provides full spectrum detention per MHFD requirements. The MHFD-UD-Detention spreadsheet was utilized to determine the WQCV, EURV, and 100-year volumes of the pond. The outlet will discharge the 100-year peak inflow of 183.00 CFS into a pipe which goes underneath the Lower Boulder Ditch and into the regional outflow channel. The outlet structure has been sized but is not yet designed. The outlet works for Pond A will be designed in the Phase III drainage report.

The table on the following page summarizes the Pond A design. Calculations for the design of Pond A can be seen in the appendix.

TABLE 5: POND A DESIGN SUMMARY

POND A DESIGN SUMMARY			
STAGE	RELATIVE DEPTH	ELEVATION	VOLUME
	(FT)	(FT)	(AC-FT)
STAGE 0	-	4996.58	-
WQCV	2.55	4999.13	1.04
EURV	4.59	5001.17	3.37
100-YEAR	6.36	5002.94	5.73
SPILLWAY INVERT	6.6	5003.18	-

Pond B is a sub-regional facility with a drainage area of 63.1 acres. The weighted average imperviousness is 55.0%. The pond provides full spectrum detention per MHFD requirements. The MHFD-UD-Detention spreadsheet was utilized to determine the WQCV, EURV, and 100-year volumes of the pond. The outlet discharges the 100-year peak inflow of 140.0 CFS into a pipe which goes under the Lower Boulder Ditch, connects with the outflow from Pond C, and is brought northwards to meet with the regional outflow channel. The outlet structure has been sized but is not yet designed. The emergency spillway and the outlet works for Pond B will be designed in the Phase III drainage report.

The table on this page summarizes the Pond B design. Calculations for the design of Pond B can be seen in the appendix.

TABLE 6: POND B DESIGN SUMMARY

POND B DESIGN SUMMARY			
STAGE	RELATIVE DEPTH	ELEVATION	VOLUME
	(FT)	(FT)	(AC-FT)
STAGE 0	-	5001.5	
WQCV	2.95	5004.45	1.16
EURV	5.32	5006.82	4.05
100-YEAR	7.25	5008.75	6.72
SPILLWAY INVERT	7.5	5009	-

Pond C is an onsite detention facility with a drainage area of 17.00 acres. The weighted average imperviousness is 45.0%. The pond provides full spectrum detention per MHFD requirements. The MHFD-UD-Detention spreadsheet was utilized to determine the WQCV, EURV, and 100-year volumes of the pond. The outlet discharges the 100-year peak inflow of 40.50 CFS into a pipe which connects to the same outflow pipe from Pond B and is brought to the regional outflow channel. The outlet structure has been sized but is not yet designed. The outlet works for Pond C will be designed in the Phase III drainage report.

The table on this page summarizes the Pond C design. Calculations for the design of Pond C can be seen in the appendix.

TABLE 7: POND C DESIGN SUMMARY

POND C DESIGN SUMMARY			
STAGE	RELATIVE DEPTH	ELEVATION	VOLUME
	(FT)	(FT)	(AC-FT)
STAGE 0	-	4974.3	-
WQCV	1.68	4975.98	0.28
EURV	2.57	4976.87	0.83
100-YEAR	3.69	4977.99	1.8
SPILLWAY INVERT	3.9	4978.2	-

Pond D is an onsite detention facility with a drainage area of 14.90 acres. The weighted average imperviousness is 45.0%. The pond provides full spectrum detention per MHFD requirements. The MHFD-UD-Detention spreadsheet was utilized to determine the WQCV, EURV, and 100-year volumes of the pond. The CUHP/SWMM with calculated allowable release rates from MHFD was utilized to determine the 100-year volume. The outlet discharges the 100-year peak inflow of 35.50 CFS into the regional outflow channel. The outlet structure has been sized but is not yet designed. The outlet works for Pond D will be designed in the Phase III drainage report.

The table on this page summarizes the Pond D design. Calculations for the design of Pond D can be seen in the appendix.

TABLE 8: POND D DESIGN SUMMARY

POND D DESIGN SUMMARY			
STAGE	RELATIVE DEPTH	ELEVATION	VOLUME
	(FT)	(FT)	(AC-FT)
STAGE 0	-	4974.3	-
WQCV	1.6	4975.9	0.24
EURV	2.42	4976.72	0.72
100-YEAR	3.69	4977.99	1.8
SPILLWAY INVERT	3.8	4978.1	-

Pond E is an onsite detention facility with a drainage area of 17.70 acres. The weighted average imperviousness is 60.0%. The pond provides full spectrum detention per MHFD requirements. The MHFD-UD-Detention spreadsheet was utilized to determine the WQCV, EURV, and 100-year volumes of the pond. The CUHP/SWMM with calculated allowable release rates from MHFD was utilized to determine the 100-year volume. The outlet discharges the 100-year peak inflow of 38.40 CFS into the regional outflow channel. The outlet structure has been sized but is not yet designed. The outlet works for Pond E will be designed in the Phase III drainage report.

The table on this page summarizes the Pond E design. Calculations for the design of Pond E can be seen in the appendix.

TABLE 9: POND E DESIGN SUMMARY

POND E DESIGN SUMMARY			
STAGE	RELATIVE DEPTH	ELEVATION	VOLUME
	(FT)	(FT)	(AC-FT)
STAGE 0	-	4950.5	-
WQCV	1.66	4952.16	0.35
EURV	2.85	4953.35	1.14
100-YEAR	4.09	4954.59	2.13
SPILLWAY INVERT	4.2	4954.7	-

Sub-basin delineation is based on the final grading of lots in a subdivision. Contours shown on the plans reflect pre-built grading. Pre-built grading does not reflect the final grading of the site, merely what is presented to the master developer. Builders will purchase lots from the master developer and finalize the lot grading. The lot grading within the Spring Hill development will be graded to fit one of four types: A, B, Walkout, and Transition. Type A's are graded to pass stormwater runoff unidirectionally, typically towards an adjacent street. Type B's are graded to direct bidirectionally. Walkouts function the same as type B, while adding a back-end drop and retaining wall which allows for placement on a steep slope. Transition lots have delineation which switches from a "B" lot half-width through to connect to the far corner.

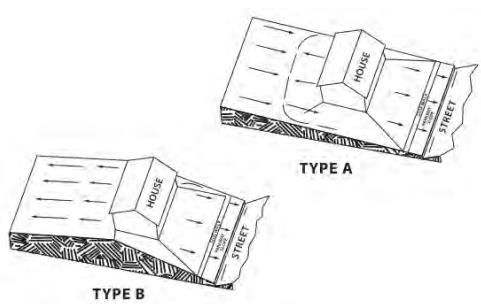


FIGURE 5: LOT TYPES

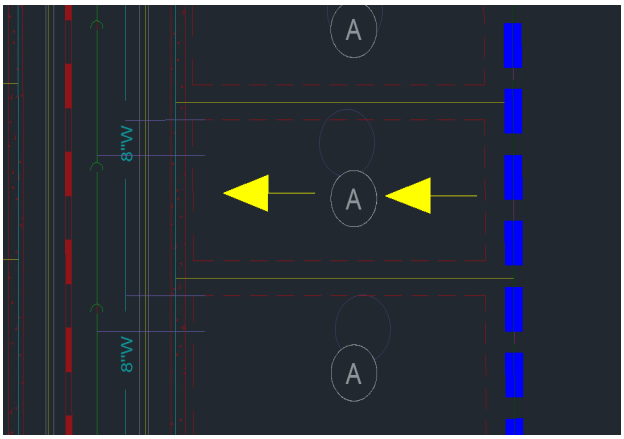


FIGURE 6: A LOT

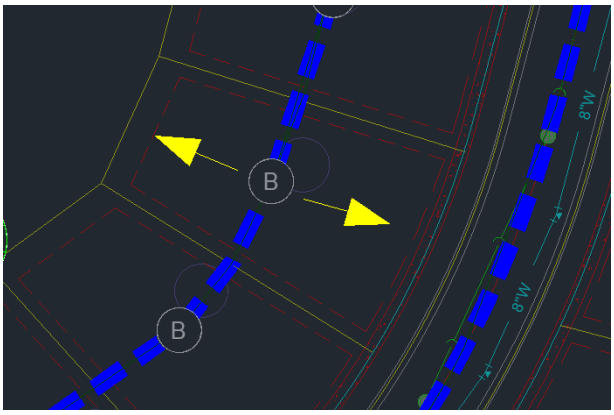


FIGURE 7: B LOT

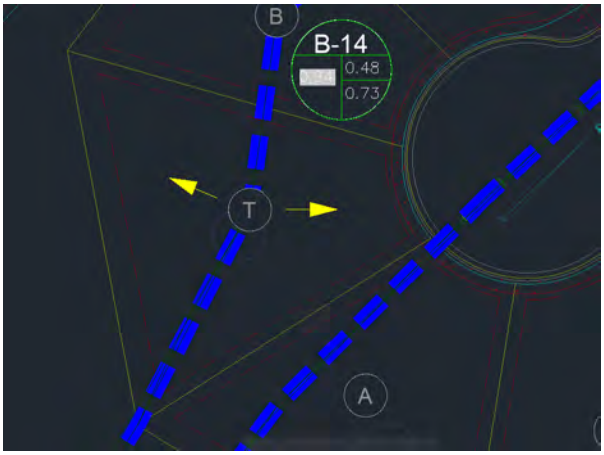


FIGURE 8: TRANSITION LOT

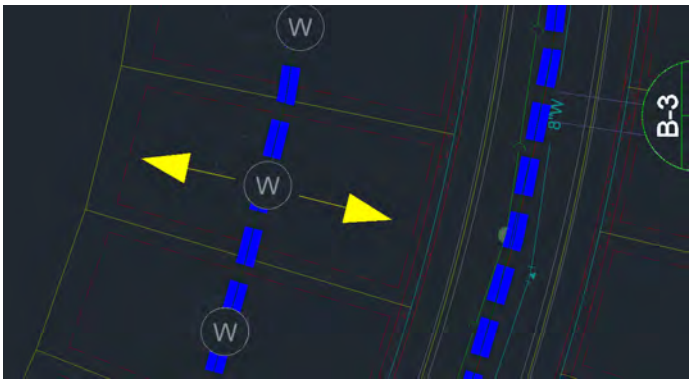


FIGURE 9: WALKAWAY LOT

Spring Hill basin tables are shown below for the on-site ponds. “A” basins drain to Pond A, while “B” basins drain to Pond B, etc. Drainage maps showing the basin locations in the plan view can be seen in the appendix.

TABLE 10: BASIN A SUMMARY TABLE

Basin Summary				
Basin	Area (acres)	% Imp.	Q2	Q100
A-0	3.49	50.30	2.6	15.1
A-1	1.23	53.97	1.1	6.2
A-1a	1.34	54.63	1.0	5.5
A-2	0.48	73.46	0.8	3.4
A-3a	0.84	56.07	0.7	3.6
A-3	1.98	49.55	1.3	7.6
A-4	0.83	81.11	1.4	5.7
A-5	0.75	58.24	0.7	3.6
A-6	2.09	39.43	1.0	7.3
A-7	2.44	41.00	1.3	8.1
A-7a	0.09	67.33	0.1	0.6
A-8	1.73	58.28	1.4	6.6
A-8a	0.56	53.07	0.5	2.4
A-9	1.13	64.32	1.0	4.5
A-10	0.99	57.68	0.8	3.9
A-11	0.13	77.38	0.2	0.9
A-12	0.73	56.99	0.6	2.8
A-13	0.40	60.80	0.5	2.5
A-14	0.71	75.15	0.9	3.8
A-15	2.85	36.06	1.2	9.3
A-16a	0.98	58.88	0.9	4.7
A-16	0.24	46.92	0.2	1.1
A-17	2.03	34.10	0.8	6.7
A-18	0.27	81.85	0.5	2.0
A-19	1.10	54.95	1.0	5.3
A-20	1.75	41.42	1.1	7.3
A-20a	0.43	33.91	0.2	1.8
A-21	2.66	55.73	2.1	11.5
A-23	0.58	56.31	0.5	2.8
A-24	0.60	65.23	0.7	3.1
A-25	0.19	63.89	0.3	1.3
A-27	1.33	61.13	1.2	6.0
A-28	0.66	47.36	0.4	2.7
A-28a	2.23	51.06	1.5	8.6
A-29	1.75	51.22	1.2	6.7
A-29a	0.80	55.10	0.8	4.2
A-30	0.16	63.25	0.2	1.1
A-31	1.44	50.26	1.1	6.3
A-32	12.32	45.02	6.4	40.8

TABLE 11: BASIN B SUMMARY TABLE

Basin Summary				
Basin	Area (acres)	% Imp.	Q2	Q100
B-0	3.10	14.17	0.3	3.1
B-1	0.96	52.04	0.7	3.2
B-2	2.14	53.58	1.7	8.0
B-3	2.80	49.01	1.9	9.4
B-4	1.63	51.68	1.0	4.9
B-5	1.66	53.84	1.5	7.0
B-6	1.15	56.33	0.9	4.2
B-7	1.12	65.41	1.1	4.6
B-8	3.33	55.02	2.0	9.4
B-9	2.90	52.30	2.2	10.5
B-10	1.58	57.61	1.2	5.5
B-11	3.52	54.53	2.4	12.4
B-12	1.10	36.80	0.4	2.3
B-13	3.02	19.76	0.4	3.6
B-14	1.31	59.66	1.2	5.8
B-15	2.07	54.68	1.6	8.5
B-16	1.47	62.69	1.4	6.0
B-17	1.01	61.03	1.0	4.2
B-18	0.81	52.67	0.6	2.8
B-19	1.58	60.61	1.3	5.6
B-20	3.31	54.69	2.1	9.9
B-21	0.74	51.03	0.5	2.5
B-22	1.18	61.63	1.1	5.0
B-23	3.96	41.83	1.7	10.5
B-24	2.13	46.32	1.5	8.7
B-25	1.43	60.63	1.4	6.8
B-26	1.56	56.18	1.1	5.0
B-27	2.80	52.31	1.8	8.4
B-28	1.74	53.62	1.2	5.6
B-29	1.98	51.72	1.1	5.2
B-30	1.73	58.90	1.3	5.6
B-31	2.22	45.36	1.1	6.6

TABLE 12: BASIN C SUMMARY TABLE

Basin Summary				
Basin	Area (acres)	% Imp.	Q2	Q100
C-0	2.76	5.22	0.1	4.0
C-1	0.52	96.23	1.2	4.2
C-2	6.01	26.20	1.7	13.3
C-3	0.21	100.00	0.5	1.7
C-4	4.99	44.13	3.2	20.6
C-5	0.21	76.67	0.4	1.5
C-6	1.60	44.26	0.8	4.7
C-3a	0.61	51.11	0.5	2.7

TABLE 13: BASIN D SUMMARY TABLE

Basin Summary				
Basin	Area (acres)	% Imp.	Q2	Q100
D-0	1.18	97.63	2.3	8.4
D-1	2.40	58.47	2.2	10.6
D-2	3.80	49.34	2.5	14.5
D-3	0.16	35.25	0.1	0.5
D-4	1.36	77.52	1.7	7.2
D-5	0.87	50.92	0.7	3.9
D-6	3.89	18.22	0.7	10.0
D-7	1.19	70.13	1.3	6.0

TABLE 14: BASIN E SUMMARY TABLE

Basin Summary				
Basin	Area (acres)	% Imp.	Q2	Q100
E-1	1.08	100.00	2.0	7.1
E-2	1.48	84.11	2.0	8.0
E-3	1.92	38.20	1.0	7.5
E-4	2.55	66.40	2.1	9.7
E-5	1.34	81.19	1.7	6.9
E-6	1.62	76.23	2.2	9.5
E-7	1.26	68.36	1.5	7.0
E-8	1.18	75.14	1.6	7.0
E-9	1.06	80.11	1.5	6.3
E-0	1.33	52.84	1.3	7.3
OS-E1	5.34	30.39	1.6	13.3
OS-E2	4.02	33.86	1.4	11.0
OS-E3	4.15	19.21	0.7	8.9

Inlet design criteria was based off Town of Erie and UDFCD criteria. MHFD-Inlet v5.01 was used to calculate the peak discharges for major and minor events, and to choose appropriate inlet types and sizes. Local and Collector streets will use CDOT Type R Inlets, inlets in swales will use CDOT Type C Inlets, the on-site school will use a stub-in, and no alleyways within the development will require an inlet.

For most inlets designed on local streets for this site, minor storm events design criteria are regulated by the requested 4” curb height, while most major storm events design criteria are regulated by the maximum water depth of 12”. For the collector street inlet design, a 6” curb height generally leads to design criteria regulation by maximum spread (T_{max}). These design criteria are Tables 800-7 and 800-8 shown in section III. There are no exceptional inlet locations besides basin A-32, which is a stub-in location for a proposed schoolyard plot. The offsite basins do not have inlets, as the runoff from those basins will be carried via swale to culvert underneath the roadway to connect with the outflow channel. Emergency overflow paths

will be designed for applicable sump-inlets during the Phase III drainage report submission. The inlet summary sheets are shown below.

TABLE 15: BASIN A DESIGN POINT SUMMARY

Design Point Summary Table Basin A			
Design Point	Inlet Type	Q2 (CFS)	Q100 (CFS)
31-A	SHEET FLOW	0.0	0.0
30-A	SHEET FLOW	0.0	0.0
29-A	15' CDOT TYPE R ON-GRADE INLET	2.3	11.1
29a-A	10' CDOT TYPE R ON-GRADE INLET	0.8	4.3
28-A	5' CDOT TYPE R ON-GRADE INLET	0.4	2.3
28a-A	SHEET FLOW	0.0	0.0
27-A	10' CDOT TYPE R ON-GRADE INLET	1.2	5.7
25-A	SHEET FLOW	0.0	0.0
24-A	SHEET FLOW	0.0	0.0
23-A	SHEET FLOW	0.0	0.0
21-A	SHEET FLOW	0.0	0.0
20-A	2 - 10' CDOT TYPE R ON-GRADE INLETS	4.4	18.8
20a-A	15' CDOT TYPE R ON-GRADE INLET	1.7	12.1
19-A	10' CDOT TYPE R ON-GRADE INLET	1.0	5.3
18-A	SHEET FLOW	0.0	0.0
17-A	SHEET FLOW	0.0	0.0
16-A	15' CDOT TYPE R ON-GRADE INLET	2.0	12.4
16a-A	SHEET FLOW	0.0	0.0
15-A	10' CDOT TYPE R ON-GRADE INLET	1.2	7.5
14-A	10' CDOT TYPE R ON-GRADE INLET	0.9	3.8
13-A	SHEET FLOW	0.0	0.0
12-A	SHEET FLOW	0.0	0.0
11-A	SHEET FLOW	0.0	0.0
10-A	SHEET FLOW	0.0	0.0
9-A	10' CDOT TYPE R ON-GRADE INLET	1.0	4.5
8a-A	SHEET FLOW	0.0	0.0
8-A	SHEET FLOW	0.0	0.0
7a-A	15' CDOT TYPE R ON-GRADE INLET	2.6	10.9
7-A	10' CDOT TYPE R ON-GRADE INLET	1.9	8.2
6-A	10' CDOT TYPE R ON-GRADE INLET	1.0	7.7
5-A	SHEET FLOW	0.0	0.0
32-A	STUB OUT	6.4	40.8
4-A	15' CDOT TYPE R ON-GRADE INLET	1.4	5.7
3a-A	10' CDOT TYPE R ON-GRADE INLET	1.3	6.8
3-A	10' CDOT TYPE R ON-GRADE INLET	1.6	8.5
2-A	10' CDOT TYPE R ON-GRADE INLET	0.8	3.5
1a-A	10' CDOT TYPE R ON-GRADE INLET	1.0	5.9
1-A	15' CDOT TYPE R ON-GRADE INLET	1.1	6.1
0-A	OVERLAND TO POND	2.6	15.3

TABLE 16: BASIN B DESIGN POINT SUMMARY

Design Point Summary Basin B			
Design Point	Inlet Type	Q2 (CFS)	Q100 (CFS)
31-B	10' CDOT TYPE R INLET ON GRADE	1.1	6.0
30-B	10' CDOT TYPE R INLET ON GRADE	1.3	5.4
29-B	10' CDOT TYPE R INLET ON GRADE	1.1	5.1
28-B	10' CDOT TYPE R INLET ON GRADE	1.2	5.4
27-B	10' CDOT TYPE R INLET ON GRADE	1.8	7.0
26-B	10' CDOT TYPE R INLET ON GRADE	1.1	5.5
25-B	10' CDOT TYPE R INLET ON GRADE	1.4	6.3
24-B	10' CDOT TYPE R INLET ON GRADE	1.5	7.4
23-B	15' CDOT TYPE R INLET ON GRADE	1.7	9.9
22-B	10' CDOT TYPE R INLET ON GRADE	1.1	5.0
21-B	10' CDOT TYPE R INLET ON GRADE	0.5	3.3
20-B	10' CDOT TYPE R INLET ON GRADE	2.1	7.7
19-B	10' CDOT TYPE R INLET ON GRADE	1.3	5.1
18-B	10' CDOT TYPE R INLET ON GRADE	0.6	4.8
17-B	10' CDOT TYPE R INLET ON GRADE	1.0	4.3
16-B	10' CDOT TYPE R INLET ON GRADE	1.4	5.7
15-B	10' CDOT TYPE R INLET ON GRADE	1.6	7.3
14-B	10' CDOT TYPE R INLET ON GRADE	1.2	5.5
13-B	10' CDOT TYPE R INLET ON GRADE	0.4	3.6
12-B	10' CDOT TYPE R INLET ON GRADE	0.4	3.5
11-B	15' CDOT TYPE R INLET ON GRADE	2.4	10.9
10-B	10' CDOT TYPE R INLET ON GRADE	1.2	5.3
9-B	10' CDOT TYPE R INLET ON GRADE	2.2	8.0
8-B	10' CDOT TYPE R INLET ON GRADE	2.0	7.4
7-B	10' CDOT TYPE R INLET ON GRADE	1.1	5.5
6-B	10' CDOT TYPE R INLET IN SUMP	0.9	4.2
5-B	10' CDOT TYPE R INLET ON GRADE	1.5	6.4
4-B	10' CDOT TYPE R INLET IN SUMP	1.0	6.9
3-B	10' CDOT TYPE R INLET ON GRADE	1.9	7.6
2-B	15' CDOT TYPE R INLET IN SUMP	1.7	8.0
1-B	10' CDOT TYPE R INLET IN SUMP	0.7	3.2
0-B	OVERLAND TO POND B	0.3	3.1

TABLE 17: BASIN C DESIGN POINT SUMMARY

`			
Design Point	Inlet Type	Q2 (CFS)	Q100 (CFS)
0-C	OVERLAND TO POND C	0.0	3.8
1-C	5' CDOT TYPE R INLET IN SUMP	1.2	4.2
2-C	2-15' CDOT TYPE R INLET IN SUMP	1.7	13.3
3-C	15' CDOT TYPE R INLET ON GRADE	0.7	3.8
4-C	2-15' CDOT TYPE R INLET ON GRADE	3.2	17.4
5-C	5' CDOT TYPE R INLET IN SUMP	0.4	1.5
6-C	10' CDOT TYPE R INLET IN SUMP	0.9	4.7
3a-C	BYPASS	0.0	0.0

TABLE 18: BASIN D DESIGN POINT SUMMARY

Design Point Summary Table Basin D			
Design Point	Inlet Type	Q2 (CFS)	Q100 (CFS)
0-D	OVERLAND TO POND D	2.3	8.4
1-D	15' CDOT TYPE R IN SUMP	2.2	11.1
2-D	15' CDOT TYPE R IN SUMP	2.5	14.9
3-D	10' CDOT TYPE R ON GRADE	0.1	0.9
4-D	10' CDOT TYPE R ON GRADE	1.7	6.3
5-D	10' CDOT TYPE R ON GRADE	0.7	5.6
6-D	10' CDOT TYPE R IN SUMP	0.7	6.9
7-D	10' CDOT TYPE R ON GRADE	1.3	5.7

TABLE 19: BASIN E DESIGN POINT SUMMARY

Design Point Summary Basin E			
Design Point	Inlet Type	Q2 (CFS)	Q100 (CFS)
9-E	Bypass	0.0	0.0
8-E	15' CDOT Type R On-Grade Inlet	2.7	10.3
7-E	15' CDOT Type R On-Grade Inlet	1.5	6.3
6-E	15' CDOT Type R On-Grade Inlet	2.2	7.6
5-E	15' CDOT Type R On-Grade Inlet	1.7	6.2
4-E	15' CDOT Type R On-Grade Inlet	2.1	7.5
3-E	15' CDOT Type R On-Grade Inlet	1.0	6.5
2-E	CDOT Type C Sump Inlet	2.0	8.0
1-E	CDOT Type C Sump Inlet	2.0	8.0
0-E	Overland to Pond	1.3	7.3
E1-OS	Swale	2.6	13.3
E2-OS	Swale	0.0	0.0
E3-OS	CDOT Type C Inlet in Depression	0.7	8.9

Culverts will be used onsite along the southern basin boundary of Major Basin E and southern boundary of basin D when the channel crosses underneath the road. Th3 culverts are designed to convey all of the channel flows through the site. Culverts were sized using HY-8. The culvert calculations can be found in Appendix B.

Swales are used on the site to carry water from the off-site basins towards the culverts. Swales on-site are grass-lined and comply with Town of Erie and UDFCD criteria. Swale calculations, cross-sections, and plan view locations can be seen in Appendix A.

C. ADAPTATIONS FROM CRITERIA

No adaptations are requested from the criteria.

V. SUMMARY

The purpose of this report is to describe the preliminary drainage design of the Spring Hill subdivision development. The designed detention ponds, inlets, storm sewer system, channel modifications, culverts, swales, overflow paths, and PBMP/BMP's all achieve the purpose of draining the 100-year storm event runoff in a safe, calculated, and environmentally friendly manner. Please refer to the appendix for detailed calculations, design drawings and additional information. Additional features, such as the detailed outlet structure for the detention ponds, will be completed for the final design report as per the Town of Erie requirements.

This Phase II Drainage Report for Spring Hill is prepared in general conformance with the "Engineering Standards & Specifications" [Ref. 5] and the "Urban Storm Drainage Criteria Manual, Volumes 1, 2, and 3" [Ref. 1]. This includes, but is not limited to, compliance with town floodplain regulations and stream preservation standards.

The report addresses drainage concepts related to conceptual drainage design and pond and storm system infrastructure sizing. The site drains to one major channel, which will be modified and detailed separately in *Spring Hill Conceptual Channel Design Memo June 2025*. Surface flow is intercepted by on-grade and sump inlets and are piped to five separate ponds. The on-site ponds will capture and detain developed runoff before exiting the site.

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. **Web Soil Survey**, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx, United States Department of Agriculture – Natural Resources Conservation Service.

3. **Town of Erie, Outfall Systems Plan (East of Coal Creek),** Town of Erie, Merrick & Company, 2020.

4. **Spring Hill Phase 1 Master Drainage Report,** Town of Erie and Weld County, CVL Consultants, November 2018

5. **Erie Colorado Engineering Standards and Specifications, Sections 100 & 800,** Town of Erie, Colorado, Engineering Division, 2021

Software used in analysis: Civil3D 2019, UD-Inlet, UD-Sewer, UD-Culvert, UD-Channel, HEC-RAS, MHFD Data Viewer, UDFCD SF-1, SF-2, SF-3

VII.APPENDICES

A. Hydrologic Computations

1. Wetland Proximity and FEMA Maps
2. Web Soil Survey
3. SF Forms 1-3
4. Runoff Reduction

B. Hydraulic Computations

1. UD Detention Pond Sizing and Forebay Calculations
2. Spillway Rip Rap Sizing
3. Inlet and Street Capacity Calculations
4. Swale Calculations
5. Culvert Calculations

C. Drainage Maps

Westwood

Appendix A – Hydrologic Computations

Wetland Proximity and FEMA Maps
Web Soil Survey
SF Forms 1-3
Runoff Reduction

Westwood

Appendix A – Hydrologic Computations

Wetland Proximity and FEMA Maps

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
DENVER REGULATORY OFFICE, 9307 SOUTH WADSWORTH BOULEVARD
LITTLETON, COLORADO 80128-6901

July 7, 2021

SUBJECT: Approved Jurisdictional Determination – Corps File No. NWO-2021-01101-DEN, 2018 Andulasia Project

Matt Janke
EJE, LLC
7353 S Alton Way

Centennial, CO 80112

Dear Mr. Janke:

This letter is in reference to the Andalusia Project property located at approximate latitude 40.079217, longitude -105.042058, in Weld County, Colorado. The submittal dated June 15, 2021, consists of a request for an Approved Jurisdictional Determination for the above project. The delineated area located on the subject property has been reviewed in accordance with Section 404 of the Clean Water Act under which the U.S. Army Corps of Engineers regulates the discharge of dredged and fill material, and any excavation activity associated with a dredge and fill project in waters of the United States.

At your request, an Approved Jurisdictional Determination (JD), a written indication that wetlands and waterways within your project area are not waters of the United States has been prepared. The review area contains the following aquatic resources that are not considered waters of the United States (WOTUS). Aquatic resources C, D, and F (the Lower Boulder Ditch, Boulder and Weld County Ditch, and Cottonwood Extension Ditch respectively) are irrigation ditches excavated in uplands and do not relocate a tributary, are not constructed in tributaries, and are not constructed in wetlands adjacent to tributaries. Aquatic resources A, B, E, and G are non-adjacent wetlands.

The JD is attached to this letter. If you are not in agreement with the JD decision, you may request an administrative appeal under regulation 33 CFR 331, by using the attached Appeal Form and Administrative Appeal Process form. The request for appeal must be received within 60 days from the date of this letter. It is not necessary to submit a Request for Appeal if you do not object to the JD.

This JD is valid for a period of five years from the date of this letter, unless new information warrants revisions of the JDs before the expiration date, or unless the Corps

has identified, after a possible public notice and comment, that specific geographic areas with rapidly changing environmental conditions merit re-verification on a more frequent basis.

If there are any questions please feel free to contact Cody Wheeler at (720) 922-3846 or by e-mail at Cody.S.Wheeler@usace.army.mil, and reference **Corps File No. NWO-2021-01101-DEN**.

Sincerely,

Kiel Downing
Chief, Denver Regulatory Office

Enclosure(s)

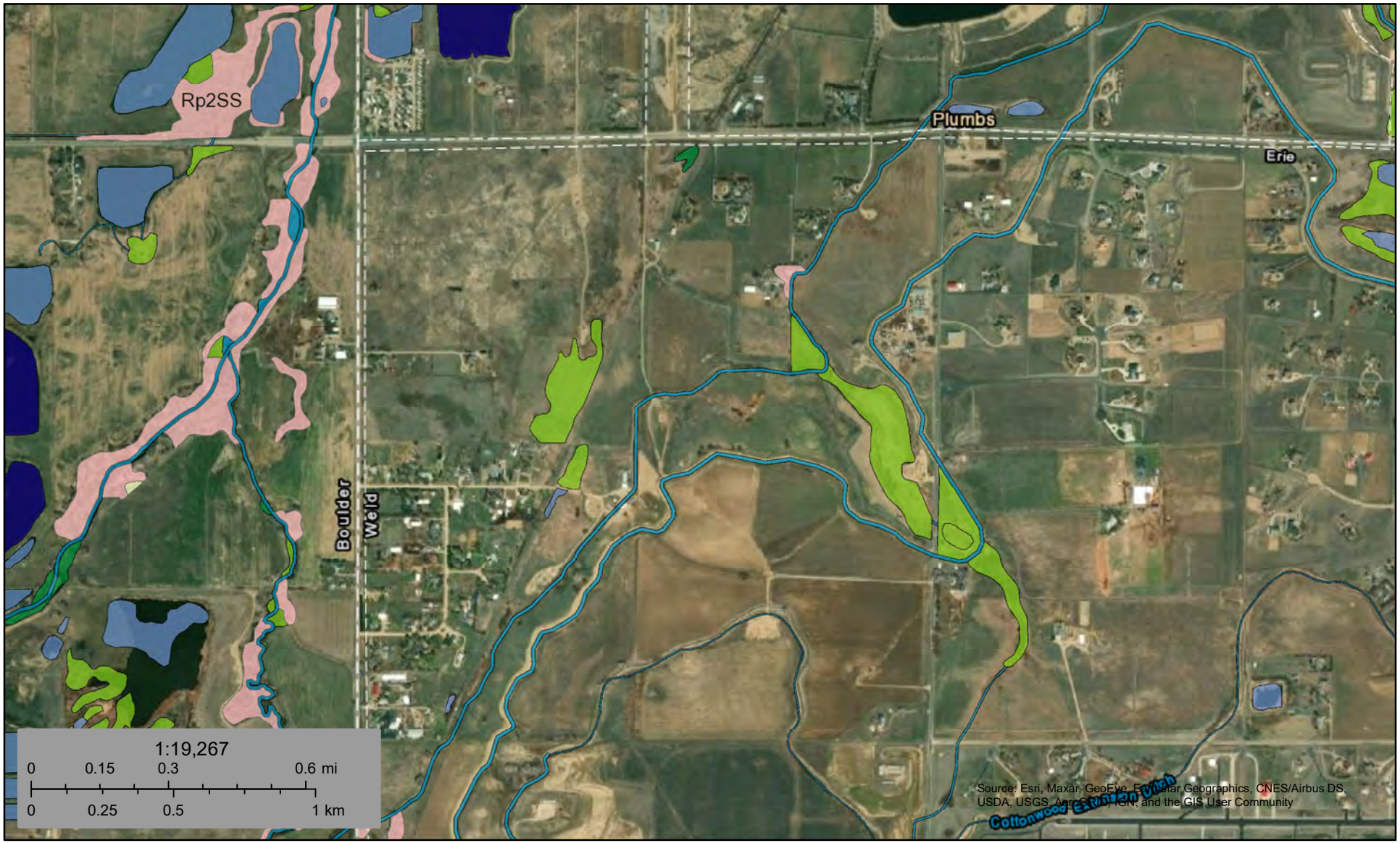
Copies Furnished:

Tyler Worley
2820 Wilderness Place, Suite A
Boulder, CO 80301

U.S. Fish and Wildlife Service

National Wetlands Inventory

Spring Hill Wetlands



February 15, 2021

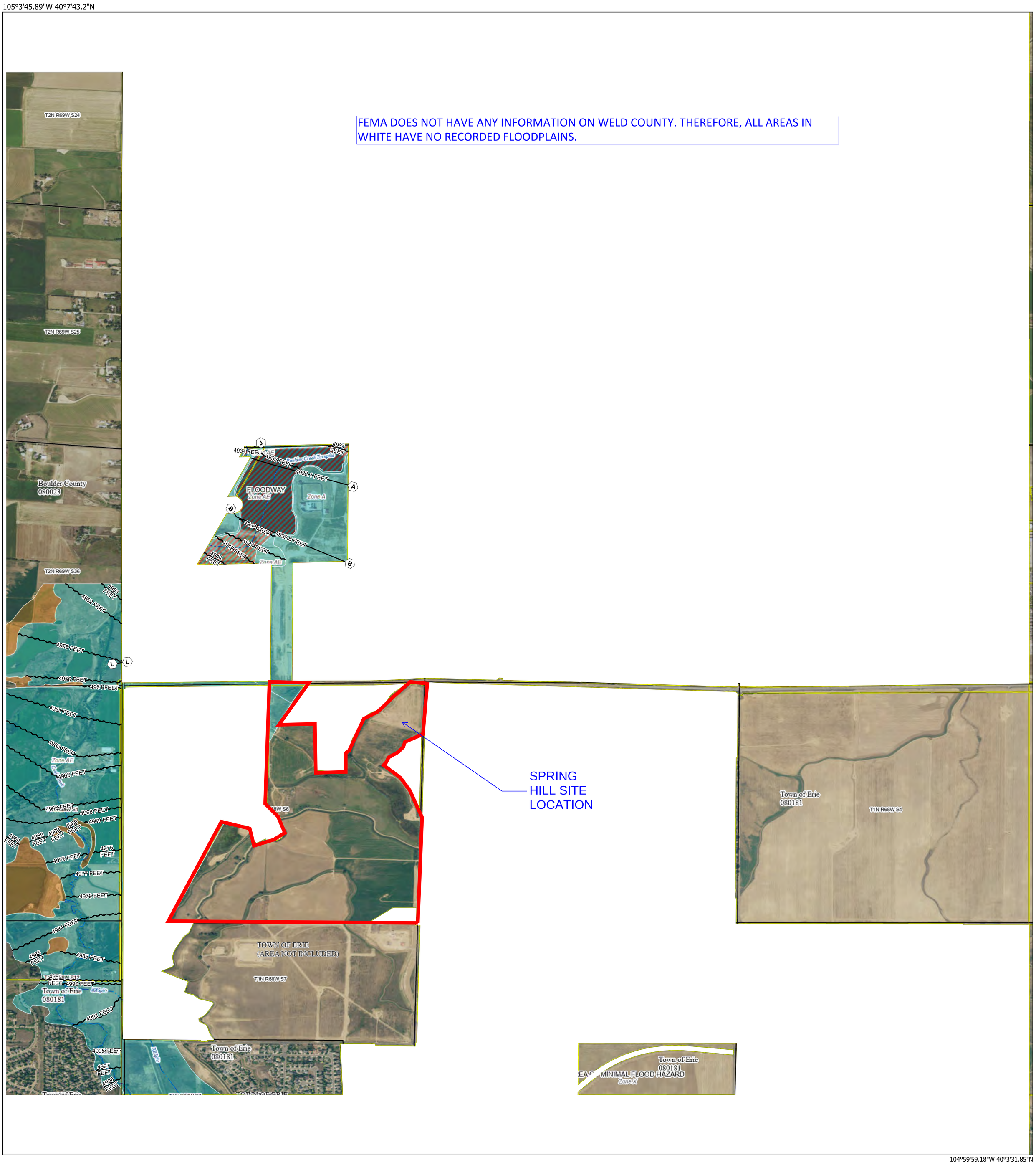
Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

105°3'45.89"W 40°7'43.2"N



104°59'59.18"W 40°3'31.85"N

FLOOD HAZARD INFORMATION

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

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Effective LOMRs
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	20.2 Cross Sections with 1% Annual Chance
	17.5 Water Surface Elevation
	Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://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 website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to 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.

Basemap information shown on this FIRM was provided in digital format by the United States Geological Survey (USGS). The basemap shown is the USGS National Map: Orthoimagery. Last refreshed October, 2020.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **8/5/2021 12:18 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards. This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date.

SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88

For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at https://msc.fema.gov

N

1 inch = 1,000 feet 1:12,000

0 500 1,000 2,000 3,000 4,000 Feet

0 105 210 420 630 840 Meters

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

PANEL **435** OF **610**

Panel Contains:

COMMUNITY	NUMBER	PANEL
WELD COUNTY	080266	0435
WELD COUNTY	080266	0435
TOWN OF ERIE	080181	0435
TOWN OF FREDERICK	080244	0435
TOWN OF ERIE	080181	0435
TOWN OF FREDERICK	080244	0435
BOULDER COUNTY	080023	0435

MAP NUMBER
08013C0435J
EFFECTIVE DATE
December 18, 2012

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 contained within the Flood Insurance Study (FIS) Report that accompanies 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 FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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 Flood Insurance Study Report for this jurisdiction.

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 **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, N/NGS12
National Geodetic Survey
SSMC-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 derived from NAIP Orthophotography produced with a one meter ground resolution from photography dated 2013.

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.

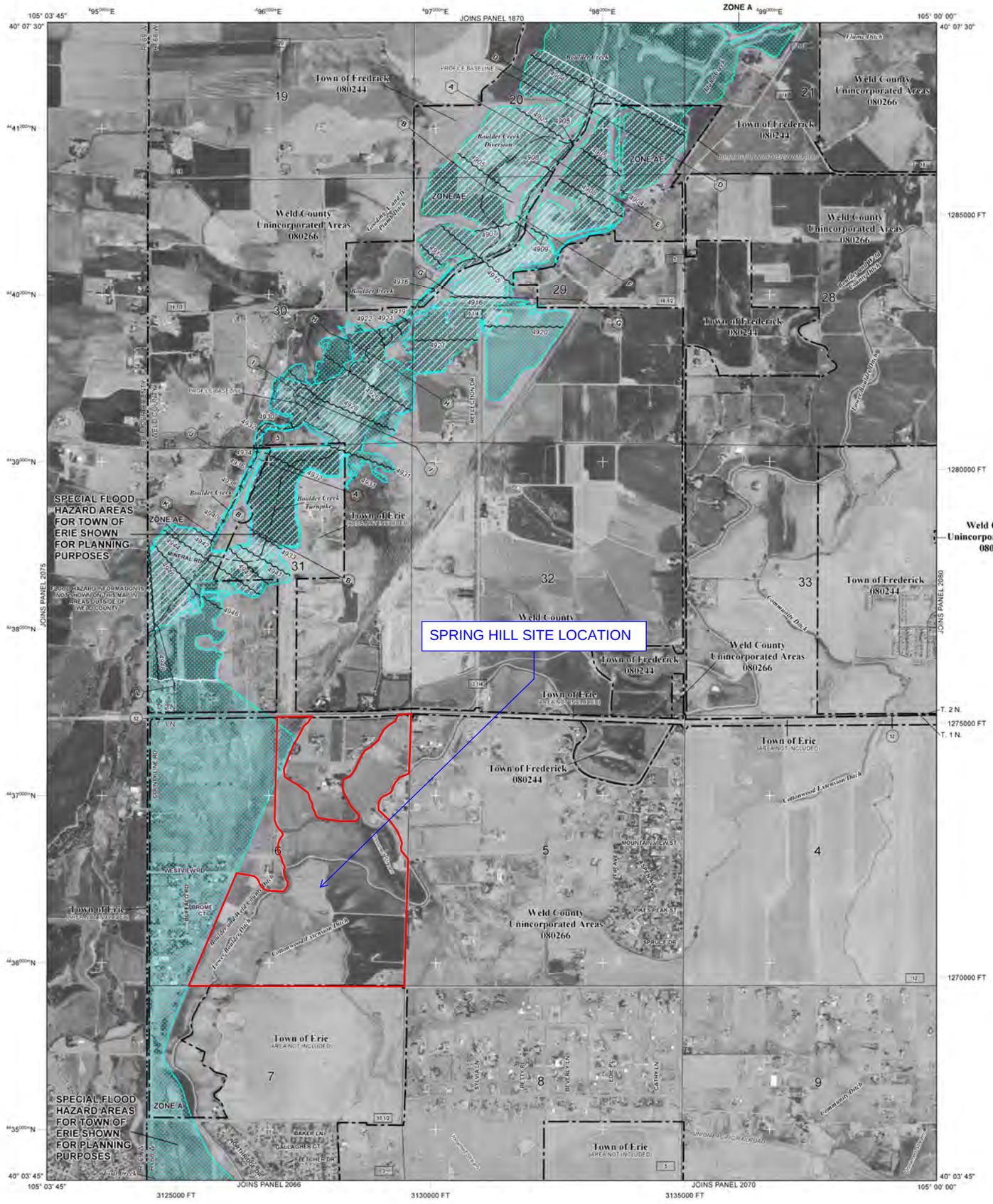
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, 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 this map.

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 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.
513	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 — A	Cross section line
23 - - - - - 23	Transect line
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
3100000 FT	5000-foot ticks: Colorado State Plane Central Zone (FIPS Zone 0502), Lambert Conformal Conic projection
4489000 N	1000-meter Universal Transverse Mercator grid values, zone 13
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.8	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
January 20, 2016

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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" = 1000'

500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2060E

FIRM

FLOOD INSURANCE RATE MAP

WELD COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 2060 OF 2250

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FREDERICK, TOWN OF	080244	2060	E
WELD COUNTY	080266	2060	E

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
08123C2060E

EFFECTIVE DATE
JANUARY 20, 2016

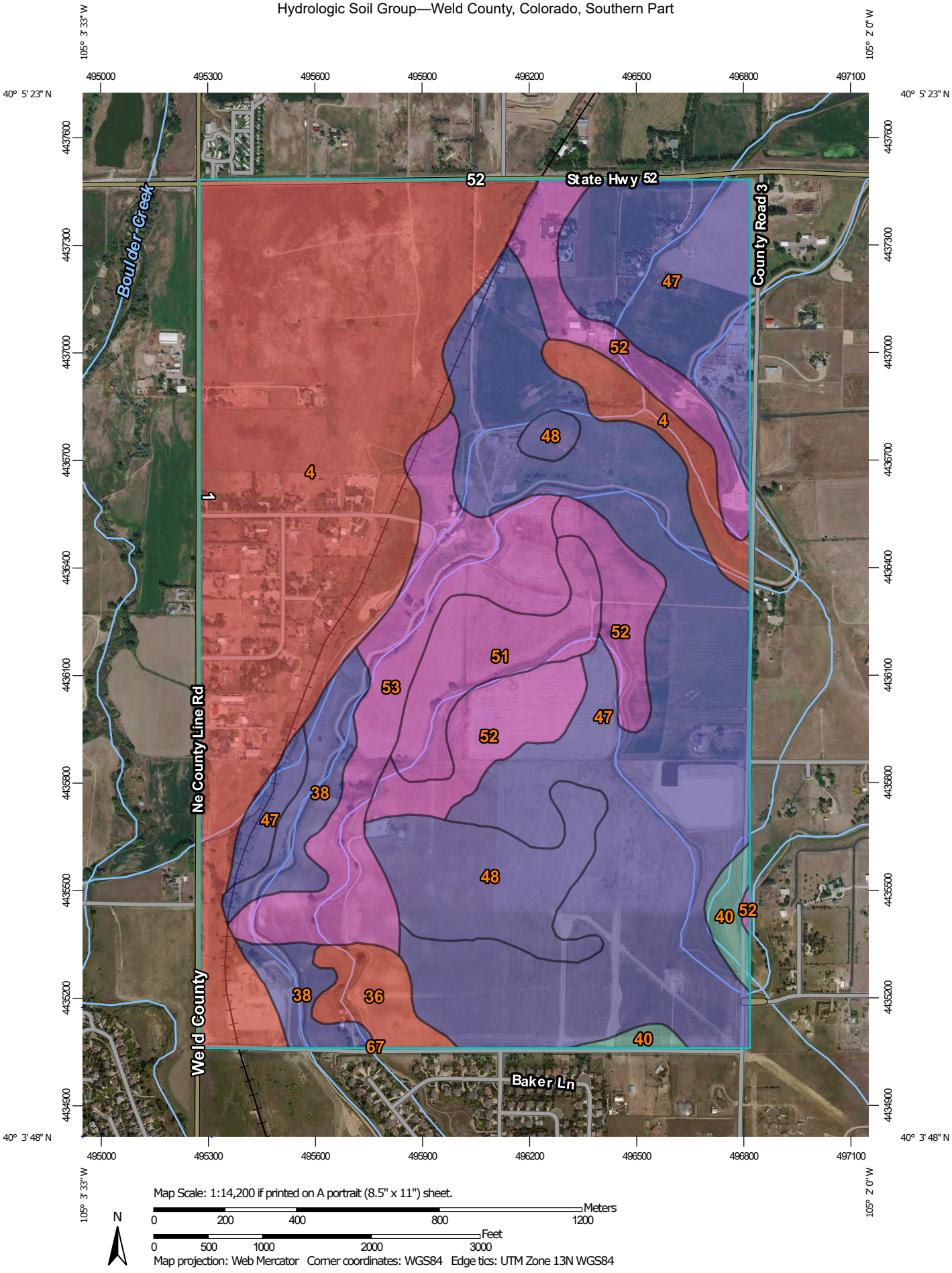
Federal Emergency Management Agency

Westwood

Appendix A – Hydrologic Computations

Web Soil Survey

Hydrologic Soil Group—Weld County, Colorado, Southern Part



Map Scale: 1:14,200 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

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

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

Soil Survey Area: Weld County, Colorado, Southern Part
Survey Area Data: Version 16, Oct 10, 2017

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—Oct 15, 2016

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
4	Aquolls and Aquepts, flooded	D	295.5	31.9%
36	Midway-Shingle complex, 5 to 20 percent slopes	D	16.8	1.8%
38	Nelson fine sandy loam, 3 to 9 percent slopes	B	35.8	3.9%
40	Nunn loam, 1 to 3 percent slopes	C	10.7	1.2%
47	Olney fine sandy loam, 1 to 3 percent slopes	B	323.6	35.0%
48	Olney fine sandy loam, 3 to 5 percent slopes	B	52.4	5.7%
51	Otero sandy loam, 1 to 3 percent slopes	A	36.4	3.9%
52	Otero sandy loam, 3 to 5 percent slopes	A	75.5	8.2%
53	Otero sandy loam, 5 to 9 percent slopes	A	79.0	8.5%
67	Ulm clay loam, 3 to 5 percent slopes	C	0.0	0.0%
Totals for Area of Interest			**925.8**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Westwood

Appendix A – Hydrologic Computations

SF Forms 1-3

SF-1 COMPOSITE BASIN LAND USE

Westwood

Project Name: Springhill E5X
Calculated By: VJH
Checked By:
Date: 6/5/2025

Basin	Type	Total Area (acres)	Single Family Res.	Multi-Family Res.	School	Park	Paved	Open Space	Commercial	Existing Report	Avg. Imp.	Soil Type A	Soil Type B	Soil Type C/D	C_2	C_5	C_{100}
			(acres)	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(%)*	*(%)*	*(%)*	*(%)*			
A-0	Proposed	3.49	0.49	-	-	-	1.48	1.52	-	-	50.3	-	100%	-	0.38	0.41	0.66
A-1	Proposed	1.23	0.76	-	-	-	0.28	0.19	-	-	54.0	-	100%	-	0.41	0.44	0.68
A-1a	Proposed	1.34	1.02	-	-	-	0.22	0.10	-	-	54.6	-	100%	-	0.41	0.45	0.68
A-2	Proposed	0.48	-	-	-	-	0.35	0.13	-	-	73.5	10%	90%	-	0.58	0.61	0.76
A-3a	Proposed	0.84	0.64	-	-	-	0.15	0.05	-	-	56.1	-	100%	-	0.43	0.46	0.69
A-3	Proposed	1.98	1.41	-	-	-	0.27	0.30	-	-	49.5	-	100%	-	0.37	0.40	0.66
A-4	Proposed	0.83	-	-	-	-	0.67	0.16	-	-	81.1	-	100%	-	0.66	0.68	0.81
A-5	Proposed	0.75	0.45	-	-	-	0.21	0.09	-	-	58.2	-	100%	-	0.45	0.48	0.70
A-6	Proposed	2.09	1.16	-	-	-	0.23	0.70	-	-	39.4	-	100%	-	0.28	0.31	0.61
A-7	Proposed	2.44	1.37	-	-	-	0.30	0.77	-	-	41.0	35%	65%	-	0.28	0.31	0.55
A-7a	Proposed	0.09	-	-	-	-	0.06	0.03	-	-	67.3	-	100%	-	0.53	0.56	0.74
A-8	Proposed	1.73	1.13	-	-	-	0.44	0.16	-	-	58.3	50%	50%	-	0.43	0.45	0.63
A-8a	Proposed	0.56	0.31	-	-	-	0.14	0.11	-	-	53.1	50%	50%	-	0.38	0.41	0.60
A-9	Proposed	1.13	0.63	-	-	-	0.41	0.09	-	-	64.3	80%	20%	-	0.48	0.50	0.64
A-10	Proposed	0.99	0.74	-	-	-	0.20	0.05	-	-	57.7	80%	20%	-	0.42	0.44	0.59
A-11	Proposed	0.13	-	-	-	-	0.10	0.03	-	-	77.4	100%	-	-	0.60	0.62	0.71
A-12	Proposed	0.73	0.53	-	-	-	0.15	0.05	-	-	57.0	100%	-	-	0.40	0.42	0.55
A-13	Proposed	0.40	-	-	-	-	0.24	0.16	-	-	60.8	-	100%	-	0.47	0.50	0.71
A-14	Proposed	0.71	-	-	-	-	0.53	0.18	-	-	75.2	15%	85%	-	0.60	0.63	0.77
A-15	Proposed	2.85	0.94	-	-	-	0.53	1.38	-	-	36.1	-	100%	-	0.25	0.28	0.60
A-16a	Proposed	0.98	0.61	-	-	-	0.27	0.10	-	-	58.9	-	100%	-	0.45	0.48	0.70
A-16	Proposed	0.24	-	-	-	-	0.11	0.13	-	-	46.9	-	100%	-	0.35	0.38	0.65
A-17	Proposed	2.03	0.99	-	-	-	0.18	0.86	-	-	34.1	-	100%	-	0.24	0.27	0.59
A-18	Proposed	0.27	-	-	-	-	0.22	0.05	-	-	81.9	-	100%	-	0.66	0.69	0.81
A-19	Proposed	1.10	0.56	-	-	-	0.32	0.22	-	-	54.9	-	100%	-	0.42	0.45	0.68
A-20	Proposed	1.75	1.09	-	-	-	0.17	0.49	-	-	41.4	-	100%	-	0.30	0.33	0.62
A-20a	Proposed	0.43	-	-	-	-	0.14	0.29	-	-	33.9	-	100%	-	0.24	0.27	0.59
A-21	Proposed	2.66	2.12	-	-	-	0.42	0.12	-	-	55.7	-	100%	-	0.42	0.46	0.69
A-23	Proposed	0.58	0.35	-	-	-	0.15	0.08	-	-	56.3	-	100%	-	0.43	0.46	0.69
A-24	Proposed	0.60	0.28	-	-	-	0.25	0.07	-	-	65.2	-	100%	-	0.51	0.54	0.73
A-25	Proposed	0.19	-	-	-	-	0.12	0.07	-	-	63.9	-	100%	-	0.50	0.53	0.73
A-27	Proposed	1.33	0.74	-	-	-	0.44	0.15	-	-	61.1	-	100%	-	0.47	0.50	0.71
A-28	Proposed	0.66	0.44	-	-	-	0.09	0.13	-	-	47.4	-	100%	-	0.35	0.38	0.65
A-28a	Proposed	2.23	1.83	-	-	-	0.22	0.18	-	-	51.1	-	100%	-	0.38	0.41	0.67
A-29	Proposed	1.75	1.08	-	-	-	0.35	0.32	-	-	51.2	-	100%	-	0.38	0.42	0.67
A-29a	Proposed	0.80	0.15	-	-	-	0.36	0.29	-	-	55.1	-	100%	-	0.42	0.45	0.68
A-30	Proposed	0.16	-	-	-	-	0.10	0.06	-	-	63.3	-	100%	-	0.49	0.52	0.72
A-31	Proposed	1.44	1.06	-	-	-	0.19	0.19	-	-	50.3	-	100%	-	0.38	0.41	0.66
A-32	Proposed	12.32	-	-	10.00	-	-	2.32	-	-	45.0	-	85%	15%	0.33	0.37	0.64

Land Use	% Imp.
Single Family Res.	50
Multi-Family Res.	75
School	55
Park	10
Paved	100
Open Space	2
Commercial	95
Existing Report	-

Sum of Areas =	56.31
A*I =	2824.74
Weighted I =	50.2%

SF-2 TIME OF CONCENTRATION FOR EACH SUB-BASIN

Project Name: Springhill E5X

BASIN INFORMATION			INITIAL/OVERLAND FLOW			CHANNELIZED FLOW					TOTAL Tc	MHFD T_c Check				EFFECTIVE Tc
BASIN	AREA	C_5	L_i	S_i	T_i	L_t	S_t	LAND SURFACE	VEL.	T_t	$T_c = T_I + T_T$	% IMP.	LENGTH	SLOPE	T_c	
	(AC)	-	FT	FT/FT	MINUTES	FT	FT/FT		FPS	MINUTES	MINUTES	%	FT	FT/FT	MINUTES	MINUTES
A-0	3.49	0.41	208	0.070	9.5	420	0.010	Paved area	2.00	3.5	13.0	50%	420	0.010	21.8	13.0
A-1	1.23	0.44	65	0.020	7.6	220	0.010	Paved area	2.00	1.8	9.5	54%	220	0.010	19.0	9.5
A-1a	1.34	0.45	202	0.020	13.4	265	0.010	Paved area	2.00	2.2	15.6	55%	265	0.010	19.4	15.6
A-2	0.48	0.61	15	0.020	2.7	250	0.010	Paved area	2.00	2.1	4.8	73%	250	0.010	15.7	5.0
A-3a	0.84	0.46	197	0.020	12.9	205	0.010	Paved area	2.00	1.7	14.6	56%	205	0.010	18.5	14.6
A-3	1.98	0.40	210	0.020	14.6	259	0.010	Paved area	2.00	2.2	16.7	50%	259	0.010	20.3	16.7
A-4	0.83	0.68	17	0.020	2.5	699	0.020	Paved area	2.83	4.1	6.6	81%	699	0.020	16.3	6.6
A-5	0.75	0.48	114	0.020	9.5	297	0.010	Paved area	2.00	2.5	12.0	58%	297	0.010	19.0	12.0
A-6	2.09	0.31	184	0.020	15.3	250	0.010	Paved area	2.00	2.1	17.4	39%	250	0.010	22.2	17.4
A-7	2.44	0.31	180	0.040	12.1	443	0.010	Paved area	2.00	3.7	15.8	41%	443	0.010	24.0	15.8
A-7a	0.09	0.56	15	0.020	3.0	122	0.010	Paved area	2.00	1.0	4.0	67%	122	0.010	15.7	5.0
A-8	1.73	0.45	85	0.020	8.5	850	0.010	Paved area	2.00	7.1	15.6	58%	850	0.010	24.3	15.6
A-8a	0.56	0.41	65	0.020	8.0	275	0.010	Paved area	2.00	2.3	10.3	53%	275	0.010	19.8	10.3
A-9	1.13	0.50	150	0.020	10.6	468	0.010	Paved area	2.00	3.9	14.5	64%	468	0.010	19.4	14.5
A-10	0.99	0.44	120	0.020	10.5	289	0.020	Paved area	2.83	1.7	12.2	58%	289	0.020	18.2	12.2
A-11	0.13	0.62	15	0.020	2.7	158	0.030	Paved area	3.46	0.8	3.4	77%	158	0.030	13.6	5.0
A-12	0.73	0.42	129	0.020	11.1	82	0.010	Paved area	2.00	0.7	11.8	57%	82	0.010	17.1	11.8
A-13	0.40	0.50	17	0.020	3.6	372	0.020	Paved area	2.83	2.2	5.7	61%	372	0.020	18.2	5.7
A-14	0.71	0.63	15	0.020	2.6	1,000	0.010	Paved area	2.00	8.3	11.0	75%	1,000	0.010	21.8	11.0
A-15	2.85	0.28	152	0.030	12.6	764	0.010	Paved area	2.00	6.4	19.0	36%	764	0.010	28.9	19.0
A-16a	0.98	0.48	68	0.020	7.3	515	0.010	Paved area	2.00	4.3	11.6	59%	515	0.010	21.0	11.6
A-16	0.24	0.38	65	0.020	8.4	155	0.010	Paved area	2.00	1.3	9.7	47%	155	0.010	19.7	9.7
A-17	2.03	0.27	188	0.030	14.4	442	0.010	Paved area	2.00	3.7	18.0	34%	442	0.010	25.6	18.0
A-18	0.27	0.69	20	0.020	2.6	273	0.040	Paved area	4.00	1.1	3.8	82%	273	0.040	13.2	5.0
A-19	1.10	0.45	65	0.020	7.5	800	0.040	Paved area	4.00	3.3	10.9	55%	800	0.040	20.7	10.9
A-20	1.75	0.33	196	0.080	9.8	280	0.010	Paved area	2.00	2.3	12.1	41%	280	0.010	22.1	12.1
A-20a	0.43	0.27	62	0.030	8.3	221	0.010	Paved area	2.00	1.8	10.1	34%	221	0.010	22.9	10.1
A-21	2.66	0.46	165	0.040	9.5	571	0.010	Paved area	2.00	4.8	14.2	56%	571	0.010	22.2	14.2
A-23	0.58	0.46	65	0.020	7.4	479	0.010	Paved area	2.00	4.0	11.4	56%	479	0.010	21.2	11.4
A-24	0.60	0.54	69	0.020	6.7	479	0.010	Paved area	2.00	4.0	10.7	65%	479	0.010	19.3	10.7
A-25	0.19	0.53	15	0.020	3.2	224	0.030	Paved area	3.46	1.1	4.3	64%	224	0.030	16.3	5.0
A-27	1.33	0.50	70	0.020	7.2	852	0.010	Paved area	2.00	7.1	14.3	61%	852	0.010	23.7	14.3
A-28	0.66	0.38	131	0.020	11.8	291	0.010	Paved area	2.00	2.4	14.2	47%	291	0.010	21.1	14.2
A-28a	2.23	0.41	186	0.020	13.4	432	0.010	Paved area	2.00	3.6	17.0	51%	432	0.010	21.8	17.0
A-29	1.75	0.42	131	0.020	11.3	700	0.010	Paved area	2.00	5.8	17.1	51%	700	0.010	24.5	17.1
A-29a	0.80	0.45	15	0.020	3.6	650	0.010	Paved area	2.00	5.4	9.0	55%	650	0.010	23.1	9.0
A-30	0.16	0.52	15	0.020	3.2	197	0.010	Paved area	2.00	1.6	4.9	63%	197	0.010	17.1	5.0
A-31	1.44	0.41	137	0.020	11.7	195	0.030	Paved area	3.46	0.9	12.6	50%	195	0.030	18.6	12.6
A-32	12.32	0.37	300	0.020	18.2	500	0.020	Paved area	2.83	2.9	21.2	45%	500	0.020	22.2	21.2

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

Project Name: Springhill E5X
Design Storm: 2 YEAR
2-Year P1 = 0.81 in. UDFCD Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C2)	C2*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
A-31	1.44	0.38	0.54	12.6	2.0	1.09
A-30	0.16	0.49	0.08	5.0	2.7	0.22
A-29	1.75	0.38	0.67	17.1	1.7	1.17
A-29a	0.80	0.42	0.33	9.0	2.3	0.77
A-28	0.66	0.35	0.23	14.2	1.9	0.44
A-28a	2.23	0.38	0.85	17.0	1.7	1.49
A-27	1.33	0.47	0.63	14.3	1.9	1.19
A-25	0.19	0.50	0.09	5.0	2.7	0.26
A-24	0.60	0.51	0.31	10.7	2.1	0.66
A-23	0.58	0.43	0.25	11.4	2.1	0.52
A-21	2.66	0.42	1.13	14.2	1.9	2.14
A-20	1.75	0.30	0.52	12.1	2.0	1.07
A-20a	0.43	0.24	0.10	10.1	2.2	0.22
A-19	1.10	0.42	0.46	10.9	2.1	0.98
A-18	0.27	0.66	0.18	5.0	2.7	0.50
A-17	2.03	0.24	0.48	18.0	1.7	0.82
A-16a	0.98	0.45	0.44	11.6	2.1	0.92
A-16	0.24	0.35	0.08	9.7	2.2	0.19

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C2*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
31-A	A-31	SHEET FLOW	0.54	12.6	2.0	1.09							1.09 cfs Total Flow at DP 31-A
			0.00	12.6	2.0			0.00					0 cfs Captured by DP 31-A.
			0.54	12.6	2.0		1.09		1.5	650.0	2.45	4.4	1.09 cfs-Bypass Flow to DP 29-A
30-A	A-30	SHEET FLOW	0.08	5.0	2.75	0.22							0.22 cfs Total Flow at DP 30-A
			0.00	5.0	2.7			0.00					0 cfs Captured by DP 30-A.
			0.08	5.0	2.7		0.22		1.5	650.0	2.45	4.4	0.22 cfs-Bypass Flow to DP 29-A
29-A	A-29, A-31, A-30	15' CDOT TYPE R ON-GRADE INLET	1.29	17.1	1.7	2.25							2.25 cfs Total Flow at DP 29-A
			1.29	17.1	1.7			2.25					2.25 cfs Captured by DP 29-A.
			0.00	17.1	1.7						-	-	No Bypass Flow
29a-A	A-29a	10' CDOT TYPE R ON-GRADE INLET	0.33	9.0	2.3	0.77							0.77 cfs Total Flow at DP 29a-A
			0.33	9.0	2.3			0.77					0.77 cfs Captured by DP 29a-A.
			0.00	9.0	2.3						-	-	No Bypass Flow
28-A	A-28	5' CDOT TYPE R ON-GRADE INLET	0.23	14.2	1.9	0.44							0.44 cfs Total Flow at DP 28-A
			0.23	14.2	1.9			0.44					0.44 cfs Captured by DP 28-A.
			0.00	14.2	1.9						-	-	No Bypass Flow
28a-A	A-28a	SHEET FLOW	0.85	17.0	1.7	1.49							1.49 cfs Total Flow at DP 28a-A
			0.00	17.0	1.7			0.00					0 cfs Captured by DP 28a-A.
			0.85	17.0	1.7		1.49				-	-	1.49 cfs-Bypass Flow to DP 20a-A
27-A	A-27	10' CDOT TYPE R ON-GRADE INLET	0.63	14.3	1.9	1.19							1.19 cfs Total Flow at DP 27-A
			0.63	14.3	1.9			1.19					1.19 cfs Captured by DP 27-A.
			0.00	14.3	1.9						-	-	No Bypass Flow
25-A	A-25	SHEET FLOW	0.09	5.0	2.7	0.26							0.26 cfs Total Flow at DP 25-A
			0.00	5.0	2.7			0.00					0 cfs Captured by DP 25-A.
			0.09	5.0	2.7		0.26				-	-	0.26 cfs-Bypass Flow to DP 20-A
24-A	A-24	SHEET FLOW	0.31	10.7	2.1	0.66							0.66 cfs Total Flow at DP 24-A
			0.00	10.7	2.1			0.00					0 cfs Captured by DP 24-A.
			0.31	10.7	2.1		0.66				-	-	0.66 cfs-Bypass Flow to DP 20-A
23-A	A-23	SHEET FLOW	0.25	11.4	2.1	0.52							0.52 cfs Total Flow at DP 23-A
			0.00	11.4	2.1			0.00					0 cfs Captured by DP 23-A.
			0.25	11.4	2.1		0.52				-	-	0.52 cfs-Bypass Flow to DP 20-A
21-A	A-21	SHEET FLOW	1.13	14.2	1.9	2.14							2.14 cfs Total Flow at DP 21-A
			0.00	14.2	1.9			0.00					0 cfs Captured by DP 21-A.
			1.13	14.2	1.9		2.14				-	-	2.14 cfs-Bypass Flow to DP 20-A
20-A	A-20, A-25, A-24, A-23, A-21	2 - 10' CDOT TYPE R ON-GRADE INLETS	2.30	14.2	1.9	4.38							4.38 cfs Total Flow at DP 20-A
			2.30	14.2	1.9			4.37					4.37 cfs Captured by DP 20-A.
			0.01	14.2	1.9		0.01		1.5	205.0	2.45	1.4	0.01 cfs-Bypass Flow to DP 20a-A
20a-A	A-20a, A-28a, A-20	15' CDOT TYPE R ON-GRADE INLET	0.96	17.0	1.7	1.68							1.68 cfs Total Flow at DP 20a-A
			0.96	17.0	1.7			1.68					1.68 cfs Captured by DP 20a-A.
			0.00	17.0	1.7						-	-	No Bypass Flow
19-A	A-19	10' CDOT TYPE R ON-GRADE INLET	0.46	10.9	2.1	0.98							0.98 cfs Total Flow at DP 19-A
			0.46	10.9	2.1			0.98					0.98 cfs Captured by DP 19-A.
			0.00	10.9	2.1						-	-	No Bypass Flow
18-A	A-18	SHEET FLOW	0.18	5.0	2.7	0.50							0.5 cfs Total Flow at DP 18-A
			0.00	5.0	2.7			0.00					0 cfs Captured by DP 18-A.
			0.18	5.0	2.7		0.50				-	-	0.5 cfs-Bypass Flow to DP 16-A
17-A	A-17	SHEET FLOW	0.48	18.0	1.7	0.82							0.82 cfs Total Flow at DP 17-A
			0.00	18.0	1.7			0.00					0 cfs Captured by DP 17-A.
			0.48	18.0	1.7		0.82				-	-	0.82 cfs-Bypass Flow to DP 16-A
16a-A	A-16a	SHEET FLOW	0.44	11.6	2.1	0.92							0.92 cfs Total Flow at DP 16a-A
			0.00	11.6	2.1			0.00					0 cfs Captured by DP 16a-A.
			0.44	11.6	2.1		0.92				-	-	0.92 cfs-Bypass Flow to DP 16-A
16-A	A-16, A-18, A-17, A-16a	15' CDOT TYPE R ON-GRADE INLET	1.19	18.0	1.7	2.02							2.02 cfs Total Flow at DP 16-A
			1.19	18.0	1.7			2.02					2.02 cfs Captured by DP 16-A.

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

Project Name: Springhill E5X
Design Storm: 2 YEAR
2-Year P1 = 0.81 in. UDFCD Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C2)	C2*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
A-15	2.85	0.25	0.73	19.0	1.6	1.20
A-14	0.71	0.60	0.42	11.0	2.1	0.90
A-13	0.40	0.47	0.19	5.7	2.6	0.50
A-12	0.73	0.40	0.29	11.8	2.0	0.61
A-11	0.13	0.60	0.08	5.0	2.7	0.22
A-10	0.99	0.42	0.41	12.2	2.0	0.84
A-9	1.13	0.48	0.54	14.5	1.9	1.02
A-8a	0.56	0.38	0.22	10.3	2.2	0.47
A-8	1.73	0.43	0.75	15.6	1.8	1.36
A-7a	0.09	0.53	0.05	5.0	2.7	0.13
A-7	2.44	0.28	0.69	15.8	1.8	1.26
A-6	2.09	0.28	0.59	17.4	1.7	1.02
A-5	0.75	0.45	0.33	12.0	2.0	0.69
A-32	12.32	0.33	4.09	21.2	1.5	6.37
A-4	0.83	0.66	0.55	6.6	2.5	1.40
A-3a	0.84	0.43	0.36	14.6	1.9	0.67
A-3	1.98	0.37	0.73	16.7	1.7	1.29

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C2*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
	10a	GRADE INLET	0.00	18.0	1.7						-	-	No Bypass Flow
15-A	A-15	10' CDOT TYPE R ON-GRADE INLET	0.73	19.0	1.6	1.20							1.2 cfs Total Flow at DP 15-A
			0.73	19.0	1.6			1.20					1.2 cfs Captured by DP 15-A.
			0.00	19.0	1.6						-	-	No Bypass Flow
14-A	A-14	10' CDOT TYPE R ON-GRADE INLET	0.42	11.0	2.1	0.90							0.9 cfs Total Flow at DP 14-A
			0.42	11.0	2.1			0.90					0.9 cfs Captured by DP 14-A.
			0.00	11.0	2.1						-	-	No Bypass Flow
13-A	A-13	SHEET FLOW	0.19	5.7	2.6	0.50							0.5 cfs Total Flow at DP 13-A
			0.00	5.7	2.6			0.00					0 cfs Captured by DP 13-A.
			0.19	5.7	2.6		0.50				-	-	0.5 cfs-Bypass Flow to DP 3-A
12-A	A-12	SHEET FLOW	0.29	11.8	2.0	0.61							0.61 cfs Total Flow at DP 12-A
			0.00	11.8	2.0			0.00					0 cfs Captured by DP 12-A.
			0.29	11.8	2.0		0.61				-	-	0.61 cfs-Bypass Flow to DP 7-A
11-A	A-11	SHEET FLOW	0.08	5.0	2.7	0.22							0.22 cfs Total Flow at DP 11-A
			0.00	5.0	2.7			0.00					0 cfs Captured by DP 11-A.
			0.08	5.0	2.7		0.22				-	-	0.22 cfs-Bypass Flow to DP 7-A
10-A	A-10	SHEET FLOW	0.41	12.2	2.0	0.84							0.84 cfs Total Flow at DP 10-A
			0.00	12.2	2.0			0.00					0 cfs Captured by DP 10-A.
			0.41	12.2	2.0		0.84				-	-	0.84 cfs-Bypass Flow to DP 7a-A
9-A	A-9	10' CDOT TYPE R ON-GRADE INLET	0.54	14.5	1.9	1.02							1.02 cfs Total Flow at DP 9-A
			0.54	14.5	1.9			1.02					1.02 cfs Captured by DP 9-A.
			0.00	14.5	1.9						-	-	No Bypass Flow
8a-A	A-8a	SHEET FLOW	0.22	10.3	2.2	0.47							0.47 cfs Total Flow at DP 8a-A
			0.00	10.3	2.2			0.00					0 cfs Captured by DP 8a-A.
			0.22	10.3	2.2		0.47				-	-	0.47 cfs-Bypass Flow to DP 7a-A
8-A	A-8	SHEET FLOW	0.75	15.6	1.8	1.36							1.36 cfs Total Flow at DP 8-A
			0.00	15.6	1.8			0.00					0 cfs Captured by DP 8-A.
			0.75	15.6	1.8		1.36				-	-	1.36 cfs-Bypass Flow to DP 7a-A
7a-A	A-7a, A-10, A-8a, A-8	15' CDOT TYPE R ON-GRADE INLET	1.42	15.6	1.8	2.58							2.58 cfs Total Flow at DP 7a-A
			1.42	15.6	1.8			2.58					2.58 cfs Captured by DP 7a-A.
			0.00	15.6	1.8						-	-	No Bypass Flow
7-A	A-7, A-12, A-11	10' CDOT TYPE R ON-GRADE INLET	1.07	15.8	1.8	1.93							1.93 cfs Total Flow at DP 7-A
			1.07	15.8	1.8			1.93					1.93 cfs Captured by DP 7-A.
			0.00	15.8	1.8						-	-	No Bypass Flow
6-A	A-6	10' CDOT TYPE R ON-GRADE INLET	0.59	17.4	1.7	1.02							1.02 cfs Total Flow at DP 6-A
			0.59	17.4	1.7			1.02					1.02 cfs Captured by DP 6-A.
			0.00	17.4	1.7						-	-	No Bypass Flow
5-A	A-5	SHEET FLOW	0.33	12.0	2.0	0.69							0.69 cfs Total Flow at DP 5-A
			0.00	12.0	2.0			0.00					0 cfs Captured by DP 5-A.
			0.33	12.0	2.0		0.69				-	-	0.69 cfs-Bypass Flow to DP 3a-A
32-A	A-32	STUB OUT	4.09	21.2	1.5	6.37							6.37 cfs Total Flow at DP 32-A
			4.09	21.2	1.5			6.37					6.37 cfs Captured by DP 32-A.
			0.00	21.2	1.5						-	-	No Bypass Flow
4-A	A-4	15' CDOT TYPE R ON-GRADE INLET	0.55	6.6	2.5	1.40							1.4 cfs Total Flow at DP 4-A
			0.55	6.6	2.5			1.40					1.4 cfs Captured by DP 4-A.
			0.00	6.6	2.5						-	-	No Bypass Flow
3a-A	A-3a, A-5	10' CDOT TYPE R ON-GRADE INLET	0.69	14.6	1.9	1.30							1.3 cfs Total Flow at DP 3a-A
			0.69	14.6	1.9			1.30					1.3 cfs Captured by DP 3-A.
			0.00	14.6	1.9						-	-	No Bypass Flow
3-A	A-3, A-13	10' CDOT TYPE R ON-GRADE INLET	0.92	16.7	1.7	1.62							1.62 cfs Total Flow at DP 3-A
			0.92	16.7	1.7			1.62					1.62 cfs Captured by DP 3-A.
			0.00	16.7	1.7						-	-	No Bypass Flow
		10' CDOT TYPE R ON-	0.28	5.0	2.7	0.78							0.78 cfs Total Flow at DP 2-A

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

Project Name: Springhill E5X
Design Storm: 2 YEAR
2-Year P1 = 0.81 in. UDFCD Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C2)	C2*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
A-2	0.48	0.58	0.28	5.0	2.7	0.78
A-1a	1.34	0.41	0.56	15.6	1.8	1.01
A-1	1.23	0.41	0.50	9.5	2.2	1.13
A-0	3.49	0.38	1.31	13.0	2.0	2.60

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C2*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
2-A	A-2	10' CDOT TYPE R ON-GRADE INLET	0.28	5.0	2.7			0.78					0.78 cfs Captured by DP 2-A.
			0.00	5.0	2.7						-	-	No Bypass Flow
1a-A	A-1a	10' CDOT TYPE R ON-GRADE INLET	0.56	15.6	1.8	1.01							1.01 cfs Total Flow at DP 1a-A
			0.56	15.6	1.8			1.01					1.01 cfs Captured by DP 1a-A.
			0.00	15.6	1.8						-	-	No Bypass Flow
1-A	A-1	15' CDOT TYPE R ON-GRADE INLET	0.50	9.5	2.2	1.13							1.13 cfs Total Flow at DP 1-A
			0.50	9.5	2.2			1.13					1.13 cfs Captured by DP 1-A.
			0.00	9.5	2.2						-	-	No Bypass Flow
0-A	A-0	OVERLAND TO POND	1.31	13.0	2.0	2.60							2.6 cfs Total Flow at DP 0-A
			1.31	13.0	2.0			2.60					2.6 cfs Captured by DP 0-A.
			0.00	13.0	2.0						-	-	No Bypass Flow

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

Project Name: Springhill E5X
Design Storm: 100 YEAR
100-Year P1 = 2.68 in. UDFCD Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C100)	C_{100}*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
A-31	1.44	0.66	0.95	12.6	6.6	6.34
A-30	0.16	0.72	0.12	5.0	9.1	1.06
A-29	1.75	0.67	1.17	17.1	5.7	6.72
A-29a	0.80	0.68	0.55	9.0	7.5	4.17
A-28	0.66	0.65	0.43	14.2	6.2	2.69
A-28a	2.23	0.67	1.49	17.0	5.7	8.57
A-27	1.33	0.71	0.95	14.3	6.2	5.96
A-25	0.19	0.73	0.14	5.0	9.1	1.26
A-24	0.60	0.73	0.44	10.7	7.1	3.13
A-23	0.58	0.69	0.40	11.4	6.9	2.78
A-21	2.66	0.69	1.83	14.2	6.2	11.51
A-20	1.75	0.62	1.09	12.1	6.7	7.33
A-20a	0.43	0.59	0.25	10.1	7.2	1.83
A-19	1.10	0.68	0.75	10.9	7.0	5.32
A-18	0.27	0.81	0.22	5.0	9.1	2.01
A-17	2.03	0.59	1.19	18.0	5.6	6.67
A-16a	0.98	0.70	0.69	11.6	6.8	4.74
A-16	0.24	0.65	0.16	9.7	7.3	1.15

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C100*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
31-A	A-31	SHEET FLOW	0.95	12.6	6.6	6.34							6.34 cfs Total Flow at DP 31-A
			0.00	12.6	6.6			0.00					0 cfs Captured by DP 31-A.
			0.95	12.6	6.6		6.34		1.5	650.0	2.45	4.4	6.34 cfs-Bypass Flow to DP 29-A
30-A	A-30	SHEET FLOW	0.12	5.0	9.1	1.06							1.06 cfs Total Flow at DP 30-A
			0.00	5.0	9.1			0.00					0 cfs Captured by DP 30-A.
			0.12	5.0	9.1		1.06		1.5	650.0	2.45	4.4	1.06 cfs-Bypass Flow to DP 29-A
29-A	A-29, A-31, A-30	15' CDOT TYPE R ON-GRADE INLET	2.24	17.1	5.7	12.88							12.88 cfs Total Flow at DP 29-A
			1.92	17.1	5.7			11.07					11.07 cfs Captured by DP 29-A.
			0.31	17.1	5.7		1.81		1.5	765.0	2.45	5.2	1.81 cfs-Bypass Flow to DP 29a-A
29a-A	A-29a, A-29	10' CDOT TYPE R ON-GRADE INLET	0.86	22.3	5.0	4.33							4.33 cfs Total Flow at DP 29a-A
			0.86	22.3	5.0			4.31					4.31 cfs Captured by DP 29a-A.
			0.00	22.3	5.0		0.02		2.0	840.0	2.83	4.9	0.02 cfs-Bypass Flow to DP 4-A
28-A	A-28	5' CDOT TYPE R ON-GRADE INLET	0.43	14.2	6.2	2.69							2.69 cfs Total Flow at DP 28-A
			0.37	14.2	6.2			2.32					2.32 cfs Captured by DP 28-A.
			0.06	14.2	6.2		0.37		1.5	760.0	2.45	5.2	0.37 cfs-Bypass Flow to DP 20a-A
28a-A	A-28a	SHEET FLOW	1.49	17.0	5.7	8.57							8.57 cfs Total Flow at DP 28a-A
			0.00	17.0	5.7			0.00					0 cfs Captured by DP 28a-A.
			1.49	17.0	5.7		8.57		1.5	218.0	2.45	1.5	8.57 cfs-Bypass Flow to DP 20a-A
27-A	A-27	10' CDOT TYPE R ON-GRADE INLET	0.95	14.3	6.2	5.96							5.96 cfs Total Flow at DP 27-A
			0.90	14.3	6.2			5.66					5.66 cfs Captured by DP 27-A.
			0.05	14.3	6.2		0.30		1.5	210.0	2.45	1.4	0.3 cfs-Bypass Flow to DP 20a-A
25-A	A-25	SHEET FLOW	0.14	5.0	9.1	1.26							1.26 cfs Total Flow at DP 25-A
			0.00	5.0	9.1			0.00					0 cfs Captured by DP 25-A.
			0.14	5.0	9.1		1.26				-	-	1.26 cfs-Bypass Flow to DP 20-A
24-A	A-24	SHEET FLOW	0.44	10.7	7.1	3.13							3.13 cfs Total Flow at DP 24-A
			0.00	10.7	7.1			0.00					0 cfs Captured by DP 24-A.
			0.44	10.7	7.1		3.13				-	-	3.13 cfs-Bypass Flow to DP 20-A
23-A	A-23	SHEET FLOW	0.40	11.4	6.9	2.78							2.78 cfs Total Flow at DP 23-A
			0.00	11.4	6.9			0.00					0 cfs Captured by DP 23-A.
			0.40	11.4	6.9		2.78				-	-	2.78 cfs-Bypass Flow to DP 20-A
21-A	A-21	SHEET FLOW	1.83	14.2	6.2	11.51							11.51 cfs Total Flow at DP 21-A
			0.00	14.2	6.2			0.00					0 cfs Captured by DP 21-A.
			1.83	14.2	6.2		11.51				-	-	11.51 cfs-Bypass Flow to DP 20-A
20-A	A-20, A-25, A-24, A-23, A-21	2 - 10' CDOT TYPE R ON-GRADE INLETS	3.89	14.2	6.2	24.49							24.49 cfs Total Flow at DP 20-A
			2.99	14.2	6.2			18.78					18.78 cfs Captured by DP 20-A.
			0.91	14.2	6.2		5.71		1.5	205.0	2.45	1.4	5.71 cfs-Bypass Flow to DP 20a-A
20a-A	A-20a, A-28, A-28a, A-27, A-20	15' CDOT TYPE R ON-GRADE INLET	2.75	19.4	5.4	14.86							14.86 cfs Total Flow at DP 20a-A
			2.24	19.4	5.4			12.08					12.08 cfs Captured by DP 20a-A.
			0.51	19.4	5.4		2.78		2.0	785.0	2.83	4.6	2.78 cfs-Bypass Flow to DP 4-A
19-A	A-19	10' CDOT TYPE R ON-GRADE INLET	0.75	10.9	7.0	5.32							5.32 cfs Total Flow at DP 19-A
			0.74	10.9	7.0			5.26					5.26 cfs Captured by DP 19-A.
			0.01	10.9	7.0		0.06		2.0	775.0	2.83	4.6	0.06 cfs-Bypass Flow to DP 4-A
18-A	A-18	SHEET FLOW	0.22	5.0	9.1	2.01							2.01 cfs Total Flow at DP 18-A
			0.00	5.0	9.1			0.00					0 cfs Captured by DP 18-A.
			0.22	5.0	9.1		2.01				-	-	2.01 cfs-Bypass Flow to DP 16-A
17-A	A-17	SHEET FLOW	1.19	18.0	5.6	6.67							6.67 cfs Total Flow at DP 17-A
			0.00	18.0	5.6			0.00					0 cfs Captured by DP 17-A.
			1.19	18.0	5.6		6.67				-	-	6.67 cfs-Bypass Flow to DP 16-A
16a-A	A-16a	SHEET FLOW	0.69	11.6	6.8	4.74							4.74 cfs Total Flow at DP 16a-A
			0.00	11.6	6.8			0.00					0 cfs Captured by DP 16a-A.
			0.69	11.6	6.8		4.74				-	-	4.74 cfs-Bypass Flow to DP 16-A
16-A	A-16, A-18, A-17, A-16a	15' CDOT TYPE R ON-GRADE INLET	2.25	18.0	5.6	12.63							12.63 cfs Total Flow at DP 16-A
			2.22	18.0	5.6			12.44					12.44 cfs Captured by DP 16-A.

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

Project Name: Springhill E5X
Design Storm: 100 YEAR
100-Year P1 = 2.68 in. UDFCD Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C100)	C_{100}*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
A-15	2.85	0.60	1.70	19.0	5.4	9.26
A-14	0.71	0.77	0.54	11.0	7.0	3.83
A-13	0.40	0.71	0.28	5.7	8.8	2.51
A-12	0.73	0.55	0.40	11.8	6.8	2.77
A-11	0.13	0.71	0.09	5.0	9.1	0.85
A-10	0.99	0.59	0.58	12.2	6.7	3.92
A-9	1.13	0.64	0.72	14.5	6.2	4.47
A-8a	0.56	0.60	0.34	10.3	7.2	2.43
A-8	1.73	0.63	1.09	15.6	6.0	6.58
A-7a	0.09	0.74	0.07	5.0	9.1	0.61
A-7	2.44	0.55	1.35	15.8	5.9	8.06
A-6	2.09	0.61	1.28	17.4	5.7	7.29
A-5	0.75	0.70	0.52	12.0	6.7	3.56
A-32	12.32	0.64	7.91	21.2	5.1	40.81
A-4	0.83	0.81	0.67	6.6	8.4	5.68
A-3a	0.84	0.69	0.58	14.6	6.2	3.59
A-3	1.98	0.66	1.30	16.7	5.8	7.60

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C100*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
	10a	GRADE INLET	0.03	18.0	5.6		0.19		2.0	790.0	2.83	4.7	0.19 cfs-Bypass Flow to DP 2-A
15-A	A-15	10' CDOT TYPE R ON-GRADE INLET	1.70	19.0	5.4	9.26							9.26 cfs Total Flow at DP 15-A
			1.37	19.0	5.4			7.49					7.49 cfs Captured by DP 15-A.
			0.32	19.0	5.4		1.77		2.0	800.0	2.83	4.7	1.77 cfs-Bypass Flow to DP 2-A
14-A	A-14	10' CDOT TYPE R ON-GRADE INLET	0.54	11.0	7.0	3.83							3.83 cfs Total Flow at DP 14-A
			0.54	11.0	7.0			3.83					3.83 cfs Captured by DP 14-A.
			0.00	11.0	7.0						-	-	No Bypass Flow
13-A	A-13	SHEET FLOW	0.28	5.7	8.8	2.51							2.51 cfs Total Flow at DP 13-A
			0.00	5.7	8.8			0.00					0 cfs Captured by DP 13-A.
			0.28	5.7	8.8		2.51				-	-	2.51 cfs-Bypass Flow to DP 3-A
12-A	A-12	SHEET FLOW	0.40	11.8	6.8	2.77							2.77 cfs Total Flow at DP 12-A
			0.00	11.8	6.8			0.00					0 cfs Captured by DP 12-A.
			0.40	11.8	6.8		2.77				-	-	2.77 cfs-Bypass Flow to DP 7-A
11-A	A-11	SHEET FLOW	0.09	5.0	9.1	0.85							0.85 cfs Total Flow at DP 11-A
			0.00	5.0	9.1			0.00					0 cfs Captured by DP 11-A.
			0.09	5.0	9.1		0.85				-	-	0.85 cfs-Bypass Flow to DP 7-A
10-A	A-10	SHEET FLOW	0.58	12.2	6.7	3.92							3.92 cfs Total Flow at DP 10-A
			0.00	12.2	6.7			0.00					0 cfs Captured by DP 10-A.
			0.58	12.2	6.7		3.92				-	-	3.92 cfs-Bypass Flow to DP 7a-A
9-A	A-9	10' CDOT TYPE R ON-GRADE INLET	0.72	14.5	6.2	4.47							4.47 cfs Total Flow at DP 9-A
			0.72	14.5	6.2			4.47					4.47 cfs Captured by DP 9-A.
			0.00	14.5	6.2						-	-	No Bypass Flow
8a-A	A-8a	SHEET FLOW	0.34	10.3	7.2	2.43							2.43 cfs Total Flow at DP 8a-A
			0.00	10.3	7.2			0.00					0 cfs Captured by DP 8a-A.
			0.34	10.3	7.2		2.43				-	-	2.43 cfs-Bypass Flow to DP 7a-A
8-A	A-8	SHEET FLOW	1.09	15.6	6.0	6.58							6.58 cfs Total Flow at DP 8-A
			0.00	15.6	6.0			0.00					0 cfs Captured by DP 8-A.
			1.09	15.6	6.0		6.58				-	-	6.58 cfs-Bypass Flow to DP 7a-A
7a-A	A-7a, A-10, A-8a, A-8	15' CDOT TYPE R ON-GRADE INLET	2.08	15.6	6.0	12.50							12.5 cfs Total Flow at DP 7a-A
			1.80	15.6	6.0			10.85					10.85 cfs Captured by DP 7a-A.
			0.27	15.6	6.0		1.65		1.0	460.0	2.00	3.8	1.65 cfs-Bypass Flow to DP 1a-A
7-A	A-7, A-12, A-11	10' CDOT TYPE R ON-GRADE INLET	1.85	15.8	5.9	11.04							11.04 cfs Total Flow at DP 7-A
			1.36	15.8	5.9			8.16					8.16 cfs Captured by DP 7-A.
			0.48	15.8	5.9		2.88		1.0	190.0	2.00	1.6	2.88 cfs-Bypass Flow to DP 6-A
6-A	A-6, A-7	10' CDOT TYPE R ON-GRADE INLET	1.76	17.4	5.7	10.03							10.03 cfs Total Flow at DP 6-A
			1.36	17.4	5.7			7.74					7.74 cfs Captured by DP 6-A.
			0.40	17.4	5.7		2.29		1.0	350.0	2.00	2.9	2.29 cfs-Bypass Flow to DP 3a-A
5-A	A-5	SHEET FLOW	0.52	12.0	6.7	3.56							3.56 cfs Total Flow at DP 5-A
			0.00	12.0	6.7			0.00					0 cfs Captured by DP 5-A.
			0.52	12.0	6.7		3.56				-	-	3.56 cfs-Bypass Flow to DP 3a-A
32-A	A-32	STUB OUT	7.91	21.2	5.1	40.81							40.81 cfs Total Flow at DP 32-A
			7.91	21.2	5.1			40.81					40.81 cfs Captured by DP 32-A.
			0.00	21.2	5.1						-	-	No Bypass Flow
4-A	A-4, A-29a, A-20a, A-19	15' CDOT TYPE R ON-GRADE INLET	0.67	6.6	8.4	5.68							5.68 cfs Total Flow at DP 4-A
			0.67	6.6	8.4			5.68					5.68 cfs Captured by DP 4-A.
			0.00	6.6	8.4						-	-	No Bypass Flow
3a-A	A-3a, A-6, A-5	10' CDOT TYPE R ON-GRADE INLET	1.51	20.3	5.2	7.93							7.93 cfs Total Flow at DP 3a-A
			1.29	20.3	5.2			6.78					6.78 cfs Captured by DP 3-A.
			0.22	20.3	5.2		1.15		1.0	295.0	2.00	2.5	1.15 cfs-Bypass Flow to DP 3-A
3-A	A-3, A-13, A-3a	10' CDOT TYPE R ON-GRADE INLET	1.81	22.8	4.9	8.96							8.96 cfs Total Flow at DP 3-A
			1.71	22.8	4.9			8.46					8.46 cfs Captured by DP 3-A.
			0.10	22.8	4.9		0.50		0.8	30.0	-	-	0.5 cfs-Bypass Flow to DP 1-A
		10' CDOT TYPE R ON-	0.72	23.7	4.8	3.51							3.51 cfs Total Flow at DP 2-A

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

Project Name: Springhill E5X
Design Storm: 100 YEAR
100-Year P1 = 2.68 in. UDFCD Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C100)	C_{100}*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
A-2	0.48	0.76	0.37	5.0	9.1	3.35
A-1a	1.34	0.68	0.91	15.6	6.0	5.51
A-1	1.23	0.68	0.84	9.5	7.4	6.24
A-0	3.49	0.66	2.31	13.0	6.5	15.15

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C100*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
2-A	A-2, A-16, A-15	10' CDOT TYPE R ON-GRADE INLET	0.72	23.7	4.8			3.51					3.51 cfs Captured by DP 2-A.
			0.00	23.7	4.8						-	-	No Bypass Flow
1a-A	A-1a, A-7a	10' CDOT TYPE R ON-GRADE INLET	1.19	19.5	5.3	6.41							6.41 cfs Total Flow at DP 1a-A
			1.10	19.5	5.3			5.93					5.93 cfs Captured by DP 1a-A.
			0.09	19.5	5.3		0.48		1.0	330.0	2.00	2.8	0.48 cfs-Bypass Flow to DP 1-A
1-A	A-1, A-3, A-1a	15' CDOT TYPE R ON-GRADE INLET	0.84	9.5	7.4	6.24							6.24 cfs Total Flow at DP 1-A
			0.81	9.5	7.4			6.07					6.07 cfs Captured by DP 1-A.
			0.02	9.5	7.4		0.17				-	-	0.17 cfs-Bypass Flow to DP 0-A
0-A	A-0, A-1	OVERLAND TO POND	2.33	13.0	6.5	15.30							15.3 cfs Total Flow at DP 0-A
			2.33	13.0	6.5			15.30					15.3 cfs Captured by DP 0-A.
			0.00	13.0	6.5						-	-	No Bypass Flow

SF-1 COMPOSITE BASIN LAND USE

Westwood

Project Name: SPRING HILL
Calculated By: GR
Checked By: MS
Date: 6/2/2025

Basin	Type	Total Area (acres)	Single Family Res	Multi Family Res	Playground	Park	Paved	Historic	Open Space	Existing Report	Avg. Imp.	Soil Type A	Soil Type B	Soil Type C/D	C_2	C_5	C_{100}
			(acres)	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(%)*	*(%)*	*(%)*	*(%)*			
B-0	Proposed	3.10	0.50	-	-	-	0.14	-	2.46	-	14.2	100%	-	-	0.07	0.07	0.22
B-1	Proposed	0.96	0.47	-	-	-	0.26	-	0.23	-	52.0	100%	-	-	0.36	0.37	0.52
B-2	Proposed	2.14	1.34	-	-	-	0.47	-	0.33	-	53.6	100%	-	-	0.37	0.39	0.53
B-3	Proposed	2.80	1.64	-	-	-	0.54	-	0.62	-	49.0	100%	-	-	0.33	0.35	0.49
B-4	Proposed	1.63	1.34	-	-	-	0.17	-	0.12	-	51.7	100%	-	-	0.36	0.37	0.51
B-5	Proposed	1.66	1.16	-	-	-	0.31	-	0.19	-	53.8	100%	-	-	0.38	0.39	0.53
B-6	Proposed	1.15	0.73	-	-	-	0.28	-	0.14	-	56.3	100%	-	-	0.40	0.41	0.55
B-7	Proposed	1.12	0.52	-	-	-	0.47	-	0.13	-	65.4	100%	-	-	0.48	0.50	0.62
B-8	Proposed	3.33	2.80	-	-	-	0.43	-	0.10	-	55.0	100%	-	-	0.39	0.40	0.54
B-9	Proposed	2.90	2.12	-	-	-	0.45	-	0.33	-	52.3	100%	-	-	0.36	0.38	0.52
B-10	Proposed	1.58	0.83	-	-	-	0.49	-	0.26	-	57.6	100%	-	-	0.41	0.43	0.56
B-11	Proposed	3.52	2.75	-	-	-	0.54	-	0.23	-	54.5	42%	58%	-	0.40	0.42	0.62
B-12	Proposed	1.10	-	-	-	0.62	0.34	-	0.14	-	36.8	100%	-	-	0.23	0.24	0.40
B-13	Proposed	3.02	-	-	-	2.54	0.34	-	0.14	-	19.8	100%	-	-	0.10	0.11	0.26
B-14	Proposed	1.31	0.90	-	-	-	0.33	-	0.08	-	59.7	55%	45%	-	0.44	0.47	0.63
B-15	Proposed	2.07	1.70	-	-	-	0.28	-	0.09	-	54.7	-	100%	-	0.41	0.45	0.68
B-16	Proposed	1.47	0.94	-	-	-	0.45	-	0.08	-	62.7	100%	-	-	0.46	0.47	0.60
B-17	Proposed	1.01	0.65	-	-	-	0.29	-	0.07	-	61.0	100%	-	-	0.44	0.46	0.59
B-18	Proposed	0.81	0.61	-	-	-	0.12	-	0.08	-	52.7	100%	-	-	0.36	0.38	0.52
B-19	Proposed	1.58	0.99	-	-	-	0.46	-	0.13	-	60.6	100%	-	-	0.44	0.45	0.58
B-20	Proposed	3.31	2.49	-	-	-	0.56	-	0.26	-	54.7	100%	-	-	0.38	0.40	0.54
B-21	Proposed	0.74	0.47	-	-	-	0.14	-	0.13	-	51.0	100%	-	-	0.35	0.36	0.51
B-22	Proposed	1.18	0.69	-	-	-	0.38	-	0.11	-	61.6	95%	5%	-	0.45	0.47	0.60
B-23	Proposed	3.96	2.25	-	0.33	-	0.43	-	0.95	-	41.8	37%	63%	-	0.29	0.31	0.55
B-24	Proposed	2.13	1.04	-	0.23	-	0.40	-	0.46	-	46.3	24%	76%	-	0.33	0.36	0.60
B-25	Proposed	1.43	0.93	-	-	-	0.40	-	0.10	-	60.6	49%	51%	-	0.45	0.48	0.65
B-26	Proposed	1.56	1.23	-	-	-	0.26	-	0.07	-	56.2	100%	-	-	0.40	0.41	0.55
B-27	Proposed	2.80	2.20	-	-	-	0.36	-	0.24	-	52.3	100%	-	-	0.36	0.38	0.52
B-28	Proposed	1.74	1.32	-	-	-	0.27	-	0.15	-	53.6	100%	-	-	0.37	0.39	0.53
B-29	Proposed	1.98	1.03	-	-	-	0.50	-	0.45	-	51.7	100%	-	-	0.36	0.37	0.51
B-30	Proposed	1.73	1.03	-	-	-	0.50	-	0.20	-	58.9	100%	-	-	0.42	0.44	0.57
B-31	Proposed	2.22	1.25	-	-	-	0.37	-	0.60	-	45.4	47%	53%	-	0.32	0.34	0.56

Land Use	% Imp.
Single Family Res	50
Multi Family Res	75
Playground	25
Park	10
Paved	100
Historic	2
Open Space	2
Existing Report	-

Basin B-0 to B-31 are tributary to Pond B

Sum of Areas =	63.04
A*I =	3133.94
Weighted I =	49.7%

SF-2 TIME OF CONCENTRATION FOR EACH SUB-BASIN

Project Name: SPRING HILL

BASIN INFORMATION			INITIAL/OVERLAND FLOW			CHANNELIZED FLOW					TOTAL Tc	MHFD T_c Check				EFFECTIVE Tc
BASIN	AREA	C_5	L_i	S_i	T_i	L_t	S_t	LAND SURFACE	VEL.	T_t	$T_c = T_I + T_T$	% IMP.	LENGTH	SLOPE	T_c	
	(AC)	-	FT	FT/FT	MINUTES	FT	FT/FT		FPS	MINUTES	MINUTES	%	FT	FT/FT	MINUTES	MINUTES
B-0	3.10	0.07	400	0.020	29.6	120	0.005	Short pasture and lawns	0.49	4.0	33.6	14%	120	0.005	26.2	26.2
B-1	0.96	0.37	100	0.020	10.4	320	0.010	Paved area	2.00	2.7	13.1	52%	320	0.010	20.4	13.1
B-2	2.14	0.39	70	0.020	8.6	445	0.026	Paved area	3.22	2.3	10.9	54%	445	0.026	19.7	10.9
B-3	2.80	0.35	70	0.020	9.1	570	0.030	Paved area	3.46	2.7	11.8	49%	570	0.030	21.1	11.8
B-4	1.63	0.37	190	0.020	14.4	400	0.020	Paved area	2.83	2.4	16.8	52%	400	0.020	20.1	16.8
B-5	1.66	0.39	20	0.020	4.6	550	0.020	Paved area	2.83	3.2	7.8	54%	550	0.020	20.8	7.8
B-6	1.15	0.41	75	0.020	8.5	505	0.010	Paved area	2.00	4.2	12.7	56%	505	0.010	21.4	12.7
B-7	1.12	0.50	60	0.020	6.7	710	0.010	Paved area	2.00	5.9	12.6	65%	710	0.010	21.4	12.6
B-8	3.33	0.40	200	0.020	14.2	755	0.010	Paved area	2.00	6.3	20.5	55%	755	0.010	24.2	20.5
B-9	2.90	0.38	35	0.020	6.2	820	0.018	Paved area	2.68	5.1	11.2	52%	820	0.018	23.4	11.2
B-10	1.58	0.43	70	0.020	8.1	835	0.012	Paved area	2.19	6.4	14.5	58%	835	0.012	23.7	14.5
B-11	3.52	0.42	180	0.020	13.0	815	0.023	Paved area	3.03	4.5	17.5	55%	815	0.023	22.1	17.5
B-12	1.10	0.24	300	0.016	23.0	190	0.024	Paved area	3.10	1.0	24.0	37%	190	0.024	21.2	21.2
B-13	3.02	0.11	300	0.020	24.7	345	0.010	Paved area	2.00	2.9	27.5	20%	345	0.010	27.5	27.5
B-14	1.31	0.47	70	0.020	7.6	580	0.020	Paved area	2.83	3.4	11.0	60%	580	0.020	19.8	11.0
B-15	2.07	0.45	185	0.020	12.8	485	0.020	Paved area	2.83	2.9	15.6	55%	485	0.020	20.1	15.6
B-16	1.47	0.47	55	0.020	6.7	640	0.010	Paved area	2.00	5.3	12.0	63%	640	0.010	21.3	12.0
B-17	1.01	0.46	65	0.020	7.4	525	0.020	Paved area	2.83	3.1	10.5	61%	525	0.020	19.2	10.5
B-18	0.81	0.38	120	0.020	11.3	225	0.020	Paved area	2.83	1.3	12.7	53%	225	0.020	18.7	12.7
B-19	1.58	0.45	70	0.020	7.8	880	0.010	Paved area	2.00	7.3	15.1	61%	880	0.010	24.1	15.1
B-20	3.31	0.40	185	0.020	13.7	790	0.020	Paved area	2.83	4.7	18.4	55%	790	0.020	22.3	18.4
B-21	0.74	0.36	120	0.020	11.6	210	0.020	Paved area	2.83	1.2	12.8	51%	210	0.020	18.9	12.8
B-22	1.18	0.47	65	0.020	7.3	605	0.020	Paved area	2.83	3.6	10.9	62%	605	0.020	19.6	10.9
B-23	3.96	0.31	400	0.020	22.6	565	0.015	Paved area	2.45	3.8	26.4	42%	565	0.015	24.1	24.1
B-24	2.13	0.36	65	0.020	8.6	625	0.022	Paved area	2.97	3.5	12.1	46%	625	0.022	22.7	12.1
B-25	1.43	0.48	50	0.020	6.3	630	0.022	Paved area	2.97	3.5	9.9	61%	630	0.022	19.7	9.9
B-26	1.56	0.41	175	0.020	13.1	450	0.010	Paved area	2.00	3.8	16.8	56%	450	0.010	20.9	16.8
B-27	2.80	0.38	180	0.020	13.9	500	0.020	Paved area	2.83	2.9	16.9	52%	500	0.020	20.7	16.9
B-28	1.74	0.39	180	0.020	13.7	260	0.020	Paved area	2.83	1.5	15.2	54%	260	0.020	18.7	15.2
B-29	1.98	0.37	165	0.010	16.9	750	0.016	Paved area	2.53	4.9	21.9	52%	750	0.016	23.3	21.9
B-30	1.73	0.44	180	0.020	12.8	565	0.010	Paved area	2.00	4.7	17.5	59%	565	0.010	21.4	17.5
B-31	2.22	0.34	210	0.010	19.9	455	0.080	Paved area	5.66	1.3	21.2	45%	455	0.080	20.0	20.0

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

Project Name: SPRING HILL
Design Storm: 2 YEAR
2-Year P1 = 0.81 in. UDFCD Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C2)	C2*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
B-31	2.22	0.32	0.71	20.0	1.6	1.13
B-30	1.73	0.42	0.73	17.5	1.7	1.26
B-29	1.98	0.36	0.70	21.9	1.5	1.08
B-28	1.74	0.37	0.65	15.2	1.8	1.19
B-27	2.80	0.36	1.01	16.9	1.7	1.77
B-26	1.56	0.40	0.62	16.8	1.7	1.09
B-25	1.43	0.45	0.65	9.9	2.2	1.44
B-24	2.13	0.33	0.71	12.1	2.0	1.45
B-23	3.96	0.29	1.15	24.1	1.4	1.68
B-22	1.18	0.45	0.53	10.9	2.1	1.13
B-21	0.74	0.35	0.26	12.8	2.0	0.52
B-20	3.31	0.38	1.27	18.4	1.7	2.13
B-19	1.58	0.44	0.69	15.1	1.8	1.28
B-18	0.81	0.36	0.30	12.7	2.0	0.59
B-17	1.01	0.44	0.45	10.5	2.1	0.97
B-16	1.47	0.46	0.67	12.0	2.0	1.38
B-15	2.07	0.41	0.86	15.6	1.8	1.56
B-14	1.31	0.44	0.58	11.0	2.1	1.23

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C2*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
31-B	B-31	10' CDOT TYPE R INLET ON GRADE	0.71	20.0	1.6	1.13							1.13 cfs Total Flow at DP 31-B
			0.71	20.0	1.6			1.13					1.13 cfs Captured by DP 31-B.
			0.00	20.0	1.6						-	-	No Bypass Flow
30-B	B-30	10' CDOT TYPE R INLET ON GRADE	0.73	17.5	1.71	1.26							1.26 cfs Total Flow at DP 30-B
			0.73	17.5	1.7			1.26					1.26 cfs Captured by DP 30-B.
			0.00	17.5	1.7						-	-	No Bypass Flow
29-B	B-29	10' CDOT TYPE R INLET ON GRADE	0.70	21.9	1.5	1.08							1.08 cfs Total Flow at DP 29-B
			0.70	21.9	1.5			1.08					1.08 cfs Captured by DP 29-B.
			0.00	21.9	1.5						-	-	No Bypass Flow
28-B	B-28	10' CDOT TYPE R INLET ON GRADE	0.65	15.2	1.8	1.19							1.19 cfs Total Flow at DP 28-B
			0.65	15.2	1.8			1.19					1.19 cfs Captured by DP 28-B.
			0.00	15.2	1.8						-	-	No Bypass Flow
27-B	B-27	10' CDOT TYPE R INLET ON GRADE	1.01	16.9	1.7	1.77							1.77 cfs Total Flow at DP 27-B
			1.01	16.9	1.7			1.77					1.77 cfs Captured by DP 27-B.
			0.00	16.9	1.7						-	-	No Bypass Flow
26-B	B-26	10' CDOT TYPE R INLET ON GRADE	0.62	16.8	1.7	1.09							1.09 cfs Total Flow at DP 26-B
			0.62	16.8	1.7			1.09					1.09 cfs Captured by DP 26-B.
			0.00	16.8	1.7						-	-	No Bypass Flow
25-B	B-25	10' CDOT TYPE R INLET ON GRADE	0.65	9.9	2.2	1.44							1.44 cfs Total Flow at DP 25-B
			0.65	9.9	2.2			1.44					1.44 cfs Captured by DP 25-B.
			0.00	9.9	2.2						-	-	No Bypass Flow
24-B	B-24	10' CDOT TYPE R INLET ON GRADE	0.71	12.1	2.0	1.45							1.45 cfs Total Flow at DP 24-B
			0.71	12.1	2.0			1.45					1.45 cfs Captured by DP 24-B.
			0.00	12.1	2.0						-	-	No Bypass Flow
23-B	B-23	15' CDOT TYPE R INLET ON GRADE	1.15	24.1	1.4	1.68							1.68 cfs Total Flow at DP 23-B
			1.15	24.1	1.4			1.68					1.68 cfs Captured by DP 23-B.
			0.00	24.1	1.4						-	-	No Bypass Flow
22-B	B-22	10' CDOT TYPE R INLET ON GRADE	0.53	10.9	2.1	1.13							1.13 cfs Total Flow at DP 22-B
			0.53	10.9	2.1			1.13					1.13 cfs Captured by DP 22-B.
			0.00	10.9	2.1						-	-	No Bypass Flow
21-B	B-21	10' CDOT TYPE R INLET ON GRADE	0.26	12.8	2.0	0.52							0.52 cfs Total Flow at DP 21-B
			0.26	12.8	2.0			0.52					0.52 cfs Captured by DP 21-B.
			0.00	12.8	2.0						-	-	No Bypass Flow
20-B	B-20	10' CDOT TYPE R INLET ON GRADE	1.27	18.4	1.7	2.13							2.13 cfs Total Flow at DP 20-B
			1.27	18.4	1.7			2.13					2.13 cfs Captured by DP 20-B.
			0.00	18.4	1.7						-	-	No Bypass Flow
19-B	B-19	10' CDOT TYPE R INLET ON GRADE	0.69	15.1	1.8	1.28							1.28 cfs Total Flow at DP 19-B
			0.69	15.1	1.8			1.28					1.28 cfs Captured by DP 19-B.
			0.00	15.1	1.8						-	-	No Bypass Flow
18-B	B-18	10' CDOT TYPE R INLET ON GRADE	0.30	12.7	2.0	0.59							0.59 cfs Total Flow at DP 18-B
			0.30	12.7	2.0			0.59					0.59 cfs Captured by DP 18-B.
			0.00	12.7	2.0						-	-	No Bypass Flow
17-B	B-17	10' CDOT TYPE R INLET ON GRADE	0.45	10.5	2.1	0.97							0.97 cfs Total Flow at DP 17-B
			0.45	10.5	2.1			0.97					0.97 cfs Captured by DP 17-B.
			0.00	10.5	2.1						-	-	No Bypass Flow
16-B	B-16	10' CDOT TYPE R INLET ON GRADE	0.67	12.0	2.0	1.38							1.38 cfs Total Flow at DP 16-B
			0.67	12.0	2.0			1.38					1.38 cfs Captured by DP 16-B.
			0.00	12.0	2.0						-	-	No Bypass Flow
15-B	B-15	10' CDOT TYPE R INLET ON GRADE	0.86	15.6	1.8	1.56							1.56 cfs Total Flow at DP 15-B
			0.86	15.6	1.8			1.56					1.56 cfs Captured by DP 15-B.
			0.00	15.6	1.8						-	-	No Bypass Flow
14-B	B-14	10' CDOT TYPE R INLET ON GRADE	0.58	11.0	2.1	1.23							1.23 cfs Total Flow at DP 14-B
			0.58	11.0	2.1			1.23					1.23 cfs Captured by DP 14-B.
			0.00	11.0	2.1						-	-	No Bypass Flow

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

Project Name: SPRING HILL
Design Storm: 2 YEAR
2-Year P1 = 0.81 in. UDFCD Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C2)	C2*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
B-13	3.02	0.10	0.31	27.5	1.3	0.41
B-12	1.10	0.23	0.25	21.2	1.5	0.39
B-11	3.52	0.40	1.41	17.5	1.7	2.42
B-10	1.58	0.41	0.65	14.5	1.9	1.22
B-9	2.90	0.36	1.05	11.2	2.1	2.21
B-8	3.33	0.39	1.28	20.5	1.6	2.04
B-7	1.12	0.48	0.54	12.6	2.0	1.09
B-6	1.15	0.40	0.46	12.7	2.0	0.91
B-5	1.66	0.38	0.62	7.8	2.4	1.51
B-4	1.63	0.36	0.58	16.8	1.7	1.02
B-3	2.80	0.33	0.93	11.8	2.0	1.92
B-2	2.14	0.37	0.80	10.9	2.1	1.71
B-1	0.96	0.36	0.34	13.1	2.0	0.68
B-0	3.10	0.07	0.20	26.2	1.4	0.28

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C2*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
13-B	B-13	10' CDOT TYPE R INLET ON GRADE	0.31	27.5	1.3	0.41							0.41 cfs Total Flow at DP 13-B
			0.31	27.5	1.3			0.41					0.41 cfs Captured by DP 13-B.
			0.00	27.5	1.3						-	-	No Bypass Flow
12-B	B-12	10' CDOT TYPE R INLET ON GRADE	0.25	21.2	1.5	0.39							0.39 cfs Total Flow at DP 12-B
			0.25	21.2	1.5			0.39					0.39 cfs Captured by DP 12-B.
			0.00	21.2	1.5						-	-	No Bypass Flow
11-B	B-11	15' CDOT TYPE R INLET ON GRADE	1.41	17.5	1.7	2.42							2.42 cfs Total Flow at DP 11-B
			1.41	17.5	1.7			2.42					2.42 cfs Captured by DP 11-B.
			0.00	17.5	1.7						-	-	No Bypass Flow
10-B	B-10	10' CDOT TYPE R INLET ON GRADE	0.65	14.5	1.9	1.22							1.22 cfs Total Flow at DP 10-B
			0.65	14.5	1.9			1.22					1.22 cfs Captured by DP 10-B.
			0.00	14.5	1.9						-	-	No Bypass Flow
9-B	B-9	10' CDOT TYPE R INLET ON GRADE	1.05	11.2	2.1	2.21							2.21 cfs Total Flow at DP 9-B
			1.05	11.2	2.1			2.21					2.21 cfs Captured by DP 9-B.
			0.00	11.2	2.1						-	-	No Bypass Flow
8-B	B-8	10' CDOT TYPE R INLET ON GRADE	1.28	20.5	1.6	2.04							2.04 cfs Total Flow at DP 8-B
			1.28	20.5	1.6			2.04					2.04 cfs Captured by DP 8-B.
			0.00	20.5	1.6						-	-	No Bypass Flow
7-B	B-7	10' CDOT TYPE R INLET ON GRADE	0.54	12.6	2.0	1.09							1.09 cfs Total Flow at DP 7-B
			0.54	12.6	2.0			1.09					1.09 cfs Captured by DP 7-B.
			0.00	12.6	2.0						-	-	No Bypass Flow
6-B	B-6	10' CDOT TYPE R INLET IN SUMP	0.46	12.7	2.0	0.91							0.91 cfs Total Flow at DP 6-B
			0.46	12.7	2.0			0.91					0.91 cfs Captured by DP 6-B.
			0.00	12.7	2.0						-	-	No Bypass Flow
5-B	B-5	10' CDOT TYPE R INLET ON GRADE	0.62	7.8	2.4	1.51							1.51 cfs Total Flow at DP 5-B
			0.62	7.8	2.4			1.51					1.51 cfs Captured by DP 5-B.
			0.00	7.8	2.4						-	-	No Bypass Flow
4-B	B-4	10' CDOT TYPE R INLET IN SUMP	0.58	16.8	1.7	1.02							1.02 cfs Total Flow at DP 4-B
			0.58	16.8	1.7			1.02					1.02 cfs Captured by DP 4-B.
			0.00	16.8	1.7						-	-	No Bypass Flow
3-B	B-3	10' CDOT TYPE R INLET ON GRADE	0.93	11.8	2.0	1.92							1.92 cfs Total Flow at DP 3-B
			0.93	11.8	2.0			1.92					1.92 cfs Captured by DP 3-B.
			0.00	11.8	2.0						-	-	No Bypass Flow
2-B	B-2	15' CDOT TYPE R INLET IN SUMP	0.80	10.9	2.1	1.71							1.71 cfs Total Flow at DP 2-B
			0.80	10.9	2.1			1.71					1.71 cfs Captured by DP 2-B.
			0.00	10.9	2.1						-	-	No Bypass Flow
1-B	B-1	10' CDOT TYPE R INLET IN SUMP	0.34	13.1	2.0	0.68							0.68 cfs Total Flow at DP 1-B
			0.34	13.1	2.0			0.68					0.68 cfs Captured by DP 1-B.
			0.00	13.1	2.0						-	-	No Bypass Flow
0-B	B-0	OVERLAND TO POND B	0.20	26.2	1.4	0.28							0.28 cfs Total Flow at DP 0-B
			0.20	26.2	1.4			0.28					0.28 cfs Captured by DP 0-B.
			0.00	26.2	1.4						-	-	No Bypass Flow

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

Project Name: SPRING HILL
Design Storm: 100 YEAR
100-Year P1 = 2.68 in. UDFCD Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C100)	C_{100}*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
B-31	2.22	0.56	1.24	20.0	5.3	6.56
B-30	1.73	0.57	0.99	17.5	5.6	5.61
B-29	1.98	0.51	1.02	21.9	5.0	5.15
B-28	1.74	0.53	0.92	15.2	6.0	5.60
B-27	2.80	0.52	1.45	16.9	5.7	8.40
B-26	1.56	0.55	0.86	16.8	5.8	4.96
B-25	1.43	0.65	0.93	9.9	7.3	6.81
B-24	2.13	0.60	1.28	12.1	6.7	8.68
B-23	3.96	0.55	2.19	24.1	4.8	10.55
B-22	1.18	0.60	0.70	10.9	7.0	4.97
B-21	0.74	0.51	0.38	12.8	6.5	2.48
B-20	3.31	0.54	1.78	18.4	5.5	9.87
B-19	1.58	0.58	0.92	15.1	6.1	5.63
B-18	0.81	0.52	0.42	12.7	6.6	2.80
B-17	1.01	0.59	0.59	10.5	7.1	4.24
B-16	1.47	0.60	0.88	12.0	6.7	5.97
B-15	2.07	0.68	1.41	15.6	6.0	8.50
B-14	1.31	0.63	0.83	11.0	7.0	5.84

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C100*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
31-B	B-31	10' CDOT TYPE R INLET ON GRADE	1.24	20.0	5.3	6.56							6.56 cfs Total Flow at DP 31-B
			1.12	20.0	5.3			5.96					5.96 cfs Captured by DP 31-B.
			0.11	20.0	5.3		0.60		1.7	615.0	2.61	3.9	0.6 cfs-Bypass Flow to DP 27-B
30-B	B-30	10' CDOT TYPE R INLET ON GRADE	0.99	17.5	5.6	5.61							5.61 cfs Total Flow at DP 30-B
			0.95	17.5	5.6			5.41					5.41 cfs Captured by DP 30-B.
			0.04	17.5	5.6		0.20		1.2	70.0	2.19	0.5	0.2 cfs-Bypass Flow to DP 28-B
29-B	B-29	10' CDOT TYPE R INLET ON GRADE	1.02	21.9	5.0	5.15							5.15 cfs Total Flow at DP 29-B
			1.00	21.9	5.0			5.05					5.05 cfs Captured by DP 29-B.
			0.02	21.9	5.0		0.10		1.2	45.0	2.19	0.3	0.1 cfs-Bypass Flow to DP 28-B
28-B	B-28, B-30, B-29	10' CDOT TYPE R INLET ON GRADE	0.92	15.2	6.0	5.60							5.6 cfs Total Flow at DP 28-B
			0.89	15.2	6.0			5.40					5.4 cfs Captured by DP 28-B.
			0.03	15.2	6.0		0.20		1.0	775.0	2.00	6.5	0.2 cfs-Bypass Flow to DP 16-B
27-B	B-27, B-31	10' CDOT TYPE R INLET ON GRADE	1.45	16.9	5.7	8.40							8.4 cfs Total Flow at DP 27-B
			1.21	16.9	5.7			7.00					7 cfs Captured by DP 27-B.
			0.24	16.9	5.7		1.40		1.0	550.0	2.00	4.6	1.4 cfs-Bypass Flow to DP 26-B
26-B	B-26, B-27	10' CDOT TYPE R INLET ON GRADE	1.10	21.5	5.1	5.61							5.61 cfs Total Flow at DP 26-B
			1.08	21.5	5.1			5.51					5.51 cfs Captured by DP 26-B.
			0.02	21.5	5.1		0.10		1.0	610.0	2.00	5.1	0.1 cfs-Bypass Flow to DP 5-B
25-B	B-25	10' CDOT TYPE R INLET ON GRADE	0.93	9.9	7.3	6.81							6.81 cfs Total Flow at DP 25-B
			0.86	9.9	7.3			6.31					6.31 cfs Captured by DP 25-B.
			0.07	9.9	7.3		0.50		1.8	585.0	2.68	3.6	0.5 cfs-Bypass Flow to DP 17-B
24-B	B-24	10' CDOT TYPE R INLET ON GRADE	1.28	12.1	6.7	8.68							8.68 cfs Total Flow at DP 24-B
			1.09	12.1	6.7			7.38					7.38 cfs Captured by DP 24-B.
			0.19	12.1	6.7		1.30		1.8	280.0	2.68	1.7	1.3 cfs-Bypass Flow to DP 21-B
23-B	B-23	15' CDOT TYPE R INLET ON GRADE	2.19	24.1	4.8	10.55							10.55 cfs Total Flow at DP 23-B
			2.05	24.1	4.8			9.85					9.85 cfs Captured by DP 23-B.
			0.15	24.1	4.8		0.70		1.8	255.0	2.68	1.6	0.7 cfs-Bypass Flow to DP 21-B
22-B	B-22	10' CDOT TYPE R INLET ON GRADE	0.70	10.9	7.0	4.97							4.97 cfs Total Flow at DP 22-B
			0.70	10.9	7.0			4.97					4.97 cfs Captured by DP 22-B.
			0.00	10.9	7.0						-	-	No Bypass Flow
21-B	B-21, B-24, B-23	10' CDOT TYPE R INLET ON GRADE	0.71	25.6	4.6	3.31							3.31 cfs Total Flow at DP 21-B
			0.71	25.6	4.6			3.31					3.31 cfs Captured by DP 21-B.
			0.00	25.6	4.6						-	-	No Bypass Flow
20-B	B-20	10' CDOT TYPE R INLET ON GRADE	1.78	18.4	5.5	9.87							9.87 cfs Total Flow at DP 20-B
			1.38	18.4	5.5			7.67					7.67 cfs Captured by DP 20-B.
			0.40	18.4	5.5		2.20		1.8	280.0	2.68	1.7	2.2 cfs-Bypass Flow to DP 18-B
19-B	B-19	10' CDOT TYPE R INLET ON GRADE	0.92	15.1	6.1	5.63							5.63 cfs Total Flow at DP 19-B
			0.84	15.1	6.1			5.13					5.13 cfs Captured by DP 19-B.
			0.08	15.1	6.1		0.50		1.8	250.0	2.68	1.6	0.5 cfs-Bypass Flow to DP 18-B
18-B	B-18, B-20, B-19	10' CDOT TYPE R INLET ON GRADE	0.90	20.1	5.3	4.77							4.77 cfs Total Flow at DP 18-B
			0.90	20.1	5.3			4.77					4.77 cfs Captured by DP 18-B.
			0.00	20.1	5.3						-	-	No Bypass Flow
17-B	B-17, B-25	10' CDOT TYPE R INLET ON GRADE	0.66	13.5	6.4	4.25							4.25 cfs Total Flow at DP 17-B
			0.66	13.5	6.4			4.25					4.25 cfs Captured by DP 17-B.
			0.00	13.5	6.4						-	-	No Bypass Flow
16-B	B-16, B-28	10' CDOT TYPE R INLET ON GRADE	0.88	12.0	6.7	5.97							5.97 cfs Total Flow at DP 16-B
			0.84	12.0	6.7			5.67					5.67 cfs Captured by DP 16-B.
			0.04	12.0	6.7		0.30		1.0	550.0	2.00	4.6	0.3 cfs-Bypass Flow to DP 6-B
15-B	B-15	10' CDOT TYPE R INLET ON GRADE	1.41	15.6	6.0	8.50							8.5 cfs Total Flow at DP 15-B
			1.21	15.6	6.0			7.30					7.3 cfs Captured by DP 15-B.
			0.20	15.6	6.0		1.20		2.2	345.0	-	-	1.2 cfs-Bypass Flow to DP 12-B
14-B	B-14	10' CDOT TYPE R INLET ON GRADE	0.83	11.0	7.0	5.84							5.84 cfs Total Flow at DP 14-B
			0.79	11.0	7.0			5.54					5.54 cfs Captured by DP 14-B.
			0.04	11.0	7.0		0.30		2.2	330.0	-	-	0.3 cfs-Bypass Flow to DP 12-B

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

Project Name: SPRING HILL
Design Storm: 100 YEAR
100-Year P1 = 2.68 in. UDFCD Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C100)	C_{100}*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
B-13	3.02	0.26	0.80	27.5	4.4	3.56
B-12	1.10	0.40	0.44	21.2	5.1	2.25
B-11	3.52	0.62	2.18	17.5	5.6	12.44
B-10	1.58	0.56	0.88	14.5	6.2	5.52
B-9	2.90	0.52	1.50	11.2	6.9	10.47
B-8	3.33	0.54	1.80	20.5	5.2	9.42
B-7	1.12	0.62	0.69	12.6	6.6	4.62
B-6	1.15	0.55	0.63	12.7	6.6	4.17
B-5	1.66	0.53	0.88	7.8	7.9	7.05
B-4	1.63	0.51	0.84	16.8	5.8	4.86
B-3	2.80	0.49	1.38	11.8	6.8	9.42
B-2	2.14	0.53	1.13	10.9	7.0	7.99
B-1	0.96	0.52	0.50	13.1	6.5	3.23
B-0	3.10	0.22	0.68	26.2	4.6	3.14

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C100*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
13-B	B-13	10' CDOT TYPE R INLET ON GRADE	0.80	27.5	4.4	3.56							3.56 cfs Total Flow at DP 13-B
			0.80	27.5	4.4			3.56					3.56 cfs Captured by DP 13-B.
			0.00	27.5	4.4						-	-	No Bypass Flow
12-B	B-12, B-15, B-14	10' CDOT TYPE R INLET ON GRADE	0.68	21.2	5.1	3.50							3.5 cfs Total Flow at DP 12-B
			0.68	21.2	5.1			3.50					3.5 cfs Captured by DP 12-B.
			0.00	21.2	5.1						-	-	No Bypass Flow
11-B	B-11	15' CDOT TYPE R INLET ON GRADE	2.18	17.5	5.6	12.44							12.44 cfs Total Flow at DP 11-B
			1.92	17.5	5.6			10.94					10.94 cfs Captured by DP 11-B.
			0.26	17.5	5.6		1.50		1.1	625.0	-	-	1.5 cfs-Bypass Flow to DP 9-B
10-B	B-10	10' CDOT TYPE R INLET ON GRADE	0.88	14.5	6.2	5.52							5.52 cfs Total Flow at DP 10-B
			0.85	14.5	6.2			5.32					5.32 cfs Captured by DP 10-B.
			0.03	14.5	6.2		0.20		1.1	340.0	-	-	0.2 cfs-Bypass Flow to DP 7-B
9-B	B-9, B-11	10' CDOT TYPE R INLET ON GRADE	1.50	11.2	6.9	10.47							10.47 cfs Total Flow at DP 9-B
			1.14	11.2	6.9			7.97					7.97 cfs Captured by DP 9-B.
			0.36	11.2	6.9		2.50		1.0	315.0	2.00	2.6	2.5 cfs-Bypass Flow to DP 5-B
8-B	B-8	10' CDOT TYPE R INLET ON GRADE	1.80	20.5	5.2	9.42							9.42 cfs Total Flow at DP 8-B
			1.41	20.5	5.2			7.42					7.42 cfs Captured by DP 8-B.
			0.38	20.5	5.2		2.00		1.1	315.0	-	-	2 cfs-Bypass Flow to DP 7-B
7-B	B-7, B-10, B-8	10' CDOT TYPE R INLET ON GRADE	1.11	20.5	5.2	5.81							5.81 cfs Total Flow at DP 7-B
			1.05	20.5	5.2			5.51					5.51 cfs Captured by DP 7-B.
			0.06	20.5	5.2		0.30		1.0	275.0	2.00	2.3	0.3 cfs-Bypass Flow to DP 5-B
6-B	B-6, B-16	10' CDOT TYPE R INLET IN SUMP	0.63	12.7	6.6	4.17							4.17 cfs Total Flow at DP 6-B
			0.63	12.7	6.6			4.17					4.17 cfs Captured by DP 6-B.
			0.00	12.7	6.6						-	-	No Bypass Flow
5-B	B-5, B-26, B-9, B-7	10' CDOT TYPE R INLET ON GRADE	0.88	7.8	7.9	7.05							7.05 cfs Total Flow at DP 5-B
			0.79	7.8	7.9			6.35					6.35 cfs Captured by DP 5-B.
			0.09	7.8	7.9		0.70		1.0	215.0	2.00	1.8	0.7 cfs-Bypass Flow to DP 4-B
4-B	B-4, B-5, B-3	10' CDOT TYPE R INLET IN SUMP	1.19	16.8	5.8	6.90							6.9 cfs Total Flow at DP 4-B
			1.19	16.8	5.8			6.90					6.9 cfs Captured by DP 4-B.
			0.00	16.8	5.8						-	-	No Bypass Flow
3-B	B-3	10' CDOT TYPE R INLET ON GRADE	1.38	11.8	6.8	9.42							9.42 cfs Total Flow at DP 3-B
			1.12	11.8	6.8			7.62					7.62 cfs Captured by DP 3-B.
			0.26	11.8	6.8		1.80		1.1	150.0	-	-	1.8 cfs-Bypass Flow to DP 4-B
2-B	B-2	15' CDOT TYPE R INLET IN SUMP	1.13	10.9	7.0	7.99							7.99 cfs Total Flow at DP 2-B
			1.13	10.9	7.0			7.99					7.99 cfs Captured by DP 2-B.
			0.00	10.9	7.0						-	-	No Bypass Flow
1-B	B-1	10' CDOT TYPE R INLET IN SUMP	0.50	13.1	6.5	3.23							3.23 cfs Total Flow at DP 1-B
			0.50	13.1	6.5			3.23					3.23 cfs Captured by DP 1-B.
			0.00	13.1	6.5						-	-	No Bypass Flow
0-B	B-0	OVERLAND TO POND B	0.68	26.2	4.6	3.14							3.14 cfs Total Flow at DP 0-B
			0.68	26.2	4.6			3.14					3.14 cfs Captured by DP 0-B.
			0.00	26.2	4.6						-	-	No Bypass Flow

SF-1 COMPOSITE BASIN LAND USE

Westwood

Project Name: SPRING HILL
Calculated By: BK
Checked By: MS
Date: 6/5/2025

Basin	Type	Total Area (acres)	Single Family Res	Town Homes	School	Park	Paved	Historic	Open Space	Existing Report	Avg. Imp.	Soil Type A	Soil Type B	Soil Type C/D	C_2	C_5	C_{100}
			(acres)	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(%)*	*(%)*	*(%)*	*(%)*			
C-0	Proposed	2.76	-	0.11	-	-	0.02	-	2.63	-	5.2	47%	53%	-	0.02	0.03	0.31
C-1	Proposed	0.52	-	-	-	-	0.50	-	0.02	-	96.2	13%	87%	-	0.80	0.82	0.88
C-2	Proposed	6.01	-	2.06	-	-	0.16	-	3.79	-	26.2	75%	25%	-	0.15	0.17	0.37
C-3	Proposed	0.21	-	-	-	-	0.21	-	-	-	100.0	-	100%	-	0.84	0.86	0.90
C-4	Proposed	4.99	-	1.75	-	-	1.02	-	2.22	-	44.1	1%	99%	-	0.32	0.35	0.63
C-5	Proposed	0.21	-	-	-	-	0.16	-	0.05	-	76.7	-	100%	-	0.62	0.64	0.79
C-6	Proposed	1.60	-	-	-	-	0.69	-	0.91	-	44.3	75%	25%	-	0.30	0.32	0.50
C-3a	Proposed	0.61	-	0.32	-	-	0.10	-	0.19	-	51.1	-	100%	-	0.38	0.41	0.67

Land Use	% Imp.
Single Family Res	50
Town Homes	65
School	55
Park	10
Paved	100

SF-2 TIME OF CONCENTRATION FOR EACH SUB-BASIN

Project Name: SPRING HILL

BASIN INFORMATION			INITIAL/OVERLAND FLOW			CHANNELIZED FLOW					TOTAL Tc	MHFD T_c Check				EFFECTIVE Tc
BASIN	AREA	C_5	L_i	S_i	T_i	L_t	S_t	LAND SURFACE	VEL.	T_t	$T_c = T_I + T_T$	% IMP.	LENGTH	SLOPE	T_c	
	(AC)	-	FT	FT/FT	MINUTES	FT	FT/FT		FPS	MINUTES	MINUTES	%	FT	FT/FT	MINUTES	MINUTES
C-0	2.76	0.03	305	0.045	20.6	140	0.005	Short pasture and lawns	0.49	4.7	25.3	5%	140	0.005	28.5	25.3
C-1	0.52	0.82	15	0.020	1.5	230	0.010	Paved area	2.00	1.9	3.5	96%	230	0.010	11.3	5.0
C-2	6.01	0.17	45	0.020	9.0	1,395	0.027	Paved area	3.29	7.1	16.1	26%	1,395	0.027	32.7	16.1
C-3	0.21	0.86	15	0.020	1.3	225	0.010	Paved area	2.00	1.9	3.2	100%	225	0.010	10.6	5.0
C-4	4.99	0.35	10	0.020	3.4	1,165	0.010	Paved area	2.00	9.7	13.1	44%	1,165	0.010	31.3	13.1
C-5	0.21	0.64	15	0.020	2.5	225	0.010	Paved area	2.00	1.9	4.4	77%	225	0.010	14.9	5.0
C-6	1.60	0.32	95	0.020	11.0	945	0.020	Paved area	2.83	5.6	16.5	44%	945	0.020	25.8	16.5
C-3a	0.61	0.41	160	0.020	12.5	70	0.010	Paved area	2.00	0.6	13.0	51%	70	0.010	18.0	13.0

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

Project Name: SPRING HILL
Design Storm: 2 YEAR
2-Year P1 = 0.81 in. UDFCD Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C2)	C2*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
C-6	1.60	0.30	0.48	16.5	1.8	0.85
C-5	0.21	0.62	0.13	5.0	2.7	0.36
C-4	4.99	0.32	1.61	13.1	2.0	3.17
C-3	0.21	0.84	0.18	5.0	2.7	0.49
C-2	6.01	0.15	0.93	16.1	1.8	1.66
C-1	0.52	0.80	0.42	5.0	2.7	1.16
C-0	2.76	0.02	0.06	25.3	1.4	0.09
C-3a	0.61	0.38	0.23	13.0	2.0	0.46

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C2*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
6-C	C-6	10' CDOT TYPE R INLET IN SUMP	0.48	16.5	1.8	0.85							0.85 cfs Total Flow at DP 6-C
			0.48	16.5	1.8			0.85					0.85 cfs Captured by DP 6-C.
			0.00	16.5	1.8						-	-	No Bypass Flow
5-C	C-5	5' CDOT TYPE R INLET IN SUMP	0.13	5.0	2.75	0.36							0.36 cfs Total Flow at DP 5-C
			0.13	5.0	2.7			0.36					0.36 cfs Captured by DP 5-C.
			0.00	5.0	2.7						-	-	No Bypass Flow
4-C	C-4	2-15' CDOT TYPE R INLET ON GRADE	1.61	13.1	2.0	3.17							3.17 cfs Total Flow at DP 4-C
			1.61	13.1	2.0			3.17					3.17 cfs Captured by DP 4-C.
			0.00	13.1	2.0						-	-	No Bypass Flow
3-C	C-3	15' CDOT TYPE R INLET ON GRADE	0.18	5.0	2.7	0.49							0.49 cfs Total Flow at DP 3-C
			0.18	5.0	2.7			0.49					0.49 cfs Captured by DP 3-C.
			0.00	5.0	2.7						-	-	No Bypass Flow
2-C	C-2	2-15' CDOT TYPE R INLET IN SUMP	0.93	16.1	1.8	1.66							1.66 cfs Total Flow at DP 2-C
			0.93	16.1	1.8			1.66					1.66 cfs Captured by DP 2-C.
			0.00	16.1	1.8						-	-	No Bypass Flow
1-C	C-1	5' CDOT TYPE R INLET IN SUMP	0.42	5.0	2.7	1.16							1.16 cfs Total Flow at DP 1-C
			0.42	5.0	2.7			1.16					1.16 cfs Captured by DP 1-C.
			0.00	5.0	2.7						-	-	No Bypass Flow
0-C	C-0, C-3a	OVERLAND TO POND C	0.30	25.3	1.4	0.42							0.42 cfs Total Flow at DP 0-C
			0.30	25.3	1.4			0.42					0.42 cfs Captured by DP 0-C.
			0.00	25.3	1.4						-	-	No Bypass Flow
3A-C	C-3a	BYPASS	0.23	13.0	2.0	0.46							0.46 cfs Total Flow at DP 3A-C
			0.00	13.0	2.0			0.00					0 cfs Captured by DP 3a-C.
			0.23	13.0	2.0		0.46		4.8	275.0	4.38	1.0	0.46 cfs-Bypass Flow to DP 0-C

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

Project Name: SPRING HILL
Design Storm: 100 YEAR
100-Year P1 = 2.68 in. UDFCD Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C100)	C_{100}*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
C-6	1.60	0.50	0.80	16.5	5.8	4.68
C-5	0.21	0.79	0.17	5.0	9.1	1.51
C-4	4.99	0.63	3.15	13.1	6.5	20.57
C-3	0.21	0.90	0.19	5.0	9.1	1.72
C-2	6.01	0.37	2.24	16.1	5.9	13.27
C-1	0.52	0.88	0.46	5.0	9.1	4.17
C-0	2.76	0.31	0.85	25.3	4.6	3.99
C-3a	0.61	0.67	0.41	13.0	6.5	2.66

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C100*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
6-C	C-6	10' CDOT TYPE R INLET IN SUMP	0.80	16.5	5.8	4.68							4.68 cfs Total Flow at DP 6-C
			0.80	16.5	5.8			4.68					4.68 cfs Captured by DP 6-C.
			0.00	16.5	5.8						-	-	No Bypass Flow
5-C	C-5	5' CDOT TYPE R INLET IN SUMP	0.17	5.0	9.1	1.51							1.51 cfs Total Flow at DP 5-C
			0.17	5.0	9.1			1.51					1.51 cfs Captured by DP 5-C.
			0.00	5.0	9.1						-	-	No Bypass Flow
4-C	C-4	2-15' CDOT TYPE R INLET ON GRADE	3.15	13.1	6.5	20.57							20.57 cfs Total Flow at DP 4-C
			2.66	13.1	6.5			17.37					17.37 cfs Captured by DP 4-C.
			0.49	13.1	6.5		3.20		0.5	30.0	1.41	0.4	3.2 cfs-Bypass Flow to DP 3-C
3-C	C-3, C-4	15' CDOT TYPE R INLET ON GRADE	0.68	13.5	6.4	4.38							4.38 cfs Total Flow at DP 3-C
			0.68	13.5	6.4			4.38					4.38 cfs Captured by DP 3-C.
			0.00	13.5	6.4						-	-	No Bypass Flow
2-C	C-2	2-15' CDOT TYPE R INLET IN SUMP	2.24	16.1	5.9	13.27							13.27 cfs Total Flow at DP 2-C
			2.24	16.1	5.9			13.27					13.27 cfs Captured by DP 2-C.
			0.00	16.1	5.9						-	-	No Bypass Flow
1-C	C-1	5' CDOT TYPE R INLET IN SUMP	0.46	5.0	9.1	4.17							4.17 cfs Total Flow at DP 1-C
			0.46	5.0	9.1			4.17					4.17 cfs Captured by DP 1-C.
			0.00	5.0	9.1						-	-	No Bypass Flow
0-C	C-0, C-3a	OVERLAND TO POND C	1.26	25.3	4.6	5.89							5.89 cfs Total Flow at DP 0-C
			1.26	25.3	4.6			5.89					5.89 cfs Captured by DP 0-C.
			0.00	25.3	4.6						-	-	No Bypass Flow
3A-C	C-3a	BYPASS	0.41	13.0	6.5	2.66							2.66 cfs Total Flow at DP 3A-C
			0.00	13.0	6.5			0.00					0 cfs Captured by DP 3a-C.
			0.41	13.0	6.5		2.66		4.8	275.0	4.38	1.0	2.66 cfs-Bypass Flow to DP 0-C

SF-1 COMPOSITE BASIN LAND USE

Westwood

Project Name: Spring Hill
Calculated By: VJH
Checked By: MS
Date: 6/2/2025

Basin	Type	Total Area (acres)	Pond	Townhomes	Multi-Family Res.	Roadway w/ Landscaping	Park	Concrete	Historic/Open Space	Existing Report	Avg. Imp.	Soil Type A	Soil Type B	Soil Type C/D	C_2	C_5	C_{100}
			(acres)	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(%)*	*(%)*	*(%)*	*(%)*			
D-0	Proposed	1.18	0.95	0.08	-	-	-	0.15	-	-	97.6	39%	3%	58%	0.81	0.84	0.88
D-1	Proposed	2.40	-	0.25	-	1.46	-	0.09	0.60	-	58.5	45%	55%	-	0.43	0.46	0.64
D-2	Proposed	3.80	-	1.51	-	0.31	0.79	0.56	0.63	-	49.3	21%	79%	-	0.36	0.39	0.62
D-3	Proposed	0.16	-	-	-	0.07	-	-	0.09	-	35.3	100%	-	-	0.22	0.23	0.38
D-4	Proposed	1.36	-	0.33	-	0.82	-	0.20	0.01	-	77.5	-	100%	-	0.62	0.65	0.79
D-5	Proposed	0.87	-	-	-	0.56	-	-	0.31	-	50.9	6%	94%	-	0.38	0.41	0.66
D-6	Proposed	3.89	-	-	-	0.83	-	-	3.06	-	18.2	4%	96%	-	0.11	0.13	0.50
D-7	Proposed	1.19	-	0.72	-	0.47	-	-	-	-	70.1	-	100%	-	0.55	0.58	0.76

Land Use	% Imp.
Pond	100
Townhomes	65
Multi-Family Res.	75
Roadway w/ Landscaping	78
Park	10
Concrete	100
Historic/Open Space	2
Existing Report	-

Basins D-0 to D-7 are tributary to Pond D.

Sum of Areas =	14.85
A*I =	752.71
Weighted I =	50.7%

SF-2 TIME OF CONCENTRATION FOR EACH SUB-BASIN

Project Name: Spring Hill

BASIN INFORMATION			INITIAL/OVERLAND FLOW			CHANNELIZED FLOW					TOTAL Tc	MHFD T_c Check				EFFECTIVE Tc
BASIN	AREA	C_5	L_i	S_i	T_i	L_t	S_t	LAND SURFACE	VEL.	T_t	$T_c = T_I + T_T$	% IMP.	LENGTH	SLOPE	T_c	
	(AC)	-	FT	FT/FT	MINUTES	FT	FT/FT		FPS	MINUTES	MINUTES	%	FT	FT/FT	MINUTES	MINUTES
D-0	1.18	0.84	300	0.020	6.6	170	0.020	Paved area	2.83	1.0	7.6	98%	170	0.020	10.3	7.6
D-1	2.40	0.46	16	0.020	3.7	1,112	0.014	Paved area	2.37	7.8	11.5	58%	1,112	0.014	25.2	11.5
D-2	3.80	0.39	95	0.020	10.0	757	0.015	Paved area	2.45	5.2	15.1	49%	757	0.015	24.1	15.1
D-3	0.16	0.23	17	0.020	5.2	130	0.013	Paved area	2.28	1.0	6.1	35%	130	0.013	21.4	6.1
D-4	1.36	0.65	31	0.020	3.6	1,128	0.011	Paved area	2.10	9.0	12.5	78%	1,128	0.011	21.9	12.5
D-5	0.87	0.41	38	0.020	6.1	717	0.010	Paved area	2.00	6.0	12.1	51%	717	0.010	24.8	12.1
D-6	3.89	0.13	80	0.020	12.4	1,178	0.012	Paved area	2.19	9.0	21.4	18%	1,178	0.012	38.4	21.4
D-7	1.19	0.58	115	0.020	7.9	590	0.013	Paved area	2.28	4.3	12.3	70%	590	0.013	18.7	12.3

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

Project Name: Spring Hill
Design Storm: 2 YEAR
2-Year P1 = 0.81 in. UDFCD Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C2)	C2*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
D-0	1.18	0.81	0.96	7.6	2.4	2.34
D-1	2.40	0.43	1.04	11.5	2.1	2.18
D-2	3.80	0.36	1.37	15.1	1.8	2.53
D-3	0.16	0.22	0.03	6.1	2.6	0.09
D-4	1.36	0.62	0.85	12.5	2.0	1.71
D-5	0.87	0.38	0.33	12.1	2.0	0.68
D-6	3.89	0.11	0.44	21.4	1.5	0.69
D-7	1.19	0.55	0.66	12.3	2.0	1.34

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C2*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
0-D	D-0	OVERLAND TO POND D	0.96	7.6	2.4	2.34							2.34 cfs Total Flow at DP 0D
			0.96	7.6	2.4			2.34					2.34 cfs Captured by DP 0D.
			0.00	7.6	2.4						-	-	No Bypass Flow
1-D	D-1	15' CDOT TYPE R IN SUMP	1.04	11.5	2.07	2.18							2.18 cfs Total Flow at DP 1D
			1.04	11.5	2.1			2.18					2.18 cfs Captured by DP 1D.
			0.00	11.5	2.1						-	-	No Bypass Flow
2-D	D-2	15' CDOT TYPE R IN SUMP	1.37	15.1	1.8	2.53							2.53 cfs Total Flow at DP 2D
			1.37	15.1	1.8			2.53					2.53 cfs Captured by DP 2D.
			0.00	15.1	1.8						-	-	No Bypass Flow
3-D	D-3	10' CDOT TYPE R ON GRADE	0.03	6.1	2.6	0.09							0.09 cfs Total Flow at DP 3D
			0.03	6.1	2.6			0.09					0.09 cfs Captured by DP 3D.
			0.00	6.1	2.6						-	-	No Bypass Flow
4-D	D-4	10' CDOT TYPE R ON GRADE	0.85	12.5	2.0	1.71							1.71 cfs Total Flow at DP 4D
			0.85	12.5	2.0			1.71					1.71 cfs Captured by DP 4D.
			0.00	12.5	2.0						-	-	No Bypass Flow
5-D	D-5	10' CDOT TYPE R ON GRADE	0.33	12.1	2.0	0.68							0.68 cfs Total Flow at DP 5D
			0.33	12.1	2.0			0.68					0.68 cfs Captured by DP 5D.
			0.00	12.1	2.0						-	-	No Bypass Flow
6-D	D-6	10' CDOT TYPE R IN SUMP	0.44	21.4	1.5	0.69							0.69 cfs Total Flow at DP 6D
			0.44	21.4	1.5			0.69					0.69 cfs Captured by DP 6D.
			0.00	21.4	1.5						-	-	No Bypass Flow
7-D	D-7	10' CDOT TYPE R ON GRADE	0.66	12.3	2.0	1.34							1.34 cfs Total Flow at DP 7D
			0.66	12.3	2.0			1.34					1.34 cfs Captured by DP 7D.
			0.00	12.3	2.0						-	-	No Bypass Flow

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

Project Name: Spring Hill
Design Storm: 100 YEAR
100-Year P1 = 2.68 in. UDFCD Figure RA-6

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C100)	C_{100}*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
D-0	1.18	0.88	1.04	7.6	8.0	8.39
D-1	2.40	0.64	1.54	11.5	6.8	10.61
D-2	3.80	0.62	2.37	15.1	6.1	14.49
D-3	0.16	0.38	0.06	6.1	8.6	0.53
D-4	1.36	0.79	1.07	12.5	6.6	7.15
D-5	0.87	0.66	0.57	12.1	6.7	3.86
D-6	3.89	0.50	1.95	21.4	5.1	10.00
D-7	1.19	0.76	0.90	12.3	6.7	6.05

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C100*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
0-D	D-0	OVERLAND TO POND D	1.04	7.6	8.0	8.39							8.39 cfs Total Flow at DP 0D
			1.04	7.6	8.0			8.39					8.39 cfs Captured by DP 0D.
			0.00	7.6	8.0						-	-	No Bypass Flow
1-D	D-1, D-4	15' CDOT TYPE R IN SUMP	1.67	12.5	6.6	11.12							11.12 cfs Total Flow at DP 1D
			1.67	12.5	6.6			11.12					11.12 cfs Captured by DP 1D.
			0.00	12.5	6.6						-	-	No Bypass Flow
2-D	D-2, D-7	15' CDOT TYPE R IN SUMP	2.43	15.1	6.1	14.85							14.85 cfs Total Flow at DP 2D
			2.43	15.1	6.1			14.85					14.85 cfs Captured by DP 2D.
			0.00	15.1	6.1						-	-	No Bypass Flow
3-D	D-3, D-5	10' CDOT TYPE R ON GRADE	0.14	12.1	6.7	0.94							0.94 cfs Total Flow at DP 3D
			0.14	12.1	6.7			0.94					0.94 cfs Captured by DP 3D.
			0.00	12.1	6.7						-	-	No Bypass Flow
4-D	D-4	10' CDOT TYPE R ON GRADE	1.07	12.5	6.6	7.15							7.15 cfs Total Flow at DP 4D
			0.94	12.5	6.6			6.25					6.25 cfs Captured by DP 4D.
			0.14	12.5	6.6		0.90		1.1	330.0	-	-	0.9 cfs-Bypass Flow to DP 1-D
5-D	D-5, D-6	10' CDOT TYPE R ON GRADE	1.17	21.4	5.1	6.03							6.03 cfs Total Flow at DP 5D
			1.10	21.4	5.1			5.63					5.63 cfs Captured by DP 5D.
			0.08	21.4	5.1		0.40		1.1	163.0	-	-	0.4 cfs-Bypass Flow to DP 3-D
6-D	D-6	10' CDOT TYPE R IN SUMP	1.95	21.4	5.1	10.00							10 cfs Total Flow at DP 6D
			1.35	21.4	5.1			6.90					6.9 cfs Captured by DP 6D.
			0.60	21.4	5.1		3.10		1.0	1.0	2.00	0.0	3.1 cfs-Bypass Flow to DP 5-D
7-D	D-7	10' CDOT TYPE R ON GRADE	0.90	12.3	6.7	6.05							6.05 cfs Total Flow at DP 7D
			0.84	12.3	6.7			5.65					5.65 cfs Captured by DP 7D.
			0.06	12.3	6.7		0.40		1.0	300.0	2.00	2.5	0.4 cfs-Bypass Flow to DP 2-D

SF-1 COMPOSITE BASIN LAND USE

Westwood

Project Name: Spring Hill
Calculated By: EJB
Checked By: MS
Date: 6/5/2025

Basin	Type	Total Area (acres)	Townhome	Multi-Family Res.	School	Park	Paved	Open Space	Gravel (Packed)	Existing Report	Avg. Imp.	Soil Type A	Soil Type B	Soil Type C/D	C_2	C_5	C_{100}
			(acres)	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(%)*	*(%)*	*(%)*	*(%)*			
E-1	Proposed	1.08	-	-	-	-	1.08	-	-	-	100.0	-	-	100%	0.83	0.86	0.89
E-2	Proposed	1.48	-	-	-	-	1.24	0.24	-	-	84.1	-	-	100%	0.68	0.72	0.83
E-3	Proposed	1.92	0.45	-	-	-	0.42	1.05	-	-	38.2	-	100%	-	0.27	0.30	0.61
E-4	Proposed	2.55	1.16	-	-	-	0.93	0.46	-	-	66.4	-	100%	-	0.52	0.55	0.74
E-5	Proposed	1.34	0.44	-	-	-	0.80	0.10	-	-	81.2	-	100%	-	0.66	0.69	0.81
E-6	Proposed	1.62	1.10	-	-	-	0.52	-	-	-	76.2	-	100%	-	0.61	0.64	0.78
E-7	Proposed	1.26	0.45	-	-	-	0.56	0.24	0.01	-	68.4	-	100%	-	0.54	0.57	0.75
E-8	Proposed	1.18	0.53	-	-	-	0.54	0.11	-	-	75.1	-	100%	-	0.60	0.63	0.78
E-9	Proposed	1.06	0.40	-	-	-	0.58	0.06	0.02	-	80.1	-	95%	5%	0.65	0.68	0.80
E-0	Proposed	1.33	-	-	-	-	0.69	0.64	-	-	52.8	-	-	100%	0.41	0.47	0.70
OS-E1	Proposed	5.34	-	-	-	-	-	1.35	3.99	-	30.4	40%	-	60%	0.20	0.25	0.50
OS-E2	Proposed	4.02	-	-	-	-	-	0.65	3.37	-	33.9	10%	30%	60%	0.24	0.29	0.59
OS-E3	Proposed	4.15	-	-	-	-	-	2.27	1.88	-	19.2	20%	70%	10%	0.12	0.14	0.47

Land Use	% Imp.
Townhome	65
Multi-Family Res.	75
School	55
Park	10
Paved	100
Open Space	2
Gravel (Packed)	40
Existing Report	-

Basins E-1 to E-0 are tributary to Pond E.

Sum of Areas =	28.33
A*I =	1415.59
Weighted I =	50.0%

SF-2 TIME OF CONCENTRATION FOR EACH SUB-BASIN

Project Name: Spring Hill

BASIN INFORMATION			INITIAL/OVERLAND FLOW			CHANNELIZED FLOW					TOTAL Tc	MHFD T_c Check				EFFECTIVE Tc
BASIN	AREA	C_5	L_i	S_i	T_i	L_t	S_t	LAND SURFACE	VEL.	T_t	$T_c = T_I + T_T$	% IMP.	LENGTH	SLOPE	T_c	
	(AC)	-	FT	FT/FT	MINUTES	FT	FT/FT		FPS	MINUTES	MINUTES	%	FT	FT/FT	MINUTES	MINUTES
E-1	1.08	0.86	30	0.020	1.9	960	0.010	Paved area	2.00	8.0	9.9	100%	960	0.010	16.0	9.9
E-2	1.48	0.72	80	0.020	4.8	985	0.010	Paved area	2.00	8.2	13.0	84%	985	0.010	19.6	13.0
E-3	1.92	0.30	70	0.020	9.6	470	0.010	Paved area	2.00	3.9	13.5	38%	470	0.010	25.0	13.5
E-4	2.55	0.55	236	0.020	12.1	1,107	0.010	Paved area	2.00	9.2	21.3	66%	1,107	0.010	24.8	21.3
E-5	1.34	0.69	80	0.020	5.3	1,034	0.010	Paved area	2.00	8.6	13.9	81%	1,034	0.010	20.7	13.9
E-6	1.62	0.64	50	0.020	4.7	696	0.015	Paved area	2.45	4.7	9.4	76%	696	0.015	17.9	9.4
E-7	1.26	0.57	50	0.020	5.4	708	0.020	Paved area	2.83	4.2	9.6	68%	708	0.020	18.9	9.6
E-8	1.18	0.63	80	0.020	6.0	500	0.020	Paved area	2.83	2.9	9.0	75%	500	0.020	16.2	9.0
E-9	1.06	0.68	80	0.020	5.4	703	0.020	Paved area	2.83	4.1	9.6	80%	703	0.020	16.5	9.6
E-0	1.33	0.47	85	0.020	8.4	10	0.010	Paved area	2.00	0.1	8.4	53%	10	0.010	17.1	8.4
OS-E1	5.34	0.25	300	0.030	18.6	401	0.010	Grassed waterway	1.50	4.5	23.0	30%	401	0.010	25.9	23.0
OS-E2	4.02	0.29	300	0.020	20.2	486	0.010	Grassed waterway	1.50	5.4	25.6	34%	486	0.010	26.1	25.6
OS-E3	4.15	0.14	300	0.030	20.9	700	0.020	Grassed waterway	2.12	5.5	26.4	19%	700	0.020	29.8	26.4

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

Project Name: Spring Hill
Design Storm: 2 YEAR
2-Year P1 = 0.81 in. UDFCF Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C2)	C2*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
E-9	1.06	0.65	0.69	9.6	2.2	1.54
E-8	1.18	0.60	0.71	9.0	2.3	1.63
E-7	1.26	0.54	0.68	9.6	2.2	1.52
E-6	1.62	0.61	0.99	9.4	2.2	2.24
E-5	1.34	0.66	0.88	13.9	1.9	1.69
E-4	2.55	0.52	1.33	21.3	1.5	2.06
E-3	1.92	0.27	0.52	13.5	1.9	1.02
OS-E3	4.15	0.12	0.49	26.4	1.4	0.68
E-2	1.48	0.68	1.01	13.0	2.0	2.00
E-1	1.08	0.83	0.90	9.9	2.2	1.99
OS-E2	4.02	0.24	0.96	25.6	1.4	1.35
OS-E1	5.34	0.20	1.08	23.0	1.5	1.61
E-0	1.33	0.41	0.54	8.4	2.3	1.27

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C2*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
9-E	E-9	Bypass	0.69	9.6	2.2	1.54							1.54 cfs Total Flow at DP 9-E
			0.06	9.6	2.2			0.14					No Flow Captured
			0.62	9.6	2.2		1.54		2.0	517.0	2.83	3.0	1.54 cfs-Bypass Flow to DP 8-E
8-E	E-8, E-9	15' CDOT Type R On-Grade Inlet	1.33	12.6	1.99	2.67							2.67 cfs Total Flow at DP 8-E
			1.33	12.6	2.0			2.67					2.67 cfs Captured by DP 8-E.
			0.00	12.6	2.0						-	-	No Bypass Flow
7-E	E-7	15' CDOT Type R On-Grade Inlet	0.68	9.6	2.2	1.52							1.52 cfs Total Flow at DP 7-E
			0.68	9.6	2.2			1.52					1.52 cfs Captured by DP 7-E.
			0.00	9.6	2.2						-	-	No Bypass Flow
6-E	E-6	15' CDOT Type R On-Grade Inlet	0.99	9.4	2.2	2.24							2.24 cfs Total Flow at DP 6-E
			0.99	9.4	2.2			2.24					2.24 cfs Captured by DP 6-E.
			0.00	9.4	2.2						-	-	No Bypass Flow
5-E	E-5	15' CDOT Type R On-Grade Inlet	0.88	13.9	1.9	1.69							1.69 cfs Total Flow at DP 5-E
			0.88	13.9	1.9			1.69					1.69 cfs Captured by DP 5-E.
			0.00	13.9	1.9						-	-	No Bypass Flow
4-E	E-4	15' CDOT Type R On-Grade Inlet	1.33	21.3	1.5	2.06							2.06 cfs Total Flow at DP 4-E
			1.33	21.3	1.5			2.06					2.06 cfs Captured by DP 4-E.
			0.00	21.3	1.5						-	-	No Bypass Flow
3-E	E-3	15' CDOT Type R On-Grade Inlet	0.52	13.5	1.9	1.02							1.02 cfs Total Flow at DP 3-E
			0.52	13.5	1.9			1.02					1.02 cfs Captured by DP 3-E.
			0.00	13.5	1.9						-	-	No Bypass Flow
E3-OS	OS-E3	CDOT Type C Inlet in Depression	0.49	26.4	1.4	0.68							0.68 cfs Total Flow at DP E3-OS
			0.49	26.4	1.4			0.68					0.68 cfs Captured by DP E3-OS.
			0.00	26.4	1.4						-	-	No Bypass Flow
2-E	E-2	CDOT Type C Sump Inlet	1.01	13.0	2.0	2.00							2 cfs Total Flow at DP 2-E
			1.01	13.0	2.0			2.00					2 cfs Captured by DP 2-E.
			0.00	13.0	2.0						-	-	No Bypass Flow
1-E	E-1	CDOT Type C Sump Inlet	0.90	9.9	2.2	1.99							1.99 cfs Total Flow at DP 1-E
			0.90	9.9	2.2			1.99					1.99 cfs Captured by DP 1-E.
			0.00	9.9	2.2						-	-	No Bypass Flow
E2-OS	OS-E2	Swale	0.96	25.6	1.4	1.35							1.35 cfs Total Flow at DP E2-OS
			0.00	25.6	1.4			0.00					No Flow Captured
			0.96	25.6	1.4		1.35		0.5	380.0	1.41	4.5	1.35 cfs-Bypass Flow to DP E1-OS
E1-OS	OS-E1, OS-E2	Swale	2.04	30.1	1.3	2.61							2.61 cfs Total Flow at DP E1-OS
			2.04	30.1	1.3			2.61					2.61 cfs Captured by DP E1-OS.
			0.00	30.1	1.3						-	-	No Bypass Flow
0-E	E-0	Overland to Pond	0.54	8.4	2.3	1.27							1.27 cfs Total Flow at DP 0-E
			0.54	8.4	2.3			1.27					1.27 cfs Captured by DP E-0.
			0.00	8.4	2.3						-	-	No Bypass Flow

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

Project Name: Spring Hill
Design Storm: 100 YEAR
100-Year P1 = 2.68 in. UDFCF Figure RA-1

RUNOFF GENERATED BY INDIVIDUAL BASIN						
BASIN	AREA	Runoff Coeff. (C100)	C_{100}*A	T_c	I	Q_{BASIN}
	ACRES		acres	minutes	in/hr	cfs
E-9	1.06	0.80	0.85	9.6	7.4	6.33
E-8	1.18	0.78	0.92	9.0	7.6	7.00
E-7	1.26	0.75	0.94	9.6	7.4	7.00
E-6	1.62	0.78	1.27	9.4	7.4	9.51
E-5	1.34	0.81	1.08	13.9	6.3	6.87
E-4	2.55	0.74	1.88	21.3	5.1	9.67
E-3	1.92	0.61	1.16	13.5	6.4	7.49
OS-E3	4.15	0.47	1.95	26.4	4.5	8.90
E-2	1.48	0.83	1.23	13.0	6.5	8.03
E-1	1.08	0.89	0.97	9.9	7.3	7.08
OS-E2	4.02	0.59	2.36	25.6	4.6	10.96
OS-E1	5.34	0.50	2.69	23.0	4.9	13.26
E-0	1.33	0.70	0.93	8.4	7.7	7.26

RUNOFF INCLUDING TRIBUTARY BASINS									BYPASS TC				
DESIGN POINT	TRIBUTARY BASINS	Flow Description (Inlet, Bypass, etc.)	Effective C100*A	Effective Tc	Effective I	Total Q at DP (MHFD-Inlet Input)	Q (Bypass)	Q (Captured)	Slope	Length	Velocity	Tt	Notes
			acres	minutes	in/hr	cfs	cfs	cfs	%	ft	ft/s	minutes	
9-E	E-9	Bypass	0.85	9.6	7.4	6.33							6.33 cfs Total Flow at DP 9-E
			0.03	9.6	7.4			0.21					No Flow Captured
			0.82	9.6	7.4		6.33		2.0	517.0	2.83	3.0	6.33 cfs-Bypass Flow to DP 8-E
8-E	E-8, E-9	15' CDOT Type R On-Grade Inlet	1.74	12.6	6.6	11.56							11.56 cfs Total Flow at DP 8-E
			1.55	12.6	6.6			10.29					10.29 cfs Captured by DP 8-E.
			0.19	12.6	6.6		1.27		1.0	993.0	2.00	8.3	1.27 cfs-Bypass Flow to DP 1-E
7-E	E-7	15' CDOT Type R On-Grade Inlet	0.94	9.6	7.4	7.00							7 cfs Total Flow at DP 7-E
			0.84	9.6	7.4			6.26					6.26 cfs Captured by DP 7-E.
			0.10	9.6	7.4		0.74		2.0	140.0	2.83	0.8	0.74 cfs-Bypass Flow to DP 6-E
6-E	E-6, E-7	15' CDOT Type R On-Grade Inlet	1.37	10.4	7.1	9.86							9.86 cfs Total Flow at DP 6-E
			1.06	10.4	7.1			7.61					7.61 cfs Captured by DP 6-E.
			0.31	10.4	7.1		2.25		1.0	1025.0	2.00	8.5	2.25 cfs-Bypass Flow to DP 1-E
5-E	E-5	15' CDOT Type R On-Grade Inlet	1.08	13.9	6.3	6.87							6.87 cfs Total Flow at DP 5-E
			0.97	13.9	6.3			6.18					6.18 cfs Captured by DP 5-E.
			0.11	13.9	6.3		0.69		2.0	490.0	2.83	2.9	0.69 cfs-Bypass Flow to DP 3-E
4-E	E-4	15' CDOT Type R On-Grade Inlet	1.88	21.3	5.1	9.67							9.67 cfs Total Flow at DP 4-E
			1.47	21.3	5.1			7.53					7.53 cfs Captured by DP 4-E.
			0.42	21.3	5.1		2.14		1.0	1015.0	2.00	8.5	2.14 cfs-Bypass Flow to DP 1-E
3-E	E-3, E-5	15' CDOT Type R On-Grade Inlet	1.16	13.5	6.4	7.49							7.49 cfs Total Flow at DP 3-E
			1.01	13.5	6.4			6.53					6.53 cfs Captured by DP 3-E.
			0.15	13.5	6.4		0.96		1.0	990.0	2.00	8.3	0.96 cfs-Bypass Flow to DP 2-E
E3-OS	OS-E3	CDOT Type C Inlet in Depression	1.95	26.4	4.5	8.90							8.9 cfs Total Flow at DP E3-OS
			1.95	26.4	4.5			8.90					8.9 cfs Captured by DP E3-OS.
			0.00	26.4	4.5						-	-	No Bypass Flow
2-E	E-2, E-3	CDOT Type C Sump Inlet	1.23	13.0	6.5	8.03							8.03 cfs Total Flow at DP 2-E
			1.23	13.0	6.5			8.03					8.03 cfs Captured by DP 2-E.
			0.00	13.0	6.5						-	-	No Bypass Flow
1-E	E-1, E-8, E-6, E-4	CDOT Type C Sump Inlet	1.89	29.8	4.2	8.03							8.03 cfs Total Flow at DP 1-E
			1.89	29.8	4.2			8.03					8.03 cfs Captured by DP 1-E.
			0.00	29.8	4.2						-	-	No Bypass Flow
E2-OS	OS-E2	Swale	2.36	25.6	4.6	10.96							10.96 cfs Total Flow at DP E2-OS
			0.00	25.6	4.6			0.00					No Flow Captured
			2.36	25.6	4.6		10.96		0.5	380.0	1.41	4.5	10.96 cfs-Bypass Flow to DP OS-E1
E1-OS	OS-E1	Swale	2.69	23.0	4.9	13.26							13.26 cfs Total Flow at DP E1-OS
			2.69	23.0	4.9			13.26					13.26 cfs Captured by DP E1-OS.
			0.00	23.0	4.9						-	-	No Bypass Flow
0-E	E-0	Overland to Pond	0.93	8.4	7.7	7.26							7.26 cfs Total Flow at DP 0-E
			0.93	8.4	7.7			7.26					7.26 cfs Captured by DP E-0.
			0.00	8.4	7.7						-	-	No Bypass Flow

Westwood

Appendix A – Hydrologic Computations

Runoff Reduction

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 1

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	1	UIA	BUFFER
Area Type	RPA	UIA	RPA_Buffer
Downstream Design Point ID	--	BUFFER	
DCIA (ft^2)	--	--	--
UIA (ft^2)	--	22,123	--
RPA (ft^2)	--	--	23,889
SPA (ft^2)	--	--	--

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	80.0%
HSG B (%)	--	--	20.0%
HSG C/D (%)	--	--	0.0%

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other
Irrigation Type	--	--	None

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other
Is Concrete Edger used?	--	--	--
Spacing between slots (ft)	--	--	--
Slot Opening Length (in)	--	--	--
Blind Swale Type	--	--	--
Spreader Energy Dissipation	--	--	--
Total Area of UIA:RPA (ft^2)	--	--	46,012
UIA:RPA Ratio	--	--	0.9
UIA:RPA Interface Width (ft)	--	--	427
L / W Ratio of UIA:RPA	--	--	0.25

2. Buffer Length

Average Buffer Length (ft)	--	--	56

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.013
Effective Distance (ft)	--	--	50
Number of Level Spreaders	--	--	2

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00
Mowing Strip Provided?	--	--	NO

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	48.1%
UIA:RPA Runoff (in)	--	--	0.00
UIA:RPA Runoff (ft^3)	--	--	0

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	922
Runoff Reduction (ft^3)	--	--	922
Runoff Reduction (%)	--	--	100.0%

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale

Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								

2. Swale Inflows

Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								

3. Swale Cross Section

Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								

4. Longitudinal Slope

Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								

5. Calculate Runoff from Tributary Area

Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								

6. Calculate Runoff Reduction through Swale Bottom

Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								

7. Design Discharge

2-year Discharge, Q2 (cfs)	--	--	--								

8. Design Velocity

Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								

9. Design Flow Depth

Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								

10. Swale Outflows

Outflows Considered?	--	--	--								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	1	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	22,123	46,012								
Imperviousness (%)		100.0%	48.1%								
Tributary Runoff (ft^3)	0	922	922								
Runoff Reduction (ft^3)	0	0	922								
Runoff Remaining (ft^3)	0	922	0								

Total Tributary Area entered on Site Layout Worksheet is: 46,012 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 2

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	2	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	22,605	--								
RPA (ft^2)	--	--	20,114								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	0.0%								
HSG B (%)	--	--	100.0%								
HSG C/D (%)	--	--	0.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	42,719								
UIA:RPA Ratio	--	--	1.1								
UIA:RPA Interface Width (ft)	--	--	372								
L / W Ratio of UIA:RPA	--	--	0.31								

2. Buffer Length

Average Buffer Length (ft)	--	--	54								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.025								
Effective Distance (ft)	--	--	50								
Number of Level Spreaders	--	--	2								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	52.9%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	942								
Runoff Reduction (ft^3)	--	--	942								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								
2. Swale Inflows											
Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								
3. Swale Cross Section											
Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--	--								
8. Design Velocity											
Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								
10. Swale Outflows											
Outflows Considered?	--	--	--								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	2	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	22,605	42,719								
Imperviousness (%)		100.0%	52.9%								
Tributary Runoff (ft^3)	0	942	942								
Runoff Reduction (ft^3)	0	0	942								
Runoff Remaining (ft^3)	0	942	0								

Total Tributary Area entered on Site Layout Worksheet is: 42,719 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 3

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	3	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	18,977	--								
RPA (ft^2)	--	--	19,318								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	0.0%								
HSG B (%)	--	--	100.0%								
HSG C/D (%)	--	--	0.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	38,295								
UIA:RPA Ratio	--	--	1.0								
UIA:RPA Interface Width (ft)	--	--	324								
L / W Ratio of UIA:RPA	--	--	0.36								

2. Buffer Length

Average Buffer Length (ft)	--	--	60								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.055								
Effective Distance (ft)	--	--	50								
Number of Level Spreaders	--	--	2								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	49.6%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	791								
Runoff Reduction (ft^3)	--	--	791								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								
2. Swale Inflows											
Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								
3. Swale Cross Section											
Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--	--								
8. Design Velocity											
Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								
10. Swale Outflows											
Outflows Considered?	--	--	--								

Notes: _____

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	3	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	18,977	38,295								
Imperviousness (%)		100.0%	49.6%								
Tributary Runoff (ft^3)	0	791	791								
Runoff Reduction (ft^3)	0	0	791								
Runoff Remaining (ft^3)	0	791	0								

Total Tributary Area entered on Site Layout Worksheet is: 38,295 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 4

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	4	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	13,969	--								
RPA (ft^2)	--	--	10,630								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	55.0%								
HSG B (%)	--	--	45.0%								
HSG C/D (%)	--	--	0.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	24,599								
UIA:RPA Ratio	--	--	1.3								
UIA:RPA Interface Width (ft)	--	--	225								
L / W Ratio of UIA:RPA	--	--	0.49								

2. Buffer Length

Average Buffer Length (ft)	--	--	47								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.080								
Effective Distance (ft)	--	--	25								
Number of Level Spreaders	--	--	2								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	56.8%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	582								
Runoff Reduction (ft^3)	--	--	582								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								
2. Swale Inflows											
Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								
3. Swale Cross Section											
Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--	--								
8. Design Velocity											
Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								
10. Swale Outflows											
Outflows Considered?	--	--	--								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	4	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	13,969	24,599								
Imperviousness (%)		100.0%	56.8%								
Tributary Runoff (ft^3)	0	582	582								
Runoff Reduction (ft^3)	0	0	582								
Runoff Remaining (ft^3)	0	582	0								

Total Tributary Area entered on Site Layout Worksheet is: 24,599 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 5

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	5	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	16,778	--								
RPA (ft^2)	--	--	14,697								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	0.0%								
HSG B (%)	--	--	0.0%								
HSG C/D (%)	--	--	100.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	31,475								
UIA:RPA Ratio	--	--	1.1								
UIA:RPA Interface Width (ft)	--	--	295								
L / W Ratio of UIA:RPA	--	--	0.36								

2. Buffer Length

Average Buffer Length (ft)	--	--	50								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.050								
Effective Distance (ft)	--	--	50								
Number of Level Spreaders	--	--	1								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	53.3%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	699								
Runoff Reduction (ft^3)	--	--	699								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								
2. Swale Inflows											
Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								
3. Swale Cross Section											
Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--	--								
8. Design Velocity											
Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								
10. Swale Outflows											
Outflows Considered?	--	--	--								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	5	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	16,778	31,475								
Imperviousness (%)		100.0%	53.3%								
Tributary Runoff (ft^3)	0	699	699								
Runoff Reduction (ft^3)	0	0	699								
Runoff Remaining (ft^3)	0	699	0								

Total Tributary Area entered on Site Layout Worksheet is: 31,475 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 6

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	6	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	16,991	--								
RPA (ft^2)	--	--	15,667								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	0.0%								
HSG B (%)	--	--	0.0%								
HSG C/D (%)	--	--	100.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	32,658								
UIA:RPA Ratio	--	--	1.1								
UIA:RPA Interface Width (ft)	--	--	292								
L / W Ratio of UIA:RPA	--	--	0.38								

2. Buffer Length

Average Buffer Length (ft)	--	--	54								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.080								
Effective Distance (ft)	--	--	25								
Number of Level Spreaders	--	--	3								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	52.0%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	708								
Runoff Reduction (ft^3)	--	--	708								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								
2. Swale Inflows											
Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								
3. Swale Cross Section											
Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--	--								
8. Design Velocity											
Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								
10. Swale Outflows											
Outflows Considered?	--	--	--								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	6	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	16,991	32,658								
Imperviousness (%)		100.0%	52.0%								
Tributary Runoff (ft^3)	0	708	708								
Runoff Reduction (ft^3)	0	0	708								
Runoff Remaining (ft^3)	0	708	0								

Total Tributary Area entered on Site Layout Worksheet is: 32,658 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 7

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	7	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	21,735	--								
RPA (ft^2)	--	--	26,615								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	0.0%								
HSG B (%)	--	--	95.0%								
HSG C/D (%)	--	--	5.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	48,350								
UIA:RPA Ratio	--	--	0.8								
UIA:RPA Interface Width (ft)	--	--	443								
L / W Ratio of UIA:RPA	--	--	0.25								

2. Buffer Length

Average Buffer Length (ft)	--	--	60								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.025								
Effective Distance (ft)	--	--	50								
Number of Level Spreaders	--	--	2								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	45.0%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	906								
Runoff Reduction (ft^3)	--	--	906								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale

Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								

2. Swale Inflows

Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								

3. Swale Cross Section

Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								

4. Longitudinal Slope

Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								

5. Calculate Runoff from Tributary Area

Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								

6. Calculate Runoff Reduction through Swale Bottom

Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								

7. Design Discharge

2-year Discharge, Q2 (cfs)	--	--	--								

8. Design Velocity

Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								

9. Design Flow Depth

Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								

10. Swale Outflows

Outflows Considered?	--	--	--								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	7	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	21,735	48,350								
Imperviousness (%)		100.0%	45.0%								
Tributary Runoff (ft^3)	0	906	906								
Runoff Reduction (ft^3)	0	0	906								
Runoff Remaining (ft^3)	0	906	0								

Total Tributary Area entered on Site Layout Worksheet is: 48,350 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 8

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	8	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	20,426	--								
RPA (ft^2)	--	--	25,282								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	0.0%								
HSG B (%)	--	--	100.0%								
HSG C/D (%)	--	--	0.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	45,708								
UIA:RPA Ratio	--	--	0.8								
UIA:RPA Interface Width (ft)	--	--	443								
L / W Ratio of UIA:RPA	--	--	0.23								

2. Buffer Length

Average Buffer Length (ft)	--	--	57								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.055								
Effective Distance (ft)	--	--	50								
Number of Level Spreaders	--	--	2								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	44.7%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	851								
Runoff Reduction (ft^3)	--	--	851								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								
2. Swale Inflows											
Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								
3. Swale Cross Section											
Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--	--								
8. Design Velocity											
Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								
10. Swale Outflows											
Outflows Considered?	--	--	--								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	8	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	20,426	45,708								
Imperviousness (%)		100.0%	44.7%								
Tributary Runoff (ft^3)	0	851	851								
Runoff Reduction (ft^3)	0	0	851								
Runoff Remaining (ft^3)	0	851	0								

Total Tributary Area entered on Site Layout Worksheet is: 45,708 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 9

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	9	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	15,466	--								
RPA (ft^2)	--	--	16,986								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	0.0%								
HSG B (%)	--	--	100.0%								
HSG C/D (%)	--	--	0.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	32,452								
UIA:RPA Ratio	--	--	0.9								
UIA:RPA Interface Width (ft)	--	--	292								
L / W Ratio of UIA:RPA	--	--	0.38								

2. Buffer Length

Average Buffer Length (ft)	--	--	58								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.020								
Effective Distance (ft)	--	--	50								
Number of Level Spreaders	--	--	2								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	47.7%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	644								
Runoff Reduction (ft^3)	--	--	644								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								
2. Swale Inflows											
Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								
3. Swale Cross Section											
Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--	--								
8. Design Velocity											
Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								
10. Swale Outflows											
Outflows Considered?	--	--	--								

Notes: _____

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	9	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	15,466	32,452								
Imperviousness (%)		100.0%	47.7%								
Tributary Runoff (ft^3)	0	644	644								
Runoff Reduction (ft^3)	0	0	644								
Runoff Remaining (ft^3)	0	644	0								

Total Tributary Area entered on Site Layout Worksheet is: 32,452 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 10

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	10	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	12,552	--								
RPA (ft^2)	--	--	12,873								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	0.0%								
HSG B (%)	--	--	100.0%								
HSG C/D (%)	--	--	0.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	25,425								
UIA:RPA Ratio	--	--	1.0								
UIA:RPA Interface Width (ft)	--	--	266								
L / W Ratio of UIA:RPA	--	--	0.36								

2. Buffer Length

Average Buffer Length (ft)	--	--	48								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.020								
Effective Distance (ft)	--	--	50								
Number of Level Spreaders	--	--	1								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	49.4%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	523								
Runoff Reduction (ft^3)	--	--	523								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								
2. Swale Inflows											
Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								
3. Swale Cross Section											
Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--	--								
8. Design Velocity											
Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								
10. Swale Outflows											
Outflows Considered?	--	--	--								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	10	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	12,552	25,425								
Imperviousness (%)		100.0%	49.4%								
Tributary Runoff (ft^3)	0	523	523								
Runoff Reduction (ft^3)	0	0	523								
Runoff Remaining (ft^3)	0	523	0								

Total Tributary Area entered on Site Layout Worksheet is: 25,425 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 11

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	11	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	18,873	--								
RPA (ft^2)	--	--	16,716								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	0.0%								
HSG B (%)	--	--	100.0%								
HSG C/D (%)	--	--	0.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	35,589								
UIA:RPA Ratio	--	--	1.1								
UIA:RPA Interface Width (ft)	--	--	341								
L / W Ratio of UIA:RPA	--	--	0.31								

2. Buffer Length

Average Buffer Length (ft)	--	--	49								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.120								
Effective Distance (ft)	--	--	25								
Number of Level Spreaders	--	--	2								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	53.0%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	786								
Runoff Reduction (ft^3)	--	--	786								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								
2. Swale Inflows											
Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								
3. Swale Cross Section											
Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--	--								
8. Design Velocity											
Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								
10. Swale Outflows											
Outflows Considered?	--	--	--								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	11	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	18,873	35,589								
Imperviousness (%)		100.0%	53.0%								
Tributary Runoff (ft^3)	0	786	786								
Runoff Reduction (ft^3)	0	0	786								
Runoff Remaining (ft^3)	0	786	0								

Total Tributary Area entered on Site Layout Worksheet is: 35,589 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 12

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	12	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	30,617	--								
RPA (ft^2)	--	--	36,561								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	80.0%								
HSG B (%)	--	--	20.0%								
HSG C/D (%)	--	--	0.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	67,178								
UIA:RPA Ratio	--	--	0.8								
UIA:RPA Interface Width (ft)	--	--	512								
L / W Ratio of UIA:RPA	--	--	0.26								

2. Buffer Length

Average Buffer Length (ft)	--	--	71								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.220								
Effective Distance (ft)	--	--	25								
Number of Level Spreaders	--	--	3								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	45.6%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	1,276								
Runoff Reduction (ft^3)	--	--	1,276								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								
2. Swale Inflows											
Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								
3. Swale Cross Section											
Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--	--								
8. Design Velocity											
Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								
10. Swale Outflows											
Outflows Considered?	--	--	--								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	12	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	30,617	67,178								
Imperviousness (%)		100.0%	45.6%								
Tributary Runoff (ft^3)	0	1,276	1,276								
Runoff Reduction (ft^3)	0	0	1,276								
Runoff Remaining (ft^3)	0	1,276	0								

Total Tributary Area entered on Site Layout Worksheet is: 67,178 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 13

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	13	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	45,591	--								
RPA (ft^2)	--	--	27,679								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	100.0%								
HSG B (%)	--	--	0.0%								
HSG C/D (%)	--	--	0.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	73,270								
UIA:RPA Ratio	--	--	1.6								
UIA:RPA Interface Width (ft)	--	--	358								
L / W Ratio of UIA:RPA	--	--	0.57								

2. Buffer Length

Average Buffer Length (ft)	--	--	77								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.023								
Effective Distance (ft)	--	--	50								
Number of Level Spreaders	--	--	2								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	62.2%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	1,900								
Runoff Reduction (ft^3)	--	--	1,900								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								
2. Swale Inflows											
Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								
3. Swale Cross Section											
Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--	--								
8. Design Velocity											
Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								
10. Swale Outflows											
Outflows Considered?	--	--	--								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	13	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	45,591	73,270								
Imperviousness (%)		100.0%	62.2%								
Tributary Runoff (ft^3)	0	1,900	1,900								
Runoff Reduction (ft^3)	0	0	1,900								
Runoff Remaining (ft^3)	0	1,900	0								

Total Tributary Area entered on Site Layout Worksheet is: 73,270 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 14

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	14	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	22,964	--								
RPA (ft^2)	--	--	19,317								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	0.0%								
HSG B (%)	--	--	0.0%								
HSG C/D (%)	--	--	100.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	42,281								
UIA:RPA Ratio	--	--	1.2								
UIA:RPA Interface Width (ft)	--	--	200								
L / W Ratio of UIA:RPA	--	--	1.06								

2. Buffer Length

Average Buffer Length (ft)	--	--	97								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.020								
Effective Distance (ft)	--	--	50								
Number of Level Spreaders	--	--	2								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	54.3%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	957								
Runoff Reduction (ft^3)	--	--	957								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								
2. Swale Inflows											
Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								
3. Swale Cross Section											
Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--	--								
8. Design Velocity											
Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								
10. Swale Outflows											
Outflows Considered?	--	--	--								

Notes: _____

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	14	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	22,964	42,281								
Imperviousness (%)		100.0%	54.3%								
Tributary Runoff (ft^3)	0	957	957								
Runoff Reduction (ft^3)	0	0	957								
Runoff Remaining (ft^3)	0	957	0								

Total Tributary Area entered on Site Layout Worksheet is: 42,281 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.01 (December 2024)

Designer:
Company: WESTWOOD PROFESSIONAL SERVICES
Date: June 3, 2025
Project: SPRING HILL
Location: ERIE COUNTY
Outfall ID: 15

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	15	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Downstream Design Point ID	--	BUFFER									
DCIA (ft^2)	--	--	--								
UIA (ft^2)	--	4,879	--								
RPA (ft^2)	--	--	4,598								
SPA (ft^2)	--	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	None								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	0.0%								
HSG B (%)	--	--	0.0%								
HSG C/D (%)	--	--	100.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	Other								
Irrigation Type	--	--	None								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	Other								
Is Concrete Edger used?	--	--	--								
Spacing between slots (ft)	--	--	--								
Slot Opening Length (in)	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	9,477								
UIA:RPA Ratio	--	--	1.1								
UIA:RPA Interface Width (ft)	--	--	115								
L / W Ratio of UIA:RPA	--	--	0.72								

2. Buffer Length

Average Buffer Length (ft)	--	--	40								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	0.025								
Effective Distance (ft)	--	--	50								
Number of Level Spreaders	--	--	1								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	0.00								
Mowing Strip Provided?	--	--	NO								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	51.5%								
UIA:RPA Runoff (in)	--	--	0.00								
UIA:RPA Runoff (ft^3)	--	--	0								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	203								
Runoff Reduction (ft^3)	--	--	203								
Runoff Reduction (%)	--	--	100.0%								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--								
Imperviousness (%)	--	--	--								
2. Swale Inflows											
Concentrated Flow Type	--	--	--								
Blind Swale Type	--	--	--								
Spreader Energy Dissipation	--	--	--								
Vertical Drop (in)	--	--	--								
Gutter Depression (in)	--	--	--								
Curb Opening Length (ft)	--	--	--								
Concrete Sediment Pad	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--								
Design Forebay Volume (ft^3)	--	--	--								
Max. Forebay Depth (in)	--	--	--								
Design Forebay Depth (in)	--	--	--								
Calculated Notch Width (in)	--	--	--								
Design Notch Width (in)	--	--	--								
Drain Time (minutes)	--	--	--								
Energy Dissipation Type	--	--	--								
3. Swale Cross Section											
Length of Swale (ft)	--	--	--								
Bottom Width (ft)	--	--	--								
Bottom Area (ft^2)	--	--	--								
Side Slopes (horiz/vert)	--	--	--								
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--	--								
Design Slope (ft/ft)	--	--	--								
Total Drop Height (ft)	--	--	--								
Underdrains Provided?	--	--	--								
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--								
Reduced Trib. Runoff (ft^3)	--	--	--								
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--								
Swale Discharge (ft^3)	--	--	--								
Runoff Reduction (%)	--	--	--								
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--	--								
8. Design Velocity											
Vegetal Retardance Curve	--	--	--								
Velocity, V2 (fps)	--	--	--								
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--	--								
Flow Area, A (ft^2)	--	--	--								
Wetted Perimeter, P (ft)	--	--	--								
Top Width, T (ft)	--	--	--								
Hydraulic Radius, Rh (ft)	--	--	--								
VR Product (ft^2/sec)	--	--	--								
Manning's n value	--	--	--								
Hydraulic Depth, Dh (ft)	--	--	--								
Froude Number	--	--	--								
10. Swale Outflows											
Outflows Considered?	--	--	--								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	15	UIA	BUFFER								
Area Type	RPA	UIA	RPA_Buffer								
Total Area (ft^2)	0	4,879	9,477								
Imperviousness (%)		100.0%	51.5%								
Tributary Runoff (ft^3)	0	203	203								
Runoff Reduction (ft^3)	0	0	203								
Runoff Remaining (ft^3)	0	203	0								

Total Tributary Area entered on Site Layout Worksheet is: 9,477 square feet

Westwood

Appendix B – Hydraulic Computations

UD Detention Pond Sizing and Forebay Calculations
Spillway Riprap Sizing
Inlet and Street Capacity Calculations
Swale Calculations
Culvert Calculations

Westwood

Appendix B – Hydraulic Computations

UD Detention Pond Sizing and Forebay Calculations

Pond Tributray Area and Forebay Calculations					
Pond A					
Pond A East Forebay					
Tributray Basins	Area (acres)	Imperviousness (%)	Type A Soil (%)	Type B Soil (%)	Types C/D Soil (%)
A-1	1.23	53.97	0%	100%	0%
A-1a	1.34	54.63	0%	100%	0%
A-3	1.98	49.55	0%	100%	0%
A-3a	0.84	56.07	0%	100%	0%
A-5	0.75	58.24	0%	100%	0%
A-6	2.09	39.43	0%	100%	0%
A-7	2.44	41.00	35%	65%	0%
A-7a	0.09	67.33	0%	100%	0%
A-8	1.73	58.28	50%	50%	0%
A-8a	0.56	53.07	50%	50%	0%
A-9	1.13	64.32	80%	20%	0%
A-10	0.99	57.68	80%	20%	0%
A-11	0.13	77.38	100%	0%	0%
A-12	0.73	56.99	100%	0%	0%
A-13	0.4	60.80	0%	100%	0%
Sum of Area =	16.43				
Sum of A*I =	853.26				
Weight I =	51.93				
Pond A South Forebay					
Tributray Basins	Area (acres)	Imperviousness (%)	Type A Soil (%)	Type B Soil (%)	Types C/D Soil (%)
A-2	0.48	73.46	10%	90%	0%
A-4	0.83	81.11	0%	100%	0%
A-14	0.71	75.15	15%	85%	0%
A-15	2.85	36.06	0%	100%	0%
A-16	0.24	46.92	0%	100%	0%
A-16a	0.98	58.88	0%	100%	0%
A-17	2.03	34.10	0%	100%	0%
A-18	0.27	81.85	0%	100%	0%
A-19	1.1	54.95	0%	100%	0%
A-20	1.75	41.42	0%	100%	0%
A-20a	0.43	33.91	0%	100%	0%
A-21	2.66	55.73	0%	100%	0%
A-23	0.58	56.31	0%	100%	0%
A-24	0.6	65.23	0%	100%	0%
A-25	0.19	63.89	0%	100%	0%
A-27	1.33	61.13	0%	100%	0%
A-28	0.66	47.36	0%	100%	0%
A-28a	2.23	51.06	0%	100%	0%
A-29	1.75	51.22	0%	100%	0%
A-29a	0.8	55.10	0%	100%	0%
A-30	0.16	63.25	0%	100%	0%
A-31	1.44	50.26	0%	100%	0%
A-32	12.32	45.02	0%	85%	15%
Sum of Area =	36.39				
Sum of A*I =	1795.94				
Weight I =	49.35				
Sum of Area =	52.82				
Sum of A*I =	2649.20				
Weight I =	50.16				
% Soil Type =	-	-	8.92%	87.59%	3.50%

Pond Tributray Area and Forebay Calculations					
Pond B					
Pond B Forebay					
Tributray Basins	Area (acres)	Imperviousness (%)	Type A Soil (%)	Type B Soil (%)	Types C/D Soil (%)
B-0	3.1	14.2%	100%	0%	0%
B-1	0.96	52.0%	100%	0%	0%
B-2	2.14	53.6%	100%	0%	0%
B-3	2.8	49.0%	100%	0%	0%
B-4	1.63	51.7%	100%	0%	0%
B-5	1.66	53.8%	100%	0%	0%
B-6	1.15	56.3%	100%	0%	0%
B-7	1.12	65.4%	100%	0%	0%
B-8	3.33	55.0%	100%	0%	0%
B-9	2.9	52.3%	100%	0%	0%
B-10	1.58	57.6%	100%	0%	0%
B-11	3.52	54.5%	42%	58%	0%
B-12	1.1	36.8%	100%	0%	0%
B-13	3.02	19.8%	100%	0%	0%
B-14	1.31	59.7%	55%	45%	0%
B-15	2.07	54.7%	0%	100%	0%
B-16	1.47	62.7%	100%	0%	0%
B-17	1.01	61.0%	100%	0%	0%
B-18	0.81	52.7%	100%	0%	0%
B-19	1.58	60.6%	100%	0%	0%
B-20	3.31	54.7%	100%	0%	0%
B-21	0.74	51.0%	100%	0%	0%
B-22	1.18	61.6%	95%	5%	0%
B-23	3.96	41.8%	37%	63%	0%
B-24	2.13	46.3%	24%	76%	0%
B-25	1.43	60.6%	49%	51%	0%
B-26	1.56	56.2%	100%	0%	0%
B-27	2.8	52.3%	100%	0%	0%
B-28	1.74	53.6%	100%	0%	0%
B-29	1.98	51.7%	100%	0%	0%
B-30	1.73	58.9%	100%	0%	0%
B-31	2.22	45.4%	47%	53%	0%
Sum of Area =	63.04				
Sum of A*I =	31.34				
Weight I =	49.71%				
% Soil Type =	-	-	82.90%	17.10%	0.00%

Pond Tributray Area and Forebay Calculations					
Pond C Forebay					
Pond C Forebay					
Tributray Basins	Area (acres)	Imperviousness (%)	Type A Soil (%)	Type B Soil (%)	Types C/D Soil (%)
C-1	0.52	96.23	0.13	0.87	0.00
C-2	6.01	26.20	0.75	0.25	0.00
C-3	0.21	100.00	0.00	1.00	0.00
C-4	4.99	44.13	0.01	0.99	0.00
C-5	0.21	76.67	0.00	1.00	0.00
C-6	1.60	44.26	0.75	0.25	0.00
Sum of Area =	13.54				
Sum of A*I =	535.63				
Weight I =	39.56				
% Soil Type =	-	-	43.24%	56.76%	0.00%

Pond Tributray Area and Forebay Calculations					
Pond D					
Pond D Forebay					
Tributray Basins	Area (acres)	Imperviousness (%)	Type A Soil (%)	Type B Soil (%)	Types C/D Soil (%)
D-0	1.18	97.63	0.39	0.03	0.58
D-1	2.40	58.47	0.45	0.55	0.00
D-2	3.80	49.34	0.21	0.79	0.00
D-3	0.16	35.25	1.00	0.00	0.00
D-4	1.36	77.52	0.00	1.00	0.00
D-5	0.87	50.92	0.06	0.94	0.00
D-6	3.89	18.22	0.04	0.96	0.00
D-7	1.19	70.13	0.00	1.00	0.00
Sum of Area =	14.85				
Sum of A*I =	752.71				
Weight I =	50.69				
% Soil Type =	-	-	18.22%	77.17%	4.61%

Pond Tributray Area and Forebay Calculations					
Pond E					
Pond E Forebay West					
Tributray Basins	Area (acres)	Imperviousness (%)	Type A Soil (%)	Type B Soil (%)	Types C/D Soil (%)
E-1	1.08	100	0	0	100
E-2	1.48	84.1	0	0	100
Sum of Area =	2.56				
Sum of A*I =	232.47				
Weighted I =	90.81				
Pond E Forebay South					
Tributray Basins	Area (acres)	Imperviousness (%)	Type A Soil (%)	Type B Soil (%)	Types C/D Soil (%)
E-9	1.06	80.1	0	95	5
E-8	1.18	75.1	0	100	0
E-7	1.26	68.4	0	100	0
E-6	1.62	76.2	0	100	0
E-5	1.34	81.2	0	100	0
E-4	2.55	66.4	0	100	0
E-3	1.92	38.2	0	100	0
OS-E3	4.15	19.2	20	70	10
Sum of Area =	15.08				
Sum of A*I =	814.30				
Weighted I =	54.00				
Overall					
Sum of Area =	17.64				
Sum of A*I =	1046.77				
Weighted I =	59.34				
% Soil Type =	-	-	4.71	78.13	17.17

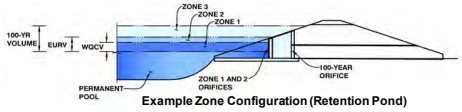
POND A - NO CLOGGING

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND A**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	56.40	acres
Watershed Length =	2,138	ft
Watershed Length to Centroid =	1,067	ft
Watershed Slope =	0.026	ft/ft
Watershed Imperviousness =	55.00%	percent
Percentage Hydrologic Soil Group A =	8.9%	percent
Percentage Hydrologic Soil Group B =	87.6%	percent
Percentage Hydrologic Soil Groups C/D =	3.5%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Erie	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

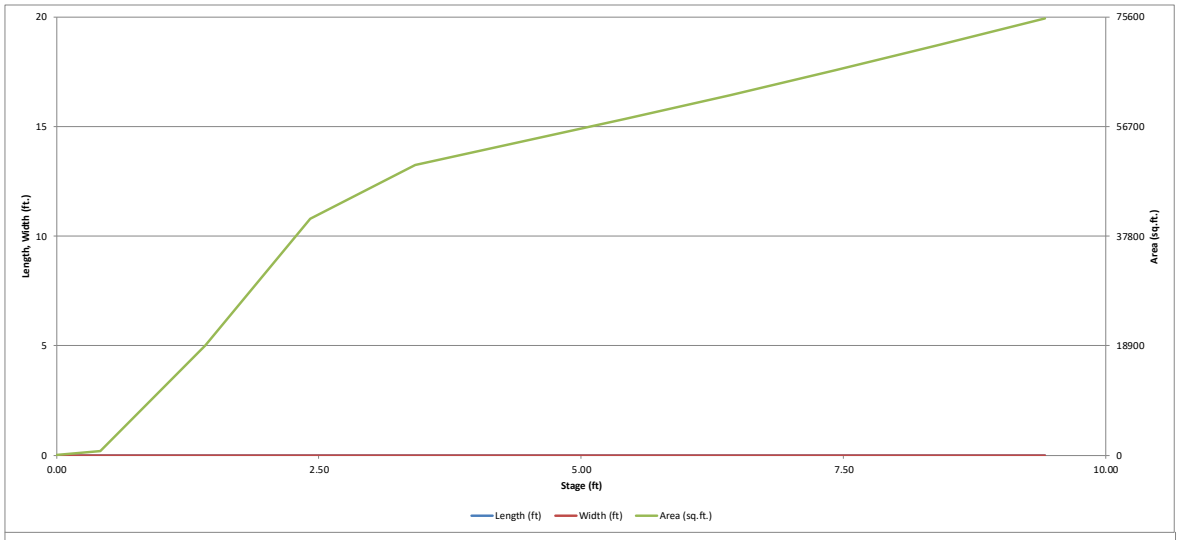
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.036	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	3.358	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.81 in.) =	1.852	acre-feet		inches
5-yr Runoff Volume (P1 = 1.11 in.) =	2.735	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	3.817	acre-feet		inches
25-yr Runoff Volume (P1 = 1.84 in.) =	6.101	acre-feet		inches
50-yr Runoff Volume (P1 = 2.24 in.) =	7.981	acre-feet		inches
100-yr Runoff Volume (P1 = 2.68 in.) =	10.291	acre-feet		inches
500-yr Runoff Volume (P1 = 3.89 in.) =	16.286	acre-feet		inches
Approximate 2-yr Detention Volume =	1.729	acre-feet		
Approximate 5-yr Detention Volume =	2.549	acre-feet		
Approximate 10-yr Detention Volume =	3.534	acre-feet		
Approximate 25-yr Detention Volume =	4.488	acre-feet		
Approximate 50-yr Detention Volume =	5.095	acre-feet		
Approximate 100-yr Detention Volume =	6.014	acre-feet		

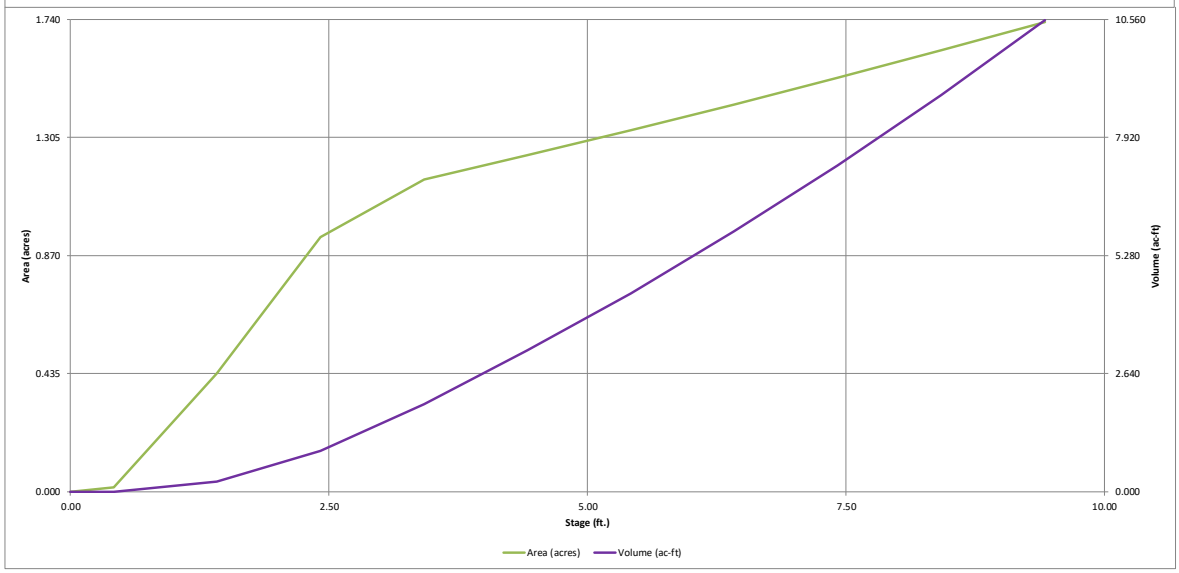
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.036	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.322	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	7.190	acre-feet
Total Detention Basin Volume =	10.548	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 1.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
4997	--	0.42	--	--	--	675	0.015	152	0.003
4998	--	1.42	--	--	--	18,943	0.435	9,961	0.229
4999	--	2.42	--	--	--	40,807	0.937	39,836	0.915
5000	--	3.42	--	--	--	50,102	1.150	85,290	1.958
5001	--	4.42	--	--	--	54,032	1.240	137,357	3.153
5002	--	5.42	--	--	--	58,053	1.333	193,400	4.440
5003	--	6.42	--	--	--	62,147	1.427	253,500	5.820
5004	--	7.42	--	--	--	66,386	1.524	317,766	7.295
5005	--	8.42	--	--	--	70,804	1.625	386,361	8.870
5006	--	9.42	--	--	--	75,422	1.731	459,474	10.548


20
15
10
5
0
Length, Width (ft.)
75600
56700
37800
18900
0
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

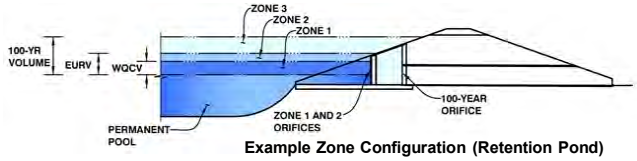

1.740
1.305
0.870
0.435
0.000
Area (acres)
10.560
7.920
5.280
2.640
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND A**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.55	1.036	Orifice Plate
Zone 2 (EURV)	4.59	2.322	Orifice Plate
Zone 3 (User)	9.42	7.190	Weir&Pipe (Restrict)
Total (all zones)		10.548	

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

Calculated Parameters for Underdrain

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	5.10	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	1.60	3.60					
Orifice Area (sq. inches)	4.00	18.00	25.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.10	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	10.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	10.00	N/A	feet
Overflow Grate Type =	No Grate	N/A	
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.10	N/A	feet
Overflow Weir Slope Length =	10.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	13.60	N/A	
Overflow Grate Open Area w/o Debris =	100.00	N/A	ft^2
Overflow Grate Open Area w/ Debris =	100.00	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 =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	30.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	7.35	N/A	ft^2
Outlet Orifice Centroid =	1.39	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.01	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.60	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	100.00	feet
Spillway End Slopes =	10.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.58	feet
Stage at Top of Freeboard =	8.18	feet
Basin Area at Top of Freeboard =	1.60	acres
Basin Volume at Top of Freeboard =	8.48	acre-ft

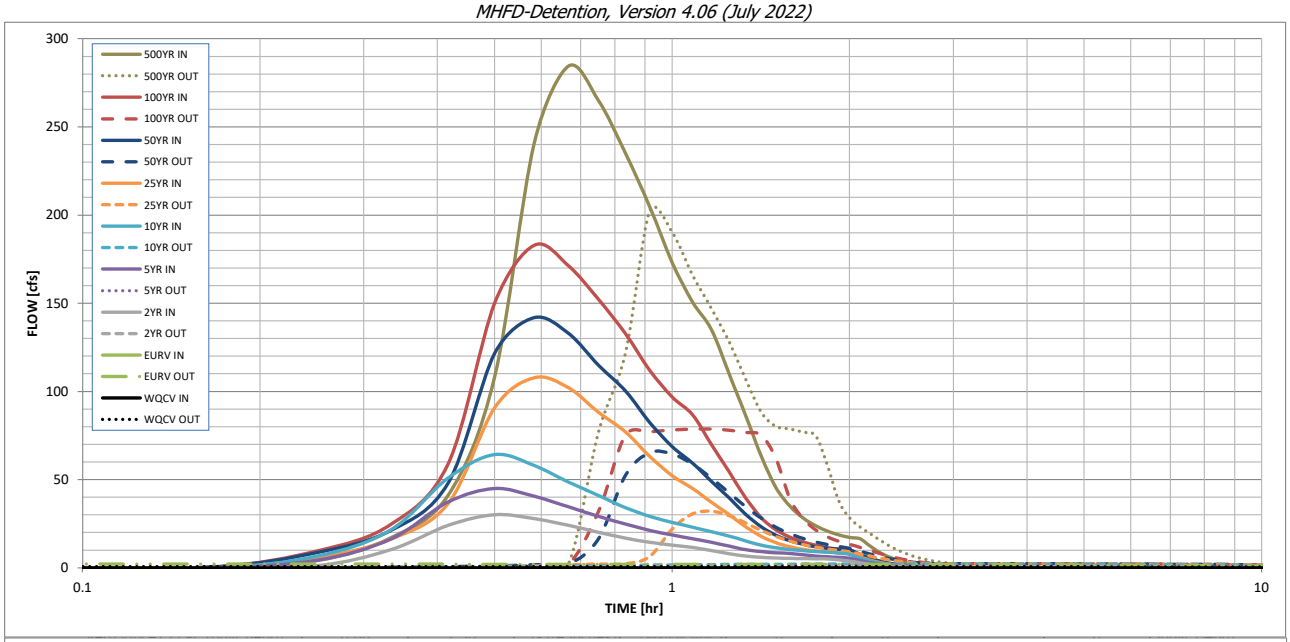
Routed Hydrograph Results

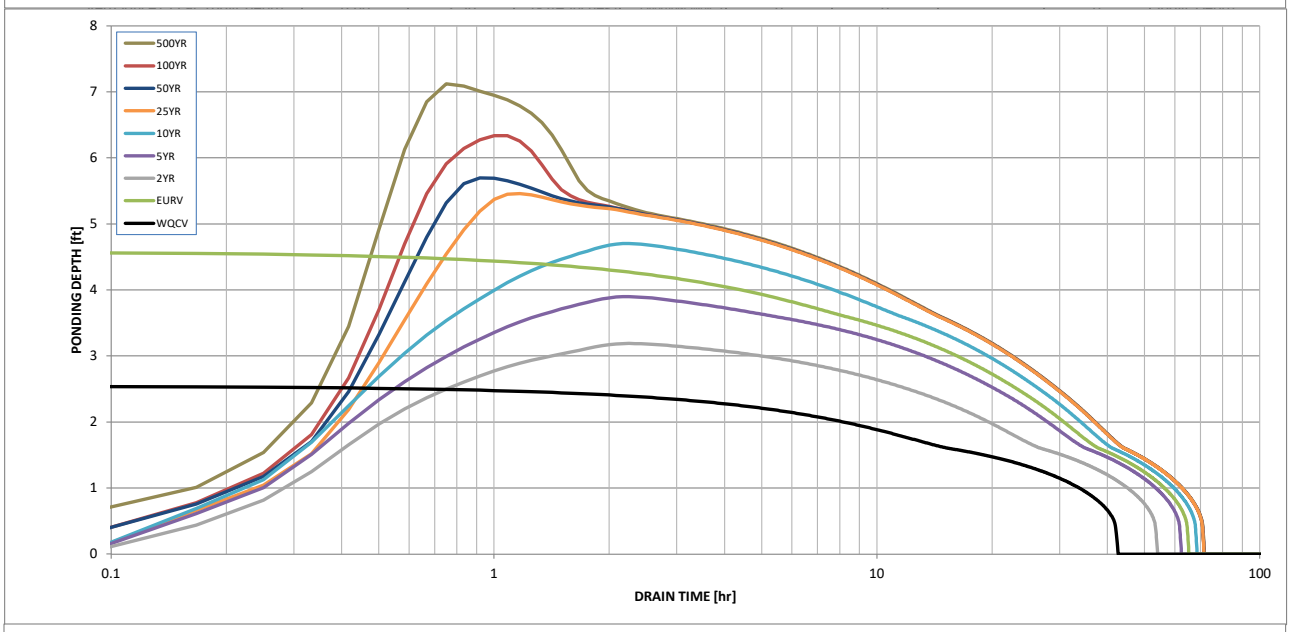
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

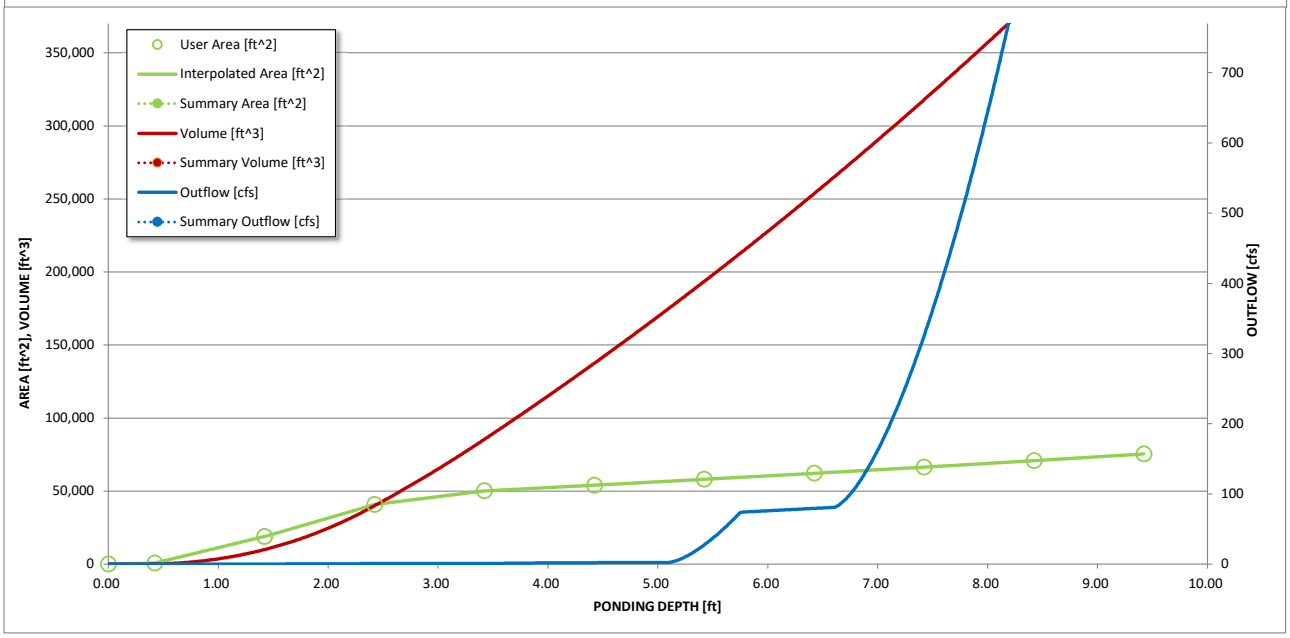
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.81	1.11	1.39	1.84	2.24	2.68	3.89
CUHP Runoff Volume (acre-ft) =	1.036	3.358	1.852	2.735	3.817	6.101	7.981	10.291	16.286
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.852	2.735	3.817	6.101	7.981	10.291	16.286
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.4	0.9	10.0	39.0	59.0	84.4	145.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.18	0.69	1.05	1.50	2.58
Peak Inflow Q (cfs) =	N/A	N/A	30.2	45.1	64.3	107.9	141.9	183.0	284.6
Peak Outflow Q (cfs) =	0.8	2.2	1.0	1.6	2.2	32.1	65.3	78.7	202.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.8	0.2	0.8	1.1	0.9	1.4
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.3	0.6	0.8	0.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	55	48	54	57	54	50	45	39
Time to Drain 99% of Inflow Volume (hours) =	**41**	61	52	59	64	65	63	61	56
Maximum Ponding Depth (ft) =	2.55	4.59	3.19	3.90	4.70	5.46	5.70	6.34	7.12
Area at Maximum Ponding Depth (acres) =	0.96	1.26	1.10	1.19	1.27	1.34	1.36	1.42	1.49
Maximum Volume Stored (acre-ft) =	1.038	3.365	1.699	2.509	3.504	4.493	4.803	5.692	6.842

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
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]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.53	4.12
	0:15:00	0.00	0.00	1.21	4.33	6.79	5.89	8.75	9.58	17.08
	0:20:00	0.00	0.00	10.43	16.36	21.55	16.28	21.22	24.62	41.16
	0:25:00	0.00	0.00	24.10	37.41	51.06	36.41	48.11	58.97	108.23
	0:30:00	0.00	0.00	30.23	45.10	64.27	90.84	121.69	150.15	240.91
	0:35:00	0.00	0.00	27.89	40.64	58.03	107.86	141.92	183.00	284.56
	0:40:00	0.00	0.00	24.25	34.60	48.68	102.12	133.00	171.40	264.99
	0:45:00	0.00	0.00	20.24	29.23	41.09	88.29	114.92	152.24	235.13
	0:50:00	0.00	0.00	16.88	24.89	34.23	77.14	100.37	132.78	204.73
	0:55:00	0.00	0.00	14.49	21.24	29.19	63.10	82.35	111.93	173.20
	1:00:00	0.00	0.00	12.89	18.64	25.86	52.36	68.80	96.94	150.72
	1:05:00	0.00	0.00	11.60	16.52	23.12	44.95	59.42	86.72	135.08
	1:10:00	0.00	0.00	9.79	14.52	20.47	37.18	49.00	69.80	109.67
	1:15:00	0.00	0.00	8.04	12.28	18.06	30.19	39.60	54.27	86.30
	1:20:00	0.00	0.00	6.71	10.28	15.25	23.28	30.41	39.65	63.19
	1:25:00	0.00	0.00	5.96	9.19	12.89	17.85	23.32	28.37	45.66
	1:30:00	0.00	0.00	5.59	8.63	11.43	14.28	18.53	21.57	34.97
	1:35:00	0.00	0.00	5.38	8.27	10.45	11.99	15.41	17.47	28.41
	1:40:00	0.00	0.00	5.27	7.46	9.75	10.55	13.40	14.71	23.93
	1:45:00	0.00	0.00	5.18	6.77	9.26	9.60	12.05	12.84	20.90
	1:50:00	0.00	0.00	5.11	6.30	8.91	9.00	11.18	11.55	18.78
	1:55:00	0.00	0.00	4.49	5.94	8.44	8.58	10.57	10.66	17.32
	2:00:00	0.00	0.00	3.91	5.51	7.64	8.30	10.18	10.19	16.52
	2:05:00	0.00	0.00	2.94	4.14	5.67	6.26	7.65	7.68	12.38
	2:10:00	0.00	0.00	2.11	2.93	4.00	4.40	5.36	5.41	8.69
	2:15:00	0.00	0.00	1.50	2.08	2.83	3.12	3.80	3.86	6.19
	2:20:00	0.00	0.00	1.05	1.44	1.99	2.19	2.66	2.71	4.35
	2:25:00	0.00	0.00	0.72	0.97	1.36	1.50	1.81	1.85	2.96
	2:30:00	0.00	0.00	0.48	0.65	0.92	1.02	1.24	1.26	2.02
	2:35:00	0.00	0.00	0.30	0.42	0.59	0.67	0.81	0.82	1.31
	2:40:00	0.00	0.00	0.16	0.25	0.33	0.39	0.47	0.48	0.76
	2:45:00	0.00	0.00	0.07	0.12	0.15	0.19	0.22	0.23	0.35
	2:50:00	0.00	0.00	0.02	0.04	0.04	0.06	0.07	0.07	0.10
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	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
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

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

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

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

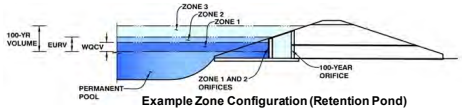
POND A - 50% CLOGGING

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND A**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	56.40	acres
Watershed Length =	2,138	ft
Watershed Length to Centroid =	1,067	ft
Watershed Slope =	0.026	ft/ft
Watershed Imperviousness =	55.00%	percent
Percentage Hydrologic Soil Group A =	8.9%	percent
Percentage Hydrologic Soil Group B =	87.6%	percent
Percentage Hydrologic Soil Groups C/D =	3.5%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Erie	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

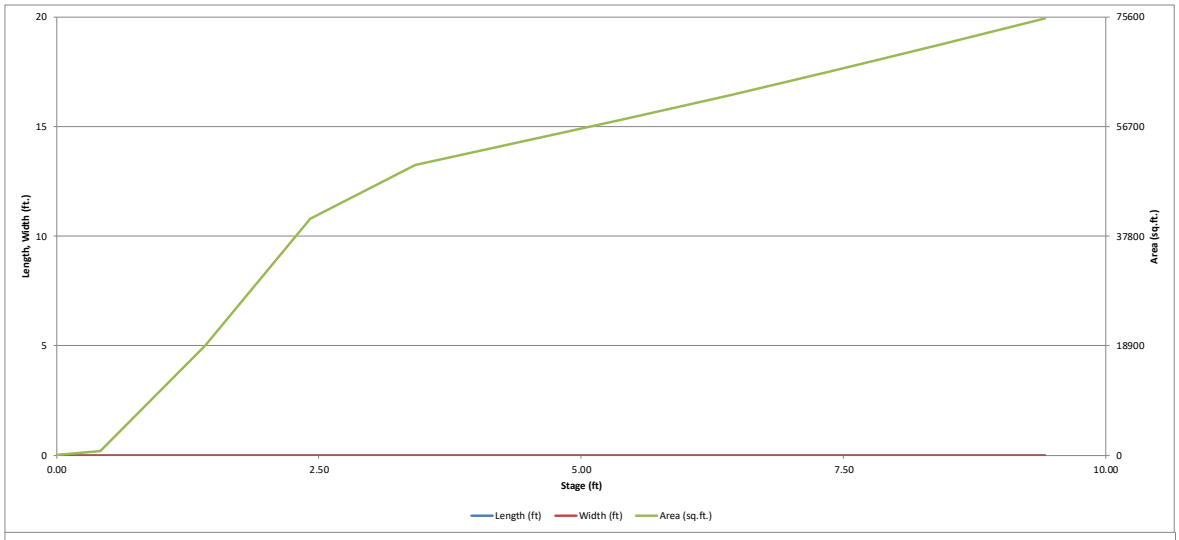
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.036	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	3.358	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.81 in.) =	1.852	acre-feet		inches
5-yr Runoff Volume (P1 = 1.11 in.) =	2.735	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	3.817	acre-feet		inches
25-yr Runoff Volume (P1 = 1.84 in.) =	6.101	acre-feet		inches
50-yr Runoff Volume (P1 = 2.24 in.) =	7.981	acre-feet		inches
100-yr Runoff Volume (P1 = 2.68 in.) =	10.291	acre-feet		inches
500-yr Runoff Volume (P1 = 3.89 in.) =	16.286	acre-feet		inches
Approximate 2-yr Detention Volume =	1.729	acre-feet		
Approximate 5-yr Detention Volume =	2.549	acre-feet		
Approximate 10-yr Detention Volume =	3.534	acre-feet		
Approximate 25-yr Detention Volume =	4.488	acre-feet		
Approximate 50-yr Detention Volume =	5.095	acre-feet		
Approximate 100-yr Detention Volume =	6.014	acre-feet		

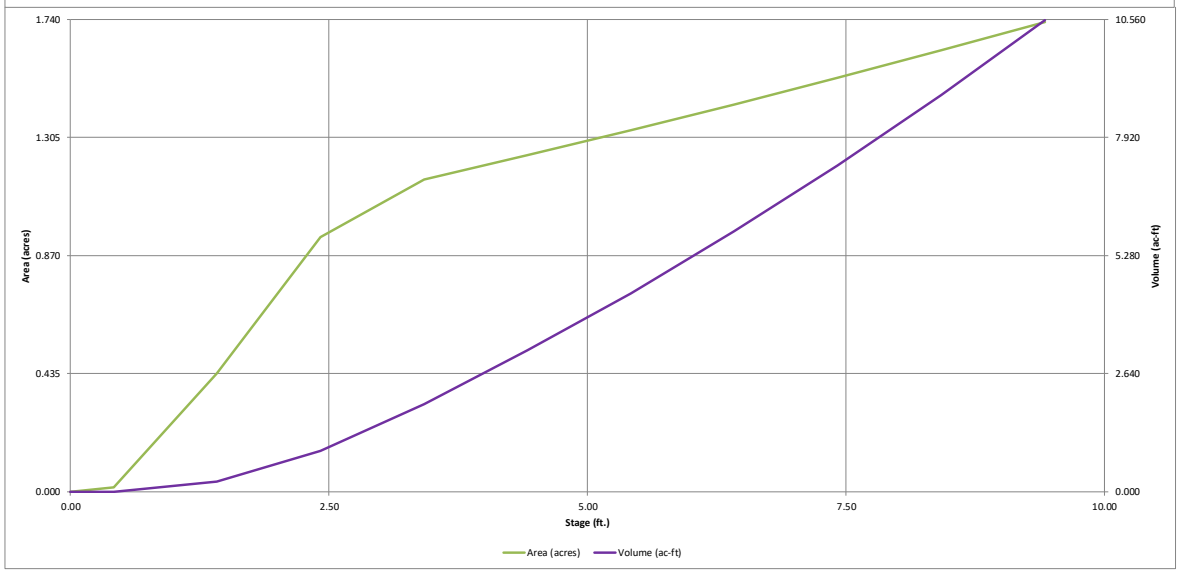
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.036	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.322	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	7.190	acre-feet
Total Detention Basin Volume =	10.548	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 1.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
4997	--	0.42	--	--	--	675	0.015	152	0.003
4998	--	1.42	--	--	--	18,943	0.435	9,961	0.229
4999	--	2.42	--	--	--	40,807	0.937	39,836	0.915
5000	--	3.42	--	--	--	50,102	1.150	85,290	1.958
5001	--	4.42	--	--	--	54,032	1.240	137,357	3.153
5002	--	5.42	--	--	--	58,053	1.333	193,400	4.440
5003	--	6.42	--	--	--	62,147	1.427	253,500	5.820
5004	--	7.42	--	--	--	66,386	1.524	317,766	7.295
5005	--	8.42	--	--	--	70,804	1.625	386,361	8.870
5006	--	9.42	--	--	--	75,422	1.731	459,474	10.548


20
15
10
5
0
Length, Width (ft.)
75600
56700
37800
18900
0
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

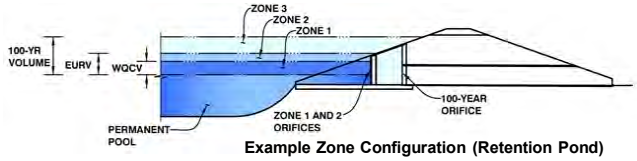

1.740
1.305
0.870
0.435
0.000
Area (acres)
10.560
7.920
5.280
2.640
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND A**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.55	1.036	Orifice Plate
Zone 2 (EURV)	4.59	2.322	Orifice Plate
Zone 3 (User)	9.42	7.190	Weir&Pipe (Restrict)
Total (all zones)		10.548	

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

Calculated Parameters for Underdrain

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	5.10	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	1.60	3.60					
Orifice Area (sq. inches)	4.00	18.00	25.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.10	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	10.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	10.00	N/A	feet
Overflow Grate Type =	No Grate	N/A	
Debris Clogging % =	25%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.10	N/A	feet
Overflow Weir Slope Length =	10.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	13.60	N/A	
Overflow Grate Open Area w/o Debris =	100.00	N/A	ft^2
Overflow Grate Open Area w/ Debris =	75.00	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 =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	30.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	7.35	N/A	ft^2
Outlet Orifice Centroid =	1.39	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.01	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.60	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	100.00	feet
Spillway End Slopes =	10.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.58	feet
Stage at Top of Freeboard =	8.18	feet
Basin Area at Top of Freeboard =	1.60	acres
Basin Volume at Top of Freeboard =	8.48	acre-ft

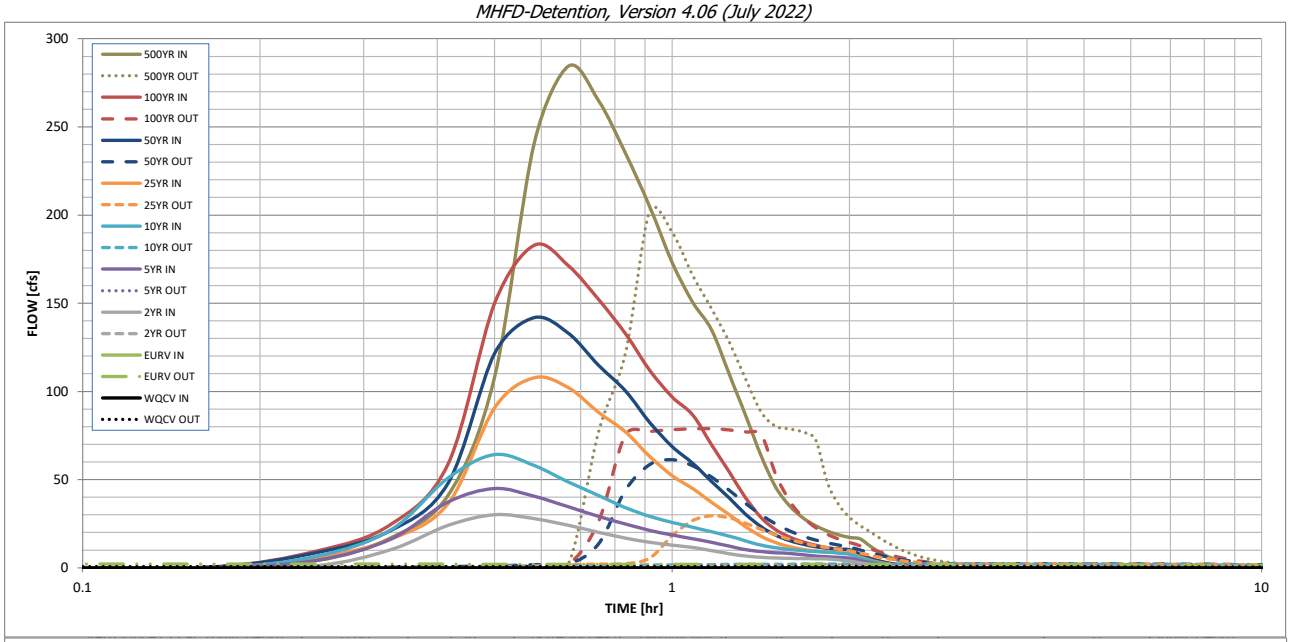
Routed Hydrograph Results

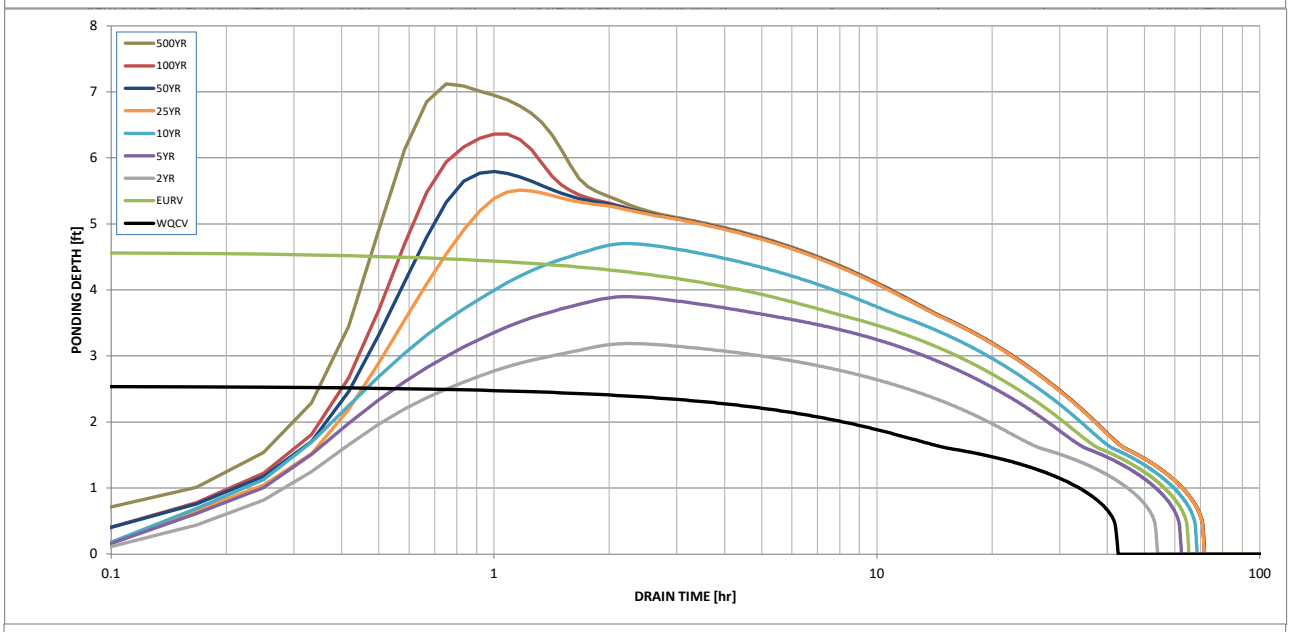
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

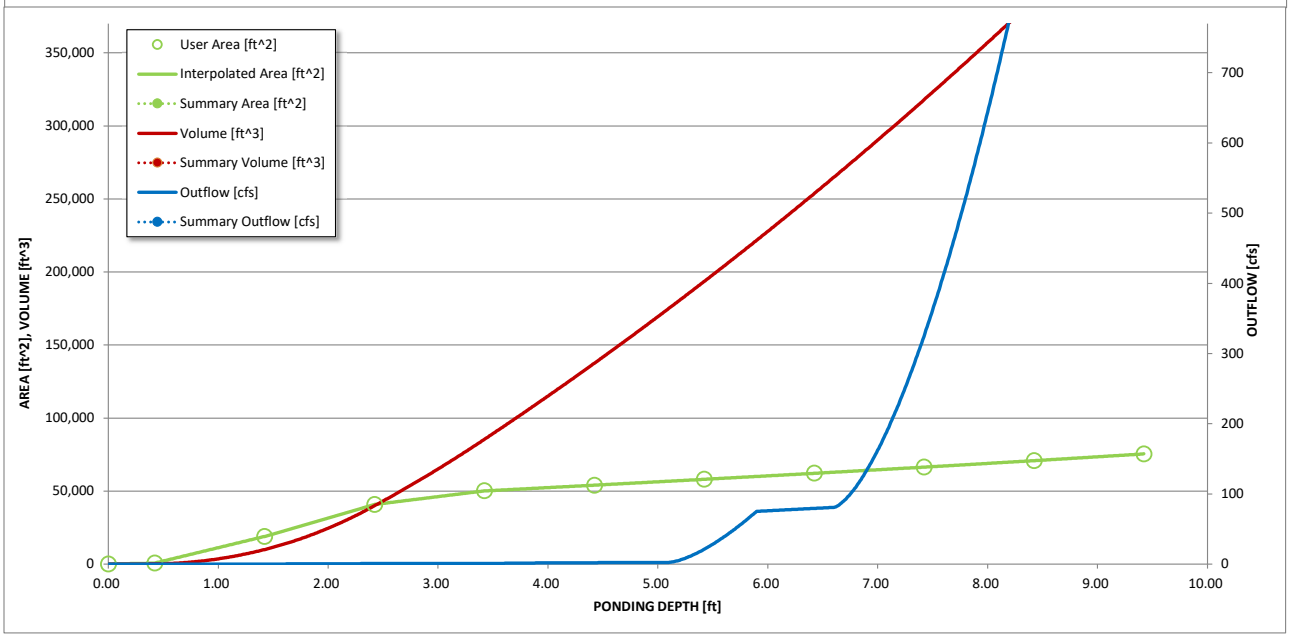
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.81	1.11	1.39	1.84	2.24	2.68	3.89
CUHP Runoff Volume (acre-ft) =	1.036	3.358	1.852	2.735	3.817	6.101	7.981	10.291	16.286
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.852	2.735	3.817	6.101	7.981	10.291	16.286
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.4	0.9	10.0	39.0	59.0	84.4	145.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.18	0.69	1.05	1.50	2.58
Peak Inflow Q (cfs) =	N/A	N/A	30.2	45.1	64.3	107.9	141.9	183.0	284.6
Peak Outflow Q (cfs) =	0.8	2.2	1.0	1.6	2.2	29.5	61.3	78.9	202.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.8	0.2	0.8	1.0	0.9	1.4
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.3	0.6	0.8	0.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	55	48	54	57	54	50	45	39
Time to Drain 99% of Inflow Volume (hours) =	**41**	61	52	59	64	65	63	61	56
Maximum Ponding Depth (ft) =	2.55	4.59	3.19	3.90	4.70	5.51	5.79	6.36	7.12
Area at Maximum Ponding Depth (acres) =	0.96	1.26	1.10	1.19	1.27	1.34	1.37	1.42	1.49
Maximum Volume Stored (acre-ft) =	1.038	3.365	1.699	2.509	3.504	4.560	4.939	5.734	6.842

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
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]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.53	4.12
	0:15:00	0.00	0.00	1.21	4.33	6.79	5.89	8.75	9.58	17.08
	0:20:00	0.00	0.00	10.43	16.36	21.55	16.28	21.22	24.62	41.16
	0:25:00	0.00	0.00	24.10	37.41	51.06	36.41	48.11	58.97	108.23
	0:30:00	0.00	0.00	30.23	45.10	64.27	90.84	121.69	150.15	240.91
	0:35:00	0.00	0.00	27.89	40.64	58.03	107.86	141.92	183.00	284.56
	0:40:00	0.00	0.00	24.25	34.60	48.68	102.12	133.00	171.40	264.99
	0:45:00	0.00	0.00	20.24	29.23	41.09	88.29	114.92	152.24	235.13
	0:50:00	0.00	0.00	16.88	24.89	34.23	77.14	100.37	132.78	204.73
	0:55:00	0.00	0.00	14.49	21.24	29.19	63.10	82.35	111.93	173.20
	1:00:00	0.00	0.00	12.89	18.64	25.86	52.36	68.80	96.94	150.72
	1:05:00	0.00	0.00	11.60	16.52	23.12	44.95	59.42	86.72	135.08
	1:10:00	0.00	0.00	9.79	14.52	20.47	37.18	49.00	69.80	109.67
	1:15:00	0.00	0.00	8.04	12.28	18.06	30.19	39.60	54.27	86.30
	1:20:00	0.00	0.00	6.71	10.28	15.25	23.28	30.41	39.65	63.19
	1:25:00	0.00	0.00	5.96	9.19	12.89	17.85	23.32	28.37	45.66
	1:30:00	0.00	0.00	5.59	8.63	11.43	14.28	18.53	21.57	34.97
	1:35:00	0.00	0.00	5.38	8.27	10.45	11.99	15.41	17.47	28.41
	1:40:00	0.00	0.00	5.27	7.46	9.75	10.55	13.40	14.71	23.93
	1:45:00	0.00	0.00	5.18	6.77	9.26	9.60	12.05	12.84	20.90
	1:50:00	0.00	0.00	5.11	6.30	8.91	9.00	11.18	11.55	18.78
	1:55:00	0.00	0.00	4.49	5.94	8.44	8.58	10.57	10.66	17.32
	2:00:00	0.00	0.00	3.91	5.51	7.64	8.30	10.18	10.19	16.52
	2:05:00	0.00	0.00	2.94	4.14	5.67	6.26	7.65	7.68	12.38
	2:10:00	0.00	0.00	2.11	2.93	4.00	4.40	5.36	5.41	8.69
	2:15:00	0.00	0.00	1.50	2.08	2.83	3.12	3.80	3.86	6.19
	2:20:00	0.00	0.00	1.05	1.44	1.99	2.19	2.66	2.71	4.35
	2:25:00	0.00	0.00	0.72	0.97	1.36	1.50	1.81	1.85	2.96
	2:30:00	0.00	0.00	0.48	0.65	0.92	1.02	1.24	1.26	2.02
	2:35:00	0.00	0.00	0.30	0.42	0.59	0.67	0.81	0.82	1.31
	2:40:00	0.00	0.00	0.16	0.25	0.33	0.39	0.47	0.48	0.76
	2:45:00	0.00	0.00	0.07	0.12	0.15	0.19	0.22	0.23	0.35
	2:50:00	0.00	0.00	0.02	0.04	0.04	0.06	0.07	0.07	0.10
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	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
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

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

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

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

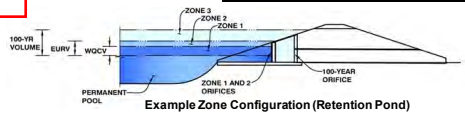
POND B - NO CLOGGING

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND B**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	63.10	acres
Watershed Length =	3,021	ft
Watershed Length to Centroid =	1,827	ft
Watershed Slope =	0.027	ft/ft
Watershed Imperviousness =	55.00%	percent
Percentage Hydrologic Soil Group A =	82.9%	percent
Percentage Hydrologic Soil Group B =	17.1%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Erie	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

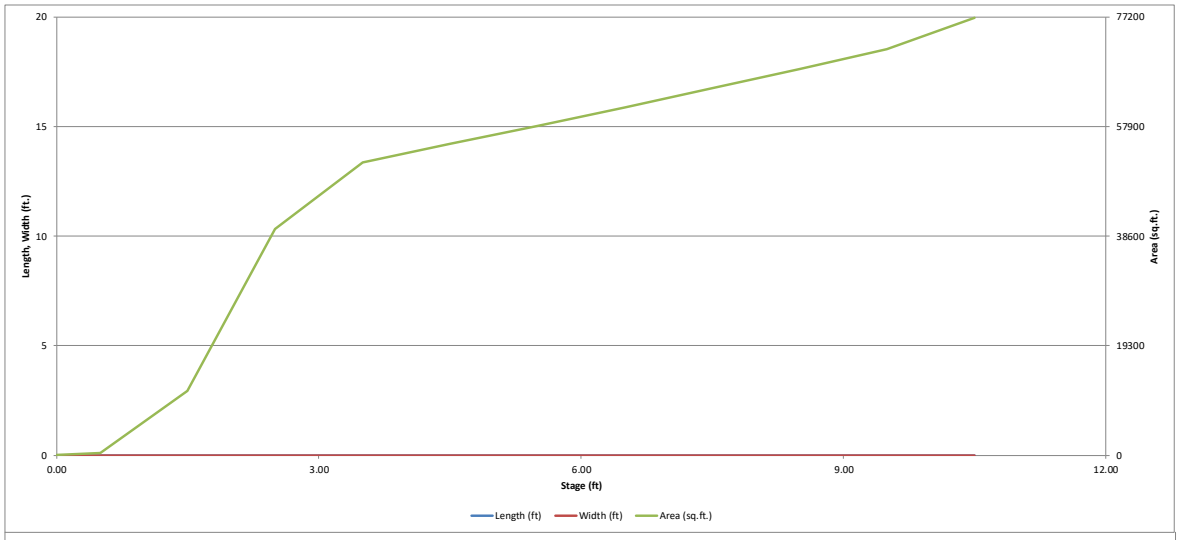
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.159	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.046	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.81 in.) =	2.013	acre-feet		inches
5-yr Runoff Volume (P1 = 1.11 in.) =	2.865	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	3.764	acre-feet		inches
25-yr Runoff Volume (P1 = 1.84 in.) =	5.673	acre-feet		inches
50-yr Runoff Volume (P1 = 2.24 in.) =	7.540	acre-feet		inches
100-yr Runoff Volume (P1 = 2.68 in.) =	9.957	acre-feet		inches
500-yr Runoff Volume (P1 = 3.89 in.) =	16.376	acre-feet		inches
Approximate 2-yr Detention Volume =	1.834	acre-feet		
Approximate 5-yr Detention Volume =	2.628	acre-feet		
Approximate 10-yr Detention Volume =	3.475	acre-feet		
Approximate 25-yr Detention Volume =	4.791	acre-feet		
Approximate 50-yr Detention Volume =	5.695	acre-feet		
Approximate 100-yr Detention Volume =	6.770	acre-feet		

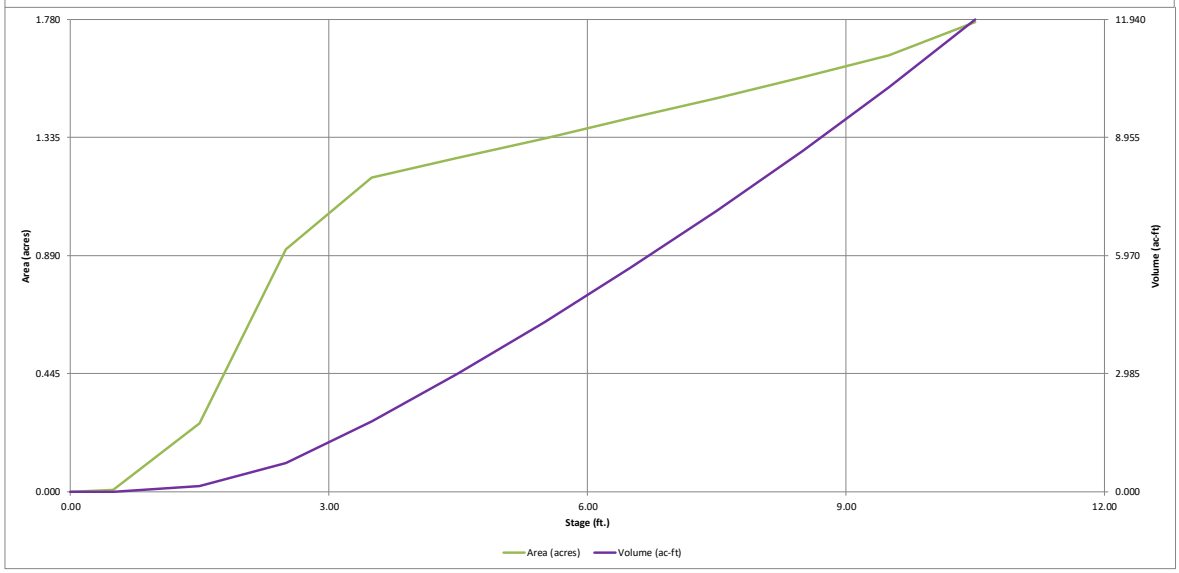
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.159	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.887	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	7.889	acre-feet
Total Detention Basin Volume =	11.935	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 1.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
5002	--	0.50	--	--	--	340	0.008	97	0.002
5003	--	1.50	--	--	--	11,271	0.259	5,903	0.136
5004	--	2.50	--	--	--	39,823	0.914	31,450	0.722
5005	--	3.50	--	--	--	51,606	1.185	77,164	1.771
5006	--	4.50	--	--	--	54,805	1.258	130,370	2.993
5007	--	5.50	--	--	--	58,009	1.332	186,777	4.288
5008	--	6.50	--	--	--	61,283	1.407	246,423	5.657
5009	--	7.50	--	--	--	64,627	1.484	309,378	7.102
5010	--	8.50	--	--	--	68,042	1.562	375,712	8.625
5011	--	9.50	--	--	--	71,588	1.643	445,527	10.228
5012	--	10.50	--	--	--	77,124	1.771	519,883	11.935


20
15
10
5
0
Length, Width (ft.)
77200
57900
38600
19300
0
Area (sq.ft.)
0.00
3.00
6.00
9.00
12.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

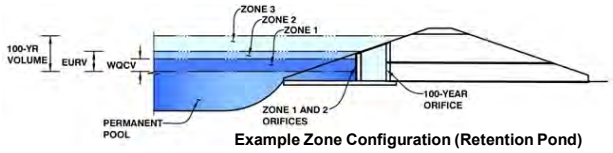

1.780
1.335
0.890
0.445
0.000
Area (acres)
11.940
8.955
5.970
2.985
0.000
Volume (ac-ft)
0.00
3.00
6.00
9.00
12.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND B**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.95	1.159	Orifice Plate
Zone 2 (EURV)	5.32	2.887	Orifice Plate
Zone 3 (User)	#VALUE!	7.889	Weir&Pipe (Restrict)
Total (all zones)		11.935	

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.40	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	sq. inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.65						
Orifice Area (sq. inches)	4.00	9.00						

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.40	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	16.00	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Type =	Close Mesh Grate	N/A	
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.40	N/A	feet
Overflow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	21.93	N/A	
Overflow Grate Open Area w/o Debris =	52.18	N/A	ft^2
Overflow Grate Open Area w/ Debris =	52.18	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 =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	17.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	2.38	N/A	ft^2
Outlet Orifice Centroid =	0.79	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.00	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	75.00	feet
Spillway End Slopes =	10.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.69	feet
Stage at Top of Freeboard =	9.19	feet
Basin Area at Top of Freeboard =	1.62	acres
Basin Volume at Top of Freeboard =	9.72	acre-ft

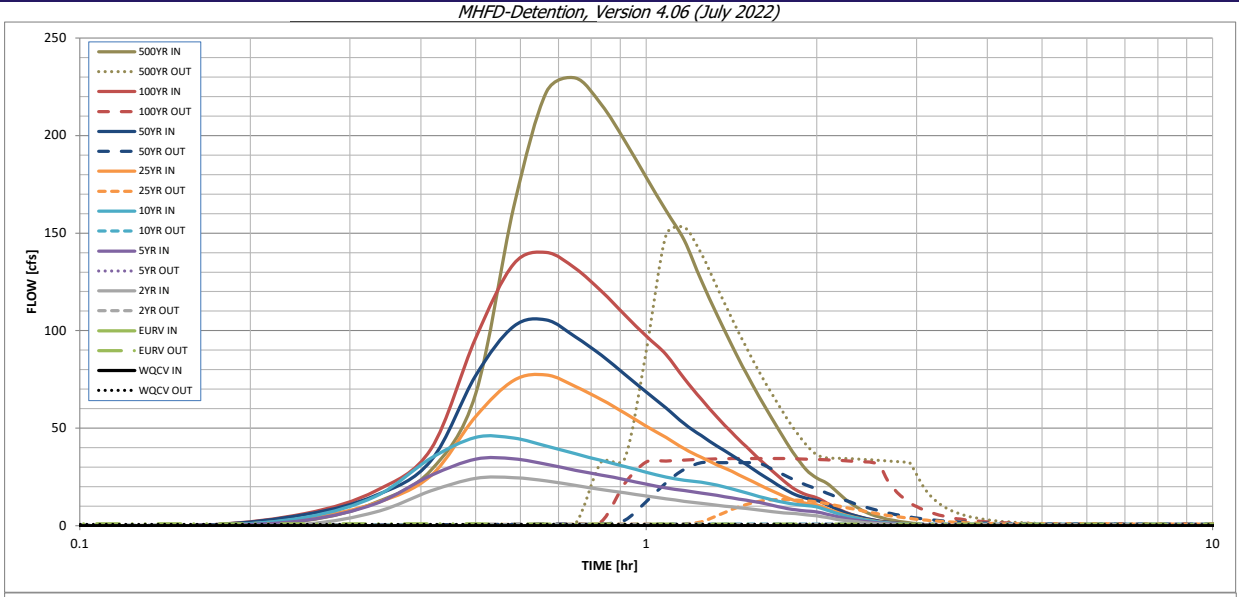
Routed Hydrograph Results

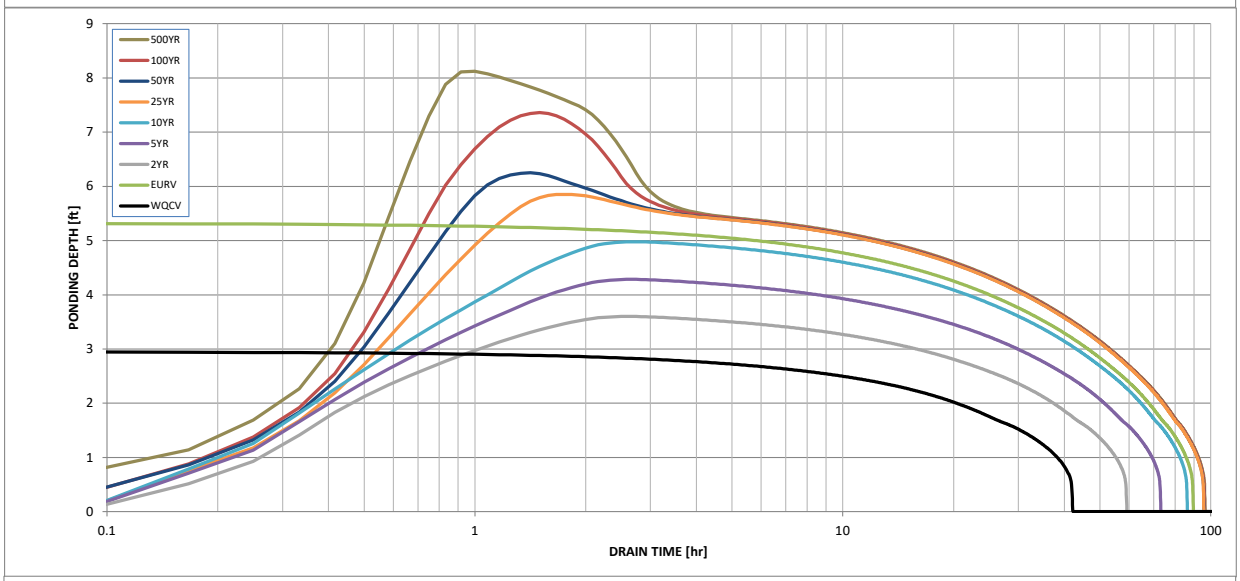
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

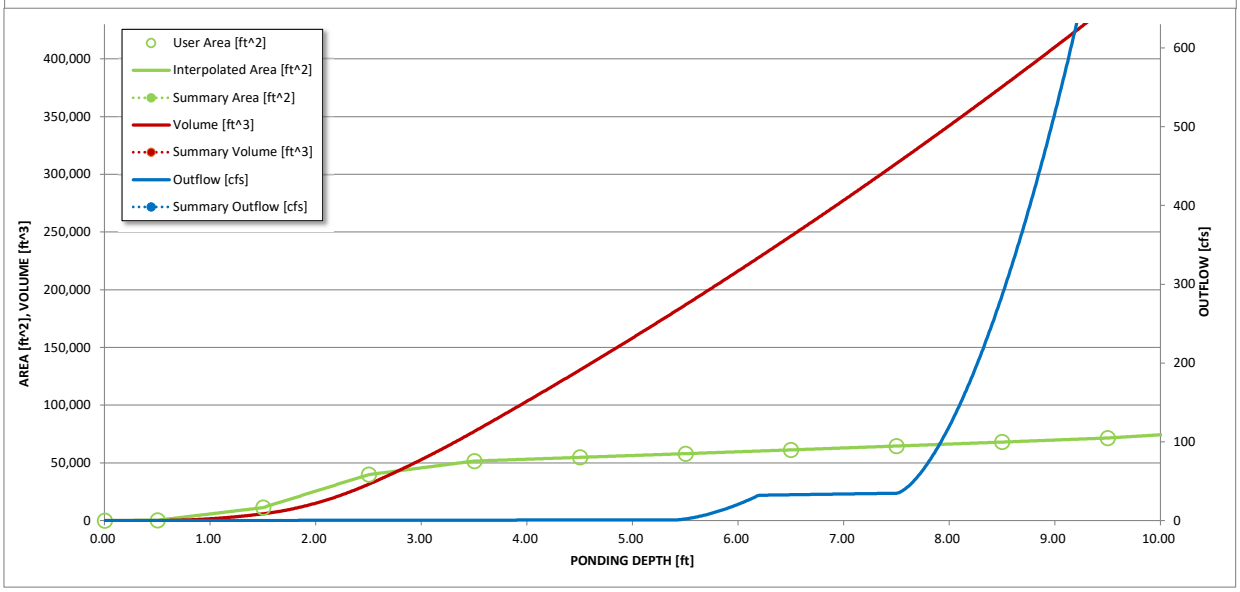
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.81	1.11	1.39	1.84	2.24	2.68	3.89
CUHP Runoff Volume (acre-ft) =	1.159	4.046	2.013	2.865	3.764	5.673	7.540	9.957	16.376
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.013	2.865	3.764	5.673	7.540	9.957	16.376
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.3	0.6	10.7	24.9	45.0	97.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.01	0.17	0.40	0.71	1.55
Peak Inflow Q (cfs) =	N/A	N/A	24.6	34.2	45.3	77.2	105.5	140.0	229.5
Peak Outflow Q (cfs) =	0.6	0.9	0.7	0.8	0.8	13.4	32.3	34.5	153.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.4	1.3	1.3	1.3	0.8	1.6
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.6	0.6	0.7
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) =	39	79	53	65	76	82	79	76	70
Time to Drain 99% of Inflow Volume (hours) =	**41**	86	57	70	83	90	89	87	83
Maximum Ponding Depth (ft) =	2.95	5.32	3.60	4.28	4.98	5.85	6.25	7.35	8.12
Area at Maximum Ponding Depth (acres) =	1.04	1.32	1.19	1.24	1.29	1.36	1.39	1.47	1.53
Maximum Volume Stored (acre-ft) =	1.161	4.049	1.878	2.718	3.592	4.745	5.294	6.881	8.022

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
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]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.34	2.66
	0:15:00	0.00	0.00	0.78	2.77	4.33	3.78	5.74	6.28	11.89
	0:20:00	0.00	0.00	7.00	11.35	15.12	11.65	15.48	17.87	28.37
	0:25:00	0.00	0.00	17.81	25.71	34.52	25.64	33.26	39.26	67.58
	0:30:00	0.00	0.00	24.19	34.08	45.26	56.00	76.97	96.15	163.30
	0:35:00	0.00	0.00	24.65	34.24	44.91	74.45	102.18	134.21	222.34
	0:40:00	0.00	0.00	22.94	31.41	40.82	77.25	105.46	140.03	229.53
	0:45:00	0.00	0.00	20.61	28.38	36.84	71.34	96.79	131.90	215.90
	0:50:00	0.00	0.00	18.56	25.98	33.39	64.70	87.37	120.20	197.36
	0:55:00	0.00	0.00	16.83	23.62	30.29	57.65	77.61	108.04	178.60
	1:00:00	0.00	0.00	15.21	21.31	27.42	51.04	68.50	97.26	161.64
	1:05:00	0.00	0.00	13.83	19.33	24.97	45.21	60.42	87.83	146.39
	1:10:00	0.00	0.00	12.52	17.97	23.33	39.46	52.29	75.49	125.78
	1:15:00	0.00	0.00	11.40	16.78	22.22	35.08	46.20	64.94	108.19
	1:20:00	0.00	0.00	10.45	15.50	20.78	31.23	40.88	55.74	92.38
	1:25:00	0.00	0.00	9.61	14.24	18.84	27.79	36.15	47.65	78.33
	1:30:00	0.00	0.00	8.81	13.04	16.84	24.31	31.40	40.59	66.09
	1:35:00	0.00	0.00	8.01	11.89	14.96	20.98	26.87	34.14	55.01
	1:40:00	0.00	0.00	7.23	10.45	13.27	17.90	22.70	28.22	44.89
	1:45:00	0.00	0.00	6.58	9.09	11.88	15.14	18.95	22.90	35.84
	1:50:00	0.00	0.00	6.18	8.14	10.97	12.84	15.83	18.50	28.70
	1:55:00	0.00	0.00	5.61	7.55	10.34	11.42	14.03	15.89	24.46
	2:00:00	0.00	0.00	5.02	7.04	9.59	10.59	12.97	14.32	21.79
	2:05:00	0.00	0.00	4.17	5.93	8.06	8.86	10.83	11.69	17.64
	2:10:00	0.00	0.00	3.33	4.72	6.43	6.98	8.50	9.01	13.46
	2:15:00	0.00	0.00	2.63	3.72	5.08	5.46	6.62	6.86	10.14
	2:20:00	0.00	0.00	2.07	2.93	4.00	4.26	5.15	5.21	7.61
	2:25:00	0.00	0.00	1.62	2.30	3.13	3.32	4.00	3.97	5.75
	2:30:00	0.00	0.00	1.26	1.78	2.41	2.56	3.08	3.06	4.40
	2:35:00	0.00	0.00	0.98	1.36	1.84	1.94	2.34	2.33	3.34
	2:40:00	0.00	0.00	0.75	1.03	1.40	1.47	1.77	1.78	2.55
	2:45:00	0.00	0.00	0.57	0.78	1.07	1.13	1.36	1.38	1.97
	2:50:00	0.00	0.00	0.42	0.57	0.81	0.85	1.02	1.03	1.47
	2:55:00	0.00	0.00	0.29	0.41	0.58	0.62	0.73	0.74	1.05
	3:00:00	0.00	0.00	0.19	0.27	0.39	0.42	0.49	0.49	0.69
	3:05:00	0.00	0.00	0.11	0.17	0.23	0.26	0.30	0.30	0.41
	3:10:00	0.00	0.00	0.05	0.09	0.12	0.13	0.15	0.15	0.20
	3:15:00	0.00	0.00	0.02	0.04	0.05	0.05	0.05	0.05	0.07
	3:20:00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	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
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

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

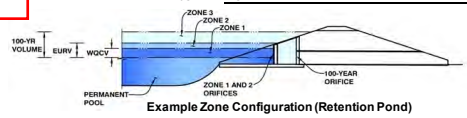
POND B - 50% CLOGGING

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND B**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	63.10	acres
Watershed Length =	3,021	ft
Watershed Length to Centroid =	1,827	ft
Watershed Slope =	0.027	ft/ft
Watershed Imperviousness =	55.00%	percent
Percentage Hydrologic Soil Group A =	82.9%	percent
Percentage Hydrologic Soil Group B =	17.1%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Erie	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

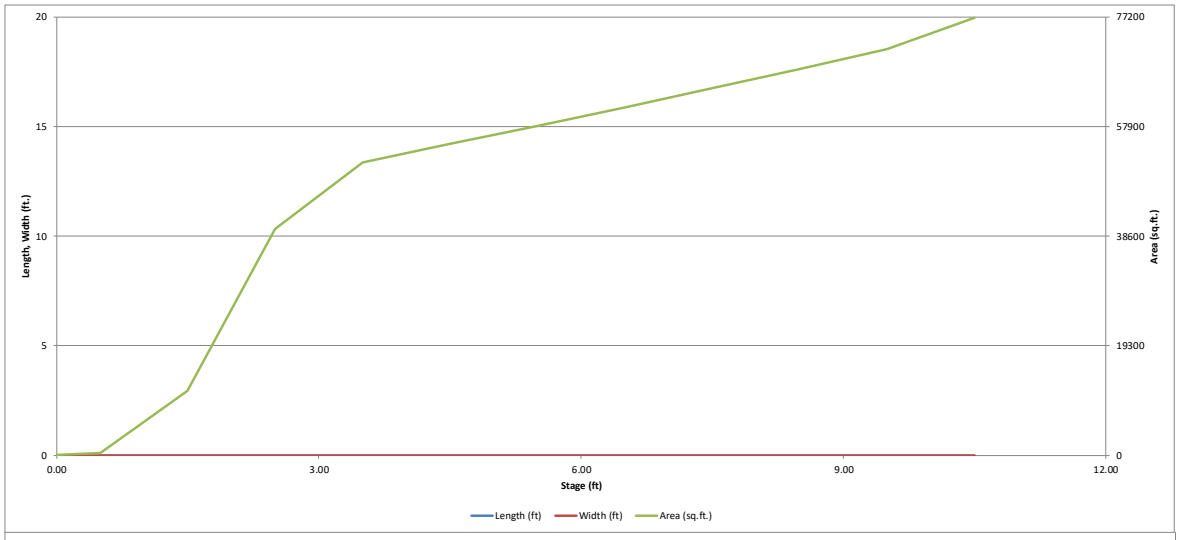
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.159	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.046	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.81 in.) =	2.013	acre-feet		inches
5-yr Runoff Volume (P1 = 1.11 in.) =	2.865	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	3.764	acre-feet		inches
25-yr Runoff Volume (P1 = 1.84 in.) =	5.673	acre-feet		inches
50-yr Runoff Volume (P1 = 2.24 in.) =	7.540	acre-feet		inches
100-yr Runoff Volume (P1 = 2.68 in.) =	9.957	acre-feet		inches
500-yr Runoff Volume (P1 = 3.89 in.) =	16.376	acre-feet		inches
Approximate 2-yr Detention Volume =	1.834	acre-feet		
Approximate 5-yr Detention Volume =	2.628	acre-feet		
Approximate 10-yr Detention Volume =	3.475	acre-feet		
Approximate 25-yr Detention Volume =	4.791	acre-feet		
Approximate 50-yr Detention Volume =	5.695	acre-feet		
Approximate 100-yr Detention Volume =	6.770	acre-feet		

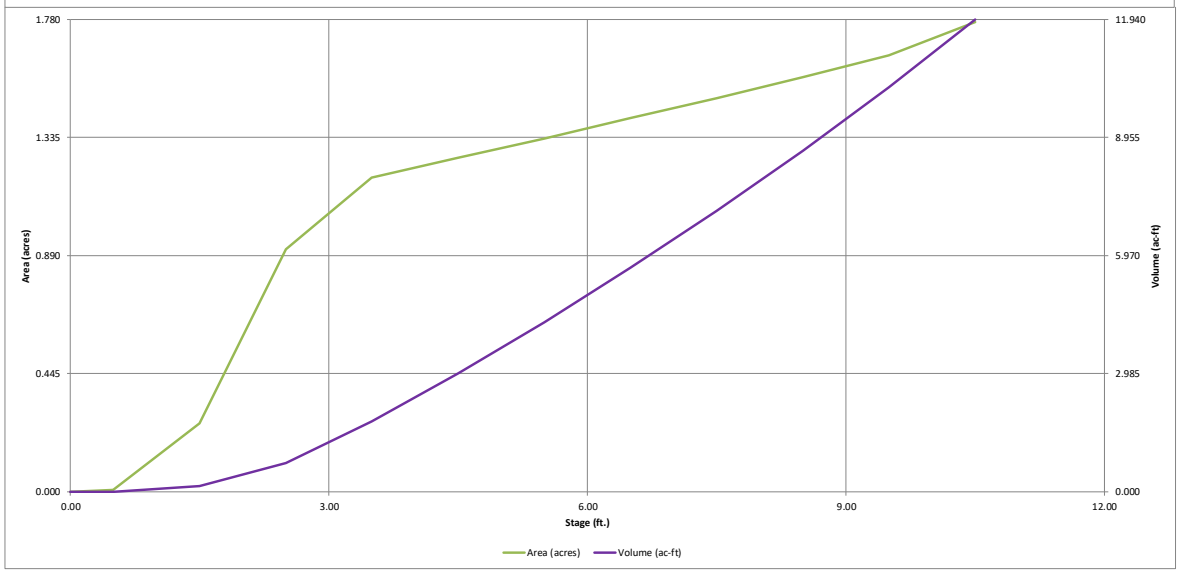
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.159	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.887	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	7.889	acre-feet
Total Detention Basin Volume =	11.935	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 1.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
5002	--	0.50	--	--	--	340	0.008	97	0.002
5003	--	1.50	--	--	--	11,271	0.259	5,903	0.136
5004	--	2.50	--	--	--	39,823	0.914	31,450	0.722
5005	--	3.50	--	--	--	51,606	1.185	77,164	1.771
5006	--	4.50	--	--	--	54,805	1.258	130,370	2.993
5007	--	5.50	--	--	--	58,009	1.332	186,777	4.288
5008	--	6.50	--	--	--	61,283	1.407	246,423	5.657
5009	--	7.50	--	--	--	64,627	1.484	309,378	7.102
5010	--	8.50	--	--	--	68,042	1.562	375,712	8.625
5011	--	9.50	--	--	--	71,588	1.643	445,527	10.228
5012	--	10.50	--	--	--	77,124	1.771	519,883	11.935


20
15
10
5
0
Length, Width (ft.)
77200
57900
38600
19300
0
Area (sq.ft.)
0.00
3.00
6.00
9.00
12.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

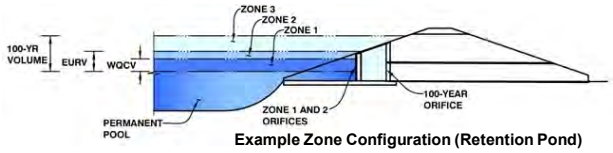

1.780
1.335
0.890
0.445
0.000
Area (acres)
11.940
8.955
5.970
2.985
0.000
Volume (ac-ft)
0.00
3.00
6.00
9.00
12.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND B**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.95	1.159	Orifice Plate
Zone 2 (EURV)	5.32	2.887	Orifice Plate
Zone 3 (User)	#VALUE!	7.889	Weir&Pipe (Restrict)
Total (all zones)		11.935	

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.40	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	sq. inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.65						
Orifice Area (sq. inches)	4.00	9.00						

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.40	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	16.00	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Type =	Close Mesh Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.40	N/A	feet
Overflow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	18.18	N/A	
Overflow Grate Open Area w/o Debris =	52.18	N/A	ft^2
Overflow Grate Open Area w/ Debris =	26.09	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 =	17.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	2.87	N/A	ft^2
Outlet Orifice Centroid =	0.81	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.70	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	75.00	feet
Spillway End Slopes =	10.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.69	feet
Stage at Top of Freeboard =	9.19	feet
Basin Area at Top of Freeboard =	1.62	acres
Basin Volume at Top of Freeboard =	9.72	acre-ft

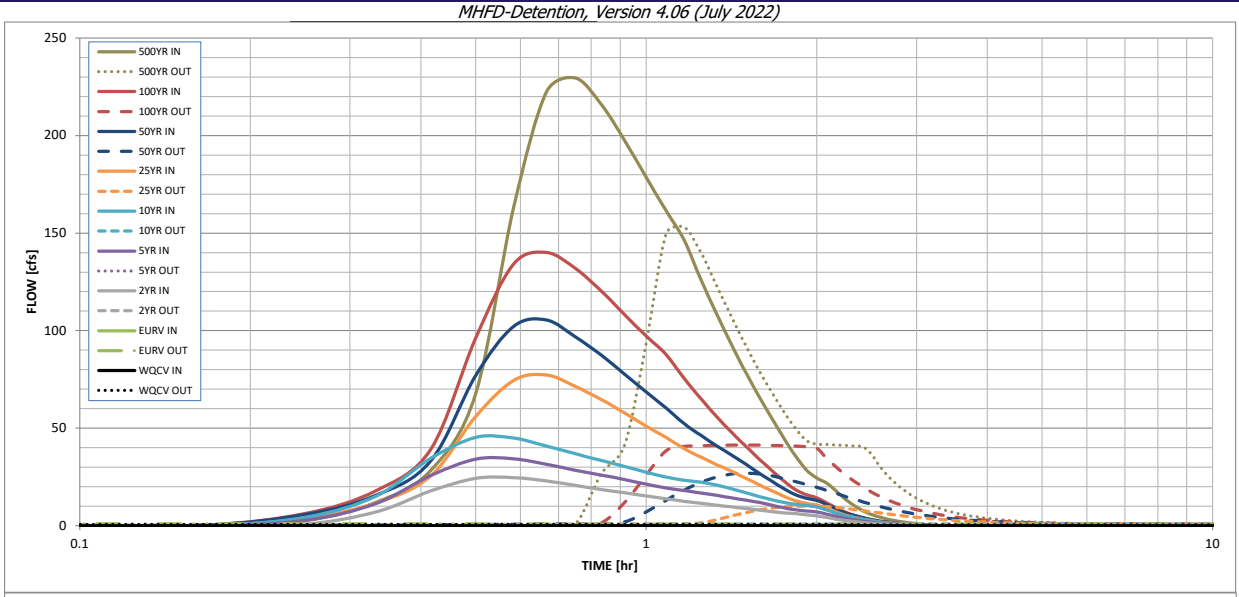
Routed Hydrograph Results

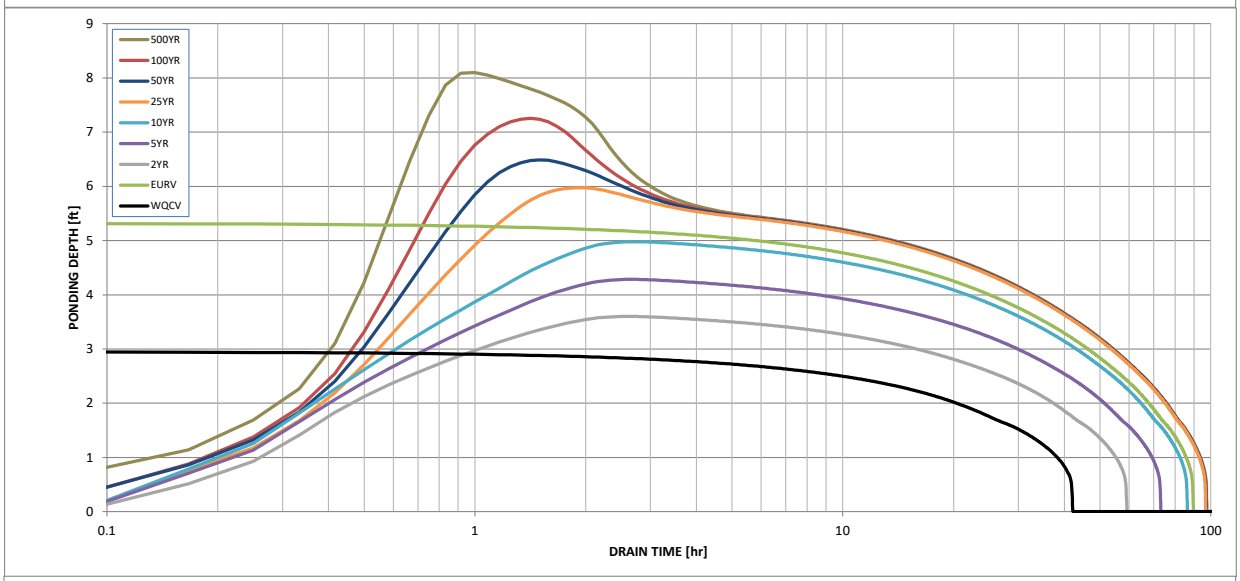
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

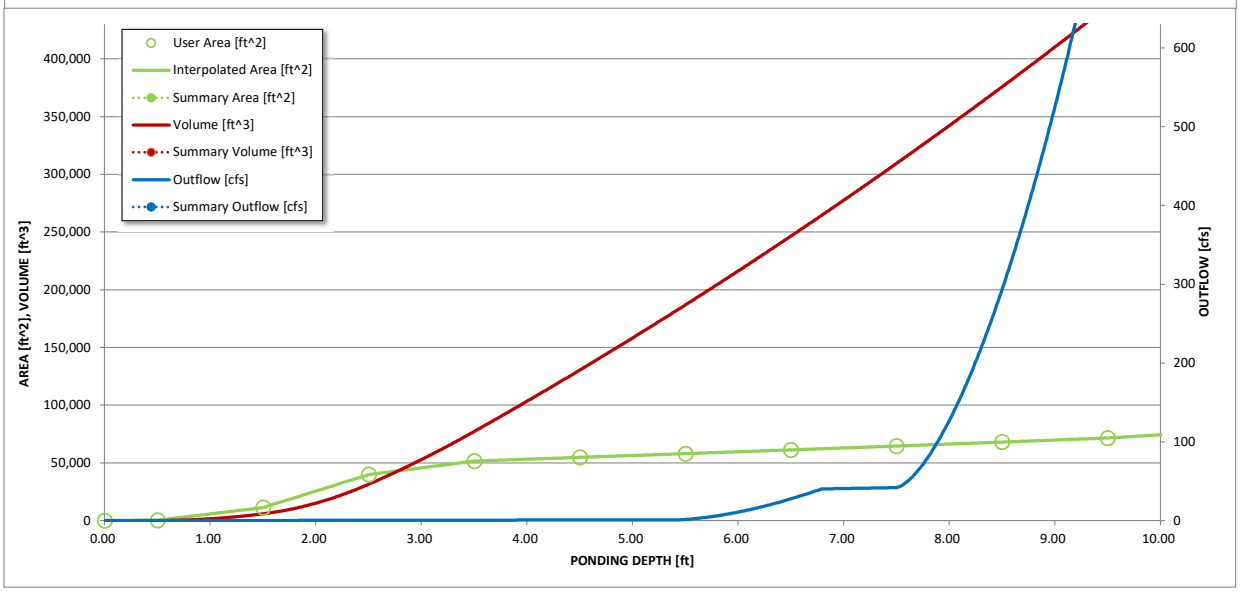
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.81	1.11	1.39	1.84	2.24	2.68	3.89
CUHP Runoff Volume (acre-ft) =	1.159	4.046	2.013	2.865	3.764	5.673	7.540	9.957	16.376
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.013	2.865	3.764	5.673	7.540	9.957	16.376
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.3	0.6	10.7	24.9	45.0	97.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.01	0.17	0.40	0.71	1.55
Peak Inflow Q (cfs) =	N/A	N/A	24.6	34.2	45.3	77.2	105.5	140.0	229.5
Peak Outflow Q (cfs) =	0.6	0.9	0.7	0.8	0.8	10.0	27.0	41.3	153.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.4	1.3	0.9	1.1	0.9	1.6
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.5	0.8	0.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	79	53	65	76	83	80	77	72
Time to Drain 99% of Inflow Volume (hours) =	**41**	86	57	70	83	92	90	88	84
Maximum Ponding Depth (ft) =	2.95	5.32	3.60	4.28	4.98	5.97	6.49	7.25	8.09
Area at Maximum Ponding Depth (acres) =	1.04	1.32	1.19	1.24	1.29	1.37	1.41	1.46	1.53
Maximum Volume Stored (acre-ft) =	1.161	4.049	1.878	2.718	3.592	4.908	5.629	6.719	7.991

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
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]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.34	2.66
	0:15:00	0.00	0.00	0.78	2.77	4.33	3.78	5.74	6.28	11.89
	0:20:00	0.00	0.00	7.00	11.35	15.12	11.65	15.48	17.87	28.37
	0:25:00	0.00	0.00	17.81	25.71	34.52	25.64	33.26	39.26	67.58
	0:30:00	0.00	0.00	24.19	34.08	45.26	56.00	76.97	96.15	163.30
	0:35:00	0.00	0.00	24.65	34.24	44.91	74.45	102.18	134.21	222.34
	0:40:00	0.00	0.00	22.94	31.41	40.82	77.25	105.46	140.03	229.53
	0:45:00	0.00	0.00	20.61	28.38	36.84	71.34	96.79	131.90	215.90
	0:50:00	0.00	0.00	18.56	25.98	33.39	64.70	87.37	120.20	197.36
	0:55:00	0.00	0.00	16.83	23.62	30.29	57.65	77.61	108.04	178.60
	1:00:00	0.00	0.00	15.21	21.31	27.42	51.04	68.50	97.26	161.64
	1:05:00	0.00	0.00	13.83	19.33	24.97	45.21	60.42	87.83	146.39
	1:10:00	0.00	0.00	12.52	17.97	23.33	39.46	52.29	75.49	125.78
	1:15:00	0.00	0.00	11.40	16.78	22.22	35.08	46.20	64.94	108.19
	1:20:00	0.00	0.00	10.45	15.50	20.78	31.23	40.88	55.74	92.38
	1:25:00	0.00	0.00	9.61	14.24	18.84	27.79	36.15	47.65	78.33
	1:30:00	0.00	0.00	8.81	13.04	16.84	24.31	31.40	40.59	66.09
	1:35:00	0.00	0.00	8.01	11.89	14.96	20.98	26.87	34.14	55.01
	1:40:00	0.00	0.00	7.23	10.45	13.27	17.90	22.70	28.22	44.89
	1:45:00	0.00	0.00	6.58	9.09	11.88	15.14	18.95	22.90	35.84
	1:50:00	0.00	0.00	6.18	8.14	10.97	12.84	15.83	18.50	28.70
	1:55:00	0.00	0.00	5.61	7.55	10.34	11.42	14.03	15.89	24.46
	2:00:00	0.00	0.00	5.02	7.04	9.59	10.59	12.97	14.32	21.79
	2:05:00	0.00	0.00	4.17	5.93	8.06	8.86	10.83	11.69	17.64
	2:10:00	0.00	0.00	3.33	4.72	6.43	6.98	8.50	9.01	13.46
	2:15:00	0.00	0.00	2.63	3.72	5.08	5.46	6.62	6.86	10.14
	2:20:00	0.00	0.00	2.07	2.93	4.00	4.26	5.15	5.21	7.61
	2:25:00	0.00	0.00	1.62	2.30	3.13	3.32	4.00	3.97	5.75
	2:30:00	0.00	0.00	1.26	1.78	2.41	2.56	3.08	3.06	4.40
	2:35:00	0.00	0.00	0.98	1.36	1.84	1.94	2.34	2.33	3.34
	2:40:00	0.00	0.00	0.75	1.03	1.40	1.47	1.77	1.78	2.55
	2:45:00	0.00	0.00	0.57	0.78	1.07	1.13	1.36	1.38	1.97
	2:50:00	0.00	0.00	0.42	0.57	0.81	0.85	1.02	1.03	1.47
	2:55:00	0.00	0.00	0.29	0.41	0.58	0.62	0.73	0.74	1.05
	3:00:00	0.00	0.00	0.19	0.27	0.39	0.42	0.49	0.49	0.69
	3:05:00	0.00	0.00	0.11	0.17	0.23	0.26	0.30	0.30	0.41
	3:10:00	0.00	0.00	0.05	0.09	0.12	0.13	0.15	0.15	0.20
	3:15:00	0.00	0.00	0.02	0.04	0.05	0.05	0.05	0.05	0.07
	3:20:00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	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
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

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

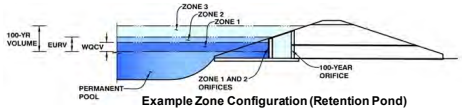
POND C - NO CLOGGING

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND C**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	17.00	acres
Watershed Length =	1,563	ft
Watershed Length to Centroid =	744	ft
Watershed Slope =	0.038	ft/ft
Watershed Imperviousness =	45.00%	percent
Percentage Hydrologic Soil Group A =	42.0%	percent
Percentage Hydrologic Soil Group B =	58.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Erie	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

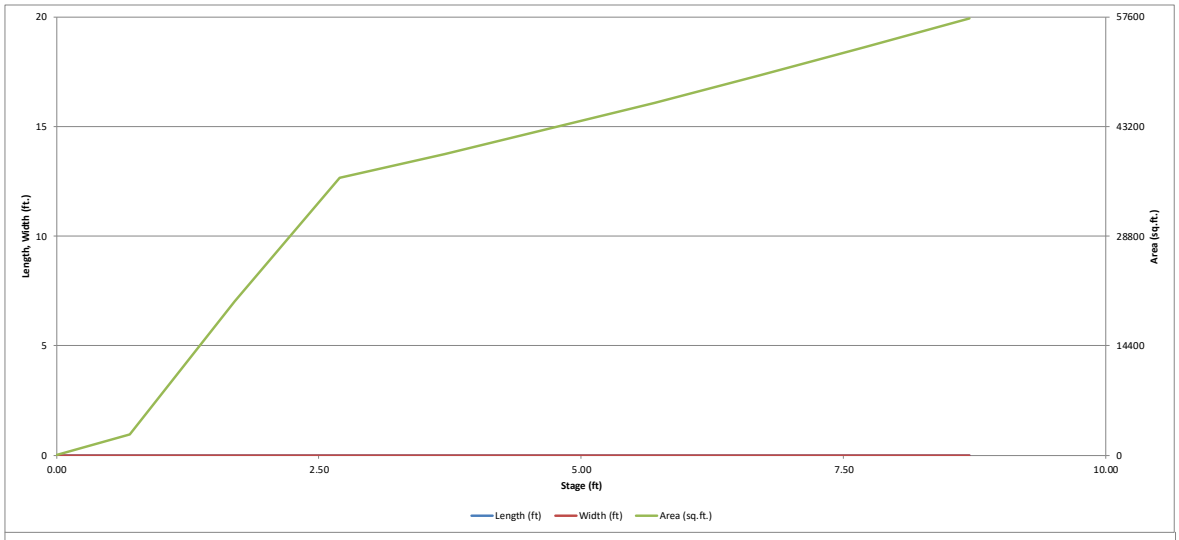
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.273	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.830	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.81 in.) =	0.416	acre-feet		inches
5-yr Runoff Volume (P1 = 1.11 in.) =	0.628	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	0.841	acre-feet		inches
25-yr Runoff Volume (P1 = 1.84 in.) =	1.477	acre-feet		inches
50-yr Runoff Volume (P1 = 2.24 in.) =	2.002	acre-feet		inches
100-yr Runoff Volume (P1 = 2.68 in.) =	2.699	acre-feet		inches
500-yr Runoff Volume (P1 = 3.89 in.) =	4.425	acre-feet		inches
Approximate 2-yr Detention Volume =	0.397	acre-feet		
Approximate 5-yr Detention Volume =	0.584	acre-feet		
Approximate 10-yr Detention Volume =	0.816	acre-feet		
Approximate 25-yr Detention Volume =	1.087	acre-feet		
Approximate 50-yr Detention Volume =	1.267	acre-feet		
Approximate 100-yr Detention Volume =	1.536	acre-feet		

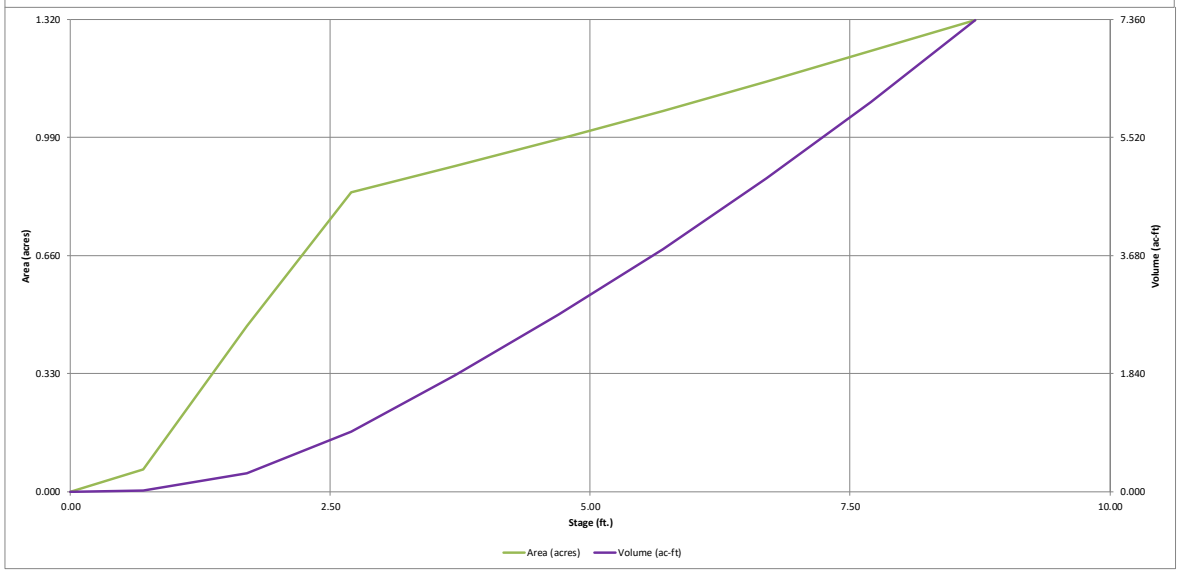
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.273	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.557	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	6.520	acre-feet
Total Detention Basin Volume =	7.350	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 1.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
4975	--	0.70	--	--	--	2,744	0.063	978	0.022
4976	--	1.70	--	--	--	20,191	0.464	12,445	0.286
4977	--	2.70	--	--	--	36,439	0.837	40,760	0.936
4978	--	3.70	--	--	--	39,612	0.909	78,786	1.809
4979	--	4.70	--	--	--	42,918	0.985	120,051	2.756
4980	--	5.70	--	--	--	46,353	1.064	164,686	3.781
4981	--	6.70	--	--	--	49,943	1.147	212,834	4.886
4982	--	7.70	--	--	--	53,630	1.231	264,621	6.075
4983	--	8.70	--	--	--	57,463	1.319	320,167	7.350


20
15
10
5
0
Length, Width (ft.)
57600
43200
28800
14400
0
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

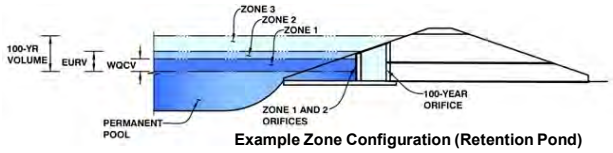

1.320
0.990
0.660
0.330
0.000
Area (acres)
7.360
5.520
3.680
1.840
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND C**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.68	0.273	Orifice Plate
Zone 2 (EURV)	2.57	0.557	Orifice Plate
Zone 3 (User)	8.70	6.520	Weir&Pipe (Restrict)
Total (all zones)		7.350	

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

Calculated Parameters for Underdrain

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	2.80	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	1.30						
Orifice Area (sq. inches)	2.00	2.00						

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.80	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.80	N/A	feet
Overflow Weir Front Edge Length =	12.00	N/A	feet	Overflow Weir Slope Length =	4.12	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	31.59	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	39.14	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	39.14	N/A	ft^2
Debris Clogging % =	0%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			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 Orifice Area =	1.24	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.48	N/A	feet
Restrictor Plate Height Above Pipe Invert =	10.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.40	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	3.90	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.78	feet
Spillway Crest Length =	13.00	feet	Stage at Top of Freeboard =	5.68	feet
Spillway End Slopes =	10.00	H:V	Basin Area at Top of Freeboard =	1.06	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.76	acre-ft

Calculated Parameters for Spillway

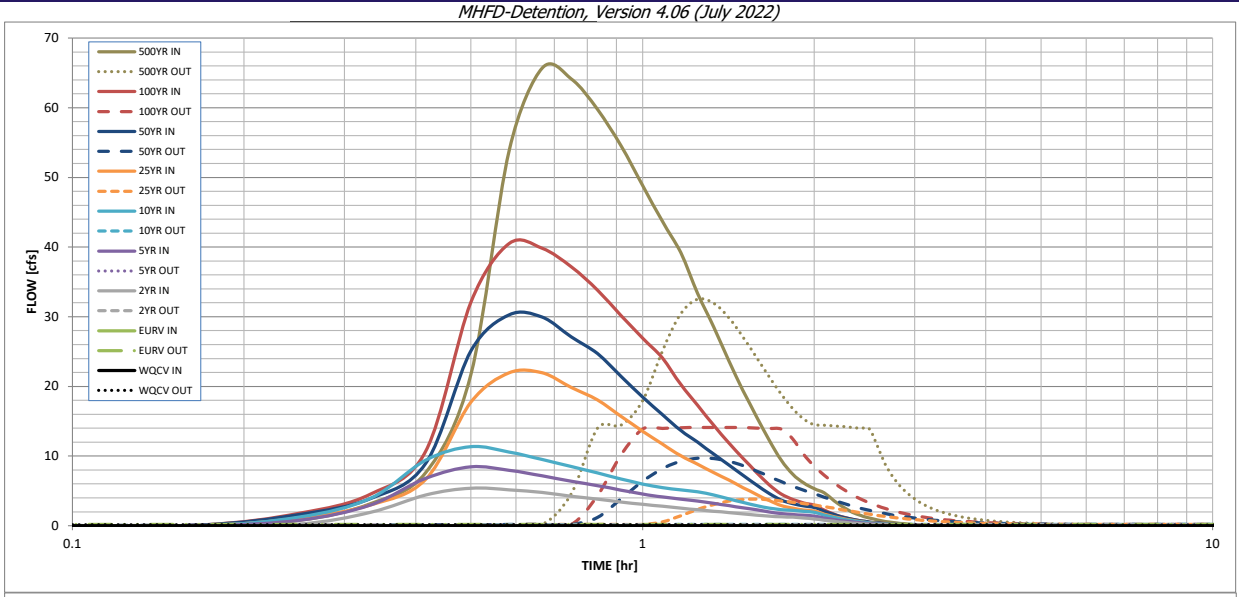
Routed Hydrograph Results

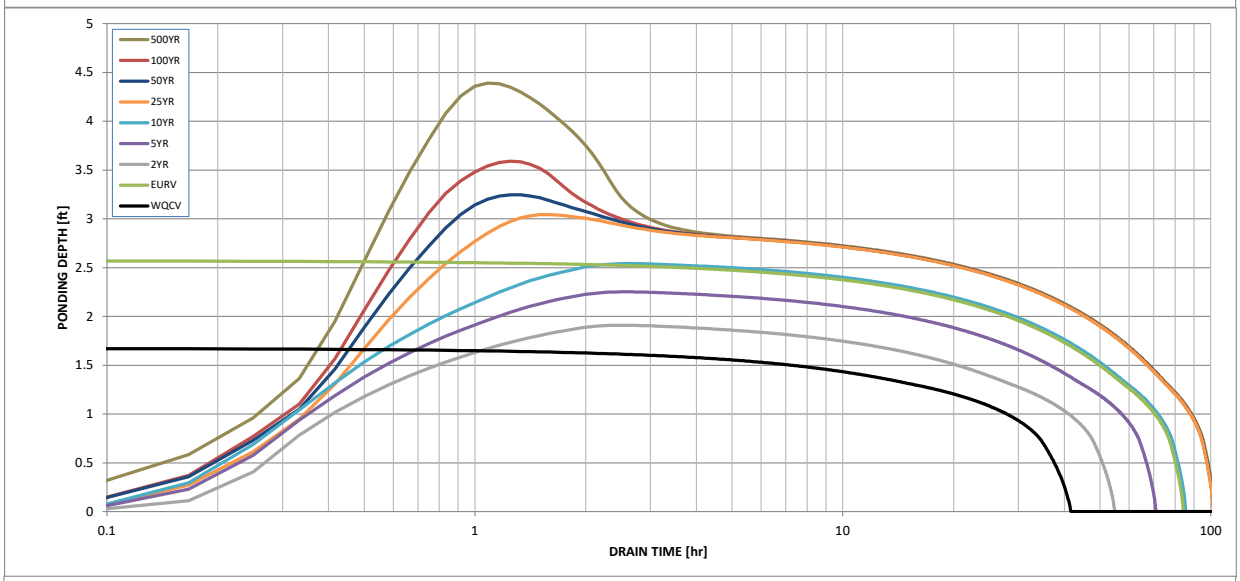
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

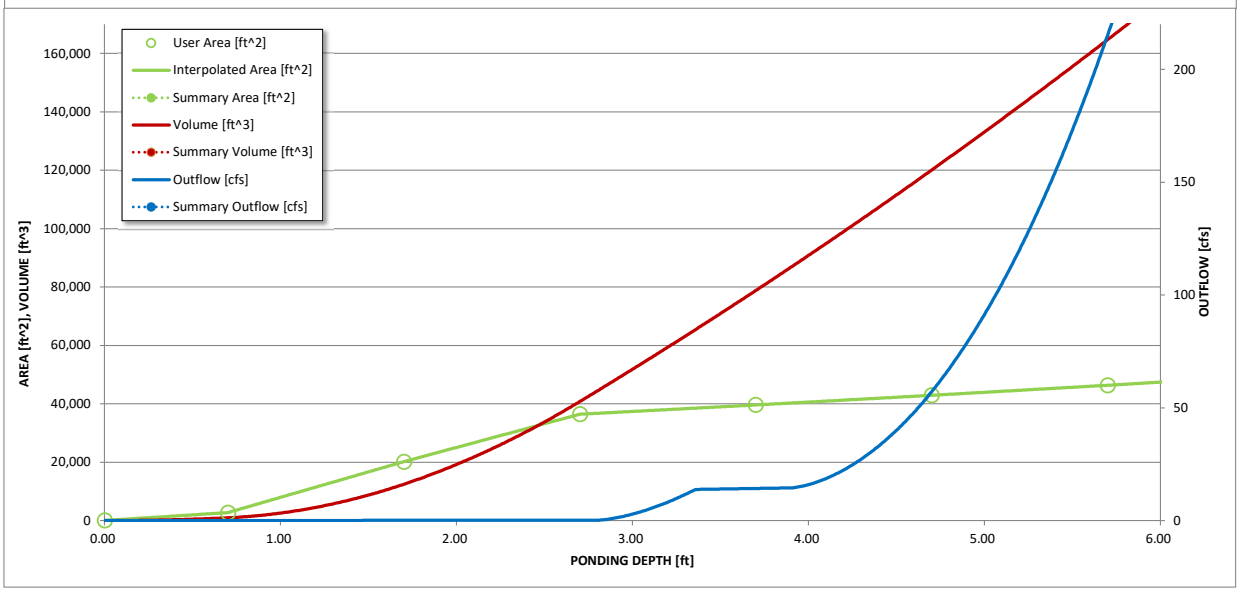
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.81	1.11	1.39	1.84	2.24	2.68	3.89
CUHP Runoff Volume (acre-ft) =	0.273	0.830	0.416	0.628	0.841	1.477	2.002	2.699	4.425
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.416	0.628	0.841	1.477	2.002	2.699	4.425
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.4	7.6	13.0	20.0	36.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.03	0.45	0.76	1.18	2.13
Peak Inflow Q (cfs) =	N/A	N/A	5.4	8.5	11.3	21.9	30.3	40.5	65.7
Peak Outflow Q (cfs) =	0.1	0.2	0.1	0.2	0.2	3.8	9.7	14.1	32.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	0.4	0.5	0.7	0.7	0.9
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.1	0.2	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) =	39	77	51	65	79	91	88	85	77
Time to Drain 99% of Inflow Volume (hours) =	**40**	81	53	69	83	97	96	95	92
Maximum Ponding Depth (ft) =	1.68	2.57	1.91	2.25	2.54	3.04	3.25	3.59	4.39
Area at Maximum Ponding Depth (acres) =	0.46	0.79	0.54	0.67	0.77	0.86	0.88	0.90	0.96
Maximum Volume Stored (acre-ft) =	0.277	0.830	0.386	0.597	0.799	1.224	1.398	1.700	2.454

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
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]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.76
	0:15:00	0.00	0.00	0.22	0.79	1.25	1.08	1.61	1.77	3.16
	0:20:00	0.00	0.00	1.91	2.97	3.94	2.99	3.91	4.54	7.61
	0:25:00	0.00	0.00	4.41	6.82	9.42	6.68	8.98	10.71	21.68
	0:30:00	0.00	0.00	5.39	8.46	11.34	17.72	25.08	32.07	53.88
	0:35:00	0.00	0.00	5.16	7.96	10.58	21.94	30.27	40.53	65.70
	0:40:00	0.00	0.00	4.76	7.15	9.50	21.94	29.93	39.82	64.14
	0:45:00	0.00	0.00	4.24	6.39	8.52	19.85	27.11	37.15	59.76
	0:50:00	0.00	0.00	3.80	5.76	7.57	18.06	24.71	33.82	54.55
	0:55:00	0.00	0.00	3.41	5.12	6.72	15.70	21.45	30.18	48.84
	1:00:00	0.00	0.00	3.06	4.55	5.99	13.56	18.49	26.94	43.66
	1:05:00	0.00	0.00	2.80	4.12	5.47	11.72	15.95	24.06	39.23
	1:10:00	0.00	0.00	2.52	3.83	5.14	10.06	13.68	20.28	33.32
	1:15:00	0.00	0.00	2.29	3.53	4.86	8.82	11.97	17.25	28.51
	1:20:00	0.00	0.00	2.08	3.20	4.41	7.63	10.28	14.40	23.70
	1:25:00	0.00	0.00	1.89	2.88	3.86	6.55	8.74	11.90	19.44
	1:30:00	0.00	0.00	1.70	2.57	3.34	5.48	7.25	9.69	15.71
	1:35:00	0.00	0.00	1.51	2.29	2.88	4.49	5.87	7.67	12.32
	1:40:00	0.00	0.00	1.36	1.96	2.52	3.61	4.64	5.89	9.42
	1:45:00	0.00	0.00	1.28	1.73	2.32	2.91	3.70	4.57	7.38
	1:50:00	0.00	0.00	1.24	1.60	2.20	2.51	3.17	3.79	6.13
	1:55:00	0.00	0.00	1.10	1.50	2.08	2.28	2.85	3.28	5.31
	2:00:00	0.00	0.00	0.99	1.40	1.91	2.13	2.64	2.93	4.72
	2:05:00	0.00	0.00	0.79	1.12	1.53	1.68	2.07	2.24	3.59
	2:10:00	0.00	0.00	0.62	0.88	1.20	1.29	1.59	1.66	2.65
	2:15:00	0.00	0.00	0.49	0.69	0.93	1.00	1.22	1.23	1.95
	2:20:00	0.00	0.00	0.38	0.53	0.72	0.76	0.93	0.92	1.45
	2:25:00	0.00	0.00	0.29	0.41	0.54	0.58	0.70	0.70	1.10
	2:30:00	0.00	0.00	0.23	0.31	0.41	0.44	0.53	0.53	0.82
	2:35:00	0.00	0.00	0.17	0.23	0.31	0.33	0.39	0.40	0.62
	2:40:00	0.00	0.00	0.13	0.17	0.23	0.25	0.30	0.30	0.47
	2:45:00	0.00	0.00	0.09	0.12	0.17	0.18	0.22	0.22	0.34
	2:50:00	0.00	0.00	0.06	0.09	0.12	0.13	0.15	0.16	0.24
	2:55:00	0.00	0.00	0.04	0.06	0.08	0.08	0.10	0.10	0.15
	3:00:00	0.00	0.00	0.02	0.04	0.04	0.05	0.06	0.06	0.09
	3:05:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.03	0.04
	3:10:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	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
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

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

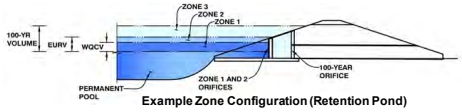
POND C - 50% CLOGGING

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND C**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	17.00	acres
Watershed Length =	1,563	ft
Watershed Length to Centroid =	744	ft
Watershed Slope =	0.038	ft/ft
Watershed Imperviousness =	45.00%	percent
Percentage Hydrologic Soil Group A =	42.0%	percent
Percentage Hydrologic Soil Group B =	58.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Erie	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

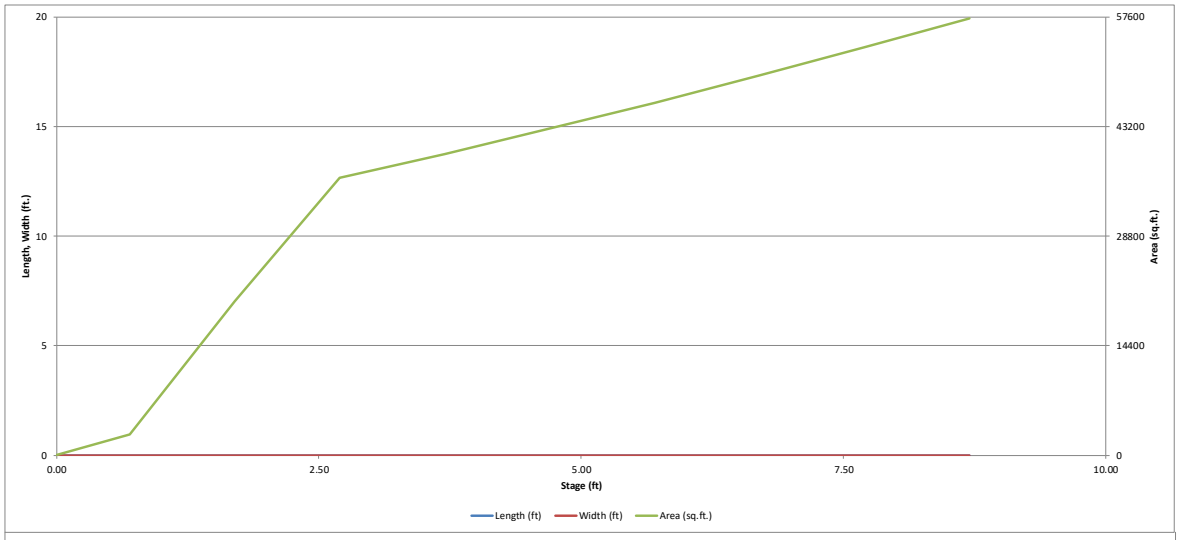
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.273	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.830	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.81 in.) =	0.416	acre-feet		inches
5-yr Runoff Volume (P1 = 1.11 in.) =	0.628	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	0.841	acre-feet		inches
25-yr Runoff Volume (P1 = 1.84 in.) =	1.477	acre-feet		inches
50-yr Runoff Volume (P1 = 2.24 in.) =	2.002	acre-feet		inches
100-yr Runoff Volume (P1 = 2.68 in.) =	2.699	acre-feet		inches
500-yr Runoff Volume (P1 = 3.89 in.) =	4.425	acre-feet		inches
Approximate 2-yr Detention Volume =	0.397	acre-feet		
Approximate 5-yr Detention Volume =	0.584	acre-feet		
Approximate 10-yr Detention Volume =	0.816	acre-feet		
Approximate 25-yr Detention Volume =	1.087	acre-feet		
Approximate 50-yr Detention Volume =	1.267	acre-feet		
Approximate 100-yr Detention Volume =	1.536	acre-feet		

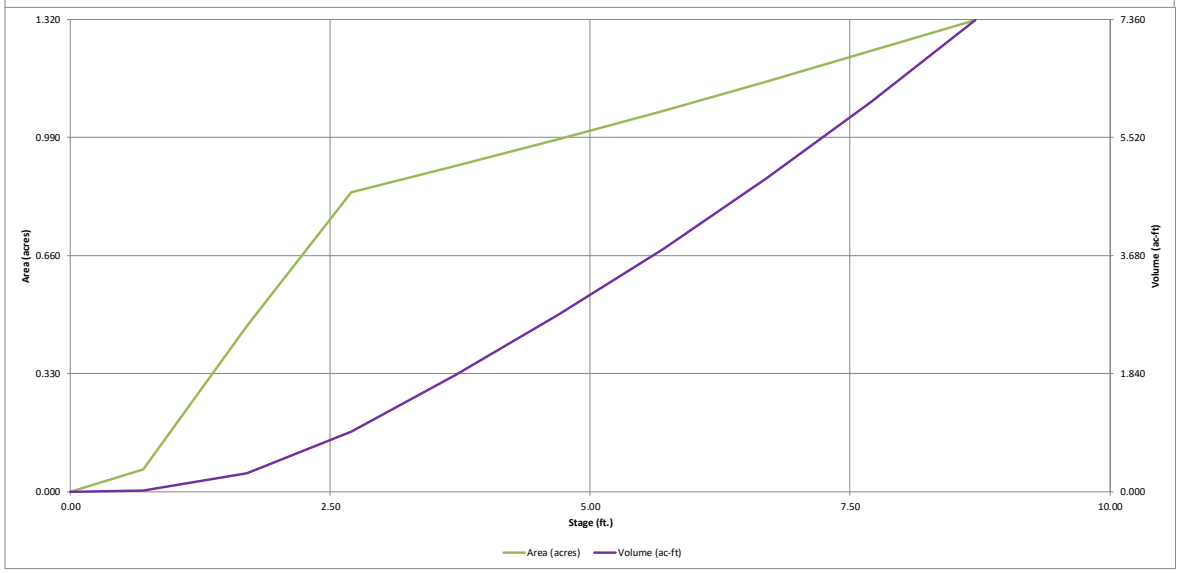
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.273	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.557	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	6.520	acre-feet
Total Detention Basin Volume =	7.350	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 1.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
4975	--	0.70	--	--	--	2,744	0.063	978	0.022
4976	--	1.70	--	--	--	20,191	0.464	12,445	0.286
4977	--	2.70	--	--	--	36,439	0.837	40,760	0.936
4978	--	3.70	--	--	--	39,612	0.909	78,786	1.809
4979	--	4.70	--	--	--	42,918	0.985	120,051	2.756
4980	--	5.70	--	--	--	46,353	1.064	164,686	3.781
4981	--	6.70	--	--	--	49,943	1.147	212,834	4.886
4982	--	7.70	--	--	--	53,630	1.231	264,621	6.075
4983	--	8.70	--	--	--	57,463	1.319	320,167	7.350


20
15
10
5
0
Length, Width (ft.)
57600
43200
28800
14400
0
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

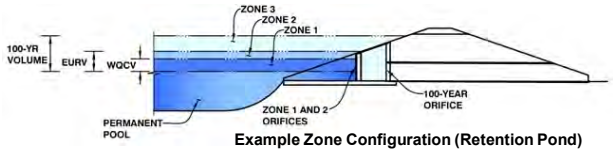

1.320
0.990
0.660
0.330
0.000
Area (acres)
7.360
5.520
3.680
1.840
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND C**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.68	0.273	Orifice Plate
Zone 2 (EURV)	2.57	0.557	Orifice Plate
Zone 3 (User)	8.70	6.520	Weir&Pipe (Restrict)
Total (all zones)		7.350	

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

Calculated Parameters for Underdrain

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	2.80	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	1.30						
Orifice Area (sq. inches)	2.00	2.00						

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.80	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.80	N/A	feet
Overflow Weir Front Edge Length =	12.00	N/A	feet	Overflow Weir Slope Length =	4.12	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	31.59	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	39.14	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	19.57	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			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 Orifice Area =	1.24	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.48	N/A	feet
Restrictor Plate Height Above Pipe Invert =	10.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.40	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	3.90	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.78	feet
Spillway Crest Length =	13.00	feet	Stage at Top of Freeboard =	5.68	feet
Spillway End Slopes =	10.00	H:V	Basin Area at Top of Freeboard =	1.06	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.76	acre-ft

Calculated Parameters for Spillway

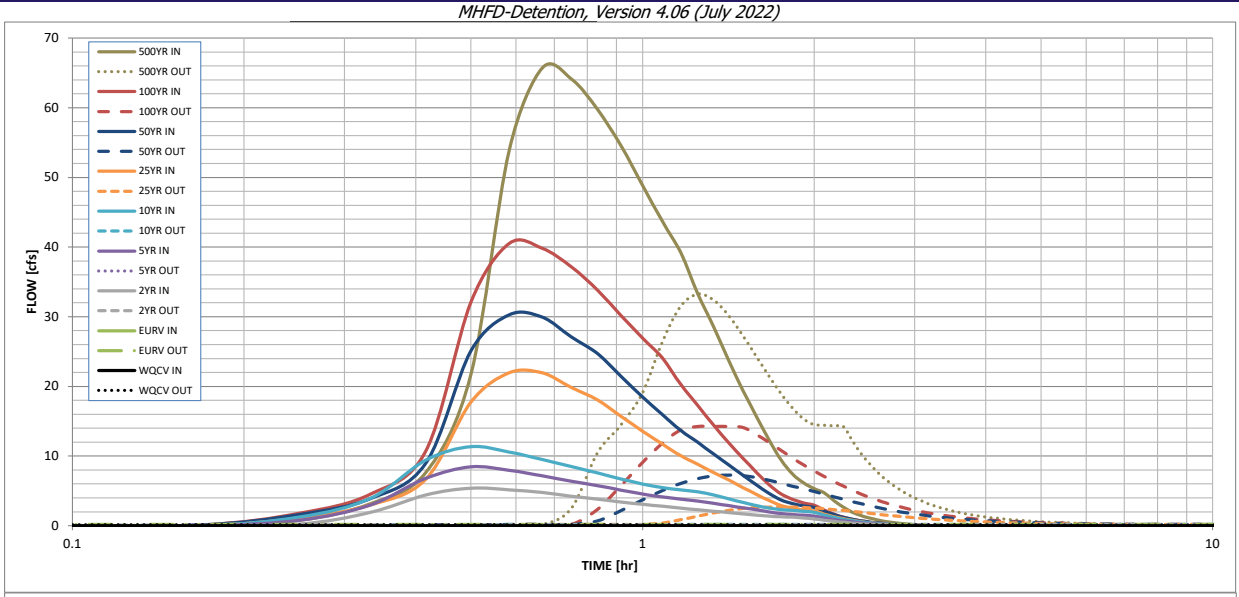
Routed Hydrograph Results

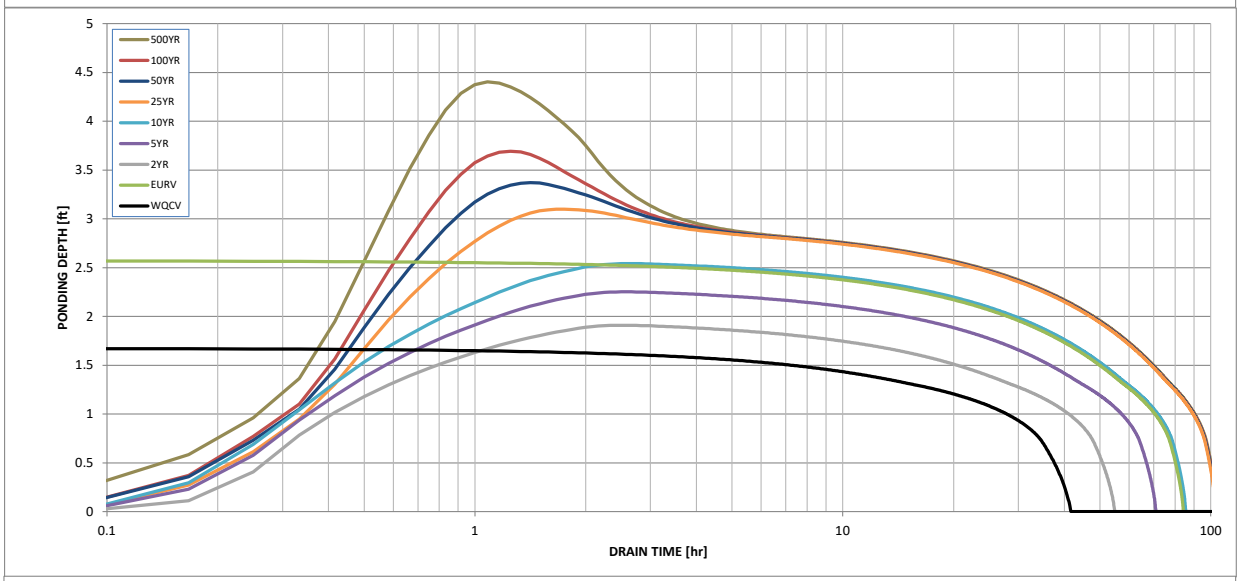
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

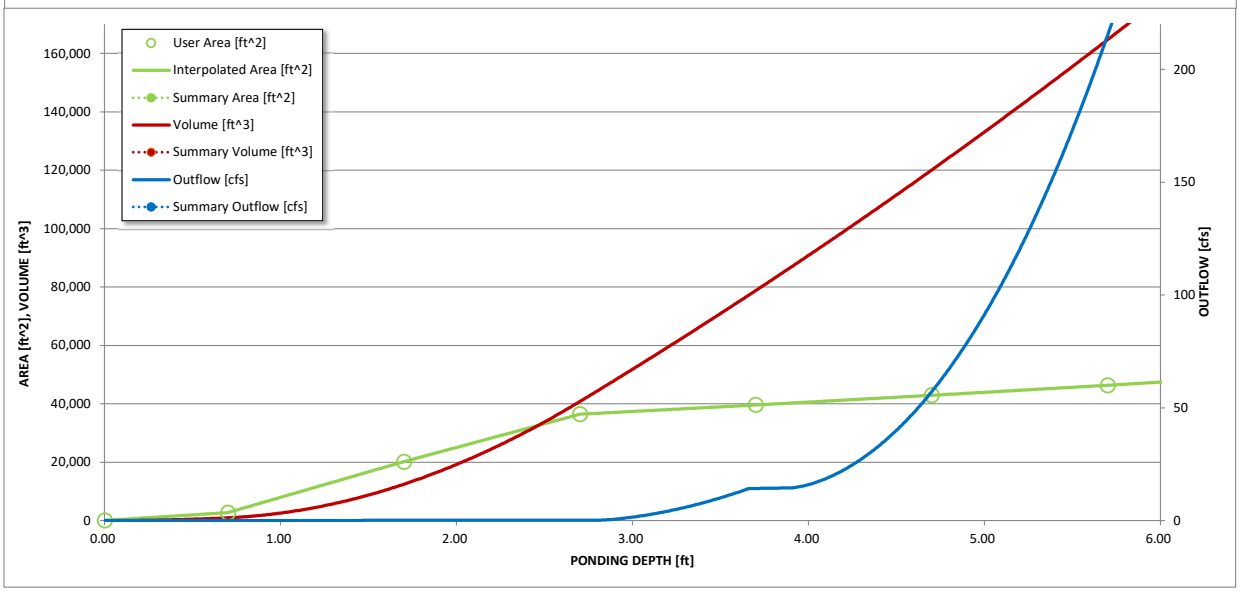
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.81	1.11	1.39	1.84	2.24	2.68	3.89
CUHP Runoff Volume (acre-ft) =	0.273	0.830	0.416	0.628	0.841	1.477	2.002	2.699	4.425
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.416	0.628	0.841	1.477	2.002	2.699	4.425
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.4	7.6	13.0	20.0	36.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.03	0.45	0.76	1.18	2.13
Peak Inflow Q (cfs) =	N/A	N/A	5.4	8.5	11.3	21.9	30.3	40.5	65.7
Peak Outflow Q (cfs) =	0.1	0.2	0.1	0.2	0.2	2.7	7.3	14.3	33.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	0.4	0.4	0.6	0.7	0.9
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.1	0.2	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) =	39	77	51	65	79	93	90	86	78
Time to Drain 99% of Inflow Volume (hours) =	**40**	81	53	69	83	99	98	96	93
Maximum Ponding Depth (ft) =	1.68	2.57	1.91	2.25	2.54	3.10	3.37	3.69	4.40
Area at Maximum Ponding Depth (acres) =	0.46	0.79	0.54	0.67	0.77	0.86	0.89	0.91	0.96
Maximum Volume Stored (acre-ft) =	0.277	0.830	0.386	0.597	0.799	1.268	1.513	1.800	2.464

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
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]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.76
	0:15:00	0.00	0.00	0.22	0.79	1.25	1.08	1.61	1.77	3.16
	0:20:00	0.00	0.00	1.91	2.97	3.94	2.99	3.91	4.54	7.61
	0:25:00	0.00	0.00	4.41	6.82	9.42	6.68	8.98	10.71	21.68
	0:30:00	0.00	0.00	5.39	8.46	11.34	17.72	25.08	32.07	53.88
	0:35:00	0.00	0.00	5.16	7.96	10.58	21.94	30.27	40.53	65.70
	0:40:00	0.00	0.00	4.76	7.15	9.50	21.94	29.93	39.82	64.14
	0:45:00	0.00	0.00	4.24	6.39	8.52	19.85	27.11	37.15	59.76
	0:50:00	0.00	0.00	3.80	5.76	7.57	18.06	24.71	33.82	54.55
	0:55:00	0.00	0.00	3.41	5.12	6.72	15.70	21.45	30.18	48.84
	1:00:00	0.00	0.00	3.06	4.55	5.99	13.56	18.49	26.94	43.66
	1:05:00	0.00	0.00	2.80	4.12	5.47	11.72	15.95	24.06	39.23
	1:10:00	0.00	0.00	2.52	3.83	5.14	10.06	13.68	20.28	33.32
	1:15:00	0.00	0.00	2.29	3.53	4.86	8.82	11.97	17.25	28.51
	1:20:00	0.00	0.00	2.08	3.20	4.41	7.63	10.28	14.40	23.70
	1:25:00	0.00	0.00	1.89	2.88	3.86	6.55	8.74	11.90	19.44
	1:30:00	0.00	0.00	1.70	2.57	3.34	5.48	7.25	9.69	15.71
	1:35:00	0.00	0.00	1.51	2.29	2.88	4.49	5.87	7.67	12.32
	1:40:00	0.00	0.00	1.36	1.96	2.52	3.61	4.64	5.89	9.42
	1:45:00	0.00	0.00	1.28	1.73	2.32	2.91	3.70	4.57	7.38
	1:50:00	0.00	0.00	1.24	1.60	2.20	2.51	3.17	3.79	6.13
	1:55:00	0.00	0.00	1.10	1.50	2.08	2.28	2.85	3.28	5.31
	2:00:00	0.00	0.00	0.99	1.40	1.91	2.13	2.64	2.93	4.72
	2:05:00	0.00	0.00	0.79	1.12	1.53	1.68	2.07	2.24	3.59
	2:10:00	0.00	0.00	0.62	0.88	1.20	1.29	1.59	1.66	2.65
	2:15:00	0.00	0.00	0.49	0.69	0.93	1.00	1.22	1.23	1.95
	2:20:00	0.00	0.00	0.38	0.53	0.72	0.76	0.93	0.92	1.45
	2:25:00	0.00	0.00	0.29	0.41	0.54	0.58	0.70	0.70	1.10
	2:30:00	0.00	0.00	0.23	0.31	0.41	0.44	0.53	0.53	0.82
	2:35:00	0.00	0.00	0.17	0.23	0.31	0.33	0.39	0.40	0.62
	2:40:00	0.00	0.00	0.13	0.17	0.23	0.25	0.30	0.30	0.47
	2:45:00	0.00	0.00	0.09	0.12	0.17	0.18	0.22	0.22	0.34
	2:50:00	0.00	0.00	0.06	0.09	0.12	0.13	0.15	0.16	0.24
	2:55:00	0.00	0.00	0.04	0.06	0.08	0.08	0.10	0.10	0.15
	3:00:00	0.00	0.00	0.02	0.04	0.04	0.05	0.06	0.06	0.09
	3:05:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.03	0.04
	3:10:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	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
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

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

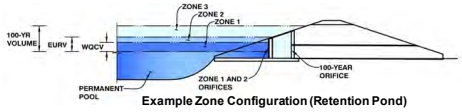
POND D - NO CLOGGING

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND D**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	14.90	acres
Watershed Length =	1,563	ft
Watershed Length to Centroid =	744	ft
Watershed Slope =	0.038	ft/ft
Watershed Imperviousness =	45.00%	percent
Percentage Hydrologic Soil Group A =	18.2%	percent
Percentage Hydrologic Soil Group B =	77.2%	percent
Percentage Hydrologic Soil Groups C/D =	4.6%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Erie	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

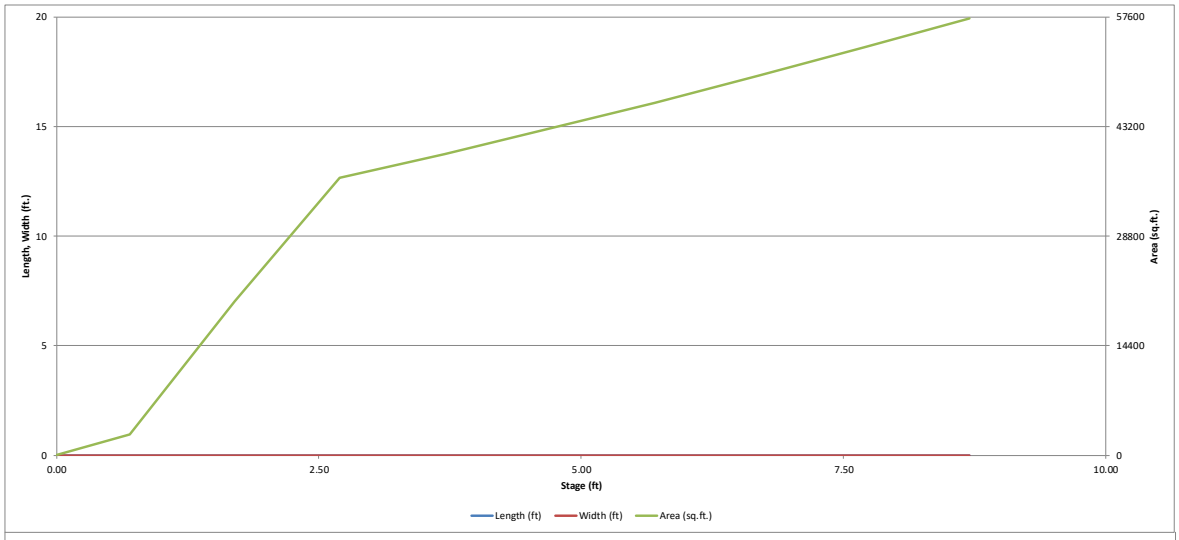
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.240	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.714	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.81 in.) =	0.377	acre-feet		inches
5-yr Runoff Volume (P1 = 1.11 in.) =	0.567	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	0.810	acre-feet		inches
25-yr Runoff Volume (P1 = 1.84 in.) =	1.395	acre-feet		inches
50-yr Runoff Volume (P1 = 2.24 in.) =	1.875	acre-feet		inches
100-yr Runoff Volume (P1 = 2.68 in.) =	2.485	acre-feet		inches
500-yr Runoff Volume (P1 = 3.89 in.) =	4.031	acre-feet		inches
Approximate 2-yr Detention Volume =	0.356	acre-feet		
Approximate 5-yr Detention Volume =	0.533	acre-feet		
Approximate 10-yr Detention Volume =	0.754	acre-feet		
Approximate 25-yr Detention Volume =	0.980	acre-feet		
Approximate 50-yr Detention Volume =	1.124	acre-feet		
Approximate 100-yr Detention Volume =	1.360	acre-feet		

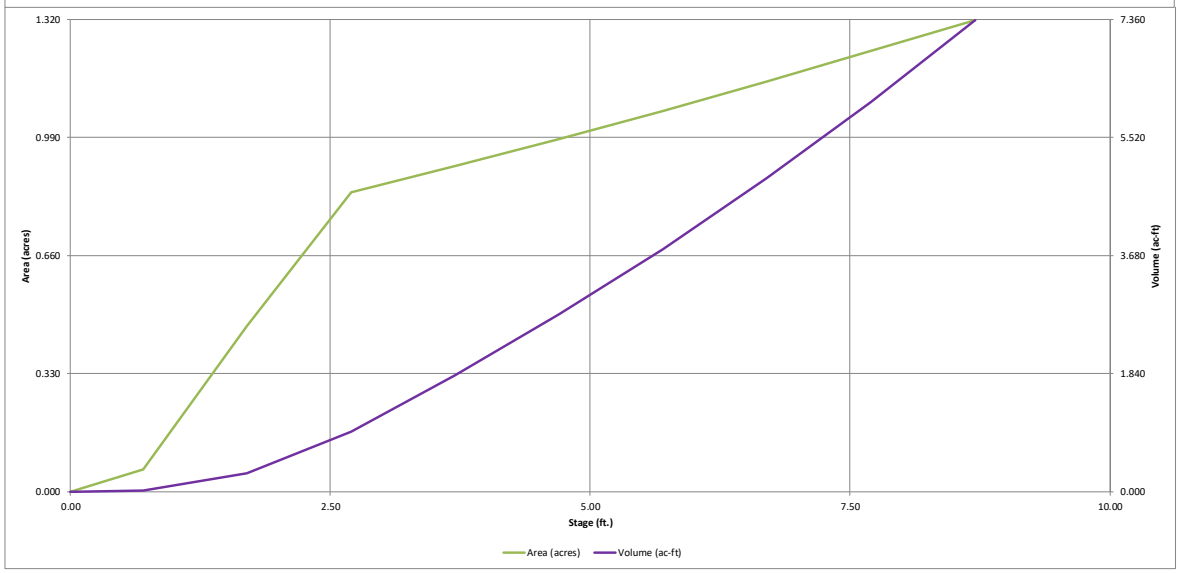
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.240	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.475	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	6.636	acre-feet
Total Detention Basin Volume =	7.350	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 1.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
4975	--	0.70	--	--	--	2,744	0.063	978	0.022
4976	--	1.70	--	--	--	20,191	0.464	12,445	0.286
4977	--	2.70	--	--	--	36,439	0.837	40,760	0.936
4978	--	3.70	--	--	--	39,612	0.909	78,786	1.809
4979	--	4.70	--	--	--	42,918	0.985	120,051	2.756
4980	--	5.70	--	--	--	46,353	1.064	164,686	3.781
4981	--	6.70	--	--	--	49,943	1.147	212,834	4.886
4982	--	7.70	--	--	--	53,630	1.231	264,621	6.075
4983	--	8.70	--	--	--	57,463	1.319	320,167	7.350


20
15
10
5
0
Length, Width (ft.)
57600
43200
28800
14400
0
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

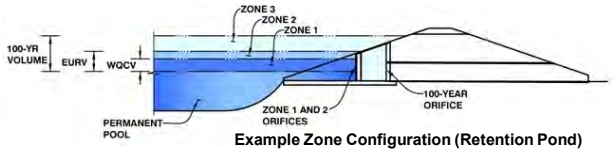

1.320
0.990
0.660
0.330
0.000
Area (acres)
7.360
5.520
3.680
1.840
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND D**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.60	0.240	Orifice Plate
Zone 2 (EURV)	2.42	0.475	Orifice Plate
Zone 3 (User)	#VALUE!	6.636	Weir&Pipe (Restrict)
Total (all zones)		7.350	

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.60	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	sq. inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.50						
Orifice Area (sq. inches)	2.00	2.00						

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.60	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Type =	Close Mesh Grate	N/A	
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.60	N/A	feet
Overflow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	11.53	N/A	
Overflow Grate Open Area w/o Debris =	13.05	N/A	ft^2
Overflow Grate Open Area w/ Debris =	13.05	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 =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	11.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.13	N/A	ft^2
Outlet Orifice Centroid =	0.52	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.79	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	3.80	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	10.00	feet
Spillway End Slopes =	10.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.80	feet
Stage at Top of Freeboard =	5.60	feet
Basin Area at Top of Freeboard =	1.06	acres
Basin Volume at Top of Freeboard =	3.67	acre-ft

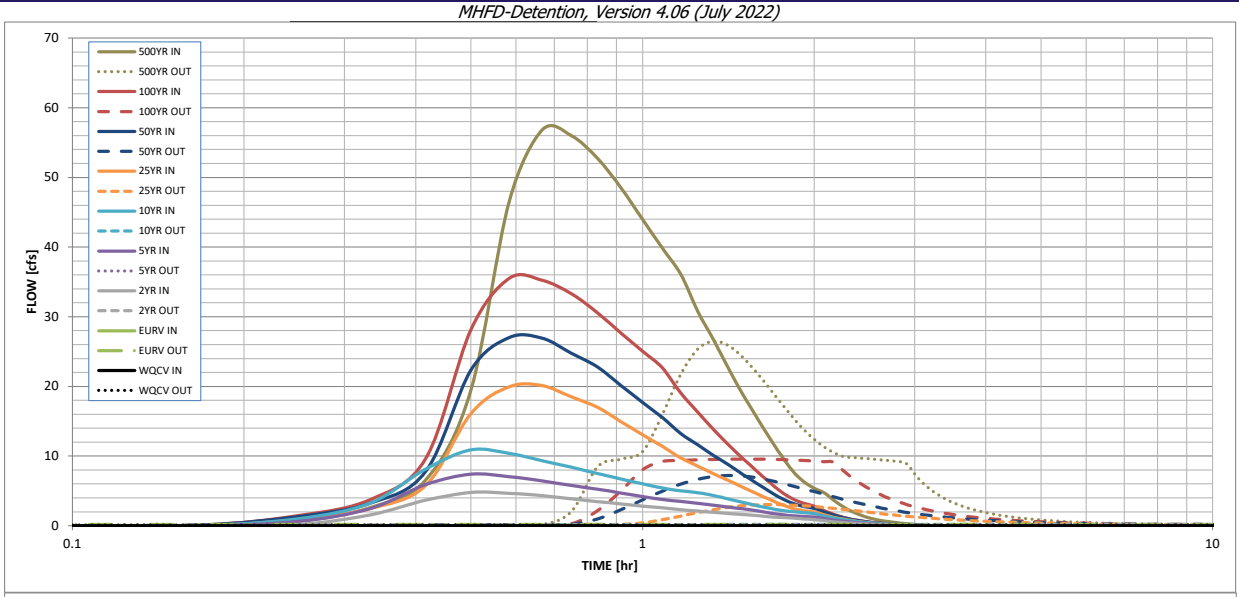
Routed Hydrograph Results

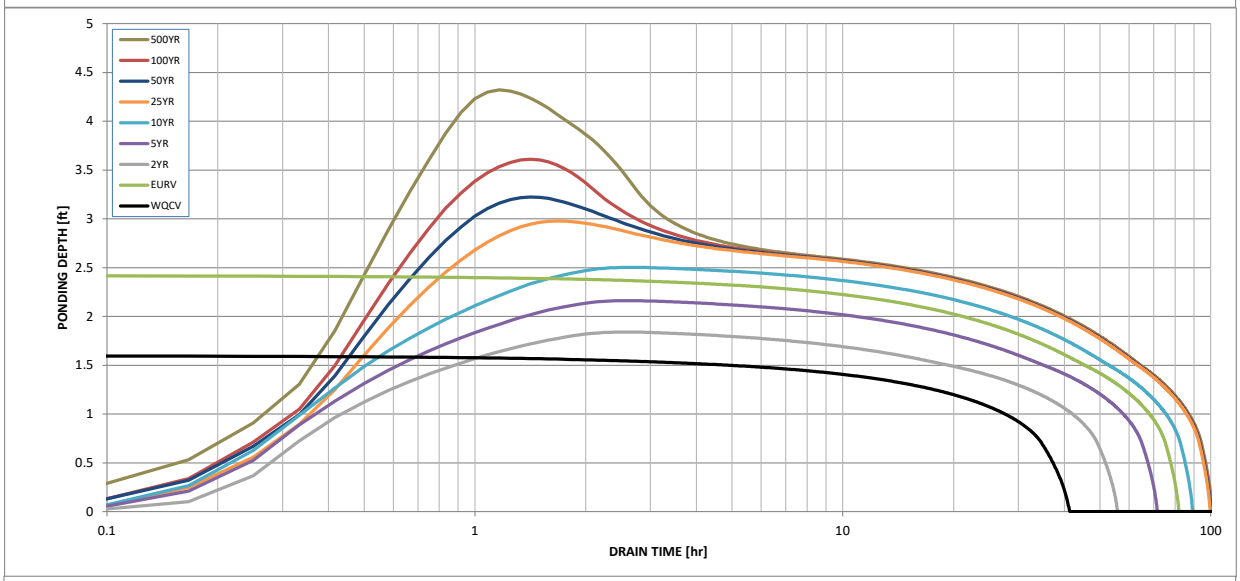
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

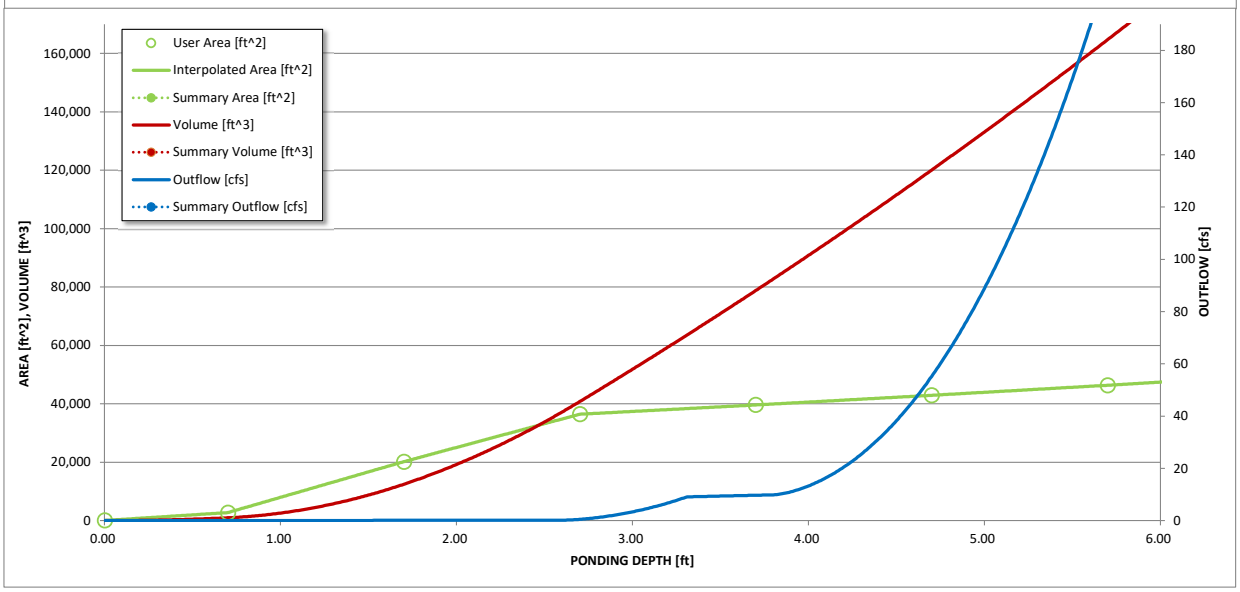
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.81	1.11	1.39	1.84	2.24	2.68	3.89
CUHP Runoff Volume (acre-ft) =	0.240	0.714	0.377	0.567	0.810	1.395	1.875	2.485	4.031
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.377	0.567	0.810	1.395	1.875	2.485	4.031
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	1.8	8.2	12.7	18.6	32.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.12	0.55	0.85	1.25	2.18
Peak Inflow Q (cfs) =	N/A	N/A	4.8	7.4	10.9	20.1	27.0	35.5	56.8
Peak Outflow Q (cfs) =	0.1	0.2	0.1	0.2	0.2	3.1	7.2	9.6	26.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.1	0.4	0.6	0.5	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.5	0.7	0.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	76	52	66	82	89	87	84	77
Time to Drain 99% of Inflow Volume (hours) =	**40**	79	54	69	86	95	94	93	91
Maximum Ponding Depth (ft) =	1.60	2.42	1.84	2.16	2.50	2.98	3.22	3.61	4.32
Area at Maximum Ponding Depth (acres) =	0.42	0.73	0.51	0.64	0.76	0.86	0.87	0.90	0.96
Maximum Volume Stored (acre-ft) =	0.241	0.716	0.349	0.538	0.776	1.164	1.381	1.718	2.378

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
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]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.63
	0:15:00	0.00	0.00	0.18	0.66	1.04	0.90	1.34	1.47	2.62
	0:20:00	0.00	0.00	1.58	2.48	3.28	2.49	3.25	3.78	6.57
	0:25:00	0.00	0.00	3.66	5.91	8.14	5.78	7.80	9.65	19.45
	0:30:00	0.00	0.00	4.78	7.39	10.90	16.10	22.33	28.13	46.55
	0:35:00	0.00	0.00	4.66	7.05	10.39	19.94	27.01	35.52	56.81
	0:40:00	0.00	0.00	4.31	6.43	9.34	20.10	26.93	35.25	56.00
	0:45:00	0.00	0.00	3.85	5.77	8.39	18.49	24.77	33.28	52.73
	0:50:00	0.00	0.00	3.47	5.26	7.49	17.01	22.78	30.57	48.52
	0:55:00	0.00	0.00	3.14	4.71	6.71	14.94	20.13	27.64	43.95
	1:00:00	0.00	0.00	2.82	4.18	6.00	13.06	17.69	25.03	39.83
	1:05:00	0.00	0.00	2.56	3.75	5.40	11.41	15.54	22.64	36.12
	1:10:00	0.00	0.00	2.29	3.47	5.01	9.74	13.25	19.06	30.79
	1:15:00	0.00	0.00	2.09	3.21	4.75	8.56	11.61	16.30	26.63
	1:20:00	0.00	0.00	1.92	2.93	4.33	7.44	10.07	13.78	22.49
	1:25:00	0.00	0.00	1.76	2.67	3.83	6.47	8.72	11.57	18.83
	1:30:00	0.00	0.00	1.61	2.42	3.35	5.51	7.37	9.65	15.65
	1:35:00	0.00	0.00	1.45	2.17	2.91	4.62	6.12	7.89	12.73
	1:40:00	0.00	0.00	1.30	1.86	2.51	3.80	4.98	6.28	10.10
	1:45:00	0.00	0.00	1.18	1.59	2.20	3.06	3.96	4.87	7.86
	1:50:00	0.00	0.00	1.11	1.44	2.01	2.50	3.21	3.85	6.32
	1:55:00	0.00	0.00	0.99	1.34	1.89	2.17	2.78	3.23	5.36
	2:00:00	0.00	0.00	0.88	1.25	1.73	1.98	2.50	2.83	4.71
	2:05:00	0.00	0.00	0.72	1.01	1.40	1.56	1.97	2.17	3.63
	2:10:00	0.00	0.00	0.57	0.80	1.11	1.21	1.51	1.62	2.72
	2:15:00	0.00	0.00	0.46	0.63	0.87	0.94	1.17	1.21	2.02
	2:20:00	0.00	0.00	0.36	0.50	0.68	0.73	0.90	0.90	1.50
	2:25:00	0.00	0.00	0.28	0.39	0.53	0.56	0.69	0.68	1.13
	2:30:00	0.00	0.00	0.22	0.30	0.40	0.43	0.52	0.51	0.85
	2:35:00	0.00	0.00	0.17	0.23	0.30	0.32	0.39	0.39	0.64
	2:40:00	0.00	0.00	0.13	0.17	0.23	0.24	0.30	0.30	0.49
	2:45:00	0.00	0.00	0.10	0.13	0.18	0.19	0.23	0.23	0.37
	2:50:00	0.00	0.00	0.07	0.09	0.13	0.14	0.17	0.17	0.27
	2:55:00	0.00	0.00	0.05	0.06	0.09	0.10	0.12	0.12	0.19
	3:00:00	0.00	0.00	0.03	0.04	0.06	0.06	0.07	0.08	0.12
	3:05:00	0.00	0.00	0.02	0.03	0.03	0.04	0.04	0.04	0.07
	3:10:00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	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
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

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

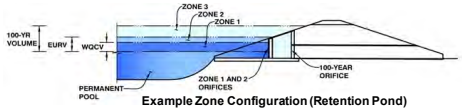
POND D - 50% CLOGGING

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND D**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	14.90	acres
Watershed Length =	1,563	ft
Watershed Length to Centroid =	744	ft
Watershed Slope =	0.038	ft/ft
Watershed Imperviousness =	45.00%	percent
Percentage Hydrologic Soil Group A =	18.2%	percent
Percentage Hydrologic Soil Group B =	77.2%	percent
Percentage Hydrologic Soil Groups C/D =	4.6%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Erie	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

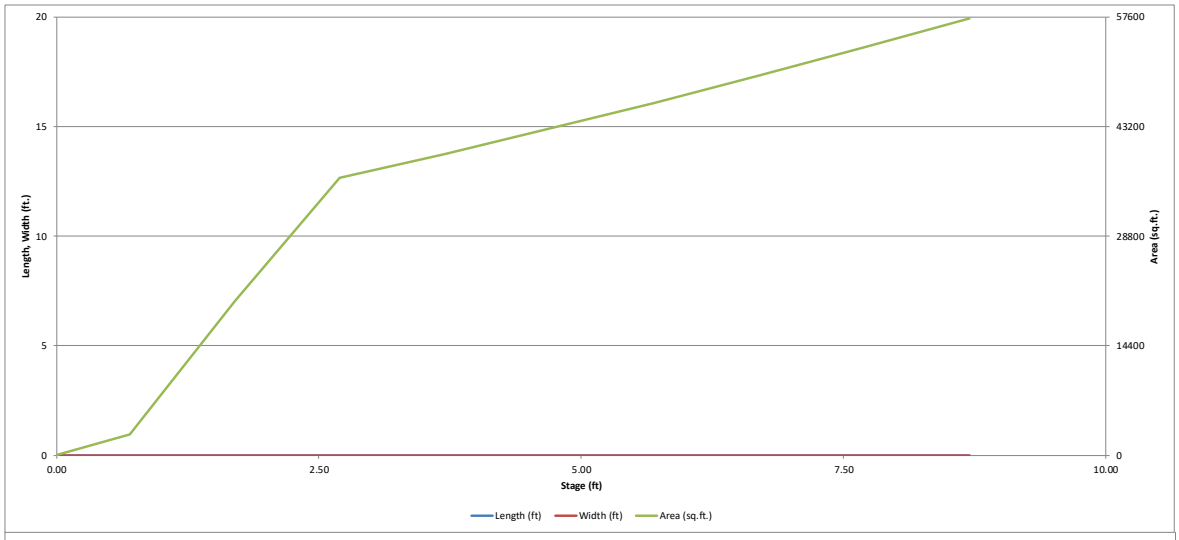
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.240	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.714	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.81 in.) =	0.377	acre-feet		inches
5-yr Runoff Volume (P1 = 1.11 in.) =	0.567	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	0.810	acre-feet		inches
25-yr Runoff Volume (P1 = 1.84 in.) =	1.395	acre-feet		inches
50-yr Runoff Volume (P1 = 2.24 in.) =	1.875	acre-feet		inches
100-yr Runoff Volume (P1 = 2.68 in.) =	2.485	acre-feet		inches
500-yr Runoff Volume (P1 = 3.89 in.) =	4.031	acre-feet		inches
Approximate 2-yr Detention Volume =	0.356	acre-feet		
Approximate 5-yr Detention Volume =	0.533	acre-feet		
Approximate 10-yr Detention Volume =	0.754	acre-feet		
Approximate 25-yr Detention Volume =	0.980	acre-feet		
Approximate 50-yr Detention Volume =	1.124	acre-feet		
Approximate 100-yr Detention Volume =	1.360	acre-feet		

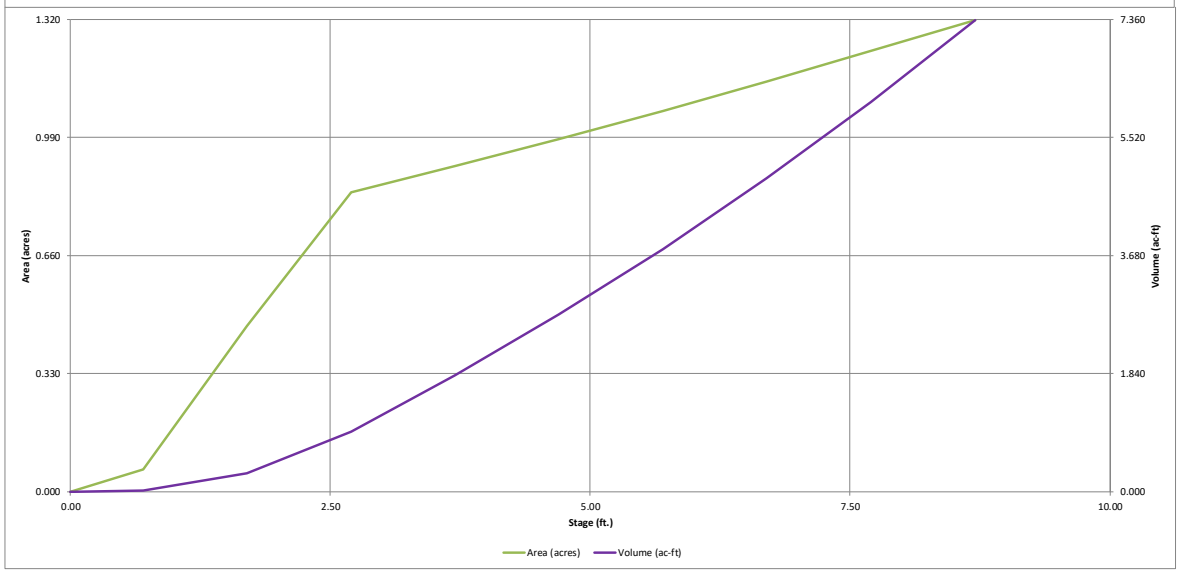
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.240	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.475	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	6.636	acre-feet
Total Detention Basin Volume =	7.350	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 1.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
4975	--	0.70	--	--	--	2,744	0.063	978	0.022
4976	--	1.70	--	--	--	20,191	0.464	12,445	0.286
4977	--	2.70	--	--	--	36,439	0.837	40,760	0.936
4978	--	3.70	--	--	--	39,612	0.909	78,786	1.809
4979	--	4.70	--	--	--	42,918	0.985	120,051	2.756
4980	--	5.70	--	--	--	46,353	1.064	164,686	3.781
4981	--	6.70	--	--	--	49,943	1.147	212,834	4.886
4982	--	7.70	--	--	--	53,630	1.231	264,621	6.075
4983	--	8.70	--	--	--	57,463	1.319	320,167	7.350


20
15
10
5
0
Length, Width (ft.)
57600
43200
28800
14400
0
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

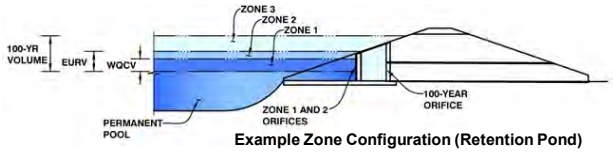

1.320
0.990
0.660
0.330
0.000
Area (acres)
7.360
5.520
3.680
1.840
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND D**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.60	0.240	Orifice Plate
Zone 2 (EURV)	2.42	0.475	Orifice Plate
Zone 3 (User)	#VALUE!	6.636	Weir&Pipe (Restrict)
Total (all zones)		7.350	

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.60	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	sq. inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.50						
Orifice Area (sq. inches)	2.00	2.00						

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.60	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Type =	Close Mesh Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.60	N/A	feet
Overflow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	11.53	N/A	
Overflow Grate Open Area w/o Debris =	13.05	N/A	ft^2
Overflow Grate Open Area w/ Debris =	6.52	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 =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	11.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.13	N/A	ft^2
Outlet Orifice Centroid =	0.52	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.79	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	3.80	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	10.00	feet
Spillway End Slopes =	10.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.80	feet
Stage at Top of Freeboard =	5.60	feet
Basin Area at Top of Freeboard =	1.06	acres
Basin Volume at Top of Freeboard =	3.67	acre-ft

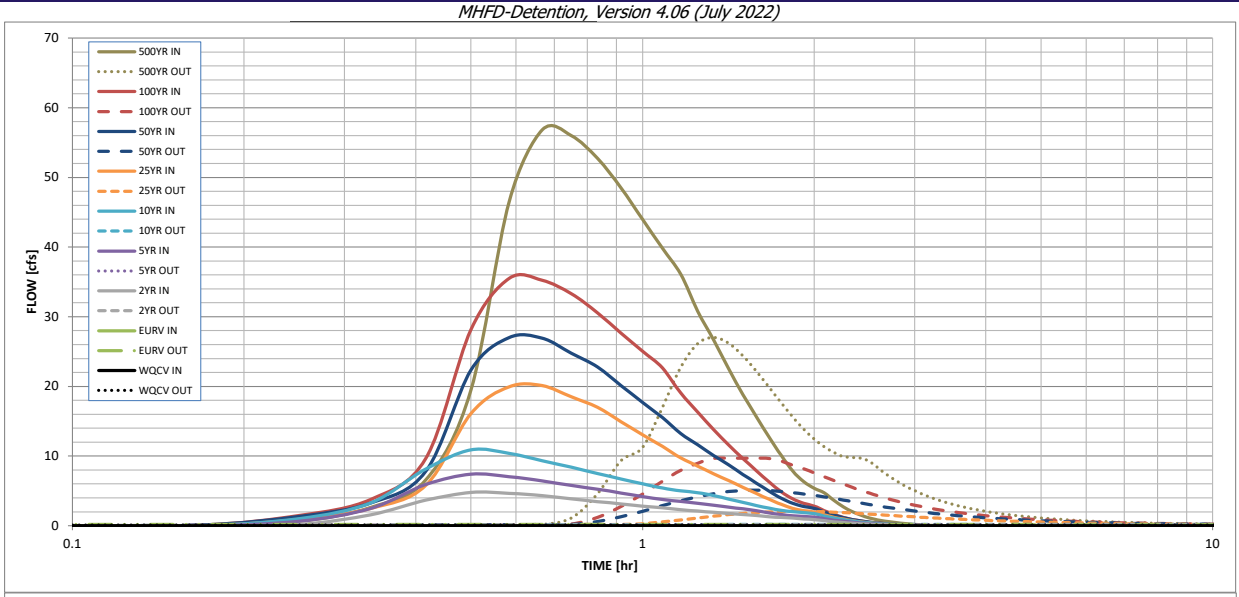
Routed Hydrograph Results

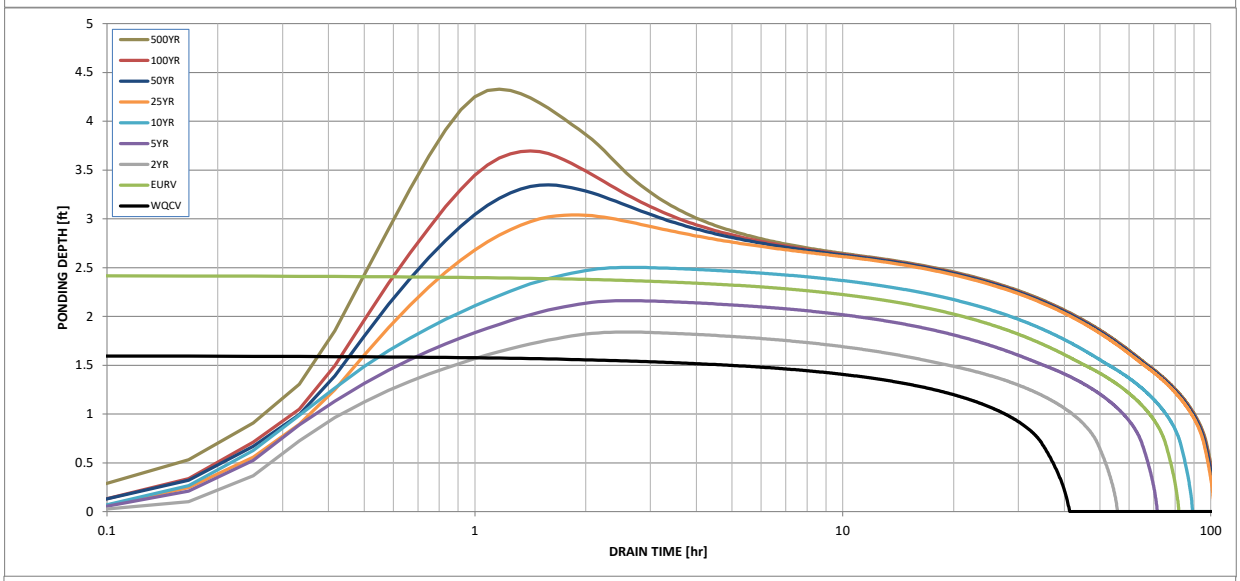
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

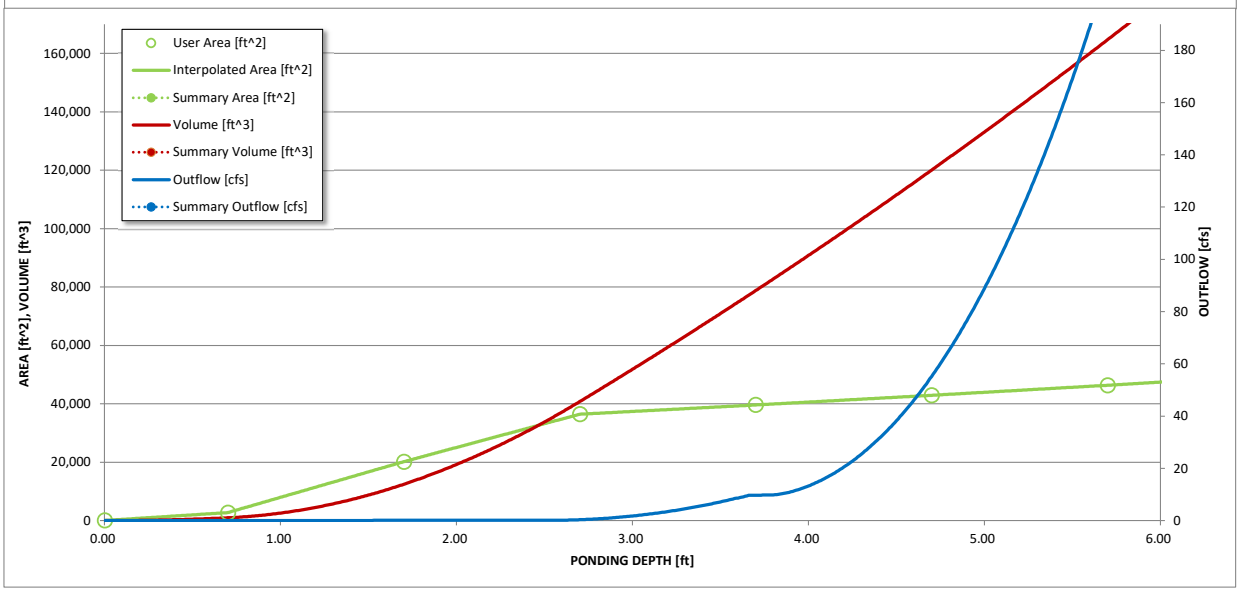
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.81	1.11	1.39	1.84	2.24	2.68	3.89
CUHP Runoff Volume (acre-ft) =	0.240	0.714	0.377	0.567	0.810	1.395	1.875	2.485	4.031
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.377	0.567	0.810	1.395	1.875	2.485	4.031
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	1.8	8.2	12.7	18.6	32.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.12	0.55	0.85	1.25	2.18
Peak Inflow Q (cfs) =	N/A	N/A	4.8	7.4	10.9	20.1	27.0	35.5	56.8
Peak Outflow Q (cfs) =	0.1	0.2	0.1	0.2	0.2	2.1	5.1	9.7	27.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.1	0.3	0.4	0.5	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.1	0.4	0.7	0.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	76	52	66	82	92	90	87	80
Time to Drain 99% of Inflow Volume (hours) =	**40**	79	54	69	86	98	98	97	94
Maximum Ponding Depth (ft) =	1.60	2.42	1.84	2.16	2.50	3.04	3.35	3.69	4.33
Area at Maximum Ponding Depth (acres) =	0.42	0.73	0.51	0.64	0.76	0.86	0.88	0.91	0.96
Maximum Volume Stored (acre-ft) =	0.241	0.716	0.349	0.538	0.776	1.216	1.486	1.800	2.387

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
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]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.63
	0:15:00	0.00	0.00	0.18	0.66	1.04	0.90	1.34	1.47	2.62
	0:20:00	0.00	0.00	1.58	2.48	3.28	2.49	3.25	3.78	6.57
	0:25:00	0.00	0.00	3.66	5.91	8.14	5.78	7.80	9.65	19.45
	0:30:00	0.00	0.00	4.78	7.39	10.90	16.10	22.33	28.13	46.55
	0:35:00	0.00	0.00	4.66	7.05	10.39	19.94	27.01	35.52	56.81
	0:40:00	0.00	0.00	4.31	6.43	9.34	20.10	26.93	35.25	56.00
	0:45:00	0.00	0.00	3.85	5.77	8.39	18.49	24.77	33.28	52.73
	0:50:00	0.00	0.00	3.47	5.26	7.49	17.01	22.78	30.57	48.52
	0:55:00	0.00	0.00	3.14	4.71	6.71	14.94	20.13	27.64	43.95
	1:00:00	0.00	0.00	2.82	4.18	6.00	13.06	17.69	25.03	39.83
	1:05:00	0.00	0.00	2.56	3.75	5.40	11.41	15.54	22.64	36.12
	1:10:00	0.00	0.00	2.29	3.47	5.01	9.74	13.25	19.06	30.79
	1:15:00	0.00	0.00	2.09	3.21	4.75	8.56	11.61	16.30	26.63
	1:20:00	0.00	0.00	1.92	2.93	4.33	7.44	10.07	13.78	22.49
	1:25:00	0.00	0.00	1.76	2.67	3.83	6.47	8.72	11.57	18.83
	1:30:00	0.00	0.00	1.61	2.42	3.35	5.51	7.37	9.65	15.65
	1:35:00	0.00	0.00	1.45	2.17	2.91	4.62	6.12	7.89	12.73
	1:40:00	0.00	0.00	1.30	1.86	2.51	3.80	4.98	6.28	10.10
	1:45:00	0.00	0.00	1.18	1.59	2.20	3.06	3.96	4.87	7.86
	1:50:00	0.00	0.00	1.11	1.44	2.01	2.50	3.21	3.85	6.32
	1:55:00	0.00	0.00	0.99	1.34	1.89	2.17	2.78	3.23	5.36
	2:00:00	0.00	0.00	0.88	1.25	1.73	1.98	2.50	2.83	4.71
	2:05:00	0.00	0.00	0.72	1.01	1.40	1.56	1.97	2.17	3.63
	2:10:00	0.00	0.00	0.57	0.80	1.11	1.21	1.51	1.62	2.72
	2:15:00	0.00	0.00	0.46	0.63	0.87	0.94	1.17	1.21	2.02
	2:20:00	0.00	0.00	0.36	0.50	0.68	0.73	0.90	0.90	1.50
	2:25:00	0.00	0.00	0.28	0.39	0.53	0.56	0.69	0.68	1.13
	2:30:00	0.00	0.00	0.22	0.30	0.40	0.43	0.52	0.51	0.85
	2:35:00	0.00	0.00	0.17	0.23	0.30	0.32	0.39	0.39	0.64
	2:40:00	0.00	0.00	0.13	0.17	0.23	0.24	0.30	0.30	0.49
	2:45:00	0.00	0.00	0.10	0.13	0.18	0.19	0.23	0.23	0.37
	2:50:00	0.00	0.00	0.07	0.09	0.13	0.14	0.17	0.17	0.27
	2:55:00	0.00	0.00	0.05	0.06	0.09	0.10	0.12	0.12	0.19
	3:00:00	0.00	0.00	0.03	0.04	0.06	0.06	0.07	0.08	0.12
	3:05:00	0.00	0.00	0.02	0.03	0.03	0.04	0.04	0.04	0.07
	3:10:00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	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
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

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

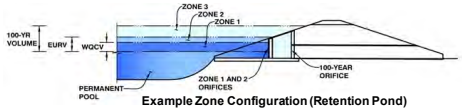
POND E - NO CLOGGING

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND E**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	17.70	acres
Watershed Length =	2,000	ft
Watershed Length to Centroid =	1,200	ft
Watershed Slope =	0.014	ft/ft
Watershed Imperviousness =	60.00%	percent
Percentage Hydrologic Soil Group A =	4.7%	percent
Percentage Hydrologic Soil Group B =	78.1%	percent
Percentage Hydrologic Soil Groups C/D =	17.2%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Erie	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

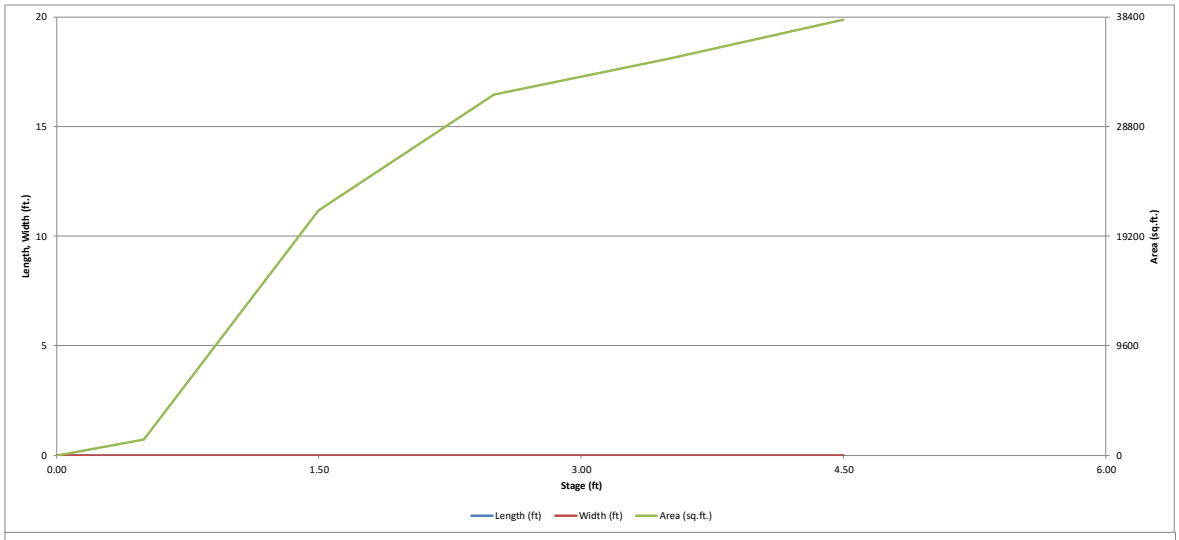
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.348	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.136	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.81 in.) =	0.650	acre-feet		inches
5-yr Runoff Volume (P1 = 1.11 in.) =	0.953	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	1.320	acre-feet		inches
25-yr Runoff Volume (P1 = 1.84 in.) =	2.044	acre-feet		inches
50-yr Runoff Volume (P1 = 2.24 in.) =	2.645	acre-feet		inches
100-yr Runoff Volume (P1 = 2.68 in.) =	3.369	acre-feet		inches
500-yr Runoff Volume (P1 = 3.89 in.) =	5.268	acre-feet		inches
Approximate 2-yr Detention Volume =	0.606	acre-feet		
Approximate 5-yr Detention Volume =	0.895	acre-feet		
Approximate 10-yr Detention Volume =	1.209	acre-feet		
Approximate 25-yr Detention Volume =	1.519	acre-feet		
Approximate 50-yr Detention Volume =	1.716	acre-feet		
Approximate 100-yr Detention Volume =	2.006	acre-feet		

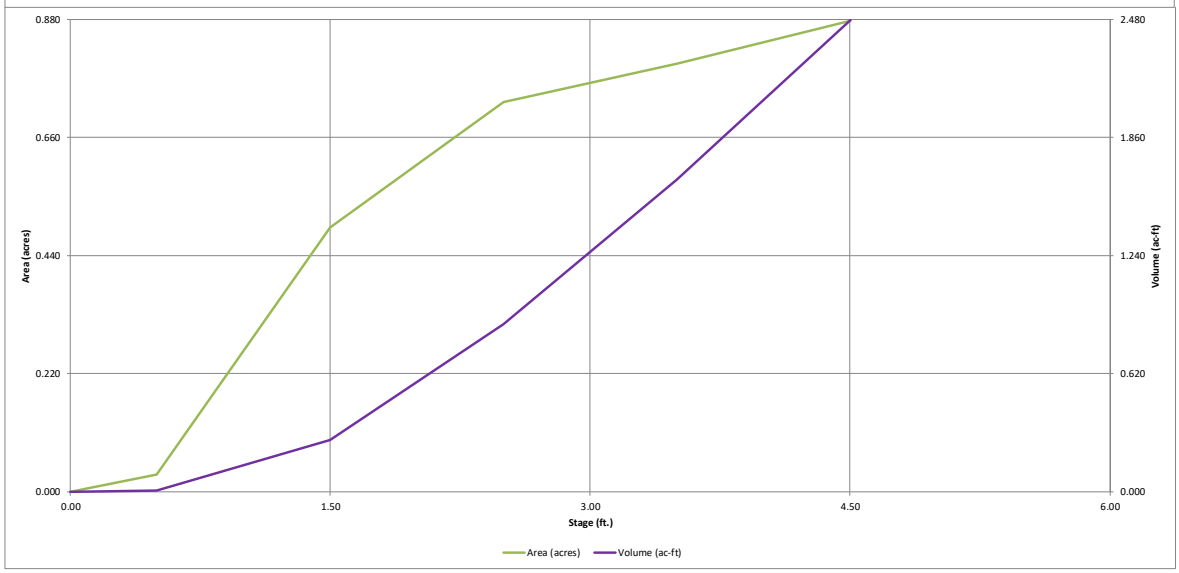
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.348	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.787	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	1.342	acre-feet
Total Detention Basin Volume =	2.478	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.50 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
4951	--	0.50	--	--	--	1,384	0.032	346	0.008
4952	--	1.50	--	--	--	21,455	0.493	11,765	0.270
4953	--	2.50	--	--	--	31,612	0.726	38,298	0.879
4954	--	3.50	--	--	--	34,730	0.797	71,469	1.641
4955	--	4.50	--	--	--	38,218	0.877	107,943	2.478


20
15
10
5
0
Length, Width (ft.)
38400
28800
19200
9600
0
Area (sq.ft.)
0.00
1.50
3.00
4.50
6.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

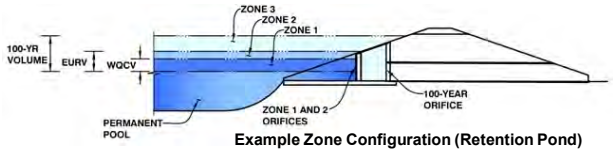

0.880
0.660
0.440
0.220
0.000
Area (acres)
2.480
1.860
1.240
0.620
0.000
Volume (ac-ft)
0.00
1.50
3.00
4.50
6.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND E**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.66	0.348	Orifice Plate
Zone 2 (EURV)	2.85	0.787	Orifice Plate
Zone 3 (User)	#VALUE!	1.342	Weir&Pipe (Restrict)
Total (all zones)		2.478	

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.00	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	sq. inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.80	1.80					
Orifice Area (sq. inches)	2.00	2.00	15.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Type =	Close Mesh Grate	N/A	
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.00	N/A	feet
Overflow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	15.72	N/A	
Overflow Grate Open Area w/o Debris =	26.09	N/A	ft^2
Overflow Grate Open Area w/ Debris =	26.09	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 =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	16.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.66	N/A	ft^2
Outlet Orifice Centroid =	0.71	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.46	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.20	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	30.00	feet
Spillway End Slopes =	10.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.51	feet
Stage at Top of Freeboard =	5.71	feet
Basin Area at Top of Freeboard =	0.88	acres
Basin Volume at Top of Freeboard =	2.48	acre-ft

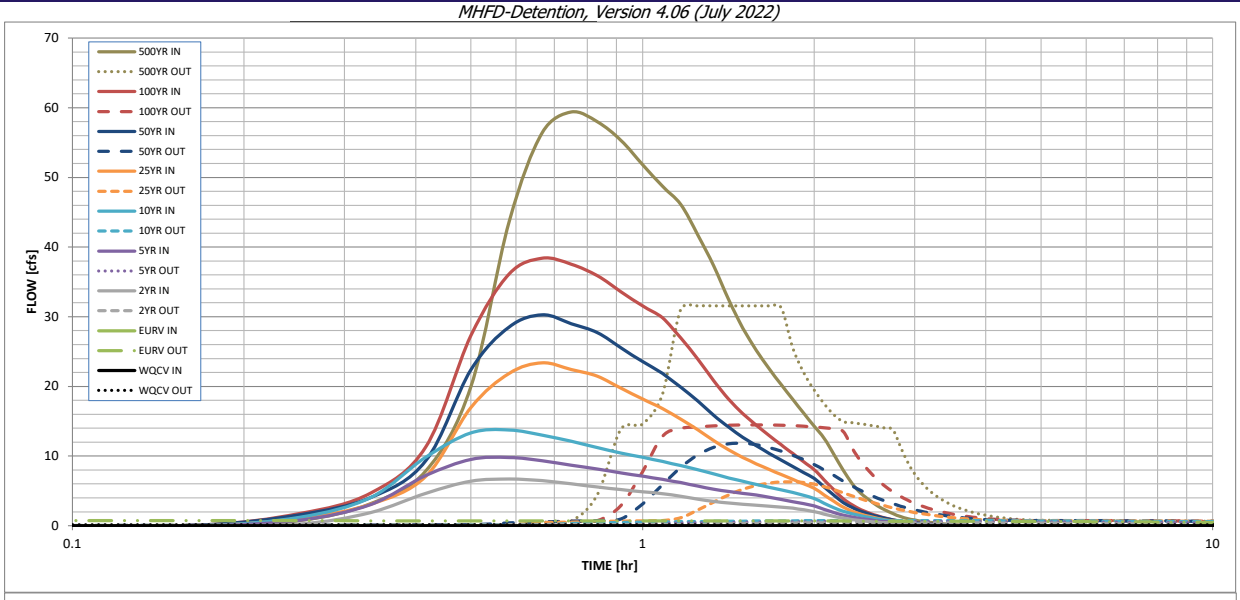
Routed Hydrograph Results

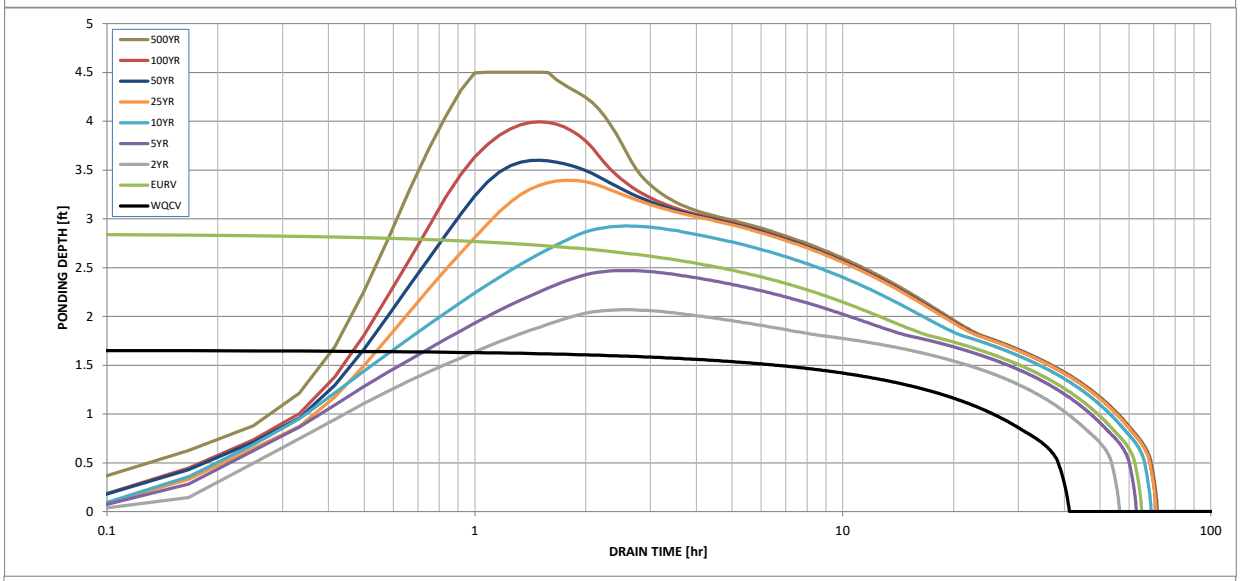
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

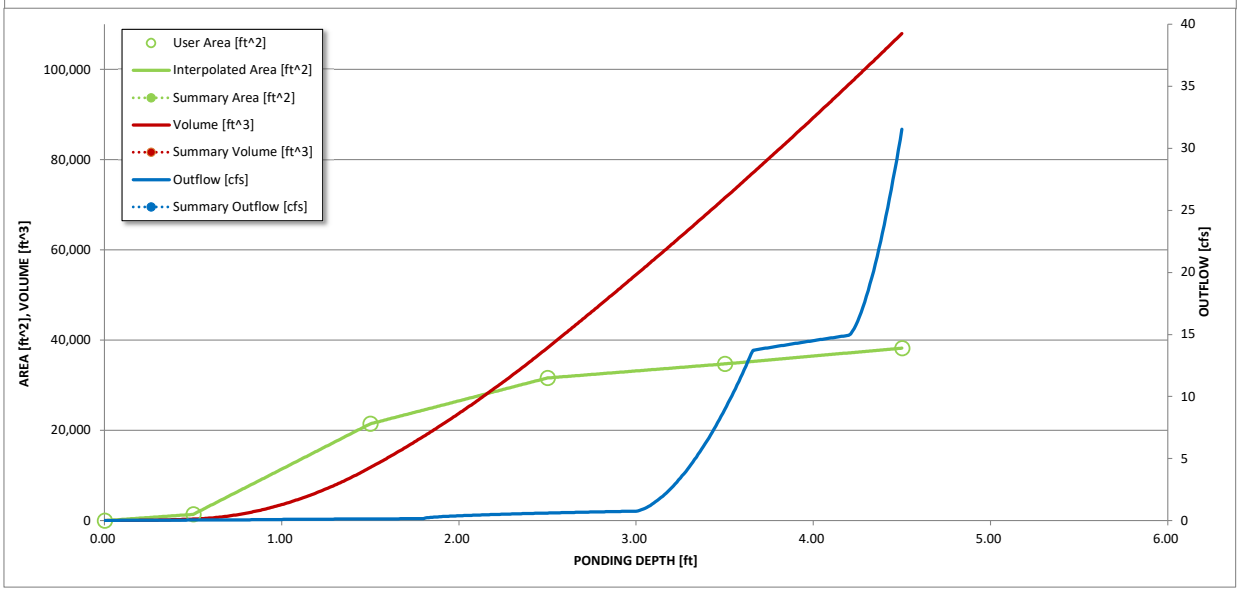
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.81	1.11	1.39	1.84	2.24	2.68	3.89
CUHP Runoff Volume (acre-ft) =	0.348	1.136	0.650	0.953	1.320	2.044	2.645	3.369	5.268
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.650	0.953	1.320	2.044	2.645	3.369	5.268
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	1.9	7.3	10.9	15.8	27.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.11	0.41	0.62	0.89	1.55
Peak Inflow Q (cfs) =	N/A	N/A	6.7	9.8	13.8	23.4	30.3	38.4	59.4
Peak Outflow Q (cfs) =	0.1	0.7	0.4	0.6	0.7	6.3	11.8	14.5	31.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.7	0.4	0.9	1.1	0.9	1.1
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.4	0.5	0.6
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	57	51	56	59	58	56	53	48
Time to Drain 99% of Inflow Volume (hours) =	**40**	61	54	60	65	66	64	63	60
Maximum Ponding Depth (ft) =	1.66	2.85	2.07	2.47	2.93	3.39	3.60	3.99	4.50
Area at Maximum Ponding Depth (acres) =	0.53	0.75	0.62	0.72	0.76	0.79	0.80	0.84	0.88
Maximum Volume Stored (acre-ft) =	0.352	1.138	0.582	0.850	1.190	1.553	1.713	2.041	2.478

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
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]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.09	0.73
	0:15:00	0.00	0.00	0.22	0.78	1.21	1.05	1.58	1.73	3.16
	0:20:00	0.00	0.00	1.91	3.05	4.05	3.08	4.06	4.69	7.86
	0:25:00	0.00	0.00	4.66	7.20	9.85	7.08	9.32	11.31	19.96
	0:30:00	0.00	0.00	6.39	9.52	13.32	16.96	22.39	27.30	43.67
	0:35:00	0.00	0.00	6.69	9.80	13.76	21.88	28.54	36.13	56.40
	0:40:00	0.00	0.00	6.47	9.32	13.01	23.37	30.27	38.38	59.38
	0:45:00	0.00	0.00	6.00	8.69	12.13	22.44	29.00	37.55	57.98
	0:50:00	0.00	0.00	5.55	8.14	11.22	21.45	27.71	35.88	55.33
	0:55:00	0.00	0.00	5.18	7.59	10.45	19.73	25.52	33.57	51.81
	1:00:00	0.00	0.00	4.88	7.11	9.81	18.17	23.56	31.54	48.73
	1:05:00	0.00	0.00	4.60	6.65	9.21	16.82	21.85	29.85	46.14
	1:10:00	0.00	0.00	4.21	6.19	8.61	15.29	19.87	26.94	41.77
	1:15:00	0.00	0.00	3.82	5.70	8.05	13.79	17.91	23.95	37.28
	1:20:00	0.00	0.00	3.49	5.24	7.44	12.22	15.86	20.80	32.42
	1:25:00	0.00	0.00	3.26	4.91	6.87	10.89	14.13	18.14	28.35
	1:30:00	0.00	0.00	3.09	4.65	6.38	9.80	12.70	16.10	25.17
	1:35:00	0.00	0.00	2.94	4.41	5.94	8.89	11.48	14.43	22.56
	1:40:00	0.00	0.00	2.80	4.09	5.53	8.08	10.40	12.96	20.25
	1:45:00	0.00	0.00	2.66	3.76	5.15	7.35	9.42	11.62	18.14
	1:50:00	0.00	0.00	2.52	3.45	4.78	6.67	8.51	10.36	16.16
	1:55:00	0.00	0.00	2.28	3.15	4.38	6.01	7.63	9.17	14.29
	2:00:00	0.00	0.00	2.02	2.83	3.90	5.37	6.78	8.05	12.53
	2:05:00	0.00	0.00	1.67	2.35	3.22	4.42	5.56	6.57	10.21
	2:10:00	0.00	0.00	1.35	1.89	2.58	3.48	4.37	5.12	7.94
	2:15:00	0.00	0.00	1.08	1.52	2.08	2.66	3.32	3.85	6.00
	2:20:00	0.00	0.00	0.89	1.25	1.72	2.08	2.60	2.97	4.66
	2:25:00	0.00	0.00	0.73	1.03	1.42	1.65	2.07	2.32	3.66
	2:30:00	0.00	0.00	0.61	0.86	1.18	1.33	1.66	1.82	2.87
	2:35:00	0.00	0.00	0.50	0.71	0.97	1.06	1.32	1.42	2.24
	2:40:00	0.00	0.00	0.41	0.58	0.79	0.85	1.05	1.09	1.73
	2:45:00	0.00	0.00	0.33	0.47	0.63	0.67	0.83	0.84	1.33
	2:50:00	0.00	0.00	0.27	0.37	0.51	0.53	0.65	0.64	1.02
	2:55:00	0.00	0.00	0.22	0.30	0.40	0.43	0.52	0.51	0.81
	3:00:00	0.00	0.00	0.18	0.24	0.32	0.34	0.41	0.41	0.65
	3:05:00	0.00	0.00	0.14	0.19	0.25	0.27	0.33	0.33	0.52
	3:10:00	0.00	0.00	0.11	0.14	0.20	0.21	0.25	0.26	0.40
	3:15:00	0.00	0.00	0.08	0.11	0.15	0.16	0.19	0.19	0.30
	3:20:00	0.00	0.00	0.06	0.08	0.11	0.11	0.14	0.14	0.22
	3:25:00	0.00	0.00	0.04	0.05	0.07	0.08	0.09	0.09	0.15
	3:30:00	0.00	0.00	0.02	0.03	0.04	0.05	0.06	0.06	0.09
	3:35:00	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.04
	3:40:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	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
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

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

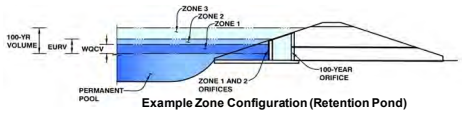
POND E - 50% CLOGGING

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND E**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	17.70	acres
Watershed Length =	2,000	ft
Watershed Length to Centroid =	1,200	ft
Watershed Slope =	0.014	ft/ft
Watershed Imperviousness =	60.00%	percent
Percentage Hydrologic Soil Group A =	4.7%	percent
Percentage Hydrologic Soil Group B =	78.1%	percent
Percentage Hydrologic Soil Groups C/D =	17.2%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Erie	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

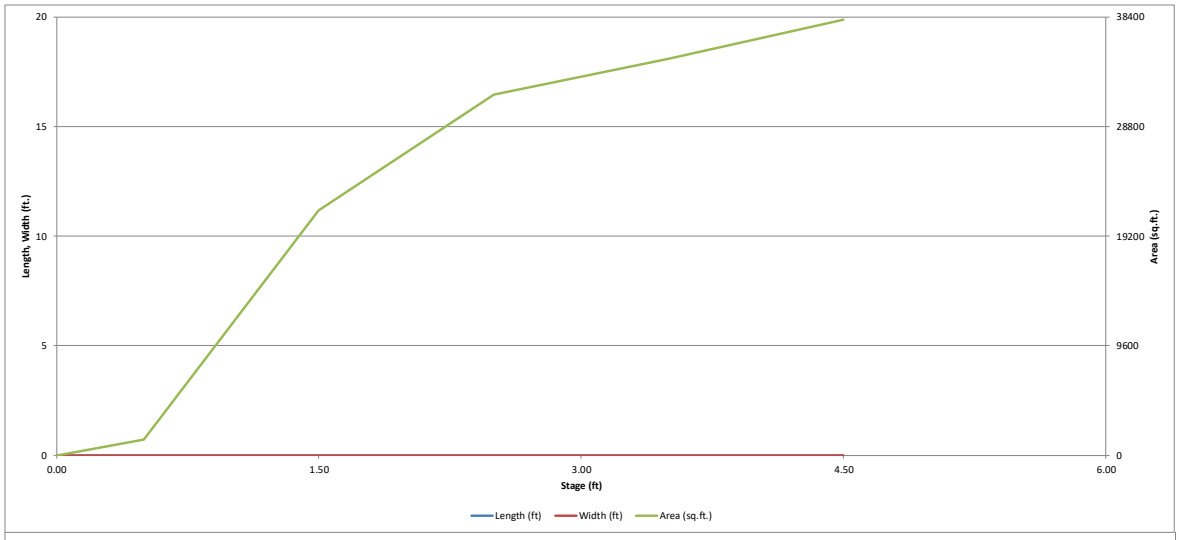
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.348	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.136	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.81 in.) =	0.650	acre-feet		inches
5-yr Runoff Volume (P1 = 1.11 in.) =	0.953	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	1.320	acre-feet		inches
25-yr Runoff Volume (P1 = 1.84 in.) =	2.044	acre-feet		inches
50-yr Runoff Volume (P1 = 2.24 in.) =	2.645	acre-feet		inches
100-yr Runoff Volume (P1 = 2.68 in.) =	3.369	acre-feet		inches
500-yr Runoff Volume (P1 = 3.89 in.) =	5.268	acre-feet		inches
Approximate 2-yr Detention Volume =	0.606	acre-feet		
Approximate 5-yr Detention Volume =	0.895	acre-feet		
Approximate 10-yr Detention Volume =	1.209	acre-feet		
Approximate 25-yr Detention Volume =	1.519	acre-feet		
Approximate 50-yr Detention Volume =	1.716	acre-feet		
Approximate 100-yr Detention Volume =	2.006	acre-feet		

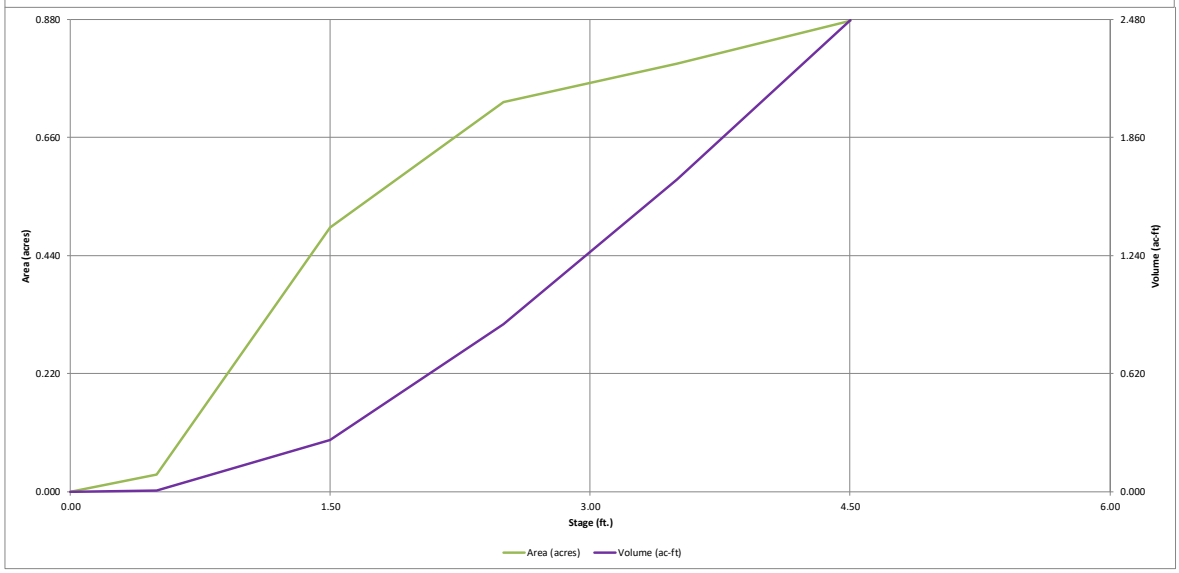
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.348	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.787	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	1.342	acre-feet
Total Detention Basin Volume =	2.478	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.50 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
4951	--	0.50	--	--	--	1,384	0.032	346	0.008
4952	--	1.50	--	--	--	21,455	0.493	11,765	0.270
4953	--	2.50	--	--	--	31,612	0.726	38,298	0.879
4954	--	3.50	--	--	--	34,730	0.797	71,469	1.641
4955	--	4.50	--	--	--	38,218	0.877	107,943	2.478


20
15
10
5
0
Length, Width (ft.)
38400
28800
19200
9600
0
Area (sq.ft.)
0.00
1.50
3.00
4.50
6.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

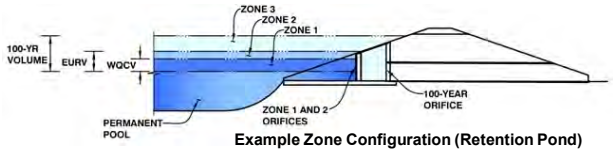

0.880
0.660
0.440
0.220
0.000
Area (acres)
2.480
1.860
1.240
0.620
0.000
Volume (ac-ft)
0.00
1.50
3.00
4.50
6.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **SPRING HILL**

Basin ID: **POND E**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.66	0.348	Orifice Plate
Zone 2 (EURV)	2.85	0.787	Orifice Plate
Zone 3 (User)	#VALUE!	1.342	Weir&Pipe (Restrict)
Total (all zones)		2.478	

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.00	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	sq. inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.80	1.80					
Orifice Area (sq. inches)	2.00	2.00	15.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Type =	Close Mesh Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.00	N/A	feet
Overflow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	15.72	N/A	
Overflow Grate Open Area w/o Debris =	26.09	N/A	ft^2
Overflow Grate Open Area w/ Debris =	13.05	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 =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	16.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.66	N/A	ft^2
Outlet Orifice Centroid =	0.71	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.46	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.20	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	30.00	feet
Spillway End Slopes =	10.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.51	feet
Stage at Top of Freeboard =	5.71	feet
Basin Area at Top of Freeboard =	0.88	acres
Basin Volume at Top of Freeboard =	2.48	acre-ft

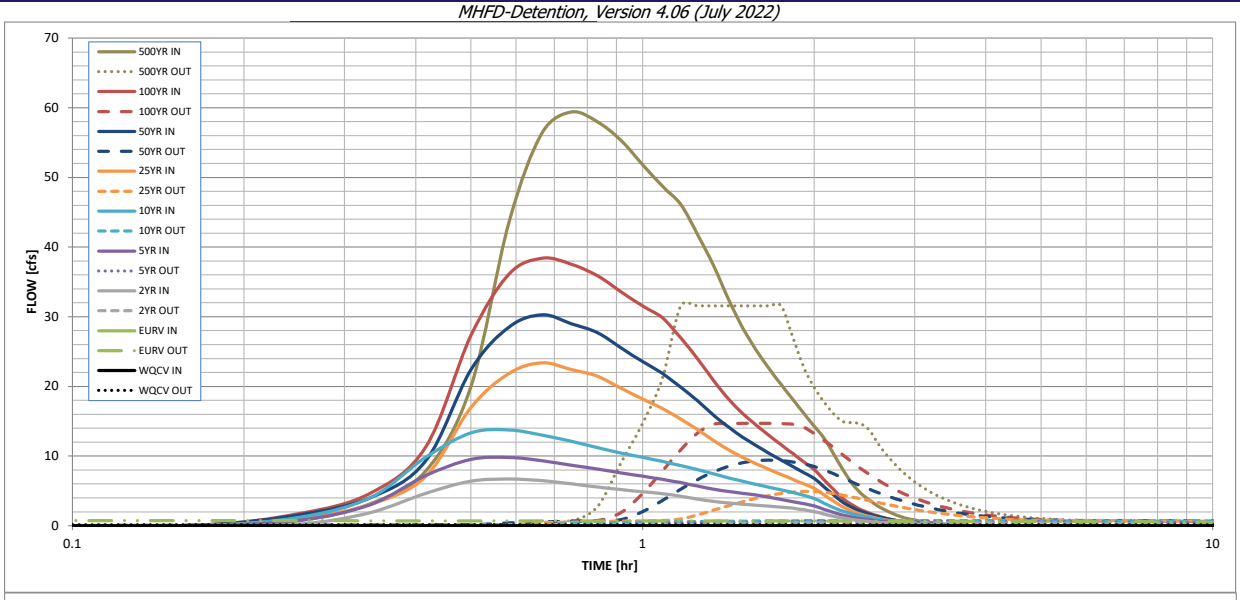
Routed Hydrograph Results

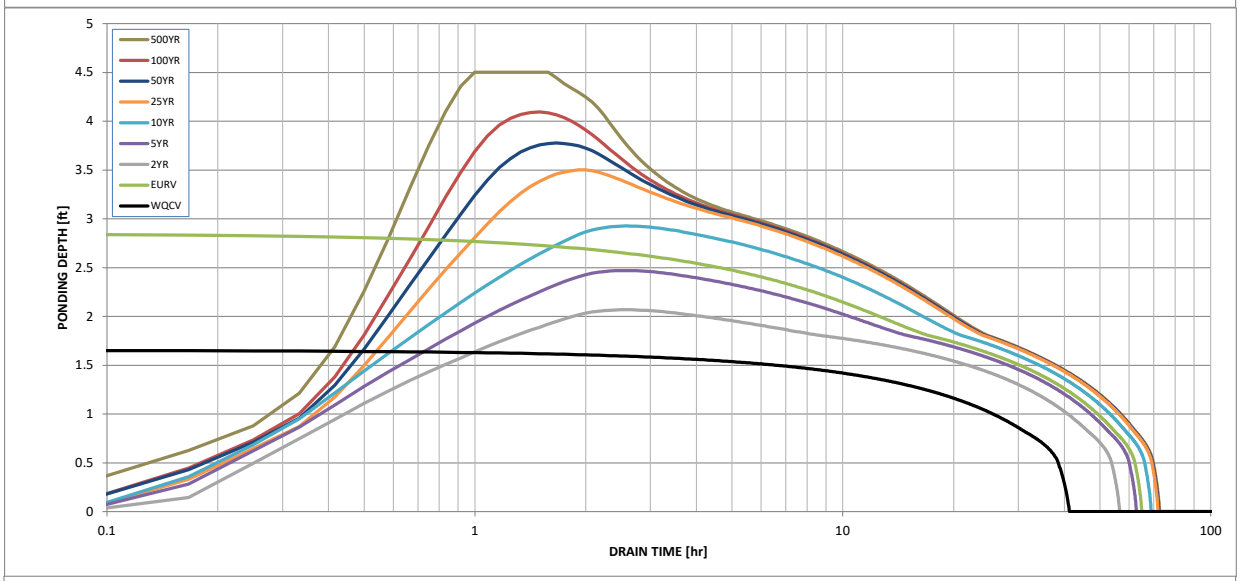
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

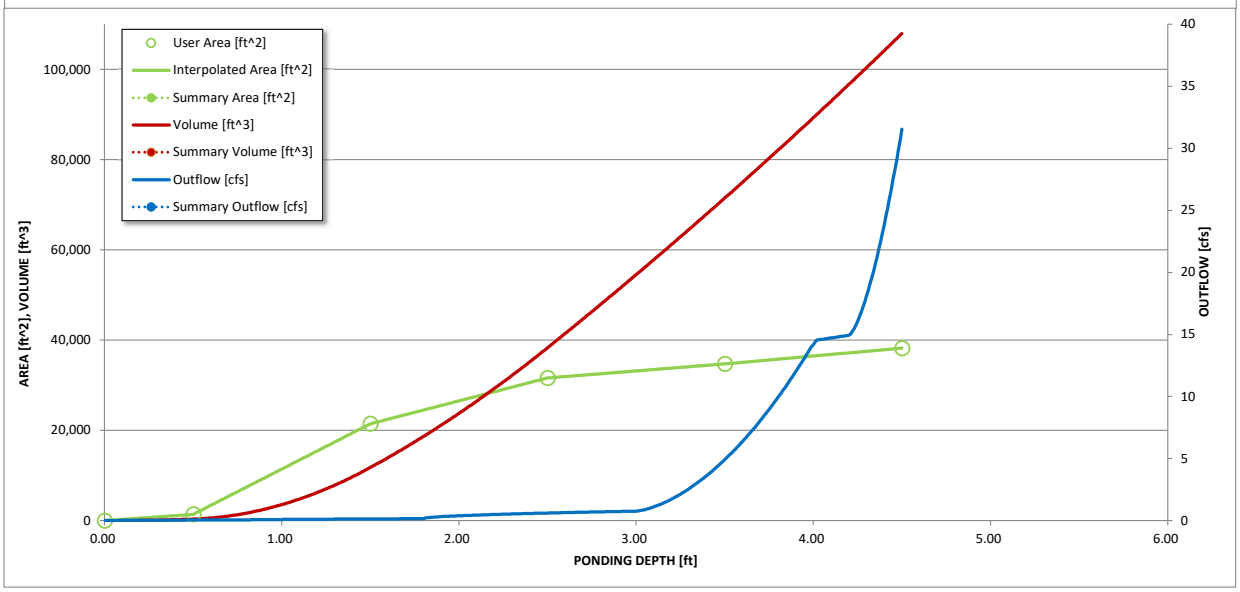
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.81	1.11	1.39	1.84	2.24	2.68	3.89
CUHP Runoff Volume (acre-ft) =	0.348	1.136	0.650	0.953	1.320	2.044	2.645	3.369	5.268
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.650	0.953	1.320	2.044	2.645	3.369	5.268
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	1.9	7.3	10.9	15.8	27.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.11	0.41	0.62	0.89	1.55
Peak Inflow Q (cfs) =	N/A	N/A	6.7	9.8	13.8	23.4	30.3	38.4	59.4
Peak Outflow Q (cfs) =	0.1	0.7	0.4	0.6	0.7	4.9	9.4	14.7	31.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.7	0.4	0.7	0.9	0.9	1.1
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.3	0.5	0.6
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	57	51	56	59	59	57	54	49
Time to Drain 99% of Inflow Volume (hours) =	**40**	61	54	60	65	66	65	64	61
Maximum Ponding Depth (ft) =	1.66	2.85	2.07	2.47	2.93	3.50	3.77	4.09	4.50
Area at Maximum Ponding Depth (acres) =	0.53	0.75	0.62	0.72	0.76	0.80	0.82	0.84	0.88
Maximum Volume Stored (acre-ft) =	0.352	1.138	0.582	0.850	1.190	1.633	1.859	2.125	2.478

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
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]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.09	0.73
	0:15:00	0.00	0.00	0.22	0.78	1.21	1.05	1.58	1.73	3.16
	0:20:00	0.00	0.00	1.91	3.05	4.05	3.08	4.06	4.69	7.86
	0:25:00	0.00	0.00	4.66	7.20	9.85	7.08	9.32	11.31	19.96
	0:30:00	0.00	0.00	6.39	9.52	13.32	16.96	22.39	27.30	43.67
	0:35:00	0.00	0.00	6.69	9.80	13.76	21.88	28.54	36.13	56.40
	0:40:00	0.00	0.00	6.47	9.32	13.01	23.37	30.27	38.38	59.38
	0:45:00	0.00	0.00	6.00	8.69	12.13	22.44	29.00	37.55	57.98
	0:50:00	0.00	0.00	5.55	8.14	11.22	21.45	27.71	35.88	55.33
	0:55:00	0.00	0.00	5.18	7.59	10.45	19.73	25.52	33.57	51.81
	1:00:00	0.00	0.00	4.88	7.11	9.81	18.17	23.56	31.54	48.73
	1:05:00	0.00	0.00	4.60	6.65	9.21	16.82	21.85	29.85	46.14
	1:10:00	0.00	0.00	4.21	6.19	8.61	15.29	19.87	26.94	41.77
	1:15:00	0.00	0.00	3.82	5.70	8.05	13.79	17.91	23.95	37.28
	1:20:00	0.00	0.00	3.49	5.24	7.44	12.22	15.86	20.80	32.42
	1:25:00	0.00	0.00	3.26	4.91	6.87	10.89	14.13	18.14	28.35
	1:30:00	0.00	0.00	3.09	4.65	6.38	9.80	12.70	16.10	25.17
	1:35:00	0.00	0.00	2.94	4.41	5.94	8.89	11.48	14.43	22.56
	1:40:00	0.00	0.00	2.80	4.09	5.53	8.08	10.40	12.96	20.25
	1:45:00	0.00	0.00	2.66	3.76	5.15	7.35	9.42	11.62	18.14
	1:50:00	0.00	0.00	2.52	3.45	4.78	6.67	8.51	10.36	16.16
	1:55:00	0.00	0.00	2.28	3.15	4.38	6.01	7.63	9.17	14.29
	2:00:00	0.00	0.00	2.02	2.83	3.90	5.37	6.78	8.05	12.53
	2:05:00	0.00	0.00	1.67	2.35	3.22	4.42	5.56	6.57	10.21
	2:10:00	0.00	0.00	1.35	1.89	2.58	3.48	4.37	5.12	7.94
	2:15:00	0.00	0.00	1.08	1.52	2.08	2.66	3.32	3.85	6.00
	2:20:00	0.00	0.00	0.89	1.25	1.72	2.08	2.60	2.97	4.66
	2:25:00	0.00	0.00	0.73	1.03	1.42	1.65	2.07	2.32	3.66
	2:30:00	0.00	0.00	0.61	0.86	1.18	1.33	1.66	1.82	2.87
	2:35:00	0.00	0.00	0.50	0.71	0.97	1.06	1.32	1.42	2.24
	2:40:00	0.00	0.00	0.41	0.58	0.79	0.85	1.05	1.09	1.73
	2:45:00	0.00	0.00	0.33	0.47	0.63	0.67	0.83	0.84	1.33
	2:50:00	0.00	0.00	0.27	0.37	0.51	0.53	0.65	0.64	1.02
	2:55:00	0.00	0.00	0.22	0.30	0.40	0.43	0.52	0.51	0.81
	3:00:00	0.00	0.00	0.18	0.24	0.32	0.34	0.41	0.41	0.65
	3:05:00	0.00	0.00	0.14	0.19	0.25	0.27	0.33	0.33	0.52
	3:10:00	0.00	0.00	0.11	0.14	0.20	0.21	0.25	0.26	0.40
	3:15:00	0.00	0.00	0.08	0.11	0.15	0.16	0.19	0.19	0.30
	3:20:00	0.00	0.00	0.06	0.08	0.11	0.11	0.14	0.14	0.22
	3:25:00	0.00	0.00	0.04	0.05	0.07	0.08	0.09	0.09	0.15
	3:30:00	0.00	0.00	0.02	0.03	0.04	0.05	0.06	0.06	0.09
	3:35:00	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.04
	3:40:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	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
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

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

Westwood

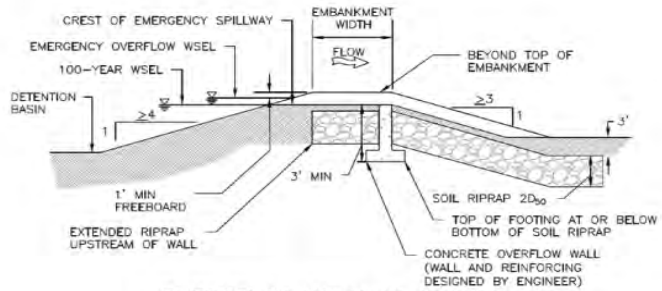
Appendix B – Hydraulic Computations

Spillway Riprap Sizing

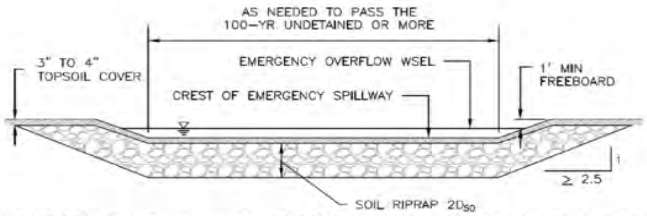
Emergency Spillway Sizing

Project Name: SPRING HILL
Calculated By: GR
Checked By: MS
Date: 6/2/2025

	POND A								
	Q	C	H	Z	Qsides	Middle W	Side W	Top W	Unit discharge Q/L
Min Width	78.9	3	1	10	24.0	18.3	20	58.3	4.31
Actual Width	78.9	3	1.04956	10	27.1	20.0	20.4956	61.0	3.945
USE TYPE		**M**	**RIPRAP**						



EMERGENCY SPILLWAY PROFILE



EMERGENCY SPILLWAY SECTION AND SPILLWAY CHANNEL

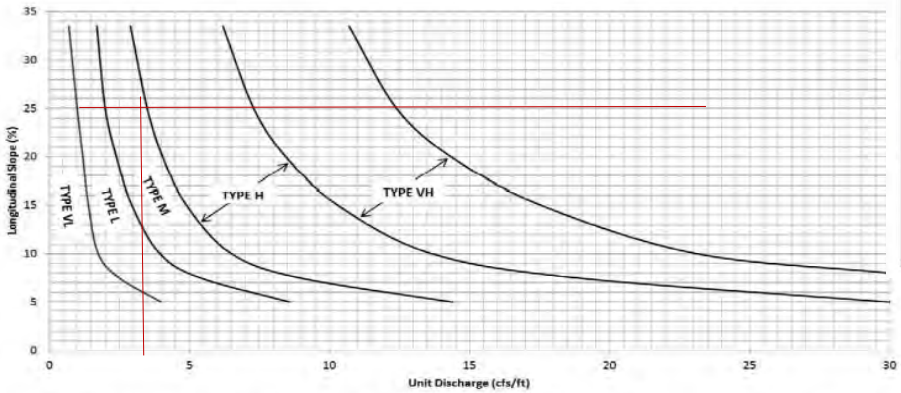


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

Table 17.1 Standard CDOT gradations for rock riprap.

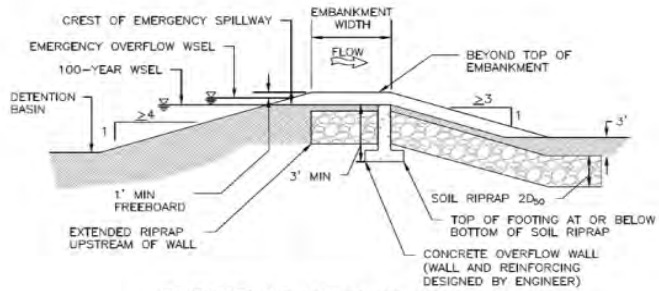
Pay Item	Stone Size d50[1] (Inches)	Percent of Material Smaller Than Typical Stone[2]	Typical Stone Dimensions[3] (Inches)	Typical Stone Weight[4] (Pounds)
Riprap	6	70-100 50-70 35-50 2-10	12 9 6 2	85 35 10 0.4
Riprap	9	70-100 50-70 35-50 2-10	15 12 9 3	160 85 35 1.3
Riprap	12	70-100 50-70 35-50 2-10	21 18 12 4	440 275 85 3
Riprap	18	100 50-70 35-50 2-10	30 24 18 6	1280 650 275 10
Riprap	24	100 50-70 35-50 2-10	42 33 24 9	3500 1700 650 35

[1]d50 = nominal stone size
[2]based on typical rock mass
[3]equivalent spherical diameter
[4]based on a specific gravity = 2.5

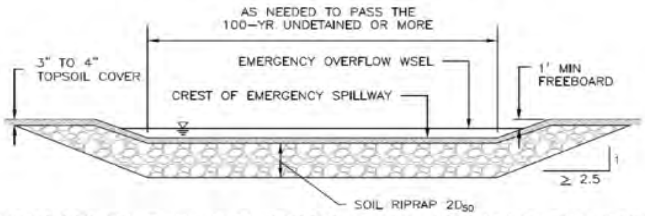
Emergency Spillway Sizing

Project Name: SPRING HILL
Calculated By: GR
Checked By: MS
Date: 6/2/2025

	POND B								
	Q	C	H	Z	Qsides	Middle W	Side W	Top W	Unit discharge Q/L
Min Width	41.3	3	1	10	24.0	5.8	20	45.8	7.16
Actual Width	41.3	3	1.04956	10	27.1	20.0	20.4956	61.0	2.065
USE TYPE	L	RIPRAP							



EMERGENCY SPILLWAY PROFILE



EMERGENCY SPILLWAY SECTION AND SPILLWAY CHANNEL

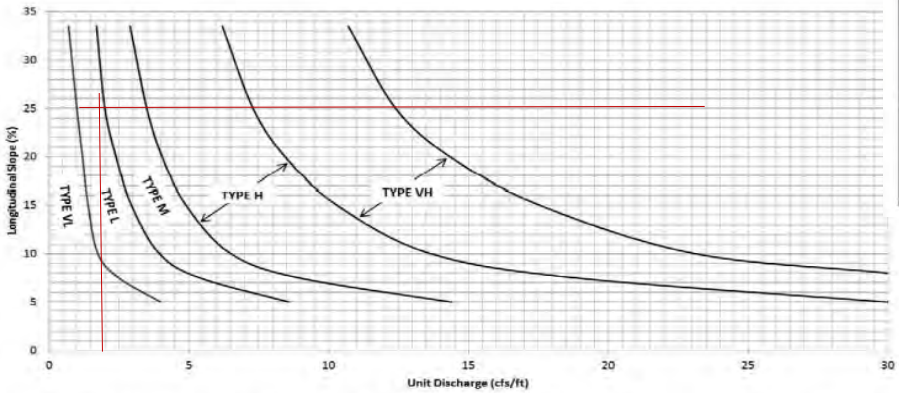


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

Table 17.1 Standard CDOT gradations for rock riprap.

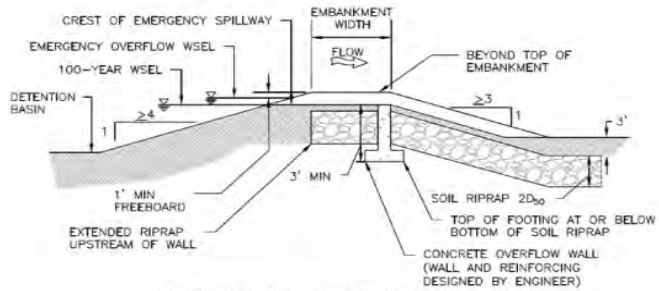
Pay Item	Stone Size d50[1] (Inches)	Percent of Material Smaller Than Typical Stone[2]	Typical Stone Dimensions[3] (Inches)	Typical Stone Weight[4] (Pounds)
Riprap	6	70-100 50-70 35-50 2-10	12 9 6 2	85 35 10 0.4
Riprap	9	70-100 50-70 35-50 2-10	15 12 9 3	160 85 35 1.3
Riprap	12	70-100 50-70 35-50 2-10	21 18 12 4	440 275 85 3
Riprap	18	100 50-70 35-50 2-10	30 24 18 6	1280 650 275 10
Riprap	24	100 50-70 35-50 2-10	42 33 24 9	3500 1700 650 35

[1]d50 = nominal stone size
[2]based on typical rock mass
[3]equivalent spherical diameter
[4]based on a specific gravity = 2.5

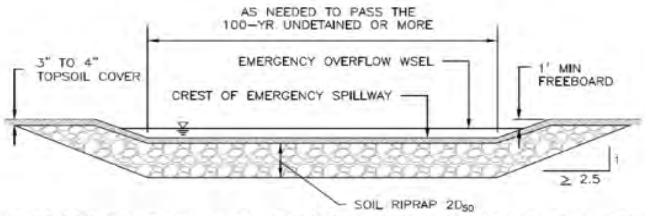
Emergency Spillway Sizing

Project Name: SPRING HILL
Calculated By: GR
Checked By: MS
Date: 6/2/2025

POND C	Q	C	H	Z	Qsides	Middle W	Side W	Top W	Unit discharge Q/L
Min Width	14.3	3	1	10	24.0	-3.2	20	36.8	-4.42
Actual Width	14.3	3	1.04956	10	27.1	10.0	20.4956	61.0	1.43
USE TYPE		L	RIPRAP						



EMERGENCY SPILLWAY PROFILE



EMERGENCY SPILLWAY SECTION AND SPILLWAY CHANNEL

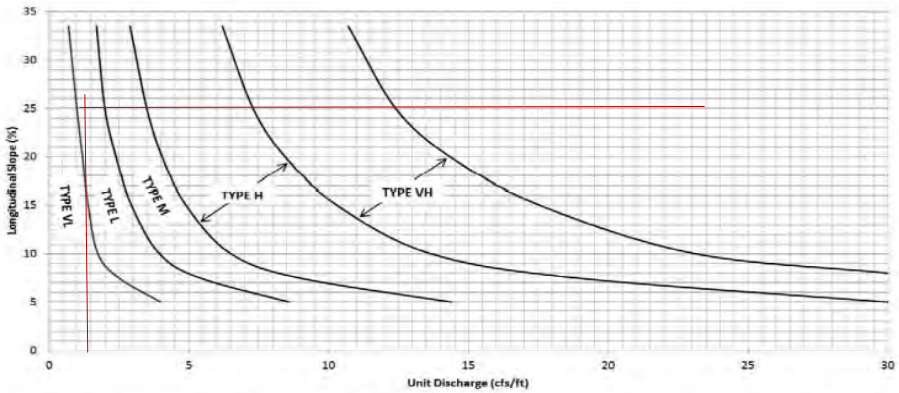


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

Table 17.1 Standard CDOT gradations for rock riprap.

Pay Item	Stone Size d50[1] (Inches)	Percent of Material Smaller Than Typical Stone[2]	Typical Stone Dimensions[3] (Inches)	Typical Stone Weight[4] (Pounds)
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Riprap	12	70-100 50-70 35-50 2-10	21 18 12 4	440 275 85 3
Riprap	18	100 50-70 35-50 2-10	30 24 18 6	1280 650 275 10
Riprap	24	100 50-70 35-50 2-10	42 33 24 9	3500 1700 650 35

[1]d50 = nominal stone size
[2]based on typical rock mass
[3]equivalent spherical diameter
[4]based on a specific gravity = 2.5

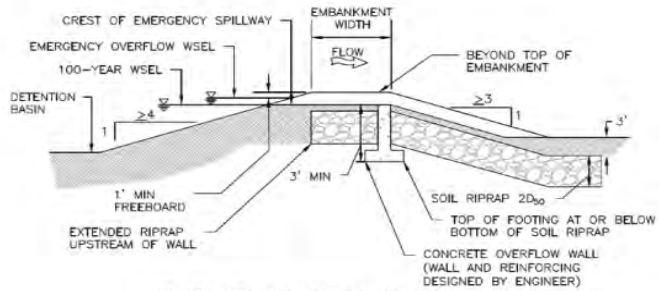
Emergency Spillway Sizing

Project Name: SPRING HILL
Calculated By: GR
Checked By: MS
Date: 6/2/2025

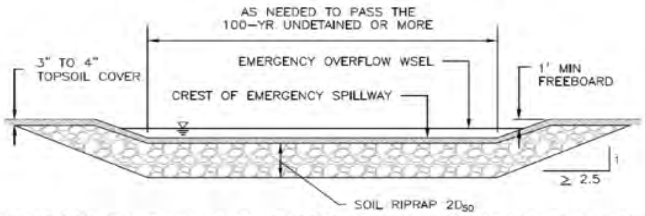
POND D

	Q	C	H	Z	Qsides	Middle W	Side W	Top W	Unit discharge Q/L
Min Width	9.7	3	1	10	24.0	-4.8	20	35.2	-2.03
Actual Width	9.7	3	1.04956	10	27.1	10.0	20.4956	61.0	0.97

USE TYPE **VL** **RIPRAP**



EMERGENCY SPILLWAY PROFILE



EMERGENCY SPILLWAY SECTION AND SPILLWAY CHANNEL

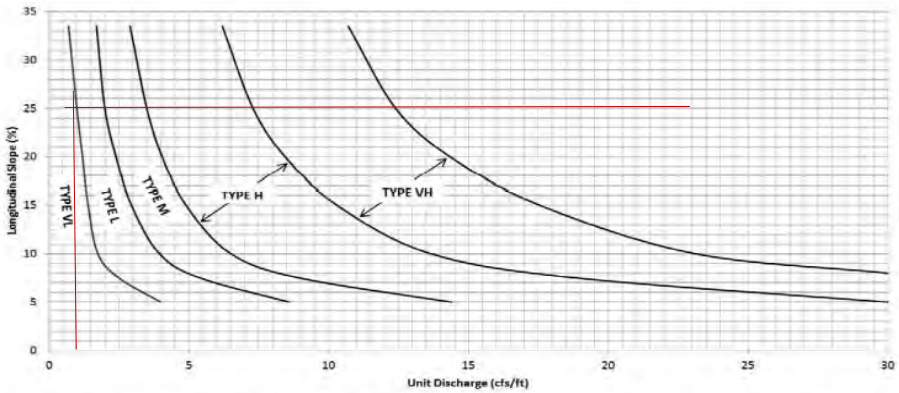


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

Table 17.1 Standard CDOT gradations for rock riprap.

Pay Item	Stone Size d50[1] (Inches)	Percent of Material Smaller Than Typical Stone[2]	Typical Stone Dimensions[3] (Inches)	Typical Stone Weight[4] (Pounds)
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[1]d50 = nominal stone size
[2]based on typical rock mass
[3]equivalent spherical diameter
[4]based on a specific gravity = 2.5

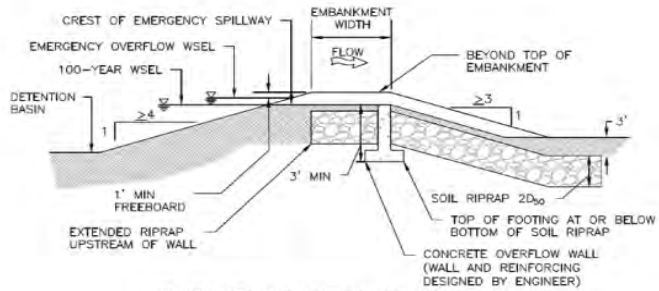
Emergency Spillway Sizing

Project Name: SPRING HILL
Calculated By: GR
Checked By: MS
Date: 6/2/2025

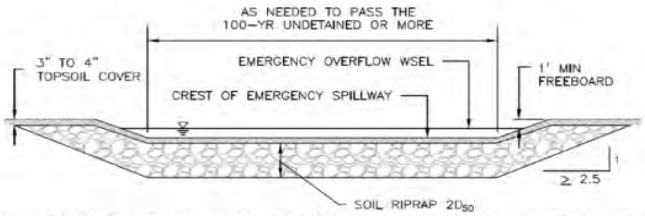
POND E

	Q	C	H	Z	Qsides	Middle W	Side W	Top W	Unit discharge Q/L
Min Width	14.7	3	1	10	24.0	-3.1	20	36.9	-4.74
Actual Width	14.7	3	1.04956	10	27.1	10.0	20.4956	61.0	1.47

USE TYPE L **RIPRAP**



EMERGENCY SPILLWAY PROFILE



EMERGENCY SPILLWAY SECTION AND SPILLWAY CHANNEL

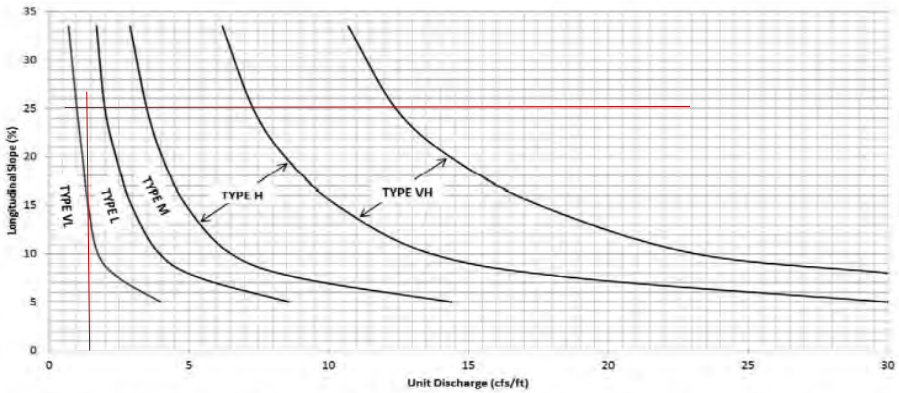


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

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Riprap	24	100 50-70 35-50 2-10	42 33 24 9	3500 1700 650 35

[1]d50 = nominal stone size
[2]based on typical rock mass
[3]equivalent spherical diameter
[4]based on a specific gravity = 2.5

Westwood

Appendix B – Hydraulic Computations

Inlet and Street Capacity Calculations

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	29-A	29a-A
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	2.25	0.77
Major Q_{Known} (cfs)	12.88	4.33

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**2.25**	**0.77**
Major Total Design Peak Flow, Q (cfs)	**12.88**	**4.33**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.00	0.00
Major Flow Bypassed Downstream, Q_b (cfs)	1.81	0.02

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	28-A	27-A
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.44	1.19
Major Q_{Known} (cfs)	2.69	5.96

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**0.44**	**1.19**
Major Total Design Peak Flow, Q (cfs)	**2.69**	**5.96**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.00	0.00
Major Flow Bypassed Downstream, Q_b (cfs)	0.37	0.30

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	20-A	20a-A
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	4.38	1.68
Major Q_{Known} (cfs)	24.49	14.86

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**4.38**	**1.68**
Major Total Design Peak Flow, Q (cfs)	**24.49**	**14.86**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.01	0.00
Major Flow Bypassed Downstream, Q_b (cfs)	5.71	2.78

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	19-A	16-A
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.98	1.45
Major Q_{Known} (cfs)	5.32	8.70

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**0.98**	**1.45**
Major Total Design Peak Flow, Q (cfs)	**5.32**	**8.70**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.00	0.00
Major Flow Bypassed Downstream, Q_b (cfs)	0.06	0.19

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	15-A	14-A
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.20	0.90
Major Q_{Known} (cfs)	9.26	3.83

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.20**	**0.90**
Major Total Design Peak Flow, Q (cfs)	**9.26**	**3.83**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.00	0.00
Major Flow Bypassed Downstream, Q_b (cfs)	1.77	0.00

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	9-A	7a-A
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.02	2.58
Major Q_{Known} (cfs)	4.47	12.50

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.02**	**2.58**
Major Total Design Peak Flow, Q (cfs)	**4.47**	**12.50**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.00	0.00
Major Flow Bypassed Downstream, Q_b (cfs)	0.00	1.65

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	7-A	6-A
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.93	1.02
Major Q_{Known} (cfs)	11.04	10.03

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.93**	**1.02**
Major Total Design Peak Flow, Q (cfs)	**11.04**	**10.03**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.00	0.00
Major Flow Bypassed Downstream, Q_b (cfs)	2.88	2.29

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	4-A	3a-A
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.40	1.30
Major Q_{Known} (cfs)	5.68	7.93

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.40**	**1.30**
Major Total Design Peak Flow, Q (cfs)	**5.68**	**7.93**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.00	0.00
Major Flow Bypassed Downstream, Q_b (cfs)	0.08	1.15

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	3-A	2-A
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.62	0.78
Major Q_{Known} (cfs)	8.96	3.51

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.62**	**0.78**
Major Total Design Peak Flow, Q (cfs)	**8.96**	**3.51**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.00	0.00
Major Flow Bypassed Downstream, Q_b (cfs)	0.50	0.00

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	1a-A
Site Type (Urban or Rural)	
Inlet Application (Street or Area)	STREET
Hydraulic Condition	On Grade
Inlet Type	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.01
Major Q_{Known} (cfs)	6.41

CALCULATED OUTPUT

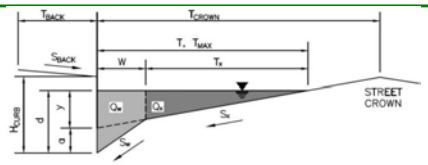
Minor Total Design Peak Flow, Q (cfs)	**1.01**
Major Total Design Peak Flow, Q (cfs)	**6.41**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.00
Major Flow Bypassed Downstream, Q_b (cfs)	2.81

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: SPRING HILL
Inlet ID: 29-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

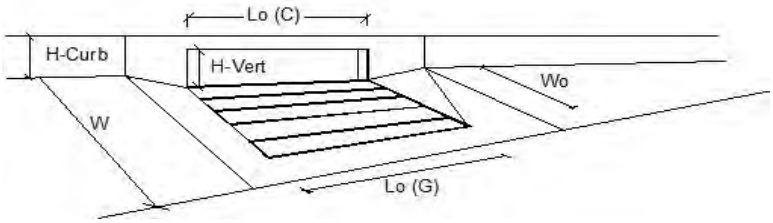
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.25 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 12.88 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

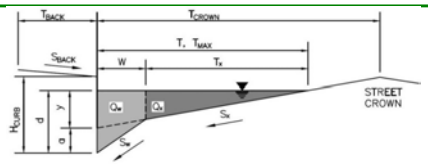


	Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
	Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Warning 2	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.04	0.04	
	Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
	Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	2.3	12.9	cfs
	Water Spread Width	T =	9.1	17.0	ft
	Water Depth at Flowline (outside of local depression)	d =	3.7	5.9	inches
	Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.3	inches
	Ratio of Gutter Flow to Design Flow	E_o =	0.625	0.325	
	Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.8	7.8	cfs
	Discharge within the Gutter Section W	Q_w =	1.4	3.8	cfs
	Discharge Behind the Curb Face	Q_{BACK} =	0.0	1.3	cfs
	Flow Area within the Gutter Section W	A_W =	0.45	0.82	sq ft
	Velocity within the Gutter Section W	V_W =	3.1	4.6	fps
	Water Depth for Design Condition	d_{LOCAL} =	8.7	10.9	inches
	Grate Analysis (Calculated)		MINOR	MAJOR	
	Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
	Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
	Under No-Clogging Condition		MINOR	MAJOR	
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Interception Capacity	Q_i =	N/A	N/A	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
	Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
	Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
	Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
	Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
	Equivalent Slope S_e	S_e =	0.190	0.108	ft/ft
	Required Length L_T to Have 100% Interception	L_T =	6.00	17.92	ft
	Under No-Clogging Condition		MINOR	MAJOR	
	Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	6.00	15.00	ft
	Interception Capacity	Q_i =	2.3	11.1	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient	CurbCoeff =	1.31	1.31	
	Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.02	0.02	
	Effective (Unclogged) Length	L_e =	6.00	14.71	ft
	Actual Interception Capacity	**Q_a =**	**2.3**	**11.1**	**cfs**
	Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.5**	**cfs**
	Summary		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**2.3**	**11.1**	**cfs**
	Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.8**	**cfs**
	Capture Percentage = Q_a/Q_o	**C% =**	**100**	**86**	**%**

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

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

Project: **SPRING HILL**
Inlet ID: **29a-A**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

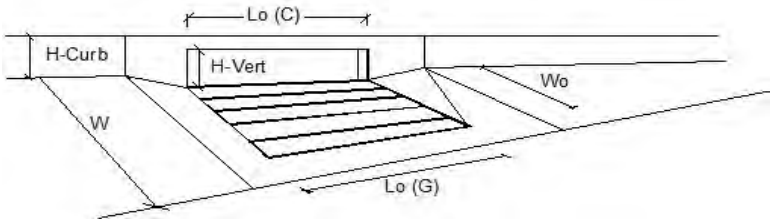
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.77 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.33 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

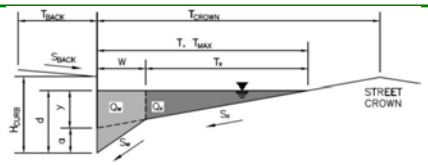


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.8	4.3	cfs
Water Spread Width	T =	5.0	12.1	ft
Water Depth at Flowline (outside of local depression)	d =	2.7	4.4	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.891	0.486	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.1	2.2	cfs
Discharge within the Gutter Section W	Q_w =	0.7	2.1	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.29	0.57	sq ft
Velocity within the Gutter Section W	V_W =	2.4	3.7	fps
Water Depth for Design Condition	d_{LOCAL} =	7.7	9.4	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.262	0.152	ft/ft
Required Length L_T to Have 100% Interception	L_T =	2.99	9.25	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	2.99	9.25	ft
Interception Capacity	Q_i =	0.8	4.3	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	2.99	9.25	ft
Actual Interception Capacity	**Q_a =**	**0.8**	**4.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.8**	**4.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**99**	**%**

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

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

Project: SPRING HILL
Inlet ID: 28-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

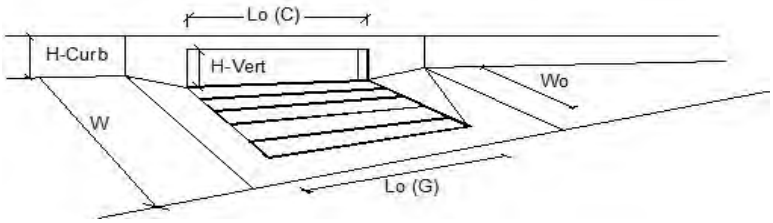
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.44 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.69 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

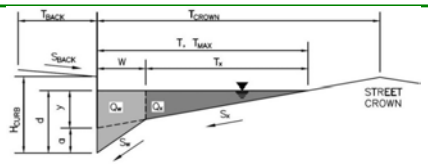


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.4	2.7	cfs
Water Spread Width	T =	2.3	9.9	ft
Water Depth at Flowline (outside of local depression)	d =	2.1	3.9	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	1.000	0.584	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.0	1.1	cfs
Discharge within the Gutter Section W	Q_w =	0.4	1.6	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.18	0.48	sq ft
Velocity within the Gutter Section W	V_W =	2.5	3.3	fps
Water Depth for Design Condition	d_{LOCAL} =	7.1	8.9	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.291	0.178	ft/ft
Required Length L_T to Have 100% Interception	L_T =	2.14	6.76	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	2.14	5.00	ft
Interception Capacity	Q_i =	0.4	2.5	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.10	0.10	
Effective (Unclogged) Length	L_e =	2.14	4.50	ft
Actual Interception Capacity	**Q_a =**	**0.4**	**2.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.4**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.4**	**2.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.4**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**86**	**%**

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

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

Project: **SPRING HILL**
Inlet ID: **27-A**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.9	6.9	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	3.7	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.9	0.9	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.5**	**11.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.3	2.3	

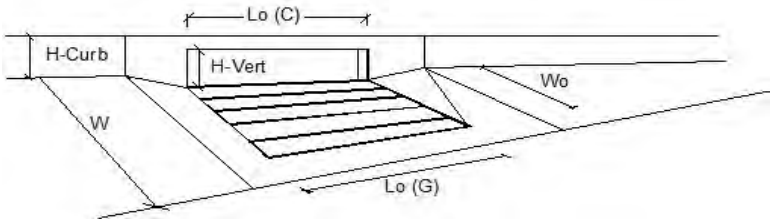
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.4	17.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.8	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	1.8	5.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.3	27.9	cfs
Average Flow Velocity Within the Gutter Section	V =	3.7	5.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.4	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.3**	**27.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.3**	**27.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.19 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.96 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



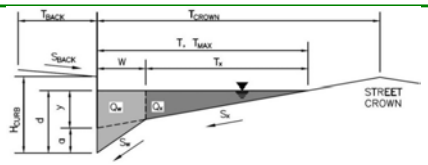
Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.2	6.0	cfs
Water Spread Width	T =	6.2	13.3	ft
Water Depth at Flowline (outside of local depression)	d =	3.0	4.7	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.807	0.445	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.2	3.3	cfs
Discharge within the Gutter Section W	Q_w =	1.0	2.6	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W	A_W =	0.33	0.62	sq ft
Velocity within the Gutter Section W	V_W =	2.9	4.2	fps
Water Depth for Design Condition	d_{LOCAL} =	8.0	9.7	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.239	0.141	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.94	11.33	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.94	10.00	ft
Interception Capacity	Q_i =	1.2	5.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	3.94	9.61	ft
Actual Interception Capacity	**Q_a =**	**1.2**	**5.7**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.2**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.2**	**5.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.3**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**95**	**%**

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: SPRING HILL
Inlet ID: 20-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.9	6.9	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	3.7	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.9	0.9	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.5**	**11.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.3	2.3	

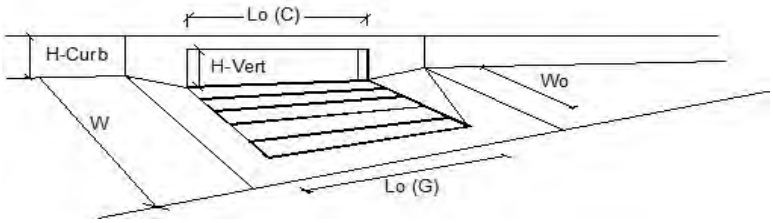
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.4	17.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.8	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	1.8	5.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.3	27.9	cfs
Average Flow Velocity Within the Gutter Section	V =	3.7	5.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.4	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.3**	**27.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.3**	**27.9**	**cfs**

WARNING: MINOR STORM max. allowable capacity is less than the design peak flow of 4.38 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 24.49 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

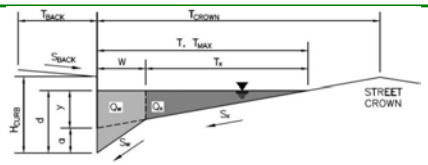


Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR & MAJOR STORM		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	4.4	24.5	cfs
Water Spread Width	T =	11.7	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	4.3	6.8	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	1.3	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.501	0.271	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	2.2	14.8	cfs
Discharge within the Gutter Section W	Q_w =	2.2	5.5	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	4.1	cfs
Flow Area within the Gutter Section W	A_W =	0.56	0.98	sq ft
Velocity within the Gutter Section W	V_W =	3.9	5.6	fps
Water Depth for Design Condition	d_{LOCAL} =	9.3	11.8	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.156	0.093	ft/ft
Required Length L_T to Have 100% Interception	L_T =	9.30	25.82	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	9.30	20.00	ft
Interception Capacity	Q_i =	4.4	19.0	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.33	1.33	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.02	0.02	
Effective (Unclogged) Length	L_e =	9.30	19.58	ft
Actual Interception Capacity	**Q_a =**	**4.4**	**18.8**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**1.6**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.4**	**18.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**5.7**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**77**	**%**

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

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

Project: **SPRING HILL**
Inlet ID: **20a-A**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

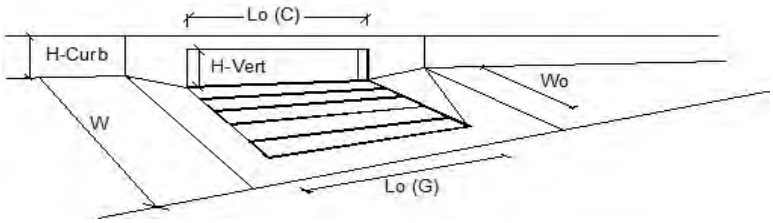
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.68 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 14.86 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

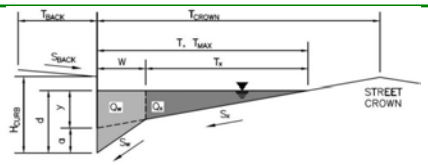


	Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
	Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Warning 2	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.04	0.04	
	Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
	Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.7	14.9	cfs
	Water Spread Width	T =	7.8	17.0	ft
	Water Depth at Flowline (outside of local depression)	d =	3.4	6.1	inches
	Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.5	inches
	Ratio of Gutter Flow to Design Flow	E_o =	0.697	0.309	
	Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.5	9.1	cfs
	Discharge within the Gutter Section W	Q_w =	1.2	4.0	cfs
	Discharge Behind the Curb Face	Q_{BACK} =	0.0	1.7	cfs
	Flow Area within the Gutter Section W	A_W =	0.40	0.86	sq ft
	Velocity within the Gutter Section W	V_W =	2.9	4.7	fps
	Water Depth for Design Condition	d_{LOCAL} =	8.4	11.1	inches
	Grate Analysis (Calculated)		MINOR	MAJOR	
	Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
	Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
	Under No-Clogging Condition		MINOR	MAJOR	
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Interception Capacity	Q_i =	N/A	N/A	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
	Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
	Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
	Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
	Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
	Equivalent Slope S_e	S_e =	0.209	0.104	ft/ft
	Required Length L_T to Have 100% Interception	L_T =	4.94	19.46	ft
	Under No-Clogging Condition		MINOR	MAJOR	
	Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.94	15.00	ft
	Interception Capacity	Q_i =	1.7	12.2	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient	CurbCoeff =	1.31	1.31	
	Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.02	0.02	
	Effective (Unclogged) Length	L_e =	4.94	14.71	ft
	Actual Interception Capacity	**Q_a =**	**1.7**	**12.1**	**cfs**
	Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**1.0**	**cfs**
	Summary		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**1.7**	**12.1**	**cfs**
	Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.8**	**cfs**
	Capture Percentage = Q_a/Q_o	**C% =**	**100**	**81**	**%**

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

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

Project: SPRING HILL
Inlet ID: 19-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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 =	0.022		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	9.3	9.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	5.0	5.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.2	1.2	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**15.5**	**15.5**	**cfs**
Flow Velocity within the Gutter Section	V =	6.5	6.5	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	3.1	3.1	

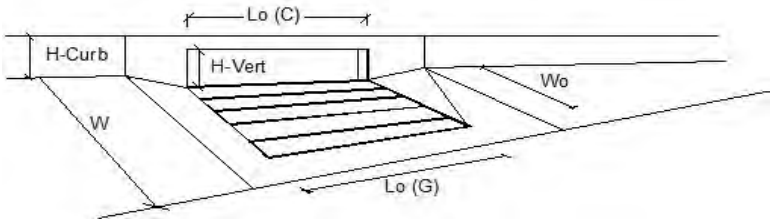
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	2.0	23.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	2.0	22.7	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.5	8.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	7.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	4.5	37.8	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	7.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.7	4.7	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.77	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**4.5**	**29.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	6.61	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.02	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**4.5**	**29.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.98 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.32 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

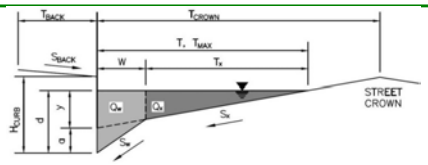


Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.0	5.3	cfs
Water Spread Width	T =	4.5	11.2	ft
Water Depth at Flowline (outside of local depression)	d =	2.6	4.2	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.923	0.522	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.1	2.5	cfs
Discharge within the Gutter Section W	Q_w =	0.9	2.8	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.26	0.53	sq ft
Velocity within the Gutter Section W	V_W =	3.4	5.2	fps
Water Depth for Design Condition	d_{LOCAL} =	7.6	9.2	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.271	0.162	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.49	10.48	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.49	10.00	ft
Interception Capacity	Q_i =	1.0	5.3	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	3.49	9.63	ft
Actual Interception Capacity	**Q_a =**	**1.0**	**5.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.1**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.0**	**5.3**	**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**	**%**

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

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

Project: SPRING HILL
Inlet ID: 16-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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 =	0.022		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	9.3	9.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	5.0	5.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.2	1.2	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**15.5**	**15.5**	**cfs**
Flow Velocity within the Gutter Section	V =	6.5	6.5	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	3.1	3.1	

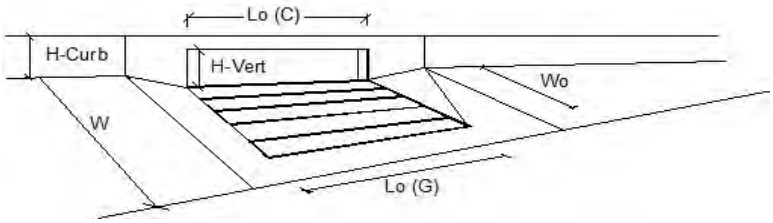
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	2.0	23.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	2.0	22.7	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.5	8.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	7.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	4.5	37.8	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	7.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.7	4.7	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.77	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**4.5**	**29.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	6.61	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.02	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**4.5**	**29.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.45 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.70 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

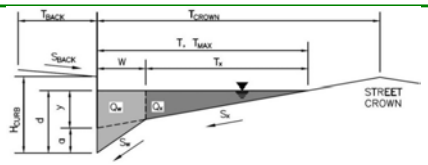


	Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
	Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Warning 2	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.04	0.04	
	Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
	Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.5	8.7	cfs
	Water Spread Width	T =	5.8	13.7	ft
	Water Depth at Flowline (outside of local depression)	d =	2.9	4.8	inches
	Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
	Ratio of Gutter Flow to Design Flow	E_o =	0.833	0.432	
	Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.2	4.8	cfs
	Discharge within the Gutter Section W	Q_w =	1.2	3.7	cfs
	Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.2	cfs
	Flow Area within the Gutter Section W	A_W =	0.32	0.64	sq ft
	Velocity within the Gutter Section W	V_W =	3.8	5.8	fps
	Water Depth for Design Condition	d_{LOCAL} =	7.9	9.8	inches
	Grate Analysis (Calculated)		MINOR	MAJOR	
	Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
	Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
	Under No-Clogging Condition		MINOR	MAJOR	
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Interception Capacity	Q_i =	N/A	N/A	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
	Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
	Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
	Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
	Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
	Equivalent Slope S_e	S_e =	0.246	0.137	ft/ft
	Required Length L_T to Have 100% Interception	L_T =	4.45	14.36	ft
	Under No-Clogging Condition		MINOR	MAJOR	
	Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.45	14.36	ft
	Interception Capacity	Q_i =	1.5	8.5	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient	CurbCoeff =	1.31	1.31	
	Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.02	0.02	
	Effective (Unclogged) Length	L_e =	4.45	14.36	ft
	Actual Interception Capacity	**Q_a =**	**1.5**	**8.5**	**cfs**
	Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
	Summary		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**1.5**	**8.5**	**cfs**
	Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.2**	**cfs**
	Capture Percentage = Q_a/Q_o	**C% =**	**100**	**98**	**%**

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

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

Project: SPRING HILL
Inlet ID: 15-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	7.7	7.7	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	4.1	4.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.0	1.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**12.8**	**12.8**	**cfs**
Flow Velocity within the Gutter Section	V =	5.4	5.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.5	2.5	

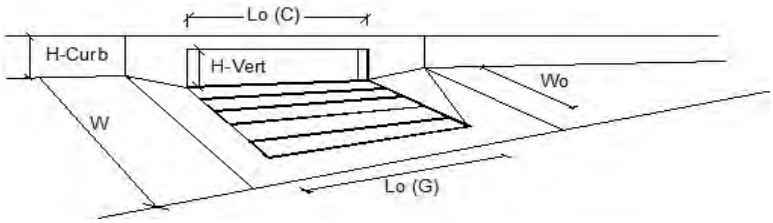
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.6	19.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.6	18.8	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	2.1	6.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.8	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.7	31.2	cfs
Average Flow Velocity Within the Gutter Section	V =	4.1	6.5	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.4	3.8	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.7**	**31.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.7**	**31.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.20 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 9.26 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

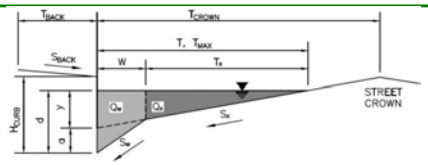


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.2	9.3	cfs
Water Spread Width	T =	5.8	15.1	ft
Water Depth at Flowline (outside of local depression)	d =	2.9	5.1	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.833	0.393	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.2	5.4	cfs
Discharge within the Gutter Section W	Q_w =	1.0	3.5	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.4	cfs
Flow Area within the Gutter Section W	A_W =	0.32	0.69	sq ft
Velocity within the Gutter Section W	V_W =	3.1	5.0	fps
Water Depth for Design Condition	d_{LOCAL} =	7.9	10.1	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.246	0.127	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.95	14.88	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.95	10.00	ft
Interception Capacity	Q_i =	1.2	7.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	3.95	9.61	ft
Actual Interception Capacity	**Q_a =**	**1.2**	**7.5**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**1.4**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.2**	**7.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.8**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**81**	**%**

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

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

Project: SPRING HILL
Inlet ID: 14-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	7.7	7.7	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	4.1	4.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.0	1.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**12.8**	**12.8**	**cfs**
Flow Velocity within the Gutter Section	V =	5.4	5.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.5	2.5	

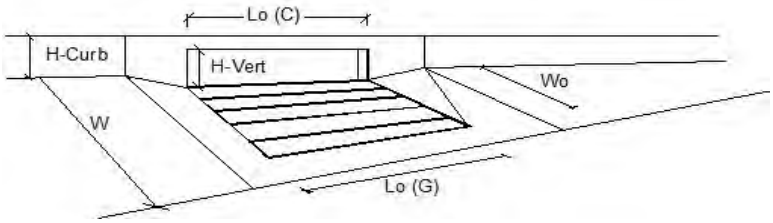
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.6	19.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.6	18.8	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.1	6.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.8	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.7	31.2	cfs
Average Flow Velocity Within the Gutter Section	V =	4.1	6.5	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.4	3.8	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.7**	**31.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.7**	**31.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.90 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.83 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

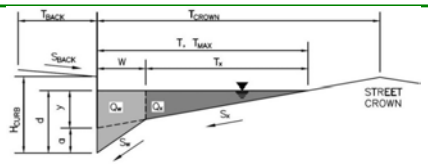


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.9	3.8	cfs
Water Spread Width	T =	4.8	10.6	ft
Water Depth at Flowline (outside of local depression)	d =	2.7	4.0	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.901	0.550	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.1	1.7	cfs
Discharge within the Gutter Section W	Q_w =	0.8	2.1	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.28	0.51	sq ft
Velocity within the Gutter Section W	V_W =	2.9	4.1	fps
Water Depth for Design Condition	d_{LOCAL} =	7.7	9.0	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.264	0.169	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.30	8.49	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.30	8.49	ft
Interception Capacity	Q_i =	0.9	3.8	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	3.30	8.49	ft
Actual Interception Capacity	**Q_a =**	**0.9**	**3.8**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.9**	**3.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

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

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

Project: SPRING HILL
Inlet ID: 9-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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 =	0.018		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	8.4	8.4	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	4.5	4.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.1	1.1	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**14.0**	**14.0**	**cfs**
Flow Velocity within the Gutter Section	V =	5.9	5.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.8	2.8	

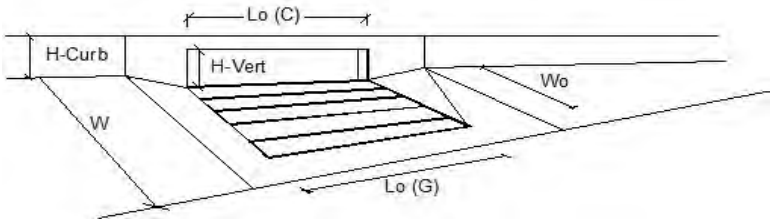
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.8	21.4	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.8	20.6	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	2.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	6.4	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	4.0	34.2	cfs
Average Flow Velocity Within the Gutter Section	V =	4.5	7.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.5	4.2	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.91	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**4.0**	**31.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	6.91	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.32	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**4.0**	**31.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.02 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.47 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

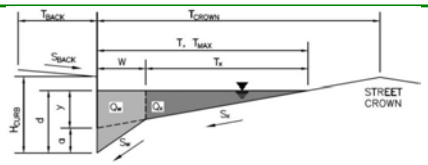


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.0	4.5	cfs
Water Spread Width	T =	4.9	10.9	ft
Water Depth at Flowline (outside of local depression)	d =	2.7	4.1	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.893	0.537	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.1	2.1	cfs
Discharge within the Gutter Section W	Q_w =	0.9	2.4	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.28	0.52	sq ft
Velocity within the Gutter Section W	V_W =	3.2	4.6	fps
Water Depth for Design Condition	d_{LOCAL} =	7.7	9.1	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.262	0.166	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.57	9.37	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.57	9.37	ft
Interception Capacity	Q_i =	1.0	4.5	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	3.57	9.37	ft
Actual Interception Capacity	**Q_a =**	**1.0**	**4.5**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.0**	**4.5**	**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**	**%**

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

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

Project: SPRING HILL
Inlet ID: 7a-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

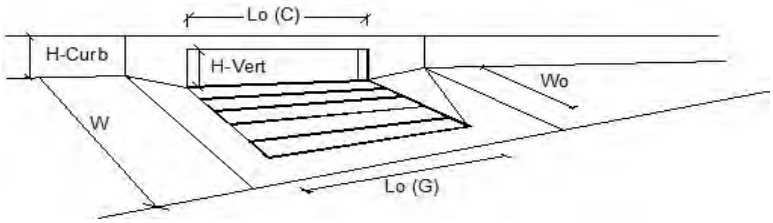
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.58 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 12.50 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

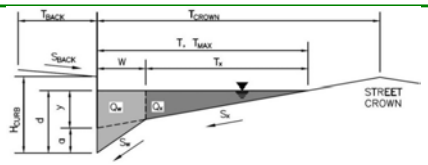


	Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
	Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Warning 2	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.04	0.04	
	Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
	Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	2.6	12.5	cfs
	Water Spread Width	T =	9.7	17.0	ft
	Water Depth at Flowline (outside of local depression)	d =	3.8	5.9	inches
	Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.3	inches
	Ratio of Gutter Flow to Design Flow	E_o =	0.593	0.328	
	Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	1.0	7.6	cfs
	Discharge within the Gutter Section W	Q_w =	1.5	3.7	cfs
	Discharge Behind the Curb Face	Q_{BACK} =	0.0	1.2	cfs
	Flow Area within the Gutter Section W	A_W =	0.47	0.81	sq ft
	Velocity within the Gutter Section W	V_W =	3.2	4.6	fps
	Water Depth for Design Condition	d_{LOCAL} =	8.8	10.9	inches
	Grate Analysis (Calculated)		MINOR	MAJOR	
	Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
	Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
	Under No-Clogging Condition		MINOR	MAJOR	
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Interception Capacity	Q_i =	N/A	N/A	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
	Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
	Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
	Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
	Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
	Equivalent Slope S_e	S_e =	0.181	0.109	ft/ft
	Required Length L_T to Have 100% Interception	L_T =	6.57	17.61	ft
	Under No-Clogging Condition		MINOR	MAJOR	
	Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	6.57	15.00	ft
	Interception Capacity	Q_i =	2.6	10.9	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient	CurbCoeff =	1.31	1.31	
	Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.02	0.02	
	Effective (Unclogged) Length	L_e =	6.57	14.71	ft
	Actual Interception Capacity	**Q_a =**	**2.6**	**10.8**	**cfs**
	Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.4**	**cfs**
	Summary		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**2.6**	**10.8**	**cfs**
	Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.7**	**cfs**
	Capture Percentage = Q_a/Q_o	**C% =**	**100**	**87**	**%**

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

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

Project: SPRING HILL
Inlet ID: 7-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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 =	0.013		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	7.2	7.2	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.9	3.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.9	0.9	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.9**	**11.9**	**cfs**
Flow Velocity within the Gutter Section	V =	5.0	5.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.3	2.3	

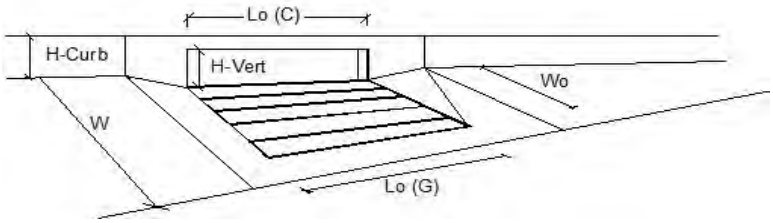
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.5	18.2	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.5	17.5	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.9	6.2	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.4	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.4	29.0	cfs
Average Flow Velocity Within the Gutter Section	V =	3.8	6.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.3	3.6	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.4**	**29.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.4**	**29.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.93 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 11.04 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

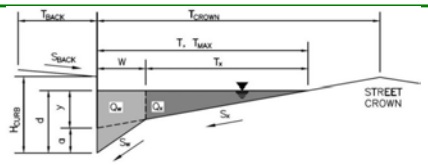


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.9	11.0	cfs
Water Spread Width	T =	7.9	16.5	ft
Water Depth at Flowline (outside of local depression)	d =	3.4	5.5	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.695	0.360	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.6	6.6	cfs
Discharge within the Gutter Section W	Q_w =	1.3	3.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.8	cfs
Flow Area within the Gutter Section W	A_W =	0.40	0.75	sq ft
Velocity within the Gutter Section W	V_W =	3.3	5.0	fps
Water Depth for Design Condition	d_{LOCAL} =	8.4	10.5	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.209	0.118	ft/ft
Required Length L_T to Have 100% Interception	L_T =	5.39	16.47	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.39	10.00	ft
Interception Capacity	Q_i =	1.9	8.4	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	5.39	9.61	ft
Actual Interception Capacity	**Q_a =**	**1.9**	**8.2**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**2.1**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.9**	**8.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.9**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**74**	**%**

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

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

Project: SPRING HILL
Inlet ID: 6-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.9	6.9	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.7	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.9	0.9	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.5**	**11.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.3	2.3	

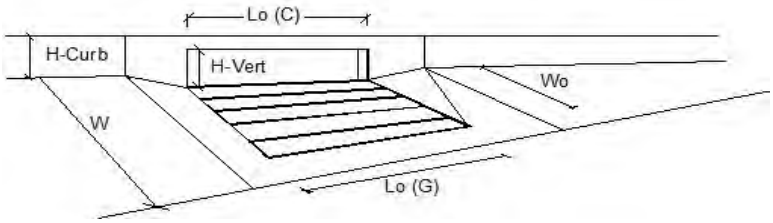
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.4	17.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.8	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.3	27.9	cfs
Average Flow Velocity Within the Gutter Section	V =	3.7	5.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.4	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.3**	**27.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.3**	**27.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.02 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 10.03 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

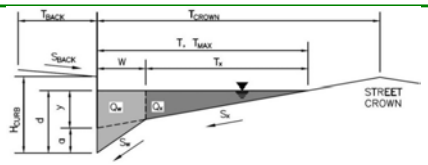


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.0	10.0	cfs
Water Spread Width		T =	5.6	16.2	ft
Water Depth at Flowline (outside of local depression)		d =	2.9	5.4	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.846	0.367	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.2	5.9	cfs
Discharge within the Gutter Section W		Q_w =	0.9	3.5	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.6	cfs
Flow Area within the Gutter Section W		A_W =	0.31	0.73	sq ft
Velocity within the Gutter Section W		V_W =	2.8	4.7	fps
Water Depth for Design Condition		d_{LOCAL} =	7.9	10.4	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.249	0.120	ft/ft
Required Length L_T to Have 100% Interception		L_T =	3.57	15.54	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	3.57	10.00	ft
Interception Capacity		Q_i =	1.0	7.9	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	3.57	9.61	ft
Actual Interception Capacity		**Q_a =**	**1.0**	**7.7**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**1.7**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.0**	**7.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**2.3**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**77**	**%**

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

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

Project: SPRING HILL
Inlet ID: 4-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.9	6.9	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.7	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.9	0.9	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.5**	**11.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.3	2.3	

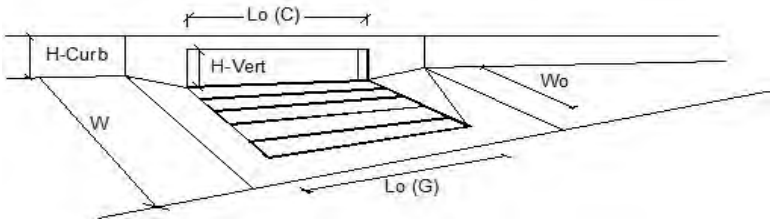
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.4	17.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.8	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.3	27.9	cfs
Average Flow Velocity Within the Gutter Section	V =	3.7	5.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.4	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.3**	**27.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.3**	**27.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.40 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.68 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

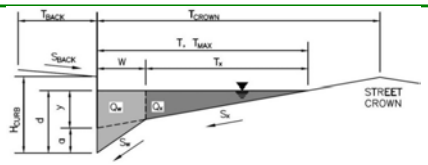


	Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
	Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Warning 2	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.04	0.04	
	Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
	Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.4	5.7	cfs
	Water Spread Width	T =	6.8	13.1	ft
	Water Depth at Flowline (outside of local depression)	d =	3.1	4.7	inches
	Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
	Ratio of Gutter Flow to Design Flow	E_o =	0.766	0.453	
	Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.3	3.1	cfs
	Discharge within the Gutter Section W	Q_w =	1.1	2.5	cfs
	Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.1	cfs
	Flow Area within the Gutter Section W	A_W =	0.36	0.61	sq ft
	Velocity within the Gutter Section W	V_W =	3.0	4.2	fps
	Water Depth for Design Condition	d_{LOCAL} =	8.1	9.7	inches
	Grate Analysis (Calculated)		MINOR	MAJOR	
	Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
	Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
	Under No-Clogging Condition		MINOR	MAJOR	
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Interception Capacity	Q_i =	N/A	N/A	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
	Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
	Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
	Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
	Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
	Equivalent Slope S_e	S_e =	0.228	0.143	ft/ft
	Required Length L_T to Have 100% Interception	L_T =	4.37	11.00	ft
	Under No-Clogging Condition		MINOR	MAJOR	
	Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.37	11.00	ft
	Interception Capacity	Q_i =	1.4	5.6	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient	CurbCoeff =	1.31	1.31	
	Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.02	0.02	
	Effective (Unclogged) Length	L_e =	4.37	11.00	ft
	Actual Interception Capacity	**Q_a =**	**1.4**	**5.6**	**cfs**
	Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
	Summary		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**1.4**	**5.6**	**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**	**%**

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

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

Project: SPRING HILL
Inlet ID: 3a-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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 =	0.011		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.6	6.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.5	3.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	4.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

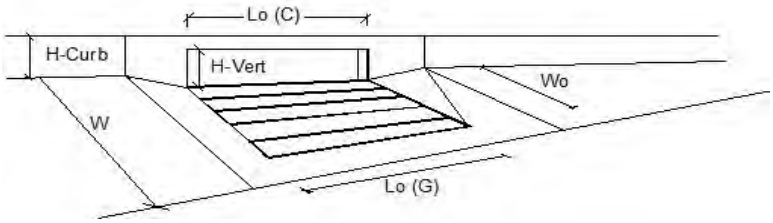
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.4	16.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.1	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.2	26.7	cfs
Average Flow Velocity Within the Gutter Section	V =	3.5	5.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.2**	**26.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.2**	**26.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.30 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 7.93 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

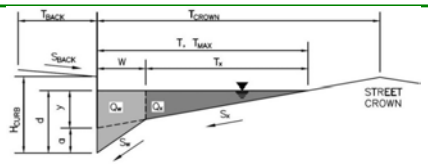


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.3	7.9	cfs
Water Spread Width	T =	6.7	15.1	ft
Water Depth at Flowline (outside of local depression)	d =	3.1	5.1	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.773	0.393	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.3	4.6	cfs
Discharge within the Gutter Section W	Q_w =	1.0	3.0	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.3	cfs
Flow Area within the Gutter Section W	A_W =	0.35	0.69	sq ft
Velocity within the Gutter Section W	V_W =	2.8	4.3	fps
Water Depth for Design Condition	d_{LOCAL} =	8.1	10.1	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.230	0.127	ft/ft
Required Length L_T to Have 100% Interception	L_T =	4.17	13.50	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.17	10.00	ft
Interception Capacity	Q_i =	1.3	6.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	4.17	9.61	ft
Actual Interception Capacity	**Q_a =**	**1.3**	**6.8**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.8**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.3**	**6.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.2**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**85**	**%**

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

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

Project: SPRING HILL
Inlet ID: 3-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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 =	0.011		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.6	6.6	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	3.5	3.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	4.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

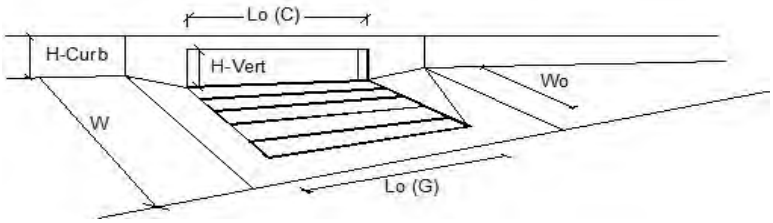
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.4	16.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.1	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	1.8	5.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.2	26.7	cfs
Average Flow Velocity Within the Gutter Section	V =	3.5	5.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.2**	**26.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.2**	**26.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.62 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.96 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

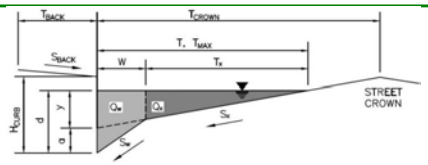


	Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
	Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Warning 2	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.04	0.04	
	Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
	Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.6	9.0	cfs
	Water Spread Width	T =	7.5	15.8	ft
	Water Depth at Flowline (outside of local depression)	d =	3.3	5.3	inches
	Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
	Ratio of Gutter Flow to Design Flow	E_o =	0.718	0.376	
	Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.5	5.3	cfs
	Discharge within the Gutter Section W	Q_w =	1.2	3.2	cfs
	Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.5	cfs
	Flow Area within the Gutter Section W	A_W =	0.39	0.72	sq ft
	Velocity within the Gutter Section W	V_W =	3.0	4.4	fps
	Water Depth for Design Condition	d_{LOCAL} =	8.3	10.3	inches
	Grate Analysis (Calculated)		MINOR	MAJOR	
	Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
	Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
	Under No-Clogging Condition		MINOR	MAJOR	
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Interception Capacity	Q_i =	N/A	N/A	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
	Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
	Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
	Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
	Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
	Equivalent Slope S_e	S_e =	0.215	0.122	ft/ft
	Required Length L_T to Have 100% Interception	L_T =	4.82	14.52	ft
	Under No-Clogging Condition		MINOR	MAJOR	
	Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.82	14.52	ft
	Interception Capacity	Q_i =	1.6	8.5	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient	CurbCoeff =	1.31	1.31	
	Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.02	0.02	
	Effective (Unclogged) Length	L_e =	4.82	14.52	ft
	Actual Interception Capacity	**Q_a =**	**1.6**	**8.5**	**cfs**
	Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
	Summary		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**1.6**	**8.5**	**cfs**
	Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.5**	**cfs**
	Capture Percentage = Q_a/Q_o	**C% =**	**100**	**94**	**%**

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

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

Project: **SPRING HILL**
Inlet ID: **2-A**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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 =	0.011		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.6	6.6	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	3.5	3.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	4.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

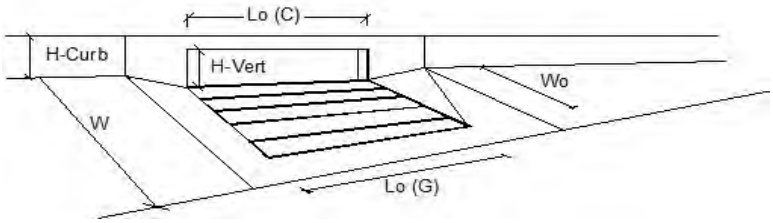
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.4	16.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.1	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	1.8	5.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.2	26.7	cfs
Average Flow Velocity Within the Gutter Section	V =	3.5	5.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.2**	**26.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.2**	**26.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.78 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.51 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

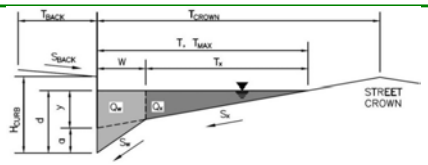


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.8	3.5	cfs
Water Spread Width	T =	4.9	10.9	ft
Water Depth at Flowline (outside of local depression)	d =	2.7	4.1	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.898	0.537	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.1	1.6	cfs
Discharge within the Gutter Section W	Q_w =	0.7	1.9	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.28	0.52	sq ft
Velocity within the Gutter Section W	V_W =	2.5	3.6	fps
Water Depth for Design Condition	d_{LOCAL} =	7.7	9.1	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.264	0.166	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.02	8.05	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.02	8.05	ft
Interception Capacity	Q_i =	0.8	3.5	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	3.02	8.05	ft
Actual Interception Capacity	**Q_a =**	**0.8**	**3.5**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.8**	**3.5**	**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**	**%**

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

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

Project: SPRING HILL
Inlet ID: 1a-A



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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 =	0.011		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.6	6.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.5	3.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	4.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

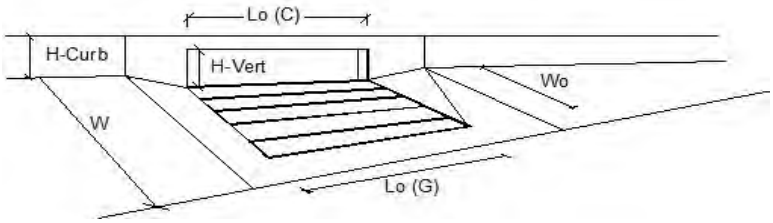
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.4	16.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.1	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.2	26.7	cfs
Average Flow Velocity Within the Gutter Section	V =	3.5	5.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.2**	**26.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.2**	**26.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.01 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.41 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	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, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.0	6.4	cfs
Water Spread Width	T =	5.8	13.9	ft
Water Depth at Flowline (outside of local depression)	d =	2.9	4.9	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.837	0.426	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.2	3.6	cfs
Discharge within the Gutter Section W	Q_w =	0.8	2.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.2	cfs
Flow Area within the Gutter Section W	A_W =	0.32	0.64	sq ft
Velocity within the Gutter Section W	V_W =	2.7	4.1	fps
Water Depth for Design Condition	d_{LOCAL} =	7.9	9.9	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.247	0.135	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.55	11.86	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.55	5.00	ft
Interception Capacity	Q_i =	1.0	3.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.10	0.10	
Effective (Unclogged) Length	L_e =	3.55	4.50	ft
Actual Interception Capacity	**Q_a =**	**1.0**	**3.6**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**2.6**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.0**	**3.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.8**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**56**	**%**

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	31-B	30-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.1	1.3
Major Q_{Known} (cfs)	6.6	5.6

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.1**	**1.3**
Major Total Design Peak Flow, Q (cfs)	**6.6**	**5.6**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.6	2.2

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	29-B	28-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.1	1.2
Major Q_{Known} (cfs)	5.2	5.6

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.1**	**1.2**
Major Total Design Peak Flow, Q (cfs)	**5.2**	**5.6**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.1	0.2

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	27-B	26-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.8	1.1
Major Q_{Known} (cfs)	8.4	5.6

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.8**	**1.1**
Major Total Design Peak Flow, Q (cfs)	**8.4**	**5.6**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	1.4	0.2

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	25-B	24-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.4	1.5
Major Q_{Known} (cfs)	6.8	8.7

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.4**	**1.5**
Major Total Design Peak Flow, Q (cfs)	**6.8**	**8.7**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.5	1.3

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	23-B	22-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.7	1.1
Major Q_{Known} (cfs)	10.6	5.0

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.7**	**1.1**
Major Total Design Peak Flow, Q (cfs)	**10.6**	**5.0**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.7	0.0

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	21-B	20-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.5	2.1
Major Q_{Known} (cfs)	3.3	9.9

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**0.5**	**2.1**
Major Total Design Peak Flow, Q (cfs)	**3.3**	**9.9**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	2.2

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	19-B	18-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.3	0.6
Major Q_{Known} (cfs)	5.6	4.8

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.3**	**0.6**
Major Total Design Peak Flow, Q (cfs)	**5.6**	**4.8**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.2	0.0

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	17-B	16-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.0	1.4
Major Q_{Known} (cfs)	4.3	6.0

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.0**	**1.4**
Major Total Design Peak Flow, Q (cfs)	**4.3**	**6.0**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	0.3

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	15-B	14-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.6	1.2
Major Q_{Known} (cfs)	8.5	5.8

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.6**	**1.2**
Major Total Design Peak Flow, Q (cfs)	**8.5**	**5.8**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	1.2	0.3

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	13-B	12-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.4	0.4
Major Q_{Known} (cfs)	3.6	3.5

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**0.4**	**0.4**
Major Total Design Peak Flow, Q (cfs)	**3.6**	**3.5**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	11-B	10-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	2.4	1.2
Major Q_{Known} (cfs)	12.4	5.5

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**2.4**	**1.2**
Major Total Design Peak Flow, Q (cfs)	**12.4**	**5.5**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	1.5	0.2

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	9-B	8-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	2.2	2.0
Major Q_{Known} (cfs)	10.5	9.4

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**2.2**	**2.0**
Major Total Design Peak Flow, Q (cfs)	**10.5**	**9.4**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	2.5	2.0

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	7-B	6-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.1	0.9
Major Q_{Known} (cfs)	5.8	4.2

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.1**	**0.9**
Major Total Design Peak Flow, Q (cfs)	**5.8**	**4.2**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.3	N/A

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	5-B	4-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.5	1.0
Major Q_{Known} (cfs)	7.1	6.9

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.5**	**1.0**
Major Total Design Peak Flow, Q (cfs)	**7.1**	**6.9**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.7	N/A

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	3-B	2-B
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.9	1.7
Major Q_{Known} (cfs)	9.4	8.0

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.9**	**1.7**
Major Total Design Peak Flow, Q (cfs)	**9.4**	**8.0**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	1.8	N/A

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	1-B
Site Type (Urban or Rural)	
Inlet Application (Street or Area)	STREET
Hydraulic Condition	In Sump
Inlet Type	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.7
Major Q_{Known} (cfs)	3.2

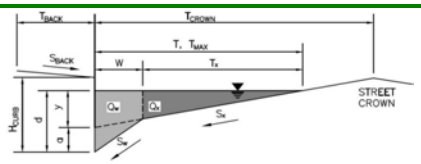
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**0.7**
Major Total Design Peak Flow, Q (cfs)	**3.2**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A

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

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

Project: SPRING HILL
Inlet ID: 31-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

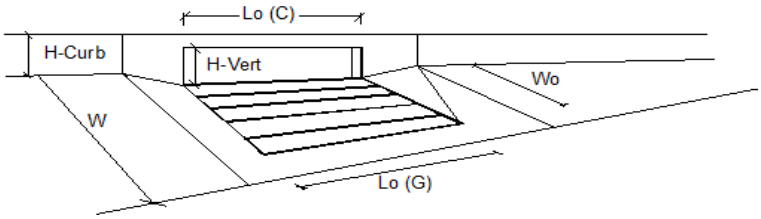
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.13 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.56 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

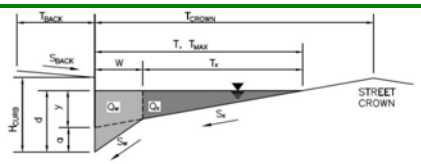


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.1	6.6	cfs
Water Spread Width		T =	6.3	14.3	ft
Water Depth at Flowline (outside of local depression)		d =	3.0	5.0	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.797	0.415	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.2	3.7	cfs
Discharge within the Gutter Section W		Q_w =	0.9	2.6	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.2	cfs
Flow Area within the Gutter Section W		A_W =	0.34	0.66	sq ft
Velocity within the Gutter Section W		V_W =	2.7	4.0	fps
Water Depth for Design Condition		d_{LOCAL} =	8.0	10.0	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.236	0.133	ft/ft
Required Length L_T to Have 100% Interception		L_T =	3.82	12.01	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	3.82	10.00	ft
Interception Capacity		Q_i =	1.1	6.1	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	3.82	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.1**	**6.0**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.3**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.1**	**6.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.6**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**92**	**%**

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

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

Project: SPRING HILL
Inlet ID: 30-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

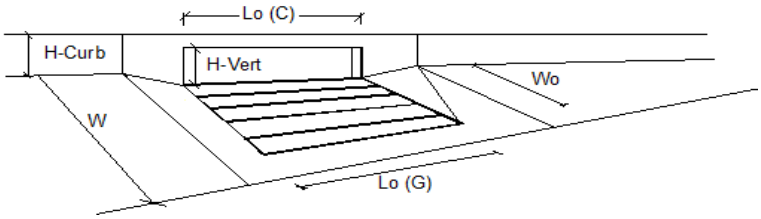
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.26 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.61 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		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, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.3	5.6	cfs
Water Spread Width		T =	6.7	13.5	ft
Water Depth at Flowline (outside of local depression)		d =	3.1	4.7	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.769	0.440	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.3	3.1	cfs
Discharge within the Gutter Section W		Q_w =	1.0	2.4	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W		A_W =	0.36	0.63	sq ft
Velocity within the Gutter Section W		V_W =	2.7	3.9	fps
Water Depth for Design Condition		d_{LOCAL} =	8.1	9.7	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.229	0.139	ft/ft
Required Length L_T to Have 100% Interception		L_T =	4.09	10.91	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	4.09	5.00	ft
Interception Capacity		Q_i =	1.3	3.7	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.10	0.10	
Effective (Unclogged) Length		L_e =	4.09	4.50	ft
Actual Interception Capacity		**Q_a =**	**1.3**	**3.4**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**2.1**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.3**	**3.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**2.2**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**60**	**%**

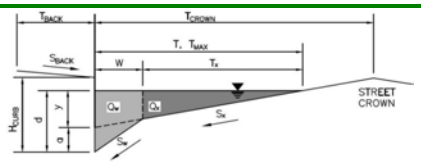
MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: SPRING HILL

Inlet ID: 29-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

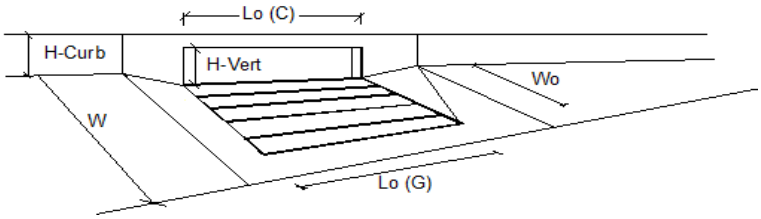
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.08 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.15 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		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, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.1	5.2	cfs
Water Spread Width		T =	6.2	13.0	ft
Water Depth at Flowline (outside of local depression)		d =	3.0	4.6	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.809	0.455	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.2	2.8	cfs
Discharge within the Gutter Section W		Q_w =	0.9	2.3	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W		A_W =	0.33	0.61	sq ft
Velocity within the Gutter Section W		V_W =	2.6	3.8	fps
Water Depth for Design Condition		d_{LOCAL} =	8.0	9.6	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.239	0.143	ft/ft
Required Length L_T to Have 100% Interception		L_T =	3.71	10.34	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	3.71	10.00	ft
Interception Capacity		Q_i =	1.1	5.1	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	3.71	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.1**	**5.0**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.0**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.1**	**5.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**98**	**%**

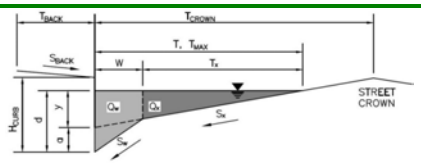
MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: SPRING HILL

Inlet ID: 28-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.9	6.9	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.7	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.9	0.9	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.5**	**11.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.3	2.3	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.4	17.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.8	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.3	27.9	cfs
Average Flow Velocity Within the Gutter Section	V =	3.7	5.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.4	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.3**	**27.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

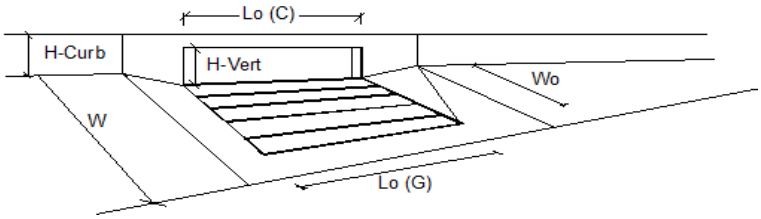
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.3**	**27.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.19 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.60 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

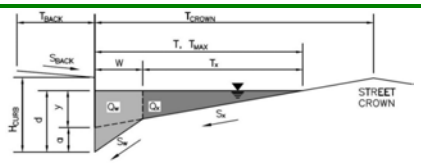


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.2	5.6	cfs
Water Spread Width		T =	6.2	13.0	ft
Water Depth at Flowline (outside of local depression)		d =	3.0	4.6	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.807	0.455	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.2	3.0	cfs
Discharge within the Gutter Section W		Q_w =	1.0	2.5	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W		A_W =	0.33	0.61	sq ft
Velocity within the Gutter Section W		V_W =	2.9	4.1	fps
Water Depth for Design Condition		d_{LOCAL} =	8.0	9.6	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.239	0.143	ft/ft
Required Length L_T to Have 100% Interception		L_T =	3.94	10.90	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	3.94	10.00	ft
Interception Capacity		Q_i =	1.2	5.5	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	3.94	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.2**	**5.4**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.1**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.2**	**5.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.2**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**97**	**%**

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

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

Project: SPRING HILL
Inlet ID: 27-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.9	6.9	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.7	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.9	0.9	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.5**	**11.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.3	2.3	

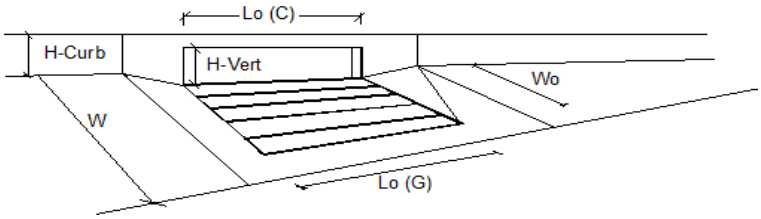
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.4	17.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.8	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.3	27.9	cfs
Average Flow Velocity Within the Gutter Section	V =	3.7	5.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.4	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.3**	**27.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.3**	**27.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.77 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.40 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

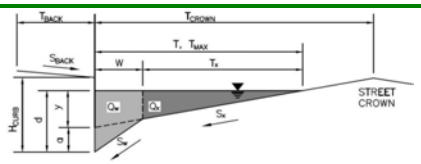


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.8	8.4	cfs
Water Spread Width		T =	7.7	15.2	ft
Water Depth at Flowline (outside of local depression)		d =	3.4	5.2	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.706	0.391	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.5	4.9	cfs
Discharge within the Gutter Section W		Q_w =	1.2	3.1	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.4	cfs
Flow Area within the Gutter Section W		A_W =	0.39	0.69	sq ft
Velocity within the Gutter Section W		V_W =	3.2	4.5	fps
Water Depth for Design Condition		d_{LOCAL} =	8.4	10.2	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.212	0.126	ft/ft
Required Length L_T to Have 100% Interception		L_T =	5.10	13.99	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	5.10	10.00	ft
Interception Capacity		Q_i =	1.8	7.2	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	5.10	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.8**	**7.0**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**1.0**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.8**	**7.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**1.4**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**84**	**%**

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

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

Project: SPRING HILL
Inlet ID: 26-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

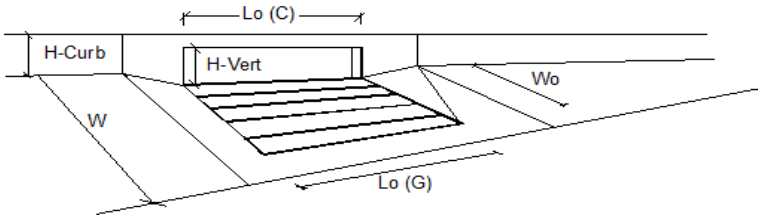
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.09 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.61 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

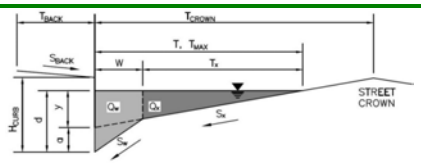


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.1	5.6	cfs
Water Spread Width		T =	6.2	13.5	ft
Water Depth at Flowline (outside of local depression)		d =	3.0	4.7	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.806	0.440	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.2	3.1	cfs
Discharge within the Gutter Section W		Q_w =	0.9	2.4	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W		A_W =	0.33	0.63	sq ft
Velocity within the Gutter Section W		V_W =	2.6	3.9	fps
Water Depth for Design Condition		d_{LOCAL} =	8.0	9.7	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.239	0.139	ft/ft
Required Length L_T to Have 100% Interception		L_T =	3.73	10.91	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	3.73	10.00	ft
Interception Capacity		Q_i =	1.1	5.4	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	3.73	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.1**	**5.4**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.1**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.1**	**5.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.2**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**96**	**%**

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

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

Project: SPRING HILL
Inlet ID: 25-B



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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 =	0.022		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	9.3	9.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	5.0	5.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.2	1.2	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**15.5**	**15.5**	**cfs**
Flow Velocity within the Gutter Section	V =	6.5	6.5	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	3.1	3.1	

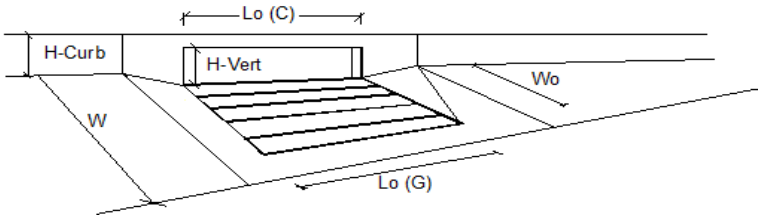
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	2.0	23.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	2.0	22.7	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.5	8.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	7.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	4.5	37.8	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	7.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.7	4.7	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.77	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**4.5**	**29.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	6.61	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.02	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**4.5**	**29.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.43 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.83 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

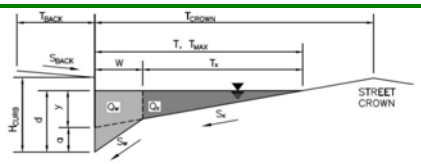


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.4	6.8	cfs
Water Spread Width		T =	5.8	12.5	ft
Water Depth at Flowline (outside of local depression)		d =	2.9	4.5	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.836	0.473	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.2	3.6	cfs
Discharge within the Gutter Section W		Q_w =	1.2	3.2	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W		A_W =	0.32	0.58	sq ft
Velocity within the Gutter Section W		V_W =	3.8	5.5	fps
Water Depth for Design Condition		d_{LOCAL} =	7.9	9.5	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.247	0.148	ft/ft
Required Length L_T to Have 100% Interception		L_T =	4.41	12.33	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	4.41	10.00	ft
Interception Capacity		Q_i =	1.4	6.4	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	4.41	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.4**	**6.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.4**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.4**	**6.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.5**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**93**	**%**

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

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

Project: SPRING HILL
Inlet ID: 24-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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 =	0.022	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	9.3	9.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	5.0	5.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.2	1.2	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**15.5**	**15.5**	**cfs**
Flow Velocity within the Gutter Section	V =	6.5	6.5	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	3.1	3.1	

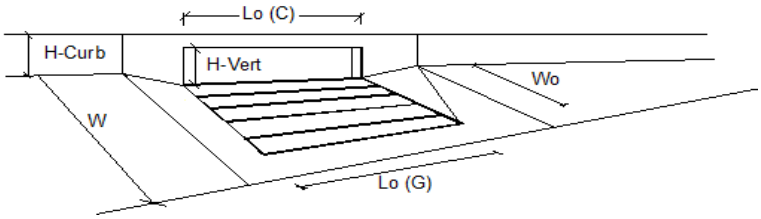
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	2.0	23.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	2.0	22.7	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.5	8.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	7.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	4.5	37.8	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	7.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.7	4.7	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.77	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**4.5**	**29.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	6.61	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.02	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**4.5**	**29.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.45 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.70 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

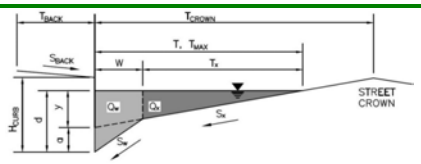


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.5	8.7	cfs
Water Spread Width		T =	5.8	13.7	ft
Water Depth at Flowline (outside of local depression)		d =	2.9	4.8	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.833	0.432	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.2	4.8	cfs
Discharge within the Gutter Section W		Q_w =	1.2	3.7	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.2	cfs
Flow Area within the Gutter Section W		A_W =	0.32	0.64	sq ft
Velocity within the Gutter Section W		V_W =	3.8	5.8	fps
Water Depth for Design Condition		d_{LOCAL} =	7.9	9.8	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.246	0.137	ft/ft
Required Length L_T to Have 100% Interception		L_T =	4.45	14.36	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	4.45	10.00	ft
Interception Capacity		Q_i =	1.5	7.5	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	4.45	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.5**	**7.4**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**1.2**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.5**	**7.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**1.3**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**85**	**%**

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

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

Project: SPRING HILL
Inlet ID: 23-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	7.7	7.7	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	4.1	4.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.0	1.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**12.8**	**12.8**	**cfs**
Flow Velocity within the Gutter Section	V =	5.4	5.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.5	2.5	

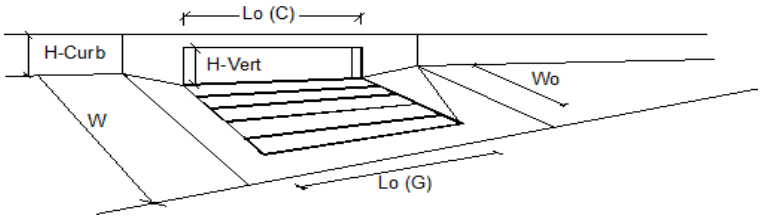
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.6	19.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.6	18.8	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.1	6.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.8	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.7	31.2	cfs
Average Flow Velocity Within the Gutter Section	V =	4.1	6.5	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.4	3.8	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.7**	**31.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.7**	**31.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.68 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 10.55 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

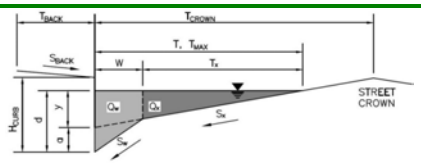


	Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
	Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Warning 2	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.04	0.04	
	Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
	Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.7	10.6	cfs
	Water Spread Width	T =	7.1	15.9	ft
	Water Depth at Flowline (outside of local depression)	d =	3.2	5.3	inches
	Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
	Ratio of Gutter Flow to Design Flow	E_o =	0.748	0.375	
	Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.4	6.2	cfs
	Discharge within the Gutter Section W	Q_w =	1.3	3.7	cfs
	Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.6	cfs
	Flow Area within the Gutter Section W	A_W =	0.37	0.72	sq ft
	Velocity within the Gutter Section W	V_W =	3.4	5.2	fps
	Water Depth for Design Condition	d_{LOCAL} =	8.2	10.3	inches
	Grate Analysis (Calculated)		MINOR	MAJOR	
	Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
	Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
	Under No-Clogging Condition		MINOR	MAJOR	
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Interception Capacity	Q_i =	N/A	N/A	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
	Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
	Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
	Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
	Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
	Equivalent Slope S_e	S_e =	0.223	0.122	ft/ft
	Required Length L_T to Have 100% Interception	L_T =	4.91	16.08	ft
	Under No-Clogging Condition		MINOR	MAJOR	
	Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.91	15.00	ft
	Interception Capacity	Q_i =	1.7	9.9	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient	CurbCoeff =	1.31	1.31	
	Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.02	0.02	
	Effective (Unclogged) Length	L_e =	4.91	14.74	ft
	Actual Interception Capacity	**Q_a =**	**1.7**	**9.8**	**cfs**
	Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.1**	**cfs**
	Summary		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**1.7**	**9.8**	**cfs**
	Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.7**	**cfs**
	Capture Percentage = Q_a/Q_o	**C% =**	**100**	**93**	**%**

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

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

Project: SPRING HILL
Inlet ID: 22-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	7.7	7.7	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	4.1	4.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.0	1.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**12.8**	**12.8**	**cfs**
Flow Velocity within the Gutter Section	V =	5.4	5.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.5	2.5	

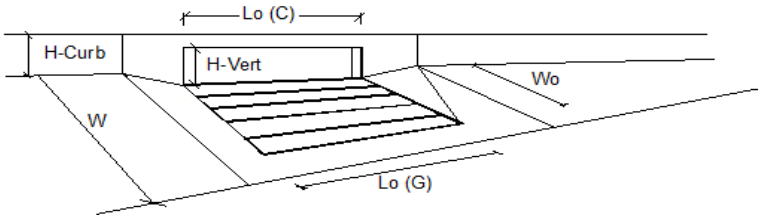
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.6	19.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.6	18.8	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.1	6.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.8	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.7	31.2	cfs
Average Flow Velocity Within the Gutter Section	V =	4.1	6.5	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.4	3.8	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.7**	**31.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.7**	**31.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.13 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.97 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

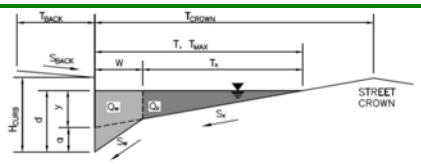


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.1	5.0	cfs
Water Spread Width		T =	5.6	11.8	ft
Water Depth at Flowline (outside of local depression)		d =	2.9	4.4	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.848	0.497	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.2	2.5	cfs
Discharge within the Gutter Section W		Q_w =	1.0	2.5	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.31	0.56	sq ft
Velocity within the Gutter Section W		V_W =	3.1	4.4	fps
Water Depth for Design Condition		d_{LOCAL} =	7.9	9.4	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.250	0.155	ft/ft
Required Length L_T to Have 100% Interception		L_T =	3.81	10.08	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	3.81	10.00	ft
Interception Capacity		Q_i =	1.1	5.0	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	3.81	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.1**	**4.9**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.0**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.1**	**4.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**99**	**%**

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

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

Project: SPRING HILL
Inlet ID: 21-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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 =	0.018	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	8.4	8.4	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	4.5	4.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.1	1.1	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**14.0**	**14.0**	**cfs**
Flow Velocity within the Gutter Section	V =	5.9	5.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.8	2.8	

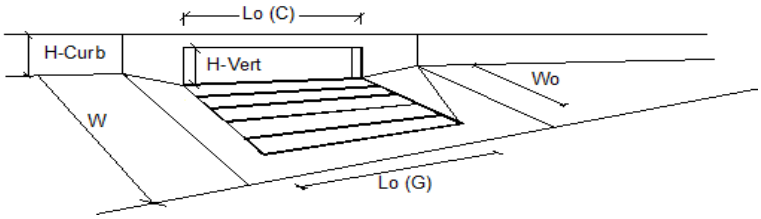
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.8	21.4	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.8	20.6	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	6.4	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	4.0	34.2	cfs
Average Flow Velocity Within the Gutter Section	V =	4.5	7.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.5	4.2	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.91	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**4.0**	**31.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	6.91	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.32	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**4.0**	**31.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.53 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.31 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

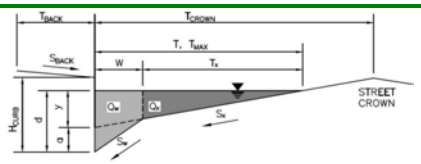


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	0.5	3.3	cfs
Water Spread Width		T =	2.2	9.5	ft
Water Depth at Flowline (outside of local depression)		d =	2.0	3.8	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	1.000	0.604	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.0	1.3	cfs
Discharge within the Gutter Section W		Q_w =	0.5	2.0	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.17	0.46	sq ft
Velocity within the Gutter Section W		V_W =	3.1	4.3	fps
Water Depth for Design Condition		d_{LOCAL} =	7.0	8.8	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.291	0.184	ft/ft
Required Length L_T to Have 100% Interception		L_T =	2.44	7.67	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	2.44	7.67	ft
Interception Capacity		Q_i =	0.5	3.3	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	2.44	7.67	ft
Actual Interception Capacity		**Q_a =**	**0.5**	**3.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.0**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**0.5**	**3.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**100**	**%**

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

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

Project: SPRING HILL
Inlet ID: 20-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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 =	0.011	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.6	6.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.5	3.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	4.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

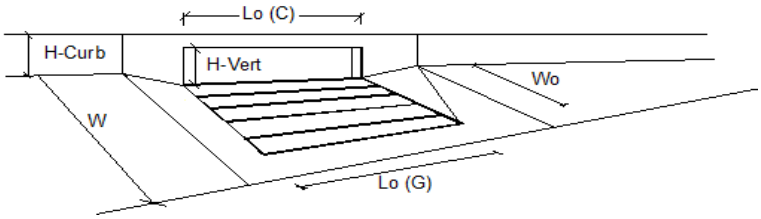
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.4	16.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.1	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.2	26.7	cfs
Average Flow Velocity Within the Gutter Section	V =	3.5	5.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.2**	**26.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.2**	**26.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.13 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 9.87 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

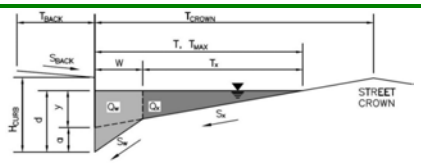


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	2.1	9.9	cfs
Water Spread Width		T =	8.6	16.4	ft
Water Depth at Flowline (outside of local depression)		d =	3.6	5.4	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.650	0.363	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.7	5.9	cfs
Discharge within the Gutter Section W		Q_w =	1.4	3.3	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.6	cfs
Flow Area within the Gutter Section W		A_W =	0.43	0.74	sq ft
Velocity within the Gutter Section W		V_W =	3.2	4.5	fps
Water Depth for Design Condition		d_{LOCAL} =	8.6	10.4	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.196	0.118	ft/ft
Required Length L_T to Have 100% Interception		L_T =	5.77	15.39	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	5.77	10.00	ft
Interception Capacity		Q_i =	2.1	7.8	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	5.77	9.63	ft
Actual Interception Capacity		**Q_a =**	**2.1**	**7.6**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**1.6**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**2.1**	**7.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**2.2**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**77**	**%**

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

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

Project: SPRING HILL
Inlet ID: 19-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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 =	0.011	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.6	6.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.5	3.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	4.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

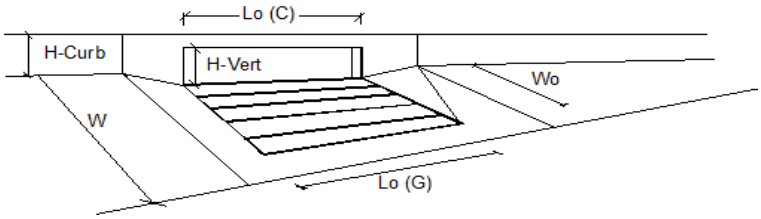
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.4	16.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.1	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.2	26.7	cfs
Average Flow Velocity Within the Gutter Section	V =	3.5	5.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.2**	**26.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.2**	**26.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.28 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.63 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

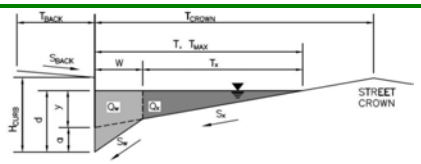


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.3	5.6	cfs
Water Spread Width		T =	6.6	13.3	ft
Water Depth at Flowline (outside of local depression)		d =	3.1	4.7	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.778	0.447	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.3	3.1	cfs
Discharge within the Gutter Section W		Q_w =	1.0	2.5	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W		A_W =	0.35	0.62	sq ft
Velocity within the Gutter Section W		V_W =	2.8	4.0	fps
Water Depth for Design Condition		d_{LOCAL} =	8.1	9.7	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.231	0.141	ft/ft
Required Length L_T to Have 100% Interception		L_T =	4.13	10.94	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	4.13	10.00	ft
Interception Capacity		Q_i =	1.3	5.5	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	4.13	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.3**	**5.4**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.1**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.3**	**5.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.2**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**96**	**%**

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

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

Project: SPRING HILL
Inlet ID: 18-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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 =	0.018	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	8.4	8.4	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	4.5	4.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.1	1.1	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**14.0**	**14.0**	**cfs**
Flow Velocity within the Gutter Section	V =	5.9	5.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.8	2.8	

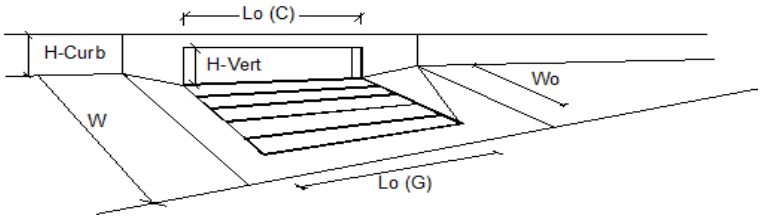
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.8	21.4	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.8	20.6	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	6.4	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	4.0	34.2	cfs
Average Flow Velocity Within the Gutter Section	V =	4.5	7.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.5	4.2	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.91	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**4.0**	**31.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	6.91	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.32	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**4.0**	**31.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.59 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.77 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

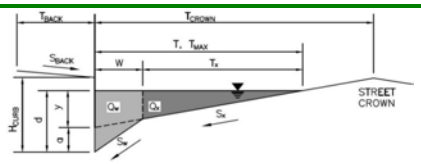


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	0.6	4.8	cfs
Water Spread Width		T =	2.3	11.2	ft
Water Depth at Flowline (outside of local depression)		d =	2.1	4.2	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	1.000	0.523	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.0	2.3	cfs
Discharge within the Gutter Section W		Q_w =	0.6	2.5	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.18	0.53	sq ft
Velocity within the Gutter Section W		V_W =	3.3	4.7	fps
Water Depth for Design Condition		d_{LOCAL} =	7.1	9.2	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.291	0.162	ft/ft
Required Length L_T to Have 100% Interception		L_T =	2.57	9.79	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	2.57	9.79	ft
Interception Capacity		Q_i =	0.6	4.8	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	2.57	9.63	ft
Actual Interception Capacity		**Q_a =**	**0.6**	**4.8**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.0**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**0.6**	**4.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**100**	**%**

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

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

Project: SPRING HILL
Inlet ID: 17-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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 =	0.018	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	8.4	8.4	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	4.5	4.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.1	1.1	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**14.0**	**14.0**	**cfs**
Flow Velocity within the Gutter Section	V =	5.9	5.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.8	2.8	

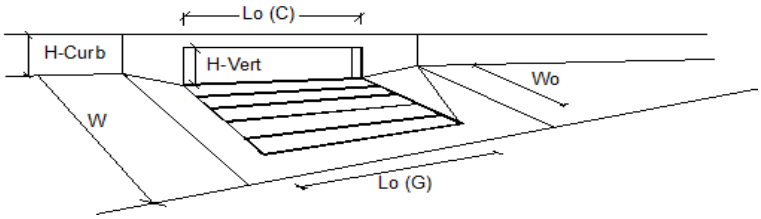
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.8	21.4	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.8	20.6	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	6.4	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	4.0	34.2	cfs
Average Flow Velocity Within the Gutter Section	V =	4.5	7.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.5	4.2	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.91	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**4.0**	**31.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	6.91	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.32	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**4.0**	**31.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.98 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.25 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

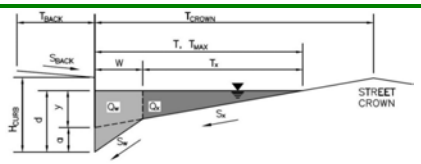


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.0	4.3	cfs
Water Spread Width		T =	4.8	10.6	ft
Water Depth at Flowline (outside of local depression)		d =	2.7	4.1	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.902	0.548	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.1	1.9	cfs
Discharge within the Gutter Section W		Q_w =	0.9	2.3	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.28	0.51	sq ft
Velocity within the Gutter Section W		V_W =	3.2	4.6	fps
Water Depth for Design Condition		d_{LOCAL} =	7.7	9.1	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.265	0.169	ft/ft
Required Length L_T to Have 100% Interception		L_T =	3.48	9.06	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	3.48	9.06	ft
Interception Capacity		Q_i =	1.0	4.2	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	3.48	9.06	ft
Actual Interception Capacity		**Q_a =**	**1.0**	**4.2**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.0**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.0**	**4.2**	**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**	**%**

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

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

Project: SPRING HILL
Inlet ID: 16-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

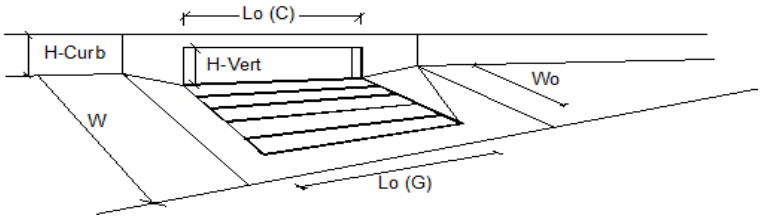
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.38 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.97 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

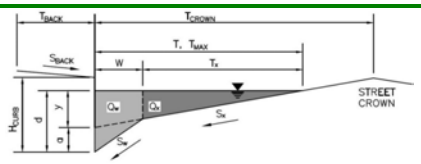


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.4	6.0	cfs
Water Spread Width		T =	7.1	13.8	ft
Water Depth at Flowline (outside of local depression)		d =	3.2	4.8	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.747	0.430	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.3	3.3	cfs
Discharge within the Gutter Section W		Q_w =	1.0	2.5	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W		A_W =	0.37	0.64	sq ft
Velocity within the Gutter Section W		V_W =	2.8	3.9	fps
Water Depth for Design Condition		d_{LOCAL} =	8.2	9.8	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.223	0.137	ft/ft
Required Length L_T to Have 100% Interception		L_T =	4.34	11.34	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	4.34	10.00	ft
Interception Capacity		Q_i =	1.4	5.7	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	4.34	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.4**	**5.6**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.2**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.4**	**5.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.3**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**94**	**%**

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

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

Project: SPRING HILL
Inlet ID: 15-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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 =	0.022	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	9.3	9.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	5.0	5.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.2	1.2	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**15.5**	**15.5**	**cfs**
Flow Velocity within the Gutter Section	V =	6.5	6.5	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	3.1	3.1	

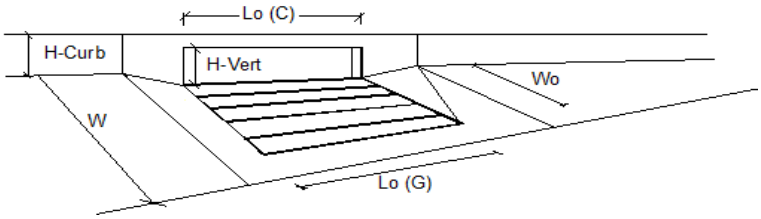
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	2.0	23.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	2.0	22.7	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.5	8.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	7.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	4.5	37.8	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	7.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.7	4.7	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.77	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**4.5**	**29.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	6.61	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.02	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**4.5**	**29.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.56 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.50 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		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, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.6	8.5	cfs
Water Spread Width		T =	6.1	13.6	ft
Water Depth at Flowline (outside of local depression)		d =	3.0	4.8	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.815	0.435	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.3	4.7	cfs
Discharge within the Gutter Section W		Q_w =	1.3	3.6	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.2	cfs
Flow Area within the Gutter Section W		A_W =	0.33	0.63	sq ft
Velocity within the Gutter Section W		V_W =	3.9	5.7	fps
Water Depth for Design Condition		d_{LOCAL} =	8.0	9.8	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.241	0.138	ft/ft
Required Length L_T to Have 100% Interception		L_T =	4.67	14.16	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	4.67	10.00	ft
Interception Capacity		Q_i =	1.6	7.4	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	4.67	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.6**	**7.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**1.1**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.6**	**7.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**1.2**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**85**	**%**

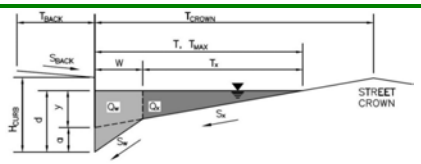
MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: SPRING HILL

Inlet ID: 14-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

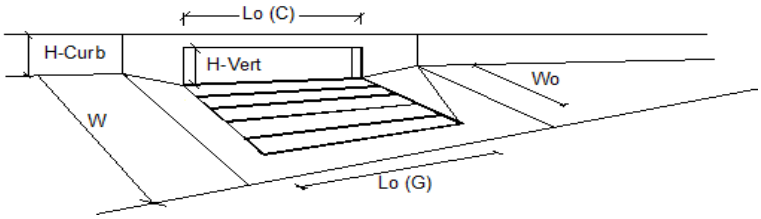
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.23 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.84 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

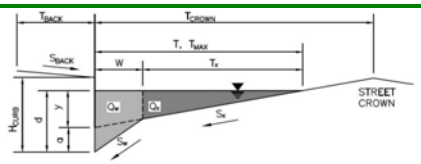


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.2	5.8	cfs
Water Spread Width		T =	6.6	13.7	ft
Water Depth at Flowline (outside of local depression)		d =	3.1	4.8	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.775	0.432	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.3	3.2	cfs
Discharge within the Gutter Section W		Q_w =	1.0	2.5	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W		A_W =	0.35	0.63	sq ft
Velocity within the Gutter Section W		V_W =	2.7	3.9	fps
Water Depth for Design Condition		d_{LOCAL} =	8.1	9.8	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.230	0.137	ft/ft
Required Length L_T to Have 100% Interception		L_T =	4.03	11.19	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	4.03	10.00	ft
Interception Capacity		Q_i =	1.2	5.6	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	4.03	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.2**	**5.5**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.2**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.2**	**5.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.3**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**95**	**%**

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

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

Project: SPRING HILL
Inlet ID: 13-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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 =	0.013	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	7.2	7.2	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.9	3.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.9	0.9	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.9**	**11.9**	**cfs**
Flow Velocity within the Gutter Section	V =	5.0	5.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.3	2.3	

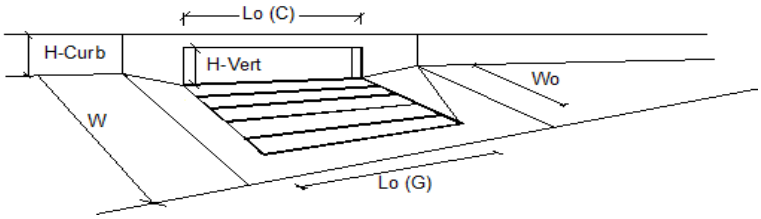
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.5	18.2	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.5	17.5	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.9	6.2	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.4	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.4	29.0	cfs
Average Flow Velocity Within the Gutter Section	V =	3.8	6.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.3	3.6	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.4**	**29.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.4**	**29.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.41 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.56 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

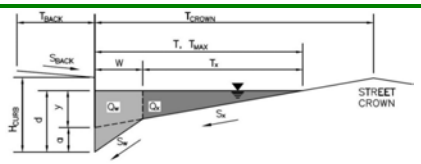


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	0.4	3.6	cfs
Water Spread Width		T =	2.1	10.5	ft
Water Depth at Flowline (outside of local depression)		d =	2.0	4.0	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	1.000	0.551	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.0	1.6	cfs
Discharge within the Gutter Section W		Q_w =	0.4	2.0	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.17	0.51	sq ft
Velocity within the Gutter Section W		V_W =	2.4	3.9	fps
Water Depth for Design Condition		d_{LOCAL} =	7.0	9.0	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.291	0.170	ft/ft
Required Length L_T to Have 100% Interception		L_T =	2.10	8.10	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	2.10	8.10	ft
Interception Capacity		Q_i =	0.4	3.6	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	2.10	8.10	ft
Actual Interception Capacity		**Q_a =**	**0.4**	**3.6**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.0**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**0.4**	**3.6**	**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**	**%**

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

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

Project: SPRING HILL
Inlet ID: 12-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.9	6.9	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.7	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.9	0.9	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.5**	**11.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.3	2.3	

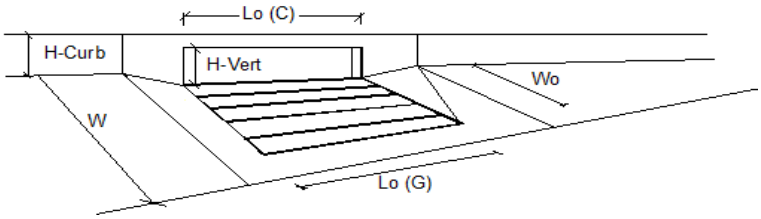
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.4	17.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.8	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.3	27.9	cfs
Average Flow Velocity Within the Gutter Section	V =	3.7	5.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.4	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.3**	**27.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.3**	**27.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.39 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.50 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

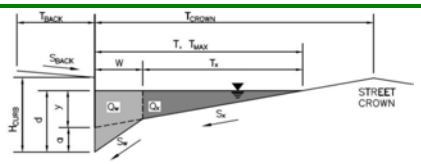


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	0.4	3.5	cfs
Water Spread Width		T =	2.1	10.7	ft
Water Depth at Flowline (outside of local depression)		d =	2.0	4.1	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	1.000	0.546	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.0	1.6	cfs
Discharge within the Gutter Section W		Q_w =	0.4	1.9	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.17	0.51	sq ft
Velocity within the Gutter Section W		V_W =	2.3	3.7	fps
Water Depth for Design Condition		d_{LOCAL} =	7.0	9.1	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.291	0.168	ft/ft
Required Length L_T to Have 100% Interception		L_T =	2.04	8.03	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	2.04	8.03	ft
Interception Capacity		Q_i =	0.4	3.5	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	2.04	8.03	ft
Actual Interception Capacity		**Q_a =**	**0.4**	**3.5**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.0**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**0.4**	**3.5**	**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**	**%**

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

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

Project: SPRING HILL
Inlet ID: 11-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.9	6.9	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.7	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.9	0.9	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.5**	**11.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.3	2.3	

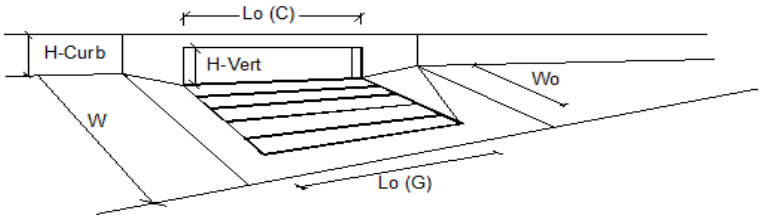
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.4	17.5	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.8	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.3	27.9	cfs
Average Flow Velocity Within the Gutter Section	V =	3.7	5.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.4	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.3**	**27.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.3**	**27.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.42 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 12.44 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

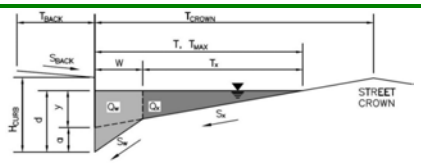


	Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
	Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Warning 2	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.04	0.04	
	Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
	Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	2.4	12.4	cfs
	Water Spread Width	T =	9.0	17.0	ft
	Water Depth at Flowline (outside of local depression)	d =	3.7	5.7	inches
	Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.1	inches
	Ratio of Gutter Flow to Design Flow	E_o =	0.629	0.339	
	Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.9	7.5	cfs
	Discharge within the Gutter Section W	Q_w =	1.5	3.9	cfs
	Discharge Behind the Curb Face	Q_{BACK} =	0.0	1.1	cfs
	Flow Area within the Gutter Section W	A_W =	0.45	0.79	sq ft
	Velocity within the Gutter Section W	V_W =	3.4	4.9	fps
	Water Depth for Design Condition	d_{LOCAL} =	8.7	10.7	inches
	Grate Analysis (Calculated)		MINOR	MAJOR	
	Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
	Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
	Under No-Clogging Condition		MINOR	MAJOR	
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Interception Capacity	Q_i =	N/A	N/A	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
	Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
	Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
	Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
	Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
	Equivalent Slope S_e	S_e =	0.191	0.112	ft/ft
	Required Length L_T to Have 100% Interception	L_T =	6.28	17.65	ft
	Under No-Clogging Condition		MINOR	MAJOR	
	Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	6.28	15.00	ft
	Interception Capacity	Q_i =	2.4	11.0	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient	CurbCoeff =	1.31	1.31	
	Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.02	0.02	
	Effective (Unclogged) Length	L_e =	6.28	14.74	ft
	Actual Interception Capacity	**Q_a =**	**2.4**	**10.9**	**cfs**
	Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.4**	**cfs**
	Summary		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**2.4**	**10.9**	**cfs**
	Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.5**	**cfs**
	Capture Percentage = Q_a/Q_o	**C% =**	**100**	**88**	**%**

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

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

Project: SPRING HILL
Inlet ID: 10-B



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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 =	0.011		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.6	6.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.5	3.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	4.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

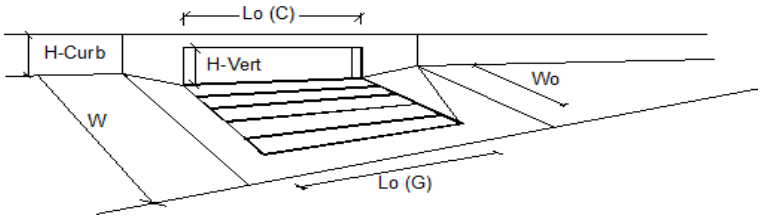
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.4	16.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.1	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.2	26.7	cfs
Average Flow Velocity Within the Gutter Section	V =	3.5	5.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.2**	**26.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.2**	**26.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.22 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.52 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

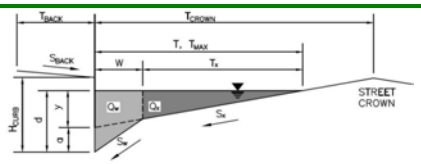


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.2	5.5	cfs
Water Spread Width		T =	6.4	13.2	ft
Water Depth at Flowline (outside of local depression)		d =	3.1	4.7	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.790	0.450	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.3	3.0	cfs
Discharge within the Gutter Section W		Q_w =	1.0	2.4	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W		A_W =	0.34	0.61	sq ft
Velocity within the Gutter Section W		V_W =	2.8	4.0	fps
Water Depth for Design Condition		d_{LOCAL} =	8.1	9.7	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.234	0.142	ft/ft
Required Length L_T to Have 100% Interception		L_T =	4.01	10.80	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	4.01	10.00	ft
Interception Capacity		Q_i =	1.2	5.4	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	4.01	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.2**	**5.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.1**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.2**	**5.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.2**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**97**	**%**

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

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

Project: SPRING HILL
Inlet ID: 9-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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 =	0.011	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.6	6.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.5	3.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	4.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

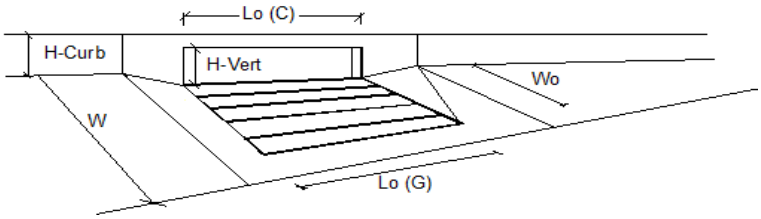
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.4	16.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.1	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.2	26.7	cfs
Average Flow Velocity Within the Gutter Section	V =	3.5	5.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.2**	**26.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.2**	**26.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.20 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 10.48 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

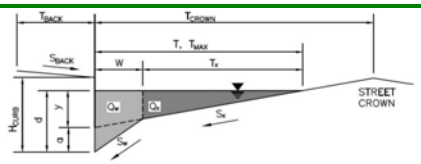


	Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
	Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Warning 2	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.04	0.04	
	Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
	Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	2.2	10.5	cfs
	Water Spread Width	T =	8.8	16.7	ft
	Water Depth at Flowline (outside of local depression)	d =	3.6	5.5	inches
	Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
	Ratio of Gutter Flow to Design Flow	E_o =	0.642	0.356	
	Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.8	6.3	cfs
	Discharge within the Gutter Section W	Q_w =	1.4	3.5	cfs
	Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.8	cfs
	Flow Area within the Gutter Section W	A_W =	0.44	0.76	sq ft
	Velocity within the Gutter Section W	V_W =	3.2	4.6	fps
	Water Depth for Design Condition	d_{LOCAL} =	8.6	10.5	inches
	Grate Analysis (Calculated)		MINOR	MAJOR	
	Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
	Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
	Under No-Clogging Condition		MINOR	MAJOR	
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Interception Capacity	Q_i =	N/A	N/A	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
	Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
	Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
	Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
	Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
	Equivalent Slope S_e	S_e =	0.194	0.116	ft/ft
	Required Length L_T to Have 100% Interception	L_T =	5.90	15.93	ft
	Under No-Clogging Condition		MINOR	MAJOR	
	Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.90	10.00	ft
	Interception Capacity	Q_i =	2.2	8.1	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient	CurbCoeff =	1.25	1.25	
	Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.03	0.03	
	Effective (Unclogged) Length	L_e =	5.90	9.75	ft
	Actual Interception Capacity	**Q_a =**	**2.2**	**8.0**	**cfs**
	Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**1.8**	**cfs**
	Summary		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**2.2**	**8.0**	**cfs**
	Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.5**	**cfs**
	Capture Percentage = Q_a/Q_o	**C% =**	**100**	**76**	**%**

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

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

Project: SPRING HILL
Inlet ID: 8-B



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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 =	0.011		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.6	6.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.5	3.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	4.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

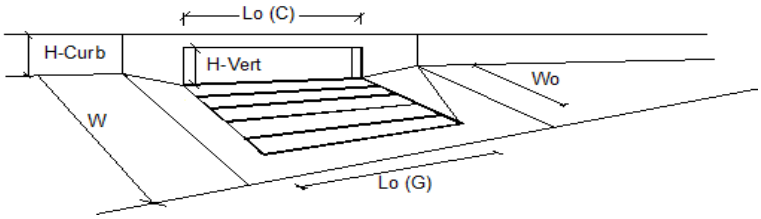
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.4	16.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.1	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.2	26.7	cfs
Average Flow Velocity Within the Gutter Section	V =	3.5	5.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.2**	**26.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.2**	**26.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.04 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 9.42 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

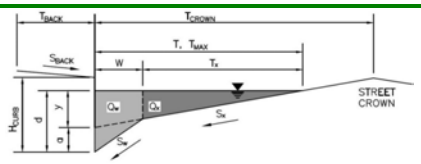


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	2.0	9.4	cfs
Water Spread Width		T =	8.4	16.1	ft
Water Depth at Flowline (outside of local depression)		d =	3.5	5.4	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.660	0.370	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.7	5.6	cfs
Discharge within the Gutter Section W		Q_w =	1.3	3.3	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.6	cfs
Flow Area within the Gutter Section W		A_W =	0.42	0.73	sq ft
Velocity within the Gutter Section W		V_W =	3.2	4.5	fps
Water Depth for Design Condition		d_{LOCAL} =	8.5	10.4	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.199	0.120	ft/ft
Required Length L_T to Have 100% Interception		L_T =	5.61	14.96	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	5.61	10.00	ft
Interception Capacity		Q_i =	2.0	7.6	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	5.61	9.63	ft
Actual Interception Capacity		**Q_a =**	**2.0**	**7.5**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**1.4**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**2.0**	**7.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**2.0**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**79**	**%**

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

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

Project: SPRING HILL
Inlet ID: 7-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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 =	0.011	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.6	6.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.5	3.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	4.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

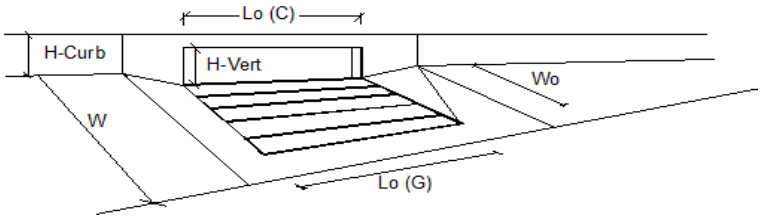
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.4	16.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.1	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.2	26.7	cfs
Average Flow Velocity Within the Gutter Section	V =	3.5	5.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.2**	**26.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.2**	**26.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.09 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.81 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

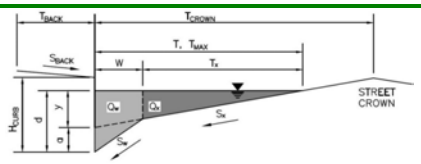


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.1	5.8	cfs
Water Spread Width		T =	6.0	13.4	ft
Water Depth at Flowline (outside of local depression)		d =	3.0	4.7	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.819	0.441	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.2	3.2	cfs
Discharge within the Gutter Section W		Q_w =	0.9	2.5	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W		A_W =	0.33	0.62	sq ft
Velocity within the Gutter Section W		V_W =	2.7	4.0	fps
Water Depth for Design Condition		d_{LOCAL} =	8.0	9.7	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.242	0.140	ft/ft
Required Length L_T to Have 100% Interception		L_T =	3.73	11.16	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	3.73	10.00	ft
Interception Capacity		Q_i =	1.1	5.6	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	3.73	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.1**	**5.5**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**0.2**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.1**	**5.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.3**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**95**	**%**

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

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

Project: SPRING HILL
Inlet ID: 6-B



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

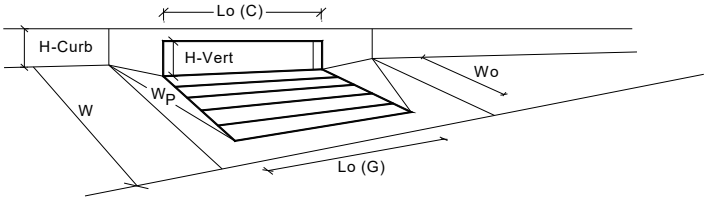
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	17.0	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.349	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

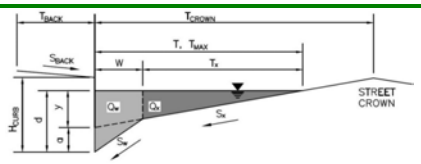


Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	5.6	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
Open Area 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	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) =	0.06	0.06	
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	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.25	1.25	
Clogging Factor for Multiple Units	Clog =	0.04	0.04	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	2.6	7.3	cfs
Interception with Clogging	Q_{wa} =	2.5	7.0	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	19.5	21.8	cfs
Interception with Clogging	Q_{oa} =	18.8	21.0	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	6.7	11.8	cfs
Interception with Clogging	Q_{ma} =	6.4	11.3	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**2.5**	**7.0**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.00	10.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	10.4	17.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.30	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.91	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.5**	**7.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.9	4.2	cfs

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

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

Project: SPRING HILL
Inlet ID: 5-B



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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 =	0.011	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.6	6.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.5	3.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.6	4.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

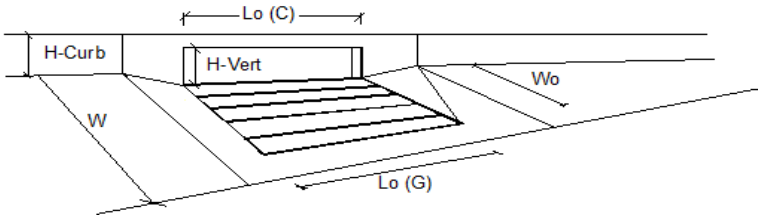
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.4	16.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.1	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.2	26.7	cfs
Average Flow Velocity Within the Gutter Section	V =	3.5	5.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.2**	**26.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.2**	**26.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.51 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 7.05 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



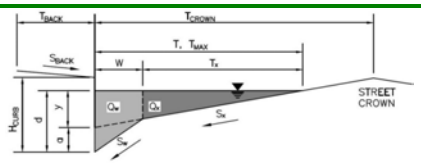
Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.5	7.1	cfs
Water Spread Width	T =	7.2	14.5	ft
Water Depth at Flowline (outside of local depression)	d =	3.3	5.0	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.735	0.410	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.4	4.0	cfs
Discharge within the Gutter Section W	Q_w =	1.1	2.8	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.2	cfs
Flow Area within the Gutter Section W	A_W =	0.38	0.66	sq ft
Velocity within the Gutter Section W	V_W =	3.0	4.2	fps
Water Depth for Design Condition	d_{LOCAL} =	8.3	10.0	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.219	0.131	ft/ft
Required Length L_T to Have 100% Interception	L_T =	4.60	12.57	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.60	10.00	ft
Interception Capacity	Q_i =	1.5	6.4	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	4.60	9.63	ft
Actual Interception Capacity	**Q_a =**	**1.5**	**6.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.5**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.5**	**6.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.7**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**90**	**%**

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

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

Project: SPRING HILL

Inlet ID: 4-B



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

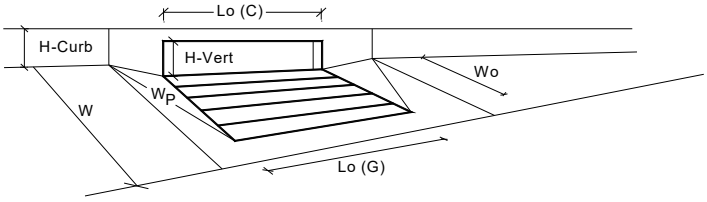
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	17.0	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.349	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

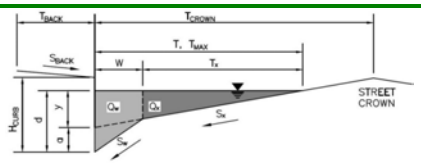


Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	5.6	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
Open Area 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	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) =	0.06	0.06	
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	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.25	1.25	
Clogging Factor for Multiple Units	Clog =	0.04	0.04	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	2.6	7.3	cfs
Interception with Clogging	Q_{wa} =	2.5	7.0	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	19.5	21.8	cfs
Interception with Clogging	Q_{oa} =	18.8	21.0	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	6.7	11.8	cfs
Interception with Clogging	Q_{ma} =	6.4	11.3	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**2.5**	**7.0**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.00	10.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	10.4	17.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.30	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.91	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.5**	**7.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.0	6.9	cfs

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

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

Project: SPRING HILL
Inlet ID: 3-B



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	8.9	8.9	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	4.8	4.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.1	1.1	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**14.8**	**14.8**	**cfs**
Flow Velocity within the Gutter Section	V =	6.2	6.2	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.9	2.9	

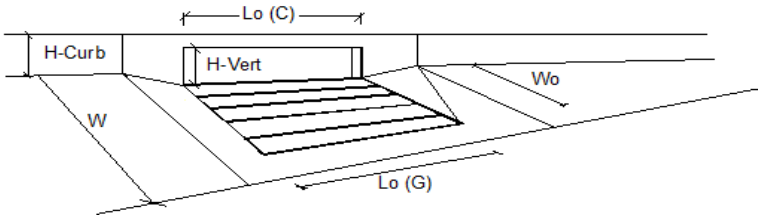
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.9	22.6	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.9	21.7	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	2.4	7.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	6.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	4.3	36.0	cfs
Average Flow Velocity Within the Gutter Section	V =	4.8	7.5	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.6	4.4	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	0.83	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**4.3**	**30.1**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	6.75	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.16	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**4.3**	**30.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.92 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 9.42 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

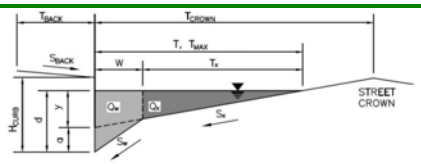


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	1.9	9.4	cfs
Water Spread Width		T =	7.0	14.4	ft
Water Depth at Flowline (outside of local depression)		d =	3.2	5.0	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.751	0.412	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.5	5.4	cfs
Discharge within the Gutter Section W		Q_w =	1.4	3.8	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.3	cfs
Flow Area within the Gutter Section W		A_W =	0.37	0.66	sq ft
Velocity within the Gutter Section W		V_W =	3.9	5.7	fps
Water Depth for Design Condition		d_{LOCAL} =	8.2	10.0	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.224	0.132	ft/ft
Required Length L_T to Have 100% Interception		L_T =	5.34	15.08	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	5.34	10.00	ft
Interception Capacity		Q_i =	1.9	7.8	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	5.34	9.63	ft
Actual Interception Capacity		**Q_a =**	**1.9**	**7.7**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.0**	**1.5**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.9**	**7.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**1.8**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**100**	**81**	**%**

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

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

Project: SPRING HILL
Inlet ID: 2-B



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

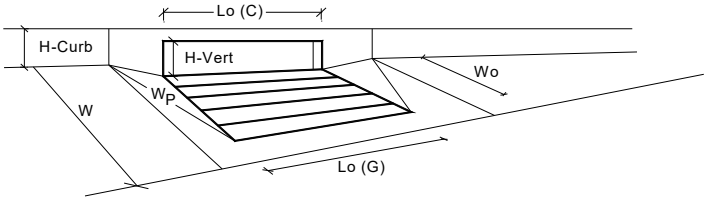
Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	17.0	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.349	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



	Design Information (Input) — CDOT Type R Curb Opening		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	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 =	4.0	5.6	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
	Open Area 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	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
Warning 3	Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.04	0.04	
	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	
	Grate Flow Analysis (Calculated)		MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
	Clogging Factor for Multiple Units	Clog =	N/A	N/A	
	Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
	Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
	Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
	Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
	Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
	Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
	Grate Capacity as Mixed Flow		MINOR	MAJOR	
	Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
	Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
	Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
	Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
	Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	
	Clogging Factor for Multiple Units	Clog =	0.02	0.02	
	Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
	Interception without Clogging	Q_{wi} =	2.9	8.4	cfs
	Interception with Clogging	Q_{wa} =	2.9	8.2	cfs
	Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
	Interception without Clogging	Q_{oi} =	29.3	32.7	cfs
	Interception with Clogging	Q_{oa} =	28.7	32.2	cfs
	Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
	Interception without Clogging	Q_{mi} =	8.6	15.4	cfs
	Interception with Clogging	Q_{ma} =	8.4	15.1	cfs
	Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**2.9**	**8.2**	**cfs**
	Resultant Street Conditions		MINOR	MAJOR	
	Total Inlet Length	L =	15.00	15.00	feet
	Resultant Street Flow Spread (based on street geometry from above)	T =	10.4	17.0	ft
	Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
	Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
	Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
	Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.30	ft
	Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
	Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.64	0.76	
	Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
			MINOR	MAJOR	
	Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.9**	**8.2**	**cfs**
	Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.7	8.0	cfs

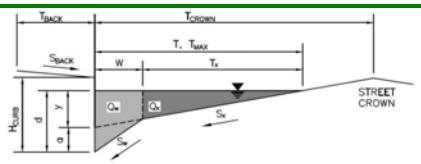
Warning 3: Clogging Factor is not the recommended value for inlet type specified..

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

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

Project: SPRING HILL

Inlet ID: 1-B



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

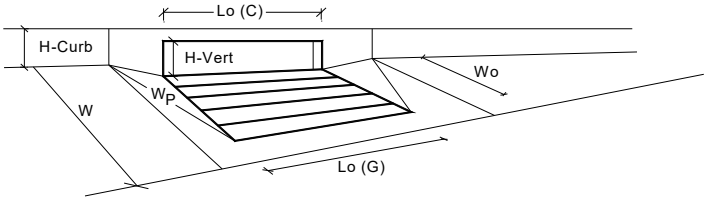
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	17.0	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.349	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	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 =	4.0	5.6	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
Open Area 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	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) =	0.06	0.06	
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	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.25	1.25	
Clogging Factor for Multiple Units	Clog =	0.04	0.04	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	2.6	7.3	cfs
Interception with Clogging	Q_{wa} =	2.5	7.0	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	19.5	21.8	cfs
Interception with Clogging	Q_{oa} =	18.8	21.0	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	6.7	11.8	cfs
Interception with Clogging	Q_{ma} =	6.4	11.3	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**2.5**	**7.0**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.00	10.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	10.4	17.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.30	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.91	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.5**	**7.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.7	3.2	cfs

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	6-C	5-C
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.9	0.4
Major Q_{Known} (cfs)	4.7	1.5

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**0.9**	**0.4**
Major Total Design Peak Flow, Q (cfs)	**4.7**	**1.5**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	4-C	3-C
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	3.2	0.5
Major Q_{Known} (cfs)	20.6	4.4

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**3.2**	**0.5**
Major Total Design Peak Flow, Q (cfs)	**20.6**	**4.4**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	3.2	0.0

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	2-C	1-C
Site Type (Urban or Rural)		
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.7	1.2
Major Q_{Known} (cfs)	13.3	4.2

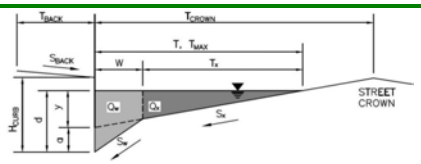
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.7**	**1.2**
Major Total Design Peak Flow, Q (cfs)	**13.3**	**4.2**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A

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

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

Project: SPRING HILL
Inlet ID: 1-C



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

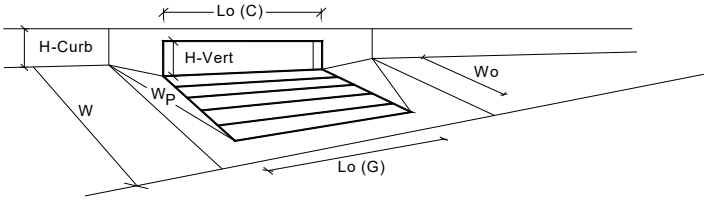
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	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 =	4.0	5.6	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat	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	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	2.1	5.1	cfs
Interception with Clogging	Q_{wa} =	1.9	4.6	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	9.8	10.9	cfs
Interception with Clogging	Q_{oa} =	8.8	9.8	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	4.2	6.9	cfs
Interception with Clogging	Q_{ma} =	3.8	6.2	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**1.9**	**4.6**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	10.4	17.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.30	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.9**	**4.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.2	4.2	cfs

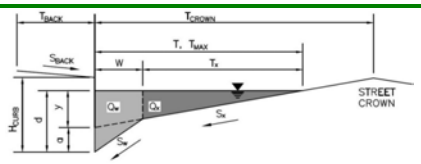
MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: SPRING HILL

Inlet ID: 2-C



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

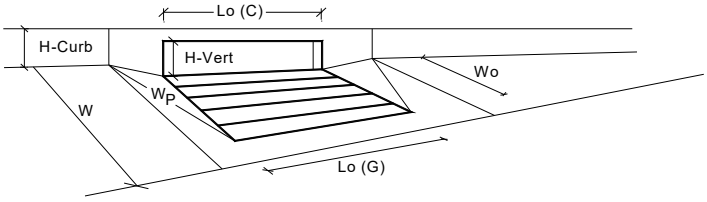
Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



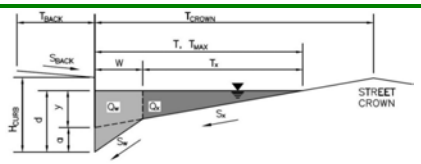
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	2	2	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.0	5.6	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
Open Area 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		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
Warning 3 Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.04	0.04	
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	
Grate Flow Analysis (Calculated)			MINOR	MAJOR	
Clogging Coefficient for Multiple Units		Coef =	N/A	N/A	
Clogging Factor for Multiple Units		Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{wi} =	N/A	N/A	cfs
Interception with Clogging		Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{oi} =	N/A	N/A	cfs
Interception with Clogging		Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow			MINOR	MAJOR	
Interception without Clogging		Q_{mi} =	N/A	N/A	cfs
Interception with Clogging		Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)		**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)			MINOR	MAJOR	
Clogging Coefficient for Multiple Units		Coef =	1.33	1.33	
Clogging Factor for Multiple Units		Clog =	0.01	0.01	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{wi} =	5.3	15.1	cfs
Interception with Clogging		Q_{wa} =	5.2	15.0	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{oi} =	58.5	65.5	cfs
Interception with Clogging		Q_{oa} =	58.0	64.9	cfs
Curb Opening Capacity as Mixed Flow			MINOR	MAJOR	
Interception without Clogging		Q_{mi} =	16.3	29.3	cfs
Interception with Clogging		Q_{ma} =	16.2	29.0	cfs
Resulting Curb Opening Capacity (assumes clogged condition)		**Q_{Curb} =**	**5.2**	**15.0**	**cfs**
Resultant Street Conditions			MINOR	MAJOR	
Total Inlet Length		L =	30.00	30.00	feet
Resultant Street Flow Spread (based on street geometry from above)		T =	10.4	17.0	ft
Resultant Flow Depth at Street Crown		d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.17	0.30	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.64	0.76	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**5.2**	**15.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_{PEAK\ REQUIRED}$ =	1.7	13.3	cfs

Warning 3: Clogging Factor is not the recommended value for inlet type specified..

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

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

Project: SPRING HILL
Inlet ID: 3-C



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

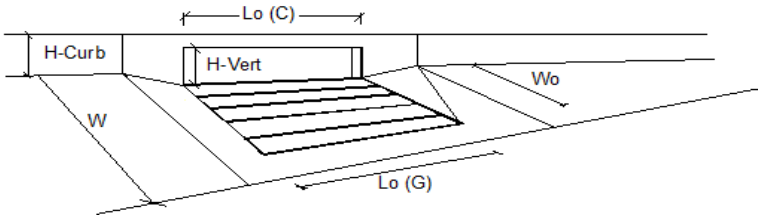
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.49 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.38 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



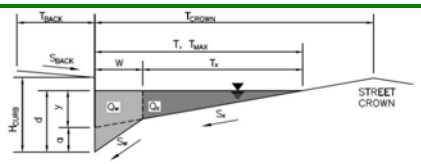
	Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
	Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Warning 2	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.04	0.04	
	Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
	Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.5	4.4	cfs
	Water Spread Width	T =	3.5	12.2	ft
	Water Depth at Flowline (outside of local depression)	d =	2.3	4.4	inches
	Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
	Ratio of Gutter Flow to Design Flow	E_o =	0.974	0.483	
	Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.0	2.2	cfs
	Discharge within the Gutter Section W	Q_w =	0.5	2.1	cfs
	Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
	Flow Area within the Gutter Section W	A_W =	0.22	0.57	sq ft
	Velocity within the Gutter Section W	V_W =	2.1	3.7	fps
	Water Depth for Design Condition	d_{LOCAL} =	7.3	9.4	inches
	Grate Analysis (Calculated)		MINOR	MAJOR	
	Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
	Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
	Under No-Clogging Condition		MINOR	MAJOR	
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Interception Capacity	Q_i =	N/A	N/A	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
	Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
	Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
	Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
	Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
	Equivalent Slope S_e	S_e =	0.284	0.151	ft/ft
	Required Length L_T to Have 100% Interception	L_T =	2.29	9.32	ft
	Under No-Clogging Condition		MINOR	MAJOR	
	Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	2.29	9.32	ft
	Interception Capacity	Q_i =	0.5	4.4	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient	CurbCoeff =	1.31	1.31	
	Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.02	0.02	
	Effective (Unclogged) Length	L_e =	2.29	9.32	ft
	Actual Interception Capacity	**Q_a =**	**0.5**	**4.4**	**cfs**
	Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
	Summary		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**0.5**	**4.4**	**cfs**
	Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o	**C% =**	**100**	**99**	**%**

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

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

Project: SPRING HILL

Inlet ID: 4-C



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

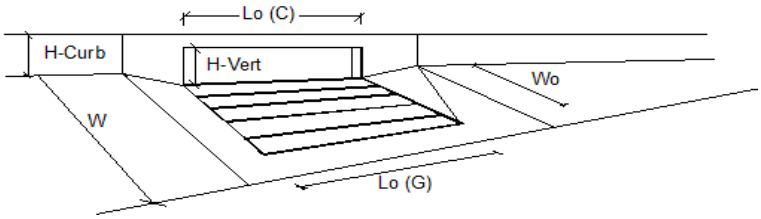
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

WARNING: MINOR STORM max. allowable capacity is less than the design peak flow of 3.17 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 20.56 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

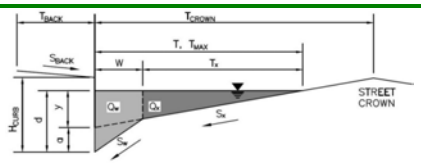


	Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
	Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Warning 2	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.04	0.04	
	Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR & MAJOR STORM		MINOR	MAJOR	
	Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	3.2	20.6	cfs
	Water Spread Width	T =	10.6	17.0	ft
	Water Depth at Flowline (outside of local depression)	d =	4.1	6.7	inches
	Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	1.1	inches
	Ratio of Gutter Flow to Design Flow	E_o =	0.548	0.278	
	Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	1.4	12.5	cfs
	Discharge within the Gutter Section W	Q_w =	1.7	4.8	cfs
	Discharge Behind the Curb Face	Q_{BACK} =	0.0	3.2	cfs
	Flow Area within the Gutter Section W	A_W =	0.51	0.95	sq ft
	Velocity within the Gutter Section W	V_W =	3.4	5.1	fps
	Water Depth for Design Condition	d_{LOCAL} =	9.1	11.7	inches
	Grate Analysis (Calculated)		MINOR	MAJOR	
	Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
	Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
	Under No-Clogging Condition		MINOR	MAJOR	
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Interception Capacity	Q_i =	N/A	N/A	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
	Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
	Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
	Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
	Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
	Equivalent Slope S_e	S_e =	0.169	0.095	ft/ft
	Required Length L_T to Have 100% Interception	L_T =	7.54	23.30	ft
	Under No-Clogging Condition		MINOR	MAJOR	
	Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	7.54	23.30	ft
	Interception Capacity	Q_i =	3.2	17.3	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient	CurbCoeff =	1.33	1.33	
	Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.01	0.01	
	Effective (Unclogged) Length	L_e =	7.54	23.30	ft
	Actual Interception Capacity	**Q_a =**	**3.2**	**17.3**	**cfs**
	Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
	Summary		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**3.2**	**17.3**	**cfs**
	Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**3.2**	**cfs**
	Capture Percentage = Q_a/Q_o	**C% =**	**100**	**84**	**%**

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

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

Project: SPRING HILL
Inlet ID: 5-C



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

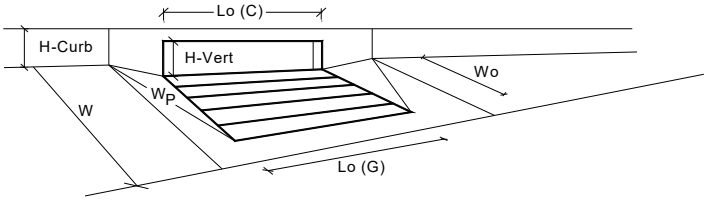
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	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 =	4.0	5.6	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
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat	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	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	2.1	5.1	cfs
Interception with Clogging	Q_{wa} =	1.9	4.6	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	9.8	10.9	cfs
Interception with Clogging	Q_{oa} =	8.8	9.8	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	4.2	6.9	cfs
Interception with Clogging	Q_{ma} =	3.8	6.2	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**1.9**	**4.6**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	10.4	17.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.30	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.9**	**4.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.4	1.5	cfs

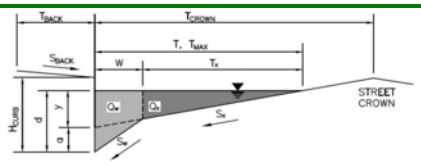
MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: SPRING HILL

Inlet ID: 6-C



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	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} =	0.016	
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} =	0.018	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

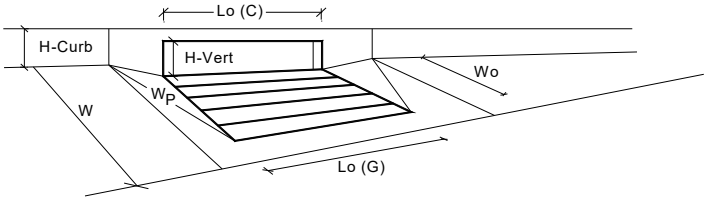
Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	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 =	4.0	5.6	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
Open Area 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	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) =	0.06	0.06	
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	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.25	1.25	
Clogging Factor for Multiple Units	Clog =	0.04	0.04	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	2.6	7.3	cfs
Interception with Clogging	Q_{wa} =	2.5	7.0	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	19.5	21.8	cfs
Interception with Clogging	Q_{oa} =	18.8	21.0	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	6.7	11.8	cfs
Interception with Clogging	Q_{ma} =	6.4	11.3	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**2.5**	**7.0**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.00	10.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	10.4	17.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.30	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.91	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.5**	**7.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.9	4.7	cfs

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	7D	6D	5D
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.3	0.7	0.7
Major Q_{Known} (cfs)	6.1	10.0	6.0

Bypass (Carry-Over) Flow from Upstream

Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.3**	**0.7**	**0.7**
Major Total Design Peak Flow, Q (cfs)	**6.1**	**10.0**	**6.0**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.4	N/A	0.4

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	4D	3D	2D
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.7	0.1	2.5
Major Q_{Known} (cfs)	7.2	0.9	14.9

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.7**	**0.1**	**2.5**
Major Total Design Peak Flow, Q (cfs)	**7.2**	**0.9**	**14.9**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.9	0.0	N/A

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	1D
Site Type (Urban or Rural)	URBAN
Inlet Application (Street or Area)	STREET
Hydraulic Condition	In Sump
Inlet Type	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	3.1
Major Q_{Known} (cfs)	15.4

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0

Watershed Characteristics

Subcatchment Area (acres)	
Percent Impervious	
NRCS Soil Type	

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

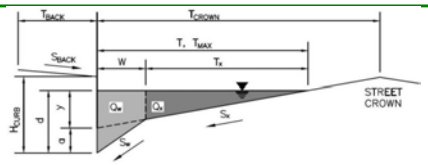
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**3.1**
Major Total Design Peak Flow, Q (cfs)	**15.4**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A

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

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

Project: **SpringHill E5X**
Inlet ID: **7D**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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 =	0.011		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

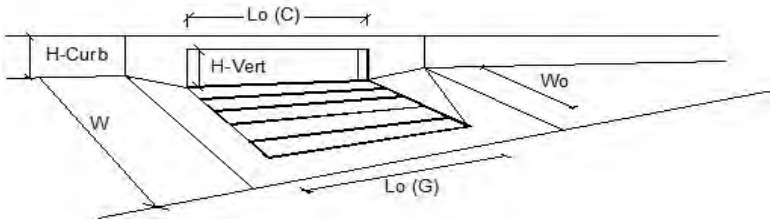
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	2.64	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.15	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	9.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.532	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	1.7	6.6	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	1.9	3.5	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**3.6**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	3.6	4.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.3	2.2	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.4	16.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.1	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.2	26.7	cfs
Average Flow Velocity Within the Gutter Section	V =	3.5	5.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.2**	**26.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.2**	**26.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.34 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.05 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

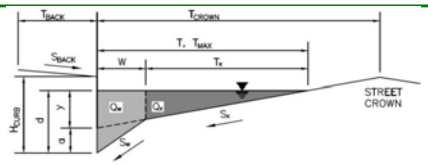


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.3	6.1	cfs
Water Spread Width	T =	6.8	13.6	ft
Water Depth at Flowline (outside of local depression)	d =	3.1	4.8	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.766	0.435	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.3	3.3	cfs
Discharge within the Gutter Section W	Q_w =	1.0	2.6	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W	A_W =	0.36	0.63	sq ft
Velocity within the Gutter Section W	V_W =	2.9	4.1	fps
Water Depth for Design Condition	d_{LOCAL} =	8.1	9.8	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.228	0.138	ft/ft
Required Length L_T to Have 100% Interception	L_T =	4.26	11.44	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.26	10.00	ft
Interception Capacity	Q_i =	1.3	5.8	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	4.26	9.38	ft
Actual Interception Capacity	**Q_a =**	**1.3**	**5.7**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.3**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.3**	**5.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.4**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**93**	**%**

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

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

Project: **SpringHill E5X**
Inlet ID: **6D**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

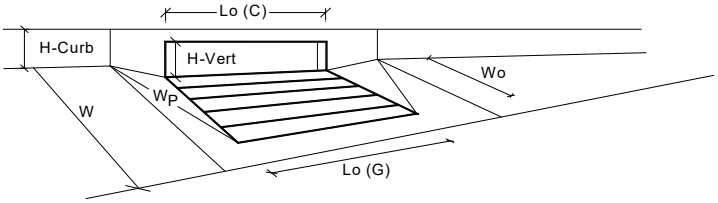
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	2.64	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.15	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	9.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.532	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	17.0	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.349	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

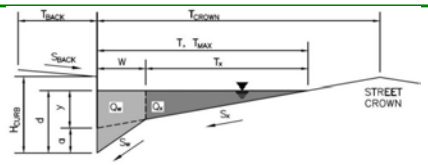


Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	5.6	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
Open Area 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	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	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.25	1.25	
Clogging Factor for Multiple Units	Clog =	0.06	0.06	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	2.6	7.3	cfs
Interception with Clogging	Q_{wa} =	2.5	6.9	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	19.5	21.8	cfs
Interception with Clogging	Q_{oa} =	18.3	20.5	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	6.7	11.8	cfs
Interception with Clogging	Q_{ma} =	6.3	11.0	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**2.5**	**6.9**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.00	10.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	10.4	17.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.30	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.91	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.5**	**6.9**	**cfs**
WARNING: Inlet Capacity < Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	0.7	10.0	cfs

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

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

Project: **SpringHill E5X**
Inlet ID: **5D**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	2.64	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.15	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	9.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.532	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	1.6	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	1.8	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**3.4**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	3.5	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.2	2.1	

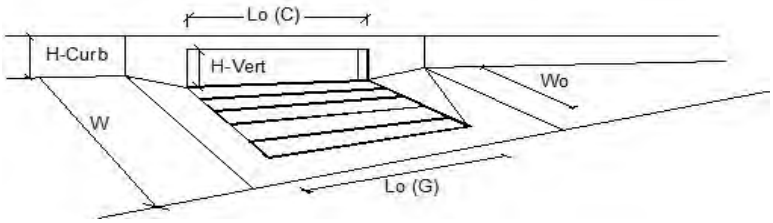
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.68 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.03 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

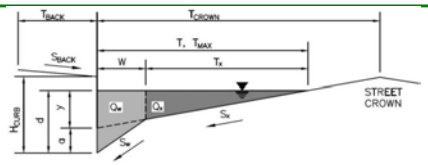


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.7	6.0	cfs
Water Spread Width	T =	4.6	13.9	ft
Water Depth at Flowline (outside of local depression)	d =	2.6	4.8	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.917	0.427	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.1	3.4	cfs
Discharge within the Gutter Section W	Q_w =	0.6	2.5	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W	A_W =	0.27	0.64	sq ft
Velocity within the Gutter Section W	V_W =	2.3	3.9	fps
Water Depth for Design Condition	d_{LOCAL} =	7.6	9.8	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.269	0.136	ft/ft
Required Length L_T to Have 100% Interception	L_T =	2.78	11.42	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	2.78	10.00	ft
Interception Capacity	Q_i =	0.7	5.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	2.78	9.38	ft
Actual Interception Capacity	**Q_a =**	**0.7**	**5.6**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.3**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.7**	**5.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.4**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**93**	**%**

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

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

Project: **SpringHill E5X**
Inlet ID: **4D**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	2.64	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.15	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	9.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.532	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	1.6	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	1.8	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**3.4**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	3.5	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.2	2.1	

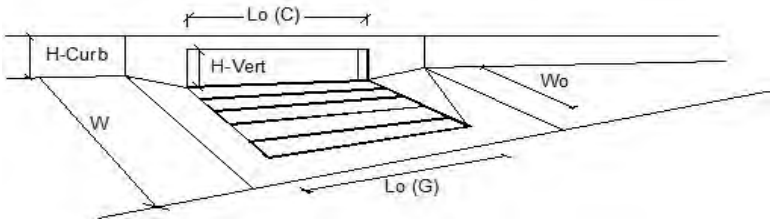
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.0**	**25.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.71 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 7.15 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

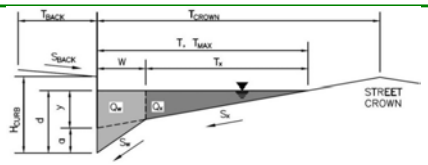


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.7	7.2	cfs
Water Spread Width	T =	7.9	14.8	ft
Water Depth at Flowline (outside of local depression)	d =	3.4	5.1	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.693	0.401	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.5	4.1	cfs
Discharge within the Gutter Section W	Q_w =	1.2	2.8	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.3	cfs
Flow Area within the Gutter Section W	A_W =	0.40	0.68	sq ft
Velocity within the Gutter Section W	V_W =	2.9	4.1	fps
Water Depth for Design Condition	d_{LOCAL} =	8.4	10.1	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.208	0.129	ft/ft
Required Length L_T to Have 100% Interception	L_T =	5.00	12.67	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.00	10.00	ft
Interception Capacity	Q_i =	1.7	6.5	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	5.00	9.38	ft
Actual Interception Capacity	**Q_a =**	**1.7**	**6.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.6**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.7**	**6.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.9**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**88**	**%**

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

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

Project: **SpringHill E5X**
Inlet ID: **3D**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.5		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 =	0.011		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	17.5	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

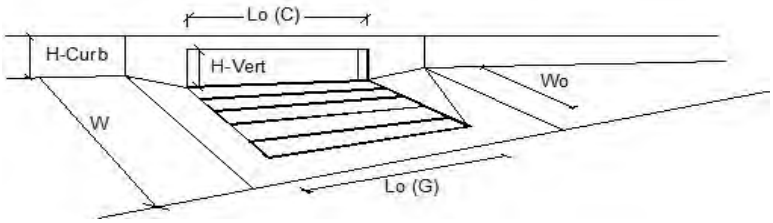
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	2.64	4.20	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.15	5.71	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	9.0	15.5	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.532	0.340	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	1.7	7.2	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	1.9	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	1.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**3.6**	**11.9**	**cfs**
Flow Velocity within the Gutter Section	V =	3.6	4.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.3	2.2	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.4	16.7	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.4	16.2	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.8	5.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.2	26.8	cfs
Average Flow Velocity Within the Gutter Section	V =	3.5	5.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.2	3.3	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.2**	**26.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.39	inches
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**3.2**	**26.8**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.09 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 0.94 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

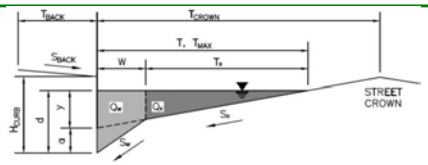


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.1	0.9	cfs
Water Spread Width	T =	1.2	5.5	ft
Water Depth at Flowline (outside of local depression)	d =	1.8	2.8	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	1.000	0.854	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.0	0.1	cfs
Discharge within the Gutter Section W	Q_w =	0.1	0.8	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.00	0.31	sq ft
Velocity within the Gutter Section W	V_W =	0.0	2.6	fps
Water Depth for Design Condition	d_{LOCAL} =	6.8	7.8	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.291	0.252	ft/ft
Required Length L_T to Have 100% Interception	L_T =	0.96	3.39	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	0.96	3.39	ft
Interception Capacity	Q_i =	0.1	0.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	0.96	3.39	ft
Actual Interception Capacity	**Q_a =**	**0.1**	**0.9**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.1**	**0.9**	**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**	**%**

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

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

Project: **SpringHill E5X**
Inlet ID: **2D**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

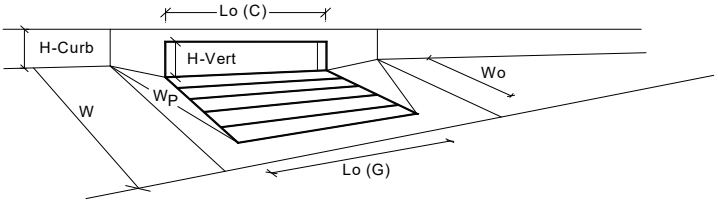
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	2.64	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.15	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	9.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.532	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



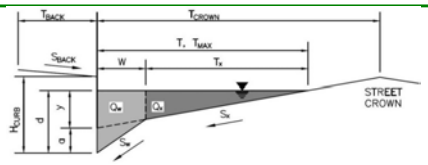
Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	7.1	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
Open Area 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	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
Warning 3 Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.04	0.04	
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	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	
Clogging Factor for Multiple Units	Clog =	0.02	0.02	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	2.9	15.8	cfs
Interception with Clogging	Q_{wa} =	2.9	15.5	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	29.3	35.7	cfs
Interception with Clogging	Q_{oa} =	28.7	35.0	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	8.6	22.1	cfs
Interception with Clogging	Q_{ma} =	8.4	21.7	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**2.9**	**15.5**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.00	15.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	10.4	23.3	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	1.5	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.43	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.64	0.85	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.9**	**15.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.5	14.9	cfs

Warning 3: Clogging Factor is not the recommended value for inlet type specified..

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

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

Project: **SpringHill E5X**
Inlet ID: **1D**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

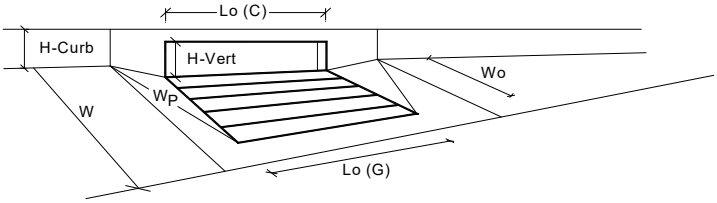
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	2.64	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	4.15	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	9.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.532	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	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 =	4.1	7.1	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
Open Area 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		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
Warning 3 Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.04	0.04	
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	
Grate Flow Analysis (Calculated)			MINOR	MAJOR	
Clogging Coefficient for Multiple Units		Coef =	N/A	N/A	
Clogging Factor for Multiple Units		Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{wi} =	N/A	N/A	cfs
Interception with Clogging		Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{oi} =	N/A	N/A	cfs
Interception with Clogging		Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow			MINOR	MAJOR	
Interception without Clogging		Q_{mi} =	N/A	N/A	cfs
Interception with Clogging		Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)		**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)			MINOR	MAJOR	
Clogging Coefficient for Multiple Units		Coef =	1.31	1.31	
Clogging Factor for Multiple Units		Clog =	0.02	0.02	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{wi} =	3.2	15.8	cfs
Interception with Clogging		Q_{wa} =	3.1	15.5	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{oi} =	29.5	35.7	cfs
Interception with Clogging		Q_{oa} =	28.9	35.0	cfs
Curb Opening Capacity as Mixed Flow			MINOR	MAJOR	
Interception without Clogging		Q_{mi} =	9.0	22.1	cfs
Interception with Clogging		Q_{ma} =	8.8	21.7	cfs
Resulting Curb Opening Capacity (assumes clogged condition)		**Q_{Curb} =**	**3.1**	**15.5**	**cfs**
Resultant Street Conditions			MINOR	MAJOR	
Total Inlet Length		L =	15.00	15.00	feet
Resultant Street Flow Spread (based on street geometry from above)		T =	10.8	23.3	**ft. >T-Crown**
Resultant Flow Depth at Street Crown		d_{CROWN} =	0.0	1.5	inches
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.18	0.43	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.65	0.85	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**3.1**	**15.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_{PEAK\ REQUIRED}$ =	3.1	15.4	cfs

Warning 3: Clogging Factor is not the recommended value for inlet type specified..

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	8-E	7-E	6-E
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	2.67	1.52	2.24
Major Q_{Known} (cfs)	11.56	7.00	9.86

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**2.67**	**1.52**	**2.24**
Major Total Design Peak Flow, Q (cfs)	**11.56**	**7.00**	**9.86**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.00	0.00	0.00
Major Flow Bypassed Downstream, Q_b (cfs)	1.27	0.74	2.25

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	5-E	4-E	3-E
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.69	2.06	1.02
Major Q_{Known} (cfs)	6.87	9.67	7.49

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.69**	**2.06**	**1.02**
Major Total Design Peak Flow, Q (cfs)	**6.87**	**9.67**	**7.49**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.00	0.00	0.00
Major Flow Bypassed Downstream, Q_b (cfs)	0.69	2.14	0.96

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	E3-OS	2-E	1-E
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	STREET	STREET
Hydraulic Condition	Swale	In Sump	In Sump
Inlet Type	CDOT Type C (Depressed)	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.68	2.00	1.99
Major Q_{Known} (cfs)	8.90	8.03	8.03

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

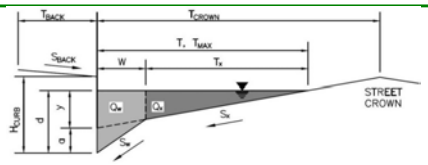
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**0.68**	**2.00**	**1.99**
Major Total Design Peak Flow, Q (cfs)	**8.90**	**8.03**	**8.03**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.00	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.00	N/A	N/A

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

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

Project: **Spring Hill Pond E**
Inlet ID: **8-E**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

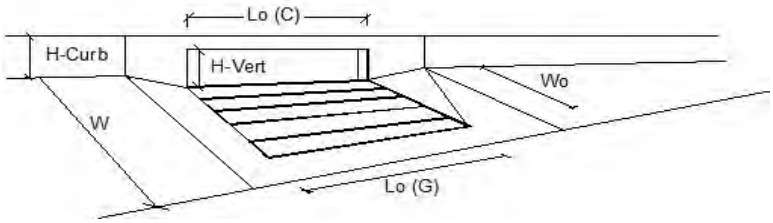
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**3.0**	**10.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.67 cfs on sheet 'Inlet Management'
WARNING: MAJOR STORM max. allowable capacity is less than the design peak flow of 11.56 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

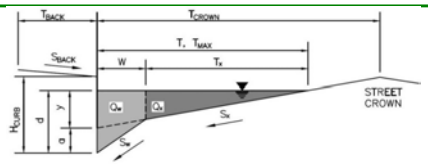


	Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
	Type of Inlet	Type =	CDOT Type R Curb Opening		
	Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
	Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
	Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
	Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
	Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Warning 2	Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.04	0.04	
	Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM		MINOR	MAJOR	
	Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	2.7	11.6	cfs
	Water Spread Width	T =	9.8	17.0	ft
	Water Depth at Flowline (outside of local depression)	d =	3.9	5.7	inches
	Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.1	inches
	Ratio of Gutter Flow to Design Flow	E_o =	0.586	0.337	
	Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	1.1	7.0	cfs
	Discharge within the Gutter Section W	Q_w =	1.6	3.6	cfs
	Discharge Behind the Curb Face	Q_{BACK} =	0.0	1.0	cfs
	Flow Area within the Gutter Section W	A_W =	0.48	0.79	sq ft
	Velocity within the Gutter Section W	V_W =	3.3	4.5	fps
	Water Depth for Design Condition	d_{LOCAL} =	8.9	10.7	inches
	Grate Analysis (Calculated)		MINOR	MAJOR	
	Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
	Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
	Under No-Clogging Condition		MINOR	MAJOR	
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Interception Capacity	Q_i =	N/A	N/A	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
	Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
	Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
	Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
	Interception Rate of Frontal Flow	R_f =	N/A	N/A	
	Interception Rate of Side Flow	R_x =	N/A	N/A	
	Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
	Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
	Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
	Equivalent Slope S_e	S_e =	0.179	0.111	ft/ft
	Required Length L_T to Have 100% Interception	L_T =	6.72	16.84	ft
	Under No-Clogging Condition		MINOR	MAJOR	
	Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	6.72	15.00	ft
	Interception Capacity	Q_i =	2.7	10.3	cfs
	Under Clogging Condition		MINOR	MAJOR	
	Clogging Coefficient	CurbCoeff =	1.31	1.31	
	Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.02	0.02	
	Effective (Unclogged) Length	L_e =	6.72	14.71	ft
	Actual Interception Capacity	**Q_a =**	**2.7**	**10.3**	**cfs**
	Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.3**	**cfs**
	Summary		MINOR	MAJOR	
	Total Inlet Interception Capacity	**Q =**	**2.7**	**10.3**	**cfs**
	Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.3**	**cfs**
	Capture Percentage = Q_a/Q_o	**C% =**	**100**	**89**	**%**

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

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

Project: Spring Hill Pond E
Inlet ID: 7-E



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

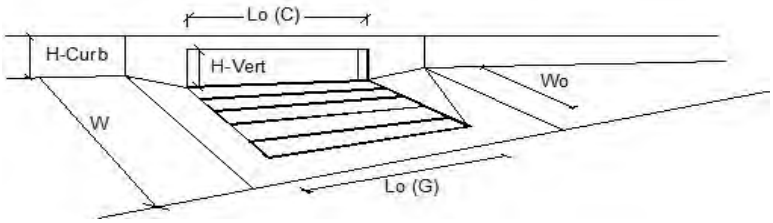
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**3.0**	**10.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.52 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 7.00 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

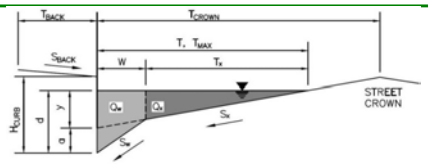


Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.5	7.0	cfs
Water Spread Width	T =	7.5	14.7	ft
Water Depth at Flowline (outside of local depression)	d =	3.3	5.0	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.721	0.404	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.4	4.0	cfs
Discharge within the Gutter Section W	Q_w =	1.1	2.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.3	cfs
Flow Area within the Gutter Section W	A_W =	0.38	0.67	sq ft
Velocity within the Gutter Section W	V_W =	2.9	4.0	fps
Water Depth for Design Condition	d_{LOCAL} =	8.3	10.0	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.216	0.130	ft/ft
Required Length L_T to Have 100% Interception	L_T =	4.63	12.51	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.63	10.00	ft
Interception Capacity	Q_i =	1.5	6.4	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	4.63	9.61	ft
Actual Interception Capacity	**Q_a =**	**1.5**	**6.3**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.5**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.5**	**6.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.7**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**89**	**%**

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

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

Project: **Spring Hill Pond E**
Inlet ID: **6-E**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

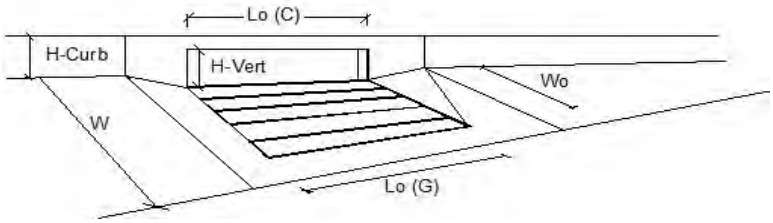
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**3.0**	**10.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.24 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 9.86 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

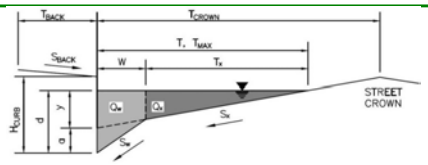


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	2.2	9.9	cfs
Water Spread Width	T =	9.0	16.6	ft
Water Depth at Flowline (outside of local depression)	d =	3.7	5.5	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.626	0.357	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.8	5.9	cfs
Discharge within the Gutter Section W	Q_w =	1.4	3.3	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.7	cfs
Flow Area within the Gutter Section W	A_W =	0.45	0.75	sq ft
Velocity within the Gutter Section W	V_W =	3.1	4.4	fps
Water Depth for Design Condition	d_{LOCAL} =	8.7	10.5	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.190	0.117	ft/ft
Required Length L_T to Have 100% Interception	L_T =	5.98	15.34	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.98	10.00	ft
Interception Capacity	Q_i =	2.2	7.8	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	5.98	9.61	ft
Actual Interception Capacity	**Q_a =**	**2.2**	**7.6**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**1.6**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.2**	**7.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.3**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**77**	**%**

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

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

Project: **Spring Hill Pond E**
Inlet ID: **5-E**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

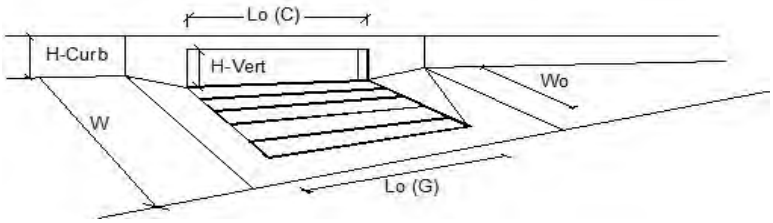
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**3.0**	**10.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.69 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.87 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

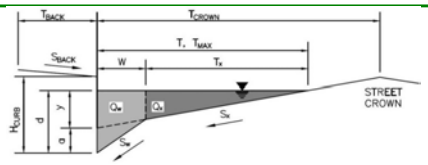


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.7	6.9	cfs
Water Spread Width	T =	7.9	14.6	ft
Water Depth at Flowline (outside of local depression)	d =	3.4	5.0	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.694	0.407	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.5	3.9	cfs
Discharge within the Gutter Section W	Q_w =	1.2	2.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.2	cfs
Flow Area within the Gutter Section W	A_W =	0.40	0.67	sq ft
Velocity within the Gutter Section W	V_W =	2.9	4.0	fps
Water Depth for Design Condition	d_{LOCAL} =	8.4	10.0	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.208	0.130	ft/ft
Required Length L_T to Have 100% Interception	L_T =	4.96	12.37	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	4.96	10.00	ft
Interception Capacity	Q_i =	1.7	6.3	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	4.96	9.61	ft
Actual Interception Capacity	**Q_a =**	**1.7**	**6.2**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.4**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.7**	**6.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.7**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**90**	**%**

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

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

Project: Spring Hill Pond E
Inlet ID: 4-E



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.5	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	2.40	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	3.91	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	8.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.577	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	1.2	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	1.6	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**2.8**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	3.3	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.1	2.1	

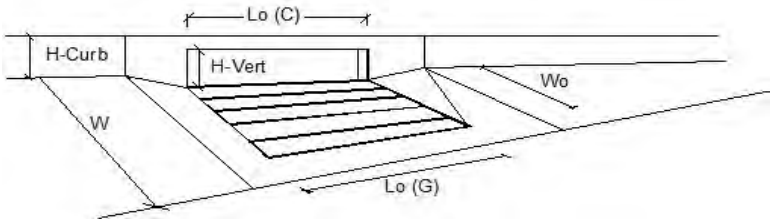
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	16.6	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	8.4	14.6	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.358	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	1.3	5.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	5.9	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	3.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	9.8	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	4.4	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	2.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**9.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	5.50	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.00	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**2.8**	**9.8**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.06 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 9.67 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)

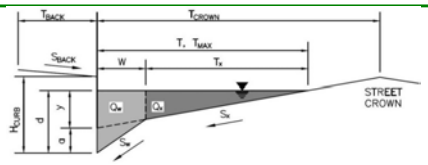


Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	2.1	9.7	cfs
Water Spread Width	T =	8.7	16.5	ft
Water Depth at Flowline (outside of local depression)	d =	3.6	5.5	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.646	0.359	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.7	5.8	cfs
Discharge within the Gutter Section W	Q_w =	1.3	3.2	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.7	cfs
Flow Area within the Gutter Section W	A_W =	0.43	0.75	sq ft
Velocity within the Gutter Section W	V_W =	3.1	4.3	fps
Water Depth for Design Condition	d_{LOCAL} =	8.6	10.5	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.195	0.117	ft/ft
Required Length L_T to Have 100% Interception	L_T =	5.66	15.18	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.66	10.00	ft
Interception Capacity	Q_i =	2.1	7.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	5.66	9.61	ft
Actual Interception Capacity	**Q_a =**	**2.1**	**7.5**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**1.5**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.1**	**7.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.1**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**78**	**%**

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

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

Project: **Spring Hill Pond E**
Inlet ID: **3-E**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0		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} =	0.016		
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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	6.3	6.3	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	3.4	3.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	0.8	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**10.5**	**10.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.4	4.4	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.1	2.1	

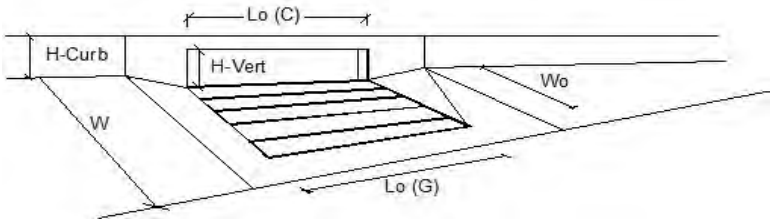
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	23.3	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	21.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.253	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	1.3	15.9	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	1.3	15.3	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	1.7	5.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	4.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	3.0	25.5	cfs
Average Flow Velocity Within the Gutter Section	V =	3.4	5.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.1	3.1	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	1.00	1.00	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**3.0**	**25.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.51	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**3.0**	**10.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.02 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 7.49 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

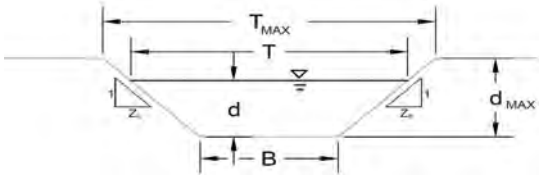
MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	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, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.06	0.06	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.0	7.5	cfs
Water Spread Width	T =	6.0	15.1	ft
Water Depth at Flowline (outside of local depression)	d =	2.9	5.1	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.822	0.395	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.2	4.3	cfs
Discharge within the Gutter Section W	Q_w =	0.8	2.8	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.3	cfs
Flow Area within the Gutter Section W	A_W =	0.32	0.69	sq ft
Velocity within the Gutter Section W	V_W =	2.6	4.1	fps
Water Depth for Design Condition	d_{LOCAL} =	7.9	10.1	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.243	0.127	ft/ft
Required Length L_T to Have 100% Interception	L_T =	3.57	13.02	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	3.57	10.00	ft
Interception Capacity	Q_i =	1.0	6.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	3.57	9.61	ft
Actual Interception Capacity	**Q_a =**	**1.0**	**6.5**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.6**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.0**	**6.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**87**	**%**

AREA INLET IN A SWALE

Spring Hill Pond E
E3-OS



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.035	
Channel Invert Slope	S_O =	0.0200	ft/ft
Bottom Width	B =	4.00	ft
Left Side Slope	Z1 =	5.00	ft/ft
Right Side Sloe	Z2 =	5.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- ○ Non-Cohesive
- ◉ Cohesive
- ○ Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	**T_{MAX} =**	**25.00**	**25.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	**d_{MAX} =**	**1.75**	**1.75**	**ft**

Maximum Channel Capacity Based On Allowable Top Width

		Minor Storm	Major Storm	
Maximum Allowable Top Width	**T_{MAX} =**	**25.00**	**25.00**	**ft**
Water Depth	d =	2.10	2.10	ft
Flow Area	A =	30.45	30.45	sq ft
Wetted Perimeter	P =	25.42	25.42	ft
Hydraulic Radius	R =	1.20	1.20	ft
Manning's n	n =	0.035	0.035	
Flow Velocity	V =	6.79	6.79	fps
Velocity-Depth Product	VR =	8.14	8.14	ft^2/s
Hydraulic Depth	D =	1.22	1.22	ft
Froude Number	Fr =	1.08	1.08	
Maximum Flow Based on Allowable Water Depth	**Q_T =**	**206.8**	**206.8**	**cfs**

Maximum Channel Capacity Based On Allowable Water Depth

		Minor Storm	Major Storm	
Maximum Allowable Water Depth	**d_{MAX} =**	**1.75**	**1.75**	**ft**
Top Width	T =	21.50	21.50	ft
Flow Area	A =	22.31	22.31	sq ft
Wetted Perimeter	P =	21.85	21.85	ft
Hydraulic Radius	R =	1.02	1.02	ft
Manning's n	n =	0.035	0.035	
Flow Velocity	V =	6.11	6.11	fps
Velocity-Depth Product	VR =	6.24	6.24	ft^2/s
Hydraulic Depth	D =	1.04	1.04	ft
Froude Number	Fr =	1.06	1.06	
Maximum Flow Based On Allowable Water Depth	**Q_d =**	**136.2**	**136.2**	**cfs**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**136.2**	**136.2**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	**d_{allow} =**	**1.75**	**1.75**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	**Q_o =**	**0.7**	**8.9**	**cfs**
Water Depth	**d =**	**0.11**	**0.47**	**ft**
Top Width	T =	5.14	8.74	ft
Flow Area	A =	0.52	3.02	sq ft
Wetted Perimeter	P =	5.16	8.84	ft
Hydraulic Radius	R =	0.10	0.34	ft
Manning's n	n =	0.035	0.035	
Flow Velocity	V =	1.31	2.94	fps
Velocity-Depth Product	VR =	0.13	1.01	ft^2/s
Hydraulic Depth	D =	0.10	0.35	ft
Warning 04 Froude Number	Fr =	0.72	0.88	

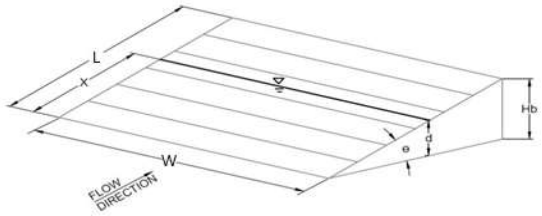
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

AREA INLET IN A SWALE

Spring Hill Pond E
E3-OS

Inlet Design Information (Input)

Type of Inlet	CDOT Type C (Depressed)	Inlet Type =	CDOT Type C (Depressed)	
Angle of Inclined Grate (must be <= 30 degrees)		θ =	0.00	degrees
Width of Grate		W =	3.00	ft
Length of Grate		L =	3.00	ft
Open Area Ratio		A_{RATIO} =	0.70	
Height of Inclined Grate		H_B =	0.00	ft
Clogging Factor		C_f =	0.50	
Grate Discharge Coefficient		C_d =	0.84	
Orifice Coefficient		C_o =	0.56	
Weir Coefficient		C_w =	1.81	



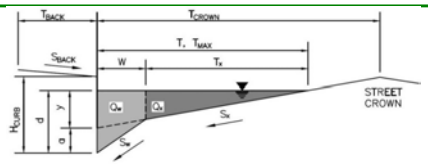
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	1.11	1.47	
Grate Capacity as a Weir				
Submerged Side Weir Length	X =	3.00	3.00	ft
Inclined Side Weir Flow	Q_{ws} =	11.2	17.0	cfs
Base Weir Flow	Q_{wb} =	15.9	24.3	cfs
Interception Without Cloggging	Q_{wi} =	38.2	58.2	cfs
Interception With Clogging	Q_{wa} =	19.1	29.1	cfs
Grate Capacity as an Orifice				
Interception Without Clogging	Q_{oi} =	30.0	34.5	cfs
Interception With Clogging	Q_{oa} =	15.0	17.3	cfs
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**15.0**	**17.3**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

Warning 04: Froude No. exceeds USDCM Volume I recommendation.

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

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

Project: **Spring Hill Pond E**
Inlet ID: **2-E**



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	16.0		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} =	0.016		
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.0		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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.6	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

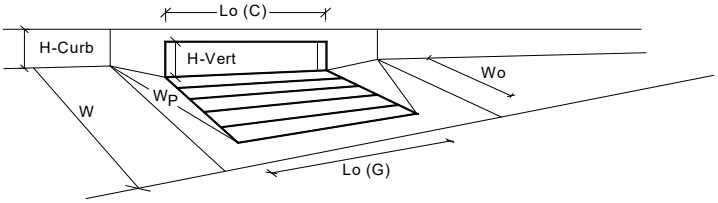
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	3.84	3.84	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.35	5.35	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	14.0	14.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.372	0.372	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	25.4	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	23.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.231	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

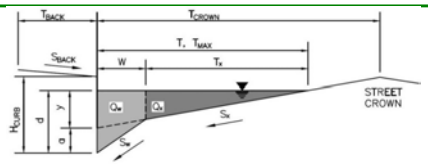


Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	5.4	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
Open Area 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	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) =	0.06	0.06	
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	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	
Clogging Factor for Multiple Units	Clog =	0.02	0.02	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	3.7	9.4	cfs
Interception with Clogging	Q_{wa} =	3.6	9.2	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	39.0	43.0	cfs
Interception with Clogging	Q_{oa} =	38.2	42.1	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	11.2	18.7	cfs
Interception with Clogging	Q_{ma} =	10.9	18.3	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**3.6**	**9.2**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	20.00	20.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	10.4	16.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.28	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.64	0.74	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**3.6**	**9.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.0	8.0	cfs

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

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

Project: Spring Hill Pond E
Inlet ID: 1-E



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	16.0		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} =	0.018		
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.0		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} =	0.018		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	7.6	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	3.84	3.84	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	2.0	2.0	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline (y + a)	d =	5.35	5.35	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	14.0	14.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.372	0.372	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	10.4	25.4	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	8.4	23.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.560	0.231	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

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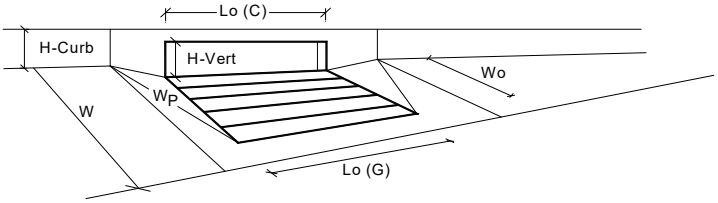


Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	5.4	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
Open Area 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	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) =	0.06	0.06	
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	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	
Clogging Factor for Multiple Units	Clog =	0.02	0.02	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	3.7	9.4	cfs
Interception with Clogging	Q_{wa} =	3.6	9.2	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	39.0	43.0	cfs
Interception with Clogging	Q_{oa} =	38.2	42.1	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	11.2	18.7	cfs
Interception with Clogging	Q_{ma} =	10.9	18.3	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**3.6**	**9.2**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	20.00	20.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	10.4	16.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.28	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.64	0.74	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**3.6**	**9.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.0	8.0	cfs

Westwood

Appendix B – Hydraulic Computations

Swale Calculations

Worksheet for Offsite Swale 1 - 2 Year

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.032
Channel Slope	0.005 ft/ft
Left Side Slope	5.000 H:V
Right Side Slope	5.000 H:V
Discharge	2.61 cfs

Results	
Normal Depth	7.2 in
Flow Area	1.8 ft²
Wetted Perimeter	6.1 ft
Hydraulic Radius	3.5 in
Top Width	6.00 ft
Critical Depth	5.3 in
Critical Slope	0.025 ft/ft
Velocity	1.45 ft/s
Velocity Head	0.03 ft
Specific Energy	0.63 ft
Froude Number	0.468
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	7.2 in
Critical Depth	5.3 in
Channel Slope	0.005 ft/ft
Critical Slope	0.025 ft/ft

Worksheet for Offsite Swale 1 - 100 Year

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.032
Channel Slope	0.005 ft/ft
Left Side Slope	5.000 H:V
Right Side Slope	5.000 H:V
Discharge	13.29 cfs

Results	
Normal Depth	13.2 in
Flow Area	6.1 ft²
Wetted Perimeter	11.3 ft
Hydraulic Radius	6.5 in
Top Width	11.04 ft
Critical Depth	10.2 in
Critical Slope	0.020 ft/ft
Velocity	2.18 ft/s
Velocity Head	0.07 ft
Specific Energy	1.18 ft
Froude Number	0.517
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	13.2 in
Critical Depth	10.2 in
Channel Slope	0.005 ft/ft
Critical Slope	0.020 ft/ft

Worksheet for Offsite Swale 2 - 2 Year

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.032
Channel Slope	0.005 ft/ft
Left Side Slope	5.000 H:V
Right Side Slope	5.000 H:V
Bottom Width	4.00 ft
Discharge	0.68 cfs

Results	
Normal Depth	1.9 in
Flow Area	0.8 ft²
Wetted Perimeter	5.6 ft
Hydraulic Radius	1.7 in
Top Width	5.62 ft
Critical Depth	1.1 in
Critical Slope	0.034 ft/ft
Velocity	0.88 ft/s
Velocity Head	0.01 ft
Specific Energy	0.17 ft
Froude Number	0.415
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	1.9 in
Critical Depth	1.1 in
Channel Slope	0.005 ft/ft
Critical Slope	0.034 ft/ft

Worksheet for Offsite Swale 2 - 100 Yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.032
Channel Slope	0.005 ft/ft
Left Side Slope	5.000 H:V
Right Side Slope	5.000 H:V
Bottom Width	4.00 ft
Discharge	8.90 cfs

Results	
Normal Depth	7.8 in
Flow Area	4.7 ft²
Wetted Perimeter	10.6 ft
Hydraulic Radius	5.3 in
Top Width	10.46 ft
Critical Depth	5.3 in
Critical Slope	0.022 ft/ft
Velocity	1.90 ft/s
Velocity Head	0.06 ft
Specific Energy	0.70 ft
Froude Number	0.502
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	7.8 in
Critical Depth	5.3 in
Channel Slope	0.005 ft/ft
Critical Slope	0.022 ft/ft

Westwood

Appendix B – Hydraulic Computations

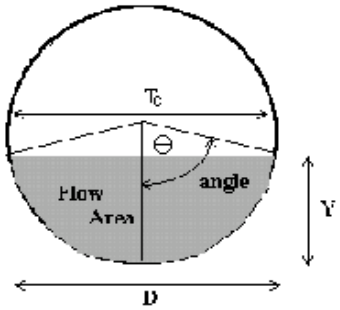
Culvert Calculations

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: SPRING HILL

Pipe ID: POND B-C OUTFALL Q2 = 0.8 CFS



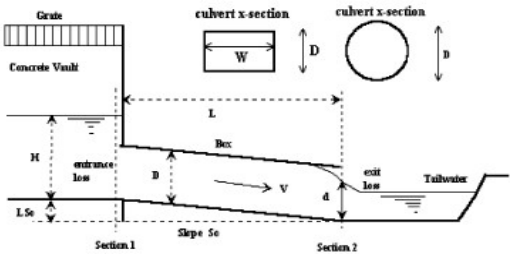
Design Information (Input)			
Pipe Invert Slope	So =	0.0140	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	48.00	inches
Design discharge	Q =	0.80	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	12.57	sq ft
Full-flow wetted perimeter	Pf =	12.57	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	170.42	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	0.45	radians
Flow area	An =	0.23	sq ft
Top width	Tn =	1.73	ft
Wetted perimeter	Pn =	1.79	ft
Flow depth	Yn =	0.20	ft
Flow velocity	Vn =	3.46	fps
Discharge	Qn =	0.80	cfs
Percent of Full Flow	Flow =	0.5%	of full flow
Normal Depth Froude Number	Fr_n =	1.67	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	0.51	radians
Critical flow area	Ac =	0.34	sq ft
Critical top width	Tc =	1.96	ft
Critical flow depth	Yc =	0.26	ft
Critical flow velocity	Vc =	2.36	fps
Critical Depth Froude Number	Fr_c =	1.00	

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

MHFD-Culvert, Version 4.00 (May 2020)

Project: SPRING HILL

ID: POND B-C OUTFALL Q100 = 55.6 CFS



Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	48	inches
	Inlet Edge Type (Choose from pull-down list)		Grooved Edge Projecting	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	H (Rise) =		ft
	Barrel Width (Span) in Feet	W (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	# Barrels =	1	
	Inlet Elevation at Culvert Invert	Elev IN =	4971.8	ft
	Outlet Elevation **OR** Slope	Elev OUT =	4967.3	ft
	Culvert Length	L =	322	ft
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	1.58
Sum of All Loss Coefficients	K_s =	2.78
Minimum Energy Condition Coefficient	KE_{low} =	-0.0290
Orifice Inlet Condition Coefficient	C_d =	0.67

Calculations of Culvert Capacity (output):

Backwater calculations required to obtain Outlet Control Flowrate when HWo < 0.75 * Culvert Rise

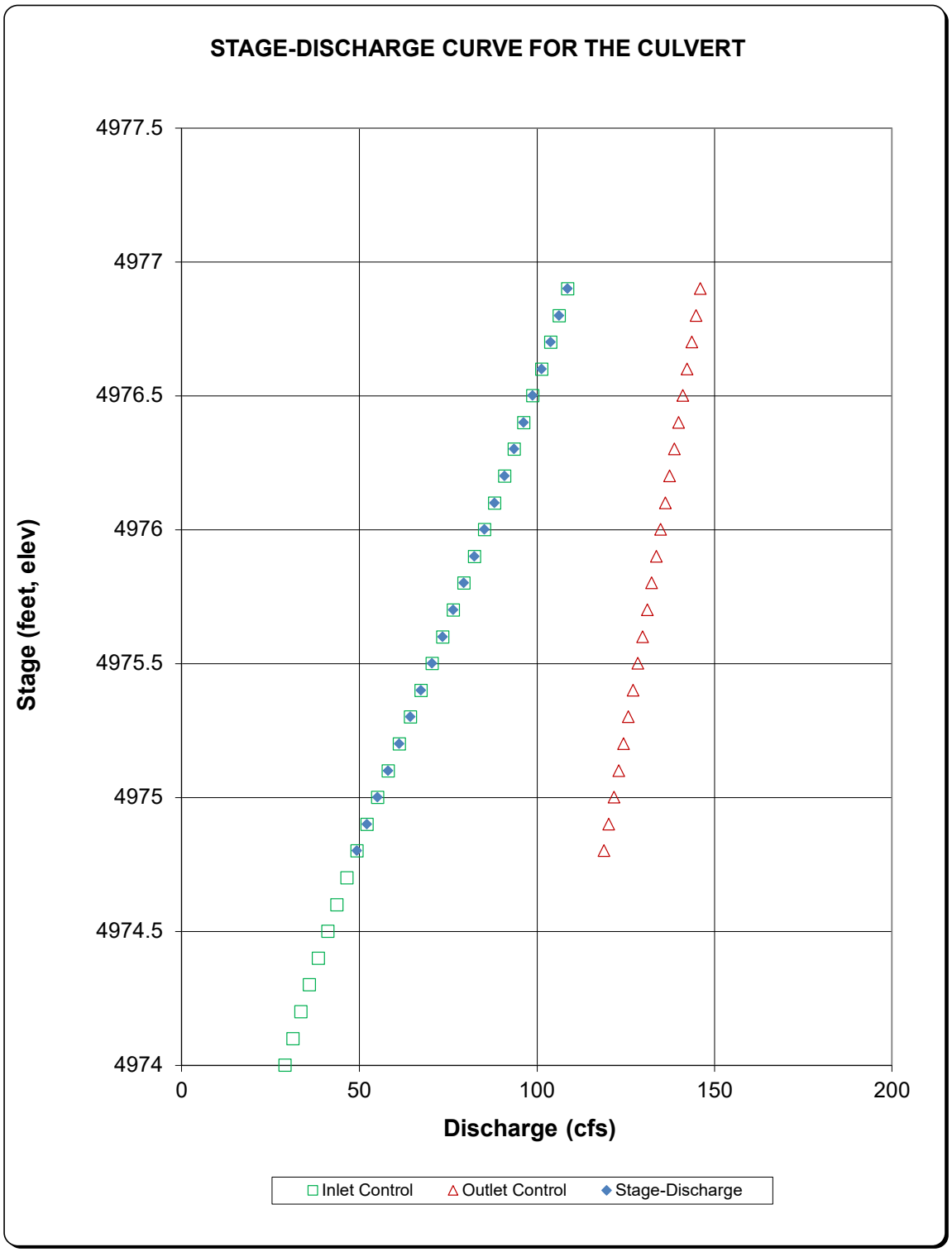
Headwater Surface Elevation (ft)	Tailwater Surface Elevation (ft)	Inlet Control Equation Used	Inlet Control Flowrate (cfs)	Outlet Control Flowrate (cfs)	Controlling Culvert Flowrate (cfs)	Flow Control Used
4974.00		Regression Eqn.	29.04	#N/A	#N/A	#N/A
4974.10		Regression Eqn.	31.31	#N/A	#N/A	#N/A
4974.20		Regression Eqn.	33.61	#N/A	#N/A	#N/A
4974.30		Regression Eqn.	36.01	#N/A	#N/A	#N/A
4974.40		Regression Eqn.	38.51	#N/A	#N/A	#N/A
4974.50		Regression Eqn.	41.11	#N/A	#N/A	#N/A
4974.60		Regression Eqn.	43.76	#N/A	#N/A	#N/A
4974.70		Regression Eqn.	46.51	#N/A	#N/A	#N/A
4974.80		Regression Eqn.	49.35	118.94	**49.35**	INLET
4974.90		Regression Eqn.	52.25	120.34	**52.25**	INLET
4975.00		Regression Eqn.	55.21	121.73	**55.21**	INLET
4975.10		Regression Eqn.	58.22	123.11	**58.22**	INLET
4975.20		Regression Eqn.	61.31	124.47	**61.31**	INLET
4975.30		Regression Eqn.	64.34	125.81	**64.34**	INLET
4975.40		Regression Eqn.	67.41	127.15	**67.41**	INLET
4975.50		Regression Eqn.	70.47	128.49	**70.47**	INLET
4975.60		Regression Eqn.	73.52	129.80	**73.52**	INLET
4975.70		Regression Eqn.	76.53	131.12	**76.53**	INLET
4975.80		Regression Eqn.	79.51	132.39	**79.51**	INLET
4975.90		Regression Eqn.	82.44	133.68	**82.44**	INLET
4976.00		Regression Eqn.	85.32	134.97	**85.32**	INLET
4976.10		Regression Eqn.	88.14	136.24	**88.14**	INLET
4976.20		Regression Eqn.	90.91	137.49	**90.91**	INLET
4976.30		Regression Eqn.	93.62	138.74	**93.62**	INLET
4976.40		Regression Eqn.	96.31	139.97	**96.31**	INLET
4976.50		Regression Eqn.	98.85	141.20	**98.85**	INLET
4976.60		Regression Eqn.	101.41	142.41	**101.41**	INLET
4976.70		Regression Eqn.	103.85	143.64	**103.85**	INLET
4976.80		Regression Eqn.	106.31	144.83	**106.31**	INLET
4976.90		Regression Eqn.	108.64	146.04	**108.64**	INLET
				Processing Time:	**00.30 Seconds**	

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

MHFD-Culvert, Version 4.00 (May 2020)

Project: **SPRING HILL**

ID: **POND B-C OUTFALL Q100 = 55.6 CFS**

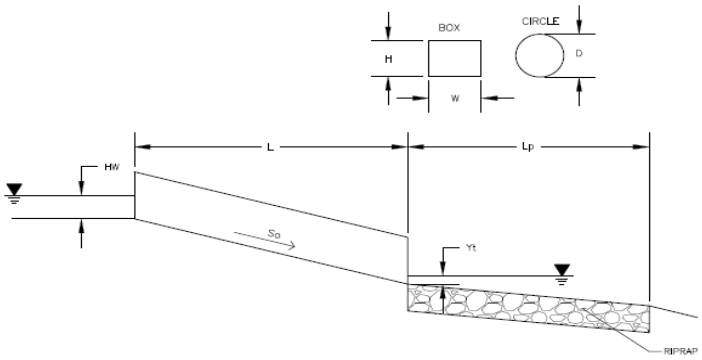


DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: SPRING HILL

ID: POND B-C OUTFALL Q100 = 55.6 CFS



Soil Type:

Choose One:

- ○ Sandy
- ◉ Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge	Q =	55.6	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	48	inches
Inlet Edge Type (Choose from pull-down list)		Grooved Edge Projecting	
OR:			
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	1	
Inlet Elevation	Elev IN =	4971.8	ft
Outlet Elevation **OR** Slope	Elev OUT =	4967.3	ft
Culvert Length	L =	322	ft
Manning's Roughness	n =	0.013	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =		ft
Max Allowable Channel Velocity	V =	7	ft/s

Calculated Results:

Culvert Cross Sectional Area Available	A =	12.57	ft^2
Culvert Normal Depth	Y_n =	1.57	ft
Culvert Critical Depth	Y_c =	2.24	ft
Froude Number	Fr =	1.97	**Supercritical!**
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	1.58	
Sum of All Loss Coefficients	k_s =	2.78	ft
Headwater:			
Inlet Control Headwater	HW_I =	3.21	ft
Outlet Control Headwater	HW_O =	N/A	ft
Design Headwater Elevation	**HW =**	**4975.01**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**0.80**	

Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	1.74	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	1.60	ft
Tailwater/Diameter	Yt/D =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	5.99	
Flow Area at Max Channel Velocity	A_t =	7.94	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
Length of Riprap Protection	**L_p =**	**12**	**ft**
Width of Riprap Protection at Downstream End	**T =**	**7**	**ft**
Adjusted Diameter for Supercritical Flow	Da =	2.79	ft
Minimum Theoretical Riprap Size	d_{50} min=	6	in
Nominal Riprap Size	d_{50} nominal=	9	in
MHFD Riprap Type	**Type =**	**L**	

BASIN E ROADWAY CULVERT

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 893.16 cfs

Maximum Flow: 893.16 cfs

Table 1 - Summary of Culvert Flows at Crossing: Crossing 1 - Basin E Roadway

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4967.39	0.00	0.00	0.00	1
4968.59	89.32	89.32	0.00	1
4969.30	178.63	178.63	0.00	1
4969.90	267.95	267.95	0.00	1
4970.43	357.26	357.26	0.00	1
4970.91	446.58	446.58	0.00	1
4971.37	535.90	535.90	0.00	1
4971.80	625.21	625.21	0.00	1
4972.21	714.53	714.53	0.00	1
4972.60	803.84	803.84	0.00	1
4972.98	893.16	893.16	0.00	1
4982.23	3085.60	3085.60	0.00	Overtopping

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	4967.39	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
89.32	89.32	4968.59	1.148	1.204	3-M1t	0.797	0.755	0.881	0.881	4.226	2.855
178.63	178.63	4969.30	1.822	1.911	3-M1t	1.242	1.198	1.317	1.317	5.649	3.638
267.95	267.95	4969.90	2.388	2.506	3-M1t	1.617	1.570	1.662	1.662	6.716	4.170
357.26	357.26	4970.43	2.893	3.036	3-M1t	1.956	1.902	1.957	1.957	7.605	4.582
446.58	446.58	4970.91	3.357	3.523	3-M2t	2.273	2.207	2.219	2.219	8.385	4.923
535.90	535.90	4971.37	3.791	3.977	2-M2c	2.573	2.492	2.492	2.457	8.959	5.215
625.21	625.21	4971.80	4.209	4.407	2-M2c	2.861	2.762	2.762	2.676	9.431	5.472
714.53	714.53	4972.21	4.617	4.817	2-M2c	3.138	3.019	3.019	2.879	9.860	5.702
803.84	803.84	4972.60	5.012	5.209	2-M2c	3.408	3.266	3.266	3.071	10.255	5.910
893.16	893.16	4972.98	5.395	5.587	2-M2c	3.672	3.504	3.504	3.252	10.622	6.102

****

Straight Culvert

Inlet Elevation (invert): 4967.39 ft, Outlet Elevation (invert): 4967.16 ft

Culvert Length: 111.20 ft, Culvert Slope: 0.0021

****

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4967.39 ft

Outlet Station: 111.20 ft

Outlet Elevation: 4967.16 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 12.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: 1:1 Bevel (45º flare) Wingwall

Inlet Depression: None

Water Surface Profile Plot for Culvert: Culvert 1

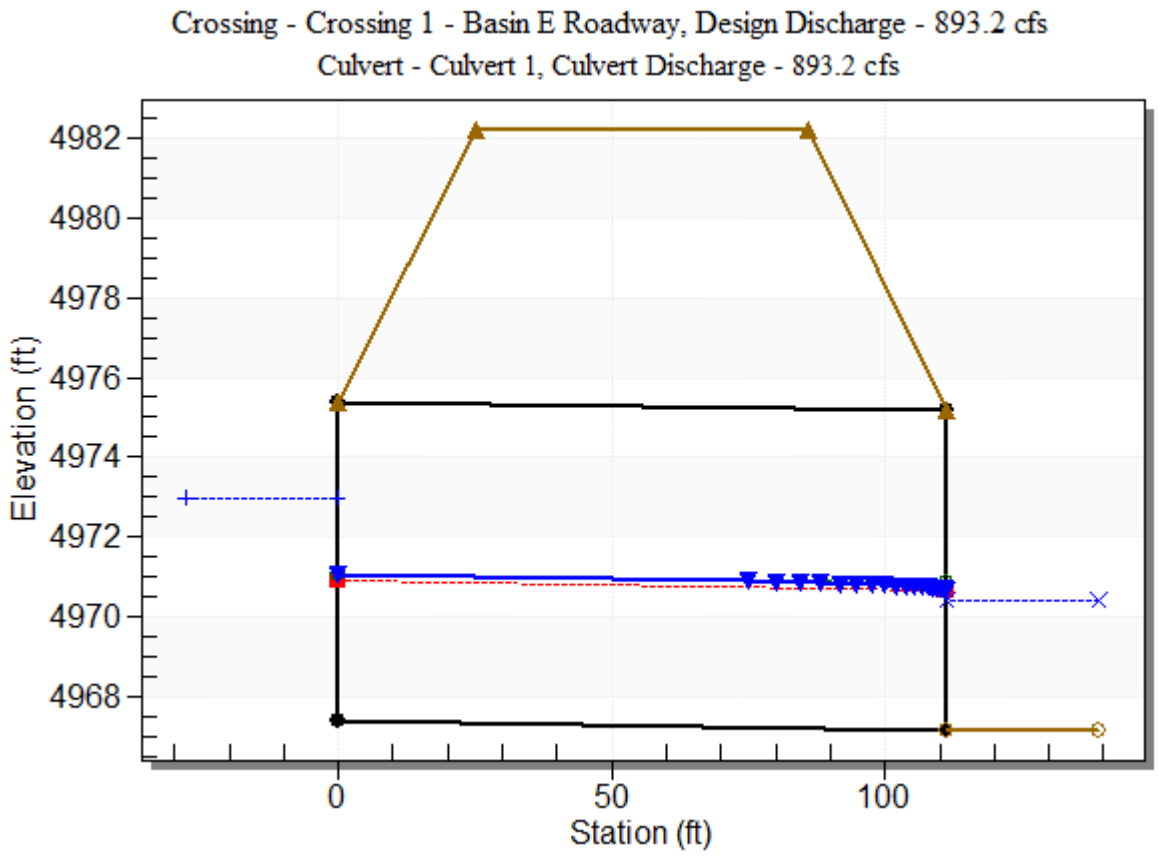


Table 3 - Downstream Channel Rating Curve (Crossing: Crossing 1 - Basin E

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	4967.16	0.00	0.00	0.00	0.00
89.32	4968.04	0.88	2.86	0.11	0.56
178.63	4968.48	1.32	3.64	0.16	0.60
267.95	4968.82	1.66	4.17	0.21	0.62
357.26	4969.12	1.96	4.58	0.24	0.63
446.58	4969.38	2.22	4.92	0.28	0.64
535.90	4969.62	2.46	5.22	0.31	0.65
625.21	4969.84	2.68	5.47	0.33	0.66
714.53	4970.04	2.88	5.70	0.36	0.67
803.84	4970.23	3.07	5.91	0.38	0.67
893.16	4970.41	3.25	6.10	0.41	0.68

Tailwater Channel Data - Crossing 1 - Basin E Roadway

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 32.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0020

Channel Manning's n: 0.0200

Channel Invert Elevation: 4967.16 ft

Roadway Data for Crossing: Crossing 1 - Basin E Roadway

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 4982.23 ft

Roadway Surface: Paved

Roadway Top Width: 61.00 ft

HY-8 CULVERT ANALYSIS REPORT
BASIN D ROADWAY CULVERT

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 889.25 cfs

Maximum Flow: 889.25 cfs

Table 1 - Summary of Culvert Flows at Crossing: Crossing 2 - Basin D Roadway

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4983.77	0.00	0.00	0.00	1
4985.87	88.92	88.92	0.00	1
4987.11	177.85	177.85	0.00	1
4988.15	266.77	266.77	0.00	1
4989.08	355.70	355.70	0.00	1
4989.59	444.63	444.63	0.00	1
4989.84	533.55	533.55	0.00	1
4990.14	622.48	622.48	0.00	1
4990.48	711.40	711.40	0.00	1
4990.88	800.32	800.32	0.00	1
4991.42	889.25	889.25	0.00	1
4997.59	1283.75	1283.75	0.00	Overtopping

Crossing

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	4983.77	0.000	2.760	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
88.92	88.92	4985.87	2.085	4.858	7-A2c	-1.000	1.349	1.349	0.849	6.591	2.802
177.85	177.85	4987.11	3.310	6.096	7-A2c	-1.000	2.142	2.142	1.272	8.304	3.578
266.77	266.77	4988.15	4.344	7.138	7-A2c	-1.000	2.806	2.806	1.607	9.506	4.108
355.70	355.70	4989.08	5.293	8.071	7-A2c	-1.000	3.400	3.400	1.893	10.463	4.519
444.63	444.63	4989.59	6.180	8.576	7-A2c	-1.000	3.945	3.945	2.148	11.271	4.860
533.55	533.55	4989.84	7.028	8.830	7-A2c	-1.000	4.455	4.455	2.379	11.977	5.153
622.48	622.48	4990.14	7.859	9.129	7-A2c	-1.000	4.937	4.937	2.593	12.608	5.410
711.40	711.40	4990.48	8.688	9.475	7-A2c	-1.000	5.397	5.397	2.792	13.182	5.641
800.32	800.32	4990.88	9.534	9.866	7-A2c	-1.000	5.837	5.837	2.979	13.710	5.850
889.25	889.25	4991.42	10.407	10.304	7-A2t	-1.000	6.262	6.262	3.157	14.200	6.042

****

Straight Culvert

Inlet Elevation (invert): 4981.01 ft, Outlet Elevation (invert): 4983.77 ft

Culvert Length: 192.62 ft, Culvert Slope: -0.0143

****

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4981.01 ft

Outlet Station: 192.60 ft

Outlet Elevation: 4983.77 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 10.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: 1:1 Bevel (45º flare) Wingwall

Inlet Depression: None

Water Surface Profile Plot for Culvert: Culvert 1

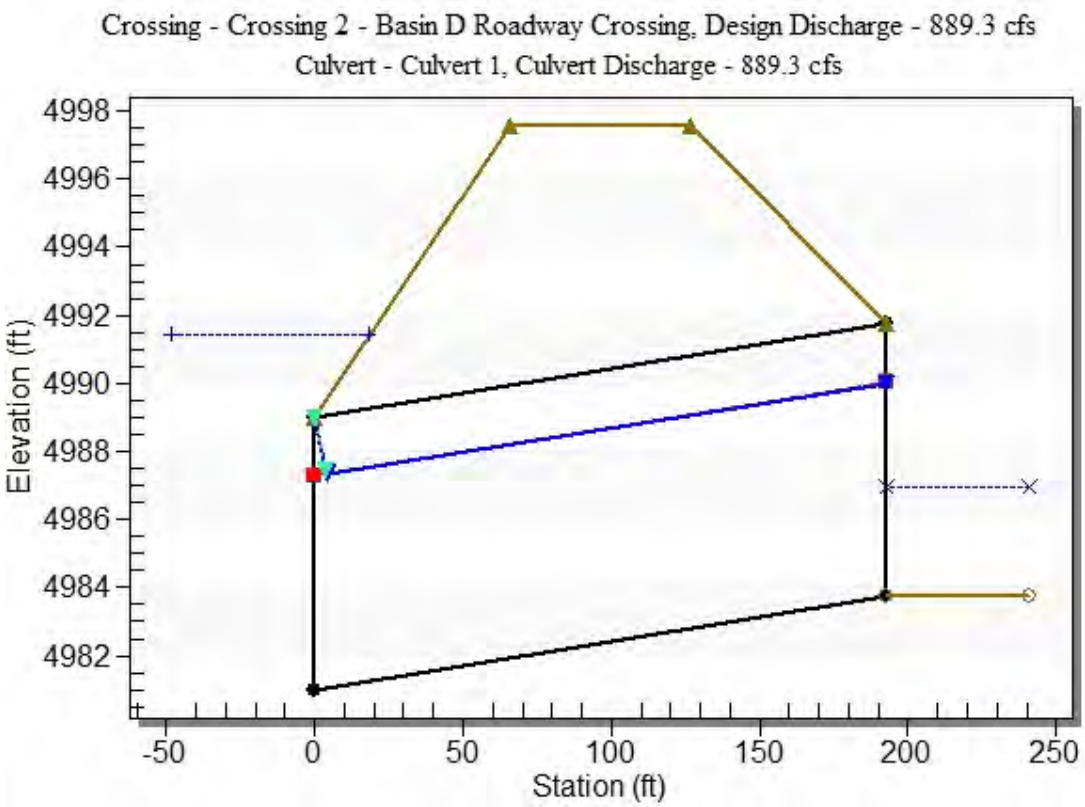


Table 3 - Downstream Channel Rating Curve (Crossing: Crossing 2 - Basin D Roadway Crossing)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	4983.77	0.00	0.00	0.00	0.00
88.92	4984.62	0.85	2.80	0.11	0.56
177.85	4985.04	1.27	3.58	0.16	0.59
266.77	4985.38	1.61	4.11	0.20	0.61
355.70	4985.66	1.89	4.52	0.24	0.63
444.63	4985.92	2.15	4.86	0.27	0.64
533.55	4986.15	2.38	5.15	0.30	0.65
622.48	4986.36	2.59	5.41	0.32	0.66
711.40	4986.56	2.79	5.64	0.35	0.66
800.32	4986.75	2.98	5.85	0.37	0.67
889.25	4986.93	3.16	6.04	0.39	0.68

Tailwater Channel Data - Crossing 2 - Basin D Roadway Crossing

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 34.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0020

Channel Manning's n: 0.0200

Channel Invert Elevation: 4983.77 ft

Roadway Data for Crossing: Crossing 2 - Basin D Roadway Crossing

Roadway Profile Shape: Constant Roadway Elevation

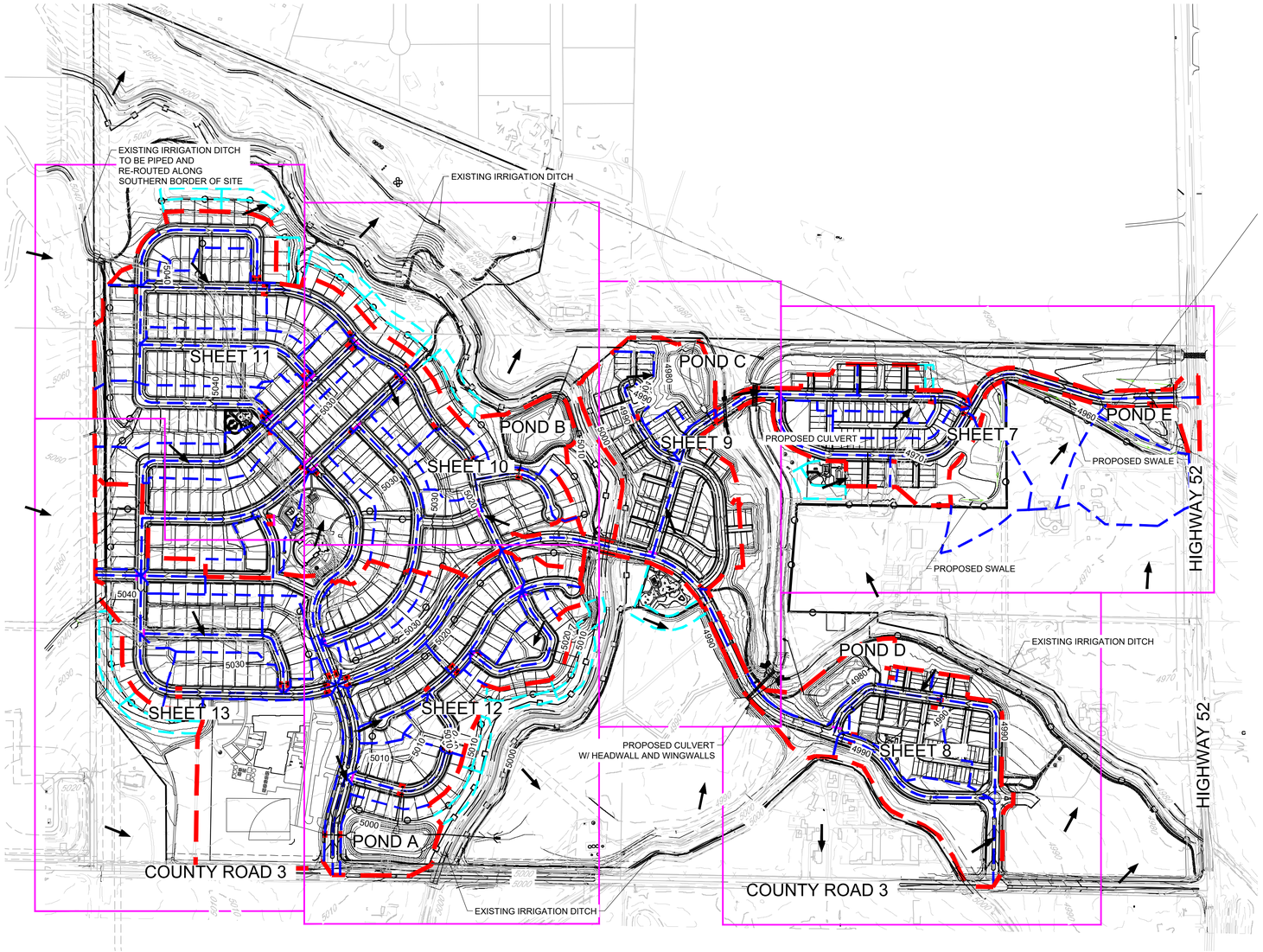
Crest Length: 100.00 ft

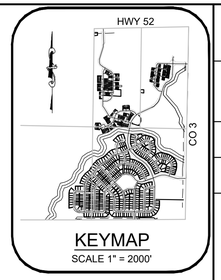
Crest Elevation: 4997.59 ft

Roadway Surface: Paved

Roadway Top Width: 60.30 ft

Appendix C – Drainage Maps





KEYMAP
SCALE 1" = 2000'

300 150 0 300 600

SCALE: 1" = 300

LEGEND

XX / A / C2 / C100	XX = BASIN ID
	DESIGN POINT
	EXISTING DRAINAGE BOUNDARY
	MINOR BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
	RUNOFF BASIN BOUNDARY
	LAYOUT MATCHLINE
5050	EXISTING MAJOR CONTOURS
5040	EXISTING MINOR CONTOURS
5050	PROPOSED MAJOR CONTOURS
5040	PROPOSED MINOR CONTOURS
	EMERGENCY OVERFLOW PATH
	PROPOSED STORM
	EXISTING STORM
	PROPOSED FLOW ARROW
	100-YEAR FLOOD PLAIN
A	LOT TYPES
	PAGE BOUNDARIES
	AREAS OUTSIDE OF POND DELINEATION

MAJOR BASIN SUMMARY	
BASIN A AREA (ac)	56.48
BASIN A IMPERVIOUSNESS (%)	55.00%
BASIN B AREA (ac)	62.70
BASIN B IMPERVIOUSNESS (%)	55.00%
BASIN C AREA (ac)	15.85
BASIN C IMPERVIOUSNESS (%)	50.00%
BASIN D AREA (ac)	16.73
BASIN D IMPERVIOUSNESS (%)	50.00%
BASIN E AREA (ac)	14.50
BASIN E IMPERVIOUSNESS (%)	60.00%

NOTES:

1. ALL PONDS ARE PRIVATE AND ARE MAINTAINED BY METRO DISTRICT.
2. ALL STORM INLETS PIPES HAVE BEEN DESIGNED FOR THE 100-YEAR STORM.
3. ALL STORM INLETS AND PIPES SHOWN ARE PUBLIC AND WILL BE MAINTAINED BY THE METRO DISTRICT UNLESS OTHERWISE NOTED.
4. OUTLET STRUCTURE AND OVERFLOW WEIR DETAILS WILL BE PROVIDED WITH FINAL DRAINAGE REPORT.
5. ALL ROADS ARE CLASSIFIED AS PUBLIC WITH THE EXCEPTION OF THE PRIVATE ALLEYWAYS.
6. SEE FIRM MAP, APPENDIX A FOR MORE INFORMATION REGARDING THE FLOODPLAIN.
7. DIRECT RUNOFF BASINS SHOWN IN CYAN ARE NOT INCLUDED IN STORM PIPE AND INLET SIZING. DIRECT RUNOFF BASINS ARE TREATED THROUGH THE RUNOFF REDUCTION METHOD SHOWN IN THE DRAINAGE REPORT.

BENCHMARK
THE SOUTHWEST CORNER OF SECTION 6, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, BEING A 2-1/2" ALUMINUM CAP STAMPED "LS 23501 POWERS ELEV CO" HAVING A PUBLISHED ELEVATION OF 4983.02 FEET, NAVD 1988 DATUM, PER THE TOWN OF ERIE CONTROL MAP (JANUARY 25, 2004 REVISION).

BASIS OF BEARINGS:
BEARINGS ARE BASED ON THE NORTH LINE OF THE NORTHEAST QUARTER OF SECTION 6, TOWNSHIP 1 NORTH, RANGE 68 WEST, 6TH PRINCIPAL MERIDIAN, BEING MONUMENTED AT THE NORTH ONE QUARTER CORNER OF SAID SECTION 6 BY A FOUND NO. 6 REBAR WITH A 3-1/4 INCH DIAMETER ALUMINUM CAP SET BY PLS 36053 AND AT THE NORTHEAST CORNER OF SAID SECTION 6 BY A FOUND NO. 6 REBAR WITH A 2-1/2 INCH DIAMETER ALUMINUM CAP SET BY PLS 25937. THE LINE IS ASSUMED TO BEAR N88°46'59"E, A DISTANCE OF 2642.32 FEET.

All work shall be constructed to Town of Erie STANDARDS AND SPECIFICATIONS. This drawing has been reviewed and found to be in general compliance with these STANDARDS AND SPECIFICATION and other Town requirements. THE ENGINEERING DESIGN AND CONCEPT REMAINS THE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEAR HEREON.

Accepted by: _____ Town Engineer _____ Date

PREPARED UNDER THE SUPERVISION OF

MARK SCHEURER
COLORADO P.E. 48988

CALL 811
TWO WORKING DAYS
BEFORE YOU DIG
1-800-922-1987
UNCC UTILITY NOTIFICATION CENTER OF COLORADO

No.	Revisions	Date	Init.	Appr.	Date
			CVL		

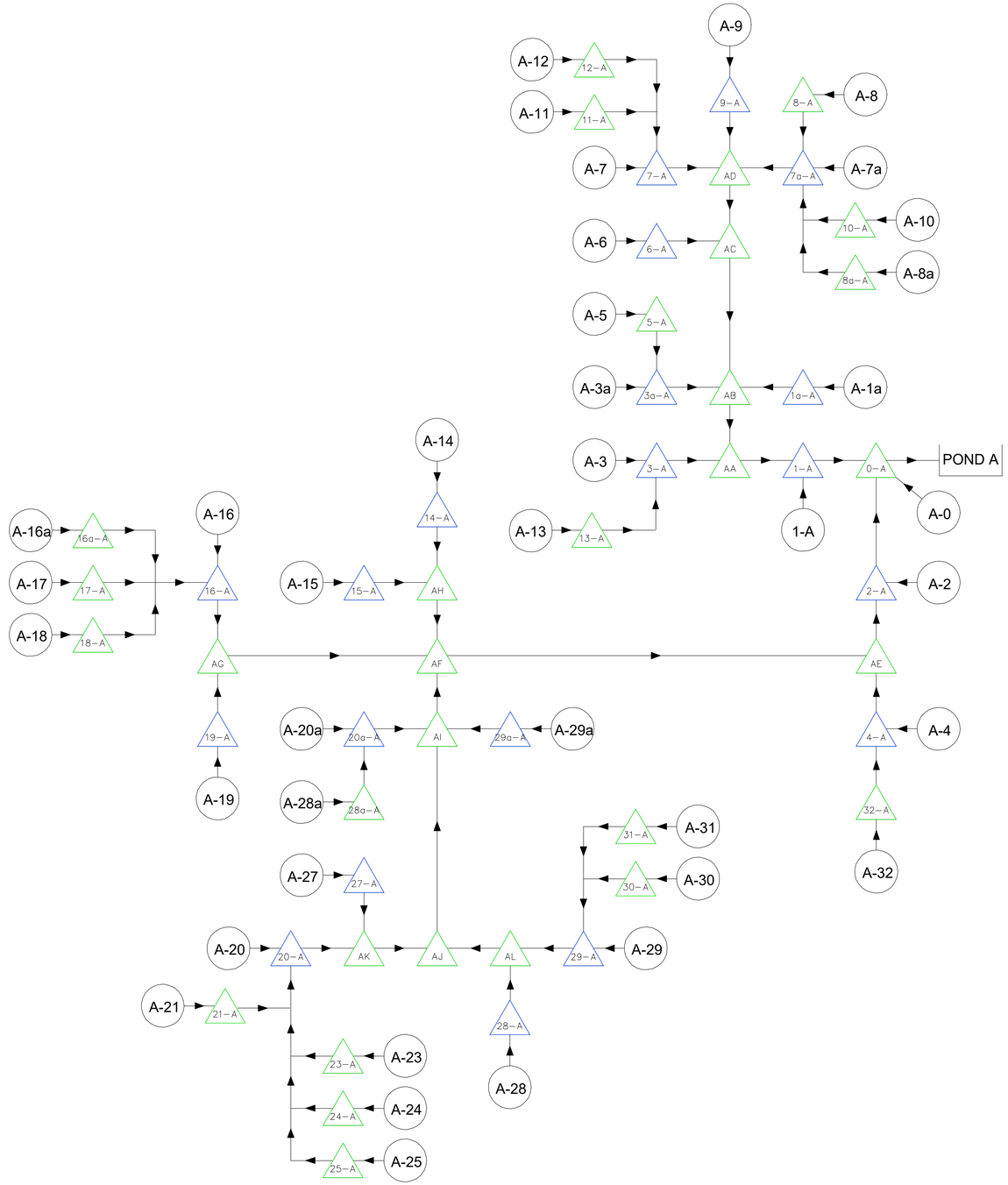
Westwood
10333 E DRY CREEK RD.
SUITE 240
ENGLEWOOD, CO 80112
TEL: 720.482.9526
Westwoodps.com
Westwood Professional Services, Inc.

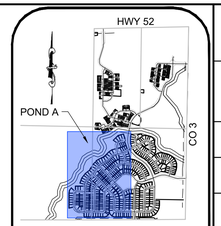
ME ERIE, LLC
7353 SOUTH ALTON WAY
CENTENNIAL, CO 80112

SPRING HILL
PRELIMINARY DRAINAGE MAPS
OVERALL DRAINAGE MAP

SCALE: AS SHOWN
FILE NO: 8130307501
DRAWN BY: EWA
CHECKED BY: MS
DATE: JUNE 2025
SHEET NUMBER 1

N:\PROJECTS\SPRING HILL\SERVICE GROUPS\WATER RESOURCES\03 PRELIMINARY DRAINAGE\04_EXHIBITS\OVERALL DRAINAGE MAP.DWG, E.BEITEL, 6/5/2025 5:08 PM





KEYMAP
SCALE 1" = 2000'

LEGEND

DESIGN POINT	1–A
DESIGN POINT W/ INLET	1–A
AREA BASIN LABEL	A-1
FLOW PATH W/ ARROW	
OUTFALL TO POND	POND X

POND A ROUTING

BENCHMARK
THE SOUTHWEST CORNER OF SECTION 6, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, BEING A 2-1/2" ALUMINUM CAP STAMPED "LS 23501 POWERS ELEV CO" HAVING A PUBLISHED ELEVATION OF 4983.02 FEET, NAVD 1988 DATUM, PER THE TOWN OF ERIE CONTROL MAP (JANUARY 25, 2004 REVISION).

BASIS OF BEARINGS:
BEARINGS ARE BASED ON THE NORTH LINE OF THE NORTHEAST QUARTER OF SECTION 6, TOWNSHIP 1 NORTH, RANGE 68 WEST, 6TH PRINCIPAL MERIDIAN, BEING MONUMENTED AT THE NORTH ONE QUARTER CORNER OF SAID SECTION 6 BY A FOUND NO. 6 REBAR WITH A 3-1/4 INCH DIAMETER ALUMINUM CAP SET BY PLS 36053 AND AT THE NORTHEAST CORNER OF SAID SECTION 6 BY A FOUND NO. 6 REBAR WITH A 2-1/2 INCH DIAMETER ALUMINUM CAP SET BY PLS 25937. THE LINE IS ASSUMED TO BEAR N88°46'59"E, A DISTANCE OF 2642.32 FEET.

All work shall be constructed to Town of Erie STANDARDS AND SPECIFICATIONS. This drawing has been reviewed and found to be in general compliance with these STANDARDS AND SPECIFICATION and other Town requirements. THE ENGINEERING DESIGN AND CONCEPT REMAINS THE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEAR HEREON.

Accepted by: _____ Town Engineer _____ Date

PREPARED UNDER THE SUPERVISION OF

MARK SCHEURER
COLORADO P.E. 48988

CALL 811
TWO WORKING DAYS
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1-800-922-1987
UNCC UTILITY NOTIFICATION CENTER OF COLORADO

No.	Revisions	Date	Init.	Appr.	Date
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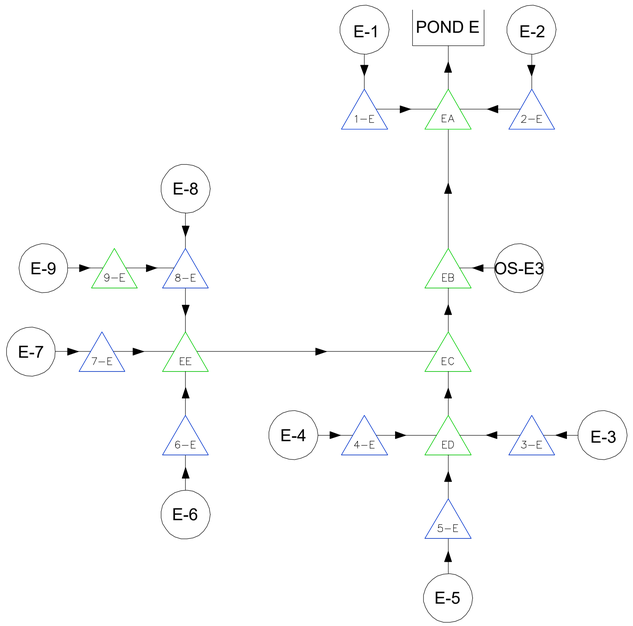
Westwoodps.com
Westwood Professional Services, Inc.

ME ERIE, LLC
7353 SOUTH ALTON WAY
CENTENNIAL, CO 80112

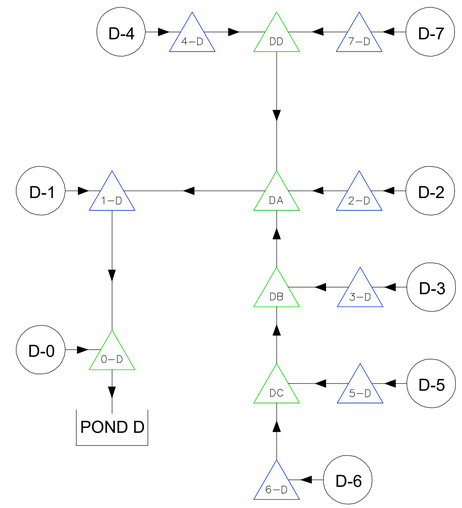
SPRING HILL
PRELIMINARY DRAINAGE MAPS
POND A ROUTING

SCALE: AS SHOWN
FILE NO: 8130307501
DRAWN BY: EWA
CHECKED BY: MS
DATE: JUNE 2025
SHEET NUMBER 2

N:\PROJECTS\SPRING HILL\SERVICE GROUP\SWATER RESOURCES\03 PRELIMINARY DRAINAGE\04_EXHIBITS\OVERALL DRAINAGE MAP.DWG, EJBEITEL, 6/5/2025 5:08 PM



POND E ROUTING



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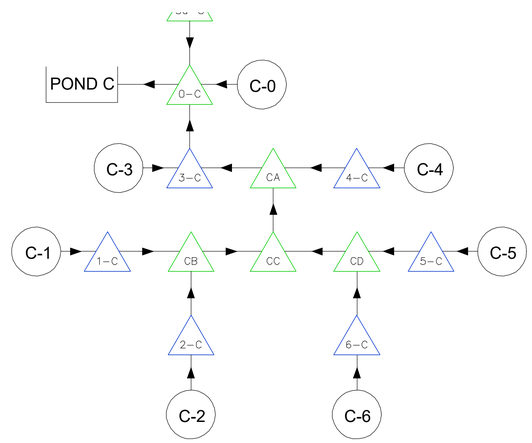
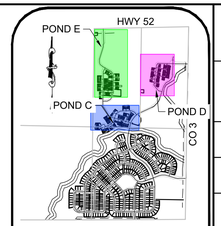


POND C ROUTING



KEYMAP
SCALE 1" = 2000'

LEGEND

DESIGN POINT	1—A
DESIGN POINT W/ INLET	1—A
AREA BASIN LABEL	A-1
FLOW PATH W/ ARROW	
OUTFALL TO POND	POND X

BENCHMARK
THE SOUTHWEST CORNER OF SECTION 6, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, BEING A 2-1/2" ALUMINUM CAP STAMPED "LS 23501 POWERS ELEV CO" HAVING A PUBLISHED ELEVATION OF 4983.02 FEET, NAVD 1988 DATUM, PER THE TOWN OF ERIE CONTROL MAP (JANUARY 25, 2004 REVISION).

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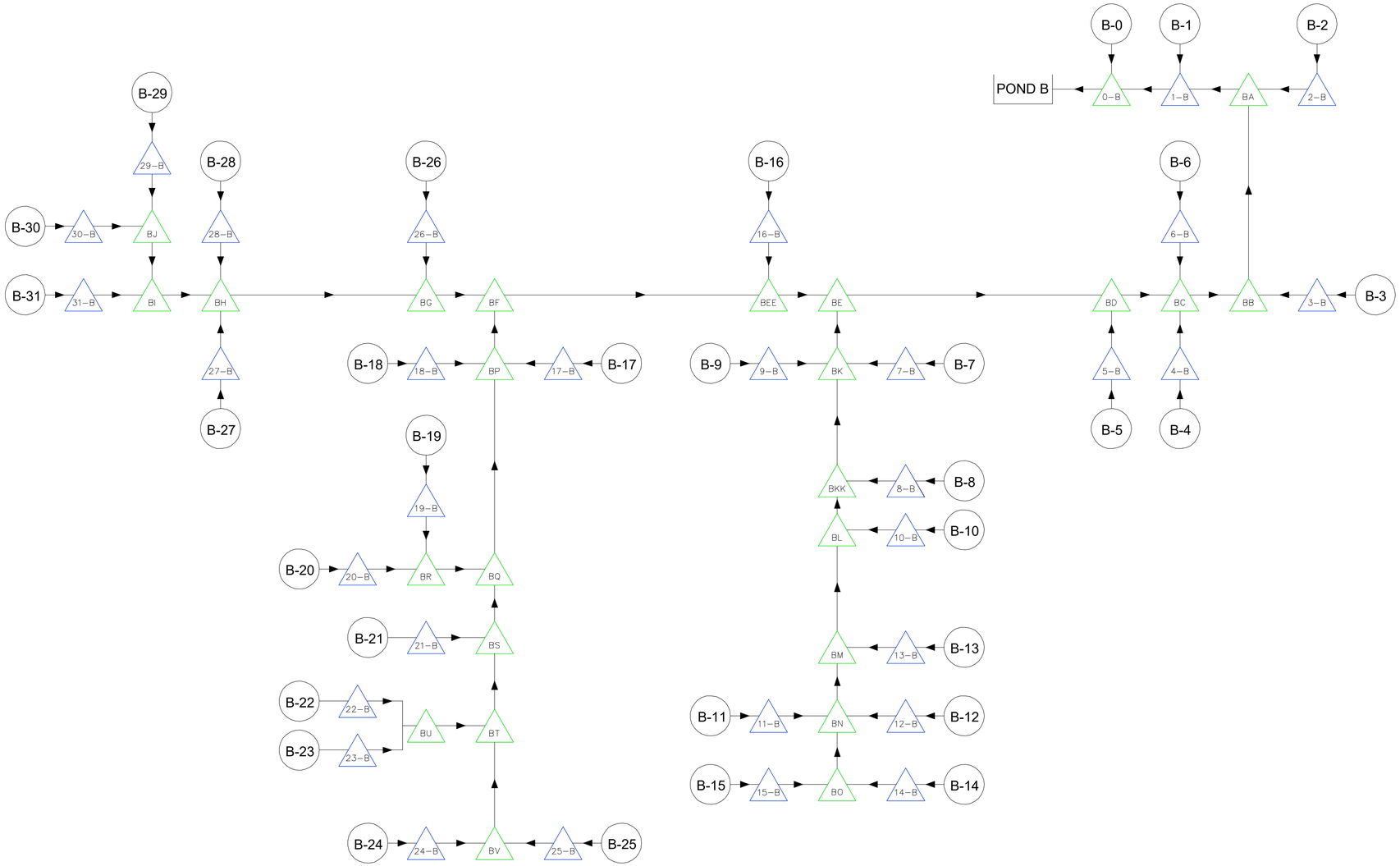
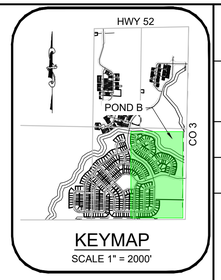
SPRING HILL
PRELIMINARY DRAINAGE MAPS
PONDS C, D, & E ROUTING

SCALE: AS SHOWN
FILE NO. 8130307501
DRAWN BY: EWA
CHECKED BY: MS
DATE: JUNE 2025
SHEET NUMBER 3

N:\PROJECTS\SPRING HILL\SERVICE GROUPS\WATER RESOURCES\03 PRELIMINARY DRAINAGE\04_EXHIBITS\OVERALL DRAINAGE MAP.DWG, EJBEITEL, 6/5/2025 5:09 PM



POND B ROUTING



LEGEND

DESIGN POINT	1—A
DESIGN POINT W/ INLET	1—A
AREA BASIN LABEL	A-1
FLOW PATH W/ ARROW	
OUTFALL TO POND	POND X

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PRELIMINARY DRAINAGE MAPS
POND B ROUTING

SCALE: AS SHOWN
FILE NO: 8130307501
DRAWN BY: EWA
CHECKED BY: MS
DATE: JUNE 2025
SHEET NUMBER 4

N:\PROJECTS\SPRING HILL\SERVICE GROUPS\WATER RESOURCES\03 PRELIMINARY DRAINAGE\04_EXHIBITS\OVERALL DRAINAGE MAP.DWG, E.BEITEL, 6/5/2025 5:09 PM

Basin A Summary				
Basin	Area (acres)	% Imp.	Q2	Q100
A-0	3.49	50.30	2.6	15.1
A-1	1.23	53.97	1.1	6.2
A-1a	1.34	54.63	1.0	5.5
A-2	0.48	73.46	0.8	3.4
A-3a	0.84	56.07	0.7	3.6
A-3	1.98	49.55	1.3	7.6
A-4	0.83	81.11	1.4	5.7
A-5	0.75	58.24	0.7	3.6
A-6	2.09	39.43	1.0	7.3
A-7	2.44	41.00	1.3	8.1
A-7a	0.09	67.33	0.1	0.6
A-8	1.73	58.28	1.4	6.6
A-8a	0.56	53.07	0.5	2.4
A-9	1.13	64.32	1.0	4.5
A-10	0.99	57.68	0.8	3.9
A-11	0.13	77.38	0.2	0.9
A-12	0.73	56.99	0.6	2.8
A-13	0.40	60.80	0.5	2.5
A-14	0.71	75.15	0.9	3.8
A-15	2.85	36.06	1.2	9.3
A-16a	0.98	58.88	0.9	4.7
A-16	0.24	46.92	0.2	1.1
A-17	2.03	34.10	0.8	6.7
A-18	0.27	81.85	0.5	2.0
A-19	1.10	54.95	1.0	5.3
A-20	1.75	41.42	1.1	7.3
A-20a	0.43	33.91	0.2	1.8
A-21	2.66	55.73	2.1	11.5
A-23	0.58	56.31	0.5	2.8
A-24	0.60	65.23	0.7	3.1
A-25	0.19	63.89	0.3	1.3
A-27	1.33	61.13	1.2	6.0
A-28	0.66	47.36	0.4	2.7
A-28a	2.23	51.06	1.5	8.6
A-29	1.75	51.22	1.2	6.7
A-29a	0.80	55.10	0.8	4.2
A-30	0.16	63.25	0.2	1.1
A-31	1.44	50.26	1.1	6.3
A-32	12.32	45.02	6.4	40.8

Design Point Summary Table Basin A			
Design Point	Inlet Type	Q2 (CFS)	Q100 (CFS)
31-A	SHEET FLOW	0.0	0.0
30-A	SHEET FLOW	0.0	0.0
29-A	15' CDOT TYPE R ON-GRADE INLET	2.3	11.1
29a-A	10' CDOT TYPE R ON-GRADE INLET	0.8	4.3
28-A	5' CDOT TYPE R ON-GRADE INLET	0.4	2.3
28a-A	SHEET FLOW	0.0	0.0
27-A	10' CDOT TYPE R ON-GRADE INLET	1.2	5.7
25-A	SHEET FLOW	0.0	0.0
24-A	SHEET FLOW	0.0	0.0
23-A	SHEET FLOW	0.0	0.0
21-A	SHEET FLOW	0.0	0.0
20-A	2 - 10' CDOT TYPE R ON-GRADE INLETS	4.4	18.8
20a-A	15' CDOT TYPE R ON-GRADE INLET	1.7	12.1
19-A	10' CDOT TYPE R ON-GRADE INLET	1.0	5.3
18-A	SHEET FLOW	0.0	0.0
17-A	SHEET FLOW	0.0	0.0
16-A	15' CDOT TYPE R ON-GRADE INLET	2.0	12.4
16a-A	SHEET FLOW	0.0	0.0
15-A	10' CDOT TYPE R ON-GRADE INLET	1.2	7.5
14-A	10' CDOT TYPE R ON-GRADE INLET	0.9	3.8
13-A	SHEET FLOW	0.0	0.0
12-A	SHEET FLOW	0.0	0.0
11-A	SHEET FLOW	0.0	0.0
10-A	SHEET FLOW	0.0	0.0
9-A	10' CDOT TYPE R ON-GRADE INLET	1.0	4.5
8a-A	SHEET FLOW	0.0	0.0
8-A	SHEET FLOW	0.0	0.0
7a-A	15' CDOT TYPE R ON-GRADE INLET	2.6	10.9
7-A	10' CDOT TYPE R ON-GRADE INLET	1.9	8.2
6-A	10' CDOT TYPE R ON-GRADE INLET	1.0	7.7
5-A	SHEET FLOW	0.0	0.0
32-A	STUB OUT	6.4	40.8
4-A	15' CDOT TYPE R ON-GRADE INLET	1.4	5.7
3a-A	10' CDOT TYPE R ON-GRADE INLET	1.3	6.8
3-A	10' CDOT TYPE R ON-GRADE INLET	1.6	8.5
2-A	10' CDOT TYPE R ON-GRADE INLET	0.8	3.5
1a-A	10' CDOT TYPE R ON-GRADE INLET	1.0	5.9
1-A	15' CDOT TYPE R ON-GRADE INLET	1.1	6.1
0-A	OVERLAND TO POND	2.6	15.3

Basin B Summary				
Basin	Area (acres)	% Imp.	Q2	Q100
B-0	3.10	14.17	0.3	3.1
B-1	0.96	52.04	0.7	3.2
B-2	2.14	53.58	1.7	8.0
B-3	2.80	49.01	1.9	9.4
B-4	1.63	51.68	1.0	4.9
B-5	1.66	53.84	1.5	7.0
B-6	1.15	56.33	0.9	4.2
B-7	1.12	65.41	1.1	4.6
B-8	3.33	55.02	2.0	9.4
B-9	2.90	52.30	2.2	10.5
B-10	1.58	57.61	1.2	5.5
B-11	3.52	54.53	2.4	12.4
B-12	1.10	36.80	0.4	2.3
B-13	3.02	19.76	0.4	3.6
B-14	1.31	59.66	1.2	5.8
B-15	2.07	54.68	1.6	8.5
B-16	1.47	62.69	1.4	6.0
B-17	1.01	61.03	1.0	4.2
B-18	0.81	52.67	0.6	2.8
B-19	1.58	60.61	1.3	5.6
B-20	3.31	54.69	2.1	9.9
B-21	0.74	51.03	0.5	2.5
B-22	1.18	61.63	1.1	5.0
B-23	3.96	41.83	1.7	10.5
B-24	2.13	46.32	1.5	8.7
B-25	1.43	60.63	1.4	6.8
B-26	1.56	56.18	1.1	5.0
B-27	2.80	52.31	1.8	8.4
B-28	1.74	53.62	1.2	5.6
B-29	1.98	51.72	1.1	5.2
B-30	1.73	58.90	1.3	5.6
B-31	2.22	45.36	1.1	6.6

Design Point Summary Basin B			
Design Point	Inlet Type	Q2 (CFS)	Q100 (CFS)
31-B	10' CDOT TYPE R INLET ON GRADE	1.1	6.0
30-B	10' CDOT TYPE R INLET ON GRADE	1.3	5.4
29-B	10' CDOT TYPE R INLET ON GRADE	1.1	5.1
28-B	10' CDOT TYPE R INLET ON GRADE	1.2	5.4
27-B	10' CDOT TYPE R INLET ON GRADE	1.8	7.0
26-B	10' CDOT TYPE R INLET ON GRADE	1.1	5.5
25-B	10' CDOT TYPE R INLET ON GRADE	1.4	6.3
24-B	10' CDOT TYPE R INLET ON GRADE	1.5	7.4
23-B	15' CDOT TYPE R INLET ON GRADE	1.7	9.9
22-B	10' CDOT TYPE R INLET ON GRADE	1.1	5.0
21-B	10' CDOT TYPE R INLET ON GRADE	0.5	3.3
20-B	10' CDOT TYPE R INLET ON GRADE	2.1	7.7
19-B	10' CDOT TYPE R INLET ON GRADE	1.3	5.1
18-B	10' CDOT TYPE R INLET ON GRADE	0.6	4.8
17-B	10' CDOT TYPE R INLET ON GRADE	1.0	4.3
16-B	10' CDOT TYPE R INLET ON GRADE	1.4	5.7
15-B	10' CDOT TYPE R INLET ON GRADE	1.6	7.3
14-B	10' CDOT TYPE R INLET ON GRADE	1.2	5.5
13-B	10' CDOT TYPE R INLET ON GRADE	0.4	3.6
12-B	10' CDOT TYPE R INLET ON GRADE	0.4	3.5
11-B	15' CDOT TYPE R INLET ON GRADE	2.4	10.9
10-B	10' CDOT TYPE R INLET ON GRADE	1.2	5.3
9-B	10' CDOT TYPE R INLET ON GRADE	2.2	8.0
8-B	10' CDOT TYPE R INLET ON GRADE	2.0	7.4
7-B	10' CDOT TYPE R INLET ON GRADE	1.1	5.5
6-B	10' CDOT TYPE R INLET IN SUMP	0.9	4.2
5-B	10' CDOT TYPE R INLET ON GRADE	1.5	6.4
4-B	10' CDOT TYPE R INLET IN SUMP	1.0	6.9
3-B	10' CDOT TYPE R INLET ON GRADE	1.9	7.6
2-B	15' CDOT TYPE R INLET IN SUMP	1.7	8.0
1-B	10' CDOT TYPE R INLET IN SUMP	0.7	3.2
0-B	OVERLAND TO POND B	0.3	3.1

Basin C Summary				
Basin	Area (acres)	% Imp.	Q2	Q100
C-0	2.76	5.22	0.1	4.0
C-1	0.52	96.23	1.2	4.2
C-2	6.01	26.20	1.7	13.3
C-3	0.21	100.00	0.5	1.7
C-4	4.99	44.13	3.2	20.6
C-5	0.21	76.67	0.4	1.5
C-6	1.60	44.26	0.8	4.7
C-3a	0.61	51.11	0.5	2.7

Design Point Summary Basin C			
Design Point	Inlet Type	Q2 (CFS)	Q100 (CFS)
0-C	OVERLAND TO POND C	0.0	3.8
1-C	5' CDOT TYPE R INLET IN SUMP	1.2	4.2
2-C	2-15' CDOT TYPE R INLET IN SUMP	1.7	13.3
3-C	15' CDOT TYPE R INLET ON GRADE	0.7	3.8
4-C	2-15' CDOT TYPE R INLET ON GRADE	3.2	17.4
5-C	5' CDOT TYPE R INLET IN SUMP	0.4	1.5
6-C	10' CDOT TYPE R INLET IN SUMP	0.9	4.7
3a-C	BYPASS	0.0	0.0

Basin D Summary				
Basin	Area (acres)	% Imp.	Q2	Q100
D-0	1.18	97.63	2.3	8.4
D-1	2.40	58.47	2.2	10.6
D-2	3.80	49.34	2.5	14.5
D-3	0.16	35.25	0.1	0.5
D-4	1.36	77.52	1.7	7.2
D-5	0.87	50.92	0.7	3.9
D-6	3.89	18.22	0.7	10.0
D-7	1.19	70.13	1.3	6.0

Design Point Summary Table Basin D			
Design Point	Inlet Type	Q2 (CFS)	Q100 (CFS)
0-D	OVERLAND TO POND D	2.3	8.4
1-D	15' CDOT TYPE R IN SUMP	2.2	11.1
2-D	15' CDOT TYPE R IN SUMP	2.5	14.9
3-D	10' CDOT TYPE R ON GRADE	0.1	0.9
4-D	10' CDOT TYPE R ON GRADE	1.7	6.3
5-D	10' CDOT TYPE R ON GRADE	0.7	5.6
6-D	10' CDOT TYPE R IN SUMP	0.7	6.9
7-D	10' CDOT TYPE R ON GRADE	1.3	5.7

Basin E Summary				
Basin	Area (acres)	% Imp.	Q2	Q100
E-1	1.08	100.00	2.0	7.1
E-2	1.48	84.11	2.0	8.0
E-3	1.92	38.20	1.0	7.5
E-4	2.55	66.40	2.1	9.7
E-5	1.34	81.19	1.7	6.9
E-6	1.62	76.23	2.2	9.5
E-7	1.26	68.36	1.5	7.0
E-8	1.18	75.14	1.6	7.0
E-9	1.06	80.11	1.5	6.3
E-0	1.33	52.84	1.3	7.3
OS-E1	5.34	30.39	1.6	13.3
OS-E2	4.02	33.86	1.4	11.0
OS-E3	4.15	19.21	0.7	8.9

Design Point Summary Basin E			
Design Point	Inlet Type	Q2 (CFS)	Q100 (CFS)
9-E	BYPASS	0.0	0.0
8-E	15' CDOT TYPE R ON-GRADE INLET	2.7	10.3
7-E	15' CDOT TYPE R ON-GRADE INLET	1.5	6.3
6-E	15' CDOT TYPE R ON-GRADE INLET	2.2	7.6
5-E	15' CDOT TYPE R ON-GRADE INLET	1.7	6.2
4-E	15' CDOT TYPE R ON-GRADE INLET	2.1	7.5
3-E	15' CDOT TYPE R ON-GRADE INLET	1.0	6.5
2-E	CDOT TYPE C SUMP INLET	2.0	8.0
1-E	CDOT TYPE C SUMP INLET	2.0	8.0
0-E	OVERLAND TO POND	1.3	7.3
E1-OS	SWALE	2.6	13.3
E2-OS	SWALE	0.0	0.0
E3-OS	CDOT TYPE C INLET IN DEPRESSION	0.7	8.9

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Town Engineer Date

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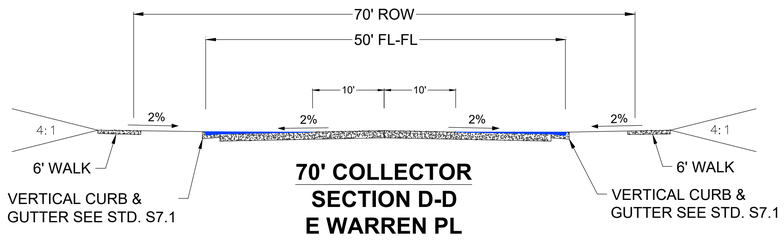
SPRING HILL
PRELIMINARY DRAINAGE MAPS
BASIN SUMMARY TABLES

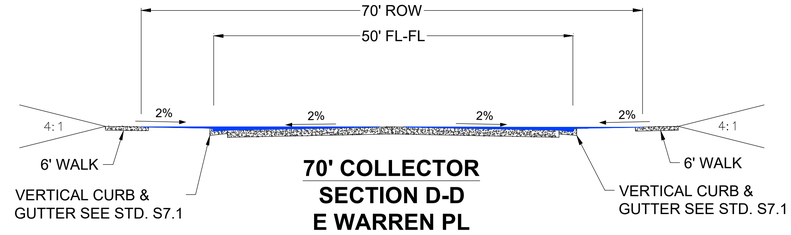
SCALE: AS SHOWN
FILE NO: 8130307501
DRAWN BY: EWA
CHECKED BY: MS
DATE: JUNE 2025
SHEET NUMBER 5

N:\PROJECTS\SPRING HILL\SERVICE GROUPS\WATER RESOURCES\03 PRELIMINARY DRAINAGE\04_EXHIBITS\BASIN SUMMARY TABLES.DWG, EJBEITEL, 6/5/2025 5:09 PM



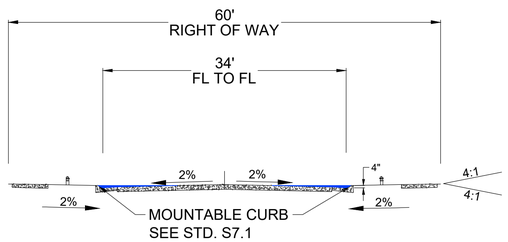
70' COLLECTOR
SECTION D-D
E WARREN PL

MINOR (2-YEAR) STORM EVENT



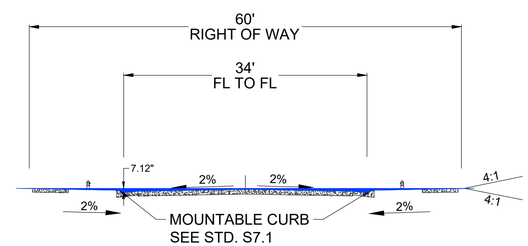
70' COLLECTOR
SECTION D-D
E WARREN PL

MAJOR (100-YEAR) STORM EVENT



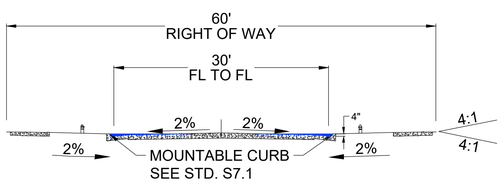
60' LOCAL STREET TYPE 1
SECTION F-F
VARIOUS INTERNAL STREETS

MINOR (2-YEAR) STORM EVENT



60' LOCAL STREET TYPE 1
SECTION F-F
VARIOUS INTERNAL STREETS

MAJOR (100-YEAR) STORM EVENT



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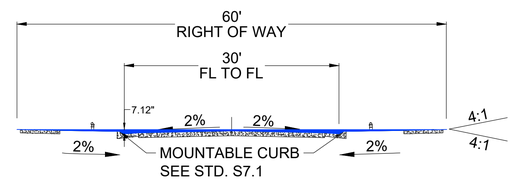
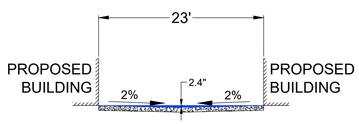
SECTION G-G
VARIOUS INTERNAL STREETS

MINOR (2-YEAR) STORM EVENT



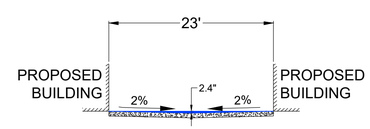
60' LOCAL STREET TYPE 2
SECTION G-G
VARIOUS INTERNAL STREETS

MAJOR (100-YEAR) STORM EVENT



TYPICAL ALLEY

MINOR (2-YEAR) STORM EVENT



TYPICAL ALLEY

MAJOR (100-YEAR) STORM EVENT

TABLE 800-7
ALLOWABLE PAVEMENT ENCROACHMENT AND DEPTH OF FLOW FOR INITIAL STORM RUNOFF

Street Classification	Maximum Encroachment*
Local	No curb overtopping; flow may spread to crown of street.
Collector	No curb overtopping; flow spread must leave the equivalent of one 10-foot driving lane clear of water.
Arterials	No curb overtopping; flow spread must leave the equivalent of two 10-foot driving lanes clear of water - one lane in each direction.
Freeways	No encroachment is allowed on any traffic lane.

TABLE 800-8
ALLOWABLE DEPTH OF FLOW AND INUNDATED AREA FOR MAJOR STORM RUNOFF

Street Classification	Allowable Depth and Inundated Areas
Local & Collector	Residential dwellings and public, commercial, and industrial buildings shall be no less than 12 inches above the 100-year flood at the ground line or lowest water entry of the building. The depth of water over the gutter flow line must not exceed 12 inches.
Arterial & Freeway	Residential dwellings and public, commercial, and industrial buildings must be no less than 12 inches above the 100-year flood at the ground line or lowest water entry of the building. The depth of water must not exceed the street crown to allow operation of emergency vehicles. The depth of water over gutter flow line must not exceed twelve (12).inches

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10 5 0 10 20
SCALE: 1" = 10

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SPRING HILL
PRELIMINARY DRAINAGE MAPS
AREA DRAINAGE MAP

SCALE: AS SHOWN
FILE NO. 8130307501
DRAWN BY: EWA
CHECKED BY:
DATE: JUNE 2025
SHEET NUMBER 6

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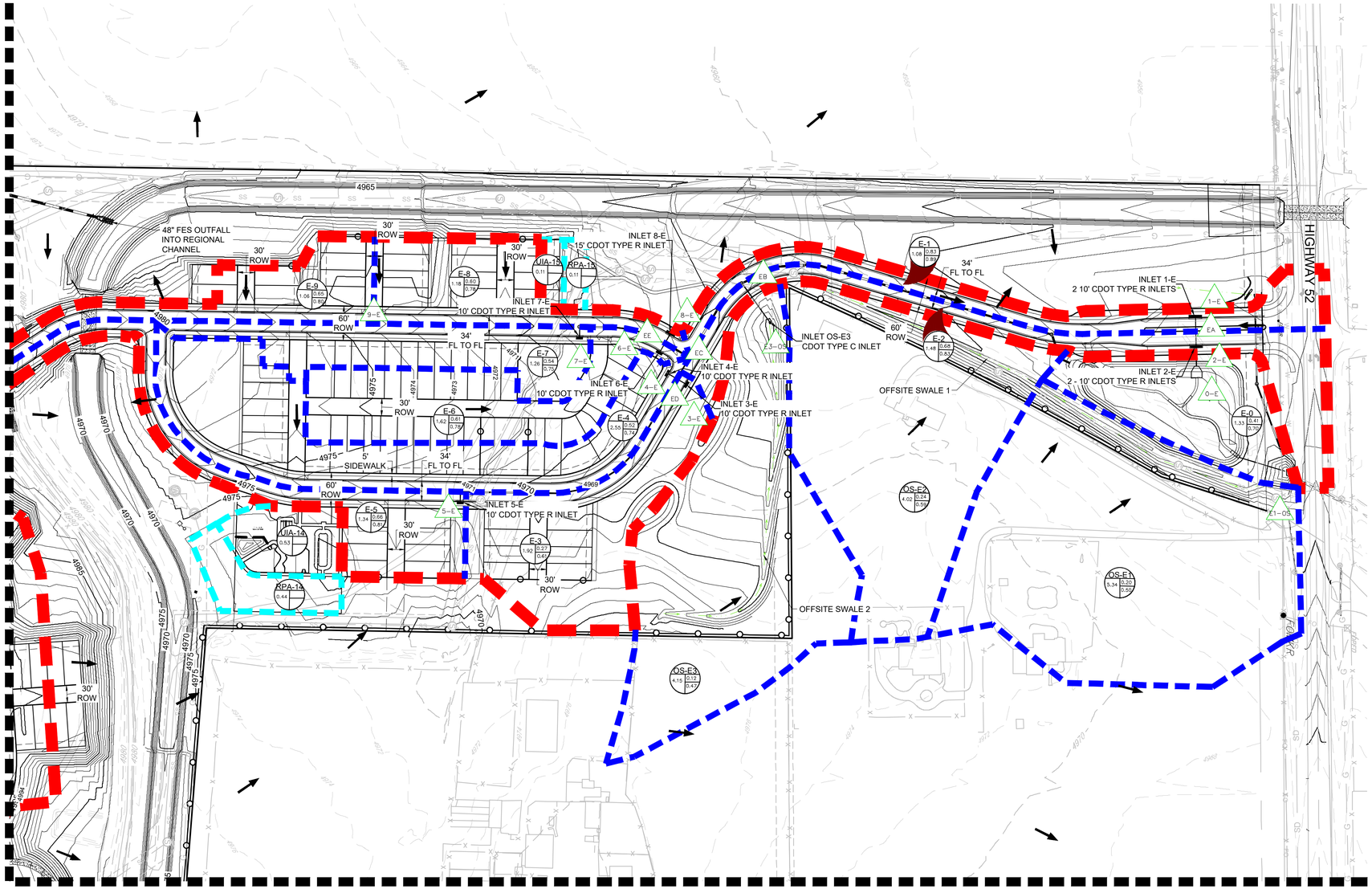

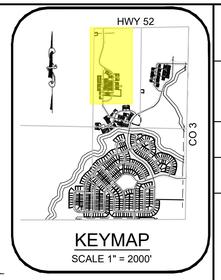

100 50 0 100 200

SCALE: 1" = 100

LEGEND

XX / A / CZ / C100	XX = BASIN ID
XX	DESIGN POINT
	EXISTING DRAINAGE BOUNDARY
	MINOR BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
	RUNOFF BASIN BOUNDARY
	LAYOUT MATCHLINE
5650	EXISTING MAJOR CONTOURS
5650	EXISTING MINOR CONTOURS
5650	PROPOSED MAJOR CONTOURS
5649	PROPOSED MINOR CONTOURS
	EMERGENCY OVERFLOW PATH
	PROPOSED STORM
	EXISTING STORM
	PROPOSED FLOW ARROW
	100-YEAR FLOOD PLAIN
A	LOT TYPES
	PAGE BOUNDARIES
	AREAS OUTSIDE OF POND DELINEATION

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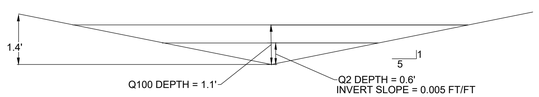
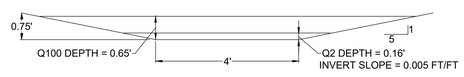


OFFSITE SWALE 1
GRASS LINED
SCALE: 1" = 2'



OFFSITE SWALE 2
GRASS LINED
SCALE: 1" = 2'

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SPRING HILL
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AREA DRAINAGE MAP

SCALE: AS SHOWN
FILE NO: 8130307501
DRAWN BY: DJS
CHECKED BY:
DATE: JUNE 2025
SHEET NUMBER 7

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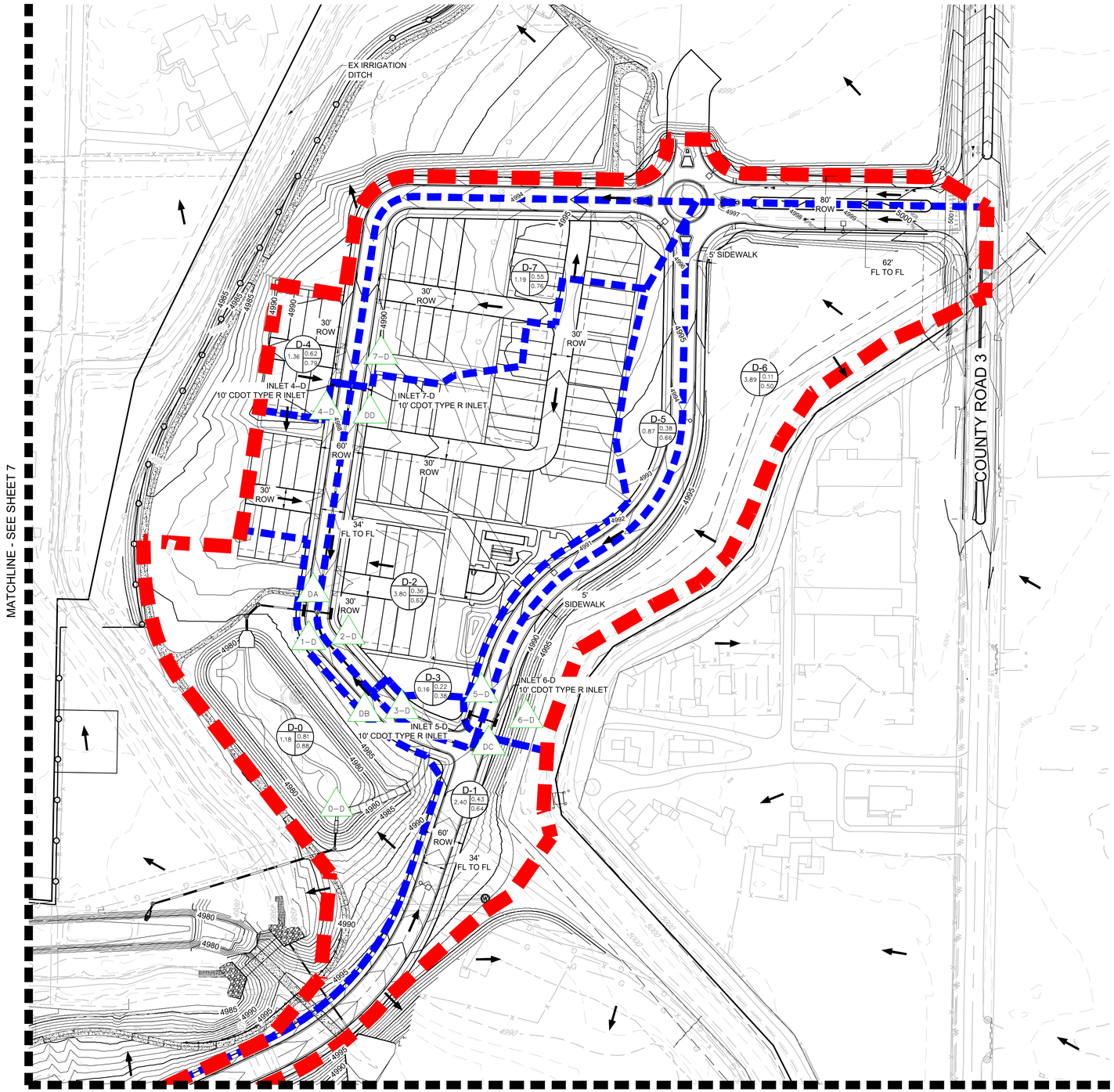

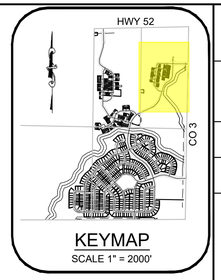

80 40 0 80 160

SCALE: 1" = 80

LEGEND

XX / A / CZ / C100	XX = BASIN ID
XX	DESIGN POINT
	EXISTING DRAINAGE BOUNDARY
	MINOR BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
	RUNOFF BASIN BOUNDARY
	LAYOUT MATCHLINE
5650	EXISTING MAJOR CONTOURS
5650	EXISTING MINOR CONTOURS
5650	PROPOSED MAJOR CONTOURS
5649	PROPOSED MINOR CONTOURS
	EMERGENCY OVERFLOW PATH
	PROPOSED STORM
	EXISTING STORM
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A	LOT TYPES
	PAGE BOUNDARIES
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FILE NO. 8130307501
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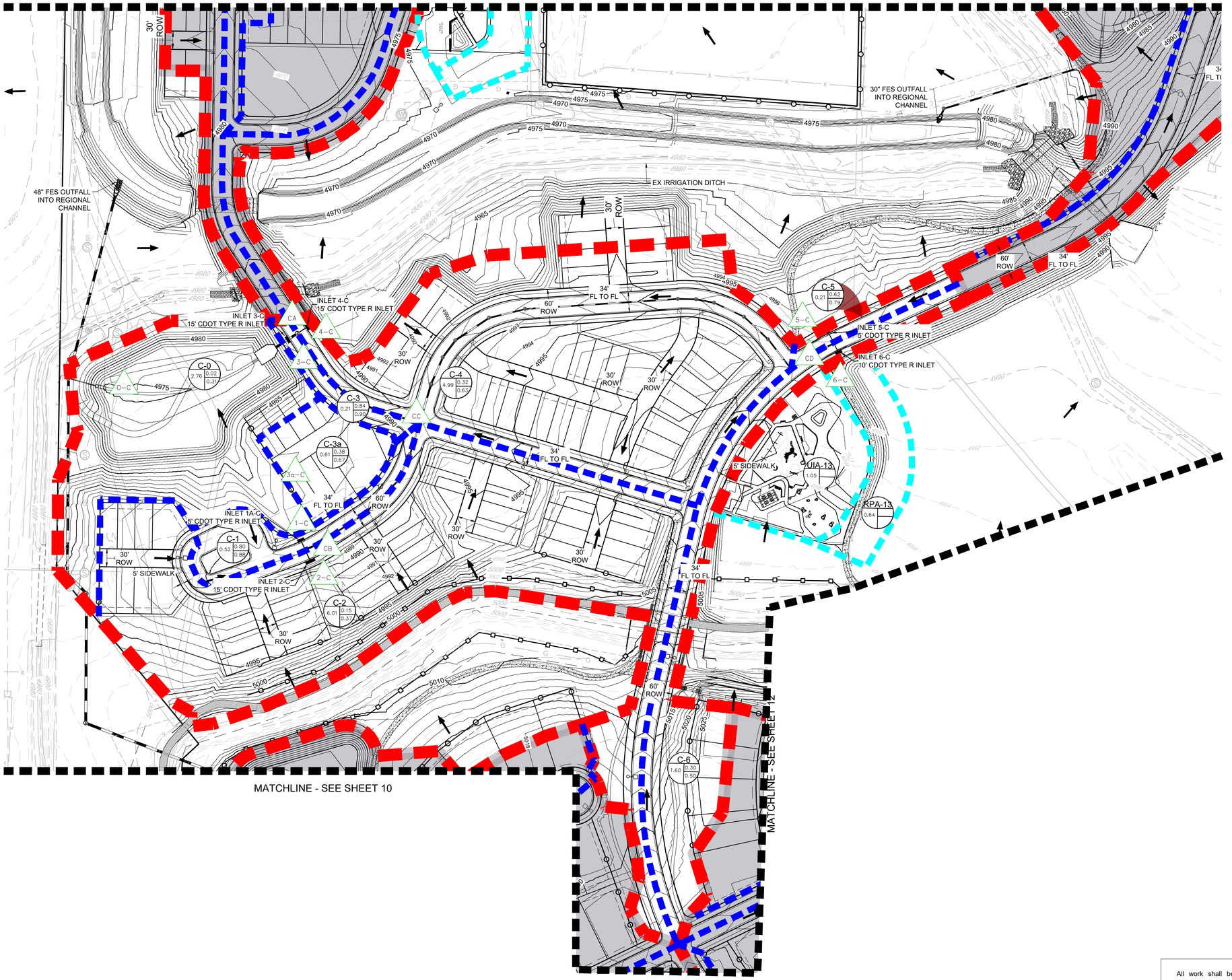

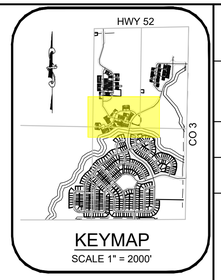

KEYMAP
SCALE 1" = 2000'

80 40 0 80 160

SCALE: 1" = 80

LEGEND

XX / A / CZ / C100	XX = BASIN ID
XX	DESIGN POINT
	EXISTING DRAINAGE BOUNDARY
	MINOR BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
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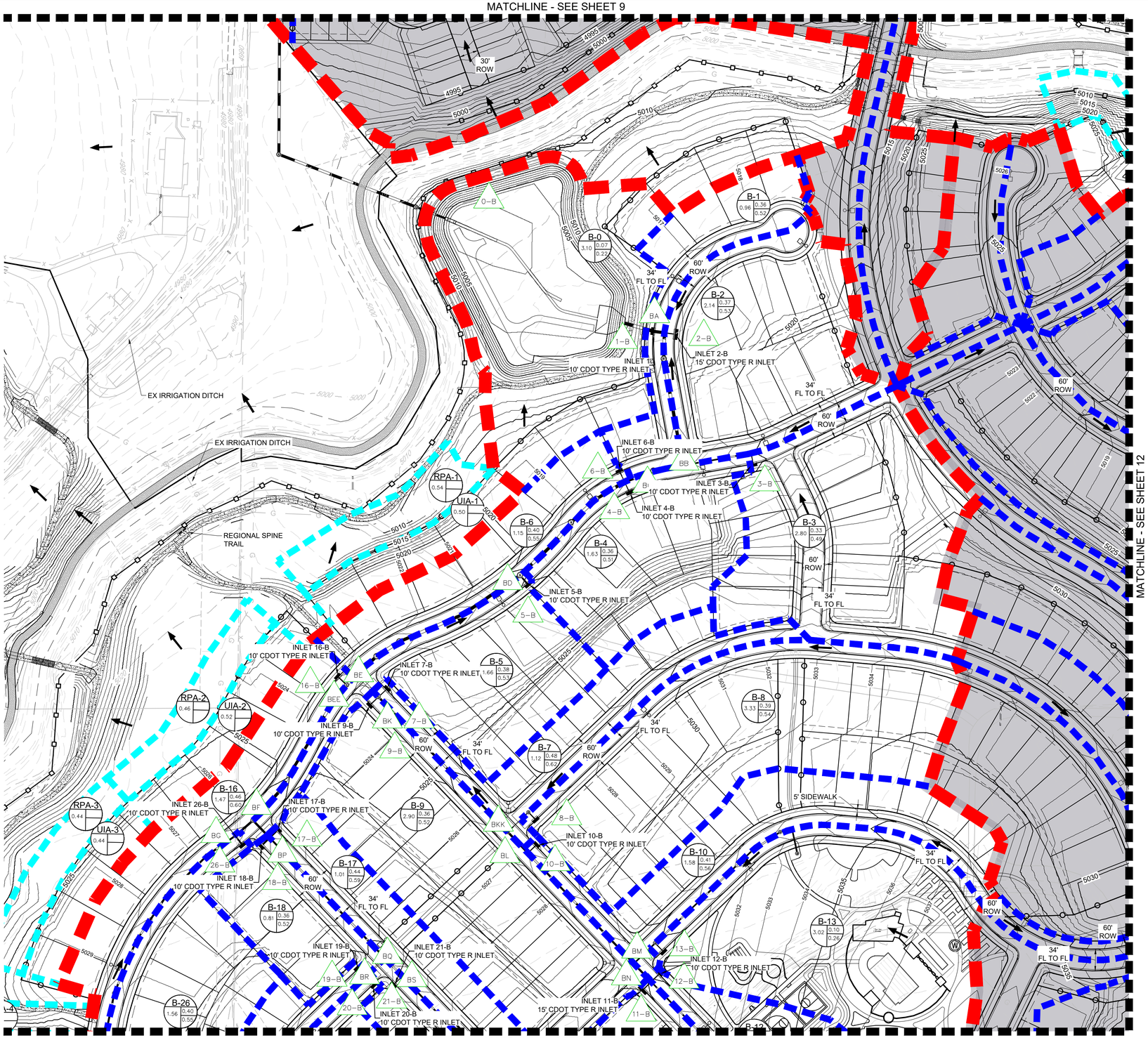
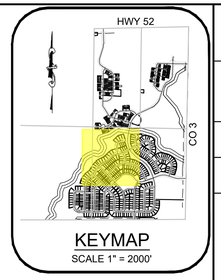
DATE: JUNE 2025
SHEET NUMBER 9

N:\PROJECTS\SPRING HILL\SERVICE GROUPS\WATER RESOURCES\03 PRELIMINARY DRAINAGE\04_EXHIBITS\AREA DRAINAGE MAPS.DWG, GREHM, 6/6/2025 9:41 AM





80 40 0 80 160

SCALE: 1" = 80

LEGEND

XX / A / CZ / C100	XX = BASIN ID
XX	DESIGN POINT
	EXISTING DRAINAGE BOUNDARY
	MINOR BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
	RUNOFF BASIN BOUNDARY
	LAYOUT MATCHLINE
5650	EXISTING MAJOR CONTOURS
5650	EXISTING MINOR CONTOURS
5650	PROPOSED MAJOR CONTOURS
5649	PROPOSED MINOR CONTOURS
	EMERGENCY OVERFLOW PATH
	PROPOSED STORM
	EXISTING STORM
	PROPOSED FLOW ARROW
	100-YEAR FLOOD PLAIN
A	LOT TYPES
	PAGE BOUNDARIES
	AREAS OUTSIDE OF POND DELINEATION

NOTES:

1. ALL PONDS ARE PRIVATE AND ARE MAINTAINED BY METRO DISTRICT.
2. ALL STORM INLETS PIPES HAVE BEEN DESIGNED FOR THE 100-YEAR STORM.
3. ALL STORM INLETS AND PIPES SHOWN ARE PUBLIC AND WILL BE MAINTAINED BY THE METRO DISTRICT UNLESS OTHERWISE NOTED.
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5. OUTLET STRUCTURE AND OVERFLOW WEIR DETAILS WILL BE PROVIDED WITH FINAL DRAINAGE REPORT.
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7. SEE FIRM MAP, APPENDIX A FOR MORE INFORMATION REGARDING THE FLOODPLAIN.
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BENCHMARK
THE SOUTHWEST CORNER OF SECTION 6, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, BEING A 2-1/2" ALUMINUM CAP STAMPED "LS 23501 POWERS ELEV CO" HAVING A PUBLISHED ELEVATION OF 4983.02 FEET, NAVD 1988 DATUM, PER THE TOWN OF ERIE CONTROL MAP (JANUARY 25, 2004 REVISION).

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All work shall be constructed to Town of Erie STANDARDS AND SPECIFICATIONS. This drawing has been reviewed and found to be in general compliance with these STANDARDS AND SPECIFICATION and other Town requirements. THE ENGINEERING DESIGN AND CONCEPT REMAINS THE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEAR HEREON.

Accepted by: _____ _____
Town Engineer Date

PREPARED UNDER THE SUPERVISION OF

MARK SCHEURER
COLORADO P.E. 48988

No.	Revisions	Date	Init.	Appr.	Date
			CVL		

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Westwood Professional Services, Inc.

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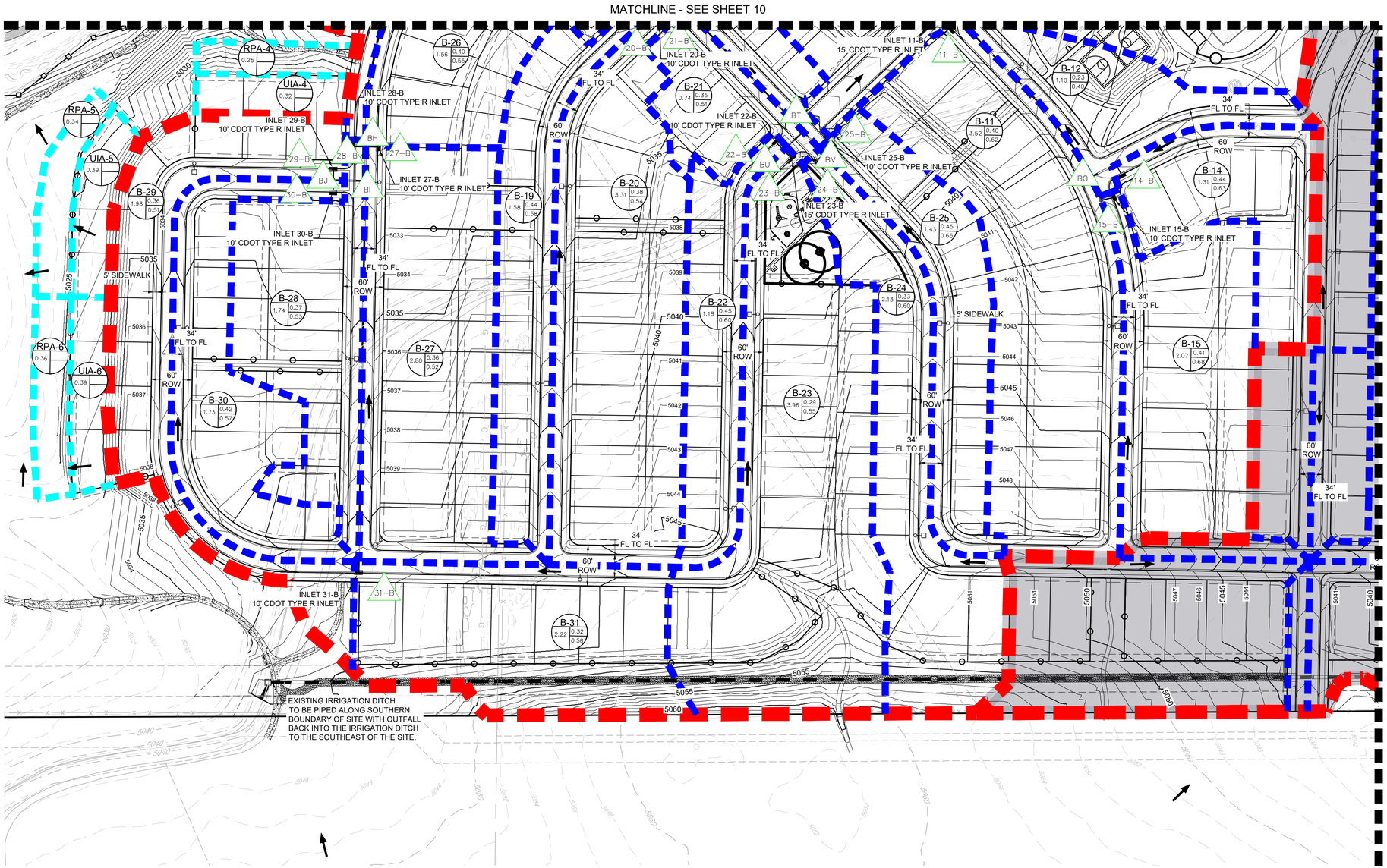
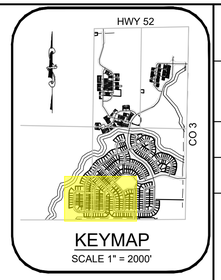
7353 SOUTH ALTON WAY
CENTENNIAL, CO 80112

SPRING HILL
PRELIMINARY DRAINAGE MAPS
AREA DRAINAGE MAP

SCALE: AS SHOWN
FILE NO. 8130307501
DRAWN BY: DJS
CHECKED BY:
DATE: JUNE 2025
SHEET NUMBER 10

N:\PROJECTS\SPRING HILL\SERVICE GROUP\SWATER RESOURCES\03 PRELIMINARY DRAINAGE\04_EXHIBITS\AREA DRAINAGE MAPS.DWG, GREHM, 6/6/2025 9:41 AM





80 40 0 80 160

SCALE: 1" = 80

LEGEND

XX / A / CZ / C100	XX = BASIN ID
XX	DESIGN POINT
	EXISTING DRAINAGE BOUNDARY
	MINOR BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
	RUNOFF BASIN BOUNDARY
	LAYOUT MATCHLINE
5650	EXISTING MAJOR CONTOURS
5650	EXISTING MINOR CONTOURS
5650	PROPOSED MAJOR CONTOURS
5649	PROPOSED MINOR CONTOURS
	EMERGENCY OVERFLOW PATH
	PROPOSED STORM
	EXISTING STORM
	PROPOSED FLOW ARROW
	100-YEAR FLOOD PLAIN
A	LOT TYPES
	PAGE BOUNDARIES
	AREAS OUTSIDE OF POND DELINEATION

NOTES:

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Accepted by: _____ Town Engineer _____ Date

PREPARED UNDER THE SUPERVISION OF

MARK SCHEURER
COLORADO P.E. 48988

No.	Revisions	Date	Init.	Appr.	Date
			CVL		

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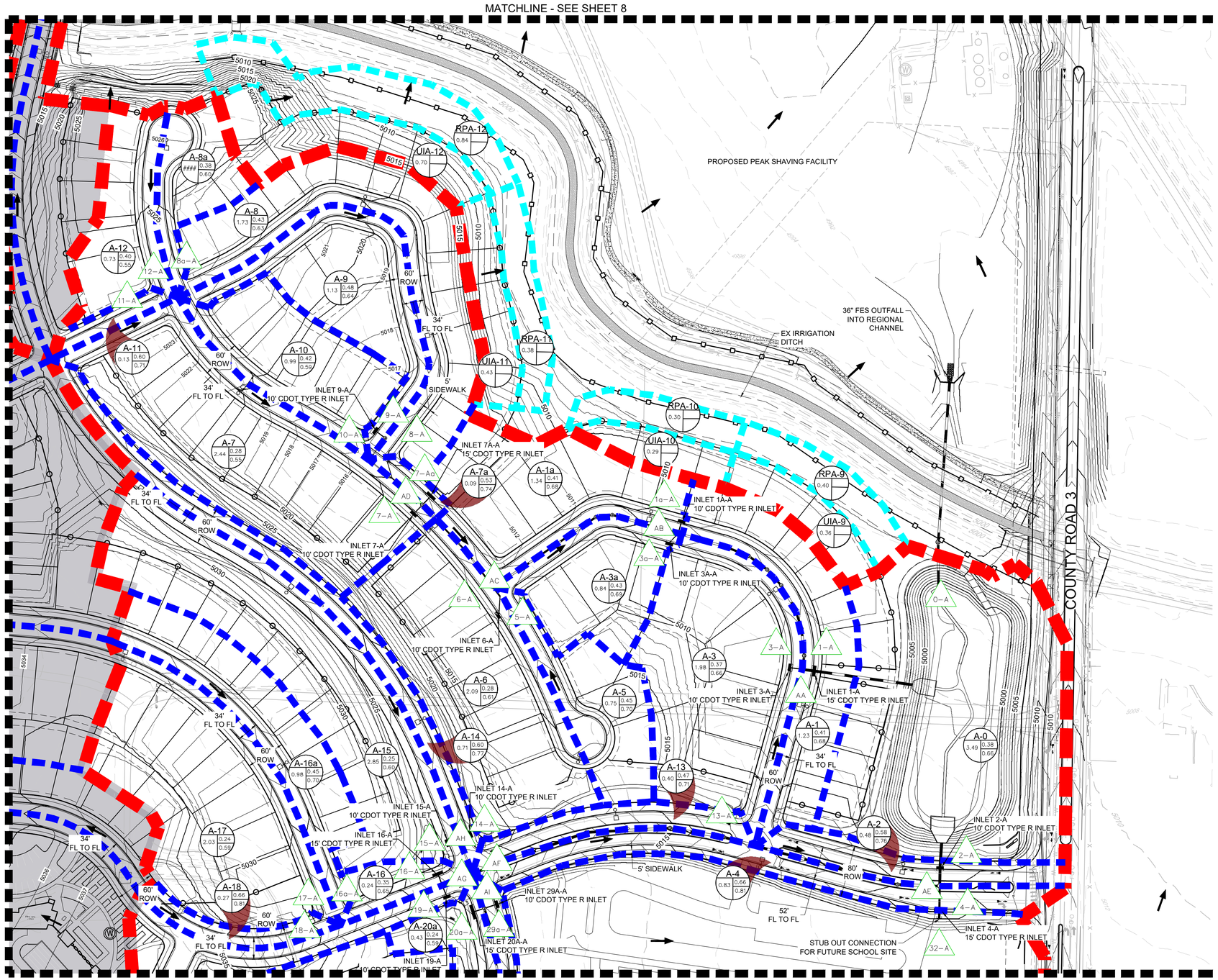
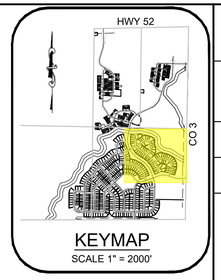
SPRING HILL
PRELIMINARY DRAINAGE MAPS
AREA DRAINAGE MAP

SCALE: AS SHOWN
FILE NO: 8130307501
DRAWN BY: DJS
CHECKED BY:
DATE: JUNE 2025
SHEET NUMBER 11

N:\PROJECTS\SPRING HILL\SERVICE GROUPS\WATER RESOURCES\03 PRELIMINARY DRAINAGE\04_EXHIBITS\AREA DRAINAGE MAPS.DWG, GREIM, 6/6/2025 9:41 AM





80 40 0 80 160

SCALE: 1" = 80

LEGEND

XX / A / CZ / C100	XX = BASIN ID
XX	DESIGN POINT
	EXISTING DRAINAGE BOUNDARY
	MINOR BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
	RUNOFF BASIN BOUNDARY
	LAYOUT MATCHLINE
5650	EXISTING MAJOR CONTOURS
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SPRING HILL
PRELIMINARY DRAINAGE MAPS
AREA DRAINAGE MAP

SCALE: AS SHOWN
FILE NO: 8130307501
DRAWN BY: DJS
CHECKED BY:
DATE: JUNE 2025
SHEET NUMBER 12

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BENCHMARK
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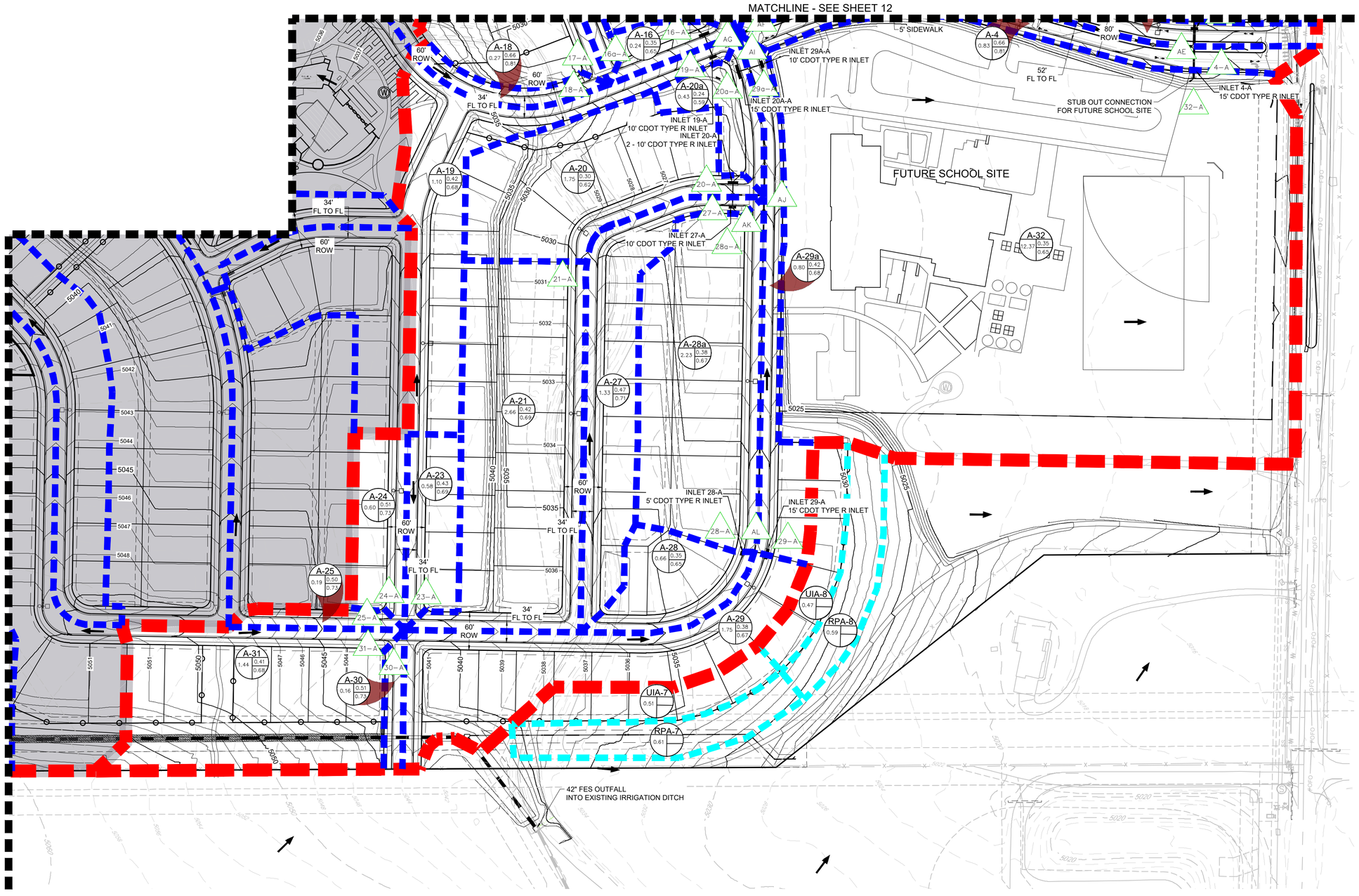
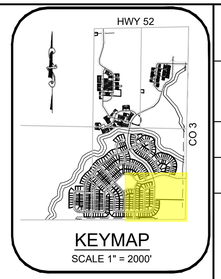
Accepted by: _____ _____
Town Engineer Date

PREPARED UNDER THE SUPERVISION OF

MARK SCHEURER
COLORADO P.E. 48988

N:\PROJECTS\SPRING HILL\SERVICE GROUPS\WATER RESOURCES\03 PRELIMINARY DRAINAGE\04_EXHIBITS\AREA DRAINAGE MAPS.DWG, GREIMM, 6/6/2025 9:41 AM





100 50 0 100 200

SCALE: 1" = 100

LEGEND

XX / A / CZ / C100	XX = BASIN ID
XX	DESIGN POINT
	EXISTING DRAINAGE BOUNDARY
	MINOR BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
	RUNOFF BASIN BOUNDARY
	LAYOUT MATCHLINE
5650	EXISTING MAJOR CONTOURS
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A	LOT TYPES
	PAGE BOUNDARIES
	AREAS OUTSIDE OF POND DELINEATION

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SPRING HILL
PRELIMINARY DRAINAGE MAPS
AREA DRAINAGE MAP

SCALE: AS SHOWN
FILE NO. 8130307501
DRAWN BY: EWM
CHECKED BY:
DATE: JUNE 2025
SHEET NUMBER 13

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BENCHMARK
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Accepted by: _____ Town Engineer _____ Date

PREPARED UNDER THE SUPERVISION OF

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COLORADO P.E. 48988

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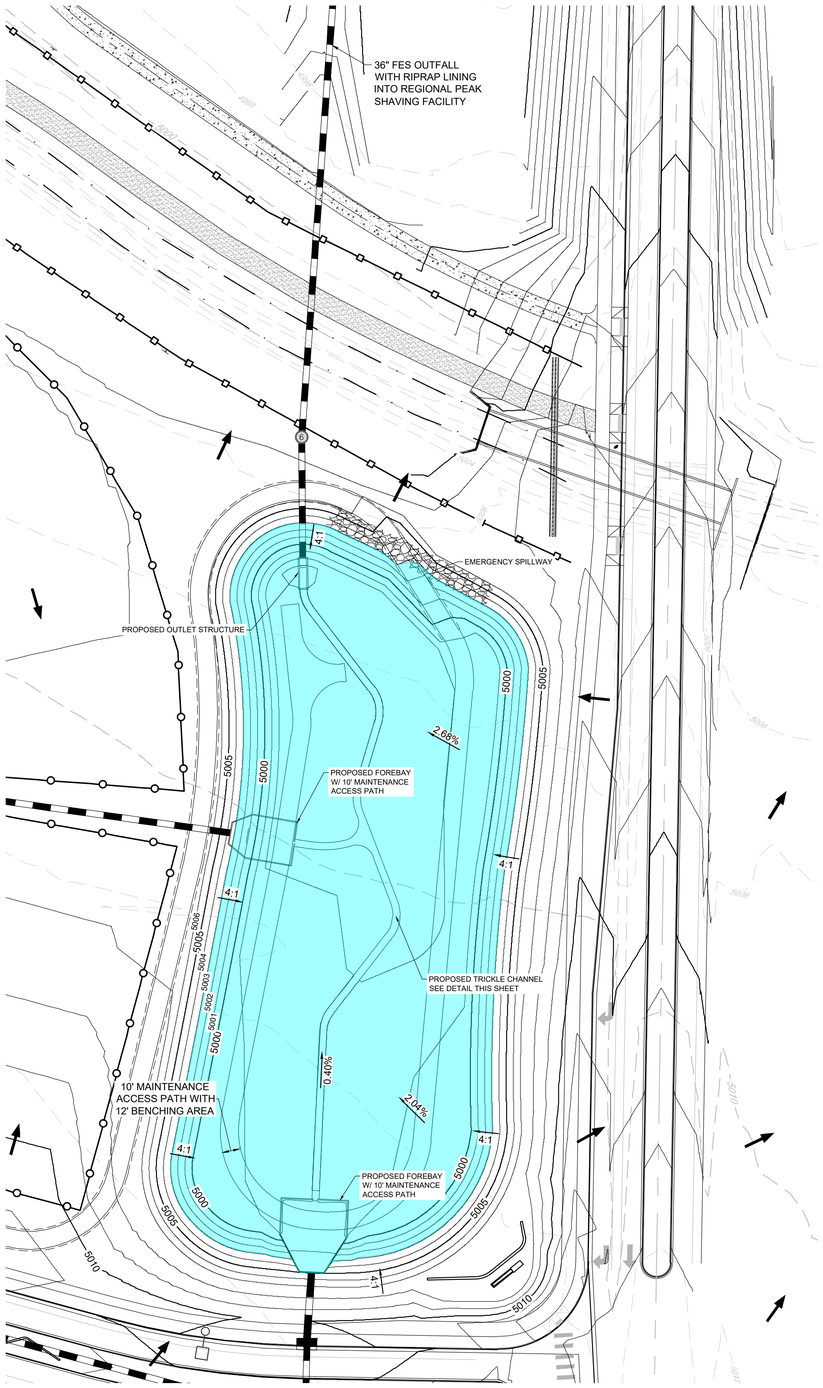
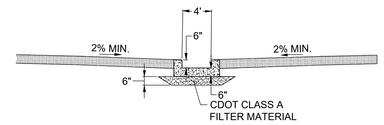


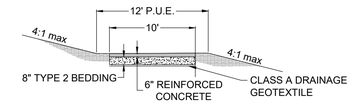
POND A OVERALL

1" = 40'



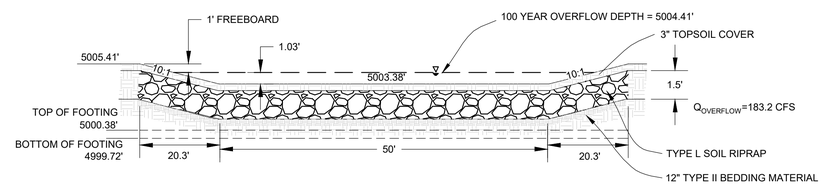
TRICKLE CHANNEL DETAIL

NOT TO SCALE



CONCRETE TRAIL DETAIL

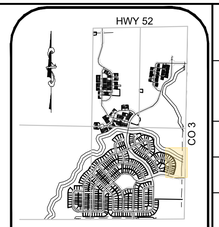
NOT TO SCALE



EMERGENCY SPILLWAY SECTION

NOT TO SCALE

POND A DESIGN SUMMARY			
STAGE	RELATIVE DEPTH	ELEVATION	VOLUME
	(FT)	(FT)	(AC-FT)
STAGE 0	-	4996.58	-
WQCV	2.55	4999.13	1.04
EURV	4.59	5001.17	3.37
100-YEAR	6.36	5002.94	5.73
SPILLWAY INVERT	6.6	5003.18	–



KEYMAP

SCALE 1" = 2000'

40 20 0 40 80

SCALE: 1" = 40

LEGEND

XX / A / C2 / C100	XX = BASIN ID
XX	DESIGN POINT
	EXISTING DRAINAGE BOUNDARY
	MINOR BASIN BOUNDARY
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A	LOT TYPES
	PAGE BOUNDARIES
	AREAS OUTSIDE OF POND DELINEATION

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3. TRICKLE CHANNEL DETAILS WILL BE PROVIDED IN THE FINAL DRAINAGE PLAN/REPORT.
4. OUTLET STRUCTURE AND FOREBAY SIZING/CALCS WILL BE PROVIDED WITHIN THE FINAL DRAINAGE PLAN/REPORT.

BENCHMARK
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Accepted by: _____ _____
Town Engineer Date

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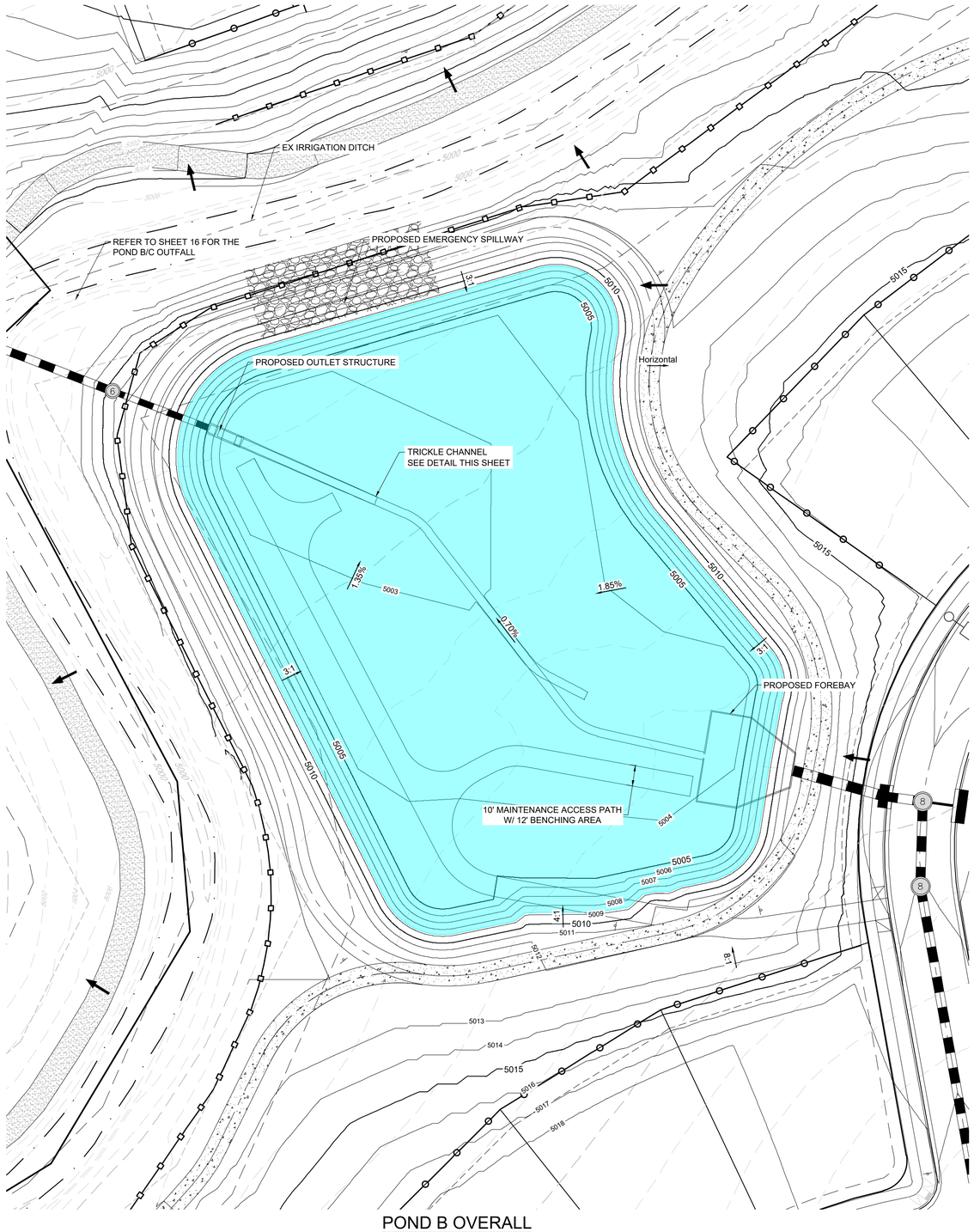
SPRING HILL
PRELIMINARY DRAINAGE MAPS
POND A - OVERALL

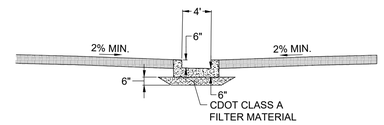
SCALE: AS SHOWN
FILE NO: 8130307501
DRAWN BY: EWA
CHECKED BY:
DATE: JUNE 2025
SHEET NUMBER 14

N:\PROJECTS\SPRING HILL\SERVICE GROUPS\WATER RESOURCES\03 PRELIMINARY DRAINAGE\04_EXHIBITS\POND A.DWG, EJBEITEL, 6/5/2025 5:10 PM



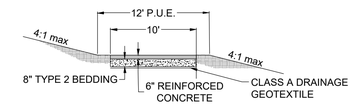
POND B OVERALL

1" = 30'



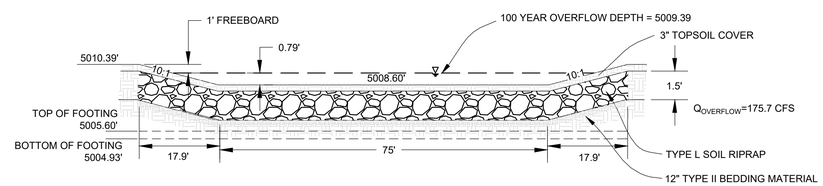
TRICKLE CHANNEL DETAIL

NOT TO SCALE



CONCRETE TRAIL DETAIL

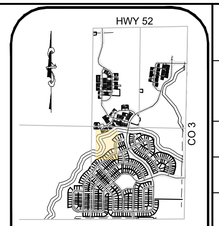
NOT TO SCALE



EMERGENCY SPILLWAY SECTION

NOT TO SCALE

POND B DESIGN SUMMARY			
STAGE	RELATIVE DEPTH	ELEVATION	VOLUME
	(FT)	(FT)	(AC-FT)
STAGE 0	-	5001.5	
WQCV	2.95	5004.45	1.16
EURV	5.32	5006.82	4.05
100-YEAR	7.25	5008.75	6.72
SPILLWAY INVERT	7.5	5009	-



KEYMAP

SCALE 1" = 2000'

30 15 0 30 60

SCALE: 1" = 30

LEGEND

XX / A / C2 / C100	XX = BASIN ID
XX	DESIGN POINT
	EXISTING DRAINAGE BOUNDARY
	MINOR BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
	RUNOFF BASIN BOUNDARY
	LAYOUT MATCHLINE
5650	EXISTING MAJOR CONTOURS
5650	EXISTING MINOR CONTOURS
5650	PROPOSED MAJOR CONTOURS
5640	PROPOSED MINOR CONTOURS
	EMERGENCY OVERFLOW PATH
	PROPOSED STORM
	EXISTING STORM
	PROPOSED FLOW ARROW
	100-YEAR FLOOD PLAIN
A	LOT TYPES
	PAGE BOUNDARIES
	AREAS OUTSIDE OF POND DELINEATION

NOTES:

1. REFER TO POND C SHEET FOR THE POND B OUTFALL.
2. ALL PONDS ARE PRIVATE AND WILL BE MAINTAINED BY THE METRO DISTRICT.
3. POND FINAL DESIGN WILL BE COMPLETED IN THE FINAL DRAINAGE PLAN.
4. TRICKLE CHANNEL DETAILS WILL BE PROVIDED IN THE FINAL DRAINAGE PLAN/REPORT.
5. OUTLET STRUCTURE AND FOREBAY SIZING/CALCS WILL BE PROVIDED WITHIN THE FINAL DRAINAGE PLAN/REPORT.

BENCHMARK
THE SOUTHWEST CORNER OF SECTION 6, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, BEING A 2-1/2" ALUMINUM CAP STAMPED "LS 23501 POWERS ELEV CO" HAVING A PUBLISHED ELEVATION OF 4983.02 FEET, NAVD 1988 DATUM, PER THE TOWN OF ERIE CONTROL MAP (JANUARY 25, 2004 REVISION).

BASIS OF BEARINGS:
BEARINGS ARE BASED ON THE NORTH LINE OF THE NORTHEAST QUARTER OF SECTION 6, TOWNSHIP 1 NORTH, RANGE 68 WEST, 6TH PRINCIPAL MERIDIAN, BEING MONUMENTED AT THE NORTH ONE QUARTER CORNER OF SAID SECTION 6 BY A FOUND NO. 6 REBAR WITH A 3-1/4 INCH DIAMETER ALUMINUM CAP SET BY PLS 36053 AND AT THE NORTHEAST CORNER OF SAID SECTION 6 BY A FOUND NO. 6 REBAR WITH A 2-1/2 INCH DIAMETER ALUMINUM CAP SET BY PLS 25937. THE LINE IS ASSUMED TO BEAR N88°46'59"E, A DISTANCE OF 2642.32 FEET.

All work shall be constructed to Town of Erie STANDARDS AND SPECIFICATIONS. This drawing has been reviewed and found to be in general compliance with these STANDARDS AND SPECIFICATION and other Town requirements. THE ENGINEERING DESIGN AND CONCEPT REMAINS THE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEAR HEREON.

Accepted by: _____ Town Engineer _____ Date

PREPARED UNDER THE SUPERVISION OF

MARK SCHEURER
COLORADO P.E. 48988

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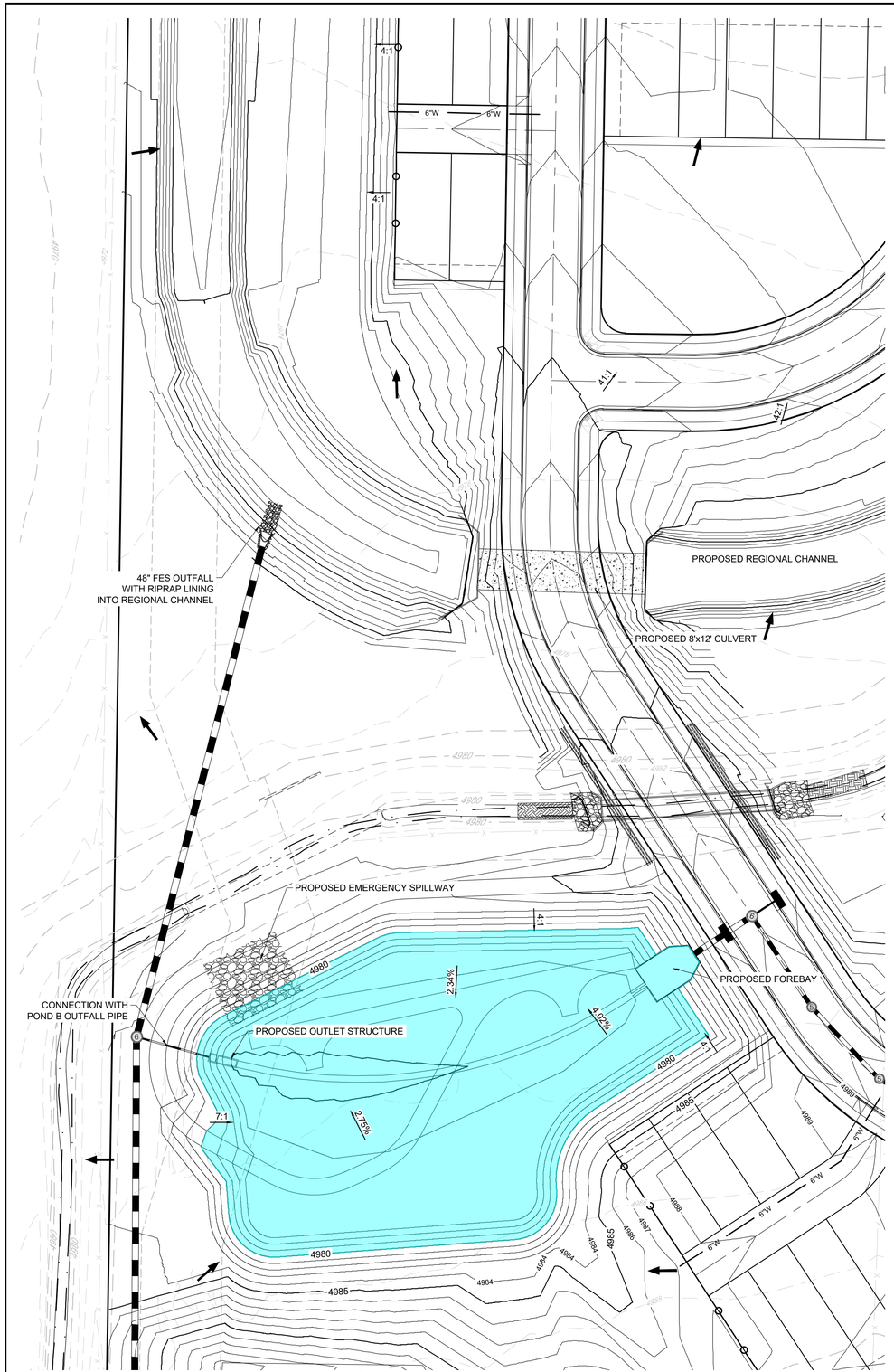
SPRING HILL
PRELIMINARY DRAINAGE MAPS
POND B - OVERALL

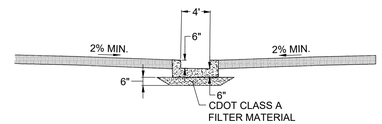
SCALE: AS SHOWN
FILE NO: 8130307501
DRAWN BY: EWA
CHECKED BY:
DATE: JUNE 2025
SHEET NUMBER 15

N:\PROJECTS\SPRING HILL\SERVICE GROUPS\WATER RESOURCES\03 PRELIMINARY DRAINAGE\04_EXHIBITS\POND B.DWG, EJBEITEL, 6/5/2025 5:10 PM



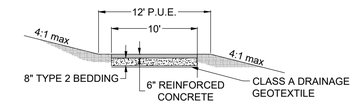
POND C OVERALL

1" = 40'



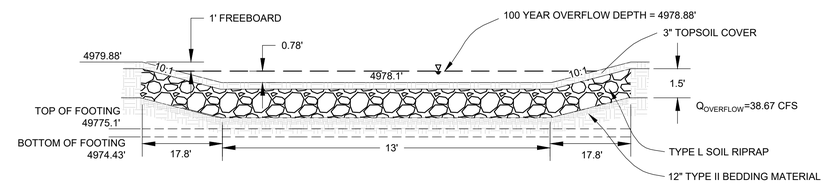
TRICKLE CHANNEL DETAIL

NOT TO SCALE



CONCRETE TRAIL DETAIL

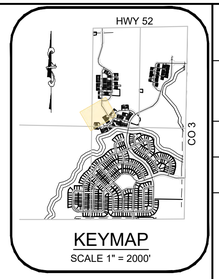
NOT TO SCALE



EMERGENCY SPILLWAY SECTION

NOT TO SCALE

POND C DESIGN SUMMARY			
STAGE	RELATIVE DEPTH	ELEVATION	VOLUME
	(FT)	(FT)	(AC-FT)
STAGE 0	-	4974.3	-
WQCV	1.68	4975.98	0.28
EURV	2.57	4976.87	0.83
100-YEAR	3.69	4977.99	1.8
SPILLWAY INVERT	3.9	4978.2	-



KEYMAP

SCALE 1" = 2000'

40 20 0 40 80

SCALE: 1" = 40

LEGEND

XX / A / C2 / C100	XX = BASIN ID
XX	DESIGN POINT
	EXISTING DRAINAGE BOUNDARY
	MINOR BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
	RUNOFF BASIN BOUNDARY
	LAYOUT MATCHLINE
5650	EXISTING MAJOR CONTOURS
5650	EXISTING MINOR CONTOURS
5650	PROPOSED MAJOR CONTOURS
5649	PROPOSED MINOR CONTOURS
	EMERGENCY OVERFLOW PATH
	PROPOSED STORM
	EXISTING STORM
	PROPOSED FLOW ARROW
	100-YEAR FLOOD PLAIN
A	LOT TYPES
	PAGE BOUNDARIES
	AREAS OUTSIDE OF POND DELINEATION

NOTES:

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BENCHMARK
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Accepted by: _____ Town Engineer _____ Date

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COLORADO P.E. 48988

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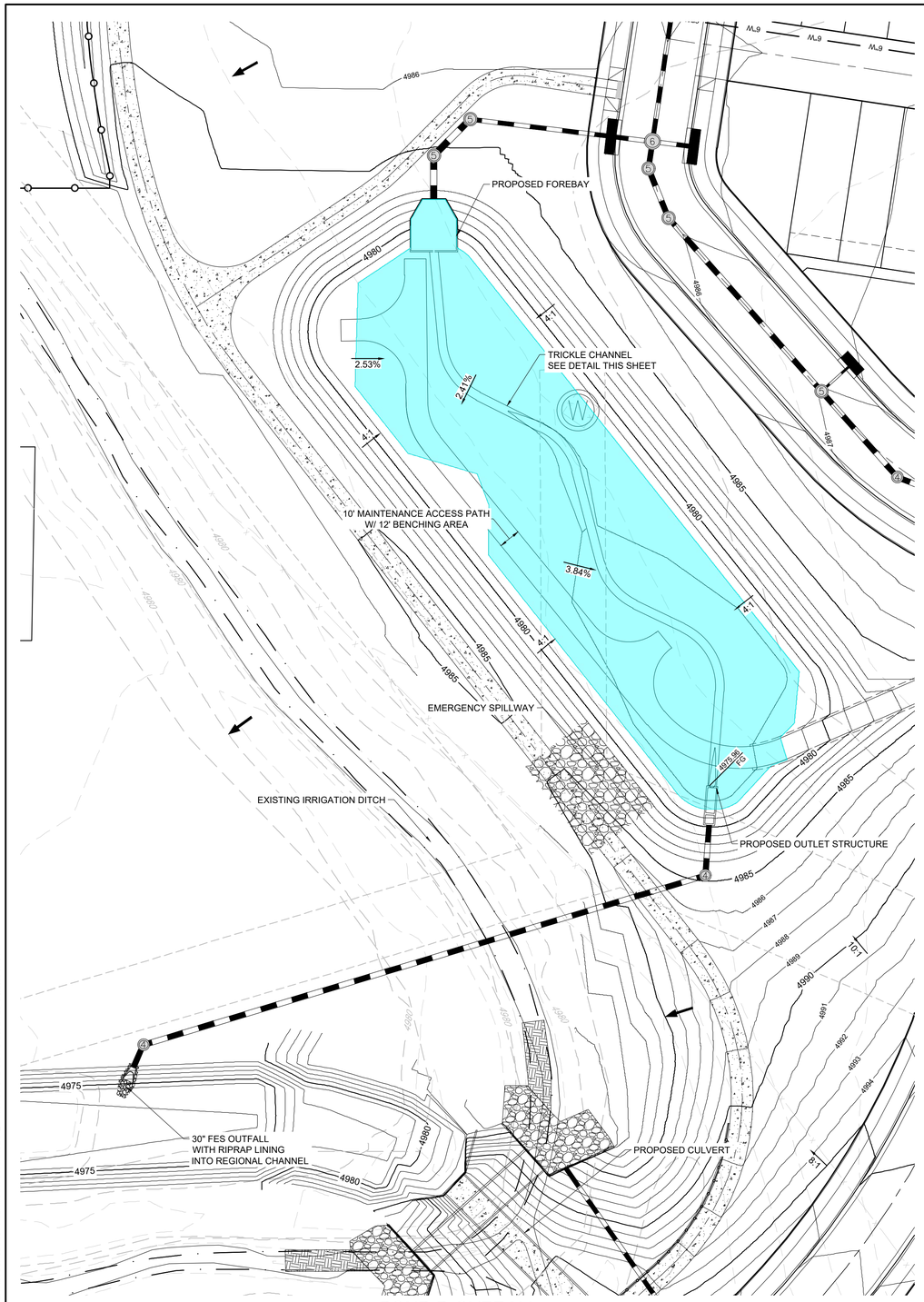
SPRING HILL
PRELIMINARY DRAINAGE MAPS
POND C - OVERALL

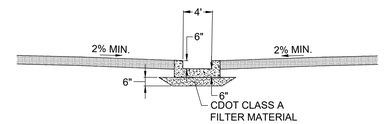
SCALE: AS SHOWN
FILE NO: 8130307501
DRAWN BY: EWA
CHECKED BY:
DATE: JUNE 2025
SHEET NUMBER 16

N:\PROJECTS\SPRING HILL\SERVICE GROUPS\WATER RESOURCES\03 PRELIMINARY DRAINAGE\04_EXHIBITS\POND C.DWG, E.BEITEL, 6/5/2025 5:10 PM



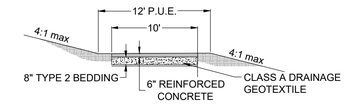
POND D OVERALL

1" =30'



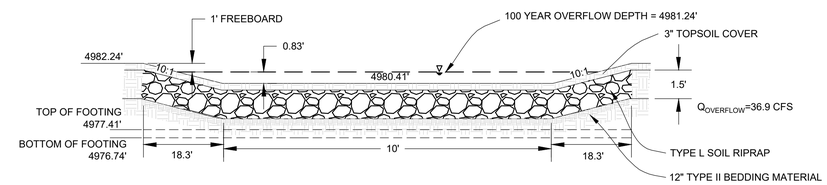
TRICKLE CHANNEL DETAIL

NOT TO SCALE



CONCRETE TRAIL DETAIL

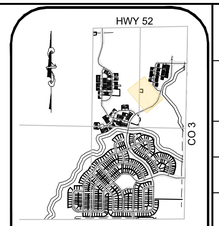
NOT TO SCALE



EMERGENCY SPILLWAY SECTION

NOT TO SCALE

POND D DESIGN SUMMARY			
STAGE	RELATIVE DEPTH	ELEVATION	VOLUME
	(FT)	(FT)	(AC-FT)
STAGE 0	-	4974.3	-
WQCV	1.6	4975.9	0.24
EURV	2.42	4976.72	0.72
100-YEAR	3.69	4977.99	1.8
SPILLWAY INVERT	3.8	4978.1	-



KEYMAP

SCALE 1" = 2000'

30 15 0 30 60

SCALE: 1" = 30

LEGEND

XX / A / C2 / C100	XX = BASIN ID
XX	DESIGN POINT
	EXISTING DRAINAGE BOUNDARY
	MINOR BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
	RUNOFF BASIN BOUNDARY
	LAYOUT MATCHLINE
5650	EXISTING MAJOR CONTOURS
5650	EXISTING MINOR CONTOURS
5650	PROPOSED MAJOR CONTOURS
5649	PROPOSED MINOR CONTOURS
	EMERGENCY OVERFLOW PATH
6	PROPOSED STORM
	EXISTING STORM
	PROPOSED FLOW ARROW
	100-YEAR FLOOD PLAIN
A	LOT TYPES
	PAGE BOUNDARIES
	AREAS OUTSIDE OF POND DELINEATION

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BENCHMARK
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COLORADO P.E. 48988

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SPRING HILL
PRELIMINARY DRAINAGE MAPS
POND D - OVERALL

SCALE: AS SHOWN
FILE NO: 8130307501
DRAWN BY: EWA
CHECKED BY:
DATE: JUNE 2025
SHEET NUMBER 17

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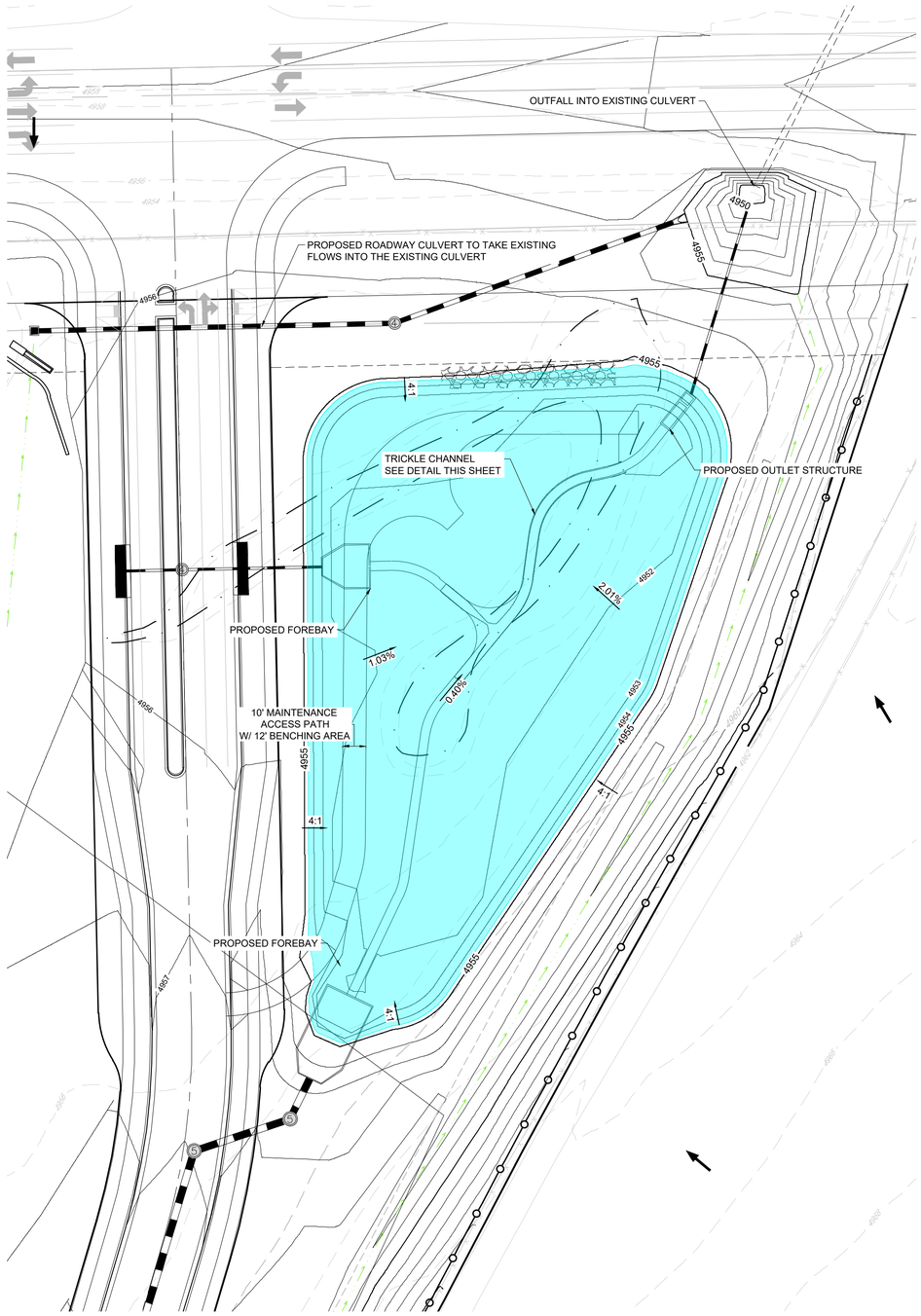
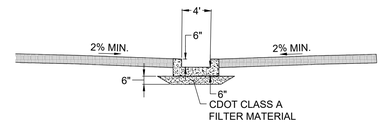


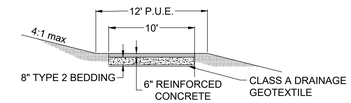
POND E OVERALL

1" =30'



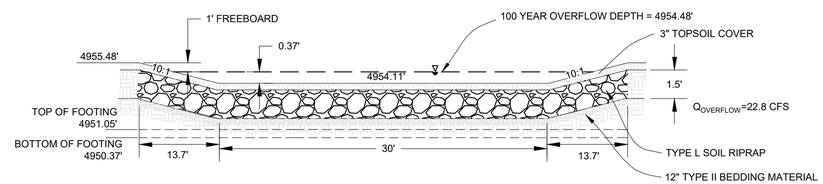
TRICKLE CHANNEL DETAIL

NOT TO SCALE



CONCRETE TRAIL DETAIL

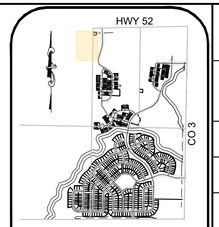
NOT TO SCALE



EMERGENCY SPILLWAY SECTION

NOT TO SCALE

POND E DESIGN SUMMARY			
STAGE	RELATIVE DEPTH	ELEVATION	VOLUME
	(FT)	(FT)	(AC-FT)
STAGE 0	-	4950.5	-
WQCV	1.66	4952.16	0.35
EURV	2.85	4953.35	1.14
100-YEAR	4.09	4954.59	2.13
SPILLWAY INVERT	4.2	4954.7	-



KEYMAP

SCALE 1" = 2000'

30 15 0 30 60

SCALE: 1" = 30

LEGEND

XX / A / C2 / C100	XX = BASIN ID
XX	DESIGN POINT
	EXISTING DRAINAGE BOUNDARY
	MINOR BASIN BOUNDARY
	MAJOR BASIN BOUNDARY
	RUNOFF BASIN BOUNDARY
	LAYOUT MATCHLINE
5650	EXISTING MAJOR CONTOURS
5650	EXISTING MINOR CONTOURS
5650	PROPOSED MAJOR CONTOURS
5649	PROPOSED MINOR CONTOURS
	EMERGENCY OVERFLOW PATH
S	PROPOSED STORM
	EXISTING STORM
	PROPOSED FLOW ARROW
	100-YEAR FLOOD PLAIN
A	LOT TYPES
	PAGE BOUNDARIES
	AREAS OUTSIDE OF POND DELINEATION

NOTES:

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BENCHMARK
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SPRING HILL
PRELIMINARY DRAINAGE MAPS
POND E - OVERALL

SCALE: AS SHOWN
FILE NO: 8130307501
DRAWN BY: EWA
CHECKED BY:
DATE: JUNE 2025
SHEET NUMBER 18

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